City of Trinidad
Storm Water Management Improvement Project

Final Sampling and Analysis Report
(October 2011 – April 2015)

August 25, 2015

Prepared for:

City of Trinidad
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Trinidad, CA 95570

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List of Acronyms and Abbreviations

ADH	ADH Environmental
ASBS	Area of Special Biological Significance
CAS	Columbia Analytical Services
CD	compact disk
CEDEN	California Environmental Data Exchange Network
CISS	cast-in-steel-shell
COP	California Ocean Plan
CRM	certified reference material
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
EDD	electronic data deliverable
ERL	effects range-low
FDA	Food and Drug Administration
GPS	Global Positioning System
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MDL	method detection limit
MLLW	mean lower low water
MP	monitoring plan
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NAD	North American datum
NELAP	National Environmental Laboratory Accreditation Program
NOAA	National Oceanographic and Atmospheric Administration
NS&T	National Status and Trends
NTU	Nephelometric turbidity unit
ORW	ocean receiving water
PAEP	project assessment and evaluation plan
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
QPF	quantitative precipitation forecast
RPD	relative percent difference
SCCWRP	Southern California Coastal Water Research Project
SQG	Sediment Quality Guidelines
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TOC	total organic carbon
TPRP	Trinidad Pier Reconstruction Project
TSS	total suspended solids
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This Sampling and Analysis Report documents the results of pre- and post-construction monitoring activities performed for the City of Trinidad's Storm Water Management Improvement Project (Improvement Project). All monitoring was performed in satisfaction of State Water Resources Control Board (SWRCB) Agreement No. 10-427-550 for the Proposition 84 Area of Special Biological Significance (ASBS) Grant awarded to the City of Trinidad for funding of the Improvement Project. All monitoring and reporting were in accordance with the Improvement Project's Quality Assurance Project Plan (QAPP) and Water Quality Monitoring Plan.

The primary objective of the Improvement Project was to reduce the City's stormwater discharges to Trinidad Bay, part of the Trinidad Head Area of Special Biological Significance (ASBS). This was to be accomplished through the implementation of BMPs. Monitoring activities were designed to measure the effectiveness of the pollutant load reductions resulting from the implementation of BMPs. These were accomplished by collecting pre- and post-construction monitoring data for several environmental parameters, including stormwater volume and quality discharged by the City's stormwater outfall, ocean receiving water quality, water toxicity, subtidal sediment chemistry, and California mussel tissue chemistry. These project effectiveness monitoring measures were to accomplish the following:

- Characterize pre- and post-construction water quality and toxicity for stormwater and ocean receiving water and characterize tissue chemistry,
- Characterize tissue and sediment chemistry,
- Quantify the reduction in stormwater runoff volume, and
- Determine the relative reduction in pollutant loading from the City's outfall.

Pre-construction monitoring consisted of the following:

- Stormwater discharge sampling and analysis for three storm events,
- Ocean receiving water sampling and analysis for the same three storm events,
- Continuous recording of rainfall during the 2011-2012 wet season (October through April),
- Continuous recording of rainfall during winter/spring 2014 (February through June),
- Continuous recording of stormwater flow during the above mentioned periods,
- Subtidal sediment sampling and analysis, and
- California mussel tissue collection and analysis.

Post-construction monitoring consisted of the following:

- Stormwater discharge sampling and analysis for three storm events,
- Ocean receiving water sampling and analysis for the same three storm events,
- Continuous recording of rainfall during the 2014-2015wet season (October through April),
- Continuous recording of stormwater flow during the wet season.

Project Effectiveness – Reduction in Stormwater Runoff and Pollutant Loading

The effectiveness of the Improvement Project in achieving volume and pollutant loading reductions was determined by comparing the average stormwater runoff volume per inch of

rainfall for the pre- and post-construction monitoring periods. These data indicate that a runoff volume reduction of 36.8% was achieved. This correlates to a similar reduction in pollutant loading to the ASBS.

In terms of the actual volume, pre-construction flow and rainfall data indicated that the annual stormwater discharge, based on an average annual rainfall of 48 inches, was approximately 8.520 million gallons. The calculated post-construction annual discharge was 5.385 million gallons.

Pollutant loadings for each detected analyte were calculated using the mean concentration from three storm events from each of the pre- and post-construction monitoring seasons. Although these data represent pollutant loading for just the three events from each season, the data was extrapolated to arrive at an annual loading based on the total flow measured for each season. Based on the extrapolated data, it appears that pollutant loadings for numerous analytes increased in the post-construction monitoring season, which is the opposite of what might be expected, given that the Improvement Project was supposed to improve water quality. However, a strong argument can be made that it is not appropriate to analyze the data this way and make conclusions based on it. The following is a list of factors that undermine the validity of such an analysis:

- Post-construction monitoring timing immediately following a summer of heavy and unusual construction activities where construction debris and sediment likely became entrained in stormwater runoff
- Small sample size (only 3 storm events monitored out of dozens)
- Storm event variability:
    - Storm rainfall intensity differed among events
    - Storm duration differed among events
    - Antecedent dry periods differed among events
- Variable residential and/or commercial activities
- Variable laboratory method detection limits for some analytes

By far the largest pollutant inputs to the ASBS are TSS (2,144 to 4,339 kg/year), TOC (194 to 1,550 kg/year), nitrate (4.5 to 161 kg/year), and oil & grease (34 to 76 kg/year). However, these inputs are clearly variable from year to year. In general, pollutant loadings for metals and organic pollutants were relatively low and do not pose a great water quality threat to the ASBS.

Loadings for copper, chromium, lead, nickel and zinc were much higher than the other metals in both monitoring seasons. However, except for zinc (1.1 to 2.5 kg/year), loadings for these metals were all less than 0.5 kg/year (ranging from 0.13-0.24 kg/year for lead, to 0.24-0.41 kg/year for copper).

Regardless of how pollutants loadings may be analyzed and interpreted, water quality data for the ocean receiving waters indicate that mean analyte concentrations were generally similar between pre- and post-construction monitoring periods and did not exceed California Ocean Plan criteria.

Water, Sediment and Tissue Analyses

Targeted monitoring parameters for stormwater, ocean receiving water and subtidal sediment included a suite of physical and chemical components: conventional parameters, total metals, organochlorine and organophosphorus pesticides, pyrethroid pesticides, and semi-volatile organic compounds (SVOCs). The suite of parameters for mussel tissue monitoring included total solids, total lipids, total metals, PAHs, organochlorine pesticides, PCBs, and PBDEs.

Analytical results were evaluated in relation to numeric Water Quality Objectives (WQOs) established in the California Ocean Plan (Ocean Plan or COP), to Sediment Quality Guidelines (SQGs) developed by the National Oceanographic and Atmospheric Administration (NOAA), and to the Food and Drug Administration's guidance levels for pollutants in seafood.

Stormwater Discharge Data Results

Indicator Bacteria: Bacteria concentrations were high in all stormwater samples collected during the 2011-2012 monitoring season, and potentially contributed to the ORW exceedances of COP criteria that were observed. However, such stormwater bacteria results are relatively typical of most municipal storm drain systems and are not surprising.

Turbidity: Turbidity concentrations in pre- and post-construction stormwater samples were low. The highest turbidity (43.6 NTU) was measured during the post-construction October 2014 storm event.

Total Suspended Solids: TSS concentrations in pre- and post-construction stormwater samples were less than 100 mg/L in four of the six samples. Both higher instances occurred during the post-construction monitoring season, with the highest (197 mg/L) recorded in one of the first storms of the season in October 2014. This result is likely related to the construction project itself, which was completed just over a month earlier.

Nutrients: Nutrient (ammonia, nitrate, nitrate + nitrite, total phosphorus and total orthophosphate) concentrations in pre- and post-construction stormwater samples were mostly low. Nitrate was unusually high during the first post-construction storm event of October 2014 (13.27 mg/L nitrate); nitrate concentrations were less than 0.4 mg/L for the next two storm events monitored.

Total Organic Carbon: TOC concentrations were relatively low for five of six samples collected. In the January 2012 sampling event the analytical laboratory diluted the sample by a factor of 200 and reported a result of 120 mg/L. This is compared to the next highest value of 8.6 mg/L for the entire project. The January result appears to be an outlier, and it is difficult to explain the cause for such high a TOC value for stormwater in the middle of the storm season.

Oil & Grease: Oil & grease concentrations in pre- and post-construction stormwater samples were low. The highest concentration (3 mg/L) of oil & grease was recorded from the first post-construction storm event in October 2014. As with TSS, this result may be related to the construction project itself, which was completed just over a month earlier.

Diesel, Motor Oil and Gasoline: These compounds were either not detected or were detected at low levels, generally less than the MRL.

Total Metals: Antimony, arsenic, beryllium, cadmium, selenium, silver, and thallium concentrations in pre- and post-construction stormwater samples were all low (less than 1.0 or 2.0 µg/L). Chromium concentrations were lower in pre-construction samples, ranging from 2.5-4.8 µg/L versus 3.5 to 9.1 µg/L in post-construction samples. Copper was above 10 µg/L in the first pre-construction storm sample and in the first and third post-construction samples; all other copper concentrations were less than 6 µg/L. Lead was approximately two times higher in the first post-construction sample (10.9 µg/L) compared to all other samples. Nickel was approximately two times higher in the first and third post-construction samples (12.3 and 10.1 µg/L, respectively) compared to all other samples. Zinc was over two times higher in the first post-construction sample than the highest pre-construction sample (108 µg/L versus 53 µg/L). Although higher, this value is not exceptionally high for municipal stormwater.

Total Mercury: Mercury was detected in all pre-construction samples from the 2011-2012 storm season but was not detected thereafter. This is rather odd and may have to do with the use of different laboratories over the course of the project. Regardless of the reason(s) for the stormwater mercury results, concentrations were overall either not detected or relatively low.

Polycyclic Aromatic Hydrocarbons: Total PAH concentrations in pre- and post-construction stormwater samples were low (approximately 1.0 µg/L or less). Unfortunately, no comparison can be made between pre- and post-construction samples because of differences in the MDLs achieved by the laboratories. However, it is notable that each of the 25 PAHs was positively detected above the 0.005 µg/L MRL for most of the three 2014-2015 storm events, indicating the low-level presence of many PAHs in Trinidad stormwater runoff.

Organochlorine Pesticides and PCBs: Organochlorine pesticides were largely not detected in stormwater, except in two instances. Endosulfan sulfate was detected at a low concentration (5.9 µg/L) in the January, 20, 2012 pre-construction sample and trans-nonachlor was detected at a concentration between the MDL and MRL in the February 03, 2015 post-construction sample. Only seven Aroclors were analyzed for in the pre-construction samples. For the post-construction monitoring an additional 53 individual PCB compounds were analyzed for. No Aroclors or individual PCBs were detected in any pre- or post-construction stormwater samples.

Organophosphorus Pesticides: Organophosphorus pesticides were not detected in any pre- or post-construction stormwater samples.

Pyrethroid Pesticides: Five pyrethroid pesticides were detected in stormwater samples. Bifenthrin was detected above the MRL in the pre-construction October 2011 sample (0.019 µg/L) and in the post-construction October 2014 and March 2015 samples (0.0071 and 0.0068 µg/L, respectively). Cyfluthrin, cypermethrin, and lambda-cyhalothrin were detected at variable levels above the MRL in the post-construction February and March 2015 samples. These data results indicate that a number of pyrethroid pesticides are currently in use and present Trinidad stormwater runoff, particularly more so in recent post-construction monitoring events.

Other SVOCs: Of 55-57 non-PAH SVOCs analyzed for, 13 were detected at low concentrations in pre- and post-construction stormwater samples. Half of these were phthalates, which are somewhat ubiquitous in the urban environment and are also common laboratory contaminants. Four of seven non-PAH and non-phthalate SVOCs were detected at low concentrations in at least one sample in both the pre- and post-construction samples; these include benzoic acid, benzyl alcohol, 2,4-dichlorophenol, isophorone, pentachlorophenol, and phenol. There are no other notable non-PAH SVOC results in the data results.

Ocean Receiving Water Data Results

In general, water quality results for Trinidad Bay ocean receiving waters were unremarkable and there were no exceedances of Ocean Plan WQOs, except for indicator bacteria.

Indicator Bacteria: Total coliform concentrations slightly exceeded the COP criterion in October 2011. Enterococcus concentrations exceeded the COP criterion in both October 2011 and January 2012. Runoff from the City's stormwater, runoff from the harbor parking lot, and hillside seeps all are likely to have contributed to the ORW exceedances of COP criteria that were observed.

Physical Parameters: All physical parameters measured were typical for seawater and there were no notable results.

Conventional Parameters and Hydrocarbons: All conventional parameters analyzed for were typical for seawater and all hydrocarbons were either not detected or were detected at very low concentrations.

Total Metals: All metals analyzed for were either not detected or were detected at concentrations well below the Ocean Plan WQOs.

Organochlorine Pesticides and PCBs: None of the 24 organochlorine pesticides analyzed for were detected. None of the7 Aroclor PCBs and 53 individual PCBs analyzed for were detected.

Organophosphorus Pesticides: None of the 22 to 25 organophosphorus pesticides analyzed for were detected.

Pyrethroid Pesticides: Bifenthrin was detected at a low concentration (0.0029 µg/L) above the MRL in the October 2011 pre-construction sample; 15 other pyrethroids analyzed for were not detected. Bifenthrin was also detected in the ocean receiving waters in July 2011 (different project) and in the City's stormwater discharge in October 2011 and 2014 and March 2015. This indicates bifenthrin is in regular use in the Trinidad area and is discharging to the ASBS in measurable amounts.

Polycyclic Aromatic Hydrocarbons (PAHs): Most of the 25 PAHs that were analyzed for were detected at least once at low concentrations. Total detectable PAHs were less than 2 µg/L for all storm events.

Other SVOCs: Of 55 to 57 non-PAH SVOCs analyzed for, five phthalates, benzoic acid and bis(2-chloroethyl) ether were detected at low concentrations, primarily in post-constructions samples due to the use of a lower detection limit.

Sediment Data Results

Sediment sampled in Trinidad Bay was primarily fine sand. Sediment particle size distribution for the composite sample was 84.26% sand, 12.89% silt, 2.41% clay, and 0.06% gravel.

Sediment concentrations of nearly all analytes were either relatively low or not detected. Among metals and PAHs, except for nickel, all detected analytes were in concentrations well below the NOAA Sediment Quality Guideline (SQG) Effects Range Low (ERL) and Effects Range Median (ERM) values (NOAA, 1999).

Total Metals: Nickel was detected at a concentration of 65.8 mg/kg, higher than the NOAA SQG ERL and ERM values of 20.9 and 51.6 mg/kg, respectively. The high concentration of nickel in Trinidad Bay sediments may have little to do with anthropogenic inputs and more to do with the native soils and rocks, some of which are serpentine which is known to contain nickel.

The relatively high detected levels of total chromium, which also can occur in serpentine soils and rocks, may lend support to this idea.

Pesticides, PCBs and Pyrethroids: Three organochlorine pesticides, delta-BHC, endrin, and heptachlor epoxide, were detected at very low concentrations in Trinidad Bay sediments. These three compounds are referred to as "legacy persistent organic pollutants" and are representative of their historical, not current, use. PCBs, organophosphorus pesticides, and pyrethroids (which are the latest current-use pesticides) were not detected in Trinidad Bay sediments.

Butyltins: Two of four butyltin (or organotin) compounds were detected at low concentrations between the MDL and MRL. Used for decades in anti-fouling paint for boat hulls, butyltins were phased out in the 1980s and do not appear to have persisted in Trinidad Bay sediments, if they were ever present in greater concentrations.

PAHs and Other SVOCs: Five PAHs, one phthalate and phenol were detected at relatively low concentrations. Several of the PAHs are commonly associated with the wood preservative creosote and may, in part, represent a legacy of PAH pollutants from the old wooden Trinidad Pier.

California Mussel Tissue Data Results

Concentrations of nearly all analytes analyzed for in California mussel tissue samples from Trinidad Bay were either low or not detected. Concentrations of metals, organochlorine pesticides and PCBs that were positively detected in tissues were generally much lower than the applicable FDA Guidance Levels for Seafood (FDA, 2001). The exception was cadmium which was detected at a concentration that was relatively similar to, but still below, the FDA guidance level. There are no FDA guidance levels for seafood for PAHs/SVOCs, or PBDEs.

Metals: Except for antimony, thallium, and tin, all metals that were analyzed for were detected at concentrations above the MRL. Tin was not detected.

PAHs and Other SVOCs: Of the 24 PAHs analyzed for, 7 were detected at very low concentrations between the MDL and MRL. Four PAHs were detected at concentrations above the MRL: 2,6-dimethylnaphthalene, perylene, phenanthrene, and carbazole (a component of creosote). No other SVOCs were detected in the mussel tissue samples.

Organochlorine Pesticides and PCBs: Of the 15 organochlorine pesticides analyzed for, 6 were detected at low concentrations. Only heptachlor epoxide was detected at a concentration above the MRL. Heptachlor epoxide was also detected at low concentrations in subtidal sediments in Trinidad Bay, but was not detected in any City stormwater discharges. Of the 57 PCBs analyzed for, PCB 095 was detected at a very low concentration.

Polybrominated Diphenyl Ethers: Of the 17 PBDEs analyzed for, none were detected. Used as a flame retardant in a wide array of products, it is good news that California mussels in Trinidad Bay exhibit no exposure to these compounds.

Summary

The water, sediment, and tissue data summarized above do not directly provide quantifiable information on the water quality improvements, per se, in the Trinidad Head ASBS as a result of the Improvement Project. The data do, however, characterize the City's stormwater runoff and roughly estimate the pollutant loading to the ASBS. Admittedly, the data are based on a limited number of samples and the accuracy of the annual loadings calculations is unknown; only three out of dozens of recorded storm events during each storm season were sampled. Yet, together, the stormwater, ocean receiving water, subtidal sediment and California mussel tissue data provide valuable baseline information for future management and study of the ASBS.

The most obvious measure of the effectiveness of the Improvement Project to improve water quality in the ASBS is the reduction of stormwater runoff volume of 36.8%. Although it is impossible to accurately calculate the reduction in pollutant loading based on the small sample size for pre- and post-construction monitoring seasons, the fact that the Improvement Project is successfully capturing and treating a significant amount of the City’s stormwater runoff is evidence that the project has been effective in improving water quality in the Trinidad Head ASBS.

This sampling and analysis report concludes the monitoring requirements of SWRCB Agreement No. 10-427-550.

1.0 INTRODUCTION

This report presents pre- and post-construction monitoring results for the City of Trinidad's (City) Storm Water Management Improvement Project (Improvement Project). The primary objective of the Improvement Project was to reduce the City's stormwater discharges to Trinidad Bay, part of the Trinidad Head Area of Special Biological Significance (ASBS). Pre-construction baseline data was collected on the following:

1. Quantity and quality of the City's stormwater discharge to the bay
2. Quality of the ocean receiving waters (ORW) in the bay
3. Quality of subtidal sediments in the bay
4. Tissue chemistry of the California mussel (*Mytilus californianus*) in the bay

Post-construction data was collected only on the City's stormwater discharge and the ORW.

2.0 PROJECT BACKGROUND

The impetus for implementing the Improvement Project was a desire to improve water quality within the Trinidad Head ASBS, designated as such because of the large kelp beds to the north and south of Trinidad Head. This section provides some background on the regulatory setting for the Improvement Project, the project's purpose, scope and location, and the monitoring program designed to assess the success of the project.

2.1 Water Quality Regulatory Background

On March 21, 1974 the Trinidad Head ASBS was designated by the State Water Resources Control Board (SWRCB) as one of 34 ASBS along the California coast. The kelp beds within this ASBS are considered biologically significant for both the food and shelter provided to fish and invertebrates. As a subset of State Water Quality Protection Areas (SWQPA), ASBS represent marine areas "designated to protect marine species or biological communities from an undesirable alteration in natural water quality" (Public Resources Code section 36700(f)). The California Ocean Plan defines an ASBS as "those areas designated by the State Water Board as ocean areas requiring protection of species or biological communities to the extent that alteration of natural water quality is undesirable", and mandates that all waste discharges must be prohibited or limited (SWRCB, 2012a).

In its 2003 report, *Final Report: Discharges into State Water Quality Protection Areas*, the SWRCB identified the City of Trinidad's' stormwater discharge outfall (designated as TRI032) as a High Threat Discharge to the Trinidad Head ASBS (SCCWRP, 2003). In 2005 the SWRCB issued cease and desist orders (CDO) to all California stakeholders identified in the 2003 report, including the City, to stop all unpermitted discharges into ASBS, including stormwater.

In response to the SWRCB, the City conducted preliminary baseline water quality sampling (grab sampling) of stormwater, seeps, springs and streams discharging to Trinidad Bay and, in 2006, included these results as a required element in their Application for an Exception for Discharge into ASBS. Such an Exception was provided for in the COP as long as certain conditions are met by the discharger, one of which is environmental monitoring; the application also included results from 2006 biological surveys of both the intertidal and subtidal habitats of the Trinidad Head ASBS. Much of the baseline water and sediment quality data for Trinidad Bay that has been compiled to date was presented in the City's Exception Application, as well as in Appendix A of the Improvement Project's *Project Assessment and Evaluation Plan* (PAEP; ADH 2011c).

In 2008, the City submitted a grant proposal to the SWRCB's Proposition 84 ASBS Grant Program to implement the Improvement Project in order to partially address the City's stormwater discharges. The grant proposal was ultimately awarded as SWRCB Agreement No. 10-427-550. The conditions of the Agreement required the development of a PAEP, QAPP and Monitoring Plan (MP) in order to assess the project's success in improving water quality within the ASBS. The QAPP and MP were based, in part, on a draft SWRCB resolution on protecting ASBS (see below).

In 2012 the SWRCB adopted Resolution No. 2012-0031 Approving Exceptions to the California Ocean Plan for Selected Discharges into Areas of Special Biological Significance, Including Special Protections for Beneficial Uses, and Certifying a Program Environmental Impact Report.

Attachment B of the resolution, Special Protections for Areas of Special Biological Significance, Governing Point Source Discharges of Storm Water and Nonpoint Source Waste Discharges, is referred to as the Special Protections and established the monitoring requirements for all dischargers to ASBS.

3.0 PROJECT AND MONITORING OVERVIEW

This section provides information about the Improvement Project's purpose, scope and location, and the monitoring program designed to assess the success of the project.

3.1 Improvement Project Purpose and Overview

The purpose of the Improvement Project is to implement enhancements to the City's existing stormwater system that will help to protect the water quality and beneficial uses of the Trinidad Head ASBS. The project diverts a significant percentage of stormwater runoff into treatment and infiltration-to-ground Best Management Practices (BMP) and Low Impact Development (LID) technologies, resulting in reduced runoff volume and pollutant loading to the ASBS. Reconstruction of the existing system included the installation of infiltration galleries/trenches, grassy swales, vegetated infiltration strips, and other BMP/LID technologies.

Although the long-term project design encompasses two areas of the City, defined as the upper and lower areas, the final stormwater management improvement design and construction elements have only been completed for the upper area with the current Prop 84 grant funds. The scope of work, however, was to complete the concept development, geotechnical work, and groundwater modeling for both the upper and lower areas to serve as the basis of design for the project. The lower area is included in the concept development because the upper and lower areas are hydrologically connected.

The upper area was the priority for this phase of final design and implementation because improvements to the lower area cannot be effective without the upper area improvements due to limitations in the capacity to manage the entire volume of stormwater collected. The upper area work benefits the ASBS immediately by redirecting an estimated 22%-40% of the City's stormwater and treating these flows through the upper area infiltration BMP/LID technologies.

Environmental sampling and analysis was required as an integral part of the Improvement Project in order to assess and evaluate the project's effectiveness in reducing stormwater runoff volume and associated pollutant loading to the ASBS.

3.2 Monitoring Objective and Overview

The primary objective of the Improvement Project's monitoring program was to assess the effectiveness of the project in reducing stormwater related pollution to the ASBS. This was primarily accomplished through pre-construction and post-construction flow monitoring of the City's stormwater discharge and water quality monitoring of both the discharge and ocean receiving waters in the vicinity of the discharge. Pre- and post-construction results were compared and pollutant loadings to Trinidad Head ASBS was calculated using data collected from continuous flow monitoring of the City's discharge and chemical analytical results from flow-weighted water quality sampling of storm events.

Pre-construction monitoring program consisted of:

1. Stormwater discharge sampling and analysis for three storm events
2. Ocean receiving water sampling and analysis for the same three storm events
3. Continuous recording of rainfall during the 2011-2012 wet season (October through April)

4. Continuous recording of rainfall during winter/spring 2014 (February through June)
5. Continuous recording of stormwater flow during the above mentioned periods
6. Subtidal sediment sampling and analysis
7. California mussel tissue sampling and analysis

Post-construction monitoring consisted of:

1. Stormwater discharge sampling and analysis for three storm events
2. Ocean receiving water sampling and analysis for the same three storm events
3. Continuous recording of rainfall during the 2014-2015wet season (October through April)
4. Continuous recording of stormwater flow during the wet season

The monitoring program followed the design and requirements established in the PAEP, QAPP, MP and addendums and amendments to these documents as discussed in Section 3.3 below. Appropriate field sampling quality assurance/quality control (QA/QC) measures were performed by field crews to ensure the representativeness and integrity of samples during sample collection, processing and shipping. Appropriate laboratory QA/QC procedures were conducted by the analytical laboratories at the appropriate batch frequency. Complete data reports, including all QA/QC results, were produced by the laboratories and are included on CD with this report. A list of analytical data reports is provided in Appendix F.

Analytical constituents and parameters selected for this program were originally based, in part, upon the California Ocean Plan (SWRCB, 2012), the *Draft Special Protections for Selected Storm Water and Non-Point Discharges into Areas of Special Biological Significance*, and the National Oceanographic and Atmospheric Administration's National Status and Trends (NOAA NS&T) Mussel Watch program. Samples were analyzed for selected conventional, microbiological, nutrient, trace metals, and organic parameters. Table 3-1 reflects the program's original parameters for each sample matrix, although not all of these were maintained throughout the course of the project. Water quality toxicity testing, which was added later in the program is also included in Table 3-1.

Table 3-1 Sample Analyses for Water, Sediment and Tissue

Constituent	Stormwater Discharge	Ocean Receiving Water	Subtidal Sediment	Mussel Tissue
Physical Parameters				
pH	✓	✓		
Temperature	✓	✓		
Salinity	✓	✓		
Specific Conductance	✓	✓		
Sediment Particle Size			✓	
Total Solids			✓	✓
Indicator Bacteria				
Total Coliforms	✓	✓		
E. Coli Bacteria	✓	✓		
Enterococcus Bacteria	✓	✓		

Table 3-1 Sample Analyses for Water, Sediment and Tissue

Constituent	Stormwater Discharge	Ocean Receiving Water	Subtidal Sediment	Mussel Tissue
Conventionals and Hydrocarbons				
Turbidity	✓	✓		
Total Suspended Solids	✓	✓		
Settleable Solids	✓	✓		
Ammonia as Nitrogen	✓	✓	✓	
Nitrate as N	✓			
Nitrate + Nitrite as N		✓		
Total Phosphorus as P	✓	✓		
Total Orthophosphate as P	✓	✓		
Total Organic Carbon	✓	✓	✓	
Total Cyanide	✓	✓	✓	
Surfactants (MBAS)	✓	✓		
Oil & Grease	✓	✓	✓	
TPH as Diesel	✓	✓	✓	
TPH as Motor Oil	✓	✓	✓	
TPH as Gasoline	✓	✓		
Total Metals				
Antimony	✓	✓	✓	✓
Arsenic	✓	✓	✓	✓
Beryllium	✓	✓	✓	✓
Cadmium	✓	✓	✓	✓
Total Chromium	✓	✓	✓	✓
Chromium VI	✓	✓		
Copper	✓	✓	✓	✓
Lead	✓	✓	✓	✓
Mercury	✓	✓	✓	✓
Nickel	✓	✓	✓	✓
Selenium	✓	✓	✓	✓
Silver	✓	✓	✓	✓
Thallium	✓	✓	✓	✓
Zinc	✓	✓	✓	✓
Polycyclic Aromatic Hydrocarbons (Up to 25 PAHs were analyzed for.)				
PAHs	✓	✓	✓	✓
Other Non-PAH SVOCs (Up to 57 SVOCs were analyzed for.)				
Other SVOCs	✓	✓	✓	✓
Organochlorine Pesticides (Up to 57 Organochlorine Pesticides were analyzed for.)				
Organochlorine Pesticides	✓	✓	✓	✓
PCBs and Aroclors (7 Aroclors and 53 PCBs were analyzed for.)				
PCBs and Aroclors	✓	✓	✓	✓
Organophosphorus Pesticides (Up to 25 Organophosphorus Pesticides were analyzed for.)				
Organophosphorus Pesticides	✓	✓	✓	
Pyrethroid Pesticides (Up to 16 Pyrethroid Pesticides were analyzed for.)				
Pyrethroid Pesticides	✓	✓	✓	

Table 3-1 Sample Analyses for Water, Sediment and Tissue

Constituent	Stormwater Discharge	Ocean Receiving Water	Subtidal Sediment	Mussel Tissue
Polybrominated Diphenly Ethers (17 PBDEs were analyzed for.)				
PBDEs				✓
Organotins (Butyltins) (4 organotins were analyzed for.)				
Organotins (Butyltins)			✓	
Toxicology [1, 2]				
Toxicology (1 species & 3 species)	✓	✓		

[1] A single species test was performed for stormwater samples (urchin fertilization).
[2] Three species tests were performed for ORW samples (urchin fertilization, bivalve survival/development, and kelp germination and growth).

3.3 Mid-Project Changes to the Improvement Project Monitoring Program

Several changes to the monitoring program were made mid-project for various reasons, as described below.

3.3.1 California Mussel Tissue Analysis

In March 2013 the monitoring program was amended to confirm that the collection of California mussel tissue for chemical analysis would be performed; the original MP only mentioned this task as a tentative possibility. The method for mussel collection within Trinidad Bay was also changed from a plan to deploy bagged mussels for a certain period of time to one in which mussels would be directly collected from rocks by hand.

