appendix C

QUALITY ASSURANCE/ QUALITY CONTROL

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) 2011-12 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 ocean monitoring staff collected 474, 615, 609, and 759 discrete ammonia samples, respectively, during the four quarters beginning July 1, 2011 and ending June 30, 2012. All samples were iced upon collection, preserved with 1:1 sulfuric acid upon receipt by the laboratory staff, and stored at 4 ± 2 °C until analysis according to laboratory 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 Methods 4500-NH_3 G. In the analysis, sodium phenolate and sodium hypochlorite react with ammonia to form indophenol blue in a concentration proportional to the ammonia concentration in the sample. The blue color is intensified with sodium nitroprusside and is measured at 660 nm.

QA/QC - Ammonia

A typical sample batch include a blank every 20% of samples, an external reference standard monthly, and a spike in seawater collected from a control site every 20% of samples . One spike and spike replicate is added to the batch every ten 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. 158 out of the 158 analyses met the QA/QC criteria for blanks. 147 out of 152 analyses met the QA/QC criteria for blank spikes. Those results out of control can be attributed to rounding or instrument malfunction.

All analyses met the QA/QC criteria for the external reference sample. Zero of 49 matrix spike recoveries, one of 49 matrix spike replicate recoveries, and one of precision measurements for the matrix spike and matrix spike replicate samples were out of control for first quarter samples. Zero of 55 matrix spike recoveries, Zero of 55 matrix spike replicate recoveries and one of 63 precision measurements for the matrix spike and matrix spike replicates were out of control for second quarter samples. Zero of 73 matrix spike replicate samples, two of 73 matrix spike replicate recoveries and one of 73 precision measurements for matrix spike and matrix spike replicates were out of control for third quarter samples. Zero of 93 matrix spike recoveries, one of 93 matrix spike replicate recoveries and two of 93 precision measurements for matrix spike and matrix spike replicates were out of control for fourth quarter samples. In all cases, it was determined that recovery and precision criteria were exceeded due to matrix effect 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-1. Ocean monitoring program sample collection requirements and percent completion, July 2011–June 2012.

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	114	181	16	100
		Ammonium	522	615	93	100
		Bacteria	260	410	45	100
	Sediment Chemistry	Grain size	49	69	8	100
		TOC	49	69	5	100
		Dissolved Sulfides	49	69	8	100
		Metals	49	69	7	100
		PCB/Pesticides	49	69	8	100
		PAH	49	69	8	100
		LAB	49	69	8	100
	Benthic Infauna	Infauna	49	69	NA	100
	Fish Community	Trawls *	23	16	NA	100
	Fish Tissue	Hornyhead turbot	20 X 2 = 40 **	14 X 2 **	4 X 2	70 ***
		English sole	20 X 2 = 40 **	20 X 2 **	4 X 2	100
2	Water Quality	CTD Drops	114	181	16	100
		Ammonium	522	615	93	100
		Bacteria	260	410	45	100
	Sediment Chemistry	Grain size	10	NS	NS	****
		TOC	10	NS	NS	****
		Dissolved Sulfides	10	NS	NS	****
		Metals	10	NS	NS	****
		PCB/Pesticides	10	NS	NS	****
		PAH	10	NS	NS	****
	Benthic Infauna	Infauna	30	NS	NS	****
3	Water Quality	CTD Drops	114	178	15	100
		Ammonium	522	629	93	100
		Bacteria	260	386	42	100
	Sediment Chemistry	Grain size	69	69	7	100
		TOC	10	69	3	100
		Dissolved Sulfides	10	69	7	100
		Metals	10	69	7	100
		PCB/Pesticides	10	69	8	100
		PAH	10	69	8	100
	Benthic Infauna	Infauna	30	69	8	100
	Fish Community	Trawls	23	16	NA	100
4	Water Quality	CTD Drops	114	182	16	100
		Ammonium	522	615	93	100
		Bacteria	260	410	45	100
	Sediment Chemistry	Grain size	10	NS	NS	****
		TOC	10	NS	NS	****
		Dissolved Sulfides	10	NS	NS	****
		Metals	10	NS	NS	****
		PCB/Pesticides	10	NS	NS	****
		PAH	10	NS	NS	****
	Benthic Infauna	Infauna	30	NS	NS	****

NA = not applicable, NS = not sampled

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

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

*** Hornyhead turbot samples were reduced due to insufficient numbers of that species in the catch.

**** Sample effort for sediment geochemistry and benthic infauna in Fall 2011 and Spring 2012 traded to increase sampling effort in Winter 2012.

Table C-2. Water Quality Ammonium QA/QC Summary, July 2011–June 2012.

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	NH3WQ110810-1	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	NH3WQ110811-1	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	
Summer	NH3WQ110823-1	Ammonium	Blank	8	8	<2X MDL	N/A
			Matrix Spike	11	11	80-120	
			Matrix Spike Dup	11	11	80-120	
			Matrix Spike Precision	11	11		< 11%
			Blank Spike	6	6	90-110	
Summer	NH3WQ110825-1	Ammonium	Blank	8	8	<2X MDL	N/A
			Matrix Spike	11	11	80-120	
			Matrix Spike Dup	11	11	80-120	
			Matrix Spike Precision	11	11		< 11%
			Blank Spike	6	6	90-110	
Summer	NH3WQ110829-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	6	6	80-120	
			Matrix Spike Dup	6	5	80-120	
			Matrix Spike Precision	6	5		< 11%
			Blank Spike	3	3	90-110	
Summer	NH3WQ110913-1	Ammonium	Blank	8	8	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	6	6	90-110	

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
Summer	NH3WQ110914-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Blank Spike	5	5	90-110	
			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	
Fall	NH3WQ111103-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	12	12		< 11%
			Blank Spike	6	5	90 - 110	
Fall	NH3WQ111104-1	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%
			Blank Spike	3	3	90 - 110	
Fall	NH3WQ11109-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	11	11	80-120	
			Matrix Spike Dup	11	11	80-120	
			Matrix Spike Precision	11	10		< 11%
			Blank Spike	6	6	90-110	
Fall	NH3WQ11114-1	Ammonium	Blank	6	6	<2X MDL	N/A
			Matrix Spike	12	12	80-120	
			Matrix Spike Dup	12	12	80-120	
			Matrix Spike Precision	12	12		< 11%
			Blank Spike	6	6	90-110	
Fall	NH3WQ11116-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	4	90-110	

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	NH3WQ120103-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	10	9	80-120	
			Matrix Spike Dup	10	9	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	5	4	90-110	
Fall	NH3WQ120104-1	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%
			Blank Spike	3	3	90-110	
Winter	NH3WQ120131-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	4	90-110	
Winter	NH3WQ120202-1	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%
			Blank Spike	3	3	90-110	
Winter	NH3WQ120215-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Winter	NH3WQ120216-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	10	10	80-120	
			Matrix Spike Dup	10	10	80-120	
			Matrix Spike Precision	10	10		< 11%
			Blank Spike	5	5	90-110	

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	NH3WQ120222-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Winter	NH3WQ120223-1	Ammonium	Blank	2	2	<2X MDL	N/A
			Blank Spike	3	3	90-110	
			Matrix Spike	3	3	80-120	
			Matrix Spike Dup	3	3	80-120	
			Matrix Spike Precision	3	3		< 11%
			ERA Check Standard	1	1	87 - 114	
Winter	NH3WQ110229-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Matrix Spike	7	7	80-120	
			Matrix Spike Dup	7	7	80-120	
			Matrix Spike Precision	7	7		< 11%
			Blank Spike	4	4	90-110	
Winter	NH3WQ120307-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Blank Spike	7	7	90-110	
			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	
Winter	NH3WQ120313-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Winter	NH3WQ120322-1	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%
			Blank Spike	3	3	90-110	

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	NH3WQ120501-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Spring	NH3WQ120502-1	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%
			Blank Spike	3	3	90-110	
Spring	NH3WQ120515-1	Ammonium	Blank	7	7	<2X MDL	N/A
			Matrix Spike	13	13	80-120	
			Matrix Spike Dup	13	13	80-120	
			Matrix Spike Precision	13	13		< 11%
			Blank Spike	7	6*	90-110	
Spring	NH3WQ120517-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	8**		< 11%
			Blank Spike	5	5	90-110	
Spring	NH3WQ120522-1	Ammonium	Blank	3	3	<2X MDL	N/A
			Matrix Spike	6	6	80-120	
			Matrix Spike Dup	6	5*	80-120	
			Matrix Spike Precision	6	5**		< 11%
			Blank Spike	3	3	90-110	
Spring	NH3WQ120523-1	Ammonium	Blank	4	4	<2X MDL	N/A
			Blank Spike	4	4	90-110	
			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
Spring	NH3WQ120620-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Matrix Spike	9	9	80-120	
			Matrix Spike Dup	9	9	80-120	
			Matrix Spike Precision	9	9		< 11%
			Blank Spike	5	5	90-110	
Spring	NH3WQ120621-1	Ammonium	Blank	5	5	<2X MDL	N/A
			Blank Spike	3	3	90-110	
			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 2011)

Introduction

OCSD's laboratory received 69 sediment samples from ocean monitoring staff during the months of July and August 2011. All samples were stored according to Laboratory Operating Procedures Manual (LOPM). All samples were analyzed for organochlorine pesticides, polychlorinated biphenyl congeners (PCBs), polycyclic aromatic hydrocarbons (PAHs), linear alkyl benzenes (LABs), trace metals, mercury, dissolved sulfides (DS), total organic carbon (TOC), and grain size.

