appendix C

# QUALITY ASSURANCE/ QUALITY CONTROL

This appendix details quality assurance/quality control information for the water quality analyses, sediment geochemistry analyses, tissue chemistry analyses, invertebrate taxonomy, and otter trawl sample collection conducted for the Orange County Sanitation District's (OCSD) 2010-11 ocean monitoring program.

## INTRODUCTION

The Core monitoring program was designed to measure compliance with permit conditions and for temporal and spatial trend analysis. The program includes measurements of:

- Water quality;
- Sediment quality;
- Benthic infaunal community health;
- Fish and macroinvertebrate community health;
- Fish tissue contaminant concentrations (chemical body burden); and
- Fish health (including external parasites and diseases).

The Core monitoring program complies with the Orange County Sanitation District (OCSD) Quality Assurance/Quality Control (QA/QC) Program requirements and applicable federal, state, local, and contract requirements. The objectives of the quality assurance program are as follows:

- Scientific data generated will be of sufficient quality to stand up to scientific and legal scrutiny.
- Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data.
- Data will be of known and acceptable precision, accuracy, representativeness, completeness, and comparability as required by the program.

The various aspects of the program are conducted on a schedule that varies weekly, monthly, quarterly, semi-annually, and annually. Table C-1 shows that sampling goals were achieved for >99.6 percent of the required samples. Sampling and data analysis is characterized by quarters 1 through 4, which are representative of summer (July–September), fall (October–December), winter (January–March), and spring (April–June) seasons, respectively.

## WATER QUALITY NARRATIVE

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) staff collected 551 discrete ammonia samples during each of the four quarters beginning July 1, 2010 and ending June 30, 2011. All samples were iced upon collection, preserved with 1:1 sulfuric acid upon receipt by the ELOM laboratory staff, and stored at 4 ± 2 °C until analysis according to ESL Standard Operating Procedures (SOPs), which are found in the Laboratory Operating Procedures Manual (LOPM).

Analytical Method - Ammonia

The samples were analyzed for ammonia on a segmented flow analyzer using Standard Method 4500-$NH_3$ G (Standard Methods 1998). In the analysis, sodium phenolate and sodium hypochlorite react with ammonia to form indophenol blue in a concentration proportional to the ammonia concentration in

**Table C-1. Ocean monitoring program sample collection requirements and percent completion, July 2010–June 2011.**

Orange County Sanitation District, California.

| Quarter | Program Type | Parameter | Nominal # of Samples | # of Samples Collected | # of QA Duplicates * (≥10%) | %Samples Collected |
|---|---|---|---|---|---|---|
| 1 | Water Quality | CTD Drops | 105 | 105 | 15 | 100 |
| | | Ammonium | 470 | 551 | 81 | 100 |
| | | Bacteria | 260 | 259 | 30 | 99.6 |
| | Sediment Chemistry | Grain size | 49 | 49 | 5 | 100 |
| | | TOC | 49 | 49 | 2 | 100 |
| | | Dissolved Sulfides | 49 | 49 | 5 | 100 |
| | | Metals | 49 | 49 | 5 | 100 |
| | | PCB/Pesticides | NA | NA | NA | NA |
| | | PAH | 49 | 49 | 6 | 100 |
| | | LAB | 49 | 49 | 6 | 100 |
| | Benthic Infauna | Infauna | 49 | 49 | 0 | 100 |
| | Fish Community | Trawls * | 23 | 23 | NA | 100 |
| 2 | Water Quality | CTD Drops | 105 | 105 | 22 | 100 |
| | | Ammonium | 470 | 551 | 81 | 100 |
| | | Bacteria | 260 | 260 | 30 | 100 |
| | Sediment Chemistry | Grain size | 10 | 10 | 1 | 100 |
| | | TOC | 10 | 10 | 0 | 100 |
| | | Dissolved Sulfides | 10 | 10 | 1 | 100 |
| | | Metals | 10 | 10 | 1 | 100 |
| | | PCB/Pesticides | 10 | 10 | 1 | 100 |
| | | PAH | 10 | 10 | 1 | 100 |
| | Benthic Infauna | Infauna | 30 | 30 | 0 | 100 |
| 3 | Water Quality | CTD Drops | 105 | 105 | 21 | 100 |
| | | Ammonium | 470 | 551 | 81 | 100 |
| | | Bacteria | 260 | 260 | 30 | 100 |
| | Sediment Chemistry | Grain size | 10 | 10 | 1 | 100 |
| | | TOC | 10 | 10 | 0 | 100 |
| | | Dissolved Sulfides | 10 | 10 | 1 | 100 |
| | | Metals | 10 | 10 | 1 | 100 |
| | | PCB/Pesticides | 10 | 10 | 1 | 100 |
| | | PAH | 10 | 10 | 1 | 100 |
| | Benthic Infauna | Infauna | 30 | 30 | 3 | 100 |
| | Fish Community | Trawls | 23 | 23 | NA | 100 |
| | Fish Tissue | Hornyhead turbot | 20 X 2 * | 20 X 2 * | 4 | 100 |
| | | English sole | 20 X 2 * | 20 X 2 * | 6 | 100 |
| | | Sanddab Guild | 12 | 12 | 2 | 100 |
| 4 | Water Quality | CTD Drops | 105 | 105 | 15 | 100 |
| | | Ammonium | 470 | 551 | 81 | 100 |
| | | Bacteria | 260 | 260 | 30 | 100 |
| | Sediment Chemistry | Grain size | 10 | 10 | 1 | 100 |
| | | TOC | 10 | 10 | 1 | 100 |
| | | Dissolved Sulfides | 10 | 10 | 1 | 100 |
| | | Metals | 10 | 10 | 1 | 100 |
| | | PCB/Pesticides | 10 | 10 | 1 | 100 |
| | | PAH | 10 | 10 | 1 | 100 |
| | Benthic Infauna | Infauna | 30 | 30 | 0 | 100 |

NA = not applicable

* Number of QA duplicates indicates number of field duplicates or lab sample splits only. It does not include other QA samples.

** English sole and hornyhead turbot samples were analyzed for both muscle and liver tissue.

the sample. The blue color is intensified with sodium nitroprusside and is measured at 660 nm.

<u>QA/QC - Ammonia</u>
A typical sample batch includes three blanks, an external reference standard, a spike, and a spike replicate in seawater collected from a control site. One spike and spike replicate is added to the batch every 10 samples. The method detection limit (MDL) for low-level ammonia samples using the segmented flow instrument is 0.02 mg/L. QA/QC summary data are presented in Table C-2. All samples were analyzed within the required holding time with 100% of the 78 analyses meeting the QA/QC criteria for blanks. All analyses met the QA/QC criteria for the external reference sample. The 54 first quarter sample matrix spike recoveries, replicate recoveries, and precision measurements were all within target limits. The 63 second quarter sample matrix spike and replicate recoveries were within target limits, while two of the 63 precision measurements were outside target limits. Three of 89 matrix spike replicate samples, two of 89 matrix spike replicate recoveries, and one of 89 precision measurements for matrix spike and matrix spike replicates were out of control for the third quarter samples. All 69 fourth quarter samples met target limits for matrix spike recoveries, replicates, and precision measurements. In all cases, it was determined that recovery and precision criteria were exceeded due to matrix effects or instrumentation malfunction. Additionally, the set of results following those in question were within the control limits and therefore all results are considered valid.

**Table C-2. Water quality ammonium QA/QC summary, July 2010–June 2011.**

Orange County Sanitation District, California.

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Summer | NH3WQ100716-1 | Ammonium | Blank | 6 | 6 | <2X MDL | N/A |
| | | | Matrix Spike | 14 | 10, 4* | 80-120 | |
| | | | Matrix Spike Dup | 14 | 11, 3* | 80-120 | |
| | | | Matrix Spike Precision | 14 | 13, 1** | | < 11% |
| | | | ERA Check Standard | 2 | 2 | 87 - 114 | |
| Summer | NH3WQ100804-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 15 | 14 | 80-120 | |
| | | | Matrix Spike Dup | 15 | 14, 1* | 80-120 | |
| | | | Matrix Spike Precision | 15 | 12, 3** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Summer | NH3WQ100804-2 | Ammonium | Blank | 0 | 0 | <2X MDL | N/A |
| | | | Matrix Spike | 5 | 5 | 80-120 | |
| | | | Matrix Spike Dup | 5 | 5 | 80-120 | |
| | | | Matrix Spike Precision | 5 | 5 | | < 11% |
| | | | ERA Check Standard | 0 | 0 | 87 - 114 | |
| Summer | NH3WQ100812-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 13 | 12, 1* | 80-120 | |
| | | | Matrix Spike Dup | 13 | 13 | 80-120 | |
| | | | Matrix Spike Precision | 13 | 13 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Summer | NH3WQ100813-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 7 | 7 | 80-120 | |
| | | | Matrix Spike Dup | 7 | 7 | 80-120 | |
| | | | Matrix Spike Precision | 7 | 7 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |

**Table C-2 Continues.**

**Table C-2 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Fall | NH3WQ100924-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 9 | 9 | 80-120 | |
| | | | Matrix Spike Dup | 9 | 9 | 80-120 | |
| | | | Matrix Spike Precision | 9 | 7, 2** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Fall | NH3WQ100928-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 6 | 6 | 80-120 | |
| | | | Matrix Spike Dup | 6 | 6 | 80-120 | |
| | | | Matrix Spike Precision | 6 | 6 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Fall | NH3WQ101103-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 11 | 11 | 80-120 | |
| | | | Matrix Spike Dup | 11 | 11 | 80-120 | |
| | | | Matrix Spike Precision | 11 | 8, 3** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Fall | NH3WQ101104-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 11 | 10, 1* | 80-120 | |
| | | | Matrix Spike Dup | 11 | 10, 1* | 80-120 | |
| | | | Matrix Spike Precision | 11 | 10, 1** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Fall | NH3WQ101105-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 10 | 10 | 80-120 | |
| | | | Matrix Spike Dup | 10 | 10 | 80-120 | |
| | | | Matrix Spike Precision | 10 | 5, 5** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Fall | NH3WQ101108-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 6 | 6 | 80-120 | |
| | | | Matrix Spike Dup | 6 | 6 | 80-120 | |
| | | | Matrix Spike Precision | 6 | 2, 4** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |

**Table C-2 Continues.**

**Table C-2 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Fall | NH3WQ101117-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 10 | 10 | 80-120 | |
| | | | Matrix Spike Dup | 10 | 10 | 80-120 | |
| | | | Matrix Spike Precision | 10 | 4, 4** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ101216-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 10 | 10 | 80-120 | |
| | | | Matrix Spike Dup | 10 | 10 | 80-120 | |
| | | | Matrix Spike Precision | 10 | 7, 3** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ101217-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 5 | 5 | 80-120 | |
| | | | Matrix Spike Dup | 5 | 5 | 80-120 | |
| | | | Matrix Spike Precision | 5 | 5 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110131-1 | Ammonium | Blank | 3 | 2 | <2X MDL | N/A |
| | | | Matrix Spike | 7 | 6 | 80-120 | |
| | | | Matrix Spike Dup | 7 | 5, 1* | 80-120 | |
| | | | Matrix Spike Precision | 7 | 6, 1** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110201-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 8 | 7 | 80-120 | |
| | | | Matrix Spike Dup | 8 | 8 | 80-120 | |
| | | | Matrix Spike Precision | 8 | 8 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110202-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 8 | 8 | 80-120 | |
| | | | Matrix Spike Dup | 8 | 8 | 80-120 | |
| | | | Matrix Spike Precision | 8 | 3, 5** | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |

**Table C-2 Continues.**

**Table C-2 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Winter | NH3WQ110208-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 8 | 8 | 80-120 | |
| | | | Matrix Spike Dup | 8 | 8 | 80-120 | |
| | | | Matrix Spike Precision | 8 | 8 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110209-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 7 | 7 | 80-120 | |
| | | | Matrix Spike Dup | 7 | 7 | 80-120 | |
| | | | Matrix Spike Precision | 7 | 7 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110217-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 11 | 11 | 80-120 | |
| | | | Matrix Spike Dup | 11 | 11 | 80-120 | |
| | | | Matrix Spike Precision | 11 | 11 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110223-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 12 | 11 | 80-120 | |
| | | | Matrix Spike Dup | 12 | 11 | 80-120 | |
| | | | Matrix Spike Precision | 12 | 11 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Winter | NH3WQ110224-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 13 | 13 | 80-120 | |
| | | | Matrix Spike Dup | 13 | 13 | 80-120 | |
| | | | Matrix Spike Precision | 13 | 13 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110324-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 9 | 9 | 80-120 | |
| | | | Matrix Spike Dup | 9 | 9 | 80-120 | |
| | | | Matrix Spike Precision | 9 | 9 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110328-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 6 | 6 | 80-120 | |
| | | | Matrix Spike Dup | 6 | 6 | 80-120 | |
| | | | Matrix Spike Precision | 6 | 6 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |

**Table C-2 Continues.**

**Table C-2 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Spring | NH3WQ110502-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 5 | 5 | 80-120 | |
| | | | Matrix Spike Dup | 5 | 5 | 80-120 | |
| | | | Matrix Spike Precision | 5 | 5 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110503-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 8 | 8 | 80-120 | |
| | | | Matrix Spike Dup | 8 | 8 | 80-120 | |
| | | | Matrix Spike Precision | 8 | 8 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110511-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 10 | 10 | 80-120 | |
| | | | Matrix Spike Dup | 10 | 10 | 80-120 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110512-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 11 | 11 | 80-120 | |
| | | | Matrix Spike Dup | 11 | 11 | 80-120 | |
| | | | Matrix Spike Precision | 11 | 11 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110517-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 10 | 10 | 80-120 | |
| | | | Matrix Spike Dup | 10 | 10 | 80-120 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Spring | NH3WQ110518-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 10 | 10 | 80-120 | |
| | | | Matrix Spike Dup | 10 | 10 | 80-120 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Summer | NH3WQ110615-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 9 | 9 | 80-120 | |
| | | | Matrix Spike Dup | 9 | 9 | 80-120 | |
| | | | Matrix Spike Precision | 9 | 9 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |
| Summer | NH3WQ110620-1 | Ammonium | Blank | 3 | 3 | <2X MDL | N/A |
| | | | Matrix Spike | 6 | 6 | 80-120 | |
| | | | Matrix Spike Dup | 6 | 6 | 80-120 | |
| | | | Matrix Spike Precision | 6 | 6 | | < 11% |
| | | | ERA Check Standard | 1 | 1 | 87 - 114 | |

* Recovery (70% or 130%) was out of control due to rounding.
** Matrix spike precision was out of control due to rounding.  The associated method blank and check standard were in control and therefore the data were reported.

# SEDIMENT CHEMISTRY NARRATIVE

## FIRST QUARTER (JULY 2010)

Introduction

OCSD's laboratory received 49 sediment samples from ocean monitoring staff during the month of July 2010. All samples were stored according to the LOPM. All samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), linear alkyl benzenes (LABs), trace metals, mercury, dissolved sulfides (DS), total organic carbon (TOC), and grain size. First quarter sediment samples were not analyzed for organochlorine pesticides or polychlorinated biphenyl congeners (PCBs), with approval from the California Regional Water Quality Control Board and USEPA due to an OCSD sediment-mapping project. In addition, 20 samples typically collected during the first quarter (replicate samples 2 and 3) were not collected, and were re-directed toward the sediment mapping study.

Analytical Methods - PAHs and LABs

The analytical methods used to detect PAHs and LABs in the samples are described in the LOPM. All sediment samples were extracted using an accelerated solvent extractor (ASE) during the months of August through September 2010. Approximately 10 grams (dry weight) of sample were used for each analysis. A separatory funnel extraction was performed using 100 milliliters of sample when field and rinse blanks were included in the batch.

A typical sample batch included 18 field samples with required quality control (QC) samples. Each sample batch analyzed for PAHs and LABs included the following QC samples: one sand blank, one reporting level spike (PAH or LAB), two standard reference materials (SRM), one matrix spike set (PAH or LAB), and two sample extraction duplicates. There were four batches extracted and analyzed for PAHs. In addition, one batch contained one rinse sample and one field blank. Method detection limits (MDLs) are presented in Table C-3. Acceptance criteria for PAH SRMs are presented in Table C-4.

Sediment PAH and LAB QA/QC summary data are presented in Table C-5. All analyses were performed within holding times and with appropriate quality control measures, as stated in the program's Quality Assurance Project Plan (QAPP). Any variances are noted in the Comments/Notes section of each batch summary.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

Organochlorine pesticides and PCB congener samples were not analyzed for the summer of 2010. MDLs for PCBs/pesticides for fall through spring samples are presented in Tables C-6 and C-7. Acceptance Criteria for PCB/pesticide SRMs are presented in Table C-8. Sediment PCB/pesticide QA/QC summary data are presented in Table C-9.