3.3.2 Additional Chemistry and Toxicity Analyses

In December 2013 an addendum to the monitoring program was made which added pre-storm ORW chemistry monitoring, and during-storm toxicity monitoring of the City's discharge and the ORW. This was done in order to better satisfy the monitoring requirements of the Special Protections. Stormwater samples were analyzed for urchin fertilization only, and ORW samples were analyzed for urchin fertilization, bivalve survival/development, and kelp germination and growth.

3.3.3 Elimination of Bacteria Sampling

Indicator bacteria sampling was discontinued after the pre-construction monitoring season. This was done because 1) there is no requirement in the Special Protections to monitor for bacteria, 2) the difficulty and safety issues associated with sampling the storm drain at Galindo and Van Wyke Streets due to the extremely heavy square metal grate, and 3) sometimes impossible logistics for sampling at peak flow and delivering samples within the 6 hour holding time to a laboratory that only accepts samples 4 days a week.

3.3.4 Elimination of Post-Construction Subtidal Sediment Sampling

In early May 2015 an addendum to the MP was made which eliminated the post-construction subtidal sediment sampling component of the monitoring program. This was done because it was agreed that it was premature to collect post-construction sediment data to compare to pre-construction data. Surficial subtidal sediment chemistry was not expected to respond quickly to the project's alteration in the quantity/quality of the City's stormwater discharge to the ASBS. This is a process that takes place over years, not the 7 months that had elapsed since the end of the construction phase.

3.4 Project Location and Sampling Sites

The City of Trinidad is located on the northern California coast in Humboldt County, approximately 300 miles north of San Francisco (or 25 miles north of Eureka), in Big Lagoon Hydrologic Area No. 108.10. Trinidad is a small town with a population just over 300 residents and a developed land area of approximately 66 acres. Significant commercial or municipal properties include a gas station, grocery store, elementary school, town hall, three restaurants, a university marine research laboratory, and an oceanfront pier and marina that are used for commercial fishing and recreational purposes. Except for the Seascape Restaurant, which has an advanced wastewater treatment system, all of the residents and businesses in town employ on-site wastewater treatment systems (OWTS/septic systems).

The City constructed a storm water drainage system in the early 1970's which collects storm water from a portion of the City's impervious watershed, which covers approximately 21 acres of land within the City limits. A single 32-inch stormwater outfall drains the entire system and discharges to Trinidad Bay at Launcher Beach, along the west shore of the southern portion of the Trinidad Head ASBS. This discharge accounts for the majority of the City's stormwater runoff to the southern half of the ASBS. Initial estimates by the City's engineer indicated that, based on an average rainfall of 48 inches and the estimated impervious surface area in the City's watershed, the total annual volume of discharge to the ASBS should be in the order of 1.6 million cubic feet or 12 million gallons. See Section 5.2.1 for a discussion of the actual discharge volumes measured over the course of the project.

3.4.1 Stormwater and Receiving Water Sampling Locations

Three locations were sampled for water quality during a storm event (Figure 1):

1) At the primary stormwater sampling location, a rain gauge, flow meter, and auto sampler were installed to record rainfall and stormwater flow and to collect flow-weighted stormwater composite samples; this location is at the corner of Galindo and Van Wycke Streets where the last access point to the storm drain system is located. Physical measurements, such as temperature, pH, and conductivity were also performed here when sea conditions did not permit sampling at the outfall (end of pipe).

2) The secondary stormwater sampling location is the stormwater outfall discharge point onto Launcher Beach. There are no significant stormwater inputs to the drainage system between the site at Galindo and Van Wycke and the outfall. This location was only used to collect discrete grab samples for indicator bacteria and oil & grease, and to perform physical measurements. This sampling location was discontinued after the pre-

construction monitoring for several reasons: 1) seawater enters the pipe at high tides, and because the pipe is approximately 80% full of sand, gravel, rock and flotsam the seawater is not easily flushed out, leading to samples that were observed to be a mix of stormwater and seawater; 2) it was discovered that, during wet weather, the basement sump pump of a private residence discharged into the storm drain system between the primary monitoring location at Galindo and Van Wyke Streets and the ocean.

3) The single ORW sampling location is in the shallow waters of Trinidad Bay in close vicinity to the City's stormwater discharge at Launcher Beach. Multiple grab samples were collected here throughout a storm event and mixed together to create a composite seawater sample that roughly represented ocean conditions during the event.

3.4.2 Sediment Sampling Locations

Sediment sampling locations within Trinidad Bay were similar, but not identical, to the four locations sampled for the Trinidad Pier Reconstruction Project in July 2011 (Figure 1). Due to the rocky nature of the ocean bottom within Trinidad Bay, sediment sampling is literally hit or miss and sampling locations are variable. Latitude and longitude coordinates provided in this report are the best approximate coordinates for each location sampled in May 2012.

Figure 3-1 Project Sampling Locations

4.0 FIELD METHODS

The following subsections briefly describe sample collection, processing and handling methods performed during field operations, as well as flow and rainfall data collection methods. A more detailed description of certain project methods is presented in the QAPP (ADH, 2012a) and Monitoring Plan (ADH, 2012b).

4.1 Decontamination of Sampling Equipment

All water and sediment sampling equipment was pre-cleaned prior to field deployment in accordance with the QAPP. The equipment included 20-liter borosilicate glass stormwater composite sample bottles, Teflon intake hose, silicon tubing for the peristaltic pump, sub-sampling hose, receiving water grab sample jars, sediment grab sampler, and stainless steel pans and spoons for sediment processing.

4.2 Water Sample Collection

As described in Section 3.4.1 there were three water sampling locations and methodologies: one for stormwater composite sampling, one for stormwater grab sampling, and one for ORW composite sampling. Flow and rainfall were recorded continuously throughout the 2011-2012 wet season, the spring months of 2014, and the 2014-2015 wet season. Three storm events during 2011-2012, two storm events in early 2014, and three storm events during 2014-2015 were sampled.

4.2.1 Stormwater Composite Sampling

Flow-weighted stormwater composite sampling was accomplished through the use of a Teledyne ISCO 750 Area Velocity Flow Module and ISCO 6712 Portable Sampler, configured as the Improvement Project's primary stormwater sampling station. In advance of the storm season these components were securely installed at the last access point to the City's stormwater discharge system, approximately 300 feet up-pipe of the actual outfall. The 750 Modules' area velocity sensor uses Doppler technology to directly measure velocity in the flow stream; an integral pressure transducer in the sensor measures liquid depth. Flow is automatically calculated using these parameters and the dimension of the pipe. Flow data recorded by the 750 Module is communicated to the ISCO 6712 for storage and for triggering the sampler pump to take a sample after a predetermined volume of water has passed the station.

Prior to sampling a storm event the equipment was programmed for the predicted amount of rainfall and estimated volume of discharge; the initial discharge volume estimate was calculated based on a rough survey of the major impervious surfaces within the portion of the City that drains to the stormwater collection system. The station was programmed to collect at least 80 individual 250-milliliter sample aliquots into a protocol-cleaned 20-liter borosilicate glass composite bottle over the course of a storm event. Ice was placed around the composite bottle throughout the duration of the sampling event to keep the sample water cold.

During-storm monitoring consisted of periodic site visits by field technicians to the sampling station to perform the following tasks:

- Verify the flow module was functioning properly
- Verify the sampler was successfully collecting samples
- Verify the rain gauge was functioning properly
- Periodically download flow and rainfall data
- Measure physical water quality parameters such as temperature, pH and conductivity
- Collect grab samples for bacteria and oil & grease (see section 4.2.2 below)

Physical water quality parameters were either measured in-situ in the pipe at the stormwater monitoring station or downstream at the outfall by collecting a grab sample.

Following the storm event, stormwater collected in the composite bottle was brought to the ADH field office and subsampled into the appropriate, certified-clean sample containers for packing and shipment to the analytical laboratory for analysis. A protocol-cleaned subsampling hose and peristaltic pump was utilized for this purpose. During subsampling, the composite bottle was constantly agitated in order to keep the sample well mixed. The sample water was always kept on ice and in the dark, except during subsampling. Clean nitrile gloves were worn whenever the sample bottles were handled.

4.2.2 Stormwater Grab Sampling

Grab samples for bacteria and oil & grease were collected once during each storm in which stormwater composite samples were collected, and as close to the time of peak flow as possible. Samples were collected directly from the end of the City's stormwater outfall pipe at Launcher Beach. Grab samples for bacteria were sometimes collected earlier or later during a storm event in order to facilitate their timely transport to the laboratory within the six hour holding time. The bacteria samples were hand delivered to the analytical laboratory within six hours of the sampling time. Oil & grease samples were shipped to another analytical laboratory along with all the other water samples. Samples were kept on ice and in the dark at all times. Clean nitrile gloves were worn whenever the sample bottles were handled. Grab sampling was discontinued after 2011-2012 because of seawater intrusion into, and retention within, the outfall pipe and the uncertainty of successfully collecting a non-commingled sample. It was noticed that even after considerable rainfall and discharge from the outfall that salinities were still relatively high; the outfall is approximately 80% filled with rock, gravel, sand and drift seaweed and apparently retains seawater for long periods.

4.2.3 Ocean Receiving Water Sampling

Ocean receiving water sampling was performed in Trinidad Bay in close vicinity to the point where the City's stormwater discharge meets the ocean. Samples were collected concurrent to the stormwater sampling. Time-based composite samples of seawater were generated by temporally spacing the collection of five or more discrete seawater grab samples between the time of peak stormwater discharge and the end of a storm event and mixing them together.

Grab samples were collected in approximately knee to waist deep water in front of the location where the stormwater discharge meets the ocean. Care was taken to ensure the samples were collected "up current" from the sampler. All samples were collected in a protocol-cleaned 4-liter glass jar and then combined in a clean 20-liter borosilicate glass bottle to create the composite sample. Depending on the volume required for all constituent analyses and quality control (QC) analyses, the size of the grab samples were adjusted (i.e., more than one 4-liter bottle was filled when a field duplicate sample was also being collected). Physical parameters of temperature, pH, and salinity were measured simultaneous to each grab sample collection.

Following the collection of all grab samples into the 20-liter composite bottle(s), subsamples were pumped into the appropriate, certified-clean sample containers to be packaged and delivered to the analytical laboratory for analysis. Equipment used for subsampling included a peristaltic pump and protocol-cleaned Teflon and silicon tubing. During subsampling the composite bottle was constantly agitated in order to keep the sample well mixed. The sample water was always kept on ice and in the dark, except during subsampling.

In addition to the collection of the receiving water composite sample, discrete grab samples for bacteria and oil & grease were collected by hand at the same location in the receiving waters, at approximately the period of peak stormwater discharge, or when the same samples were collected from the stormwater outfall. Handling of these samples was the same as for the stormwater grab samples. Clean nitrile gloves were worn whenever the sample bottles were handled.

4.3 Subtidal Sediment Grab Sampling

Sediment grab samples were collected in equal volumes from four separate locations within Trinidad Bay and homogenized together to create a composite sample representative of the various sedimentary environments that were located during the sampling process. Samples were collected with a Petite Ponar grab sampler and processed using protocol-cleaned stainless-steel processing trays and spoons. The grab sampler was deployed and retrieved by hand.

Upon retrieval of the grab sampler the integrity of each sediment sample was inspected for surface disturbance or significant wash-out. Only undisturbed samples were retained for subsequent subsampling of approximately the top 2 centimeters of the surface layer. Sample material was spooned into a stainless steel tray with a lid and kept on ice inside a cooler.

Once sampling was complete the collected sediment was brought to a controlled environment on shore for processing. The sediment was thoroughly homogenized by hand using a stainless steel spoon and then transferred into the appropriate, certified-clean sample jars for shipment to the analytical laboratory for analysis. Extreme care was taken to ensure the samples were not subject to any sources of contamination. The transfer of processed sediment from the stainless steel tray to glass sample jars was done in a place, time, and manner that minimized any contamination of the sample, transfer spoon or sample jar lids. Clean nitrile gloves were worn during all phases of sample handling. Once filled, sample containers were immediately stored on ice in coolers and kept in the dark; sample jars for pyrethroid analysis were frozen with dry ice.

4.4 California Mussel Tissue Sampling

Mussels were collected at low tide by hand from three sub-locations (Stations A, B and C) within Trinidad Bay. A total of 25 mussels in the size range 50 to 80 millimeters were collected at each station. For field quality control purposes a replicate sample of 25 mussels was also collected. All collected mussels were thoroughly rinsed on site to remove external debris other easily removed organisms in order to remove possible sources of contamination to the tissues inside. Mussels were allowed to drain before being placed into individual plastic bags and stored on ice;

later excess water in the bags was poured off. The samples were shipped on ice overnight to the analytical laboratory for processing and chemical analysis. The laboratory performed whole tissue resection of the mussels and then composited and homogenized the three samples, creating one field sample and one field duplicate sample for analysis.

Mussel sample collection and shipping followed protocols established by the NOAA National Status & Trends Mussel Watch Program and detailed in the *Southern California Coastal Water Research Project (SCCWRP) Standard Operating Procedure (SOP)* for NOAA NS&T *Mussel Collection and Shipment* (Diehl, 2007).

4.5 Field Documentation

Separate field log forms were filled out for the various components of the sampling program and are included in the final report CD:

- Station Maintenance Log Sheet
- Pre-Storm Station Checklist
- During Storm Field Data Log Sheet
- Post-Storm Station Checklist
- Seawater Grab Sample Field Data Log Sheet
- Sediment Grab Sampling Log
- California Mussel Tissue Collection Log

At a minimum, all field log forms included the following:

- Project name
- Sample/Station ID
- Date and time of visit or sample collection
- Standard observations
- Physical parameters, if measured (temperature, pH, specific conductivity or salinity)
- Name of person completing log

4.6 Chain-of-Custody Documentation

Chain-of-custody documentation was completed for all stormwater, receiving water and sediment samples. Each chain-of-custody form contained space for the following information:

- Analytical laboratory name, address and phone number
- Name, address, phone number and point of contact for ADH
- Project name and number
- Required completion date
- Sample ID
- Lab ID
- Sample matrix
- Analyses to be performed
- Container size, type and number
- Preservation type
- Collection date and time
- Condition upon receipt

- Special instructions/comments
- Signature lines with date/time for transfer of custody (relinquishment and receipt)

The completed chain-of-custody forms were retained with the samples from the time of collection to delivery to each respective analytical laboratory. Chains of custody are included within each laboratory data report on the final report CD.

4.7 Shipping

In preparation for shipping, samples containers were carefully packed in bubble wrap in coolers and iced using either "blue" ice or double-bagged wet ice. Chain-of-custody documentation was packaged with each shipment. All coolers were shipped for overnight delivery.

5.0 FIELD SAMPLING AND FLOW MONITORING RESULTS SUMMARY

The following subsections summarize results from the field sampling activities that were successfully performed for the stormwater, ORW, sediment, and mussel tissue sampling components of the monitoring program.

Field measurements and laboratory analytical data results for all detected analytes are presented in Section 6. All analytical data results, including non-detects, are presented in Appendices B, C and D.

5.1 Field Samples Collected

Table 5-1 presents a summary of all water, sediment, and mussel tissue samples that were collected for analytical testing. ADH Environmental performed all sample collection.

5.2 Monthly Flow and Rainfall Monitoring Results

Tables 5-2 and 5-3 present pre- and post-construction monthly flow and rainfall summary statistics that were recorded by the monitoring station at Galindo and Van Wyke Streets. This includes continuously recorded stormwater flow and rainfall monitoring results for 1) October 2011 through April 2012, 2) April through June 2014, and 3) October 2014 through April 2015. Monthly hydrographs are presented in Appendix A.

5.2.1 Stormwater Runoff Reduction Achieved by Improvement Project

The percent reduction in stormwater runoff was calculated using the difference in the average runoff volumes per inch of rainfall for the pre- and post-construction monitoring periods.

% Reduction = ABS[((LI-Post/LI-Pre)*100)-100], where:

LI-Pre is the average of liters per inch (L/inch) calculated for each month for the Pre-Construction period

LI-Post is the average of liters per inch calculated for each month for the Post-Construction period

Flow data from three months (February and March 2014, and February 2015) were not included in the calculations for the percent reduction in runoff because the data was rejected for reasons explained below:

1. The monitoring station was relocated during the 2012-2013 wet season to monitor another project at the Trinidad Pier. After the monitoring station was re-installed at the City's monitoring site it was later discovered that the flow sensor had been re-installed in the storm pipe in a slightly different configuration than in 2011-2012. This resulted in inaccurate flow measurements for February and March 2014; the installation was corrected for the months April through June 2014.

2. The total flow measured for the month of February 2015 was approximately one-half of what was expected. The reason for this is unknown but may have been because some object or debris was lodged against the flow sensor and prevented accurate flow readings.

Based on the flow data that was included in the calculations the percent reduction of stormwater runoff between pre-and post-construction flow measurements was 36.8%. This is in agreement with the City’s engineer’s calculations that the Improvement Project, through the use of infiltration BMP/LID technologies, would result in a reduction of between 22%-40% of the City’s stormwater runoff.

Table 5-1 Field Samples Collected

Sample Date	Sample Type	Field Sample ID*	Laboratory ID and Laboratory
Pre-Construction Monitoring			
September 22, 2011	Equipment Blank Water Chemistry	TSIP-SW-092211-EB	K1108986 (CAS) L090815-001 (CAL)
October 03, 2011	Water Chemistry, Bacteria	TSIP-SW-100311-FS TSIP-RW-100311-FS	K1109477-001 & -002 (CAS) L100257-001 & -002 (CAL) W111159 (HCPHL) W111161 (HCPHL)
January 20, 2012	Water Chemistry, Bacteria	TSIP-SW-012012-FS TSIP-RW-012012-FS TSIP-RW-012012-FD	2A21001-01, -02 & -03 (Weck) 2A21001-01RE1 (Weck) 2A21001-02RE1 (Weck) 2A21001-03RE1 (Weck) W120063 (HCPHL) W120064 (HCPHL)
April 13, 2012	Water Chemistry, Bacteria	TSIP-SW-041312-FS TSIP-RW-041312-FS	2D16050-01 & -02 (Weck) W120432 (HCPHL) W120433 (HCPHL)
May 08, 2012	Sediment Chemistry	TSIP-SD-050812-FS TSIP-SD-050812-FD	K1204503-001 & -002 (ALS) M050480-001 & -002(CAL)
April 12, 2013	California Mussel Tissue	TSIP-TS-041213-FS TSIP-TS-041213-FD	K1303372-004 (ALS) K1303372-008 (ALS)
January 10, 2014	Water Chemistry	TRI-REC-100114-P1	24158-R1 & -R2 (Physis)
January 11, 2014	Water Chemistry & Toxicity	TRI-REC-100114-D1 TRI-REC-100114-D2 TRI-REC-100114-D3	24162-R1 & -R2 (Physis) 24163-R1 & -R2 (Physis) 24164-R1 & -R2 (Physis)
Post-Construction Monitoring			
October 15, 2014	Water Chemistry & Toxicity	TRI-032-DIS-151014-D1 TRI-REC-151014-D1	29328-R1 & R2 (Physis) 29329-R1 & R2 (Physis) 347796-001 & -002 (Physis) 348083-001 (Physis)
February 03, 2015	Water Chemistry & Toxicity	TSIP-RW-020315-D1 TSIP-SW-020315-D1	30870-R1 & -R2 (Physis) 30871-R1 (Physis) 352445-001 & -002 (Physis)
March 11, 2015	Water Chemistry & Toxicity	TSIP-SW-031115-D1	31304-R1 & -R2 (Physis) 353824-001 (Physis)
March 12, 2015	Water Chemistry & Toxicity	TSIP-RW-031215-D1 TSIP-RW-031215-D2 TSIP-RW-031215-D3	31305-R1 (Physis) 31306-R1 & -R2 (Physis) 31307-R1 (Physis) 353824-002 & 003 (Physis)

*Sample ID Interpretation:

TSIP	Trinidad Stormwater Improvement Project
EB	Equipment Blank
FS	Field Sample
FD	Field Duplicate
RW	Receiving Water
SD	Sediment
SW	Stormwater
TS	Tissue
D1	Field Sample, During-Storm
D2	Field Duplicate Sample, During-Storm
D3	Field Blank, During Storm
P1	Field Sample, Pre-Storm
TRI-032-DIS	Stormwater
TRI-REC	Receiving Water
ALS	ALS Global (formerly CAS)
CAS	Columbia Analytical Services
CAL	Caltest Analytical Laboratory
HCPHL	Humboldt County Public Health Laboratory
Weck	Weck Laboratories, Inc.
Physis	Physis Environmental Laboratories

Table 5-2 Pre-Construction Flow and Rainfall Summary

Month	Total Rainfall (inches)	Total Flow (liters)	Liters/ Inch Rainfall	Total Flow (gallons)	Gallons/ Inch Rainfall	Total Flow (cubic feet)	Cubic Feet/ Inch Rainfall
2011-2012 Wet Season							
October	3.86	2,035,850	527,422	537,815	139,330	71,895	18,626
November	4.10	2,892,870	705,578	764,216	186,394	102,161	24,917
December	3.64	2,478,556	680,922	654,765	179,881	87,529	24,047
January	9.74	8,129,933	834,695	2,147,701	220,503	287,106	29,477
February	3.44	2,225,771	647,026	587,987	170,926	78,602	22,850
March	14.03	12,566,467	895,685	3,319,710	236,615	443,781	31,631
April	4.13	2,590,661	627,279	684,380	165,710	91,488	22,152
2013-2014 Wet Season							
February*	6.80	1,217,487	179,042	321,626	47,298	42,995	6,323
March*	6.92	1,308,979	189,159	345,796	49,970	46,226	6,680
April	1.54	937,844	608,990	247,752	160,878	33,120	21,506
May	0.76	365,902	481,450	96,661	127,186	12,922	17,002
June	0.64	454,433	710,052	120,049	187,576	16,048	25,075
Average	*4.59*	*3,467,829*	*671,910*	*916,104*	*177,500*	*122,465*	*23,728*

*The February and March 2014 flow data were rejected as outliers.

Table 5-3 Post-Construction Flow and Rainfall Summary Statistics

Month	Total Rainfall (inches)	Total Flow (liters)	Liters/ Inch Rainfall	Total Flow (gallons)	Gallons/ Inch Rainfall	Total Flow (cubic feet)	Cubic Feet/ Inch Rainfall
2014-2015 Wet Season							
October	5.53	2,240,912	405,228	591,986	107,050	79,137	14,311
November	4.52	1,787,318	395,424	472,160	104,460	63,119	13,964
December	9.21	4,392,403	476,917	1,160,350	125,988	155,116	16,842
January	1.69	728,258	430,922	192,385	113,838	25,718	15,218
February*	3.72	741,949	199,449	196,002	52,689	26,202	7,043
March	3.35	1,433,189	427,818	378,609	113,017	50,613	15,108
April	2.42	996,785	411,895	263,323	108,811	35,201	14,546
Average	*4.35*	*1,760,116*	*424,701**	*464,974*	*103,693*	*62,158*	*13,862*

*The February 2015 flow data were rejected as an outlier.

5.3 Pre-Construction Storm Event Summaries (2011-2012)

Three storm events during the 2011-2012 wet season were monitored during which stormwater flow and rainfall were recorded, and stormwater and ORWs were sampled for analytical testing. Summary descriptions of these events are described in the subsections below.

5.3.1 Storm Event #1 Monitoring Summary

Storm Event #1 occurred on October 2-3, 2011 and was the first rain event of the 2011-2012 wet season. As summarized in Figure 5-1, this event concluded with a total rainfall amount of 1.07 inches and a total runoff discharge of 580,445 liters. During the sampling period the sampler collected 56 aliquots of storm water for a total composite of approximately 14 liters. For the entire storm event, the percent of the stormwater runoff that was captured (sampled) in a representative, flow-weighted manner was 99.2%; by terminating sampling prior to the complete cessation of flow, percent capture was reduced.

5.3.2 Storm Event #2 Monitoring Summary

Storm Event #2 occurred on January 17-20, 2012. As summarized in Figure 5-2, this event concluded with a total rainfall amount of 4.99 inches and a runoff discharge total of 4,015,230 liters. During the sampling period the sampler collected 120 aliquots of storm water for a total composite of approximately 25 liters; only one sample was missed during the duration of the storm. For the entire storm event, the percent of the stormwater runoff that was captured (sampled) in a representative, flow-weighted manner was 98.9%.

5.3.3 Storm Event #3 Monitoring Summary

Storm Event #3 occurred on April 10-13, 2012. As summarized in Figure 5-3, this event concluded with a total rainfall amount of 1.28 inches and a runoff discharge total of 1,217,432 liters. During the sampling period the sampler collected 125 aliquots of storm water for a total composite of approximately 31 liters.

It should be noted that for a period of 52 minutes on the night of April 10 (from 20:23 to 21:15) the sampling station was not operating due to efforts to troubleshoot what appeared to be an incorrect instantaneous flow reading of zero that was observed on the ISCO sampler liquid crystal display (LCD). When the data was downloaded at a later time, this was not seen in the one-minute averaged data that was actually recorded. Fortunately, this period was at the tail end of a rainy period and a relatively insignificant percentage of the entire storm event was not sampled. For the entire storm event, the percent of the stormwater runoff that was captured (sampled) in a representative, flow-weighted manner was 97%.

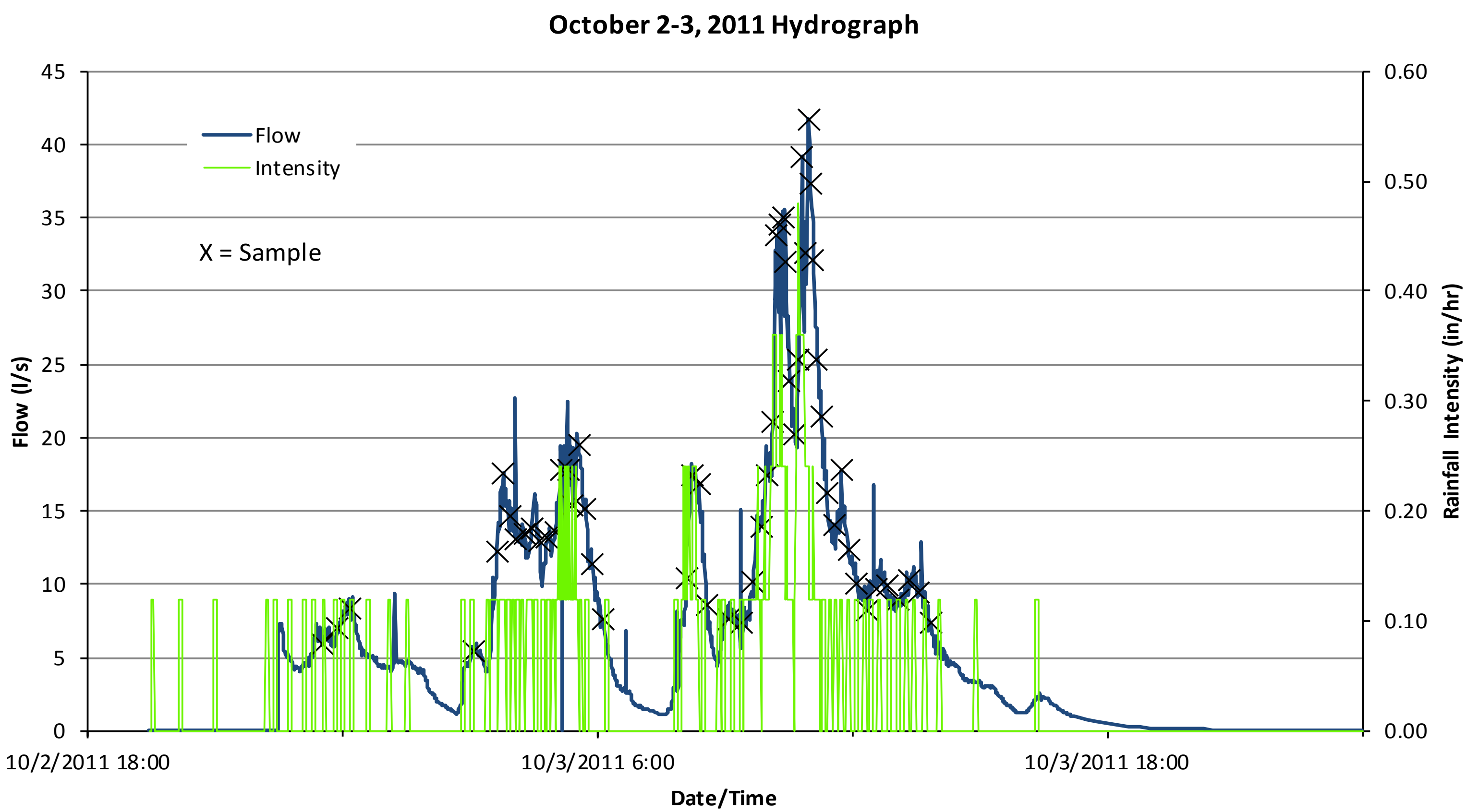
5.4 Pre-Construction Storm Events Summaries (2013-2014)

As an amendment to the original Scope of Work in SWRCB Agreement No. 10-427-550 additional pre-construction sampling was performed during the 2013-2014 wet season. This consisted of: 1) pre- and during-storm chemistry sampling and analysis for the ORW for one storm only; 2) during-storm single-species (urchin) toxicity testing for the stormwater discharge for three storms; and 3) during-storm three-species (urchin, kelp, mussel) toxicity testing for the

ORW for one storm. However, only two storms were ultimately sampled in the 2013-2014 season.