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 November 2011. 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. Sample batches that were analyzed for PAHs included the following QC samples: one sand blank, one PAH reporting level spike, two standard reference materials (SRM), one PAH matrix spike set, 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) for PAHs are presented in Table C-3. Acceptance criteria for PAH SRMs are presented in Table C-4.

QC samples for LAB analyses included one sand blank, one LAB reporting level spike, two SRM, one LAB matrix spike set, and two sample extraction duplicates. In addition, one batch contained a field blank and one rinse sample. There were four batches extracted and analyzed for LABs. MDLs for LABs are presented in Table C-3.

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

The analytical methods used to process the organochlorine pesticides and PCB congeners samples are described in the LOPM. An ASE was used to extract the sediment samples during the months of August through December 2011. All sediment extracts were analyzed by GC/MS/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 18 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 two duplicate sample extractions. There were three

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.

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 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 84.9% and 130%. The RPDs between the sample and its duplicate analysis are from -9.5% to 15.7%. The RPDs for the spike and spike duplicate analysis are from -5.3% to 3.7%.

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.

All samples, with some noted exceptions, met the QA/QC criteria guidelines for accuracy and precision. One Pb and two Hg duplicate analysis RPDs 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 eight matrix spike dup 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 and matrix spike. The samples and their duplicate analyses had a RPD of less than 10%. The recoveries for matrix spike were within 80-120% range.

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. Nine 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. Eight samples and their duplicate analyses had a RPD ≤10%.

SECOND QUARTER (NOVEMBER 2011)

Routine OMP sediment samples were not collected or analyzed during the second quarter as a result of regulatory relief granted by the California Regional Water Quality Control Board due to a sediment mapping project occurring in June 2012.

OCSD's laboratory received 9 sediment samples from the ocean monitoring staff during the month of November 2011 as part of a special project. All samples were stored according to methods described in the LOPM. All samples were analyzed for trace metals, mercury, dissolved, grain size, and TOC.

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 87.4% and 120.0%. The RPDs of the sample and its duplicate were from -2.8.0% to 9.7%. The RPDs of the spike and spike duplicate were from -3.9% to 0.6%.

Sediment mercury QA/QC summary data are presented in Table C-12. 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-14 through C-16. One TOC sediment duplicate analysis had a precision greater than 10% due to matrix interference.

THIRD QUARTER (JANUARY 2012)

OCSD's laboratory received 69 sediment samples from the ocean monitoring staff during the month of January 2012. 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 during the months of February through June 2012. All sediment samples that were analyzed for PAHs were extracted during the months of January through June 2012. Any variances are noted in the batch summary. All sediment samples were extracted using an ASE. All sediment extracts 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 89.3% and 130.0%. The RPDs of the sample and its duplicate were from -13.0% to 13.7%. The RPDs of the spike and spike duplicate were from -3.7% to 8.6%.

Sediment mercury QA/QC summary data are presented in Table C-12. All samples met the QA criteria guidelines except for one Ag duplicate analysis RPD (-54.4%) was out of range due to low results and non-homogeneous sample matrices.

The analyses for TOC and grain size met the QA criteria guidelines specified in the QAPP. For dissolved sulfide analysis, two of 7 blank spike recoveries (79% and 76%) were slightly out of control and all other quality control parameters met QA criteria. MDL, SRM, and QA/QC summary data are presented in Tables C-13 through C-16.

FOURTH QUARTER (APRIL 2012)

Sediment samples were not collected during the fourth quarter as a result of regulatory relief granted by the California Regional Water Quality Control Board due to a sediment mapping project occurring in June 2012.

Table C-3. Method detection levels for PAH and LAB compounds in sediments, July 2011–June 2012.

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 2011–June 2012.

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 2011–June 2012.

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_Jul11_DX	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	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	11	10	NA	< 20% @ 3 x MDL of Sample Mean	91% Pass
		PAH Duplicate Analysis - #2	11	7			64% Fail
		LAB Duplicate Analysis - #1	8	4			50% Fail
		PAH Duplicate Analysis - #2	4	2			50% Fail
1	Sedcore_Jul11_DY	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	9	6	NA	< 20% @ 3 x MDL of Sample Mean	67% Fail
		PAH Duplicate Analysis - #2	6	4			67% Fail
		LAB Duplicate Analysis - #1	15	0			0% Fail
		PAH Duplicate Analysis - #2	8	4			50% Fail

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_Jul11_DZ	PAH SRM 1944	15	12	25% of the certified or published acceptance limits[1]	NA	80% Pass
		PAH SRM 1941b	15	12			80% Pass
		PAH Reporting Level Spike	25	25	60 -120		100% Pass
		LAB Reporting Level Spike	25	23			92% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	17	40 - 120	NA	68% Pass
		LAB Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	11	5	NA	< 20% @ 3 x MDL of Sample Mean	45% Fail
		PAH Duplicate Analysis - #2	9	1			11% Fail
		LAB Duplicate Analysis - #1	2	1			50% Fail
		LAB Duplicate Analysis - #2	0	0			100% Pass
1	Sedcore_Jul11_EA	PAH SRM 1944	15	12	25% of the certified or published acceptance limits[1]	NA	80% Pass
		PAH SRM 1941b	15	12			80% 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	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	5	4	NA	< 20% @ 3 x MDL of Sample Mean	80% Pass
		PAH Duplicate Analysis - #2	NA	NA			NA
		LAB Duplicate Analysis - #1	25	25			100% Pass
		LAB Duplicate Analysis - #2	NA	NA			NA

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_Jan12_EB	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	15	60 -120		60% *Fail
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	25	40 - 120	NA	100% Pass
		PAH Duplicate Analysis - #1	16	5	NA	< 20% @ 3 x MDL of Sample Mean	31% Fail
		PAH Duplicate Analysis - #2	18	9			50% Fail
3	Sedcore_Jan12_ED	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	15			100% 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	10	3	NA	< 20% @ 3 x MDL of Sample Mean	30% Pass
		PAH Duplicate Analysis - #2	13	0			0% Fail
3	Sedcore_Jan12_EE	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	15			100% 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	14	7	NA	< 20% @ 3 x MDL of Sample Mean	43% Pass
		PAH Duplicate Analysis - #2	19	0			0% Fail

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_Jan12_EF	PAH SRM 1944	15	13	25% of the certified or published acceptance limits[1]	NA	93% Pass
		PAH SRM 1941b	15	13			93% Pass
		PAH Reporting Level Spike	25	25	60 -120		100% Pass
		PAH Matrix Spike					
		Based on Mean of MS and MSD	25	22	40 - 120	NA	80% Pass
		PAH Duplicate Analysis - #1	21	11	NA	< 20% @ 3 x MDL of Sample Mean	52% Fail
		PAH Duplicate Analysis - #2	16	2			13% Fail

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

Higher RSD values occurred for the individual analytes that were associated with concentrations near the method detection limits. Corrective action for low % precision involved a review of sample preparation before extraction.

Matrix interferences from duplicate analyses and or matrix spike samples have caused some analytes to fail the established criteria for precision factors and % recoveries respectively. Visual inspection of the replicate samples and the spike samples did not reveal any obvious interference. A system check was performed prior to sample analysis and all the analytes of concern from calibration standards were within 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, Ion Trap July 2011–June 2012.

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 DSQII, July 2011–June 2012.

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		

DSQII = Dual Stage Quadrupole Gas Chromatograph/Mass Spectrometer
NA = Not analyzed.

Table C-8. Acceptance criteria for standard reference materials of pesticides/PCBs in sediments, July 2011–June 2012

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 2011–June 2012.

Orange County Sanitation District, California.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
1	ET	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	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	3	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	7	4		
		Pesticide	Reporting Level Spike	19	16	60 -120	NA
		Pesticide	Matrix Spike	19	18	40 - 120	NA
		Pesticide	Matrix Spike Dup	19	18	40 - 120	NA
		Pesticide	Matrix Spike Precision	19	18	NA	< 20%
		PCB	Duplicate 1	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 1	2	2	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	1	1	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA
1	EU	PCB	SRM 1944a	27	26	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	3	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	7	5		
		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	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	1	1	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Table C-8 Continues.

Table C-9 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
1	EV	PCB	SRM 1944a	27	26	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	6		
		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	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 1	11	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	11	1	NA	NA
		PCB	Duplicate 2	NA1	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	NA1	1	NA	
		PCBs and Pesticides	Duplicate 2 Sum	NA1	1	NA	NA
1	EW	PCB	SRM 1944a	27	25	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	25		
		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	1	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	1	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	2	2	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	1	0	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Table C-8 Continues.

Table C-9 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
3	EX	PCB	SRM 1944a	27	26	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	26		
		PCB	Reporting Level Spike	44	43	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	6		
		Pesticide	Reporting Level Spike	19	18	60 -120	NA
		Pesticide	Matrix Spike	19	19	40 - 120	NA
		Pesticide	Matrix Spike Dup	19	17	40 - 120	NA
		Pesticide	Matrix Spike Precision	19	19	NA	< 20%
		PCB	Duplicate 1	2	2	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	1	2	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	2	2	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA
3	EY	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	6		
		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	5	4	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	1	0	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	4	3	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	2	2	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA

Table C-8 Continues.

Table C-9 Continued.

