SURFACE SEDIMENT CHARACTERIZATION AND POLYCHAETE TISSUE COLLECTION PROGRAM

GREATER LOS ANGELES AND LONG BEACH HARBOR WATERS

Prepared for

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LIST OF ACRONYMS AND ABBREVIATIONS

Bight	Regional Southern California Bight Monitoring
cm	centimeter
DDT	dichlorodiphenyltrichloroethane
DGPS	differential global positioning system
EDD	electronic data deliverable
EQuIS	Environmental Quality Information System
g	gram
HRGC/HRMS	high-resolution gas chromatography/high-resolution mass spectrometry
MLLW	mean lower low water
PCB	polychlorinated biphenyl
Ports	Ports of Long Beach and Los Angeles
PQAPP	Programmatic Quality Assurance Project Plan
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SAP	Sampling and Analysis Plan
SAR	Sampling and Analysis Report
SWAMP	California Surface Water Ambient Monitoring Plan
TDDT	total dichlorodiphenyltrichloroethane
TMDL	total maximum daily load
TPCB	total polychlorinated biphenyl
USCG	U.S. Coast Guard
WRAP	Water Resource Action Plan

1 INTRODUCTION

The *Final Basin Plan Amendment*, an amendment to the *Water Quality Control Plan—Los Angeles Region to Incorporate the Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters* (RWQCB 2011), includes fish tissue and sediment total polychlorinated biphenyl (TPCB) and total dichlorodiphenyltrichloroethane (TDDT) numeric targets. A technically sound and logistically feasible management strategy for attaining these targets is needed due to the size and complexity of the Los Angeles/Long Beach Harbor, the widespread distribution of legacy pollutants within the region, and the potential ecological and financial costs associated with sediment remediation. To better understand how compliance with Harbor Toxics Total Maximum Daily Load (TMDL) targets may be achieved, the Ports of Long Beach and Los Angeles (Ports) are developing a bioaccumulation model as part of a Sediment Quality Objective indirect effects Tier III assessment of the Los Angeles/Long Beach Harbor (Anchor QEA 2013a). The objectives of the bioaccumulation model are to develop a scientifically defensible link between fish contaminant concentrations and contaminant sources and provide the Ports with a tool for identifying effective remediation options.

The Water Resources Action Plan (WRAP) Model will be used to understand the chemical fate and sediment transport mechanisms affecting polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethanes (DDTs) in the Los Angeles/Long Beach Harbor and will be linked to a bioaccumulation model to evaluate the relative contribution of water column and sediment sources of PCBs and DDTs to receptors of concern. In support of modeling efforts, an extensive data gaps analysis was performed (Anchor QEA 2014a). Filling these data gaps will be critical to the parameterization and calibration of the WRAP and bioaccumulation models. Several key data gaps were found, including surface sediment chemistry, food web tissue chemistry, and food web structure data gaps. Spatial data gaps in surface sediment PCB and DDT data within the Los Angeles/Long Beach Harbor were identified; these data gaps would leave some uncertainty in the WRAP Model calibration. Data gaps in the food web were also identified, including spatial and temporal gaps in TPCB and TDDT concentrations for target fish species and their key prey organisms. The food web structure or the trophic position and dietary sources for representative species and their prey in the Los Angeles/Long Beach Harbor was also identified as a data gap.

The conceptual site model for bioaccumulation (Anchor QEA 2014a) identified representative species of the harbor food web. Specifically, the bioaccumulation model will include a bottom-feeding predator (i.e., white croaker [*Genyonemus lineatus*]), a sport fish (i.e., California halibut [*Paralichthys californicus*]) whose diet is based on the pelagic portion of the food web, and a prey fish (i.e., shiner surfperch [*Cymatogaster aggregate*]). Invertebrates also have been chosen to represent deposit- and water-column feeders. Mussels will be used to represent water-column feeding organisms; polychaetes (i.e., worms) will be used to represent deposit-feeders; and crustaceans, including amphipods, will represent organisms feeding on a mixture of plankton and detritus. Additional groups of organisms may also be included as part of future model development. This representative food web will enable exposure of receptors of concern to the water column and sediment sources of PCBs and DDTs.

This work plan has been designed to fill the surface sediment data gap and one component of the food web tissue data gap: specifically, polychaete TPCB and TDDT concentrations. While the understanding of bioaccumulation in polychaetes is technically part of a larger food web sampling program designed to address food web tissue chemistry and food web structure data gaps, they are included in this work plan in order to the sediment and polychaete samples can be co-located for purposes of direct comparison. The synoptic collection of sediment and polychaetes also provides sampling efficiencies, because both are expected to be collected using sediment grab sampling techniques.

1.1 Objectives

The purpose of this study is to fill chemistry data gaps associated with surface sediment and polychaetes that are necessary to support the parameterization and calibration of the WRAP and bioaccumulation models. Upon their development and calibration, the linked models will provide the Ports with a tool that can be used to assess the effectiveness of various sediment management alternatives at reducing TPCB and TDDT concentrations in target fish species.

1.2 Programmatic Quality Assurance Project Plan

A Programmatic Quality Assurance Project Plan (PQAPP; Appendix A) was developed to ensure high-quality data collection as part of compliance monitoring and special studies required by and in support of the Harbor Toxics TMDL. The PQAPP includes the following key elements that focus on analytical methods and data generated during a project:

- **Program Management**. This section identifies specific roles and responsibilities of data collectors and data managers and describes the sequence for processing, reducing, and storing field analytical data in an Environmental Quality Information System (EQuIS) database by the managing consultant.
- **Field Sampling Data Quality Objectives**. This section includes detailed information on field collection requirements, including sample processing, sample handling, sample identification codes, sample custody and shipping, field quality control (QC) sample requirements with associated performance criteria, field records, and field electronic data deliverable (EDD) requirements.
- **Laboratory Data Quality Objectives**. This section includes detailed information on analytical methods, analyte lists and reporting limits, laboratory QC sample requirements with associated performance criteria and corrective actions, laboratory record requirements, and laboratory EDD requirements.
- **Data Review, Verification, and Validation**. This section outlines procedures used to ensure that project data quality objectives are met.

The PQAPP was designed to be programmatic in nature and does not target any one study, as it plans for both compliance monitoring and a variety of other Harbor Toxics TMDL-related sampling and analysis activities over the next 5 years. While the PQAPP complies with California Surface Water Ambient Monitoring Program (SWAMP) protocols and is SWAMP compatible, it is not written in the format of a SWAMP Quality Assurance Project Plan (QAPP). In addition, it does not include all elements of SWAMP QAPP guidance (SWRCB 2008). This format was not possible, because not all special studies have been designed or contractors determined. Instead, the PQAPP states that elements of the SWAMP QAPP guidance document relating to project-specific field collection requirements should be included in Sampling and Analysis Plans (SAPs) developed to support Harbor Toxics TMDL-related studies. The programmatic approach outlined in the PQAPP provides a uniform data collection and management program for all Harbor Toxics TMDL-related

studies that provides high-quality data and efficiencies by standardizing sample collection, nomenclature, analysis, data review/validation, processing, storage, management, and seamless data export to the Regional Monitoring Coalition and State of California databases, regardless of study type or contractors performing the work.

1.3 Document Organization

The remainder of the document is organized as follows:

- **Section 2: Overview of Field Program**. This section presents the field sampling program for surface sediment and polychaetes, including sampling design and rationale for sampling location placement, station positioning, sample nomenclature, sample collection methods, and sample processing and decontamination procedures.
- **Section 3: Laboratory Analytical Methods**. This section presents key analytes, methods, associated detection limits, and minimum requirements.
- **Section 4: Quality Assurance and Quality Control**. This section presents quality assurance (QA) and QC procedures associated with field sampling methods and chemical analysis.
- **Section 5: Data Analysis and Reporting**. This section presents data processing objectives and report requirements.
- **Section 6: References.** This section presents relevant citations or reference material.

2 OVERVIEW OF FIELD PROGRAM

The two parts of the sediment and polychaete field sampling program include: 1) sediment-only sampling; and 2) concurrent sampling of surface sediment and polychaetes. The field sampling program is anticipated to require substantial effort (with additional effort potentially needed for sorting organisms) to obtain enough polychaete or alternate benthic organism tissue mass necessary for chemical analysis (Section 2.5). Table 1 summarizes the collection program, with sample identifications, proposed coordinates, sampling intervals, and prescribed laboratory analyses. Details of the field program are presented in this section.

2.1 Target Station Locations

A total of 33 sampling locations have been targeted for this sampling program (Figure 1): 22 locations will be sampling for surface sediment (top 0 to 5 centimeters [cm]) only and the remaining 11 location will be concurrently sampled for surface sediment and polychaetes (top 0 to 10 cm). Table 1 presents the target coordinates for these locations as well as station identification codes, sample identification codes, and targeted analytes.

2.1.1 Sediment Only

Twenty-two surface-sediment-only sampling locations were identified as part of the recent data gaps analysis (Anchor QEA 2014a). Sampling locations were selected judgmentally and through a pseudo-random sample selection approach. This approach was presented to the Harbor Technical Working Group on May 21, 2014, and was found to be acceptable (Anchor QEA 2014b). Selected locations are shown along with previous measurements of surface sediment TPCB and TDDT concentrations in Figures 2 and 3, respectively.

Judgmental sampling locations were strategically selected within Eastern San Pedro Bay to evaluate whether the gradients in TPCB and TDDT concentrations observed in data from 1998 are still present in surface sediments. Strategic locations were also selected in Outer Los Angeles Harbor to characterize a specific source (i.e., Terminal Island Water Reclamation Plant outfall), a clean sediment storage area, and a potential gradient in concentration caused by the flux across Angel's Gate. Finally, strategic locations were selected in Fish Harbor to characterize areas where contaminant concentrations in the bioactive layer (i.e., top 0 to

5 cm) is unknown but where contamination at depth has been observed (i.e., measured in cores with coarse sectioning [greater than 16 cm]).

Spatial data gaps were identified in Cerritos Channel, Inner Los Angeles Harbor, and Outer Long Beach Harbor areas. Given that specific (i.e., strategically selected) sampling locations were not important, locations were selected with a pseudo-random approach. The approach involved developing sampling grids within each subarea. The grid cell sizes were proportional to the size of the subarea. Within each subarea, the number of locations targeted were determined by randomly selected grid cells with no existing data or planned data collected (e.g., polychaete [Section 2.1.2], geochronology cores [Anchor QEA 2013b]) and that are at least 1,000 feet away from existing data.

2.1.2 Sediment and Polychaetes

Eleven locations will be sampled concurrently for surface sediment and polychaetes (Figure 1); the top 5 cm will be targeted for sediment and the top 10 cm will be targeted for polychaete sample collection at these stations. Concurrent surface sediment and polychaete sampling locations were chosen for several reasons including the following:

- To capture the relationship between sediment and polychaete TPCB and TDDT concentrations across a wide range of sediment concentrations
- To characterize TPCB and TDDT concentrations in prey near proposed fish collection stations (provided as part of a separate work plan)
- The frequency of fish movement, as measured by the white croaker tracking study
- Elevated abundance of benthic infauna or polychaete worms

In addition, areas that were recently dredged were not targeted for sampling location placement based on recent data that suggest that white croaker avoid these areas (Ahr 2014).

2.2 Sample Identification

Each sample will be assigned a unique alphanumeric identification code as described in Section 3.1.3 of the PQAPP (Appendix A) and based on the following scheme:

- Waterbody or other area code (e.g., OA for Outer Los Angeles Harbor)

- Media code (i.e., SS for surface sediment and WO for whole organism)
- Organism code (i.e., PW for polychaete worm), if applicable
- Station number (e.g., 01, 02, 03…33)
- Depth interval (e.g., 0-5 to represent a 0 to 5 cm depth), if applicable
- Date of collection (e.g., 20141015 to represent October 15, 2014)
- Indication of field duplicate (i.e., add 1000 to station number)

An example sample identification code for a surface sediment collected from Los Angeles Harbor/Inner Cabrillo Beach Area at Station 24 on October 15, 2014:

CB-SS-24-0-5-20141015

An example sample identification code for the co-located polychaete tissue sample collected concurrently with the previous example:

CB-WO-PW-24-0-10-20141015

2.3 Sample Platform Requirements

Sample collection will be conducted from a suitable vessel capable of accommodating the field crew and with sufficient deck space to stage the sampling equipment required. It is recommended that the vessel be U.S. Coast Guard (USCG)-inspected and be captained by a USCG-Licensed Master.

2.4 Navigation Requirements

On-vessel navigation and positioning will be accomplished using a differential global positioning system (DGPS). The navigation system will be used to guide the vessel to predetermined sampling locations, with an accuracy of plus or minus 10 feet. Horizontal positions will be reported in latitude and longitude in decimal degrees (to five decimal places). Positions will be relative to the World Geodetic System 1984.

Upon locating the sampling location, station depth will be measured using an onboard calibrated fathometer or a leadline. The mudline elevation relative to the mean lower low

water (MLLW) datum will be determined by adding the tidal elevation to the measured depth. All vertical elevations will be reported to the nearest 0.1 foot relative to MLLW.

2.5 Collection Methods

Surface sediment and benthic invertebrates, including polychaetes, can be collected using a variety of methods. A double van Veen grab sampler is recommended for this program, because it has a capacity of up to 12 liters per bucket (depending on target depth), which will facilitate the collection of a sufficient amount of polychaete tissue mass for laboratory chemical analysis. The target polychaete tissue mass required for the planned analyses is approximately 60 grams (g) wet weight. A depth of 5 cm is targeted for the collection of surface sediments, and a depth of 10 cm is targeted for the collection of polychaetes, which is consistent with Regional Southern California Bight Monitoring (Bight) protocols (Bight '13 2013a) and is believed to represent the bioactive layer of sediment (Boudreau 1998; Kristensen 2005; McCall and Tevesz 1982; Thibodeaux and Bierman 2003). Ten to 15 double van Veen grab samples are anticipated to be taken at each station to achieve the target tissue mass.

Sampling procedures for double van Veen grab sampling and sediment evaluation for acceptance should be in accordance with the *Bight '13 Contaminant Impact Assessment Field Operations Manual*, Section VIII (Bight '13 2013b).

2.6 Sample Processing

Sediment sample processing and handling for purposes of sediment chemical analysis should be performed in accordance with procedures specified in the *Sediment Quality Assessment Draft Technical Support Manual* (Bay et al. 2009) and the *Bight '13 Contaminant Impact Assessment Field Operations Manual* (Bight '13 2013). Methods are also included in standard operating procedures: Sediment Chemistry Sample Processing, Sediment Toxicity Sample Processing, and Benthic Infauna Processing (Appendix B). Recommended conditions for sampling containers and sample handling and storage are listed in Table 2.

2.6.1 Sediment

Sediment-only samples will be subsampled from double van Veen grab samples. Sediment samples concurrently collected with polychaete samples will be subsampled from each grab sample that contributes polychaetes to the polychaete composite; in other words, sediment will be combined in equal volumes from each subsample to create a sediment composite sample for each station.

Sediment subsamples will be collected by taking a 2 to 3 inch diameter push core (or similar method) to 5 cm from the undisturbed surface material from each side of each double van Veen grab sample taken at a station. Sediment within 1 cm of the metal sides of the device will be avoided to prevent sample contamination. Material from each push core will be placed into a stainless-steel bowl and homogenized. The homogenized composite will then be subsampled and placed into a sample container. The sediment samples from each collection location will be preserved on ice, as indicated in Table 2. Equipment will be decontaminated prior to use at each station in accordance with standard procedures.

2.6.2 Polychaetes

After subsampling for sediment, the remainder of the grab samples will be retained to a depth of 10 cm for benthic organism collection and analysis. Benthic organisms from these grab samples will be washed over a 1.0-millimeter mesh sieve using 0.45-micrometer filtered seawater. All organisms will be retained and sorted. Polychaetes of all sizes will be retained for analysis. Polychaetes will be placed in pre-cleaned containers (provided by the analytical laboratory) on ice until they can be weighed. The remaining organisms will be sorted into the following four groups:

1. Other families of worms of all sizes
2. Other deposit-feeding organisms
3. All remaining organisms less than 2 cm in total length
4. All remaining organisms greater than 2 cm in total length

Polychaete worms will be weighed and composited. Organisms from the four other groups will be retained in pre-cleaned, wide-mouth glass jars until it can be determined whether there is sufficient polychaete worm tissue mass for chemical analysis.

If there is sufficient polychaete tissue mass for chemical analysis (approximately 60 g), polychaetes will be composited and placed in large pre-cleaned, wide-mouth glass jars and capped with Teflon®-lined lids for transport to the laboratory. Samples will be stored on ice in the field. Equipment will be decontaminated prior to use at each station. Tissue will be homogenized at the analytical laboratory according to the laboratory's standard operating procedures. Upon homogenization, tissue homogenates will be separated into appropriately sized, pre-cleaned, wide-mouth glass jars for analysis and stored according to Table 2. Organisms from the other four groups should be archived.

If sufficient polychaete tissue mass (less than 60 g) is not collected after approximately 10 to 15 grab samples per station[1], alternative compositing approaches will be implemented as described below (Section 2.6.2.2).

2.6.2.1 Phased Analytical Approach

A phased analytical approach should be used to analyze polychaete (or alternative tissue) samples for Station 31, located within the Inner Los Angeles Harbor. Specifically, tissue should be archived until the Ports determine whether white croaker and California halibut are being tracked in that part of the harbor as part of the second phase of the California State University Long Beach fish tracking study (Lowe et al. 2014).

2.6.2.2 Alternate Benthic Organism Compositing

If sufficient polychaete tissue mass (less than 60 g) is not collected, the Ports should be consulted about how to best combine additional benthic organisms for chemical analysis. A compositing plan should be developed for the sample with the fewest polychaetes, and then all other stations, regardless of initial polychaete tissue mass collected, should follow this compositing plan such that the same types of benthic organisms comprise all composite samples. The following steps should be followed for developing the compositing plan:

[1] One field day per station, with 10 to 15 double van Veen grab samples per station, is anticipated to collect sufficient mass of polychaetes for chemical analysis. Therefore, field work is assumed to require a minimum of 11 field days to collect samples from the specified 11 concurrent surface sediment and polychaete tissue stations.

1. To increase mass for chemical analysis, other non-polychaete worms (group 1 from Section 2.6.2) should first be added to the polychaete composite and the composite sample should be re-weighed to see if the minimum mass requirement has been met.
2. If there is still insufficient worm tissue mass (less than 60 g) after combining polychaetes and non-polychaete worms, other depositing-feeder benthic organisms (group 2 from Section 2.6.2) should then be added to the worm composite and the composite sample should be re-weighed to see if the minimum mass requirement has been met.
3. If there is still insufficient tissue mass (less than 60 g) after combining all depositing-feeder benthic organisms, then all remaining benthic organisms less than 2 cm in length should be added to the benthic composite, and the composite sample should be re-weighed to see if the minimum mass requirement has been met.
4. If there is still insufficient tissue mass (less than 60 g) after combining all depositing-feeder benthic organisms and all remaining benthic organisms less than 2 cm in length, then further consultation with the Ports should occur to discuss the compositing scheme and analytical approach.

When sufficient mass from all composites is available for chemical analysis, the composite samples should be placed in large, pre-cleaned, wide-mouth glass jars and capped with Teflon®-lined lids for transport to the laboratory. All organisms not included in the composite samples should be archived.

2.7 Waste Disposal

Any incidental sediment remaining after sampling will be washed overboard at the collection site, prior to moving to the next sampling location. All disposable sampling materials and personal protective equipment used in sample processing (such as disposable coveralls, gloves, and paper towels) will be placed in heavyweight garbage bags or other appropriate containers. Disposable supplies will be removed from the site by sampling personnel and placed in a normal refuse container for disposal as solid waste.

3 LABORATORY ANALYTICAL METHODS

Sediment will be analyzed for bulk density, specific gravity, total solids, grain size, total organic carbon, porewater dissolved organic carbon, DDTs, and PCBs by high-resolution gas chromatography/high-resolution mass spectrometry (HRGC/HRMS). A subset of sediments will also be analyzed for stable isotopes of carbon and nitrogen and PCBs using a low-resolution analytical method as specified in Table 1. Polychaete or alternate tissue samples will be analyzed for HRGC/HRMS PCBs, lipids, low-resolution DDTs, stable isotopes of carbon and nitrogen, and total solids. If sufficient sample mass is not collected even after initiating the backup compositing plan (i.e., less than 60 g wet weight), the priority for analyses will be PCBs, lipids, DDTs, stable isotopes, and total solids. However, the Ports should be consulted prior to analysis if there is limited mass. Sediment and tissue analytical methods and target analytes are listed in Tables 3 and 4, respectively. Physical and chemical analyses will be conducted at accredited facilities. Samples for stable isotope analysis may require additional preparation prior to submission for analysis. All samples will be maintained according to the appropriate holding times and temperatures for each analysis as listed in Table 2. Each laboratory will prepare detailed reports in accordance with Section 4.4 of the PQAPP (Appendix A). See Section 4 of the PQAPP for more information regarding analytical methods.

4 QUALITY ASSURANCE AND QUALITY CONTROL

Field and laboratory QA/QC requirements are described in detail in Sections 3 and 4 of the PQAPP (Appendix A). Laboratory QA/QC definitions and frequencies are summarized in Tables 5 and 6, respectively. Data quality objectives were derived from SWAMP guidance (SWRCB 2008) and are summarized in Table 7.

5 DATA ANALYSIS AND REPORTING

At a minimum, the final Sampling and Analysis Report (SAR) will detail sample collection and analytical methods used to generate project data, any deviations from the SAP, a summary of the data validation evaluation, and a summary of sediment and polychaete or alternate tissue chemistry results. Results from the study will be presented in a manner to facilitate peer and agency review and acceptance.

To facilitate data validation and management for the Ports' TMDL program, field and analytical EDDs should be provided to the Ports as specified in Sections 3.3.2.3 and 4.5 of the PQAPP (Appendix A). Briefly, field data collection, including observations, field measurements, and sample generation, should be compiled into a field EDD generated from the custom field application or field collection logs and provided to the Ports in an electronic format. A template for the field EDD will be provided to the contractor upon request. Final, validated analytical EDDs will be provided to the Ports in a pre-specified custom EQuIS EDD format. The Ports' contractor may request analytical laboratory EDDs in any format as long as final data sent to the Ports' data manager is provided in the custom EQuIS EDD format described in the PQAPP. At the time of submittal of the final, validated analytical and field EDDs, the laboratory reports (in PDF format) associated with analytical data should also be provided to the Ports' data manager.

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TABLES

Table 1
Proposed Sampling Coordinates and Investigation Components

Waterbody or Area	Station ID	Sample ID	Proposed Coordinates[1,2]		Sample Matrix	Sampling Interval	Testing	
			Latitude	Longitude			Chemistry/Physical[3,4]	Additional Chemistry
Surface Sediment Characterization and Polychaete Tissue Collection Program								
Angel's Gate (outside breakwater)	19	AG-SS-19-0-5-YYYYMMDD	-118.24398	33.70959	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	22	AG-SS-22-0-5-YYYYMMDD	-118.25944	33.70461	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
Cabrillo Beach	24	CB-SS-24-0-5-YYYYMMDD	-118.28161	33.71157	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		CB-WO-PW-24-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Consolidated Slip	27	CS-SS-27-0-5-YYYYMMDD	-118.24752	33.77379	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		CS-WO-PW-27-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
	28	CS-SS-28-0-5-YYYYMMDD	-118.24451	33.77551	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		CS-WO-PW-28-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Fish Harbor	04	FH-SS-04-0-5-YYYYMMDD	-118.26455	33.73342	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	05	FH-SS-05-0-5-YYYYMMDD	-118.26808	33.73400	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	06	FH-SS-06-0-5-YYYYMMDD	-118.26723	33.73640	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	25	FH-SS-25-0-5-YYYYMMDD	-118.26640	33.73805	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		FH-WO-PW-25-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Los Angeles Inner Harbor	02	IA-SS-02-0-5-YYYYMMDD	-118.26993	33.72176	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	03	IA-SS-03-0-5-YYYYMMDD	-118.27087	33.72760	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	07	IA-SS-07-0-5-YYYYMMDD	-118.27184	33.74762	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	08	IA-SS-08-0-5-YYYYMMDD	-118.27476	33.75994	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	09	IA-SS-09-0-5-YYYYMMDD	-118.25395	33.76176	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	26	IA-SS-26-0-5-YYYYMMDD	-118.25211	33.76779	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		IA-WO-PW-26-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
	31	IA-SS-31-0-5-YYYYMMDD	-118.24952	33.74186	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		IA-WO-PW-31-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Long Beach Inner Harbor	10	IB-SS-10-0-5-YYYYMMDD	-118.23929	33.76527	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	

Table 1
Proposed Sampling Coordinates and Investigation Components

Waterbody or Area	Station ID	Sample ID	Proposed Coordinates[1,2]		Sample Matrix	Sampling Interval	Testing	
			Latitude	Longitude			Chemistry/Physical[3,4]	Additional Chemistry
Long Beach Inner Harbor	11	IB-SS-11-0-5-YYYYMMDD	-118.22898	33.76912	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	12	IB-SS-12-0-5-YYYYMMDD	-118.21897	33.77265	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	29	IB-SS-29-0-5-YYYYMMDD	-118.21434	33.77035	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		IB-WO-PW-29-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
	30	IB-SS-30-0-5-YYYYMMDD	-118.23557	33.74820	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		IB-WO-PW-30-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Los Angeles Outer Harbor (inside breakwater)	01	OA-SS-01-0-5-YYYYMMDD	-118.26652	33.70540	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	17	OA-SS-17-0-5-YYYYMMDD	-118.23895	33.72314	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	18	OA-SS-18-0-5-YYYYMMDD	-118.24230	33.72025	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	20	OA-SS-20-0-5-YYYYMMDD	-118.24847	33.71298	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	21	OA-SS-21-0-5-YYYYMMDD	-118.25529	33.71015	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	23	OA-SS-23-0-5-YYYYMMDD	-118.27336	33.70928	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		OA-WO-PW-23-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Long Beach Outer Harbor	16	OB-SS-16-0-5-YYYYMMDD	-118.20418	33.73460	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	
	32	OB-SS-32-0-5-YYYYMMDD	-118.22275	33.74051	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		OB-WO-PW-32-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
	33	OB-SS-33-0-5-YYYYMMDD	-118.23523	33.73115	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope, PCB congeners (low resolution)
		OB-WO-PW-33-YYYYMMDD			Polychaete worm	0 to 10 cm	PCBs, lipids, DDX, total solids	Stable isotope
Eastern San Pedro Bay	13	SP-SS-13-0-5-YYYYMMDD	-118.17916	33.74651	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope
	14	SP-SS-14-0-5-YYYYMMDD	-118.16654	33.73472	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope
	15	SP-SS-15-0-5-YYYYMMDD	-118.17815	33.72638	Surface sediment grab	0 to 5 cm	TOC, TS, DOC, DDX, PCBs, GS, bulk density, specific gravity	Stable isotope

Notes:
1 Coordinates are listed as target locations; actual locations may vary depending on conditions and substrate.
2 Coordinates are shown in decimal degrees, World Geodetic System 1984 (WGS84)
3 Chemical and Physical testing: TOC = total organic carbon, TS = total solids, DOC = dissolved organic carbon, PCB = polychlorinated biphenyl, DDX = dichlorodiphenyltrichloroethane derivatives, GS = grain size.
4 All PCB analysis is high resolution, unless otherwise noted. All DDX analysis is low resolution.

Table 2
Sample Containers, Holding Times, and Preservation Methods

Parameter	Sample Size		Container Size and Type	Holding Time	Preservative
	Ideal	Minimum			
Sediments					
Bulk density	50 g		2 inch x 6 inch tube	None established	Cool ≤6°C
Specific gravity	100 g		16-oz glass	None established	Ambient
Total solids	10 g		8-oz glass	14 days	Cool ≤6°C
				1 year	Freeze -20°C
Grain size	300 g	100 g	16-oz plastic	6 months	Cool ≤6°C
DOC in porewater	1- to 2-L sediment[1]		2 X 1-L amber glass	48 hours for extraction, filtration and preservation; 28 days to analysis	HCl or H2SO4 to pH<2 after filtration; Cool ≤6°C and dark
TOC	10 g	5 g	4-oz glass	28 days	Cool ≤6°C
				1 year, if frozen within 28 days of collection	Freeze -20°C
DDX	500 g	20 g	8-oz glass	14 days to extraction	Cool ≤6°C
				1 year to extraction; samples must be extracted within 14 days of thawing	Freeze -20°C
				40 days after extraction	Cool ≤6°C
PCB Congeners	500 g	50 g	8-oz glass	None[1]	Cool ≤6°C
					Freeze -20°C
Stable isotopes	2 g	2 g	Contact laboratory for container type	None established	Cool ≤6°C
Tissues					
Lipids	200 g	10 g	Foil or 8-oz glass	1 year	Freeze -20°C
Total solids	50 g	10 g		1 year	Freeze -20°C
DDX	200 g	10 g		14 days to extraction	Cool ≤6°C
				1 year to extraction; samples must be extracted within 14 days of thawing	Freeze -20°C
				40 days after extraction	Cool ≤6°C
PCB congeners	200 g	10 g		None[2]	Cool ≤6°C
					Freeze -20°C
Stable isotopes	2 g	2 g	Contact laboratory for container type	None established	Cool ≤6°C

Table 2
Sample Containers, Holding Times, and Preservation Methods

Notes:

Some criteria may differ from SWAMP guidance; however, criteria are consistent with analytical methods.

Recommendations are intended as guidance only. The selection of sample container and amount of sample required may vary per contracted laboratory sampling requirements.