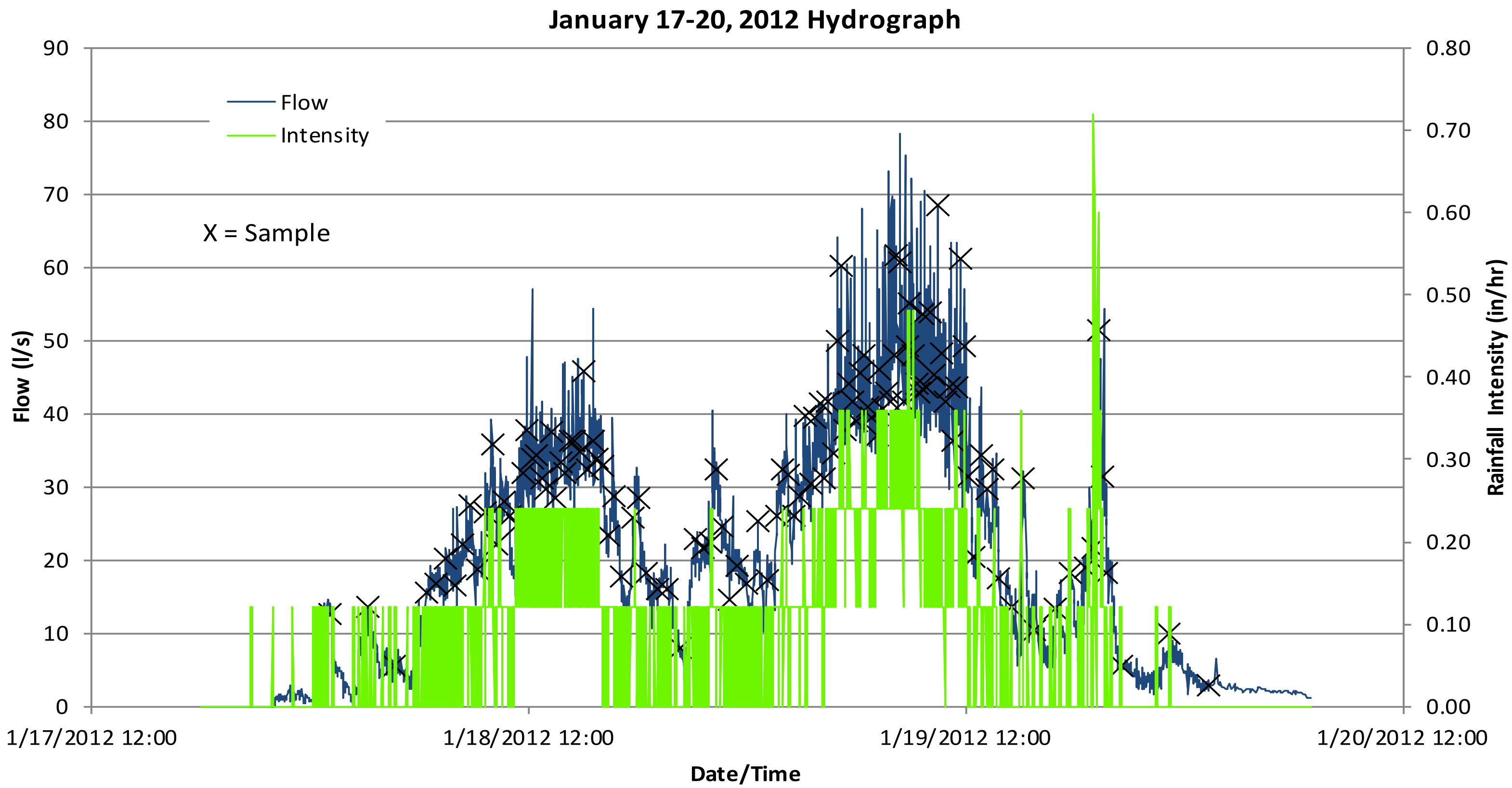
Storm event hydrographs were not produced for the January 11, 2014 and March 26, 2014 sampling events because no flow weighted composite samples for stormwater monitoring were collected; only one toxicity grab sample was collected from the Galindo and Van Wyke sampling location during each event.

Figure 5-1 Pre-Construction Hydrograph; Storm Event #1, October 2-3, 2011



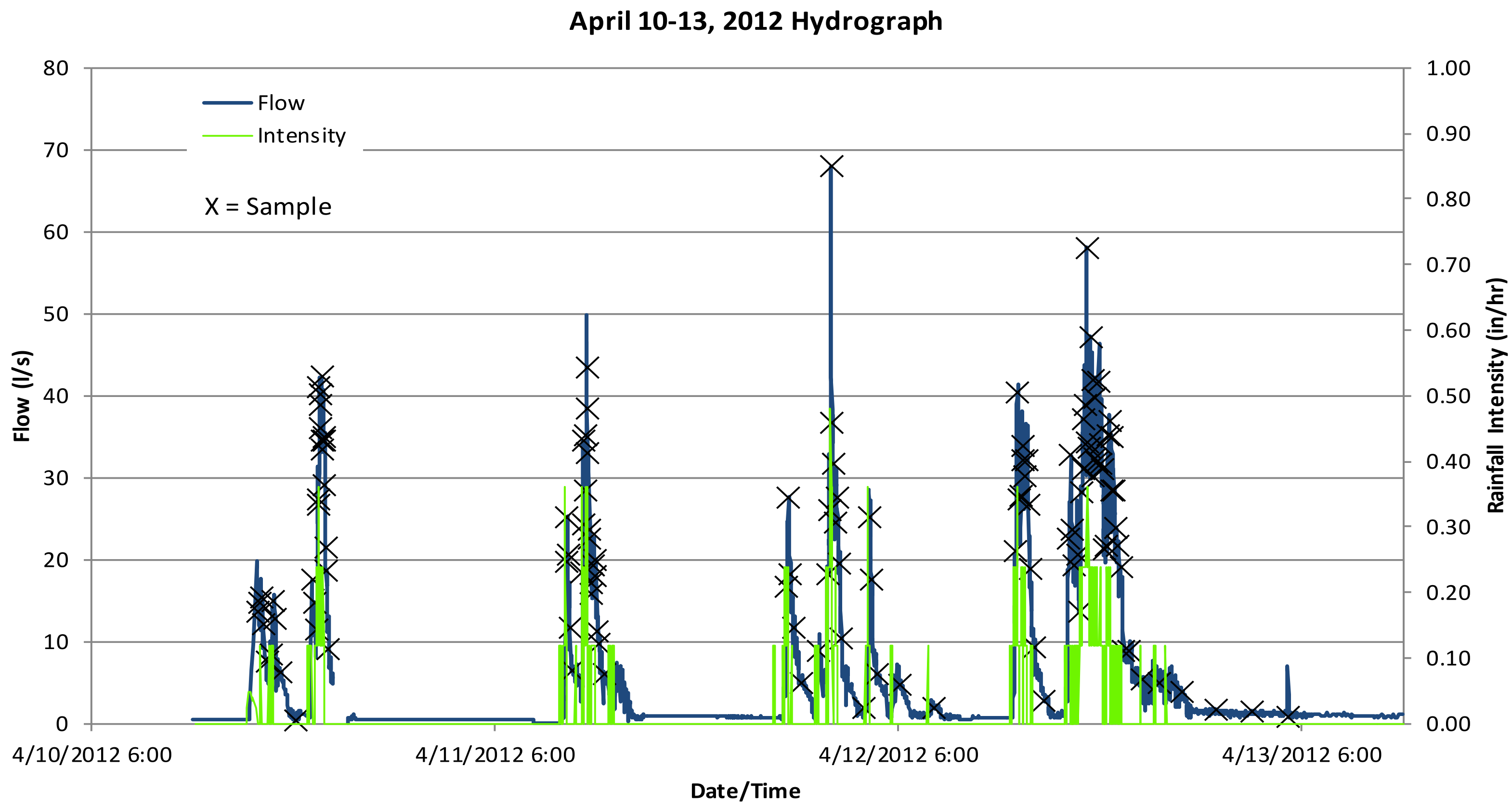
Rain Data		Runoff Data		Sample Data	
Start Date/Time	10/2/11 19:31	Start Date/Time	10/2/11 22:28	First Sample Date/Time	10/2/11 23:30
Stop Date/Time	10/3/11 16:20	Stop Date/Time	10/3/11 23:15	Last Sample Date/Time	10/3/11 13:51
Duration (hr)	20.8	Duration (hr)	24.8	Duration (hr)	14.3
Event Rain (in.)	1.07	Total Flow Volume (L)	580445	Number of Samples	56
Max Intensity (in/hr)	0.48	Peak Flow (L/s)	42		

Figure 5-2 Pre-Construction Hydrograph; Storm Event #2, January 17-20, 2012



Rain Data		Runoff Data		Sample Data	
Start Date/Time	1/17/12 20:46	Start Date/Time	1/17/12 22:06	First Sample Date/Time	1/18/12 1:05
Stop Date/Time	1/19/12 23:12	Stop Date/Time	1/20/12 6:55	Last Sample Date/Time	1/20/12 1:20
Duration (hr)	50.4	Duration (hr)	56.8	Duration (hr)	48.2
Event Rain (in.)	4.99	Total Flow Volume (L)	4015230	Number of Samples	120
Max Intensity (in/hr)	0.72	Peak Flow (L/s)	78		

Figure 5-3 Pre-Construction Hydrograph; Storm Event #3, April 10-13, 2012



Rain Data		Runoff Data		Sample Data	
Start Date/Time	4/10/12 15:25	Start Date/Time	4/10/12 12:05	First Sample Date/Time	4/10/12 15:55
Stop Date/Time	4/12/12 21:52	Stop Date/Time	4/13/12 12:00	Last Sample Date/Time	4/13/12 5:13
Duration (hr)	54.5	Duration (hr)	71.9	Duration (hr)	61.3
Event Rain (in.)	1.28	Total Flow Volume (L)	1217432	Number of Samples	125
Max Intensity (in/hr)	0.48	Peak Flow (L/s)	68.0		

5.5 Post-Construction Storm Event Summaries (2014-2015)

Three storm events during the 2014-2015 wet season were monitored during which stormwater flow and rainfall were recorded, and stormwater and ORWs were sampled for analytical testing. Summary descriptions of these events are described in the subsections below.

5.5.1 Storm Event #1 Monitoring Summary

Storm Event #1 occurred on October 14-15, 2014. As summarized in Figure 5-4, this event concluded with a total rainfall amount of 1.02 inches and a runoff discharge total of 336,256 liters. During the sampling period the sampler collected 114 aliquots of storm water for a total composite of approximately 25.5 liters. During the site visit on October 14, just as rainfall had started, the field crew inadvertently reprogrammed the data logger improperly and lost all rainfall and flow data between October 1 and the time of the site visit. For the entire storm event, the percent of the stormwater runoff that was captured (sampled) in a representative, flow-weighted manner was 97.9%.

5.5.2 Storm Event #2 Monitoring Summary

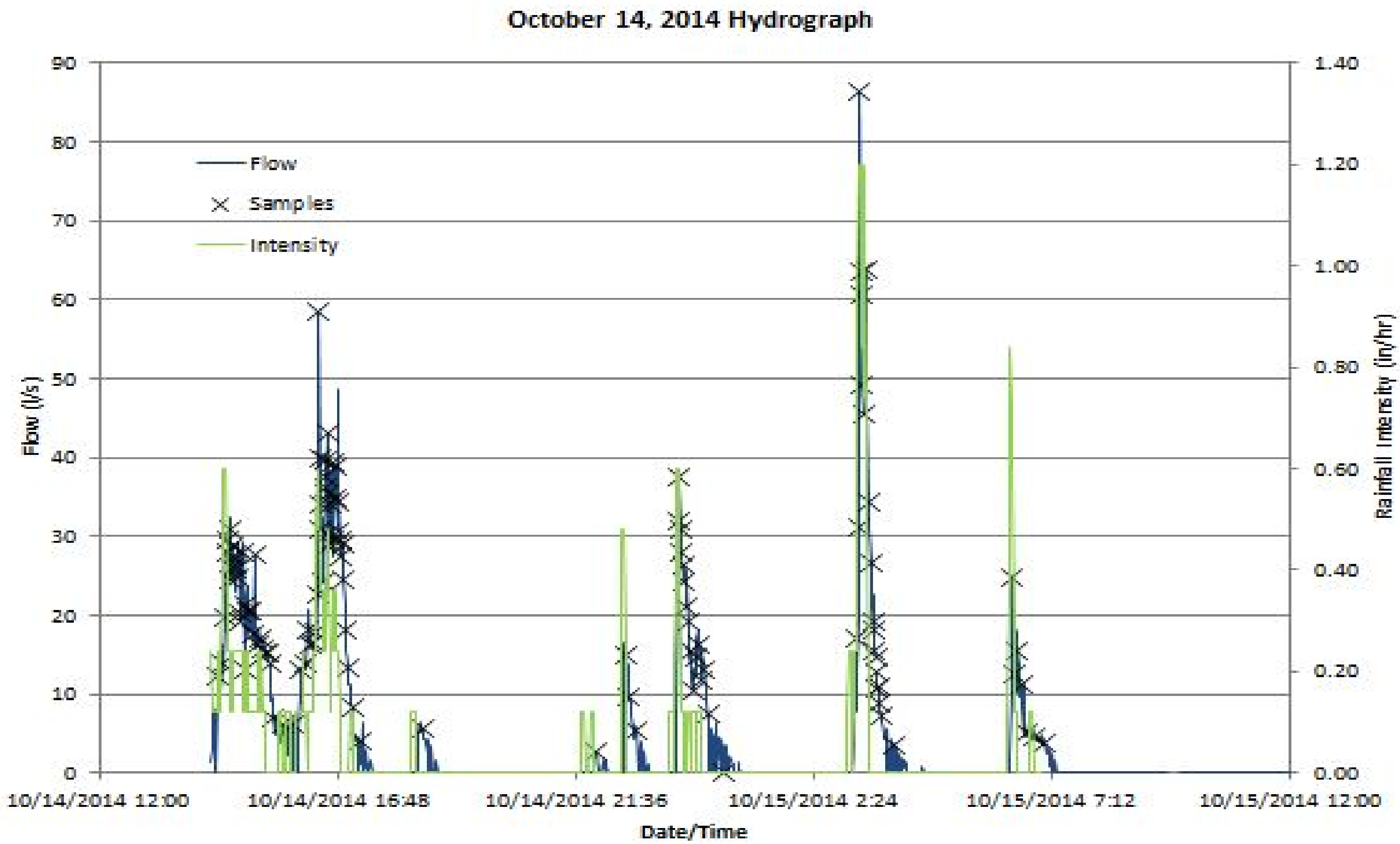
Storm Event #2 occurred on February 01-03, 2015. As summarized in Figure 5-5, this event concluded with a total rainfall amount of 1.05 inches and a runoff discharge total of 328,452 liters. During the sampling period the sampler collected 109 aliquots of storm water for a total composite of approximately 24 liters. For the entire storm event, the percent of the stormwater runoff that was captured (sampled) in a representative, flow-weighted manner was 98.1%.

5.5.3 Storm Event #3 Monitoring Summary

Storm Event #3 occurred on March 11, 2015. As summarized in Figure 5-6, this event concluded with a total rainfall amount of 0.28 inches and a runoff discharge total of 88,300 liters. During the sampling period the sampler collected 67 aliquots of storm water for a total composite of approximately 16 liters. For the entire storm event, the percent of the stormwater runoff that was captured (sampled) in a representative, flow-weighted manner was 99.2%.

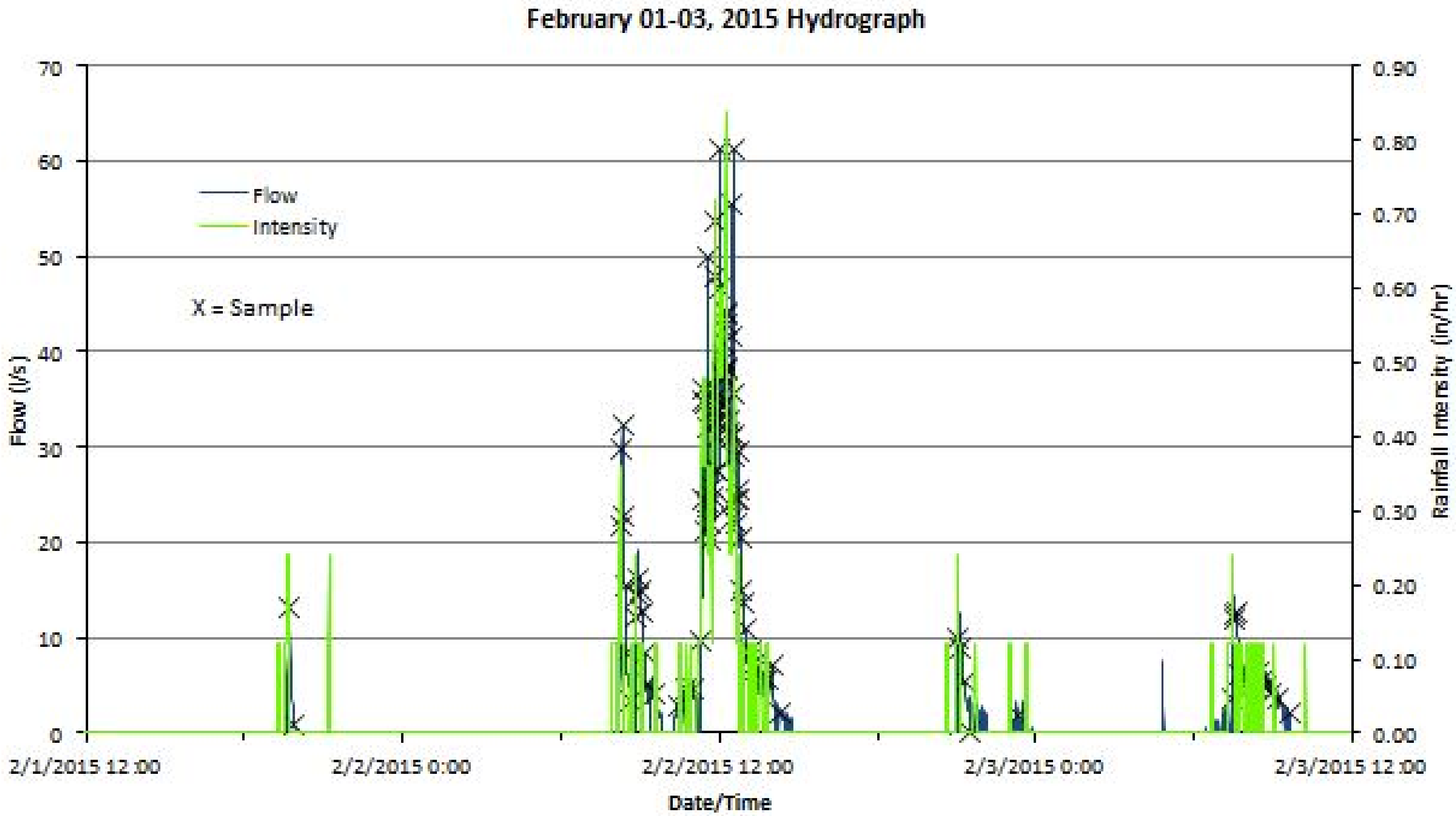
It should be noted that this storm event was predicted to produce at least 0.4 to 0.6 inches of rainfall (depending on the forecaster). Although one forecast was below the 0.5 inches required by the program MP, the decision was made to initiate sampling because of worries that another qualifying rain event may not occur in 2015 due to the ongoing drought being experienced in California.

Figure 5-4 Post Construction Hydrograph; Storm Event #1, October 14, 2014



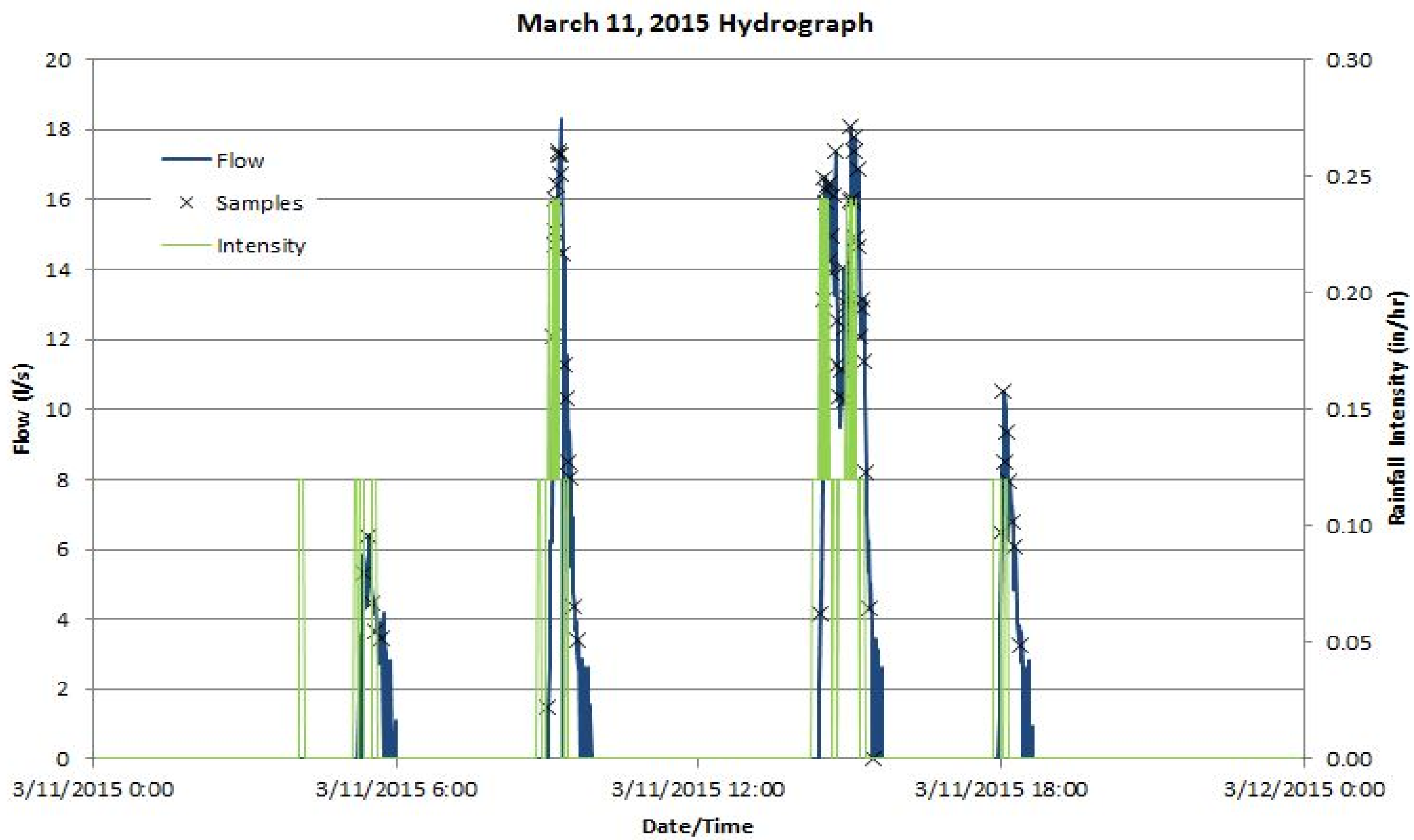
Rain Data		Runoff Data		Sample Data	
Start Date/Time	10/14/14 14:07	Start Date/Time	10/14/14 14:15	First Sample Date/Time	10/14/14 14:23
Stop Date/Time	10/15/14 6:46	Stop Date/Time	10/15/14 7:17	Last Sample Date/Time	10/15/14 6:51
Duration (hr)	16.65	Duration (hr)	17.03	Duration (hr)	16.47
Event Rain (in.)	1.02	Total Flow Volume (L)	336256.02	Number of Samples	114
Max Intensity (in/hr)	1.20	Peak Flow (L/s)	86.30		

Figure 5-5 Post Construction Hydrograph; Storm Event #2, February 1-3, 2015



Rain Data		Runoff Data		Sample Data	
Start Date/Time	2/1/15 19:19	Start Date/Time	2/1/15 19:36	First Sample Date/Time	2/1/15 19:42
Stop Date/Time	2/3/15 10:11	Stop Date/Time	2/3/15 19:49	Last Sample Date/Time	2/3/15 9:35
Duration (hr)	38.9	Duration (hr)	48.2	Duration (hr)	37.9
Event Rain (in.)	1.05	Total Flow Volume (L)	328452	Number of Samples	109
Max Intensity (in/hr)	0.84	Peak Flow (L/s)	61		

Figure 5-6 Post Construction Hydrograph; Storm Event #3, March 11, 2015



Rain Data		Runoff Data		Sample Data	
Start Date/Time	3/11/15 4:08	Start Date/Time	3/11/15 5:16	First Sample Date/Time	3/11/15 0:00
Stop Date/Time	3/11/15 18:06	Stop Date/Time	3/11/15 18:38	Last Sample Date/Time	3/11/15 18:21
Duration (hr)	13.97	Duration (hr)	13.37	Duration (hr)	18.35
Event Rain (in.)	0.28	Total Flow Volume (L)	88300.02	Number of Samples	67
Max Intensity (in/hr)	0.24	Peak Flow (L/s)	18.33		

5.6 Subtidal Sediment Sample Collection

Sediment grab sampling in Trinidad Bay was performed by ADH on May 08, 2012. Sediment samples were collected from four sites within Trinidad Bay (Figure 1). Despite difficulties locating areas with favorable soft-bottom substrate in a largely rocky-bottomed harbor, surficial sediment samples representative of recent surface deposition were successfully collected at three locations in relatively shallow water and one in deeper water. The four samples were combined and homogenized into one composite sample to better represent the average sediment conditions of Trinidad Bay. In addition to the field sample, a field duplicate sample was also made from this composite sample for quality assurance purposes. Samples were subjected to the following chemical analyses: physical parameters (total percent solids and sediment particle size), conventionals, hydrocarbons, total metals, organic constituents, and butyltins.

At each grab sampling location, several grabs were required to provide sufficient sediment volume for the physical, chemical, and archive samples. This was because the sediment depth recovered by the sampler was often very shallow and did not provide much volume. At each of the four locations, four grab samples were collected for both sufficient sample volume and better representativeness. Many grab sample attempts were either not successful (no sediment) or were rejected due to excessive wash out or disturbance. Overall, sediment was successfully collected from 16 grab samples out of numerous attempts at four locations; this does not include many exploratory sampling efforts in other locations within the harbor.

Sampling summaries detailing the collection date and time, water depth, grab recovery depth, and position coordinates are presented in Table 5-4. Sediment sample descriptions are summarized in Table 5-5. All field sediment sampling logs are presented in Appendix F on the final report CD.

Table 5-4 Sediment Replicate Grab Sample Recoveries and Coordinates (May 8, 2012)

Sample ID*	Time	Water Depth (MLLW, Feet)	Grab Recovery (Centimeters)	Latitude	Longitude
Replicate 4-1	09:25	9.8	3	41º 03' 21.8"	-124º 08' 40.9"
Replicate 4-2	09:42	8.9	4	41º 03' 21.8"	-124º 08' 40.9"
Replicate 4-3	09:49	10.2	3	41º 03' 21.7"	-124º 08' 41.1"
Replicate 4-4	10:00	9.8	3	41º 03' 21.7"	-124º 08' 41.2"
Replicate 2-1	10:10	14.8	3	41º 03' 18.8"	-124º 08' 48.0"
Replicate 2-2	10:17	14.0	2	41º 03' 18.4"	-124º 08' 48.3"
Replicate 2-3	10:24	13.7	2	41º 03' 18.8"	-124º 08' 48.2"
Replicate 2-4	10:28	14.7	2.5	41º 03' 17.9"	-124º 08' 48.0"
Replicate 5-1	11:01	39.1	3	41º 03' 11.1"	-124º 08' 46.5"
Replicate 5-2	11:47	43.1	2	41º 03' 10.4"	-124º 08' 43.6"
Replicate 5-3	11:59	45.1	5.5	41º 03' 10.7"	-124º 08' 44.0"
Replicate 5-4	12:19	44.3	3.5	41º 03' 09.1"	-124º 08' 42.9"
Replicate 6-1	13:06	13.0	2	41º 03' 19.0"	-124º 08' 50.6"
Replicate 6-2	13:09	13.0	2	41º 03' 19.1"	-124º 08' 50.3"
Replicate 6-3	13:13	13.1	3	41º 03' 18.9"	-124º 08' 50.3"
Replicate 6-4	13:06	11.1	2.5	41º 03' 18.8"	-124º 08' 50.0"

* Replicate sample location numbers 2 and 4 correspond to locations previously sampled for the Trinidad Pier Reconstruction Project in July 2011. Replicate sample location numbers 5 and 6 are new sampling locations.

Table 5-5 Sediment Grab Sample Descriptions (May 8, 2012)

Sample ID	Sediment Type	Odor/ Sheen	Color	Debris	Biological Activity
Replicate 4-1	FINE SAND w/ Trace Fines	Slight Oil Sheen	Gray	Trace Fine Organic Debris	Amphipod Tubes, Olivella Snail
Replicate 4-2	FINE SAND w/ Trace Fines	Slight Oil Sheen	Gray	Trace Fine Organic Debris	Amphipod Tubes, Olivella Snail, Polychaete
Replicate 4-3	FINE SAND w/ Trace Fines	Slight Oil Sheen	Gray	Trace Fine Organic Debris	Amphipod Tubes
Replicate 4-4	FINE SAND w/ Trace Fines	None	Gray	Trace Fine Organic Debris	Amphipod Tubes
Replicate 2-1	FINE SAND w/ Little Fines	Slight Oil Sheen	Gray-Green	Little Fine Organic Debris	Olivella Snail
Replicate 2-2	FINE SAND w/ Little Fines	Slight Oil Sheen	Gray-Green	Little Fine Organic Debris	Olivella Snail
Replicate 2-3	FINE SAND w/ Little Fines	Slight Oil Sheen	Gray-Green	Trace Fine Organic Debris	Amphipod Tubes
Replicate 2-4	FINE SAND w/ Little Fines	Slight Oil Sheen	Gray-Green	Trace Fine Organic Debris	Amphipod Tubes, Polychaetes
Replicate 5-1	Thin Layer SILT over FINE SAND w/ Little Fines, Shell Hash	None	Tan-Gray Silt, Gray Sand	None	None
Replicate 5-2	Loose SILT w/ Trace Fine Sand, 1 cobble	None	Tan	None	None
Replicate 5-3	Thin Layer SILT over SILT w/ Little Fine Sand	None	Tan Silt Layer, Gray-Black Sandy Silt	None	None
Replicate 5-4	Thin Layer SILT over FINE SAND and SILT w/ Little Shell Hash	None	Gray	None	None
Replicate 6-1	FINE SAND	None	Gray	None	Amphipod Tubes
Replicate 6-2	FINE SAND	None	Gray	None	Amphipod Tubes
Replicate 6-3	FINE SAND	None	Gray	None	Amphipod Tubes
Replicate 6-4	FINE SAND	None	Gray	None	Amphipod Tubes

5.7 California Mussel Tissue Sample Collection

Mussel sampling in Trinidad Bay was performed by ADH on April 12, 2013. Sample collection could not be performed from shore because there are no suitable mussel beds on rocks in inner Trinidad Bay. Therefore, three separate offshore rocks, approximately 290, 480 and 650 meters from the City of Trinidad's stormwater outfall, were accessed by rowboat for sample collection (Figure 1-1). Table 5-6 presents the coordinates of each sampling location and the range and average shell length of the mussels collected.