Quarter	Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
3	EZ	PCB	SRM 1944a	27	26	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	27		
		PCB	Reporting Level Spike	44	43	60 -120	NA
		PCB	Matrix Spike	44	41	40 - 120	NA
		PCB	Matrix Spike Dup	44	41	40 - 120	NA
		PCB	Matrix Spike Precision	44	41	NA	< 20%
		Pesticide	SRM 1944a	4	4	25% of the certified ranges or published acceptance limits	NA
		Pesticide	SRM 1941b	7	6		
		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	18	NA	< 20%
		PCB	Duplicate 1	0	0	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	0	0	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticides	Duplicate 2	2	1	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	NA	NA
3	FA	PCB	SRM 1944a	27	26	25% of the certified ranges or published acceptance limits	NA
		PCB	SRM 1941b	27	24		
		PCB	Reporting Level Spike	44	43	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	41	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	18	NA	< 20%
		PCB	Duplicate 1	3	2	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 1	2	2	NA	
		PCBs and Pesticides	Duplicate 1 Sum	1	1	NA	NA
		PCB	Duplicate 2	2	1	NA	< 20% @ 3 x MDL of Sample Mean.
		Pesticide	Duplicate 2	2	2	NA	
		PCBs and Pesticides	Duplicate 2 Sum	1	1	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

Table C-10. Method detection limits for trace metals in sediments, July 2011–June 2012.

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 2011–June 2012

Orange County Sanitation District, California.

Parameter	True Value (mg/kg)	Certified Acceptance Criteria (mg/kg)	
		Min.	Min.
Environmental Resource Associates D069-540 Priority PollutnT™ /CLP Inorganic Soils – Microwave Digestion Environmental Resource Associates			
Aluminum	9780	4340	15200
Arsenic	109	76.2	143
Beryllium	92.1	68.6	116
Cadmium	110	80.6	139
Chromium	93.4	64.7	122
Copper	74.7	55.0	94.5
Iron	13100	4250	21900
Lead	152	112	192
Mercury	16.3	8.37	24.2
Nickel	109	78.8	138
Selenium	207	142	272
Silver	51.9	34.5	69.2
Zinc	299	214	383
Resource Technology Corporation CRM016-050 Natural Matrix Certified Reference Material Lot BE016			
Mercury	0.11	0.02	0.21

Table C-12. Sediment metals QA/QC summary, July 2011–June 2012.

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	HMSED110831-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	30	30	<3X MDL	N/A
			Blank Spike	10	10	85-115	N/A
			Matrix Spike	10	10	70-130	
			Matrix Spike Dup	10	10	70-130	
			Matrix Spike Precision	10	10		< 25%
			Duplicate Analysis	10	9 *	NA	@ ≥ 10 X MDL < 30%
Summer	HMSED111026-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	50	50	<3X MDL	N/A
			Blank Spike	10	10	85-115	N/A
			Matrix Spike	20	20	70-130	
			Matrix Spike Dup	20	20	70-130	
			Matrix Spike Precision	20	20		< 25%
			Duplicate Analysis	20	20	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Summer	HMSED111115-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	50	50	<3X MDL	N/A
			Blank Spike	20	20	85-115	N/A
			Matrix Spike	40	40	70-130	
			Matrix Spike Dup	40	40	70-130	
			Matrix Spike Precision	40	40		< 25%
			Duplicate Analysis	40	40	NA	@ ≥ 10 X MDL < 30%
Summer	ALFESED110902-1	Aluminum, Iron	Blank	6	6	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
Summer	ALFESED111027-1	Aluminum, Iron	Blank	10	10	<3X MDL	N/A
			Duplicate Analysis	4	4	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater.	
Summer	ALFESED111116-1	Aluminum, Iron	Blank	10	10	<3X MDL	N/A
			Duplicate Analysis	8	8	NA	@ ≥ 10 X MDL < 30%

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	HGSED110830-1	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.	
Summer	HGSED111102-1	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	2	70-130	
			Matrix Spike Precision	2	2		< 25%
			Duplicate Analysis	2	1 ***	NA	@ ≥ 10 X MDL < 30%
Summer/ Fall	HGSED111109-1	Mercury	Blank	1	1	<2X MDL	N/A
			Blank Spike	2	2	90-110	N/A
			Matrix Spike	4	4	70-130	
			Matrix Spike Dup	4	4	70-130	
			Matrix Spike Precision	4	4		< 25%
			Duplicate Analysis	4	2 ****	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Fall	HMSED120126-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	10	10	<3X MDL	N/A
			Blank Spike	10	10	85-115	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 < 30%
			CRM Analysis	10	10	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
Fall	ALFESED120126-1	Aluminum, Iron	Blank	2	2	<3X MDL	N/A
			Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	2	2	80-120% or certified value, whichever is greater	
Fall	HGSED120203-1	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.	
Winter	HMSED120307-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	30	30	<3X MDL	N/A
			Blank Spike	10	10	85-115	N/A
			Matrix Spike	30	30	70-130	
			Matrix Spike Dup	30	30	70-130	
			Matrix Spike Precision	30	30		< 20%
			Duplicate Analysis	30	29 *****	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	10	10	80-120% or certified value, whichever is greater.	
Winter	HMSED120322-1	Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Zinc	Blank	30	30	<3X MDL	N/A
			Blank Spike	20	20	85-115	N/A
			Matrix Spike	30	30	70-130	
			Matrix Spike Dup	30	30	70-130	
			Matrix Spike Precision	30	30		< 20%
			Duplicate Analysis	30	30	NA	@ ≥ 10 X MDL < 30%
Winter	ALFESED120307-1	Aluminum, Iron	Blank	6	6	<3X MDL	N/A
			Duplicate Analysis	6	6	NA	@ ≥ 10 X MDL < 30%
			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	ALFESED120326-1	Aluminum, Iron	Blank	6	6	<3X MDL	N/A
			Duplicate Analysis	8	8	NA	@ ≥ 10 X MDL < 30%
Winter	HGSED120309-1	Mercury	Blank	2	2	<2X MDL	N/A
			Blank Spike	2	2	90-110	N/A
			Matrix Spike	6	6	70-130	
			Matrix Spike Dup	6	6	70-130	
			Matrix Spike Precision	6	6		< 25%
			Duplicate Analysis	6	6	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	
Winter	HGSED120330-1	Mercury	Blank	2	2	<2X MDL	N/A
			Blank Spike	2	2	90-110	N/A
			Matrix Spike	8	8	70-130	
			Matrix Spike Dup	8	8	70-130	
			Matrix Spike Precision	8	8		< 25%
			Duplicate Analysis	6	6	NA	@ ≥ 10 X MDL < 30%
			CRM Analysis	1	1	80-120% or certified value, whichever is greater.	

NA = Not applicable.

* Oone RPD out of range due to non-homogeneous sample for Pb.

** One matrix spike out of range due to matrix interference.

*** One RPD out of range due to nonhomogeneous samples.

**** Two duplicate analysis RPDs were out of range due to low results and non-homogeneous samples.

***** One Ag RPD out of range due to non-homogeneous sample matrices.

Table C-13. Method Detection Limits for Dissolved Sulfides, Total Organic Carbon, and Grain Size in Sediments, July 2011–June 2012.

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 2011–June 2012.

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	SULFIDE110809-1 SULFIDE110810-1 SULFIDE110816-1 SULFIDE110817-1 SULFIDE110823-1 SULFIDE110905-1	Dissolved Sulfides	Method Blank	8	8	<2X MDL	N/A
			Blank Spike	8	8	80 -120	N/A
			Matrix Spike	8	8	70 - 130	
			Matrix Spike Dup	8	7*	70 - 130	
			Matrix Spike Precision	8	8		<30%
Fall	SULFIDE111130-1	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 & Spring	SULFIDE120111-1 SULFIDE120125-1 SULFIDE120127-1 SULFIDE120207-1 SULFIDE120208-1 SULFIDE120215-1 SULFIDE120220-1	Dissolved Sulfides	Method Blank	7	7	<2X MDL	N/A
			Blank Spike	7	5**	80 -120	N/A
			Matrix Spike	7	7	70 - 130	
			Matrix Spike Dup	7	7	70 - 130	
			Matrix Spike Precision	7	7		<30%

* Matrix spike duplicate recovery (68%) was out of control due to matrix interferences.
** Two blank spike recoveries (79% & 76%) were out of target limits.

Table C-15. Sediment Total Organic Carbon QA/QC Summary, July 2011–June 2012.

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-110804-1	Total Organic Carbon	Duplicate and Matrix Spike	3	3	80-120[1]	10%[1]
Fall	TOC-111222-1	Total Organic Carbon	Duplicate and Matrix Spike	1	1*	80-120[1]	10%[1]
Winter & Spring	TOC-120131-1	Total Organic Carbon	Duplicate and Matrix Spike	3	3	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 (12.9%) 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	PSIZ-111031-1-1	Grain Size	Reference Standard	9	9	NA	Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt
			Duplicate	8	8		≤10%
Fall	PSIZ-120131-1	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%
Winter & Spring	PSIZ-120402-1	Grain Size	Reference Standard	8	8	NA	Mean ± 3 σ of the reference standard for median phi, skewness, dispersion, % gravel, % sand, % clay, and % silt
			Duplicate	11	11		≤10%

FISH TISSUE CHEMISTRY NARRATIVE

FIRST QUARTER (AUGUST 2011)

Introduction

OCSD's Environmental Laboratory and Ocean Monitoring (ELOM) laboratory received 34 individual fish samples from ELOM's ocean monitoring staff during the month of August 2011. The individual samples were stored, dissected, and homogenized according to methods described in the OCSD ELOM 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 metals and organic chemistry sections of the analytical chemistry laboratory for analyses.

The organic chemistry section extracted 34 fish muscle samples, and 34 fish liver 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 choice was 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 ELOM 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 Table C-17 and C-18. 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 batch summary.