^{o}C = degrees Celsius

DDX = dichlorodiphenyltrichloroethane derivatives listed in Table 3 and 4

DOC = dissolved organic carbon

g = gram

L = liter

oz = ounce

PCB = polychlorinated biphenyl

SWAMP = California Surface Water Ambient Monitoring Program

TOC = total organic carbon

USEPA = U.S. Environmental Protection Agency

1 Volume of sediment collected must be sufficient to produce a minimum of 150 milliliters of porewater.

2 PCB hold time was removed in SW-846, Chapter 4, Revision 4, February 2007 for aqueous and solid samples stored

Table 3
Sediment Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
Conventional Parameters		
Bulk density	ASTM D7263	--
Specific gravity	ASTM D854	--
Total solids (% wet weight)	SM 2540G / USEPA 160.3	0.1
Grain size (% retained)	ASTM D442 / SM 2560	1.0
Total organic carbon (%)	SM 5310B / USEPA 9060A	0.01% OC
Sediment porewater dissolved organic carbon	USEPA 9060M	0.5
Stable Isotopes		
$^{13}C/^{12}C$ and $^{15}N/^{14}N$	EA-IRMS	N/A
Organochlorine Pesticides (ng/g or µg/kg) - Low Resolution Analytical Methods		
2,4'-DDD	USEPA 8081A / 8270C	1.0
2,4'-DDE	USEPA 8081A / 8270C	1.0
2,4'-DDT	USEPA 8081A / 8270C	1.0
4,4'-DDD	USEPA 8081A / 8270C	1.0
4,4'-DDE	USEPA 8081A / 8270C	1.0
4,4'-DDT	USEPA 8081A / 8270C	1.0
4,4'-DDMU	USEPA 8081A / 8270C	1.0
PCB Congeners (ng/g or µg/kg)[5] - Low Resolution Analytical Methods		
CL1-PCB-3	USEPA 8270C / 8270D-SIM	0.2
CL2-PCB-5	USEPA 8270C / 8270D-SIM	0.2
CL2-PCB-8	USEPA 8270C / 8270D-SIM	0.2
CL2-PCB-15	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-18	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-27	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-28	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-29	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-31	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-33	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-37	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-44	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-49	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-52	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-56	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-60	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-66	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-70	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-74	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-77	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-81	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-87	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-95	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-97	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-99	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-101	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-105	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-110	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-114	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-118	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-119	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-123	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-126	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-128	USEPA 8270C / 8270D-SIM	0.2

Table 3
Sediment Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL6-PCB-137	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-138	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-141	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-149	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-151	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-153	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-156	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-157	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-158	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-167	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-168	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-169	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-170	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-174	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-177	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-180	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-183	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-187	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-189	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-194	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-195	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-200	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-201	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-203	USEPA 8270C / 8270D-SIM	0.2
CL9-PCB-206	USEPA 8270C / 8270D-SIM	0.2
CL10-PCB-209	USEPA 8270C / 8270D-SIM	0.2
PCB Congeners (ng/g or µg/kg)[5]- High Resolution Analytical Methods		
CL1-PCB-1	USEPA 1668	0.0025
CL1-PCB-2	USEPA 1668	0.0025
CL1-PCB-3	USEPA 1668	0.0025
CL2-PCB-4	USEPA 1668	0.0025
CL2-PCB-5	USEPA 1668	0.0025
CL2-PCB-6	USEPA 1668	0.0025
CL2-PCB-7	USEPA 1668	0.0025
CL2-PCB-8	USEPA 1668	0.0025
CL2-PCB-9	USEPA 1668	0.0025
CL2-PCB-10	USEPA 1668	0.0025
CL2-PCB-11	USEPA 1668	0.0025
CL2-PCB-12	USEPA 1668	0.0025
CL2-PCB-13	USEPA 1668	0.0025
CL2-PCB-14	USEPA 1668	0.0025
CL2-PCB-15	USEPA 1668	0.0025
CL3-PCB-16	USEPA 1668	0.0025
CL3-PCB-17	USEPA 1668	0.0025
CL3-PCB-18	USEPA 1668	0.0025
CL3-PCB-19	USEPA 1668	0.0025
CL3-PCB-20	USEPA 1668	0.0025
CL3-PCB-21	USEPA 1668	0.0025
CL3-PCB-22	USEPA 1668	0.0025
CL3-PCB-23	USEPA 1668	0.0025
CL3-PCB-24	USEPA 1668	0.0025
CL3-PCB-25	USEPA 1668	0.0025

Table 3
Sediment Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL3-PCB-26	USEPA 1668	0.0025
CL3-PCB-27	USEPA 1668	0.0025
CL3-PCB-28	USEPA 1668	0.0025
CL3-PCB-29	USEPA 1668	0.0025
CL3-PCB-30	USEPA 1668	0.0025
CL3-PCB-31	USEPA 1668	0.0025
CL3-PCB-32	USEPA 1668	0.0025
CL3-PCB-33	USEPA 1668	0.0025
CL3-PCB-34	USEPA 1668	0.0025
CL3-PCB-35	USEPA 1668	0.0025
CL3-PCB-36	USEPA 1668	0.0025
CL3-PCB-37	USEPA 1668	0.0025
CL3-PCB-38	USEPA 1668	0.0025
CL3-PCB-39	USEPA 1668	0.0025
CL4-PCB-40	USEPA 1668	0.0025
CL4-PCB-41	USEPA 1668	0.0025
CL4-PCB-42	USEPA 1668	0.0025
CL4-PCB-43	USEPA 1668	0.0025
CL4-PCB-44	USEPA 1668	0.0025
CL4-PCB-45	USEPA 1668	0.0025
CL4-PCB-46	USEPA 1668	0.0025
CL4-PCB-47	USEPA 1668	0.0025
CL4-PCB-48	USEPA 1668	0.0025
CL4-PCB-49	USEPA 1668	0.0025
CL4-PCB-50	USEPA 1668	0.0025
CL4-PCB-51	USEPA 1668	0.0025
CL4-PCB-52	USEPA 1668	0.0025
CL4-PCB-53	USEPA 1668	0.0025
CL4-PCB-54	USEPA 1668	0.0025
CL4-PCB-55	USEPA 1668	0.0025
CL4-PCB-56	USEPA 1668	0.0025
CL4-PCB-57	USEPA 1668	0.0025
CL4-PCB-58	USEPA 1668	0.0025
CL4-PCB-59	USEPA 1668	0.0025
CL4-PCB-60	USEPA 1668	0.0025
CL4-PCB-61	USEPA 1668	0.0025
CL4-PCB-62	USEPA 1668	0.0025
CL4-PCB-63	USEPA 1668	0.0025
CL4-PCB-64	USEPA 1668	0.0025
CL4-PCB-65	USEPA 1668	0.0025
CL4-PCB-66	USEPA 1668	0.0025
CL4-PCB-67	USEPA 1668	0.0025
CL4-PCB-68	USEPA 1668	0.0025
CL4-PCB-69	USEPA 1668	0.0025
CL4-PCB-70	USEPA 1668	0.0025
CL4-PCB-71	USEPA 1668	0.0025
CL4-PCB-72	USEPA 1668	0.0025
CL4-PCB-73	USEPA 1668	0.0025
CL4-PCB-74	USEPA 1668	0.0025
CL4-PCB-75	USEPA 1668	0.0025
CL4-PCB-76	USEPA 1668	0.0025
CL4-PCB-77	USEPA 1668	0.0025
CL4-PCB-78	USEPA 1668	0.0025

Table 3
Sediment Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL4-PCB-79	USEPA 1668	0.0025
CL4-PCB-80	USEPA 1668	0.0025
CL4-PCB-81	USEPA 1668	0.0025
CL5-PCB-82	USEPA 1668	0.0025
CL5-PCB-83	USEPA 1668	0.0025
CL5-PCB-84	USEPA 1668	0.0025
CL5-PCB-85	USEPA 1668	0.0025
CL5-PCB-86	USEPA 1668	0.0025
CL5-PCB-87	USEPA 1668	0.0025
CL5-PCB-88	USEPA 1668	0.0025
CL5-PCB-89	USEPA 1668	0.0025
CL5-PCB-90	USEPA 1668	0.0025
CL5-PCB-91	USEPA 1668	0.0025
CL5-PCB-92	USEPA 1668	0.0025
CL5-PCB-93	USEPA 1668	0.0025
CL5-PCB-94	USEPA 1668	0.0025
CL5-PCB-95	USEPA 1668	0.0025
CL5-PCB-96	USEPA 1668	0.0025
CL5-PCB-97	USEPA 1668	0.0025
CL5-PCB-98	USEPA 1668	0.0025
CL5-PCB-99	USEPA 1668	0.0025
CL5-PCB-100	USEPA 1668	0.0025
CL5-PCB-101	USEPA 1668	0.0025
CL5-PCB-102	USEPA 1668	0.0025
CL5-PCB-103	USEPA 1668	0.0025
CL5-PCB-104	USEPA 1668	0.0025
CL5-PCB-105	USEPA 1668	0.0025
CL5-PCB-106	USEPA 1668	0.0025
CL5-PCB-107	USEPA 1668	0.0025
CL5-PCB-108	USEPA 1668	0.0025
CL5-PCB-109	USEPA 1668	0.0025
CL5-PCB-110	USEPA 1668	0.0025
CL5-PCB-111	USEPA 1668	0.0025
CL5-PCB-112	USEPA 1668	0.0025
CL5-PCB-113	USEPA 1668	0.0025
CL5-PCB-114	USEPA 1668	0.0025
CL5-PCB-115	USEPA 1668	0.0025
CL5-PCB-116	USEPA 1668	0.0025
CL5-PCB-117	USEPA 1668	0.0025
CL5-PCB-118	USEPA 1668	0.0025
CL5-PCB-119	USEPA 1668	0.0025
CL5-PCB-120	USEPA 1668	0.0025
CL5-PCB-121	USEPA 1668	0.0025
CL5-PCB-122	USEPA 1668	0.0025
CL5-PCB-123	USEPA 1668	0.0025
CL5-PCB-124	USEPA 1668	0.0025
CL5-PCB-125	USEPA 1668	0.0025
CL5-PCB-126	USEPA 1668	0.0025
CL5-PCB-127	USEPA 1668	0.0025
CL6-PCB-128	USEPA 1668	0.0025
CL6-PCB-129	USEPA 1668	0.0025
CL6-PCB-130	USEPA 1668	0.0025
CL6-PCB-131	USEPA 1668	0.0025

Table 3
Sediment Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL6-PCB-132	USEPA 1668	0.0025
CL6-PCB-133	USEPA 1668	0.0025
CL6-PCB-134	USEPA 1668	0.0025
CL6-PCB-135	USEPA 1668	0.0025
CL6-PCB-136	USEPA 1668	0.0025
CL6-PCB-137	USEPA 1668	0.0025
CL6-PCB-138	USEPA 1668	0.0025
CL6-PCB-139	USEPA 1668	0.0025
CL6-PCB-140	USEPA 1668	0.0025
CL6-PCB-141	USEPA 1668	0.0025
CL6-PCB-142	USEPA 1668	0.0025
CL6-PCB-143	USEPA 1668	0.0025
CL6-PCB-144	USEPA 1668	0.0025
CL6-PCB-145	USEPA 1668	0.0025
CL6-PCB-146	USEPA 1668	0.0025
CL6-PCB-147	USEPA 1668	0.0025
CL6-PCB-148	USEPA 1668	0.0025
CL6-PCB-149	USEPA 1668	0.0025
CL6-PCB-150	USEPA 1668	0.0025
CL6-PCB-151	USEPA 1668	0.0025
CL6-PCB-152	USEPA 1668	0.0025
CL6-PCB-153	USEPA 1668	0.0025
CL6-PCB-154	USEPA 1668	0.0025
CL6-PCB-155	USEPA 1668	0.0025
CL6-PCB-156	USEPA 1668	0.0025
CL6-PCB-157	USEPA 1668	0.0025
CL6-PCB-158	USEPA 1668	0.0025
CL6-PCB-159	USEPA 1668	0.0025
CL6-PCB-160	USEPA 1668	0.0025
CL6-PCB-161	USEPA 1668	0.0025
CL6-PCB-162	USEPA 1668	0.0025
CL6-PCB-163	USEPA 1668	0.0025
CL6-PCB-164	USEPA 1668	0.0025
CL6-PCB-165	USEPA 1668	0.0025
CL6-PCB-166	USEPA 1668	0.0025
CL6-PCB-167	USEPA 1668	0.0025
CL6-PCB-168	USEPA 1668	0.0025
CL6-PCB-169	USEPA 1668	0.0025
CL7-PCB-170	USEPA 1668	0.0025
CL7-PCB-171	USEPA 1668	0.0025
CL7-PCB-172	USEPA 1668	0.0025
CL7-PCB-173	USEPA 1668	0.0025
CL7-PCB-174	USEPA 1668	0.0025
CL7-PCB-175	USEPA 1668	0.0025
CL7-PCB-176	USEPA 1668	0.0025
CL7-PCB-177	USEPA 1668	0.0025
CL7-PCB-178	USEPA 1668	0.0025
CL7-PCB-179	USEPA 1668	0.0025
CL7-PCB-180	USEPA 1668	0.0025
CL7-PCB-181	USEPA 1668	0.0025
CL7-PCB-182	USEPA 1668	0.0025
CL7-PCB-183	USEPA 1668	0.0025
CL7-PCB-184	USEPA 1668	0.0025

Table 3
Sediment Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL7-PCB-185	USEPA 1668	0.0025
CL7-PCB-186	USEPA 1668	0.0025
CL7-PCB-187	USEPA 1668	0.0025
CL7-PCB-188	USEPA 1668	0.0025
CL7-PCB-189	USEPA 1668	0.0025
CL7-PCB-190	USEPA 1668	0.0025
CL7-PCB-191	USEPA 1668	0.0025
CL7-PCB-192	USEPA 1668	0.0025
CL7-PCB-193	USEPA 1668	0.0025
CL8-PCB-194	USEPA 1668	0.0025
CL8-PCB-195	USEPA 1668	0.0025
CL8-PCB-196	USEPA 1668	0.0025
CL8-PCB-197	USEPA 1668	0.0025
CL8-PCB-198	USEPA 1668	0.0025
CL8-PCB-199	USEPA 1668	0.0025
CL8-PCB-200	USEPA 1668	0.0025
CL8-PCB-201	USEPA 1668	0.0025
CL8-PCB-202	USEPA 1668	0.0025
CL8-PCB-203	USEPA 1668	0.0025
CL8-PCB-204	USEPA 1668	0.0025
CL8-PCB-205	USEPA 1668	0.0025
CL9-PCB-206	USEPA 1668	0.0025
CL9-PCB-207	USEPA 1668	0.0025
CL9-PCB-208	USEPA 1668	0.0025
CL10-PCB-209	USEPA 1668	0.0025

Notes:
µg/g = microgram per gram
CL = chlorine homolog group
EA-IRMS = Elemental Analysis - Isotope Ratio Mass Spectrometry
EDL = estimated detection limit
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
ng/g = nanograms per gram
OC = organic carbon
PCB = polychlorinated biphenyl
RL = reporting limit
USEPA = U.S. Environmental Protection Agency
wt = weight

1 Units in dry weight unless otherwise noted.

2 Laboratories may use different versions of recommended methods (i.e., USEPA 8270C) as long as the QA/QC elements identified in the QAPP are met.

3 Laboratory reporting limits are revised periodically and may change over the duration of this project. Reporting limits should be verified by each laboratory when writing Sampling and Analysis Plans.

4 Matrix interference, total solid concentrations, and/or dilutions due to non-target analytes may increase actual reporting limits. The method detection limit (MDL) should be at least three times lower than the reporting limit (40 Code of Federal Regulations Part 136) but will vary per instrument by MDL study.

5 PCB co-elutions will vary by instrument and column and may increase reporting limits for some congeners.

Table 4
Tissue Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
Conventionals (%)		
Lipids	NOAA 1993a / Gravimetric	0.5
Total solids (% wet weight)	SM 2540G / USEPA 160.3	0.1
Organochlorine Pesticides (ng/g or µg/kg wet weight) - Low Resolution Analytical Methods		
2,4'-DDD	USEPA 8081A / 8270C / 8270D TQ	4.0
2,4'-DDE	USEPA 8081A / 8270C / 8270D TQ	4.0
2,4'-DDT	USEPA 8081A / 8270C / 8270D TQ	6.0
4,4'-DDD	USEPA 8081A / 8270C / 8270D TQ	4.0
4,4'-DDE	USEPA 8081A / 8270C / 8270D TQ	4.0
4,4'-DDT	USEPA 8081A / 8270C / 8270D TQ	10.0
4,4'-DDMU	USEPA 8081A / 8270C / 8270D TQ	10.0
Stable Isotopes		
$^{13}C/^{12}C$ and $^{15}N/^{14}N$	EA-IRMS	N/A
PCB Congeners (ng/g or µg/kg)[5]- High Resolution Analytical Methods		
CL1-PCB-1	USEPA 1668	0.001
CL1-PCB-2	USEPA 1668	0.001
CL1-PCB-3	USEPA 1668	0.001
CL2-PCB-4	USEPA 1668	0.001
CL2-PCB-5	USEPA 1668	0.001
CL2-PCB-6	USEPA 1668	0.001
CL2-PCB-7	USEPA 1668	0.001
CL2-PCB-8	USEPA 1668	0.001
CL2-PCB-9	USEPA 1668	0.001
CL2-PCB-10	USEPA 1668	0.001
CL2-PCB-11	USEPA 1668	0.001
CL2-PCB-12	USEPA 1668	0.001
CL2-PCB-13	USEPA 1668	0.001
CL2-PCB-14	USEPA 1668	0.001
CL2-PCB-15	USEPA 1668	0.001
CL3-PCB-16	USEPA 1668	0.001
CL3-PCB-17	USEPA 1668	0.001
CL3-PCB-18	USEPA 1668	0.001
CL3-PCB-19	USEPA 1668	0.001
CL3-PCB-20	USEPA 1668	0.001
CL3-PCB-21	USEPA 1668	0.001
CL3-PCB-22	USEPA 1668	0.001
CL3-PCB-23	USEPA 1668	0.001
CL3-PCB-24	USEPA 1668	0.001
CL3-PCB-25	USEPA 1668	0.001
CL3-PCB-26	USEPA 1668	0.001
CL3-PCB-27	USEPA 1668	0.001
CL3-PCB-28	USEPA 1668	0.001
CL3-PCB-29	USEPA 1668	0.001
CL3-PCB-30	USEPA 1668	0.001
CL3-PCB-31	USEPA 1668	0.001
CL3-PCB-32	USEPA 1668	0.001
CL3-PCB-33	USEPA 1668	0.001
CL3-PCB-34	USEPA 1668	0.001
CL3-PCB-35	USEPA 1668	0.001

Table 4
Tissue Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL3-PCB-36	USEPA 1668	0.001
CL3-PCB-37	USEPA 1668	0.001
CL3-PCB-38	USEPA 1668	0.001
CL3-PCB-39	USEPA 1668	0.001
CL4-PCB-40	USEPA 1668	0.001
CL4-PCB-41	USEPA 1668	0.001
CL4-PCB-42	USEPA 1668	0.001
CL4-PCB-43	USEPA 1668	0.001
CL4-PCB-44	USEPA 1668	0.001
CL4-PCB-45	USEPA 1668	0.001
CL4-PCB-46	USEPA 1668	0.001
CL4-PCB-47	USEPA 1668	0.001
CL4-PCB-48	USEPA 1668	0.001
CL4-PCB-49	USEPA 1668	0.001
CL4-PCB-50	USEPA 1668	0.001
CL4-PCB-51	USEPA 1668	0.001
CL4-PCB-52	USEPA 1668	0.001
CL4-PCB-53	USEPA 1668	0.001
CL4-PCB-54	USEPA 1668	0.001
CL4-PCB-55	USEPA 1668	0.001
CL4-PCB-56	USEPA 1668	0.001
CL4-PCB-57	USEPA 1668	0.001
CL4-PCB-58	USEPA 1668	0.001
CL4-PCB-59	USEPA 1668	0.001
CL4-PCB-60	USEPA 1668	0.001
CL4-PCB-61	USEPA 1668	0.001
CL4-PCB-62	USEPA 1668	0.001
CL4-PCB-63	USEPA 1668	0.001
CL4-PCB-64	USEPA 1668	0.001
CL4-PCB-65	USEPA 1668	0.001
CL4-PCB-66	USEPA 1668	0.001
CL4-PCB-67	USEPA 1668	0.001
CL4-PCB-68	USEPA 1668	0.001
CL4-PCB-69	USEPA 1668	0.001
CL4-PCB-70	USEPA 1668	0.001
CL4-PCB-71	USEPA 1668	0.001
CL4-PCB-72	USEPA 1668	0.001
CL4-PCB-73	USEPA 1668	0.001
CL4-PCB-74	USEPA 1668	0.001
CL4-PCB-75	USEPA 1668	0.001
CL4-PCB-76	USEPA 1668	0.001
CL4-PCB-77	USEPA 1668	0.001
CL4-PCB-78	USEPA 1668	0.001
CL4-PCB-79	USEPA 1668	0.001
CL4-PCB-80	USEPA 1668	0.001
CL4-PCB-81	USEPA 1668	0.001
CL5-PCB-82	USEPA 1668	0.001
CL5-PCB-83	USEPA 1668	0.001
CL5-PCB-84	USEPA 1668	0.001

Table 4
Tissue Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL5-PCB-85	USEPA 1668	0.001
CL5-PCB-86	USEPA 1668	0.001
CL5-PCB-87	USEPA 1668	0.001
CL5-PCB-88	USEPA 1668	0.001
CL5-PCB-89	USEPA 1668	0.001
CL5-PCB-90	USEPA 1668	0.001
CL5-PCB-91	USEPA 1668	0.001
CL5-PCB-92	USEPA 1668	0.001
CL5-PCB-93	USEPA 1668	0.001
CL5-PCB-94	USEPA 1668	0.001
CL5-PCB-95	USEPA 1668	0.001
CL5-PCB-96	USEPA 1668	0.001
CL5-PCB-97	USEPA 1668	0.001
CL5-PCB-98	USEPA 1668	0.001
CL5-PCB-99	USEPA 1668	0.001
CL5-PCB-100	USEPA 1668	0.001
CL5-PCB-101	USEPA 1668	0.001
CL5-PCB-102	USEPA 1668	0.001
CL5-PCB-103	USEPA 1668	0.001
CL5-PCB-104	USEPA 1668	0.001
CL5-PCB-105	USEPA 1668	0.001
CL5-PCB-106	USEPA 1668	0.001
CL5-PCB-107	USEPA 1668	0.001
CL5-PCB-108	USEPA 1668	0.001
CL5-PCB-109	USEPA 1668	0.001
CL5-PCB-110	USEPA 1668	0.001
CL5-PCB-111	USEPA 1668	0.001
CL5-PCB-112	USEPA 1668	0.001
CL5-PCB-113	USEPA 1668	0.001
CL5-PCB-114	USEPA 1668	0.001
CL5-PCB-115	USEPA 1668	0.001
CL5-PCB-116	USEPA 1668	0.001
CL5-PCB-117	USEPA 1668	0.001
CL5-PCB-118	USEPA 1668	0.001
CL5-PCB-119	USEPA 1668	0.001
CL5-PCB-120	USEPA 1668	0.001
CL5-PCB-121	USEPA 1668	0.001
CL5-PCB-122	USEPA 1668	0.001
CL5-PCB-123	USEPA 1668	0.001
CL5-PCB-124	USEPA 1668	0.001
CL5-PCB-125	USEPA 1668	0.001
CL5-PCB-126	USEPA 1668	0.001
CL5-PCB-127	USEPA 1668	0.001
CL6-PCB-128	USEPA 1668	0.001
CL6-PCB-129	USEPA 1668	0.001
CL6-PCB-130	USEPA 1668	0.001
CL6-PCB-131	USEPA 1668	0.001
CL6-PCB-132	USEPA 1668	0.001
CL6-PCB-133	USEPA 1668	0.001

Table 4
Tissue Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL6-PCB-134	USEPA 1668	0.001
CL6-PCB-135	USEPA 1668	0.001
CL6-PCB-136	USEPA 1668	0.001
CL6-PCB-137	USEPA 1668	0.001
CL6-PCB-138	USEPA 1668	0.001
CL6-PCB-139	USEPA 1668	0.001
CL6-PCB-140	USEPA 1668	0.001
CL6-PCB-141	USEPA 1668	0.001
CL6-PCB-142	USEPA 1668	0.001
CL6-PCB-143	USEPA 1668	0.001
CL6-PCB-144	USEPA 1668	0.001
CL6-PCB-145	USEPA 1668	0.001
CL6-PCB-146	USEPA 1668	0.001
CL6-PCB-147	USEPA 1668	0.001
CL6-PCB-148	USEPA 1668	0.001
CL6-PCB-149	USEPA 1668	0.001
CL6-PCB-150	USEPA 1668	0.001
CL6-PCB-151	USEPA 1668	0.001
CL6-PCB-152	USEPA 1668	0.001
CL6-PCB-153	USEPA 1668	0.001
CL6-PCB-154	USEPA 1668	0.001
CL6-PCB-155	USEPA 1668	0.001
CL6-PCB-156	USEPA 1668	0.001
CL6-PCB-157	USEPA 1668	0.001
CL6-PCB-158	USEPA 1668	0.001
CL6-PCB-159	USEPA 1668	0.001
CL6-PCB-160	USEPA 1668	0.001
CL6-PCB-161	USEPA 1668	0.001
CL6-PCB-162	USEPA 1668	0.001
CL6-PCB-163	USEPA 1668	0.001
CL6-PCB-164	USEPA 1668	0.001
CL6-PCB-165	USEPA 1668	0.001
CL6-PCB-166	USEPA 1668	0.001
CL6-PCB-167	USEPA 1668	0.001
CL6-PCB-168	USEPA 1668	0.001
CL6-PCB-169	USEPA 1668	0.001
CL7-PCB-170	USEPA 1668	0.001
CL7-PCB-171	USEPA 1668	0.001
CL7-PCB-172	USEPA 1668	0.001
CL7-PCB-173	USEPA 1668	0.001
CL7-PCB-174	USEPA 1668	0.001
CL7-PCB-175	USEPA 1668	0.001
CL7-PCB-176	USEPA 1668	0.001
CL7-PCB-177	USEPA 1668	0.001
CL7-PCB-178	USEPA 1668	0.001
CL7-PCB-179	USEPA 1668	0.001
CL7-PCB-180	USEPA 1668	0.001
CL7-PCB-181	USEPA 1668	0.001
CL7-PCB-182	USEPA 1668	0.001

Table 4
Tissue Analytical Methods and Target Reporting Limits

Parameter[1]	Analytical Method[2]	Target Reporting Limit[3,4]
CL7-PCB-183	USEPA 1668	0.001
CL7-PCB-184	USEPA 1668	0.001
CL7-PCB-185	USEPA 1668	0.001
CL7-PCB-186	USEPA 1668	0.001
CL7-PCB-187	USEPA 1668	0.001
CL7-PCB-188	USEPA 1668	0.001
CL7-PCB-189	USEPA 1668	0.001
CL7-PCB-190	USEPA 1668	0.001
CL7-PCB-191	USEPA 1668	0.001
CL7-PCB-192	USEPA 1668	0.001
CL7-PCB-193	USEPA 1668	0.001
CL8-PCB-194	USEPA 1668	0.001
CL8-PCB-195	USEPA 1668	0.001
CL8-PCB-196	USEPA 1668	0.001
CL8-PCB-197	USEPA 1668	0.001
CL8-PCB-198	USEPA 1668	0.001
CL8-PCB-199	USEPA 1668	0.001
CL8-PCB-200	USEPA 1668	0.001
CL8-PCB-201	USEPA 1668	0.001
CL8-PCB-202	USEPA 1668	0.001
CL8-PCB-203	USEPA 1668	0.001
CL8-PCB-204	USEPA 1668	0.001
CL8-PCB-205	USEPA 1668	0.001
CL9-PCB-206	USEPA 1668	0.001
CL9-PCB-207	USEPA 1668	0.001
CL9-PCB-208	USEPA 1668	0.001
CL10-PCB-209	USEPA 1668	0.001

Notes:

µg/g = micrograms per gram
CL = chlorine homolog group
EA-IRMS = Elemental Analysis - Isotope Ratio Mass Spectrometry
EDL = estimated detection limit
MDL = method detection limit
mg/kg = milligrams per kilogram
N/A = not applicable
ng/g = nanograms per gram
OC = organic carbon
PCB = polychlorinated biphenyl
RL = reporting limit
USEPA = U.S. Environmental Protection Agency
wt = weight

1 Units in dry weight unless otherwise noted.

2 Laboratories may use different versions of recommended methods (i.e., USEPA 8270C) as long as the QA/QC elements identified in the QAPP are met.

3 Laboratory reporting limits are revised periodically and may change over the duration of this project. Reporting limits should be verified by each laboratory when writing Sampling and Analysis Plans.

4 Matrix interference, total solid concentrations, and/or dilutions due to non-target analytes may increase actual reporting limits. The method detection limit (MDL) should be at least three times lower than the reporting limit (40 Code of Federal Regulations Part 136) but will vary per instrument by MDL study.

5 PCB co-elutions will vary by instrument and column and may increase reporting limits for some congeners.

Table 5
Laboratory Quality Assurance/Quality Control Definitions

Laboratory Quality Control	Definition
Calibration	A comparison of a measurement standard, instrument, or item with one having higher accuracy to detect, quantify, and record any inaccuracy or variation; the process by which an instrument setting is adjusted based on response to a standard to eliminate the inaccuracy.
Certified/Standard Reference Material	A substance whose property values are certified by a procedure that establishes its traceability and uncertainty at a stated level of confidence.
Continuing Calibration Verification	A periodic standard used to assess instrument drift between calibrations.
Internal Standard	Pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution. The internal standard must be an analyte that is not a sample component.
Laboratory Replicate	Two or more representative portions taken from one homogeneous sample by the analyst and analyzed in the same testing facility.
Laboratory Control Sample	A specimen of known composition prepared using contaminant-free reagent water, or an inert solid, which is spiked with the analyte of interest at the midpoint of the calibration curve or at the level of concern, and then analyzed using the same preparation, reagents, and analytical methods employed for regular specimens and at the intervals set in the Quality Assurance Project Plan.
Matrix Spike	A test specimen prepared by adding a known concentration of the target analyte to a specified amount of a specific homogenized specimen where an estimate of the target concentration is available and subjected to the entire analytical protocol.
Matrix Spike Duplicate	A sample prepared simultaneously as a split with the matrix spike sample with each specimen being spiked with identical, known concentrations of targeted analyte.
Method Blank	A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.
Sample Batch	Twenty or fewer field samples prepared and analyzed with a common set of quality assurance samples.
Surrogate	A pure substance with properties that mimics the analyte of interest (organics only) and which is unlikely to be found in environmental samples. It is added into a sample before sample preparation.

Table 6
Frequencies for Laboratory Quality Assurance/Quality Control Samples

Analysis Type	Initial Calibration[1,2]	Continuing Calibration Verification	LCS or SRM[3]	Replicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes	Internal Standard
Total solids	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Lipids	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Grain size	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Stable isotope	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Total and dissolved organic carbon	Daily or each batch	1 per 10 analytical runs	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	N/A	Each batch	N/A	N/A
PCB Congeners by low resolution method	As needed	Every 12 hours	1 per 20 samples or 1 per batch	N/A	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	Each batch	Every sample	Every sample
PCB Congeners by high resolution method	As needed	Every 12 hours	1 per 20 samples	N/A	N/A[4]	N/A[4]	1 per 20 samples	N/A[4]	Every sample
DDX by low resolution method	As needed	Per 10 analytical runs	1 per 20 samples or 1 per batch	N/A	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	Each batch	Every sample	Every sample

Notes:

Primary column is considered the column that contains the highest value with the least interference. Values should have RPDs less than 40 percent or they are P flagged.

ICALS = 20 percent or less and CCALS = 15 percent or less.

DDX = DDT derivatives

LCS = Laboratory control sample

N/A = not applicable

SRM = standard reference material

PCB = polychlorinated biphenyl

1 For physical tests, calibration and certification of drying ovens and weighing scales are conducted annually.

2 Calibrations should be conducted per analytical methods or instrument manufacturers specifications.

3 When a Standard Reference Material is not available, an LCS will be analyzed.

4 Isotope dilution quantitation technique accounts for matrix interferences thus MS/MSD are not required.

Table 7
Laboratory and Reporting Data Quality Objectives

Parameter	Precision[1]	Accuracy[2]	Completeness[3]
Sediments			
Total solids	± 25% RPD	N/A	90%
Grain size	± 25% RPD	N/A	90%
Total and dissolved organic carbon	± 25% RPD	80-120% R	90%
DDX[4]	± 25% RPD	50-150% R	90%
PCB Congeners[4]	± 25% RPD	50-150% R	90%
Tissues			
Lipids	± 25% RPD	N/A	90%
Total solids	± 25% RPD	N/A	90%
Stable isotope	± 25% RPD	N/A	90%
DDX[4]	± 25% RPD	50-150% R	90%
PCB Congeners[4]	± 25% RPD	50-150% R	90%

Notes:
CRM = certified reference material
DDX = DDT derivatives
PCB = polychlorinated biphenyl
R = recovery
RPD = relative percent difference
1 Not applicable if native concentration of either sample is less than five times the reporting limit. In these situations, the difference between the sample result and duplicate result must be within ± 2 times the reporting limit.
2 Laboratory control sample , CRMs, and matrix spike/matrix spike duplicate percent recovery.
3 Percent of each class of analytes that are not rejected after data validation conducted in accordance with the Technical Support Manual (Bay et al. 2009).
4 The accuracy goal is 70 to 130% R if certified reference material is used.

FIGURES

Q:\Jobs\120711-01.01_Port_of_Los_Angeles\POLA_POLB_Bioaccumulation_Modeling_Support\Maps\2014_06_Proposed_Sampling_Locs\ProposedSedPolychaeteLocs.mxd ckiblinger 6/10/2014 2:21:57 PM

DRAFT

ANCHOR QEA

Figure 1
Proposed Sediment and Polychaete Worm Sampling Locations
Greater Los Angeles and Long Beach Harbor Waters

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DRAFT

ANCHOR QEA

Figure 2
Proposed Sampling Locations and Recent Surface Sediment TPCB Data
Greater Los Angeles and Long Beach Harbor Waters

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DRAFT

ANCHOR QEA

Figure 3
Proposed Sampling Locations and Recent Surface Sediment TDDT Data
Greater Los Angeles and Long Beach Harbor Waters

APPENDIX A
PROGRAMMATIC QUALITY ASSURANCE PROJECT PLAN

DRAFT PROGRAMMATIC QUALITY ASSURANCE PROJECT PLAN

SUPPORTING COMPLIANCE MONITORING AND SPECIAL STUDIES RELATED TO THE HARBOR TOXICS TOTAL MAXIMUM DAILY LOAD

Prepared for

Port of Long Beach
925 Harbor Plaza
Long Beach, California 90802

Port of Los Angeles
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Prepared by

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August 2014

DOCUMENT TITLE

Draft Programmatic Quality Assurance Project Plan Supporting Compliance Monitoring and Special Studies Related to the Harbor Toxics Total Maximum Daily Load

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Quality Assurance Manager Joy Dunay, Anchor QEA, L.P.	Date

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LIST OF ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
CLP	Contract Laboratory Program
COC	chain-of-custody
DQO	data quality objective
eCOC	electronic chain-of-custody
EDD	Electronic Data Deliverable
EDL	estimated detection limit
Harbor Toxics TMDL	*Final Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants Total Maximum Daily Load*
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high-density polyethylene
LOD	limit of detection
MDL	method detection limit
MRL	method reporting limit
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
POLA	Port of Los Angeles
POLB	Port of Long Beach
Ports	Ports of Long Beach and Los Angeles
PQAPP	Programmatic Quality Assurance Project Plan
PTFE	polytetrafluoroethylene
QA	quality assurance
QC	quality control
SAP	Sampling and Analysis Plan
SQO	Sediment Quality Objective
SOP	standard operating procedure
SWAMP	Surface Water Ambient Monitoring Program
TMDL	total maximum daily load
USEPA	U.S. Environmental Protection Agency

1 INTRODUCTION

This section includes an overview of the *Final Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants Total Maximum Daily Load* (Harbor Toxics TMDL; RWQCB and USEPA 2011), a brief description of studies required to support its implementation, and the rationale and intent of a Programmatic Quality Assurance Project Plan (PQAPP) for ensuring data quality as part of upcoming TMDL compliance monitoring studies and other special studies.

1.1 Background

The Harbor Toxics TMDL has been established to protect marine life and minimize human health risks from the consumption of fish in the Los Angeles and Long Beach Harbor and adjacent waterbodies. The Harbor Toxics TMDL includes annual contaminant limits in surface sediment, stormwater effluent, and fish tissues in these waterbodies. These limits are defined as target loads or concentrations for compliance by 2032 within the Harbor Toxics TMDL. The City of Los Angeles (including the Port of Los Angeles [POLA]) and the City of Long Beach (including the Port of Long Beach [POLB]) are identified in the Harbor Toxics TMDL as two of the responsible parties. Consequently, the Ports of Long Beach and Los Angeles (Ports) are responsible, together with other stakeholders, for complying with the Harbor Toxics TMDL and ultimately identifying and reducing sediment and fish tissue concentrations in harbor waters to levels that do not cause further social or environmental harm.

To assist with the long-term goal of compliance, the Harbor Toxics TMDL includes a phased Implementation Plan that specifies implementation actions required to meet the goals of the total maximum daily load (TMDL). Implementation will be iterative, and information acquired during each phase of implementation will be used to inform later phases. The Harbor Toxics TMDL requires that the first phase of implementation include the development and initiation of the required compliance monitoring program. Monitoring must be initiated in May 2014 at specific locations and frequencies for water column chemistry (annually), sediment chemistry (every 2 years), Sediment Quality Objectives (SQO) evaluation (every 5 years), and fish tissue chemistry (every 2 years). Specific locations and analytes to be monitored are provided in Section 7.6.2 of the Harbor Toxics TMDL and

will be detailed in the Coordinated Compliance Monitoring and Reporting Plan. The Harbor Toxics TMDL also states that "All samples will be collected in accordance with California Surface Water Ambient Monitoring Program (SWAMP) protocols."

In addition to compliance monitoring as part of Phase I implementation, the Ports' plan to perform special studies to support TMDL compliance and site-specific management strategies and their implementation, which are required as part of Phases II and III of implementation activities. Planned special studies have been designed to determine causes of elevated fish tissue concentrations (e.g., site-specific harbor sediments, ongoing sources, and off-site regional sources) and the necessary reductions of these sources that will effectively reduce fish tissue concentrations. To identify these causes, the Ports' plan includes using scientific- and data-based models of the conditions in the harbor and the food web. Specifically, hydrodynamic, sediment transport, chemical fate, and bioaccumulation models will be integrated and used to evaluate the effectiveness of specific remedial actions and the impact of out-of-harbor sources (e.g., Palos Verdes Shelf). Calibration and validation of these models will require the collection of physical, chemical, and biological data to fill current data gaps.

