APPENDIX E1

SECTION 103 EVALUATION

BAYOU CASOTTE ENERGY LLC

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CASOTTE LANDING NATURAL GAS IMPORT TERMINAL PROJECT

CASOTTE LANDING SLIP SEDIMENT EVALUATION REPORT – ODMDS SUITABILITY

JULY 13, 2006

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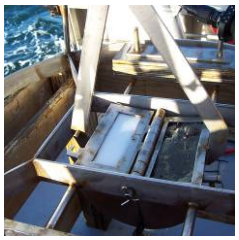
Prepared for:
Bayou Casotte Energy LLC



Casotte Landing Slip Sediment Evaluation Report – ODMDS Suitability

ENSR Corporation
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ACRONYMS

ADDAMS - Automated Dredging and Disposal Alternatives Management System

AET - Apparent Effects Threshold

AL - Action Level

ANOVA - Analysis of Variance

BGS - Below Ground Surface

BSAF - Biota to Sediment Accumulation Factor

CBR - Critical Body Residue

CDF - Confined Disposal Facility

CE SAM - U.S. Army Corps of Engineers Mobile District

CLLNG - Casotte Landing Liquified Natural Gas

COC - Chain-of-Custody

CY - Cubic Yards

DGPS - Differential Global Positioning System

EPA - U.S. Environmental Protection Agency

ERDC - Engineering Research and Development Center (USACE)

ERL - Effects Range-Low

ERM - Effects Range-Median

ERLQ - Effects Range-Low Quotient

ESI - EnviroSystems, Inc.

FDA - Food and Drug Administration

FSP - Field Sampling Plan

GC - Gas Chromatograph

LPC - Limiting Permissible Concentration

MCY - Million Cubic Yards

MLLW - Mean Lower Low Water

MPRSA - Marine Protection Research and Sanctuaries Act

ND - Not Detected

NOEC - No-Observed-Effect Concentration

NS&T - National Status and Trends

ODMDS - Ocean Dredged Material Disposal Site

PAH - Polynuclear Aromatic Hydrocarbon

PCB - Polychlorinated Biphenyl

QAPP - Quality Assurance Project Plan

RL - Reporting Limit

RTR - Ratio to Reference

SAP - Sampling and Analysis Plan

SOW - Scope of Work

SPP - Suspended Particulate Phase

STFATE - Short Term FATE Numerical Model

SWMU - Solid Waste Management Unit

TAT - Turn-Around Time

TOC - Total Organic Carbon

TPH - Total Petroleum Hydrocarbons

USACE - U.S. Army Corps of Engineers

VOC - Volatile Organic Carbon

WQC - Water Quality Criteria

WQS - Water Quality Standards

Executive Summary

Bayou Casotte Energy LLC, a subsidiary of Chevron U.S.A., Inc. (CUSA), proposes to build and operate an onshore liquefied natural gas (LNG) import terminal and associated facilities south of the existing CUSA Pascagoula Refinery on Bayou Casotte, just east of Pascagoula, Mississippi. The proposed Casotte Landing Natural Gas Import Terminal Project includes the construction of a new double-berth slip for accommodation of an LNG Berth and the relocation of an existing refinery berth for the Pascagoula Refinery along the eastern shore of Bayou Casotte.

Creation of the slip will require removal of approximately 4.5 million cubic yards (mcy) of material. A large portion (ca. 1 mcy) of the upper soil material will be excavated and used on-site for construction purposes. The remaining material (ca. 3.5 mcy) will be dredged and placed at one of the locations under consideration for the project. This study was performed to support agency decision-making related to the suitability of Casotte Landing slip material for placement at the Pascagoula Offshore Dredged Material Disposal Site (ODMDS).

An agency-approved Sampling and Analysis Plan (SAP) was distributed to the project team in November, 2005 and incorporated all chemical, physical, and biological testing required by CE SAM and EPA to make a suitability determination under the MPRSA Section 103.

While suitability of the material for offshore placement will ultimately be decided by CE SAM and EPA, the bulk sediment evaluations conducted in this study provide a large weight-of-evidence that the material to be dredged is clean from a chemical perspective. Further, bioassay test organisms appear to be healthy after exposure tests, although given the unique low biogenic carbon sediment content, the material may not provide a sufficient food source for deposit feeders at the ODMDS until biogenic particles, raining down from the overlying water column, accumulate on the sediment surface for some weeks or months.

Water column suspended particulate phase (SPP) bioassay tests, often the most sensitive indicators of biological effects, measured very good survival and development results by the time SPP mixtures were diluted in half. Water column (STFATE) simulations predict that limiting permissible concentrations (LPCs) would be reached well within the allowed 4-hour threshold and that related water column plumes would not travel very far.

Lastly, because of the relatively clean nature of the site overall, only a few stations required further evaluation of potential bioaccumulative concerns. Of the many parameters measured, only six were at concentrations statistically greater than those of reference-exposed and pre-exposed tissue levels, but were nonetheless measured at very low concentrations and well within available No Observed Effect Concentration (NOEC) levels for aquatic organisms.

The many evaluations conducted in this study provide a large weight-of-evidence that exposure to the Casotte Landing sediment dredged from the slip area will have little or no biological effect on the marine environment at the ODMDS and will provide a firm basis for agency decision-making.

1.0 Introduction

Bayou Casotte Energy LLC (BCE), a subsidiary of Chevron USA, proposes to build and operate an onshore liquefied natural gas (LNG) import terminal and associated facilities south of the existing Chevron Pascagoula Refinery on Bayou Casotte, just east of Pascagoula, Mississippi in Jackson County. The proposed Casotte Landing Natural Gas Import Terminal Project includes the construction of a new double-berth slip to accommodate LNG tankers and the relocation of an existing berth for the Pascagoula Refinery along the eastern shore of Bayou Casotte (Figure 1-1). The slip would be constructed to a depth of 46 feet below mean lower low water (MLLW) including advanced maintenance and overdepth dredging by cutting in from the existing navigation channel.

Creation of the slip will require removal of approximately 4.5 million cubic yards (mcy) of material. A large portion (ca. 1 mcy) of the upper soil material will be excavated and used on-site for construction purposes. The remaining material (ca. 3.5 mcy) will be dredged and placed at one of the locations under consideration for the project. The purpose of this investigation is to evaluate the suitability of the soil and sediment material to be removed for placement at the Pascagoula ODMDS (ODMDS) located to the south of Horn Island. This evaluation follows guidelines provided by the United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (EPA) (EPA/USACE, 1991; EPA/USACE, 1993) to ensure that coastal waters are protected from any potential adverse effects as specified under Section 103 of the Marine Protection Research and Sanctuaries Act (MPRSA).

1.1 Site History

Before industry moved into the area around 1960, the proposed Casotte Landing LNG (CLLNG) slip area was largely aquatic as depicted in Figure 1-2. During the 1950's the slip area was filled, apparently with material dredged from Bayou Casotte as a way to establish what was then the largest industrial site in the state (Goodwin and Associates, 2005; Sullivan, 1985).

The slip area and larger LNG terminal site were initially occupied by Corning Glass Works (formerly Cohart Refractory), where high temperature brick was manufactured at the site until 1989 using a magnesite refractory process. A landfill and two settling ponds/lagoons were established and used on the site by Corning/Cohart Refractory while they occupied the site (Figure 1-3). The landfill was an unlined facility used to store waste generated during the manufacturing process (Solid Waste Management Unit [SWMU] 5 on Figure 1-3). The material discarded included red furnace dust containing chromium, sand containing chromium, chrome ore, lime, concrete rubble, scrap metal, and wood. In 1984, the landfill waste was excavated and disposed of offsite and the site was backfilled with a mixture of soil and refractory brick debris.

Two unlined surface impoundments were also established and used as settling ponds for wastewater containing fines southeast of the slip area (SWMU 14 on Figure 1-3). The fines contain elevated concentrations of Cr, Mg, Ni, Pb and lime waste. Dolomite, a magnesium rich limestone, was used as the raw material for magnesium recovery in the refractory process. As a result, lime waste is abundant within the former lagoon. The lagoons covered a combined area of 6 acres. The north lagoon averaged 6 feet deep. The south lagoon averaged 3 feet deep. Both lagoons were removed from service in 1989, filled with lime and capped (URS, 2005). After investigation of soil and water contamination issues, the site was issued a "No Further Action" status by the U.S. Environmental Protection Agency (USEPA) circa 1989. Before initiating the slip construction, fill material contained in these former settling ponds will be excavated and transported to a permitted RCRA Subtitle D (Solid Waste) facility as part of site preparation.

1.2 Soil/Sediment Evaluation

To understand the suitability of material for offshore placement, a tiered approach is recommended by agency guidance. The process begins with a review of existing data, followed by modeling and detailed testing of the material. Testing results provide the information needed to understand potential biological effects that could occur at the ODMDS in the benthic sediments, in the water column, and within the food web. In this program, many of the tiers have been applied simultaneously to expedite the overall project schedule and to provide greater weight-of-evidence for the decision making.

In 2005, BCE initiated a program to evaluate site soils and sediments, through its contractor ENSR, to collect the necessary information to understand the suitability of the material for various placement options including beneficial uses, placement in a confined disposal facility (CDF), and placement at the ODMDS. This document presents all project details and findings related to ODMDS suitability. Project soils and sediments were also evaluated under several earlier efforts (URS, 2005a; URS, 2005b). Data from those efforts were useful in developing the sampling plan for the current effort and are summarized in *Field Sampling Plan and Quality Assurance Project Plan Supporting Casotte Landing Slip Dredged Material CWA/MPSRA Suitability Testing* (ENSR, 2005).

Non-Internet Public

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
PROPOSED CASOTTE LANDING LNG TERMINAL
AND PIPELINE PROJECT
Docket No. CP05-420-000

Appendix E-1 page 14
Figure 1-1 CLLNG Slip Location

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
PROPOSED CASOTTE LANDING LNG TERMINAL
AND PIPELINE PROJECT
Docket No. CP05-420-000

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Figure 1-2 CLLNG Slip Area and 1940 Land Facilities

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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED CASOTTE LANDING LNG TERMINAL AND PIPELINE PROJECT
Docket No. CP05-420-000

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Figure 1-3 CLLNG Slip Area with Terminal Slip Footprint and Solid Waste Management Units

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2.0 Methods

Field and laboratory methods are detailed in the project Sampling and Analysis Plan (SAP), comprised of a field sampling plan (FSP) and a quality assurance project plan (QAPP). These documents are included by reference (ENSR, 2005). Brief summaries of the methods used are included in the following subsections.

2.1 Field sampling

Project sampling sites were located in a grid-like fashion to represent the slip material while including side-wall and main facility locations. The final sampling design was approved by the USACE Mobile District (CE SAM) and the EPA Region 4. Sediment and soil samples were collected from 15 stations to characterize the material proposed for placement at the ODMDS (Figure 2-1). Twelve stations were distributed throughout the portion of the slip area that was historically filled and is currently upland (SB1 - SB12). Two of these stations were selected based on their proximity to ditches that traverse the slip area, two were located within the historical landfill (SWMU 5), and one was located within the former settling pond that intersects the area (SWMU 14) to evaluate any possible contaminant migration into underlying soil. Sediment was collected from three stations located in the submerged portion of the slip area (SC1 - SC3 in Figure 2-1).

The field program objective was to collect representative samples needed to evaluate the potential contamination pathways related to placement at the ODMDS. This included the following three primary pathways:

- Direct exposure to the dredged material following placement (bulk soil/sediment);
- Direct exposure to the water column during/after mixing (elutriate and particulate phase analysis); and
- Bioaccumulation potential resulting from dredged material exposure over a period of time (bioaccumulation bioassays followed by tissue analysis).

Sampling efforts included soil and sediment coring, sampling pit excavations, sediment grabs and surface water collections. Appendix A includes the field logs associated with these efforts.

2.1.1 Soil collection

The soil column was stratified, with a surficial fill layer varying in thickness from 0 to 14 feet, but generally less than 10 feet. Beneath the fill was a sandy layer, underlain by a mixture of clay, silt and sand. Because the surficial fill layer will be used for on-site construction and will not be placed at the ODMDS, this material was not sampled or tested. The sandy and underlying clayey layers were designated as “upper” and “lower” layers, respectively, and analyzed separately.

Soils were collected in the upland area using 2 approaches. Initially, cores were collected at each station using rotosonic drilling technology to the project depth of -46 feet MLLW. However, the upper sandy layer was thinner than expected and so sampling pits were excavated to collect large volume samples from this sand horizon. As-cored or as-dug sample positions were determined using a Trimble Pro-XRS DGPS (differential global positioning system).

Site elevations ranged from 8 to 14 feet above MLLW and so the soil cores were generally collected to a depth of 60 feet below ground surface (bgs). Continuous sampling from land surface to the desired depth was accomplished using a five foot split core barrel containing clear plastic Lexan liners. Five foot sub-cores were then transferred intact to the core processing facility. Sampling pits were excavated using a track hoe with a reach of approximately 17 to 20 feet and a bucket capacity of about 1 cubic yard (cy). Excavated samples were contained in 5-gallon buckets for delivery to the processing facility.

All soil collection equipment was steam cleaned between collection stations as detailed in the project SAP. An equipment blank was collected from the rotosonic equipment and the excavator bucket once during the field effort. Project samples were placed in refrigerated storage on site during the field effort and transported to the processing facility/biological testing laboratory using refrigerated trucking services. Table 2-1 summarizes the sample testing prescribed for individual and composite stations.

2.1.2 Sediment collection

Sediment was collected from the subtidal slip area in water depths ranging from 1 to 15 feet below MLLW using vibracoring equipment. Full-length sediment cores were collected at each of the three aquatic stations and ranged in length from 36 to 40 feet. Cores were contained in Lexan liners and cut into five foot sections, sealed, and placed in refrigerated storage until transported under refrigeration to the core-processing facility.

Reference sediment samples were collected from Grand Bay using a 0.1 m^2 stainless steel GOMEX box core (Figure 2-2). The samples were dispensed to 5-gal collection buckets and transferred to the processing lab for subsequent homogenization and analysis. Based on the initial reference results, agencies (CE SAM, EPA) recommended that another sample be collected from the site in March 2006.

Navigational positioning for the reference sediment sampling was accomplished using a Garmin 2010 DGPS integrated with PC-based HYPACK hydrographic software. The navigation system provided a real-time display of vessel position on an electronic nautical chart and provided the vessel operator with range and bearing information to pre-selected waypoints for accurate positioning and station-keeping during the sample collection process. The stated accuracy of the system is +/-1 meter.

2.1.3 Surface water collection

Water needed for elutriate chemistry and bioassay testing was collected from the ODMDS and Bayou Casotte at 1 meter depth using a 12-volt Teflon diaphragm pump and a suitable length of composite tubing (CFlex™) (Figure 2-3). Water for background chemistry measurements was dispensed directly from the pump system to storage containers and water for bulk elutriate/bioassay samples was dispensed directly to plastic cube containers.

Navigational positioning for the surface water collection was accomplished in the same manner as for reference sediment sampling.

2.2 Sample processing and analysis

The project QAPP provides detailed descriptions of all aqueous, sediment, soil and tissue sample handling and the methods used for chemical, physical and biological testing. Tables A-3 through A-5 of the QAPP summarize the chemical and physical testing methods used. Section B.4.6 of the QAPP summarizes the bioassay and bioaccumulation test methods.

2.2.1 Phased testing

Testing was conducted in two phases. The first phase provided CE SAM and EPA Region 4 with rapid soil/sediment chemistry and grainsize results to enable the agencies to develop a pooling scheme for subsequent testing. The second phase represented full scale testing of the site material including physical and chemical testing, toxicity bioassays, and bioaccumulation bioassays, all performed on the same sample homogenates.

Because the upper sandy layer was thinner than expected, limited volume of this stratum was collected during the coring effort. For this reason, cored upper material was only used for the rapid Phase 1 testing exercises.

The large volume of excavated material (from sampling pits) was used for the full scale testing in Phase 2 of the analytical program. Based on Phase 1 chemistry results, Phase 2 samples were not analyzed for VOCs.

2.2.2 Core and excavation sample handling

At the core processing laboratory, the five foot soil/sediment sub-cores were split and subsampled. Core sections were split length-wise using an electric stainless steel shearing device. Two (opposing) cuts were made in the hard plastic and a plastic filament was pulled through the core material to separate the core into two halves. VOC subsamples were collected without delay using the criteria detailed in Section B.4.1 of the project QAPP. After VOC subsamples were collected and preserved, each 5-foot core section was visually classified and logged (Appendix A). EnCore™ sampling devices were replaced with pre-preserved VOA vials containing sodium bisulfate and methanol to allow weekend sample shipment without exceeding preservation holding times.

Each core or set of cores representing the depth interval of interest was scraped along the entire interval and homogenized to obtain a depth-integrated subsample. This subsample was then transferred to the testing laboratories for rapid chemical and physical testing (Phase 1 testing). The remaining core material was placed in 5-gal plastic buckets and refrigerated until pooling decision-making was complete.

Sampling pit material was visually described at the site during the excavation process, homogenized in the excavator bucket using carbon steel shovels, and placed directly into 5-gal plastic buckets for refrigerated storage. Samples were further homogenized at the processing laboratory before testing.

2.2.3 Test sample preparation and pooling

Following the compositing recommendations made by CE SAM and EPA Region 4, soil/sediment composites were prepared at ESI by combining equal volumes of the material from the various stations to be composited. Material was dispensed from the 5-gallon buckets into a plasticized trough and raked using an unpainted carbon steel rake until the samples were fully blended. Individual Phase 2 sampling locations not included in composite samples were homogenized using the same methods. The composites or individual samples were then split and subsamples transferred to the physical and chemical testing laboratories. The remaining material was retained at the biological laboratory for subsequent bioassay and bioaccumulation testing. In each case under Phase 2 testing, chemical, physical, and biological testing was performed on the same sample homogenate.

Ten-day whole sediment bioassays were conducted in accordance with EPA/USACE guidance for the South Atlantic Division (USACE/EPA, 1993), the Inland Testing Manual (EPA/USACE, 1998), and the project QAPP (ENSR, 2005). The 10-day whole sediment bioassays were conducted with the amphipod (*Leptocheirus plumulosus*) and the mysid shrimp (*Americamysis bahia*). Additional *L. plumulosus* testing was conducted to evaluate the potential impact of the sterile nature of the tested material containing a very limited food source and to assess the unusually low survival observed in the Grand Bay reference sediment. A framework for this additional testing was approved by EPA and USACE in a technical memorandum dated March 27, 2006 (Attachment 1).

2.2.4 Physical and chemical sample analysis

Physical and chemical analysis methods are fully detailed in the project QAPP. In some cases, specialized or modified methods were specified to accommodate unique project objectives. A description of the specialized or modified methods is also provided in this section.

A hydrofluoric acid (HF) digestion procedure (EPA SW-846 method 3052) was used to produce total sample decomposition of the soil/sediment samples prior to their analysis for Al by inductively coupled plasma-atomic emission spectroscopy (ICP-AES). The HF digestion procedure involved adding hydrochloric acid, nitric acid

and hydrofluoric acid to the solid sample in a Teflon vessel and heating it for two hours. These procedures allowed for analysis of total Al, which was used to normalize metals data for data synthesis.

Soil/sediment samples were analyzed for ammonia, total Kjeldahl nitrogen (TKN), nitrate, nitrite, nitrate/nitrite, and total phosphorous using aqueous EPA methods that were modified by the laboratory for solid matrices. TKN digestions were performed by adding the solid matrix directly to the TKN apparatus; remaining nitrogen and phosphorous parameters were extracted, filtered and analyzed using the method-specified instrumentation.

EPA SW-846 method 8082 is specifically set up for measuring PCB Aroclors and consequently requires modification for application to congener analysis. EPA SW-846 method 8082 used for PCB congener analysis of soils/sediments was modified by using standards made from individual congeners. Furthermore, while Aroclor quantitation is based on multiple peak pattern analysis, congeners were quantified from individual chromatogram peaks.

Seawater samples analyzed for all metals, except Cr^{6+}, Hg, and Se, were first subjected to a reductive precipitation technique to separate the analytes of interest from the interfering matrix that contained high levels of total dissolved solids. The samples were treated with iron and palladium followed by sodium borohydride as a reductant. The resulting precipitate effectively scavenged the analytes of interest from the solution, which were then redissolved in an acid matrix as detailed in EPA Method 1640. An inductively coupled plasma-mass spectrometer (ICP-MS) was then used for the analysis of the precipitated metals.

EPA SW-846 method 7742 (hydride generation) was used for the analysis of selenium in the seawater samples. For this method, the samples were heated in a Teflon vessel for two hours with nitric acid to oxidize the solubilized organic and inorganic selenium without losses due to volatilization. Reaction of the sample with sodium borohydride released hydrides that were analyzed using an atomic absorption spectrophotometer.

2.2.5 Elutriate/suspended particulate phase sample preparation

Bayou Casotte water, as site water, was used in the preparation of all chemical elutriates and formed the basis of all suspended particulate phase (SPP) sample preparations. Water from the ODMDS was used for all SPP dilutions and bioassay laboratory control water was obtained from the Hampton Estuary, NH.

Each elutriate/SPP batch was prepared by adding the homogenized soil/sediment to the site water (i.e., Bayou Casotte water) in a 1:4 volumetric ratio, stirring the mixture for 30 minutes, and then allowing the mixture to settle for 1 hour. The stirring speed was carefully set to allow mixing without cavitation. The mixture was also stirred manually at approximately ten-minute intervals during the mixing period. The supernatant was siphoned off using Teflon tubing and centrifuged prior to chemical and biological evaluations. All samples were stored at 4°C when not in use. The portion used for SPP bioassay test was chilled and used within 24 hours of preparation. Related SPP toxicity dilutions series were prepared using water from the ODMDS. Elutriate samples were containerized for chemistry analysis and sent via overnight delivery to the chemistry laboratory. Samples collected for metals analysis were additionally split and filtered (using a 0.45 µm membrane) at the chemistry laboratory prior to analyses to obtain total and dissolved metal fractions as needed.

Water column bioassays were conducted in accordance with EPA/USACE guidance for the South Atlantic Division (USACE/EPA, 1993), the Inland Testing Manual (EPA/USACE, 1998) and the project QAPP (ENSR, 2005). Test organisms for the water column bioassays included mysid shrimp (*A. bahia*), silverside minnow (*Menidia beryllina*), and sea urchin embryos (*Arbacia punctulata*).

2.2.6 Tissue sample preparation

A 28-day solid phase/bioaccumulation evaluation was conducted in accordance with EPA/USACE guidance for the South Atlantic Division (USACE/EPA, 1993), the Inland Testing Manual (EPA/USACE, 1998) and the project QAPP (ENSR, 2005). Testing was conducted with the bivalve (*Macoma nasuta*) and the burrowing polychaete *(Nereis virens*).

At the end of the 28-day bioaccumulation assay exposure period and the 24 hour depuration period, the test organisms (*M. nasuta* and *N. virens*) were recovered, rinsed with clean seawater, frozen in clean glass containers and shipped on dry ice via overnight courier to the chemistry laboratory for preparation and analysis.

2.3 Data analysis

The array of chemical, physical and biological testing that was performed on the CLLNG soils/sediments provides a comprehensive data set from which material quality and its suitability for unconfined placement at the ODMDS can be assessed. These data sets were evaluated in the following ways:

- Biological testing data were compared using Analysis of Variance (ANOVA) and t-tests to indicate those cases where site mortality results were significantly higher than reference or control values;
- Elutriate chemistry data were compared to Federal and State water quality criteria/standards (WQC/WQS);
- SPP toxicity results were also modeled using STFATE to examine water column effects relative to 0.01 of the potential median lethal (LC_{50}) or effects-based (EC_{50}) values where applicable;
- Bulk soil/sediment chemistry data were compared to reference locations, screening levels and historical datasets using descriptive statistics and graphical methods;
- Biota to Sediment Accumulation Factors (BSAFs) were calculated;
- Tissue chemistry results were compared to U.S. Food and Drug Administration (FDA) action levels using confidence-interval testing; and
- Tissue chemistry results were compared to the reference site tissue chemistry using non-parametric and t-tests.

A description of these evaluation methods is provided below.

2.3.1 Sediment screening levels

Sediment quality investigators often use sediment-screening thresholds or benchmarks in the assessment of sediments to examine potential risk to sediment-associated receptors. Several authors have described the use of biological effect threshold values (Carr et al., 1996; Long et al., 1998a and 1998b), such as Effects Range-Low (ERL), Effects Range-Median (ERM), and other thresholds developed from a large database of bioassay, benthic ecological, and microtoxicity results. Buchman (1999) provides a summary of these biological thresholds. Table 2-2 summarizes the available ERL and ERM screening values against which CLLNG soils/sediments have been compared. Effects Range-Low quotients (ERLQs) have been calculated when CLLNG soils/sediments exceed the screening thresholds so that readers can quickly assess the level of threshold exceedences. ERLQs were calculated as follows:

$$ERLQ = C_c/ERL$$

C_c = CLLNG concentration that exceeds ERL

2.3.2 Sediment reference comparisons

Dredged material comparisons to reference sites form the basis for open water placement suitability decision-making. Since soil/sediment contaminant levels can vary naturally as a function of basic mineralogy, the metals data were first normalized to total Al. Aluminum covaries with clay mineralogy and so was used to treat the soil/sediment metals data. Although organic compounds generally correlate with total organic carbon (TOC), no relationship was found in this case, so organics data were not normalized to TOC.

For the purposes of chemical comparisons, station-to-reference (or ratio-to-reference when normalized to Al) values have been calculated and presented graphically. In this way, the magnitude of station-to-reference differences can be more easily identified. It must be emphasized however, that the chemical observations were not replicated sufficiently to provide ANOVA statistical testing, since the cost to obtain and analyze several replicate samples per site would have been prohibitively expensive. However, these station-to-reference results can be used in conjunction with the other findings to add to the weight-of-evidence in support of overall conclusions.

2.3.3 Toxicity bioassay statistics

Survival and effects data were analyzed using statistical software to determine significant differences between the project soils/sediments and the laboratory control, and between project soils/sediments and the agency selected reference site in Grand Bay. Survival data were evaluated to determine homogeneity of sample variances and normality of distribution using appropriate statistics. Data sets were subsequently evaluated using the appropriate parametric or non-parametric Analysis of Variance (ANOVA) statistic. Pair-wise comparisons were based on the appropriate statistical analysis presented in the EPA decision tree guidelines specified in individual test methods. Statistical difference was evaluated at α=0.05. For the SPP testing, acute exposure endpoints, LC_{50} and EC_{50} values were calculated and survival in the undiluted SPP solution was evaluated against the survival in the reference site diluent. Statistics were not calculated when the survival in the project sample was equal to or greater than survival experienced in the reference sample.

2.3.4 STFATE modeling

The short-term fate of dredged material placement in open water following instantaneous discharge was modeled using STFATE, a module of the Automated Dredging and Disposal Alternatives Management System (ADDAMS) described and recommended for use by the Green Book and the Inland Testing Manual (EPA/USACE, 1991; EPA/USACE, 1998).

Model input data characterizing the disposal were assumed based on likely equipment and operations to be employed. Disposal was assumed to occur from a split-hull barge. Four scenarios were modeled: one without overflow of the barge as it is loaded and one allowing for overflow, each for a 3,000 cubic yard (cy) barge and a 5,000 cy barge. Model input parameters are summarized in Table 2-3.

Standard model input parameters and those specific to the disposal site were provided by EPA Region 4 for Zone B of the Pascagoula ODMDS (Attachment 2). Model input characterizing sediment solids fraction was derived from the grain size data collected at SC123, the station representing the “worst case scenario” for toxic effects, as described in Section 4. Percent volumetric solids content for the two scenarios was assumed based on conversations with personnel at USACE’s Engineering Research and Development Center (ERDC) and engineering judgment.

The STFATE model is generally run for two scenarios: toxicity and elutriate chemistry. The toxicity scenario is run if an LC_{50} or EC_{50} is calculated. Calculation of LC_{50} and EC_{50} values is described above. The elutriate chemistry scenario is run if the dilution required to meet Federal and State WQC (dilution factor) is substantially greater than 0. The dilution factor was calculated for each analyte as follows:

Dilution Factor = (M – W)/(W – R)

M = Maximum elutriate concentration across stations

W = WQC (the more stringent between Federal and State)

R = Elutriate concentration at reference station

Under typical tiered dredged material evaluations, bulk sediment is input as a gross approximation of the chemical impacts as they relate to Federal and State WQC. If criteria are exceeded, then a more refined approach may be undertaken by replacing bulk sediment data with actual chemical elutriate results. For the purposes of this study, elutriate results were obtained from the outset and so only this refined data set has been used as the best approximation of water column conditions relative to the relevant WQC.

Because the dilution required to meet WQC was lower than that required for the bioassay SPP results, STFATE was only run for the bioassay SPP results. The most conservative test (i.e., the one that produced the lowest EC_{50} or LC_{50}) was used. In this case, the most conservative test was the *Arbacia punctulata* embryo development test. The lowest EC_{50} was 50.8% (SC123). Thus, the STFATE model was run on this worst case scenario.

Suitability decisions are based upon limiting permissible concentration (LPC) thresholds, which must not be exceeded at the ODMDS boundary at any time, and must be within acceptable levels within ODMDS four hours after the discharge. Project results have been presented relative to these limits.

2.3.5 BSAF calculations

BSAFs are defined by EPA (1995) as:

> The ratio of a substance's lipid-normalized concentration in tissue of an aquatic organism to its organic carbon-normalized concentration in surface sediment, in situations where the ratio does not change substantially over time, both the organism and its food are exposed and the surface sediment is representative of average surface sediment in the vicinity of the organism.

This definition was used in the formulation/calculation of BSAFs which may be represented by the following:

$BSAF = (C_t/L)/(C_s/TOC)$

C_t = Contaminant concentration in the tissue matrix

L = Lipid content of the organism in percent

C_s = Contaminant concentration in the sediment matrix

TOC = Sediment total organic carbon

2.3.6 Bioaccumulative tissue statistics

Tissue chemistry results that were below FDA action levels (ALs) were further evaluated relative to the ALs by calculating an upper confidence limit (UCL) at the 95% confidence level. 95% UCL concentrations were calculated using USEPA's ProUCL Version 3.0 software (Singh et al., 2004)

Pair-wise comparison analysis based on the t-test was used to statistically evaluate tissue differences relative to the reference site after assessing normality of the datasets. Variances were assumed to be heterogeneous,

and the t-test for heterogeneous variance was used. The Shapiro-Wilks test was used to test the data groups for normality. When the raw datasets were not normally distributed, the log-transformed data were tested for normality. In cases when the raw data were not normal but the log-transformed data were normal, t-tests were run on the log-transformed data. When neither the raw data nor the log-transformed data were normally distributed, the Wilcoxan Rank Sum non-parametric test was used. In cases where less than 50% of the replicate data were detected values, the data were not compared statistically. Instead, the greatest detected values in the two datasets were qualitatively compared. When 50-80% of the replicate data were detected values, the two datasets were compared using the Wilcoxan Rank Sum test.

Table 2-1 Collection dates and testing specifications for soil / sediment samples (page 1 of 2)

Sample ID	Date	Physical Tests	Metals	Non-Metals, Non-Organics	PAHs, TPH, TOC	PCB Congeners, Nutrients	Pesticides, PCB Aroclors	VOCs
PHASE 1[1]								
Sediment Grabs								
Grand Bay Reference	5-Dec-05	x	x	x	x	x	x	x
Soil Cores								
SB1U1	5-Dec-05	x	x	x	x	x	x	x
SB1L1	5-Dec-05	x	x	x	x	x	x	x
SB2U1	5-Dec-05	x	x	x	x	x	x	x
SB2L1	5-Dec-05	x	x	x	x	x	x	x
SB3U1	4-Dec-05	x	x	x	x	x	x	x
SB3L1	4-Dec-05	x	x	x	x	x	x	x
SB4U1	2-Dec-05	x	x	x	x	x	x	x
SB4L1	2-Dec-05	x	x	x	x	x	x	x
SB5U1	2-Dec-05	x	x	x	x	x	x	x
SB5L1	2-Dec-05	x	x	x	x	x	x	x
SB6U1	1-Dec-05	x	x	x	x	x	x	x
SB6L1	1-Dec-05	x	x	x	x	x	x	x
SB7U1	6-Dec-05	x	x	x	x	x	x	x
SB7L1	6-Dec-05	x	x	x	x	x	x	x
SB8U1	2-Dec-05	x	x	x	x	x	x	x
SB8L1	2-Dec-05	x	x	x	x	x	x	x
SB9U1	1-Dec-05	x	x	x	x	x	x	x
SB9L1	1-Dec-05	x	x	x	x	x	x	x
SB10U1	3-Dec-05	x	x	x	x	x	x	x
SB10L1	3-Dec-05	x	x	x	x	x	x	x
SB11U1	3-Dec-05	x	x	x	x	x	x	x
SB11L1	3-Dec-05	x	x	x	x	x	x	x
SB12U1	30-Nov-05	x	x	x	x	x	x	x
SB12L1	30-Nov-05	x	x	x	x	x	x	x
Sediment Cores								
SC1	3-Dec-05	x	x	x	x	x	x	x
SC2	3-Dec-05	x	x	x	x	x	x	x
SC3	3-Dec-05	x	x	x	x	x	x	x

Table 2-1 Collection dates and testing specifications for soil (SB) and sediment (SC) samples (page 2 of 2)

Sample ID	Date	Physical Tests	Metals	Non-Metals, Non-Organics	PAHs, TPH, TOC	PCB Congeners, Nutrients	Pesticides, PCB Aroclors	VOCs	SPP Bioassay	10-d Sediment Bioassay	28-d Bioaccumulation	Elutriate Chemistry
PHASE 2												
Sediment Grabs												
Grand Bay Reference	5-Dec-05	Analyses conducted in Phase 1								x	x	
Grand Bay Reference (resample)[2]	21-Mar-06	x	x	x	x	x	x			x		
Soil Cores												
SB7L2	6-Dec-05	x	x	x	x	x	x		x	x	x	x
SB10L2	3-Dec-05	x	x	x	x	x	x		x	x	x	x
SB12L2	30-Nov-05	x	x	x	x	x	x		x	x	x	x
Sampling Pits												
SB4U2	19-Dec-05	x	x	x	x	x	x		x	x	x	x
SB7U2	20-Dec-05	x	x	x	x	x	x		x	x	x	x
SB9U2	19-Dec-05	x	x	x	x	x	x		x	x	x	x
SB10U2	20-Dec-05	x	x	x	x	x	x		x	x	x	x
SB11U2	20-Dec-05	x	x	x	x	x	x		x	x	x	x
SB12U2	19-Dec-05	x	x	x	x	x	x		x	x	x	x
SB1U2	20-Dec-05	Analysis of composite only										
SB2U2	20-Dec-05	Analysis of composite only										
SB3U2	20-Dec-05	Analysis of composite only										
SB5U2	19-Dec-05	Analysis of composite only										
SB6U2	19-Dec-05	Analysis of composite only										
SB8U2	19-Dec-05	Analysis of composite only										
Composites[3]												
C1U2 (SB1U2,SB2U2,SB3U2)	N/A	x	x	x	x	x	x		x	x	x	x
C2U2 (SB5U2,SB6U2,SB8U2)	N/A	x	x	x	x	x	x		x	x	x	x
C3L2 (SB1L1,SB2L1,SB3L1,SB4L1)	N/A	x	x	x	x	x	x		x	x	x	x
C4L2 (SB5L1,SB6L1,SB8L1,SB9L1,SB 11L1)	NA	x	x	x	x	x	x		x	x	x	x
SC123 (SC1,SC2,SC3)	NA	x	x	x	x	x	x		x	x	x	x

[1] Phase 1 testing was conducted to aid subsequent composite decision-making. All Phase 2 test parameters were measured on the same sample homogenate.
[2] 10-d sediment bioassay testing consisted of second round of *Leptocheirus plumulosus* testing only.
[3] Composite makeup; e.g. SB1L, SB2L, SB3L and SB4L were pooled together to form a single composite.

Table 2-2 Available Sediment Screening ERL and ERM Levels (from Buchman, 1999)

Parameter	Units[1]	ERL	ERM
Arsenic	mg/kg	8.2	70
Cadmium	mg/kg	1.2	9.6
Chromium	mg/kg	81	370
Copper	mg/kg	34	270
Lead	mg/kg	46.7	218
Mercury	mg/kg	0.15	0.71
Nickel	mg/kg	20.9	51.6
Silver	mg/kg	1	3.7
Zinc	mg/kg	150	410
2-Methylnaphthalene	ug/kg	70	670
Acenaphthene	ug/kg	16	500
Acenaphthylene	ug/kg	44	640
Anthracene	ug/kg	85	1100
Benzo(a)anthracene	ug/kg	261	1600
Benzo(a)pyrene	ug/kg	430	1600
Chrysene	ug/kg	384	2800
Dibenzo(a,h)anthracene	ug/kg	63	260
Fluoranthene	ug/kg	600	5100
Naphthalene	ug/kg	160	2100
Phenanthrene	ug/kg	240	1500
Pyrene	ug/kg	665	2600
Total PCBs	ug/kg	22.7	180
4,4'-DDD	ug/kg	2	20
4,4'-DDE	ug/kg	2.2	27
4,4'-DDT	ug/kg	1	7
Alpha-Chlordane	ug/kg	0.5	6
Dieldrin	ug/kg	0.02	8
Gamma-BHC (lindane)	ug/kg	-	0.99[2]

[1] All values are represented in dry wt units.
[2] Probable Effect Level.

Table 2-3 STFATE Model Input Parameters for Disposal in Zone B of the Pascagoula ODMDS

Input Parameter	Units	Value(s)	
Current Velocity	ft/s	0.328 at 5 ft depth 0.164 at 40 ft depth	
Duration of Simulation	Sec	14,400	
Vessel Capacity	yd^3	3000, 5000	
Vessel Speed	ft/s	0	
Pre- and Post- Dump Draft	ft	20/4	
Size of Vessel	L (ft) x W (ft)	250 x 55	
Time to Empty Vessel	Sec	25	
		No overflow	Overflow
Volumetric % Solids[1]	Volume of total barge volume (%)	50	65
Sediment Fraction	Sand Silt Clay Clumps (assume 25%)[1]	0.199 0.098 0.079 0.125	0.258 0.127 0.102 0.163
Density of Site Dredging Water	g/cm^3	1.02 (average of surface and bottom water density at ODMDS)	
Chemical Elutriate Simulation Input			
Contaminant in Material	mg/L	N/A[2]	
Background Concentration	mg/L	N/A[2]	
WQC Standard	mg/L	N/A[2]	
SPP Bioassay Toxicity Test Input			
Most Sensitive Organism		*Arbacia punctulata* embryo development	
Sample/Composite with greatest impact		SC123	
LC_{50}/EC_{50}value		EC_{50} – 50.8%	
Limiting Permissible Concentration		0.508%	

[1]Assumed based on discussions with ERDC.
[2]Dilution required to meet WQC is less than that required for the bioassay SPP result.

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Appendix E-1 page 29
Figure 2-1 Proposed and Actual Soil and Sediment Sampling Locations Slip Area MPRSA/CWA Characterization

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

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Appendix E-1 page 30
Figure 2-2 Reference Sedimentation Station

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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
PROPOSED CASOTTE LANDING LNG TERMINAL
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Figure 2-3 Inshore and Offshore Water Sample Locations

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3.0 Project field effort

This section provides a chronology of field events, final station position information, and difficulties encountered during the effort. Project soil sampling commenced November 30, 2005, and the site soil/sediment sampling objectives were completed in December 2005. Water-related sampling was performed in subsequent months and another reference sediment sampling was amended to the program and collected on March 21, 2006, to complete the field program. Table 3-1 provides a summary and chronology of the field activities.

3.1 Mobilization and navigation

Several field teams were mobilized during the performance of the field program as listed below:

- Boart Longyear (Huntsville, AL) performed rotosonic soil collection;
- Mullins Construction Co. (Pascagoula, MS) conducted the track hoe excavations;
- Walters Marine (Pascagoula, MS) provided waterfront equipment and services (tug, spud barge and crane operations); and
- Brunswick Pilots (Brunswick, GA) provided vessel support for coastal and offshore water and sediment collections.
- Alpine Ocean Seismic Survey (Norwood, NJ) provided vibracoring services.

Sampling positions in upland areas were flagged for easy site recognition. Coastal locations were marked with a small surface float to assist the crane operator with vibracore frame positioning. Offshore positioning was accomplished using DGPS instrumentation as described in Section 2. Table 3-2 summarizes the actual station positions achieved.

Field observations including material recovery, visual descriptions, and penetration depth were documented on field logs and are provided in Appendix A.

3.2 Sample transfers

The analytical project team included four laboratories:

- Envirosystems, Inc (ESI; Hampton, NH) provided core processing facilities and performed bulk sediment, suspended particulate phase, and bioaccumulation bioassays;
- WestonSolutions, Inc. (Port Gamble, WA) performed specialized bulk sediment toxicity bioassays;
- GeoTesting Express (Boxborough, MA) provided physical testing services; and
- Columbia Analytical Services (Kelso, WA) provided chemical testing services.