Analytical Methods - Trace Metals

Dried sediment samples were analyzed for trace metals in accordance with methods in the LOPM. A typical sample batch for silver, cadmium, chromium, copper, nickel, lead, zinc, selenium, arsenic, and beryllium analyses included three blanks, a blank spike, and one SRM. Additionally, duplicate samples, spiked samples and duplicate spiked samples were analyzed a minimum of once every 10 sediment samples. QC for a typical sample batch for aluminum and iron analyses included three blanks, an SRM, sediment sample with duplicates, spiked samples and duplicate spiked samples analyzed a minimum of once every 10 sediment samples. The analysis of the blank spike and SRM provided a measure of the accuracy of the analysis. The analysis of the sample, its

**Table C-3. Method detection levels for PAH and LAB compounds in sediments, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight) | Parameter | Accelerated Solvent Extraction SIM Detection Limit, (ng/g dry weight) |
|---|---|---|---|
| **PAH Compounds** | | | |
| 1,6,7-Trimethylnaphthalene | 0.20 | Benzo[k]fluoranthene | 0.20 |
| 1-Methylnaphthalene | 0.30 | Biphenyl | 0.30 |
| 1-Methylphenanthrene | 0.20 | Chrysene | 0.20 |
| 2,6-Dimethylnaphthalene | 0.30 | Dibenz[a,h]anthracene | 0.10 |
| 2-Methylnaphthalene | 0.50 | Dibenzothiophene | 0.20 |
| Acenaphthene | 0.40 | Fluoranthene | 0.30 |
| Acenaphthylene | 0.60 | Fluorene | 0.20 |
| Anthracene | 0.70 | Indeno[1,2,3-c,d]pyrene | 0.20 |
| Benz[a]anthracene | 0.20 | Naphthalene | 0.50 |
| Benzo[a]pyrene | 0.10 | Perylene | 0.20 |
| Benzo[b]fluoranthene | 0.30 | Phenanthrene | 0.40 |
| Benzo[e]pyrene | 0.50 | Pyrene | 0.30 |
| Benzo[g,h,I]perylene | 0.30 | | |
| **PAH Alkylated Homologues** | | | |
| C1-Chrysenes | 2 | C1-Fluoranthenes/Pyrenes | 2 |
| C2-Chrysenes | 2 | C1-Naphthalenes | 2 |
| C3-Chrysenes | 2 | C2-Naphthalenes | 2 |
| C4-Chrysenes | 2 | C3-Naphthalenes | 2 |
| C1-Dibenzothiophenes | 2 | C4-Naphthalenes | 2 |
| C2-Dibenzothiophenes | 2 | C1-Phenanthrenes/Anthracenes | 2 |
| C3-Dibenzothiophenes | 2 | C2-Phenanthrenes/Anthracenes | 2 |
| C1-Fluorenes | 2 | C3-Phenanthrenes/Anthracenes | 2 |
| C2-Fluorenes | 2 | C4-Phenanthrenes/Anthracenes | 2 |
| C3-Fluorenes | 2 | | |
| **LAB Compounds** | | | |
| 2-Phenyldecane | 0.10 | 6-Phenyltetradecane | 0.40 |
| 3-Phenyldecane | 0.10 | 7-Phenyltetradecane | 0.10 |
| 4-Phenyldecane | 0.10 | 2-Phenylundecane | 0.10 |
| 5-Phenyldecane | 0.10 | 3-Phenylundecane | 0.10 |
| 2-Phenyltridecane | 0.30 | 4-Phenylundecane | 0.10 |
| 3-Phenyltridecane | 0.10 | 5-Phenylundecane | 0.10 |
| 4-Phenyltridecane | 0.20 | 6-Phenylundecane | 0.10 |
| 5-Phenyltridecane | 0.30 | 2-Phenyldodecane | 0.20 |
| 6-Phenyltridecane+7-Phenyltridecane | 0.40 | 3-Phenyldodecane | 0.10 |
| 2-Phenyltetradecane | 0.10 | 4-Phenyldodecane | 0.20 |
| 3-Phenyltetradecane | 0.10 | 5-Phenyldodecane | 0.20 |
| 4-Phenyltetradecane | 0.10 | 6-Phenyldodecane | 0.20 |
| 5-Phenyltetradecane | 0.20 | | |

**Table C-4. Acceptance criteria for standard reference materials of PAHs in sediments, July 2010–June 2011.**

Orange County Sanitation District, California.

| Compound Name | True Value µg/g | Certified Acceptance Criteria µg/g | |
|---|---|---|---|
| | | Min. | Max. |
| **SRM 1944A - Organics in Marine Sediment National Institute of Standards and Technology.** | | | |
| Anthracene | 1.77 | 0.44 | 2.21 |
| Benz[a]anthracene | 4.72 | 1.18 | 5.90 |
| Benzo[a]pyrene | 4.30 | 1.08 | 5.38 |
| Benzo[b]fluoranthene | 3.87 | 0.97 | 4.84 |
| Benzo[e]pyrene | 3.28 | 0.82 | 4.10 |
| Benzo[g,h,i]perylene | 2.84 | 0.71 | 3.55 |
| Benzo[k]fluoranthene | 2.30 | 0.58 | 2.88 |
| Chrysene | 4.86 | 1.22 | 6.08 |
| Dibenz[a,h]anthracene | 0.42 | 0.11 | 0.53 |
| Fluoranthene | 8.92 | 2.23 | 11.15 |
| Indeno(1,2,3-c,d)pyrene | 2.78 | 0.70 | 3.48 |
| Naphthalene | 1.65 | 0.41 | 2.06 |
| Perylene | 1.17 | 0.29 | 1.46 |
| Phenanthrene | 5.27 | 1.32 | 6.59 |
| Pyrene | 9.70 | 2.43 | 12.13 |
| **SRM 1941B - Organics in Marine Sediment National Institute of Standards and Technology** | | | |
| Anthracene | 184 | 110 | 258 |
| Benz[a]anthracene | 335 | 201 | 469 |
| Benzo[a]pyrene | 358 | 215 | 501 |
| Benzo[b]fluoranthene | 453 | 272 | 634 |
| Benzo[e]pyrene | 325 | 195 | 455 |
| Benzo[g,h,i]perylene | 307 | 184 | 430 |
| Benzo[k]fluoranthene | 225 | 135 | 315 |
| Chrysene | 291 | 175 | 407 |
| Dibenz[a,h]anthracene | 53 | 32 | 74 |
| Fluoranthene | 651 | 391 | 911 |
| Indeno(1,2,3-c,d)pyrene | 341 | 205 | 477 |
| Naphthalene | 848 | 509 | 1,187 |
| Perylene | 397 | 238 | 556 |
| Phenanthrene | 406 | 244 | 568 |
| Pyrene | 581 | 349 | 813 |

**Table C-5. Sediment PAH/LAB QA/QC summary, July 2010–June 2011.**
Orange County Sanitation District, California.

| Quarter | Sample Set | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD | Comments |
|---|---|---|---|---|---|---|---|
| 1 | Sedcore_Jul10_DM | PAH SRM 1944 | 15 | 12 | 25% of the certified or published acceptance limits[1] | NA | 80% Pass |
| | | PAH SRM 1941b | 15 | 14 | | | 93% Pass |
| | | PAH Reporting Level Spike | 25 | 25 | 60 -120 | | 100% Pass |
| | | LAB Reporting Level Spike | 25 | 20 | | | 80% Pass |
| | | PAH Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 25 | 40 - 120 | NA | 100% Pass |
| | | LAB Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 23 | 40 - 120 | NA | 92% Pass |
| | | PAH Duplicate Analysis - #1 | 11 | 9 | NA | < 20% @ 3 x MDL of Sample Mean | 82% Pass |
| | | PAH Duplicate Analysis - #2 | 14 | 14 | | | 100% Pass |
| | | LAB Duplicate Analysis - #1 | 14 | 14 | | | 100% Pass |
| | | PAH Duplicate Analysis - #2 | 11 | 6 | | | 55% Pass |
| 1 | Sedcore_Jul10_ DN | PAH SRM 1944 | 15 | 12 | 25% of the certified or published acceptance limits[1] | NA | 80% Pass |
| | | PAH SRM 1941b | 15 | 14 | | | 93% Pass |
| | | PAH Reporting Level Spike | 25 | 25 | 60 -120 | | 100% Pass |
| | | LAB Reporting Level Spike | 25 | 25 | | | 100% Pass |
| | | PAH Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 25 | 40 - 120 | NA | 100% Pass |
| | | LAB Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 22 | 40 – 120 | NA | 88% Pass |
| | | PAH Duplicate Analysis - #1 | 24 | 20 | NA | < 20% @ 3 x MDL of Sample Mean | 83% Pass |
| | | PAH Duplicate Analysis - #2 | 15 | 15 | | | 100% Pass |
| | | LAB Duplicate Analysis - #1 | 23 | 22 | | | 96% Pass |
| | | PAH Duplicate Analysis - #2 | 15 | 1 | | | 6% Pass |

**Notes: [1] SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes. (NIST, Certificate of Analysis, SRM 1941b, SRM 1944a, Organics in Marine Sediment).**
**OCSD laboratory results are not corrected for surrogate recoveries, causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values. N/A=not applicable**

**Table C-5 Continues.**

**Table C-5 Continued.**

| Quarter | Sample Set | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD | Comments |
|---|---|---|---|---|---|---|---|
| 1 | Sedcore_Jul10_DO | PAH SRM 1944 | 15 | 13 | 25% of the certified or published acceptance limits[1] | NA | 87% Pass |
| | | PAH SRM 1941b | 15 | 14 | | | 93% Pass |
| | | PAH Reporting Level Spike | 25 | 22 | 60 -120 | | 88% Pass |
| | | LAB Reporting Level Spike | 25 | 25 | | | 100% Pass |
| | | PAH Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 25 | 40 - 120 | NA | 100% Pass |
| | | LAB Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 25 | 40 - 120 | NA | 100% Pass |
| | | PAH Duplicate Analysis - #1 | 15 | 10 | NA | < 20% @ 3 x MDL of Sample Mean | 83% Pass |
| | | PAH Duplicate Analysis - #2 | 14 | 14 | | | 78% Pass |
| | | LAB Duplicate Analysis - #1 | 20 | 14 | | | 82% Pass |
| | | LAB Duplicate Analysis - #2 | 15 | 16 | | | 100% Pass |
| 2 | Sedcore_Oct10_DS | PAH SRM 1944 | 15 | 13 | 25% of the certified or published acceptance limits[1] | NA | 87% Pass |
| | | PAH SRM 1941b | 15 | 14 | | | 93% Pass |
| | | PAH Reporting Level Spike | 25 | 24 | 60 -120 | | 96% Pass |
| | | LAB Reporting Level Spike | NA | NA | | | NA |
| | | PAH Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 25 | 40 - 120 | NA | 100% Pass |
| | | LAB Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | NA | NA | 40 - 120 | NA | NA |
| | | PAH Duplicate Analysis - #1 | 17 | 13 | NA | < 20% @ 3 x MDL of Sample Mean | 76% Pass |
| | | PAH Duplicate Analysis - #2 | NA | NA | | | NA |
| | | LAB Duplicate Analysis - #1 | NA | NA | | | NA |
| | | LAB Duplicate Analysis - #2 | NA | NA | | | NA |

**Notes:**
[1] **SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes. (NIST, Certificate of Analysis, SRM 1941b, SRM 1944, Organics in Marine Sediment).**
**OCSD laboratory results are not corrected for surrogate recoveries, causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values. N/A=not applicable.**

**Table C-5 Continues.**

**Table C-5 Continued.**

| Quarter | Sample Set | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD | Comments |
|---|---|---|---|---|---|---|---|
| 3 | Sedcore_Jan11_DV | PAH SRM 1944 | 15 | 10 | 25% of the certified or published acceptance limits[1] | NA | *67% Pass |
| | | PAH SRM 1941b | 15 | 14 | | | 93% Pass |
| | | PAH Reporting Level Spike | 25 | 25 | 60 -120 | | 100% Pass |
| | | PAH Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 25 | 40 - 120 | NA | 100% Pass |
| | | PAH Duplicate Analysis - #1 | 17 | 9 | NA | < 20% @ 3 x MDL of Sample Mean | **43% Pass |
| | | PAH Duplicate Analysis - #2 | N/A | NA | | | N/A |
| 4 | Sedcore_Apr11_DV | PAH SRM 1944 | 15 | 14 | 25% of the certified or published acceptance limits[1] | NA | 93% Pass |
| | | PAH SRM 1941b | 15 | 14 | | | 93% Pass |
| | | PAH Reporting Level Spike | 25 | 22 | 60 -120 | | 88% Pass |
| | | PAH Matrix Spike | | | | | |
| | | Based on Mean of MS and MSD | 25 | 21 | 40 - 120 | NA | 84% Pass |
| | | PAH Duplicate Analysis - #1 | 12 | 8 | NA | < 20% @ 3 x MDL of Sample Mean | **40% Pass |
| | | PAH Duplicate Analysis - #2 | N/A | NA | | | N/A |

**Notes:**
**[1]SRM certified values are based on the addition of selected compounds prior to extraction for use as internal standards for quantification purposes.**
**(NIST, Certificate of Analysis, SRM 1944, SRM 1941b, Organics in Marine Sediment).**
**OCSD laboratory results are not corrected for surrogate recoveries, thus causing some analytes with lower molecular weights and boiling points to fail the established criteria for SRM certified values.**
***PAH results for SRM 1944 were low but the surrogate recoveries were within the limits**
****Variability within replicate samples are commonly observed, especially for detectable analytes which are near the reporting levels, have caused some analytes to fail the established criteria for precision factors. The surrogate recoveries of these replicates were within the limits, and visual inspection of the replicate samples did not reveal any obvious interferences. No further corrective action is needed for the replicates. The blank and matrix spikes were all within the specifications. Data set integrity was verified and accepted.**
**N/A=not applicable**

**Table C-6. Method detection levels for PCB congeners and pesticides in sediments using GC/MS ion trap, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | ASE & GC/MS/MS Method Detection Limit (ng/g dry weight) | Parameter | ASE & GC/MS/MS Method Detection Limit (ng/g dry weight) |
|---|---|---|---|
| Aldrin | 0.12 | PCB 101 | 0.08 |
| *alpha*-Chlordane | 0.17 | PCB 105 | 0.19 |
| *cis*-NoNAchlor | 0.20 | PCB 110 | 0.16 |
| Dieldrin | 0.32 | PCB 114 | 0.22 |
| Endrin | 0.53 | PCB 118 | 0.18 |
| *gamma*-BHC | 0.12 | PCB 119 | 0.09 |
| *gamma*-Chlordane | 0.15 | PCB 123 | 0.18 |
| Heptachlor | 0.11 | PCB 126 | 0.31 |
| Heptachlor epoxide | 0.19 | PCB 128 | 0.22 |
| Hexachlorobenzene | 0.21 | PCB 138 | 0.14 |
| Mirex | 0.14 | PCB 149 | 0.12 |
| *trans*-NoNAchlor | 0.16 | PCB 151 | 0.11 |
| 2,4'-DDD (o,p'-DDD) | 0.15 | PCB 153 | NA |
| 2,4'-DDE (o,p'-DDE) | 0.13 | PCB 153/168 | 0.28 |
| 2,4'-DDT (o,p'-DDT) | 0.16 | PCB 156 | 0.21 |
| 4,4'-DDD (p,p'-DDD) | 0.17 | PCB 157 | 0.22 |
| 4,4'-DDE (p,p'-DDE) | 0.15 | PCB 158 | 0.17 |
| 4,4'-DDT (p,p'-DDT) | 0.18 | PCB 167 | 0.28 |
| 4,4'-DDMU | 0.50 [1] | PCB 168 | NA |
| PCB 8 | 0.14 | PCB 169 | 0.30 |
| PCB 18 | 0.14 | PCB 170 | 0.17 |
| PCB 28 | 0.09 | PCB 177 | 0.11 |
| PCB 37 | 0.24 | PCB 180 | 0.16 |
| PCB 44 | 0.11 | PCB 183 | 0.19 |
| PCB 49 | 0.09 | PCB 187 | 0.18 |
| PCB 52 | 0.08 | PCB 189 | 0.22 |
| PCB 66 | 0.20 | PCB 194 | 0.14 |
| PCB 70 | 0.20 | PCB 195 | 0.14 |
| PCB 74 | 0.28 | PCB 200 | 0.21 |
| PCB 77 | 0.21 | PCB 201 | 0.20 |
| PCB 81 | 0.24 | PCB 206 | 0.16 |
| PCB 87 | 0.13 | PCB 209 | 0.10 |
| PCB 99 | 0.11 | | |

[1] Value is the reporting limit (RL).

NA = Not analyzed.