1.2 Rationale and Intent of the Programmatic Quality Assurance Project Plan

A PQAPP is necessary to support all sampling and analysis activities planned as part of either the required compliance monitoring or the special studies needed to support model development. Specifically, the intent of this PQAPP is to:

- Provide a user-friendly QAPP that will provide consistency and will result in cost savings through the use of a standardized, pre-defined data collection and reporting process, which can be easily followed by contractors performing monitoring or other special studies for the Ports.
- Provide necessary procedures to ensure that data collection and analysis is standardized, efficient, and of high quality, regardless of study type or the contractors/subcontractors involved in data collection, testing, or analysis.
- Ensure that all field and laboratory data are defensible and meet specified data quality objectives (DQOs), which are based on the (Surface Water Ambient Monitoring Program (SWAMP) protocols (SWRCB 2008), U.S. Environmental Protection Agency

(USEPA) SW-846 (2004), and USEPA National Functional Guidelines data validation criteria (1999, 2004b, 2005, 2008), and other applicable analytical method guidance.

- Outline data management steps that will allow for quality-ensured, integrated, and efficient data management, including importing collected data to an EQuIS database, processing, and exporting to the Ports and agency databases.

Given the extent and variety of sampling and analysis activities planned for the next 5 years, it is essential that this PQAPP be programmatic in nature and not target one study. Each study is anticipated to have its own Sampling and Analysis Plan (SAP) specifying study-specific details that have not yet been defined. This programmatic approach will allow for an overall data collection program that provides high quality data and is highly efficient due to standardization of sample collection, nomenclature, analysis, data review/validation, processing, storage, management, and seamless data export to Ports and State databases, regardless of study type or contractors performing the work. Consequently, while this PQAPP complies with SWAMP protocols and is SWAMP compatible, it is not written in the format of a SWAMP QAPP with elements specified as A1 through D3. This format is not possible, because sampling and analysis details (i.e., equipment and instrument types) will vary by study type and contractor, which have not been identified at this time. Those elements not covered in this document will be covered in the Coordinated Compliance Monitoring and Reporting Plan and in every SAP associated with a special study. Table 1 summarizes the recommended SWAMP QAPP elements and indicates whether each element is included in this PQAPP or will be included in the corresponding Compliance Monitoring and Reporting Plan or special study SAPs.

1.3 Updates

The intent of this PQAPP is to ensure data quality as part of all sampling and analysis activities associated with compliance monitoring or special studies mentioned above. Updates to this document may be required to address any unanticipated special studies with methods currently not described herein, improvements in analytical methods or detection limits over time, or changes associated with monitoring requirements that may occur as part of the TMDL reopener process.

2 PROGRAM MANAGEMENT

This section identifies specific roles and responsibilities of team members and describes the process through which field and analytical data will be processed, reduced, and stored in an EQuIS database. A project organization chart is presented as Figure 1.

2.1 Roles and Responsibilities

Specific roles and responsibilities of project managers, data managers, and laboratory project managers are shown on Figure 1. The contact information for key members of the TMDL Study Team are provided in Table 2.

2.1.1 Project Managers

The Ports' project managers will be responsible for project administration and will serve as the lead contacts for TMDL compliance monitoring and TMDL-related special studies. The Ports' project managers will also serve as the point of contact between the Ports and the consulting team and will manage all project activities.

The TMDL Study project manager will be responsible for:

- Managing the overall TMDL program
- Ensuring the project and the Ports' objectives are met throughout project activities
- Coordinating internal communications with the Ports, the Ports' contractors, the data manager, and the quality assurance (QA) manager
- Overseeing all project deliverables
- Performing administrative tasks needed to ensure timely and successful completion of TMDL program special studies
- Resolution of project concerns or conflicts related to technical matters

For each compliance monitoring event or special study, the Ports will select a contractor to be the monitoring/special study project manager. This project manager will be identified in the SAP prepared prior to conducting the study. The monitoring/special study project manager will be responsible for:

- Providing oversight, overall special study project management, and progress reports

- Communicating with the TMDL study project manager and the Ports
- Organizing field staff
- Coordinating with subcontract laboratories
- Scheduling sampling days
- Installing and maintaining field sampling equipment, sample handling and transport, data transmittal in accordance with this PQAPP, and study reporting

2.1.2 Field Coordinator

For each compliance monitoring event or special study, a field coordinator will be identified in the SAP prepared by the contractor awarded the work. The field coordinator for each sampling program will be responsible for day-to-day technical and QA and quality control (QC) oversight. The field coordinator will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to selected laboratories for chemical and physical analyses. The field coordinator will also be responsible for submitting the finalized field data to the QA manager in a pre-determined format, as discussed in Section 2.2.

2.1.3 Laboratory Project Managers

The laboratory manager of any laboratory testing samples for the Ports will oversee all laboratory operations associated with the receipt of environmental samples, chemical and physical analyses, and laboratory report preparation for special studies. The laboratory manager will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analysis.

Analytical testing laboratories will be responsible for the following:

- Delivering sample confirmation receipt notifications to the field coordinator and QA manager (by submittal to the TMDL Study project manager)
- Performing analytical methods described in this PQAPP
- Following documentation, custody, and sample logbook procedures
- Ensuring that personnel engaged in preparation and analysis tasks have appropriate, documented training
- Meeting all reporting and QA/QC requirements

- Delivering electronic data files as specified in this PQAPP
- Meeting turnaround times for deliverables

2.1.4 QA Manager

The QA manager will provide QA oversight for field sampling and laboratory programs associated with the TMDL study (i.e., either compliance monitoring or special studies). The QA manager will also ensure that samples are collected and documented appropriately, ensure field and analytical data quality, oversee data validation, and supervise overall project QA coordination.

2.1.5 Data Managers

The data manager will compile field observations and analytical data from laboratories into a database, review data for completeness and consistency, append the database with qualifiers assigned by the data validator, and ensure that data obtained is in a format suitable for inclusion in the appropriate databases and delivery to the Ports and agencies.

The data validator will be responsible for verifying and validating all analytical data and submitting assigned data qualifiers to the database manager.

2.2 Overview of Data Management Process

Figures 2 provides an overview of the data flow process. After each field event, field data will be imported into the EQuIS database. These field data will undergo QC checks such as sample identifier review, transcription error review, and completeness verification. Independent of field data, laboratory data will be submitted to the QA manager in specified PDF and electronic data deliverable (EDD) formats. These data will undergo verification and validation using a combination of manual validation and Automated Data Review (ADR) software and then will be uploaded into the EQuIS database with the applied final validation qualifiers. These two datasets will be linked in the database to retain corresponding field data for each sample. Data will be exported from EQuIS in custom formats to meet POLB, POLA, and agency database requirements.

3 FIELD SAMPLING DATA QUALITY OBJECTIVES

This section includes detailed information on field collection requirements, including sample processing, handling, and identification; sample custody and shipping requirements; and field QC protocols.

3.1 Sample Processing, Handling, and Identification

Field personnel will identify and label samples in a consistent manner to ensure that field samples are traceable and that labels provide all information necessary for the laboratory to conduct required analyses properly. Samples will be placed in appropriate containers and preserved for shipment to the laboratory.

3.1.1 Sample Processing

Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sample material must meet high standards of cleanliness. All equipment and instruments used that are in direct contact with various media collected for chemical analysis must be made of glass, stainless steel, high-density polyethylene (HDPE), or polytetrafluoroethylene (PTFE) and will be cleaned prior to each day's use and between sampling or compositing events. The decontamination procedure is as follows:

1. Pre-wash rinse with tap or site water.
2. Wash with solution of warm tap water or site water and Alconox soap.
3. Rinse with tap or site water.
4. Rinse thoroughly with organic-free water.
5. Cover (no contact) all decontaminated items with aluminum foil.
6. Store in a clean, closed container for next use.

3.1.2 Sample Containers

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided. Specific container requirements are included in Table 3.

3.1.3 Sample Identification and Labels

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identifier
- Date and time of sample collection
- Preservative type (if applicable)
- Analysis to be performed

The sample nomenclature should include the identifiers listed below. A catalogue of identification codes is provided in Table 4. Identifiers shown below should be used when applicable; however, sample identification requirements for special studies are not yet defined and consequently, minor modifications to the recommended identification codes will be acceptable in these cases.

- Waterbody or site as shown in Table 4 (i.e., TMDL waterbody or other site in which sample was collected within each port jurisdiction)
- Media or sampling method code
- Organism common name, if applicable
- Station number
- Depth interval (in metric units), if applicable
- Date of collection
- Indication of field duplicate (i.e., add 1000 to station number)

For equipment rinsate blank or field blank samples, "EB" or "FB" will be used, respectively, in place of the waterbody or site and station number. The date of sample collection will be added to end in YYYYMMDD format.

An example sample identifier for a sediment core at 0 to 15 centimeters, Station 54 from Outer Harbor – Los Angeles on July 31, 2013:

OA-SC-54-0-15-20130731

An example sample identifier for an equipment blank of the decontaminated sample processing equipment after sample collection of the above sample would be:

EB-20130731

An example sample identifier for a sediment core at 0 to 15 centimeters, Station 54 from Outer Harbor – Los Angeles on July 31, 2013, that is a field duplicate:

OA-SC-1054-0-15-20130731

An example sample identifier for a white croaker fish fillet skin off, station number 23 from Inner Harbor – Long Beach on July 31, 2013:

IH-FF-WC-23-20130731

3.2 Sample Custody and Shipping Requirements

Samples are considered to be in one's custody if they are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal(s) so that the sample cannot be reached without breaking the seal(s).

Chain-of-custody (COC) procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. All manual data entries will be made using an indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank lines and spaces on the COC form will be lined out, dated, and initialed by the individual maintaining custody. Electronic COC (eCOC) forms generated from a custom field application will be emailed directly to the laboratory and QA managers.

A COC form will accompany each container of samples to the analytical laboratory. Each person in custody of samples will sign the COC form and ensure the samples are not left

unattended unless properly secured. Copies of all COC forms will be retained in the project files.

All samples will be shipped or hand delivered to the analytical laboratory no later than the day after collection. Samples collected on Friday may be held until the following Monday for shipment provided that this delay does not jeopardize any holding time requirements. Specific sample shipping procedures are as follows:

- Each cooler or container containing samples for analysis will be shipped via overnight delivery to the laboratory. In the event that Saturday delivery is required, the field coordinator will contact the analytical laboratory before 3 p.m. on Friday to ensure that the laboratory is aware of the number of containers shipped and the airbill tracking numbers for those containers. Following each shipment, the field coordinator will call the laboratory and verify that the shipment from the day before has been received and is in good condition.
- Coolant ice will be sealed in separate double plastic bags and placed in the shipping containers.
- Individual sample containers will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.
- The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
- Shipping waybill number will be documented on all COC forms accompanying samples.
- A sealed envelope containing COC forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- A minimum of two signed and dated custody seals will be placed on adjacent sides of each cooler prior to shipping.
- Each cooler will be wrapped securely with strapping tape, labeled "Glass – Fragile" and "This End Up," and will be clearly labeled with the laboratory's shipping address and the consultant's return address.

Upon transfer of sample possession to the analytical laboratory, the person(s) transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the custody seals will be broken, and the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

3.3 Field Quality Assurance and Quality Control

Field QA/QC sampling and analysis procedures that will be conducted as part of Compliance Monitoring or special studies conducted by contractors for the Ports and steps will be taken to ensure all field records are retained and submitted accurately as part of the data flow process described above (see Section 2.2 and Figure 2).

3.3.1 Field Quality Assurance and Quality Control Sampling and Analysis

Field QA/QC samples will be collected along with environmental samples. Field QA/QC samples will be useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA/QC samples will follow SWAMP guidance and may include field (homogenization) duplicates, rinsate (equipment) blanks, and/or field blanks (SWRCB 2008). Field duplicates will be collected at a frequency of 5 percent of total project sample count. Rinsate blanks or field blanks will be collected as needed (e.g., when low level contamination is suspected). Field QA/QC sample frequencies and performance criteria are presented in Table 5.

Additional sample volume will be collected to ensure that the laboratory has sufficient sample volume to run the program-required analytical QA/QC samples for analysis, as specified in Section 4.2.

3.3.2 Field Records

All collected field samples will be documented using a custom field application or field collection logs that will be manually converted to a field EDD prior to data submittal. Additionally, the field coordinator or designee will keep a daily record of significant events, observations, and measurements on a daily log. Entries for each day will begin on a new page. The person recording information must enter the date and time and initial each entry.

In general, sufficient information will be recorded during sampling to reconstruct the event can without relying on the memory of the field personnel.

The daily log will contain the following information, at a minimum:

- Project name
- Field personnel on site
- Site visitors
- Weather conditions
- Field observations
- Maps and/or drawings
- Date and time sample collected
- Sampling method and description of activities
- Identification or serial numbers of instruments or equipment used
- Deviations from the PQAPP or SAP
- Conferences associated with field sampling activities

After each field event, field data will be imported into the EQuIS database either by direct import using a custom field application export or manual submittal of a field EDD containing information from field collection logs (Figure 2). Field data collection and management options are described below along with field EDD requirements.

3.3.2.1 Field Data Option 1: Custom Field Application

Electronic field EDDs can be generated from a custom field application that provides electronic data entry forms for field information and generates field collection logs, sample labels, and eCOCs. A custom field application improves data quality by minimizing hand-written errors through the use of required data entry elements and controlled, unique identifiers for locations, samples, and analytical test requests. In addition, it promotes efficiency in the field and provides eCOCs for laboratory sample check-in and for loading field information to the TMDL Study Team's data management system, further reducing transcription errors. When a custom field application is used in place of field collection logs, all information and generated forms are backed up to removable storage devices and should be emailed to the QA manager at the end of each field day, for data security. The same

elements required for the field logs described in Sections 3.3.2.2 would be captured in the custom field application. To use this application, the field coordinator should coordinate with the QA manager.

3.3.2.2 Field Data Option 2: Field Collection Logs

All field sample collection information will be recorded on field collection logs maintained by the field coordinator, or designee, for each activity. Key information should be recorded for each sample, such as sample station, station coordinates, sample identifier, and sample matrix. The information recorded during sample collection should fulfill requirements of the field EDD described in Section 3.3.2.3.

Notes will be taken in indelible, waterproof blue or black ink. Errors will be corrected by crossing out with a single line, dating, and initialing. Each field collection log will be marked with the project name, number, and date. The field logs will be will be scanned at the end of each field day and emailed to the monitoring/special study project manager.

3.3.2.3 Field Electronic Data Deliverable Requirements

Field data collection, including observations, field measurements, and sample generation, will be facilitated by submittal of a field EDD generated from the custom field application or field collection logs. Field data must be submitted to the managing consultant. It is imperative that the field sample data match field forms and COC forms. The field EDD template (Excel workbook format) will be provided by the QA manager upon request. Required, conditional, and optional fields will be identified in the field EDD template along with defined valid values. Required fields must be filled out prior to submittal of field data. Conditional fields are required for specific matrices, collection methods, or if a field QC sample is collected. Optional fields may be populated at the field coordinator's discretion. Columns may be left blank but should not be deleted. Any questions with regarding completion of the field EDD should be directed to the QA manager.

4 LABORATORY DATA QUALITY OBJECTIVES

It is critical to ensure that data collected are of acceptable quality so that the project objectives for each special study or monitoring program sampling are achievable. Guidance for DQOs is derived from the SWAMP guidance (SWRCB 2008). The quality of laboratory data is assessed by precision, accuracy, representativeness, comparability, completeness, and sensitivity. Applicable quantitative goals for laboratory precision, accuracy, and completeness are described in Section 4.3. The definitions for the data quality indicators are as follows:

- Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and laboratory analysis.
- Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value.
- Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For the sampling program, analyte lists presented in Section 4.1 have been identified to provide a comprehensive assessment of sediment, water, and tissue quality at the Ports.
- Comparability expresses the confidence with which one dataset can be evaluated in relation to another dataset. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats and use of common traceable calibration and reference materials.
- Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected.
- Sensitivity is related to the instrument calibration low level standard, method detection limits (MDLs), and/or estimated detection limits (EDLs). For each special study, analytical methods will be selected to achieve reporting limits that comply with, or are close to, target detection limits.

4.1 Analyte Lists, Analytical Methods, and Reporting Limits

Analyte lists and target reporting limits for sediment, water, and tissues are identified in Tables 6, 7, and 8, respectively. Analytical methods and target detection limits were selected to comply with SWAMP guidance (SWRCB 2008). The analyte list for sediments includes

recommended chemical analytes needed to calculate the chemistry exposure line of evidence for application of the California sediment quality assessment framework (SWRCB 2009). For some analyte groups (e.g., polychlorinated biphenyls [PCBs]), several methodologies have been included to allow for flexibility of method selection based on the DQOs for compliance monitoring and special studies.

For high-resolution isotope dilution methods, the EDL sample concentration, or the estimated maximum possible concentration, should be calculated and reported for each target compound. For all other methods, the laboratory should report detected compounds to the MDL, if applicable. The laboratory should also provide the instrument verified limit of detection (LOD) for each analyte in the laboratory report and EDD, whenever possible. Reported values between the MDL and method reporting limit (MRL) should be qualified with a "J." Non-detects should be reported at the lowest calibration level (typically the MRL) or LOD, whichever is lower. In some cases, non-detects may be reported at the MDL.

4.2 Laboratory Quality Control Sample Requirements

Laboratory QA/QC definitions are identified in Table 9. Laboratory QC frequency requirements were derived from SWAMP guidance (SWRCB 2008) and are identified in Table 10.

4.3 Performance Criteria

Applicable quantitative goals for precision, accuracy, and completeness are derived from SWAMP guidance (SWRCB 2008) and provided in Table 11.

4.4 Laboratory Record Requirements

Analytical data records (bookmarked PDF and EDD formats) will be generated by the laboratory and submitted to the TMDL study project manager upon completion. If files are too large to be emailed, a notification email with download instructions can be sent to the TMDL Study Team at labdata@anchorqea.com. The data package level will depend on the sampling event. The field coordinator or QA manager will identify the required data package level on the COC.

The analytical laboratory will be required to report the following, where applicable:

- **Case Narrative.** This summary will discuss problems encountered during any aspect of analysis, if any. It should discuss, but is not be limited to, QC issues, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate. Analytical QC samples that exceed project performance criteria and/or laboratory performance criteria should also be discussed in the case narrative.
- **COC Records.** Legible copies of COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.
- **Sample Results.** The data package will summarize results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identifier and corresponding laboratory identification code
  - Sample matrix
  - Date and time of sample extraction
  - Date and time of analysis
  - Final concentration volumes and dilution factors
  - Instrument and analyst identification
  - MRLs and MDLs accounting for sample-specific factors (e.g., dilution and total solids)
  - Analytical results with reporting units identified
  - Data qualifiers and their definitions
  - Raw data including instrument printouts, chromatograms, and bench sheets (required for full data packages)
- **QA/QC Summaries.** Contract Laboratory Program (CLP)-like form summaries should be generated for all required laboratory QC components and samples (i.e., method blanks, instrument daily tunes, surrogate spikes, internal standards, and laboratory control samples). These summaries should include spike volumes, parent sample concentrations, percent recoveries, relative percent differences, area counts, and

laboratory control limits as applicable. For full data packages, associated raw data files should be included.

- **Instrument Calibration Data.** CLP-like form summaries of calibration data (i.e., initial calibration, initial calibration verification, and continuing calibration verification) should be included in all data packages. For full data packages, associated raw data files should be included.

All instrument data shall be fully restorable at the laboratory from electronic backup. The laboratory will be required to maintain all records relevant to project analyses for a minimum of 5 years.

4.5 Laboratory Electronic Deliverable Requirements

The Ports contractor may obtain laboratory EDDs in any format as long as the key fields and formats required by the Ports (Appendix A) are populated. Final, validated laboratory EDDs will be submitted to the Ports' data manager in a custom EQuIS format. Specifications and valid values associated with this format can be found in Appendix A. Updates to specifications and valid values will occur over time and will be distributed to the laboratory or Ports' contractor when they become available. Laboratory reports (in PDF format) associated with final electronic analytical data should also be submitted to the Ports' data manager.

5 ASSESSMENTS AND OVERSIGHT

The following sections describe the types of assessments that may be conducted for this project and how these assessments will be reported to project management.

5.1 Assessments and Response Actions

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. The field coordinator is responsible for assessing field activities and has the authority to issue a stop work order on sample collection. The TMDL study project manager or designee provides additional oversight on all field and laboratory activities and consequently may also issue a stop work order on sample collection if warranted. Laboratory audits are not anticipated to be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA manager upon request. The laboratory is required to have written procedures addressing internal QA/QC (i.e., QA Plan), which will be reviewed by the project QA manager to ensure compliance with the project SAP. The laboratory must ensure that personnel engaged in sampling and analysis tasks have appropriate training. As part of the audit process, the laboratory will provide written details of any and all method modifications planned for consultant's review. Laboratory non-conformances will be documented and submitted to the QA manager for review. All non-conformances will be discussed in the final data report.

5.2 Corrective Actions

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or nonconformance to protocols identified in this document.

5.2.1 Field Activities

The field coordinator will be responsible for correcting equipment malfunctions during the field sampling effort. The QA manager will be responsible for resolving situations identified by the field coordinator that may result in noncompliance with the SAP. All corrective measures will be immediately documented in the field logbook.

5.2.2 Laboratory

The laboratory is required to comply with its standard operating procedures (SOPs). The laboratory manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this PQAPP. All laboratory personnel will be responsible for reporting problems that may compromise quality data.

The laboratory manager will be notified if any QC sample grossly exceeds the laboratory in-house control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. If the anomaly cannot be corrected, the laboratory manager will document the corrective action taken in a memorandum submitted to the QA manager within 5 days of the initial notification. A narrative describing the anomaly, steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package.

5.3 Reports to Management

QA reports to project management will include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the TMDL study project manager.

Progress reports will be prepared by the field coordinator and delivered to the TMDL study project manager following each sampling event. These progress reports will contain final versions (peer reviewed) of field logs, field notebooks, COCs, observations, etc.

6 DATA VALIDATION AND USABILITY

The following sections describe the processes that will be used to review project data quality.

6.1 Data Review, Validation, and Verification

During the validation process, analytical data will be electronically and/or manually evaluated for method and laboratory QC compliance and their validity and applicability for program purposes will be determined.

Based on findings of the validation process, data validation qualifiers may be assigned. Validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

6.2 Verification and Validation Methods

Data verification includes a review for completeness and accuracy by the field coordinator and laboratory manager; review by the data manager for outliers and omissions; and the use of performance criteria to identify laboratory QC sample outliers. Data verification can be conducted manually or using specialized automated software programs such as ADR. ADR is an efficient tool that can be used to generate outlier reports for all analytical results outside the performance criteria presented in this PQAPP. For this program, Stage 2A verification/validation will be conducted consisting of completeness checks (target analyte lists, etc.), holding time compliance, and laboratory QC sample performance evaluations (see the list in the next paragraph). Data validation will then be conducted by the data validator and will consist of accepting, rejecting, or applying qualifiers to data based on the verification findings, analytical method criteria, National Functional Guidelines data validation guidance (USEPA 1999, 2004, 2005, 2008), and professional judgment. A data validation report will be generated to document qualifications applied to data. All validated data will be entered into the Ports' data manager's EQuIS database, and a final data file will be exported. Verification of the database export against the PDF data report will be performed by the QA manager or designee. Any errors found in the data file export will be corrected in the database and reviewed for systemic reporting errors. Once all discrepancies are resolved, the database will be established.

All laboratory data will receive a Stage 2A validation (USEPA 2009). The recommended QC checks identified in a Stage 2A validation are as follows:

- Completeness
- Holding times
- Requested methods were performed
- MRLs and EDLs - project requirements were met
- Sample-related QC data were analyzed at the required frequencies
- QC performance criteria were met for the following:
  - Laboratory control samples
  - Matrix spike/matrix spike duplicate
  - Standard reference material
  - Surrogate recoveries
  - Method blanks
- Field QC samples

The QA manager will be responsible for the final review of all data validation reports.

6.3 Reconciliation with User Requirements

The QA manager will review data at the completion of each task to determine if DQOs have been met. If data do not meet the project's specifications, the QA manager will review the errors and determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and will suggest corrective action, if appropriate. It is expected that problem would be able to be corrected by retraining, revising techniques, or replacing supplies/equipment; if not, the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA manager will recommend appropriate modifications. If matrix interference is suspected to have attributed to the exceedance, adequate laboratory documentation must be presented to demonstrate that instrument performance and/or laboratory technique did not bias the result. In cases where the DQOs have been exceeded and corrective actions did not resolve the outlier, data will be qualified per USEPA National Functional Guidelines (1999, 2004, 2005, 2008). In these instances, the usability of data will be determined by the extent of the exceedance. Rejected data will be assigned an "R" qualifier and will not be used for any purposes.

7 ADDITIONAL QUALITY ASSURANCE PROJECT PLAN ELEMENTS

The following section provides general guidance on special training and certifications; documentation and record keeping; and instrument/equipment maintenance and calibration protocols. More specific requirements for special training and certifications may be included in the Compliance Monitoring and Reporting Plan or special study SAPs; if provided, these documents would supersede the information provided below.

7.1 Special Training Requirements and Certifications

For sample preparation tasks, field crews will be trained in standardized sample collection requirements so that the samples collected and data generated from samples are consistent among field crews. The field coordinator must ensure that all field crew members are fully trained in the collection and processing of sediment, surface water, tissues, decontamination protocols, and sample transport and COC procedures.

Some special studies may require that all sampling personnel have 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and the 8-hour refresher course, as necessary, to meet the 29 Code of Federal Regulations 1910.120 Occupational Safety and Health Administration (OSHA) regulations. The Ports will determine if this training is necessary.

7.2 Documentation and Records

Document requirements for field records and laboratory reports are provided in Sections 3.3.2 and 4.5, respectively. Each project team member (field coordinator, QA manager, etc.) is responsible for documenting all necessary project information and should maintain files for individual tasks but must provide such files to the TMDL study project manager upon completion of each sampling event. A central project file will be maintained by the TMDL Study Team. Hard copy documents will be kept on file with the TMDL Study Team or at a document storage facility throughout the duration of the project. All electronic documents and work products will be stored in a project-specific directory on secured and a backed-up server. All electronic analytical data will be maintained in a central database with the TMDL Study Team. Data will be periodically exported to the POLB and POLA databases after the completion of each monitoring event or special study. Additionally as required, data will be

submitted to the California Environmental Data Exchange Network using templates provided on its website: http://water100.waterboards.ca.gov/ceden/ceden_submitdata.shtml# templates.

7.3 Instrument and Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

7.3.1 Field Instruments and Equipment

The field coordinator or designee will maintain inventories of field instruments and equipment and will be responsible for the preparation, documentation, and implementation of preventative maintenance. The frequency and types of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

The field coordinator or designee will also be responsible for navigation and will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system. Samplers will be inspected daily for any mechanical problems, and problems will be noted in the field logbook and corrected prior to continuing sampling operations.

7.3.2 Laboratory Instruments and Equipment

Selected laboratories will maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

Selected laboratories will have a preventative maintenance program, as detailed in their QA Plans, organized to maintain proper instrument and equipment performance and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics, the availability of spare parts, and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, shown to give suspect results, determined to be defective will be taken out of service, or tagged with the discrepancy note, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. The QA manager will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The QA manager will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times. Selected laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. A laboratory QA/QC manager or designee shall be responsible for verifying compliance.

7.4 Instrument and Equipment Calibration

Proper calibration of equipment and instrumentation is an integral part of providing quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

7.4.1 Field Instrument and Equipment Calibration

Field equipment will be calibrated prior to the sampling event according to manufacturer's recommendations using manufacturer's standards. A calibration check will be performed at the beginning of each day. The equipment, calibration, and maintenance information will be documented in the instrument calibration log. The frequency of calibration is dependent on the type and stability of the equipment, the methods used the intended use of the equipment, and the recommendations of the manufacturer. Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals. Equipment that fails calibration will be recalibrated prior to use.

7.4.2 Laboratory Instrument and Equipment Calibration

As part of their QC program, selected laboratories will perform two types of calibrations. A periodic calibration is performed at prescribed intervals for relevant instruments and laboratory equipment (i.e., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory's QA Plan. Calibrations are discussed in the laboratory's SOPs for analyses.

The laboratory QA/QC manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory manager. Recognized procedures (USEPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the National Institute of Standards and Technology. Chemical reference standards shall be NIST standard reference materials or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory's SOPs or QA Plan for each instrument or analytical method in use. An instrument that fails calibration will be recalibrated prior to use. All calibrations shall be preserved on electronic media.

8 REFERENCES

RWQCB and USEPA (Los Angeles Regional Water Quality Control Board and U.S. Environmental Protection Agency), 2011. *Final Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants Total Maximum Daily Loads*. June 2011.

SWRCB (State Water Resources Control Board), 2008. *Surface Water Ambient Monitoring Program Quality Assurance Program Plan.* Final Technical Report Version 1. September 2008.

SWRCB (State Water Resource Control Board), 2009. *Water Quality Control Plan for Enclosed Bays and Estuaries.* August 25, 2009.

USEPA (U.S. Environmental Protection Agency), 1999. *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. USEPA, Office of Emergency Response. USEPA 540/R-99/008. October 1999.

USEPA, 2004a. SW-846 On-line, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Revision 6. Available online at: http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm.

USEPA, 2004b. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. USEPA540-R-04-004. October 2004.

USEPA, 2005. *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans Data Review*. OSWER 9240.1-51, USEPA-540-R-05-001. September 2005.

USEPA, 2008. *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. USEPA, Office of Emergency Response. USEPA 540/R-08-01. June 2008.

USEPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. USEPA, Office of Solid Waste and Emergency Response. OSWER No. 9200.1-85. January 2009.