Analytical Methods – Lipid Content

Percent lipid content was determined for each sample of fish using methods described in the ELOM LOPM. Lipids were extracted by dichloromethane from approximately 1 to 2 g of sample and concentrated to 2 mL. A 100 µL 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.

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 ELOM 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 ten 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.

Table C-17. Method detection levels for pesticides and PCB congeners in fish tissue using Ion Trap, July 2011–June 2012.

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 DSQII, July 2011– June 2012

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 2011–June 2012.

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 2011–June 2012

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 2011–June 2012.

Orange County Sanitation District, California.

Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
Sample Set – ME (17 Muscle Tissue Samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	39		
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	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		
Sample Set – MF (17 Muscle Tissue Samples)				
NRCC CARP-2	10	8	according to published acceptance criteria	NA
SRM 1946	40	35		
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	18	70-130	NA
Pesticide Matrix Spike Dup	19	19		
Precision	19	17	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	2	1	NA	
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 – MG (17 liver samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	38		
PCB Reporting Level Spike	44	43	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	19	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	3	2	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	2	0		
Duplicate 1 Sum of Pesticides and PCBs	1	0		
Duplicate 2 PCB	4	0		
Duplicate 2 Pesticides	2	0		
Duplicate 2 Sum of Pesticides and PCBs	1	1		
Sample Set – LE (17 liver samples)				
NRCC CARP-2	10	10	according to published acceptance criteria	NA
SRM 1946	40	38		
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	19	75 -125	NA
Pesticide Matrix Spike	19	18	70-130	NA
Pesticide Matrix Spike Dup	19	18		
Precision	19	18	NA	< 25%
PCB/Pesticide Duplicate Analysis				
Duplicate 1 PCB	7	5	NA	< 25% @ 3 x MDL of Sample Mean.
Duplicate 1 Pesticides	3	2		
Duplicate 1 Sum of Pesticides and PCBs	1	1		
Duplicate 2 PCBs	12	9		
Duplicate 2 Pesticides	2	2		
Duplicate 2 Sum of Pesticides and PCBs	1	1		

Comments/Notes:

CARP-2: National Research Council Canada

SRM 1946: National Institute of Standards & Technology, Lake Superior Fish Tissue

N/A=not applicable

Table C-22. Fish tissue percent lipid QA/QC summary, July 2011–June 2012.

Orange County Sanitation District, California.

Sample Set	Tissue Type	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Precision % RPD
ME	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MF	Muscle	Percent Lipid	Duplicate Samples	2	2	<25%
MG	Liver	Percent Lipid	Duplicate Samples	2	2	<25%
LE	Liver	Percent Lipid	Duplicate Samples	2	2	<25%

Table C-23. Method detection levels for mercury in fish tissue, July 2011–June 2012.

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 2011–June 2012.

Orange County Sanitation District, California.

Mercury	True Value (ng/g)	Acceptance Range (ng/g)	
		Minimum	Maximum
DORM-3	0.382	0.322	0.442

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

Table C-25. Fish tissue mercury QA/QC summary, July 2011–June 2012.

Orange County Sanitation District, California.

Sample Set	Parameter	Description	Number of Compounds Tested	Number of Compounds Passed	Target Accuracy % Recovery	Target Precision % RPD
HGFISH111227-1	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	70-130	
		Matrix Spike Precision	2	2		< 25%
		Duplicate Analysis	2	2	NA	@ ≥ 10 X MDL < 30%
HGFISH111228-1	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	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.	
HGFISH120109-1	Mercury	Blank	2	2	<2X MDL	NA
		Blank Spike	2	2	90-110	NA
		Matrix Spike	3	3	70-130	
		Matrix Spike Dup	3	3	70-130	
		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.	

BENTHIC INFAUNA NARRATIVE

SORTING AND TAXONOMY QA/QC

The OCSD has completed the insourcing the infaunal taxonomy program element. However, because of the District's staffing and permitting issues, a number of samples were sent out for identification by a contractor (Weston Solutions, Inc.). See Table A-9 for details. New metrics developed last year were used to evaluate the results for both in-house and the contracting taxonomists. These methods differ from the 2010-11 QAPP, which will be modified next year to reflect the new protocols. 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 two surveys: the summer (July 2011, Cruise # OC-2011-024) and winter (January 2012, Cruise # OC-2012-001) surveys. Taxonomic re-identifications were conducted for the winter surveys (January 2012).

Sorting QA/QC Procedures

The infaunal community was monitored by collecting marine sediments during July 2011 and January 2012 at 9 semi-annual stations, 39 annual stations and 21 additional new stations that ranged in depth from 40 to 303 m located on the San Pedro Shelf (Table A-1, Figure 5-1). Single samples were collected at all stations in each of the two surveys. The sorting procedure involved removal by Weston Solutions, Inc. (Weston) personnel of all biological organisms and fragments from each benthic sample. Organisms were further sorted by taxa, transferred to separate vials, and total counts per station 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. QA sorting procedures were performed on one replicate infaunal sample collected from each of three randomly selected semi-annual stations from the summer survey and an additional four samples (at least one from each of the four major depth contour intervals) from the summer annual survey. 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.

2011-12 Sorting QA/QC Status

Sorting results for all 2011-12 QA samples were well within the 5% QC limit (99.5 % accuracy). The average was 0.3 % (n= 7).

Taxonomic Identification QA/QC Procedures

Benthic infauna samples undergo comparative taxonomic analysis by two independent groups of taxonomists. The selected infauna samples were first identified by either OCSD's or Weston's taxonomists (Table A-9). The re-identifications were conducted by OCSD taxonomists by swapping assigned samples chosen for re-analysis. The resulting two data sets were then compared and a discrepancy report was generated. All discrepancies were then reviewed and resolved by OCSD taxonomists. Following their review, any necessary corrections to taxon names or abundances were made to the database. The results, i.e., errors, were tallied by station (Table C-26) and percent errors were calculated (Table C-27) 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 a station as a whole, 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 (i.e., QC) but is considered too sensitive a measure for samples with low diversities, which are commonly found in samples of Echinodermata and Minor Phyla.

2011-12 Taxonomic QA/QC Results

The QA/QC results are presented in Table C-27. All stations met their QC objectives for percent error of number of identified individuals (Eq. 4) with a mean of 2.2%. All samples were under the actionable threshold for all QA measures.

In addition to the re-identifications, a synoptic data review was conducted upon completion of all data entry and QA. This consisted of a review of the infauna data for the survey year aggregated by depth and taxonomist (both in-house and contract) by OCSD's taxonomists. From this, we can identify anomalous species reports, e.g., species reported outside known depth range, nomenclatural differences of name application, possible data entry errors, etc. The resulting major nomenclatural changes made to the final data set are cataloged in Table C-28.

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
5	1	No. of Individuals	477	10	474
		No. of Taxa	132	9	131
39	1	No. of Individuals	345	7	347
		No. of Taxa	72	5	77
59	1	No. of Individuals	546	6	549
		No. of Taxa	105	6	106
SM_35	1	No. of Individuals	265	10	268
		No. of Taxa	76	8	82

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

Orange County Sanitation District, California.

Error Type	Station (rep)				
	5(1)	39(1)	59(1)	SM_35(1)	Mean
1. %Error $_{\text{\# Taxa}}$	0.8	6.5	0.9	7.3	3.9
2. %Error $_{\text{\# Individuals}}$	0.6	0.6	0.5	1.1	0.7
3. %Error $_{\text{\# ID Taxa}}$	6.9	6.5	5.7	9.8	7.2
4. %Error $_{\text{\# ID Individuals}}$	2.1	2.0	1.1	3.7	2.2

Table C-28. Infaunal name changes resulting from synoptic data review.

Orange County Sanitation District, California.

Original ID	Final ID	Reason for change
Aphelochaeta petersenae Blake 1996	*Aphelochatea* sp LA1 Brantley, 1999	Differences in name application
Anopla sp OC1	Palaeonemertea	Provisional species not recognized universally
Protomedeia sp	*Protomedeia articulata* Cmplx	OCSD ID convention
Tetrastemma candidum (O. F. Müller 1774)	*Tetrastemma* sp	OCSD ID convention
Edwardsia juliae Daly & Ljubenkov 2008	*Edwardsia olguini* Daly & Ljubenkov 2008	Discrepancy in methodology for morphometric diagnosis

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-29 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.

Summer 2011

For summer 2011, trawl distances ranged from 251 to 497 m with the average trawl length being 446.1 m and the average trawl speed being 1.7 kts for all trawls combined (Table C-30). 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-31) 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.

Winter 2012

For winter 2012, all trawl lengths ranged from 417 to 563 m with the average trawl length being 450.6 m and the average trawl speed being 1.7 kts for all trawls combined (Table C-32). 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-33) and distance traveled (Figure C-4). Station T3 was again the only anomalous station.

Table C-29. 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-30. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, August 2011.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
August 25, 2011	T0	1	449.0	-0.2	543	1.6
August 24, 2011	T1	2	454.8	1.1	516	1.7
August 17, 2011	T2	1	457.1	1.6	455	2.0
August 17, 2011	T3	1	453.6	0.8	463	1.9
August 17, 2011	T6	1	455.5	1.2	471	1.9
August 18, 2011	T10	1	463.1	2.9	480	1.9
August 24, 2011	T11	2	453.8	0.8	551	1.6
August 18, 2011	T12	1	456.2	1.4	448	2.0
August 18, 2011	T13	1	463.2	2.9	477	1.9
August 17, 2011	T14	1	251.2	-44.2	295	1.7
August 18, 2011	T17	1	462.6	2.8	465	1.9
August 17, 2011	T18	1	453.3	0.7	463	1.9
August 24, 2011	T19	1	461.5	2.6	657	**1.4**
August 25, 2011	T20	1	454.9	1.1	685	**1.3**
August 25, 2011	T21	1	451.5	0.3	585	1.5
August 18, 2011	T22	1	496.5	10.3	536	1.8
Mean value			446.1	-0.9	505.6	1.7

* Target Distance – 450 meters

** Target Speed – 1.5 – 2.0 knot

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.