## Table C-7. Method detection levels for PCB congeners and pesticides in sediments using GC/MS DSQII, July 2010–June 2011

Orange County Sanitation District, California.

| Parameter | ASE & GC/MS/MS Method Detection Limit (ng/g dry weight) | Parameter | ASE & GC/MS/MS Method Detection Limit (ng/g dry weight) |
|---|---|---|---|
| Aldrin | 0.06 | PCB 101 | 0.13 |
| *alpha*-Chlordane | 0.13 | PCB 105 | 0.14 |
| *cis*-NoNAchlor | 0.08 | PCB 110 | 0.07 |
| Dieldrin | 0.16 | PCB 114 | 0.13 |
| Endrin | 0.15 | PCB 118 | 0.07 |
| *gamma*-BHC | 0.06 | PCB 119 | 0.11 |
| *gamma*-Chlordane | 0.05 | PCB 123 | 0.11 |
| Heptachlor | 0.06 | PCB 126 | 0.08 |
| Heptachlor epoxide | 0.08 | PCB 128 | 0.14 |
| Hexachlorobenzene | 0.04 | PCB 138 | 0.13 |
| Mirex | 0.14 | PCB 149 | 0.11 |
| *trans*-NoNAchlor | 0.09 | PCB 151 | 0.10 |
| 2,4'-DDD (o,p'-DDD) | 0.14 | PCB 153 | NA |
| 2,4'-DDE (o,p'-DDE) | 0.11 | PCB 153/168 | 0.25 |
| 2,4'-DDT (o,p'-DDT) | 0.14 | PCB 156 | 0.07 |
| 4,4'-DDD (p,p'-DDD) | 0.10 | PCB 157 | 0.09 |
| 4,4'-DDE (p,p'-DDE) | 0.08 | PCB 158 | 0.12 |
| 4,4'-DDT (p,p'-DDT) | 0.13 | PCB 167 | 0.11 |
| 4,4'-DDMU | 0.08 | PCB 168 | NA |
| PCB 8 | 0.06 | PCB 169 | 0.13 |
| PCB 18 | 0.04 | PCB 170 | 0.08 |
| PCB 28 | 0.05 | PCB 177 | 0.10 |
| PCB 37 | 0.15 | PCB 180 | 0.11 |
| PCB 44 | 0.09 | PCB 183 | 0.13 |
| PCB 49 | 0.07 | PCB 187 | 0.11 |
| PCB 52 | 0.05 | PCB 189 | 0.10 |
| PCB 66 | 0.09 | PCB 194 | 0.17 |
| PCB 70 | 0.11 | PCB 195 | 0.13 |
| PCB 74 | 0.11 | PCB 200 | 0.11 |
| PCB 77 | 0.07 | PCB 201 | 0.17 |
| PCB 81 | 0.07 | PCB 206 | 0.16 |
| PCB 87 | 0.06 | PCB 209 | 0.29 |
| PCB 99 | 0.17 | | |

[1] Value is the reporting limit (RL).
NA = Not analyzed.

**Table C-8. Acceptance criteria for standard reference materials of pesticides/PCBs in sediments, July 2010–June 2011**

Orange County Sanitation District, California.

| Parameter | True Value (ng/g) | Acceptance Range (ng/g) | | Parameter | True Value (ng/g) | Acceptance Range (ng/g) | |
|---|---|---|---|---|---|---|---|
| | | min. | max. | | | min. | max. |
| **SRM 1944a - Organics in Marine Sediment, National Institute of Standards and Technology, New York/New Jersey Waterway Sediment** | | | | | | | |
| *alpha*-Chlordane | 16.51 | 15.7 | 17.3 | PCB 99 | 37.5 | 35.1 | 39.9 |
| *cis*-Nonachlor * | 3.70 | 3.00 | 4.40 | PCB 101 | 73.4 | 70.9 | 75.9 |
| *gamma*-Chlordane * | 8.00 | 6.00 | 10.0 | PCB 105 | 24.5 | 23.4 | 25.6 |
| Hexachlorobenzene | 6.0 | 5.68 | 6.38 | PCB 110 | 63.5 | 58.8 | 68.2 |
| *trans*-Nonachlor | 8.20 | 7.69 | 8.71 | PCB 118 | 58.0 | 53.7 | 62.3 |
| 2,4'-DDD * | 38.0 | 30.0 | 46.0 | PCB 128 | 8.47 | 8.19 | 8.75 |
| 2,4'-DDE * | 19.0 | 16.0 | 22.0 | PCB 138 | 62.1 | 59.1 | 65.1 |
| 4,4'-DDD * | 108 | 92.0 | 124 | PCB 149 | 49.7 | 48.5 | 50.9 |
| 4,4'-DDE * | 86.0 | 74.0 | 98.0 | PCB 151 | 16.93 | 16.57 | 17.3 |
| 4,4'-DDT | 119 | 108 | 130 | PCB 153 | 74.0 | 71.1 | 76.9 |
| 2,4'-DDD * | 38.0 | 30.0 | 46.0 | PCB 156 | 6.52 | 5.86 | 7.18 |
| PCB 8 | 22.3 | 20.0 | 24.6 | PCB 170 | 22.6 | 21.2 | 24.0 |
| PCB 18 | 51.0 | 48.4 | 53.6 | PCB 180 | 44.3 | 43.1 | 45.5 |
| PCB 28 | 80.8 | 78.1 | 83.5 | PCB 183 | 12.19 | 11.6 | 12.8 |
| PCB 44 | 60.2 | 58.2 | 62.2 | PCB 187 | 25.1 | 24.1 | 26.1 |
| PCB 49 | 53.0 | 51.3 | 54.7 | PCB 194 | 11.2 | 9.80 | 12.6 |
| PCB 52 | 79.4 | 77.4 | 81.4 | PCB 195 | 3.75 | 3.36 | 4.14 |
| PCB 66 | 71.9 | 67.6 | 76.2 | PCB 206 | 9.21 | 8.70 | 9.72 |
| PCB 87 | 29.9 | 25.6 | 34.2 | | | | |
| **SRM 1941B - Organics in Marine Sediment, National Institute of Standards and Technology, New York/New Jersey Waterway Sediment** | | | | | | | |
| *alpha*-Chlordane | 0.850 | 0.740 | 0.960 | PCB 99 | 2.90 | 2.54 | 3.26 |
| *cis*-Nonachlor | 0.378 | 0.325 | 0.431 | PCB 101 | 5.11 | 4.77 | 5.45 |
| gamma-Chlordane | 0.566 | 0.473 | 0.659 | PCB 105 | 1.43 | 1.33 | 1.53 |
| Hexachlorobenzene | 5.83 | 5.45 | 6.21 | PCB 110 | 4.62 | 4.26 | 4.98 |
| *trans*-Nonachlor | 0.438 | 0.365 | 0.511 | PCB 118 | 4.23 | 4.04 | 4.42 |
| 2.4'-DDE * | 0.380 | 0.260 | 0.500 | PCB 128 | 0.696 | 0.652 | 0.740 |
| 4,4'-DDE | 3.22 | 2.94 | 3.50 | PCB 138 | 3.60 | 3.32 | 3.88 |
| 4,4'-DDD | 4.66 | 4.20 | 5.12 | PCB 149 | 4.35 | 4.09 | 4.61 |
| 4,4'-DDT * | 1.12 | 0.700 | 1.54 | PCB 153/168 | 5.47 | 5.15 | 5.79 |
| PCB 8 | 1.65 | 1.46 | 1.84 | PCB 156 | 0.507 | 0.417 | 0.597 |
| PCB 18 | 2.39 | 2.10 | 2.68 | PCB 158 * | 0.650 | 0.500 | 0.800 |
| PCB 28 | 4.52 | 3.95 | 5.09 | PCB 170 | 1.35 | 1.26 | 1.44 |
| PCB 44 | 3.85 | 3.65 | 4.05 | PCB 180 | 3.24 | 2.73 | 3.75 |
| PCB 49 | 4.34 | 4.06 | 4.62 | PCB 183 | 0.979 | 0.892 | 1.07 |
| PCB 52 | 5.24 | 4.96 | 5.52 | PCB 187 | 2.17 | 1.95 | 2.39 |
| PCB 66 | 4.96 | 4.43 | 5.49 | PCB 194 | 1.04 | 0.980 | 1.10 |
| PCB 70 * | 4.99 | 4.70 | 5.28 | PCB 195 | 0.645 | 0.585 | 0.705 |
| PCB 74 * | 2.04 | 1.89 | 2.19 | PCB 201 | 0.770 | 0.736 | 0.804 |
| PCB 77 * | 0.310 | 0.280 | 0.340 | PCB 206 | 2.42 | 2.23 | 2.61 |
| PCB 87 | 1.14 | 0.980 | 1.30 | PCB 209 | 4.86 | 4.41 | 5.31 |
| PCB 8 | 1.65 | 1.46 | 1.84 | PCB 99 | 2.90 | 2.54 | 3.26 |
| PCB 18 | 2.39 | 2.10 | 2.68 | PCB 101 | 5.11 | 4.77 | 5.45 |

* non-certified

## Table C-9. Sediment PCB/pesticide QA/QC summary, July 2010–June 2011.

Orange County Sanitation District, California.

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| 2 | EO | PCB | SRM 1944a | 27 | 25 | 25% of the certified ranges or published acceptance limits | NA |
| | | PCB | SRM 1941b | 27 | 26 | | |
| | | PCB | Reporting Level Spike | 44 | 44 | 60 -120 | NA |
| | | PCB | Matrix Spike | 44 | 37 | 40 - 120 | NA |
| | | PCB | Matrix Spike Dup | 44 | 37 | 40 - 120 | NA |
| | | PCB | Matrix Spike Precision | 44 | 44 | NA | < 20% |
| | | Pesticide | SRM 1944a | 4 | 4 | 25% of the certified ranges or published acceptance limits | NA |
| | | Pesticide | SRM 1941b | 7 | 7 | | |
| | | Pesticide | Reporting Level Spike | 19 | 8 | 60 -120 | NA |
| | | Pesticide | Matrix Spike | 19 | 16 | 40 - 120 | NA |
| | | Pesticide | Matrix Spike Dup | 19 | 15 | 40 - 120 | NA |
| | | Pesticide | Matrix Spike Precision | 19 | 18 | NA | < 20% |
| | | PCB | Duplicate 1 | 3 | 3 | NA | < 20% @ 3 x MDL of Sample Mean. |
| | | Pesticides | Duplicate 1 | 1 | 1 | NA | |
| | | PCBs and Pesticides | Duplicate 1 Sum | 1 | 1 | NA | NA |
| | | PCB | Duplicate 2 | NA | NA | NA | < 20% @ 3 x MDL of Sample Mean. |
| | | Pesticides | Duplicate 2 | NA | NA | NA | |
| | | PCBs and Pesticides | Duplicate 2 Sum | NA | NA | NA | NA |

**Comments:**
Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.
NA = Not Applicable

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| 3, 4 | EQ, ER | PCB | SRM 1944a | 27 | 27 | 25% of the certified ranges or published acceptance limits | NA |
| | | PCB | SRM 1941b | 27 | 27 | | |
| | | PCB | Reporting Level Spike | 44 | 44 | 60 -120 | NA |
| | | PCB | Matrix Spike | 44 | 44 | 40 - 120 | NA |
| | | PCB | Matrix Spike Dup | 44 | 44 | 40 - 120 | NA |
| | | PCB | Matrix Spike Precision | 44 | 44 | NA | < 20% |
| | | Pesticide | SRM 1944a | 4 | 4 | 25% of the certified ranges or published acceptance limits | NA |
| | | Pesticide | SRM 1941b | 7 | 7 | | |
| | | Pesticide | Reporting Level Spike | 19 | 19 | 60 -120 | NA |
| | | Pesticide | Matrix Spike | 19 | 19 | 40 - 120 | NA |
| | | Pesticide | Matrix Spike Dup | 19 | 19 | 40 - 120 | NA |
| | | Pesticide | Matrix Spike Precision | 19 | 19 | NA | < 20% |
| | | PCB | Duplicate 1 | 6 | 6 | NA | < 20% @ 3 x MDL of Sample Mean. |
| | | Pesticide | Duplicate 1 | 1 | 1 | NA | |
| | | PCBs and Pesticides | Duplicate 1 Sum | 11 | 1 | NA | NA |
| | | PCB | Duplicate 2 | NA | NA | NA | < 20% @ 3 x MDL of Sample Mean. |
| | | Pesticide | Duplicate 2 | NA | NA | NA | |
| | | PCBs and Pesticides | Duplicate 2 Sum | NA | NA | NA | NA |

**Comments:**
Samples from the 3rd quarter (Set EQ) were re-extracted with samples from the 4th quarter (Set ER) due to contamination during the extraction process.
Review of calibration check standards injected after sample injections, extraction notes, and instrument conditions did not indicate any atypical circumstances.
NA = Not Applicable

duplicate, and the two spiked samples were evaluated for precision. The samples that were spiked with aluminum and iron were not evaluated for spike recoveries because the spike levels were extremely low compared to the concentrations of aluminum and iron in the native samples. The samples were spiked at 20 mg/kg dry weight whereas the native concentrations ranged between 5,000 and 35,000 mg/kg dry weight.

All samples were analyzed within their 6-month holding times. If any analyte exceeded the appropriate calibration curve, and Linear Dynamic Range, the sample was diluted and reanalyzed. MDLs for metals are presented in Table C-10. Acceptance criteria for trace metal SRMs are presented in Table C-11.

The digested samples were analyzed for silver, cadmium, chromium, copper, nickel, lead, zinc, selenium, arsenic, and beryllium by inductively coupled mass spectroscopy (ICPMS). Aluminum and iron were analyzed using inductively coupled emission spectroscopy (ICPES). Sediment trace metal QA/QC summary data are presented in Table C-12. All spike recoveries were between 88% and 106%. The relative percent difference (RPD) between the sample and its duplicate analysis ranged from -27.2% to 9.7%. The RPDs for the spike and spike duplicate analysis ranged from -2.2% to 2.5%.

Analytical Methods - Mercury

Dried sediment samples were analyzed for mercury in accordance with methods described in the LOPM. QC for a typical batch included a blank, blank spike, and SRM. Sediment samples with duplicates, spiked samples and duplicate spiked samples were run approximately once every 10 sediment samples. All samples were analyzed within their 6-month holding time. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

The MDL for sediment mercury is presented in Table C-10. Acceptance criteria for mercury SRM is presented in Table C-11. All QA/QC summary data are presented in Table C-12. The first and second quarter samples were run together in the same analysis batches.

All samples, with some noted exceptions, met the QA/QC criteria guidelines for accuracy and precision. Two duplicate analysis RPDs, two matrix spike recoveries, one matrix spike duplicate recovery, and one matrix spike precision RPD were out of range due to low results and non-homogeneous sample matrices.

Analytical Methods - Dissolved Sulfides

Dissolved sulfides samples were analyzed in accordance with methods described in the LOPM. The MDL for dissolved sulfides is presented in Table C-13. Sediment dissolved sulfides QA/QC summary data are presented in Table C-14. All samples were analyzed within their required holding times. All analyses met the QA/QC criteria for blanks, blank spikes, matrix spike dups, and matrix spike precisions. One of five matrix spike recoveries was out of control due to matrix interferences.

Analytical Methods - Total Organic Carbon

Total Organic Carbon (TOC) samples were analyzed by a contract laboratory, Columbia Analytical Services, Kelso, WA. The MDL for TOC is presented in Table C-13. Sediment TOC QA/QC summary data are presented in Table C-15. The samples were analyzed within their required holding times. Three samples were analyzed in duplicate. The samples and their duplicate analyses had a RPD of less than 10%. The recoveries for matrix spike were within the 80–120% range.

**Table C-10. Method detection limits for trace metals in sediments, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | Detection Limits (mg/kg dry weight) |
|---|---|
| Aluminum | 50 |
| Arsenic | 0.15 |
| Beryllium | 0.01 |
| Cadmium | 0.01 |
| Chromium | 0.15 |
| Copper | 0.10 |
| Iron | 50 |
| Lead | 0.10 |
| Nickel | 0.10 |
| Mercury | 0.00011 |
| Selenium | 0.15 |
| Silver | 0.02 |
| Zinc | 0.15 |

**Table C-11. Acceptance criteria for standard reference materials of metals in sediments, July 2010–June 2011**

Orange County Sanitation District, California.

| Parameter | True Value (mg/kg) | Certified Acceptance Criteria (mg/kg) | |
|---|---|---|---|
| | | Min. | Max. |
| **Environmental Resource Associates D056-540 Priority PollutnT™/CLP Inorganic Soils – Microwave Digestion Environmental Resource Associates** | | | |
| Aluminum | 10400 | 6370 | 14400 |
| Arsenic | 280 | 226 | 333 |
| Beryllium | 51 | 42.4 | 59.6 |
| Cadmium | 182 | 149 | 215 |
| Chromium | 142 | 115 | 170 |
| Copper | 132 | 110 | 155 |
| Iron | 16600 | 9490 | 23700 |
| Lead | 72.2 | 59.1 | 85.4 |
| Nickel | 155 | 128 | 182 |
| Selenium | 165 | 128 | 203 |
| Silver | 126 | 83.7 | 169 |
| Zinc | 346 | 273 | 418 |
| **Resource Technology Corporation CRM016-050 Natural Matrix Certified Reference Material Lot BE016** | | | |
| Mercury | 0.158 | 0.00 | 0.357 |

**Table C-12. Sediment metals QA/QC summary, July 2010–June 2011.**

Orange County Sanitation District, California.