TABLES

Table 1
SWAMP, USEPA, and QAPP Review Checklist

SWAMP Element Number	Element Name and Review Aspect	PQAPP	Compliance Monitoring Plans, Sampling and Analysis Plans, or Other Documents
A	**PROJECT MANAGEMENT**		
A1.	**Title and Approval Sheet (s)**		
A1.1	Contains project title	X	X
A1.2	Indicates revision number, if applicable	X	X
A1.3	Indicates organization's name	X	
A1.4	Includes signature of organization's project manager	X	
A1.5	Includes signature block for organization's project manager	X	
A1.6	Includes signature block for organization's QA officer	X	
A1.7	Includes signature block for Port program managers	X	
A1.8	Includes signature block for RWQCB QA officer	N/A	N/A
A2.	**Table of Contents**		
A2.1	Lists QAPP information sections	X	X
A2.2	Includes document control information	X	X
A2.3	Provides lists of tables and figures	X	X
A2.4	Provides contents of each appendix	X	X
A2.5	Lists all attached standard operating procedures (with names, not just numbers)	N/P	
A3.	**Distribution List**		
A3.1	Includes all individuals who are to receive a copy of the QAPP, and identifies their organization	X	X
A4.	**Project/Task Organization**		
A4.1	Identifies key individuals involved in all major aspects of the project, including contractors	X	
A4.2	Discusses their responsibilities	X	
A4.3	Confirms that the project QA officer position is independent of data generation	X	
A4.4	Identifies individual responsible for maintaining the official, approved QAPP	X	
A4.5	Includes organizational chart that shows lines of authority and reporting responsibilities	X	
A4.6	Clearly identifies who is part of the project team and who is related to the project in an advisory role (but is not responsible for delivery of any product)	X	
A5.	**Problem Definition/Background**		
A5.1	States decisions to be made, actions to be taken, or outcomes expected from the information to be obtained	X	
A5.2	Clearly explains the reason (site background or historical context) for initiating this project	X	
A5.3	Identifies regulatory information, applicable criteria, or action limits necessary to the project		X
A6.	**Project/Task Description**		
A6.1	Summarizes work to be performed (e.g., measurements to be made, data files to be obtained)	X	X
A6.2	Provides a work schedule, indicating critical project points (e.g., start and completion dates for activities such as sampling, analysis, data reviews, assessments)		X
A6.3	Details geographical locations to be studied, including maps where possible		X
A6.4	Describes resource and time constraints, if applicable		X
A7.	**Quality Objectives and Criteria**		X
A7.1	Identifies measurement quality objectives that meet or exceed those mandated by SWAMP	X	
A7.2	Identifies project action limits for all parameters of interest	X	X
A7.3	Identifies acceptance criteria for all previously collected information	X	
A7.4	Discusses precision	X	X
A7.5	Addresses bias	X	X
A7.6	Discusses representativeness and how it will be assessed and controlled	X	X
A7.7	Identifies the need for completeness	X	X
A8.	**Special Training/Certifications**		X
A8.1	Identifies any specialized training or certifications required of project personnel	X	X
A8.2	Discusses how this training will be provided		X
A8.3	Identifies individual(s) responsible for ensuring sufficient training and certification	X	X

Table 1
SWAMP, USEPA, and QAPP Review Checklist

SWAMP Element Number	Element Name and Review Aspect	PQAPP	Compliance Monitoring Plans, Sampling and Analysis Plans, or Other Documents
A8.4	Identifies where training and certification information is documented		X
A9.	**Documentation and Records**		
A9.1	Identifies report format and summarizes all data report package information	X	
A9.2	Lists all other project documents, records, and electronic files that will be produced	X	
A9.3	Identifies where project information should be kept and for how long	X	
A9.4	Discusses backup plans for records stored electronically	X	
A9.5	States how the individuals identified in Element A3 will receive the most current copy of the approved QAPP, and identifies the individual(s) responsible for this	X	
B	**DATA GENERATION AND ACQUISITION**		
B01.	**Sampling Process Design (Sampling Design and Logistics)**		
B01.1	Provides the design information, or a reference to a specific document that contains it, with sufficient detail to assess data against project objectives		X
B01.2	Describes and justifies design strategy, indicating the size of the area and time period to be represented by a sample		X
B01.3	Details the type and total number of samples, matrices, and runs expected and needed		X
B01.4	Indicates where samples should be taken and how sites will be identified		X
B01.5	Discusses what to do if sampling sites become inaccessible		X
B01.6	Identifies project activity schedules (e.g., sampling events, shipping times)		X
B01.7	Specifies what information is critical and what is for informational purposes only		X
B01.8	Identifies sources of natural variability and how this variability should be reconciled with project information		X
B01.9	Identifies potential sources of bias or misrepresentation and how their contribution can be minimized		X
B02.	**Sampling (sample collection) Methods**		
B02.1	Identifies all sampling standard operating procedures by number, date, and regulatory citation, indicating sampling options or modifications to be taken. Non-SWAMP standard operating procedures should be attached		X
B02.2	If bioassessment sampling, implements the standard operating procedure *Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California*		X
B02.3	Indicates how each kind of matrix and each sample type should be collected		X
B02.4	Indicates how samples are to be homogenized, composited, split, or filtered		X
B02.5	Indicates what sample containers and sample volumes should be used		X
B02.6	Identifies whether samples should be preserved, and indicates methods that should be followed	X	X
B02.7	Describes how sampling equipment and samplers should be cleaned and decontaminated, including the disposal of byproducts	X	X
B02.8	Identifies any equipment and support facilities needed		X
B02.9	Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented	X	X
B03.	**Sample Handling and Custody**		
B03.1	For each parameter, states maximum holding times allowed from sample collection to preparation and analysis	X	X
B03.2	Identifies how samples should be physically handled, transported, received, and stored in the laboratory or office (including temperature upon receipt)	X	X
B03.3	Indicates how sample handling and custody information should be documented, identifying individual(s) responsible	X	X
B03.4	Identifies chain-of-custody procedures and includes form to track custody	X	X
B04.	**Analytical Methods and Field Measurements**		
B04.01	Identifies all standard operating procedures that should be followed by number, date, and regulatory citation, indicating options or modifications; standard operating procedures should be attached or referenced	N/P	X
B04.02	Lists all the instruments and kits that will be used in the field and describes their measurement principle (e.g., nephelometric or transparency) and major attributes (e.g., automatic temperature compensation, range and resolution)		X

Table 1
SWAMP, USEPA, and QAPP Review Checklist

SWAMP Element Number	Element Name and Review Aspect	PQAPP	Compliance Monitoring Plans, Sampling and Analysis Plans, or Other Documents
B04.03	If in situ monitoring, indicates how instruments should be deployed and operated to avoid fouling and ensure maintenance of proper data		X
B04.04	If continuous monitoring, indicates how instruments should store and maintain raw data		X
B04.05	Identifies all laboratory standard operating procedures that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken (e.g., such as sub-sampling and extraction procedures)	N/P	X
B04.06	Identifies equipment or instrumentation needed for laboratory analyses	X	
B04.07	Specifies any specific method performance criteria	X	X
B04.08	Provides target analytical reporting limits or method detection limits	X	X
B04.09	Identifies procedures to follow when failures occur, identifying individual(s) responsible for corrective action and associated documentation	X	X
B04.10	Identifies sample disposal procedures		X
B04.11	Specifies laboratory turnaround times needed		X
B04.12	Provides documentation for the use of non-standard methods		X
B05.	**Quality Control**		
B05.1	For each parameter, identifies quality control activities (e.g., blanks, spikes, duplicates) that meet those mandated by SWAMP	X	X
B05.2	Details what should be done when control limits are exceeded and how corrective actions will be assessed and documented	X	X
B05.3	Identifies procedures and formulas for calculating quality control results (e.g., precision, bias)	X	
B06.	**Instrument/Equipment Testing, Inspection, and Maintenance**		
B06.1	Identifies field and laboratory equipment needing periodic maintenance and the associated schedule	X	X
B06.2	Identifies testing criteria; this information is instrument-specific and may be included in the standard operating procedure for each instrument	X	X
B06.3	Notes availability and location of spare parts	X	X
B06.4	Indicates procedures in place for inspecting equipment before usage (this information is instrument-specific and may be already included in the standard operating procedure for each Instrument)	X	X
B06.5	Identifies individual(s) responsible for testing, inspection, and maintenance	X	X
B06.6	Indicates how deficiencies should be resolved, and how corrective actions should be assessed and documented	X	X
B07.	**Instrument/Equipment Calibration and Frequency**		
B07.1	Identifies equipment, tools, and instruments that should be calibrated, and the frequency for this calibration		X
B07.2	Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment (this information is instrument-specific and may be already included in the standard operating procedure for each Instrument)		X
B07.3	Identifies how deficiencies should be resolved and documented		X
B08.	**Inspection/Acceptance for supplies and Consumables**		
B08.1	Identifies critical field and laboratory supplies and consumables; noting supply source, acceptance criteria, and procedures for tracking, storing, and retrieving these materials		X
B08.2	Identifies the individual(s) responsible for this task		X
B09	**Non-direct Measurements**		
B09.1	Identifies data sources (e.g., computer databases, literature files, models) that should be assessed and used		X
B09.2	Describes the intended use of this information and the rationale for their selection		X
B09.3	Indicates the acceptance criteria for these data sources or models		X
B09.4	Identifies key resources and support facilities needed		X
B09.5	Describes how limits to validity and operating conditions should be determined (e.g., internal checks, beta testing)		X
B10.	**Data Management**		

Table 1
SWAMP, USEPA, and QAPP Review Checklist

SWAMP Element Number	Element Name and Review Aspect	PQAPP	Compliance Monitoring Plans, Sampling and Analysis Plans, or Other Documents
B10.01	Describes the data management scheme from field to final use and storage	X	
B10.02	Verifies that all continuous monitoring raw data will be kept in the original sonde file (and stored on a PC); Endpoints (e.g., averages) can be calculated after downloading and trimming records		X
B10.03	Describes the filing and document control system, or cites documentation such as standard operating procedures	X	
B10.04	Identifies data handling equipment and procedures that should be used to process, compile, analyze, and transmit data reliably and accurately	X	
B10.05	Describes how field and laboratory data will be formatted and entered into SWAMP's Information Management System	X	
B10.06	Identifies individual(s) responsible for each step and task	X	
B10.09	Describes procedures to demonstrate the acceptability of hardware and software configurations	X	
B10.10	Attaches checklists and forms that should be used (or refers to standard operating procedures)	X	
C	**ASSESSMENT AND OVERSIGHT**		
C1.	**Assessments and Response Actions**		
C1.1	Lists the number, frequency, and type of assessment activities that should be conducted, including approximate dates	X	X
C1.2	Identifies individual(s) responsible for conducting assessments; including their authority to issue stop work orders	X	X
C1.3	Describes how and to whom assessment information should be reported	X	X
C1.4	Identifies how corrective actions should be addressed and by whom, and how they should be verified and documented	X	X
C2.	**Reports to Management**		
C2.1	Identifies what project quality assurance reports are needed and how frequently		X
C2.2	Identifies who should write and receive these reports		X
D	**DATA VALIDATION AND USABILITY**		
D1.	**Data Review, Verification, and Validation**		
D1.1	Describes SWAMP criteria that should be used for accepting, rejecting, or qualifying project data (or refers to Element 7)	X	
D2	**Verification and Validation Methods**		
D2.1	Describes processes for data verification and validation, including standard operating procedures and data validation software	X	
D2.2	Identifies who is responsible for verifying and validating different components of project information (e.g., chain-of-custody forms, receipt logs, calibration information)	X	
D2.3	Describes the issue resolution process, and individual(s) responsible for conveying results to data users	X	
D2.4	Attaches checklists, forms, and calculations (including electronic formulae if using spreadsheets)	X	
D3.	**Reconciliation with User Requirements**		
D3.1	Describes procedures used to evaluate the uncertainty of the validated data (or refers to previous elements)	X	
D3.2	Describes how limitations on data use should be reported to the data users	X	
D3.3	Identifies how the data will be used in the context of the various SWAMP components, including the SWAMP Information Management System	X	

Table 2
Contact Information

Name	Title/Position	Organization	Phone Number	Email	Mailing Address
Kathryn Curtis Andrew Jirik	POLA Project Managers	Port of Los Angeles Environmental Management Division	(310) 732-3681	kcurtis@portla.org ajirik@portla.org	425 S. Palos Verdes Street San Pedro, California 90731
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Laurel Menoche	Data Manager	Anchor QEA	(206) 903-3372	lmenoche@anchorqea.com	720 Olive Way, Suite 1900 Seattle, Washington 98101
Joy Dunay	QA Manager	Anchor QEA	(206) 903-3320	jdunay@anchorqea.com	720 Olive Way, Suite 1900 Seattle, Washington 98101
Cindy Fields	Data Validator	Anchor QEA	206-903-3394	cfields@anchorqea.com	720 Olive Way, Suite 1900 Seattle, Washington 98101

Table 3
Sample Containers, Holding Times, and Preservation Methods

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Sediments				
Bulk density	50 g	4-oz glass	None established	Ambient
Ammonia	10 g	4-oz glass	7 days to extraction; 48 hours cooled, 28 days frozen	Cool ≤ 6°C, pH <2 with 2 mL 9N H_2SO_4
Sulfide	20 g	4-oz glass	7 days	Cool ≤4°C
Specific gravity	100 g	16-oz glass	None established	Ambient
Total solids	10 g	8-oz glass (can be combined with other parameters)	14 days	Cool ≤6°C
			1 year	Freeze -20°C
Grain size	300 g	16-oz plastic	6 months	Cool ≤6°C
DOC in porewater	1- 2 L sediment[a]	2 X 1-L amber glass	48 hours for extraction, filtration and preservation; 28 days to analysis	HCl or H2SO4 to pH<2 after filtration; Cool ≤6°C and dark
TOC	10 g	4-oz glass	28 days	Cool ≤6°C
			1 year, if frozen within 28 days of collection	Freeze -20°C
Total metals and mercury	100 g	4-oz glass	6 months	Cool ≤6°C
			1 year; samples must be extracted within 14 days of thawing	Freeze -20°C[c]
PAHs/ Organochlorine pesticides	500 g	8-oz glass	14 days to extraction	Cool ≤6°C
			1 year to extraction; samples must be extracted within 14 days of thawing	Freeze -20°C
			40 days after extraction	Cool ≤6°C
PCBs	500 g	8-oz glass	None[a]	Cool ≤6°C
				Freeze -20°C
Tissues				
Lipids	200 g	Split taken from sample for chemistry analyses	1 year	Freeze -20°C
Organochlorine pesticides	200 g	Foil or 8-oz glass	14 days to extraction	Cool ≤6°C
			1 year to extraction; samples must be extracted within 14 days of thawing	Freeze -20°C
			40 days after extraction	Cool ≤6°C
PCBs	200 g	Foil or 8-oz glass	None[b]	Cool ≤6°C
				Freeze -20°C

Table 3
Sample Containers, Holding Times, and Preservation Methods

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Waters				
Particle size determination	1 L	1-L HDPE	7 days	Cool ≤6°C
Total suspended solids	1 L	1-L HDPE	7 days	Cool ≤6°C
Total dissolved solids	1 L	1-L HDPE	7 days	Cool ≤6°C
TOC	150 mL	250 mL amber glass	28 days	Cool ≤6°C and dark; HCl or H2SO4 to pH<2
	40 mL	40 mL VOA vials		
DOC	200 mL	3 x 250mL glass	48 hours to filtration; 28 days to analysis	Cool ≤6°C and dark; HCl or H2SO4 to pH<2 after filtration
POC	2 - 5 L[d]	10L	48 hours to filtration; 28 days to analysis	Cool ≤6°C
Total Metals and hardness	100 mL	250 mL HDPE	48 hours until preservation	Cool ≤6°C
			6 months to analysis	Ambient; HNO3 to pH<2
Dissolved metals	100 mL	250 mL HDPE	Field filter; 48 hours until preservation	Cool ≤6°C
			6 months to analysis	Ambient; HNO_3 to pH<2 after filtration
Organochlorine pesticides	1 to 2 L	2 X 1-L amber glass	14 days to extraction	Cool ≤6°C; pH 5-9
			40 days after extraction	Cool ≤6°C
PCBs	1 to 2 L	2 X 1-L amber glass	None[b]	Cool ≤6°C

Notes:
Some criteria may differ from SWAMP guidance; however, criteria are consistent with analytical methods.
Recommendations are intended as guidance only. The selection of sample container and amount of sample required may vary per contracted laboratory sampling requirements.

°C = degrees Celsius
DOC = dissolved organic carbon
g = gram
HDPE = high-density polyethylene
L = liter
mL = milliliter
oz = ounce
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
POC = particulate organic carbon
SWAMP = California Surface Water Ambient Monitoring Program
TOC = total organic carbon
USEPA = U.S. Environmental Protection Agency
VOA = volatile organic analysis

a Volume of sediment collected must be sufficient to produce a minimum of 40 mL of porewater.
b PCB hold time was removed in SW-846, Chapter 4, Revision 4, February 2007 for aqueous and solid samples stored cool ≤6°C.
c Mercury will be analyzed prior to freezing.
d POC solids are analyzed for TOC by USEPA 9060. The volume of water collected must be sufficient to produce a minimum of 10 g of suspended sediment. Water may be field filtered.

Table 4
Sample Nomenclature Codes

Waterbody or Other Area Codes												
Actual	Outer Harbor - LA	Outer Harbor - LB	Inner Harbor - LA	Inner Harbor - LB	Consolidated Slip	Fish Harbor	Cabrillo Marina	Inner Cabrillo Beach	Eastern San Pedro Bay	Dominguez Channel	Cabrillo Pier	Angels Gate
Code	OA	OB	IA	IB	CS	FH	CM	CB	SP	DC	CP	AG

Media Codes												
Actual	Receiving Water	Porewater	Stormwater	Surface Sediment	Sediment Core	Whole Organism	Fish Fillet skin off (muscle)	Soft Tissue	Offal	Otolith	Field Blank	Equipment Rinsate Blank
Code	RW	PW	STW	SS	SC	WO	FF	ST	OF	OL	FB	EB

Organism									
Scientific Name	*Genyonemus lineatus*	*Cymatogaster aggregata*	*Atherinops affinis*	*Seriphus politus*	*Paralichthys californicus*	*Scomber japonicus*	*Paralabrax clathratus*	*Mytilus spp.*	*Polychaeta*
Common Name	White Croaker	Shiner Surfperch	Topsmelt	Queenfish	California Halibut	Chub Mackerel	Kelp Bass	Mussels	Polychaete worms
Code	WC	SS	TS	QF	CH	CM	KB	MS	PW

Organism or Composite Number	
Individual fish	1 or COMP1
Code	01 or C1

Station Number	
Station	01
Code	01

Date of Collection	
Date	1-Jul-14
Code	20140701

Depth	
Actual	0-15 cm
Code	0-15

Table 5
Frequencies and Performance Criteria for Field Quality Assurance/Quality Control Samples

Analysis Type	Field Duplicate	Field Duplicate Performance Criteria[a,b]	Field and Rinse Blank[c]	Field and Rinse Performance Criteria[d]
Total solids and conventionals	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Lipids	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Grain size	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Particle size determination for suspended solids	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Total suspended and dissolved solids	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Total and dissolved organic carbon	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Particulate organic carbon	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Total metals	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Polycyclic aromatic hydrocarbons	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Organochlorine pesticides	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
PCB Congeners	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL

Notes:
NA = not applicable
PCB = polychlorinated biphenyl
RL = reporting limit
RPD = relative percent difference
SWAMP = California Surface Water Ambient Monitoring Program

a Field duplicate RPD exceedances alone would not result in data qualification. Further evaluation into the sample collection procedures should be conducted.

b This criteria is a slight deviation from SWAMP due to the ultra low detection levels utilized for these studies.

c If low level contamination could potentially bias results, field blanks and/or rinse (equipment) blanks should be collected.

d The determination to qualify results based on field and/or rinse blank concentrations will be made by the QA Manager as part of the overall data usability assessment.

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
Conventional Parameters		
Ammonia (mg/kg)	SM 4500-NH_3 B/C/D (M)	0.20
Sulfide (mg/kg)	USEPA 376.2	0.50
Bulk density	ASTM D7263	--
Specific gravity	ASTM D854	--
Total solids (% wet weight)	SM 2540B/G / USEPA 160.3	0.1
Grain size (% retained)	ASTM D442 / SM 2560	1.0
Total organic carbon (%)	SM 5310B / USEPA 9060A	0.01% OC
Sediment porewater dissolved organic carbon (mg/L)	USEPA 9060M	0.5
Metals (µg/g or mg/kg)		
Cadmium	USEPA 6010B/6020	0.01
Chromium	USEPA 6010B/6020	0.1
Copper	USEPA 6010B/6020	0.01
Lead	USEPA 6010B/6020	0.01
Mercury	USEPA 6010B/6020/7471A/245.7/1631	0.03
Zinc	USEPA 6010B/6020	0.10
Polycyclic Aromatic Hydrocarbons (ng/g or µg/kg)		
Acenaphthene	USEPA 8270C / 8270D - SIM	20
Anthracene	USEPA 8270C / 8270D - SIM	20
Biphenyl	USEPA 8270C / 8270D - SIM	20
Naphthalene	USEPA 8270C / 8270D - SIM	20
2,6-Dimethylnaphthalene	USEPA 8270C / 8270D - SIM	20
Fluorene	USEPA 8270C / 8270D - SIM	20
1-Methylnaphthalene	USEPA 8270C / 8270D - SIM	20
2-Methylnaphthalene	USEPA 8270C / 8270D - SIM	20
1-Methylphenanthrene	USEPA 8270C / 8270D - SIM	20
Phenanthrene	USEPA 8270C / 8270D - SIM	20
Benz[a]anthracene	USEPA 8270C / 8270D - SIM	20
Benzo[a]pyrene	USEPA 8270C / 8270D - SIM	20
Benzo(e)pyrene	USEPA 8270C / 8270D - SIM	20
Chrysene	USEPA 8270C / 8270D - SIM	20
Dibenz[a,h]anthracene	USEPA 8270C / 8270D - SIM	20
Fluoranthene	USEPA 8270C / 8270D - SIM	20
Perylene	USEPA 8270C / 8270D - SIM	20
Pyrene	USEPA 8270C / 8270D - SIM	20
Organochlorine Pesticides (ng/g or µg/kg) - Low Resolution Analytical Methods		
Total Chlordane[e]	USEPA 8081A / 8270C	--
alpha-Chlordane (cis-chlordane)	USEPA 8081A / 8270C	0.5
gamma-Chlordane (trans-chlordane)	USEPA 8081A / 8270C	0.5
Oxychlordane	USEPA 8081A / 8270C	0.5
cis-Nonachlor	USEPA 8081A / 8270C	0.5
trans-Nonachlor	USEPA 8081A / 8270C	0.5
Dieldrin[f]	USEPA 8081A / 8270C	0.02
Toxaphene[f]	USEPA 8081A / 8270C	0.10
2,4'-DDD	USEPA 8081A / 8270C	1.0
2,4'-DDE	USEPA 8081A / 8270C	1.0
2,4'-DDT	USEPA 8081A / 8270C	1.0
4,4'-DDD	USEPA 8081A / 8270C	1.0
4,4'-DDE	USEPA 8081A / 8270C	1.0
4,4'-DDT	USEPA 8081A / 8270C	1.0
DDMU	USEPA 8081A / 8270C	1.0

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
Organochlorine Pesticides (ng/g or µg/kg) - High Resolution Analytical Methods		
Total Chlordane[e]	USEPA 1699	--
alpha-Chlordane (cis-chlordane)	USEPA 1699	0.5
gamma-Chlordane (trans-chlordane)	USEPA 1699	0.5
Oxychlordane	USEPA 1699	0.5
cis-Nonachlor	USEPA 1699	0.5
trans-Nonachlor	USEPA 1699	0.5
Dieldrin	USEPA 1699	0.02
Toxaphene[f]	USEPA 1699	0.10
2,4'-DDD	USEPA 1699	1.0
2,4'-DDE	USEPA 1699	1.0
2,4'-DDT	USEPA 1699	1.0
4,4'-DDD	USEPA 1699	1.0
4,4'-DDE	USEPA 1699	1.0
4,4'-DDT	USEPA 1699	1.0
4,4'-DDMU	USEPA 1699	1.0
PCB Aroclors (ng/g or µg/kg)		
Aroclor-1016	USEPA 8082 / 8270C	10.0
Aroclor-1221	USEPA 8082 / 8270C	10.0
Aroclor-1232	USEPA 8082 / 8270C	10.0
Aroclor-1242	USEPA 8082 / 8270C	10.0
Aroclor-1248	USEPA 8082 / 8270C	10.0
Aroclor-1254	USEPA 8082 / 8270C	10.0
Aroclor-1260	USEPA 8082 / 8270C	10.0
Aroclor-1262	USEPA 8082 / 8270C	10.0
Aroclor-1268	USEPA 8082 / 8270C	10.0
PCB Congeners (ng/g or µg/kg)[g] - Low Resolution Analytical Methods		
CL1-PCB-3	USEPA 8270C / 8270D-SIM	0.2
CL2-PCB-5	USEPA 8270C / 8270D-SIM	0.2
CL2-PCB-8	USEPA 8270C / 8270D-SIM	0.2
CL2-PCB-15	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-18	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-27	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-28	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-29	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-31	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-33	USEPA 8270C / 8270D-SIM	0.2
CL3-PCB-37	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-44	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-49	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-52	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-56	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-60	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-66	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-70	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-74	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-77	USEPA 8270C / 8270D-SIM	0.2
CL4-PCB-81	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-87	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-95	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-97	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-99	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-101	USEPA 8270C / 8270D-SIM	0.2

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
CL5-PCB-105	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-110	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-114	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-118	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-119	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-123	USEPA 8270C / 8270D-SIM	0.2
CL5-PCB-126	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-128	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-137	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-138	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-141	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-149	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-151	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-153	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-156	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-157	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-158	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-167	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-168	USEPA 8270C / 8270D-SIM	0.2
CL6-PCB-169	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-170	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-174	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-177	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-180	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-183	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-187	USEPA 8270C / 8270D-SIM	0.2
CL7-PCB-189	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-194	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-195	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-200	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-201	USEPA 8270C / 8270D-SIM	0.2
CL8-PCB-203	USEPA 8270C / 8270D-SIM	0.2
CL9-PCB-206	USEPA 8270C / 8270D-SIM	0.2
CL10-PCB-209	USEPA 8270C / 8270D-SIM	0.2
PCB Congeners (ng/g or µg/kg)[g] - High Resolution Analytical Methods		
CL1-PCB-1	USEPA 1668	0.0025
CL1-PCB-2	USEPA 1668	0.0025
CL1-PCB-3	USEPA 1668	0.0025
CL2-PCB-4	USEPA 1668	0.0025
CL2-PCB-5	USEPA 1668	0.0025
CL2-PCB-6	USEPA 1668	0.0025
CL2-PCB-7	USEPA 1668	0.0025
CL2-PCB-8	USEPA 1668	0.0025
CL2-PCB-9	USEPA 1668	0.0025
CL2-PCB-10	USEPA 1668	0.0025
CL2-PCB-11	USEPA 1668	0.0025
CL2-PCB-12	USEPA 1668	0.0025
CL2-PCB-13	USEPA 1668	0.0025
CL2-PCB-14	USEPA 1668	0.0025
CL2-PCB-15	USEPA 1668	0.0025
CL3-PCB-16	USEPA 1668	0.0025
CL3-PCB-17	USEPA 1668	0.0025
CL3-PCB-18	USEPA 1668	0.0025
CL3-PCB-19	USEPA 1668	0.0025

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
CL3-PCB-20	USEPA 1668	0.0025
CL3-PCB-21	USEPA 1668	0.0025
CL3-PCB-22	USEPA 1668	0.0025
CL3-PCB-23	USEPA 1668	0.0025
CL3-PCB-24	USEPA 1668	0.0025
CL3-PCB-25	USEPA 1668	0.0025
CL3-PCB-26	USEPA 1668	0.0025
CL3-PCB-27	USEPA 1668	0.0025
CL3-PCB-28	USEPA 1668	0.0025
CL3-PCB-29	USEPA 1668	0.0025
CL3-PCB-30	USEPA 1668	0.0025
CL3-PCB-31	USEPA 1668	0.0025
CL3-PCB-32	USEPA 1668	0.0025
CL3-PCB-33	USEPA 1668	0.0025
CL3-PCB-34	USEPA 1668	0.0025
CL3-PCB-35	USEPA 1668	0.0025
CL3-PCB-36	USEPA 1668	0.0025
CL3-PCB-37	USEPA 1668	0.0025
CL3-PCB-38	USEPA 1668	0.0025
CL3-PCB-39	USEPA 1668	0.0025
CL4-PCB-40	USEPA 1668	0.0025
CL4-PCB-41	USEPA 1668	0.0025
CL4-PCB-42	USEPA 1668	0.0025
CL4-PCB-43	USEPA 1668	0.0025
CL4-PCB-44	USEPA 1668	0.0025
CL4-PCB-45	USEPA 1668	0.0025
CL4-PCB-46	USEPA 1668	0.0025
CL4-PCB-47	USEPA 1668	0.0025
CL4-PCB-48	USEPA 1668	0.0025
CL4-PCB-49	USEPA 1668	0.0025
CL4-PCB-50	USEPA 1668	0.0025
CL4-PCB-51	USEPA 1668	0.0025
CL4-PCB-52	USEPA 1668	0.0025
CL4-PCB-53	USEPA 1668	0.0025
CL4-PCB-54	USEPA 1668	0.0025
CL4-PCB-55	USEPA 1668	0.0025
CL4-PCB-56	USEPA 1668	0.0025
CL4-PCB-57	USEPA 1668	0.0025
CL4-PCB-58	USEPA 1668	0.0025
CL4-PCB-59	USEPA 1668	0.0025
CL4-PCB-60	USEPA 1668	0.0025
CL4-PCB-61	USEPA 1668	0.0025
CL4-PCB-62	USEPA 1668	0.0025
CL4-PCB-63	USEPA 1668	0.0025
CL4-PCB-64	USEPA 1668	0.0025
CL4-PCB-65	USEPA 1668	0.0025
CL4-PCB-66	USEPA 1668	0.0025
CL4-PCB-67	USEPA 1668	0.0025
CL4-PCB-68	USEPA 1668	0.0025
CL4-PCB-69	USEPA 1668	0.0025
CL4-PCB-70	USEPA 1668	0.0025
CL4-PCB-71	USEPA 1668	0.0025
CL4-PCB-72	USEPA 1668	0.0025
CL4-PCB-73	USEPA 1668	0.0025
CL4-PCB-74	USEPA 1668	0.0025

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
CL4-PCB-75	USEPA 1668	0.0025
CL4-PCB-76	USEPA 1668	0.0025
CL4-PCB-77	USEPA 1668	0.0025
CL4-PCB-78	USEPA 1668	0.0025
CL4-PCB-79	USEPA 1668	0.0025
CL4-PCB-80	USEPA 1668	0.0025
CL4-PCB-81	USEPA 1668	0.0025
CL5-PCB-82	USEPA 1668	0.0025
CL5-PCB-83	USEPA 1668	0.0025
CL5-PCB-84	USEPA 1668	0.0025
CL5-PCB-85	USEPA 1668	0.0025
CL5-PCB-86	USEPA 1668	0.0025
CL5-PCB-87	USEPA 1668	0.0025
CL5-PCB-88	USEPA 1668	0.0025
CL5-PCB-89	USEPA 1668	0.0025
CL5-PCB-90	USEPA 1668	0.0025
CL5-PCB-91	USEPA 1668	0.0025
CL5-PCB-92	USEPA 1668	0.0025
CL5-PCB-93	USEPA 1668	0.0025
CL5-PCB-94	USEPA 1668	0.0025
CL5-PCB-95	USEPA 1668	0.0025
CL5-PCB-96	USEPA 1668	0.0025
CL5-PCB-97	USEPA 1668	0.0025
CL5-PCB-98	USEPA 1668	0.0025
CL5-PCB-99	USEPA 1668	0.0025
CL5-PCB-100	USEPA 1668	0.0025
CL5-PCB-101	USEPA 1668	0.0025
CL5-PCB-102	USEPA 1668	0.0025
CL5-PCB-103	USEPA 1668	0.0025
CL5-PCB-104	USEPA 1668	0.0025
CL5-PCB-105	USEPA 1668	0.0025
CL5-PCB-106	USEPA 1668	0.0025
CL5-PCB-107	USEPA 1668	0.0025
CL5-PCB-108	USEPA 1668	0.0025
CL5-PCB-109	USEPA 1668	0.0025
CL5-PCB-110	USEPA 1668	0.0025
CL5-PCB-111	USEPA 1668	0.0025
CL5-PCB-112	USEPA 1668	0.0025
CL5-PCB-113	USEPA 1668	0.0025
CL5-PCB-114	USEPA 1668	0.0025
CL5-PCB-115	USEPA 1668	0.0025
CL5-PCB-116	USEPA 1668	0.0025
CL5-PCB-117	USEPA 1668	0.0025
CL5-PCB-118	USEPA 1668	0.0025
CL5-PCB-119	USEPA 1668	0.0025
CL5-PCB-120	USEPA 1668	0.0025
CL5-PCB-121	USEPA 1668	0.0025
CL5-PCB-122	USEPA 1668	0.0025
CL5-PCB-123	USEPA 1668	0.0025
CL5-PCB-124	USEPA 1668	0.0025
CL5-PCB-125	USEPA 1668	0.0025
CL5-PCB-126	USEPA 1668	0.0025
CL5-PCB-127	USEPA 1668	0.0025
CL6-PCB-128	USEPA 1668	0.0025
CL6-PCB-129	USEPA 1668	0.0025

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
CL6-PCB-130	USEPA 1668	0.0025
CL6-PCB-131	USEPA 1668	0.0025
CL6-PCB-132	USEPA 1668	0.0025
CL6-PCB-133	USEPA 1668	0.0025
CL6-PCB-134	USEPA 1668	0.0025
CL6-PCB-135	USEPA 1668	0.0025
CL6-PCB-136	USEPA 1668	0.0025
CL6-PCB-137	USEPA 1668	0.0025
CL6-PCB-138	USEPA 1668	0.0025
CL6-PCB-139	USEPA 1668	0.0025
CL6-PCB-140	USEPA 1668	0.0025
CL6-PCB-141	USEPA 1668	0.0025
CL6-PCB-142	USEPA 1668	0.0025
CL6-PCB-143	USEPA 1668	0.0025
CL6-PCB-144	USEPA 1668	0.0025
CL6-PCB-145	USEPA 1668	0.0025
CL6-PCB-146	USEPA 1668	0.0025
CL6-PCB-147	USEPA 1668	0.0025
CL6-PCB-148	USEPA 1668	0.0025
CL6-PCB-149	USEPA 1668	0.0025
CL6-PCB-150	USEPA 1668	0.0025
CL6-PCB-151	USEPA 1668	0.0025
CL6-PCB-152	USEPA 1668	0.0025
CL6-PCB-153	USEPA 1668	0.0025
CL6-PCB-154	USEPA 1668	0.0025
CL6-PCB-155	USEPA 1668	0.0025
CL6-PCB-156	USEPA 1668	0.0025
CL6-PCB-157	USEPA 1668	0.0025
CL6-PCB-158	USEPA 1668	0.0025
CL6-PCB-159	USEPA 1668	0.0025
CL6-PCB-160	USEPA 1668	0.0025
CL6-PCB-161	USEPA 1668	0.0025
CL6-PCB-162	USEPA 1668	0.0025
CL6-PCB-163	USEPA 1668	0.0025
CL6-PCB-164	USEPA 1668	0.0025
CL6-PCB-165	USEPA 1668	0.0025
CL6-PCB-166	USEPA 1668	0.0025
CL6-PCB-167	USEPA 1668	0.0025
CL6-PCB-168	USEPA 1668	0.0025
CL6-PCB-169	USEPA 1668	0.0025
CL7-PCB-170	USEPA 1668	0.0025
CL7-PCB-171	USEPA 1668	0.0025
CL7-PCB-172	USEPA 1668	0.0025
CL7-PCB-173	USEPA 1668	0.0025
CL7-PCB-174	USEPA 1668	0.0025
CL7-PCB-175	USEPA 1668	0.0025
CL7-PCB-176	USEPA 1668	0.0025
CL7-PCB-177	USEPA 1668	0.0025
CL7-PCB-178	USEPA 1668	0.0025
CL7-PCB-179	USEPA 1668	0.0025
CL7-PCB-180	USEPA 1668	0.0025
CL7-PCB-181	USEPA 1668	0.0025
CL7-PCB-182	USEPA 1668	0.0025
CL7-PCB-183	USEPA 1668	0.0025
CL7-PCB-184	USEPA 1668	0.0025

Table 6
Sediment Analytical Methods and Target Reporting Limits

Parameter[a,b]	Analytical Method[c]	Target Reporting Limit[d]
CL7-PCB-185	USEPA 1668	0.0025
CL7-PCB-186	USEPA 1668	0.0025
CL7-PCB-187	USEPA 1668	0.0025
CL7-PCB-188	USEPA 1668	0.0025
CL7-PCB-189	USEPA 1668	0.0025
CL7-PCB-190	USEPA 1668	0.0025
CL7-PCB-191	USEPA 1668	0.0025
CL7-PCB-192	USEPA 1668	0.0025
CL7-PCB-193	USEPA 1668	0.0025
CL8-PCB-194	USEPA 1668	0.0025
CL8-PCB-195	USEPA 1668	0.0025
CL8-PCB-196	USEPA 1668	0.0025
CL8-PCB-197	USEPA 1668	0.0025
CL8-PCB-198	USEPA 1668	0.0025
CL8-PCB-199	USEPA 1668	0.0025
CL8-PCB-200	USEPA 1668	0.0025
CL8-PCB-201	USEPA 1668	0.0025
CL8-PCB-202	USEPA 1668	0.0025
CL8-PCB-203	USEPA 1668	0.0025
CL8-PCB-204	USEPA 1668	0.0025
CL8-PCB-205	USEPA 1668	0.0025
CL9-PCB-206	USEPA 1668	0.0025
CL9-PCB-207	USEPA 1668	0.0025
CL9-PCB-208	USEPA 1668	0.0025
CL10-PCB-209	USEPA 1668	0.0025

Notes:
Laboratory reporting limits are revised periodically and may change over the duration of this project. Reporting limits should be verified by each laboratory when writing Sampling and Analysis Plans.
µg/g = microgram per gram
EDL = estimated detection limit
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
ng/g = nanogram per gram
OC = organic carbon
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
RL = reporting limit
SQO = sediment quality objectives
SWAMP = California Surface Water Ambient Monitoring Program
TBD = to be determined
TMDL = Total Maximum Daily Load
USEPA = U.S. Environmental Protection Agency
wt = weight
a Specific analytes used for each study conducted for the Ports may vary by waterbody, according to the listings.
b Units in dry weight unless otherwise noted. Specific analytes used for each study conducted for the Ports may vary by waterbody, according to the listings.
c Laboratories may use different versions of recommended methods (i.e. USEPA 8270C) as long as the QA/QC elements identified in this QAPP are met.
d Matrix interference, total solid concentrations and/or dilutions due to non-target analytes may increase actual reporting limits. The method detection limit (MDL) should be at least three times lower than the reporting limit (40 CFR part 136) but will vary per instrument by MDL study.
e Total chlordane is calculated using the following compounds: alpha-chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor.
f TMDL sediment target for this compound is currently below achievable laboratory reporting limits. Results should be reported to the EDL/MDL.
g PCB co-elutions will vary by instrument and column, and may increase reporting limits for some congeners.