Table C-31. Ten percent trawl depth QA, August 2011.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
August 25, 2011	T0	1	18	16.2–19.8	SBE DATA	19.5	Y
					SOD DATA	18.0	Y
August 24, 2011	T1	2	55	49.5 - 60.5	SBE DATA	56.8	Y
					SOD DATA	55.0	Y
August 17, 2011	T2	1	35	31.5 - 38.5	SBE DATA	35.9	Y
					SOD DATA	34.5	Y
August 17, 2011	T3	1	55	49.5 - 60.5	SBE DATA	63.5	N
					SOD DATA	57.5	Y
August 17, 2011	T6	1	36	32.4 - 39.6	SBE DATA	37.8	Y
					SOD DATA	36.5	Y
August 18, 2011	T10	1	137	123.3 - 150.7	SBE DATA	139.2	Y
					SOD DATA	131.0	Y
August 24, 2011	T11	2	60	54.0 - 66.0	SBE DATA	62.7	Y
					SOD DATA	61.5	Y
August 18, 2011	T12	1	57	51.3 - 62.7	SBE DATA	57.7	Y
					SOD DATA	54.5	Y
August 18, 2011	T13	1	60	54.0 - 66.0	SBE DATA	63.5	Y
					SOD DATA	61.0	Y
August 17, 2011	T14	1	137	123.3 - 150.7	SBE DATA	140.2	Y
					SOD DATA	137.0	Y
August 18, 2011	T17	1	60	54.0 - 66.0	SBE DATA	63.2	Y
					SOD DATA	61.5	Y
August 17, 2011	T18	1	36	32.4 - 39.6	SBE DATA	40.0	N
					SOD DATA	38.5	Y
August 24, 2011	T19	1	137	123.3 - 150.7	SBE DATA	148.2	Y
					SOD DATA	149.0	Y
August 25, 2011	T20	1	240	216.0 - 264.0	SBE DATA	245.9	Y
					SOD DATA	224.5	Y
August 25, 2011	T21	1	90	81.0 - 99.0	SBE DATA	92.9	Y
					SOD DATA	89.5	Y
August 18, 2011	T22	1	60	54.0 - 66.0	SBE DATA	62.6	Y
					SOD DATA	60.5	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-32. Trawl sample dates, track distances, percent difference from target track distance, elapsed time, and vessel speed, February 2012.

Orange County Sanitation District, California.

Date	Station	Haul	Distance Trawled (meters)	Percent Difference from Target Distance *	Elapsed Time (seconds)	Trawl speed (knots)**
February 29, 2012	T0	1	455.5	1.2	526	1.7
February 21, 2012	T1	1	457.5	1.7	523	1.7
February 28, 2012	T2	1	416.7	-7.4	470	1.7
February 22, 2012	T3	1	457.2	1.6	449	2.0
February 22, 2012	T6	1	453.2	0.7	478	1.8
February 29, 2012	T10	1	455.1	1.1	514	1.7
February 21, 2012	T11	1	455.1	1.1	575	1.5
February 28, 2012	T12	1	456.7	1.5	478	1.9
February 22, 2012	T13	2	463.1	2.9	503	1.8
February 29, 2012	T14	1	456.9	1.5	494	1.8
February 28, 2012	T17	1	456.3	1.4	435	2.0
February 21, 2012	T18	1	424.5	-5.7	569	1.5
February 21, 2012	T19	1	450.7	0.2	590	1.5
February 22, 2012	T20	1	444.3	-1.3	648	**1.3**
February 29, 2012	T21	1	450.7	0.2	568	1.5
February 28, 2012	T22	1	456.5	1.5	429	**2.1**
Mean value			450.6	0.1	516	1.7

* Target Distance – 450 meters

** Target Speed – 1.5 – 2.0 knots

Hauls with speeds less than 1.5 knots or greater than 2 knots are denoted in bold.

Table C-33. Ten percent trawl depth QA, February 2012.

Orange County Sanitation District, California.

Date	Station	Haul	Nominal Depth (m)	QA Range (m)	Data Source	Average Bottom Depth (m)	10% Y/N
February 29, 2012	T0	1	18	16.2–19.8	SBE DATA	19.2	Y
					SOD DATA	18.0	Y
February 21, 2012	T1	2	55	49.5 - 60.5	SBE DATA	57.6	Y
					SOD DATA	55.5	Y
February 28, 2012	T2	1	35	31.5 - 38.5	SBE DATA	35.5	Y
					SOD DATA	34.5	Y
February 22, 2012	T3	1	55	49.5 - 60.5	SBE DATA	58.5	Y
					SOD DATA	56.5	Y
February 22, 2012	T6	1	36	32.4 - 39.6	SBE DATA	37.0	Y
					SOD DATA	35.5	Y
February 29, 2012	T10	1	137	123.3 - 150.7	SBE DATA	140.3	Y
					SOD DATA	141.0	Y
February 21, 2012	T11	2	60	54.0 - 66.0	SBE DATA	56.8	Y
					SOD DATA	58.0	Y
February 28, 2012	T12	1	57	51.3 - 62.7	SBE DATA	57.6	Y
					SOD DATA	56.0	Y
February 22, 2012	T13	1	60	54.0 - 66.0	SBE DATA	61.1	Y
					SOD DATA	58.5	Y
February 29, 2012	T14	1	137	123.3 - 150.7	SBE DATA	140.6	Y
					SOD DATA	141.0	Y
February 28, 2012	T17	1	60	54.0 - 66.0	SBE DATA	64.7	Y
					SOD DATA	64.5	Y
February 21, 2012	T18	1	36	32.4 - 39.6	SBE DATA	38.8	Y
					SOD DATA	37.0	Y
February 21, 2012	T19	1	137	123.3 - 150.7	SBE DATA	152.9	N
					SOD DATA	160.0	N
February 22, 2012	T20	1	240	216.0 - 264.0	SBE DATA	231.1	Y
					SOD DATA	227.5	Y
February 29, 2012	T21	1	90	81.0 - 99.0	SBE DATA	89.2	Y
					SOD DATA	84.0	Y
February 28, 2012	T22	1	60	54.0 - 66.0	SBE DATA	61.5	Y
					SOD DATA	59.5	Y

Notes:

Station T19 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

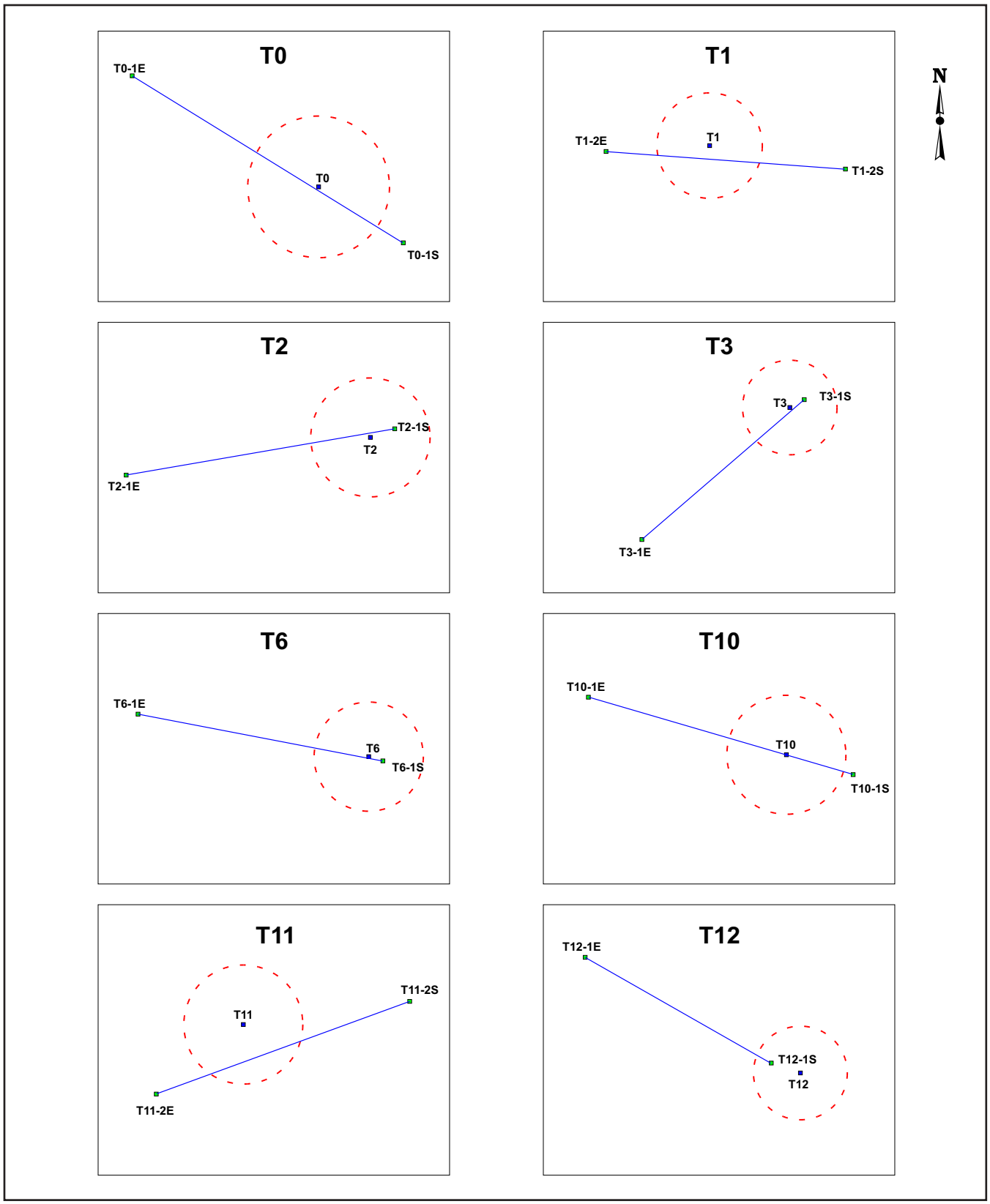

Figure C-1. Quality assurance plots of distance to station for otter trawl hauls, August 2011.