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Summer | HMSED100928-1 | Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc | Blank | 10 | 10 | <3X MDL | N/A |
| | | | Blank Spike | 10 | 10 | 90-110 | N/A |
| | | | Matrix Spike | 10 | 10 | 70-130 | |
| | | | Matrix Spike Dup | 10 | 10 | 70-130 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 20% |
| | | | Duplicate Analysis | 10 | 10 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 10 | 10 | 80-120% or certified value, whichever is greater. | |
| Summer | HMSED101007-1 | Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc | Blank | 10 | 10 | <3X MDL | N/A |
| | | | Blank Spike | 10 | 10 | 90-110 | N/A |
| | | | Matrix Spike | 10 | 10 | 70-130 | |
| | | | Matrix Spike Dup | 10 | 10 | 70-130 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 20% |
| | | | Duplicate Analysis | 10 | 10 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 10 | 10 | 80-120% or certified value, whichever is greater. | |
| Summer | HMSED101026-1 | Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc | Blank | 10 | 10 | <3X MDL | N/A |
| | | | Blank Spike | 10 | 10 | 90-110 | N/A |
| | | | Matrix Spike | 10 | 10 | 70-130 | |
| | | | Matrix Spike Dup | 10 | 10 | 70-130 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 20% |
| | | | Duplicate Analysis | 10 | 10 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 10 | 10 | 80-120% or certified value, whichever is greater. | |
| Summer | ALFESED101004-1 | Aluminum, Iron | Blank | 2 | 2 | <3X MDL | N/A |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 2 | 2 | 80-120% or certified value, whichever is greater | |
| Summer | ALFESED101012-1 | Aluminum, Iron | Blank | 2 | 2 | <3X MDL | N/A |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 2 | 2 | 80-120% or certified value, whichever is greater. | |

**Table C-12 Continues.**

**Table C-12 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Summer | ALFESED101104-1 | Aluminum, Iron | Blank | 2 | 2 | <3X MDL | N/A |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 2 | 2 | 80-120% or certified value, whichever is greater. | |
| Summer | HGSED100928-1 | Mercury | Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 90-110 | N/A |
| | | | Matrix Spike | 2 | **1 | 70-130 | |
| | | | Matrix Spike Dup | 2 | **1 | 70-130 | |
| | | | Matrix Spike Precision | 2 | **1 | | < 25% |
| | | | Duplicate Analysis | 2 | **1 | NA | @ ≥ 10 X MDL < 30% |
| | | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |
| Summer | HGSED101006-1 | Mercury | Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 90-110 | N/A |
| | | | Matrix Spike | 3 | **2 | 70-130 | |
| | | | Matrix Spike Dup | 3 | 3 | 70-130 | |
| | | | Matrix Spike Precision | 3 | **2 | | < 25% |
| | | | Duplicate Analysis | 3 | **2 | NA | @ ≥ 10 X MDL < 30% |
| | | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |
| Summer/ Fall | HGSED101102-1 | Mercury | Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 90-110 | N/A |
| | | | Matrix Spike | 2 | 2 | 70-130 | |
| | | | Matrix Spike Dup | 2 | 2 | 70-130 | |
| | | | Matrix Spike Precision | 2 | 2 | | < 25% |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 30% |
| | | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |

** Two duplicate analysis RPDs were out of range due to low results and non-homogeneous samples. Two matrix spike recoveries, one matrix spike duplicate recovery, and one matrix spike precision RPD failed due to non-homogeneous sample matrices.

**Table C-12 Continues.**

**Table C-12 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Fall | HMSED101103-1 | Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc | Blank | 10 | 10 | <3X MDL | N/A |
| | | | Blank Spike | 10 | 10 | 90-110 | N/A |
| | | | Matrix Spike | 10 | 10 | 70-130 | |
| | | | Matrix Spike Dup | 10 | 10 | 70-130 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 20% |
| | | | Duplicate Analysis | 10 | 10 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 10 | 10 | 80-120% or certified value, whichever is greater. | |
| Fall | ALFESED101104-2 | Aluminum, Iron | Blank | 2 | 2 | <3X MDL | N/A |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 2 | 2 | 80-120% or certified value, whichever is greater | |
| Winter | HMSED110217-1 | Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc | Blank | 10 | 10 | <3X MDL | N/A |
| | | | Blank Spike | 10 | 10 | 90-110 | N/A |
| | | | Matrix Spike | 10 | 10 | 70-130 | |
| | | | Matrix Spike Dup | 10 | 10 | 70-130 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 20% |
| | | | Duplicate Analysis | 10 | 10 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 10 | 10 | 80-120% or certified value, whichever is greater. | |
| Winter | ALFESED110218-1 | Aluminum, Iron | Blank | 2 | 2 | <3X MDL | N/A |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 2 | 2 | 80-120% or certified value, whichever is greater. | |

**Table C-12 Continues.**

**Table C-12 Continued.**

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Winter | HGSED110222-1 | Mercury | Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 90-110 | N/A |
| | | | Matrix Spike | 1 | **0 | 70-130 | |
| | | | Matrix Spike Dup | 1 | **0 | 70-130 | |
| | | | Matrix Spike Precision | 1 | **0 | | < 25% |
| | | | Duplicate Analysis | 1 | 1 | NA | @ ≥ 10 X MDL < 30% |
| | | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |
| Spring | HMSED110526-1 | Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc | Blank | 10 | 10 | <3X MDL | N/A |
| | | | Blank Spike | 10 | 10 | 90-110 | N/A |
| | | | Matrix Spike | 10 | 10 | 70-130 | |
| | | | Matrix Spike Dup | 10 | 10 | 70-130 | |
| | | | Matrix Spike Precision | 10 | 10 | | < 20% |
| | | | Duplicate Analysis | 10 | 10 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 10 | 10 | 80-120% or certified value, whichever is greater. | |
| Spring | ALFESED110602-1 | Aluminum, Iron | Blank | 2 | 2 | <3X MDL | N/A |
| | | | Duplicate Analysis | 2 | 2 | NA | @ ≥ 10 X MDL < 20% |
| | | | CRM Analysis | 2 | 2 | 80-120% or certified value, whichever is greater. | |
| Spring | HGSED110531-1 | Mercury | Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 90-110 | N/A |
| | | | Matrix Spike | 1 | 1 | 70-130 | |
| | | | Matrix Spike Dup | 1 | 1 | 70-130 | |
| | | | Matrix Spike Precision | 1 | 1 | | < 25% |
| | | | Duplicate Analysis | 1 | 1 | NA | @ ≥ 10 X MDL < 30% |
| | | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |

** One Matrix spike recovery, one matrix spike duplicate recovery, and one matrix spike precision RPD were out of range due to non-homogeneous sample matrices.

NA = Not applicable.

**Table C-13. Method detection limits for dissolved sulfides, total organic carbon, and grain size in sediments, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | Detection Limits |
|---|---|
| Dissolved Sulfides (OCSD) | 1.03 mg/kg dry weight |
| Total Organic Carbon (Columbia Analytical Services) | 0.05% |
| Grain Size (Weston Solutions, Inc.) | 0.001 % |

**Table C-14. Sediment dissolved sulfides QA/QC summary, July 2010–June 2011.**

Orange County Sanitation District, California.

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Summer | SULFIDE100720-1<br>SULFIDE100728-1<br>SULFIDE100819-1<br>SULFIDE100824-1<br>SULFIDE100826-1 | Dissolved Sulfides | Method Blank | 5 | 5 | <2X MDL | N/A |
| | | | Blank Spike | 5 | 5 | 80 -120 | N/A |
| | | | Matrix Spike | 5 | 4* | 70 - 130 | |
| | | | Matrix Spike Dup | 5 | 5 | 70 - 130 | |
| | | | Matrix Spike Precision | 5 | 5 | | <30% |
| Fall | SULFIDE101021-1 | Dissolved Sulfides | Method Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 80 -120 | N/A |
| | | | Matrix Spike | 1 | 1 | 70 - 130 | |
| | | | Matrix Spike Dup | 1 | 1 | 70 - 130 | |
| | | | Matrix Spike Precision | 1 | 1 | | <30% |
| Winter | SULFIDE110111-1 | Dissolved Sulfides | Method Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 80 -120 | N/A |
| | | | Matrix Spike | 1 | 1 | 70 - 130 | |
| | | | Matrix Spike Dup | 1 | 1 | 70 - 130 | |
| | | | Matrix Spike Precision | 1 | 1 | | <30% |
| Spring | SULFIDE110412-1 | Dissolved Sulfides | Method Blank | 1 | 1 | <2X MDL | N/A |
| | | | Blank Spike | 1 | 1 | 80 -120 | N/A |
| | | | Matrix Spike | 1 | 1 | 70 - 130 | |
| | | | Matrix Spike Dup | 1 | 1 | 70 - 130 | |
| | | | Matrix Spike Precision | 1 | 1 | | <30% |

*, Matrix spike recovery (67%) was out of control due to matrix interferences.

## Table C-15. Sediment total organic carbon QA/QC summary, July 2010–June 2011.

Orange County Sanitation District, California.

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Summer | TOC-100928-1 | Total Organic Carbon | Duplicate and matrix spike | 3 | 3 | 80-120[1] | 10%[1] |
| Fall | TOC-101123-1 | Total Organic Carbon | Duplicate and Matrix Spike | 1 | 1* | 80-120[1] | 10%[1] |
| Winter | TOC-110201-1 | Total Organic Carbon | Duplicate and Matrix Spike | 1 | 1 | 80-120[1] | 10%[1] |
| Spring | TOC-110512-1 | Total Organic Carbon | Duplicate and Matrix Spike | 2 | 2 | 80-120[1] | 10%[1] |

[1] TOC Target Precision/Accuracy of QC Criteria is not described in the Core Monitoring Quality Assurance Project Plan. * One sample dup precision (16.7%) was out of range due to matrix interference.



## Table C-16. Sediment Grain Size QA/QC Summary, July 2010 – June 2011.

Orange County Sanitation District, California.

| Quarter | Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|---|
| Summer | PSIZE101012-1 | Grain Size | Reference Standard | 15 | 15 | NA | Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt |
| | | | Duplicate | 11 | 11 | | ≤10% |
| Fall | PSIZ-110107-1 | Grain Size | Reference Standard | 1 | 1 | NA | Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt |
| | | | Duplicate | 1 | 1 | | ≤10% |
| Winter | PSIZ-110317-1 | Grain Size | Reference Standard | 2 | 2 | NA | Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt |
| | | | Duplicate | 1 | 1 | | ≤10% |
| Spring | PSIZE110531-1 | Grain Size | Reference Standard | 2 | 2 | NA | Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt |
| | | | Duplicate | 1 | 1 | | ≤10% |

Analytical Methods - Grain Size

Grain size samples were analyzed by a contract laboratory, Weston Solutions, Carlsbad, CA. The MDL for sediment grain size is presented in Table C-13. Sediment grain size QA/QC summary data are presented in Table C-16. Fifteen standard reference material (SRM) samples were analyzed. All analyses were within three standard deviations of SRM for the statistical parameters (median phi, dispersion, and skewness), percent gravel, percent sand, percent clay, and percent silt. Eleven samples and their duplicate analyses had a RPD ≤10%.

**SECOND QUARTER (OCTOBER 2010)**

OCSD's laboratory received 10 sediment samples from the ocean monitoring staff during the month of October 2010. All samples were stored according to methods described in the LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples that were analyzed for organochlorine pesticides and PCB congeners were extracted on November 11, 2010. All sediment samples that were analyzed for PAHs were extracted on November 17, 2010. Any variances that occurred during sample processing or analysis are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

The analytical methods used to process the organochlorine pesticides and PCB congeners samples are described in the LOPM. All sediment extracts were analyzed by GC/MS. Approximately 10 grams (dry weight) of sample were used for each analysis. If a field blank and rinse were included in the batch, a separatory funnel extraction was performed using 100 milliliters of sample.

A typical sample batch consisted of 10 field samples with required QC samples, which included one sand blank, two SRM, one PCB/pesticide reporting level spike, one PCB/pesticide matrix spike set, and one duplicate sample extraction. There were two batches extracted. In addition, one batch contained a rinse sample and a field blank. MDLs for PCBs/pesticides are presented in Table C-6 and C-7. Acceptance Criteria for PCB/pesticide SRMs are presented in Table C-8.

Sediment PCB/pesticide QA/QC summary data are presented in Table C-9. All analyses were performed within QAPP stated holding times and with appropriate quality control measures. When constituent concentrations exceeded the calibration range of the instrument, dilutions were performed and the samples reanalyzed. Any variances are noted in the Comments/Notes section of each batch summary.

All samples were analyzed for metals within their holding times. All of the metals analyses met the QA criteria guidelines. Sediment metals QA/QC summary data are presented in Table C-12. All spike recoveries were between 86.9% and 103.1%. The RPDs of the sample and its duplicate ranged from -16.1% to 2.1%. The RPDs of the spike and spike duplicate ranged from -3.3% and 3.1%.

Sediment Mercury QA/QC summary data are presented in Table C-12. Fall samples were batched with summer samples and all samples met the QA criteria guidelines.

The analyses for dissolved sulfides, TOC, and grain size met criteria guidelines as specified in the project QAPP. MDL, SRM, and QA/QC summary data are presented in

Tables C-13 through C-16. One TOC sediment duplicate analysis had a precision greater than 10% due to matrix interference.

**THIRD QUARTER (JANUARY 2011)**

OCSD's laboratory received 10 sediment samples from the ocean monitoring staff during the month of January 2011. All samples were stored according to methods described in the LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples that were analyzed for organochlorine pesticides and PCB congeners were first extracted on February 24, 2011. Due to contamination during the extraction process, all samples were re-extracted on April 20, 2011. All sediment samples that were analyzed for PAHs were extracted on January 20, 2011. Any variances are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE. All sediment extracts for PCB congeners and pesticides were analyzed by GC/MS.

All samples were analyzed for metals within their holding times. Sediment metals QA/QC summary data are presented in Table C-12. All spike recoveries were between 89.5% and 113.0%. The RPDs of the sample and its duplicate ranged from -17.0% and 3.1%. The RPDs of the spike and spike duplicate ranged from -2.9% and -1.1%.

Sediment mercury QA/QC summary data are presented in Table C-12. All samples met the QA criteria guidelines except for one matrix spike recovery, one matrix spike duplicate recovery, and one matrix spike precision RPD due to low results and non-homogeneous sample matrices.

The analyses for dissolved sulfide, TOC, and grain size met the QA criteria guidelines specified in the QAPP. MDL, SRM, and QA/QC summary data are presented in Tables C-13 through C-16.

**FOURTH QUARTER (APRIL 2011)**

OCSD's laboratory received 10 sediment samples from the ocean monitoring staff during the month of April 2011. All samples were stored according to methods described in the LOPM. All samples were analyzed for organochlorine pesticides, PCB congeners, PAHs, trace metals, mercury, dissolved sulfides, grain size, and TOC.

All sediment samples being analyzed for organochlorine pesticides and PCB congeners were extracted on April 20, 2011. All sediment samples being analyzed for PAHs were extracted on May 15, 2011. Any variances, which may have occurred during sample processing or analysis, are noted in the Comments/Notes section of each batch summary. All sediment samples were extracted using an ASE. All sediment extracts for PCB congeners and pesticides were analyzed by Ion Trap GC/MS.

All samples were analyzed for metals within their holding times. All metal analyses met the QA objectives. Sediment metals QA/QC summary data are presented in Table C-12. All spike recoveries were between 89.5% and 105.8%. The RPDs of the sample and its duplicate ranged from -7.6% and 12.8%. The RPDs of the spike and spike duplicate ranged from 0.9% and 2.2%. Sediment mercury QA/QC summary data are presented in Table C-12. All samples met the QA criteria guidelines. The analyses for dissolved sulfide, TOC, and grain size met the QA criteria guidelines specified in the QAPP. MDL, SRM, and QA/QC summary data are presented in Tables C-13 through C-16.

## FISH TISSUE CHEMISTRY NARRATIVE

### THIRD QUARTER (JANUARY 2011)

Introduction

OCSD's laboratory received 40 individual fish samples and 12 composite samples (containing six fish per bag), from the ocean monitoring staff during the month of January 2011. The individual samples were stored, dissected, and homogenized according to methods described in the LOPM. A 1:1 muscle to water ratio was used. No water was used during liver homogenization. After the individual samples were homogenized, equal aliquots of muscle and liver from each sample were frozen and distributed to the inorganic and organic chemistry sections of the laboratory for analyses. Each of the 12 composites were weighed and homogenized using a 1:1 whole body fish to water ratio, according to methods described in the LOPM. After the composites were homogenized, equal aliquots were frozen and distributed to the inorganic and organic chemistry sections of the laboratory for analyses.