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
Conventionals		
Total dissolved solids (mg/L)	USEPA 160.1 / SM 2540 C	2.0
Total suspended solids (mg/L)	USEPA 160.2 / SM 2540 D	0.5
Hardness (mg $CaCO_3$ / L)[d]	SM2340B	1
Total and dissolved organic carbon (mg/L)	9060M / SM 5310 D	0.6
Particulate organic carbon (mg/L)	9060 Modified/Lloyd Kahn with filtrate/USEPA 440	0.1
Particle size determination (%)	Laser diffraction (ASTM D4464M) or SSC (ASTM 3977)	0.1
Water Total and Dissolved Metals (µg/L)		
Cadmium	USEPA 6010A/6020/200.8/1640	0.01
Chromium	USEPA 6010A/6020/200.8/1640	0.1
Copper	USEPA 6010A/6020/200.8/1640	0.01
Lead	USEPA 6010A/6020/200.8/1640	0.01
Mercury	USEPA 7470A/245.7/1631	0.0002
Zinc	USEPA 6010A/6020/200.8/1640	0.10
Organochlorine Pesticides (ng/L) - Low Resolution Analytical Methods		
Total Chlordane[e]	USEPA 8081A / 625	--
alpha-Chlordane (cis-chlordane)	USEPA 8081A / 625	0.50
gamma-Chlordane (trans-chlordane)	USEPA 8081A / 625	0.50
Oxychlordane	USEPA 8081A / 625	0.50
cis-Nonachlor	USEPA 8081A / 625	0.50
trans-Nonachlor	USEPA 8081A / 625	0.50
Dieldrin	USEPA 8081A / 625	0.10
Toxaphene	USEPA 8081A / 625	2.0
2,4'-DDD	USEPA 8081A / 625	0.50
2,4'-DDE	USEPA 8081A / 625	0.50
2,4'-DDT	USEPA 8081A / 625	0.50
4,4'-DDD	USEPA 8081A / 625	0.50
4,4'-DDE	USEPA 8081A / 625	0.50
4,4'-DDT	USEPA 8081A / 625	0.50
4,4'-DDMU	USEPA 8081A / 625	0.50
Organochlorine Pesticides (ng/L) - High Resolution Analytical Method		
Total Chlordane[e]	USEPA 1699	--
alpha-Chlordane (cis-chlordane)	USEPA 1699	0.50
gamma-Chlordane (trans-chlordane)	USEPA 1699	0.50
Oxychlordane	USEPA 1699	0.50
cis-Nonachlor	USEPA 1699	0.50
trans-Nonachlor	USEPA 1699	0.50
Dieldrin	USEPA 1699	0.10
Toxaphene	USEPA 1699	2.0
2,4'-DDD	USEPA 1699	0.50
2,4'-DDE	USEPA 1699	0.50

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
2,4'-DDT	USEPA 1699	0.50
4,4'-DDD	USEPA 1699	0.50
4,4'-DDE	USEPA 1699	0.50
4,4'-DDT	USEPA 1699	0.50
4,4'-DDMU	USEPA 1699	0.50
PCB Aroclors (ng/L) - Low Resolution Analytical Method		
Aroclor-1016	USEPA 8082 / 625	500
Aroclor-1221	USEPA 8082 / 625	500
Aroclor-1232	USEPA 8082 / 625	500
Aroclor-1242	USEPA 8082 / 625	500
Aroclor-1248	USEPA 8082 / 625	500
Aroclor-1254	USEPA 8082 / 625	500
Aroclor-1260	USEPA 8082 / 625	500
Aroclor-1262	USEPA 8082 / 625	500
Aroclor-1268	USEPA 8082 / 625	500
PCB Congeners (ng/L)[f] - Low Resolution Analytical Methods		
CL1-PCB-3	USEPA 8270C (SIM or TQ) / 625	0.1
CL2-PCB-5	USEPA 8270C (SIM or TQ) / 625	0.1
CL2-PCB-8	USEPA 8270C (SIM or TQ) / 625	0.1
CL2-PCB-15	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-18	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-27	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-28	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-29	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-31	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-33	USEPA 8270C (SIM or TQ) / 625	0.1
CL3-PCB-37	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-44	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-49	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-52	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-56	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-60	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-66	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-70	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-74	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-77	USEPA 8270C (SIM or TQ) / 625	0.1
CL4-PCB-81	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-87	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-95	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-97	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-99	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-101	USEPA 8270C (SIM or TQ) / 625	0.1

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL5-PCB-105	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-110	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-114	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-118	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-119	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-123	USEPA 8270C (SIM or TQ) / 625	0.1
CL5-PCB-126	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-128	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-137	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-138	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-141	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-149	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-151	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-153	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-156	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-157	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-158	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-167	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-168	USEPA 8270C (SIM or TQ) / 625	0.1
CL6-PCB-169	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-170	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-174	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-177	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-180	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-183	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-187	USEPA 8270C (SIM or TQ) / 625	0.1
CL7-PCB-189	USEPA 8270C (SIM or TQ) / 625	0.1
CL8-PCB-194	USEPA 8270C (SIM or TQ) / 625	0.1
CL8-PCB-195	USEPA 8270C (SIM or TQ) / 625	0.1
CL8-PCB-200	USEPA 8270C (SIM or TQ) / 625	0.1
CL8-PCB-201	USEPA 8270C (SIM or TQ) / 625	0.1
CL8-PCB-203	USEPA 8270C (SIM or TQ) / 625	0.1
CL9-PCB-206	USEPA 8270C (SIM or TQ) / 625	0.1
CL10-PCB-209	USEPA 8270C (SIM or TQ) / 625	0.1
PCB Congeners (ng/L) [f,g] - High Resolution Analytical Method		
CL1-PCB-1	USEPA 1668B	0.005
CL1-PCB-2	USEPA 1668B	0.005
CL1-PCB-3	USEPA 1668B	0.005
CL2-PCB-4	USEPA 1668B	0.005
CL2-PCB-5	USEPA 1668B	0.005
CL2-PCB-6	USEPA 1668B	0.005
CL2-PCB-7	USEPA 1668B	0.005
CL2-PCB-8	USEPA 1668B	0.005

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL2-PCB-9	USEPA 1668B	0.005
CL2-PCB-10	USEPA 1668B	0.005
CL2-PCB-11	USEPA 1668B	0.005
CL2-PCB-12	USEPA 1668B	0.005
CL2-PCB-13	USEPA 1668B	0.005
CL2-PCB-14	USEPA 1668B	0.005
CL2-PCB-15	USEPA 1668B	0.005
CL3-PCB-16	USEPA 1668B	0.005
CL3-PCB-17	USEPA 1668B	0.005
CL3-PCB-18	USEPA 1668B	0.005
CL3-PCB-19	USEPA 1668B	0.005
CL3-PCB-20	USEPA 1668B	0.005
CL3-PCB-21	USEPA 1668B	0.005
CL3-PCB-22	USEPA 1668B	0.005
CL3-PCB-23	USEPA 1668B	0.005
CL3-PCB-24	USEPA 1668B	0.005
CL3-PCB-25	USEPA 1668B	0.005
CL3-PCB-26	USEPA 1668B	0.005
CL3-PCB-27	USEPA 1668B	0.005
CL3-PCB-28	USEPA 1668B	0.005
CL3-PCB-29	USEPA 1668B	0.005
CL3-PCB-30	USEPA 1668B	0.005
CL3-PCB-31	USEPA 1668B	0.005
CL3-PCB-32	USEPA 1668B	0.005
CL3-PCB-33	USEPA 1668B	0.005
CL3-PCB-34	USEPA 1668B	0.005
CL3-PCB-35	USEPA 1668B	0.005
CL3-PCB-36	USEPA 1668B	0.005
CL3-PCB-37	USEPA 1668B	0.005
CL3-PCB-38	USEPA 1668B	0.005
CL3-PCB-39	USEPA 1668B	0.005
CL4-PCB-40	USEPA 1668B	0.005
CL4-PCB-41	USEPA 1668B	0.005
CL4-PCB-42	USEPA 1668B	0.005
CL4-PCB-43	USEPA 1668B	0.005
CL4-PCB-44	USEPA 1668B	0.005
CL4-PCB-45	USEPA 1668B	0.005
CL4-PCB-46	USEPA 1668B	0.005
CL4-PCB-47	USEPA 1668B	0.005
CL4-PCB-48	USEPA 1668B	0.005
CL4-PCB-49	USEPA 1668B	0.005
CL4-PCB-50	USEPA 1668B	0.005
CL4-PCB-51	USEPA 1668B	0.005

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL4-PCB-52	USEPA 1668B	0.005
CL4-PCB-53	USEPA 1668B	0.005
CL4-PCB-54	USEPA 1668B	0.005
CL4-PCB-55	USEPA 1668B	0.005
CL4-PCB-56	USEPA 1668B	0.005
CL4-PCB-57	USEPA 1668B	0.005
CL4-PCB-58	USEPA 1668B	0.005
CL4-PCB-59	USEPA 1668B	0.005
CL4-PCB-60	USEPA 1668B	0.005
CL4-PCB-61	USEPA 1668B	0.005
CL4-PCB-62	USEPA 1668B	0.005
CL4-PCB-63	USEPA 1668B	0.005
CL4-PCB-64	USEPA 1668B	0.005
CL4-PCB-65	USEPA 1668B	0.005
CL4-PCB-66	USEPA 1668B	0.005
CL4-PCB-67	USEPA 1668B	0.005
CL4-PCB-68	USEPA 1668B	0.005
CL4-PCB-69	USEPA 1668B	0.005
CL4-PCB-70	USEPA 1668B	0.005
CL4-PCB-71	USEPA 1668B	0.005
CL4-PCB-72	USEPA 1668B	0.005
CL4-PCB-73	USEPA 1668B	0.005
CL4-PCB-74	USEPA 1668B	0.005
CL4-PCB-75	USEPA 1668B	0.005
CL4-PCB-76	USEPA 1668B	0.005
CL4-PCB-77	USEPA 1668B	0.005
CL4-PCB-78	USEPA 1668B	0.005
CL4-PCB-79	USEPA 1668B	0.005
CL4-PCB-80	USEPA 1668B	0.005
CL4-PCB-81	USEPA 1668B	0.005
CL5-PCB-82	USEPA 1668B	0.005
CL5-PCB-83	USEPA 1668B	0.005
CL5-PCB-84	USEPA 1668B	0.005
CL5-PCB-85	USEPA 1668B	0.005
CL5-PCB-86	USEPA 1668B	0.005
CL5-PCB-87	USEPA 1668B	0.005
CL5-PCB-88	USEPA 1668B	0.005
CL5-PCB-89	USEPA 1668B	0.005
CL5-PCB-90	USEPA 1668B	0.005
CL5-PCB-91	USEPA 1668B	0.005
CL5-PCB-92	USEPA 1668B	0.005
CL5-PCB-93	USEPA 1668B	0.005
CL5-PCB-94	USEPA 1668B	0.005
CL5-PCB-95	USEPA 1668B	0.005

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL5-PCB-96	USEPA 1668B	0.005
CL5-PCB-97	USEPA 1668B	0.005
CL5-PCB-98	USEPA 1668B	0.005
CL5-PCB-99	USEPA 1668B	0.005
CL5-PCB-100	USEPA 1668B	0.005
CL5-PCB-101	USEPA 1668B	0.005
CL5-PCB-102	USEPA 1668B	0.005
CL5-PCB-103	USEPA 1668B	0.005
CL5-PCB-104	USEPA 1668B	0.005
CL5-PCB-105	USEPA 1668B	0.005
CL5-PCB-106	USEPA 1668B	0.005
CL5-PCB-107	USEPA 1668B	0.005
CL5-PCB-108	USEPA 1668B	0.005
CL5-PCB-109	USEPA 1668B	0.005
CL5-PCB-110	USEPA 1668B	0.005
CL5-PCB-111	USEPA 1668B	0.005
CL5-PCB-112	USEPA 1668B	0.005
CL5-PCB-113	USEPA 1668B	0.005
CL5-PCB-114	USEPA 1668B	0.005
CL5-PCB-115	USEPA 1668B	0.005
CL5-PCB-116	USEPA 1668B	0.005
CL5-PCB-117	USEPA 1668B	0.005
CL5-PCB-118	USEPA 1668B	0.005
CL5-PCB-119	USEPA 1668B	0.005
CL5-PCB-120	USEPA 1668B	0.005
CL5-PCB-121	USEPA 1668B	0.005
CL5-PCB-122	USEPA 1668B	0.005
CL5-PCB-123	USEPA 1668B	0.005
CL5-PCB-124	USEPA 1668B	0.005
CL5-PCB-125	USEPA 1668B	0.005
CL5-PCB-126	USEPA 1668B	0.005
CL5-PCB-127	USEPA 1668B	0.005
CL6-PCB-128	USEPA 1668B	0.005
CL6-PCB-129	USEPA 1668B	0.005
CL6-PCB-130	USEPA 1668B	0.005
CL6-PCB-131	USEPA 1668B	0.005
CL6-PCB-132	USEPA 1668B	0.005
CL6-PCB-133	USEPA 1668B	0.005
CL6-PCB-134	USEPA 1668B	0.005
CL6-PCB-135	USEPA 1668B	0.005
CL6-PCB-136	USEPA 1668B	0.005
CL6-PCB-137	USEPA 1668B	0.005
CL6-PCB-138	USEPA 1668B	0.005
CL6-PCB-139	USEPA 1668B	0.005

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL6-PCB-140	USEPA 1668B	0.005
CL6-PCB-141	USEPA 1668B	0.005
CL6-PCB-142	USEPA 1668B	0.005
CL6-PCB-143	USEPA 1668B	0.005
CL6-PCB-144	USEPA 1668B	0.005
CL6-PCB-145	USEPA 1668B	0.005
CL6-PCB-146	USEPA 1668B	0.005
CL6-PCB-147	USEPA 1668B	0.005
CL6-PCB-148	USEPA 1668B	0.005
CL6-PCB-149	USEPA 1668B	0.005
CL6-PCB-150	USEPA 1668B	0.005
CL6-PCB-151	USEPA 1668B	0.005
CL6-PCB-152	USEPA 1668B	0.005
CL6-PCB-153	USEPA 1668B	0.005
CL6-PCB-154	USEPA 1668B	0.005
CL6-PCB-155	USEPA 1668B	0.005
CL6-PCB-156	USEPA 1668B	0.005
CL6-PCB-157	USEPA 1668B	0.005
CL6-PCB-158	USEPA 1668B	0.005
CL6-PCB-159	USEPA 1668B	0.005
CL6-PCB-160	USEPA 1668B	0.005
CL6-PCB-161	USEPA 1668B	0.005
CL6-PCB-162	USEPA 1668B	0.005
CL6-PCB-163	USEPA 1668B	0.005
CL6-PCB-164	USEPA 1668B	0.005
CL6-PCB-165	USEPA 1668B	0.005
CL6-PCB-166	USEPA 1668B	0.005
CL6-PCB-167	USEPA 1668B	0.005
CL6-PCB-168	USEPA 1668B	0.005
CL6-PCB-169	USEPA 1668B	0.005
CL7-PCB-170	USEPA 1668B	0.005
CL7-PCB-171	USEPA 1668B	0.005
CL7-PCB-172	USEPA 1668B	0.005
CL7-PCB-173	USEPA 1668B	0.005
CL7-PCB-174	USEPA 1668B	0.005
CL7-PCB-175	USEPA 1668B	0.005
CL7-PCB-176	USEPA 1668B	0.005
CL7-PCB-177	USEPA 1668B	0.005
CL7-PCB-178	USEPA 1668B	0.005
CL7-PCB-179	USEPA 1668B	0.005
CL7-PCB-180	USEPA 1668B	0.005
CL7-PCB-181	USEPA 1668B	0.005
CL7-PCB-182	USEPA 1668B	0.005

Table 7
Water Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL7-PCB-183	USEPA 1668B	0.005
CL7-PCB-184	USEPA 1668B	0.005
CL7-PCB-185	USEPA 1668B	0.005
CL7-PCB-186	USEPA 1668B	0.005
CL7-PCB-187	USEPA 1668B	0.005
CL7-PCB-188	USEPA 1668B	0.005
CL7-PCB-189	USEPA 1668B	0.005
CL7-PCB-190	USEPA 1668B	0.005
CL7-PCB-191	USEPA 1668B	0.005
CL7-PCB-192	USEPA 1668B	0.005
CL7-PCB-193	USEPA 1668B	0.005
CL8-PCB-194	USEPA 1668B	0.005
CL8-PCB-195	USEPA 1668B	0.005
CL8-PCB-196	USEPA 1668B	0.005
CL8-PCB-197	USEPA 1668B	0.005
CL8-PCB-198	USEPA 1668B	0.005
CL8-PCB-199	USEPA 1668B	0.005
CL8-PCB-200	USEPA 1668B	0.005
CL8-PCB-201	USEPA 1668B	0.005
CL8-PCB-202	USEPA 1668B	0.005
CL8-PCB-203	USEPA 1668B	0.005
CL8-PCB-204	USEPA 1668B	0.005
CL8-PCB-205	USEPA 1668B	0.005
CL9-PCB-206	USEPA 1668B	0.005
CL9-PCB-207	USEPA 1668B	0.005
CL9-PCB-208	USEPA 1668B	0.005
CL10-PCB-209	USEPA 1668B	0.005

Notes:

High volume alternative sampling techniques may be used to achieve lower reporting limits for these analyses.

Laboratory reporting limits are revised periodically, and may change over the duration of this project.

Reporting limits should be verified by each lab when writing Sampling and Analysis Plans.

mg/L = milligram per liter

µg/L = microgram per liter

ng/L = nanogram per liter

pg/L = picogram per liter

EDL = estimated detection limit

MDL = method detection limit

RL = reporting limit

PCB = polychlorinated biphenyl

TBD = to be determined

wt = weight

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
Conventionals (%)		
Lipids	NOAA 1993a / Gravimetric	0.5
Organochlorine Pesticides (ng/g or µg/kg wet weight) - Low Resolution Analytical Methods		
Total Chlordane[d]	USEPA 8081A / 8270C / 8270D TQ	--
alpha-Chlordane (cis-chlordane)	USEPA 8081A / 8270C / 8270D TQ	4.0
gamma-Chlordane (trans-chlordane)	USEPA 8081A / 8270C / 8270D TQ	4.0
Oxychlordane	USEPA 8081A / 8270C / 8270D TQ	2.0
cis-Nonachlor	USEPA 8081A / 8270C / 8270D TQ	4.0
trans-Nonachlor	USEPA 8081A / 8270C / 8270D TQ	2.0
Dieldrin[f]	USEPA 8081A / 8270C / 8270D TQ	0.46
Toxaphene[f]	USEPA 8081A / 8270C / 8270D TQ	6.1
2,4'-DDD	USEPA 8081A / 8270C / 8270D TQ	4.0
2,4'-DDE	USEPA 8081A / 8270C / 8270D TQ	4.0
2,4'-DDT	USEPA 8081A / 8270C / 8270D TQ	6.0
4,4'-DDD	USEPA 8081A / 8270C / 8270D TQ	4.0
4,4'-DDE	USEPA 8081A / 8270C / 8270D TQ	4.0
4,4'-DDT	USEPA 8081A / 8270C / 8270D TQ	10.0
4,4'-DDMU	USEPA 8081A / 8270C / 8270D TQ	10.0
Organochlorine Pesticides (ng/g or µg/kg wet weight) - High Resolution Analytical Method		
Total Chlordane[d]	USEPA 1699	--
alpha-Chlordane (cis-chlordane)	USEPA 1699	4.0
gamma-Chlordane (trans-chlordane)	USEPA 1699	4.0
Oxychlordane	USEPA 1699	2.0
cis-Nonachlor	USEPA 1699	4.0
trans-Nonachlor	USEPA 1699	2.0
Dieldrin[f]	USEPA 1699	0.46
Toxaphene	USEPA 1699	6.1
2,4'-DDD	USEPA 1699	4.0
2,4'-DDE	USEPA 1699	4.0
2,4'-DDT	USEPA 1699	6.0
4,4'-DDD	USEPA 1699	4.0
4,4'-DDE	USEPA 1699	4.0
4,4'-DDT	USEPA 1699	10.0
4,4'-DDMU	USEPA 1699	10.0
PCB Aroclors (ng/g or µg/kg)		
Aroclor-1016	USEPA 8082 / 8270C	2.0
Aroclor-1221	USEPA 8082 / 8270C	2.0
Aroclor-1232	USEPA 8082 / 8270C	2.0
Aroclor-1242	USEPA 8082 / 8270C	2.0
Aroclor-1248	USEPA 8082 / 8270C	2.0
Aroclor-1254	USEPA 8082 / 8270C	2.0
Aroclor-1260	USEPA 8082 / 8270C	2.0
Aroclor-1262	USEPA 8082 / 8270C	2.0
Aroclor-1268	USEPA 8082 / 8270C	2.0
PCB Congeners (ng/g or µg/kg wet weight) - Low Resolution Analytical Methods		
CL1-PCB-3	USEPA 8270C / 8270D	0.4
CL2-PCB-5	USEPA 8270C / 8270D	0.4

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL2-PCB-8	USEPA 8270C / 8270D	0.4
CL2-PCB-15	USEPA 8270C / 8270D	0.4
CL3-PCB-18	USEPA 8270C / 8270D	0.4
CL3-PCB-27	USEPA 8270C / 8270D	0.4
CL3-PCB-28	USEPA 8270C / 8270D	0.4
CL3-PCB-29	USEPA 8270C / 8270D	0.4
CL3-PCB-31	USEPA 8270C / 8270D	0.4
CL3-PCB-33	USEPA 8270C / 8270D	0.4
CL3-PCB-37	USEPA 8270C / 8270D	0.4
CL4-PCB-44	USEPA 8270C / 8270D	0.4
CL4-PCB-49	USEPA 8270C / 8270D	0.4
CL4-PCB-52	USEPA 8270C / 8270D	0.4
CL4-PCB-56	USEPA 8270C / 8270D	0.4
CL4-PCB-60	USEPA 8270C / 8270D	0.4
CL4-PCB-66	USEPA 8270C / 8270D	0.4
CL4-PCB-70	USEPA 8270C / 8270D	0.4
CL4-PCB-74	USEPA 8270C / 8270D	0.4
CL4-PCB-77	USEPA 8270C / 8270D	0.4
CL4-PCB-81	USEPA 8270C / 8270D	0.4
CL5-PCB-87	USEPA 8270C / 8270D	0.4
CL5-PCB-95	USEPA 8270C / 8270D	0.4
CL5-PCB-97	USEPA 8270C / 8270D	0.4
CL5-PCB-99	USEPA 8270C / 8270D	0.4
CL5-PCB-101	USEPA 8270C / 8270D	0.4
CL5-PCB-105	USEPA 8270C / 8270D	0.4
CL5-PCB-110	USEPA 8270C / 8270D	0.4
CL5-PCB-114	USEPA 8270C / 8270D	0.4
CL5-PCB-118	USEPA 8270C / 8270D	0.4
CL5-PCB-119	USEPA 8270C / 8270D	0.4
CL5-PCB-123	USEPA 8270C / 8270D	0.4
CL5-PCB-126	USEPA 8270C / 8270D	0.4
CL6-PCB-128	USEPA 8270C / 8270D	0.4
CL6-PCB-137	USEPA 8270C / 8270D	0.4
CL6-PCB-138	USEPA 8270C / 8270D	0.4
CL6-PCB-141	USEPA 8270C / 8270D	0.4
CL6-PCB-149	USEPA 8270C / 8270D	0.4
CL6-PCB-151	USEPA 8270C / 8270D	0.4
CL6-PCB-153	USEPA 8270C / 8270D	0.4
CL6-PCB-156	USEPA 8270C / 8270D	0.4
CL6-PCB-157	USEPA 8270C / 8270D	0.4
CL6-PCB-158	USEPA 8270C / 8270D	0.4
CL6-PCB-167	USEPA 8270C / 8270D	0.4
CL6-PCB-168	USEPA 8270C / 8270D	0.4
CL6-PCB-169	USEPA 8270C / 8270D	0.4
CL7-PCB-170	USEPA 8270C / 8270D	0.4
CL7-PCB-174	USEPA 8270C / 8270D	0.4
CL7-PCB-177	USEPA 8270C / 8270D	0.4

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL7-PCB-180	USEPA 8270C / 8270D	0.4
CL7-PCB-183	USEPA 8270C / 8270D	0.4
CL7-PCB-187	USEPA 8270C / 8270D	0.4
CL7-PCB-189	USEPA 8270C / 8270D	20.0
CL8-PCB-194	USEPA 8270C / 8270D	0.4
CL8-PCB-195	USEPA 8270C / 8270D	0.4
CL8-PCB-200	USEPA 8270C / 8270D	0.4
CL8-PCB-201	USEPA 8270C / 8270D	0.4
CL8-PCB-203	USEPA 8270C / 8270D	0.4
CL9-PCB-206	USEPA 8270C / 8270D	0.4
CL10-PCB-209	USEPA 8270C / 8270D	0.4
PCB Congeners (ng/g or µg/kg)[e] - High Resolution Analytical Methods		
CL1-PCB-1	USEPA 1668	0.001
CL1-PCB-2	USEPA 1668	0.001
CL1-PCB-3	USEPA 1668	0.001
CL2-PCB-4	USEPA 1668	0.001
CL2-PCB-5	USEPA 1668	0.001
CL2-PCB-6	USEPA 1668	0.001
CL2-PCB-7	USEPA 1668	0.001
CL2-PCB-8	USEPA 1668	0.001
CL2-PCB-9	USEPA 1668	0.001
CL2-PCB-10	USEPA 1668	0.001
CL2-PCB-11	USEPA 1668	0.001
CL2-PCB-12	USEPA 1668	0.001
CL2-PCB-13	USEPA 1668	0.001
CL2-PCB-14	USEPA 1668	0.001
CL2-PCB-15	USEPA 1668	0.001
CL3-PCB-16	USEPA 1668	0.001
CL3-PCB-17	USEPA 1668	0.001
CL3-PCB-18	USEPA 1668	0.001
CL3-PCB-19	USEPA 1668	0.001
CL3-PCB-20	USEPA 1668	0.001
CL3-PCB-21	USEPA 1668	0.001
CL3-PCB-22	USEPA 1668	0.001
CL3-PCB-23	USEPA 1668	0.001
CL3-PCB-24	USEPA 1668	0.001
CL3-PCB-25	USEPA 1668	0.001
CL3-PCB-26	USEPA 1668	0.001
CL3-PCB-27	USEPA 1668	0.001
CL3-PCB-28	USEPA 1668	0.001
CL3-PCB-29	USEPA 1668	0.001
CL3-PCB-30	USEPA 1668	0.001
CL3-PCB-31	USEPA 1668	0.001
CL3-PCB-32	USEPA 1668	0.001
CL3-PCB-33	USEPA 1668	0.001
CL3-PCB-34	USEPA 1668	0.001
CL3-PCB-35	USEPA 1668	0.001
CL3-PCB-36	USEPA 1668	0.001
CL3-PCB-37	USEPA 1668	0.001
CL3-PCB-38	USEPA 1668	0.001

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL3-PCB-39	USEPA 1668	0.001
CL4-PCB-40	USEPA 1668	0.001
CL4-PCB-41	USEPA 1668	0.001
CL4-PCB-42	USEPA 1668	0.001
CL4-PCB-43	USEPA 1668	0.001
CL4-PCB-44	USEPA 1668	0.001
CL4-PCB-45	USEPA 1668	0.001
CL4-PCB-46	USEPA 1668	0.001
CL4-PCB-47	USEPA 1668	0.001
CL4-PCB-48	USEPA 1668	0.001
CL4-PCB-49	USEPA 1668	0.001
CL4-PCB-50	USEPA 1668	0.001
CL4-PCB-51	USEPA 1668	0.001
CL4-PCB-52	USEPA 1668	0.001
CL4-PCB-53	USEPA 1668	0.001
CL4-PCB-54	USEPA 1668	0.001
CL4-PCB-55	USEPA 1668	0.001
CL4-PCB-56	USEPA 1668	0.001
CL4-PCB-57	USEPA 1668	0.001
CL4-PCB-58	USEPA 1668	0.001
CL4-PCB-59	USEPA 1668	0.001
CL4-PCB-60	USEPA 1668	0.001
CL4-PCB-61	USEPA 1668	0.001
CL4-PCB-62	USEPA 1668	0.001
CL4-PCB-63	USEPA 1668	0.001
CL4-PCB-64	USEPA 1668	0.001
CL4-PCB-65	USEPA 1668	0.001
CL4-PCB-66	USEPA 1668	0.001
CL4-PCB-67	USEPA 1668	0.001
CL4-PCB-68	USEPA 1668	0.001
CL4-PCB-69	USEPA 1668	0.001
CL4-PCB-70	USEPA 1668	0.001
CL4-PCB-71	USEPA 1668	0.001
CL4-PCB-72	USEPA 1668	0.001
CL4-PCB-73	USEPA 1668	0.001
CL4-PCB-74	USEPA 1668	0.001
CL4-PCB-75	USEPA 1668	0.001
CL4-PCB-76	USEPA 1668	0.001
CL4-PCB-77	USEPA 1668	0.001
CL4-PCB-78	USEPA 1668	0.001
CL4-PCB-79	USEPA 1668	0.001
CL4-PCB-80	USEPA 1668	0.001
CL4-PCB-81	USEPA 1668	0.001
CL5-PCB-82	USEPA 1668	0.001
CL5-PCB-83	USEPA 1668	0.001
CL5-PCB-84	USEPA 1668	0.001
CL5-PCB-85	USEPA 1668	0.001
CL5-PCB-86	USEPA 1668	0.001
CL5-PCB-87	USEPA 1668	0.001
CL5-PCB-88	USEPA 1668	0.001

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL5-PCB-89	USEPA 1668	0.001
CL5-PCB-90	USEPA 1668	0.001
CL5-PCB-91	USEPA 1668	0.001
CL5-PCB-92	USEPA 1668	0.001
CL5-PCB-93	USEPA 1668	0.001
CL5-PCB-94	USEPA 1668	0.001
CL5-PCB-95	USEPA 1668	0.001
CL5-PCB-96	USEPA 1668	0.001
CL5-PCB-97	USEPA 1668	0.001
CL5-PCB-98	USEPA 1668	0.001
CL5-PCB-99	USEPA 1668	0.001
CL5-PCB-100	USEPA 1668	0.001
CL5-PCB-101	USEPA 1668	0.001
CL5-PCB-102	USEPA 1668	0.001
CL5-PCB-103	USEPA 1668	0.001
CL5-PCB-104	USEPA 1668	0.001
CL5-PCB-105	USEPA 1668	0.001
CL5-PCB-106	USEPA 1668	0.001
CL5-PCB-107	USEPA 1668	0.001
CL5-PCB-108	USEPA 1668	0.001
CL5-PCB-109	USEPA 1668	0.001
CL5-PCB-110	USEPA 1668	0.001
CL5-PCB-111	USEPA 1668	0.001
CL5-PCB-112	USEPA 1668	0.001
CL5-PCB-113	USEPA 1668	0.001
CL5-PCB-114	USEPA 1668	0.001
CL5-PCB-115	USEPA 1668	0.001
CL5-PCB-116	USEPA 1668	0.001
CL5-PCB-117	USEPA 1668	0.001
CL5-PCB-118	USEPA 1668	0.001
CL5-PCB-119	USEPA 1668	0.001
CL5-PCB-120	USEPA 1668	0.001
CL5-PCB-121	USEPA 1668	0.001
CL5-PCB-122	USEPA 1668	0.001
CL5-PCB-123	USEPA 1668	0.001
CL5-PCB-124	USEPA 1668	0.001
CL5-PCB-125	USEPA 1668	0.001
CL5-PCB-126	USEPA 1668	0.001
CL5-PCB-127	USEPA 1668	0.001
CL6-PCB-128	USEPA 1668	0.001
CL6-PCB-129	USEPA 1668	0.001
CL6-PCB-130	USEPA 1668	0.001
CL6-PCB-131	USEPA 1668	0.001
CL6-PCB-132	USEPA 1668	0.001
CL6-PCB-133	USEPA 1668	0.001
CL6-PCB-134	USEPA 1668	0.001
CL6-PCB-135	USEPA 1668	0.001
CL6-PCB-136	USEPA 1668	0.001
CL6-PCB-137	USEPA 1668	0.001

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL6-PCB-138	USEPA 1668	0.001
CL6-PCB-139	USEPA 1668	0.001
CL6-PCB-140	USEPA 1668	0.001
CL6-PCB-141	USEPA 1668	0.001
CL6-PCB-142	USEPA 1668	0.001
CL6-PCB-143	USEPA 1668	0.001
CL6-PCB-144	USEPA 1668	0.001
CL6-PCB-145	USEPA 1668	0.001
CL6-PCB-146	USEPA 1668	0.001
CL6-PCB-147	USEPA 1668	0.001
CL6-PCB-148	USEPA 1668	0.001
CL6-PCB-149	USEPA 1668	0.001
CL6-PCB-150	USEPA 1668	0.001
CL6-PCB-151	USEPA 1668	0.001
CL6-PCB-152	USEPA 1668	0.001
CL6-PCB-153	USEPA 1668	0.001
CL6-PCB-154	USEPA 1668	0.001
CL6-PCB-155	USEPA 1668	0.001
CL6-PCB-156	USEPA 1668	0.001
CL6-PCB-157	USEPA 1668	0.001
CL6-PCB-158	USEPA 1668	0.001
CL6-PCB-159	USEPA 1668	0.001
CL6-PCB-160	USEPA 1668	0.001
CL6-PCB-161	USEPA 1668	0.001
CL6-PCB-162	USEPA 1668	0.001
CL6-PCB-163	USEPA 1668	0.001
CL6-PCB-164	USEPA 1668	0.001
CL6-PCB-165	USEPA 1668	0.001
CL6-PCB-166	USEPA 1668	0.001
CL6-PCB-167	USEPA 1668	0.001
CL6-PCB-168	USEPA 1668	0.001
CL6-PCB-169	USEPA 1668	0.001
CL7-PCB-170	USEPA 1668	0.001
CL7-PCB-171	USEPA 1668	0.001
CL7-PCB-172	USEPA 1668	0.001
CL7-PCB-173	USEPA 1668	0.001
CL7-PCB-174	USEPA 1668	0.001
CL7-PCB-175	USEPA 1668	0.001
CL7-PCB-176	USEPA 1668	0.001
CL7-PCB-177	USEPA 1668	0.001
CL7-PCB-178	USEPA 1668	0.001
CL7-PCB-179	USEPA 1668	0.001
CL7-PCB-180	USEPA 1668	0.001
CL7-PCB-181	USEPA 1668	0.001
CL7-PCB-182	USEPA 1668	0.001
CL7-PCB-183	USEPA 1668	0.001
CL7-PCB-184	USEPA 1668	0.001
CL7-PCB-185	USEPA 1668	0.001
CL7-PCB-186	USEPA 1668	0.001

Table 8
Tissue Analytical Methods and Target Reporting Limits

Parameter[a]	Analytical Method[b]	Target Reporting Limit[c]
CL7-PCB-187	USEPA 1668	0.001
CL7-PCB-188	USEPA 1668	0.001
CL7-PCB-189	USEPA 1668	0.001
CL7-PCB-190	USEPA 1668	0.001
CL7-PCB-191	USEPA 1668	0.001
CL7-PCB-192	USEPA 1668	0.001
CL7-PCB-193	USEPA 1668	0.001
CL8-PCB-194	USEPA 1668	0.001
CL8-PCB-195	USEPA 1668	0.001
CL8-PCB-196	USEPA 1668	0.001
CL8-PCB-197	USEPA 1668	0.001
CL8-PCB-198	USEPA 1668	0.001
CL8-PCB-199	USEPA 1668	0.001
CL8-PCB-200	USEPA 1668	0.001
CL8-PCB-201	USEPA 1668	0.001
CL8-PCB-202	USEPA 1668	0.001
CL8-PCB-203	USEPA 1668	0.001
CL8-PCB-204	USEPA 1668	0.001
CL8-PCB-205	USEPA 1668	0.001
CL9-PCB-206	USEPA 1668	0.001
CL9-PCB-207	USEPA 1668	0.001
CL9-PCB-208	USEPA 1668	0.001
CL10-PCB-209	USEPA 1668	0.001

Notes:

Data will be reported uncorrected for lipids or moisture content.