Background samples for chemical or physical testing were transferred directly from the field to the associated laboratory. All other samples (as intact cores, bulk excavation material, sediment or water grab samples) were transferred to the processing facility (ESI) for further processing before subsequent testing commenced. All field to lab and inter-lab transfers were conducted under chain-of-custody procedures as specified in the project QAPP. These records are included in the laboratory backup appendices.

3.3 SAP deviations and difficulties encountered

Difficulties encountered during the field effort generally related to station access or sediment recovery. Several stations were moved to allow access by the drilling support truck or to avoid site obstructions, although soils and sediments were generally collected within 100 feet of the target sampling locations. Final sampling positions are depicted in Figure 2-1.

Soil cores associated with stations SB1, SB8, SB9 and SB12 were repositioned more than 100 feet from the original target location. Station SB1 was shifted to the northeast because the proposed location was not accessible by the support truck. Station SB8 was also relocated in order to avoid a former building slab and foundation. Stations SB9 and SB12 were repositioned to the northeast and southeast, respectively, in order to avoid other obstacles.

Sediment cores labeled SC1 and SC2 were collected in close proximity to original target positions, however, coastal station SC3 was repositioning due to shallow water restrictions. All soil and sediment cores reached the project depth of 46 feet below MLLW with the exception of core SC1, which reached only 38 feet below MLLW. However, this does not critically affect the suitability evaluation of this coastal area since the area has been evaluated as a single unit (SC1, SC2, and SC3 composite). As an added note, soil cores at stations SB7 and SB10 were collected from sidewall locations with location-specific project depths of 26 feet and 12 feet below MLLW, respectively. Figure 3-1 depicts the penetration depth achieved at each site sampling station.

Initially coring methods were expected to obtain sufficient material from upper and lower site strata to meet all project needs. However, the upper sand horizon was thinner than expected and so an excavation approach was mobilized within a few weeks of the coring effort to obtain the needed sample volumes. A standard track hoe was used for most excavations but because three of the stations (SB1, SB10, and SB11) were in wetlands, a track hoe with an extended arm, capable of reaching ca. 30 to 35 feet was mobilized.

In some cases excavations required further repositioning (versus cored positions) to avoid sampling constraints. Sampling pit SB9 was positioned about 120 feet to the northeast and sampling pit SB2 was relocated a short distance to the east. Sampling pit SB11 was also moved to the northwest to an area that contained less standing water.

During excavation of the sampling pits, the water table at station SB4 was within the upper sand layer creating a slurry when supporting sidewall material was removed. Recovery was therefore very poor at the sand/clay interface, creating a gap in the soil column at this station (Figure 3-1). A similar gap (of about four feet) was not collected during excavation activities at station SB3 because of track hoe arm (reach) limitations. An apparent gap of 1-2 feet is also depicted at a few other locations (Figure 3-1), but is likely related to topographic variability of the interface at these stations since some offset occurred between coring versus sampling pit positioning.

No difficulties were encountered during reference site or water column sampling efforts.

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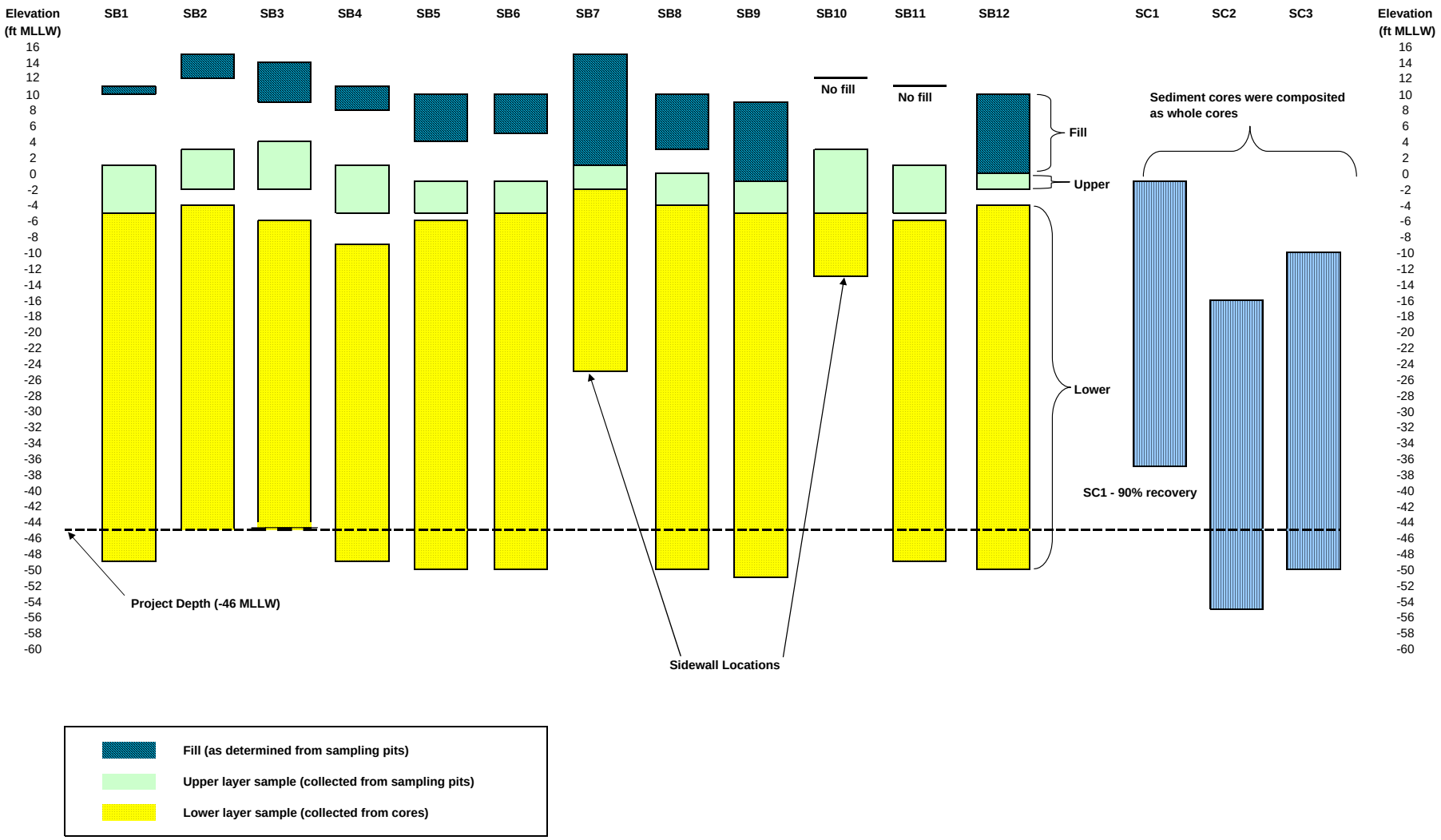
Figure 3-1 Sampling pit and soil/sediment core collection intervals, with fill layers



4.0 Results and discussion

To evaluate suitability, the site to be dredged was divided into upper and lower sampling units based on site stratigraphy. The surface fill from these sites was not included in this evaluation because it will be re-used for onsite construction and not removed for offsite placement. Suitability discussions focus on the upper sand layer (immediately below the surface fill), the lower clay-rich sediment (beneath the sand horizon), and the coastal sediment section. The lower clay-rich layer could be subdivided further, because a deeper interbedded sand and clay exists below the thick clay-rich layer, but for the purposes of this evaluation, a 2-layer model is sufficient.

Selected individual stations were pooled together to form an area-wide composite while other stations were evaluated individually. Cores collected in the coastal area were pooled together from the start. The final sample pooling recommendations provided by CE SAM and EPA are summarized in Table 4-1.

The dredged material testing program proceeded in two phases. Phase 1 rapid chemistry and grain size analyses were conducted to support sample pooling decisions and maximize full scale testing efficiency. These data are included here to incorporate the only VOC measurements made in this program and provide a complete record of the project data (Table 4-2). Physical and chemical analyses were later repeated during Phase 2 of the testing program so that all chemical, physical, and biological testing could be performed on the same sample homogenate. It is the Phase 2 dataset that forms the basis of the suitability decision-making, therefore, subsequent discussions focus primarily on the Phase 2 dataset.

The following sections present results from the three potential exposure pathways evaluated under the MPRSA; bulk sediment quality, water column impacts, and bioaccumulative potential of the site material.

4.1 Sediment physical, chemical and toxicity characteristics

Bulk sediment quality and character are based on physical, chemical and toxicity bioassay tests. A wide range of chemical parameters was examined (Table 4-2) and toxicity was determined using 10-day exposures to crustaceans and amphipods. The following sections present these findings; full laboratory backup files are provided in Appendices B, C and D.

4.1.1 Sediment texture

Two primary sediment characteristics are sediment grain size and organic carbon content. Understanding sediment particle sizes and corresponding mineralogy is critical for evaluating sediment chemistry because chemical components vary naturally based on the mineralogy present. For example, the metal concentrations associated with quartz sand are naturally much lower than those associated with fine-grained aluminosilicates (clay minerals). For this reason, direct site-to-reference comparisons are most useful if data are first normalized to aluminum. Similarly, total organic carbon (TOC) is another primary sediment characteristic. Chemical affinity to naturally occurring organic compounds, and chemical enrichment within biogenic carbon material are important processes that result in chemical enrichment within sedimentary organic carbon. For this reason, TOC is often used to normalize chemical parameters, particularly organic compounds. Both TOC and corresponding organic chemical concentrations were generally very low at the project site and so TOC normalization was not necessary.

Figure 4-1 summarizes the sediment textures observed at the site. The site is characterized by a sand-rich upper layer, underlain by material that contains greater amounts of clay. Samples collected from the upper layer typically contained more than 70% sand and only 5-15% clay. Samples collected from the lower sediment layer were generally more than 50 percent silt and clay, particularly in side-wall areas (SB7 and SB10), where project-required collection depths were relatively shallow, and deeper sand horizons were not

penetrated. One minor deviation to this trend occurred at station SB12, where the upper material contained a greater fraction of silt (ca. 50%). Overall, the coarse grained nature of the surface layer prevailed and corresponding chemical signatures were lowest across the entire site in this upper sand layer, as further detailed in the following section.

The coastal cores were pooled to form a single horizontal and vertical (surface to maximum depth) composite. On a tertiary diagram (Figure 4-1), the composite grain size results plot between the coarse grained upper and fine grained lower site stations. The Grand Bay reference site is similar to SB12 in that it contains a high percentage of silt (51%). Grain size curves for all samples are provided in Appendix B.

TOC measurements are critical for geochemical evaluations because of the chemical enrichments that occur in carbon-rich horizons. The findings from station SB4UU analyzed during Phase 1 of the testing program illustrate this fact. During the initial core processing exercises, the field team noted that the uppermost portion of material at station SB4 was moist, gray to brown material containing peat. It was this unique organic-rich feature that prompted the field team to segment this station during Phase 1 subsampling, breaking the upper layer into two sampling units. The uppermost peat-rich layer was labeled SB4UU, and the more common sand-rich horizon was labeled SB4U. When analyzed, this brownish peat-rich material from station SB4UU contained some of the highest metal concentrations for the site.

Nonetheless, TOC is relatively unimportant throughout the site as a determinant of sediment chemistry because carbon concentrations were very low with the exception of station SB4UU. This was particularly true in the upper sand layer where concentrations ranged from 0.04 to 0.24% (Tables 4-2 and 4-3). Lower layer TOC measurements were in the 0.33 to 1.21% range and coastal values, including the reference site, were measured in the range of 0.34 to 1.37%.

Detailed physical and chemical sediment measurements are provided in Table 4-2 (Phase 1) and Table 4-3 (Phase 2). In cases where values were quantified between the laboratory method detection limit (MDL) and the reporting limit (RL), the result is considered an estimate and qualified with a “J” in the data table. In cases where analyte signals were not detected, the RL value with an accompanying "U" qualifier has been provided. Unless otherwise noted, nondetected results were censored to maximize data usage for subsequent graphical data comparisons to either reference sites or screening values. In these cases, the nondetected result was replaced with one-half the RL. This censoring method is considered appropriate to match the existing data structure since the reported J-qualified data were generally a small fraction of the RL.

4.1.2 Sediment chemistry

After basic sediment properties like grain size and TOC content are understood, the chemical properties can be evaluated. As expected, clay-rich station samples, like SB7L and SB10L are generally enriched with metals relative to sandy sediment samples. Further, station SB4UU, unique in its elevated TOC content relative to the other stations, contains the highest concentration of As and Hg.

One way to address this natural co-variation between sediment properties and sediment chemistry is to normalize the results before making reference comparisons. For metals, this is typically done using Al data as a surrogate for aluminosilicate (clay) minerals. The validity of this process is underscored by the high degree of correlation observed between individual metals and Al. Table 4-4 lists metal correlation coefficients and Figure 4-2 provides example plots.

Under some circumstances, organic chemical data can be normalized to TOC measurements to factor out carbon enrichment phenomenon as discussed earlier. However, in this case sedimentary carbon is generally very low in the project samples and there is no apparent correlation (e.g., r^2=0.006 and r^2=0.05 for Phase 1 and Phase 2 Total PAHs) so TOC normalization was not performed.

There are several ways to evaluate the environmental significance of sediment-bound contaminants, and the following are incorporated in this assessment:

1) Reference comparisons
2) Regional comparisons
3) Biological thresholds
4) Bioavailablilty considerations

Site to reference comparisons. To aid in station-to-reference comparisons, ratios have been calculated and presented graphically in figures 4-3, 4-4, and 4-5. For calculation purposes, when neither station nor reference values were detected, the ratio was assigned a value of one. PCBs and pesticides were not generally detected and so were not included in this assessment.

These data illustrate that in most cases, site concentrations were lower than reference site concentrations (i.e., most values were <1.0). The most prominent deviation is apparent at station SB7U, where total PAHs and Ag exceed concentrations at the reference site. Again sedimentary Ag was normalized using Al for the site and reference station samples. Apparent Sb and Se differences that are noted between site SB11 and the reference site are in fact related to using reporting limits in the calculation. These metals were not detected in the site sample, but small amounts were detected at the reference site and so a large difference was calculated using ½ the corresponding reporting limits.

Regional comparisons. Historic regional datasets provide an excellent means for placing localized sediment chemical observations within a regional context. For this purpose, Casotte Landing slip area sediment data (CLLNG data) have been compared to NOAA's National Status and Trends (NS&T) data for four sediment monitoring sites in the vicinity of the Casotte Landing project area (Table 4-5, Figure 4-6). Data from 1984 to 1990, the most recent monitoring years available, were used for the comparison.

For consistency across datasets, non-detect values were replaced with "0" since NS&T data used this approach. NS&T data were averaged across sampling years for each station. Because replicate information is limited for many of these datasets, rigorous statistical comparisons were not undertaken. Rather, descriptive statistics have been generated and form the basis of these comparisons. To further improve the comparability of the datasets, metals data have been normalized to Al in an attempt to minimize apparent bias resulting from natural changes in mineralogy. Organics data were not normalized to TOC because there was no correlation between organics and TOC for the CLLNG data, as described above.

Metals concentrations in the Casotte Landing dataset were generally comparable to the NS&T dataset, indicating that dramatic changes in sediment metal chemistry have not occurred since the earlier study (Figure 4-7). In fact, metals concentrations were generally lower in slip area sediments than in NS&T sediments.

PAH, PCB, and pesticide comparisons are provided in Figure 4-8. PAH concentrations were generally lower in the Casotte Landing slip sediments than in the NS&T sediments, although variability was high within each dataset. PCBs and pesticides were generally not detected in the CLLNG sediments, and when they were detected, they were at lower concentrations than in the NS&T site sediments.

Biological effect benchmarks. Reference or regional sediment data comparisons provide an excellent way to identify contaminants that are elevated above regional or background concentrations, but the environmental significance of such elevated concentrations requires further assessment. One way to evaluate this significance is to compare site data to biological effect benchmarks such as Effect Range Low (ERL) or Effect Range Median (ERM) thresholds established for this purpose (e.g., Buchman, 1999). ERL and ERM values are provided in Table 2-2. In relation to these benchmarks, only a few CLLNG project samples exceed the lowest (ERL) threshold and these exceedances are minor. Arsenic and Hg contained in the sediment

collected from station SB4UU each exceeded corresponding ERL values by a factor of 1.1. Acenaphthene measured in the material collected from station SB7U exceeded the corresponding ERL by a factor of 1.6. None of the samples analyzed during the Phase 2 testing program exceeded even the lowest (ERL) benchmark.

Overall, while selected parameters were measured above reference or background concentration levels, these concentrations are still very low relative to biological effect benchmarks. The few values that exceed ERL thresholds are printed in boldface in Table 4-2. Corresponding quotients (ERLQ), derived by dividing the sediment chemical concentration by the corresponding chemical ERL value, are indicated in parentheses following the exceeded ERL result.

Contaminant bioavailability. When assessing sediment quality, the bioaccumulative potential of sediment contaminants is another important consideration. The most rigorous way to address bioaccumulation is to perform bioaccumulation bioassays as was done during this study. These findings are discussed in a later section.

In the case of metal contaminants, the relationship between sedimentary sulfides and sulfide-forming heavy metals provides information for making bioavailability predictions. If available sulfide concentrations are sufficiently high relative to the available metal concentrations, then very insoluble metal sulfides will precipitate from solution, effectively immobilizing the metals and rendering them unavailable to the resident biology. While this is a simpler approach than bioaccumulation studies, these measurements were made during the testing program as another line of investigation and so related data are presented in this section.

To evaluate the sedimentary sulfide to metal relationship, the ratio of the sum of simultaneously extracted metals (Cd, Cu, Pb, Hg, Ni and Zn) to acid volatile sulfide (SEM/AVS) has been calculated and provided in Tables 4-2 and 4-3. Available sulfide was not detected in most CLLNG samples and so existing SEM metals could potentially be available for biological uptake. Only CLLNG stations SC123 (coastal cores), SB3U, SB3L, SB6L, SB7L and the reference site contained measurable AVS concentrations. However, results from this simplified approach are of less diagnostic value than the actual bioaccumulation tissue chemistry results and associated biota to sediment accumulation factors presented in subsequent sections.

4.1.3 Whole sediment toxicity

Bulk sediment bioassays are an important part of the overall suitability testing framework for ODMDS consideration and agency guidance specifies that a filter feeder, a deposit feeder, and a burrowing organism be represented in the assay. The crustacean *Americamysis bahia* and the crustacean amphipod *Leptocheirus plumulosus* were selected in this study to represent these feeding strategies. *A. bahia* is a filter and deposit feeder that spends much of its time in the water above the sediment-water interface. The amphipod *L. plumulosus* is a burrowing filter and deposit feeder that builds and lives in a tube-like structure within the sediment.

The amphipod is particularly useful for evaluating the potential effects on organisms living and feeding within the sediment matrix given its burrowing and deposit feeding habits. However, there are some benthic habitats (i.e. sediment types) that are not hospitable to amphipods. For example, amphipods are unable to burrow and build tube structures within sediment with a texture at either end of the grainsize spectrum. In fact, experiments conducted at ERDC have identified adverse amphipod effects when placed in sediments of this nature (T. Bridges, pers. comm).

Casotte Landing test materials are unique in that a thick layer of dense, clay-rich sediment is present below a compacted sand layer. Furthermore, much of the material is carbon-poor (low TOC), is deeply buried, and has been separated from the marine environment for a very long time. These are important characteristics because it has been demonstrated that an established marine microbial assemblage and sufficient organic

carbon as a food source are essential when conducting toxicity bioassays. If these conditions are not met, then spurious test organism mortality can occur (Word et al., 2005).

Casotte Landing material therefore required additional sediment bioassay testing to evaluate the potential effects of the sediment texture and the sterile, nutrient-poor nature of the sediments. As a starting point, the standard toxicity bioassays were conducted with the shrimp and amphipod using standard handling procedures. Survival of the shrimp was very good in all samples but, as expected, higher than normal mortality was observed in many of the amphipod tests. An experimental framework was next developed in consultation with CE SAM and EPA to evaluate the sediment sterility and lack of an adequate carbon food source (Attachment 1). A complicating factor was identified in that amphipods exposed to the reference site, not tested since hurricane Katrina ravaged the area, also exhibited a higher than expected rate of mortality.

The testing framework was developed to answer the following questions:

- Although the amphipods survived very well in lab control sediments, was the batch of organisms compromised in some way, leading to the lower than expected observed survival, particularly in the Grand Bay reference sediment?
- Would conditioning the sediments for a few weeks and allowing the marine microbes to be established be sufficient to enhance amphipod survival?
- Is the (low) sediment TOC bioavailable to benthic organisms or is the lack of bioavailable TOC related to the observed mortality?

To address the question of amphipod quality, the tests were re-run using archived sediment from each of the stations. The remaining questions have been examined by other authors. The issue of sterility due to a lack of marine microbial community was addressed by Word et al. (2001) in an evaluation of proposed dredged material from a freshwater habitat, Bahia Lagoon, adjacent to the Petaluma River, California, to a marine disposal site. After allowing the sediments to acclimate to marine conditions, amphipod and polychaete worm assays were successfully conducted and the agencies determined that the sediment was suitable for beneficial use in the marine environment.

The issue of low usable TOC in sediments was addressed by Pinza, Mayhew and Word (Pinza et al 1996) during an evaluation of deeply buried sediment from Richmond Harbor, California as part of a dredged material evaluation project for the USACE San Francisco District. This project required evaluating deeply buried material similar to that of Casotte Landing for placement in the marine environment. Like the Casotte Landing material, the Richmond Harbor material contained little/no contaminants, but it was hard packed and contained very low TOC. Concerns were raised with the agencies about the nutrient poor nature of the sediments, and with agency approval, the investigators provided a minimal food source (TetraMin™ and *Enteromorpha* sp algae) to the test organisms so that chemical toxicity could be distinguished from organism starvation. Under these conditions, the test organisms interacted with the test sediment in a normal manner and survival in the test treatments increased substantially. The agencies reviewed the successful test results and determined that sediment from Richmond Harbor was suitable for unconfined marine placement.

In addition, a number of standardized protocols recognize the need to meet the nutritional requirements of test organisms by providing a minimal food source (e.g., TetraMin™) during the exposure period. This includes chronic toxicity tests with the amphipod *L. plumulosus* (USEPA 2001) and the polychaete, *Neanthes arenaceodentata* (Puget Sound Estuary Protocols, 1995; Bridges et al., 1997). A TOC study conducted during the development of the chronic *L. plumulosus* assay found no significant effects between TOC concentrations of 1% to 7%; however, below 1% TOC, significant decreases in survival, growth and reproduction were observed (DeWitt et al. 1997 as cited in USEPA, 2001). This is particularly relevant at Casotte Landing where sedimentary TOC is very limited and of questionable value to organisms.

To fully answer these questions as they relate to Casotte Landing sediments, the following three experimental treatments, modeled after the USACE Richmond Harbor and other studies, were undertaken with CE SAM and EPA approval:

Treatment I – Archived site sediments and freshly collected Grand Bay reference sediment were tested with a new batch of test organisms.

Treatment II – Archived site sediments were conditioned, or "acclimated" to establish a marine sediment microbial assemblage. In some cases, samples used for the 28-day bioaccumulation test were re-used as it was acknowledged that their conditioning would be complete. In other cases, untested archive sediments were conditioned prior to testing. For these sediments, ammonia levels were measured during the conditioning process to monitor microbial activity.

Treatment III – Previously conditioned sediment was supplemented with TetraMin™ in a manner similar to the EPA protocol for the chronic test with the amphipod, *L plumulosus* (USEPA, 2001). The food ration was set at two feedings in 10 days to minimize the amount of food in the test system.

For each treatment, the freshly collected reference sediment was tested, but since the reference sediment was taken directly from the marine environment, it was not conditioned for the tests. TetraMin™ supplements were added to the reference sediment in the Treatment III scenario for consistency. The tests were conducted in three batches, each with separate lab control samples and reference samples.

Test Results

The mysid shrimp survival is summarized in Table 4-6a. Tables 4-6b and 4-6c summarize the amphipod survival results for various treatment scenarios. Laboratory bench sheets are included in Appendix D and supporting statistics are summarized in Tables 4-7a and 4-7b. One lab control failure (<90% survivorship) occurred during the amphipod testing (batch 2) and the samples in the batch were re-tested.

Average *A. bahia* survival in the Grand Bay reference site sample was 90% and survivorship in site sample exposures ranged from 73% to 98%. The lowest survivorship (73%) was measured for *A. bahia* exposed to SB12L2, although there was no statistical difference from the reference sample and survival in 4 out of 5 replicates was within the same range as the reference replicates. The statistical evaluation for *A. bahia* is provided in Table 4-7a.

L. plumulosus whole sediment assay results are summarized in Table 4-6b, which includes results for the original amphipod assay and the subsequent experimental assays, labeled Treatment I, II, and III. As discussed previously, a review of the initial test results by EPA and CE SAM identified unusually low survival for Grand Bay reference sediment relative to historic testing results. Therefore, a second Grand Bay reference sample was collected and included in the additional experimental assays.

Treatment I results. Survival in the archived slip area station tests ranged from 8% in SC123 to 60% in SB10L. Survival in the archived Grand Bay reference site was only 31%, confirming that the low survival observed in the initial testing of this material was probably not related to the general health of the test organism culture. Furthermore, survival in the freshly collected Grand Bay reference sample (obtained March 2006) ranged from 52% to 81% in the three test batches. Because this level of mortality is uncommon for this reference site, hurricane Katrina or other "natural" phenomenon may have negatively altered the site. Overall, the results of testing with the archived site samples are generally consistent with the reduced survival observed in the initial *L. plumulosus* assay.

Treatment II results. *L. plumulosus* survival in the acclimated sediment from slip area stations ranged from 16% in SB4U to 62% in SB12U (Table 4-6b) indicating that conditioning these largely sterile deep sediments alone is insufficient to provide a suitable environment for the amphipods.

Treatment III results. Survival in the Grand Bay reference sample with the addition of food ranged from 81% to 87% representing a survivorship increase above the same reference sample without TetraMin™ added (52% to 81%). Survival in the acclimated slip area station sediments with the addition of food ranged from 62% in C3L2 to 88% in SB7L representing a significant increase over the archived and acclimated sediments, implying that a lack of food is likely responsible for the observed mortality in these treatments. Furthermore, observations made by laboratory staff indicate that the *L. plumulosus* in the acclimated and fed treatments were actively burrowing and interacting with the sediments and surviving test organisms appeared healthier (e.g., better color, more active) than those observed in the un-fed treatments which were thinner and slow moving.

Statistical comparisons presented in Table 4-7b indicate that four samples (C2U2, SB12U2, C3L2, and C4L2) prepared according to Treatment III were statistically different from the batch-specific Grand Bay reference sample. However, survival in all slip area stations is within 20% of the batch specific reference sample, which is the critical threshold for identifying acutely toxic conditions in amphipod bioassay results (EPA/USACE, 1998). Based on these results the material is not considered toxic to marine benthic organisms. However, it is nutrient poor and benthic infauna would begin to colonize the surface sediment in the natural marine environment only after biogenic carbon accumulated at the sediment surface from the overlying water column.

The Treatment III bioassay was considered successful for several reasons:

- Amphipod survival was greater than 90% in the lab controls;
- Amphipods behaved normally; they burrowed into the sediment and showed no signs of reacting to the sediment itself; and
- There was no sign of food or detritus on the sediment surface, indicating that the minimal TetraMin™ amount provided was appropriate.

Based on these results, and the lack of significant levels of chemical contaminants in the sediment, it is apparent that it was a lack of food (e.g., bioavailable organic material) in the station samples, and not chemical stressor(s) that caused decreased survival in the original assay.

Ancillary test information. During the amphipod bioassay, the organisms were closely observed to ensure that they were interacting with the test sediment normally. Figure 4-12 shows an example of the sediment surface in an amphipod test chamber that received TetraMin™. This indicates that the food ration was minimal and that the organisms were burrowing and behaving normally when exposed to the test material. Biologists at the testing laboratory also noted that surviving organisms associated with Treatment I and II were smaller than normal and slow moving. This “lethargic” character, as described by the testing staff, is contrary to normal test organism appearance, which is typically either healthy looking (normal size and active) or dead. It was the opinion of the testing staff that starvation would produce the lethargic characteristic and lack of growth.

Ancillary data, including bioassay TOC data and the physical and chemical data associated with the Grand Bay reference sample collected in March 2006, are provided in Appendix E.

Overall, the results of the whole sediment toxicity tests with *A. bahia* indicate that the Casotte Landing sediments collected are not acutely toxic relative to the associated reference sediment. On the whole, Treatments II and III simulate the natural sequence of events when marine sediments are disturbed or scoured to a depth where surface microfauna do not exist and food for benthic organisms is initially limited. During the natural recovery process, the typical microbial community would re-establish itself within days/weeks (as observed in laboratory studies; Word et. al., 2005) and, in quiescent areas, a natural accumulation of fresh biogenic material raining down from the overlying water column would occur. The whole sediment toxicity tests with *L. plumulosus* in Treatment III indicate that the Casotte Landing sediments are not acutely toxic, relative to the associated reference sediment.

4.2 Water column evaluations

Water column evaluations performed in this study incorporated the analysis of chemical elutriate samples and suspended particulate phase bioassay tests. The full suite of chemicals were measured in the elutriate mixtures to evaluate possible dredged material effects on water quality at the ODMDS. Suspended particulate phase toxicity bioassays included three test species: crustacean, fish, and sea urchin larvae. Acute toxicity as well as very sensitive (larvae) developmental effects have been evaluated.

4.2.1 Elutriate chemistry

Table 4-8 summarizes elutriate chemistry results obtained after mixing the site materials with Bayou Casotte seawater to simulate dredged material mixing at the ODMDS. Evaluation of water quality parameters is an important part of determining whether dredged material is suitable for placement at an ODMDS and so maximum chemical elutriate results measured among the full station set are provided along with MS State and Federal Water Quality Criteria (WQC) in Table 4-9.

Overall, the prepared elutriate seawater samples contained chemicals at concentrations that were very low relative to the WQC. PCBs and pesticides were not detected in any of the seawater samples. With the exception of naphthalene, which was measured at 0.26 ug/L in sample C2U2, all measured PAHs were either undetected or detected as estimates (J-qualified) below laboratory reporting limits. All measured organic compound concentrations (including naphthalene) where well below relevant water quality standards.

Metals were evaluated relative to dissolved fractions, since MS State criteria are based on this aqueous phase. Total (dissolved + particulate) Hg was also evaluated. Most metals and non-metals/nutrients were also measured in elutriate seawater mixtures at concentrations below water quality standards. Exceptions included phosphorous, Ni, and Hg.

Phosphorous contained in the elutriate mixture prepared from the station SB10U sample was in excess of the water quality standard by a factor 2. Nickel contained in the seawater elutriate prepared from station SB10L exceeded water quality standards by a factor of 2. Mercury contained in the sample prepared from station SB11U was measured above the State standard by a factor of 16 but was below the Federal WQC.

With respect to elutriate Hg data, it is important to note that the method specified rendered a laboratory reporting limit above the water quality standard by a factor of 8. Furthermore, measured Hg concentrations were all within a factor of 2 of the reporting limit. However, because chemical measurements of the background conditions require greater sensitivity, an alternate method (EPA Method 1620), providing a reporting limit in the sub part per trillion range, was employed to measure Hg at the ODMDS.

4.2.2 SPP bioassay results

Water column SPP tests were conducted in several batches on the full set of Casotte Landing slip area sediments. Batches were started on February 1, 2, 6, and 8, 2006. A re-test of the February 2, 2006 (Batch 2) and February 8, 2006 (Batch 4) *A. punctulata* assays were required because fertilization was insufficient. The assays were re-initiated on February 11, 2006.

The tests showed little or no toxicity to the crustacean *A. bahia* (with the exception of minor toxicity in SB7L2) or fish *Menidia beryllina*. However, the SPP mixtures from selected sites were sufficiently toxic to the sea urchin larvae *Arbacia punctulata* to allow calculation of median lethal and effects concentration values (LC_{50} and EC_{50}, respectively). Tables 4-10a, 4-10b, and 4-10c summarize species survivorship in the various SPP mixtures. Table 4-11 lists LC_{50} and EC_{50} values and supporting statistics are summarized in Tables 4-12a, 4-12b, and 4-12c. Laboratory bench sheets are included in Appendix D.

Laboratory Control Findings

Americamysis bahia. After 96 hours of exposure, survival in the laboratory controls was 98%, 98%, 92% and 98% for Batches 1 through 4, respectively (Table 4-10a). All laboratory controls met the minimum test acceptability criterion of 90% survival. Survival in the dilution water control was 94%, 98%, 98%, and 96%, indicating that water from the disposal site used to dilute the suspended particulate phase solutions had no adverse impact on the outcome of the assays.

Menidia beryllina. After 96 hours of exposure, *M. beryllina* survival in the laboratory controls was 100%, 100%, 98% and 98% for Batches 1 through 4, respectively (Table 4-10b). All laboratory controls met the minimum test acceptability criterion of 90% survival. Survival in the dilution water control was 98%, 98%, 98%, and 90%, indicating that water from the disposal site used to dilute the suspended particulate phase solutions had no adverse impact on the outcome of the assays.

Arbacia punctulata. The *A. punctulata* development assays were terminated after it was determined that at least 90% of the embryos in the laboratory control had reached the pluteus developmental (larval) stage. Three batches of the *A. punctulata* assay were conducted. The mean embryo survival in the laboratory controls was 93% in all three batches, with 92%, 90%, and 92% of the embryos exhibiting normal development for Batches 1 through 3, respectively (Table 4-10c). These results exceed minimum test acceptability criteria of 90% embryo survival and 70% normal development.

The mean embryo survival in the diluent control was 95%, 65%, and 81% for Batches 1 through 3, respectively. The mean normal development in the diluent control was 94%, 62%, and 76% for Batches 1 through 3, respectively.

Project site results

Undiluted SPP solutions prepared from a limited number of Casotte Landing slip area sediments had a significant impact on *A. bahia* and *A. punctulata*, while *M. beryllina* did not show any indication of a toxic effect (i.e., LC_{50} > 100%; Table 4-11). Survival of *A. bahia* was sufficiently reduced to result in an LC_{50} value of 99.2% for the station SB7L sample. SPP solutions prepared from station SB4U and SB7U had a significant impact on survival and development of *A. punctulata*, with LC_{50}s of 89% and 68%, respectively. Development EC_{50} (median effective concentration) values for *A. punctulata* were 68%, 60% and 51% for stations SB4U, SB7U and SC123, respectively.

The first causative considerations in SPP toxicity generally relate to basic water quality conditions. Low dissolved oxygen or high ammonia levels unrelated to material contaminants can adversely affect the test organisms. In the case of *A. punctulata*, TSS can be a factor since these organisms are small spherical swimmers. In these SPP samples, basic water quality parameters were within the normal range during the tests where toxicity was observed. Ammonia levels monitored during the course of the assays were low (generally below 2 mg/L), indicating that ammonia was not likely to be a significant stressor in the SPP solutions. The highest ammonia levels measured during the assay were recorded for the SC123 sample (up to 8.7 mg/L in the *A. punctulata* assay), but these levels are still below the Federal acute WQC, which is approximately 27 mg/L at test condition salinity (30 ppt), pH (7.3), and temperature (20°C).

4.3 Bioaccumulation potential

This section presents Biota-Sediment Accumulation Factors (BSAFs) calculated for Casotte Landing materials and the bioaccumulation bioassay tissue testing data to address Casotte Landing bioaccumulation considerations. A subset of project parameters was measured in exposed tissue material, given the (clean) sediment chemistry results. The final CE SAM and EPA tissue analysis recommendations are summarized in Table 4-13.

4.3.1 BSAF findings

Since the BSAF model is appropriate for hydrophobic organic compounds (HOCs), only PAHs have been included in this assessment. Furthermore, only station SB7U required PAH investigation per agency recommendations. Table 4-14 summarizes the PAH BSAFs calculated for Station SB7U and the reference sediments. BSAFs for detected PAH compounds were generally greater at the reference station than at SB7U. The greatest BSAF was 0.78 for indeno(1,2,3-cd)pyrene, far below the value of 4 which is often used to evaluate HOC risk associated with dredged materials (EPA and USACE, 1991). Based on BSAF calculations, the accumulation of PAHs in marine tissues exposed to Casotte Landing sediments would not be significant.

4.3.2 28-day bioaccumulation bioassay

To evaluate bioaccumulation potential of Casotte Landing sediments, the clam *Macoma nasuta* and the worm *Nereis virens* were exposed to material from the project stations. The clam assay was initiated on February 2, 2006 and the worm assay was started on February 15, 2006. Laboratory bench sheets are included in Appendix D. *M. nasuta* and *N. virens* survival following a 28 day exposure to Casotte Landing sediments are provided in Tables 4-15a and 4-15b.

Average survival for the clam assay was 95% in the laboratory control and 92% in the reference sample. Mean survival for the worm assay was 93% in the laboratory control and 95% in the reference sample. The clam survivorship in the project samples ranged from 87% in composite C3L2 to 96% in SB4U and SB7U. Worm survival ranged from 75% associated with samples C3L2 and SB7L, to 95% survival in station SB10L sample. Overall, clam and worm survival following a 28-day exposure period was very good relative to reference.

Test organism tissues were analyzed for the chemical parameters listed in Table 4-13 to evaluate the bioaccumulative aspect of project material. The chemical results are provided on a wet weight basis in Tables 4-17 and 4-18.

FDA action limit comparisons. Tissue chemistry data were compared to FDA action limits for those compounds that have established limits. In this case, Hg is the only FDA-relevant parameter. The Hg data were compared to the FDA threshold using upper confidence limit (UCL) statistical procedures. FDA limits are listed in Table 4-19, UCL test results are summarized in Table 4-20.

The Hg UCLs for project site tissues were substantially less than the FDA action level (more than one order of magnitude less for *N. virens* and more than two orders of magnitude less for *M. nasuta*). Furthermore, Hg concentrations in the site-exposed tissues were generally the same as those in the reference-exposed and unexposed tissue concentrations, confirming that Hg bioaccumulation within site-exposed tissues is not an ecological or human health concern.

Reference site comparisons. Site-exposed tissue data were compared to reference-exposed tissue data using t-tests whenever the concentration mean values for site-exposed tissues were greater than those of the mean reference-exposed tissue. Non-parametric tests were used whenever raw or log transformed data where not normally distributed (medians were compared for non-parametric tests). If less than 50 percent of the data were detected, then statistical analysis was not performed. Statistical significance of those cases where contaminants in the site-exposed tissues exceeded reference is summarized in Tables 4-21 and 4-22. Raw statistical data are provided in Appendix E.

M. nasuta and *N. virens* tissue samples were analyzed for a wide range of chemical parameters although many were not detected, particularly in the worm tissue. Of the detected chemical parameters, many were at concentrations statistically equivalent to or lower than reference-exposed tissues, and these are summarized in Table 4-23. In the final analysis, the concentrations of five metals and seven PAH compounds were detected in site-exposed tissues at statistically greater levels than in reference-exposed tissues. To further evaluate the importance of these differences, the mean concentration values associated with each of these statistical conditions are provided in Table 4-24.

The metals As, Cd, Ni, Pb, and Sb were present at significantly greater concentrations in site versus reference-exposed tissues in one or more tissue types (clams or worms). In each case, however, these metals were at equivalent or higher concentrations in unexposed tissue material. The unexposed tissue material in this case is tissue from the same batch of test clams or worms used in the bioassay, and represents the concentration of metals in the tissue at the start of the test.

The PAHs 2-methylnaphthalene, anthracene, chrysene, fluoranthene, fluorene, phenanthrene, and pyrene were detected in SB7U-exposed tissues and measured at concentrations that were significantly greater than reference-exposed tissue although most of these comparisons were made using data that were reported below the laboratory reporting limit. Furthermore, all PAHs at statistically greater concentrations in SB7U-exposed worm tissue relative to reference-exposed worm tissue were below unexposed worm tissue levels. Only clam tissue contained selected PAH compounds that were at higher concentrations than those in the unexposed clam tissue and of these, only fluoranthene and phenanthrene were consistently reported above laboratory reporting limits. Pyrene was detected in clam tissue above laboratory reporting limits in just two of the five SB7U replicates.

Critical body residue (CBR) information available through ERDC provides an excellent way to evaluate the biological importance of contaminants found in animal tissues. For this analysis, the Environmental Residue-Effects Database (ERED) was searched for all marine organisms that have reported No Observable Effect Concentration (NOEC) data for the chemical parameters of interest. NOECs related to behavioral, reproductive, physiological/developmental, growth, and lethal effects are provided in Table 4-25. In cases where marine organism data were not available for a particular parameter of interest, freshwater animal data were obtained from ERED.

In the final analysis of station SB7U, the compounds anthracene, chrysene, fluoranthene, fluorene, phenanthrene, and pyrene were measured in clam tissue at concentrations greater than in the reference-exposed and unexposed tissue. However, the available CBR data indicate that the observed concentrations are two to three orders of magnitude below available NOECs for marine organisms. Since corresponding marine organism data were not available, freshwater organism data were used to evaluate pyrene and this compound was also measured at concentrations within NOEC levels. Thus, based on available CBR information, the observed PAH concentrations measured in SB7U-exposed tissues did not accumulate to levels that would negatively affect marine organisms.