The Organic Chemistry Section extracted 40 fish muscle samples, 40 fish liver samples, and 12 whole body composite samples and analyzed them for PCB congeners and organochlorine pesticides. Percent lipid content was also determined for each sample. A typical organic tissue sample batch included 15 field samples with required QC samples. The QC samples included one hydromatrix blank, two duplicate sample extractions, one matrix spike, one matrix duplicate spike, two SRMs, and one reporting level spike (matrix of store bought, farm-raised, *Tilapia*).

For mercury analysis, one sample batch consisted of 15–20 fish tissue samples and the required QC samples, which included a blank, blank spike, SRM, sample duplicates, matrix spikes, and matrix spike duplicates.

Analytical Methods - Organochlorine Pesticides and PCB Congeners

The analytical methods used for organochlorine pesticides and PCB congeners were according to methods described in the LOPM. All fish tissue was extracted using an ASE 200 and analyzed by GC/MS.

The MDLs for pesticides and PCBs in fish tissue are presented in Tables C-17 and C18. Acceptance criteria for PCB SRMs in fish tissue are presented in Tables C-19 and C-20. Fish tissue pesticide and PCB QA/QC summary data are presented in Table C-21. All analyses were performed within the required holding times and with appropriate quality control measures. In cases where constituent concentrations exceeded the calibration range of the instrument, the samples were diluted and reanalyzed. Any variances that occurred during sample preparation or analyses are noted in the Comments/Notes section of each batch summary.

Analytical Methods – Lipid Content

Percent lipid content was determined for each sample using methods described in the LOPM. Lipids were extracted by dichloromethane from approximately 1 to 2 g of sample and concentrated to 2 mL. A 100 uL aliquot of the extract was placed in a tarred aluminum weighing boat and the solvent allowed to evaporate to dryness. The remaining residue was weighed, and the percent lipid content calculated. Lipid content QA/QC summary data are presented in Table C-22. All analyses were performed within the required holding times and with appropriate quality control measures. Any variances that occurred during sample preparation or analyses are noted in the Comments/Notes section of the Fish Tissue Percent QA/QC Summary.

**Table C-17. Method detection levels for pesticides and PCB congeners in fish tissue using GC/MS ion trap, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameters | Method Detection Limit ng/g wet weight | Parameters | Method Detection Limit ng/g wet weight |
|---|---|---|---|
| **Pesticides** | | | |
| o,p'-DDD | 0.90 | Dieldrin | 1.0 |
| o,p'-DDE | 0.80 | Endrin | 1.4 |
| o,p'-DDT | 0.68 | *gamma*-BHC | 0.72 |
| p,p'-DDD | 1.2 | *gamma*-Chlordane | 0.78 |
| p,p'-DDE | 0.92 | Heptachlor | 0.71 |
| p,p'-DDT | 0.85 | Heptachlor epoxide | 0.72 |
| p,p'-DDMU | 0.50 | Hexachlorobenzene | 0.83 |
| Aldrin | 0.67 | Mirex | 0.63 |
| *alpha*-Chlordane | 0.75 | *trans*-Nonachlor | 0.83 |
| *cis*-Nonachlor | 0.70 | | |
| **PCB Congeners** | | | |
| PCB 8 | 0.86 | PCB 128 | 0.65 |
| PCB 18 | 0.54 | PCB 138 | 0.86 |
| PCB 28 | 0.70 | PCB 149 | 1.1 |
| PCB 37 | 0.66 | PCB 151 | 0.61 |
| PCB 44 | 0.68 | PCB 156 | 1.0 |
| PCB 49 | 0.87 | PCB 157 | 1.2 |
| PCB 52 | 0.73 | PCB 158 | 1.2 |
| PCB 66 | 0.65 | PCB 167 | 1.3 |
| PCB 70 | 1.2 | PCB 168/153 | 2.6 |
| PCB 74 | 1.1 | PCB 169 | 1.5 |
| PCB 77 | 1.3 | PCB 170 | 1.3 |
| PCB 81 | 0.83 | PCB 177 | 1.2 |
| PCB 87 | 0.87 | PCB 180 | 0.64 |
| PCB 99 | 0.90 | PCB 183 | 0.88 |
| PCB 101 | 0.84 | PCB 187 | 1.1 |
| PCB 105 | 1.1 | PCB 189 | 1.3 |
| PCB 110 | 0.84 | PCB 194 | 0.97 |
| PCB 114 | 0.59 | PCB 195 | 0.77 |
| PCB 118 | 1.1 | PCB 200 | 1.2 |
| PCB 119 | 0.84 | PCB 201 | 0.91 |
| PCB 123 | 1.1 | PCB 206 | 1.1 |
| PCB 126 | 1.1 | PCB 209 | 1.2 |

**Table C-18. Method detection levels for pesticides and PCB congeners in fish tissue using GC/MS DSQII, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameters | Method Detection Limit ng/g wet weight | Parameters | Method Detection Limit ng/g wet weight |
|---|---|---|---|
| **Pesticides** | | | |
| o,p'-DDD | 0.33 | Dieldrin | 0.31 |
| o,p'-DDE | 0.23 | Endrin | 0.64 |
| o,p'-DDT | 0.33 | *gamma*-BHC | 0.21 |
| p,p'-DDD | 0.16 | *gamma*-Chlordane | 0.25 |
| p,p'-DDE | 0.31 | Heptachlor | 0.23 |
| p,p'-DDT | 0.24 | Heptachlor epoxide | 0.37 |
| p,p'-DDMU | 0.43 | Hexachlorobenzene | 0.32 |
| Aldrin | 0.30 | Mirex | 0.29 |
| *alpha*-Chlordane | 0.33 | *trans*-Nonachlor | 0.21 |
| *cis*-Nonachlor | 0.19 | | |
| **PCB Congeners** | | | |
| PCB 8 | 0.24 | PCB 128 | 0.08 |
| PCB 18 | 0.24 | PCB 138 | 0.16 |
| PCB 28 | 0.21 | PCB 149 | 0.33 |
| PCB 37 | 0.27 | PCB 151 | 0.22 |
| PCB 44 | 0.36 | PCB 156 | 0.10 |
| PCB 49 | 0.17 | PCB 157 | 0.10 |
| PCB 52 | 0.17 | PCB 158 | 0.18 |
| PCB 66 | 0.26 | PCB 167 | 0.09 |
| PCB 70 | 0.23 | PCB 168/153 | 0.23 |
| PCB 74 | 0.24 | PCB 169 | 0.15 |
| PCB 77 | 0.21 | PCB 170 | 0.18 |
| PCB 81 | 0.19 | PCB 177 | 0.09 |
| PCB 87 | 0.17 | PCB 180 | 0.18 |
| PCB 99 | 0.44 | PCB 183 | 0.13 |
| PCB 101 | 0.14 | PCB 187 | 0.06 |
| PCB 105 | 0.13 | PCB 189 | 0.12 |
| PCB 110 | 0.19 | PCB 194 | 0.17 |
| PCB 114 | 0.10 | PCB 195 | 0.13 |
| PCB 118 | 0.22 | PCB 200 | 0.08 |
| PCB 119 | 0.14 | PCB 201 | 0.20 |
| PCB 123 | 0.21 | PCB 206 | 0.11 |
| PCB 126 | 0.11 | PCB 209 | 0.29 |

**Table C-19. Acceptance criteria for standard reference materials of PCB congeners in fish tissue, CARP-2, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | True Value (ng/g) | Acceptance Range (ng/g) | |
|---|---|---|---|
| | | Minimum | Maximum |
| PCB 18 | 27.3 | 23.3 | 31.3 |
| PCB 28 | 34.0 | 26.8 | 41.2 |
| PCB 52 | 138 | 95.0 | 181 |
| PCB 44 | 86.6 | 60.7 | 112 |
| PCB 118 | 148 | 115 | 181 |
| PCB 153 | 105 | 83.0 | 127 |
| PCB 128 | 20.4 | 16.0 | 24.8 |
| PCB 180 | 53.3 | 40.3 | 66.3 |
| PCB 194 | 10.9 | 7.80 | 14.0 |
| PCB 206 | 4.40 | 3.30 | 5.50 |

CARP-2, Ground Whole Carp Reference Material for Organochlorine Compounds, National Research Council Canada.

**Table C-20. Acceptance criteria for standard reference materials of pesticides and PCB congeners in fish tissue, SRM-1946, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | True Value (ng/g) | Acceptance Range (ng/g) | | Parameter | True Value (ng/g) | Acceptance Range (ng/g) | |
|---|---|---|---|---|---|---|---|
| | | Minimum | Maximum | | | Minimum | Maximum |
| *gamma*-BHC | 1.14 | 0.96 | 1.32 | PCB 99 | 25.6 | 23.3 | 27.9 |
| Dieldrin | 32.5 | 29.0 | 36.0 | PCB 101 | 34.6 | 32.0 | 37.2 |
| Heptachlor epoxide | 5.50 | 5.27 | 5.73 | PCB 105 | 19.9 | 19.0 | 20.8 |
| Hexachlorobenzene | 7.25 | 6.42 | 8.08 | PCB 110 | 22.8 | 20.8 | 24.8 |
| *alpha*-Chlordane | 32.5 | 30.7 | 34.3 | PCB 118 | 52.1 | 51.1 | 53.1 |
| *gamma*-Chlordane | 8.36 | 7.45 | 9.27 | PCB 126 | 0.380 | 0.363 | 0.397 |
| *cis*-Nonachlor | 59.1 | 55.5 | 62.7 | PCB 128 | 22.8 | 20.9 | 24.7 |
| *trans*-Nonachlor | 99.6 | 92.0 | 107 | PCB 138 | 115 | 102 | 128 |
| Mirex | 6.47 | 5.70 | 7.24 | PCB 149 | 26.3 | 25.0 | 27.6 |
| o,p'-DDD | 2.20 | 1.95 | 2.45 | PCB 153/168 | 170 | 161 | 179 |
| p,p'-DDD | 17.7 | 14.9 | 20.5 | PCB 156 | 9.52 | 9.01 | 10.0 |
| p,p'-DDE | 373 | 325 | 421 | PCB 169 | 0.106 | 0.092 | 0.120 |
| p,p'-DDT | 37.2 | 33.7 | 40.7 | PCB 170 | 25.2 | 23.0 | 27.4 |
| PCB 44 | 4.66 | 3.80 | 5.52 | PCB 180 | 74.4 | 70.4 | 78.4 |
| PCB 49 | 3.80 | 3.41 | 4.19 | PCB 183 | 21.9 | 19.4 | 24.4 |
| PCB 52 | 8.1 | 7.10 | 9.10 | PCB 187 | 55.2 | 53.1 | 57.3 |
| PCB 66 | 10.8 | 8.90 | 12.7 | PCB 194 | 13.0 | 11.7 | 14.3 |
| PCB 70 | 14.9 | 14.3 | 15.5 | PCB 195 | 5.30 | 4.85 | 5.75 |
| PCB 74 | 4.83 | 4.32 | 5.34 | PCB 206 | 5.40 | 4.97 | 5.83 |
| PCB 77 | 0.327 | 0.302 | 0.352 | PCB 209 | 1.30 | 1.09 | 1.51 |
| PCB 87 | 9.4 | 8.00 | 10.8 | | | | |

SRM 1946, Organics in Lake Superior Fish Tissue, National Institute of Standards and Technology.

**Table C-21. Fish tissue PCB/pesticide QA/QC summary, July 2010–June 2011.**

Orange County Sanitation District, California.

| Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|
| **Sample Set – MB (15 Muscle Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 10 | according to published acceptance criteria | NA |
| SRM 1946 | 40 | 30 | according to published acceptance criteria | NA |
| PCB Reporting Level Spike | 44 | 44 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 44 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 43 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 18 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 19 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 18 | | |
| Precision | 19 | 19 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 1 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 3 | 3 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 1 | 1 | | |
| Duplicate 2 PCB | 8 | 8 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 4 | 4 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 1 | | |
| **Sample Set – MA2 (15 Muscle Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 10 | according to published acceptance criteria | NA |
| SRM 1946 | 40 | 38 | according to published acceptance criteria | NA |
| PCB Reporting Level Spike | 44 | 43 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 43 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 43 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 19 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 19 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 19 | | |
| Precision | 19 | 19 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 0 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 1 | 1 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 1 | 1 | | |
| Duplicate 2 PCB | 0 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 1 | 1 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 1 | | |

**Table C-21 Continues.**

**Table C-21 Continued.**

| Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|
| **Sample Set – MC2 (10 Muscle Tissue and 5 Whole Body Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 10 | according to published acceptance criteria | NA |
| SRM 1946 | 40 | 38 | according to published acceptance criteria | NA |
| PCB Reporting Level Spike | 44 | 44 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 42 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 42 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 19 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 19 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 19 | | |
| Precision | 19 | 19 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 0 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 2 | 1 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 1 | 1 | | |
| Duplicate 2 PCB | 0 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 2 | 2 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 1 | | |
| **Sample Set – MD2 (7 Whole Body Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 10 | according to published acceptance criteria | NA |
| SRM 1946 | 40 | 40 | according to published acceptance criteria | NA |
| PCB Reporting Level Spike | 44 | 43 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 43 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 43 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 19 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 19 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 19 | | |
| Precision | 19 | 19 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 0 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 3 | 2 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 11 | 1 | | |
| Duplicate 2 PCBs | 0 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 1 | 1 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 1 | | |

**Table C-21 Continues.**

**Table C-21 Continued.**

| Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|
| **Sample Set – LA (15 Liver Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 10 | according to published acceptance criteria | NA |
| SRM 1946 * | 40 | 37 | according to published acceptance criteria | |
| PCB Reporting Level Spike | 44 | 43 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 43 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 43 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 19 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 18 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 18 | | |
| Precision | 19 | 19 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 1 | 1 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 3 | 2 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 1 | 1 | | |
| Duplicate 2 PCB | 1 | 1 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 3 | 2 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 1 | | |
| **Sample Set – LB (15 Liver Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 7 | according to published acceptance criteria | NA |
| SRM 1946 | 40 | 36 | according to published acceptance criteria | |
| PCB Reporting Level Spike | 44 | 44 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 44 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 44 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 19 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 17 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 16 | | |
| Precision | 19 | 17 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 2 | 1 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 3 | 1 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 1 | 1 | | |
| Duplicate 2 PCB | 3 | 0 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 1 | 0 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 0 | | |

**Table C-21 Continues.**

**Table C-21 Continued.**

| Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|
| **Sample Set – LC (10 Liver Tissue Samples)** | | | | |
| NRCC CARP-2 | 10 | 9 | according to published acceptance criteria | NA |
| SRM 1946 | 40 | 338 | according to published acceptance criteria | |
| PCB Reporting Level Spike | 44 | 142 | 75 -125 | NA |
| PCB Matrix Spike: | 44 | 843 | 70 - 130 | NA |
| PCB Matrix Spike Dup | 44 | 44 | | |
| Precision | 44 | 44 | NA | < 25% |
| Pesticide Reporting Level Spike | 19 | 19 | 75 -125 | NA |
| Pesticide Matrix Spike | 19 | 17 | 70-130 | NA |
| Pesticide Matrix Spike Dup | 19 | 18 | | |
| Precision | 19 | 19 | NA | < 25% |
| PCB/Pesticide Duplicate Analysis | | | | |
| Duplicate 1 PCB | 1 | 3 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 1 Pesticides | 4 | 3 | | |
| Duplicate 1 Sum of Pesticides and PCBs | 1 | 1 | | |
| Duplicate 2 PCB | 9 | 8 | NA | < 25% @ 3 x MDL of Sample Mean. |
| Duplicate 2 Pesticides | 4 | 4 | | |
| Duplicate 2 Sum of Pesticides and PCBs | 1 | 1 | | |

**CARP-2: National Research Council Canada; SRM 1946: National Institute of Standards & Technology**

**Table C-22. Fish tissue percent lipid QA/QC summary, July 2010–June 2011.**

Orange County Sanitation District, California.

| Sample Set | Tissue Type | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Precision % RPD |
|---|---|---|---|---|---|---|
| MB | Muscle | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |
| MA2 | Muscle | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |
| MC2 | Muscle | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |
| MD2 | Whole Body | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |
| LA | Liver | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |
| LB | Liver | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |
| LC | Liver | Percent Lipid | Duplicate Samples | 2 | 2 | <25% |

**Table C-23. Method detection levels for mercury in fish tissue, July 2010–June 2011.**

Orange County Sanitation District, California.

| Parameter | Method Detection Limit (ng/g wet weight) |
|---|---|
| Mercury | 0.002 |

**Table C-24. Acceptance criteria for standard reference materials of mercury in fish tissue, July 2010–June 2011.**

Orange County Sanitation District, California.

| Mercury | True Value (ng/g) | Acceptance Range (ng/g) | |
|---|---|---|---|
| | | Minimum | Maximum |
| DORM-2 | 4.64 | 4.38 | 4.90 |
| DORM-3 | 0.382 | 0.322 | 0.442 |

Dogfish Muscle and Liver Reference Material for Mercury, National Research Council Canada.