Laboratory reporting limits are revised periodically, and may change over the duration of this project. Reporting limits should be verified by each lab when

CFR = Code of Federal Regulations

ng/g = nanogram per gram

MDL = method detection limit

N/A = not applicable

NOAA = National Oceanic and Atmospheric Administration

QAPP = Quality Assurance Project Plan

QA/QC = quality assurance/quality control

RL = reporting limit

PCB = polychlorinated biphenyl

SWAMP = California Surface Water Ambient Monitoring Program

TBD = to be determined

USEPA = U.S. Environmental Protection Agency

a Specific analytes used for each study conducted for the Ports may vary by waterbody, according to the listings.

b Laboratories may use different versions of recommended methods (i.e. USEPA 8270C) as long as the QA/QC elements identified in this QAPP are met.

c Matrix interference and/or dilutions due to non-target analytes may increase target reporting limits. The method detection limit (MDL) should be at least three times lower than the reporting limit (40 CFR part 136) but will vary per instrument by MDL study.

d Total chlordane is calculated using the following compounds: alpha-chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor.

e PCB co-elutions will vary by instrument and column, and may increase reporting limits for some congeners.

f TMDL sediment target for this compound is currently below achievable laboratory reporting limits. Results should be reported to the EDL/MDL.

Table 9
Laboratory Quality Assurance/Quality Control Definitions

Laboratory Quality Control	Definition
Calibration	A comparison of a measurement standard, instrument, or item with one having higher accuracy to detect, quantify, and record any inaccuracy or variation; the process by which an instrument setting is adjusted based on response to a standard to eliminate the inaccuracy.
Certified/Standard Reference Material	A substance whose property values are certified by a procedure that establishes its traceability and uncertainty at a stated level of confidence.
Continuing Calibration Verification	A periodic standard used to assess instrument drift between calibrations.
Internal Standard	Pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of othermethod analytes that are components of the same sample or solution. The internal standard must be an analyte that is not a sample component.
Laboratory Replicate	Two or more representative portions taken from one homogeneous sample by the analyst and analyzed in the same testing facility.
Laboratory Control Sample	A specimen of known composition prepared using contaminant-free reagent water, or an inert solid, which is spiked with the analyte of interest at the midpoint of the calibration curve or at the level of concern, and then analyzed using the same preparation, reagents, and analytical methods employed for regular specimens and at the intervals set in the Quality Assurance Project Plan.
Matrix Spike	A test specimen prepared by adding a known concentration of the target analyte to a specified amount of a specific homogenized specimen where an estimate of the target concentration is available and subjected to the entire analytical protocol.
Matrix Spike Duplicate	A sample prepared simultaneously as a split with the matrix spike sample with each specimen being spiked with identical, known concentrations of targeted analyte.
Method Blank	A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.
Sample Batch	Twenty or fewer field samples prepared and analyzed with a common set of quality assurance samples.
Surrogate	A pure substance with properties that mimics the analyte of interest (organics only) and which is unlikely to be found in environmental samples. It is added into a sample before sample preparation.

Table 10
Frequencies for Laboratory Quality Assurance/Quality Control Samples

Analysis Type	Initial Calibration[a,b]	Continuing Calibration Verification	LCS or SRM[c]	Replicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes	Internal Standard
Total solids and conventionals	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Lipids	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Grain size	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Particle size determination	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Total suspended and dissolved solids	Daily or each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A	N/A
Total and dissolved organic carbon	Daily or each batch	1 per 10 analytical runs	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	N/A	Each batch	N/A	N/A
Particulate organic carbon	Daily or each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A	Each batch	N/A	N/A
Total and dissolved metals	Daily or each batch	Per 10 analytical runs	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	N/A	Each batch	N/A	Per method
PCBs by low resolution method	As needed	Every 12 hours	1 per 20 samples or 1 per batch	N/A	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	Each batch	Every sample	Every sample
PCB Congeners by high resolution method	As needed	Every 12 hours	1 per 20 samples	N/A	N/A[d]	N/A[d]	1 per 20 samples	N/A[d]	Every sample
PAHs	As needed	Every 12 hours	1 per 20 samples or 1 per batch	N/A	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	Each batch	Every sample	Every sample
Organochlorine pesticides by low resolution method	As needed	Per 10 analytical runs	1 per 20 samples or 1 per batch	N/A	1 per 20 samples or 1 per batch	1 per 20 samples or 1 per batch	Each batch	Every sample	Every sample
Organochlorine pesticides by high resolution method	As needed	Every 12 hours	1 per 20 samples	N/A	N/A[d]	N/A[d]	1 per 20 samples	N/A[d]	Every sample

Notes:
Primary column is considered the column that contains the highest value with the least interference.
Values should have RPDs less than 40 percent or they are P flagged. ICALS = 20 percent or less and CCALS = 15 percent or less.
LCS = Laboratory control sample
N/A = not applicable
SRM = standard reference material
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
a For physical tests, calibration and certification of drying ovens and weighing scales are conducted annually.
b Calibrations should be conducted per analytical methods or instrument manufacturers specifications.
c When a Standard Reference Material is not available, an LCS will be analyzed.
d Isotope dilution quantitation technique accounts for matrix interferences thus MS/MSD are not required.

Table 11
Laboratory and Reporting Data Quality Objectives

Parameter	Precision[a]	Accuracy[b]	Completeness[c]
Sediments			
Total solids and conventionals	± 25% RPD	N/A	90%
Grain size	± 25% RPD	N/A	90%
Total organic carbon	± 25% RPD	80-120% R	90%
Porewater dissolved organic carbon	± 25% RPD	80-120% R	90%
Total metals	± 25% RPD	75-125% R	90%
Polycyclic aromatic hydrocarbons[d]	± 25% RPD	50-150% R	90%
Organochlorine pesticides[d]	± 25% RPD	50-150% R	90%
PCB Congeners[d]	± 25% RPD	50-150% R	90%
Tissues			
Lipids	± 25% RPD	N/A	90%
Organochlorine pesticides[d]	± 25% RPD	50-150% R	90%
PCB Congeners[d]	± 25% RPD	50-150% R	90%
Water			
Particle size determination	± 25% RPD	N/A	90%
Hardness	± 25% RPD	N/A	90%
Total suspended and dissolved solids	± 25% RPD	N/A	90%
Total and dissolved organic carbon	± 25% RPD	80-120% R	90%
Particulate organic carbon	± 25% RPD	80-120% R	90%
Total and dissolved metals	± 25% RPD	75-125% R	90%
Organochlorine pesticides[d]	± 25% RPD	50-150% R	90%
PCB Congeners[d]	± 25% RPD	50-150% R	90%

Notes:
CRM = certified reference material
PCB = polychlorinated biphenyl
R = recovery
RPD = relative percent difference
a Not applicable if native concentration of either sample is less than five times the reporting limit. In these situations, the difference between the sample result and duplicate result must be within ± 2 times the reporting limit for sediments, or ± 1 times the reporting limit for waters to meet control
b Laboratory control sample , CRMs, and matrix spike/matrix spike duplicate percent recovery.
c Percent of each class of analytes that are not rejected after data validation conducted in accordance
d The accuracy goal is 70 to 130% R if certified reference material is used.

FIGURES

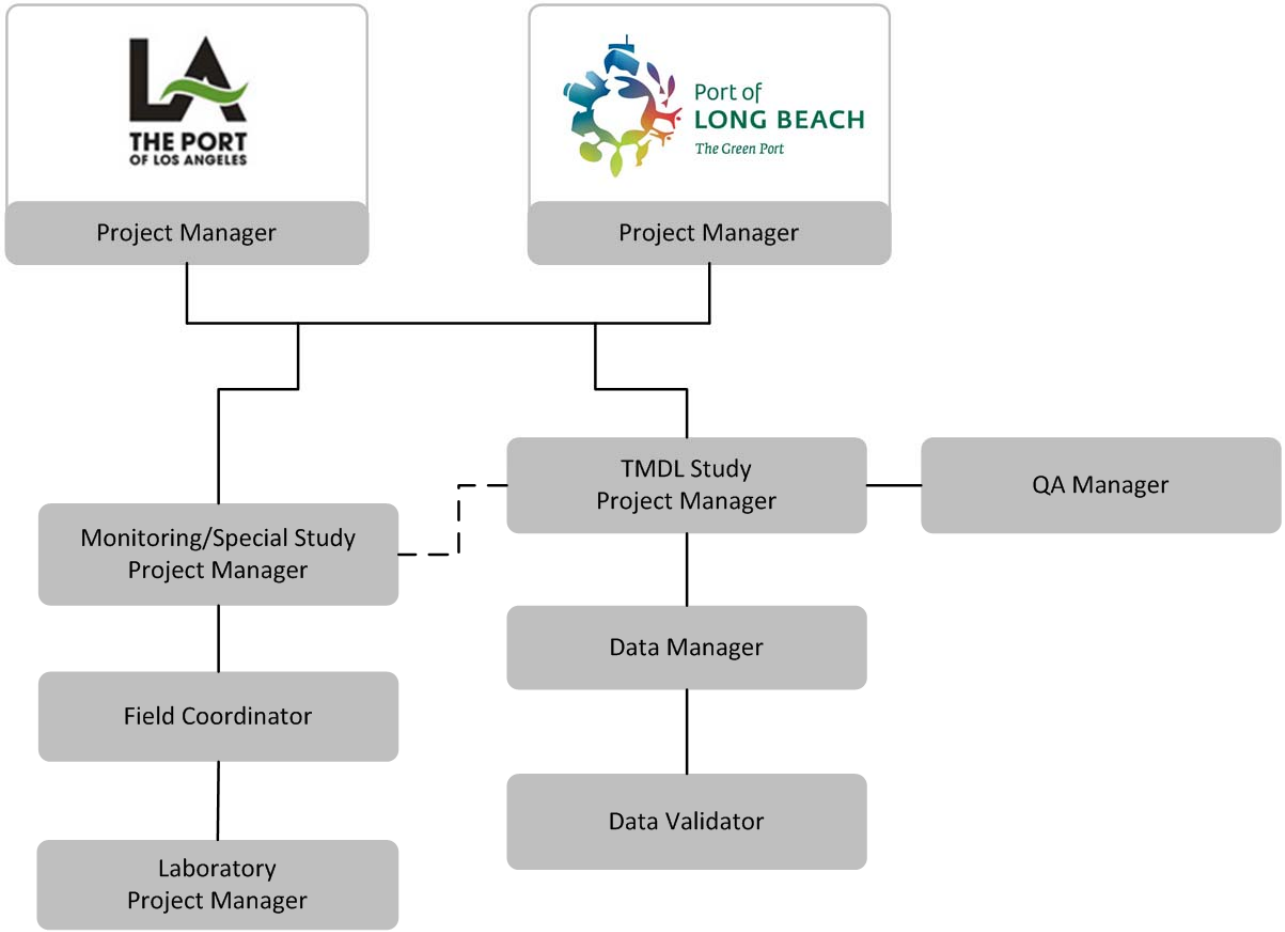
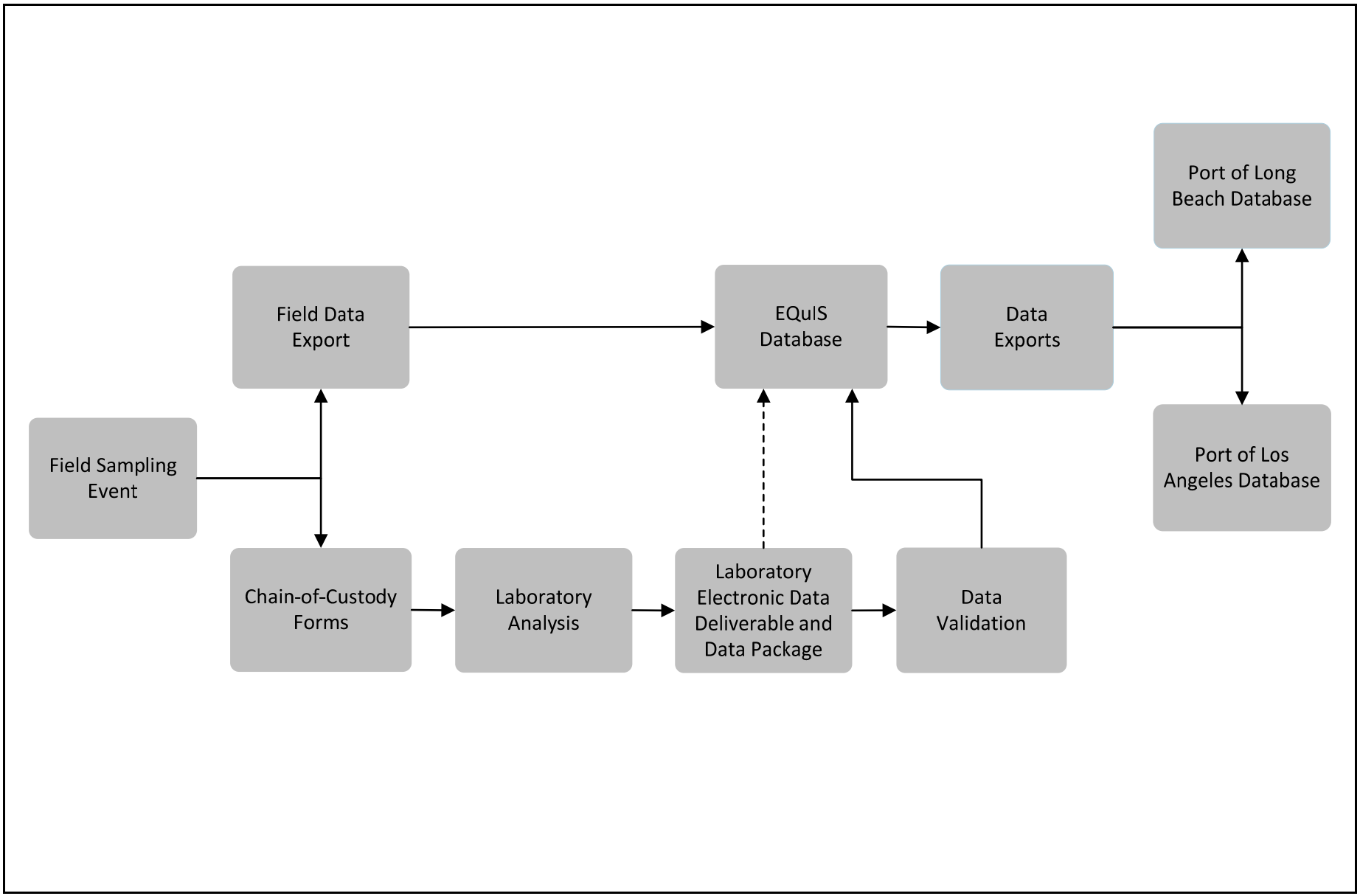


Figure 1
Organizational Chart
Monitoring/Special Studies for Harbor Toxics TMDL



ANCHOR QEA

Figure 2
Data Flow Diagram
Monitoring/Special Studies for Harbor Toxics TMDL

APPENDIX A
CUSTOM EQUIS ELECTRONIC DATA DELIVERABLE SPECIFICATIONS

Table A-1
SMP File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
sys_sample_code	Unique sample identifier	**REQUIRED.** Text(40)		Sample-CMP4	Each sample, including field and laboratory QC samples, spikes, duplicates, and blanks must have a unique value. It should match the sample ID on the chain-of-custody form. For example, trip blanks should be given a unique value such as "TB-01-20140101" instead of "Trip Blank".
sample_name	Sample identifier	Text(50)		*NULL*	Populate with the sys_sample_code or leave as NULL.
sample_matrix_code	Code that distinguishes between different types of sample matrix. For example, soil samples must be distinguished from ground water samples.	**REQUIRED.** Text(10)	Refer to rt_matrix	SE	The matrix of the sample as analyzed may be different from the matrix of the sample as collected (e.g., leachates), so this field is required at both the sample and the test level. For samples that have sample_type_code of MB, BS, BSD, SRM, RB, or TB, the sample_matrix_code should be SQ or WQ.
sample_type_code	Code that distinguishes between different types of samples. For example, normal field samples must be distinguished from laboratory method blank samples.	**REQUIRED.** Text(20)	Refer to rt_sample_type	N	Use "BS" for ongoing precision and recovery samples.
sample_source	Field that identifies the location where the sample was collected or where the field observation or measurement was made.	**REQUIRED.** Text(10)	**Field** - if a test was requested by the client **Lab** - if a test is run for laboratory QC purposes	Field	
parent_sample_code	The source sample associated with this sample. For example, the parent sample of a lab duplicate sample would be the sample that was duplicated.	**REQUIRED if the sample is a matrix spike or a replicate.** Text(40)	Must match an existing sys_sample_code in this table.	(Where applicable)	A matrix spike or a replicate would have a sample_type_code of LR, MS, MSD, or BSD, for example. Field replicates may be submitted blind to the laboratory, so this field is not required for those samples. Must be NULL for samples that have no parent (e.g., normal field sample, blank, and blank spike).
sample_date	The date/time data were collected in the field (e.g., sample collection, field measurement, and field observation).	**REQUIRED.** DateTime (mm/dd/yyyy HH:MM)		6/5/02 14:30	Date/time information must be identical with the date/time on the chain-of-custody form. Leave blank for laboratory samples.
sys_loc_code	Unique location ID	Optional. Text(20)		*NULL*	
start_depth	Beginning depth (top) of soil sample	Optional. Numeric		*NULL*	
end_depth	Ending depth (bottom) of soil sample	Optional. Numeric		*NULL*	
depth_unit	Depth unit	Optional. Text(15)		*NULL*	
chain_of_custody	Chain-of-custody identifier	Optional. Text(40)		*NULL*	
sent_to_lab_date	The date/time sample was sent to the laboratory	Optional. DateTime (mm/dd/yyyy HH:MM)		6/10/02 15:01	Date/time information must be identical with the date/time on the chain-of-custody form. Leave blank for laboratory samples.
sample_receipt_date	The date/time sample was received by the laboratory	**REQUIRED.** DateTime (mm/dd/yyyy HH:MM)		6/10/02 15:02	Date/time information must be identical with the date/time on the chain-of-custody form. Leave blank for laboratory samples.

Table A-1
SMP File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
sampler	Name of person who collected data (e.g., sample, measurement, and observation)	Optional. Text(50)		*NULL*	
sampling_company_code	Name of the company associated with the sampler	Optional. Text(20)		*NULL*	
sampling_reason	Reason for sampling	Optional. Text(30)		*NULL*	
sample_method	Sampling technique	Optional. Text(40)		*NULL*	
task_code	Task code specific to Anchor QEA's EQuIS database	Optional. Text(40)		*NULL*	
composite_yn	Indicates whether or not the sample is a composite	Optional. Text(1)	**Y** - Yes **N** - No	*NULL*	
composite_desc	Description related to the composite sample or compositing procedures	Optional. Text(255)		*NULL*	
sample_class		Optional. Text(10)		*NULL*	
comment	Sample-specific comments	Optional. Text(2000)		*NULL*	

Notes:
Red fields are required.
NULL = no value expected from laboratory

Table A-2
TST File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
sys_sample_code	Unique sample identifier	**REQUIRED.** Text(40)	Must match the sys_sample_codes listed in .SMP file	Sample-CMP1	Each sample, including field and laboratory QC samples, spikes, duplicates, and blanks must have a unique value. It should match the sample ID on the chain of custody form. For example, trip blanks should be given a unique value such as "TB-01-20140101" instead of "Trip Blank".
analytic_method	Laboratory analytical method name	**REQUIRED.** Text(20)	Refer to rt_analytic_method	SW8081	Contact Anchor QEA personnel to request a method to be added to the reference tables.
analysis_date	The date/time sample was analyzed in the laboratory	**REQUIRED.** DateTime (mm/dd/yyyy HH:MM)		6/21/02 14:10	
fraction	Sample fraction	**REQUIRED.** Text(10)	**T -** Total or not applicable **D -** Dissolved	T	Use "D" for total dissolved solids results.
column_number	Column number assigned by the laboratory	**REQUIRED.** Text(2)	**NA** - not applicable **1C** - column 1 **2C** - column 2	NA	All results can be reported as "NA". The column_number could also be 1C or 2C, etc., if the instrument uses multiple columns.
test_type	Type of test in the laboratory. This field is used to distinguish between initial runs, reextractions, reanalysis, and dilutions.	**REQUIRED.** Text(10)	**AverageLab** - Average of several results, laboratory calculated **Dilution** - Dilution **Dilution2** - Dilution (second time) **Initial** - Initial **Initial2** - Second initial run where multiple analysis on same sample and test is requested **Reanalysis** - Reanalysis (first time) **Reanal2** - Reanalysis (second time) **Reextract** - Reextract Refer to rt_test_type for more details.	Initial	

Table A-2
TST File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
lab_matrix_code	Code which describes the matrix as analyzed by the laboratory	**REQUIRED.** Text(10)	**AIR** - Air **SE** - Sediment **SO** - Soil **SQ** - Soil/solid quality control matrix **STS** - Stormwater solids **TA** - Animal tissue **TBIO** - Tissue bioaccumulation testing **TQ** - Tissue quality control matrix **WEL** - Elutriate **WG** - Groundwater **WH** - Equipment wash water **WIPE** - Swab or wipe **WL** - Leachate **WQ** - Water quality control matrix **WS** - Surface water **WSP** - Seep water **WST** - Stormwater **WW** - Wastewater **WX** - Porewater Refer to rt_matrix for complete list.	SE	Lab_matrix_code must match sample_matrix_code for all samples except leachate, elutriate, and porewater samples. All leachate, elutriate, and porewater samples are required to have unique test records that have lab_matrix_code of "WL", "WEL", and "WX", respectively. Do not use "SO" for Solid. SO = Soil Use "SQ" or "WQ" for laboratory or field QC samples (e.g. blank, blank spike, blank spike duplicate, and rinse blank). For samples that have a parent sample (e.g. laboratory replicate, matrix spike, matrix spike duplicate, and field replicate), use the same code as the parent sample.
analysis_location	Note where was sample analyzed	**REQUIRED.** Text(2)	**FI** - Field instrument **FL** - Mobile field laboratory analysis **LB** - Fixed-based laboratory analysis	LB	Most commonly LB.
basis	Measurement basis for the data	**REQUIRED.** Text(10)	**Dry** - Dry-weight basis reporting **Wet** - Wet-weight basis reporting **NA** - Not applicable	Dry	For solid matrices, basis must be either "Dry" for dry-weight basis reporting, "Wet" for wet-weight basis reporting, or "NA" for tests for which this distinction is not applicable. For example, total solids should be reported as "NA". For aqueous matrices, basis must be "NA" since measuring basis conversions cannot be performed. Total dissolved solids should be reported as "NA".
container_id	Sample container identifier	Optional. Text(30)			
dilution_factor	Dilution factor at which the analyte was measured effectively	**REQUIRED.** Numeric		1	Enter "1" if not diluted.
prep_method	Laboratory sample preparation method code	**REQUIRED.** Text(20)	Refer to rt_prep_method	SW3550B	Use "METHOD" if the preparation method is included in the analytic_method. Contact Anchor QEA personnel to request a value to be added to the reference tables.
prep_date	The date/time sample was prepared or extracted in the laboratory	**REQUIRED.** DateTime (mm/dd/yyyy HH:MM)		6/14/02 13:10	

Table A-2
TST File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
leach_elut_method	Laboratory leachate generation method name	**REQUIRED if lab_matrix_code is WL or WEL.** Text(15)	**DI-WET** - Waste Extraction Test with deionized water **DRET** - Dredge Elutriate Test **MET** - Modified Elutriate Test **PCLT** - Pancake Column Leachate Test **SBLT** - Sequential Batch Leachate Test **SET** - Standard Elutriate Test **SW1311** - TCLP **SW1312** - SPLP	SW1311	Must be populated for leachate or elutriate samples. Contact Anchor QEA personnel to request a value to be added to the reference tables.
leach_elut_date	The date/time leachate was prepared or extracted in the laboratory	**REQUIRED if lab_matrix_code is WL or WEL.** DateTime (mm/dd/yyyy HH:MM)		6/15/02 13:10	
lab_name_code	Unique identifier of the laboratory	**REQUIRED.** Text(20)	Refer to rt_company	ARIS	Contact Anchor QEA personnel to request a value to be added to the reference tables.
qc_level	Quality control level of analysis	Optional. Text(10)			
lab_sample_id	Laboratory LIMS sample identifier	**REQUIRED.** Text(40)		02-7599-EL34A	If necessary, a field sample may have more than one LIMS lab_sample_id (maximum one per each test event).
percent_moisture	Default is NULL	*NULL*		*NULL*	DO NOT POPULATE WITH A RESULT. These results should be included as a row in the RES file.
subsample_amount	Amount of sample used for test	Optional. Text(14)		25.4	
subsample_amount_unit	Unit of measurement for subsample_amount	Optional. Text(15)	Refer to rt_unit	g	Contact Anchor QEA personnel to request a value to be added to the reference tables.
analyst_name	Name or initials of laboratory analyst	Optional. Text(50)		MDR	
instrument_id	Instrument identifier	Optional. Text(60)		ECD4	
comment	Test-specific comments	Optional. Text(2000)		*NULL*	
preservative	Sample preservative used	Optional. Text(20)	**4degC** - Store cool at 4 degC **Frozen** - Frozen, anything below zero degrees Celsius **H2SO4** - Sulfuric acid **HCl** - Hydrochloric acid **HNO3** - Nitric acid **MeOH** - Methanol **NaHSO4** - Sodium bisulfate **NaOH** - Sodium hydroxide **NaOH-ZnAc** - Sodium hydroxide and zinc acetate (common preservative for sulfide analysis) **None** - Unpreserved Refer to rt_preservative	*NULL*	Contact Anchor QEA personnel to request a value to be added to the reference tables.
final_volume	The final volume of the sample after sample preparation	**REQUIRED.** Text(15)		5	Include all dilution factors.
final_volume_unit	Unit of measurement for final_volume	**REQUIRED.** Text(15)		mL	

Table A-2
TST File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
Lab_SDG	Sample delivery group number assigned by the laboratory	**REQUIRED.** Text(20)		EL34	

Notes:
Red fields are required.
NULL = no value expected from laboratory

Table A-3
RES File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
sys_sample_code	Unique sample identifier	**REQUIRED.** Text(40)	Must match the sys_sample_codes listed in .SMP file	Sample-CMP4	Each sample, including field and laboratory QC samples, spikes, duplicates, and blanks, must have a unique value. It should match the sample ID on the chain of custody form. For example, trip blanks should be given a unique value such as "TB-01-20140101" instead of "Trip Blank".
analytic_method	Laboratory analytic method name	**REQUIRED.** Text(20)	Refer to rt_analytic_method Must match the analytical method entered in .TST file	SW8270	Contact Anchor QEA personnel to request a method to be added to the reference tables.
analysis_date	The date/time sample was analyzed in the laboratory	REQUIRED. DateTime (mm/dd/yyyy HH:MM)		6/21/02 14:10	
fraction	Sample fraction	**REQUIRED.** Text(10)	**T -** Total or not applicable **D -** Dissolved	T	
column_number	Column number assigned by the laboratory	**REQUIRED.** Text(2)	**NA - not applicable** **1C - column 1** **2C - column 2**	NA	All results can be reported as "NA". The column_number could also be 1C or 2C, etc., if the instrument uses multiple columns.
test_type	Type of test in the laboratory. This field is used to distinguish between initial runs, reextractions, reanalysis, and dilutions.	**REQUIRED.** Text(10)	AverageLab - Average of several results, laboratory calculated Dilution - Dilution Dilution2 - Dilution (second time) Initial - Initial Initial2 - Second initial run where multiple analysis on same sample and test is requested Reanalysis - Reanalysis (first time) Reanal2 - Reanalysis (second time) Reextract - Reextract Refer to rt_test_type for more details.	Initial	
cas_rn	CAS Registry Number	**REQUIRED.** Text(15)	Refer to rt_analyte	108-95-2	
chemical_name	Corresponding chemical name of CAS number	**REQUIRED.** Text(255)	Must match the CAS number and chemical as listed in rt_analyte	Phenol	

Table A-3
RES File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
result_value	Result value with appropriate significant digits	**REQUIRED.** Text(19)		20	Must be left blank if analyte was not detected. Surrogates must be reported as a percent recovery in "pct" units and not as the measured concentration. Laboratory QC samples (e.g., blank, blank spike, and matrix spike) must be reported as a measured concentration. If result is numeric, ensure that significant digits for zeros are maintained. May be populated with non-numeric results (e.g., "Non-Plastic" for Atterberg Limits or "DETECT" for TPH-HCID results).
result_error_delta	Error range applicable to the result value	**REQUIRED for radiochemistry results.** Text(20)		0.07	Typically used for radiochemistry results
uncertainty	Amount of uncertainty associated with result_value	**REQUIRED for radiochemistry results.** Text(10)		2 sigma	Typically used for radiochemistry results (e.g., 2 sigma)
result_type_code	Result type	**REQUIRED.** Text(10)	**IS** - Internal standard **SC** - Spiked compound **SUR** - Surrogate **TIC** - Tentatively identified compound **TRG** - Target compound (regular result)	TRG	Typically "TRG" for regular results and "SC" for blank spikes and matrix spikes
reportable_result	Indicates whether or not the result is reportable or useable	**REQUIRED.** Text(10)	**Yes** **No**	Yes	If a dilution, reextraction, or reanalysis was completed, assign "No" to the superseded or unusable results.
detect_flag	Indicates whether or not the result is detected	**REQUIRED.** Text(2)	**Y** - detect **N** - non-detect	Y	
lab_qualifiers	Qualifier flags assigned by the laboratory	**REQUIRED.** Text(20)		J	If applicable
method_detection_limit	MDL value	**REQUIRED.** Text(20)		15	May be populated with the EDL for high-resolution methods or CRDL. Limits should be reported in the same unit as the result_value.
reporting_detection_limit	MRL	**REQUIRED.** Text(20)		20	Limits should be reported in the same unit as the result_value.
quantitation_limit	PQL	Optional. Text(20)		15	Limits should be reported in the same unit as the result_value.
result_unit	Units of measurement for the result unit	**REQUIRED.** Text(15)	Refer to rt_unit	µg/kg	
tic_retention_time	TIC retention time	Optional. Text(8)			
result_comment	Result-specific comments	Optional. Text(2000)			

Table A-3
RES File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
qc_original_conc	The concentration of the analyte in the original (unspiked) sample	**REQUIRED for laboratory QC samples.** Text(14)		0	Might be required for spikes and spike duplicates (depending on user needs). Not necessary for surrogates or blank spikes where the original concentration is assumed to be zero. Must be reported in the same units as the result_value.
qc_spike_added	The concentration of the analyte added to the original sample	**REQUIRED for laboratory QC samples.** Text(14)		450	Might be required for matrix spikes, surrogates, blank spikes, and any spiked samples (depending on user needs). Must be reported in the same units as the result_value.
qc_spike_measured	The measured concentration of the analyte	**REQUIRED for laboratory QC samples.** Text(14)		400	Use zero for spiked compounds that were not detected in the sample. Might be required for matrix spikes, spike duplicates, surrogates, blank spikes, and any spiked samples (depending on user needs). Must be reported in the same units as the result_value.
qc_spike_recovery	The percent recovery calculated as specified by the laboratory QC program	**REQUIRED for laboratory QC samples.** Text(14)		0	Always required for matrix spikes, spike duplicates, surrogates, blank spikes, and any spiked samples. Report as percentage multiplied by 100 (e.g., report 120% as 120).
qc_dup_original_conc	The concentration of the analyte in the original (unspiked) sample	**REQUIRED for laboratory QC samples.** Text(14)			Might be required for spike or blank spike duplicates only (depending on user needs). Not necessary for surrogates or blank spikes (where the original concentration is assumed to be zero). Must be reported in the same units as the result_value.
qc_dup_spike_added	The concentration of the analyte added to the duplicate sample	**REQUIRED for laboratory QC samples.** Text(14)			Might be required for spike or blank spike duplicates, surrogates, and any spiked and duplicated samples (depending on user needs). Must be reported in the same units as the result_value.
qc_dup_spike_measured	The measured concentration of the analyte in the duplicate	**REQUIRED for laboratory QC samples.** Text(14)			Use zero for spiked compounds that were not detected in the sample. Might be required for matrix spikes and blank spike duplicates, surrogates, and any other spiked and duplicated samples.
qc_dup_spike_recovery	The duplicate percent recovery calculated as specified by the laboratory QC program	**REQUIRED for laboratory QC samples.** Text(14)			Always required for matrix spike or blank spike duplicates, surrogates, and any other spiked and duplicated samples. Report as percentage multiplied by 100 (e.g., 50% as 50).