Table 5-6 California Mussel Shell Length and Station Coordinates (April 12, 2013)				
Sampling Site	Mussel Shell Length Average (cm)	Mussel Shell Length Range (cm)	Latitude	Longitude
Station A & Duplicate	6.5	5.2 – 8.4	41º 05488	-124º 14425
Station B & Duplicate	6.4	5.1 – 8.1	41º 05306	-124º 14058
Station C & Duplicate	6.5	5.1 – 8.1	41º 05256	-124º 14442

6.0 WATER QUALITY DATA RESULTS

Stormwater and seawater samples collected from the City of Trinidad's stormwater discharge and the ORW included flow-weighted stormwater composite samples and ORW composite samples. These samples were each subjected to a comprehensive suite of chemical analyses. Toxicity testing was performed on samples collected in the pre-construction 2013-2014 and post-construction 2014-2015 seasons only. Discrete grab samples for indicator bacteria and oil & grease were collected at approximately peak flow at the outfall for storm events sampled during 2011-2012 only; for 2013-2014 and 2014-2015 bacteria sampling was discontinued and oil & grease was sampled via the composite sampler. Physical parameters such as temperature, pH, specific conductivity and salinity (seawater only) were measured in the field periodically throughout each storm event.

Field, chemistry, and toxicity results are presented in Tables 6-1a through 6-3b. Due to the long list of organic constituents (PAHs, SVOCs, organochlorine and organophosphorus pesticides, PCBs, and PBDEs) that were analyzed for, only those that were detected are included in these tables. A list of all analytical laboratory data reports is included in Appendix F; all data reports and a summary electronic data deliverable (EDD) are provided on CD.

6.1 Field Measurement Data Results

Pre-construction field measurement results for the 2011-2012 and 2013-2014 storm seasons are presented in Table 5-1a and post-construction field measurement results for the 2014-2015 storm season are presented in Table 5-1b.

Table 6-1a	Pre-Construction Water Quality – Field Measurements				
Date	Time	Temperature (ºC)	pH (units)	Specific Conductance (µS/cm)	Salinity (ppt)
Storm Event #1 (October 2-3, 2011)					
Stormwater Field Measurements [1]					
10-03-11	09:05	9.11	NT*	1,469**	NT
10-03-11	10:30	9.34	NT*	2,025**	NT
10-03-11	13:30	9.52	NT*	723**	NT
10-04-11	17:22	15.30	NT*	95	NT
10-04-11	20:15	15.00	NT*	71	NT
10-05-11	09:35	14.90	NT*	60	NT
Receiving Water Field Measurements [2]					
10-03-11	08:45	13.38	NT*	50,510	33.09
10-03-11	10:30	13.40	NT*	46,010	29.79
10-03-11	11:45	13.40	NT*	49,900	32.64
10-03-11	14:50	13.42	NT*	50,400	33.02
10-03-11	17:03	13.40	NT*	50,840	33.33
Storm Event #2 (January 17-20, 2012)					
Stormwater Field Measurements [1]					
01-17-12	23:00	9.40	7.09	3056**	NT
01-18-12	07:30	7.43	7.18	80	NT
01-18-12	12:53	8.77	7.93	62	NT
01-18-12	18:48	9.23	7.49	192	NT
01-19-12	00:25	9.57	7.38	92	NT
01-19-12	06:35	9.70	7.17	106	NT
01-19-12	12:38	10.29	7.26	135	NT
01-19-12	18:35	10.53	7.11	158	NT
01-20-12	00:35	10.63	7.56	317	NT
Receiving Water Field Measurements [2]					
01-18-12	07:36	8.51	7.89	48,030	31.02
01-18-12	13:00	9.08	7.91	46,600	30.04
01-18-12	18:42	9.18	7.96	48,170	31.16
01-19-12	00:25	9.28	7.89	47,870	30.96
01-19-12	06:35	9.40	7.91	43,080	27.55
01-19-12	12:26	9.69	`7.92	42,840	27.41
01-19-12	18:45	9.83	7.89	44,840	28.86
01-20-12	00:35	10.02	7.85	46,410	29.96
Storm Event #3 (April 10-13, 2012)					
Stormwater Field Measurements [1, 3]					
04-10-12	18:35	12.41	7.31	23	NT
04-12-12	00:37	10.01	7.62	71	NT
04-12-12	06:10	9.91	7.50	122	NT
04-12-12	14:20	10.26	7.24	50	NT
04-12-12	18:11	9.07	7.68	39	NT
04-12-12	23:06	8.74	7.96	69	NT

Table 6-1a	Pre-Construction Water Quality – Field Measurements				
Date	Time	Temperature (ºC)	pH (units)	Specific Conductance (µS/cm)	Salinity (ppt)
Receiving Water Field Measurements[2, 3]					
04-10-12	20:55	11.35	7.97	38,670	24.53
04-12-12	06:40	10.07	7.97	42,400	27.11
04-12-12	14:41	10.36	7.98	36,660	23.12
04-12-12	18:16	9.92	7.66	34,020	21.44
04-12-12	23:18	9.86	7.81	42,840	27.43
04-13-12	06:54	9.83	7.95	43,940	28.20
Storm Event #4 (January 10-11, 2014)					
Stormwater Field Measurements					
Field log forms for this event were lost.					
Receiving Water Field Measurements					
Field log forms for this event were lost.					
Storm Event #5 (March 24-26, 2014)					
Stormwater Field Measurements					
03-26-14	07:00	11.5	7.88	131	0.08
Receiving Water Field Measurements					
NA: no ORW was sampled for this event.					

Note: Physical parameters were measured by a YSI 556 MPS hand held water quality meter.
* The pH probe was malfunctioning.
** These high values are likely due to residual seawater inside the outfall pipe, which is nearly full of rocks and sand.
1 Physical measurements were performed nearly each time the stormwater sampling station was visited.
2 Physical measurements were performed each time a seawater grab sample was collected; multiple grabs were collected for the creation of a receiving water “composite” sample.
3 Values presented here are the third measurement of triplicate readings.

Table 6-1b	Post-Construction Water Quality – Field Measurements				
Date	Time	Temperature (ºC)	pH (units)	Specific Conductance (µS/cm)	Salinity (ppt)
Storm Event #1 (October 10-11, 2014)					
Stormwater Field Measurements [1]					
10-14-14	16:34	16.29	7.35	69	NA
10-15-14	10:00	14.93	7.82	423	NA
Receiving Water Field Measurements [2]					
10-14-14	16:45	13.7	7.64	38,254	24.52
10-14-14	18:10	13.17	8.01	44,986	29.18
10-15-14	07:00	12.57	7.26	48,890	31.95
10-15-14	10:00	12.9	7.91	49,784	32.58
Storm Event #2 (February 2-3, 2015)					
Stormwater Field Measurements [1]					
02-02-15	08:30	10.2	7.43	85	NA
02-02-15	11:30	11.4	7.59	102	NA
02-03-15	10:15	10.8	7.32	61	NA
Receiving Water Field Measurements [2]					
02-01-15	16:30	12.6	7.9	49,100	32.0
02-02-15	08:15	12.3	8.1	NR	29.8
02-02-15	09:30	12.5	8.0	NR	31.4
02-02-15	11:30	12.7	7.8	NR	29.5
02-02-15	15:45	13.5	7.9	NR	30.5
02-03-15	08:30	12.5	8.0	NR	29.2
Storm Event #3 (March 11-12, 2015)					
Stormwater Field Measurements [1]					
03-11-15	08:00	NS	NS	NS	NS
03-12-15	05:00	NS	NS	NS	NS
Receiving Water Field Measurements [2]					
03-10-15	21:00	11.3	8.0	NA	35.6
03-11-15	08:00	11.0	8.0	NA	35.3
03-11-15	16:00	11.9	7.9	NA	34.5
03-12-15	03:00	11.8	7.8	NA	33.3

Note: Physical parameters were measured by a YSI 556 MPS hand held water quality meter.

1 Physical measurements were performed nearly each time the stormwater sampling station was visited.

2 Physical measurements were performed each time a seawater grab sample was collected; multiple grabs were collected for the creation of a receiving water "composite" sample.

NR Not Recorded

NS Not Sampled

6.2 Water Chemistry Data Results

Pre-construction water chemistry results for the 2011-2012 and 2013-2014 storm seasons are presented in Table 6-2a; post-construction results for the 2014-2015 post-construction storm season are presented in Table 6-2b. Only those organic compounds that were detected at least once are included in these tables. Refer to Appendix B, Tables B-1a and B-1b, for all data results. All laboratory data reports and an EDD for water chemistry data are on a CD included with the final report.

Table 6-2a Pre-Construction Water Quality – Analytical Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	Post-Storm ORW	
Indicator Bacteria (MPN/100ml)									
Total Coliforms	>24,196	10,462	7,701	809, NT	>24,196	4611	NT	NT	10,000
E. coli	9,208	350	341	41, NT	185	20	NT	NT	400
Enterococcus	14,136	1,119	1,106	253, NT	305	63	NT	NT	104
Conventionals & Hydrocarbons									
Turbidity (NTU)	32.5, 39.0	18.0	12	26, 7.6	19	7.2	NT	9.81, 9.75	-
TSS (mg/L)	85.5, 152	95.0, 95.0	40	120, 120	60	71	20.2	41, 52.8	-
Settleable Solids (ml/L/hr)	0.2	0.1	0.1	0.3, 0.3	0.1	0.15	NT	NT	-
Ammonia as N (mg/L)	0.068	0.07	0.22	0.048 U, 0.053 J	0.20	0.048 U	0.04 J	0.03 J, 0.03 J	2.4, 6.0 [b]
Nitrate as N (mg/L)	0.264	NT	0.041 U	NT	0.37	NT	0.24	0.24, 0.21	-
Nitrate+Nitrite as N (mg/L)	NT	0.094	NT	0.27, 0.43	NT	0.13	NT	NT	-
Total Phosphorus (mg/L)	0.328	0.116	0.073	0.12, 0.14	0.17	0.094	NT	NT	-
Orthophosphate (mg/L)	NT	NT	NT	NT	NT	NT	0.05	0.06, 0.06	-
Total Cyanide (µg/L)	NT	3 U	2.7 U	2.7 U	2.7 U	2.7 U	NT	NT	4, 10 [b]
MBAS (mg/L)	0.050 U	0.054	0.033 J	0.027 J, 0.030 J	0.066	0.043 J	NT	NT	-
TOC (mg/L)	5.3	2.1	120 D(200x)	2.1, 1.6	3.7	66 D(40x)	NT	NT	-
Oil & Grease (mg/L)	0.8 J	0.8 U	1.3 U	2.2 J, 1.3 U	1.3 U	1.3 U	1.0 U	1.0 U, 1.0 U	-
Diesel Range Organics (mg/L)	0.42	0.028 J	0.098 J	0.024 U	0.24 U D(10x)	0.055 J	NT	NT	-
Total Metals (µg/L)									
Antimony	0.39	2.04	0.11 J	0.15 J, 0.14 J	0.098 J	0.14 J	NT	NT	1,200 [c]
Arsenic	0.70	1.83 N	0.36	1.4, 1.4	0.22	1.4	1.593	1.388, 1.256	32, 80 [b]
Beryllium	0.038	0.0316	0.039 U	0.039 U, 0.078	0.039 U	0.039 U	NT	NT	0.033 [c]
Cadmium	0.081	0.103	0.034	0.071, 0.077	0.061	0.063	0.048	0.0476, 0.0499	4, 10 [b]
Total Chromium	4.78	3.75	3.4	5.7, 5.7	2.5	2.2	2.864	2.764, 2.1357	8, 20 [b]
Chromium VI	NR	0.01 J,H	NT	NT	NT	NT	NT	NT	8, 20 [b]
Copper	12.8	2.380	3.5	2.5, 2.9	4.2	2.9	0.989	1.178, 1.365	12, 30 [b]
Lead	5.360	0.874	2.6	1.1, 1.3	3.1	0.73	0.2872	0.3127, 0.2866	8, 20 [b]

Table 6-2a Pre-Construction Water Quality – Analytical Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	Post-Storm ORW	
Mercury	0.0154	0.0049	0.0024 H	0.0053 H, 0.0061 H	0.013	0.013	0.0012 U	0.0012 U, 0.0012 U	0.16, 0.4 [b]
Nickel	6.75	6.40	2.5	7.3, 8.1	1.4	5.4	3.0634	2.6327, 3.2059	20, 50 [b]
Selenium	0.2 U	0.2 U	0.034 U	0.045 J, 0.044 J	0.034 U	0.060 J	0.018	0.016, 0.025	60, 150 [b]
Silver	0.30	0.014 J	0.018 U	0.018 U, 0.018 U	0.038 J	0.018 U	0.01 U	0.01 U, 0.01 J	2.8, 7 [b]
Thallium	0.024	0.010 J	0.011 U	0.015 J, 0.014 J	0.011 U	0.011 J	NT	NT	2 [c]
Zinc	53.0	5.87	21	6.4, 6.7	25	5.4	13.6612	2.7661, 2.4869	80, 200 [b]
Polycyclic Aromatic Hydrocarbons (µg/L)									
Acenaphthene	0.031 U	0.029 U	0.020 U,H,PJM	0.020 U,H,PJM 0.038 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Acenaphthylene	0.029 J	0.017 U	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Anthracene	0.037 J	0.017 U	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	NR	NR	0.0088 [d]
Benzo(a)anthracene	0.030 J	0.020 U	0.024 J,H,PJM	0.020 U,H,PJM 0.035 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(a)pyrene	0.037 U	0.035 U	0.020 U,H,PJM	0.020 U,H,PJM 0.033 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(b)fluoranthene	0.050 J	0.019 U	0.020 U,H,PJM	0.020 U,H,PJM 0.039 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(g,h,i)perylene	0.056 J	0.022 U	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(k)fluoranthene	0.046 J	0.027 U	0.020 U,H,PJM	0.020 U,H,PJM 0.039 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Chrysene	0.061 J	0.032 U	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Fluoranthene	0.078 J	0.023 J	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	NR	NR	15 [c]
Fluorene	0.033 U	0.030 U	0.020 U,H,PJM	0.020 U,H,PJM 0.027 J,H,PJM	0.10 U	0.10 U	0.0016 J	0.0035 J, 0.0039 J	0.0088 [d]

Table 6-2a Pre-Construction Water Quality – Analytical Data Results									
	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria[a]
Parameter	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	Post-Storm ORW	
Indeno(1,2,3-c,d)pyrene	0.025 U	0.024 U	0.020 U,H,PJM	0.020 U,H,PJM 0.031 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Methylnaphthalene, 2-	0.040 J	0.029 U	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.1000 U	0.1000 U	NR	NR	0.0088 [d]
Naphthalene	0.068 J	0.025 U	0.020 U,H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	NR	NR	0.0088 [d]
Phenanthrene	0.056 J	0.036 J	0.020 U,H,PJM	0.024 J,H,PJM 0.065 J,H,PJM	0.10 U	0.10 U	0.0029 J	0.0059, 0.0065	0.0088 [d]
Pyrene	0.078 J	0.029 J	0.020 U,H,PJM	0.020 U,H,PJM 0.025 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Total Detectable PAHs	*0.629*	*0.089*	*0.024*	*0.0, 0.332*	*0.0*	*0.0*	*0.0045*	*0.0094*	-
Organochlorine Pesticides (ng/L)									
Of 24 organochlorine pesticides analyzed for, only one was detected (below).									
Endosulfan Sulfate	2.5 Ui	0.28 U	5.9	5.0 U	5.0 U	5.0 U	NT	NT	18, 27 [b]
Polychlorinated Biphenyls (PCBs) (ng/L)									
Of 7 Aroclors analyzed for, none were detected.									
Organophosphorus Pesticides (µg/L)									
Of 25 organochlorine pesticides analyzed for, none were detected.									
Pyrethroid Pesticides (µg/L)									
Of 16 pyrethroid pesticides analyzed for, two were detected (below).									
Allethrin	0.0001 U	0.0001 U	0.00085 U	0.00085 U	0.310 D (5)	0.00085 U	NT	NT	-
Bifenthrin	0.019	0.0029	0.00079 U	0.00079 U	0.00079 U	0.00079 U	0.0005 U	0.0005 U, 0.0005 U	-
Other SVOCs, including Phenols and Phthalates (µg/L)									
Of 57 non-PAH SVOCs analyzed for, 13 were detected (below).									
Benzoic Acid	1.6 J	1.3 U	8.6 U,H,PJM	8.6 U,H,PJM 8.6 U,H,PJM	8.6 U	8.6 U	NT	NT	-
Benzyl Alcohol	0.17 J	0.082 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	-

Table 6-2a Pre-Construction Water Quality – Analytical Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	Post-Storm ORW	
Bis(2-ethylhexyl) Phthalate	1.10 J	0.30 J	2.3 U,H,PJM	2.3 U,H,PJM 2.9 J,H,PJM	2.3 U	2.3 U	NT	NT	-
Butyl Benzyl Phthalate	0.17 J	0.041 J	0.18 U,H,PJM	0.18 U,H,PJM 0.18 U,H,PJM	0.18 U	0.18 U	NT	NT	-
Dibenzofuran	0.039 J	0.020 U	0.37 U,H,PJM	0.37 U,H,PJM 0.37 U,H,PJM	0.37 U	0.37 U	NT	NT	-
Dichlorophenol, 2,4-	0.060 J	0.053 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	-
Diethyl Phthalate	0.81	0.051 J	0.40 J,H,PJM	0.15 U,H,PJM 0.25 U,H,PJM	0.58 J	0.15 U	NT	NT	33,000 d
Dimethyl Phthalate	0.8	0.028 J	0.18 U,H,PJM	0.18 U,H,PJM 0.18 U,H,PJM	0.18 U	0.18 U	NT	NT	820,000 d
Di-n-butyl Phthalate	0.11 J	0.034 J	0.24 U,H,PJM	0.24 U,H,PJM 0.24 U,H,PJM	0.24 U	0.24 U	NT	NT	3,500 d
Di-n-octyl Phthalate	0.11 J	0.020 U	0.19 U,H,PJM	0.19 U,H,PJM 0.19 U,H,PJM	0.19 U	0.19 U	NT	NT	-
Isophorone	0.087 J	0.018 U	0.21 U,H,PJM	0.21 U,H,PJM 0.21 U,H,PJM	0.21 U	0.21 U	NT	NT	730 b
Pentachlorophenol	0.55 J	0.38 U	0.19 U,H,PJM	0.19 U,H,PJM 0.19 U,H,PJM	1.2	0.19 U	NT	NT	1, 4, 10 c
Phenol	1.4	0.070 U	0.16 U,H,PJM	0.16 U,H,PJM 0.16 U,H,PJM	0.16 U	0.16 U	NT	NT	3, 120, 300 c

1 The high conductivity values are likely due to residual seawater inside the outfall pipe, which is nearly full with rocks and sand.
* Results presented are for the original sample and a field duplicate sample.
a California Ocean Plan (COP) water quality objectives for receiving waters; objectives for protection of marine aquatic life and objectives for protection of human health.
b Daily Maximum and Instantaneous Maximum concentrations (x, x).
c 30-day Average Concentration.
d 30-day Average Concentration for the sum of 13 COP PAHs, not including fluoranthene.
i The MRL/MDL is elevated due to a chromatographic interference.
D Analyte analyzed at a secondary dilution; the number in parentheses is the dilution factor.
H A holding time violation occurred.
J The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
PJM The result is from a re-extraction and re-analysis to confirm original result.
U The compound was analyzed for, but was not detected at or above the associated MDL.
NR Not Reported
NT Not Tested
ORW Ocean Receiving Water
PAHs Polycyclic Aromatic Hydrocarbons
PCBs Polychlorinated Biphenyls
SVOCs Semi-Volatile Organic Compounds
TRI-032 Trinidad ASBS stormwater discharge

Table 6-2b Post-Construction Water Quality – Analytical Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	Post-Storm ORW	TRI-032	Post-Storm ORW	TRI-032	Post-Storm ORW*	
Indicator Bacteria (MPN/100ml)							
Total Coliforms	NT	NT	NT	NT	NT	NT	10,000
E. coli	NT	NT	NT	NT	NT	NT	400
Enterococcus	NT	NT	NT	NT	NT	NT	104
Conventionals							
Turbidity (NTU)	43.6	5.3	33.9	7.44	37.7	4.88, 5.96	-
TSS (mg/L)	197.3	95.7	68.6	123	109.5	66.8, 44.1	-
Settleable Solids (ml/L/hr)	0.3	0.4	0.2	0.3	0.2	0.2	-
Ammonia as N (mg/L)	0.02 U	0.02 U	0.03 J	0.03 J	0.07	0.02 U, 0.02 U	2.4, 6 [b]
Nitrate as N (mg/L)	13.27	0.35	0.29	0.14	0.39	0.15, 0.16	-
Nitrate+Nitrite as N (mg/L)	NT	NT	NT	NT	NT	NT	-
Total Phosphorus (mg/L)	NT	NT	NT	NT	NT	NT	-
Orthophosphate (mg/L)	0.22	0.05	0.1	0.06	0.03	0.05, 0.05	-
Total Cyanide (µg/L)	NT	NT	NT	NT	NT	NT	4, 10 [b]
MBAS (mg/L)	NT	NT	NT	NT	NT	NT	-
TOC (mg/L)	8.6	NR	1.7	1.4	8.2	1.0, 1.1	-
Oil & Grease (mg/L)	3	1 U	1.2	1 U	2.4	1 U, 1 U	-
Diesel Range Organics (mg/L)	0.17	0.04 U	0.064 J	0.0412 U	0.064 J	0.0436 U, 0.0436 U	-
Oil Range Organics (mg/L)	0.23 J	0.07 U	0.097 J	0.0721 U	0.097 J	0.0763 U, 0.0763 U	-
Gas Range Organics (mg/L)	0.06 U	0.06 U	0.0636 U	0.0618 U	0.0636 U	0.0654 U, 0.0654 U	-
Total Metals (µg/L)							
Antimony	0.32	0.11	0.09	0.08	NT	NT	1,200 [c]
Arsenic	0.723	1.989	0.321	1.949	0.611	1.952, 1.902	32, 80 [b]
Beryllium	0.064	0.023	0.017	0.024	NT	NT	0.033 [c]
Cadmium	0.1325	0.0988	0.0396	0.0335	0.0704	0.0712, 0.0421	4, 10 [b]
Total Chromium	7.9536	4.5834	3.5094	2.8689	9.1029	4.6273, 5.482	8, 20 [b]
Copper	18.601	4.12	5.948	2.156	11.276	1.572, 1.75	12, 30 [b]
Lead	10.8805	1.2462	5.442	1.1372	4.7526	0.4108, 0.4803	8, 20 [b]
Mercury	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U, 0.0012 U	0.16, 0.4 [b]

Table 6-2b Post-Construction Water Quality – Analytical Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	Post-Storm ORW	TRI-032	Post-Storm ORW	TRI-032	Post-Storm ORW*	
Nickel	12.2502	4.7174	4.8522	5.0047	10.1367	5.1077, 5.8688	20, 50 [b]
Selenium	0.054	0.005 U	0.022	0.016	0.042	0.023, 0.028	60, 150 [b]
Silver	0.05	0.05	0.03	0.05	0.01 U	0.01 U, 0.01 U	2.8, 7 [b]
Thallium	0.013	0.005 U	0.005 U	0.005 U	NT	NT	2 [c]
Zinc	107.8856	8.9982	27.7458	3.6612	82.9803	4.1125, 3.7111	80, 200 [b]
Polycyclic Aromatic Hydrocarbons (µg/L)							
Acenaphthene	0.0038	0.0021 J	0.0062	0.0017 J	0.001 U	0.001 U, 0.001 U	0.0088 [d]
Acenaphthylene	0.0084	0.001 U	0.003 J	0.001 U	0.0106	0.001 U, 0.001 U	0.0088 [d]
Anthracene	0.0054	0.0018 J	0.0092	0.001 U	0.0115	0.001 U, 0.001 U	0.0088 [d]
Benzo(a)anthracene	0.0267	0.0025 J	0.0297	0.001 U	0.0282	0.0016 J, 0.0013 J	0.0088 [d]
Benzo(a)pyrene	0.0411	0.0031 J	0.119	0.001 U	0.0366	0.001 U, 0.001 U	0.0088 [d]
Benzo(b)fluoranthene	0.0966	0.0064	0.0623	0.0018 J	0.1162	0.0061, 0.0054	0.0088 [d]
Benzo(e)pyrene	0.1002	0.0067	0.1088	0.0014 J	0.163	0.0059, 0.0045 J	0.0088 [d]
Benzo(g,h,i)perylene	0.0817	0.0048 J	0.1461	0.0033 J	0.0459	0.001 U, 0.001 U	0.0088 [d]
Benzo(k)fluoranthene	0.0594	0.0053	0.0115	0.001 U	0.0171	0.001 U, 0.001 U	0.0088 [d]
Biphenyl	0.0154	0.0086	0.0197	0.0092	0.0138	0.0058, 0.0079	0.0088 [d]
Chrysene	0.1635	0.01	0.124	0.0034 J	0.0935	0.0031 J, 0.0029 J	0.0088 [d]
Dibenzo(a,h)anthracene	0.0085	0.001 U	0.0425	0.001 U	0.001 U	0.001 U, 0.001 U	0.0088 [d]
Dibenzothiophene	0.0076	0.0026 J	0.0155	0.001 U	0.0082	0.001 U, 0.001 U	0.0088 [d]
Dimethylnaphthalene, 2,6-	0.0176	0.012	0.0279	0.0107	0.011	0.0088, 0.0112	0.0088 [d]
Fluoranthene	0.0989	0.0133	0.1069	0.0049 J	0.0963	0.004 J, 0.0034 J	15 [c]
Fluorene	0.0096	0.0087	0.014	0.0105	0.0101	0.0062, 0.0093	0.0088 [d]
Indeno(1,2,3-c,d)pyrene	0.0279	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0088 [d]
Methylnaphthalene, 1-	0.015	0.012	0.0285	0.0116	0.0122	0.0067, 0.011	0.0088 [d]
Methylnaphthalene, 2-	0.0324	0.0222	0.0559	0.0196	0.0215	0.0102, 0.0164	0.0088 [d]
Methylphenanthrene, 1-	0.0218	0.0081	0.0237	0.0054	0.0199	0.0035 J, 0.005 J	0.0088 [d]
Naphthalene	0.0396	0.0217	0.0386	0.0128	0.0322	0.0068, 0.0096	0.0088 [d]
Perylene	0.0227	0.0048 J	0.0902	0.001 U	0.0132	0.001 U, 0.001 U	0.0088 [d]
Phenanthrene	0.0863	0.0259	0.1269	0.0195	0.0624	0.0098, 0.0127	0.0088 [d]

Table 6-2b Post-Construction Water Quality – Analytical Data Results

Parameter	Storm Event #1 10/15/2014 TRI-032	Storm Event #1 10/15/2014 Post-Storm ORW	Storm Event #2 02/03/2015 TRI-032	Storm Event #2 02/03/2015 Post-Storm ORW	Storm Event #3 03/12/2015 TRI-032	Storm Event #3 03/12/2015 Post-Storm ORW*	California Ocean Plan Criteria[a]
Pyrene	0.1212	0.0136	0.1058	0.0045 J	0.1366	0.0045 J, 0.0038 J	0.0088 [d]
Trimethylnaphthalene, 2,3,5-	0.0045 J	0.002 J	0.0062	0.0022 J	0.001 U	0.0015 J, 0.0022 J	0.0088 [d]
Total Detectable PAHs	*1.1159*	*0.1982*	*1.3221*	*0.1225*	*0.96*	*0.0845*	*0.0088 [d]*
Organochlorine Pesticides (µg/L)							
Of 24 organochlorine pesticides analyzed for, 1 was detected (below).							
Trans-Nonachlor	0.001 U	0.001 U	0.0013 J	0.001 U	0.001 U	0.001 U, 0.001 U	
Polychlorinated Biphenyls (PCBs) (µg/L)							
Of 7 Aroclors and 53 PCBs analyzed for, 0 were detected.							
Organophosphorus Pesticides (µg/L)							
Of 22 organophosphorus pesticides analyzed for, 0 were detected.							-
Pyrethroid Pesticides (ng/L)							
Of 10 pyrethroid pesticides analyzed for, 4 were detected (below).							
Bifenthrin	0.0071	0.0005 U	0.0005 U	0.0005 U	0.0068	0.0005 U, 0.0005 U	-
Cyfluthrin	0.0005 U	0.0005 U	0.0141	0.0005 U	0.0316	0.0005 U, 0.0005 U	-
Cypermethrin	0.0005 U	0.0005 U	0.0248	0.0005 U	0.007	0.0005 U, 0.0005 U	-
Lambda-Cyhalothrin	0.0005 U	0.0005 U	0.0546	0.0005 U	0.0336	0.0005 U, 0.0005 U	-
Other SVOCs, including Phenols and Phthalates (µg/L)							
Of 55 SVOCs analyzed for, 14 were detected (below).							
Benzoic Acid	0.436927	0.341916	0.1 U	0.1 U	1.277471	0.229079, 0.19406 J	2.6 [c]
Benzyl Alcohol	0.480109	0.1 U	0.1 U	0.1 U	0.240501	0.1 U, 0.1 U	-
Bis(2-chloroethyl) Ether	0.05 U	0.05 U	0.05 U	0.05 U	0.09041	0.05 U, 0.05787 J	0.045 [c]
Bis(2-ethylhexyl) Phthalate	1.34322	0.14746	0.7806	0.13012	5.41392	0.15797, 0.96696	3.5 [c]
Butyl Benzyl Phthalate	0.62612	0.16999	0.82372	0.79946	0.86663	0.31408, 0.25579	-
Dibutyl phthalate	0.16329	0.06181	0.084910	0.077120	0.20054	0.04256, 0.03387	
Dichlorophenol, 2,4-	0.06206 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Diethyl Phthalate	1.26321	0.13965	1.26182	0.20401	1.14628	0.19255, 0.21569	33,000 [c]
Dimethyl Phthalate	0.20744	0.01354 J	0.17188	0.03171	0.16682	0.03053, 0.03448	820,000 [c]
Hexachlorobenzene	0.001 U	0.001 U	0.0058	0.001 U	0.001 U	0.001 U, 0.001 U	0.00021 [c]
Isophorone	0.070410 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	730 [c]
Pentachlorophenol	0.25174	0.05 U	0.05 U	0.05 U	0.09733	0.05 U, 0.05 U	-

Table 6-2b	Post-Construction Water Quality – Analytical Data Results					
	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
Parameter	TRI-032	Post-Storm ORW	TRI-032	Post-Storm ORW	TRI-032	Post-Storm ORW*	
Phenol	**0.237658**	0.1 U	**0.104919 J**	0.1 U	**0.151753**	0.1 U, 0.1 U	-
Trichlorobenzene, 1,2,4-	0.01 U	0.01 U	0.01 U	0.01 U	**0.02614**	0.01 U, 0.01 U	-

Bolded values for PAHs, Other SVOCs and Pesticides indicate the constituent was detected at or above the method detection limit (MDL); this was done only for visual purposes.