Table 4-1 Agency provided sample analysis recommendations

Site identifier	Sample ID
Stations tested individually	
Upper site material	
SB4U	SB4U2
SB7U	SB7U2
SB9U	SB9U2
SB10U	SB10U2
SB11U	SB11U2
SB12U	SB12U2
Lower site material	
SB7L	SB7L2
SB10L	SB10L2
SB12L	SB12L2
Stations pooled for testing	
Upper site material	
SB1/SB2/SB3	C1U2
SB5/SB6/SB8	C2U2
Lower site material	
SB1/SB2/SB3/SB4	C3L2
SB5/SB6/SB8/SB9/SB11	C4L2
Coastal site material	
SC1, SC2, SC3	SC123

Table 4-2 CLLNG Phase 1 Chemistry and Grain Size Results

	Sample ID	SB1U1	SB1L1	SB2U1	SB2L1	SB3U1	SB3L1	SB4UU1	SB4U1	SB4L1	SB5U1	SB5L1	SB6U1	SB6L1A	SB6L1B	SB7U1	SB7L1
Sampling Interval Upper Limit (bgs)	**Feet**	**10**	**15**	**15**	**19**	**18**	**20.5**	**10**	**15**	**20**	**10**	**15.5**	**11**	**15**	**15**	**14.5**	**18**
Sampling Interval Lower Limit (bgs)	**Feet**	**15**	**60**	**19**	**60**	**20.5**	**60**	**15**	**20**	**60**	**15.5**	**60**	**15**	**60**	**60**	**18**	**40**
Chemical Name	**Unit**																
PHYSICAL TESTS																	
MOISTURE CONTENT	%	22	45	20	38	22	38	96	17	38	19	39	20	44	44	23	65
GRAVEL	%	0	1	0	0	0	0	0	0	1	0	2	0	1	3	0	0
SAND	%	63	37	69	55	54	55	34	65	47	61	42	66	45	46	78	11
SILT + CLAY	%	37	62	31	45	46	45	66	35	52	39	56	34	54	51	22	89
TOTAL ORGANIC CARBON	%	0.13	0.85	0.09	0.66	0.08	0.89	5.40	0.08	0.56	0.17	1.21	0.17	0.86	1.01	0.11	0.89
METALS																	
ALUMINUM	mg/kg	21800	54700	20900	40600	26300	41100	37100	14000	53000	13000	43600	14100	45400	45900	21500	80300
ANTIMONY	mg/kg	0.05 J,N	0.06 N	0.05 U,N	0.05 N	0.05 N	0.04 J,N	0.08 N	0.06 U,N	0.11 N	0.05 J,N	0.06 J,N	0.08 N	0.06 N	0.06 N	0.04 J,N	0.09 N
ARSENIC	mg/kg	2.28	5.26	1.14	4.62	2.28	4.76	**9.13** *	0.68 *	4.97 *	1.15 *	5 *	1.16 *	7.63 *	4.79 *	0.93 *	7.38 *
BERYLLIUM	mg/kg	0.103	0.803	0.068	0.621	0.166	0.753	0.658	0.07	0.722	0.057	0.734	0.084	0.689	0.715	0.053	1
CADMIUM	mg/kg	0.028 J	0.134	0.028 J	0.107	0.032 J	0.113	0.09	0.024 J	0.093	0.041 J	0.137	0.041 J	0.123	0.116	0.026 J	0.216
CHROMIUM	mg/kg	9.04	14.3	5.74	12.1	11	13.8	14.8	5.43	9.86	47.1	12.5	13.9	12.1	16.9	13.4	17.7
COPPER	mg/kg	1.12	7.54	0.68	5.77	1.62	5.27	3.67	0.79	7.22	1.04	7.53	1.2	8.08	7.54	0.86	13.7
LEAD	mg/kg	4.71	10.2	3.78	8.41	5.89	8.52	10.2	2.98	8.7	2.74	9.49	3.85	10.4	10.1	3.81	15.6
MERCURY	mg/kg	0.009 J	0.022	0.019 U	0.018 J	0.019 U	0.019 J	**0.158**	0.019 U	0.019 J	0.009 J	0.028	0.02 U	0.024	0.029	0.018 U	0.191
NICKEL	mg/kg	1.98	11	1.1	9.05	1.92	9.54	7.08	1.45	8.26	1.7	10.8	3.23	11.2	11.2	1.79	17.8
SELENIUM	mg/kg	0.4 J	0.4 J	0.3 J	0.4 J	0.4 J	0.5 J	1.2	0.3 J	0.6 J	0.6 J	0.6 J	0.3 J	0.6 J	0.3 J	1.2 U	0.9 J
SILVER	mg/kg	0.011 J	0.038	0.007 J	0.029	0.013 J	0.025	0.033	0.023 U	0.03	0.008 J	0.031	0.009 J	0.037	0.03	0.028	0.058
THALLIUM	mg/kg	0.085	0.182	0.041	0.148	0.077	0.185	0.129	0.05	0.125	0.034	0.132	0.053	0.154	0.166	0.037	0.216
ZINC	mg/kg	3.71	31.8	2.21	26.8	5.51	30	15.4	4.5	26.4	4.7	32.3	5.5	31.9	32.8	3	48.7
AVS/SEM																	
CADMIUM	umol/g	0.0006 U	0.002	0.0006 U	0.001	0.0006 U	0.001	0.0008 U	0.0006 U	0.002	0.0006 U	0.002	0.0006 U	0.002	0.002	0.0006 U	0.003
COPPER	umol/g	0.006	0.090	0.005	0.074	0.013	0.019	.003 U	0.005	0.060	0.013	0.093	0.008	0.094	0.098	0.008	0.170
LEAD	umol/g	0.012	0.031	0.009	0.028	0.012	0.016	0.030	.0058 U	0.023	0.009	0.028	0.009	0.035	0.031	0.011	0.048
MERCURY	umol/g	0.00005 U	0.00006 U	0.00004 U	0.00005 U	0.00004 U	0.00005 U	0.00007 U	0.00005 U	0.00005 U	0.00004 U	0.00006 U	0.00005 U	0.00007 U	0.00006 U	0.00005 U	0.00008 U
NICKEL	umol/g	0.015	0.111	.003 U	0.095	.003 U	0.051	0.041	0.005	0.082	0.017	0.111	0.031	0.112	0.123	0.017	0.170
ZINC	umol/g	0.031	0.413	0.003	0.332	0.015	0.340	0.138	0.020	0.326	0.025	0.441	0.067	0.427	0.372	0.017	0.594
TOTAL METALS	umol/g	0.064	0.646	0.017	0.530	0.040	0.427	0.209	0.030	0.492	0.063	0.674	0.115	0.671	0.625	0.053	0.985
ACID VOLATILE SULFIDE	umol/g	0.028 U	0.028 U	0.028 U	0.028 U	0.037	0.025 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.225	0.031 U	0.031 U	0.031 U
SEM:AVS RATIO	umol/g	4.6	46.2	1.2	37.9	1.1	17.1	13.4	1.9	31.5	4.0	43.2	7.4	3.0	40.1	3.4	63.1
NONMETALS/OTHER																	
SULFIDE	ug/kg	0.8 U	11.5	0.21 J	6.4	2.9	8.6	9.6	2.1	2.4	1.0 U	17.1	1.0 U	10.9	11.6	3.4	25.9
AMMONIA	ug/kg	1.3	6.7	1.7	5.9	2.6	6.6	60.9	2.3	4.8	1.3	11.8	2.2	7.0	6.7	26.8	9.6
NITRATE	ug/kg	0.03 J	0.06 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
NITRITE	ug/kg	0.04 J	0.03 J	0.03 J	0.04 J	0.03 J	0.03 J	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
NITRATE + NITRITE	ug/kg	0.07 J	0.09 J	0.5 U	0.04 J	0.5 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
NITROGEN, KJELDAHL, TOTAL	ug/kg	86	385	82	269	113	359	2340	54.8	304	75	398	98.3	631	343	150	554
PHOSPHOROUS	ug/kg	13.0	88.2	11.1	93.8	8.1	82.5	53.3	6.4	90.6	13.1	96.6	11	140	130	8.8	212
CYANIDE	ug/kg	0.2 U	0.2 U	0.2 U	0.2 U	0.06 J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
OXIDATION REDUCTION POTENTIAL	MILLIVOLTS	91.4	66.3	110	35.8	94.9	64.5	44.9	96.2	80.1	85.8	61.3	99.0	35.1	22.5	74.0	-79.5
PH	pH UNITS	7.57	8.09	7.26	7.73	7.42	7.43	8.01	7.77	8.10	7.51	7.90	8.77	7.82	7.64	9.89	7.44
PAHs																	
1-METHYLNAPHTHALENE	ug/kg	3.1 U	3.7 U	0.36 J	0.39 J	3.1 U	0.41 J	0.83 J	0.47 J	0.67 J	0.51 J	0.69 J	0.46 J	2.5 U	0.58 J	22	0.83 J
2-METHYLNAPHTHALENE	ug/kg	3.1 U	3.7 U	0.58 J	0.60 J	3.1 U	0.55 J	1.3 J	0.65 J	1.1 J	0.72 J	0.93 J	0.74 J	2.5 U	0.85 J	29	1.2 J
ACENAPHTHENE	ug/kg	3.1 U	3.7 U	3.0 U	3.5 U	3.1 U	3.4 U	0.39 J	3.0 U	0.31 J	0.45 J	3.6 U	0.65 J	2.5 U	3.6 U	**26**	4.2 U
ACENAPHTHYLENE	ug/kg	3.1 U	3.7 U	0.31 J	3.5 U	3.1 U	3.4 U	4.8 U	3.0 U	0.33 J	3.0 U	3.6 U	3.1 U	2.5 U	3.6 U	3.1 U	4.2 U
ANTHRACENE	ug/kg	3.1 U	3.7 U	0.34 J	3.5 U	3.1 U	0.34 J	4.8 U	3.0 U	0.50 J	0.36 J	3.6 U	0.55 J	2.5 U	3.6 U	7.1	4.2 U
BENZO(A)ANTHRACENE	ug/kg	3.1 U	3.7 U	0.94 J	3.5 U	3.1 U	0.60 J	4.8 U	3.0 U	3.4 U	1.8 J	0.23 J	3.6	0.92 J	0.23 J	2.6 J	4.2 U
BENZO(A)PYRENE	ug/kg	0.28 J	3.7 U	0.82 J	3.5 U	3.1 U	0.42 J	4.8 U	3.0 U	3.4 U	1.6 J	3.6 U	5.3	0.77 J	0.38 J	1.1 J	4.2 U
BENZO(B)FLUORANTHENE	ug/kg	3.1 U	3.7 U	0.83 J	3.5 U	3.1 U	3.4 U	0.91 J	3.0 U	3.4 U	1.8 J	3.6 U	4.8	2.5 U	3.6 U	1.3 J	4.2 U
BENZO(G,H,I)PERYLENE	ug/kg	0.31 J	3.7 U	0.65 J	3.5 U	3.1 U	0.53 J	0.48 J	3.0 U	0.52 J	1.4 J	0.44 J	4.3	0.65 J	0.46 J	0.61 J	0.46 J
BENZO(K)FLUORANTHENE	ug/kg	3.1 U	3.7 U	0.65 J	3.5 U	3.1 U	3.4 U	4.8 U	3.0 U	3.4 U	1.2 J	3.6 U	4.2	0.68 J	3.6 U	0.89 J	4.2 U
CHRYSENE	ug/kg	3.1 U	3.7 U	0.81 J	3.5 U	3.1 U	0.58 J	4.8 U	3.0 U	3.4 U	1.8 J	3.6 U	4.0	0.77 J	3.6 U	3.3	4.2 U
DIBENZ(A,H)ANTHRACENE	ug/kg	3.1 U	3.7 U	3.0 U	3.5 U	3.1 U	3.4 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	0.68 J	2.5 U	3.6 U	3.1 U	4.2 U
FLUORANTHENE	ug/kg	0.45 J	0.51 J	1.7 J	3.5 U	3.1 U	1.1 J	1.4 J	0.41 J	0.72 J	3.5	0.83 J	5.8	1.8 J	0.75 J	19	0.70 J
FLUORENE	ug/kg	3.1 U	3.7 U	3.0 U	3.5 U	3.1 U	0.38 J	0.46 J	3.0 U	0.56 J	0.28 J	3.6 U	0.28 J	2.5 U	3.6 U	20	4.2 U
INDENO(1,2,3-CD)PYRENE	ug/kg	3.1 U	3.7 U	0.63 J	3.5 U	3.1 U	0.40 J	0.47 J	3.0 U	0.36 J	1.5 J	0.37 J	5.2	0.64 J	0.42 J	0.72 J	4.2 U
NAPHTHALENE	ug/kg	1.3 J	1.6 J	1.6 J	1.9 J	1.2 J	1.4 J	3.8 J	2.2 J	2.7 J	2.2 J	3.0 J	2.3 J	1.1 J	2.8 J	22	3.9 J
PHENANTHRENE	ug/kg	3.1 U	0.51 J	1.2 J	0.68 J	3.1 U	1.1 J	0.87 J	0.48 J	0.98 J	1.8 J	0.72 J	2.3 J	0.70 J	0.64 J	39	0.80 J
PYRENE	ug/kg	3.1 U	3.7 U	2.4 J	3.5 U	3.1 U	0.95 J	3.6 J	3.0 U	0.62 J	2.4 J	0.71 J	5.6	1.3 J	0.60 J	12	4.2 U

Table 4-2 CLLNG Phase 1 Chemistry and Grain Size Results

													SEDIMENT CORES[3]		GBAY REF
	Sample ID	**SB8U1**	**SB8L1**	**SB9U1**	**SB9L1**	**SB10U1A**	**SB10U1B**	**SB10L1**	**SB11U1**	**SB11L1**	**SB12U1**	**SB12L1**	**SC123A**	**SC123B**	**RO**
Sampling Interval Upper Limit (bgs)	**Feet**	**10.7**	**13.5**	**11**	**13.5**	**10**	**10**	**16.5**	**10**	**16.5**	**11.5**	**15**	**-0.5**	**-0.5**	**0**
Sampling Interval Lower Limit (bgs)	**Feet**	**13.5**	**60**	**13.5**	**60**	**16.5**	**16.5**	**25**	**16.5**	**60**	**15**	**60**	**-54.5**	**-54.5**	**0.5**
Chemical Name	**Unit**														
PHYSICAL TESTS															
MOISTURE CONTENT	%	22	36	25	42	21	21	58	20	36	29	54	37	36	71
GRAVEL	%	0	0	0	0	0	0	0	0	2	1	0	0	2	0
SAND	%	73	61	59	46	76	74	9	95	52	33	27	53	51	33
SILT + CLAY	%	27	39	41	54	24	26	91	5	46	66	73	47	47	67
TOTAL ORGANIC CARBON	%	0.17	0.59	0.23	0.59	0.10	0.15	0.37	0.04 J	0.73	0.17	0.91	0.83	1.37	0.34
METALS															
ALUMINUM	mg/kg	15900	35800	30000	47600	22000	20500	75600	2910	30700	46300	60500	33700	25100	23900
ANTIMONY	mg/kg	0.04 J,N	0.04 J,N	0.03 J,N	0.06 N	0.04 J,N	0.04 J,N	0.13 N	0.05 U,N	0.04 J,N	0.04 J,N	0.07 N	0.04 J,N	0.04 J,N	0.03 J,N
ARSENIC	mg/kg	1.54	4.49	2.26 *	4.69 *	2.45	2.21	5	0.36 J	3.43	0.97 *	6.86 *	3.83	3.79	4.41
BERYLLIUM	mg/kg	0.097	0.56	0.374	0.772	0.094	0.118	1.5	0.024	0.523	0.516	0.933	0.546	0.561	0.422
CADMIUM	mg/kg	0.044 J	0.093	0.086	0.148	0.029 J	0.037 J	0.394	0.026 J	0.103	0.029 J	0.151	0.075	0.095	0.071
CHROMIUM	mg/kg	4.54	8.67	7.37	12.9	7.26	9.91	24.9	2.13	11.6	6.97	17.5	9.17	11.9	13.6
COPPER	mg/kg	1.15	5.37	4.43	8.56	0.69	0.79	17	0.43	4.31	3.33	9.89	3.94	4.18	3.38
LEAD	mg/kg	3.91	7.24	6.1	9.71	3.59	4.62	19.7	1.52	7.72	6.39	13.1	6.74	7.63	8.35
MERCURY	mg/kg	0.02 U	0.016 J	0.013 J	0.021	0.011 J	0.009 J	0.032	0.019 U	0.015 J	0.017	0.028	0.014 J	0.063	0.024
NICKEL	mg/kg	1.47	8.24	6.57	11.2	1.28	2.4	23.4	0.79	7.18	1.42	14	6.28	7.12	5.59
SELENIUM	mg/kg	0.7 J	0.5 J	0.6 J	0.5 J	1 U	0.3 J	0.6 J	1 U	0.3 J	0.5 J	0.6 J	0.5 J	0.4 J	0.5 J
SILVER	mg/kg	0.01 J	0.027	0.02 J	0.036	0.008 J	0.007 J	0.077	0.004 J	0.033	0.016 J	0.042	0.025	0.027	0.028
THALLIUM	mg/kg	0.068	0.124	0.098	0.148	0.046	0.071	0.349	0.014 J	0.136	0.077	0.208	0.099	0.127	0.14
ZINC	mg/kg	2.75	24.2	18.1	31.5	3.06	33.8	57.3	1.71	20.6	5.8	42.6	20.9	22.9	23.6
AVS/SEM															
CADMIUM	umol/g	0.0006 U	0.002	0.001	0.003	0.0006 U	0.0006 U	0.003	0.0004 U	0.001	0.0006 U	0.003	0.001	0.001	0.001
COPPER	umol/g	0.006	0.063	0.057	0.110	0.005	0.003	0.192	0.003	0.036	0.049	0.105	0.197	0.019	0.028
LEAD	umol/g	0.015	0.024	0.019	0.032	0.008	0.009	0.048	0.005 U	0.021	0.020	0.039	0.019	0.016	0.029
MERCURY	umol/g	0.00005 U	0.00005 U	0.00005 U	0.00001 U	0.00005 U	0.00005 U	0.00009 U	0.00004 U	0.00005 U	0.00005 U	0.00006 U	0.00005 U	0.00005 U	0.00006 U
NICKEL	umol/g	0.005 U	0.087	0.080	0.124	0.0034 U	0.003 U	0.204	0.003 U	0.053	0.005	0.129	0.175	0.044	0.029
ZINC	umol/g	0.006	0.326	0.251	0.413	0.026	2.570	0.565	0.008	0.237	0.041	0.520	0.268	0.223	0.314
TOTAL METALS	umol/g	0.028	0.501	0.408	0.682	0.039	2.582	1.012	0.011	0.348	0.116	0.797	0.660	0.304	0.400
ACID VOLATILE SULFIDE	umol/g	0.028 U	0.028 U	0.031 U	0.031 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.031 U	0.031 U	0.128	0.306	0.465
SEM:AVS RATIO	umol/g	2.0	35.8	26.1	43.7	2.8	184.4	72.3	0.8	24.9	7.4	51.1	5.2	1.0	0.9
NONMETALS/OTHER															
SULFIDE	ug/kg	0.8 U	7.2	1.5	8.6	0.8	1.1	10.4	0.9	6.7	8.0	16.3	68.4	84.7	18.0
AMMONIA	ug/kg	3.7	5.0	4.7	5.9	7.7	7.9	3.9	0.3	6.0	2.8	9.7	26.9	29.3	8.8
NITRATE	ug/kg	0.03 J	0.03 J	0.2 U	0.2 U	0.05 J	0.03 J	0.06 J	0.5 U	0.5 U	0.2 U	42.8	0.5 U	0.5 U	0.5 U
NITRITE	ug/kg	0.03 J	0.06 J	1.9 U	1.9 U	0.03 J	0.05 J	0.02 J	0.03 J	0.05 J	1.9 U	1.9 U	0.04 J	0.04 J	0.5 U
NITRATE + NITRITE	ug/kg	0.06 J	0.09 J	0.2 U	0.2 U	0.08 J	0.08 J	0.08 J	0.5 U	0.06 J	0.2 U	42.8	0.5 U	0.5 U	0.5 U
NITROGEN, KJELDAHL, TOTAL	ug/kg	108	314	163	335	79	154	603	43	272	580	429	367	328	896
PHOSPHOROUS	ug/kg	10.9	103	28.9	169	16.4	12.3	149	3.7	75.4	19.3	132	78.8	108	71.8
CYANIDE	ug/kg	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.07 J	0.2 U	0.2 U
OXIDATION REDUCTION POTENTIAL	MILLIVOLTS	95.1	81.9	91.9	73.0	87.5	88.2	-9.8	140	73.3	113	65.3	87.9	49.4	63.7
PH	pH UNITS	7.92	7.81	7.05	7.82	8.01	7.92	6.65	8.09	7.74	8.43	7.77	7.75	7.83	7.92
PAHs															
1-METHYLNAPHTHALENE	ug/kg	3.1 U	3.6 U	2.5 U	0.68 J	3.0 U	0.37 J	0.55 J	0.66 J	0.39 J	0.55 J	0.65 J	0.43 J	3.5 U	0.52 J
2-METHYLNAPHTHALENE	ug/kg	0.64 J	3.6 U	2.5 U	1.1 J	0.45 J	0.49 J	0.72 J	1.3 J	0.55 J	0.86 J	0.86 J	0.53 J	3.5 U	0.89 J
ACENAPHTHENE	ug/kg	0.23 J	3.6 U	2.5 U	0.27 J	3.0 U	3.1 U	4.0 U	3.0 U	3.3 U	3.3 U	3.9 U	0.22 J	3.5 U	4.3 U
ACENAPHTHYLENE	ug/kg	3.1 U	3.6 U	2.5 U	3.6 U	3.0 U	3.1 U	4.0 U	3.0 U	3.3 U	3.3 U	3.9 U	3.4 U	3.5 U	4.3 U
ANTHRACENE	ug/kg	1.7 J	3.6 U	2.5 U	3.6 U	3.0 U	3.1 U	4.0 U	0.67 J	3.3 U	3.3 U	3.9 U	0.31 J	3.5 U	0.51 J
BENZO(A)ANTHRACENE	ug/kg	1.3 J	3.6 U	2.5 U	0.76 J	0.28 J	0.24 J	0.49 J	1.9 J	3.3 U	0.53 J	0.66 J	0.82 J	0.44 J	1.5 J
BENZO(A)PYRENE	ug/kg	1.1 J	3.6 U	2.5 U	3.6 U	0.29 J	0.39 J	0.72 J	2.1 J	3.3 U	3.3 U	3.9 U	0.84 J	0.42 J	1.1 J
BENZO(B)FLUORANTHENE	ug/kg	1.5 J	3.6 U	2.5 U	3.6 U	3.0 U	3.1 U	4.0 U	1.5 J	3.3 U	3.3 U	3.9 U	1.1 J	3.5 U	1.2 J
BENZO(G,H,I)PERYLENE	ug/kg	1.0 J	0.33 J	0.44 J	0.45 J	0.64 J	0.43 J	1.1 J	2.5 J	3.3 U	0.36 J	0.54 J	0.80 J	0.36 J	0.99 J
BENZO(K)FLUORANTHENE	ug/kg	0.97 J	3.6 U	2.5 U	3.6 U	3.0 U	3.1 U	0.60 J	1.1 J	3.3 U	3.3 U	3.9 U	0.66 J	3.5 U	1.0 J
CHRYSENE	ug/kg	1.8 J	3.6 U	2.5 U	3.6 U	3.0 U	3.1 U	4.0 U	3.7	3.3 U	3.3 U	3.9 U	0.94 J	3.5 U	1.3 J
DIBENZ(A,H)ANTHRACENE	ug/kg	0.55 J	3.6 U	2.5 U	3.6 U	3.0 U	3.1 U	0.48 J	0.82 J	3.3 U	3.3 U	3.9 U	3.4 U	3.5 U	4.3 U
FLUORANTHENE	ug/kg	1.8 J	3.6 U	2.5 U	1.7 J	0.73 J	0.64 J	0.77 J	1.3 J	3.3 U	0.52 J	0.75 J	2.7 J	1.5 J	2.7 J
FLUORENE	ug/kg	0.28 J	3.6 U	2.5 U	0.35 J	3.0 U	3.1 U	4.0 U	3.0 U	3.3 U	3.3 U	3.9 U	0.26 J	3.5 U	4.3 U
INDENO(1,2,3-CD)PYRENE	ug/kg	0.91 J	3.6 U	2.5 U	0.36 J	0.47 J	0.30 J	0.95 J	0.94 J	3.3 U	3.3 U	0.52 J	0.65 J	0.36 J	0.90 J
NAPHTHALENE	ug/kg	1.8 J	1.5 J	1.1 J	3.2 J	1.7 J	1.4 J	1.9 J	1.7 J	1.3 J	2.7 J	3.1 J	1.8 J	1.3 J	2.3 J
PHENANTHRENE	ug/kg	0.59 J	3.6 U	2.5 U	1.9 J	0.73 J	0.60 J	0.72 J	1.1 J	3.3 U	0.56 J	1.0 J	0.66 J	0.55 J	1.9 J
PYRENE	ug/kg	1.4 J	3.6 U	2.5 U	1.1 J	3.0 U	0.45 J	0.68 J	1.5 J	3.3 U	0.48 J	3.9 U	2.3 J	1.3 J	3.2 J

Table 4-2 CLLNG Phase 1 Chemistry and Grain Size Results

	Sample ID	SB1U1	SB1L1	SB2U1	SB2L1	SB3U1	SB3L1	SB4UU1	SB4U1	SB4L1	SB5U1	SB5L1	SB6U1	SB6L1A	SB6L1B	SB7U1	SB7L1
Sampling Interval Upper Limit (bgs)	**Feet**	**10**	**15**	**15**	**19**	**18**	**20.5**	**10**	**15**	**20**	**10**	**15.5**	**11**	**15**	**15**	**14.5**	**18**
Sampling Interval Lower Limit (bgs)	**Feet**	**15**	**60**	**19**	**60**	**20.5**	**60**	**15**	**20**	**60**	**15.5**	**60**	**15**	**60**	**60**	**18**	**40**
Chemical Name	**Unit**																
LMW PAH[1]	ug/kg	12	13	7.4	11	12	7.6	12	9.8	7.2	7.8	13	8.8	9.3	12	167	15
HMW PAH[1]	ug/kg	12	17	11	18	16	9.7	19	14	12	19	12	43	10	10	43	18
PAH Sum[1]	ug/kg	24	30	18	28	28	17	31	24	20	26	24	52	19	22	210	33
PESTICIDES																	
2,4-DDD	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 Ui	4.2 U
2,4-DDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
2,4-DDT	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
4,4-DDD	ug/kg	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	0.40 J	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 Ui	4.2 Ui
4,4-DDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.34 J	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
4,4-DDT	ug/kg	5.0 U	5.0 U	5.0 Ui	5.0 U	5.0 Ui	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ALDRIN	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ALPHA-BHC	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ALPHA-CHLORDANE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
BETA-BHC	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
CIS-NONACHLOR	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
DELTA-BHC	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
DIELDRIN	ug/kg	5.0 U	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ENDOSULFAN I	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 Ui	3.1 U	4.0 Ui	3.6 Ui	3.1 U	4.2 Ui
ENDOSULFAN II	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.41 J	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ENDOSULFAN SULFATE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 U	3.0 U	0.18 J	3.1 U	4.0 Ui	3.6 U	3.1 U	4.2 U
ENDRIN	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 Ui	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ENDRIN ALDEHYDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
ENDRIN KETONE	ug/kg	5.0 U	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 Ui	3.0 Ui	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
GAMMA-BHC (LINDANE)	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
GAMMA-CHLORDANE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
HEPTACHLOR	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
HEPTACHLOR EPOXIDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
HEXACHLOROBENZENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
METHOXYCHLOR	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 Ui	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
MIREX	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 Ui	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
OXYCHLORDANE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.8 U	3.0 U	3.4 U	3.0 U	3.6 U	3.1 U	4.0 U	3.6 U	3.1 U	4.2 U
TOXAPHENE	ug/kg	250 U	250 U	250 U	250 Ui	250 Ui	250 U	240 Ui	150 U	170 U	150 Ui	180 Ui	160 U	200 Ui	180 Ui	160 U	210 U
TRANS-NONACHLOR	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCBs																	
PCB 8 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 18 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 Ui
PCB 28 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.63 U	0.72 U	0.63 U	0.75 U	0.65 U	0.85 U	0.76 U	0.66 U	0.89 U
PCB 44 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 49 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 52 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 66 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 77 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 87 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 101 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.12 J	0.71 U	0.61 U	0.80 U	0.72 U	0.19 J	0.84 U
PCB 105 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 Ui	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 118 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.15 J	0.84 U
PCB 126 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 128 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 Ui	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 138 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.37 J	0.71 U	0.61 U	0.80 U	0.72 U	0.15 J	0.84 U
PCB 153 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 Ui	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 156 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 169 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 170 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.21 JP	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 180 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.50 J	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 183 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.12 J	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 184 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 187 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.29 J	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 195 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 206 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB 209 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.95 U	0.59 U	0.68 U	0.59 U	0.71 U	0.61 U	0.80 U	0.72 U	0.62 U	0.84 U
PCB Sum[2]	ug/kg	13	13	13	13	13	13	12	7.7	8.9	7.5	9.3	8.0	10	9.4	7.6	11

Table 4-2 CLLNG Phase 1 Chemistry and Grain Size Results

													SEDIMENT CORES[3]		GBAY REF
	Sample ID	**SB8U1**	**SB8L1**	**SB9U1**	**SB9L1**	**SB10U1A**	**SB10U1B**	**SB10L1**	**SB11U1**	**SB11L1**	**SB12U1**	**SB12L1**	**SC123A**	**SC123B**	**RO**
Sampling Interval Upper Limit (bgs)	**Feet**	**10.7**	**13.5**	**11**	**13.5**	**10**	**10**	**16.5**	**10**	**16.5**	**11.5**	**15**	**-0.5**	**-0.5**	**0**
Sampling Interval Lower Limit (bgs)	**Feet**	**13.5**	**60**	**13.5**	**60**	**16.5**	**16.5**	**25**	**16.5**	**60**	**15**	**60**	**-54.5**	**-54.5**	**0.5**
Chemical Name	**Unit**														
LMW PAH[1]	ug/kg	8.3	14	9.9	11	10	9.1	12	9.9	10	11	13	5.9	12	13
HMW PAH[1]	ug/kg	12	17	12	13	9.9	8.7	9.8	17	17	12	14	13	11	16
PAH Sum[1]	ug/kg	21	31	22	24	20	18	22	27	27	23	28	18	24	29
PESTICIDES															
2,4-DDD	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
2,4-DDE	ug/kg	5.0 U	5.0 Ui	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
2,4-DDT	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
4,4-DDD	ug/kg	5.0 Ui	5.0 Ui	3.2 U	3.6 U	5.0 Ui	5.0 Ui	5.0 U	5.0 U	5.0 Ui	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
4,4-DDE	ug/kg	5.0 Ui	5.0 U	3.2 U	3.6 U	5.0 Ui	5.0 Ui	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 Ui	5.0 U
4,4-DDT	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.22 JP	3.9 U	5.0 U	5.0 U	5.0 U
ALDRIN	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	3.3 U	3.9 U	5.0 U	5.0 U	0.18 JP
ALPHA-BHC	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
ALPHA-CHLORDANE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
BETA-BHC	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
CIS-NONACHLOR	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 Ui	1.0 Ui	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.1 Ui	1.0 U	1.0 U
DELTA-BHC	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
DIELDRIN	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
ENDOSULFAN I	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
ENDOSULFAN II	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
ENDOSULFAN SULFATE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
ENDRIN	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
ENDRIN ALDEHYDE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 Ui	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
ENDRIN KETONE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
GAMMA-BHC (LINDANE)	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
GAMMA-CHLORDANE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 Ui
HEPTACHLOR	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 Ui
HEPTACHLOR EPOXIDE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
HEXACHLOROBENZENE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
METHOXYCHLOR	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 Ui	5.0 U	5.0 U
MIREX	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
OXYCHLORDANE	ug/kg	5.0 U	5.0 U	3.2 U	3.6 U	5.0 Ui	5.0 Ui	5.0 U	5.0 U	5.0 U	3.3 U	3.9 U	5.0 U	5.0 U	5.0 U
TOXAPHENE	ug/kg	250 U	250 U	160 U	180 U	250 Ui	250 U	250 U	250 Ui	250 Ui	170 U	200 Ui	250 Ui	250 U	250 Ui
TRANS-NONACHLOR	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 Ui	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCBs															
PCB 8 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 Ui	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 Ui
PCB 18 (BZ)	ug/kg	1.0 Ui	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 Ui	1.0 U	0.65 U	0.77 U	1.0 Ui	1.0 Ui	1.0 Ui
PCB 28 (BZ)	ug/kg	1.0 U	1.0 U	0.67 U	0.76 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.69 U	0.82 U	1.0 U	1.0 U	1.0 U
PCB 44 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 49 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 52 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 66 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 77 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 87 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 101 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 105 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 118 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 126 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 128 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 138 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 153 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 156 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 169 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 170 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 180 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 183 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 184 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 187 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 195 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 206 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB 209 (BZ)	ug/kg	1.0 U	1.0 U	0.64 U	0.72 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.65 U	0.77 U	1.0 U	1.0 U	1.0 U
PCB Sum[2]	ug/kg	13	13	8.3	9.4	13	13	13	13	13	8.5	10	13	13	13

Table 4-2 CLLNG Phase 1 Chemistry and Grain Size Results

	Sample ID	SB1U1	SB1L1	SB2U1	SB2L1	SB3U1	SB3L1	SB4UU1	SB4U1	SB4L1	SB5U1	SB5L1	SB6U1	SB6L1A	SB6L1B	SB7U1	SB7L1
Sampling Interval Upper Limit (bgs)	**Feet**	**10**	**15**	**15**	**19**	**18**	**20.5**	**10**	**15**	**20**	**10**	**15.5**	**11**	**15**	**15**	**14.5**	**18**
Sampling Interval Lower Limit (bgs)	**Feet**	**15**	**60**	**19**	**60**	**20.5**	**60**	**15**	**20**	**60**	**15.5**	**60**	**15**	**60**	**60**	**18**	**40**
Chemical Name	**Unit**																
VOLATILES																	
BENZENE	ug/kg	4.5 U	4.8 U	4.1 U	5.2 U	4.6 U	5.6 U	9.1 U	4.1 U	5.2 U	4.6 U	5.6 U	4.6 U	5.9 U	5.0 U	4.4 U	9.2 U
CHLOROFORM	ug/kg	4.5 U	4.8 U	4.1 U	5.2 U	4.6 U	5.6 U	9.1 U	4.1 U	5.2 U	4.6 U	5.6 U	4.6 U	5.9 U	5.0 U	4.4 U	9.2 U
ETHYLBENZENE	ug/kg	4.5 U	4.8 U	4.1 U	5.2 U	4.6 U	5.6 U	9.1 U	4.1 U	5.2 U	4.6 U	5.6 U	4.6 U	5.9 U	5.0 U	4.4 U	9.2 U
TETRACHLOROETHENE	ug/kg	4.5 U	4.8 U	4.1 U	5.2 U	4.6 U	5.6 U	9.1 U	4.1 U	5.2 U	4.6 U	5.6 U	4.6 U	5.9 U	5.0 U	4.4 U	9.2 U
TOLUENE	ug/kg	1.1 J	4.8 U	4.1 U	5.2 U	4.6 U	5.6 U	9.1 U	4.1 U	5.2 U	4.6 U	5.6 U	4.6 U	5.9 U	5.0 U	1.8 J	3.5 J
TRICHLOROETHENE	ug/kg	4.5 U	4.8 U	4.1 U	5.2 U	4.6 U	5.6 U	9.1 U	4.1 U	5.2 U	4.6 U	5.6 U	4.6 U	5.9 U	5.0 U	4.4 U	9.2 U
XYLENES (TOTAL)	ug/kg	9.0 U	9.6 U	8.2 U	10 U	9.2 U	11 U	18 U	8.2 U	10 U	9.2 U	11 U	9.2 U	12 U	10 U	8.8 U	18 U
TPH																	
RESIDUAL RANGE ORGANICS	mg/kg	6.7 J	22 J	16 J	29 Z	15 J	28 Z	290 Z	5.9 J	14 J	6.2 J	18 J	14 J	17 J	18 J	29 Z	22 J
TPH AS DIESEL	mg/kg	25 U	30 U	24 U	27 U	25 U	28 U	24 J	24 U	28 U	25 U	30 U	8.8 J	33 U	29 U	6 J	35 U

Table 4-2 CLLNG Phase 1 Chemistry and Grain Size Results

													SEDIMENT CORES[3]		GBAY REF
	Sample ID	**SB8U1**	**SB8L1**	**SB9U1**	**SB9L1**	**SB10U1A**	**SB10U1B**	**SB10L1**	**SB11U1**	**SB11L1**	**SB12U1**	**SB12L1**	**SC123A**	**SC123B**	**RO**
Sampling Interval Upper Limit (bgs)	**Feet**	**10.7**	**13.5**	**11**	**13.5**	**10**	**10**	**16.5**	**10**	**16.5**	**11.5**	**15**	**-0.5**	**-0.5**	**0**
Sampling Interval Lower Limit (bgs)	**Feet**	**13.5**	**60**	**13.5**	**60**	**16.5**	**16.5**	**25**	**16.5**	**60**	**15**	**60**	**-54.5**	**-54.5**	**0.5**
Chemical Name	**Unit**														
VOLATILES															
BENZENE	ug/kg	1.2 J	5.3 U	4.5 U	5.7 U	4.6 U	3.7 U	NA	5.1 U	4.6 U	5.9 U	7.2 U	NA	NA	NA
CHLOROFORM	ug/kg	4.6 U	5.3 U	4.5 U	5.7 U	4.6 U	3.7 U	NA	5.1 U	4.6 U	5.9 U	7.2 U	NA	NA	NA
ETHYLBENZENE	ug/kg	2.0 J	5.3 U	4.5 U	5.7 U	4.6 U	3.7 U	NA	5.1 U	4.6 U	5.9 U	7.2 U	NA	NA	NA
TETRACHLOROETHENE	ug/kg	4.6 U	5.3 U	4.5 U	5.7 U	4.6 U	3.7 U	NA	5.1 U	4.6 U	5.9 U	7.2 U	NA	NA	NA
TOLUENE	ug/kg	4.6 U	1.4 J	4.5 U	5.7 U	4.6 U	3.7 U	NA	5.1 U	4.6 U	5.9 U	1.7 J	NA	NA	NA
TRICHLOROETHENE	ug/kg	4.6 U	5.3 U	4.5 U	5.7 U	4.6 U	3.7 U	NA	5.1 U	4.6 U	5.9 U	7.2 U	NA	NA	NA
XYLENES (TOTAL)	ug/kg	9.2 U	11 U	9.0 U	11 U	9.2 U	7.4 U	NA	10 U	9.2 U	12 U	14 U	NA	NA	NA
TPH															
RESIDUAL RANGE ORGANICS	mg/kg	6.9 J	18 J	12 J	16 J	10 J	9.6 J	16 J	15 J	47 Z	16 J	30 J	43 Z	44 Z	72 Z
TPH AS DIESEL	mg/kg	26 U	29 U	27 U	30 U	25 U	25 U	32 U	23 U	4.6 J	27 U	6.0 J	5.5 J	5.7 J	12 J

Bold blue values exceed ER-L sediment screening values.
Brackets [ ] represent ERLQ as the sediment value/screening value quotient.

[1]PAH summation of Low Molecular Weight PAHs, High Molecular Weight PAHs, and Total PAHs; 1/2 RL used in the summation in non-detect cases.
[2]PCB summation using 1/2 RL in non-detect cases.
[3] Sediment core depth intervals are based on MLLW, not ground surface.
Data Qualifiers:
U: Undetected; parameter was not detected above the laboratory RL.
*: The duplicate analysis was not within control limits.
J: The result is an estimated concentration that is less than the RL but greater than or equal to the MDL.
P: The GC confirmation criteria were exceeded. The RPD is greater than 40% between the two analytical results (25% for CLP Pesticides).
i: The RL/MDL has been elevated, due to a chromatographic interference.
N: MS/MSD exceed acceptance criteria.
Z: The chromatoagraphic fingerprint does not resemble a petroleum product.
NA: Not Analyzed. Station SB10L VOC sample was lost and VOC analysis of aquatic sites (SC123, RO) was not specified/required.