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.

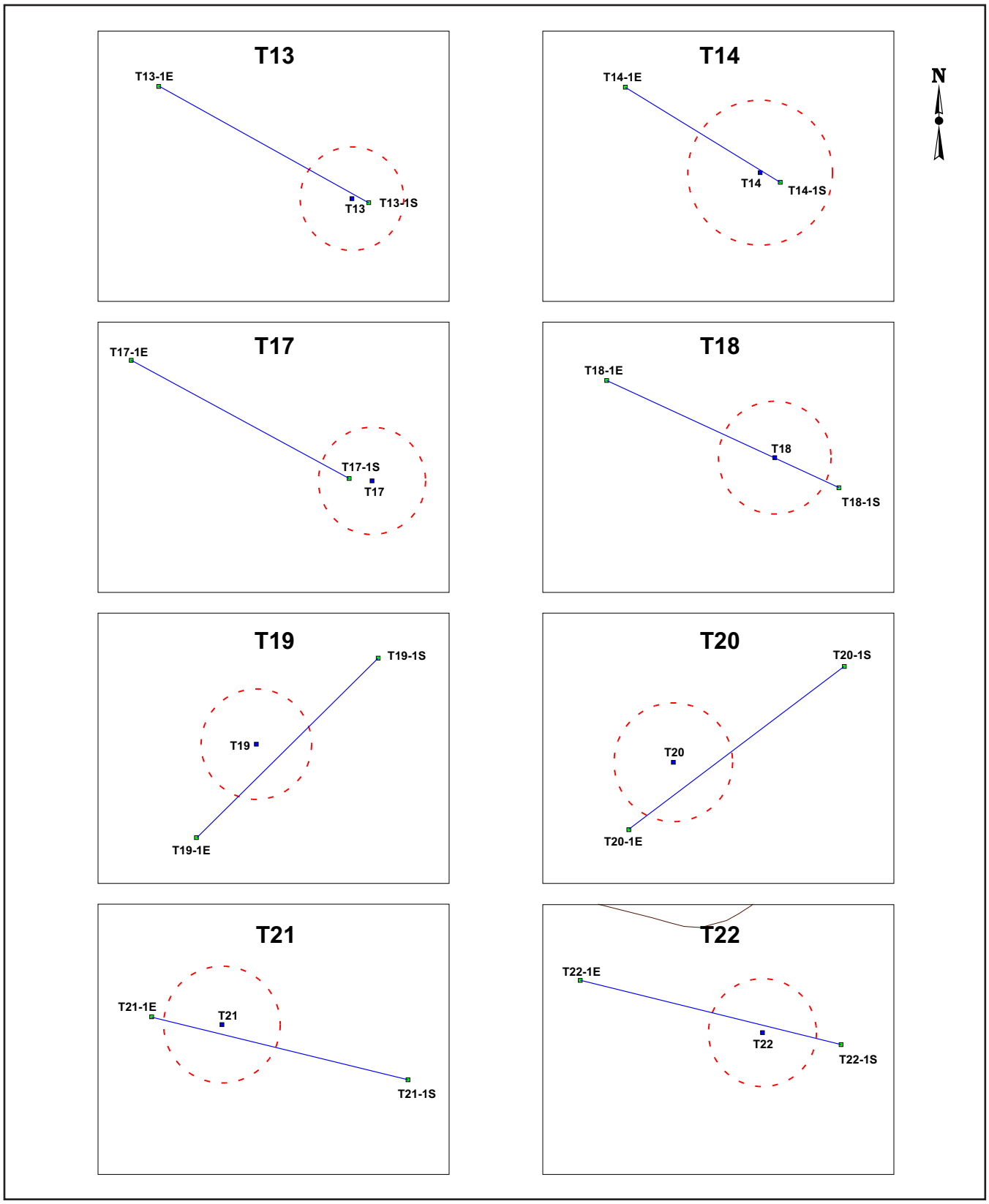

Figure C-1 continued.

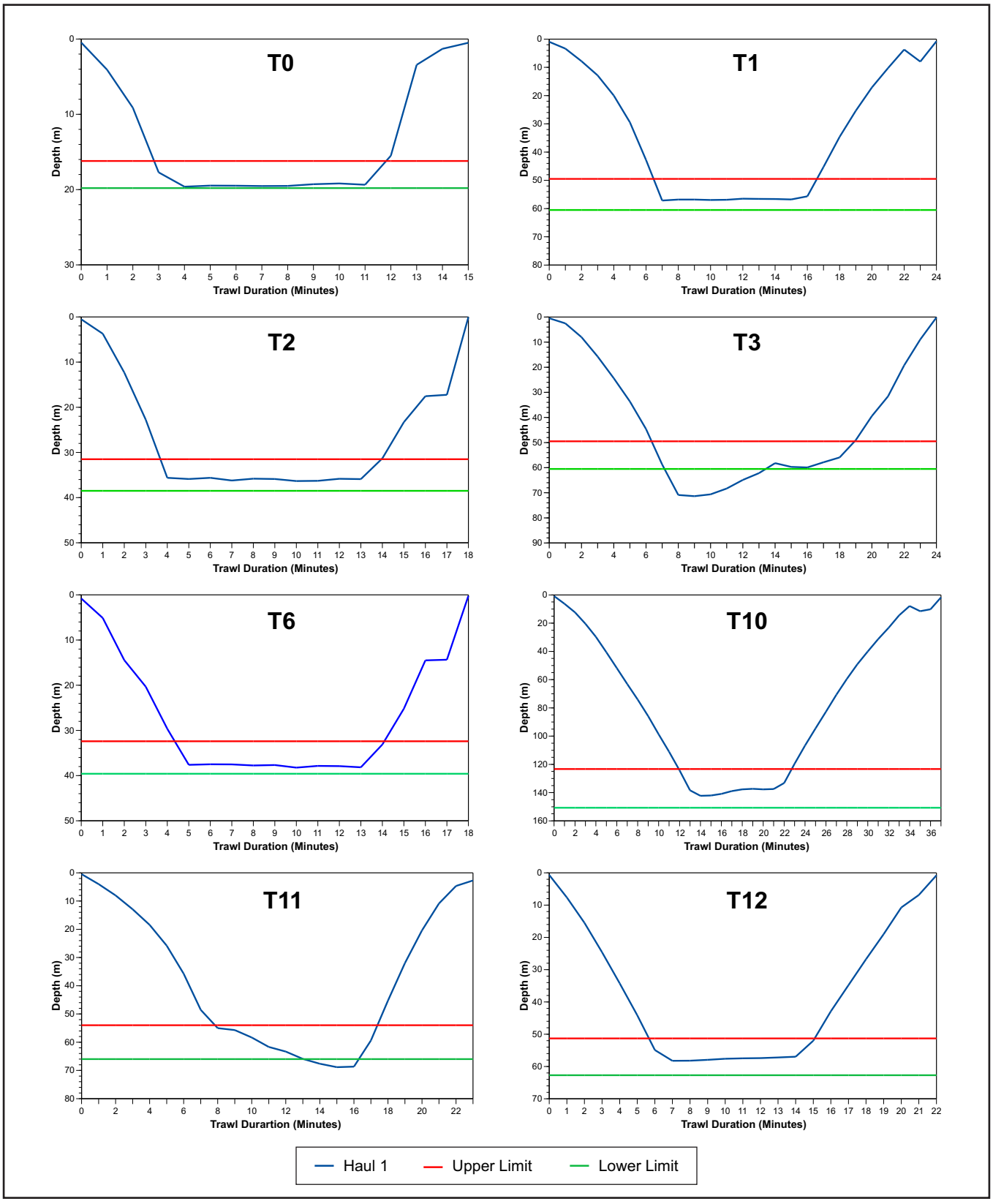

Figure C-2. **Quality assurance plots of trawl depth and trawl duration per haul for otter trawl stations, August 2011.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