*	Results presented are for the original field sample and a field duplicate sample.
a	California Ocean Plan (COP) water quality objectives for receiving waters; objectives for protection of marine aquatic life and objectives for protection of human health.
b	Daily Maximum and Instantaneous Maximum concentrations (x, x).
c	30-day Average Concentration.
d	30-day Average Concentration for the sum of 13 COP PAHs, not including fluoranthene.
J	The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
U	The compound was analyzed for, but was not detected at or above the associated MDL.
NR	Not Reported
NT	Not Tested
ORW	Ocean Receiving Water
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
SVOCs	Semi-Volatile Organic Compounds
TRI-032	Trinidad ASBS stormwater discharge

6.3 Water Toxicity Data Results

Per the original project QAPP and MP no toxicity sampling was required and no toxicity samples were collected during the 2011-2012 storm season. Specific toxicity testing was added later and is presented here. Pre-construction water toxicity results for the 2013-2014 storm seasons are presented in Table 6-3a; post-construction toxicity results for the 2014-2015 storm season are presented in Table 6-3b. Refer to Appendix B, Tables B-2a and B-2b, for all data results. All laboratory data reports and EDDs are on the CD included with the final report.

All pre-construction and post-construction samples for both stormwater and ORW were found to be not toxic to test organisms.

Table 6-3a Pre-Construction Water Quality Toxicity Data Results

Site	Sample Date	Test Organism	Parameter	TST Test Result (Pass/Fail)
TRI-032	01/11/2014	Sea Urchin	Egg Fertilization (%)	Pass
ORW		Sea Urchin	Egg Fertilization (%)	Pass
		Mussel	Embryo Survival/Development (%)	Pass
		Kelp	Germination (%)	Pass
		Kelp	Growth (µm)	Pass
TRI-032	03/26/2014	Sea Urchin	Egg Fertilization (%)	Pass
		Mussel	Embryo Survival/Development (%)	Pass
		Kelp	Germination (%)	Pass
		Kelp	Growth (µm)	Pass

Table 6-3b Post-Construction Water Quality Toxicity Data Results

Site	Sample Date	Test Organism	Parameter	TST Test Result (Pass/Fail)
TRI-032	10/15/2014	Sea Urchin	Egg Fertilization (%)	Pass
ORW		Sea Urchin	Egg Fertilization (%)	Pass
		Mussel	Embryo Survival/Development (%)	Pass
		Kelp	Germination (%)	Pass
		Kelp	Growth (µm)	Pass
TRI-032	02/03/2015	Sea Urchin	Egg Fertilization (%)	Pass
ORW		Sea Urchin	Egg Fertilization (%)	Pass
		Mussel	Embryo Survival/Development (%)	Pass
		Kelp	Germination (%)	Pass
		Kelp	Growth (µm)	Pass
ORW	03/12/2015	Sea Urchin	Egg Fertilization (%)	Pass
		Mussel	Embryo Survival/Development (%)	Pass
		Kelp	Germination (%)	Pass
		Kelp	Growth (µm)	Pass

7.0 SUBTIDAL SEDIMENT DATA RESULTS

Pre-construction sediment chemistry results are presented in Table 7-1. Only those organic compounds that were detected at least once are included in this table. Refer to Appendix C, Table C-1, for all data results. All laboratory data reports and a summary EDD are on the CD included with the final report. Post-construction sediment sampling and analysis was eliminated from the monitoring program for reasons described earlier in Section 3.3.4.

Table 7-1 Subtidal Sediment Analytical Data Results

Parameter	Subtidal Sediment		NOAA Guideline
	Field Sample	Field Duplicate Sample	ERL/ERM[1]
Total Solids (%; CAS)	73.4	74.1	-
Total Solids (%; Caltest)	95	94	-
*Sediment Particle Size (%)**			
Total Sand (0.0625-2.0 mm)	84.26	81.64	-
Gravel (>2 mm)	0.06	0.06	-
Sand, very coarse (1.00-2.00 mm)	0.34	0.39	-
Sand, coarse (0.500-1.00 mm)	0.96	0.94	-
Sand, medium (0.250-0.500 mm)	2.39	2.11	-
Sand, fine (0.125-0.250 mm)	39.46	39.19	-
Sand, very fine (0.0625-0.125 mm)	41.05	38.95	-
Silt (0.0039-0.0625 mm)	12.89	12.21	-
Clay (<0.0039 mm)	2.41	2.31	-
Conventionals & Hydrocarbons			
Ammonia as Nitrogen (mg/kg)	12.1	14.2	-
Total Organic Carbon (%)	0.364	0.363	-
Total Cyanide	0.27	0.27	-
Oil & Grease (mg/kg)	110 U	110 J	-
TPH-Diesel (mg/kg)	2.5 J	3.7 FDP,J	-
TPH Oil (mg/kg)	12 J	16 FDP,J	-
Total Metals (mg/kg)			
Antimony	0.127 D	0.245 D,FDP	-
Arsenic	4.15 D	3.70 D	8.2/70
Beryllium	0.200 D	0.169 D	-
Cadmium	0.073 D	0.071 D	1.2/9.6
Total Chromium	57.1 D	51.4 D	81/370
Chromium VI	0.44 D,J	0.22 D,FDP,J	-
Copper	14.9 D	12.2 D	34/270
Lead	4.270 D	4.020 D	8.0/218
Mercury	0.0203 D	0.0229 D	0.15/0.71
Nickel	65.8 D	60.4 D	20.9/51.6
Selenium	0.07 D,J	0.06 D,J	-
Silver	0.032 D	0.048 D,FDP	1.0/3.7
Thallium	0.0583 D	0.0585 D	-
Zinc	42.1 D	39.8 D	150/410

Table 7-1 Subtidal Sediment Analytical Data Results			
Parameter	Subtidal Sediment		NOAA Guideline
	Field Sample	Field Duplicate Sample	ERL/ERM[1]
Organochlorine Pesticides (µg/kg)			
Of 24 organochlorine pesticides analyzed for, 3 were detected (below).			
delta-BHC[4]	0.01 J	0.074 U	-
Endrin	0.094 U	0.12 J	-
Heptachlor Epoxide	0.12 J	0.27 FDP,J	-
Polychlorinated Biphenyls (PCBs) (µg/kg)			
Of 7 Aroclors analyzed for, 0 were detected.			
Organophosphorus Pesticides (µg/kg)			
Of 24 organophosphorus pesticides analyzed for, 0 were detected.			
Pyrethroid Pesticides (µg/kg)			
Of 11 pyrethroid pesticides analyzed for, 0 were detected.			
Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg)			
Of 15 PAHs analyzed for, 5 were detected.			
1-Methylnaphthalene	4.7 J	5.3 J	-
2-Methylnaphthalene	9.1	9.1	70/670
Fluorene	4.2 J	4.1 J	19/540
Naphthalene	5.6 J	5.6 J	160/2100
Phenanthrene	8.8	8.3	240/1500
Total Detectable PAHs	*18.6*	*18.0*	*4022/44792*
Other SVOCs, including Phenols and Phthalates (µg/kg)			
Of 50 SVOCSs analyzed for, 2 were detected.			
Di-n-butyl Phthalate	6.0 J	6.4 J	-
Phenol	12 J	7.5 FDP,J	-
Butyltins (µg/kg)			
Monobutyltin	0.53 JP	0.36 U	-
Dibutyltin	0.26 U	0.28 J	-
Tributyltin	0.58 U	0.58U	-
Tetrabutyltin	0.60 U	0.60 U	-

Bolded values indicate the constituent was detected at or above the method detection limit (MDL)
* Values are normalized to 100 percent recovery.
D Analyte analyzed at a secondary dilution.
FDP Field duplicate RPD above QC limit.
J The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
U The compound was analyzed for, but was not detected at or above the associated method detection limit.
Caltest Caltest Analytical Laboratories
CAS Columbia Analytical Services
ERL Effects Range Low
ERM Effects Range Median
SVOCs Semi-Volatile Organic Compounds

8.0 CALIFORNIA MUSSEL TISSUE DATA RESULTS

Pre-construction California mussel tissue chemistry results are presented in Table 8-1. Only those organic compounds that were detected at least once are included in this table. Refer to Appendix D, Table D-1, for all data results. All laboratory data reports and a summary EDD are on the CD included with the final report. Post-construction mussel tissue sampling and analysis was not included in the monitoring program.

Tissue concentrations of all analytes were either very low or not detected. All detected analytes were in concentrations well below the Food and Drug Administration's guidance levels for seafood (FDA, 2001).

Table 8-1 Pre-Construction California Mussel Tissue Chemistry

Parameter	California Mussel Tissue (04/10/2013)		FDA Guidance Levels for Seafood [1]
	Field Sample	Field Duplicate Sample	
Total Solids (%)	17.10	17.10	NA
Total Lipids (%)	0.81	0.99	NA
Total Metals (mg/Kg dw; ppm)			
Aluminum	36.5 N	34.8 N	-
Antimony	0.0031 D (5x), J	0.0020 D (5x), J	-
Arsenic	1.830 D (5x)	1.88 D (5x)	86 ppm
Beryllium	NT	NT	-
Cadmium	1.130 D (5x)	1.38 D (5x)	4 ppm
Total Chromium	0.28 D (5x)	0.31 D (5x)	13 ppm
Chromium VI	NT	NT	-
Copper	1.04 D (5x)	1.11 D (5x)	-
Lead	0.18 D (5x)	0.20 D (5x)	1.7 ppm
Manganese	1.26	1.23	-
Mercury (ng/g; ppb)	21.7 D (100x)	23.6 D (100x)	1,000 ppb (for methyl mercury)
Nickel	0.42 D (5x)	0.45 D (5x)	80 ppm
Selenium	0.49 D (5x)	0.57 D (5x)	-
Silicon	30.10	33.60	-
Silver	0.01 D (5x)	0.01 D (5x)	-
Thallium	0.0010 D (5x), J	0.0011 D (5x), J	-
Tin	0.0510 U	0.0510 U	-
Zinc	20.00 D (5x)	23.40 D (5x)	-
Polycyclic Aromatic Hydrocarbons & Carbazole (µg/Kg dw; ppb)			
Of 24 PAHs analyzed for, 11 were detected (below).			
Benzo(a)pyrene	0.29 J	0.44 J	-
Biphenyl	0.54 J	0.45 J	-
Dimethylnaphthalene, 2,6-	1.60	2.7	-
Fluoranthene	0.19 J	0.23 J	-
Fluorene	0.16 J	0.15 J	-
Methylnaphthalene, 2-	0.42 J	0.1200 U	-
Naphthalene	0.64 J	0.76 J	-

Table 8-1 Pre-Construction California Mussel Tissue Chemistry			
Parameter	California Mussel Tissue (04/10/2013)		FDA Guidance Levels for Seafood [1]
	Field Sample	Field Duplicate Sample	
Perylene	0.38 J	0.52	-
Phenanthrene	0.55	0.56	-
Pyrene	0.14 J	0.15 J	-
Trimethylnaphthalene, 2,3,5-	0.0530 U	0.26 J	-
Total Detectable PAHs	4.91	6.22	-
Carbazole	1.40	2.00	-
Organochlorine Pesticides (µg/Kg dw; ppb)			
Of 15 OC pesticides analyzed for, 6 detected (below).			
alpha-BHC	0.23 J	0.39 J	-
delta-BHC	0.32 J	0.29 J	-
alpha-Chlordane	0.49 J	0.43 J	300 ppb
Dieldrin	0.46 J	0.55 J	300 ppb
Chlorpyrifos	0.53 J	0.61 J	-
Heptachlor Epoxide	4.50	4.40	300 ppb
Polychlorinated Biphenyls (PCBs) (µg/Kg dw; ppb)			
Of 57 PCBs analyzed for, only one was detected (below).			
PCB 095	0.21 J	0.2800 U	200 ppb
Polybrominated Diphenyl Ethers (µg/Kg dw; ppb)			
Of 17 PBDEs analyzed for, none were detected.			

1 Food and Drug Administration action levels, tolerances and guidance levels for poisonous or deleterious substances in seafood (FDA, 2001).
D = The laboratory diluted the sample. The number in parentheses is the dilution factor.
J The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
N Tentatively Identified Compound
U The compound was analyzed for, but was not detected at or above the associated MDL.
ppb parts per billion
ppm parts per million
PAHs Polycyclic Aromatic Hydrocarbons
PCBs Polychlorinated Biphenyls
SVOCs Semi-Volatile Organic Compounds

9.0 PROJECT EFFECTIVENESS AND RESULTS DISCUSSION

The following subsections provide brief discussions of the project effectiveness, and notable field sampling and analytical data results. Overall, nearly all sampling and analysis components of the Monitoring Plan were successfully completed, all required field and laboratory QA/QC procedures were successfully performed, and the data can be considered acceptable for interpretation.

9.1 Project Effectiveness

As explained in the introduction, the primary purpose of the project effectiveness monitoring was to demonstrate how the City's Improvement Project has reduced its stormwater runoff volume, thereby reducing pollutant loading to the Trinidad Head ASBS and improving water quality.

9.1.1 Reduction in Stormwater Runoff

Initial estimates by the City's engineer indicated that, based on an average rainfall of 48 inches and the estimated impervious surface area in the City's watershed, the total annual volume of discharge to the ASBS should be in the order of 12 million gallons. Pre-construction stormwater flow data collected by the City's monitoring station indicate that the annual discharge was approximately 8.520 million gallons, based on an average annual rainfall of 48 inches (refer to Section 5 Table 5-2, and see explanation below). Post-construction stormwater flow data indicate that the new annual discharge is approximately 5.385 million gallons, based on an average annual rainfall of 48 inches. This calculates to a stormwater discharge reduction achievement of 36.8%, which is near the high end of the City's originally predicted project goal of 22-40%. This demonstrates that the Improvement Project, by treating stormwater flows through infiltration BMP/LID technologies, has been effective in achieving its primary goal.

Pre- and post-construction annual discharge calculation explanation:

1. Pre-construction average gallons/inch rainfall multiplied by 48 inches of rainfall (177,500 gallons/inch * 48 inches = 8,520,000 gallons),
2. Post-construction average gallons/inch rainfall multiplied by 48 inches of rainfall (112,194 gallons/inch * 48 inches = 5,385,000 gallons),

The percent reduction in stormwater runoff was calculated using the difference in the average runoff volumes per inch of rainfall for the pre- and post-construction monitoring periods (flow data was recorded in liters):

% Reduction = ABS[((LI-Post/LI-Pre)*100)-100], where:

LI-Pre is the average of liters per inch (L/inch) calculated for each month for the pre-construction period.

LI-Post is the average of liters per inch calculated for each month for the post-construction period.

9.1.2 Reduction in Pollutant Loading

Based solely on the percent reduction in stormwater discharge volume achieved by the project, it follows that there was a similar reduction of approximately 36.8% in pollutant loading to the Trinidad ASBS.

Table 9-1 presents calculated pollutant loadings based on the three pre- and three post-construction storm events that were monitored and sampled on a flow-weighted basis. Only analytes that were detected at least once are included in this analysis. Mean concentration calculations for analytes not detected 100 percent of the time use one-half (1/2) the MDL for instances of non-detect. Loadings for 2014-2015 were also normalized to the higher runoff volume measured during the 2011-2012 season, but were not reduced by the 36.8% decrease in post-construction discharge volume.

Pollutant loadings presented in Table 9-1 are best estimations that are based on a small subset (3) of dozens of storm events which occurred over the course of each monitored storm season. These numbers should not be used to definitively demonstrate that an annual reduction or increase in pollutant loading has occurred, but do provide a rough estimate of what pollutants are present in the City's stormwater discharge and possibly in what quantities.

Multiple factors associated with each monitored storm event make it difficult to interpret these data as representing an increase or decrease in pollutant loading for a particular analyte as a result of the Improvement Project. These factors include, but are not limited to, the following:

- Small sample size (only 3 storm events monitored out of dozens),
- Post-construction monitoring timing (immediately following a summer of heavy and unusual construction activities),
- Antecedent dry periods differed among events
- Storm event variability:
- Storm rainfall intensity differed among events
- Storm duration differed among events
- Variable residential and/or commercial activities
- Variable laboratory method detection limits for some analytes

The simple comparison of the pre- and post-construction stormwater quality data appears to indicate that the mean concentrations for the majority of detected conventional analytes, common metals, and PAHs in the post-construction samples were either similar to or higher than in the pre-construction samples (Table 9-1). The above mentioned complicating factors make this comparison tenuous. For example, if a fourth storm event had been sampled for each monitoring season and incorporated here, the calculated loading results could be completely different. And the same thing if a fifth event was sampled. Only when all storm events are sampled can one say accurately what the pollutant loading really is.

By far the largest pollutant inputs to the ASBS are TSS (2,144 to 4,339 kg/year), TOC (194 to 1,550 kg/year), nitrate (4.5 to 161 kg/year), and oil & grease (34 to 76 kg/year). However, these inputs are clearly variable from year to year. In general, pollutant loadings for metals and organic pollutants were relatively low and do not pose a great water quality threat to the ASBS.

Loadings for copper, chromium, lead, nickel and zinc were much higher than the other metals in both monitoring seasons. However, except for zinc (1.1 to 2.5 kg/year), loadings for these metals were all less than 0.5 kg/year (ranging from 0.13-0.24 kg/year for lead, to 0.24-0.41 kg/year for copper).

Regardless of how pollutants loadings may be analyzed and interpreted, water quality data for the ocean receiving waters indicate that mean analyte concentrations were generally similar between pre- and post-construction monitoring periods and did not exceed COP criteria.

Table 9-1 Pre- and Post-Construction Pollutant Loading for Detected Analytes

Parameter	Pre-Construction (2011-2012)		Post Construction (2014-2015)		
	3-Storm Mean Concentration	Total Loading [1]	3-Storm Mean Concentration	Total Loading [1]	Normalized Loading [2]
Conventionals & Hydrocarbons (mg/L)		*kg/season*		*kg/season*	*kg/season*
Total Suspended Solids	61.8	2,144	125.1	1,542	4,339.4
Total Organic Carbon	44.7	1,550	5.6	69	194.2
Ammonia as N	0.1627	5.641	0.3200	3.94	11.1
Nitrate + Nitrite as N	0.0880	3.052	NT	NA	NA
Nitrate as N	0.1302	4.514	4.650	57.29	161.3
Phosphorus as P	0.1903	6.600	NT	NA	NA
OrthoPhosphate as P	NT	NA	0.1167	1.437	4.0
Oil & Grease	0.9667	33.522	2.2000	27.11	76.3
TPH as Diesel C10-C28	0.2127	7.376	NT	NA	NA
TPH as Diesel C10-C22	NT	NA	0.0780	0.961	2.7
TPH as Motor Oil C22-C36	ND	NA	0.1090	1.342	3.8
Total Metals (ug/L)		*gm/season*		*gm/season*	*gm/season*
Antimony	0.1993	6.91	0.1367	1.68	4.74
Arsenic	0.4267	14.8	0.5517	6.80	19.1
Beryllium	0.0257	0.89	0.0271	0.33	0.94
Cadmium	0.0587	2.03	0.0808	1.00	2.80
Chromium	3.5600	123	6.8553	84	238
Copper	6.8333	237	11.9417	147	414
Lead	3.6867	128	7.0250	87	244
Mercury (ng/L)	10.2667	0.36	ND	NA	NA
Nickel	3.5500	123	9.0797	112	315
Selenium	ND	NA	0.0393	0.48	1.36
Silver	0.0257	0.89	0.0283	0.35	0.98
Thallium	0.0117	0.40	0.0052	0.06	0.18
Zinc	33.0000	1,144	72.8706	898	2,527
Polycyclic Aromatic Hydrocarbons (ug/L)		*gm/season*		*gm/season*	*gm/season*
Acenaphthene	ND	ND	0.0035	0.04	0.12
Acenaphthylene	0.0297	1.03	0.0073	0.09	0.25
Anthracene	0.0323	1.12	0.0087	0.11	0.30
Benz(a)anthracene	0.0347	1.20	0.0282	0.35	0.98
Benzo(a)pyrene	ND	NA	0.0656	0.81	2.27
Benzo(b)fluoranthene	0.0367	1.27	0.0917	1.13	3.18

Table 9-1 Pre- and Post-Construction Pollutant Loading for Detected Analytes

Parameter	Pre-Construction (2011-2012)		Post Construction (2014-2015)		
	3-Storm Mean Concentration	Total Loading [1]	3-Storm Mean Concentration	Total Loading [1]	Normalized Loading [2]
Benzo(e)pyrene	NR	NA	0.1240	1.53	4.30
Benzo(g,h,i)perylene	0.0380	1.32	0.0912	1.12	3.16
Benzo(k)fluoranthene	0.0353	1.23	0.0293	0.36	1.02
Biphenyl	NR	NA	0.0163	0.20	0.57
Chrysene	0.0403	1.40	0.1270	1.56	4.40
Dibenz(a,h)anthracene	ND	NA	0.0172	0.21	0.60
Dibenzothiophene	NR	NA	0.0271	0.33	0.94
Dimethylnaphthalene, 2,6-	NR	NA	0.0188	0.23	0.65
Fluoranthene	0.0460	1.60	0.1007	1.24	3.49
Fluorene	ND	ND	0.0113	0.14	0.39
Indeno(1,2,3-c,d)pyrene	ND	ND	0.0096	0.12	0.33
Methylnaphthalene, 1-	ND	ND	0.0186	0.23	0.64
Methylnaphthalene, 2-	0.0333	1.16	0.0366	0.45	1.27
Methylphenanthrene, 1-	NR	NR	0.0218	0.27	0.76
Naphthalene	0.0427	1.48	0.0368	0.45	1.28
Perylene	NR	NR	0.0420	0.52	1.46
Phenanthrene	0.0387	1.34	0.0919	1.13	3.19
Pyrene	0.0460	1.60	0.1212	1.49	4.20
Trimethylnaphthalene, 2,3,5-	NR	NR	0.0037	0.05	0.13
Total Detectable PAHs	*0.45 ug/L*	*15.7 gm*	*1.15 ug/L*	*14.2 gm*	*39.9 gm*
Other SVOCs (ug/L)		*gm/season*		*gm/season*	*gm/season*
Benzoic Acid	3.4000	117.91	0.5881	7.25	20.40
Benzyl Alcohol	0.1433	4.97	0.2569	3.16	8.91
Bis(2-chloroethyl)ether	ND	ND	0.0468	0.58	1.62
Bis(2-ethylhexyl)phthalate	1.1333	39.30	2.5126	30.96	87.13
Butyl benzyl phthalate	0.1167	4.05	0.7722	9.51	26.78
Dibenzofuran	0.1363	4.73	ND	NA	NA
Dibutyl Phthalate	ND	ND	0.1499	1.85	5.20
Dichlorophenol, 2,4-	0.1067	3.70	0.0374	0.46	1.30
Diethyl phthalate	0.5967	20.69	1.2238	15.08	42.44
Dimethyl phthalate	0.3267	11.33	0.1820	2.24	6.31
Di-n-butyl phthalate	0.1167	4.05	ND	NA	NA
Di-n-octyl phthalate	0.1000	3.47	ND	NA	NA
Hexachlorobenzene	ND	ND	0.0023	0.03	0.08
Isophorone	0.0990	3.43	0.0401	0.49	1.39
Pentachlorophenol	0.6150	21.33	0.1247	1.54	4.32
Phenol	ND	NA	0.1648	2.03	5.71
Trichlorobenzene, 1,2,4-	ND	NA	0.0120	0.15	0.42
Total Other SVOCs	*7.4 ug/L*	*257 gm*	*6.1 ug/L*	*75.3 gm*	*212.0 gm*
Organochlorine Pesticides (ug/L)		*gm/season*		*gm/season*	*gm/season*
Endosulfan sulfate	0.0032	0.11	ND	ND	ND
Nonachlor, trans-	ND	ND	0.0008	0.01	0.03

Table 9-1 Pre- and Post-Construction Pollutant Loading for Detected Analytes

Parameter	Pre-Construction (2011-2012)		Post Construction (2014-2015)		
	3-Storm Mean Concentration	Total Loading [1]	3-Storm Mean Concentration	Total Loading [1]	Normalized Loading [2]
Pyrethroid Pesticides (ug/L)		*gm/season*		*gm/season*	*gm/season*
Allethrin	103.49	3.59	ND	NA	NA
Bifenthrin	6.60	0.23	0.0047	0.06	0.16
Cyfluthrin, total	ND	NA	0.0153	0.19	0.53
Cyhalothrin, Total lambda-	ND	NA	0.0295	0.36	1.02
Cypermethrin, total	ND	NA	0.0107	0.13	0.37
Total Pyrethroids	*ND*	*NA*	*0.06 ug/L*	*0.74 gm*	*2.1 gm*

1 Total loading is calculated as kilograms per wet season for conventionals and hydrocarbons and as grams per wet season for metals and organics, based on total stormwater flow recorded for each season; 34,678,287 liters for 2011-2012 and 12,320,814 liters for 2014-2015.
2 Total loading for 2014-2015 was normalized to the runoff volume for 2011-2012.
ND Not Detected (in any of three storms)
NR Not Reported
NT Not Tested

9.2 Data Results Summary and Discussion

This section briefly summarizes and discusses results in the stormwater, ORW, sediment, and mussel tissue data collected for the Improvement Project.

First, several important points must be made regarding the legitimacy of making comparisons between the pre-and post-construction stormwater results:

1. Improvement Project construction activities during the summer of 2014 constituted a very different condition within the City's stormwater runoff watershed than what was essentially the pre-construction status quo from 2011 through spring of 2014. Thus, some initially negative post-construction water quality results may actually be attributable to the Improvement Project itself. The presence/use of new asphalt and concrete pavements, galvanized metals, heavy equipment, traffic detours, etc. are factors that potentially influenced the post-construction monitoring results. Ideally, post-construction monitoring would have been performed in the 2015-2016 wet season to avoid sampling the temporary remnant pollution generated from the Improvement Project.
2. Laboratory detection and reporting limits were not always the same due to the use of multiple analytical laboratories over the course of the program. This is an unfortunate situation which developed out of a desire to actually consolidate analytical work with one lab, and at the same time realize cost savings. The original primary laboratory sub-contracted pyrethroid analyses, while the replacement laboratory did pyrethroid analyses in-house, had lower analytical costs, and claimed to have lower MDLs and MRLs for certain analytes. Shipping costs were also less for the second lab. Unfortunately, the second laboratory that was used had multiple QAQC problems, including higher MDLs and MRLs. Refer to Appendix E for a QAQC discussion detailing issues encountered with this laboratory. For the spring 2014 pre-construction and 2014-2015 post-construction monitoring a third analytical laboratory was used. This laboratory was used because it was the primary laboratory performing all of the analytical work for northern and southern California ASBS monitoring programs; and, ADH Environmental, the

Improvement Project consultant, had confidence in the laboratory after using them during the 2012-2013 and 2013-2014 seasons for other ASBS projects.

9.2.1 Stormwater Discharge Data Results

This section briefly summarizes and discusses results in the stormwater data collected for the Improvement Project.

Indicator Bacteria

Indicator bacteria concentrations (for which sampling was discontinued after the pre-construction monitoring season: refer to Section 3.3.3 for an explanation) were high in all stormwater samples collected during the 2011-2012 monitoring season, and likely contributed to ORW exceedances of COP criteria that were observed. However, runoff from the harbor parking lot and hillside seeps may also have contributed to the observed bacteria levels in the ORW. In addition, such high stormwater bacteria results are not uncommon in municipal storm sewer discharges.

Turbidity

Turbidity concentrations in pre- and post-construction stormwater samples were low. The highest turbidity (43.6 NTU) was measured during the post-construction October 2014 storm event.