Table 4-3 CLLNG Phase 2 Chemistry and Grain Size Results

Chemical Name	Sample ID Unit	C1U2	C2U2A	C2U2B	SB4U2	SB7U2	SB9U2	SB10U2	SB11U2	SB12U2	C3L2	C4L2A	C4L2B	SB7L2	SB10L2	SB12L2	GBAY REF
PHYSICAL TESTS																	
MOISTURE CONTENT	%	21	19	20	17	25	20	19	19	30	39	39	38	65	50	40	71
GRAVEL	%	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0
SAND	%	76	80	79	68	76	59	74	94	25	48	47	51	24	23	40	33
SILT + CLAY	%	24	20	21	32	24	41	26	6	75	52	53	49	76	77	60	67
TOTAL ORGANIC CARBON	%	0.17	0.07	0.09	0.10	0.20	0.24	0.10	0.11	0.17	0.42	0.41	0.49	0.52	0.33	0.43	0.34
METALS																	
ALUMINUM	mg/kg	11600	17400	17300	12400	19400	27200	18800	3110	51500	41600	43600	39500	75500	63600	44300	23900
ANTIMONY	mg/kg	0.06 U,N	0.06 U,N	0.06 U,N	0.06 U,N	0.06 U,N	0.05 U,N	0.06 U,N	0.06 U,N	0.05 U,N	0.06 U,N	0.06 U,N	0.06 U,N	0.05 U,N	0.05 U,N	0.05 U,N	0.03 J,N
ARSENIC	mg/kg	1.2	0.69	1.36	0.82	0.66	2.34	1.8	0.24 J	2.11	4.33	4.25	3.68	5.99	4.66	4.26	4.41
BERYLLIUM	mg/kg	0.1	0.081	0.071	0.066	0.047	0.436	0.086	0.017 J	1.28	0.784	0.683	0.706	1.08	1.05	0.683	0.422
CADMIUM	mg/kg	0.01 J	0.06 U	0.062 U	0.059 U	0.062 U	0.068	0.06 U	0.059 U	0.017 J	0.106	0.102	0.091	0.161	0.246	0.089	0.071
CHROMIUM	mg/kg	5.35	7.09	7.09	5.41	19	12.4	8.13	1.92	15.7	18.1	14.7	17.2	26.6	22.8	14.3	13.6
COPPER	mg/kg	0.8	0.72	0.77	0.67	0.89	4.45	0.76	0.4	8.4	6.91	6.62	6.35	11.6	13.2	6.4	3.38
LEAD	mg/kg	2.73	3.79	3.59	3.05	3.68	5.95	3.5	1.08	12.3	9.81	9.06	9.05	16.6	15.5	9.85	8.35
MERCURY	mg/kg	0.011 J	0.009 J	0.009 J	0.01 J	0.015 J	0.02	0.015 J	0.008 J	0.024	0.027	0.027	0.025	0.032	0.029	0.025	0.024
NICKEL	mg/kg	1.69	1.87	1.3	1.34	2.24	6.8	1.51	0.57	2.97	11.5	9.78	9.92	17.1	16.9	9.44	5.59
SELENIUM	mg/kg	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	0.5 J	1.2 U	1.2 U	0.6 J	0.3 J	0.3 J	0.3 J	0.5 J	0.4 J	0.5 J	0.5 J
SILVER	mg/kg	0.009 J	0.007 J	0.005 J	0.011 J	0.179	0.028	0.006 J	0.003 J	0.067	0.029	0.036	0.035	0.057	0.067	0.029	0.028
THALLIUM	mg/kg	0.048	0.043	0.037	0.038	0.024 J	0.088	0.038	0.024 U	0.093	0.164	0.138	0.152	0.28	0.257	0.144	0.14
ZINC	mg/kg	5	3.8	2.9	4	2.6	18.9	3.5	1.3	11.9	34.5	32.9	32.9	50.5	52.1	35.4	23.6
AVS/SEM																	
CADMIUM	umol/g	0.0005 U	0.0005 U	0.0005 U	0.0004 U	0.0005 U	0.001	0.0005 U	0.0005 U	0.0006 U	0.001 U	0.0006 U	0.0007 U	0.007	0.002	0.0007 U	0.001
COPPER	umol/g	0.006	0.005	0.005	0.006	0.011	0.104	0.008	0.003	0.057	0.069	0.061	0.082	0.192	0.225	0.071	0.028
LEAD	umol/g	0.008	0.009	0.008	0.005	0.010	0.028	0.010	0.005 U	0.025	0.033	0.026	0.028	0.058	0.056	0.029	0.029
MERCURY	umol/g	0.00004 U	0.00004 U	0.00004 U	0.00004 U	0.00004 U	0.00004 U	0.00004 U	0.00004 U	0.00005 U	0.00009 U	0.00006 U	0.00006 U	0.00007 U	0.00007 U	0.00006 U	0.00006 U
NICKEL	umol/g	0.007	0.003 U	0.003 U	0.0034 U	0.027	0.118	0.005	0.003	0.009	0.118	0.087	0.114	0.206	0.245	0.078	0.029
ZINC	umol/g	0.026	0.005	0.005	0.009	0.028	0.425	0.017	0.011	0.052	0.480	0.341	0.355	0.647	0.639	0.295	0.314
TOTAL METALS	umol/g	0.047	0.018	0.018	0.021	0.076	0.675	0.040	0.017	0.142	0.700	0.515	0.578	1.111	1.167	0.474	0.400
ACID VOLATILE SULFIDE	umol/g	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.028 U	0.377	0.028 U	0.028 U	0.465
SEM:AVS RATIO	umol/g	3.4	1.3	3.4	1.5	5.4	48.2	2.9	1.2	10.1	50.0	36.8	41.3	2.9	83.3	33.9	0.9
NONMETALS/OTHER																	
SULFIDE	mg/kg	1.2	0.9 U	0.6 J	1.1	2.1	0.5 J	1.3	0.9 U	22.3	7.0	7.8	9.6	15.6	90.5	7.5	18.0
AMMONIA	mg/kg	4.3	2.9	3.5	1.5	18.3	6.6	7.9	0.3 J	3.1	6.0	5.7	6.1	9.1	5.3	8.8	8.8
NITRATE	mg/kg	0.5 U	0.09 J	0.08 J	0.08 J	0.08 J	0.07 J	0.5 U	0.5 U	0.5 U	0.09 J	0.5 U	0.07 J	0.5 U	0.09 J	0.5 U	0.5 U
NITRITE	mg/kg	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NITRATE + NITRITE	mg/kg	0.5 U	0.09 J	0.08 J	0.08 J	0.08 J	0.07 J	0.5 U	0.5 U	0.5 U	0.09 J	0.5 U	0.07 J	0.5 U	0.09 J	0.5 U	0.5 U
NITROGEN, KJELDAHL, TOTAL	mg/Kg	116	104	168	85	139	185	103	60	270	333	473	352	1000	454	377	896
PHOSPHOROUS	mg/Kg	21.0	5.5	6.5	9.7	16.8	37.1	16.1	5.6	41.2	82.9	105	108	201	114	91.6	71.8
CYANIDE	mg/kg	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.2 U
OXIDATION REDUCTION POTENTIAL	MILLIVOLTS	137	147	140	120	109	131	124	135	118	52.9	60.2	51.1	17.2	109	109	63.7
PH	pH UNITS	7.75	7.41	7.33	7.43	9.58	7.35	8.00	8.20	7.48	7.62	7.96	7.87	7.65	7.20	7.77	7.92

Table 4-3 CLLNG Phase 2 Chemistry and Grain Size Results

Chemical Name	Sample ID Unit	C1U2	C2U2A	C2U2B	SB4U2	SB7U2	SB9U2	SB10U2	SB11U2	SB12U2	C3L2	C4L2A	C4L2B	SB7L2	SB10L2	SB12L2	GBAY REF
PAHs																	
1-METHYLNAPHTHALENE	ug/kg	0.54 J	0.40 J	0.51 J	0.54 J	13	0.60 J	0.56 J	0.98 J	0.51 J	0.50 J	0.42 J	0.51 J	0.52 J	0.58 J	0.45 J	0.52 J
2-METHYLNAPHTHALENE	ug/kg	0.67 J	0.59 J	0.62 J	0.69 J	13	0.77 J	0.82 J	2.2 J	0.70 J	0.73 J	0.61 J	0.67 J	0.68 J	0.83 J	0.65 J	0.89 J
ACENAPHTHENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	20	0.46 J	5.0 U	5.0 U	5.0 U	5.0 U	0.35 J	5.0 U	5.0 U	5.0 U	5.0 U	4.3 U
ACENAPHTHYLENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	0.34 J	0.33 J	5.0 U	5.0 U	5.0 U	5.0 U	0.43 J	5.0 U	5.0 U	5.0 U	5.0 U	4.3 U
ANTHRACENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	3.5 J	0.88 J	0.30 J	0.54 J	5.0 U	5.0 U	0.36 J	5.0 U	5.0 U	5.0 U	5.0 U	0.51 J
BENZO(A)ANTHRACENE	ug/kg	5.0 U	0.26 J	5.0 U	5.0 U	1.5 J	1.3 J	0.81 J	4.8 J	0.45 J	5.0 U	1.3 J	0.33 J	0.32 J	5.0 U	5.0 U	1.5 J
BENZO(A)PYRENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	0.71 J	0.66 J	0.61 J	8.0	0.44 J	5.0 U	0.81 J	0.36 J	5.0 U	5.0 U	5.0 U	1.1 J
BENZO(B)FLUORANTHENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	0.96 J	1.1 J	0.85 J	3.9 J	1.3 J	5.0 U	1.5 J	5.0 U	1.6 J	1.1 J	5.0 U	1.2 J
BENZO(G,H,I)PERYLENE	ug/kg	5.0 U	0.95 J	5.0 U	5.0 U	0.78 J	0.66 J	1.2 J	9.4	2.4 J	0.63 J	1.6 J	0.64 J	0.67 J	0.67 J	0.51 J	0.99 J
BENZO(K)FLUORANTHENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	0.84 J	0.70 J	0.52 J	1.7 J	0.87 J	0.52 J	1.2 J	0.65 J	5.0 U	5.0 U	5.0 U	1.0 J
CHRYSENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	1.6 J	1.3 J	0.91 J	6.1	0.75 J	5.0 U	1.4 J	0.65 J	0.77 J	5.0 U	5.0 U	1.3 J
DIBENZ(A,H)ANTHRACENE	ug/kg	5.0 U	0.57 J	5.0 U	5.0 U	5.0 U	5.0 U	0.64 J	3.5 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	4.3 U
FLUORANTHENE	ug/Kg	0.45 J	0.59 J	0.58 J	5.0 U	7.3	3.0 J	2.5 J	1.0 J	0.75 J	0.59 J	3.0 J	1.2 J	1.1 J	0.58 J	0.52 J	2.7 J
FLUORENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	13	0.58 J	0.28 J	0.27 J	5.0 U	5.0 U	0.50 J	5.0 U	5.0 U	5.0 U	5.0 U	4.3 U
INDENO(1,2,3-CD)PYRENE	ug/kg	5.0 U	0.75 J	5.0 U	5.0 U	0.75 J	0.53 J	0.92 J	2.0 J	1.3 J	0.35 J	1.1 J	0.40 J	5.0 U	5.0 U	5.0 U	0.90 J
NAPHTHALENE	ug/Kg	2.3 J	3.8 J	5.4	2.5 J	8.2	2.5 J	2.4 J	3.3 J	2.4 J	2.5 J	2.3 J	2.5 J	2.2 J	2.6 J	2.5 J	2.3 J
PHENANTHRENE	ug/kg	5.0 U	0.66 J	0.78 J	0.42 J	20	2.6 J	2.6 J	1.8 J	0.50 J	0.72 J	3.2 J	1.3 J	1.2 J	0.62 J	0.61 J	1.9 J
PYRENE	ug/kg	5.0 U	0.59 J	0.50 J	5.0 U	5.8	3.1 J	1.9 J	3.4 J	0.65 J	0.71 J	2.7 J	1.4 J	1.5 J	0.84 J	0.64 J	3.2 J
LMW PAH[1]	ug/Kg	16.01	15.45	17.31	14.15	91.04	8.72	11.96	14.09	14.11	14.45	8.17	14.98	14.6	14.63	14.21	13
HMW PAH[1]	ug/Kg	22.95	13.71	21.08	25	22.74	14.85	10.86	43.8	11.41	15.3	17.11	10.63	15.96	18.19	19.17	16
PAH Sum[1]	ug/kg	38.96	29.16	38.39	39.15	113.78	23.57	22.82	57.89	25.52	29.75	25.28	25.61	30.56	32.82	33.38	29
PESTICIDES																	
2,4-DDD	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-DDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-DDT	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4,4-DDD	ug/kg	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4,4-DDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4,4-DDT	ug/Kg	0.19 JP	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ALDRIN	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	5.0 U	5.0 Ui	5.0 U	5.0 U	0.18 JP
ALPHA-BHC	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ALPHA-CHLORDANE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
BETA-BHC	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
CIS-NONACHLOR	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DELTA-BHC	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
DIELDRIN	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ENDOSULFAN I	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ENDOSULFAN II	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ENDOSULFAN SULFATE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ENDRIN	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ENDRIN ALDEHYDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ENDRIN KETONE	ug/kg	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
GAMMA-BHC (LINDANE)	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
GAMMA-CHLORDANE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui	5.0 U	5.0 Ui	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui
HEPTACHLOR	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 Ui
HEPTACHLOR EPOXIDE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
HEXACHLOROBENZENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
METHOXYCHLOR	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
MIREX	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Oxychlordane	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
TOXAPHENE	ug/kg	250 Ui	250 U	250 U	250 U	250 U	250 Ui	250 U	250 U	250 U	250 U	250 U	250 Ui	250 U	250 U	250 U	250 Ui
TRANS-NONACHLOR	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Table 4-3 CLLNG Phase 2 Chemistry and Grain Size Results

Chemical Name	Sample ID Unit	C1U2	C2U2A	C2U2B	SB4U2	SB7U2	SB9U2	SB10U2	SB11U2	SB12U2	C3L2	C4L2A	C4L2B	SB7L2	SB10L2	SB12L2	GBAY REF
PCBs																	
PCB 8 (BZ)	ug/kg	1.0 Ui	1.0 U	1.0 U	1.0 Ui	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 Ui	1.0 U	1.0 U	1.0 Ui	1.0 U	1.0 U
PCB 18 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 Ui	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 28 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 44 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 49 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 52 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 66 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 77 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 87 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 101 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 Ui
PCB 105 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 Ui
PCB 118 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 126 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 128 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 138 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 153 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 156 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 169 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 170 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 180 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 183 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 184 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 187 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 195 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 206 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB 209 (BZ)	ug/kg	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PCB Sum[2]	ug/kg	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
TPH																	
RESIDUAL RANGE ORGANICS	mg/kg	29 U	28 U	29 U	29 U	17 J	6.7 J	29 U	5.8 J	30 U	30 U	10 J	9.3 J	13 J	35 U	7.3 J	72 Z
TPH AS DIESEL	mg/kg	29 U	28 U	29 U	29 U	3.7 J	29 U	29 U	29 U	30 U	30 U	30 U	34 U	38 U	35 U	29 U	12 J

No values exceeded ER-L or ER-M

[1]PAH summation of Low Molecular Weight PAHs, High Molecular Weight PAHs, and Total PAHs; 1/2 RL used in the summation in non-detect cases.
[2]PCB summation using 1/2 RL in non-detect cases.
Data Qualifiers:
U: Undetected; parameter was not detected above the laboratory RL.
*: The duplicate analysis was not within control limits.
J: The result is an estimated concentration that is less than the RL but greater than or equal to the MDL.
P: The GC confirmation criteria were exceeded. The RPD is greater than 40% between the two analytical results (25% for CLP Pesticides).
i: The RL/MDL has been elevated, due to a chromatographic interference.
N: MS/MSD exceed acceptance criteria.
Z: The chromatoagraphic fingerprint does not resemble a petroleum product.

Table 4-4 Casotte Landing sediment aluminum to metal regression coefficients (Phase 2)

Parameter	Correlation Coefficient (r)
Antimony	
Arsenic	0.8244
Beryllium	0.8709
Cadmium	0.6271
Chromium	0.8006
Copper	0.9363
Lead	0.9878
Mercury	0.8821
Nickel	0.7928
Selenium	0.2935[1]
Silver	0.0853
Thallium	0.8806
Zinc	0.8070

[1] Selenium was not detected in 7 of 15 samples.

Table 4-5 Regional NOAA National Status and Trends comparison sites

Site	Date Sampled	Decimal Degrees		Northing/Eastings[1]	
		Longitude (X)	Latitude (Y)	Longitude (X)	Latitude (Y)
North Point (Mobile Bay), MS	1984, 1985, 1986, 1988, 1990	-88.08000	30.29667	1222000.7402	290508.1230
Pascagoula River, MS	1989	-88.56833	30.38000	1067811.8133	320124.6234
Round Island, MS	1984, 1985, 1987	-88.61000	30.30667	1054725.5574	293425.7828
Heron Bay, AL	1985, 1986, 1988	-89.47500	30.18333	781509.3733	249072.6853

[1]State Plane Mississippi East, NAD 83, US Feet

Table 4-6a Casotte Landing whole sediment bioassay findings – *Americamysis bahia* survival

	Replicate Survival at the End of 10 Days Exposure (%)					Mean Survival (%)	Statistically lower than reference and different by more than 10%?
Lab Control	100%	95%	95%	100%	95%	97%	-
Grand Bay Reference	95%	95%	95%	70%	95%	90%	-
Upper							
C1U2 [1]	95%	100%	90%	100%	90%	95%	No
C2U2 [2]	95%	95%	100%	100%	95%	97%	No
SB10U2	100%	85%	95%	95%	100%	95%	No
SB11U2	80%	90%	85%	95%	90%	88%	No
SB12U2	90%	100%	60%	95%	85%	86%	No
SB4U2	100%	100%	80%	90%	95%	93%	No
SB7U2	90%	95%	95%	95%	80%	91%	No
SB9U2	90%	75%	75%	85%	90%	83%	No
Lower							
C3L2 [3]	100%	90%	90%	95%	80%	91%	No
C4L2 [4]	90%	100%	95%	100%	100%	97%	No
SB10L2	85%	100%	100%	90%	70%	89%	No
SB12L2	90%	90%	75%	95%	15%	73%	No
SB7L2	95%	90%	85%	90%	100%	92%	No
Coastal							
SC123	95%	100%	100%	95%	100%	98%	No

[1] Composite SB1/SB2/SB3 upper layers

[2] Composite SB5/SB6/SB8 upper layers

[3] Composite SB1/SB2/SB3/SB4 lower layers

[4] Composite SB5/SB6/SB8/SB9/SB11 lower layers

Table 4-6b Casotte Landing whole sediment bioassay findings – *Leptocheirus plumulosus* survival

	Original Assay	Additional Testing			
Lab Control	90%	Batch No.	-		
	-	1	94%		
	-	2	91%		
	-	3	92%		
Grand Bay Reference	Original Assay	Batch No.	Collected Dec '05	Collected Mar '06*	Collected Mar '06**
	59%	-	-	-	-
	-	1	31%	52%	87%
	-	2	-	69%	81%
	-	3	-	81%	87%
		Treatment Scenario			
	Original Assay	**Batch No.**	**I (Archive)**	**II (Acclimated)**	**III (Acclimated/ Supplemented)**
Upper					
C1U2 [1]	67%	2	32%	25%	80%
C2U2 [2]	46%	2	29%	30%	65%
SB10U2	46%	1	39%	39%	87%
SB11U2	52%	2	9%	38%	77%
SB12U2	39%	3	44%	62%	78%
SB4U2	42%	3	32%	16%	85%
SB7U2	62%	3	43%	55%	85%
SB9U2	45%	1	43%	53%	82%
Lower					
C3L2 [3]	31%	2	20%	18%	62%
C4L2 [4]	8%	2	9%	34%	67%
SB10L2	14%	1	60%	53%	84%
SB12L2	52%	3	29%	41%	86%
SB7L2	21%	3	21%	20%	88%
Coastal					
SC1,2,3	30%	1	8%	20%	82%

[1] Composite SB1/SB2/SB3 upper layers
[2] Composite SB5/SB6/SB8 upper layers
[3] Composite SB1/SB2/SB3/SB4 lower layers
[4] Composite SB5/SB6/SB8/SB9/SB11 lower layers
*** A new reference sample was collected March 21, 2006 and tested without acclimation**
****TetraMin was also added to the (unacclimated) reference to complement treatment III samples**

Table 4-6c Casotte Landing whole sediment bioassay findings – *Leptocheirus plumulosus* survival – acclimated and supplemented treatment

	Batch No.	Replicate Survival at the End of 10 Days Exposure (%)					Mean Survival (%)	Statistically lower than reference and different by more than 20%?
Lab Control	1	95%	100%	85%	100%	90%	94%	-
	2	85%	90%	90%	100%	90%	91%	-
	3	95%	85%	95%	100%	85%	92%	-
Grand Bay Reference [5]	1	75%	100%	85%	95%	80%	87%	-
	2	85%	80%	85%	70%	85%	81%	-
	3	85%	80%	90%	95%	85%	87%	-
Upper								
C1U2 [1,7]	2	80%	75%	70%	95%	80%	80%	No
C2U2 [2,7]	2	60%	65%	55%	70%	75%	65%	No
SB10U2	1	90%	95%	80%	90%	80%	87%	No
SB11U2F [7]	2	80%	75%	70%	90%	70%	77%	No
SB12U2 [6]	3	80%	85%	80%	70%	75%	78%	No
SB4U2	3	90%	75%	75%	100%	85%	85%	No
SB7U2	3	90%	90%	75%	80%	90%	85%	No
SB9U2	1	80%	75%	85%	80%	90%	82%	No
Lower								
C3L2 [3,7]	2	65%	55%	50%	55%	85%	62%	No
C4L2 [4,7]	2	75%	65%	55%	75%	65%	67%	No
SB10L2	1	80%	95%	80%	75%	90%	84%	No
SB12L2	3	75%	90%	85%	90%	90%	86%	No
SB7L2	3	80%	85%	85%	100%	90%	88%	No
Coastal								
SC123	1	70%	80%	90%	85%	85%	82%	No

[1] Composite SB1/SB2/SB3 upper layers

[2] Composite SB5/SB6/SB8 upper layers

[3] Composite SB1/SB2/SB3/SB4 lower layers

[4] Composite SB5/SB6/SB8/SB9/SB11 lower layers

[5] Reference sample was collected March 21, 2006 and tested with Tetramin supplement but without acclimation.

[6] Sample was not retained at termination of *N. virens* assay. Sediment was acclimated prior to testing.

[7] Acclimated sample volume from *N. virens* assay was exhausted in initial Batch 2 assay that did not meet test acceptability criteria. Additional sediment was acclimated prior to Batch 2 re-test.

Table 4-7a Whole sediment bioassay statistical findings – *Americamysis bahia*

Project Site	Data Normally Distributed*	Data Variances Homogeneous*	t-Test			
			t-Value	Critical t	p-Value	Significant Difference
Project Site vs Grand Bay Reference						
Upper						
C1U2 [1]	NA	NA	NA	NA	NA	NA
C2U2 [2]	NA	NA	NA	NA	NA	NA
SB10U2	NA	NA	NA	NA	NA	NA
SB11U2	Yes	Yes	0.61095	1.85955	0.2791	No
SB12U2	Yes	Yes	0.43372	1.85955	0.3380	No
SB4U2	NA	NA	NA	NA	NA	NA
SB7U2	NA	NA	NA	NA	NA	NA
SB9U2	No	Yes	20	-	0.0754	No [5]
Lower						
C3L2 [3]	NA	NA	NA	NA	NA	NA
C4L2 [4]	NA	NA	NA	NA	NA	NA
SB10L2	Yes	Yes	0.07287	1.85955	0.4718	No
SB12L2	Yes	Yes	1.16557	1.85955	0.1387	No
SB7L2	NA	NA	NA	NA	NA	NA
Coastal						
SC123	NA	NA	NA	NA	NA	NA

***Normality evaluated using Shapiro Wilks analysis; homogeneity of variances evaluated using F-Test.**

[1] Composite of SB1/SB2/SB3 upper layers

[2] Composite of SB5/SB6/SB8 upper layers

[3] Composite of SB1/SB2/SB3/SB4 lower layers

[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers

[5] Rank Sum test conducted when data not normally distributed

NA: Not Applicable, station survivorship exceeded reference survivorship.

Table 4-7b Whole sediment bioassay statistical findings – *Leptocheirus plumulosus* – Acclimated and Supplemented Treatment

Project Site	Batch No.	Data Normally Distributed*	Data Variances Homogeneous*	t- Test			
				t-Value	Critical t	p-Value	Significant Difference
Project Site vs Grand Bay Reference							
Upper							
C1U2 [1]	2	Yes	Yes	0.20	1.85955	0.4247	No
C2U2 [2]	2	Yes	Yes	3.49	1.85955	0.0041	Yes
SB10U2	1	Yes	Yes	0.00	1.85955	0.5000	No
SB11U2	2	Yes	Yes	0.84	1.85955	0.2118	No
SB12U2	3	Yes	Yes	2.50	1.85955	0.0186	Yes
SB4U2	3	Yes	Yes	0.37	1.85955	0.3600	No
SB7U2	3	Yes	Yes	0.49	1.85955	0.3179	No
SB9U2	1	Yes	Yes	0.94	1.85955	0.1862	No
Lower							
C3L2 [3]	2	No	Yes	2.76	1.85955	0.0496	Yes[5]
C4L2 [4]	2	Yes	Yes	2.95	1.85955	0.0092	Yes
SB10L2	1	Yes	Yes	0.51	1.85955	0.3129	No
SB12L2	3	Yes	Yes	0.26	1.85955	0.4014	No
SB7L2	3	NA	NA	NA	NA	NA	NA
Coastal							
SC123	1	Yes	Yes	0.87	1.85955	0.2047	No

*** Normality evaluated using Shapiro Wilks analysis; homogeneity of variances evaluated using F-Test**

[1] Composite of SB1/SB2/SB3 upper layers

[2] Composite of SB5/SB6/SB8 upper layers

[3] Composite of SB1/SB2/SB3/SB4 lower layers

[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers

[5] Rank Sum test conducted when data not normally distributed.

[6] Round two Reference indicates a non-normal distribution

NA: Not Applicable, station survivorship exceeded reference survivorship.

Table 4-8 CLLNG Elutriate Chemistry

Chemical Name	Sample ID Units	C1U2EA	C2U2EA	SB4U2EA	SB7U2EA	SB9U2EA	SB9U2EB	SB10U2EA	SB11U2EA	SB12U2EA	C3L2EA	C4L2EA	SB7L2EA	SB10L2EA	SB12L2EA	SC123EA	SC123EB	SWRO[3]
Dissolved Metals																		
ANTIMONY	ug/L	0.8 J	0.86 J	1.89	0.69 J	0.59 J	0.69 J	0.65 J	1.03	0.73 J	1.05	1.02	0.894 J	0.332 J	0.434 J	0.604 J	0.72 J	0.168 J
ARSENIC	ug/L	0.52	0.42 J	2.39	0.54	0.36 J	0.38 J	0.46 J	0.49 J	0.46 J	0.73	0.58	0.8 J	0.8 J	1 J	0.8 J	1.2	1.3
BERYLLIUM	ug/L	0.008 J	0.009 J	0.009 J	0.009 J	0.01 J	0.009 J	0.008 J	0.007 J	0.009 J	0.009 J	0.008 J	0.0052 J	0.0084 J	0.004 J	0.0057 J	0.0051 J	0.0085 J
CADMIUM	ug/L	0.013 J	0.096	0.006 J	0.003 J	0.035	0.04	0.09	0.024	0.006 J	0.026	0.013 J	0.01 J	0.05	0.012 J	0.026	0.037	0.019 J
CHROMIUM (Cr^{3+}, Cr^{6+})	ug/L	0.1 J	0.1 J	0.15 J	0.24	0.11 J	0.14 J	0.07 J	0.08 J	0.13 J	0.08 J	0.05 J	0.2 J	0.2 J	0.03 J	0.2 J	0.04 J	0.09 J
COPPER	ug/L	1.11	0.747	0.521	0.682	0.575	0.751	0.609	0.861	0.666	0.464	0.707	0.411	0.384	0.45	0.241	0.484	0.595
LEAD	ug/L	0.296 *	0.085 *	0.042 *	0.063 *	0.086 *	0.088 *	0.096 *	0.07 *	0.079 *	0.024 *	0.031 *	0.023	0.161	0.071	0.071	0.035	0.015 J
MERCURY	ug/L	0.08 J	0.2 U	0.2 U	0.23 U	0.23 U	0.23 U	0.2 U	0.35	0.2 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.0006 J
NICKEL	ug/L	1.71	3.27	0.9	1.18	3.85	2.12	3.07	1.82	1.47	5.71	4.23	6.77	21.8	2.73	1.5	2.17	0.53
SELENIUM	ug/L	0.7 J	1.1	1 J	5.2	0.6 J	1 J	0.8 J	2.7	3.1	1.2	1 J	1 U	1 U	1 U	1 U	1 U	1 U
SILVER	ug/L	0.02 U,*N	0.02 U,*N	0.02 U,*N	0.006 J,*N	0.02 U,*N	0.02 U,*N	0.02 U,*N	0.02 U,*N	0.02 U,*N	0.02 U,*N	0.02 U,*N	0.02 U	0.02 U	0.02 U	0.005 J	0.021 U	0.02 U
THALLIUM	ug/L	0.007 J	0.023	0.002 J	0.011 J	0.013 J	0.014 J	0.062	0.011 J	0.012 J	0.002 J	0.001 J	0.0007 J	0.0068 J	0.0023 J	0.0024 J	0.0026 J	0.0121 J
ZINC	ug/L	1.57	1.18	0.37 J	0.43 J	1.4	1.16	2.09	0.54	1.44	0.93	0.6	1.12	5.82	1.07	0.89	2.62	3.29
Total Metals																		
CHROMIUM (CR^{+6})	ug/L	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
MERCURY	ug/L	0.2 U	0.2 U	0.2 U	0.23 U	0.23 U	0.23 U	0.09 J	0.4	0.2 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.0012
Nonmetals/Other																		
AMMONIA	mg/L	1.05	0.82	2.9	3.05	1.19	1.23	1.45	1.72	1.63	1.16	1.37	1.39	1.01	2.42	8.5	8.5	0.03
CYANIDE	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.005 J
NITRATE	mg/L	0.09 J	0.11 J	0.09 J	0.06 J	0.08 J	0.08 J	0.06 J	0.09 J	0.08 J	0.08 J	0.08 J	0.03 J	0.2 U	0.04 J	0.04 J	0.04 J	0.14 J
NITRATE + NITRITE	mg/L	0.09 J	0.11 J	0.11 J	0.06 J	0.08 J	0.11 J	0.06 J	0.12 J	0.08 J	0.12 J	0.12 J	0.04 J	0.04 J	0.05 J	0.05 J	0.05 J	0.14 J
NITRITE	mg/L	0.01 U	0.01 U	0.02 J	0.2 U	0.2 U	0.03 J	0.01 U	0.03 J	0.2 U	0.04 J	0.04 J	0.012 J	0.029 J	0.009 J	0.01 J	0.008 J	0.05 U
NITROGEN, KJELDAHL, TOTAL	mg/L	1.3	1.2	3.1	4.1	1.8	1.7	2.7	2.3	1.8	3.3	2.6	1.3	1	2.3	7.5	0.4	1.6
PH	Standard Units	7.38	7.29	8.62	8.45	7.3	7.31	7.41	7.03	7.17	7.2	7.5	7.15	6.85	7.23	7.07	7.05	7.99
REDOX	mV Ag/AgCl	280	190	171	184	182	144	277	274	257	216	121	402	28	192	118	40	NA
SULFIDE	mg/L	0.05 U	0.05 U	0.014 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.014 J	0.05 U	0.05 U	0.016 J	0.024 J	0.05 U	0.05 U	0.05 U
BIOCHEMICAL OXYGEN DEMAND (BOD)	mg/L	1.6 J	1.2 J	2.8 J	6	4 U	4 U	1.9 J	34	2.8 J	5	4	3.3 J	1.4 J	5	1.8 J	2.3 J	4 U
CHEMICAL OXYGEN DEMAND (COD)	mg/L	1980	1560	1250	1720	2040	1950	1700	1710	2090	1440	1320	1760	1560	1610	1480	1540	1230
PHOSPHOROUS, TOTAL ORTHOPHOSPHATE (AS P)	mg/L	0.02	0.01	0.12	0.03	0.02	0.01	0.22	0.01	0.03	0.01	0.01	0.04	0.02	0.02	0.03	0.03	0.02
TOTAL ORGANIC CARBON	mg/L	3	3.1	4	3.8	2.8	2.8	5	8.7	2.8	2.5	2.1	2.9	2.9	3	3.1	2.8	NA
TOTAL SUSPENDED SOLIDS	mg/L	5 U	5 U	5	7	6	7	5 U	7	7	6	5 U	22	22	10	9	10	6
DIESEL RANGE ORGANICS	ug/L	30 J	71 Z	34 J	44 J	39 J	36 J	26 J	57 Z	35 J	40 J	38 J	94 Z	31 J	41 J	61 Z	58 Z	19 J
RESIDUAL RANGE ORGANICS	ug/L	30 J	67 J	34 J	21 J	20 J	21 J	31 J	43 J	31 J	22 J	21 J	390 Z	29 J	28 J	53 J	41 J	25 J

Table 4-8 CLLNG Elutriate Chemistry

Chemical Name	Sample ID Units	C1U2EA	C2U2EA	SB4U2EA	SB7U2EA	SB9U2EA	SB9U2EB	SB10U2EA	SB11U2EA	SB12U2EA	C3L2EA	C4L2EA	SB7L2EA	SB10L2EA	SB12L2EA	SC123EA	SC123EB	SWRO[3]
PAHs																		
1-METHYLNAPHTHALENE	ug/L	0.02 U	0.0038 J	0.02 U	0.027 J	0.08 U	0.08 U	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.017 J	0.08 U	0.08 U	0.08 U	0.08 U	0.0086 J
2-METHYLNAPHTHALENE	ug/L	0.02 U	0.0036 J	0.02 U	0.011 J	0.08 U	0.08 U	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.017 J	0.08 U	0.08 U	0.08 U	0.08 U	0.0095 J
ACENAPHTHENE	ug/L	0.0025 J	0.003 J	0.02 U	0.054 J	0.08 U	0.08 U	0.02 U	0.02 U	0.0032 J	0.08 U	0.08 U	0.02 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
ACENAPHTHYLENE	ug/L	0.0067 J	0.0081 J	0.0027 J	0.08 U	0.08 U	0.08 U	0.0082 J	0.003 J	0.0026 J	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
ANTHRACENE	ug/L	0.02 U	0.0015 J	0.02 U	0.014 J	0.08 U	0.08 U	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
BENZO(A)ANTHRACENE	ug/L	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.013 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
BENZO(A)PYRENE	ug/L	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0023 J	0.02 U	0.08 U	0.08 U	0.016 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
BENZO(B)FLUORANTHENE	ug/L	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0033 J	0.02 U	0.08 U	0.08 U	0.017 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
BENZO(G,H,I)PERYLENE	ug/L	0.02 U	0.0038 J	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0074 J	0.02 U	0.08 U	0.08 U	0.035 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
BENZO(K)FLUORANTHENE	ug/L	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0015 J	0.02 U	0.08 U	0.08 U	0.015 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
CHRYSENE	ug/L	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0019 J	0.02 U	0.08 U	0.08 U	0.015 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
DIBENZ(A,H)ANTHRACENE	ug/L	0.02 U	0.0034 J	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0055 J	0.02 U	0.08 U	0.08 U	0.035 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
FLUORANTHENE	ug/L	0.02 U	0.0034 J	0.0034 J	0.025 J	0.016 J	0.019 J	0.0025 J	0.0038 J	0.0041 J	0.012 J	0.08 U	0.022 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
FLUORENE	ug/L	0.02 U	0.0032 J	0.02 U	0.033 J	0.08 U	0.08 U	0.02 U	0.02 U	0.02 U	0.08 U	0.08 U	0.012 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
INDENO(1,2,3-CD)PYRENE	ug/L	0.02 U	0.0034 J	0.02 U	0.08 U	0.08 U	0.08 U	0.02 U	0.0098 J	0.02 U	0.08 U	0.08 U	0.037 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
NAPHTHALENE	ug/L	0.011 J	0.26	0.0095 J	0.029 J	0.023 J	0.022 J	0.013 J	0.0094 J	0.016 J	0.021 J	0.031 J	0.05 J	0.017 J	0.026 J	0.038 J	0.039 J	0.011 J
PHENANTHRENE	ug/L	0.007 J	0.0088 J	0.0053 J	0.074 J	0.022 J	0.022 J	0.0064 J	0.0048 J	0.0057 J	0.08 U	0.027 J	0.037 J	0.08 U	0.013 J	0.08 U	0.08 U	0.02 U
PYRENE	ug/L	0.02 U	0.0025 J	0.0029 J	0.02 J	0.011 J	0.014 J	0.02 U	0.0033 J	0.003 J	0.08 U	0.0096 J	0.02 J	0.08 U	0.08 U	0.08 U	0.08 U	0.02 U
LMW PAH[1]	ug/L	0.0672	0.292	0.0675	0.282	0.285	0.284	0.0776	0.0672	0.0675	0.301	0.298	0.233	0.297	0.279	0.318	0.319	0.0791
HMW PAH[1]	ug/L	0.1	0.0665	0.0863	0.365	0.347	0.353	0.0925	0.0488	0.0871	0.372	0.3696	0.225	0.4	0.4	0.4	0.4	0.1
PAH Sum[1]	ug/L	0.1672	0.3585	0.1538	0.647	0.632	0.637	0.1701	0.116	0.1546	0.673	0.6676	0.458	0.697	0.679	0.718	0.719	0.1791
PCBs																		
PCB 8 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 18 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 Ui	4.9 Ui	4.9 U	4.8 U	4.9 Ui	5 U
PCB 28 (BZ)	ng/l	5 U	5 U	5 U	5.3 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
PCB 44 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 49 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 52 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 66 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 77 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 87 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 101 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 Ui	4.9 Ui	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 105 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 118 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 126 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 128 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 138 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 153 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 156 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 169 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 170 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 180 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 183 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 184 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 187 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 Ui	4.9 Ui	4.9 U	4.9 U	4.9 U	4.9 Ui	4.9 U	4.8 U	4.9 U	5 U
PCB 195 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 206 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB 209 (BZ)	ng/l	4.8 U	4.9 U	4.9 U	5.3 U	4.9 U	5 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.8 U	4.9 U	5 U
PCB Sum[2]	ng/l	62.5	63.75	63.75	68.9	63.75	65	63.75	63.75	63.75	63.75	63.75	63.75	63.75	63.75	62.5	63.75	87.5

Table 4-8 CLLNG Elutriate Chemistry

Chemical Name	Sample ID Units	C1U2EA	C2U2EA	SB4U2EA	SB7U2EA	SB9U2EA	SB9U2EB	SB10U2EA	SB11U2EA	SB12U2EA	C3L2EA	C4L2EA	SB7L2EA	SB10L2EA	SB12L2EA	SC123EA	SC123EB	SWRO[3]
Pesticides																		
2,4-DDD	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
2,4-DDE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
2,4-DDT	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0012 J
4,4-DDD	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
4,4-DDE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
4,4-DDT	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ALDRIN	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ALPHA-BHC	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ALPHA-CHLORDANE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
BETA-BHC	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
CIS-NONACHLOR	ug/L	0.01 U	0.01 U	0.01 Ui	0.01 Ui	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 Ui	0.0097 U
DELTA-BHC	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
DIELDRIN	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ENDOSULFAN I	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ENDOSULFAN II	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ENDOSULFAN SULFATE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ENDRIN	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ENDRIN ALDEHYDE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
ENDRIN KETONE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
GAMMA-BHC (LINDANE)	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
GAMMA-CHLORDANE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
HEPTACHLOR	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
HEPTACHLOR EPOXIDE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
HEXACHLOROBENZENE	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
METHOXYCHLOR	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
MIREX	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
OXYCHLORDANE	ug/L	0.01 Ui	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U
TOXAPHENE	ug/L	0.5 Ui	0.5 U	0.5 U	0.5 Ui	0.48 Ui	0.49 U	0.5 U	0.5 U	0.5 U	0.48 U	0.49 U	0.49 U	0.49 U	0.48 U	0.49 U	0.48 U	0.49 U
TRANS-NONACHLOR	ug/L	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.0097 U	0.0097 U	0.0097 U	0.0096 U	0.0097 U	0.0096 U	0.0097 U

[1]PAH summation of Low Molecular Weight PAHs, High Molecular Weight PAHs, and Total PAHs; 1/2 RL used in the summation in non-detect cases.
[2]PCB summation using 1/2 RL in non-detect cases.
[3] Mississippi Sound reference site water results were used for dissolved metals because dissolved metals data were not available for the ODMDS.