Analytical Methods - Mercury

Fish tissue samples were analyzed for mercury in accordance with ELOM SOP 245.1A. Typical QC analyses for a tissue sample batch included a blank, a blank spike, and SRMs (liver and muscle). In the same batch, additional QC samples included duplicate analyses of the sample, spiked samples, and duplicate spiked samples, which were run approximately once every 10 samples.

The MDL for fish mercury is presented in Table C-23. Acceptance criteria for the mercury SRMs are presented in Table C-24. Fish tissue mercury QA/QC summary data are presented in Table C-25. All samples were analyzed within their 6-month holding times and met the QA criteria guidelines.

Pretreated (resected and 1:1 muscle:water homogenized) fish samples were analyzed for mercury in accordance with methods described in the LOPM. QC for a typical batch included a blank, a blank spike, and an SRM (whole fish). Fish samples with duplicates, spiked samples, and duplicate spiked samples were run approximately once every 10 fish samples. When sample mercury concentration exceeded the appropriate calibration curve, the sample was diluted with the reagent blank and reanalyzed. The samples were analyzed for mercury on a Perkin Elmer FIMS 400 system.

All samples met the QA criteria guidelines for accuracy and precision with a few exceptions. Two sample duplicate RPDs were out of acceptable range due to low results and a non-homogeneous sample matrix. One sample duplicate spike recovery was out of its acceptable range due to a non-homogeneous sample matrix.

**Table C-25. Fish tissue mercury QA/QC summary, July 2010–June 2011.**

Orange County Sanitation District, California.

| Sample Set | Parameter | Description | Number of Compounds Tested | Number of Compounds Passed | Target Accuracy % Recovery | Target Precision % RPD |
|---|---|---|---|---|---|---|
| HGFISH110228-1 | Mercury | Blank | 1 | 1 | <2X MDL | NA |
| | | Blank Spike | 1 | 1 | 90-110 | NA |
| | | Matrix Spike | 2 | 2 | 70-130 | |
| | | Matrix Spike Dup | 2 | 2 | | |
| | | Matrix Spike Precision | 2 | 2 | | < 25% |
| | | Duplicate Analysis | 2 | **1 | NA | @ ≥ 10 X MDL < 30% |
| | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |
| HGFISH110303-1 | Mercury | Blank | 1 | 1 | <2X MDL | NA |
| | | Blank Spike | 1 | 1 | 90-110 | NA |
| | | Matrix Spike | 3 | 3 | 70-130 | |
| | | Matrix Spike Dup | 3 | 3 | | |
| | | Matrix Spike Precision | 3 | 3 | | < 25% |
| | | Duplicate Analysis | 3 | 3 | NA | @ ≥ 10 X MDL < 30% |
| | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |
| HGFISH110307-1 | Mercury | Blank | 1 | 1 | <2X MDL | NA |
| | | Blank Spike | 1 | 1 | 90-110 | NA |
| | | Matrix Spike | 4 | 4 | 70-130 | |
| | | Matrix Spike Dup | 4 | **3 | | |
| | | Matrix Spike Precision | 4 | 4 | | < 25% |
| | | Duplicate Analysis | 4 | **3 | NA | @ ≥ 10 X MDL < 30% |
| | | CRM Analysis | 1 | 1 | 80-120% or certified value, whichever is greater. | |

** Two duplicate analysis RPDs and one matrix spike duplicate recovery failed due to low results and non-homogeneous sample matrices.
NA = Not applicable.

# BENTHIC INFAUNA NARRATIVE

## SORTING AND TAXONOMY QA/QC

The OCSD is in the final stages of insourcing the infaunal taxonomy program element. This work was done exclusively by contractors (Weston Solutions, Inc., Carlsbad, CA) since about 1985. As part of the taxonomic training of OCSD staff, a series of re-identifications with the contractors were conducted. New metrics were used to evaluate the results as part of the in-house taxonomy QA/QC development. These methods differ from the 2010-11 QAPP, which will be modified next year to reflect the new protocols. However, for the sorting QA/QC, the 2010-11 QAPP procedures were followed. The following sections describe QA/QC protocols used under the program and the status of samples that have received sorting and taxonomic QA/QC. Sorting QA/QC procedures have been completed for three surveys: the summer (July 2010, Cruise # OC-2010-025), fall (October 2010, Cruise # OC-2009-040), and winter (January 2011, Cruise # OC-2011-001) surveys. Taxonomic re-identifications were conducted for the winter survey (January 2011).

<u>Sorting QA/QC Procedures</u>

OCSD's NPDES permit designates 10 quarterly (summer, fall, winter, and spring) benthic-sampling stations and 39 annual (summer) benthic-sampling stations. Sorting procedures were performed on one replicate infaunal sample collected from each of three randomly selected quarterly stations in the summer, fall, and winter quarters and an additional seven samples (at least one from each of the four major depth contour intervals) for the annual survey; no QA samples were processed for the spring survey. The sorting procedure involved removal by Weston Solutions, Inc. (Weston) personnel of all biological organisms and fragments from benthic samples. Organisms were further sorted by taxa, transferred to separate vials, and total counts per station replicate were made. When all samples from a cruise passed Weston's in-house sorting efficiency criteria, they were shipped along with any remaining particulates (RPs), including sediments and shell and kelp fragments, to OCSD for reanalysis. OCSD re-sorted the sample RPs and collected any organisms or fragments that had been missed by Weston. The sample passed the QA procedure if the total number of animals collected by OCSD from the RPs was less than or equal to 5% of the total number of individuals collected by Weston for that sample.

<u>2010-11 Sorting QA/QC Status</u>

Sorting results for all 2010-11 QA samples were well within the 5% QC limit (99.5 % accuracy).

<u>Taxonomic Identification QA/QC Procedures</u>

Benthic infauna samples undergo comparative taxonomic analysis by two independent groups of taxonomists. The selected infauna samples were first identified by OCSD taxonomists and re-identified by taxonomists from Weston. Weston then compared the two sets of data and reported any discrepancies. Taxonomic discrepancies were reviewed and resolved by OCSD taxonomists. Following their review, any necessary corrections to taxon names or abundances were made and the project database modified to reflect these changes. The results were tallied by station and percent errors were calculated using the equations below:

Equation 1. $\%Error_{\#\,Taxa} = [(\#\,Taxa_{Resolved} - \#\,Taxa_{Original}) \div \#\,Taxa_{Resolved}] * 100$

Equation 2. $\%Error_{\#\,Individuals} = (\#\,Individuals_{Resolved} - \#\,Individuals_{Original}) \div \#\,Individuals_{Resolved}] * 100$

Equation 3. $\%Error_{\#\,ID\,Taxa} = (\#\,Taxa_{MissID} \div \#\,Taxa_{Resolved}) * 100$

Equation 4. $\%Error_{\#\,ID\,Individuals} = (\#\,Individuals_{MissID} \div \#\,Individuals_{Resolved}) * 100$

These equations were adapted from the Macrobenthic (Infaunal) Sample Analysis Laboratory Manual (SCCWRP 2008). In each equation the taxa or individuals "resolved" represents the final taxonomic determination or count following resolution by OCSD staff; taxa or individuals "original" represents the originating taxonomist's taxonomic determination or count; and taxa or individuals "mis-ID" represents the number of taxa or individuals that the originating taxonomist identified incorrectly.

When applied to individual taxonomists these equations are a measure of taxonomic accuracy (i.e., QA). The first three equations are considered gauges of errors in accounting (e.g., recording on wrong line, miscounting, etc.), which by their random nature are hard to predict. Sample accuracy (i.e., QC) is calculated by station using the fourth equation reported herein. Equation 4 is the preferred measure of identification accuracy. It is weighted by abundance and has a more rigorous set of consequences (corrective actions) when errors are greater than 10%. Corrective actions include a reanalysis of additional samples for the effected taxa and additional, targeted, training. Equation 3, while included herein, was technically an assessment of identification accuracy but is considered too sensitive a measure for samples with low diversities, which are commonly found in samples of Echinodermata and Minor Phyla.

<u>2010-11 Taxonomic QA/QC Results</u>

The QA/QC results are presented in Table C-26 and C-27. All stations met their QC objectives for percent error of number of identified individuals (Eq. 4) with a mean of 4.8%.

All samples were under the actionable threshold for QA measures. However, the relative high value at Station C of 9.2% error of identified taxa was due to the somewhat high number of Polychaete taxa mis-identified (12.1% error of identified taxa) for all three stations. This, in turn, was caused by a few select problematic taxa present in these samples. In one example: the Syllid Polychaete *Syllides mikeli* was misidentified as *Syllides reishi*. All effected records were corrected. In another case, the Lumbrinerid polychaete *Lumbrineris cruzensis* was, upon reanalysis, determined to be *Lumbrineris latreilli*. It was decided that due to the subjective nature of the diagnostic character used to separate the species, no further action was warranted and better in-house conventions are being developed.

**Table C-26. Re-identification results for January 2011 QA samples.**

Orange County Sanitation District, California.

| Station | Rep | Description | Original Count | Mis-identified | Final Count |
|---|---|---|---|---|---|
| 1 | 1 | No. of Individuals | 631 | 12 | 634 |
| | | No. of Taxa | 142 | 10 | 142 |
| 12 | 1 | No. of Individuals | 206 | 14 | 203 |
| | | No. of Taxa | 96 | 6 | 98 |
| C | 1 | No. of Individuals | 422 | 24 | 430 |
| | | No. of Taxa | 140 | 13 | 141 |

**Table C-27. Percent error rates calculated for January 2011 QA samples.**

Orange County Sanitation District, California.

| Error Type | Station (rep) | | | |
|---|---|---|---|---|
| | 1(1) | 12(1) | C(1) | Mean |
| %Error $_{\# \text{ Taxa}}$ | 0.0 | 2.0 | 0.7 | 0.9 |
| %Error $_{\# \text{ Individuals}}$ | 0.5 | -1.5 | 1.9 | 0.3 |
| %Error $_{\# \text{ ID Taxa}}$ | 7.0 | 6.1 | 9.2 | 7.5 |
| %Error $_{\# \text{ ID Individuals}}$ | 1.9 | 6.9 | 5.6 | 4.8 |

## OTTER TRAWL NARRATIVE

The OCSD trawl sampling protocols are based upon regionally developed sampling methods (Mearns and Stubs 1974; Mearns and Allen 1978) and US Environmental Protection Agency 301(h) guidance documents (Tetra Tech 1986). These include a maximum distance from the nominal trawl station co-ordinates, sampling depth, vessel speed, and distance (trawl track) covered. Table C-28 lists the trawl quality assurance objectives (QAO).

Established regional survey methods for southern California requires that a portion of the trawl track must pass within a 100-m circle that originates from the nominal sample station position and be within 10% of the station's nominal depth. The speed of the trawl should range from 0.77 to 1.0 m/s or 1.5 to 2.0 kts. Since 1985, the District has trawled a set distance of 450 meters (the distance that the net is actually on the bottom collecting fish and invertebrates); regional surveys trawls are based on time on the bottom, not distance.

<u>Summer 2010</u>

For summer 2010, trawl distances ranged from 408 to 472 m with the average trawl length being 455.4 m and the average trawl speed being 1.9 kts for all trawls combined (Table C-29). All of the trawls passed through the designated 100-meter circle (Figure C-1). Trawl depths and time on the bottom were determined using an attached pressure sensor that showed excellent trawl repeatability in both depth (Table C-30) and distance traveled (Figure C-2). Station T3, which is located on the edge of the Newport submarine canyon where depth changes rapidly, was the only anomalous station (Figure 6-1). A perfectly flat trawl along an isobath is difficult to maintain at this station. While Station T3 appears not to follow the bottom depth contour, OCSD staff believe that the net is trawling properly along an irregular bottom.

<u>Winter 2011</u>

For winter 2011, all trawl lengths ranged from 449 to 547 m with the average trawl length being 464.4 m and the average trawl speed being 2.1 kts for all trawls combined (Table C-31). All the trawls passed through the designated 100-meter circle (Figure C-3). Trawl depths and time on the bottom were determined using an attached pressure sensor that showed excellent trawl repeatability in both depth (Table C-32) and distance traveled (Figure C-4). Station T3 was again the only anomalous station.

**Table C-28. Districts quality assurance objectives for trawl sampling, July 2010–June 2011.**

Orange County Sanitation District, California.

| Measure | Quality Assurance Objective (QAO) |
|---|---|
| Trawl Track Depth | ±10% of nominal station depth (at any point during the trawl) |
| Trawl Track Length | 450 m |
| Distance from nominal | 100 m |
| Vessel Speed | 1.5–2.0 knots |

**Table C-29. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, August 2010.**

Orange County Sanitation District, California.

| Date | Station | Haul | Distance Trawled (meters) | Percent Difference from Target Distance * | Elapsed Time (seconds) | Trawl speed (knots)** |
|---|---|---|---|---|---|---|
| August 18, 2010 | T1 | 1 | 470.2 | 4.5 | 538 | 1.7 |
| August 18, 2010 | T1 | 2 | 448.0 | -0.4 | 542 | 1.6 |
| August 18, 2010 | T1 | 3 | 450.1 | 0.0 | 551 | 1.6 |
| August 17, 2010 | T2 | 1 | 454.7 | 1.0 | 532 | 1.7 |
| August 17, 2010 | T2 | 2 | 461.5 | 2.6 | 556 | 1.6 |
| August 17, 2010 | T3 | 1 | 408.0 | -9.3 | 382 | **2.1** |
| August 18, 2010 | T3 | 2 | 452.8 | 0.6 | 465 | 1.9 |
| August 18, 2010 | T3 | 3 | 455.8 | 1.3 | 471 | 1.9 |
| August 17, 2010 | T6 | 1 | 451.0 | 0.2 | 642 | **1.4** |
| August 24, 2010 | T6 | 2 | 455.5 | 1.2 | 408 | **2.2** |
| August 17, 2010 | T10 | 1 | 472.0 | 4.9 | 360 | **2.5** |
| August 17, 2010 | T10 | 2 | 455.3 | 1.2 | 435 | 2.0 |
| August 24, 2010 | T11 | 1 | 460.0 | 2.2 | 472 | 1.9 |
| August 25, 2010 | T11 | 2 | 463.6 | 3.0 | 497 | 1.8 |
| August 25, 2010 | T11 | 3 | 457.5 | 1.7 | 475 | 1.9 |
| August 23, 2010 | T12 | 1 | 463.6 | 3.0 | 401 | **2.2** |
| August 23, 2010 | T12 | 2 | 458.2 | 1.8 | 432 | **2.1** |
| August 23, 2010 | T12 | 3 | 458.2 | 1.8 | 397 | **2.2** |
| August 23, 2010 | T13 | 1 | 453.8 | 0.8 | 433 | 2.0 |
| August 24, 2010 | T13 | 2 | 453.1 | 0.7 | 418 | **2.1** |
| August 24, 2010 | T13 | 3 | 453.8 | 0.8 | 448 | 2.0 |
| August 23, 2010 | T14 | 1 | 453.5 | 0.8 | 470 | 1.9 |
| August 25, 2010 | T14 | 2 | 463.9 | 3.1 | 524 | 1.7 |
| | | **Mean value** | 455.4 | 1.2 | 472 | 1.9 |

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.
* Target Distance – 450 meters
** Target Speed – 1.5 – 2.0 knot

**Table C-30. Ten percent trawl depth QA, August 2010.**

Orange County Sanitation District, California.