Total Suspended Solids

Total suspended solids concentrations in pre- and post-construction stormwater samples were below 100 mg/L in four of the six samples. Both higher instances occurred during the post-construction monitoring season, with the highest (197 mg/L) recorded in one of the first storms of the season in October 2014. The second occurrence was in March 2015 and was only slightly higher (110 mg/L). The October result is likely related to the construction project itself, which was completed just over a month earlier.

Nutrients

Nutrient (ammonia, nitrate, nitrate + nitrite, total phosphorus and total orthophosphate) concentrations in pre- and post-construction stormwater samples were mostly low. Nitrate was relatively high during the first post-construction storm event of October 2014 (13.27 mg/L nitrate); nitrate concentrations were less than 0.4 mg/L for the next two storm events monitored.

Total Cyanide and Surfactants

Total cyanide and surfactants – or methylene blue active substances (MBAS) – were analyzed for only during the pre-construction 2011-2012 monitoring season. Monitoring for this was discontinued because no cyanide or MBAS were detected during the entire season and also because they were not included as an analyte in the final Special Protections monitoring requirements.

Total Organic Carbon

Total organic carbon concentrations were relatively low for five of six samples collected. In the January 2012 sampling event the analytical laboratory diluted the sample by a factor of 200 and reported a result of 120 mg/L. This is compared to the next highest value of 8.6 mg/L for the October 2014 post-construction sample. The January result appears to be an outlier, and it is difficult to explain the cause for such high a TOC value for stormwater in the middle of the storm season.

Oil & Grease

Oil & grease concentrations in pre- and post-construction stormwater samples were low. The highest concentration (3 mg/L) of oil & grease was recorded from the first post-construction storm event in October 2014. As with TSS, this result may be related to the construction project itself, which was completed just over a month earlier.

Diesel, Motor Oil and Gasoline Range Organics

Also called total petroleum hydrocarbons (TPH) as diesel, motor oil, and gasoline, these compounds were either not detected or were detected at low levels, generally less than the MRL.

Total Metals

Antimony, arsenic, beryllium, cadmium, selenium, silver, and thallium concentrations in pre- and post-construction stormwater samples were low (all less than 1.0 or 2.0 µg/L).

Chromium concentrations were lower in pre-construction samples, ranging from 2.5 to 4.8 µg/L versus 3.5 to 9.1 µg/L in post-construction samples.

Copper was above 10 µg/L in the first pre-construction storm sample and in the first and third post-construction samples; all other copper concentrations were less than 6 µg/L.

Lead was approximately two times higher in the first post-construction sample (10.9 µg/L) compared to all other samples.

Nickel was approximately two times higher in the first and third post-construction samples (12.3 and 10.1 µg/L, respectively) compared to all other samples.

Zinc was over two times higher in the first post-construction sample than the highest pre-construction sample (108 µg/L versus 53 µg/L). Although higher, this value is not exceptionally high for municipal stormwater.

Mercury was detected in all pre-construction samples from the 2011-2012 storm season but was not detected thereafter. This is rather odd and may have to do with the use of different laboratories over the course of the project. The third laboratory, which analyzed the pre-construction sample from January 2014 and the post-construction 2014-2015 samples, had a relatively high MDL of 0.0012 µg/L compared to the two previous laboratories whose MDLs ranged from 0.00006 to 0.00011 µg/L. Yet, all of the pre-construction detected concentrations are much higher than the third laboratory's MDL. This suggests there are at least three possible explanations:

1. Mercury was present in the 2011-2012 pre-construction stormwater samples but not after.
2. Mercury contamination was a factor at the two 2011-2012 pre-construction laboratories; however, mercury was detected in only one of three method blanks for the October 2011 event and in none of the method blanks for the January and April 2012 events.
3. Mercury was present in the field samples but was not being detected by the third laboratory. This scenario, however, is not borne out by the laboratory QAQC samples, all

of which were within QC limits for spike percent recovery and relative percent difference.

Regardless of the reason(s) for the stormwater mercury results, concentrations were overall either not detected or relatively low.

Polycyclic Aromatic Hydrocarbons

Total PAH concentrations in pre- and post-construction stormwater samples were low (approximately 1.0 µg/L or less). Unfortunately, no comparison can be made between pre- and post-construction samples because of differences in the MDLs achieved by the laboratories. For the April 2012 pre-construction sampling event the second laboratory failed so badly to achieve promised MDL and MRLs that no PAHs were detected at all (the lab's MDL and MRL for this event were both 0.10 µg/L). However, it is notable that each of the 25 PAHs was positively detected above the 0.005 µg/L MRL (third and final laboratory) for most of the three 2014-2015 storm events, indicating the low-level presence of many PAHs in Trinidad stormwater runoff.

Organochlorine Pesticides and PCBs

Organochlorine pesticides were largely not detected in stormwater, except in two instances. Endosulfan sulfate was detected at a low concentration (5.9 µg/L) in the January, 20, 2012 pre-construction sample and trans-nonachlor was detected at a concentration between the MDL and MRL in the February 03, 2015 post-construction sample.

Only seven Aroclors were analyzed for in the pre-construction samples. For the post-construction monitoring an additional 53 individual PCB compounds were analyzed for. No Aroclors or individual PCBs were detected in any pre- or post-construction stormwater samples.

Organophosphorus Pesticides

Organophosphorus pesticides were not detected in any pre- or post-construction stormwater samples.

Pyrethroid Pesticides

Five pyrethroid pesticides were detected in stormwater samples. Bifenthrin was detected above the MRL in the pre-construction October 2011 sample (0.019 µg/L) and in the post-construction October 2014 and March 2015 samples (0.0071 and 0.0068 µg/L, respectively). Cyfluthrin, cypermethrin, and lambda-cyhalothrin were detected at variable levels above the MRL in the post-construction February and March 2015 samples. These data results indicate that a number of pyrethroid pesticides are present Trinidad stormwater runoff, particularly more so in recent post-construction monitoring events.

Other SVOCs

Of 55-57 non-PAH SVOCs analyzed for, 13 were detected at low concentrations in pre- and post-construction stormwater samples. Half of these were phthalates which are somewhat ubiquitous in the urban environment and are also common laboratory contaminants. Four of seven non-PAH and non-phthalate SVOCs were detected in at least one sample in both the pre- and post-construction samples; these include: benzoic acid, benzyl alcohol, dichlorophenol 2,4-, isophorone, pentachlorophenol, and phenol. There are no other notable non-PAH SVOC results in the data results. No legitimate comparison can be made between pre- and post-construction samples because of differences in the MDLs achieved by the laboratories.

Toxicity

Pre- and post-construction stormwater toxicity results indicated that no samples were toxic to the test organisms.

9.2.2 Ocean Receiving Water Data Results

Pre- and post-construction water quality results for the ORW were generally unremarkable and, except for indicator bacteria, there were no exceedances of the Ocean Plan daily maximum or instantaneous maximum WQOs.

Indicator Bacteria

Total coliform bacteria slightly exceeded the COP criterion in the October 2011 pre-construction storm event. Enterococcus bacteria exceeded the COP criterion in the October 2011 and January 2012 pre-construction storm events. Bacteria sampling was not performed after the April 2012 pre-construction storm event (refer to Section 3.3.3 for an explanation).

Turbidity

Turbidity concentrations in pre- and post-construction ORW samples were low. The highest turbidity measured (26 NTU) was during the January 2012 storm event.

Total Suspended Solids

Total suspended solids concentrations in pre- and post-construction ORW samples were below 100 mg/L in four of the six ORW samples. The higher instances occurred once during each of the pre- post-construction monitoring seasons (120 and 123 mg/L, respectively). Besides influence from the City’s stormwater discharges, TSS in Trinidad Bay is also affected by local streams and ocean conditions (wave height and swell direction). TSS measurements were taken in October 2014 and April 2014 in the ocean near the mouth of Parker Creek (approximately 560 meters to the east of the City’s ORW sampling location). This was done out of interest by the three Trinidad Bay stormwater dischargers and was not a part of the Improvement Project. Recorded TSS concentrations were 2148 mg/L and 2725 mg/L (both pre-storm samples), and 209 mg/L (a post storm sample).

Nutrients

Nutrient (ammonia, nitrate, nitrate + nitrite, total phosphorus and total orthophosphate) concentrations in pre- and post-construction stormwater samples were all either not detected or relatively low compared to the COP daily maximum criteria.

Total Organic Carbon

Total organic carbon concentrations were relatively low for five of six ORW samples collected. In the April 2012 sampling event the analytical laboratory diluted the sample by a factor of 40 and reported a result of 66 mg/L. This is compared to the next highest value of 2.1 mg/L for the October 2011 and January 2012 pre-construction samples. The April result appears to be an outlier, and it is difficult to explain the cause for such high a TOC value for ocean receiving waters late in the storm season.

Oil & Grease

Oil & grease was not detected in five of six pre- and post-construction ORW samples. In January 2012 it was detected in the field sample at a low concentration between the MDL and MRL; it was not detected in the field duplicate sample.

Diesel, Motor Oil and Gasoline Range Organics

Also called total petroleum hydrocarbons (TPH) as diesel, motor oil, and gasoline, these compounds were either not detected or were detected at low levels between the MDL and MRL.

Total Metals

All metals concentrations in pre- and post-construction ORW samples were well below the COP daily maximum and instantaneous maximum criteria.

Mercury was detected in all pre-construction samples from the 2011-2012 storm season but was not detected thereafter. As discussed in Section 9.2.1, these results are rather odd and may have to do with the use of different laboratories over the course of the project. It was also unusual that mercury results for both the stormwater and ORW samples were identical for the pre-construction April 13, 2012 monitoring event.

Polycyclic Aromatic Hydrocarbons

Most of the 25 PAHs that were analyzed for were detected at least once at low concentrations in the ORW. Total detectable PAHs were less than 2 µg/L for each pre- and post-construction storm event. Although numerous PAHs were detected at low concentrations in the ORW, they were generally always lower than the City's stormwater runoff by one order of magnitude and did not exceed COP WQOs. As mentioned in Section 9.2.1, due to the use of different laboratories which achieved different MDL and MRLs, no legitimate comparisons can be made between the pre-construction and post-construction results. Data results from the pre-construction January and April 2012 samples were either re-analyzed out of holding time or had elevated MDL/MRLs. The January 2012 samples had to be reanalyzed because of laboratory contamination from laboratory spike samples. Even then, the results were questionable because, in all but one instance, PAHs were detected in only the field duplicate ORW sample. However, the data were ultimately not rejected.

Organochlorine Pesticides and PCBs

Organochlorine pesticides were not detected in any pre- and post-construction ORW sample. Laboratory MDLs were all low, ranging from 0.00028 µg/L to 0.005 µg/L, with only a few isolated instances of elevated values for individual analytes.

Only seven Aroclors were analyzed for in the pre-construction samples. For the post-construction monitoring an additional 53 individual PCB compounds were analyzed for. No Aroclors or individual PCBs were detected in any pre- or post-construction stormwater samples.

Organophosphorus Pesticides

Organophosphorus pesticides were not detected in any pre- or post-construction ORW samples.

Pyrethroid Pesticides

Except in one instance, no pyrethroid pesticides were detected in pre-and post-construction ORW samples. Bifenthrin was detected at a low concentration (0.0029 µg/L) in the October 2011 pre-construction sample. It is notable that bifenthrin was also detected in the stormwater sample during the same storm event at a higher concentration (0.019 µg/L). Bifenthrin was also detected in the ocean receiving waters in July 2011 (different project) and in the City's stormwater discharge in October 2014 and March 2015. This indicates bifenthrin is in regular use in the Trinidad area and is discharging to the ASBS in measurable amounts.

Other SVOCs

Of 55 to 57 non-PAH SVOCs analyzed for, five phthalates, benzoic acid and bis(2-chloroethyl) ether were detected at low concentrations, primarily in post-constructions samples due to the use of a lower detection limit. Phthalates are somewhat ubiquitous in the urban environment and are also common laboratory contaminants.

Toxicity

Pre- and post-construction stormwater toxicity results indicated that no samples were toxic to the test organisms.

9.2.3 Subtidal Sediment Data Results

Sediment sampled in Trinidad Bay was primarily fine sand. Sediment particle size distribution for the composite sample was 84.26% sand, 12.89% silt, 2.41% clay, and 0.06% gravel.

Sediment concentrations of nearly all analytes were either relatively low or not detected. Among metals and PAHs, except for nickel, all detected analytes were in concentrations well below the NOAA Sediment Quality Guideline (SQG) Effects Range Low (ERL) and Effects Range Median (ERM) values (NOAA, 1999).

Total Metals

Nickel was detected at a concentration of 65.8 mg/kg, higher than the NOAA SQG ERL and ERM values of 20.9 and 51.6 mg/kg, respectively. The high concentration of nickel in Trinidad Bay sediments may have little to do with anthropogenic inputs and more to do with the native soils and rocks, some of which are serpentine which is known to contain nickel. The relatively high detected levels of total chromium, which also can occur in serpentine soils and rocks, may lend support to this idea.

It should be noted that the SQGs are based on a compilation of sediment toxicity data for the National Status and Trends Program, but are only intended as informal (non-regulatory) guidelines for use in interpreting chemical data from analyses in sediment.

Pesticides, PCBs and Synthetic Pyrethroids

Three organochlorine pesticides, delta-BHC, endrin, and heptachlor epoxide, were detected at very low concentrations in Trinidad Bay sediments. These three compounds are referred to as "legacy persistent organic pollutants" and are representative of their historical, not current, use.

PCBs, organophosphorus pesticides, and pyrethroids (which are the latest current-use pesticides) in sediment were not detected.

Butyltins

Two of four butyltin (or organotin) compounds were detected at low concentrations between the MDL and MRL. Used for decades in anti-fouling paint for boat hulls, butyltins were phased out in the 1980s and do not appear to have persisted in Trinidad Bay sediments, if they were ever present in greater concentrations.

PAHs and Other SVOCs

Sediment data results for certain PAHs and other SVOCs are worth discussion here, even though most of the detected compounds were quite low in concentration. Although present in the City's stormwater discharges, a number of these compounds are also associated with creosote, the wood preservative used on the old Trinidad Pier's wooden piles. The pier's treated wood structure was identified by the SWRCB as a pollutant source to the Trinidad Head ASBS (SCCWRP, 2003), which ultimately helped lead to the fruition and completion of the Trinidad Rancheria's Trinidad Pier Replacement Project (TPRP), another Prop 84 grant funded project. The pier replacement project was completed in the summer of 2012 and project monitoring was completed in the spring of 2013. A section of the pier project's final monitoring report has been excerpted and modified and is presented here (ADH, 2013).

Three sediment sampling events within Trinidad Bay occurred between 2011 and 2013. Pre- and post-construction sediment sampling was performed for the TPRP in July 2011 and April 2013, respectively. For the Improvement Project, sediment was sampled in May 2012. Table 9-2 lists the major compounds in creosote (by percent) and presents the three sets of sediment data results. For the sake of comparison, data results are also presented from a simulated "runoff" sampling event from the old pier's creosote treated piles.

Among the three sediment sampling events, no clear overall increasing or decreasing trend is evident in SVOC concentrations; some individual compounds appear to have decreased over time (4 compounds), while others have increased (3 compounds) or show no trend in either direction (6 compounds).

SVOCs in the pier's water "runoff" sample were detected at concentrations approximately two orders of magnitude greater than what was detected in the City's stormwater discharges. The old pier was subject to constant wave action and human activities for decades and was clearly the primary source of SVOCs in the waters and sediment of Trinidad Bay. It also may or may not have been a contributing source of SVOCs to the City of Trinidad itself through track-out via vehicles, boats & trailers, foot traffic, harbor operations, etc. Thus, when Trinidad Bay sediments are sampled in the future, and if a clear downward trend in SVOC concentrations is evident, the trend could reasonably be attributed primarily to the success of TPRP and secondarily to the Improvement Project; the first by removing a key pollutant source and the second by reducing stormwater runoff to the Trinidad ASBS.

Table 9-2 Trinidad Bay Subtidal Sediment Results and Compounds in Creosote

Compounds in Creosote (%)[a]	Sediment Sampling Events 07-20-11 (TPRP) [b]	05-08-12 (TSWMIP) [c, d]	04-25-13 (TPRP) [d]	NOAA SQGs ERLs[e, f]	Pier "Runoff" 08-14-11[g]
Units	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*	*(µg/L)*
Polycyclic Aromatic Hydrocarbons (PAHs)					
Phenanthrene (13.3%)	24	8.8 (8.3)	19 (16)	240	36
Naphthalene (9.1%)	5.5 J	5.6 J (5.6 J)	6.1 J (6.1 J)	160	13
Acenaphthene (8.4%)	3.1 J	3.2 U (3.2 U)	3.2 U (3.2 U)	16	10 U
Fluorene (6.3%)	6.7 J	4.2 J (4.1) J	6.9 (7.8)	19	10 U
1-Methylnaphthalene (4.4%)	7.4 U	4.7 J (5.3 J)	7.6 (7.1)	not listed	not tested
2-Methylnaphthalene (5.6%)	8.3 J	9.1 (9.1)	12 (12)	70	not tested
Fluoranthene (5.3%)	30	3.7 U (3.7 U)	11 (19)	600	27
Pyrene (4.3%)	21	3.7 U (3.7 U)	9.4 (18)	665	14
Anthracene (3.3%)	3.1 J	3.2 U (3.2 U)	3.2 U (3.2 U)	85.3	10 U
Chrysene (1.9%)	12	4.1 U (4.1 U)	4.7 J (8.6)	384	17
Furans					
Dibenzofuran (4.7%)	3.6 J	3.4 U (3.4 U)	3.4 U (3.4 U)	not listed	not tested
N-heterocyclics					
Carbazole (1.6%)	not tested	not tested	3.8 U (3.8 U)	not listed	not tested
Phenolics					
Cresols (1.2%) h	8.2	4.5 U (4.5 U)	16 (8.8)	not listed	not tested
Phenol (0.3%)	15 J	12 J (7.5 J)	15 J (21)	not listed	not tested

Bolded values indicate the compound was detected at or above the MDL.
a Stratus Consulting, 2006
b Data collected for the Trinidad Pier Reconstruction Project
c Data collected for the City of Trinidad Stormwater Management Improvement Project
d A blind field duplicate sample was collected during the sampling event. The duplicate result is in parentheses
e NOAA SQGs = National Oceanographic and Atmospheric Administration (NOAA) Sediment Quality Guidelines
f ERLs = Effects Range Low
g Simulated "runoff" collected from several creosote-treated pilings from the old Trinidad Pier
h Sum of 2-methylphenol (ortho-cresol) and 4-methylphenol (para-cresol)
J The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL)
U The compound was analyzed for, but was not detected at or above the associated MDL

9.2.4 California Mussel Tissue Data Results

Mussel tissue samples have been monitored for years by the NOAA NS&T Mussel Watch Program to track levels of pollutant bioaccumulation in shellfish around the country. The Improvement Project mussel tissue sampling and analysis was performed using the same protocols.

Concentrations of nearly all analytes analyzed for in California mussel tissue samples from Trinidad Bay were either low or not detected. Concentrations of metals, organochlorine pesticides and PCBs that were positively detected in tissues were generally much lower than the applicable FDA Guidance Levels for Seafood (FDA, 2001). The exception was cadmium which was detected at a concentration (1.13 µg/Kg in field sample; 1.38 in field duplicate sample) that was relatively similar to the FDA guidance level of 4 ppm. There are no FDA guidance levels for seafood for PAHs/SVOCs, or PBDEs.

Metals

Except for antimony, thallium, and tin, all metals that were analyzed for were detected at concentrations above the MRL. Tin was not detected.

PAHs and Other SVOCs

Of the 24 PAHs analyzed for, 7 were detected at very low concentrations between the MDL and MRL. Four PAHs were detected at concentrations above the MRL: 2,6-dimethylnaphthalene, perylene, phenanthrene, and carbazole (a component of creosote and not typically included in the standard list of PAHs). No other SVOCs were detected in the mussel tissue samples.

Organochlorine Pesticides and PCBs

Of the 15 organochlorine pesticides analyzed for, 6 were detected at low concentrations. Only heptachlor epoxide was detected at a concentration (4.5 µg/Kg) above the MRL (0.98 µg/Kg) Heptachlor epoxide was also detected at low concentrations between the MDL and MRL in subtidal sediments in Trinidad Bay, but was not detected in any City stormwater discharges. Although this last statement indicates the source of this legacy pollutant is only from the local sediments, it may be that local streams or private properties in the area are sources. Heptachlor was used in the 1960s and 1970s to kill termites and other insects found in or around the home. It was banned in 1988 for commercial uses. This legacy pesticide could have contaminated soils in the area which continue to discharge the substance into local waters. Or, it may actually still be in use periodically at some households with old supplies of the pesticide.

Of the 57 PCBs analyzed for, only one was detected. PCB 095 was detected at a very low concentration (0.21 µg/Kg) between the MDL and MRL. Unfortunately, the field duplicate sample had a slightly higher MDL (0.28 µg/Kg) and was not detected. PCBs are also legacy pollutants which are still widespread around the world and are often detected in animal tissue samples.

Polybrominated Diphenyl Ethers

Of the 17 PBDEs analyzed for, none were detected. Used as a flame retardant in a wide array of products, it is good news that mussel tissue in Trinidad Bay show no exposure to these compounds.

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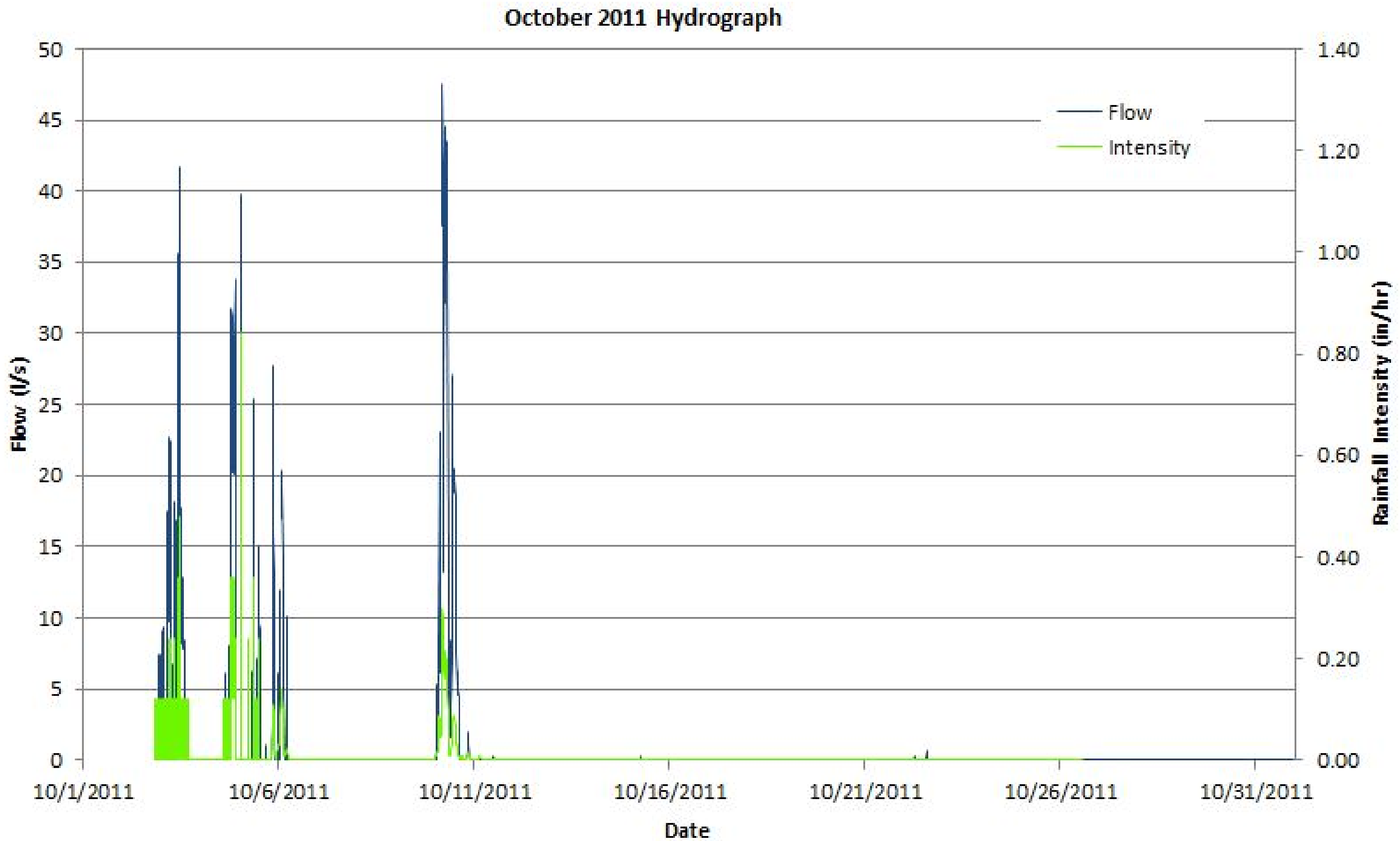
APPENDIX A: MONTHLY HYDROGRAPHS FOR 2011-2015

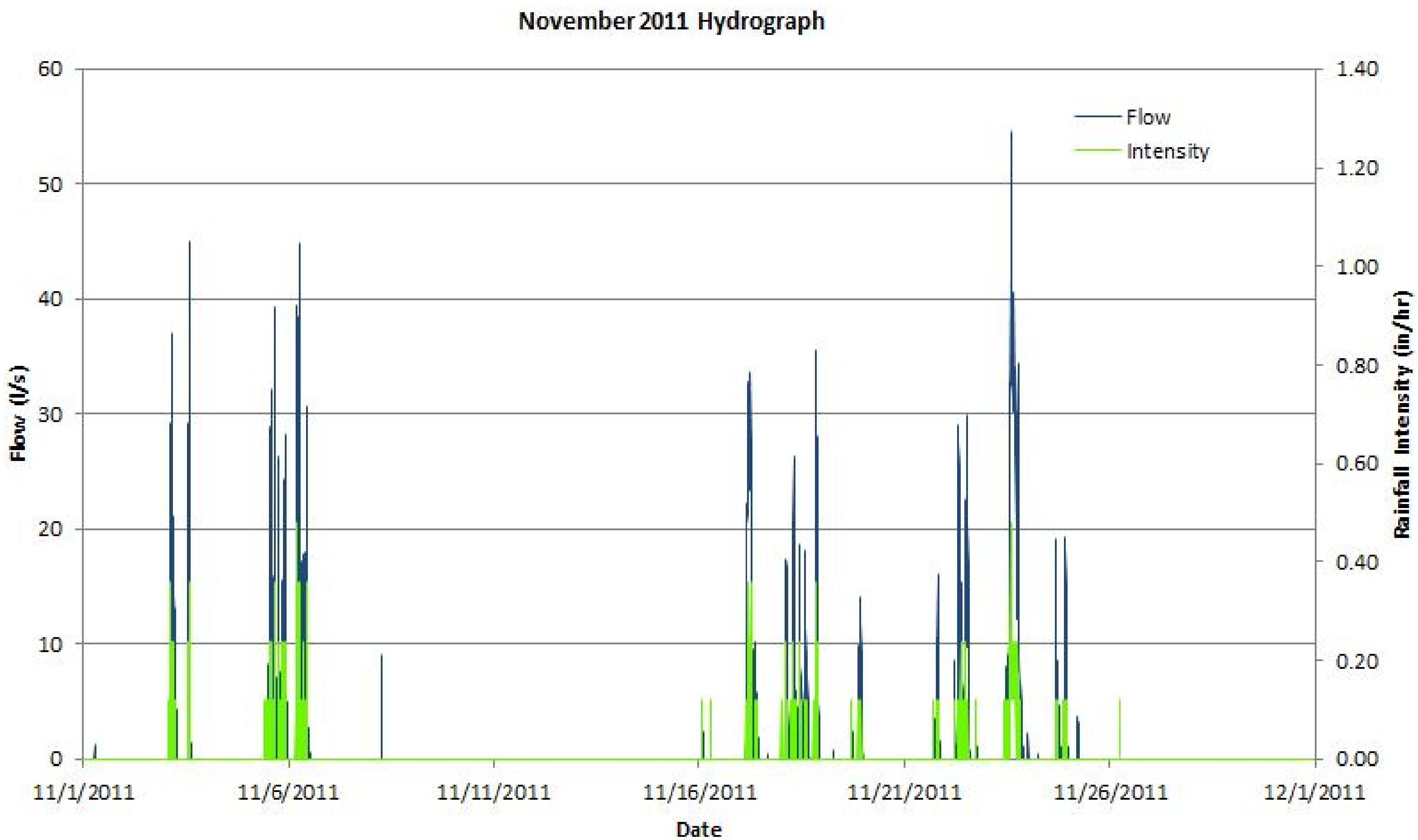
- Pre-construction Hydrographs (October to April 2011-2012)
- Pre-construction Hydrographs (February to June 2014)
- Post-construction Hydrographs (October to April 2014-2015)

Figure A-1 Monthly Hydrograph for October 2011; City of Trinidad Stormwater Discharge