Data Qualifiers:
U: The compound was analyzed for, but was not detected ("Non-detect") at or above the RL/MDL.
*: The duplicate analysis not within control limits.
J: The result is an estimated concentration that is less than the RL but greater than or equal to the MDL
i: The RL/MDL has been elevated, due to a chromatographic interference.
N: MS/MSD exceed acceptance criteria.
Z: The chromatographic fingerprint does not resemble a petroleum product.
NA: Not analyzed

Table 4-9 CLLNG Elutriate Chemistry Comparison to State and Federal Water Quality Criteria and Required Dilution Factors

Chemical Name	Unit	Highest Result[1]	Federal WQC	MS WQC	Minimum WQC	ODMDS[2]	Dilution Factor[3]
Metals							
ANTIMONY	ug/L	1.89	N.S.	N.S.	N.S.	0.168	-
ARSENIC	ug/L	2.39	36	36	36	1.3	<1
BERYLLIUM	ug/L	0.01	N.S.	N.S.	N.S.	0.0085	-
CADMIUM	ug/L	0.096	8.8	9.3	8.8	0.019	<1
CHROMIUM (Cr^{3+}, Cr^{6+})	ug/L	0.24	N.S.	N.S.	N.S.	0.09	-
CHROMIUM (HEXAVALENT)	ug/L	5 *	50	50	50	0.09 [4]	<1
COPPER	ug/L	1.11	3.1	3.1	3.1	0.595	<1
LEAD	ug/L	0.296	8.1	8.1	8.1	0.015	<1
MERCURY	ug/L	0.35	0.94	0.025	0.025	0.0006	13.3
MERCURY (TOTAL)	ug/L	0.4	0.94	0.025	0.025	0.0012	15.8
NICKEL	ug/L	21.8	8.2	18.51	8.2	0.53	1.8
SELENIUM	ug/L	5.2	71	71	71	0.5	<1
SILVER [5]	ug/L	0.0105*	1.9	1.9	1.9	0.01	<1
THALLIUM	ug/L	0.062	N.S.	N.S.	N.S.	0.0121	-
ZINC	ug/L	5.82	81	81	81	3.29	<1
Nonmetals/Other							
AMMONIA	mg/L	8.5	N.S.	N.S.	-	0.03	-
CYANIDE	mg/L	0.005*	0.001	0.001	0.001	0.005	<1
NITRATE	mg/L	0.11	N.S.	N.S.	N.S.	0.14	-
NITRATE + NITRITE	mg/L	0.12	N.S.	N.S.	N.S.	0.14	-
NITRITE	mg/L	0.1*	N.S.	N.S.	N.S.	0.025	-
NITROGEN, KJELDAHL, TOTAL	mg/L	7.5	N.S.	N.S.	N.S.	1.6	-
SULFIDE	mg/L	0.024	2	N.S.	2	0.025	<1
BIOCHEMICAL OXYGEN DEMAND (BOD)	mg/L	34	N.S.	N.S.	N.S.	2	-
CHEMICAL OXYGEN DEMAND (COD)	mg/L	2090	N.S.	N.S.	N.S.	1230	-
PHOSPHOROUS, TOTAL ORTHOPHOSPHATE (AS P)	mg/L	0.22	0.1	N.S.	0.1	0.02	1.5
TOTAL ORGANIC CARBON	mg/L	8.7	N.S.	N.S.	N.S.	--	-
TOTAL SUSPENDED SOLIDS	mg/L	22	N.S.	N.S.	N.S.	6	-
DIESEL RANGE ORGANICS	ug/L	94	N.S.	N.S.	N.S.	19	-
RESIDUAL RANGE ORGANICS	ug/L	390	N.S.	N.S.	N.S.	25	-
PAHs [6]							
1-METHYLNAPHTHALENE	ug/L	0.04*	300	N.S.	300	0.0086	<1
2-METHYLNAPHTHALENE	ug/L	0.04*	300	N.S.	300	0.0095	<1
ACENAPHTHENE [7]	ug/L	0.054	710	N.S.	710	0.01	<1
ACENAPHTHYLENE	ug/L	0.04*	300	N.S.	300	0.01	<1
ANTHRACENE	ug/L	0.04*	300	N.S.	300	0.01	<1
BENZO(A)ANTHRACENE	ug/L	0.04*	300	N.S.	300	0.01	<1
BENZO(A)PYRENE	ug/L	0.04*	300	N.S.	300	0.01	<1
BENZO(B)FLUORANTHENE	ug/L	0.04*	300	N.S.	300	0.01	<1
BENZO(G,H,I)PERYLENE	ug/L	0.04*	300	N.S.	300	0.01	<1
BENZO(K)FLUORANTHENE	ug/L	0.04*	300	N.S.	300	0.01	<1
CHRYSENE	ug/L	0.04*	300	N.S.	300	0.01	<1
DIBENZ(A,H)ANTHRACENE	ug/L	0.04*	300	N.S.	300	0.01	<1
FLUORANTHENE [7]	ug/L	0.04*	16	N.S.	16	0.01	<1
FLUORENE	ug/L	0.04*	300	N.S.	300	0.01	<1
INDENO(1,2,3-CD)PYRENE	ug/L	0.04*	300	N.S.	300	0.01	<1
NAPHTHALENE	ug/L	0.26	2350	N.S.	2350	0.011	<1
PHENANTHRENE [8]	ug/L	0.074	4.6	N.S.	4.6	0.01	<1
PYRENE	ug/L	0.04*	300	N.S.	300	0.01	<1
PCBs							
PCB 8 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 18 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 28 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 44 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 49 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 52 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 66 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 77 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 87 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 101 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 105 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 118 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 126 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-

Table 4-9 CLLNG Elutriate Chemistry Comparison to State and Federal Water Quality Criteria and Required Dilution Factors

Chemical Name	Unit	Highest Result[1]	Federal WQC	MS WQC	Minimum WQC	ODMDS[2]	Dilution Factor[3]
PCBs (con't)							
PCB 128 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 138 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 153 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 156 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 169 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 170 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 180 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 183 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 184 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 187 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 195 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 206 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
PCB 209 (BZ)	ng/L	2.65*	N.S.	N.S.	N.S.	2.5	-
Total PCBs	ng/L	68.9	0.03	N.S.	0.03	62.5	<1
Pesticides							
2,4-DDD	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
2,4-DDE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
2,4-DDT	ug/L	0.005*	N.S.	N.S.	N.S.	0.0012	-
4,4-DDD	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
4,4-DDE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
4,4-DDT	ug/L	0.005*	0.001	0.001	0.001	0.00485	<1
ALDRIN [5]	ug/L	0.005*	1.3	1.3	1.3	0.00485	<1
ALPHA-BHC	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
ALPHA-CHLORDANE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
GAMMA-CHLORDANE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
OXYCHLORDANE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
ALPHA + GAMMA + OXY-CHLORDANE	ug/L	0.005*	0.004	0.004	0.004	0.00485	<1
BETA-BHC	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
CIS-NONACHLOR	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
DELTA-BHC	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
DIELDRIN	ug/L	0.005*	0.0019	0.0019	0.0019	0.00485	<1
ENDOSULFAN I	ug/L	0.005*	0.0087	N.S.	0.0087	0.00485	<1
ENDOSULFAN II	ug/L	0.005*	0.0087	N.S.	0.0087	0.00485	<1
ENDOSULFAN I + ENDOSULFAN II	ug/L	0.005*	N.S.	0.0087	0.0087	0.00485	<1
ENDOSULFAN SULFATE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
ENDRIN	ug/L	0.005*	0.0023	0.0023	0.0023	0.00485	<1
ENDRIN ALDEHYDE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
ENDRIN KETONE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
GAMMA-BHC (LINDANE) [5]	ug/L	0.005*	0.16	0.16	0.16	0.00485	<1
HEPTACHLOR	ug/L	0.005*	0.0036	0.0036	0.0036	0.00485	<1
HEPTACHLOR EPOXIDE	ug/L	0.005*	0.0036	N.S.	0.0036	0.00485	<1
HEXACHLOROBENZENE	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-
METHOXYCHLOR	ug/L	0.005*	0.03	N.S.	0.03	0.00485	<1
MIREX	ug/L	0.005*	0.001	N.S.	0.001	0.00485	<1
TOXAPHENE	ug/L	0.25*	0.0002	0.0002	0.0002	0.245	<1
TRANS-NONACHLOR	ug/L	0.005*	N.S.	N.S.	N.S.	0.00485	-

All metals are dissolved, unless otherwise noted. All organics are total.

* Value represents 1/2 RL

N.S. - Not Specified

[1] Highest station concentration

[2] Mississippi Sound results were used for dissolved metals because dissolved metals data were not available for the ODMDS.

[3] The dilution factor calculation formula is provided in Section 2.3.4

[4] Hexavalent chromium data were not available for ODMDS, so chromium (Cr^{3+}, Cr^{6+}) result was used instead.

[5] Chronic WQC were not available. Acute WQC was used instead.

[6] Chronic WQC were not available for PAHs. Acute Lowest Observable Effect Levels (Buchman, 1999) were used instead, unless otherwise noted.

[7] Chronic WQC were not available. Chronic Lowest Observable Effect Levels (Buchman, 1999) was used instead.

8 Chronic WQC were not available. Proposed chronic WQC was used instead.

Table 4-10a Standard SPP bioassay findings – *Americamysis bahia* percent survival results

Percent Survival of *A. bahia* after 96 Hours Exposure							
Treatment	**SC123 [8]**	**C1U2 [1,5]**	**C2U2 [2, 5]**	**SB10U2 [5]**	**SB11U2 [6]**	**SB12U2 [6]**	**SB4U2 [6]**
Diluent	96%	94%	94%	94%	98%	98%	98%
Lab Control	98%	98%	98%	98%	98%	98%	98%
1% SPP	98%	100%	96%	98%	98%	94%	98%
10% SPP	100%	98%	98%	98%	96%	98%	96%
50% SPP	94%	98%	98%	98%	96%	96%	100%
100% SPP	98%	98%	100%	100%	98%	94%	100%
LC-50	>100	>100	>100	>100	>100	>100	>100

Treatment	**SB7U2 [7]**	**SB9U2 [7]**	**C3L2 [3,7]**	**C4L2 [4,7]**	**SB10L2 [8]**	**SB12L2 [8]**	**SB7L2 [8]**
Diluent	98%	98%	98%	98%	96%	96%	96%
Lab Control	92%	92%	92%	92%	98%	98%	98%
1% SPP	96%	96%	96%	98%	96%	98%	98%
10% SPP	94%	92%	98%	100%	94%	96%	92%
50% SPP	98%	94%	94%	100%	96%	100%	96%
100% SPP	94%	92%	84%	86%	96%	76%	48%
LC-50	>100	>100	>100	>100	>100	>100	99.2

[1] Composite of SB1/SB2/SB3 upper layers
[2] Composite of SB5/SB6/SB8 upper layers
[3] Composite of SB1/SB2/SB3/SB4 lower layers
[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers
[5] Testing started on 2/1/06
[6] Testing started on 2/2/06
[7] Testing started on 2/6/06
[8] Testing started on 2/8/06

Table 4-10b Standard SPP bioassay findings – *Menidia beryllina* percent survival results

Percent Survival of *M. beryllina* after 96 Hours Exposure							
Treatment	**SC123 [8]**	**C1U2 [1,5]**	**C2U2 [2,5]**	**SB10U2 [5]**	**SB11U2 [6]**	**SB12U2 [6]**	**SB4U2 [6]**
Diluent	90%	98%	98%	98%	98%	98%	98%
Lab Control	98%	100%	100%	100%	100%	100%	100%
1% SPP	92%	100%	100%	100%	98%	92%	96%
10% SPP	94%	100%	100%	100%	100%	100%	98%
50% SPP	94%	100%	100%	98%	100%	96%	92%
100% SPP	84%	100%	96%	100%	98%	90%	96%
LC-50	>100	>100	>100	>100	>100	>100	>100

Treatment	**SB7U2 [7]**	**SB9U2 [7]**	**C3L2 [3,7]**	**C4L2 [4,7]**	**SB10L2 [8]**	**SB12L2 [8]**	**SB7L2 [8]**
Diluent	98%	98%	98%	98%	90%	90%	90%
Lab Control	98%	98%	98%	98%	98%	98%	98%
1% SPP	96%	94%	88%	98%	88%	96%	96%
10% SPP	94%	98%	98%	100%	96%	98%	96%
50% SPP	96%	100%	94%	96%	98%	94%	90%
100% SPP	100%	100%	98%	100%	96%	92%	100%
LC-50	>100	>100	>100	>100	>100	>100	>100

[1] Composite of SB1/SB2/SB3 upper layers
[2] Composite of SB5/SB6/SB8 upper layers
[3] Composite of SB1/SB2/SB3/SB4 lower layers
[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers
[5] Testing started on 2/1/06
[6] Testing started on 2/2/06
[7] Testing started on 2/6/06
[8] Testing started on 2/8/06

Table 4-10c Standard SPP bioassay findings – *Arbacia punctulata* percent survival and percent normal development results

Percent Survival of *A. punctulata*							
Treatment	**SC123 [7]**	**C1U2 [1,5]**	**C2U2 [2,5]**	**SB10U2 [5]**	**SB11U2 [7]**	**SB12U2 [7]**	**SB4U2 [7]**
Diluent	81%	95%	95%	95%	81%	81%	81%
Lab Control	94%	93%	93%	93%	94%	94%	94%
1% SPP	86%	95%	96%	94%	93%	97%	97%
10% SPP	94%	96%	88%	92%	95%	90%	89%
50% SPP	81%	95%	86%	93%	94%	95%	86%
100% SPP	77%	98%	71%	83%	97%	90%	22%
LC-50	>100	>100	>100	>100	>100	>100	89.0

Treatment	**SB7U2 [6]**	**SB9U2 [6]**	**C3L2 [3,6]**	**C4L2 [4,6]**	**SB10L2 [7]**	**SB12L2 [7]**	**SB7L2 [7]**
Diluent	65%	65%	65%	65%	81%	81%	81%
Lab Control	93%	93%	93%	93%	94%	94%	94%
1% SPP	85%	66%	68%	78%	91%	93%	85%
10% SPP	74%	69%	70%	77%	82%	90%	84%
50% SPP	68%	76%	86%	77%	86%	97%	84%
100% SPP	4%	78%	90%	80%	95%	95%	98%
LC-50	67.6	>100	>100	>100	>100	>100	>100

Percent Normal Development of *A. punctulata*							
Treatment	**SC123 [7]**	**C1U2 [1,5]**	**C2U2 [2,5]**	**SB10U2 [5]**	**SB11U2 [7]**	**SB12U2 [7]**	**SB4U2 [7]**
Diluent	76%	94%	94%	94%	76%	76%	76%
Lab Control	92%	92%	92%	92%	92%	92%	92%
1% SPP	86%	95%	93%	94%	93%	97%	99%
10% SPP	94%	96%	86%	91%	95%	90%	92%
50% SPP	21%	93%	81%	92%	94%	95%	85%
100% SPP	0%	94%	66%	73%	94%	60%	0%
EC-50	50.8	>100	>100	>100	>100	>100	68.4

Treatment	**SB7U2 [6]**	**SB9U2 [6]**	**C3L2 [3,6]**	**C4L2 [4,6]**	**SB10L2 [7]**	**SB12L2 [7]**	**SB7L2 [7]**
Diluent	62%	62%	62%	62%	76%	76%	76%
Lab Control	90%	90%	90%	90%	92%	92%	92%
1% SPP	84%	64%	67%	77%	92%	93%	85%
10% SPP	71%	68%	69%	76%	82%	90%	84%
50% SPP	64%	75%	84%	76%	86%	97%	80%
100% SPP	0%	75%	87%	79%	78%	88%	75%
EC-50	60.1	>100	>100	>100	>100	>100	>100

[1] Composite of SB1/SB2/SB3 upper layers
[2] Composite of SB5/SB6/SB8 upper layers
[3] Composite of SB1/SB2/SB3/SB4 lower layers
[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers
[5] Testing started on 2/1/06
[6] Testing started on 2/6/06
[7] Testing started on 2/11/06

Table 4-11 Median lethal concentration calculation summary

	Ab LC_{50} (%)	*Mb* LC_{50} (%)	*Ap* LC_{50} (%)	*Ap* EC_{50} (%)
Upper				
C1U2 [1]	>100	>100	>100	>100
C2U2 [2]	>100	>100	>100	>100
SB10U2	>100	>100	>100	>100
SB11U2	>100	>100	>100	>100
SB12U2	>100	>100	>100	>100
SB4U2	>100	>100	89	68.4
SB7U2	>100	>100	67.6	60.1
SB9U2	>100	>100	>100	>100
Lower				
C3L2 [3]	>100	>100	>100	>100
C4L2 [4]	>100	>100	>100	>100
SB10L2	>100	>100	>100	>100
SB12L2	>100	>100	>100	>100
SB7L2	99.2	>100	>100	>100
Coastal				
SC123	>100	>100	>100	50.8

***Ab: Americamysis bahia* – survival**
***Mb: Menidia beryllina* – survival**
***Ap: Arbacia punctulata* - survival and development**
[1] Composite SB1/SB2/SB3 upper layers
[2] Composite SB5/SB6/SB8 upper layers
[3] Composite SB1/SB2/SB3/SB4 lower layers
[4] Composite SB5/SB6/SB8/SB9/SB11 lower layers

Table 4-12a Standard SPP bioassay supporting statistics – *Americamysis bahia* percent survival results

Project Site	Data Normally Distributed*	Data Variances Homogeneous*	t- Test			
			t-Value	Critical t	p-Value	Significant Difference
Project Site vs ODMDS Diluent Control						
Upper						
C1U2 [1]	NA	NA	NA	NA	NA	NA
C2U2 [2]	NA	NA	NA	NA	NA	NA
SB10U2	NA	NA	NA	NA	NA	NA
SB11U2	NA	NA	NA	NA	NA	NA
SB12U2	Yes	Yes	1.265	1.860	0.2415	No
SB4U2	NA	NA	NA	NA	NA	NA
SB7U2	Yes	Yes	0.876	1.860	0.4068	No
SB9U2	Yes	Yes	2.121	1.860	0.0667	Yes
Lower						
C3L2 [3]	Yes	Yes	3.056	1.860	0.0157	Yes
C4L2 [4]	No	Yes	19.5	-	-	No [5]
SB10L2	NA	NA	NA	NA	NA	NA
SB12L2	Yes	Yes	2.283	1.860	0.0518	Yes
SB7L2	Yes	Yes	5.735	1.860	0.0004	Yes
Coastal						
SC123	NA	NA	NA	NA	NA	NA

*** Normality evaluated using Shapiro Wilks analysis; homogeneity of variances evaluated using F-Test.**

[1] Composite of SB1/SB2/SB3 upper layers

[2] Composite of SB5/SB6/SB8 upper layers

[3] Composite of SB1/SB2/SB3/SB4 lower layers

[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers

[5] Rank Sum test conducted when data not normally distributed

NA: Not Applicable, station survivorship exceeded reference survivorship

Table 4-12b Standard SPP bioassay supporting statistics – *Menidia beryllina* percent survival results

Project Site	Data Normally Distributed*	Data Variances Homogeneous*	t- Test			
			t-Value	Critical t	p-Value	Significant Difference
Project Site vs ODMDS Diluent Control						
Upper						
C1U2 [1]	NA**	NA	NA	NA	NA	NA
C2U2 [2]	No	Yes	27	-	-	No [5]
SB10U2	NA	NA	NA	NA	NA	NA
SB11U2	NA	NA	NA	NA	NA	NA
SB12U2	Yes	Yes	2.166	1.860	0.0622	Yes
SB4U2	No	Yes	25	-	-	No [5]
SB7U2	NA	NA	NA	NA	NA	NA
SB9U2	NA	NA	NA	NA	NA	NA
Lower						
C3L2 [3]	NA	NA	NA	NA	NA	NA
C4L2 [4]	NA	NA	NA	NA	NA	NA
SB10L2	NA	NA	NA	NA	NA	NA
SB12L2	NA	NA	NA	NA	NA	NA
SB7L2	NA	NA	NA	NA	NA	NA
Coastal						
SC123	Yes	No	1.529	2.132	0.1647	No

*** Normality evaluated using Shapiro Wilks analysis; homogeneity of variances evaluated using F-Test.**
[1] Composite of SB1/SB2/SB3 upper layers
[2] Composite of SB5/SB6/SB8 upper layers
[3] Composite of SB1/SB2/SB3/SB4 lower layers
[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers
[5] Rank Sum test conducted when data not normally distributed
NA: Not Applicable, station survivorship exceeded reference survivorship

Table 4-12c Standard SPP bioassay supporting statistics – *Arbacia punctulata* percent survival results

Project Site	Data Normally Distributed*	Data Variances Homogeneous*	t- Test			
			t-Value	Critical t	p-Value	Significant Difference
Project Site vs ODMDS Diluent Control						
Upper						
C1U2 [1]	NA	NA	NA	NA	NA	NA
C2U2 [2]	Yes	Yes	7.323	1.860	8.2E-05	Yes
SB10U2	Yes	Yes	4.310	1.860	0.002581	Yes
SB11U2	NA	NA	NA	NA	NA	NA
SB12U2	NA	NA	NA	NA	NA	NA
SB4U2	Yes	Yes	15.113	1.860	3.6E-07	Yes
SB7U2	Yes	Yes	26.361	1.860	4.6E-09	Yes
SB9U2	NA	NA	NA	NA	NA	NA
Lower						
C3L2 [3]	NA	NA	NA	NA	NA	NA
C4L2 [4]	NA	NA	NA	NA	NA	NA
SB10L2	NA	NA	NA	NA	NA	NA
SB12L2	NA	NA	NA	NA	NA	NA
SB7L2	NA	NA	NA	NA	NA	NA
Coastal						
SC123	Yes	Yes	1.566	1.860	0.1560	No

*** Normality evaluated using Shapiro Wilks analysis; homogeneity of variances evaluated using F-Test.**
[1] Composite of SB1/SB2/SB3 upper layers
[2] Composite of SB5/SB6/SB8 upper layers
[3] Composite of SB1/SB2/SB3/SB4 lower layers
[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers
NA: Not Applicable, station survivorship exceeded reference survivorship

Table 4-13 Agency recommended tissue analysis scope

Parameters	Stations[1]
% Lipids, % Solids	SB7U, SB7L, SB10L, SC123, Grand Bay Reference
Metals	
Antimony	SB7L, SB10L, SC123, Grand Bay Reference
Arsenic	
Beryllium	
Cadmium	
Chromium (Total)	
Copper	
Lead	
Mercury	
Nickel	
Selenium	
Silver	
Thallium	
Zinc	
PAHs	
1-Methylnaphthalene	SB7U, Grand Bay Reference
2-Methylnaphthalene	
Acenaphthene	
Acenaphthylene	
Anthracene	
Benzo(a)anthracene	
Benzo(a)pyrene	
Benzo(b)fluoranthene	
Benzo(g,h,i)perylene	
Benzo(k)fluoranthene	
Chrysene	
Dibenz(a,h)anthracene	
Fluoranthene	
Fluorene	
Indeno(1,2,3-cd)pyrene	
Naphthalene	
Phenanthrene	
Pyrene	

[1] **5 replicates per station per tissue type**

Table 4-14 Casotte Landing Station SB7U biota to sediment accumulation factors[1]

	Macoma		*Nereis*	
	Reference	**SB7U2**	**Reference**	**SB7U2**
1-Methylnaphthalene	0.60	0.01	0.76	0.01
2-Methylnaphthalene	0.39	0.01	0.32	0.01
Acenaphthene	*0.16*	0.005	ND	0.004
Anthracene	0.16	0.11	ND	ND
Benzo(a)anthracene	0.22	0.13	ND	0.39
Benzo(a)pyrene	0.43	0.39	0.30	0.28
Benzo(b)fluoranthene	0.31	0.13	ND	0.61
Benzo(g,h,i)perylene	1.30	ND[2]	ND	0.75
Benzo(k)fluoranthene	0.58	0.09	ND	0.70
Chrysene	0.18	0.22	ND	0.37
Fluoranthene	0.40	0.42	0.13	0.07
Fluorene	*0.13*	0.02	*0.11*	0.01
Indeno(1,2,3-CD)pyrene	ND	ND	ND	0.78
Naphthalene	0.23	0.03	0.18	0.03
Phenanthrene	0.80	0.13	0.33	0.02
Pyrene	0.17	0.26	0.21	0.05

[1]BSAFs have been calculated for parameters detected in at least three tissue replicates. Italicized values were undetected in the sediment, and 1/2 RL was substituted for the calculation. Wet weight tissue concentrations were used.

[2]ND - Analyte was detected in less than three tissue replicates.

Table 4-15a 28-day bioassay survival – *Macoma nasuta* percent survival results

Project Site	Percent Survival After 28 Days Exposure*					Mean Percent Survival
Laboratory Control	100%	90%	100%	90% [5]	97%	95%
Grand Bay Reference	87%	73%	100%	100%	100%	92%
Upper						
C1U [1]	87%	100%	90%	83%	90%	90%
C2U [2]	90%	97%	90%	93%	97%	93%
SB10U2	87%	90%	90%	87%	97%	90%
SB11U2	77% [6]	93%	97%	87%	90%	89%
SB12U2	93%	100%	100%	87%	93%	95%
SB4U2	100%	94%	90%	100%	97%	96%
SB7U2	93%	100%	97%	93%	97%	96%
SB9U2	90%	87%	97%	90%	90%	91%
Lower						
C3L [3]	90%	83%	87%	83%	90%	87%
C4L [4]	93%	97%	81%	90%	77%	88%
SB10L2	83%	100%	83%	90%	87%	89%
SB12L2	97%	90%	83%	83%	93%	89%
SB7L2	87%	90%	97%	87%	90%	90%
Coastal						
SC123	90%	80%	93%	93%	80%	87%

*** n = 30 organisms per replicate**

[1] Composite of SB1/SB2/SB3 upper layers

[2] Composite of SB5/SB6/SB8 upper layers

[3] Composite of SB1/SB2/SB3/SB4 lower layers

[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers

[5] Only 20 organisms were added to this replicate (versus 30 specified)

[6] An excess of organisms were added to this replicate at test initiation. Percent survival is based on 60 original organisms (total of surviving and deceased organisms)

Table 4-15b 28-day bioassay survival – *Nereis virens* percent survival results

Project Site	Percent Survival After 28 Days Exposure*					Mean Percent Survival
Laboratory Control	90%	90%	100%	100%	85%	93%
Grand Bay Reference	100%	100%	100%	75%	100%	95%
Upper						
C1U [1]	100%	90%	80%	80%	75%	85%
C2U [2]	85%	80%	90%	100%	80%	87%
SB10U2	75%	90%	95%	85%	70%	83%
SB11U2	90%	85%	85%	90%	70%	84%
SB12U2	70%	100%	95%	85%	90%	88%
SB4U2	90%	85%	100%	90%	95%	92%
SB7U2	90%	75%	100%	60%	100%	85%
SB9U2	85%	95%	95%	70%	100%	89%
Lower						
C3L [3]	80%	65%	60%	85%	85%	75%
C4L [4]	90%	100%	90%	80%	75%	87%
SB10L2	100%	95%	100%	100%	80%	95%
SB12L2	80%	80%	100%	100%	75%	87%
SB7L2	65%	100%	65%	80%	65%	75%
Coastal						
SC123	70%	100%	85%	95%	100%	90%

*** n = 30 organisms per replicate**

[1] Composite of SB1/SB2/SB3 upper layers

[2] Composite of SB5/SB6/SB8 upper layers

[3] Composite of SB1/SB2/SB3/SB4 lower layers

[4] Composite of SB5/SB6/SB8/SB9/SB11 lower layers

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Table 4-16 Tissue Chemistry Results - *Macoma nasuta* (Wet Weight)

	Sample ID	Unexposed					Grand Bay Reference					Station SB7U				
	Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Chemical Name	Unit															
TOTAL LIPIDS	PERCENT	0.5	0.52	0.59	0.68	0.64	0.63	0.64	0.73	0.68	0.61	0.66	0.65	0.65	0.75	0.65
TOTAL SOLIDS	PERCENT	13	13.2	12.9	15.8	15	15.7	14.3	16.6	15.5	14.9	16.6	16.6	14.3	16.6	14.1
ANTIMONY	mg/kg	0.015	0.019	0.016	0.021	0.017	0.012	0.013	0.014	0.013	0.012	NA	NA	NA	NA	NA
ARSENIC	mg/kg	3.26	3.77	3.35	4.07	3.62	3.75	3.52	3.41	3.55	3.52	NA	NA	NA	NA	NA
BERYLLIUM	mg/kg	0.0007 J	0.0012 J	0.0008 J	0.0013 J	0.001 J	0.0063	0.0064	0.0086	0.0057	0.0068	NA	NA	NA	NA	NA
CADMIUM	mg/kg	0.0308	0.0327	0.0288	0.0376	0.0407	0.0322	0.032	0.0286	0.042	0.0367	NA	NA	NA	NA	NA
CHROMIUM	mg/kg	0.12	0.23	0.18	0.26	0.16	0.36	0.34	0.42	0.37	0.45	NA	NA	NA	NA	NA
COPPER	mg/kg	1.53	1.71	1.49	1.78	1.94	2.78	1.87	2.42	1.93	1.75	NA	NA	NA	NA	NA
LEAD	mg/kg	0.076	0.106	0.083	0.095	0.12	0.241	0.198	0.269	0.198	0.226	NA	NA	NA	NA	NA
MERCURY	mg/kg	0.002 J	0.003	0.003	0.003 J	0.004	0.004	0.004	0.006	0.004	0.004	NA	NA	NA	NA	NA
NICKEL	mg/kg	0.405	0.42	0.397	0.584	0.434	0.557	0.443	0.449	0.561	0.698	NA	NA	NA	NA	NA
SELENIUM	mg/kg	0.18	0.25	0.21	0.2	0.27	0.29	0.27	0.24	0.26	0.25	NA	NA	NA	NA	NA
SILVER	mg/kg	0.0507	0.07	0.0547	0.0839	0.0863	0.108	0.0631	0.0585	0.0858	0.0806	NA	NA	NA	NA	NA
THALLIUM	mg/kg	0.0011 J	0.0013 J	0.0011 J	0.0014 J	0.0014 J	0.0021 J	0.002 J	0.0026 J	0.0018 J	0.002 J	NA	NA	NA	NA	NA
ZINC	mg/kg	11.8	12.5	12.3	17	13.8	14.5	16	15.6	16.1	13.8	NA	NA	NA	NA	NA
1-METHYLNAPHTHALENE	ug/Kg	0.66 J	0.67 J	0.65 J	0.74 J	0.60 J	0.58 J	0.57 J	0.61 J	0.66 J	0.60 J	NA	0.61 J	0.57 J	0.63 J	0.56 J
2-METHYLNAPHTHALENE	ug/Kg	0.67 J	0.69 J	0.59 J	0.73 J	0.66 J	0.69 J	0.61 J	0.65 J	0.74 J	0.69 J	0.43 J	0.65 J	0.66 J	0.70 J	0.66 J
ACENAPHTHENE	ug/Kg	0.18 J	0.12 J	5.0 U	0.15 J	0.14 J	0.19 J	0.16 J	0.38 J	0.17 J	5.0 U	0.21 J	0.53 J	0.28 J	0.32 J	0.22 J
ACENAPHTHYLENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
ANTHRACENE	ug/Kg	0.20 J	0.16 J	0.15 J	0.19 J	0.20 J	0.18 J	0.14 J	0.12 J	0.19 J	0.14 J	1.4 J	2.5 J	0.90 J	1.0 J	0.69 J
BENZO(A)ANTHRACENE	ug/Kg	0.25 J	0.22 J	0.17 J	0.20 J	0.30 J	0.15 J	5.0 U	0.18 J	0.16 J	0.22 J	0.79 J	1.0 J	0.50 J	0.51 J	0.41 J
BENZO(A)PYRENE	ug/Kg	0.62 J	0.52 J	0.64 J	0.53 J	0.66 J	0.81 J	0.82 J	0.85 J	0.99 J	1.1 J	0.96 J	0.85 J	0.72 J	1.1 J	1.0 J
BENZO(B)FLUORANTHENE	ug/kg	0.24 J	5.0 U	0.24 J	5.0 U	0.26 J	5.0 U	0.25 J	0.28 J	0.33 J	0.25 J	0.48 J	0.45 J	0.38 J	0.42 J	0.30 J
BENZO(G,H,I)PERYLENE	ug/kg	0.17 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
BENZO(K)FLUORANTHENE	ug/kg	0.15 J	5.0 U	0.17 J	5.0 U	0.15 J	5.0 U	0.18 J	0.21 J	0.19 J	5.0 U	0.34 J	0.34 J	0.20 J	0.27 J	0.19 J
CHRYSENE	ug/Kg	0.48 J	0.42 J	0.43 J	0.53 J	0.52 J	0.43 J	0.42 J	0.42 J	0.51 J	0.45 J	1.3 J	1.6 J	0.98 J	1.2 J	0.89 J
DIBENZ(A,H)ANTHRACENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
FLUORANTHENE	ug/Kg	2.0 J	1.8 J	1.9 J	2.3 J	2.4 J	2.2 J	1.7 J	2.1 J	2.8 J	1.6 J	10	15	7.9	10	8.1
FLUORENE	ug/Kg	0.44 J	0.36 J	0.39 J	0.45 J	0.41 J	0.55 J	0.49 J	0.51 J	0.66 J	0.48 J	1.0 J	1.3 J	0.74 J	0.90 J	0.72 J
INDENO(1,2,3-CD)PYRENE	ug/kg	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
NAPHTHALENE	ug/Kg	0.77 J	0.84 J	0.84 J	0.96 J	0.83 J	1.1 J	1.0 J	0.97 J	1.1 J	0.97 J	0.51 J	0.94 J	0.98 J	0.98 J	0.76 J
PHENANTHRENE	ug/Kg	1.2 J	1.2 J	1.1 J	1.6 J	1.4 J	3.1 J	2.6 J	2.7 J	4.2 J	2.1 J	8.7	12	6.5	8.6	6.4
PYRENE	ug/Kg	1.0 J	0.88 J	0.95 J	1.1 J	1.2 J	1.1 J	0.96 J	0.94 J	1.4 J	0.91 J	4.1 J	7.0	4.5 J	5.3	4.2 J

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Table 4-16 Tissue Chemistry Results - *Macoma nasuta* (Wet Weight)

	Sample ID	Station SB7L					Station SB10L					Station SC123				
	Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Chemical Name	**Unit**															
TOTAL LIPIDS	PERCENT	0.59	0.58	0.54	0.6	0.65	0.62	0.59	0.59	0.56	0.62	0.68	0.73	0.65	0.73	0.66
TOTAL SOLIDS	PERCENT	14.2	15.7	13.8	13.9	14.3	14.6	16.3	14.4	14.8	14.4	13.8	14.3	14.6	16.6	14.6
ANTIMONY	mg/kg	0.013	0.016	0.015	0.014	0.018	0.02	0.014	0.017	0.016	0.016	0.013	0.014	0.012	0.015	0.013
ARSENIC	mg/kg	2.89	3.12	3.37	3.42	3.42	3.3	3.04	3.15	3.43	3.37	3.54	3.69	3.48	3.34	3.2
BERYLLIUM	mg/kg	0.0058	0.0038	0.0045	0.0048	0.0039	0.004	0.0043	0.0031	0.0033	0.0026 J	0.0033	0.0063	0.0054	0.0038	0.0044
CADMIUM	mg/kg	0.0303	0.0354	0.0362	0.0359	0.0345	0.0473	0.0357	0.036	0.0366	0.0414	0.0338	0.0418	0.0333	0.0354	0.0307
CHROMIUM	mg/kg	0.26	0.22	0.24	0.31	0.29	0.24	0.32	0.22	0.15	0.15	0.2	0.32	0.28	0.25	0.31
COPPER	mg/kg	2.29	2.12	1.85	2.03	2.12	2	1.68	2.16	2.11	2.06	1.97	1.85	1.79	2.12	1.92
LEAD	mg/kg	0.145	0.14	0.149	0.147	0.136	0.157	0.145	0.133	0.139	0.138	0.137	0.206	0.162	0.156	0.158
MERCURY	mg/kg	0.004	0.004	0.003	0.004	0.004	0.003	0.004	0.004	0.004	0.003	0.003	0.004	0.002 J	0.003	0.004
NICKEL	mg/kg	0.423	0.452	0.408	0.393	0.424	0.452	0.748	0.457	0.509	0.549	0.446	0.498	0.458	0.537	0.459
SELENIUM	mg/kg	0.25	0.26	0.25	0.22	0.26	0.2	0.22	0.22	0.18	0.21	0.17	0.27	0.27	0.25	0.28
SILVER	mg/kg	0.0531	0.0454	0.0732	0.0703	0.0626	0.0523	0.0528	0.0736	0.061	0.0522	0.11	0.0909	0.0768	0.0722	0.0735
THALLIUM	mg/kg	0.0017 J	0.0012 J	0.0014 J	0.0017 J	0.0014 J	0.0018 J	0.0015 J	0.0011 J	0.0017 J	0.0012 J	0.0014 J	0.002 J	0.0016 J	0.0013 J	0.0014 J
ZINC	mg/kg	12	14.1	13.5	16.4	13.7	18	13.5	14.3	13.2	13.3	15	17.5	13.9	14.7	14.8
1-METHYLNAPHTHALENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-METHYLNAPHTHALENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ACENAPHTHENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ACENAPHTHYLENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ANTHRACENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(A)PYRENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHRYSENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DIBENZ(A,H)ANTHRACENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FLUORANTHENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FLUORENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NAPHTHALENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PHENANTHRENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PYRENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Data Qualifiers:
U: Undetected; parameter was not detected above the laboratory RL.
J: The result is an estimated concentration that is less than the RL but greater than or equal to the MDL.
NA: Not analyzed per agency recommendation.