Table A-3
RES File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
qc_rpd	The relative percent difference calculated as specified by the laboratory QC program	**REQUIRED for laboratory QC samples.** Text(14)			Required for duplicate samples as appropriate. Report as percentage multiplied by 100 (e.g., report 30% as 30).
qc_spike_lcl	Lower control limit for spike recovery	**REQUIRED for laboratory QC samples.** Text(14)		52	Required for matrix spikes, spike duplicates, surrogates, blank spikes, and any spiked samples. Report as percentage multiplied by 100 (e.g., report 80% as 80).
qc_spike_ucl	Upper control limit for spike recovery	**REQUIRED for laboratory QC samples.** Text(14)		130	Required for matrix spikes, spike duplicates, surrogates, blank spikes, and any spiked samples. Report as percentage multiplied by 100 (e.g., report 120% as 120).
qc_rpd_cl	Relative percent difference control limit	**REQUIRED for laboratory QC samples.** Text(14)			Required for any duplicated sample. Report as percentage multiplied by 100 (e.g., report 25% as 25).
qc_spike_status	Used to indicate whether the spike recovery was within control limits	**REQUIRED for laboratory QC samples.** Text(10)	**NULL** - if within control limits ***** - if out of control limits		Use the * character to indicate failure, otherwise leave blank. Required for matrix spikes, spike duplicates, surrogates, blank spikes, and any spiked samples.
qc_dup_spike_status	Used to indicate whether the duplicate spike recovery was within control limits	**REQUIRED for laboratory QC samples.** Text(10)	**NULL** - if within control limits ***** - if out of control limits		Use the * character to indicate failure, otherwise leave blank. Required for any spiked and duplicated sample.
qc_rpd_status	Used to indicate whether the relative percent difference was within control limits	**REQUIRED for laboratory QC samples.** Text(10)	**NULL** - if within control limits ***** - if out of control limits		Use the * character to indicate failure, otherwise leave blank. Required for any duplicated sample.

Notes:
Red fields are required.
NULL = no value expected from laboratory

Table A-4
BCH File Structure and Type Descriptions

Field Name	Description	Format	Valid Values	Example	Comments
sys_sample_code	Unique sample identifier	**REQUIRED.** Text(40)	Must match the sys_sample_codes listed in .SMP file	Sample-CMP4	Each sample, including field and laboratory QC samples, spikes, duplicates, and blanks, must have a unique value. It should match the sample ID on the chain of custody form. For example, trip blanks should be given a unique value such as "TB-01-20140101" instead of "Trip Blank".
analytic_method	Laboratory analytic method name	**REQUIRED.** Text(20)	Refer to rt_analytic_method Must match the analytical method entered in .TST file	SW8270	
analysis_date	The date/time sample was analyzed in the laboratory	**REQUIRED.** DateTime (mm/dd/yyyy HH:MM)		6/20/02 17:10	
fraction	Sample fraction	**REQUIRED.** Text(10)	**T -** Total or not applicable **D -** Dissolved	T	
column_number	Column number assigned by the laboratory	**REQUIRED.** Text(2)	**NA** - not applicable **1C** - column 1 **2C** - column 2	NA	All results can be reported as "NA". The column_number could also be 1C or 2C, etc., if the instrument uses multiple columns.
test_type	Type of test in the laboratory. This field is used to distinguish between initial runs, reextractions, reanalysis, and dilutions.	**REQUIRED.** Text(10)	**AverageLab** - Average of several results, laboratory calculated **Dilution** - Dilution **Dilution2** - Dilution (second time) **Initial** - Initial **Initial2** - Second initial run where multiple analysis on same sample and test is requested **Reanalysis** - Reanalysis (first time) **Reanal2** - Reanalysis (second time) **Reextract** - Reextract Refer to rt_test_type for more details.	Initial	
test_batch_type	Laboratory batch type	**REQUIRED.** Text(10)	**Analysis** - Sample analysis batch **Elut** - Elutriate batch **Leach** - Leachate batch **Prep** - Sample preparation batch	Prep	
test_batch_id	Unique identifier for all laboratory batches	**REQUIRED.** Text(20)		580-12345	

Notes:
Red fields are required.
NULL = no value expected from laboratory

APPENDIX B
FIELD ELECTRONIC DATA DELIVERABLE FILE SPECIFICATIONS

Table B-1
Sample Location EDD Field Requirements

Field	Required/Conditional /Optional	Description
#station_id	Required	#Unique location/station identifier used to track spatial point through database system. This is a key field in the database and must be unique for each collection. If the same location is sampled more than once- append the date to the location. Set to 'Field QC' if sample_type is 'RB', 'EB', or 'TB'.
coord_datum_code	Required	Code used to identify correct coordinate system and datum for point projection. This field's vocabulary is controlled. See 'valid coord type codes' tab.
x_coord	Required	Easting/Longitude
y_coord	Required	Northing/Latitude
sample_id	Required	Unique sample identifier, these values must match the IDs provided on the Chain of Custody document. Refer to the 'Sample Nomenclature' tab for ID construction decision making flowchart.
sample_type	Required	Code used to identify sample type. This field's vocabulary is controlled and must match a provided valid value. See 'valid sample type codes' tab.
sample_parent	Conditional	Parent sample identifier for field duplicate/replicate; must match an entry in column E. This field is required if sample_type_code is 'FD' or composite_yn is 'Y'.
matrix_code	Required	Code used to identify type of sample material. This field's vocabulary is controlled and must match a provided valid value. See 'valid sample matrix codes' tab.
sample_date	Required	Date and time of field sample collection, time must be in 24-hour military time.
start_depth	Conditional	Shallowest point of the interval. Required for soil/sediment samples. Not required for composite samples.
end_depth	Conditional	Deepest point of the interval. Required for soil/sediment samples. Not required for composite samples.
depth_unit	Conditional	Code used to identify depth units. This field's vocabulary is controlled and must match a provided valid value. See 'valid units' tab.
composite_yn	Required	'Y' for Yes if sample is a composite or 'N' for No if not.

Table B-1
Sample Location EDD Field Requirements

Field	Required/Conditional /Optional	Description
composite_desc	Conditional	General description of composite. Required if composite_yn is 'Y'. Should include the list of samples combined in the composite.
archive_yn	Required	'N' if the sample is active, 'Y' if the sample is archive.
sampler	Required	Initials or name of the custodian responsible for sampling.
sampling_company	Required	Company responsible for field sampling.
comment	Optional	Optional comment about sample.

Table B-2
Tissue Sample EDD Field Requirements

Field	Required/Conditional /Optional	Description
#sample_id	Required	#Unique sample identifier, these values must match the IDs entered in the Loc_Smp tab. Refer to the 'Sample Nomenclature' tab for ID construction decision making flowchart.
parent_composite	Required	Points to the composite that the individual is a part of.
measurement_date	Required	Date and time of sample measurement, time must be in 24-hour military time.
species	Required	Common name (Genus species).
specimen_length	Required	Measured fish length (nose to caudal fork).
length_unit	Required	This field's vocabulary is controlled and must match a provided valid value. See 'valid units' tab.
specimen_weight	Required	Measured fish weight.
weight_unit	Required	This field's vocabulary is controlled and must match a provided valid value. See 'valid units' tab.

APPENDIX B
STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE: GRAB WATER SAMPLING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) describes the procedures for the collection of grab water samples using a Niskin, Van Dorn, or equivalent sampler. Grab water samples will be collected at locations described in the Coordinated Compliance Monitoring and Reporting Plan (CCMRP).

1.2 Purpose

The purpose of water sampling is to obtain data on water chemistry for contaminants of concern.

1.3 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and corresponding documents (i.e., CCMRP and Programmatic Quality Assurance Project Plan [PQAPP]). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

1.4 Procedures

Water samples will be collected from the same three depths as the in situ water quality measurements. Grab samples (i.e., instantaneous, not time- or flow-weighted composites) for total suspended solids (TSS) will be taken at all three depths during wet and dry weather events. Grab samples for analytical chemistry will be taken only from the surface sample (-3 feet below water surface). Water samples will be collected with a grab sampler (e.g., Niskin or Van Dorn) that has been decontaminated prior to sample collection at each station. Sampling methods will generally conform to U.S. Environmental Protection Agency's (USEPA's) clean sampling methodology described in the Surface Water Ambient Monitoring Program (SWAMP) SOP (MPSL-DFG 2007).

Sample processing and handling for water chemistry will be conducted in accordance with guidance developed in the Quality Assurance Management Plan for the State of California's SWAMP (California Department of Fish and Game, Pucket 2002). Aliquots for TSS, metals,

dichlorodiphenyltrichloroethane (DDT), and polychlorinated biphenyls (PCBs) will be taken directly from the grab sampler into appropriate containers or bottles (Table 1). Water samples will be preserved in the field, depending on the type of analysis, to meet specified holding times (Table 1). Water samples will be stored at less than 4 degrees Celsius (°C) until delivery to the appropriate analytical laboratory.

Table 1

Sample Containers and Holding Conditions

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Water				
Total suspended solids	1 L	1-L HDPE	7 days	Cool ≤6°C
Total Metals	100 mL	250 mL HDPE	48 hours until preservation	Cool ≤6°C
			6 months to analysis	Ambient; HNO_3 to pH<2
Dissolved metals	100 mL	250 mL HDPE	Field filter; 48 hours until preservation	Cool ≤6°C
			6 months to analysis	Ambient; HNO_3 to pH<2 after filtration
DDT	1 to 2 L	2 X 1-L amber glass	14 days to extraction	Cool ≤6°C; pH 5-9
			40 days after extraction	Cool ≤6°C
PCB Congeners	1 to 2 L	2 X 1-L amber glass	None[b]	Cool ≤6°C

Notes:
Some criteria may differ from SWAMP guidance but may be consistent with analytical method criteria. Recommendations are intended as guidance only. The selection of sample container and amount of samples required may vary per contracted laboratory sampling requirements.
°C = degrees Celsius
DDT = dichlorodiphenyltrichloroethane
HDPE = high-density polyethylene
L = liter
mL = milliliter
PCB = polychlorinated biphenyl

1.5 Quality Assurance/Quality Control

Quality control procedures will consist of following standard practices for the collection of water quality samples. Entries in the field forms and on sample container labels will be double checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Team Leader to periodically check to ensure that water sampling procedures are in conformance with those stated in this SOP.

Field quality assurance/quality control samples to be collected are included in Table 2.

Table 2

Frequencies and Performance Criteria for Field Quality Assurance/Quality Control Sampling

Analysis Type	Field Duplicate	Field Duplicate Performance Criteria[1,2]	Field and Rinse Blank[3]	Field and Rinse Performance Criteria[4]
Total suspended and dissolved solids	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Total and dissolved organic carbon	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Total metals	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
DDT	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
PCB Congeners	5% of total project sample count	≤25%RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL

Notes:

1 Field duplicate RPD exceedances alone would not result in data qualification. Further evaluation into the sample collection procedures should be conducted.

2 This criteria is a slight deviation from SWAMP due to the ultra-low detection levels utilized for these studies.

DDT = dichlorodiphenyltrichloroethane

NA = not applicable

PCB = polychlorinated biphenyl

RL = recording limit

RPD = relative percent difference

STANDARD OPERATING PROCEDURE: IN SITU WATER QUALITY MONITORING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) describes the procedures for the collection of in situ water quality data using a multi-probe water quality instrument.

1.2 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and corresponding documents (i.e., Coordinated Compliance Monitoring and Reporting Program [CCMRP] and Programmatic Quality Assurance Project Plan [PQAPP]). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

1.3 Pre-Sampling Procedures

Prior to use in the field, the water quality instrument will be calibrated according to the manufacturer's recommendation. Calibration will be documented on a calibration log.

1.4 Procedure

For each sampling event and at each station, water depth and in situ water quality parameters (temperature, dissolved oxygen [DO], pH, and salinity) will be collected. Water quality parameters and water depth will be recorded on a field data sheet or in the field electronic data deliverable (EDD).

The water depth at each station will be recorded using a probe or lead line. Water quality will be measured in situ at the station by immersing a multi-parameter instrument into the water at the desired depths. The instrument must equilibrate for at least one minute before collecting temperature, pH, conductivity, or salinity measurements, and at least 90 seconds before collecting DO measurements. Because DO takes the longest to stabilize, this parameter will be recorded after temperature, pH, conductivity, or salinity. See the surface water ambient monitoring program (SWAMP) SOP for additional details on the collection of field parameters (MPSL-DFG 2007). Water quality measurements will be collected at three depths during wet and dry weather events (surface [-3 feet below], mid-water column [to be determined in the field], and bottom [3 feet above mudline]).

1.4.1 Observations

- Water appearance – Record general appearance (e.g., color; unusual amount of suspended matter, debris, or foam)
- Water temperature
- pH (standard units)
- DO
- Conductivity/salinity
- Weather – Record recent meteorological events that may have impacted water quality (e.g., heavy rains, cold front, very dry, very wet)
- Biological Activity – Record excessive macrophyte, phytoplankton, or periphyton growth. The observation of water color and excessive algal growth is very important in explaining high chlorophyll a values. Also record other observations, such as presence of fish, birds, and spawning fish.

1.5 Quality Assurance/Quality Control

Guidance for data quality objectives (DQOs) for field measurements is derived from the SWAMP guidance for water parameters (SWRCB 2008). Quality objectives for parameters that will be measured in the field are presented in Table 1.

Field measurements will be made in triplicate on five percent of the measurements. Each result will be recorded along with the average of the three results, the difference between the largest and smallest result, and the percent difference between the largest and smallest result. The percent difference will be calculated as follows:

Percent difference = 100*(largest-smallest)/average

Triplicate measurements, the average of the results, and percent difference will be recorded on the field data sheet. The percent difference will be compared against the precision criteria established for field measurements in Table 1, as appropriate. If precision does not meet the established criteria, the equipment should be inspected to ensure that it is working properly. Equipment will be recalibrated, if necessary, and then the triplicate measurements process will be repeated until DQOs are achieved.

Table 1

DQOs for Field Measurements

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Completeness
Water	Depth (m)	± 0.1 m	± 0.1 m	NA	NA	NA
Water	Temperature (°C)	± 0.5 °C	± 0.5 °C	NA	NA	NA
Water	pH	± 0.2 units	± 0.2 units	NA	NA	NA
Water	Dissolved oxygen	± 0.2 mg/L	5 percent	NA	NA	NA
Water	Salinity[1] (ppt)	± 0.2 ppt	± 0.2 ppt	NA	NA	NA

Notes:

1 The value for salinity may be computed from specific conductance provided salinity is above 3 ppt based on previous observations at or near that location.

°C = degrees Celsius

m = meter

mg/L = milligram per liter

NA = not applicable

ppt = parts per thousand

STANDARD OPERATING PROCEDURE: SURFACE SEDIMENT GRAB SAMPLING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) is applicable to the collection of surface sediment samples using a Van Veen grab sampler (or similar). Surface sediment samples will be collected at locations described in the Coordinated Compliance Monitoring and Reporting Plan (CCMRP).

1.2 Purpose

The purpose of sediment sampling is to obtain data on localized community structure of infaunal invertebrate assemblages, sediment chemistry for contaminants of concern, and sediment toxicity.

1.3 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and corresponding documents (i.e., CCMRP and Programmatic Quality Assurance Project Plan [PQAPP]). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

1.4 General Procedures

The Field Team Leader is responsible for collecting all of the required information associated with each station occupation and each grab sampling event. While the field computer is the preferred method of collecting these data, paper data forms may be used. The required station occupation information includes the following:

- Station ID
- Date
- Vessel name
- System used for navigation
- Weather and sea conditions
- Latitude and longitude
- Depth
- Distance from station target location

1.5 Grab Sampling Procedures

Surface sediment samples will be collected at each station. Multiple grab samples will be required at each station to provide sufficient sediment volumes to complete all analyses required for the Sediment Quality Objectives (SQO) Part 1 assessment (Bay et al. 2009). The grabs will be numbered sequentially; grab numbers, visual observations, and the type of sample each grab was used for (e.g. benthic infauna, chemistry, or toxicity) will be recorded on datasheets. For benthic infauna processing, the entire grab sample will be processed. For grab samples used for chemistry and toxicity analyses, only the top 5 centimeters (cm) will be collected.

1.6 Deployment and Retrieval of the Grab Sampler

Prior to deployment, the grab sampler will be cocked with the safety key in place, then hoisted over the side of the vessel and the safety key removed. The grab sampler will be lowered at up to 2 meters per second (m/sec) until it is approximately 5 m above the bottom, then lowered at 1 m/sec to minimize the effects of bow wave disturbance of the surface sediment. In water depths greater than 300 m, the rate of deployment may have to be reduced to less than 1 m/sec to avoid "kiting" of the grab sampler or premature tripping in the water column. After bottom contact has been made (indicated by slack in the winch wire), the tension on the wire will slowly be increased, causing the lever arms to close the grab sampler. Once the grab sampler is back on board, the top doors will be opened for inspection.

While a radius limit of 100 m (200 m for island stratum) has been established for sampling, once sampling processes have begun, the Field Team Leader will ensure that the vessel remains in the same position with as much precision as conditions allow. Because analytical results from separate grab samples will be used to characterize the benthic community, contaminant load, and toxicity of the sediment, each successive grab must be collected as close as possible to the others.

1.7 Criteria for Acceptable Grab Samples

Sample acceptance criteria are shown in Figure 1. Upon retrieval of the grab sampler, the acceptability of the sample must be determined. Acceptability is based on two

characteristics: sample condition and depth of penetration. Sample condition will be judged using criteria for surface disturbance, leakage, canting, and washing.

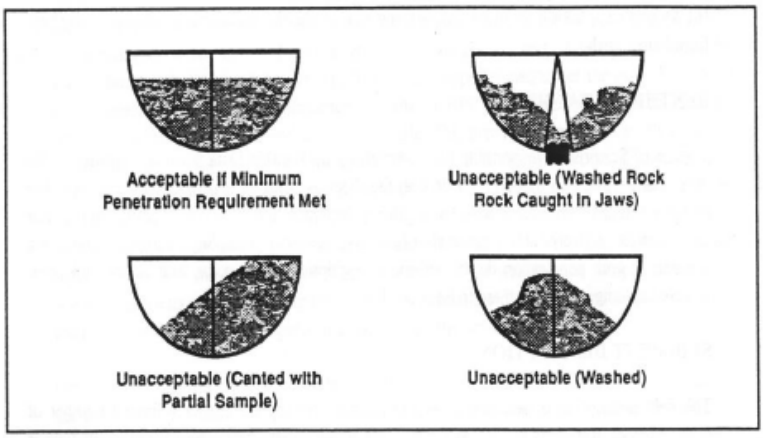


Figure 1.
Examples of acceptable and unacceptable grab sample conditions.

A grab sample will be judged acceptable if the sediment has an even surface with minimal disturbance and little or no leakage of the overlying water (see Figure 1). Heavily canted samples will be unacceptable. Samples with a large amount of humping along the midline of the grab, which indicates washing of the sample during retrieval, will also be unacceptable. While some humping will be evident in samples taken from firm sediment where penetration has been poor, this can be due to the closing action of the grab and is not necessarily evidence of unacceptable washing.

If the sample condition is acceptable, the overlying water will be drained off and the depth of penetration will be determined by insertion of a plastic (rather than metal) ruler vertically along the grab midline and measuring to the nearest 0.5 cm. Sediment penetration depth must be at least 5 cm; however, penetration depths of 7 to more than 10 cm should be obtained in silt (fine sand to clay). In habitats where sediments are unusually soft, it may be necessary to remove the lead weights to prevent the grab sampler from toppling onto its side, deeming the sample unacceptable.

Extra caution should be taken to drain the overlying water from the grabs for chemistry and toxicity samples. It is recommended that a siphon be employed for these grab samples to

avoid disturbance and loss of the surface sediments. The overlying water in grabs intended for infaunal samples may be drained by slightly opening the jaws of the grab and allowing the water to run off, as long as all drained water is captured for screening with the sediments.

If both sample condition and penetration are acceptable in the first grab, sampling at the station will proceed. It is required that all of the grabs taken at a station be of similar sediment type and depth penetration.

If sampling success at a particular station is inconsistent, the site may be abandoned after a minimum of nine attempts. The reason for site abandonment must be documented. The station should be relocated within the radius limit and +/-10% of the depth of the target site. If a station is relocated, the new coordinates should be recorded in the field computer or on a datasheet.

1.8 Sample Processing

Sediment sample processing and handling for purposes of sediment chemical analyses, sediment toxicity, and benthic infauna assessment in support of the SQOs Part 1 assessment will be performed in accordance with procedures specified in the Sediment Quality Assessment Draft Technical Support Manual (Bay et al. 2009) and the Bight Field Operations Manual (BCEC 2008). The following information will be recorded for each grab:

- Time when the grab reaches the sediment surface
- Sediment composition (type)
- Sediment odor
- Sediment color
- Presence of shell hash (note if 50% or greater)
- Sample types produced from sediment grab

Methods for processing samples are described in the corresponding SOPs for each type of sample. Recommended conditions for sampling containers, sample handling, and storage are listed in Table 11 of the CCMRP.

1.9 Quality Assurance/Quality Control

It is the responsibility of the Field Team Leader to periodically check and ensure that the sampling procedures are in conformance with those stated in this SOP.

STANDARD OPERATING PROCEDURE: SEDIMENT CHEMISTRY SAMPLE PROCESSING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) is applicable to processing of sediment grabs for chemical analyses. Surface sediment grab samples will be collected using a Van Veen sampler, or a similar sampling device, as appropriate for the type of sediment sample being collected, as is described in the Bight Field Operations Manual, Section VIII (BCEC 2008) and the corresponding SOP *Surface Sediment Grab Sampling*.

1.2 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and corresponding documents (i.e., Coordinated Compliance Monitoring and Recording Plan [CCMRP] and Programmatic Quality Assurance Project Plan [PQAPP]). Specialized training is not required for sample processing; however, field staff will be supervised by experienced staff.

1.3 Processing Sediment Samples for Chemical Analyses

Multiple grabs may be necessary to obtain sufficient sediment for chemical analyses. Sediment samples will be collected by scooping the top 5 centimeters (cm) of the undisturbed surface material with a stainless steel spoon into a stainless steel bowl. Sediment within 1 cm of the metal sides of the grab will be avoided to prevent sample contamination. Sediment will be homogenized and placed into sample containers (Table 1). Samples will be stored at 0 to 4 degrees Celsius. Equipment will be decontaminated prior to use at each station.

Table 1
Sample Containers and Holding Conditions

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Sediment				
Total solids	10 g	8-oz glass	14 days	Cool ≤6°C
Grain size	300 g	16-oz plastic	6 months	Cool ≤6°C

Parameter	Sample Size	Container Size and Type	Holding Time	Preservative
Total organic carbon	10 g	4-oz glass	28 days	H_2SO_4; pH < 2;Cool ≤6°C
			1 year, if frozen within 28 days of collection	Freeze -20°C
Total metals and mercury	100 g	4-oz glass	6 months	None
			1 year; samples must be analyzed within 14 days of thawing	Freeze -20°C[c]
Polycyclic aromatic hydrocarbons/ DDT and derivatives	500 g	Two 8-oz glass	14 days to extraction	Cool ≤6°C
			1 year to extraction; samples must be extracted within 14 days of thawing	Freeze -20°C
			40 days after extraction	Cool ≤6°C
PCB congeners	500 g	Two 8-oz glass	None[a]	Cool ≤6°C
				Freeze -20°C

Notes:
Some criteria may differ from SWAMP guidance but are consistent with analytical method criteria. Recommendations are intended as guidance only. The selection of a sample container and the amount of sample required may vary per contracted laboratory sampling requirements.
a Volume of sediment collected must be sufficient to produce a minimum of 40mL of porewater.
°C = degrees Celsius
DDT = dichlorodiphenyltrichloroethane
g = gram
oz = ounce
PCB = polychlorinated biphenyl
SWAMP = California Surface Water Ambient Monitoring Program

1.4 Quality Assurance/Quality Control

Quality control procedures will consist of following standard practices for the collection of water quality samples. Entries in the field forms and on sample container labels will be double checked by the field team staff to verify that the information is correct. It is the responsibility of the Field Team Leader to periodically check and ensure that sediment chemistry sample processing procedures are in conformance with those stated in this SOP.

Field quality assurance/quality control samples to be collected are included in Table 2.

Table 2

Frequencies and Performance Criteria for Field Quality Assurance/Quality Control Sampling

Analysis Type	Field Duplicate	Field Duplicate Performance Criteria[1,2]	Field and Rinse Blank[3]	Field and Rinse Performance Criteria[4]
Total solids	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Grain size	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Particle size determination for suspended solids	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	NA	NA
Particulate organic carbon	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Total metals	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
Polycyclic aromatic hydrocarbons	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
DDT and derivatives	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL
PCB Congeners	5% of total project sample count	≤25% RPD if both result(s) are >5x RL. Difference ≤2x RL if result(s) are ≤5x RL.	Not a method requirement. Task specific	<RL

Notes:

1 Field duplicate RPD exceedances alone would not result in data qualification. Further evaluation into the sample collection procedures should be conducted.

2 This criteria is a slight deviation from SWAMP due to the ultra-low detection levels utilized for these studies.

DDT = dichlorodiphenyltrichloroethane

NA = not applicable

PCB = polychlorinated biphenyl

RL = recording limit

RPD = relative percent difference

STANDARD OPERATING PROCEDURE: SEDIMENT TOXICITY SAMPLE PROCESSING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) is applicable to processing of sediment grabs for toxicity analyses. Surface sediment grab sampling procedures will be collected using a Van Veen sampler or similar sampling device as appropriate for the type of sediment sample being collected, as described in the *Bight Field Operations Manual*, Section VIII (BCEC 2008) and the corresponding SOP *Surface Sediment Grab Sampling*.

1.2 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and the corresponding documents (i.e., Coordinated Compliance Monitoring and Reporting Plan [CCMRP] and Programmatic Quality Assurance Project Plan [PQAPP]). Specialized training is not required for sample processing; however, all field staff will be supervised by experienced staff.

1.3 Processing Sediment Samples for Toxicity Tests

Sediment will be collected for an acute amphipod toxicity test and the sediment-water interface (SWI) test. Multiple grabs may be necessary to obtain sufficient sediment for the amphipod test. Sediment samples will be collected by scooping the top 5 cm of the undisturbed surface material with a stainless steel spoon into a stainless steel bowl. Sediment within 1 cm of the metal sides of the grab will be avoided to prevent sample contamination. Sediment for the amphipod test will be homogenized and placed into double-lined, plastic sediment bags. Samples will be stored at 0 to 4 degrees Celsius.

The SWI test is used to assess toxicity of solid phase sediment samples using the embryo or larval stages of marine and estuarine invertebrates. This test is designed to be conducted on a relatively undisturbed core sample containing the upper 5 cm of sediment, which requires the use of the special sample processing methods described in the following paragraphs. Sediment will be collected from a grab sample with a polycarbonate core (7.5 cm inner diameter). This sub-sample must be the first sediment taken from an undisturbed grab. The core will be pressed 5 cm into the sediment, and a pre-cleaned acrylic plate or a gloved hand will be inserted under the bottom of the core to prevent loss of sample as the core is removed.

Core sub-sample integrity will be verified by the presence of sediment overlying water and the required depth of sediment. If an inordinate volume of sediment is lost, the sample will be discarded, and a new one will be collected. After the core is removed from the grab and deemed acceptable, it will be gently wiped of exterior sediment, and the bottom will be capped quickly with a polyethylene plastic cap (7.5 cm inner diameter). The top will then be capped, and both ends will be taped to the tube. Each core tube will be labeled with station identification, date, time, and replicate number. Core tubes will be stored upright at or less than 4 degrees Celsius. Care must be taken to minimize tilting, shaking, or vibrating cores during transport. Precautions should also be taken to prevent contamination of the core contents by water from melting ice during storage.

Equipment will be decontaminated prior to use at each station.

1.4 Quality Assurance/Quality Control

It is the responsibility of the Field Team Leader to periodically check and ensure that the sediment toxicity sample processing procedures are in conformance with those stated in this SOP.

STANDARD OPERATING PROCEDURE: SEDIMENT TOXICITY TESTING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) provides a description of the sediment toxicity test methods specified under the draft Sediment Quality Objective (SQO; Bay et al. 2009) policy. It is intended to supplement published toxicity protocols by providing information on specific aspects of the methods that are used in many California monitoring programs so that future analyses will yield comparable and high-quality results.

1.2 Purpose

Sediment toxicity provides two types of information in this assessment: 1) the potential bioavailability of contaminants and 2) a measure of contaminant biological effects. Multiple toxicity tests are needed to assess toxicity because no single method exists that can capture the full spectrum of potential contaminant effects.

1.3 Procedures

Toxicity assessment under the SQO framework requires two types of tests: a short-term amphipod survival test and a sub-lethal test.

1.3.1 Species

The short term amphipod survival test will be performed with *Eohaustorius estuarius,* except for sediments with a high percent of fines, in which case *Leptocheirus plumulosus* will be used. The sub-lethal test will consist of the sediment-water interface test (SWI) with the bivalve, *Mytilus galloprovincialis*.

1.3.2 Sample Preparation

The amphipod survival tests should be started within one month of sample collection and SWI tests within 2 weeks of sample collection in order to minimize potential changes in toxicity due to storage. Samples should be tested as soon after collection as possible in order to minimize the potential for changes in sediment quality during storage.

Sediment for the amphipod survival tests should be homogenized and press-sieved in order to remove native animals that might be either predators or the same species as a test

organism. Press-sieving consists of forcing the sediment through a 2-millimeter mesh screen without adding water beyond that which is already naturally associated with the sample. Press-sieving is not applicable for the SWI test. Sediment within the core tubes collected in the field should not be disturbed.

1.3.3 Animal Acclimation

With respect to temperature and salinity, the test animals used in each method must be acclimated to test conditions within each laboratory prior to the start of testing. The acclimation period required for each species is variable.

1.3.4 Test Setup

Refer to U.S. Environmental Protection Agency (1994) and American Society for Testing and Materials (1996) methods for the amphipod survival test and Bight methods (Bay et al. 2009) for SWI test methods. Required test conditions are summarized in Table 1.

Table 1
Required Test Conditions for Sediment-Water Interface Test

Parameter	Amphipod Survival		SWI Test
	Eohaustorius estuarius	***Leptocheirus plumulosus***	***Mytilus galloprovincialis***
Temperature	15 ±1°C	25 ±1°C	15 ±1°C
Salinity	20 ±2 ppt	20 ±2 ppt	32 ±2 ppt
Luminance	500-1000 lux	500-1000 lux	500-1000 lux
Photoperiod	Continuous light	Continuous light	16:8 hours light:dark
Acclimation	2-10 days at test temperature and salinity	2-10 days at test temperature and salinity	2 days at test temperature and salinity; up to 4 weeks
Size and life stage	3 - 5 mm	2 - 4 mm, no mature animals	Newly fertilized eggs
Number of organisms/chamber	20	20	250
Number of replicates/treatment	5	5	4
Aeration	Enough to maintain 90% saturation	Enough to maintain 90% saturation	Enough to maintain 90% saturation
Feeding	None	None	None
Test duration	10 days	10 days	48 hours

Parameter	Amphipod Survival		SWI Test
	Eohaustorius estuarius	***Leptocheirus plumulosus***	***Mytilus galloprovincialis***
Test acceptability criteria	Mean control survival of ≥90 and ≥80% survival in each replicate	Mean control survival of ≥90 and ≥80% survival in each replicate	Mean control percent normal-alive of ≥80%; meet all water quality limits
Grain size tolerance	0.6-100% sand	0-100% sand	0-100% sand
Ammonia tolerance	<60 (total, mg/L)	<60 (total, mg/L)	< 4 (total, mg/L)
Total sulfide tolerance	1.9 mg/L	Not available	< 0.09 (mg/L)

Notes:
°C = degrees Celsius
mg/L = milligrams per liter
mg = milligrams
ppt = parts per thousand
SWI = sediment-water interface (test)

The SWI test chambers should mimic the setup shown in Figure 1.

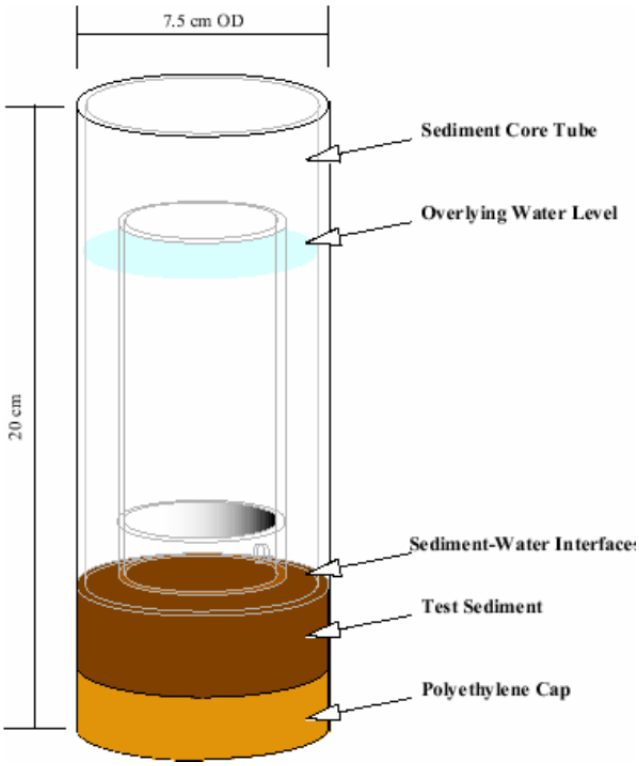


Figure 1
Sediment-water test chamber.