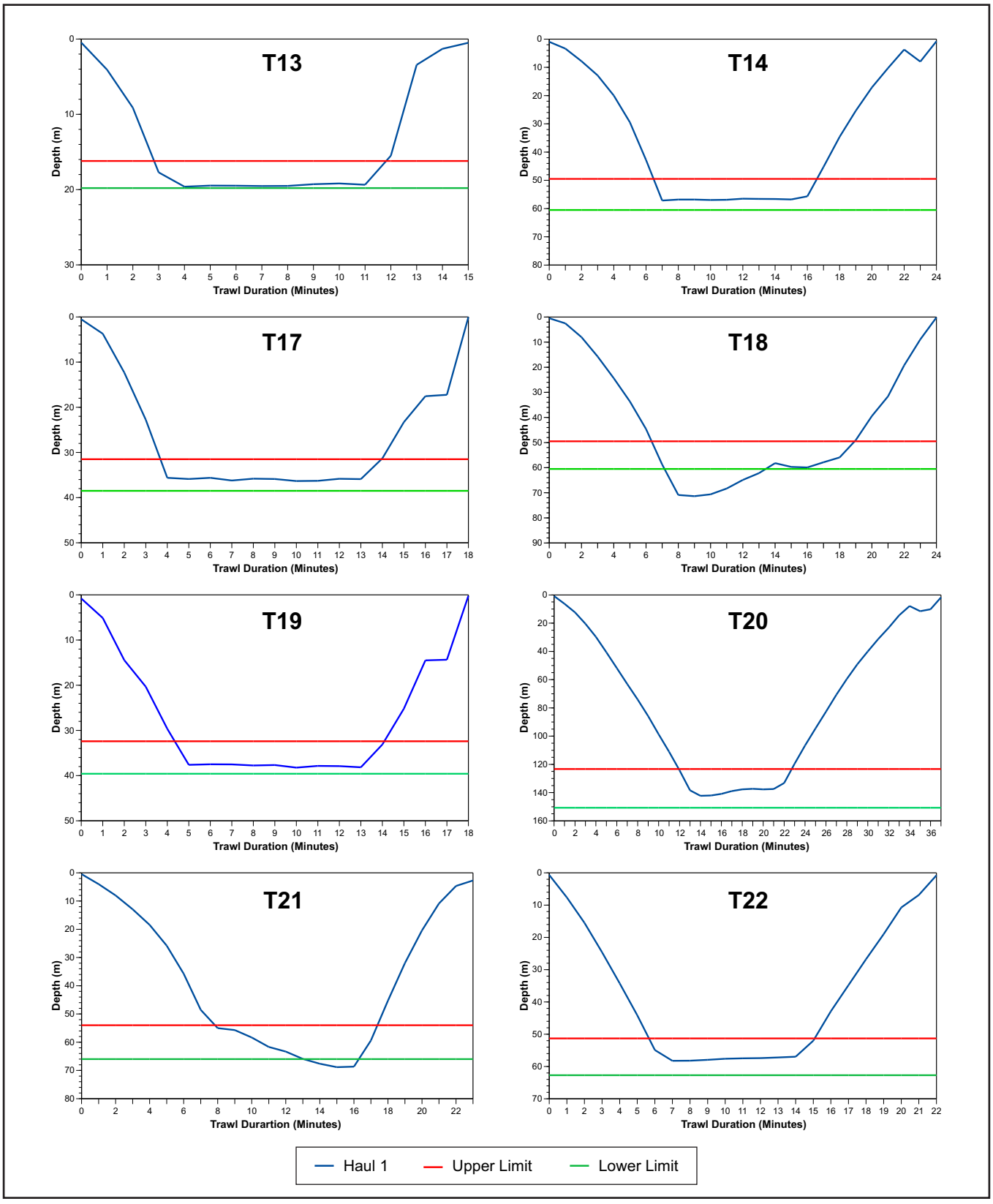

Figure C-2 continued.

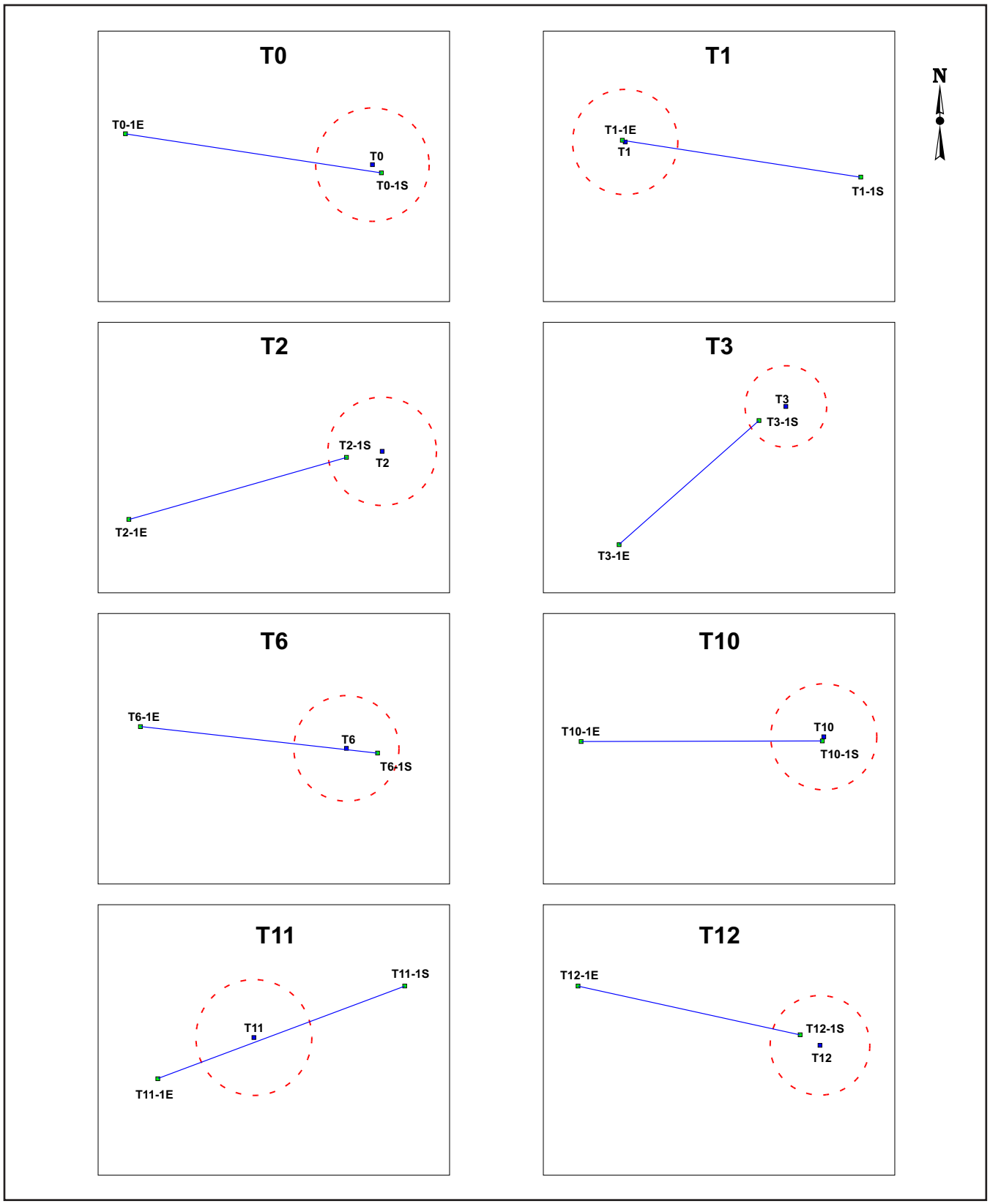

Figure C-3. Quality assurance plots of distance to station for otter trawl hauls, February 2012.

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.