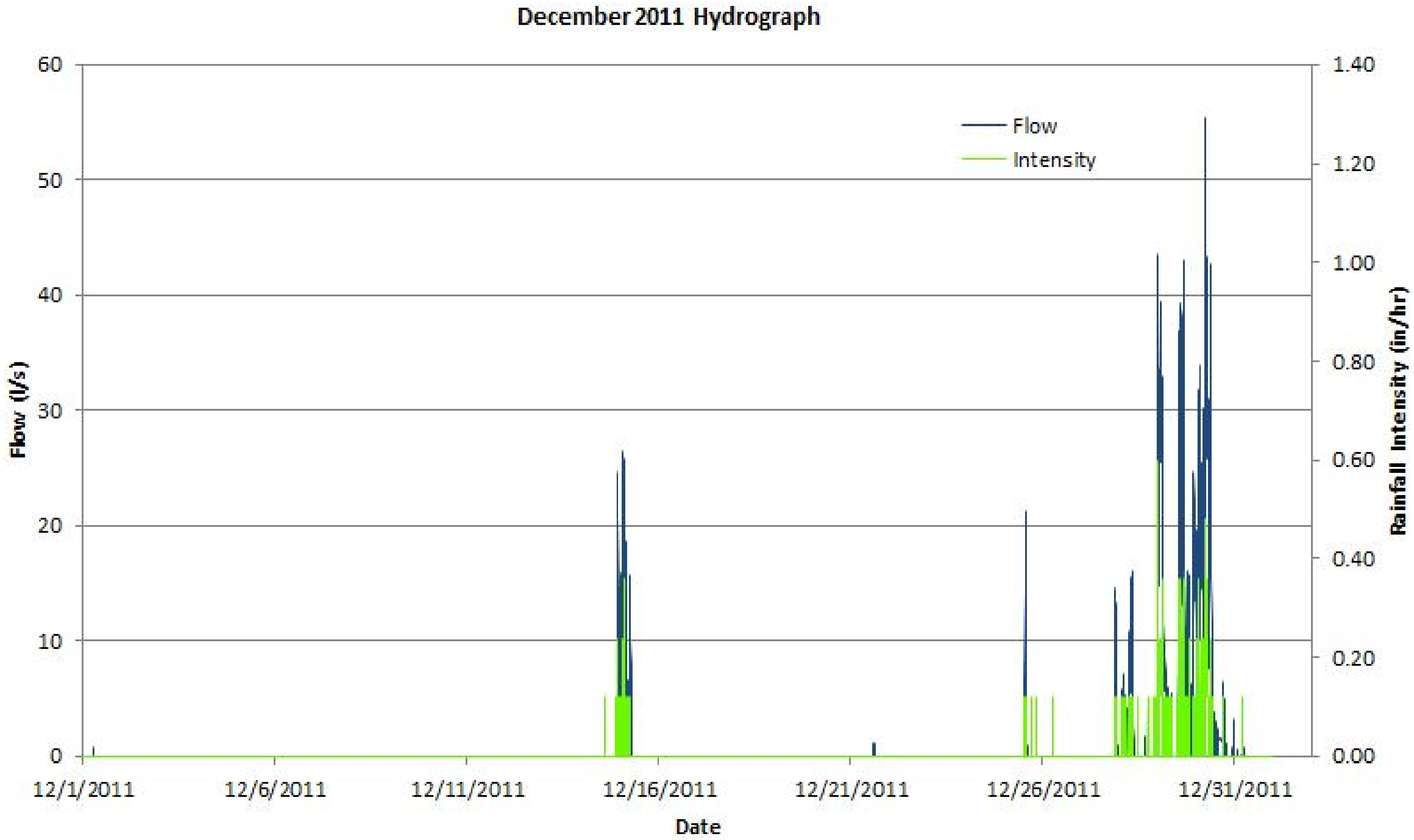
Rain Data		Runoff Data	
Monthly Rain (in.)	3.86	Total Flow Volume (L)	2035850
Max Intensity (in/hr)	0.84	Peak Flow (L/s)	48

Figure A-2 Monthly Hydrograph for November 2011; City of Trinidad Stormwater Discharge



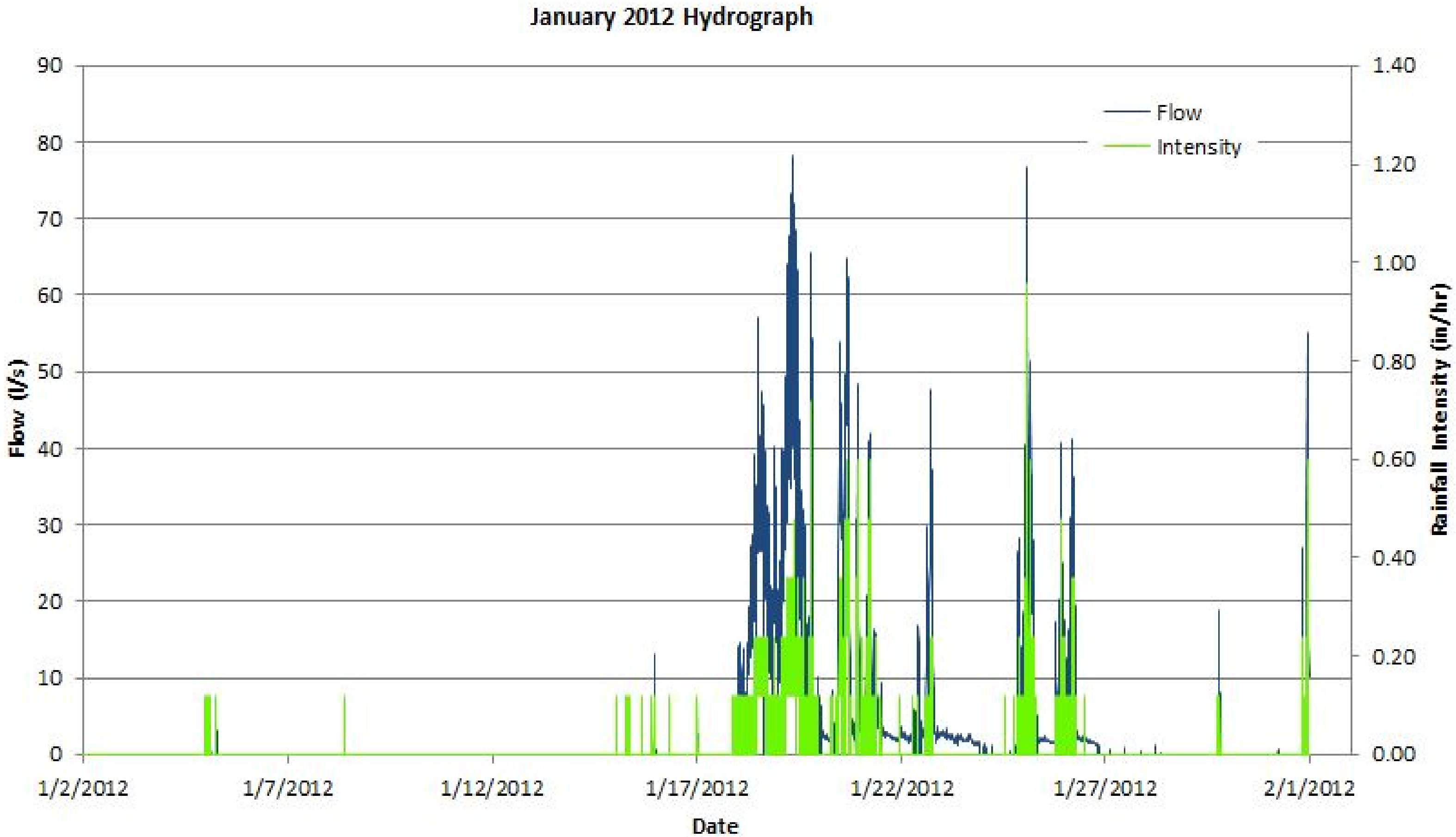
Rain Data		Runoff Data	
Monthly Rain (in.)	4.1	Total Flow Volume (L)	2892870
Max Intensity (in/hr)	0.48	Peak Flow (L/s)	55

Figure A-3 Monthly Hydrograph for December 2011; City of Trinidad Stormwater Discharge



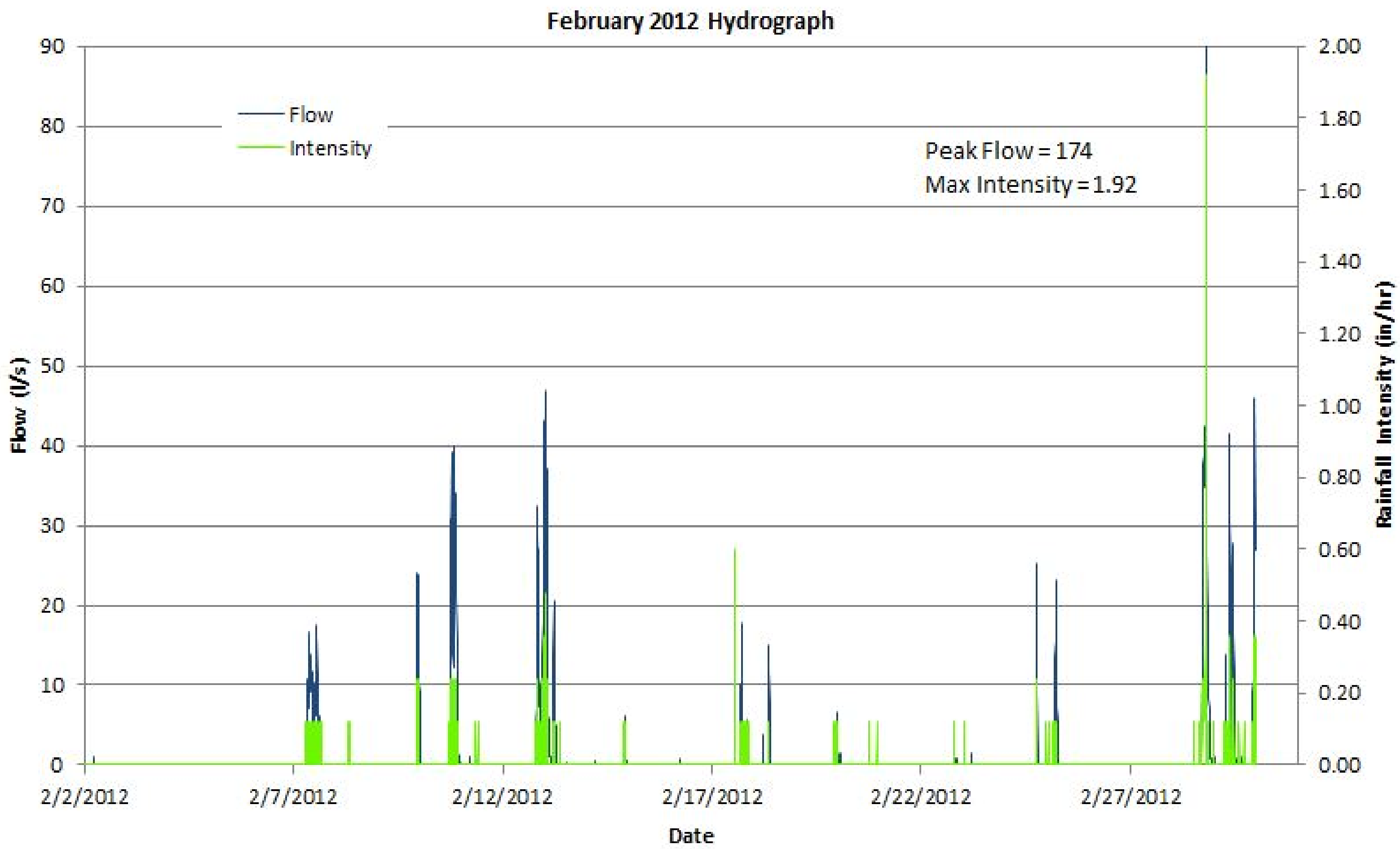
Rain Data			Runoff Data	
Monthly Rain (in.)	3.64		Total Flow Volume (L)	2478556
Max Intensity (in/hr)	0.60		Peak Flow (L/s)	55

Figure A-4 Monthly Hydrograph for January 2012; City of Trinidad Stormwater Discharge



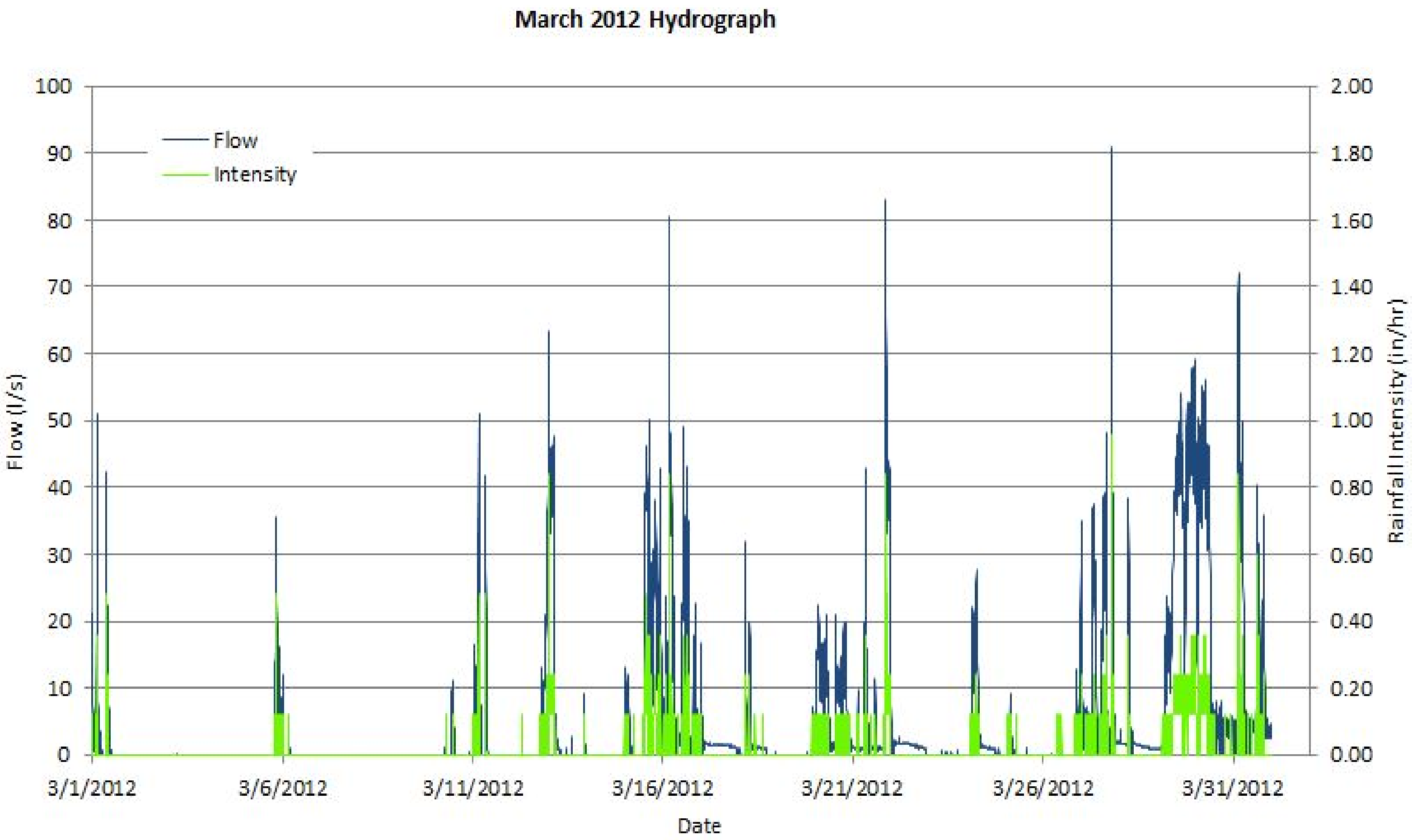
Rain Data			Runoff Data	
Monthly Rain (in.)	9.73		Total Flow Volume (L)	8129933
Max Intensity (in/hr)	0.96		Peak Flow (L/s)	78

Figure A-5 Monthly Hydrograph for February 2012; City of Trinidad Stormwater Discharge



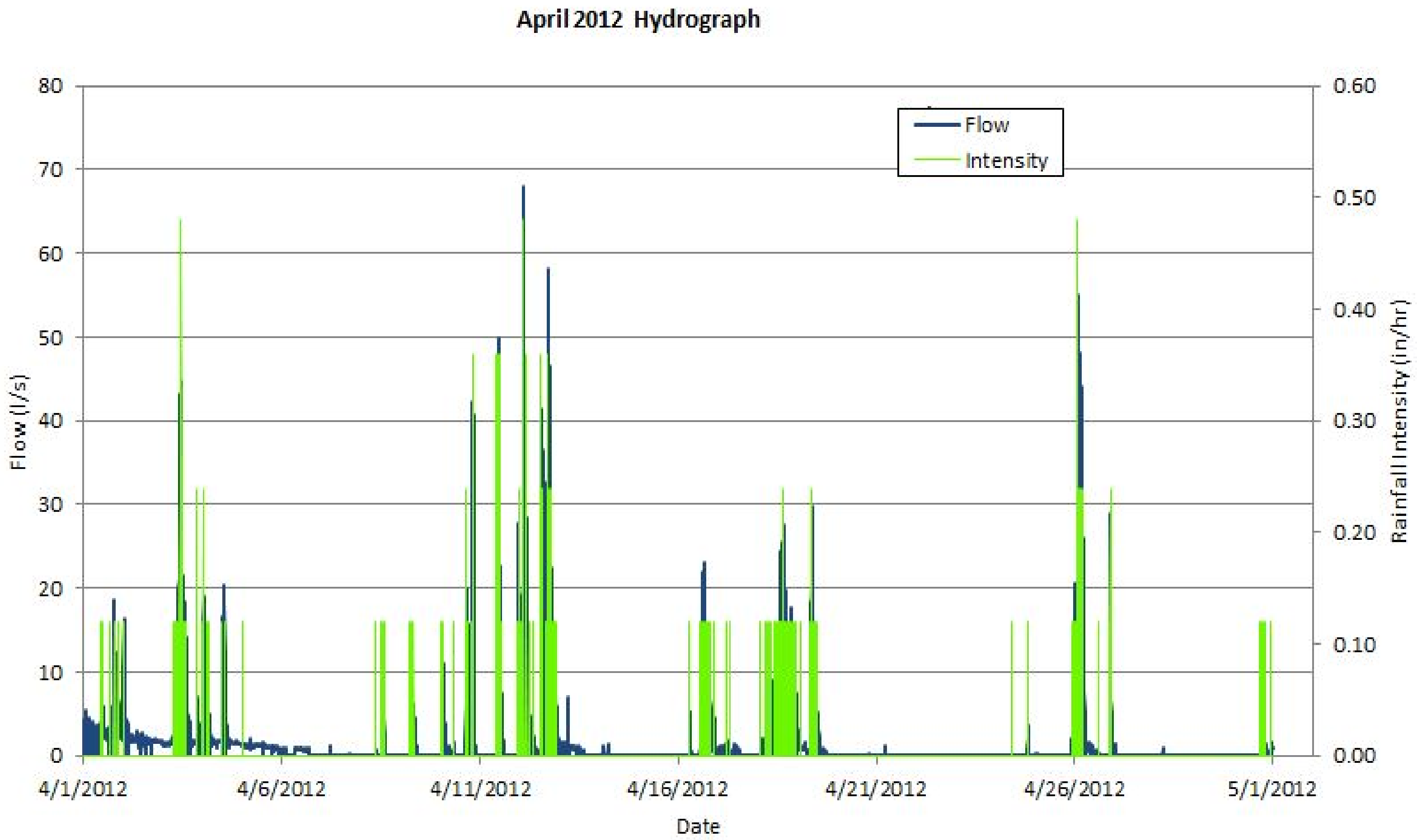
Rain Data			Runoff Data	
Monthly Rain (in.)	3.44		Total Flow Volume (L)	2225771
Max Intensity (in/hr)	1.92		Peak Flow (L/s)	174

Figure A-6 Monthly Hydrograph for March 2012; City of Trinidad Stormwater Discharge



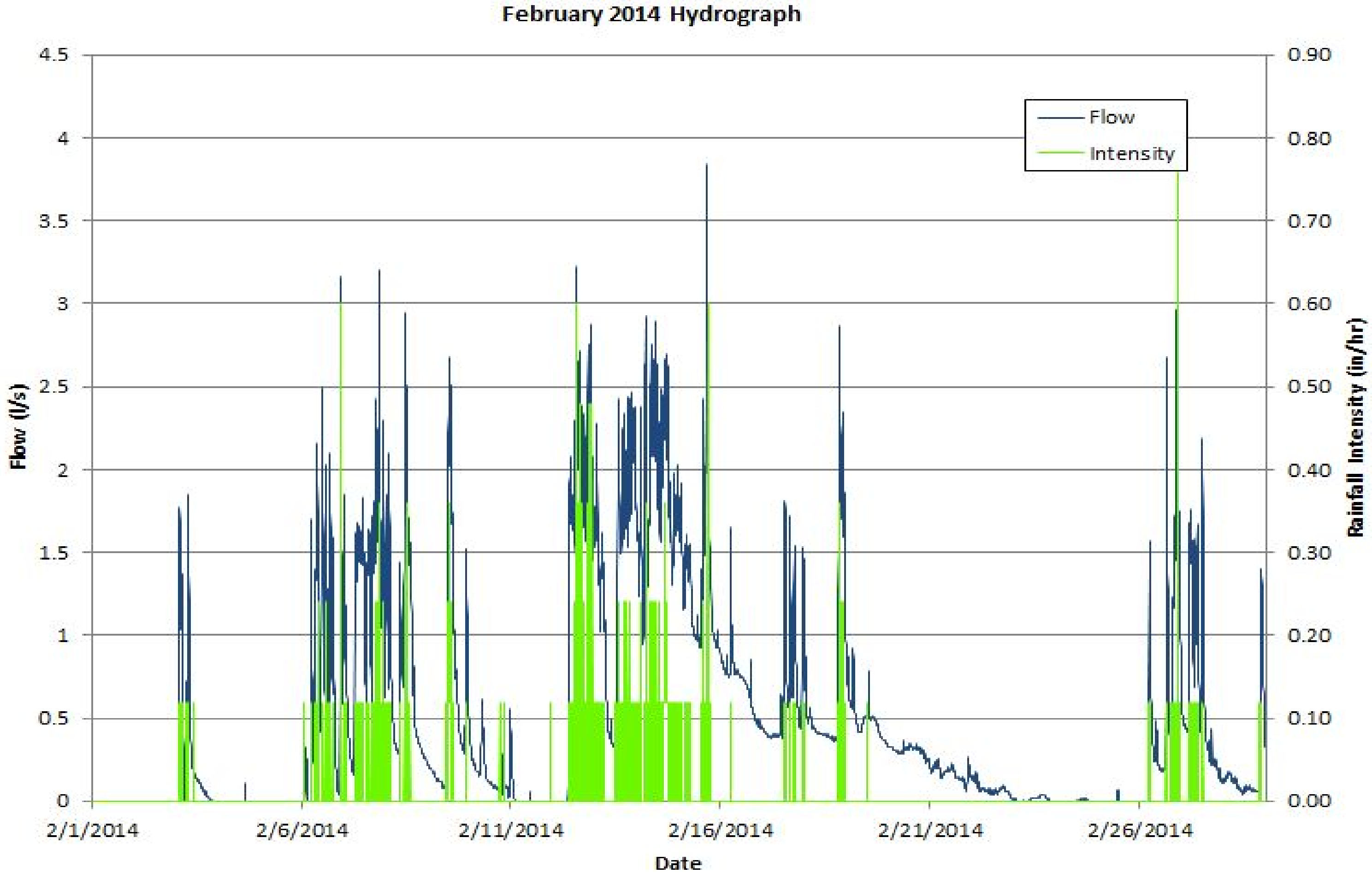
Rain Data			Runoff Data	
Monthly Rain (in.)	14.03		Total Flow Volume (L)	12566467
Max Intensity (in/hr)	0.96		Peak Flow (L/s)	91

Figure A-7 Monthly Hydrograph for April 2012; City of Trinidad Stormwater Discharge



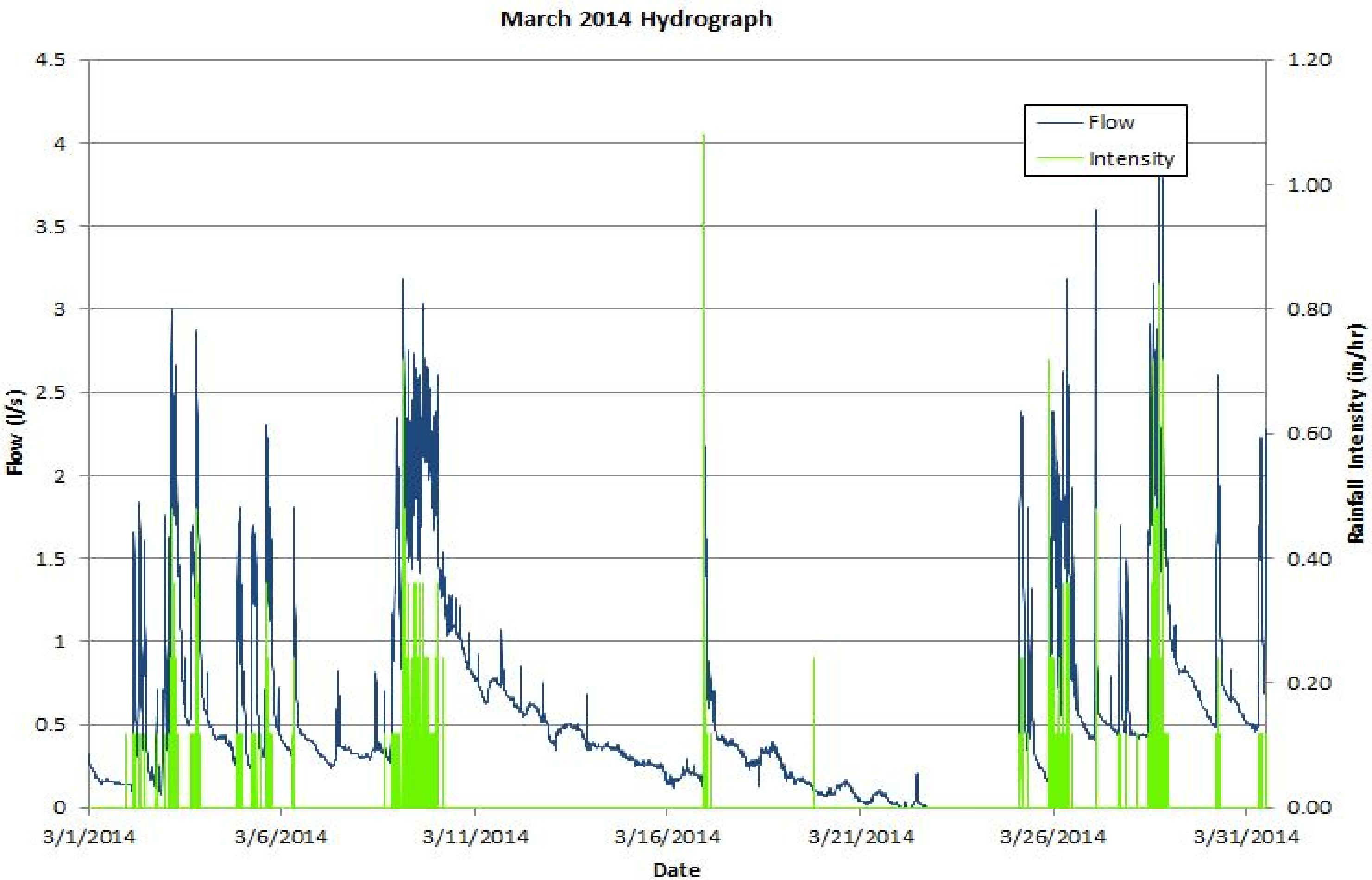
Rain Data			Runoff Data	
Monthly Rain (in.)	4.13		Total Flow Volume (L)	2590661
Max Intensity (in/hr)	0.48		Peak Flow (L/s)	68

Figure A-8 Monthly Hydrograph for February 2014; City of Trinidad Stormwater Discharge



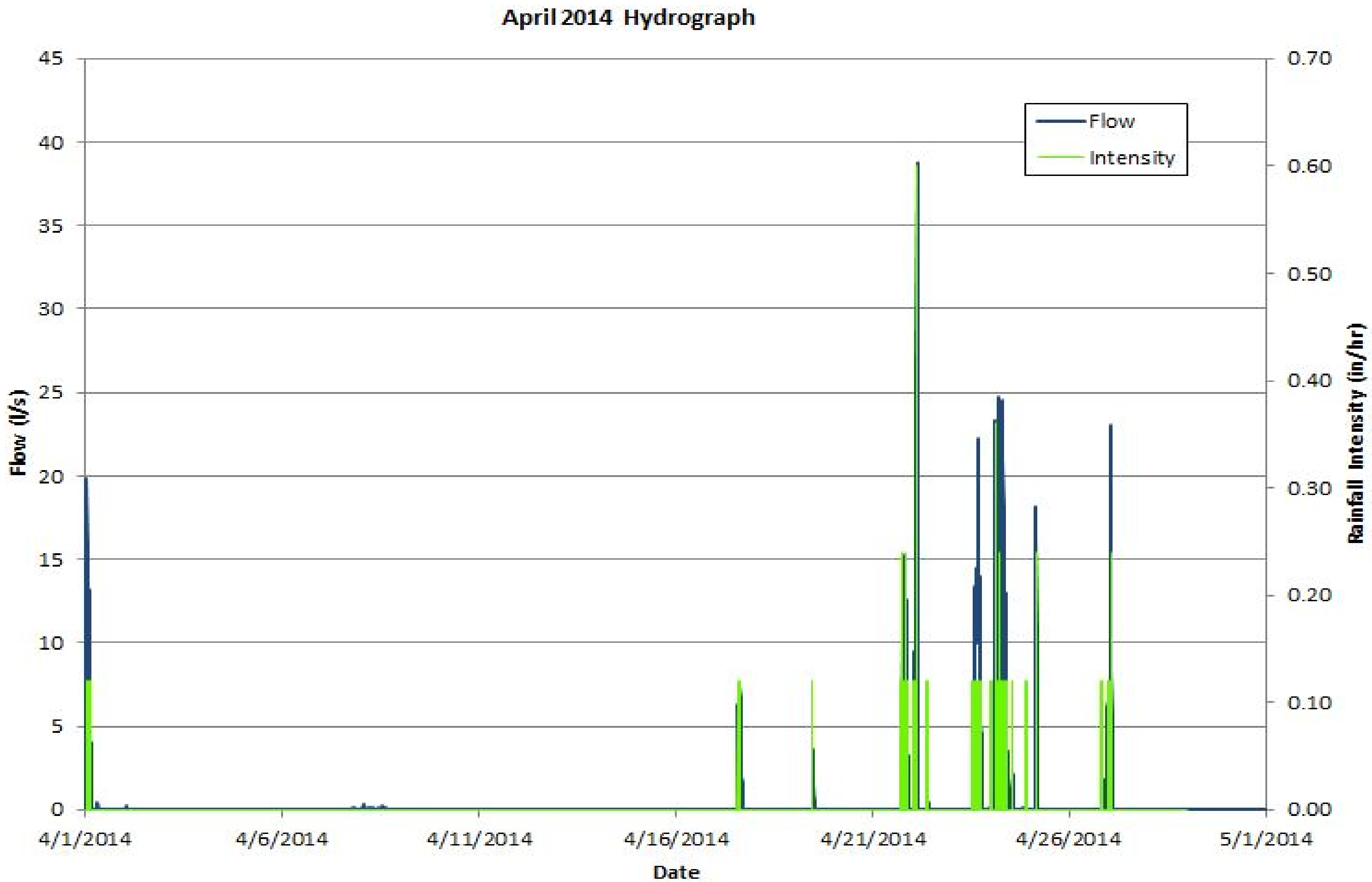
Rain Data			Runoff Data	
Monthly Rain (in.)	6.8		Total Flow Volume (L)	1217487
Max Intensity (in/hr)	0.84		Peak Flow (L/s)	4