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Table 4-17 Tissue Chemistry Results - *Nereis virens* (Wet Weight)

Chemical Name	Sample ID / Replicate / Unit	Unexposed					Grand Bay Reference					Station SB7U				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
TOTAL LIPIDS	PERCENT	0.83	0.86	0.9	0.9	0.97	0.65	0.7	0.61	0.67	0.49	1	0.84	1	0.56	0.86
TOTAL SOLIDS	PERCENT	17.5	17.9	17.6	17.8	17.5	11.9	12.9	12.4	13.2	10.8	13.0	13.7	13.2	11.6	12.8
ANTIMONY	mg/kg	0.002 J	0.004 J	0.002 J	0.002 J	0.004 J	0.002 J	0.003 J	0.003 J	0.003 J	0.003 J	NA	NA	NA	NA	NA
ARSENIC	mg/kg	2.51	2.45	2.57	2.67	2.39	1.65	2.02	1.8	1.98	1.48	NA	NA	NA	NA	NA
BERYLLIUM	mg/kg	0.0226	0.02	0.0232	0.0269	0.0206	0.0009 J	0.0026 U	0.003	0.0011 J	0.0007 J	NA	NA	NA	NA	NA
CADMIUM	mg/kg	0.0517	0.0501	0.0528	0.0539	0.0485	0.0399	0.0395	0.0407	0.038	0.0354	NA	NA	NA	NA	NA
CHROMIUM	mg/kg	1.32	1.32	1.33	1.35	1.29	0.09	0.12	0.25	0.12	0.1	NA	NA	NA	NA	NA
COPPER	mg/kg	2.22	2.19	2.28	2.27	2.12	0.981	1.16	1.04	1.11	1	NA	NA	NA	NA	NA
LEAD	mg/kg	0.437	0.447	0.447	0.457	0.411	0.078	0.091	0.124	0.105	0.082	NA	NA	NA	NA	NA
MERCURY	mg/kg	0.046	0.047	0.046	0.042	0.045	0.029	0.028	0.029	0.026	0.026	NA	NA	NA	NA	NA
NICKEL	mg/kg	0.701	0.688	0.727	0.717	0.682	0.16	0.218	0.287	0.257	0.144	NA	NA	NA	NA	NA
SELENIUM	mg/kg	0.18	0.22	0.24	0.18	0.18 J	0.16	0.16	0.17	0.11 J	0.11	NA	NA	NA	NA	NA
SILVER	mg/kg	0.0378	0.038	0.0377	0.0368	0.0356	0.0167	0.0193	0.022	0.0167	0.013	NA	NA	NA	NA	NA
THALLIUM	mg/kg	0.0059	0.0061	0.0062	0.006	0.0055	0.0024 U	0.0005 J	0.0012 J	0.0004 J	0.0003 J	NA	NA	NA	NA	NA
ZINC	mg/kg	41.6 N	34.1 N	39.9 N	74.4 N	62.7 N	20.4 N	33.7 N	37.5 N	63.3 N	19.5 N	NA	NA	NA	NA	NA
1-METHYLNAPHTHALENE	ug/Kg	0.98 J	1.0 J	1.0 J	0.93 J	1.0 J	0.79 J	0.82 J	0.45 J	0.90 J	0.68 J	1.1 J	0.86 J	0.85 J	0.67 J	0.67 J
2-METHYLNAPHTHALENE	ug/Kg	1.0 J	0.72 J	0.83 J	0.69 J	0.82 J	0.57 J	0.62 J	0.28 J	0.65 J	0.48 J	0.93 J	0.72 J	0.66 J	0.60 J	0.63 J
ACENAPHTHENE	ug/kg	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.18 J	5.0 U	5.0 U	0.53 J	0.37 J	0.36 J	0.33 J	0.32 J
ACENAPHTHYLENE	ug/kg	5.1 U	0.78 J	5.0 U	0.72 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.17 J
ANTHRACENE	ug/kg	0.54 J	0.36 J	0.29 J	5.0 U	0.40 J	5.0 U	5.0 U	0.10 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.13 J
BENZO(A)ANTHRACENE	ug/kg	1.3 J	1.1 J	0.83 J	1.4 J	1.3 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
BENZO(A)PYRENE	ug/Kg	2.4 J	2.3 J	1.9 J	2.1 J	2.4 J	0.68 J	0.55 J	0.67 J	0.62 J	0.52 J	0.59 J	0.35 J	0.45 J	0.35 J	5.0 U
BENZO(B)FLUORANTHENE	ug/kg	1.6 J	1.3 J	1.2 J	1.5 J	1.6 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
BENZO(G,H,I)PERYLENE	ug/kg	1.2 J	1.2 J	1.1 J	1.2 J	1.3 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
BENZO(K)FLUORANTHENE	ug/kg	1.5 J	1.3 J	1.2 J	1.5 J	1.3 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
CHRYSENE	ug/kg	2.1 J	2.0 J	1.6 J	3.6 J	2.2 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
DIBENZ(A,H)ANTHRACENE	ug/kg	5.1 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
FLUORANTHENE	ug/Kg	3.1 J	2.9 J	2.6 J	3.1 J	3.2 J	0.68 J	0.84 J	0.60 J	0.53 J	0.50 J	2.8 J	2.2 J	2.2 J	1.3 J	1.7 J
FLUORENE	ug/Kg	0.65 J	0.45 J	0.61 J	0.61 J	0.51 J	0.40 J	0.48 J	0.38 J	0.53 J	0.36 J	0.63 J	0.35 J	0.37 J	0.35 J	0.51 J
INDENO(1,2,3-CD)PYRENE	ug/kg	1.2 J	0.99 J	0.92 J	1.1 J	1.1 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
NAPHTHALENE	ug/Kg	1.8 J	1.3 J	1.5 J	1.7 J	1.8 J	0.67 J	0.89 J	0.40 J	1.1 J	0.68 J	1.3 J	1.1 J	1.1 J	0.88 J	0.76 J
PHENANTHRENE	ug/Kg	2.1 J	1.8 J	1.8 J	2.8 J	2.1 J	1.2 J	1.5 J	0.95 J	1.2 J	0.87 J	2.9 J	1.6 J	1.7 J	1.4 J	1.5 J
PYRENE	ug/Kg	2.8 J	2.8 J	2.4 J	2.7 J	3.0 J	0.56 J	5.0 U	0.40 J	5.0 U	0.35 J	1.6 J	1.5 J	1.2 J	0.91 J	1.2 J

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Table 4-17 Tissue Chemistry Results - *Nereis virens* (Wet Weight)

Chemical Name	Sample ID / Replicate / Unit	Station SB7L					Station SB10L					Station SC123				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
TOTAL LIPIDS	PERCENT	0.95	0.84	1.1	0.76	0.91	0.96	1.1	0.97	0.69	0.86	0.69	0.83	0.6	0.57	0.74
TOTAL SOLIDS	PERCENT	13.6	12.5	14.2	13.5	13.9	15.5	13.8	13.5	12.2	15.3	12.4	13.6	12	13.5	13.3
ANTIMONY	mg/kg	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J	0.002 J
ARSENIC	mg/kg	2.29	2.04	2.09	2.4	2.46	2.08	1.93	1.99	2.05	2.28	1.9	2.28	1.86	2.17	2.15
BERYLLIUM	mg/kg	0.0026 J	0.003	0.0033	0.001 J	0.0014 J	0.0019 J	0.0021 J	0.0052	0.0016 J	0.0037	0.0014 J	0.0005 J	0.0009 J	0.0011 J	0.0033
CADMIUM	mg/kg	0.0421	0.0433	0.0484	0.0465	0.0427	0.0563	0.0493	0.0441	0.0478	0.0581	0.0327	0.0398	0.0297	0.0461	0.0324
CHROMIUM (TOTAL)	mg/kg	0.13	0.14	0.17	0.09	0.1	0.14	0.25	0.19	0.07	0.13	0.14	0.07	0.08	0.13	0.16
COPPER	mg/kg	1.33	1.15	1.03	1.28	1.11	1.08	0.943	1.5	1.19	1.2	0.619	0.782	0.651	1.02	0.902
LEAD	mg/kg	0.101	0.11	0.119	0.085	0.099	0.114	0.115	0.125	0.11	0.112	0.1	0.093	0.074	0.114	0.104
MERCURY	mg/kg	0.02	0.017	0.019	0.02	0.017	0.02	0.017	0.018	0.018	0.021	0.013	0.014	0.016	0.022	0.019
NICKEL	mg/kg	0.311	0.296	0.356	0.373	0.268	0.856	0.494	0.477	0.47	0.647	0.191	0.206	0.171	0.307	0.308
SELENIUM	mg/kg	0.12 J	0.15	0.17	0.15	0.17	0.15 J	0.19	0.12 J	0.11 J	0.12 J	0.04 J	0.07 J	0.06 J	0.11 J	0.08 J
SILVER	mg/kg	0.0195	0.0116	0.0145	0.0113	0.0141	0.0096	0.0081	0.0093	0.0099	0.0086	0.0133	0.0215	0.0143	0.0192	0.0142
THALLIUM	mg/kg	0.0007 J	0.0009 J	0.001 J	0.0003 J	0.0005 J	0.0007 J	0.0007 J	0.0014 J	0.0008 J	0.0013 J	0.0005 J	0.0003 J	0.0004 J	0.0004 J	0.0009 J
ZINC	mg/kg	30.5 *N	15 *N	42.6 *N	8.72 *N	43.4 *N	10.6 *N	18.3 *N	10.1 *N	47.6 *N	10.9 *N	22.2 N	31.3 N	33.4 N	35.2 N	48.6 N
1-METHYLNAPHTHALENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-METHYLNAPHTHALENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ACENAPHTHENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ACENAPHTHYLENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ANTHRACENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(A)PYRENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHRYSENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DIBENZ(A,H)ANTHRACENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FLUORANTHENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FLUORENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NAPHTHALENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PHENANTHRENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PYRENE	ug/Kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Data Qualifiers:
U: Undetected; parameter was not detected above the laboratory RL.
*: The duplicate analysis not within control limits.
J: The result is an estimated concentration that is less than the RL but greater than or equal to the MDL.
N: MS/MSD exceed acceptance criteria.
NA: Not analyzed per agency recommendation.

Table 4-18 Food and Drug Administration action levels for edible fish and shellfish[1]

Substance	Action Level[2]
Metals	
Methyl Mercury	1.0 ppm
Pesticides	
Chlordane	0.3 ppm
Chlordecone (Kepone)	0.3 ppm
DDT + DDE	5.0 ppm
Dieldrin + Aldrin	0.3 ppm
Heptachlor + Heptachlor Epoxide	0.3 ppm
Mirex	0.1 ppm
Industrial Chemicals	
PCBs	(2.0 ppm)[3]

[1] References: CPG 540.600 (Hg); CPG 575.100 (pesticides).

[2] Action levels are reported in wet weight.

[3] Equal to the previous action level until a tolerance level has been established

Table 4-19 Mercury tissue upper confidence limit test results (wet weight)

	Units	UCL	Mean
Nereis virens			
SB10L	mg/kg	0.0204	0.0188
SB7L	mg/kg	0.0200	0.0186
SC123	mg/kg	0.0203	0.0168
Reference	mg/kg	0.0290	0.0276
Unexposed	mg/kg		
Macoma nasuta			
SB10L	mg/kg	0.0041	0.0036
SB7L	mg/kg	0.0042	0.0038
SC123	mg/kg	0.0040	0.0032
Reference	mg/kg	0.0053	0.0044
Unexposed	mg/kg	0.0037	0.0030
FDA Action Level	mg/kg	1.0000	

Table 4-20 Tissue exposure comparisons for detected analytes - *Macoma nasuta* (wet weight) (page 1 of 2)

Site	Data Normally Distributed[1]		t-Test[2]		Comparison to Unexposed	
	Raw (alpha=0.01)	Ln (alpha=0.01)	p-value (alpha=0.05)	Significant Difference	p-value (alpha=0.05)	Signif. > Unexposed[3]
SB7L						
Antimony	yes	-	0.0234	**yes**	Less than unexposed tissue	
Arsenic	Less than Reference[4]				-	-
Beryllium	Less than Reference[4]				-	-
Cadmium	yes	-	0.4761	no	-	-
Chromium	Less than Reference[4]				-	-
Copper	Less than Reference[4]				-	-
Lead	Less than Reference[4]				-	-
Mercury	Less than Reference[4]				-	-
Nickel	Less than Reference[4]				-	-
Selenium	Less than Reference[4]				-	-
Silver	Less than Reference[4]				-	-
Thallium	Less than Reference[4]				-	-
Zinc	Less than Reference[4]				-	-
SB10L						
Antimony	yes	-	0.0072	**yes**	Less than unexposed tissue	
Arsenic	Less than Reference[4]				-	-
Beryllium	Less than Reference[4]				-	-
Cadmium	yes	-	0.0757	no	-	-
Chromium	Less than Reference[4]				-	-
Copper	Less than Reference[4]				-	-
Lead	Less than Reference[4]				-	-
Mercury	Less than Reference[4]				-	-
Nickel	yes	-	0.4924	no	-	-
Selenium	Less than Reference[4]				-	-
Silver	Less than Reference[4]				-	-
Thallium	Less than Reference[4]				-	-
Zinc	Less than Reference[4]				-	-
SC123						
Antimony	yes	-	0.1865	no	-	-
Arsenic	Less than Reference[4]				-	-
Beryllium	Less than Reference[4]				-	-
Cadmium	yes	-	0.4099	no	-	-
Chromium	Less than Reference[4]				-	-
Copper	Less than Reference[4]				-	-
Lead	Less than Reference[4]				-	-
Mercury	Less than Reference[4]				-	-
Nickel	Less than Reference[4]				-	-
Selenium	Less than Reference[4]				-	-
Silver	yes	-	0.3216	no	-	-
Thallium	Less than Reference[4]				-	-
Zinc	Less than Reference[4]				-	-

Table 4-20 Tissue exposure comparisons for detected analytes - *Macoma nasuta* (wet weight) (page 2 of 2)

Site	Data Normally Distributed[1]		t-Test[2]		Comparison to Unexposed	
	Raw (alpha=0.01)	Ln (alpha=0.01)	p-value (alpha=0.05)	Significant Difference	p-value (alpha=0.05)	Signif. > Unexposed[3]
SB7U						
1-Methylnaphthalene	Less than Reference[4]				-	-
2-Methylnaphthalene	Less than Reference[4]				-	-
Acenaphthene	Less than Reference[4]				-	-
Anthracene	yes	-	0.0118	**yes**	0.0127	**yes**
Benzo(a)anthracene[5]	no	no	0.1172	no	-	-
Benzo(a)pyrene	yes	-	0.4465	no	-	-
Benzo(b)fluoranthene	Less than Reference[4]				-	-
Benzo(k)fluoranthene	Less than Reference[4]				-	-
Chrysene	yes	-	0.0018	**yes**	0.002	**yes**
Fluoranthene	yes	-	0.0014	**yes**	0.0015	**yes**
Fluorene	yes	-	0.0088	**yes**	0.0036	**yes**
Naphthalene	Less than Reference[4]				-	-
Phenanthrene	yes	-	0.0019	**yes**	0.001	**yes**
Pyrene	yes	-	0.0008	**yes**	0.0008	**yes**

[1] "Yes" value indicates that both station and reference datasets were normally distributed (t-test performed on either raw or log-transformed data).
[2] A two sample t-test for unequal variance was used to assess differences unless otherwise indicated.
[3] Samples were compared to the unexposed tissue results if site samples were significantly different from reference.
[4] Reference mean concentration was greater than site mean concentration.
[5] Neither raw data nor log-transformed data were normally distributed and the Wilcoxan Rank Sum non-parametric test was performed.
[6] Less than 80 percent of the data were detected; Wilcoxan Rank Sum non-parametric test was conducted.

Table 4-21 Tissue exposure comparisons for detected analytes - *Nereis virens* (wet weight) (page 1 of 2)

Site	Data Normally Distributed[1]		t-Test[2]		Comparison to Unexposed	
	Raw (alpha=0.01)	Ln (alpha=0.01)	p-value (alpha=0.05)	Significant Difference	p-value (alpha=0.05)	Signif. > Unexposed[3]
SB7L						
Antimony	Less than Reference[5]				-	-
Arsenic	yes	-	0.0038	**yes**	Less than unexposed tissue	
Beryllium	yes	-	0.0987	no	-	-
Cadmium	yes	-	0.0028	**yes**	Less than unexposed tissue	
Chromium	Less than Reference[5]				-	-
Copper	yes	-	0.0519	no	-	-
Lead	yes	-	0.262	no	-	-
Mercury	Less than Reference[5]				-	-
Nickel	yes	-	0.0072	**yes**	Less than unexposed tissue	
Selenium	yes	-	0.2765	no	-	-
Silver	Less than Reference[5]				-	-
Thallium	Less than Reference[5]				-	-
Zinc	Less than Reference[5]				-	-
SB10L						
Antimony	Less than Reference[5]				-	-
Arsenic	yes	-	0.0257	**yes**	Less than unexposed tissue	
Beryllium	yes	-	0.052	no	-	-
Cadmium	yes	-	0.0034	**yes**	Less than unexposed tissue	
Chromium	yes	-	0.3233	no	-	-
Copper	yes	-	0.1296	no	-	-
Lead	yes	-	0.0417	**yes**	Less than unexposed tissue	
Mercury	Less than Reference[5]				-	-
Nickel	yes	-	0.0025	**yes**	Less than unexposed tissue	
Selenium	Less than Reference[5]				-	-
Silver	Less than Reference[5]				-	-
Thallium[6]	no	no	0.1719	no	-	-
Zinc	Less than Reference[5]				-	-
SC123						
Antimony	Less than Reference[5]				-	-
Arsenic	yes	-	0.0303	**yes**	Less than unexposed tissue	
Beryllium	yes	-	0.4758	no	-	-
Cadmium	Less than Reference[5]				-	-
Chromium	Less than Reference[5]				-	-
Copper	Less than Reference[5]				-	-
Lead	yes	-	0.4641	no	-	-
Mercury	Less than Reference[5]				-	-
Nickel	yes	-	0.2885	no	-	-
Selenium	Less than Reference[5]				-	-
Silver	Less than Reference[5]				-	-
Thallium	Less than Reference[5]				-	-
Zinc	Less than Reference[5]				-	-

Table 4-21 Tissue exposure comparisons for detected analytes - *Nereis virens* (wet weight) (page 2 of 2)

Site	Data Normally Distributed[1]		t-Test[2]		Comparison to Unexposed	
	Raw (alpha=0.01)	Ln (alpha=0.01)	p-value (alpha=0.05)	Significant Difference	p-value (alpha=0.05)	Signif. > Unexposed[3]
SB7U						
1-Methylnaphthalene	yes	-	0.1927	no	-	-
2-Methylnaphthalene	yes	-	0.0339	**yes**	Less than unexposed tissue	
Acenaphthene	< 50% detected data. [4]					
Acenaphthylene	< 50% detected data. [4]					
Anthracene	< 50% detected data. [4]					
Benzo(a)pyrene	no	yes	0.498	no	-	-
Fluoranthene	yes	-	0.0021	**yes**	Less than unexposed tissue	
Fluorene[6]	no	no	0.6004	no	-	**-**
Naphthalene	yes	-	0.0509	no	-	-
Phenanthrene	yes	-	0.0343	**yes**	Less than unexposed tissue	
Pyrene[7]	-	-	0.5993	no	-	-

[1] "Yes" value indicates that both station and reference datasets were normally distributed (t-test performed on either raw or log-transformed data).
[2] A two sample t-test for unequal variance was used to assess differences unless otherwise indicated.
[3] Samples were compared to the unexposed tissue results if site samples were significantly different from reference.
[4] < 50% detected data, statistics were not calculated.
[5] Reference mean concentration was greater than site mean concentration.
[6] Neither raw data nor log-transformed data were normally distributed and the Wilcoxan Rank Sum non-parametric test was performed.
[7] Less than 80 percent of the data were detected; Wilcoxan Rank Sum non-parametric test was conducted.

Table 4-22 Bioaccumulation significance testing - tissue concentrations statistically greater at site vs reference[1]

	Macoma nasuta				*Nereis verens*			
Parameter	**SB7L**	**SB10L**	**SC123**	**SB7U**	**SB7L**	**SB10L**	**SC123**	**SB7U**
Antimony	Y	Y	N	-	R	R	R	-
Arsenic	R	R	R	-	Y	Y	Y	-
Beryllium	R	R	R	-	N	N	N	-
Cadmium	N	N	N	-	Y	Y	R	-
Chromium	R	R	R	-	R	N	R	-
Copper	R	R	R	-	N	N	R	-
Lead	R	R	R	-	N	Y	N	-
Mercury	R	R	R	-	R	R	R	-
Nickel	R	N	R	-	Y	Y	N	-
Selenium	R	R	R	-	N	R	R	-
Silver	R	R	N	-	R	R	R	-
Thallium	R	R	R	-	R	N[2]	R	-
Zinc	R	R	R	-	R	R	R	-
1-Methylnaphthalene	-	-	-	R	-	-	-	N
2-Methylnaphthalene	-	-	-	R	-	-	-	Y
Acenaphthene	-	-	-	R	-	-	-	ND[5]
Acenaphthylene	-	-	-	ND[4]	-	-	-	ND[5]
Anthracene	-	-	-	Y	-	-	-	ND[5]
Benzo(a)anthracene	-	-	-	N[2]	-	-	-	ND[4]
Benzo(a)pyrene	-	-	-	N	-	-	-	N
Benzo(b)fluoranthene	-	-	-	R	-	-	-	ND[4]
Benzo(g,h,i)perylene	-	-	-	ND[4]				ND[4]
Benzo(k)fluoranthene	-	-	-	R	-	-	-	ND[4]
Chrysene	-	-	-	Y	-	-	-	ND[4]
Dibenz(a,h)anthracene	-	-	-	ND[4]	-	-	-	ND[4]
Fluoranthene	-	-	-	Y	-	-	-	Y
Fluorene	-	-	-	Y	-	-	-	N[2]
Indeno(1,2,3-cd)pyrene	-	-	-	ND[4]	-	-	-	ND[4]
Naphthalene	-	-	-	R	-	-	-	N
Phenanthrene	-	-	-	Y	-	-	-	Y
Pyrene	-	-	-	Y	-	-	-	N[3]

[1]Tests were conducted using two sample t-tests on normally distributed data unless otherwise noted.
Significance codes as follows:

Y=parameter concentrations were significantly greater in site exposed tissues than in reference exposed tissues
N=parameter concentrations were not significantly greater in site tissues versus reference
R=reference mean concentration was greater than site mean concentration

[2] Neither raw data nor log-transformed data were normally distributed and the Wilcoxan Rank Sum non-parametric test was performed.

[3] Less than 80 percent of the data were detected; Wilcoxan Rank Sum non-parametric test was conducted.

[4] Parameter was not detected in any study or reference site replicate

[5] Less than 50% of the data were detected values

Table 4-23 Mean tissue concentrations associated with results that are statistically greater than reference (wet weight)

Parameter	Units	Unexposed	Ref	SB7L	SB10L	SC123	SB7U	CBR Conc[1]
***Macoma nasuta* exposures**								
Antimony	mg/Kg	0.018	0.013	0.015	0.017	-	-	NA
Anthracene	ug/Kg	0.18 J	0.15 J	-	-	-	1.30 J	NA
Chrysene	ug/Kg	0.48 J	0.45 J	-	-	-	1.19 J	930[2]
Fluoranthene	ug/Kg	2.08 J	2.08 J	-	-	-	10.2	9,040
Fluorene	ug/Kg	0.41 J	0.54 J	-	-	-	0.93 J	NA
Phenanthrene	ug/Kg	1.3 J	2.94 J	-	-	-	8.44	780
Pyrene	ug/Kg	1.03 J	1.06 J	-	-	-	5.02 K	0.8-330,000[2]
***Nereis verens* exposures**								
Arsenic	mg/Kg	2.52	1.79	2.26	2.07	2.07	-	1.15-6.39
Cadmium	mg/Kg	0.051	0.039	0.045	0.051	-	-	0.004-290
Lead	mg/Kg	0.440	0.096	-	0.115	-	-	0.58-70
Nickel	mg/Kg	0.70	0.21	0.32	0.59	-	-	79
2-Methylnaphthalene	ug/Kg	0.81 J	0.52 J	-	-	-	0.71 J	NA
Fluoranthene	ug/Kg	2.98 J	0.63 J	-	-	-	2.04 J	9,040
Phenanthrene	ug/Kg	2.12 J	1.14 J	-	-	-	1.82 J	780

[1]Critical body residue concentrations - refer to Table 4-24

[2]CBR data represent freshwater organism NOEC for selected parameters; marine organism data are not available

NA: CBR data are not available for selected parameters

J: All replicates were measured below the laboratory reporting limit. Station means were calculated using estimated values

K: Pyrene was measured below the laboratory reporting limit in 3 of 5 station SB7U replicates

Table 4-24 Critical body residue concentrations (mg/kg wet)[1]

Parameter	Measured Effect				
	Mortality	Growth	Physiological/ Developmental	Reproduction	Behavior
Antimony	--	--	--	--	--
Arsenic	3.6 [*Me*]	1.15 - 6.39 [*Pp*]	--	--	--
Cadmium	0.9 [*Pp*] - 62 [*Na*]	1.12 [*Na*] - 150 [*Nv*]	0.004 [*Cg*] -290 [*Nv*]	3.6 [*Na*] - 90 [*Pf*]	0.02 [*Hv*] - 52 [*Bc*]
Lead	0.58 [*Pl*] - 70 [*Pi*]	2.28 [*Cv*]	--	2.6 [*Cv*]	90 [*Bc*]
Nickel	79 [*Ce*]	575 [*Ce*]	167 [*Ce*]	--	--
Anthracene	--	--	--	--	--
Chrysene	0.93 [*Dp*][2]	--	--	--	--
Fluoranthene	68.7 [*Lp*] - 1,280 [*Mr*]	--	--	40.45 [S*k*] - 121.4 [*C* sp-a]	9.04 [*C* sp] - 150 [*Mb*]
Fluorene	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--
Phenanthrene	0.78 [*Na*]	--	--	--	--
Pyrene	0.0008 - 330 [*Lv*][2]	--	890 - 1,480 [*D* sp][2]	--	--

Notes:
[1]Values are no effect concentrations (NOECs).
[2]Freshwater organism. Marine organism uptake data not found.
-- = No value not found
No marine species CBR data found for: anthracene, antimony, chrysene, fluorene, 2-methylnapthalene, pyrene and thallium.
Species codes (Marine/Estuarine organisms):

[*Bc*]	*Balanus crenatus*	Barnacle	[*Me*]	*Mytilus edilus*	Blue mussel
[*C* sp]	*Capitella* sp	Polychaete	[*Mr*]	*Monopylephorus rubroniveus*	Oligochaete
[*C* sp-a]	Coullana sp	Copepod	[*Na*]	*Neanthes arenaceodentata*	Neanthes
[*Ce*]	*Cerastoderma edule*	Clam	[*Nv*]	*Nereis virens*	Polychaete (sandworm)
[*Cg*]	*Crassostrea gigas*	Pacific oyster	[*Pf*]	*Platichthys flesus*	European flounder
[*Cv*]	*Crassostrea virginica*	Eastern oyster	[*Pi*]	*Panaeus indicus*	Copepod
[*Hv*]	*Hydrobia ulvae*	Prosobranch mud snail	[*Pl*]	*Patacentrotus lividus*	Sea urchin
[*Lp*]	*Leptocheirus plumulosus*	Amphipod	[*Pp*]	*Palaemonetes pugio*	Shrimp - Grass
[*Mb*]	*Macoma balthica*	Baltic macoma	[*Sk*]	*Schizopera knabeni*	copepod

Species codes (Freshwater organisms):

[*D* sp]	*Diporeia spp.*	Amphipod	[*Lv*]	*Lumbriculus variegatus*	Oligochaete
[*Dp*]	*Dreissena polymorpha*	Mussel - Zebra			

Figure 4-1 Casotte Landing Phase 2 Sediment Grain Size

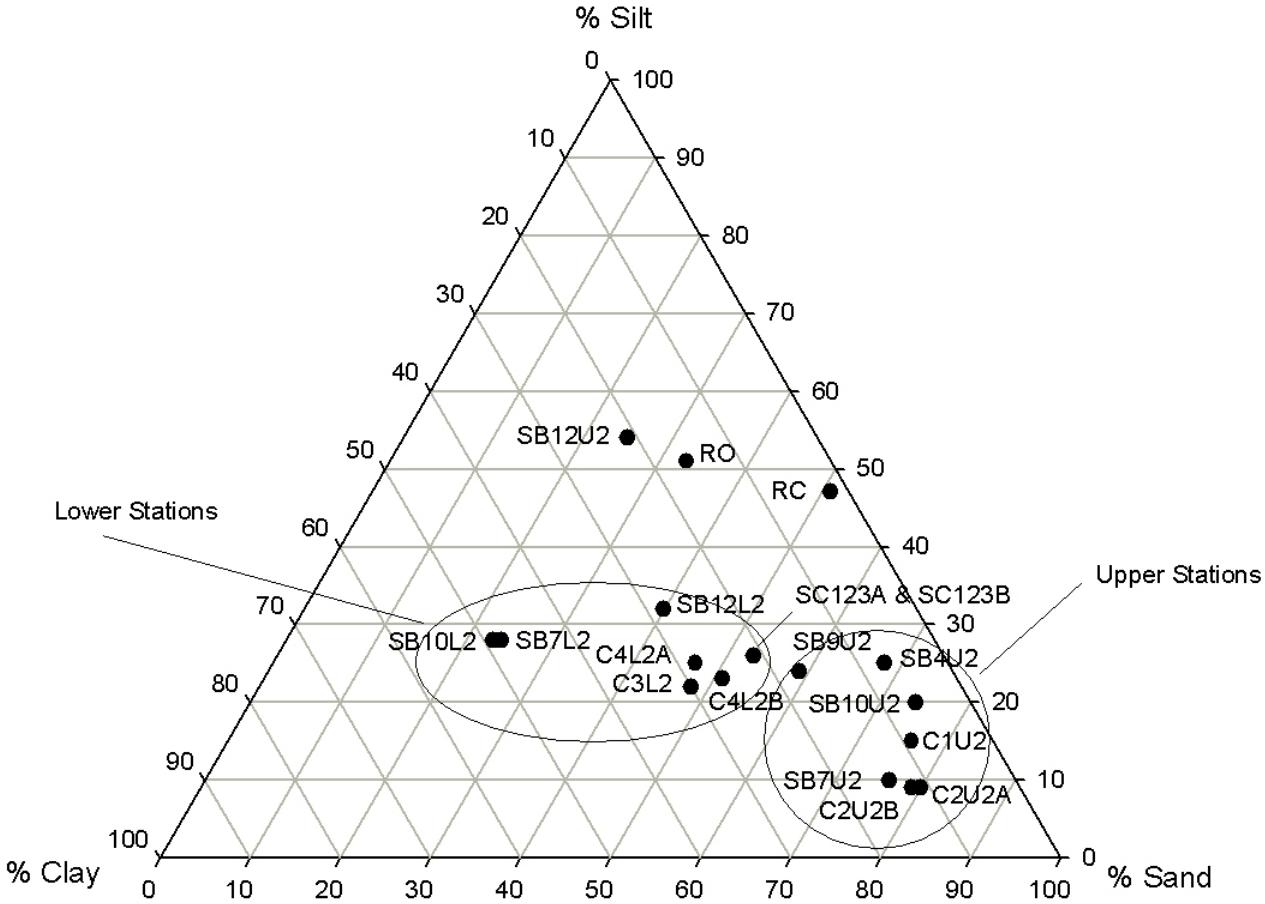
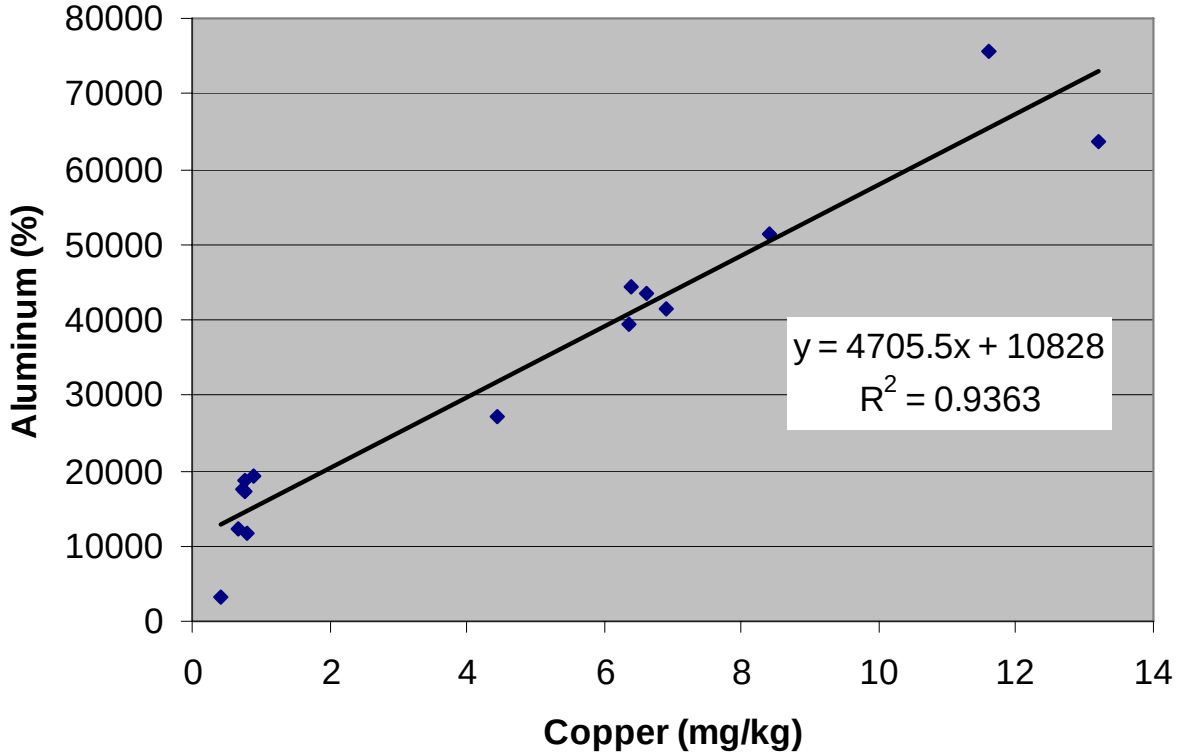


Figure 4-2 Example Metal to Aluminum Regression Findings



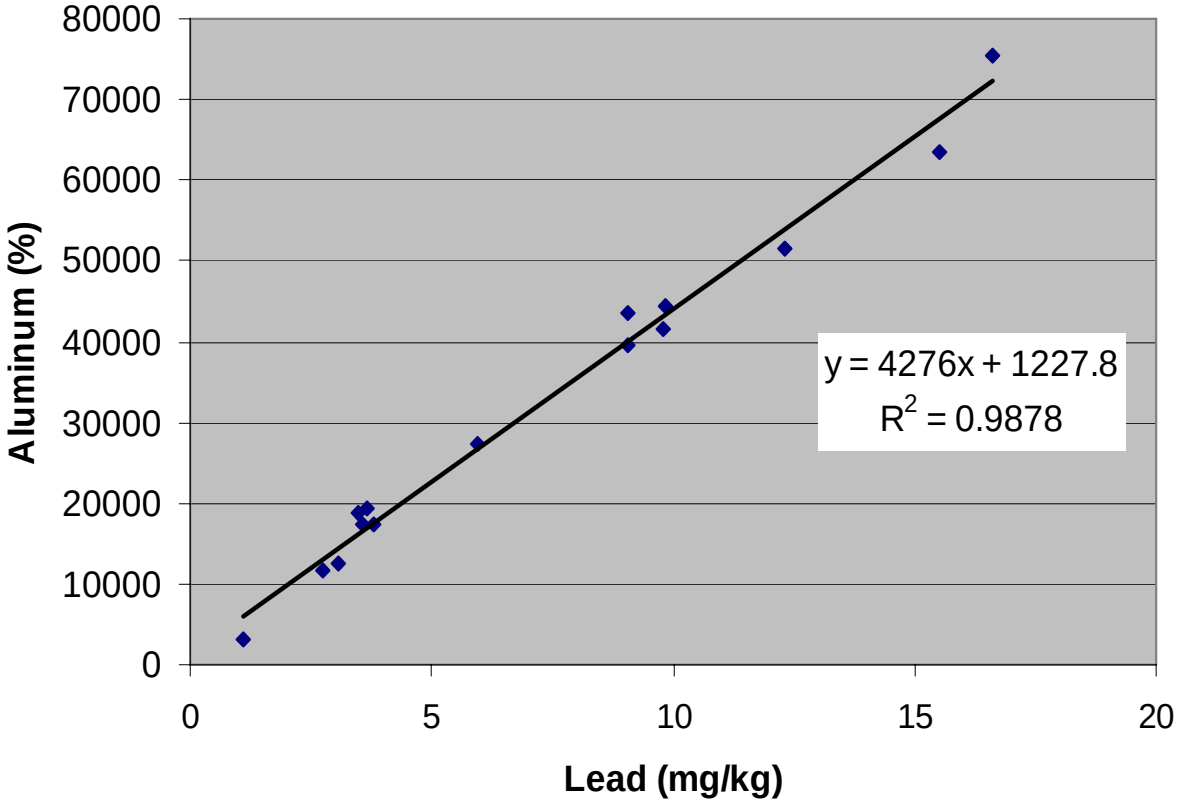
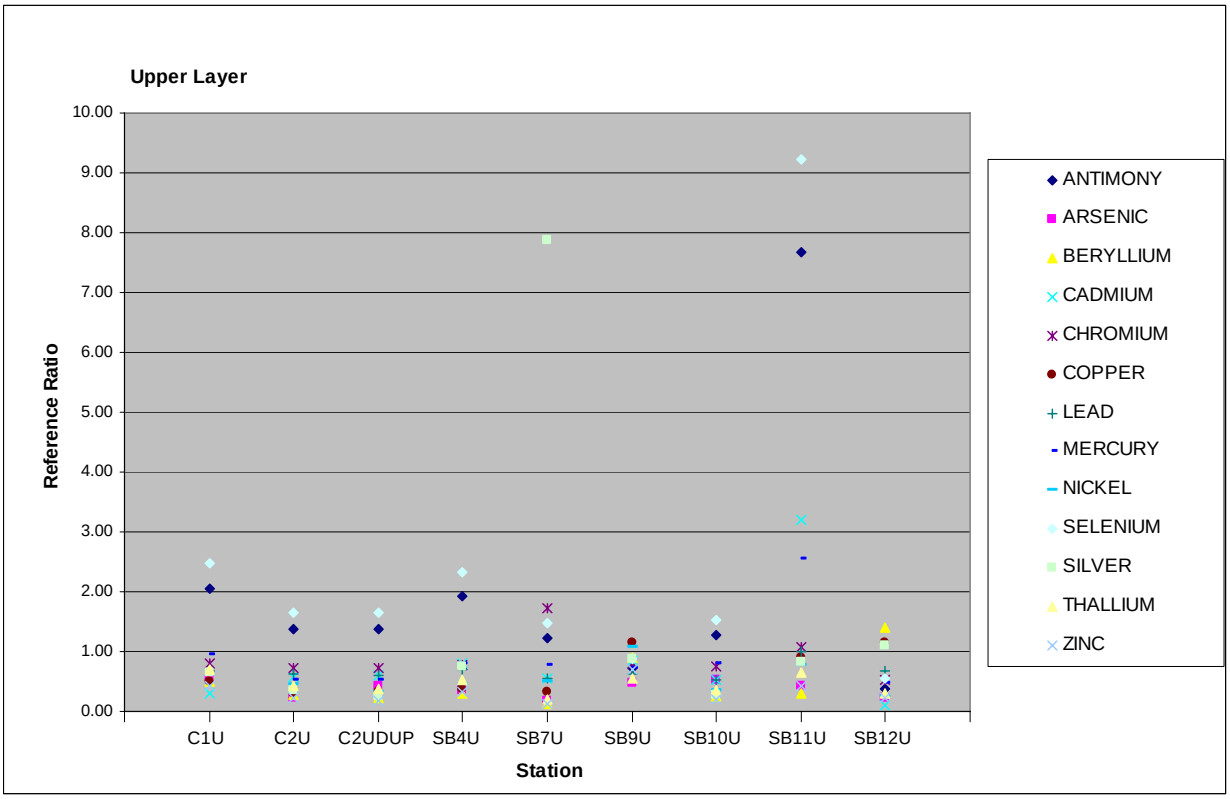


Figure 4-3 Chemical Ratios-to-Reference: Metals



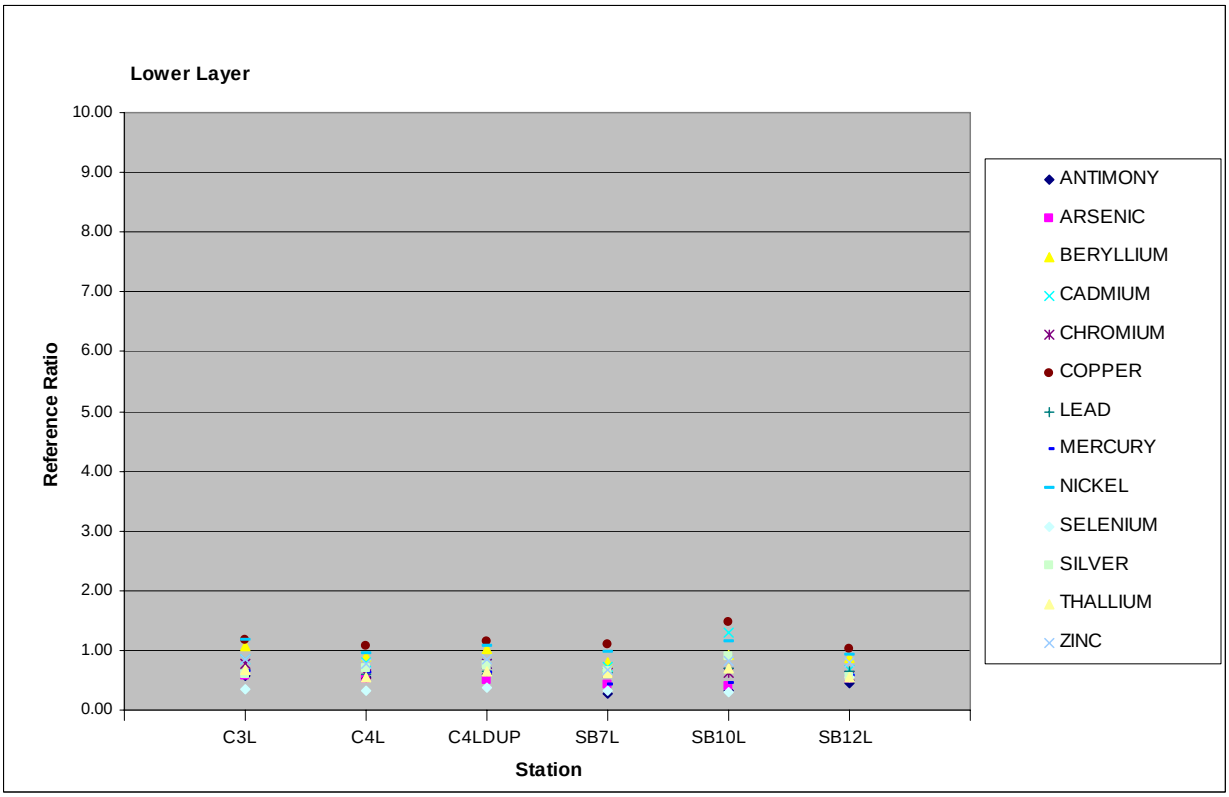
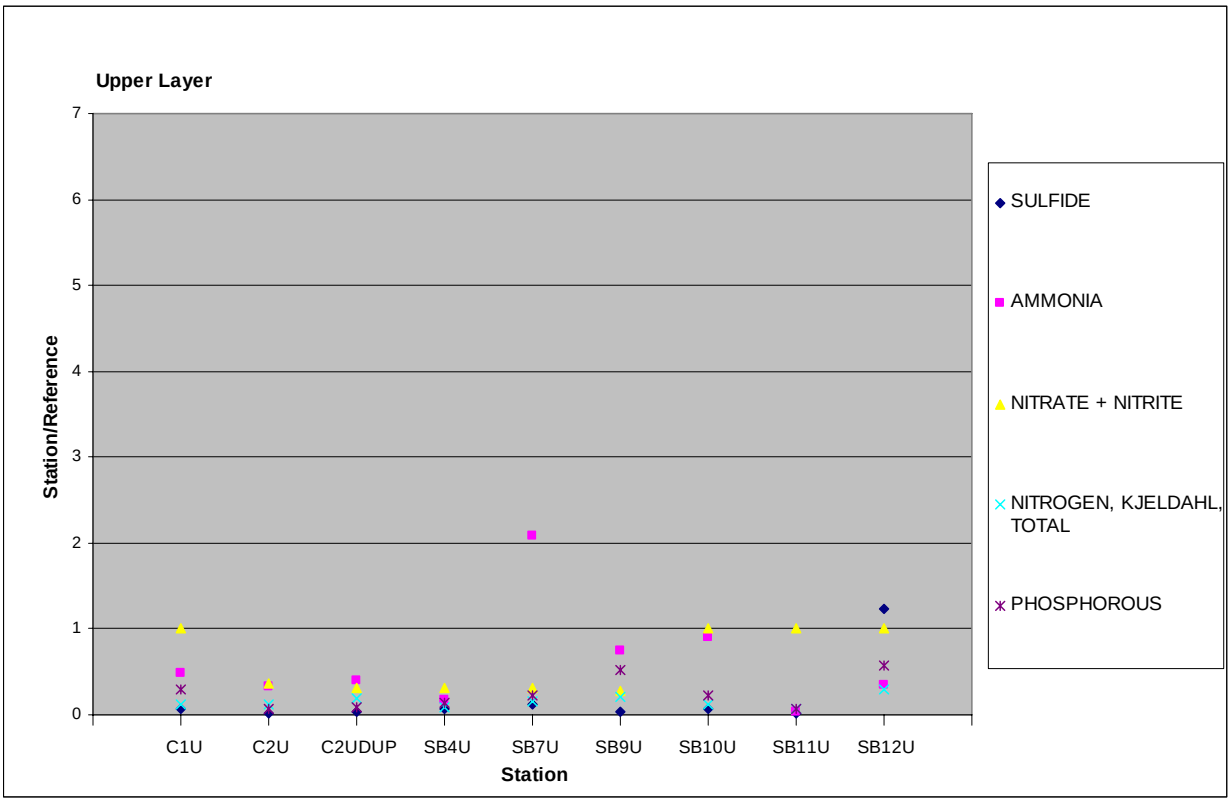