Sediment will be collected in polycarbonate core tubes (7.5 centimeters [cm] in diameter) with polyethylene caps. A sample will be collected at a depth of 5 cm. There must be at least 8 cm between the top of the sediment and the top of the core tube in order to allow room for the screen tube that will hold the embryos for the test. A minimum of four cores should be collected for toxicity testing from each station. At least one additional core should be collected for water quality measurements. Intact cores should be transported with overlying water from the sediment collection in place. Approximately 24 hours prior to test initiation, all but approximately 0.5 cm of the overlying water should be siphoned off and gently replaced with 300 milliliters of clean seawater. The core tubes will then be placed at 15 degrees Celsius with gentle aeration.

1.4 Personnel Qualifications

Laboratories will be accredited by California Environmental Laboratory Accreditation Program / National Environmental Laboratory Accreditation Program (ELAP/NELAP) for toxicological analyses. Laboratory personnel will be sufficiently trained and demonstrate proficiency in test methods.

1.5 Quality Assurance/Quality Control

A 10-day, water-only reference toxicant test using cadmium or ammonia should be performed simultaneously with each set of field samples tested. Whichever reference toxicant is chosen, each laboratory must establish a control chart consisting of at least three tests and no more than the 20 most recent tests.

The half maximal Effective Concentration (EC50) is the concentration of a toxicant that induces a response (i.e., percent mortality) that is halfway between the baseline and maximum possible effect. The EC50 for un-ionized ammonia or cadmium for each test performed should fall within two standard deviations of the mean of the previous tests on the control chart. A test falling outside two standard deviations should trigger a review of all data and test procedures to assure that the data are of good quality.

All test batches must include a negative control. The negative control should consist of sediment from the amphipod collection site or sediment with as little known contamination

as possible. The control also must have previously demonstrated that it meets test control acceptability requirements. If any of the chambers within a test exceed this ammonia concentration, 50% of the overlying water in all chambers within the experiment may be changed up to twice per day until all are below the target concentration. The mean control survival for each test batch must be 90% or greater. Individually, each control replicate must have at least 80% survival. In addition, water quality parameters must be within acceptable limits, and initial size ranges for the amphipods must be followed.

STANDARD OPERATING PROCEDURE: BENTHIC INFAUNA PROCESSING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) is applicable to processing of sediment grabs for benthic infauna community analyses. Surface sediment grab samples will be collected using a Van Veen sampler, or similar sampling device as appropriate for the type of sediment sample being collected, as described in the Bight Field Operations Manual, Section VIII (BCEC 2008) and the corresponding SOP *Surface Sediment Grab Sampling*.

1.2 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and the corresponding documents (i.e., Coordinated Compliance Monitoring and Reporting Plan [CCMRP], Programmatic Quality Assurance Project Plan [PQAPP]). Specialized training is not required for sample processing; however, field staff will be trained and supervised by experienced staff.

1.3 Benthic Infaunal Sample Processing

After the sample description has been completed, the entire sediment grab sample intended for biological analysis is washed from the sampler through a 1.0-millimeter (mm) screen or sieve. The use of a sediment-washing table is recommended, but not required. The table is useful because it provides a flat, smooth surface over which to spread and wash the sample, providing a means of gently breaking up the sediment before it runs off the end of the table into the screen box. The screen box must be equipped with stainless steel mesh with 1.0-mm openings. Wire diameter should be similar to that found in the U.S. Standard 1.00-mm Sieve (i.e., 0.58 mm). The surface area of the screen should be adequate to easily accept the sample without buildup. Raw water used to wash the samples is to be filtered to prevent the introduction of surface-water organisms. Thoroughly wash the sediment from the sampler and transfer it to a sediment-washing table (or a screen box, metal sieve, etc.) for screening. An alternative sieving method for small vessels without wash water would involve semi-submerging the sieve in seawater and swirling it in the water (taking care to prevent the loss of grab organisms and/or the introduction of surface water organisms) until the sediment washes away.

All the water drained from the sampler and used to wash the sampler must be captured and subsequently processed through screening. Typically, a tub (greater than 70-liter [L] capacity) is positioned under the grab. While washing the sample, control the water pressure to avoid damaging the organisms. Minimize direct application of water from the hose to the material and organisms collecting on the screen.

Once the sample has been washed through the screen, transfer the material (debris, coarse sediment, and organisms) retained on the screen to a sample container. Label the sample container with an external label containing the station name, sample type, date, and split number (e.g., 1 of 1, 2 of 3, etc.). An internal label bearing the same information should be placed inside the infaunal samples. This label can be written in pencil or indelible ink on 100% rag paper, poly paper, or other paper of a quality suitable for wet labels. The sample container must have a screw-cap closure and be sufficiently large to accommodate the sample material with a head space of at least 30% of the container volume. A sample may be split between two or more containers. However, each container must have external and internal labels (as described above) with the appropriate split number clearly marked. Field crews should have a broad range of sample container sizes available to them, with none less than a 16-ounce (0.47-L) capacity.

Gently remove the material retained on the screen, taking care to avoid damaging the organisms. The sample container should be filled to approximately 50% to 70% of capacity with screened material. After the bulk of material has been transferred to the container, closely examine the screen for any organisms caught in the mesh. Remove any organisms with forceps and add them to the sample container. Thoroughly wash the screen box and scrub the mesh before the next sample is screened.

All infaunal samples will be treated with a relaxant solution for approximately 30 minutes prior to fixation. Either an Epsom salts ($MgSO_4$) solution or a propylene phenoxytol solution (formulations below) may be used for this purpose. Relaxant solutions may be used as the diluent water for the fixative, or may be decanted after exposure and replaced with 10% buffered formalin. If it is used as diluent water, fill the sample container to 85% to 90% of its volume, close the container, and invert it several times to distribute the solution. Leave the sample in the relaxant. After 30 minutes, top off the container with enough sodium borate

buffered formaldehyde to achieve a 10% formalin solution. Close the container once again, and invert it several times to ensure mixing. Store the sample for return to the laboratory.

If the relaxant solution is not used as the diluent water, the relaxant must be removed from the sample container and replaced with 10% buffered formalin. After 30 minutes of treatment, decant the relaxant from the sample through a screen with a mesh size of 1.0 mm or less. Ensure that all organisms are removed from the screen and placed in the sample container. Fill the container with sodium borate buffered 10% formalin rather than undiluted formaldehyde, close the container, invert it several times, and store it for return to the laboratory.

Relaxant and fixative stock solution alternatives are as follows:

1) Epsom salts relaxant solution:	1.5 kilograms (kg) Epsom salts ($MgSO_4$ at $7H_2O$) per 20 L of freshwater
2) Propylene phenoxytol solution:	30 mL propylene phenoxytol to 20 L of seawater
3) Buffered formalin solution:	50 g sodium borate ($Na_2B_4O_7$) per 1 L of formalin
4) Buffered 10% formalin solution:	1 part buffered formalin to 9 parts fresh or salt water

1.4 Quality Assurance/Quality Control

It is the responsibility of the Field Team Leader to periodically check and ensure that the sampling procedures are in conformance with those stated in this SOP.

STANDARD OPERATING PROCEDURE: BENTHIC INFAUNA COMMUNITY ANALYSIS

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

The goal of this Standard Operating Procedure (SOP) is to provide recommendations for laboratory processing, quality assurance (QA), quality control (QC), and data analysis procedures that are recommended for assessing the condition of soft bottom benthic macroinvertebrate communities of California's bays and estuaries. It is intended to supplement protocols presently used in California with regard to methods that meet the requirements of the sediment quality assessment framework contained in the draft Sediment Quality Objectives (SQO) policy.

Benthic infauna analyses will be conducted in accordance with Sediment Quality Assessment Draft Technical Support Manual (Bay et al. 2009). Chapter 5 of the Sediment Quality Assessment Draft Technical Support Manual (Bay et al. 2009) details recommended laboratory procedures for the processing of benthic infauna samples and subsequent data analysis necessary for the SQO Part 1 assessment.

1.2 Personnel Qualifications

Personnel performing benthic sorting of organisms into major phyla will have sufficient training and experience to perform this task. Taxonomists will have a combination of education and experience to identify organisms to species level. The Quality Control/Quality Assurance (QA/QC) procedures described below shall be used to verify accuracy.

1.3 Procedures

Benthic infauna sample processing in the laboratory includes the following tasks.

1.3.1 Sample Preservation

Samples that are received from the field in formalin fixative must be washed and transferred to alcohol preservative. The removal of formalin is necessary for two reasons. Formaldehyde becomes increasingly acidic over time and prolonged exposure damages organisms with calcareous structures (e.g., shelled mollusks) which are often essential for accurate identifications. Secondly, formaldehyde is a noxious, potentially dangerous chemical. Replacing formaldehyde with ethanol makes subsequent sample handling safer.

Other benefits of the washing process are the removal of excess silt from mud balls and fecal pellets that may have broken down during fixation and, in some cases, the opportunity to separate most of the organisms in a sample from inorganic debris using an elutriation process (defined below).

Samples fixed in formalin in the field should remain in formalin fixative for at least 72 hours, but no sample should remain in fixative for longer than two weeks because formalin will decalcify mollusks and echinoderms. Benthic community samples should be preserved in a 70% ethanol solution. Denatured alcohol and dyes for staining organisms are not recommended. The alcohol preservative should be buffered with marble chips, especially if the ethanol is produced by industrial distillation rather than fermentation. Ethanol is commonly purchased as a 95% ethanol solution. To prepare 1 L of 70% ethanol solution, 263 ml of purified water (i.e., filtered and de-ionized by reverse osmosis) is added to 737 ml of 95% ethanol. If samples contain a high percent of crustaceans, it is recommended to substitute some water with glycerin (i.e., 70% ethanol, 25% purified water, 5% glycerin) to help maintain exoskeleton shape.

1.3.2 Sample Sorting

Organisms that were alive at time of collection are removed from the organic and inorganic residues (debris) that compose the sample. They are then sorted into broad taxonomic categories for analysis by taxonomists. Sorting must be accurate and complete to ensure the value of subsequent steps in the sample analysis process. Quality control procedures described in the following paragraphs are used to ensure that sorting accuracy and completeness meet data quality objectives.

Several sorting techniques are used for the removal of benthic organisms from sediment. Commonly, a small amount of sample is placed in a Petri dish, and each organism is systematically sorted and removed under a dissecting microscope using forceps. The elutriation or "floating" method is an effective technique when a sample is primarily coarse sand or highly organic. Inorganic material in the sample is separated from the lighter organic debris and organisms by the following elutriation process: After washing the formalin from the sample, spread the sample material out in a shallow pan or flat tray and

cover with water. Gently agitate the sample by hand to allow the lighter fraction of debris and organisms to separate from the heavier material. The densest material settles to the bottom while the less dense material, such as organic material, arthropods, and other soft-bodied organisms, becomes suspended. The solution is then poured through the sieve and sorted. The denser material (i.e., sand grains and mollusks) is covered with water, so that it is more easily sorted and removed under a dissecting microscope. The water containing the lighter material should be decanted through a sieve, repeating the process several times until no more material is observed in the decanted water. Then the material in the decanted water is collected into a small sample container, topped with preservative, and returned to the original sample container along with the balance of the sample material. The sample container should be filled with preservative and its lid tightly affixed. Both containers should be labeled properly with internal labels.

It is generally recommended that sorting be done in 70% ethanol, with care taken to ensure that the sample being sorted is always fully covered with alcohol. It is not uncommon for Ophiuroidea to be removed from the ethanol and air dried to assist with identification. Organisms removed from the sample are sorted into taxonomic groups for subsequent taxonomic analysis. Remove all individual organisms and fragments from the sample with the exception of nematodes, foraminifera, and planktonic species or life stages. All fragments, such as decapod chelae and legs, should be placed in their respective taxa groups. The number and identity of taxa groups composing the sorted sample, the number of containers used if sample is split, and the time (to the nearest one-half hour) required to sort the sample should be recorded on the sorting record form.

Aggregate the taxa groups into one or more sample containers. It is generally recommended that each sample container and taxa group be internally labeled with station name, sampling date and depth, and split number (if more than one container is used). Labels should be written in pencil or indelible ink on 100% rag paper, poly paper, or other paper suitable for permanent wet labels.

1.3.3 Taxonomic Analysis

The purpose of sorting into taxonomic groups is to facilitate taxonomic analysis by project taxonomists, with each group being analyzed by a single taxonomist. Therefore, the specifics of taxonomic groups may vary with the number of project taxonomists available and the details of their taxonomic expertise.

Organisms in samples are identified and counted, voucher specimens are prepared to document identifications, and taxonomic analysis accuracy may be evaluated by reanalyzing selected samples.

1.3.4 Data Analysis to Determine Benthic Invertebrate Community Condition

The composition of the benthic community constitutes an essential line of evidence (LOE) for sediment quality assessment. The Benthic LOE is a direct measure of the effect that sediment contaminant exposure has on the benthic biota of California's bays and estuaries. Determination of the Benthic LOE is based on four measures of benthic community condition: 1) the Index of Biotic Integrity (IBI), 2) the Relative Benthic Index (RBI), 3) the Benthic Response Index (BRI), and 4) the River Invertebrate Prediction and Classification System (RIVPACS). This chapter includes computational tools for calculating the Benthic LOE category and provides an example of the step-by-step process for its determination.

1.4 Quality Assurance/Quality Control (QA/QC)

Quality control of sorting is essential to ensure the value of all the subsequent steps in the sample analysis process. A standard sorting form is usually used for tracking the sample. It includes the name of the technician responsible, time required for sorting, comments, and re-sorting results. Re-sorting of samples is employed for QC purposes. It is a good practice to have, at a minimum, 10 to 20% of all samples re-sorted to monitor sorter performance.

There are two recommended approaches used for re-sorting: the aliquot sample method and the whole sample method. A laboratory may choose one of these two methods but, for consistency, a single method should be employed by a laboratory for all samples in a single project. The re-sort method used should be noted on the sorting form along with the re-sort results.

- **Whole Sample Method**. At least 10% of the samples processed by each sorter are completely re-sorted.
- **Aliquot Method**. A representative aliquot of at least 10% of the sample volume of every sample processed by each sorter is re-sorted.

Regardless of the method employed, an experienced sorter other than the original sorter conducts all re-sorting. Percent sorting efficiency is calculated as follows:

Whole Sample Method:

$$\% \text{ Efficiency} = 100 \cdot [\#\text{Organisms}_{\text{sorted}} \div (\#\text{Organisms}_{\text{sorted}} + \#\text{Organisms}_{\text{from Re-sort}})]$$

Aliquot Method:

$$\% \text{ Efficiency} = 100 \cdot [\#\text{Organisms}_{\text{sorted}} \div (\#\text{Organisms}_{\text{sorted}} + \#\text{Organisms}_{\text{from Re-sort}} \cdot \%_{\text{aliquot}})]$$

If sorting efficiency is greater than 95% (i.e., no more than 5% of the organisms in the original sample are missed), then no further action is required. Sorting efficiencies below 95% initiate continuous monitoring of the underperforming technician. Failure to achieve 95% sorting efficiency initiates re-sorting of all samples previously sorted by that technician. Organisms found during re-sort should be included in the results from the sample. The calculated sorting efficiency is recorded on the sorting form for each sample that is re-sorted. The laboratory responsible for sorting should retain sample debris left after sorting until cleared for disposal. The debris should be properly labeled and preserved with 70% ethanol. Specific attention should be given to nomenclature rules because this information significantly affects the efficiency of the benthic indices calculations and QA/QC procedures. Species lists provided should be strictly adhered to, and the most up-to-date taxon names and exact spelling of taxon names based on the species lists should be used. Doing so will prevent miscounting of key organisms and erroneous benthic indices calculations.

STANDARD OPERATING PROCEDURE: FISH COLLECTION (OTTER TRAWL NETS)

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) is applicable to the collection of targeted fish species via otter trawling. Fish tissue samples will be collected and analyzed for chemical contaminants of concern. Sampling, processing, and testing methods will be carried out in accordance with Bight protocols (BCEC 2008, 2009a). Necessary permits (e.g., scientific collection, incidental take) will be secured prior to fish collection.

Targeted species

- White croaker (*Genyonemus lineatus*)
- California halibut (*Paralichthys californicus*)
- Shiner surfperch (*Cymatogaster aggregata*)

1.2 Health and Safety Warnings

Use caution when sorting through the catch. Field personnel are likely to encounter a variety of organisms that are potentially harmful. California scorpionfish (*Scorpaena guttata*) have venomous fin spines that can cause severe pain. This species should be handled with leather gloves and/or pliers. Hot water, meat tenderizer, or ammonia should be applied to any puncture wound inflicted by this fish; heat is useful in breaking down the protein in the venom. Several species of rockfishes and the spotted ratfish (*Hydrolagus colliei*) also have mildly venomous spines that can cause a burning sensation. The round sting ray (*Urobatis halleri*), the California butterfly ray (*Gymnura marmorata*), and the bat ray (*Myliobatis californica*) all have venomous spines on their tails. The wound should be immersed in hot water to break down the protein in the venom. The Pacific electric ray (*Torpedo californica*) can emit a very strong electric shock. If you must handle this species, wear rubber gloves and hold it by the tail. Do not grasp the disk with both hands. Pacific angel sharks (*Squatina californica*), spiny dogfish (*Squalus acanthias*), spotted ratfish, Pacific electric rays, and California halibut (*Paralichthys californicus*) all have sharp teeth that can result in painful bites if they are not handled properly. Care must also be taken in handling the blueleg mantis shrimp (*Hemisquilla ensigera*). This species is capable of severely cutting a person with its raptorial appendages. Care should also be taken in handling any of the large crabs and octopi.

1.3 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and corresponding documents (i.e., Coordinated Compliance Monitoring and Reporting Plan [CCMRP] and Programmatic Quality Assurance Project Plan [PQAPP]). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection. Personnel performing species identifications will have sufficient education and project experience in marine biology and ichthyology.

1.4 Procedures

When possible, fish will be collected using a semi-balloon, 7.6-meter headrope otter trawl following the methods in the Bight Field Operations Manual (BCEC 2008). If other methods need to be employed in the case an otter trawl is not feasible (e.g., lampara net, beach seine, fish trap, or hook and line), surface water ambient monitoring program (SWAMP) methods will be used (MPSL-DFG 2001).

Pre-trawl Survey

Prior to trawling at a new station, it is important to conduct a pre-trawl survey of the trawl course. Trawl gear is likely to be lost if it becomes snagged on bottom obstructions, and replacement of nets can be costly. The trawl course at a previously unsampled station should be evaluated by use of a fathometer. This pre-trawl survey can enable the navigator to avoid uncharted reefs and other obstacles. If obstacles are encountered, resurvey a new trawl course. The Field Team Leader has the sole authority to decide whether to trawl or abandon an unknown station. This survey should always be conducted at a new sampling site to determine whether the station is acceptable or if it should be abandoned. The pre-trawl survey should follow the expected trawl course along the isobath, and the fathometer will be examined for evidence of rocks and other obstacles.

If the first run indicates that a particular site is unacceptable, another survey will be conducted within 100 meters (m) or the original location and within +/-10% of the original depth. If this attempt is unsuccessful, a third attempt will be conducted at a different

location using the same protocols (within 100 m of the original location, and within +/-10% of original depth). The site will be abandoned after three unsuccessful attempts.

Net Preparation

The trawl components should be properly prepared prior to trawling so that the trawl can be deployed in an orderly and safe manner upon arrival at a station. Nets should be inspected for holes prior to deployment, and repaired as needed. The net should be laid out and stacked on the stern of the vessel in the same configuration that it will be deployed: cod-end to the stern, floats up, and foot rope down. The trawl net should be checked to make sure that the cod-end is tied correctly, the doors should be connected properly to the leg lines, and the bridles should be securely fastened to the doors and to the tow wire.

Trawling

Trawls will be towed along, rather than across, isobaths. While the vessel is underway, the net and doors will be placed in the water. It is important that the floats skim the surface and that the net is not entangled (e.g., crossed leg lines, bunched or hooked portions of the net) prior to paying out the bridles. The bridles should be paid out by personnel on either side of the net, so as to avoid becoming entangled in the rigging during deployment.

Use of the proper scope (i.e., length of hydrowire paid out versus the water depth) is important for successful trawls. After the net touches the bottom, a sufficient length of hydrowire (towing wire) should be paid out to ensure that the net is pulled from a horizontal rather than a vertical position. Insufficient scope will prevent the net from consistently fishing the bottom and will result in a no-catch or a short-catch situation. In general, the required scope declines with increasing depth because the additional weight of the hydrowire enhances the horizontal component of the towing forces (Table 1).

Table 1.
Recommended Scope and Length of Wire for Trawling
at Different Depths in the Southern California Bight

Water Depth (m)	Tow Wire Out (m)[1]	Approximate Scope (m)
<5	50	10.0:1
10	80	8.0:1
30	180	6.0:1
60	300	5.0:1
100	400	4.0:1
150	550	3.6:1
175	625	3.5:1
200	700	3.5:1
500	1,100	2.2:1

Note:
1 Note that 25 m of bridle is included in this scope
m = meter

These scopes are for 1.0-centimeter (cm) (0.38-inch [in]) hydrowire. These scopes will have to be adjusted accordingly when using hydrowire of a different diameter.

Trawling is conducted at a speed-over-ground of 1.0 meter per second (m/sec) (or 1.5 to 2.0 knots). At stations of less than 200 m water depth, the net is towed for 10 minutes, measured on deck from the start to the end of the trawl (i.e., lock down of winch to start of retrieval). Under normal circumstances, this distance over ground is equivalent to 450 to 600 m. Trawl speed and distance can be determined by differential global positioning system (DGPS). In confined areas (e.g., bays and harbors) the trawl duration may be reduced to 5 minutes, or a distance over ground of 225 to 300 m.

Trawls are conducted in a similar manner at stations exceeding depths of 200 m. Archival tags will be employed at these stations to verify on-bottom duration. While 10 minutes on the bottom is the nominal target time for each trawl, a working range of 8 to 15 minutes is acceptable. Upon completion of each trawl, the archival tag information will be immediately downloaded to determine the on-bottom duration. If bottom time is less than 8 minutes, the trawl will be repeated, adjusting the deployment duration as necessary to fall as close to10 minutes as possible.

All archival tag information should be retained electronically and submitted with the other data types at the end of the project.

At the end of the prescribed trawl time, the net will be retrieved and brought on board the vessel, the cod-end will be opened, and the catch will be deposited into a tub or holding tank. The catch will subsequently be released to the scientific crew for processing.

Criteria for Accepting a Trawl

If a trawl is retrieved with little or no catch in the cod-end, its acceptability will be evaluated according to whether the trawl was conducted properly. The criteria used to evaluate the success of any trawl will include ensuring that proper depth, scope, speed, and distance (or duration) were maintained; whether the net was fouled (net tangled); and whether the catch shows evidence that it was on the bottom (e.g., rocks, benthic invertebrates, or fish). If any of the trawl procedures were not followed, if the net was fouled or torn (the tear must be sufficient to allow escapement), or if there was no evidence of contact with the bottom (downloading the archival tag information can be useful), the trawl will be considered unacceptable and the site will be re-trawled. When evaluating whether to abandon or re-trawl a station, the Field Team Leader should keep in mind that the goal is to collect the targeted species.

If a retrieved net has been sufficiently torn to allow escapement during the course of a trawl, the station will be abandoned. If the trawl hangs up on the bottom, the site will be resampled or abandoned at the discretion of the Field Team Leader. If re-trawling the station proves unsuccessful after two further attempts, the site will be abandoned.

Trawl Data Log

If for any reason the field computer stops functioning, the field crew will be responsible for keeping a trawl data log. The information recorded in the log will include water depth, length of tow wire used, and times and coordinates (latitude and longitude) for the net on the bottom and the end of the trawl (beginning of trawl retrieval). Similar information may also be recorded for when the net was deployed (net over) and when the net was retrieved (net on deck). Any anomalous conditions, such as rocky substrate, rocks in the catch, or a torn net, should also be recorded in the log.

1.5 Quality Assurance/Quality Control

It is the responsibility of the Field Team Leader to periodically check to ensure that fish collection procedures are in conformance with those stated in this SOP.

STANDARD OPERATING PROCEDURE: FISH COLLECTION (ALL OTHER METHODS)

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

This Standard Operating Procedure (SOP) is applicable to the collection of targeted fish species via methods other than otter trawling (i.e., lampara net, beach seine, fish trap, or hook and line). Fish tissue samples will be collected and analyzed for chemical contaminants of concern. Sampling, processing, and testing methods will be carried out in accordance with surface water ambient monitoring program (SWAMP) methods (MPSL-DFG 2001). Necessary permits (e.g., scientific collection, incidental take) will be secured prior to fish collection.

Targeted species:

- White croaker (*Genyonemus lineatus*)
- California halibut (*Paralichthys californicus*)
- Shiner surfperch (*Cymatogaster aggregata*)

1.2 Health and Safety Warnings

Use caution when sorting through the catch. Field personnel are likely to encounter a variety of organisms that are potentially harmful. California scorpionfish (*Scorpaena guttata*) have venomous fin spines that can cause severe pain. This species should be handled with leather gloves and/or pliers. Hot water, meat tenderizer, or ammonia should be applied to any puncture wound inflicted by this fish; heat is useful in breaking down the protein in the venom. Several species of rockfishes and the spotted ratfish (*Hydrolagus colliei*) also have mildly venomous spines that can cause a burning sensation. The round sting ray (*Urobatis halleri*), the California butterfly ray (*Gymnura marmorata*), and the bat ray (*Myliobatis californica*) all have venomous spines on their tails. The wound should be immersed in hot water to break down the protein in the venom. The Pacific electric ray (*Torpedo californica*) can emit a very strong electric shock. If you must handle this species, wear rubber gloves and hold it by the tail. Do not grasp the disk with both hands. Pacific angel sharks (*Squatina californica*), spiny dogfish (*Squalus acanthias*), spotted ratfish, Pacific electric rays, and California halibut (*Paralichthys californicus*) all have sharp teeth that can result in painful bites if they are not handled properly. Care must also be taken in handling the blueleg mantis shrimp (*Hemisquilla ensigera*). This species is capable of severely cutting a person

with its raptorial appendages. Care should also be taken in handling any of the large crabs and octopi.

1.3 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this SOP and corresponding documents (i.e., Coordinated Compliance Monitoring and Reporting Plan [CCMRP] and Programmatic Quality Assurance Project Plan [PQAPP]). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection. Personnel performing species identifications will have sufficient education and project experience in marine biology and ichthyology.

1.4 Procedures

Fish will be collected using the appropriate gear for the desired species and existing water conditions.

Fyke or Hoop Net

Six 36-inch-diameter hoops connected with 1-inch square mesh net will be used to collect fish, primarily catfish. The net will be placed parallel to the shore with the open hoop end facing downstream. The net will be placed in areas of slow moving water. A partially opened can of cat food will be placed in the upstream end of the net. Between two and six nets will be placed at a site overnight. Upon retrieval a grappling hook will be used to pull up the downstream anchor. The hoops and net will be pulled together and placed on a 30-gallon plastic bag in the boat. With polyethylene gloves, the desired fish will be placed in a 30-gallon plastic bag and kept in an ice chest with ice until the appropriate number and size of fish are collected.

Gill Nets

A 100 yard monofilament gill net of the appropriate mesh size for the desired fish will be set out over the bow of the boat parallel to shore. The net will be retrieved after being set for 1 to 4 hours. The boat engine will be turned off and the net pulled over the side or bow of the boat. The net will be retrieved starting from the down-current end. If the current is too

strong to pull in by hand, then the boat will be slowly motored forward and the net pulled over the bow. Before the net is brought into the boat, the fish will be picked out of the net, placed in another 30 gallon plastic bag, and kept in an ice chest with ice.

Beach Seines

In areas of shallow water, beach seines of the appropriate length, height, and mesh size will be used. One sampler in a wetsuit or waders will pull the beach seine out from shore. The weighted side of the seine must drag on the bottom while the float side is on the surface. The offshore sampler will pull the seine out as far as necessary, and then will pull the seine parallel to shore and then back to shore, forming a half circle. Another sampler will hold the other end on shore while this is occurring. When the offshore sampler reaches shore, the two samplers will come together with the seine. The seine will be pulled onto shore, making sure that the weighted side drags the bottom. When the seine is completely pulled onshore, the target fish will be collected with polyethylene gloves and placed in a 30-gallon plastic bag and kept in an ice chest with ice. The beach seine will be rinsed off in the ambient water and placed in the rinsed 30-gallon plastic bucket.

Cast Net

A 10- or 12-foot cast net will be used to collect fish off a pier, boat, or shallow water. The cast net will be rinsed in ambient water prior to use and stored in a covered plastic bucket. The target fish will be sampled with polyethylene gloves, placed in a 30-gallon plastic bag, and kept in an ice chest with ice.

Hook and Line

Fish will be caught off a pier, boat, or shore by hook and line. Hooked fish will be taken off with polyethylene gloves, placed in a Ziploc™ bag or a 30-gallon plastic bag, and kept in an ice chest with ice.

Spearfishing

Certain species of fish are captured more easily by SCUBA divers spearing the fish. Only appropriately trained divers following the dive safety program guidelines will be used for this method of collection. Generally, fish in the kelp beds are more easily captured by spearing. The fish will be shot in the head area to prevent the fillets from being damaged or

contaminated. Spear tips will be washed with a detergent and rinsed with ambient water prior to use.

1.5 Quality Assurance/Quality Control

It is the responsibility of the Field Team Leader to periodically check to ensure that fish collection procedures are in conformance with those stated in this SOP.

STANDARD OPERATING PROCEDURE: FISH PROCESSING

1 STANDARD OPERATING PROCEDURE ACKNOWLEDGEMENT FORM

Project Number: _____ Project Name: _____

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

1.1 Scope and Application

Fish tissue samples will be collected and analyzed for chemical contaminants of concern. Sampling, processing, and testing methods will be carried out in accordance with Bight protocols (BCEC 2008, 2009a). Necessary permits (e.g., scientific collection, incidental take) will be secured prior to fish collection.

Targeted species

- White croaker (*Genyonemus lineatus*)
- California halibut (*Paralichthys californicus*)
- Shiner surfperch (*Cymatogaster aggregata*)

1.2 Personnel Qualifications

Field personnel executing these procedures will read, be familiar with, and comply with the requirements of this Standard Operating Procedure (SOP) and corresponding documents (i.e., Coordinated Compliance Monitoring and Reporting Plan [CCMRP] and Programmatic Quality Assurance Project Plan [PQAPP]). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection. Personnel performing species identifications will have sufficient education and project experience in marine biology and ichthyology.

1.3 Procedures

Once the catch is onboard the vessel, the targeted species will be identified and separated for subsequent processing. At each station, 12 individuals of each fish species will be collected for further processing. There is currently no legal size limit for white croaker. An ocean fish contaminant survey was performed from 2002 to 2004 (NOAA 2007). In part, this survey sought to generate information on contaminants of concern for fish caught for sustenance in Southern California. Collection of white croaker for the Harbor Toxics TMDL study should be consistent with this survey, which recommended a minimum length of 160 millimeters (mm) (total length). Collection of California halibut that are of legal size limit is preferred. The current regulations specify at least 22 inches, or 559 mm, (total length) for California halibut (FGC 2012). Collection of adult shiner surfperch (i.e., second year age-class with a target length of 88 mm [Odenweller 1975]) is preferred. Additional individuals of the three

target species and non-target species will be returned to the ocean as soon as possible to minimize loss. It should be noted that field personnel may encounter bycatch that are potentially harmful while sorting for targeted species. The Bight Field Operations Manual (BCEC 2008) and Fish Collection SOPs in Appendix A provide information on the safe handling of these organisms.

Each targeted fish kept will be tagged with a unique identification number; measured for total length, fork length, and weight; and examined for gross pathology in accordance with guidance established in the Bight Field Operations Manual (BCEC 2008). Three composite samples per species per station will be created. A composite sample will be composed of four individuals; therefore, a total of 12 individuals per station are required. If more than 12 specimens are caught, the 12 individuals best and most closely distributed about the 75th percentile of the length distribution of all individuals will be used for the composites. The selected 12 individual fish will then be arranged by size, and the smallest four fish, the middle four fish, and the largest four fish within a species will be grouped for each composite to satisfy the 75 percent rule (the smallest individual in a composite is no less than 75 percent of the total length of the largest individual in a composite; USEPA 2000). This may permit data evaluation based on size class, if necessary. Skin-off fillets will be used. Dissection and compositing methods will be performed in the analytical laboratory in accordance with U.S. Environmental Protection Agency (USEPA) guidance (USEPA 2000).

Fish tissue will be analyzed for chemical parameters, processing, and preservation according to the methods described in the Bight Field Operations Manual and Bioaccumulation Workplan (BCEC 2008, 2009). Fish will be processed according to these steps:

1. Sacrifice fish and leave the whole body intact.
2. Blot fish dry and pack each fish in aluminum foil (shiny side out).
3. Place each packed fish in a labeled, food-grade, resalable plastic bag and store on ice.
4. Ship overnight to the analytical laboratory on wet or blue ice. If samples are held more than 24 hours, they will be packed on dry ice.

Chain-of-custody forms will be maintained. Tissue compositing will be conducted by the analytical laboratory. Recommended conditions for sampling containers, sample handling, and storage are listed in Table 11 of the CCMRP.

1.4 Quality Assurance/Quality Control

Guidance for data quality objectives (DQOs) for field measurements is derived from the surface water ambient monitoring program (SWAMP) guidance from the Bight Field Operations Manual for fish tissue parameters (BCEC 2008). Quality objectives for parameters that will be measured in the field are presented in Table 1.

All field measurements will be made in triplicate. Each result will be recorded along with the average of the three results, the difference between the largest and smallest result, and the percent difference between the largest and smallest result. The percent difference will be calculated as follows:

Percent difference = 100*(largest-smallest)/average

Triplicate measurements, the average of the results, and percent difference will be recorded on the field data sheet. The percent difference will be compared against the precision criteria established for field measurements in Table 1, as appropriate. If precision does not meet the established criteria, the equipment should be inspected to ensure that it is working properly. Equipment will be recalibrated, if necessary, and then the triplicate measurements process will be repeated until DQOs are achieved.

Table 1
DQOs for Field Measurements

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Completeness
Fish Tissue	Fish species identification	95 percent	NA	NA	NA	NA
Fish Tissue	Fish enumeration	90 percent	NA	NA	NA	NA
Fish Tissue	Fish lengths	90 percent	90 percent	NA	NA	NA
Fish Tissue	Fish weights	90 percent	Within 0.2 kg	NA	NA	NA

Notes:
kg = kilogram
NA = not applicable