| Date | Station | Haul | Nominal Depth (m) | QA Range (m) | Data Source | Average Bottom Depth (m) | 10% Y/N |
|---|---|---|---|---|---|---|---|
| August 18, 2010 | T1 | 1 | 55 | 49.5–60.5 | SBE data | 55.8 | Y |
| | | | | | SOD data | 54.5 | Y |
| August 18, 2010 | T1 | 2 | | | SBE data | 56.6 | Y |
| | | | | | SOD data | 54.0 | Y |
| August 18, 2010 | T1 | 3 | | | SBE data | 56.8 | Y |
| | | | | | SOD data | 54.5 | Y |
| August 17, 2010 | T2 | 1 | 35 | 31.5–38.5 | SBE data | 36.5 | Y |
| | | | | | SOD data | 35.0 | Y |
| August 17, 2010 | T2 | 2 | | | SBE data | 36.5 | Y |
| | | | | | SOD data | 35.0 | Y |
| August 17, 2010 | T3 | 1 | 55 | 49.5–60.5 | SBE data | 67.7 | N |
| | | | | | SOD data | 59.0 | Y |
| August 18, 2010 | T3 | 2 | | | SBE data | 74.7 | N |
| | | | | | SOD data | 67.0 | N |
| August 18, 2010 | T3 | 3 | | | SBE data | 69.8 | N |
| | | | | | SOD data | 64.0 | N |
| August 17, 2010 | T6 | 1 | 36 | 32.4–39.6 | SBE data | 37.8 | Y |
| | | | | | SOD data | 36.5 | Y |
| August 24, 2010 | T6 | 2 | | | SBE data | 37.4 | Y |
| | | | | | SOD data | 36.5 | Y |
| August 17, 2010 | T10 | 1 | 137 | 123.3–150.7 | SBE data | 136.8 | Y |
| | | | | | SOD data | 133.0 | Y |
| August 17, 2010 | T10 | 2 | | | SBE data | 143.6 | Y |
| | | | | | SOD data | 133.5 | Y |
| August 24, 2010 | T11 | 1 | 60 | 54.0–66.0 | SBE data | 60.2 | Y |
| | | | | | SOD data | 61.5 | Y |
| August 25, 2010 | T11 | 2 | | | SBE data | 54.6 | Y |
| | | | | | SOD data | 59.0 | Y |
| August 25, 2010 | T11 | 3 | | | SBE data | 62.6 | Y |
| | | | | | SOD data | 62.0 | Y |
| August 23, 2010 | T12 | 1 | 60 | 54.0–66.0 | SBE data | 58.1 | Y |
| | | | | | SOD data | 57.5 | Y |
| August 23, 2010 | T12 | 2 | | | SBE data | 59.5 | Y |
| | | | | | SOD data | 56.5 | Y |
| August 23, 2010 | T12 | 3 | | | SBE data | 58.2 | Y |
| | | | | | SOD data | 56.5 | Y |

**Table C-30 Continues.**

**Table C-30 Continued.**

| Date | Station | Haul | Nominal Depth (m) | QA Range (m) | Data Source | Average Bottom Depth (m) | 10% Y/N |
|---|---|---|---|---|---|---|---|
| August 23, 2010 | T13 | 1 | 60 | 54.0–66.0 | SBE data | 62.9 | Y |
| | | | | | SOD data | 59.5 | Y |
| August 24, 2010 | T13 | 2 | | | SBE data | 62.7 | Y |
| | | | | | SOD data | 61.0 | Y |
| August 24, 2010 | T13 | 3 | | | SBE data | 65.2 | Y |
| | | | | | SOD data | 60.0 | Y |
| August 23, 2010 | T14 | 1 | 137 | 123.3–150.7 | SBE data | 139.4 | Y |
| | | | | | SOD data | 140.0 | Y |
| August 25, 2010 | T14 | 2 | | | SBE data | 144.3 | Y |
| | | | | | SOD data | 138.0 | Y |

**Notes:**

Station T3 depth varies widely.  10% QA may not be applicable.

SBE = Seabird Electronics

SOD = Station occupation data

Y = Yes (Pass)

N = No (Fail)

N/A = Not analyzed

**Table C-31. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, January 2011.**

Orange County Sanitation District, California.

| Date | Station | Haul | Distance Trawled (meters) | Percent Difference from Target Distance * | Elapsed Time (seconds) | Trawl speed (knots)** |
|---|---|---|---|---|---|---|
| January 18, 2011 | T0 | 1 | 463.0 | 2.9 | 427 | **2.1** |
| January 19, 2011 | T1 | 1 | 464.8 | 3.3 | 448 | 2.0 |
| January 19, 2011 | T1 | 2 | 467.6 | 3.9 | 438 | **2.1** |
| January 19, 2011 | T1 | 3 | 546.9 | 21.5 | 505 | **2.1** |
| January 11, 2011 | T2 | 1 | 461.1 | 2.5 | 459 | 2.0 |
| January 12, 2011 | T2 | 2 | 459.4 | 2.1 | 381 | **2.3** |
| January 11, 2011 | T3 | 1 | 454.8 | 1.1 | 403 | **2.2** |
| January 11, 2011 | T3 | 2 | 462.7 | 2.8 | 430 | **2.1** |
| January 12, 2011 | T3 | 3 | 460.1 | 2.2 | 418 | **2.1** |
| January 12, 2011 | T6 | 1 | 455.8 | 1.3 | 426 | **2.1** |
| January 12, 2011 | T6 | 2 | 453.2 | 0.7 | 442 | 2.0 |
| January 11, 2011 | T10 | 1 | 472.6 | 5.0 | 447 | **2.1** |
| January 11, 2011 | T10 | 2 | 459.0 | 2.0 | 436 | 2.0 |
| January 18, 2011 | T11 | 1 | 458.1 | 1.8 | 440 | 2.0 |
| January 19, 2011 | T11 | 2 | 461.8 | 2.6 | 431 | **2.1** |
| January 19, 2011 | T11 | 3 | 458.3 | 1.8 | 443 | 2.0 |
| January 18, 2011 | T12 | 1 | 463.7 | 3.0 | 419 | **2.2** |
| January 18, 2011 | T12 | 2 | 463.5 | 3.0 | 434 | **2.1** |
| January 18, 2011 | T12 | 3 | 456.5 | 1.5 | 442 | 2.0 |
| January 12, 2011 | T13 | 1 | 449.1 | -0.2 | 462 | 1.9 |
| January 18, 2011 | T13 | 2 | 461.1 | 2.5 | 435 | **2.1** |
| January 18, 2011 | T13 | 3 | 471.3 | 4.7 | 444 | **2.1** |
| January 12, 2011 | T14 | 1 | 467.4 | 3.9 | 431 | **2.1** |
| January 12, 2011 | T14 | 2 | 453.7 | 0.8 | 435 | 2.0 |
| | | **Mean value** | 464.4 | 3.2 | 437 | **2.1** |

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.
* Target Distance – 450 meters
** Target Speed – 1.5 – 2.0 knots

**Table C-32. Ten percent trawl depth QA, January 2011.**

Orange County Sanitation District, California.

| Date | Station | Haul | Nominal Depth (m) | QA Range (m) | Data Source | Average Bottom Depth (m) | 10% Y/N |
|---|---|---|---|---|---|---|---|
| January 18, 2011 | T0 | 1 | 18 | 16.2–19.8 | SBE data | NA | NA |
| | | | | | SOD data | NA | NA |
| January 19, 2011 | T1 | 1 | 55 | 49.5–60.5 | SBE data | 57.6 | Y |
| | | | | | SOD data | 55.5 | Y |
| January 19, 2011 | T1 | 2 | | | SBE data | 57.3 | Y |
| | | | | | SOD data | 55.5 | Y |
| January 19, 2011 | T1 | 3 | | | SBE data | 56.8 | Y |
| | | | | | SOD data | 55.0 | Y |
| January 11, 2011 | T2 | 1 | 35 | 31.5–38.5 | SBE data | 35.7 | Y |
| | | | | | SOD data | 34.5 | Y |
| January 11, 2011 | T2 | 2 | | | SBE data | 35.5 | Y |
| | | | | | SOD data | 34.5 | Y |
| January 11, 2011 | T3 | 1 | 55 | 49.5–60.5 | SBE data | 60.3 | Y |
| | | | | | SOD data | 56.5 | Y |
| January 11, 2011 | T3 | 2 | | | SBE data | 61.2 | N |
| | | | | | SOD data | 58.0 | Y |
| January 12, 2011 | T3 | 3 | | | SBE data | 67.4 | N |
| | | | | | SOD data | 63.0 | N |
| January 12, 2011 | T6 | 1 | 36 | 32.4–39.6 | SBE data | 37.1 | Y |
| | | | | | SOD data | 36.0 | Y |
| January 12, 2011 | T6 | 3 | | | SBE data | 37.3 | Y |
| | | | | | SOD data | 36.0 | Y |
| January 11, 2011 | T10 | 1 | 137 | 123.3–150.7 | SBE data | 146.2 | Y |
| | | | | | SOD data | 133.0 | Y |
| January 11, 2011 | T10 | 2 | | | SBE data | 137.0 | Y |
| | | | | | SOD data | 136.5 | Y |
| January 18, 2011 | T11 | 1 | 60 | 54.0–66.0 | SBE data | 65.5 | Y |
| | | | | | SOD data | 58.5 | Y |
| January 19, 2011 | T11 | 2 | | | SBE data | 61.2 | Y |
| | | | | | SOD data | 53.5 | N |
| January 19, 2011 | T11 | 3 | | | SBE data | 59.9 | Y |
| | | | | | SOD data | 62.0 | Y |
| January 18, 2011 | T12 | 1 | 60 | 54.0–66.0 | SBE data | 58.9 | Y |
| | | | | | SOD data | 57.5 | Y |
| January 18, 2011 | T12 | 2 | | | SBE data | 59.0 | Y |
| | | | | | SOD data | 57.0 | Y |
| January 18, 2011 | T12 | 3 | | | SBE data | 59.0 | Y |
| | | | | | SOD data | 55.5 | Y |

**Table C-32 Continues.**

**Table C-32 Continued.**

| Date | Station | Haul | Nominal Depth (m) | QA Range (m) | Data Source | Average Bottom Depth (m) | 10% Y/N |
|---|---|---|---|---|---|---|---|
| January 12, 2011 | T13 | 1 | 60 | 54.0–66.0 | SBE data | 61.9 | Y |
| | | | | | SOD data | 57.5 | Y |
| January 18, 2011 | T13 | 2 | | | SBE data | 61.6 | Y |
| | | | | | SOD data | 55.0 | Y |
| January 18, 2011 | T13 | 3 | | | SBE data | 62.8 | Y |
| | | | | | SOD data | 58.5 | Y |
| January 12, 2011 | T14 | 1 | 137 | 123.3–150.7 | SBE data | 141.6 | Y |
| | | | | | SOD data | 140.5 | Y |
| January 12, 2011 | T14 | 2 | | | SBE data | 142.3 | Y |
| | | | | | SOD data | 136.0 | Y |

**Notes:**

Station T3 depth varies widely. 10% QA may not be applicable.

SBE = Seabird Electronics

SOD = Station occupation data

Y = Yes (Pass)

N = No (Fail)

NA = Not analyzed

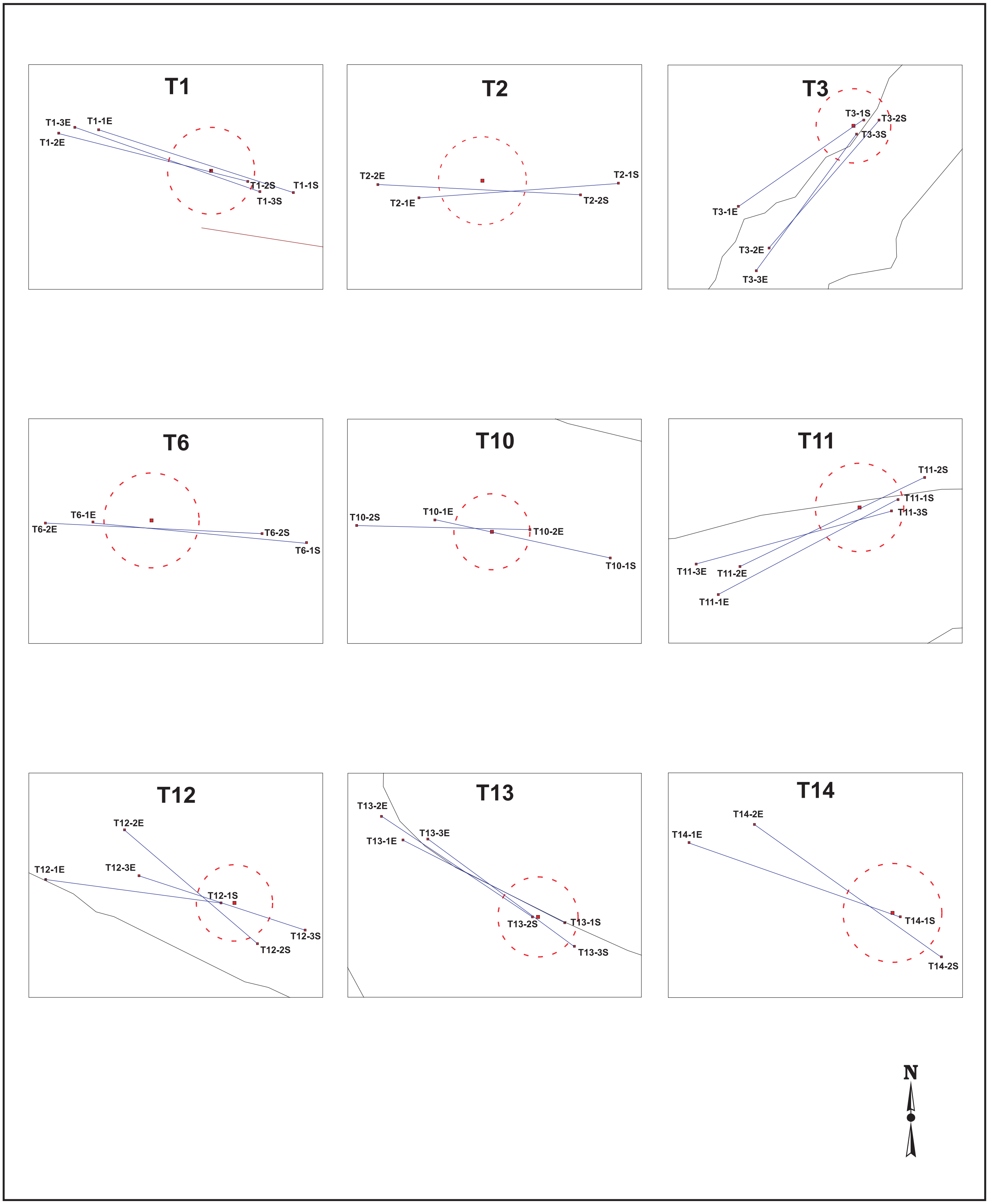


**Figure C-1.** **Quality assurance plots of distance to station for otter trawl hauls, August 2010.**

**Red circle represents 100 meter distance from nominal trawl station center point.**
**Blue lines represent trawl path while net is on the bottom.**
**Trawl endpoints are labeled by station name, haul number, start (S) and end (E).**

Orange County Sanitation District, California.

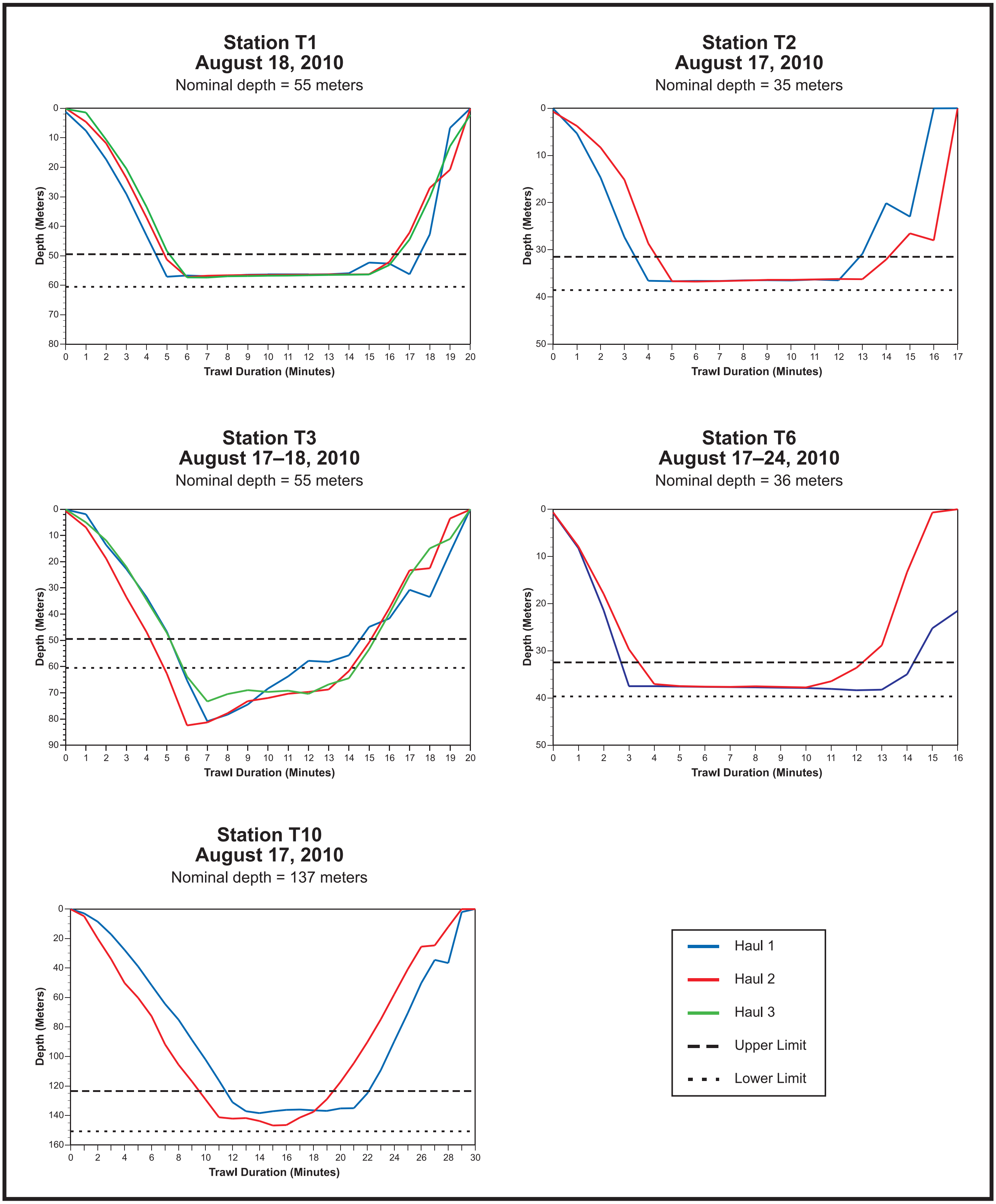


**Figure C-2. Quality assurance plots of trawl depth and trawl duration per haul for otter trawl stations, August 2010.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