Figure 4-4 Chemical Ratios-to-Reference: Non-Metals



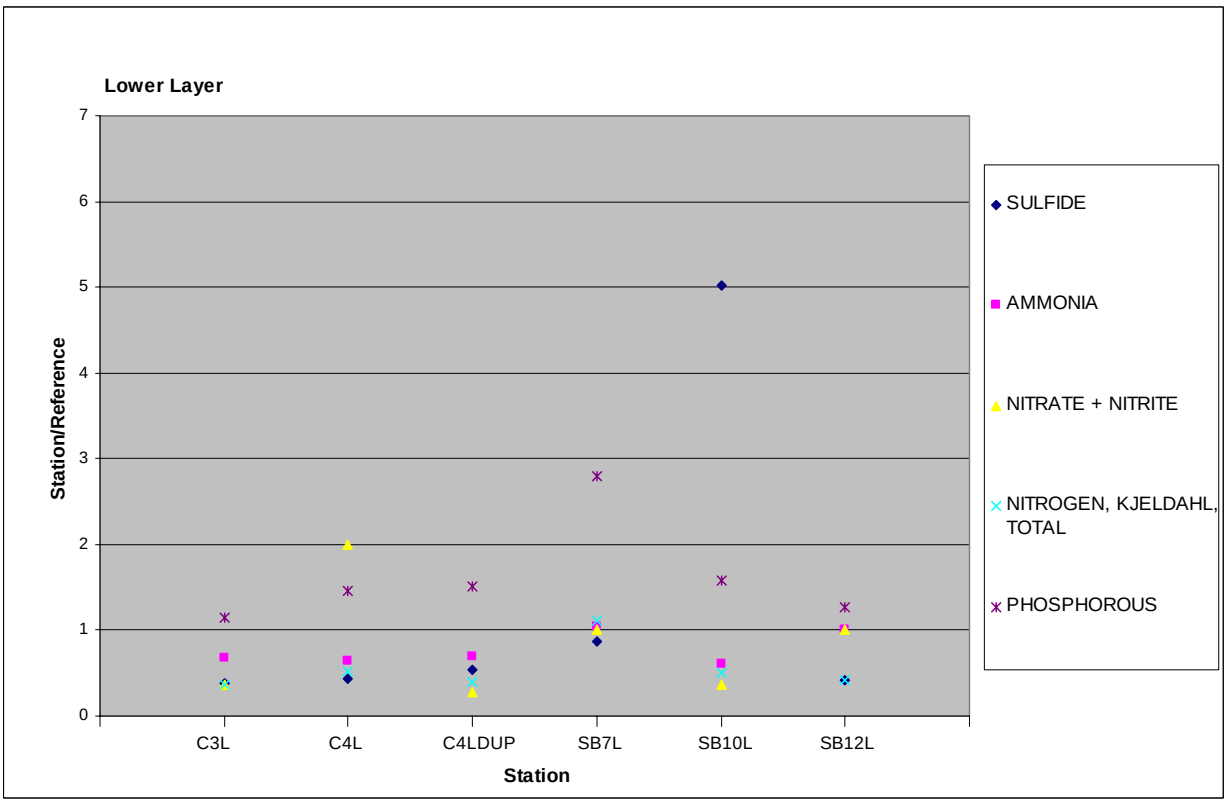
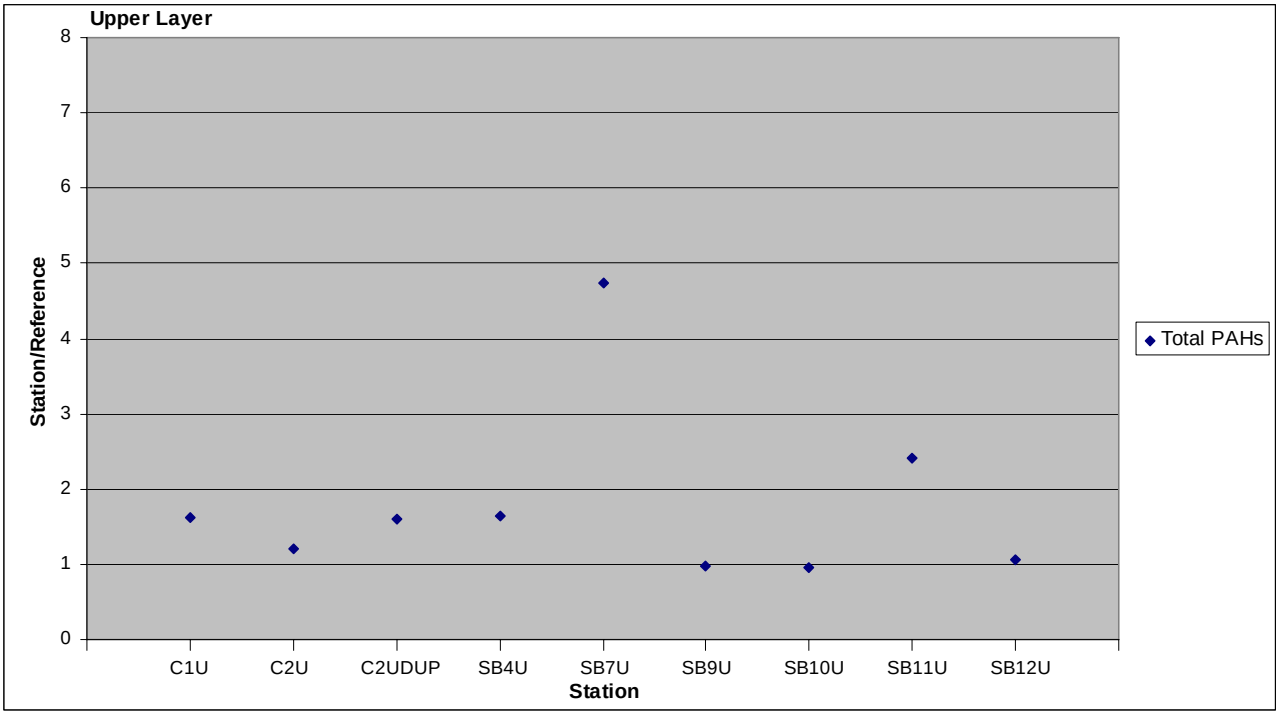


Figure 4-5 Chemical Ratios-to-Reference: PAH Compounds



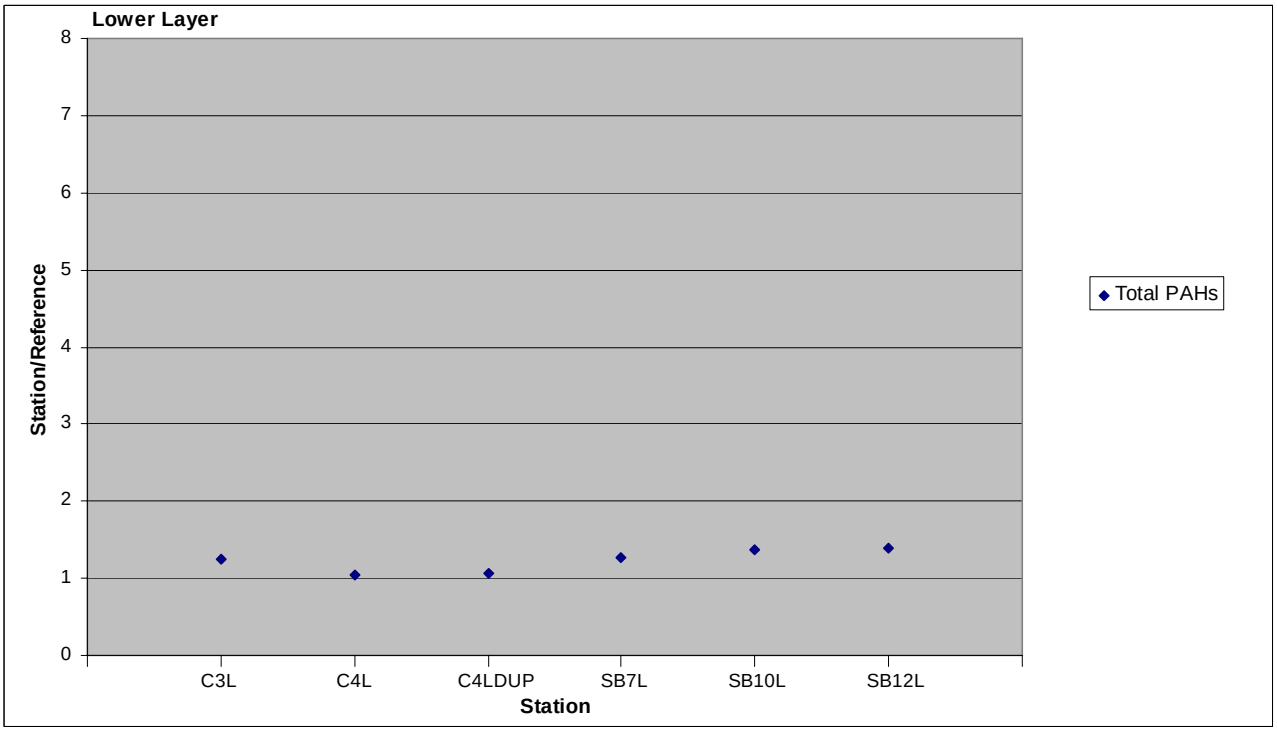


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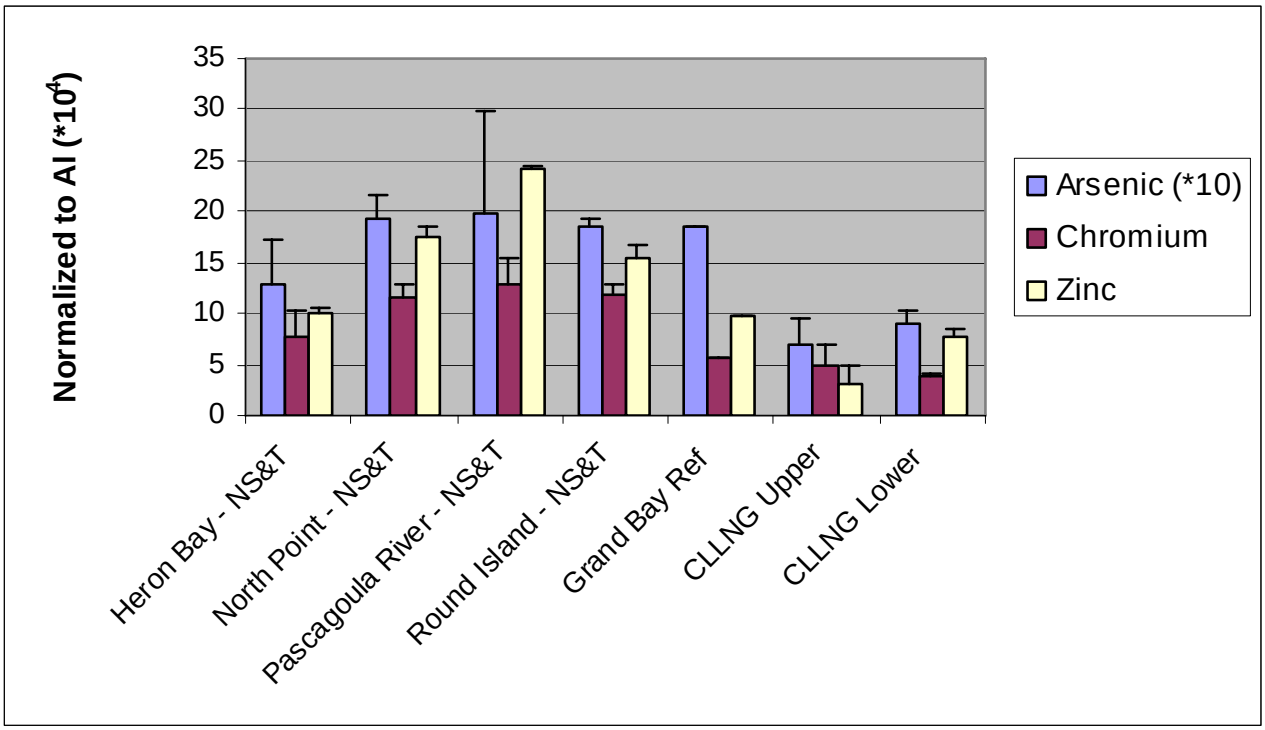
Figure 4-6 NOAA National Status and Trends Sediment Monitoring Stations

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Figure 4-7 Comparison of Metals in CLLNG Sediments to National Status and Trends and Grand Bay Reference Sediments (Page 1 of 2)



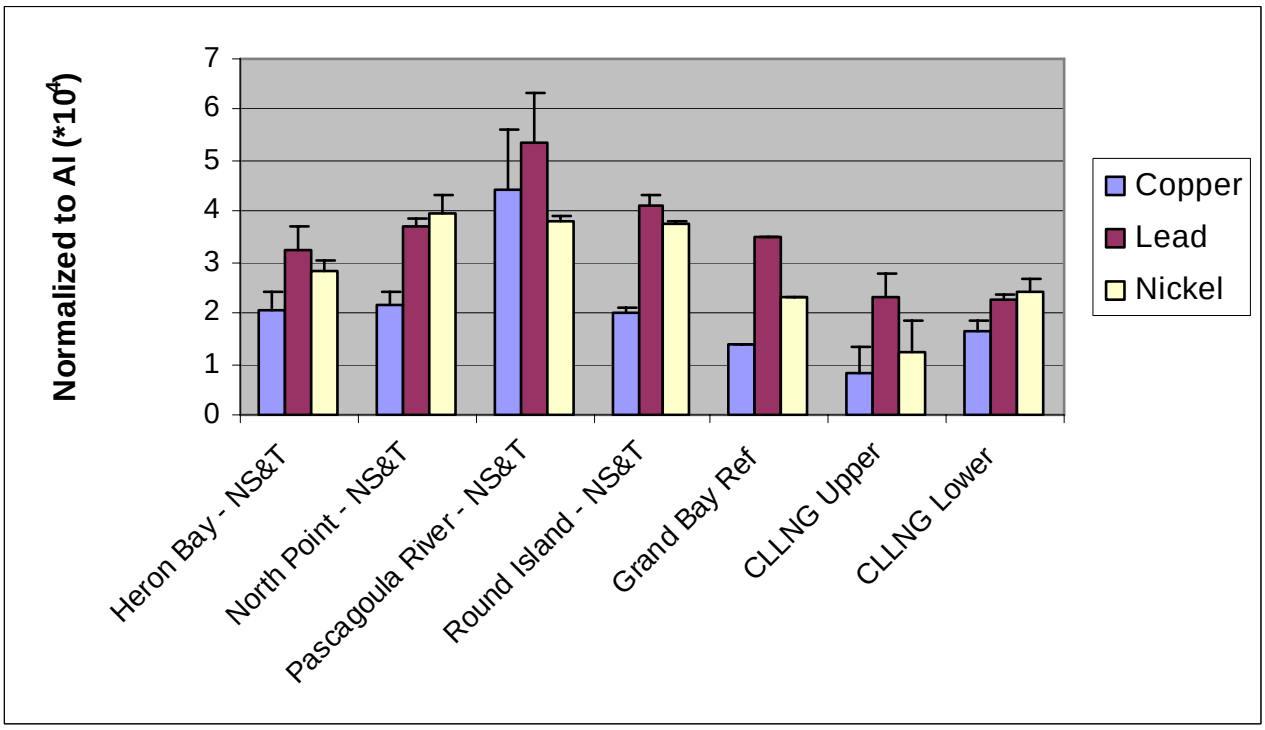
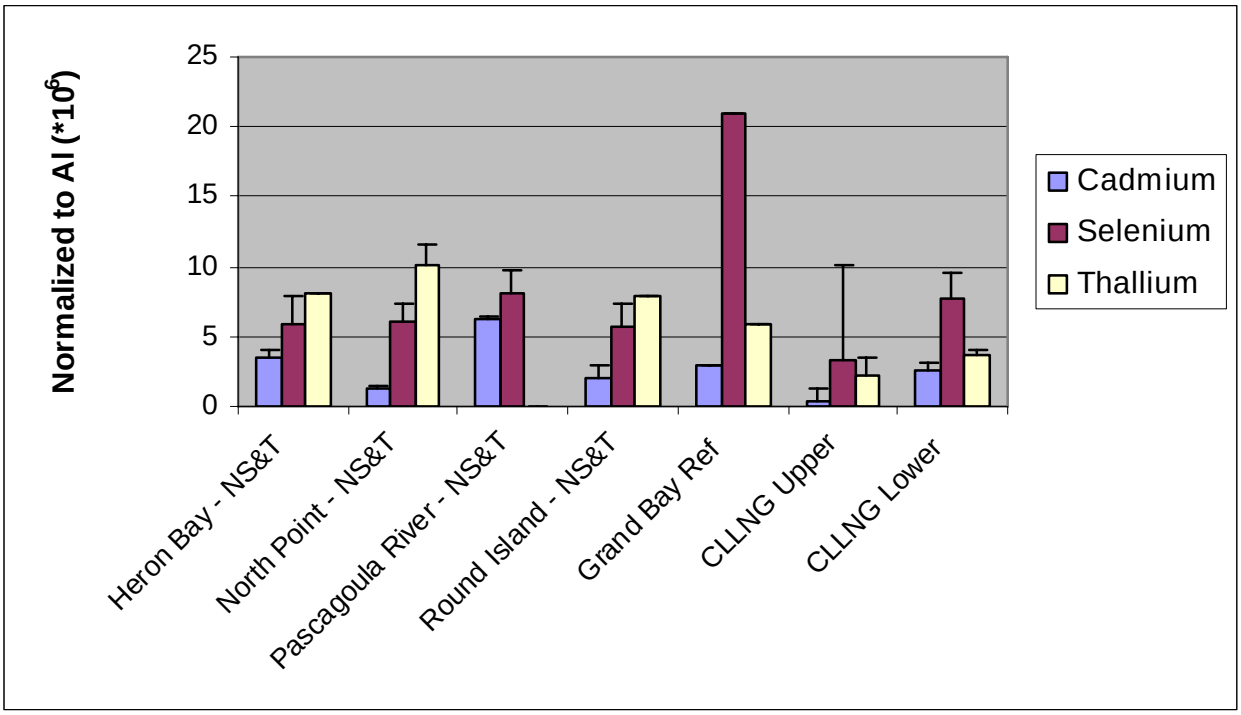
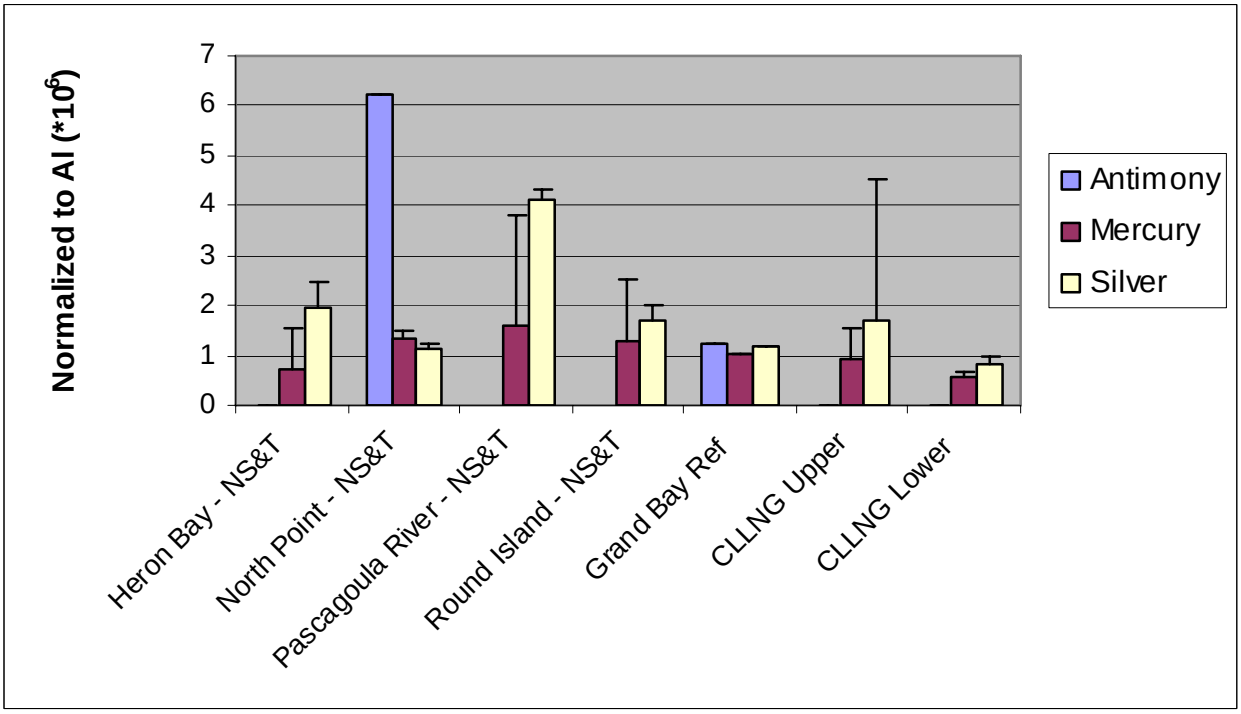


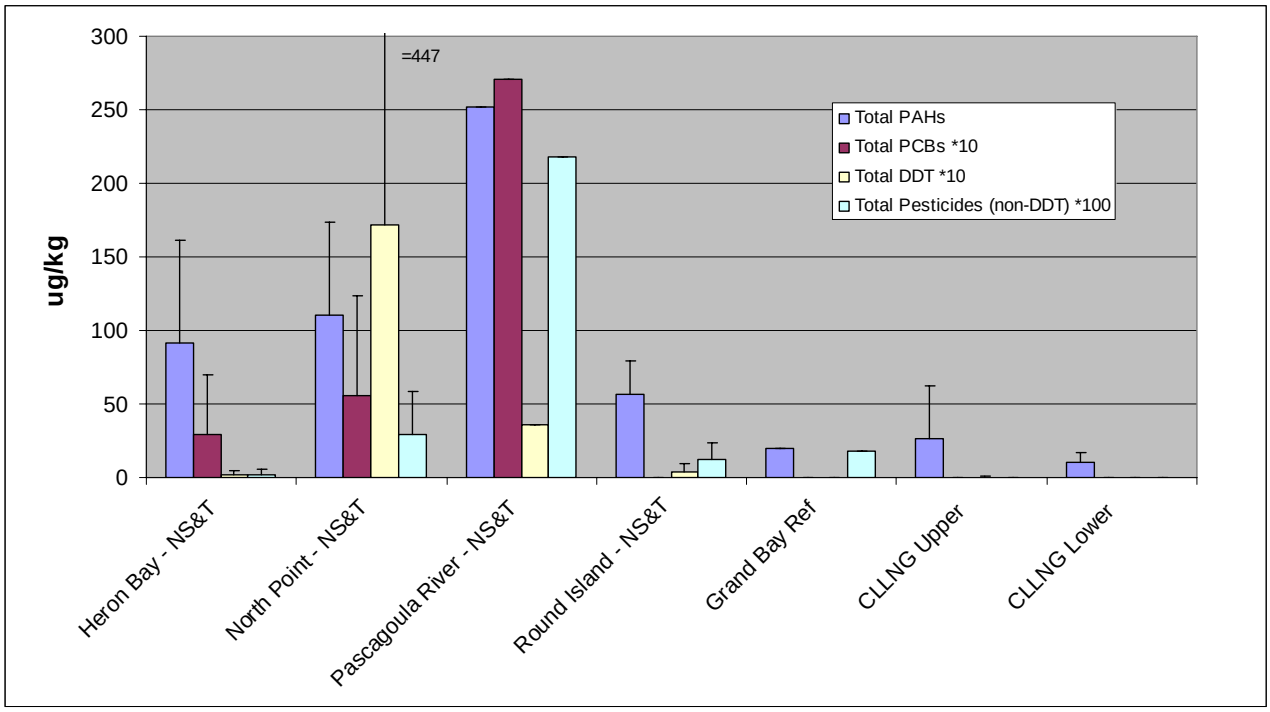
Figure 4-7 Comparison of Metals in CLLNG Sediments to National Status and Trends and Grand Bay Reference Sediments (Page 2 of 2)





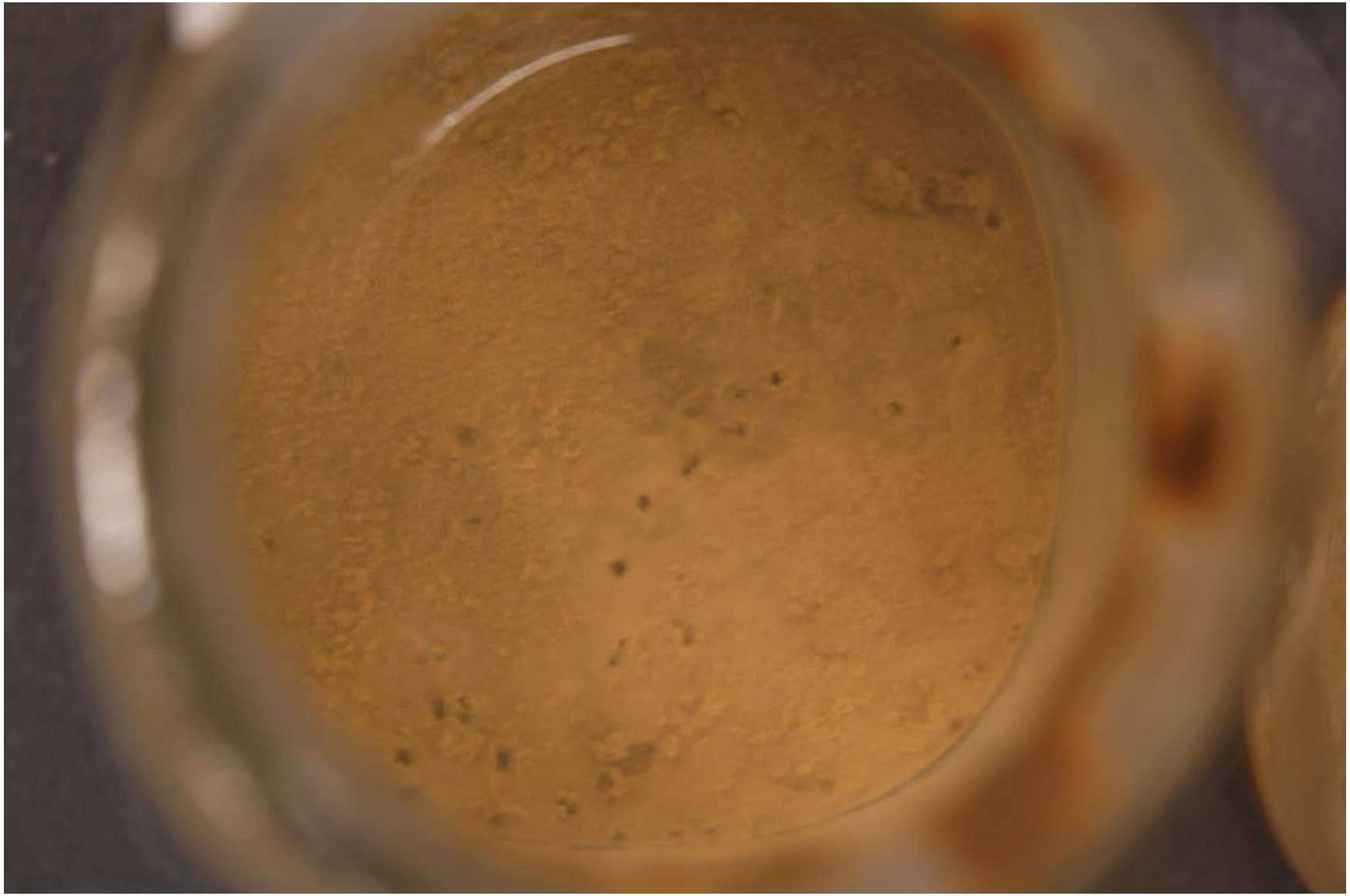
Error bars represent 1 standard deviation and are included when n $\geq$ 2.

Figure 4-8 Comparison of PAHs, PCBs, and Pesticides in CLLNG Sediments to NS&T and Grand Bay Reference Sediments



Error bars represent 1 standard deviation and are included when n $\geq$ 2.

Figure 4-9 Example Amphipod Test Chamber



5.0 Conclusions and MPRSA Section 103 considerations

This section provides an evaluation of the proposed CLLNG slip area material to be dredged. Dredging-specific information is provided in the project Dredged Material Management Plan.

A tiered approach for the evaluation of the suitability of dredged material for open water placement is described in Federal and regional guidance documents (EPA/USACE, 1991; EPA/USACE, 1993). In some cases, the full set of testing requirements is not necessary, depending upon what is already known about the material makeup and/or characteristics. For this reason, EPA and USACE have developed a framework that allows collection of sufficient information to evaluate the material suitability, without the expense of conducting the full range of chemical and biological testing. Four tiers are defined:

Tier I – Assess existing sediment information;

Tier II – Chemical assessments. Sediment and water column (elutriate) simulations;

Tier III – Bioassays. Bulk sediment, water column (suspended particulate phase), and bioaccumulation bioassays; and

Tier IV – Site-specific testing. Test organisms unique to the site or, in the case of Casotte Landing sediment material, protocol modifications to address site-specific conditions.

Tier I investigations involve the assessment of existing information and is commonly all that is needed if, for example, the material is sand or gravel without a history of spills or detrimental impacts. The project SAP summarizes available historical data, although within the limited slip area, little information was available. Therefore, the full range of chemical and biological tests under Tiers II, III, and IV were undertaken to support Section 103 suitability decision-making.

Tier II and III investigations, corresponding to chemical and biological testing, respectively, have been defined in Section 2. The bulk sediment amphipod test protocol, modified to address the lack of bioavailable carbon (food) in site material, may be considered a Tier IV assessment since the information provided in the first three tiers was insufficient to support decision-making.

For simplicity, conclusions related to Section 103 decision-making have been grouped under the three primary exposure/ecological pathways (sediment exposure, water column effects, and bioaccumulation) since some pathways are addressed in multiple testing tiers.

5.1 Sediment exposure

From a chemical standpoint, the sediment tested from within the proposed Casotte Landing slip area is generally very clean. Of the wide range of potential contaminants evaluated in this study and outlined in the project SAP (ENSR, 2005), many were not detected in the material to be dredged. Of those detected, very few were above concentrations observed in surface sediments at the regional (Grand Bay) reference site. When compared to ERLs and ERMs, two samples analyzed in Phase 1 exceeded ERL thresholds by a minor amount (SB4UU1 for As and Hg, and SB7U1 for acenaphthene) and none of the Phase 2 sample set exceeded the ERL benchmark (Tables 4-2 and 4-3). Most organic contaminants were not detected or were measured below laboratory reporting limits.

The sediment bioassay information also indicates that slip sediments are clean. The fact that sedimentary carbon is of questionable value to organisms as a food source presented a confounding factor that needed to be addressed to better evaluate the sediment quality. High survivorship was observed for the mysid shrimp

test organisms when exposed to the sediment for 10 days. The amphipod survival was also within the acceptance limits relative to reference survival as long as TetraMin™ supplements were provided on day 0 and 5 to augment the nutrient-poor sediment matrix.

5.2 Water column effects

The SPP bioassays and the chemical elutriates measured in the aqueous samples did not indicate any water quality concerns beyond the allowable mixing zone or the allowed 4-hour mixing period. Limiting Permissible Concentrations (LPCs) based on the worst case SPP result (an EC50 of 50.8%; Table 4-11) have been modeled using the regulatory model STFATE and the results are summarized in Figure 5-1. The simulation was performed using different barge loading scenarios, with the worst case conditions for two potential vessel sizes incorporated in the evaluation. Vessels in the 3,000 cubic yard (cy) size range are commonly used for transporting dredged material, but larger 5,000 cy barges are also available and may be used for the project; therefore, the simulations incorporated both of these options.

STFATE simulations predict that the LPC is met everywhere within the ODMDS after 2.2 to 2.5 hours from the initial discharge. Predictions related to the plume centroid location estimate travel distances of 600 to 1100 feet from the barge discharge point for the 3,000 and 5,000 cy vessels, respectively. Model inputs for these simulations are summarized in Table 2-3, complete input and output files are provided in Appendix F.

Aqueous chemical measurements related to the elutriate samples were also very low relative to water quality standards with few exceptions. Three inorganic parameters (Hg, Ni, phosphorous) exceeded the standard in undiluted elutriate samples, but because LPCs identified in the SPP tests required greater dilution to meet acceptance criteria, these chemical data were not evaluated further and only the worst case SPP findings were simulated using STFATE.

Overall, the fact that SPP bioassay test organisms were mostly unaffected when exposed to suspended sediment mixtures (which are typically the most sensitive biological indicator) further underscores the overall quality of the material planned for dredging at Casotte Landing.

5.3 Bioaccumulation findings

Very few sites required evaluating potential bioaccumulative concerns based on the sediment chemistry results and the fact that most compounds and metals were either not detected or measured at concentrations less than Grand Bay reference values. Furthermore, only metals and PAH compounds required analysis in tissues exposed to these few stations.

Metals were analyzed in the test organism tissues exposed to 3 of the 13 sites (SB7L, SB10L, and SC123) and PAH analysis was required of tissues exposed to just one of the stations (SB7U) relative to reference-exposed tissues.

In the final analysis, only five metals and seven PAH compounds were measured in site-exposed tissue at statistically greater concentrations than reference-exposed tissue. The metal concentrations were, however, less than pre-exposure clam and worm tissue concentrations and in the range of available NOECs. The PAH compound concentrations in worm tissues were also lower than those of pre-exposed tissues and also lower than available NOEC data for marine organisms. In Macoma clam tissues, the six PAH compounds measured as statistically greater in site-exposed versus reference-exposed tissues were also at concentrations higher than pre-exposed clam tissues but were nonetheless measured at very low concentrations (many were still below laboratory reporting limits) and well below or within the range of tissue residue NOECs (Tables 4-23 and 4-24).

5.4 Conclusions

Several lines of evidence evaluated in this investigation provide a basis for agency Section 103 decision-making:

- Bulk sediment evaluations performed in this study provide a large weight-of-evidence that the material to be dredged is clean from a chemical perspective. Further, test organisms appear to be healthy after exposure tests, although given the unique low biogenic carbon sediment content, the material may not provide a sufficient food source to deposit feeders until biogenic particles, raining down from the overlying water column, accumulate on the sediment surface for some weeks or months.
- Water column (SPP) bioassay tests, often the most sensitive indicators of biological effects, measured very good survival and development results by the time SPP mixtures were diluted in half. STFATE simulations predict LPCs would be reached well within the 4-hour threshold and that related water column plumes would not travel very far.
- Lastly, because of the relatively clean nature of the site overall, only a few stations required further evaluation of potential bioaccumulative concerns. Of the many parameters measured, only six were at concentrations statistically greater than those of reference-exposed and pre-exposed tissue levels. The few compounds measured at concentrations above pre-exposed tissue concentrations were nonetheless well within available NOEC observations for aquatic organisms.

In conclusion, the many evaluations conducted in this study provide a large weight-of-evidence that exposure to the Casotte Landing sediment dredged from the slip area will have little or no biological effect on the marine environment at the ODMDS beyond initial burial of the benthos. These findings provide a firm basis for agency decision-making.

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Figure 5-1 STFATE Model Results for 3,000 and 5,000 cy Barge
No Overflow Scenario

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

6.0 Project QA/QC findings

This section provides quality control information and documents the overall quality of the data upon which the project conclusions are drawn. Selected data are summarized in the subsections that follow.

6.1 Biological testing QA/QC

This section provides QA/QC information related to the biological testing effort including organism sources, organism age, and reference toxicant tests. All toxicity testing was conducted by ESI of Hampton, New Hampshire, with the exception of the additional *L. plumulosus* testing conducted by Weston Solutions located in Port Gamble, Washington.

The ESI control seawater, used as overlying water in whole sediment tests and as the laboratory control treatment for the SPP assays, was obtained from the Hampton Estuary. This water source has been used for the culture and maintenance of test organisms at ESI since 1978. This seawater is classified as SA-1, is obtained from a point on the bottom of the estuary approximately 1 mile from the open ocean, and is filtered prior to use. The control seawater for Weston Solutions testing was natural seawater from North Hood Canal in Port Gamble, Washington that was filtered through a 3-µm filter prior to use in the assays.

6.1.1 Whole sediment toxicity bioassays

ESI used *A. bahia* organisms cultured and maintained by Aquatic Research Organisms (ARO), Hampton, New Hampshire. Prior to use, test organisms were held for at least 2 hours under temperature, salinity, and photoperiod conditions similar to those used in the assay. *A. bahia* used in the assay were 4 days old at the start of the test on January 20, 2006. The control sediment used in the *A. bahia* assays was an artificial sediment consisting primarily of silica sand prepared at ESI.

Both ESI and Weston Solutions obtained laboratory cultured *L. plumulosus* organisms from ARO. Organisms were maintained by ESI for 24 hours prior to use in the assay (organisms are delivered directly to ESI by ARO). Weston Solutions maintained organisms in-house for 4 to 5 days after shipment and prior to test initiation. The amphipods selected for testing were juveniles, with age based on size. Control sediment used in the *L. plumulosus* assays was provided by ARO. The testing conducted at ESI started on January 20, 2006 and the three batches of testing conducted by Weston started on April 4, April 11, and May 16, 2006.

Specifics of the initial *L. plumulosus* assay conducted by ESI are not discussed below since the assay was repeated. The following sections address the reference toxicant assays and protocol deviations associated with the *L. plumulosus* assay conducted by Weston Solutions.

6.1.1.1 Reference toxicants

As part of the laboratory quality control program, standard reference toxicant assays are conducted on a regular basis for each test species. ESI started an acute 96-hour copper reference toxicant assay for *A. bahia* on January 31, 2006. Results were outside two standard deviation of the historic mean. However, based on normal statistical variation, it is expected that 1 in 20 reference toxicant assays will fall outside the acceptable range. This reference toxicant assay was not started with the batch of organisms used in the 10-day test but was conducted with organisms obtained from the same supplier. The laboratory controls for the 10-day assay met the acceptability criteria indicating that the test organisms were healthy.

Weston conducted an acute 96-hour copper reference toxicant assay with each of the three batches of tests. Results for all three reference toxicant assays control chart limits of two standard deviations of the historic mean. The laboratory controls for the 10-day assays associated with these reference toxicant assays met the acceptability criteria indicating that the test organisms were healthy.