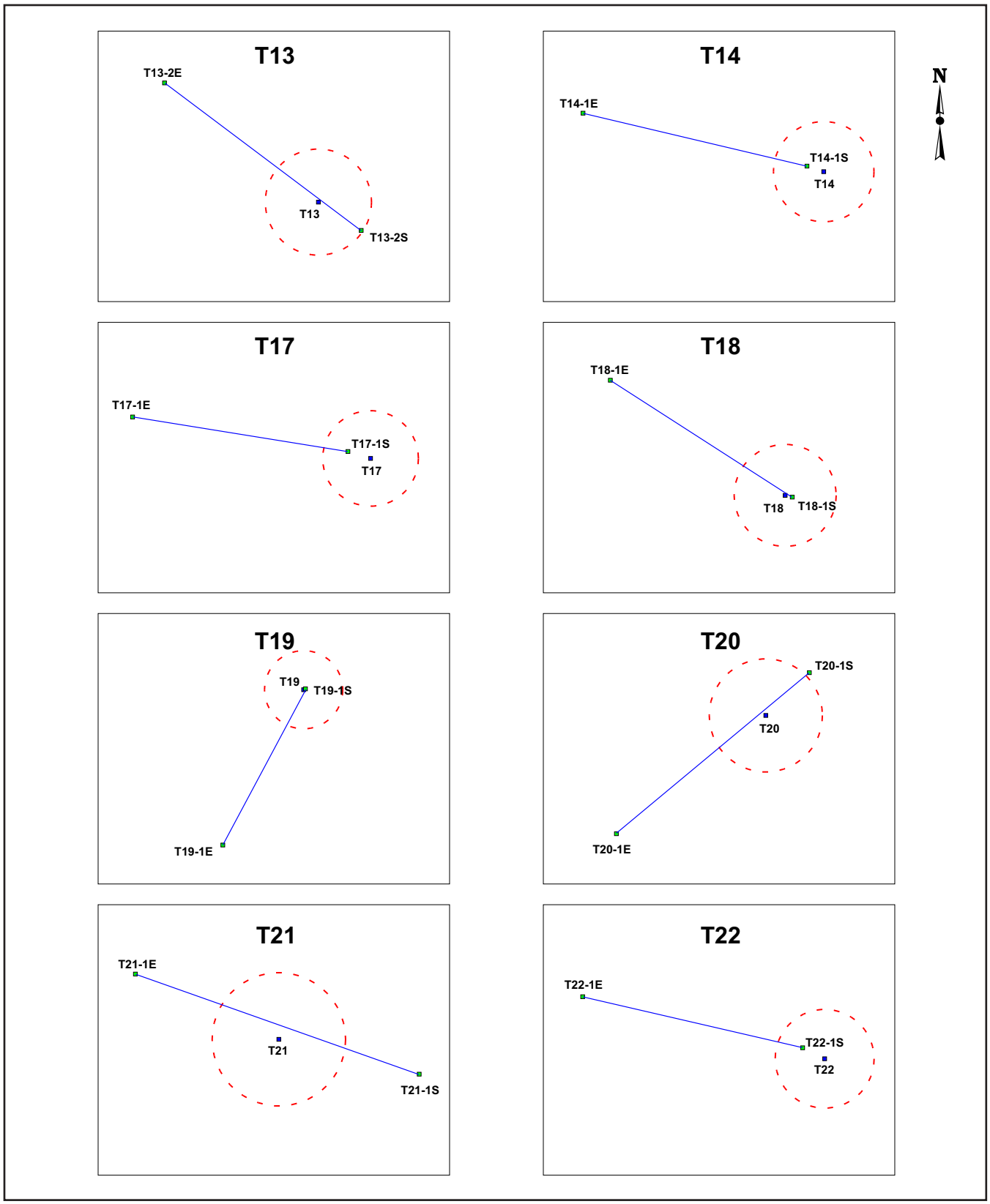

Figure C-3 continued.

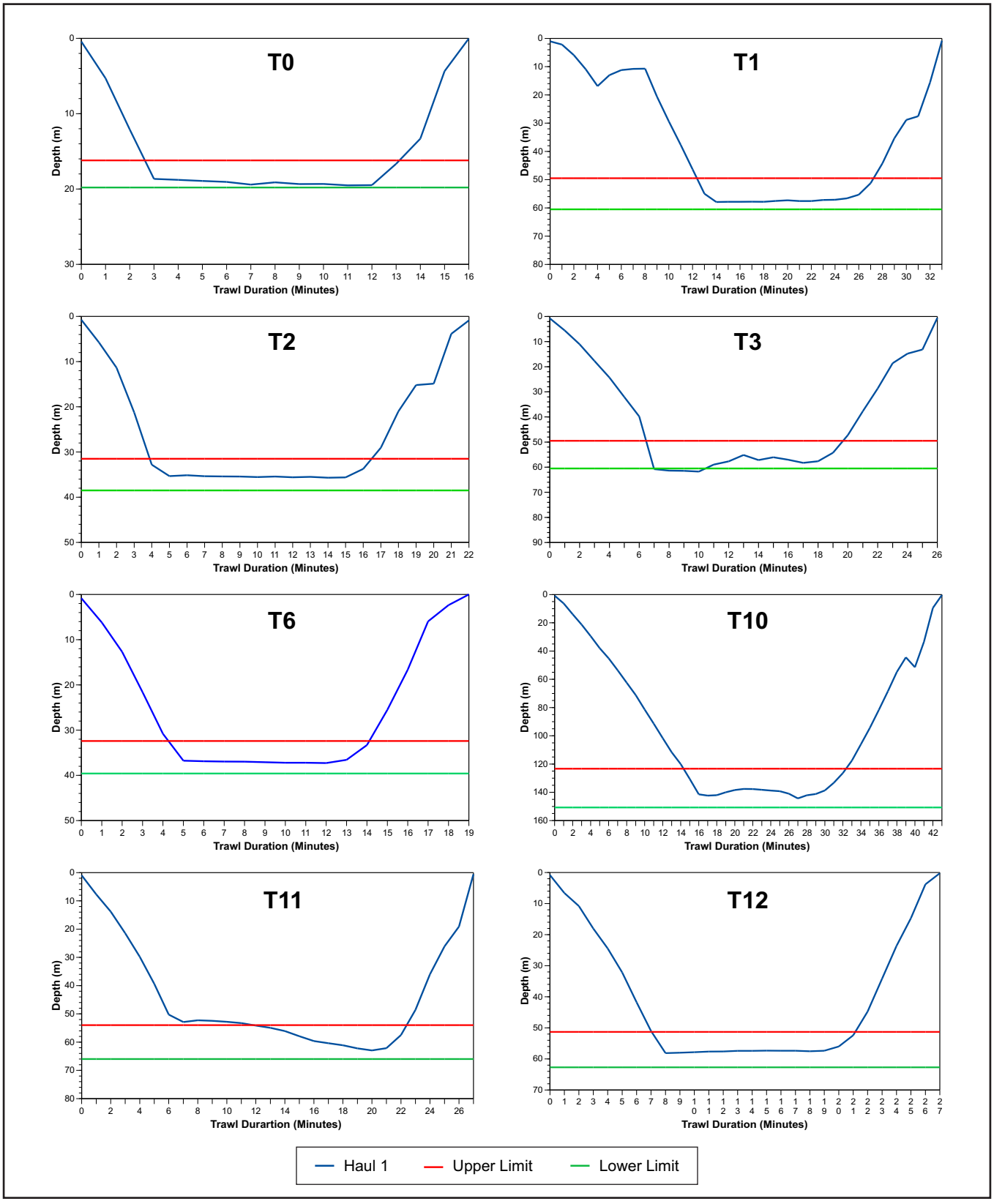

Figure C-4. **Quality assurance plots of trawl depth and trawl duration per haul for otter trawl stations, February 2012.**
Upper and lower limit lines are ± 10% of nominal trawl depth.

Orange County Sanitation District, California.

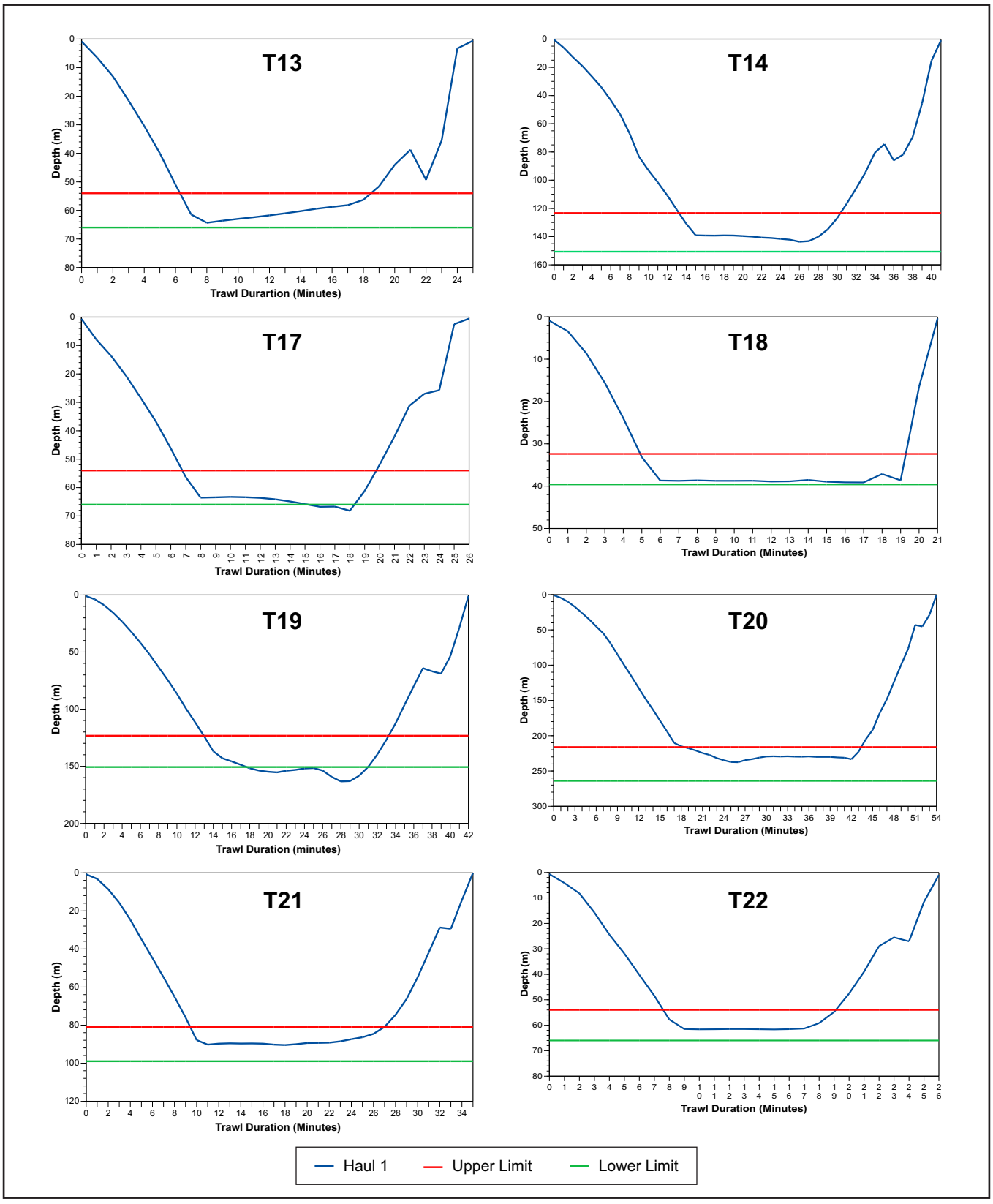

Figure C-4 continued.

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