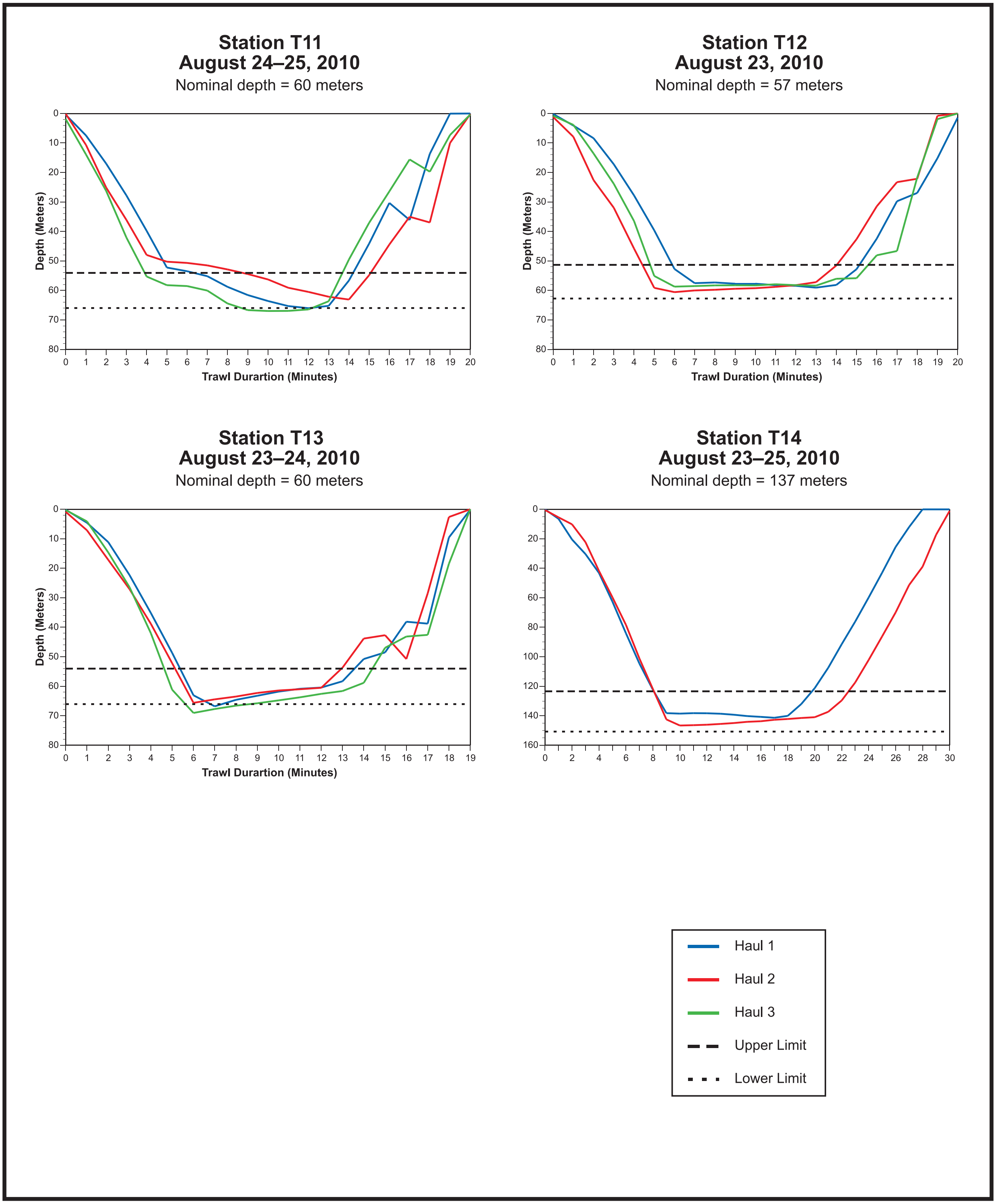


**Figure C-2 Continued.**

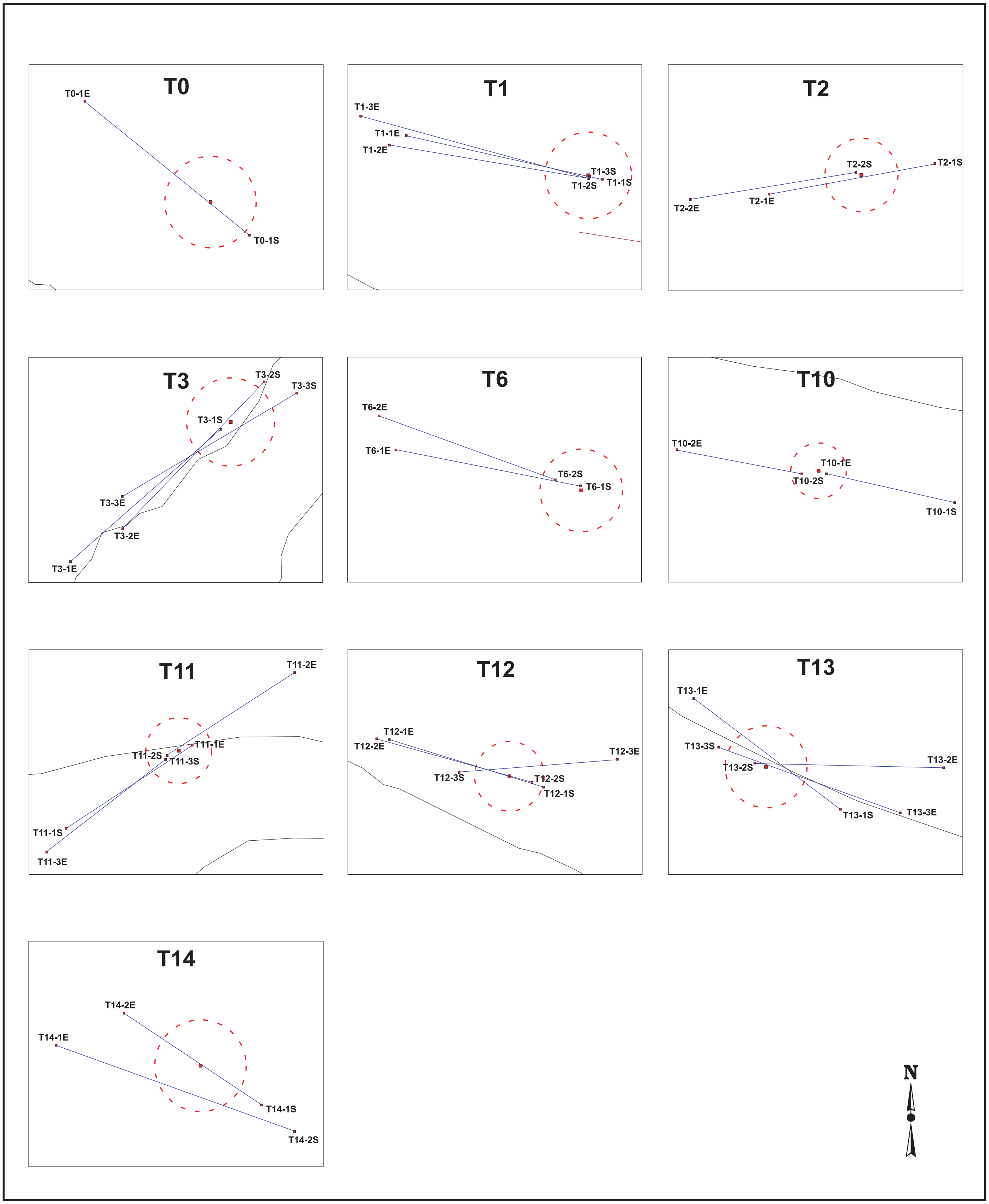


**Figure C-3. Quality assurance plots of distance to station for otter trawl hauls, January 2011.**

**Red circle represents 100 meter distance from nominal trawl station center point.**
**Blue lines represent trawl path while net is on the bottom.**
**Trawl endpoints are labeled by station name, haul number, start (S) and end (E).**

Orange County Sanitation District, California.

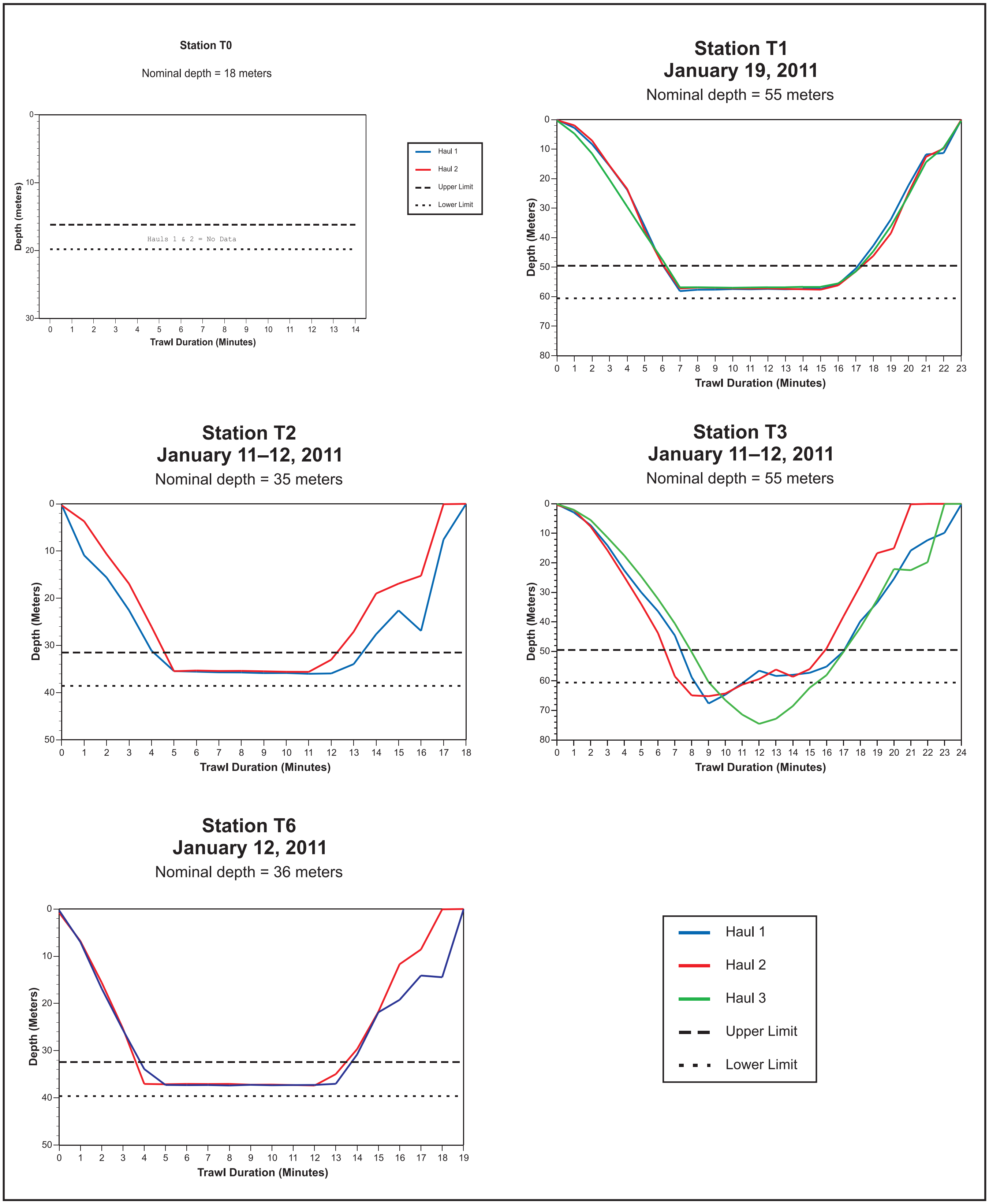


**Figure C-4.** **Quality assurance plots of trawl depth and trawl duration per haul for otter trawl stations, January 2011.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

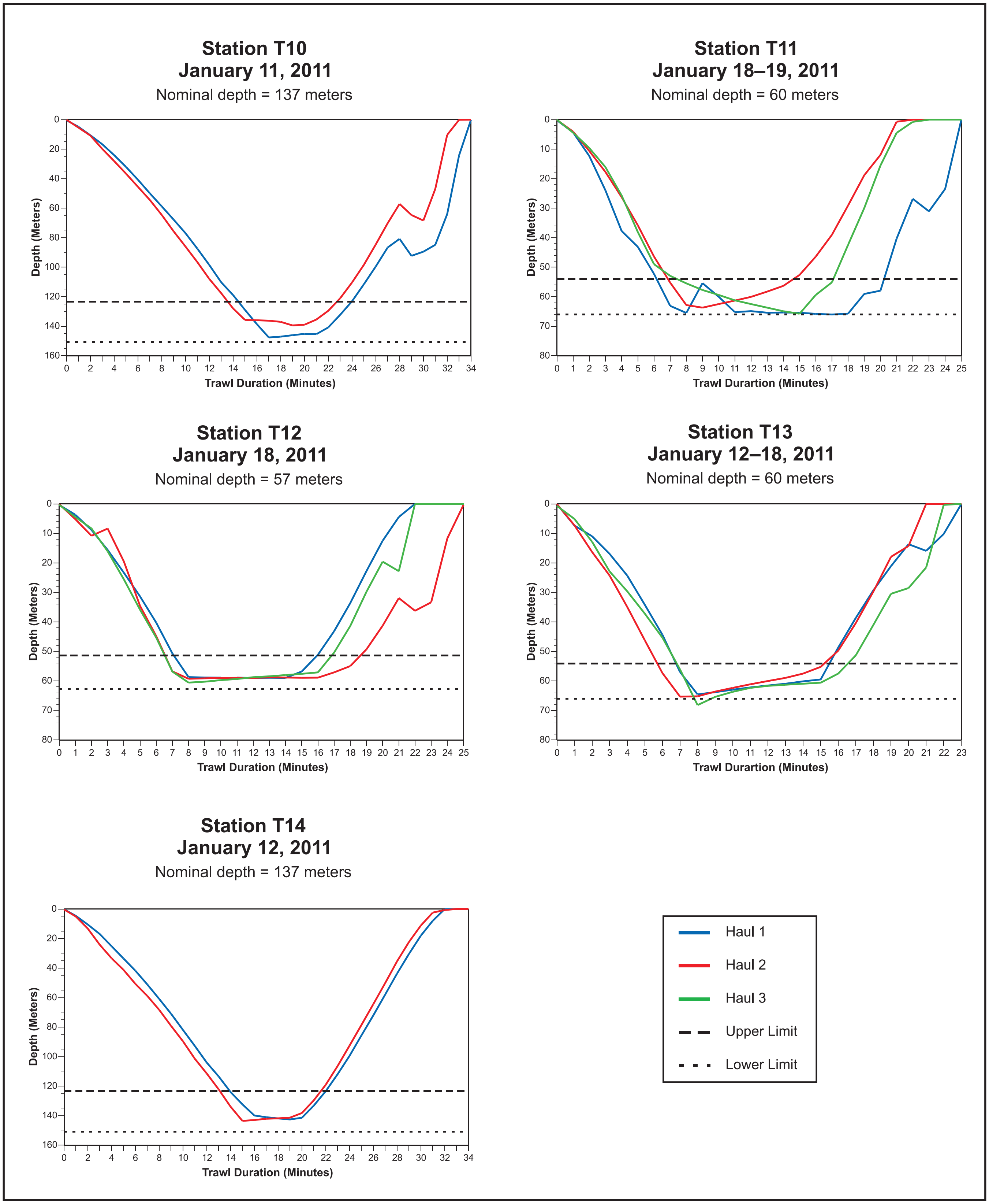


**Figure C-4 Continued.**

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