6.1.1.2 Whole sediment protocol deviations

Water quality data were not collected in all replicates of the *A. bahia* assay on Day 10 as specified due to a technician error. Water temperatures of 18°C were recorded in selected samples on Days 4, 6, and 7 in the *A. bahia* assay. This is below the 20±1°C specified in the QAPP. In six of the replicates additional *A. bahia* above the 20 added at test initiation were recovered. These additional test organisms were recovered from the following samples: C2U, SB10U, C3L, SB7L, and SC123 (two replicates). In three cases one additional organism was recovered, in one case two additional organisms were recovered, and in two cases five additional organisms were recovered. The additional organisms were the result of technician counting error during addition of the organisms to test chambers. For the purpose of statistical analysis, these replicates were considered to have had 100 % survival. Due to the random nature of this issue, this deviation did not greatly impact the results of any one sample set. Although the SC123 sample had two impacted replicates, the survival in the remaining replicates was high (95% to 100%) and consistent with the 100% assumption for the two replicates with additional organisms.

Minor temperature, salinity, and dissolved oxygen deviations were observed during the three batches of *L. plumulosus* testing conducted by Weston. The lowest temperature recorded was 1.6°C below range specified in the QAPP. Salinity was slightly above the target range towards the end of some assays, likely due to evaporation. Dissolved oxygen below the range specified in the QAPP was recorded in selected replicates but returned to within the specified range by the following day after the aeration level was increased.

These deviations are considered to have had no impact on the outcome of the assay.

6.1.2 Suspended particulate phase bioassays

A. bahia, 3-5 days old, were obtained from cultures maintained by ARO. *M. beryllina*, 10 days old, were also obtained from ARO. Prior to use, test organisms were held for a minimum of 2 hours under temperature, salinity, and photoperiod conditions similar to those used in the assay. Organisms were transferred to test vessels using a large bore pipet to minimize the amount of water added to test solutions. Twenty representative fish, measured at the start of the assay, were used to confirm that the recommended organism loading rate (<0.40 g/L) suggested for acute assays was not exceeded.

Adult *A. punctulata* were from cultures maintained by ESI. Original stock was obtained from a commercial supply. Adult sea urchins are maintained in the laboratory for approximately two weeks prior to use. Adult sea urchins were maintained in culture at a temperature of approximately 20±3°C during culture.

6.1.3 Reference toxicants

Acute 96-hour copper reference toxicant assays for *A. bahia* and *M. beryllina* were started on January 31, 2006. As discussed above, results from the *A. bahia* assay were outside two standard deviations of the historic mean. However, survival in all *A. bahia* laboratory controls exceeded the minimum acceptability criteria in all assays indicating that the test organisms were healthy. The *A. punctulata* reference toxicant assay was started on February 2, 2006. Results of the *M. beryllina* and *A. punctulata* assays were within two standard deviations of the historic mean for each species. Laboratory controls for these species also exceeded the minimum acceptability criteria for each batch of testing indicating that the test organisms were healthy.

6.1.4 Protocol Deviations

The *A. punctulata* assay started on February 2, 2006, did not meet acceptability criteria and sufficient fertilized embryos could not be generated for the assay planned to start on February 8, 2006. The re-test of these two assays was started on February 11, 2006. This was 2 and 3 days outside the 14 day hold time for the Bayou Casotte water and the ODMDS reference water, respectively. CE SAM and EPA were notified of this condition.

Review of salinity data collected during the daily water quality monitoring for the mysid and minnow assays showed variations greater than the limit specified by the protocol. The increase in salinity was usually noted as having occurred during the last 24 hours of the assay, and was determined to be the result of evaporation. In the majority of the cases, the variation was not more than 3‰. Over the course of all of the assays, the salinity ranged from a minimum of 26‰ to a maximum of 35‰. In all cases, the salinity levels were within the tolerance limits for the species.

Temperatures outside the 20±1°C specified in the QAPP were also recorded. In general, the temperatures ranged from 18ºC to 22 ºC. However, temperatures of 16ºC and 17ºC were recorded at test termination in the *A. punctulata* assay for the laboratory control, ODMDS reference water, and samples SB7U2 and C3L. Review of the data indicated that temperatures for other samples in this batch of tests were within the acceptable range specified by the protocol, as were the incubator temperatures. The *A. punctulata* laboratory control survival for this batch exceeded the test acceptability criteria, and was consistent with the laboratory controls in the other two batches, indicating that the low temperatures did not have a significant impact. Water quality measurements were not recorded at the end of the *A. punctulata* tests started on February 11, 2006.

The *A. punctulata* assays were generally extended beyond the 72 hours indicated in the QAPP. However, test termination is indicated when >70% of the laboratory control organism reach the pluteus stage and >70% have developed normally. The fact that this generally occurred beyond 72 hours does not preclude a valid assay.

These deviations are considered to have had no impact on the outcome of the assay.

6.1.5 28-day sediment bioassay/bioaccumulation tests

Macoma nasuta, 15-40 mm in total length, were obtained from ARO. At ESI, the clams were placed in flowing seawater and monitored for at least 24 hours prior to use. Damaged bivalves and those that would not close when prodded were discarded. The *Macoma* test commenced on February 2, 2006. A total of 30 organisms were added to each replicate in order to obtain sufficient tissue at test termination.

Adult *Nereis virens* were obtained from the Maine Bait Company, Newcastle, Maine. Worms were collected in the field and shipped to ESI via overnight delivery. Worms were placed in control sediment and flowing seawater and monitored for at least 24 hours prior to use. Damaged and inactive worms were not used in the assay that commenced on February 15, 2006. A total of 20 organisms were added to each replicate in order to obtain sufficient tissue at test termination.

6.1.5.1 Protocol deviations

During the assays, salinity values were reported outside of the salinity regime of 28 ±2‰ established for the assays. Mean salinity fell within the specified limits but there were individual data points outside the specified ranges. Maximum and minimum salinity levels were reported as 32 and 23‰, respectively. These values fell within the overall range specified in the Inland Testing Manual. The variations in salinity were within normal ranges for the species. As there was no evidence of adverse impacts on survival of organisms in the laboratory control treatment the fluctuations in salinity were determined to have had no significant adverse effect on the outcome of the assays.

In several replicates of the *M. nasuta* assay, there were more than 30 bivalves recovered from the sediments relative to the 30 placed in chambers at the start. The number of bivalves added to replicate "D" of the laboratory control was 20 instead of 30. When there was a variance between the final count and start number the existence of the variance was confirmed by counting recovered shells.

These deviations are considered to have had no impact on the outcome of the assay.

6.2 Chemical analyses QA/QC

The chemical data collected during the investigation was of sufficient quality and sensitivity to meet the project objectives. The majority of the QC results associated with the analytical parameters met the measurement objectives presented in Section A.7.2 of the QAPP. Nonconformances with those measurement objectives are presented below. A full set of QC sample findings (method blanks, duplicate precision results, laboratory control sample results, and matrix spike results) is provided in Appendix C-1, Chemistry Laboratory Data.

6.2.1 Analytical sensitivity

The sensitivity of program chemical measurements can sometimes dictate the ultimate usefulness of the final data. Results that are insufficiently sensitive to detect changes can limit the final project conclusions. The CLLNG project required reporting limits (RLs) were specified in the agency approved QAPP (ENSR, 2005) to detect sedimentary contaminant considerations, ambient seawater and elutriate concentrations, and bioaccumulative tissue concerns.

The QAPP prepared by ENSR for the project (ENSR, 2005) summarized the laboratory RLs and project required RLs. Method detection limits (MDLs) were used as the lower limit for quantitations. Laboratory MDLs represent an annual statistical MDL study and were conducted in accordance with 40 CFR Part 136 Appendix B. Nondetect chemistry results were reported at laboratory RLs (typically higher than MDLs by a factor of 3 to 10) since they provide greater confidence. Concentrations detected between the MDLs and RLs were qualified and reported by the laboratory.

The majority of the RLs for all sample matrices met the QAPP specifications. Some deviations from QAPP-specified limits occurred when dilutions were needed to overcome matrix interferences or when sample mass or moisture content varied considerably. The fact that results were reported between the MDL and RL for most parameters further minimizes any concern related to these deviations.

6.2.2 Contamination concerns

Sample contamination can sometimes affect sample results, particularly when measuring chemical parameters at very low concentrations. In this study, potential contamination has been monitored using method blank, filter blank, and equipment blank QC samples. In this study, a few analytes were detected in the laboratory method blanks for various parameters but only at very low concentrations between MDLs and RLs. A full discussion of QC sample results is included in Appendix C-2, Data Validation Findings.

Filter blanks, consisting of analyte-free water passed through the membranes used to filter elutriate samples for dissolved metals (see Section 2.2.4), were collected at a frequency of one per 10 elutriate samples. Only Cu was detected in filter blanks at concentrations slightly above the RL. Several other metals were detected though at concentrations below the RL.

Equipment blanks were collected at the frequency stated in the QAPP for soil/sediment and aqueous samples. Various analytes were detected in the equipment blanks; however, the majority of these concentrations were reported as estimated concentrations below the RLs. Some analytes (mostly metals) were reported at concentrations that exceeded the RLs, however, the presence of blank contamination (field or laboratory)

would potentially yield false positive results and so these findings do not affect project conclusions protective of the environment.

6.2.3 Data precision

Analytical precision was measured at the laboratory level using matrix duplicates (inorganic parameters), and laboratory control sample (LCS) duplicates or matrix spike duplicates (organic parameters). Field precision was measured using field duplicate samples. Laboratory and field precision is discussed below and in Appendix C-2, Data Validation Findings.

6.2.3.1 Field precision

To evaluate precision, relative percent differences (RPDs) were calculated and compared to the data quality objectives stated in the QAPP for solid samples (<50% RPD) and aqueous samples (<30% RPD). The majority of the RPDs were <50% for the soil/sediment field duplicate pairs. Exceedances of the sediment criterion were generally related to metal and PAH measurements and exceedances of the elutriate criterion were generally related to metal measurements. However, in all cases the sample results associated with the high RPDs were close to the RLs for those analytes, where small differences can result in large RPD values. Related precision in these instances is considered acceptable.

6.2.3.2 Laboratory analysis precision

Sediment measurement precision

Sediment analysis precision was evaluated using matrix duplicates for inorganic parameters and matrix spike duplicates or LCS duplicates for organic parameters. RPD objectives for this project ranged from 20 to 50% for matrix spike duplicates (depending on the parameter) and 20% for matrix duplicates and LCS duplicates. In general, the RPD criteria were met for all parameters. The RPDs for fluoranthene and arsenic exceeded the duplicate criteria in one batch of samples analyzed for the Rapid TAT (Phase 1) sediments, but because Phase 1 data were primarily used to develop pooling schemes for (full) Phase 2 testing, the project conclusions are unaffected by these nonconformance issues.

The laboratory inadvertently omitted matrix spike duplicate analyses for VOCs for the Rapid TAT (Phase 1) sediments. However, acceptable LCS duplicate results were reported for the VOC analyses demonstrating that method precision was in control.

Elutriate and ambient seawater measurement precision

Elutriate and ambient seawater analysis precision was evaluated using matrix duplicates for inorganic parameters and matrix spike duplicates or LCS duplicates for organic parameters. RPD objectives for this project ranged from 20 to 50% for matrix spike duplicates (depending on the parameter) and 20% for matrix duplicates and LCS duplicates. In general, the RPD criteria were met for all parameters. The only precision (RPD) deviations were noted for Pb and Ag measurements in ambient seawater.

Tissue measurement precision

Tissue analysis precision was evaluated using matrix duplicates for metals and matrix duplicates and LCS duplicates for PAHs. RPD objectives for this project were 20% for metals and 35% for PAHs. The RPD criteria were met for all parameters with four exceptions. For *Nereis virens*, the RPD for Zn exceeded the matrix duplicate criterion and the RPDs for naphthalene, 2-methylnaphthalene, and 1-methylene exceeded the matrix spike duplicate criterion.

6.2.4 Data accuracy

Accuracy was evaluated using several QC sample types by calculating the percent recovered for each parameter of interest. A recovery value of 100% corresponds to 100% accuracy in this analysis. LCS and matrix spiked samples were incorporated as accuracy QC samples. Additionally, surrogate spikes were used to evaluate the accuracy of organic measurements and certified reference matrices (CRMs) were included in the tissue analysis program.

6.2.4.1 Sediment analysis accuracy

Percent recovery objectives for sediment measurements ranged from 50 to 140% for LCSs (depending on the parameter); 30 to 140% for matrix spikes (depending on the parameter); and 30 to 150% for surrogates. In most cases accuracy measurements were excellent. The few cases where deviations from the QAPP-specified accuracy goals occurred are summarized below.

Percent recoveries for Sb for the matrix spike analyses performed on the Rapid TAT (Phase 1) sediments and the Phase 2 sediments fell below the QC acceptance criterion. However, the most significant interferences observed for Sb were associated with Phase 1 measurements and so project conclusions (based on Phase 2 findings) are not affected.

Percent recoveries for cyanide matrix spikes performed on the Rapid TAT (Phase 1) sediments fell below the QC acceptance criterion. The low recoveries were most likely due to matrix interferences. Positive and nondetect cyanide results for the Rapid TAT (Phase 1) sediments should be considered estimated values with a low bias.

The percent recovery for total phosphorus for one of the matrix spike analyses performed on a Phase 2 sediment sample fell below the QC acceptance criterion. Positive and nondetect phosphorus results for the Phase 2 sediments should be considered estimated values with a low bias.

Two Rapid TAT (Phase 1) samples, SC-123B and SB11L1, exhibited low surrogate recoveries for the PAH analyses. Positive and nondetect PAH results for these samples should be considered estimated values with a low bias. Surrogate recoveries were low for one Phase 2 sediment sample (SB12L2) for the pesticide and PCB analyses. As a corrective action measure, the sample was re-extracted and re-analyzed for these compounds. Although the re-analysis was 18 days beyond the QAPP-specified hold time, the surrogate recovery was acceptable and PCB and pesticide results were comparable to the initial data, indicating that the initial surrogate recovery problem may have been isolated to the spiking exercise and that the PCB and pesticide results are accurate.

6.2.4.2 Elutriate and ambient seawater analysis accuracy

Percent recovery objectives for aqueous measurements ranged from 50 to 120% for LCSs (depending on the parameter); 50 to 120% for matrix spikes (depending on the parameter); and 30 to 150% for surrogates. All percent recoveries for the LCSs and matrix spikes associated with the ambient seawater samples met the QAPP-specified QC acceptance criteria. A few elutriate accuracy thresholds were exceeded as summarized below.

Low recoveries were observed for Cu, Be, and Zn for the matrix spike analyses in the elutriates. The positive and nondetect results for these metals should be considered estimated with a low bias.

One elutriate sample, SB7U2EA, exhibited low surrogate recovery for the pesticide analysis. The positive and nondetect pesticide results in this sample should be considered estimated with a low bias.

The percent recoveries for several PCB compounds for the matrix spike and LCS analyses performed for the modified elutriates exceeded control limits. Results were unaffected in this case since the recoveries indicate a high bias and only nondetects were reported for PCBs.

The percent recoveries for sulfide matrix spike analyses performed for the elutriates were 3% and 68% and laboratory personnel indicated that these low recoveries were related to sample interferences. Although batch LCSs met the specified accuracy criteria, nondetect results for elutriate samples SB7U2EA, SB9U2EA, SB9U2EB, C3L2EA, and C4L2EA should be considered suspect. Positive and nondetect results reported for sulfide in the remaining standard elutriates should be considered estimated values with a low bias. These results, however, are not considered critical to the overall project conclusions because sulfide concerns were not identified in the sediments and good survivorship was observed within the complementary SPP bioassays.

6.2.4.3 Tissue analysis accuracy

LCSs, matrix spikes, and CRMs were used to assess the accuracy of the tissue chemical measurements. The CRMs analyzed for metals were “DOLT-2” and “DORM-3” composed of dogfish liver and dogfish muscle, respectively.

In general, the QAPP specified percent recoveries for LCSs, matrix spikes, and CRMs were met for all parameters and the tissue data are considered to be very accurate. The few cases where QAPP-specified accuracy goals were not met are summarized below.

Several Hg matrix spike recovery thresholds for *Nereis virens* and *Macoma nasuta* analyses fell slightly below the control limits. The matrix spike recoveries for Zn in the *Nereis virens* analyses fell outside control limits.

The percent recovery for Pb for just one of the analyses of DOLT-3 exceeded the control limits. Other QC samples associated with the batch (i.e., DORM-2 and matrix spike) yielded acceptable recoveries demonstrating that the method was in control.

PAH surrogate recoveries were high for *Nereis virens* sample SB7UNV1. The positive and nondetect PAH results in this sample should be considered estimated with a high bias.

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Attachment 1

Amphipod Evaluation Transmittal 27 March 2006

Privileged and Confidential Information -
Do Not Release

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Via E-Mail Transmittal

March 27, 2006

Dr. Susan Rees – USACE
Mr. Phil Payonk - USACE
Mr. Doug Johnson – U.S. EPA

Re: Casotte Landing Natural Gas Import Terminal Project
Suitability Testing - Amphipod Evaluations

Dear Susan, Phil and Doug:

During our Casotte Landing project meeting March 16th it was acknowledged that amphipod survivorship observed in reference site material was unusually low and perhaps related to compromised test organism health or to hurricane related site disturbances. It was then decided to collect a new sample from the site and rerun the bioassay to further evaluate the Grand Bay Site. It was also decided to examine whether the observed amphipod mortality in Casotte Landing soil/sediment was the result of the sterile nature of the material and/or the poor quality of TOC as a food source associated with these soils/sediments that have been deeply buried. This memo provides our proposed testing scheme to further evaluate these factors.

Approach

To assess the suspected confounding factors, a new reference sediment sample has been collected (March 21st) and we have set aside for further testing additional archived soil/sediment and also material that has been exposed (conditioned) to seawater for 28 days. The conditioned sediment represents the material used for the *N virens* bioassay that finished last week.

To further evaluate the poor reference site results, we propose to test the archived reference sediment in parallel with the newly collected sediment (*Leptocheirus plumulosus* 10-day assay).

To evaluate the effects of introducing test organisms to sterile sediments, we propose running the amphipod bioassay in parallel using both archived sediment and conditioned sediment at each of the sites. We will also evaluate whether the initial mortality observed may be related to insufficient (biologically available) carbon as a food source by running a third set of samples (in parallel) using the conditioned sediment and adding TetraMin™ slurry. Dosing amount will

follow that established in the 28-day test guidance (EPA, 2001). Supplements will be added by pipet on day 0 and day 5. Table 1 summarizes the overall testing framework. We propose that positive *L. plumulosus* results for any of these treatments (site results within 20% of an acceptable reference) will constitute a successful suitability test with respect to sediment quality.

Laboratory capacity to accomplish this exists at Weston's Port Gamble facility (Jack Word's Lab) and the tests will be run in multiple batches. Each batch will contain a batch-specific reference and control, as well as a reference toxicant test.

Schedule

With one exception, bioassays are expected to commence within the next few weeks. The conditioned sample SB12U (upper sand at station SB12) was disposed of following the 28-day exposure and so this (parallel) sample testing may be delayed and run later than the other site samples to accommodate an initial conditioning period before initiating the bioassay.

Table 1. Amphipod Testing Scheme.

	Treatment Scenario[1]			
Site Station ID	**I**	**II**	**III**	**Test Qty**
Reference Site				
RO (Grand Bay) – Archive	1	-	-	1
RO – Newly Collected	-	1	1	2
"Upper" Site Samples				
SB1/SB2/SB3	1	1	1	3
SB4	1	1	1	3
SB5/SB6/SB8	1	1	1	3
SB7	1	1	1	3
SB9	1	1	1	3
SB10	1	1	1	3
SB11	1	1	1	3
SB12	1	1	1	3
"Lower" Site Samples				
SB1/SB2/SB3/SB4	1	1	1	3
SB5/SB6/SB8/SB9/SB11	1	1	1	3
SB7	1	1	1	3
SB10	1	1	1	3
SB12	1	1	1	3
Coastal Samples				
SC1,2,3	1	1	1	3
Quality Control				
Laboratory Control[2]	1	1	1	3
Reference Toxicant[2]	1	1	1	3

[1]Treatments I, II, and III correspond to Archive, Conditioned, Adjusted Food Source
[2]Control and Reference Toxicant will be included with each test batch.

Treatments I, II, and III listed in Table 1 correspond to the following testing scenarios:

I. Archive. Samples held in refrigerated archive since the initial 10-day amphipod test will again be tested following the project SAP/QAPP (ENSR, 2005) except that static tests will be run and the overlying water will not be renewed unless water quality concerns arise.

II. Conditioned. Samples that have been exposed to seawater for 28 days (during the project *N virens* 28-day bioassay) should now contain an assemblage of marine sediment bacteria needed to sustain life. Results of this test will be compared to the archive results to evaluate the impact of dispensing test organisms into sterile sediment.

    In the case of the Grand Bay Reference sediment, conditioned sediment will not be prepared or tested in this way because it represents surficial sediment fully exposed to the marine aquatic environment and our intention is to further evaluate the site, which normally provides a healthy substrate for amphipods. To further assess the reference, newly collected reference sediment will be run in parallel with its corresponding archive.

III. Adjusted Food Source. A third test will be established, also using pre-conditioned sediment but in this case additional nutrients will be added on day 0 and day 5 to evaluate morality resulting from limited and/or poor food sources for the organisms. In the case of the reference sediment, the newly collected material will be treated in the same manner as the site samples to provide a basis for comparison.

As always, I thank you for your ongoing participation, consideration, and support with our project. Please advise with your concurrence with this approach or any questions/comments at your earliest convenience. Please contact Dion Lewis at ENSR at (978) 589-3036 or dlewis@ensr.com or myself at (832) 854-6228 or mdenicola@chevron.com.

Sincerely,

Michael J. De Nicola

Michael J. De Nicola
Regulatory Coordinator

cc: Jack Word, Weston Solutions
Greg Minnery, Chevron

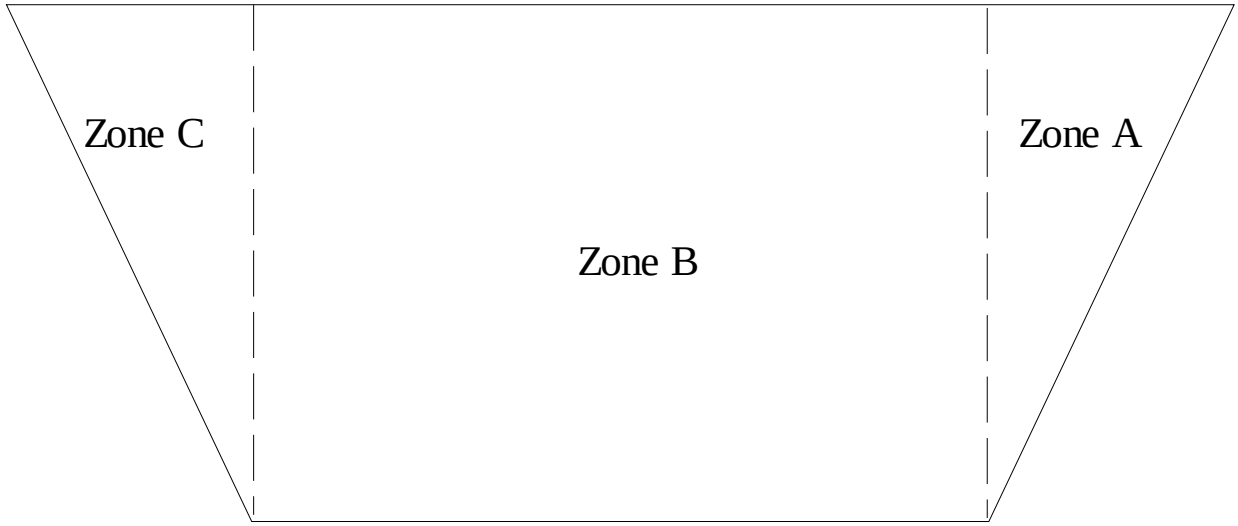
DAL:MJD

Attachment 2

Water Column Evaluations, Numerical Model (STFATE) Input Parameters

Provided by USEPA, Region 4

Pascagoula ODMDS
STFATE Modeling Zones



Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Pascagoula ODMDS Zone A

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	45	
Number of Grid Points (top to bottom)	45	
Spacing Between Grid Points (left to right)	500	ft
Spacing Between Grid Points (top to bottom)	500	ft
Constant Water Depth	44	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0	Deg.
Slope of Bottom in Z-Direction	0	Deg.
Number of Points in Ambient Density Profile Point	2	
Ambient Density at Depth = 5 ft	1.0174	g/cc
Ambient Density at Depth = 44 ft	1.0230	g/cc

AMBIENT VELOCITY DATA

Parameter	Value	Units
Profile	2-Point at constant depth	
X-Direction Velocity at Depth = 10 ft	-0.232	ft/sec
Z-Direction Velocity at Depth = 10 ft	-0.232	ft/sec
X-Direction Velocity at Depth = 40 ft	-0.116	ft/sec
Z-Direction Velocity at Depth = 40 ft	+0.116	ft/sec

DISPOSAL OPERATION DATA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	8,500[2]	ft
Location of Disposal Point from Left Edge of Grid	8,200[2]	ft
Dumping Over Depression	0	

INPUT, EXECUTION AND OUTPUT

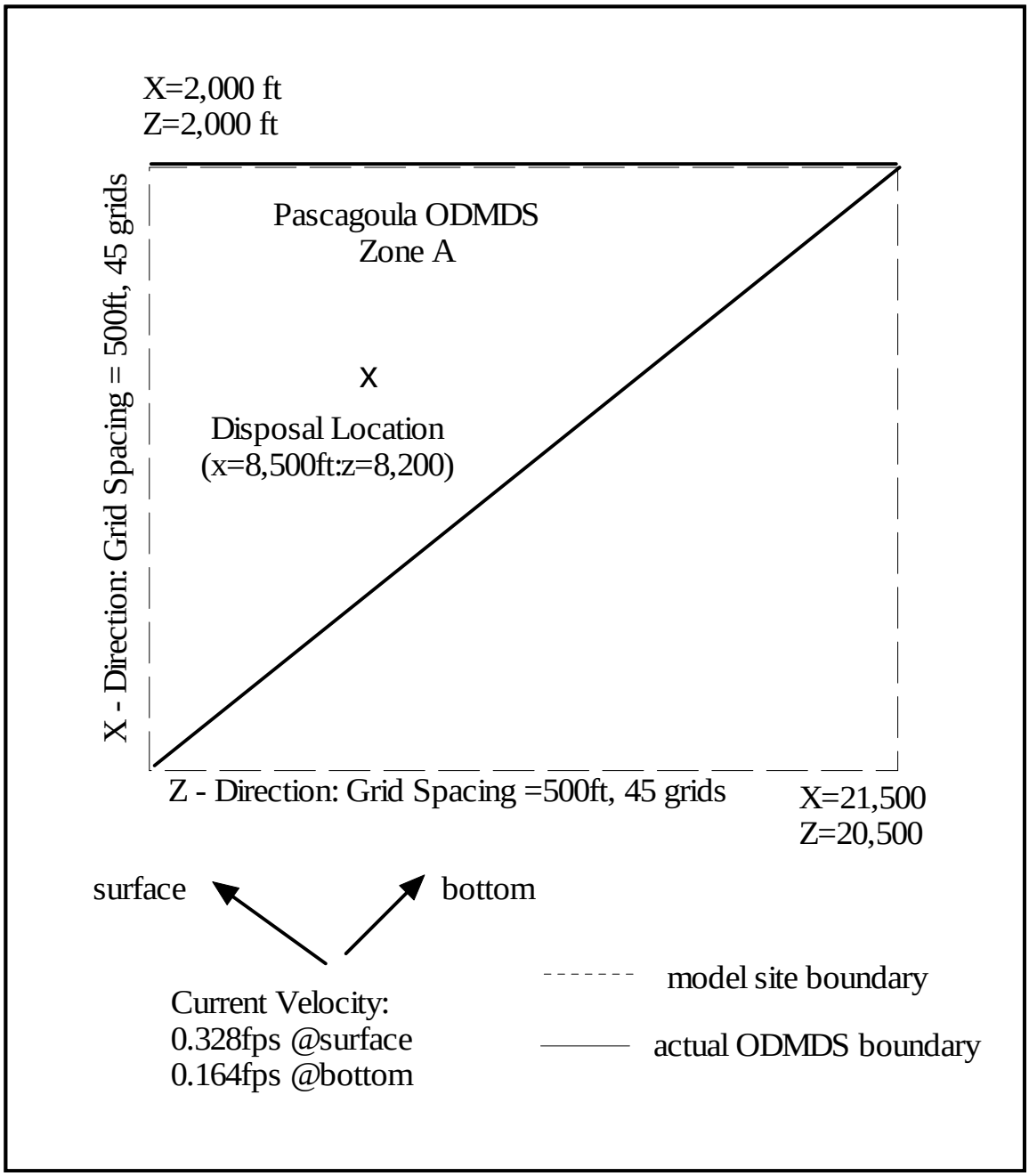
Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	2,000	ft
Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	2,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	21,500	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	20,500	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparent Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.001[1]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.235[1]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model default value
[2]Represents center of zone A. Dredged material requiring disposal in another location in order to meet the dilution criteria must be brought to the attention of EPA and the COE.

Typical dilution achieved after 4 hours = 500:1
Plume does not reach site boundaries within 4 hours


X=2,000 ft
Z=2,000 ft
Pascagoula ODMDS
Zone A
x
Disposal Location
(x=8,500ft:z=8,200)
X - Direction: Grid Spacing = 500ft, 45 grids
Z - Direction: Grid Spacing =500ft, 45 grids
X=21,500
Z=20,500
surface
bottom
Current Velocity:
0.328fps @surface
0.164fps @bottom
model site boundary
actual ODMDS boundary

Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Pascagoula ODMDS Zone B

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	45	
Number of Grid Points (top to bottom)	45	
Spacing Between Grid Points (left to right)	600	ft
Spacing Between Grid Points (top to bottom)	600	ft
Constant Water Depth	46	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0	Deg.
Slope of Bottom in Z-Direction	0	Deg.
Number of Points in Ambient Density Profile Point	2	
Ambient Density at Depth = 5 ft	1.0174	g/cc
Ambient Density at Depth = 46 ft	1.0230	g/cc

AMBIENT VELOCITY DATA

Parameter	Value	Units
Profile	2-Point at constant depth	
X-Direction Velocity at Depth = 10 ft	-0.232	ft/sec
Z-Direction Velocity at Depth = 10 ft	-0.232	ft/sec
X-Direction Velocity at Depth = 40 ft	-0.116	ft/sec
Z-Direction Velocity at Depth = 40 ft	+0.116	ft/sec

DISPOSAL OPERATION DATA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	13,500[2]	ft
Location of Disposal Point from Left Edge of Grid	14,500[2]	ft
Dumping Over Depression	0	

INPUT, EXECUTION AND OUTPUT

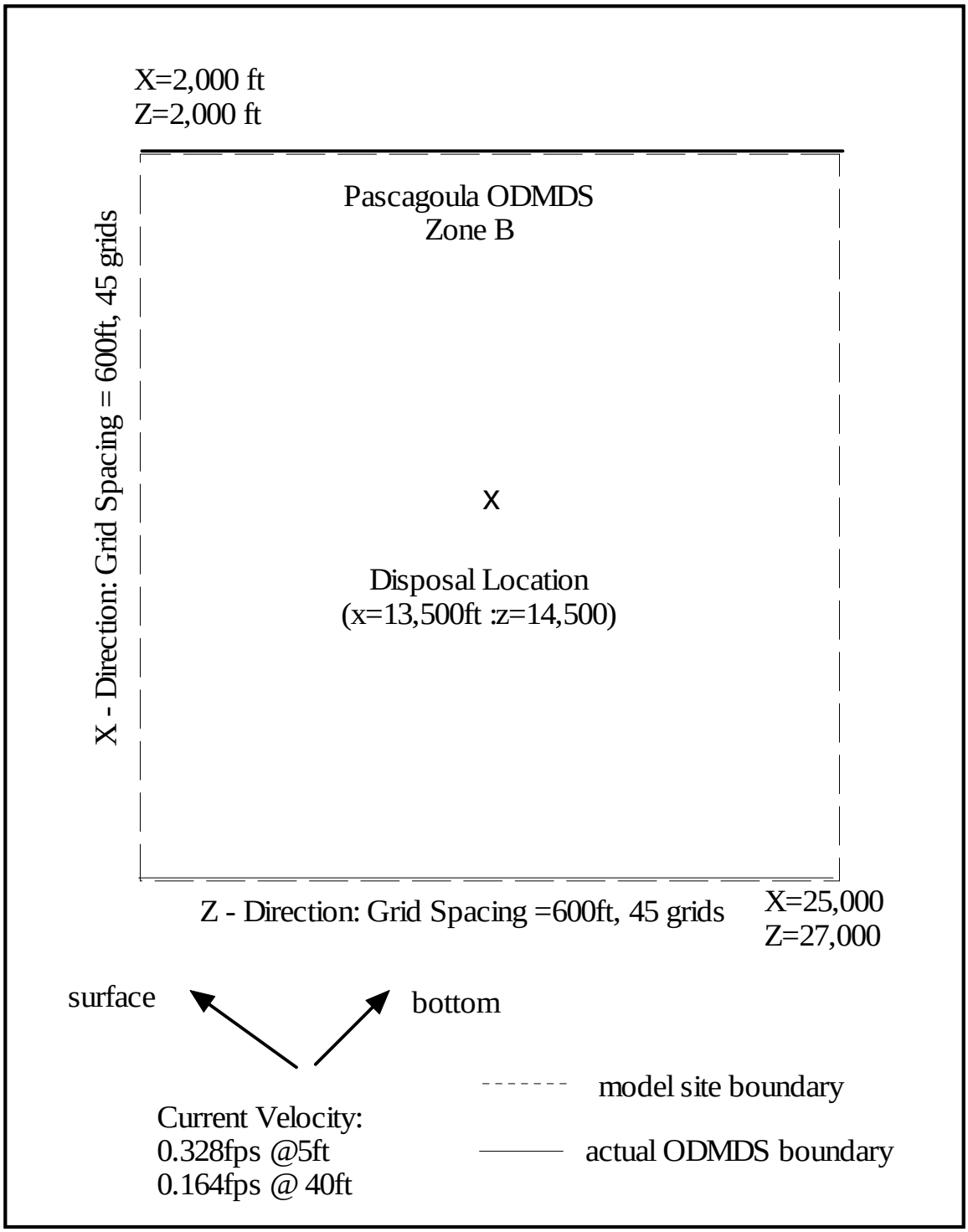
Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	2,000	ft
Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	2,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	25,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	27,000	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparent Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.001[1]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.235[1]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model default value
[2]Represents center of zone A. Dredged material requiring disposal in another location in order to meet the dilution criteria must be brought to the attention of EPA and the COE.

Typical dilution achieved after 4 hours = 500:1
Plume does not reach site boundaries within 4 hours


X=2,000 ft
Z=2,000 ft
Pascagoula ODMDS
Zone B
X - Direction: Grid Spacing = 600ft, 45 grids
x
Disposal Location
(x=13,500ft :z=14,500)
Z - Direction: Grid Spacing =600ft, 45 grids
X=25,000
Z=27,000
surface
bottom
Current Velocity:
0.328fps @5ft
0.164fps @ 40ft
model site boundary
actual ODMDS boundary

Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Pascagoula ODMDS Zone C

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	45	
Number of Grid Points (top to bottom)	45	
Spacing Between Grid Points (left to right)	400	ft
Spacing Between Grid Points (top to bottom)	600	ft
Constant Water Depth	47	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0	Deg.
Slope of Bottom in Z-Direction	0	Deg.
Number of Points in Ambient Density Profile Point	2	
Ambient Density at Depth = 5 ft	1.0174	g/cc
Ambient Density at Depth = 47 ft	1.0230	g/cc

AMBIENT VELOCITY DATA

Parameter	Value	Units
Profile	2-Point at constant depth	
X-Direction Velocity at Depth = 10 ft	-0.232	ft/sec
Z-Direction Velocity at Depth = 10 ft	-0.232	ft/sec
X-Direction Velocity at Depth = 40 ft	-0.116	ft/sec
Z-Direction Velocity at Depth = 40 ft	+0.116	ft/sec

DISPOSAL OPERATION DATA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	9,660[2]	ft
Location of Disposal Point from Left Edge of Grid	11,200[2]	ft
Dumping Over Depression	0	

INPUT, EXECUTION AND OUTPUT

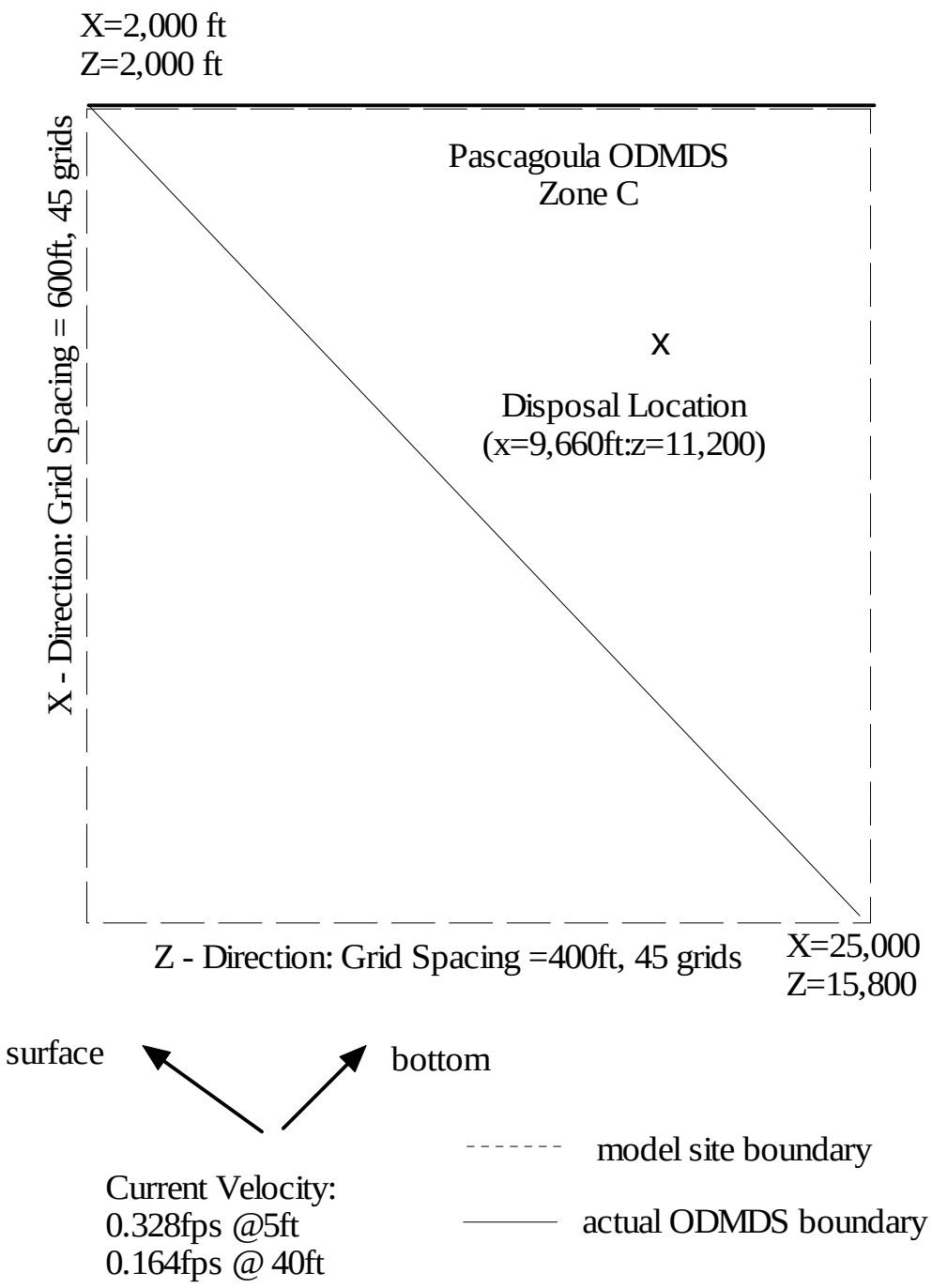
Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	2,000	ft
Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	2,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	25,000	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	15,800	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparent Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.001[1]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.235[1]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model default value
[2]Represents center of zone A. Dredged material requiring disposal in another location in order to meet the dilution criteria must be brought to the attention of EPA and the COE.

Typical dilution achieved after 4 hours = 500:1
Plume does not reach site boundaries within 4 hours


X=2,000 ft
Z=2,000 ft
Pascagoula ODMDS
Zone C
X
Disposal Location
(x=9,660ft:z=11,200)
X - Direction: Grid Spacing = 600ft, 45 grids
Z - Direction: Grid Spacing =400ft, 45 grids
X=25,000
Z=15,800
surface
bottom
Current Velocity:
0.328fps @5ft
0.164fps @ 40ft
model site boundary
actual ODMDS boundary

Appendices:

A Field Logs
B Grain Size Data
C Chemistry Data
D Toxicity Laboratory Data
E Ancillary Project Data
F Input and Output Files

This information is too voluminous to include in this EIS. Bayou Casotte Energy has filed its Section 103 evaluation with the U.S. Army Corps of Engineers who will in turn coordinate with the U.S. Environmental Protection Agency.