Figure A-9 Monthly Hydrograph for March 2014; City of Trinidad Stormwater Discharge



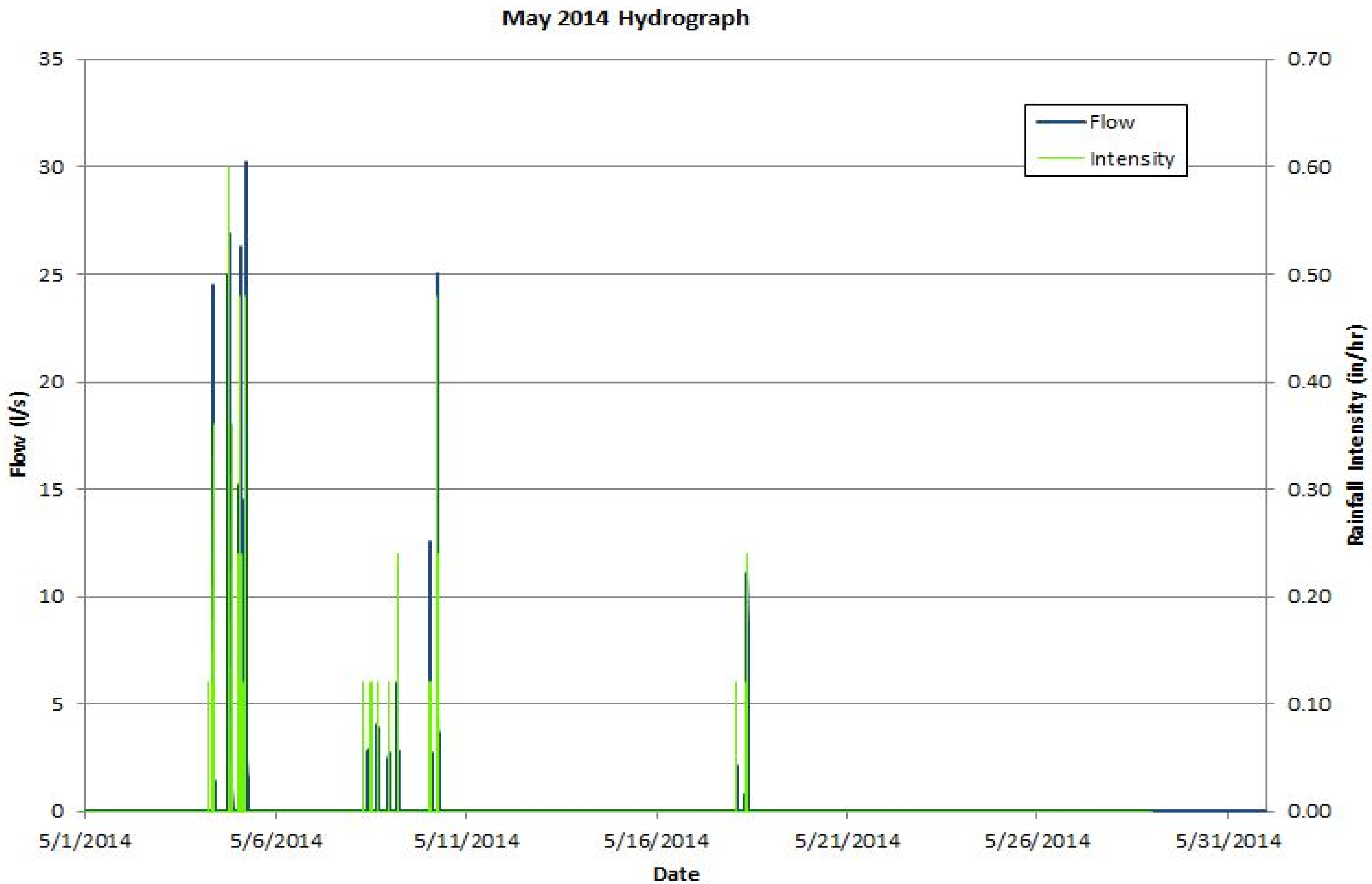
Rain Data		Runoff Data	
Monthly Rain (in.)	6.92	Total Flow Volume (L)	1308979
Max Intensity (in/hr)	1.08	Peak Flow (L/s)	4

Figure A-10 Monthly Hydrograph for April 2014; City of Trinidad Stormwater Discharge



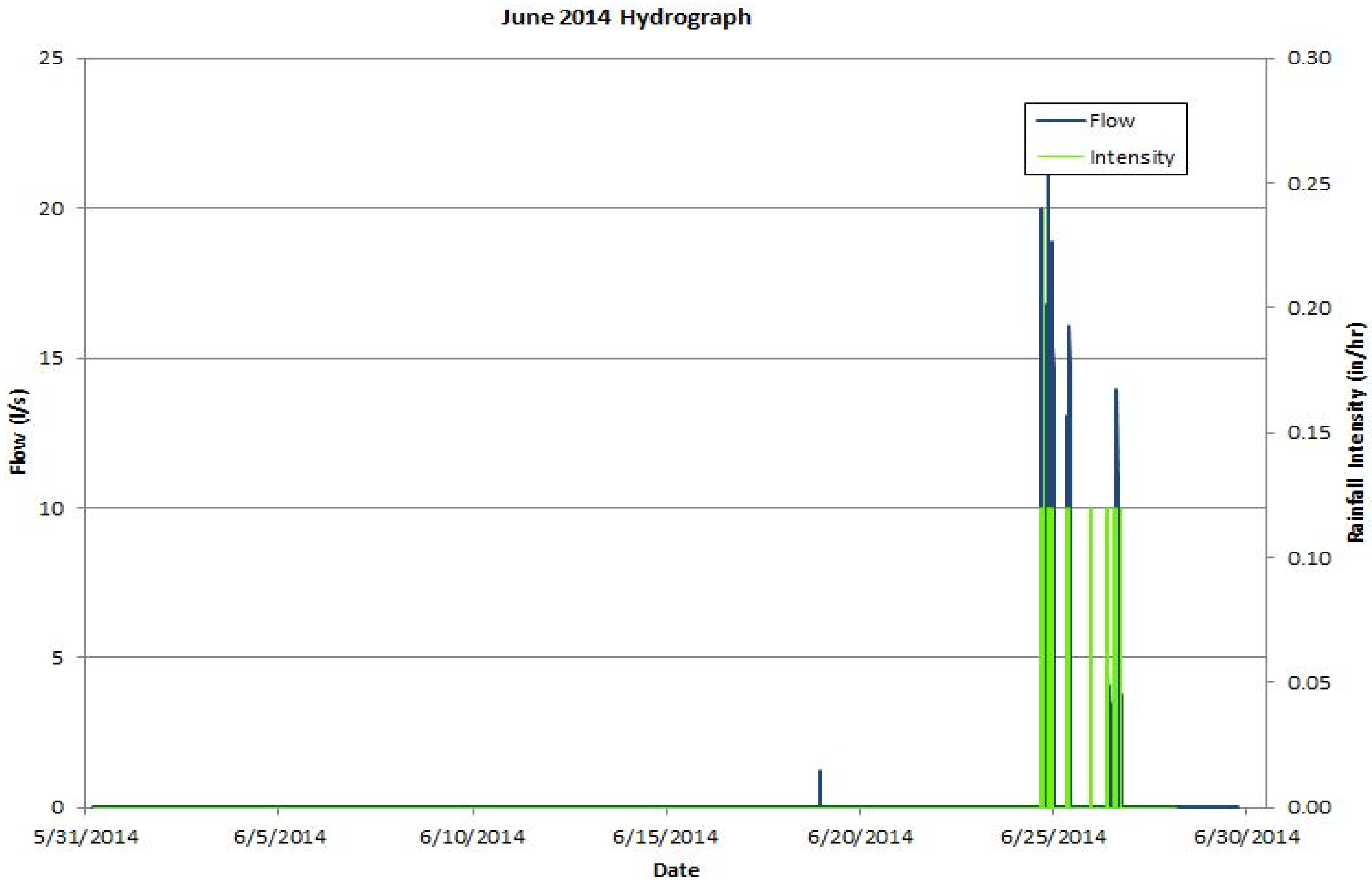
Rain Data		Runoff Data	
Monthly Rain (in.)	1.54	Total Flow Volume (L)	937844
Max Intensity (in/hr)	0.60	Peak Flow (L/s)	39

Figure A-11 Monthly Hydrograph for May 2014; City of Trinidad Stormwater Discharge



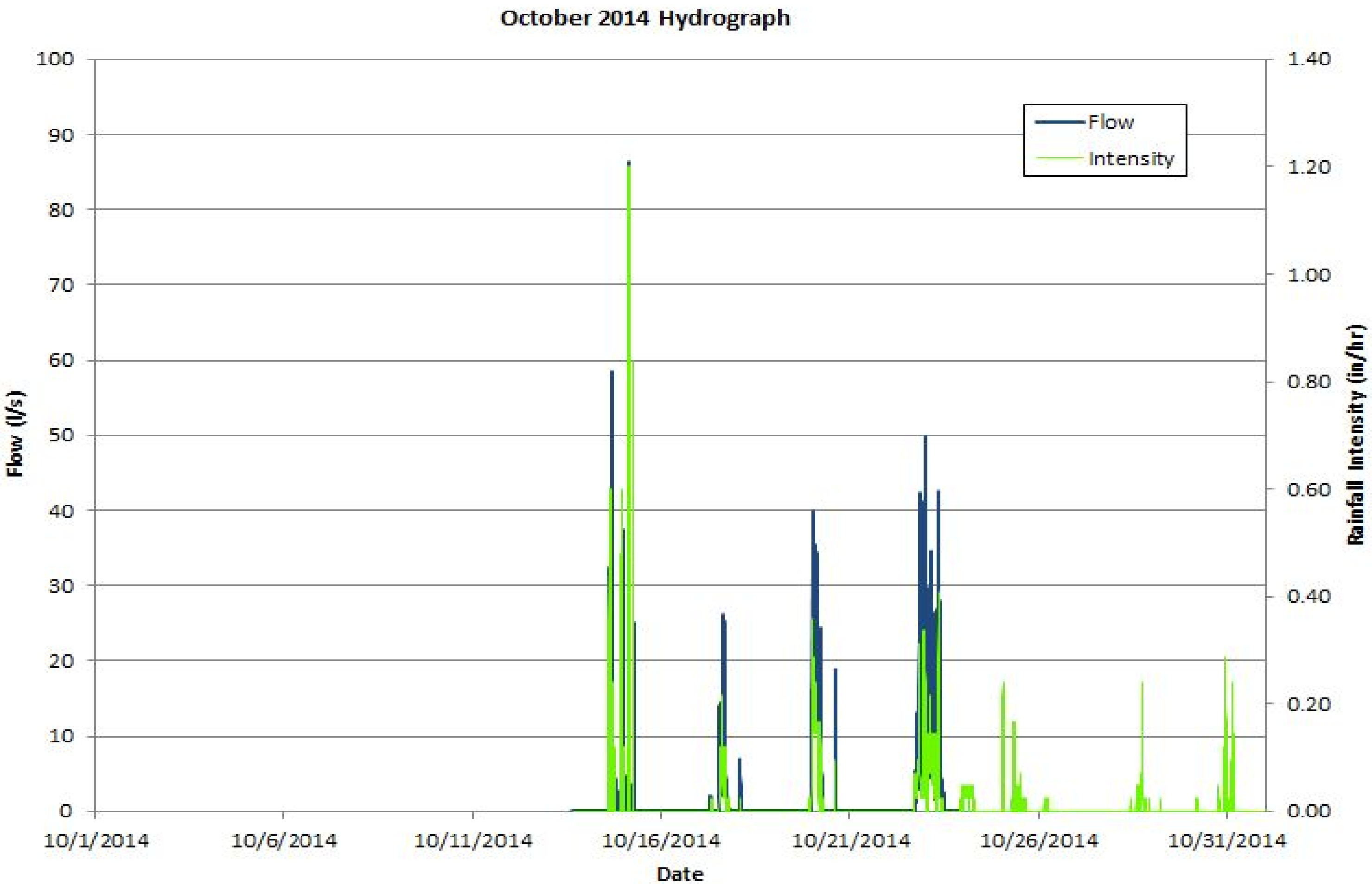
Rain Data			Runoff Data	
Monthly Rain (in.)	0.76		Total Flow Volume (L)	365902
Max Intensity (in/hr)	0.60		Peak Flow (L/s)	30

Figure A-12 Monthly Hydrograph for June 2014; City of Trinidad Stormwater Discharge



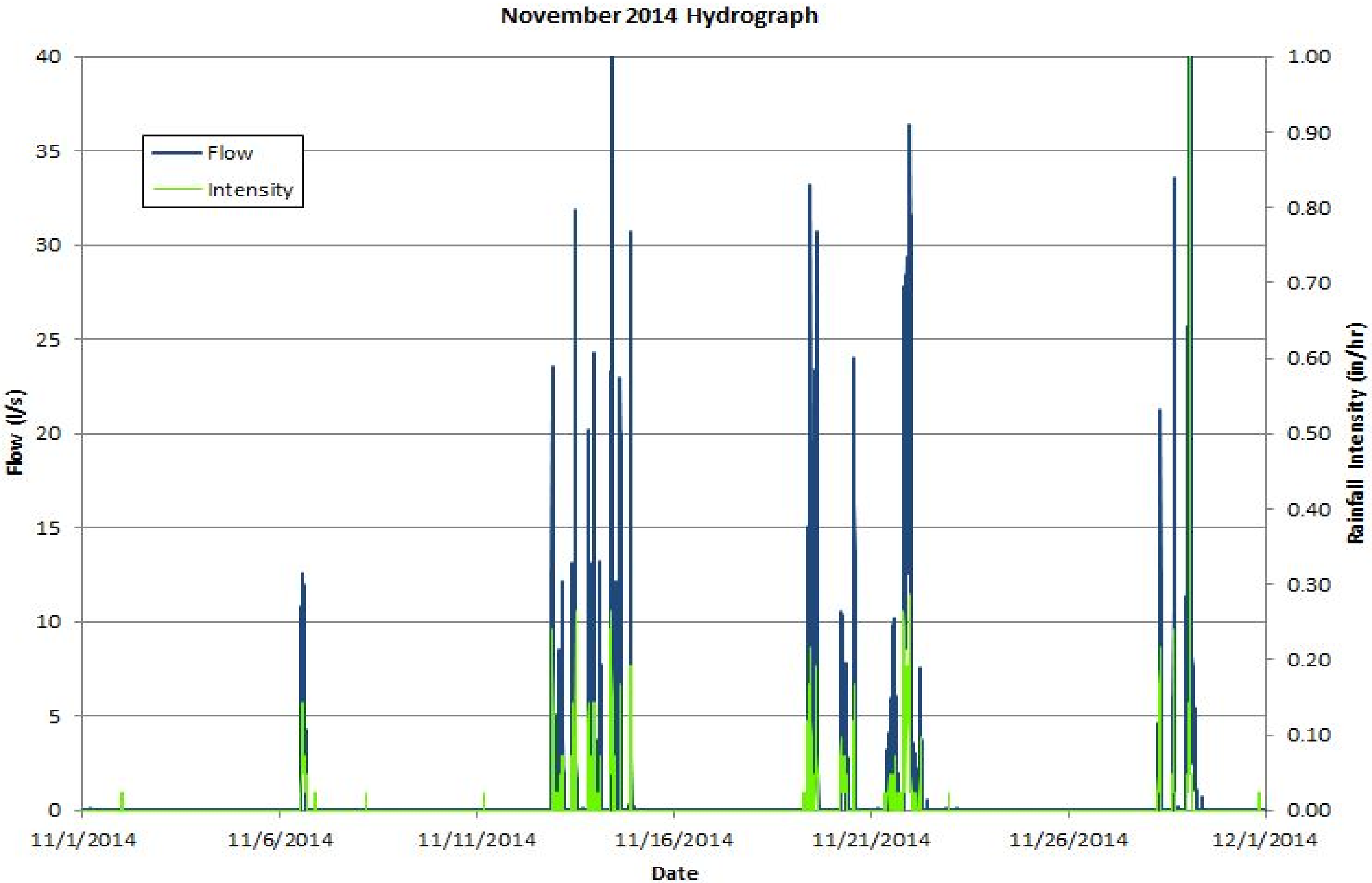
Rain Data		Runoff Data	
Monthly Rain (in.)	0.64	Total Flow Volume (L)	454433
Max Intensity (in/hr)	0.24	Peak Flow (L/s)	21

Figure A-13 Monthly Hydrograph for October 2014; City of Trinidad Stormwater Discharge



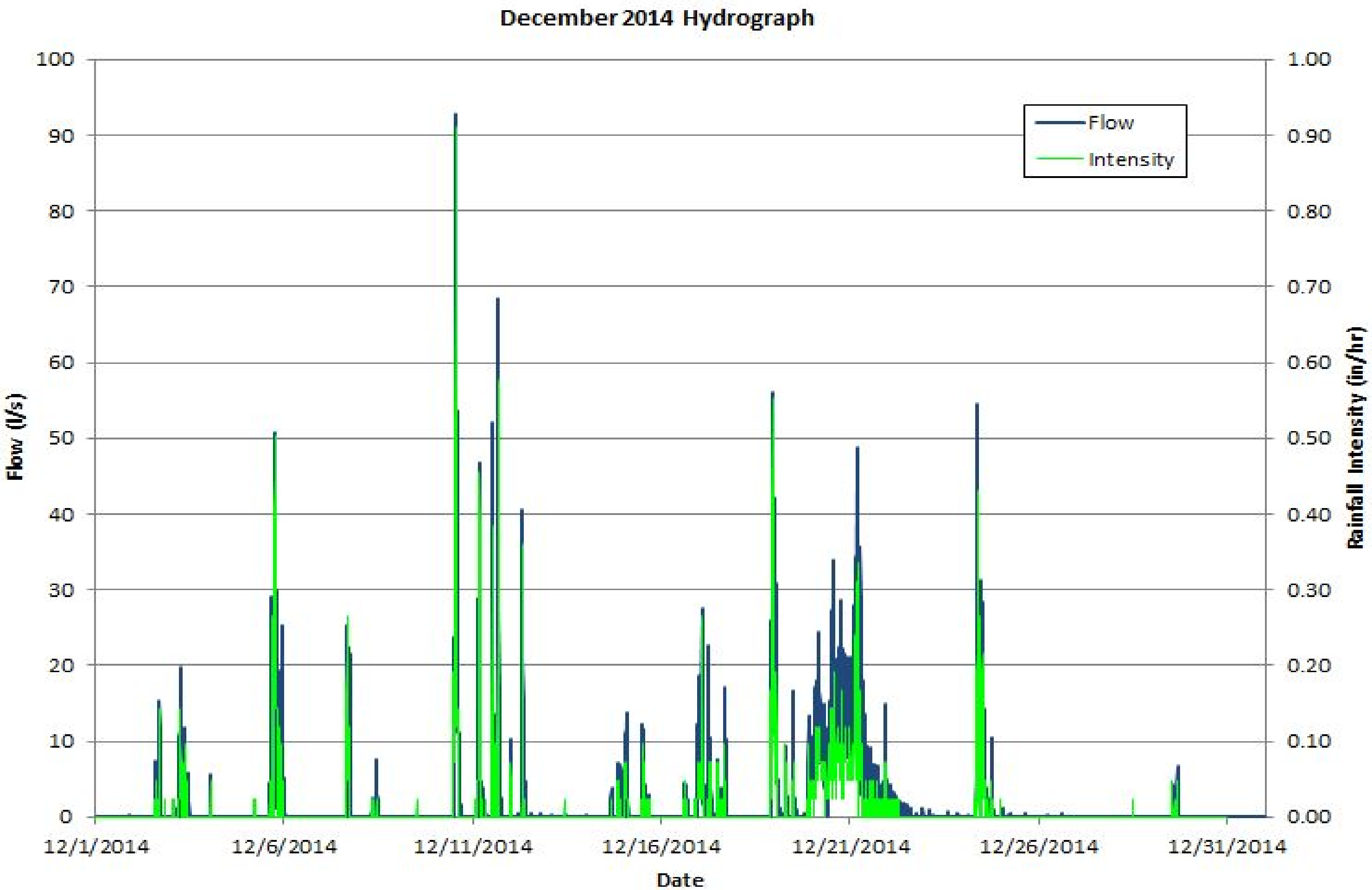
Rain Data		Runoff Data	
Monthly Rain (in.)	5.53	Total Flow Volume (L)	2240912
Max Intensity (in/hr)	1.20	Peak Flow (L/s)	86

Figure A-14 Monthly Hydrograph for November 2014; City of Trinidad Stormwater Discharge



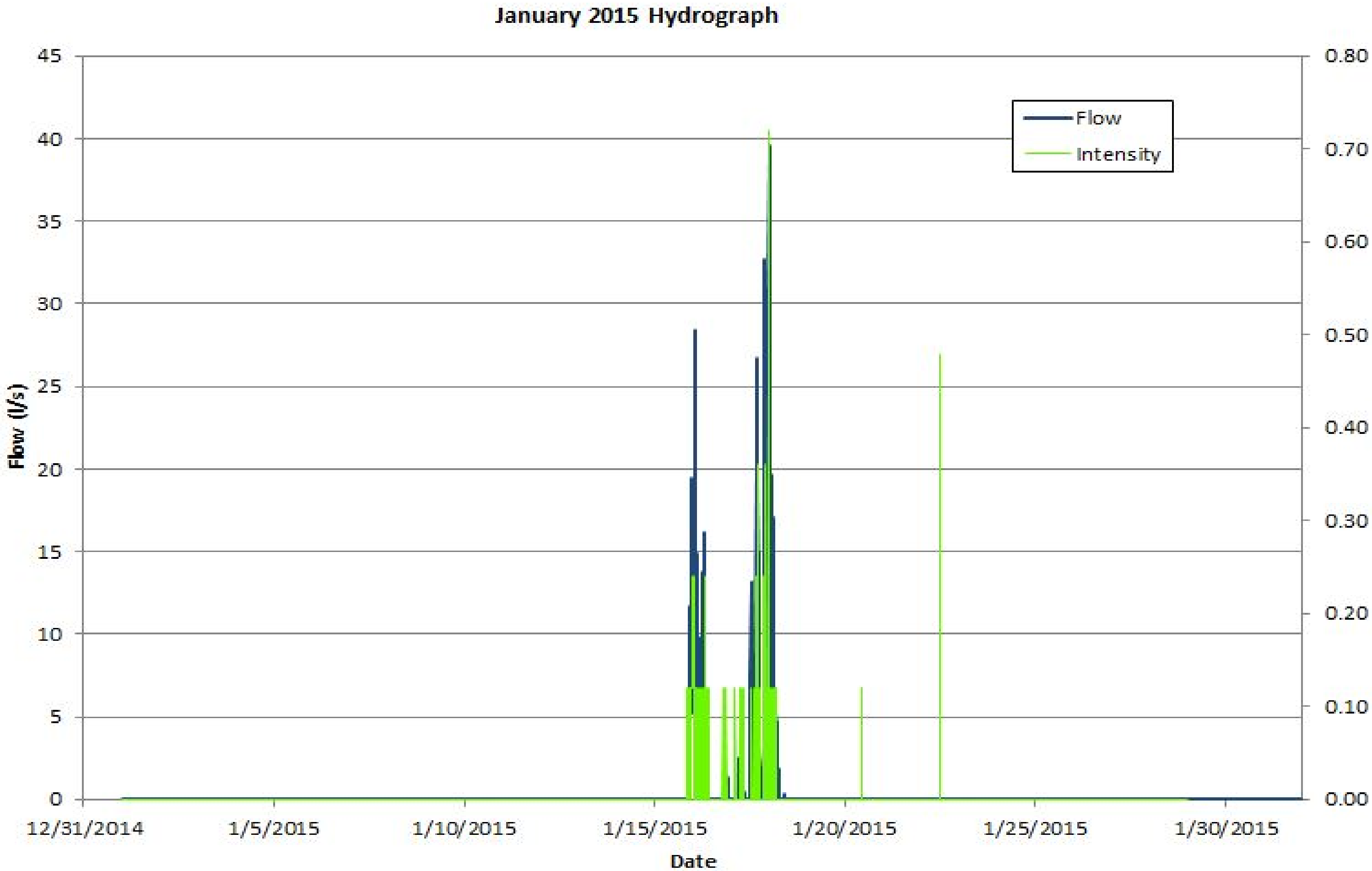
Rain Data			Runoff Data	
Monthly Rain (in.)	4.52		Total Flow Volume (L)	1787318
Max Intensity (in/hr)	1.42		Peak Flow (L/s)	172

Figure A-15 Monthly Hydrograph for December 2014; City of Trinidad Stormwater Discharge



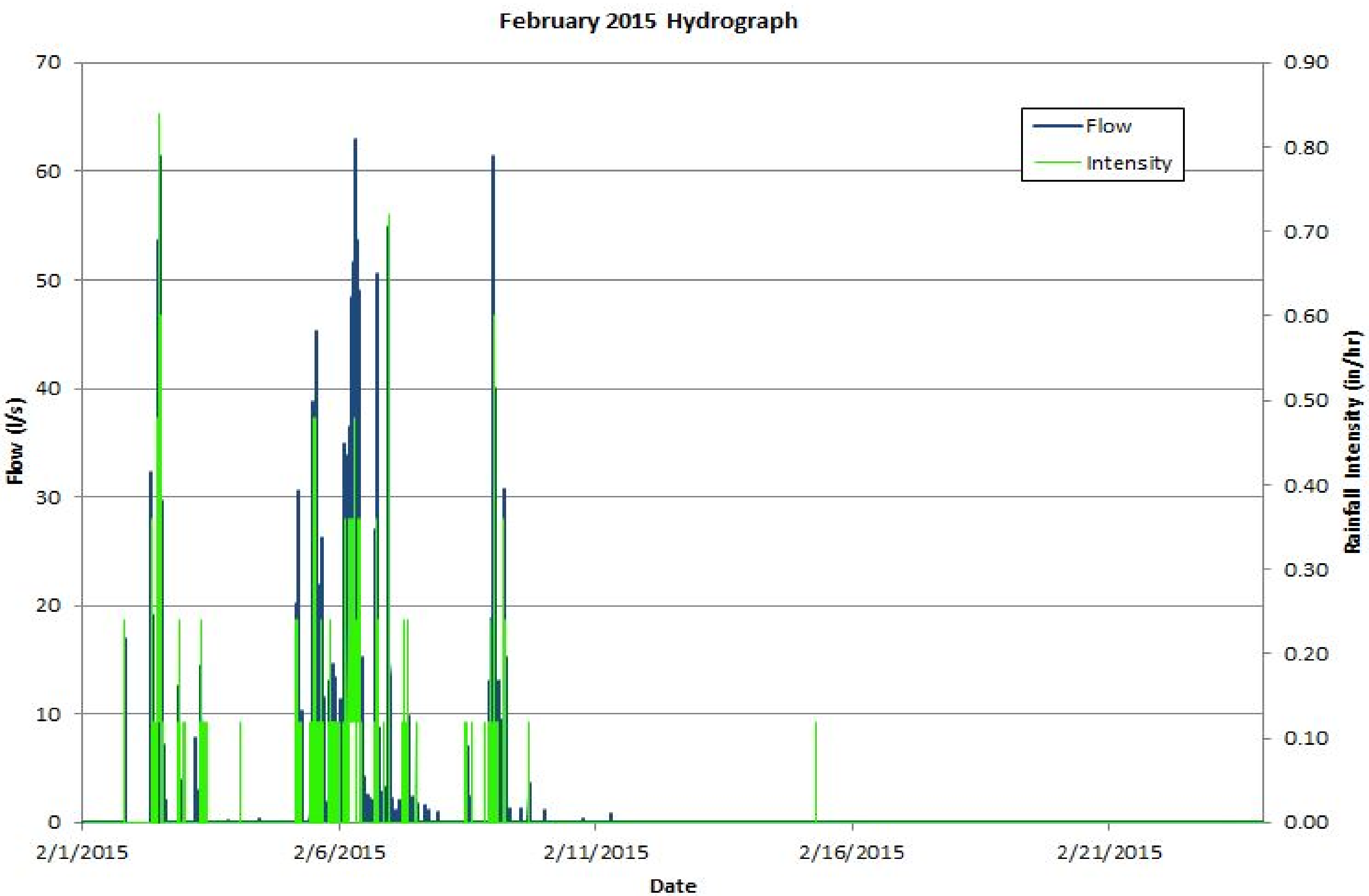
Rain Data			Runoff Data	
Monthly Rain (in.)	9.28		Total Flow Volume (L)	4392403
Max Intensity (in/hr)	0.91		Peak Flow (L/s)	93

Figure A-16 Monthly Hydrograph for January 2015; City of Trinidad Stormwater Discharge



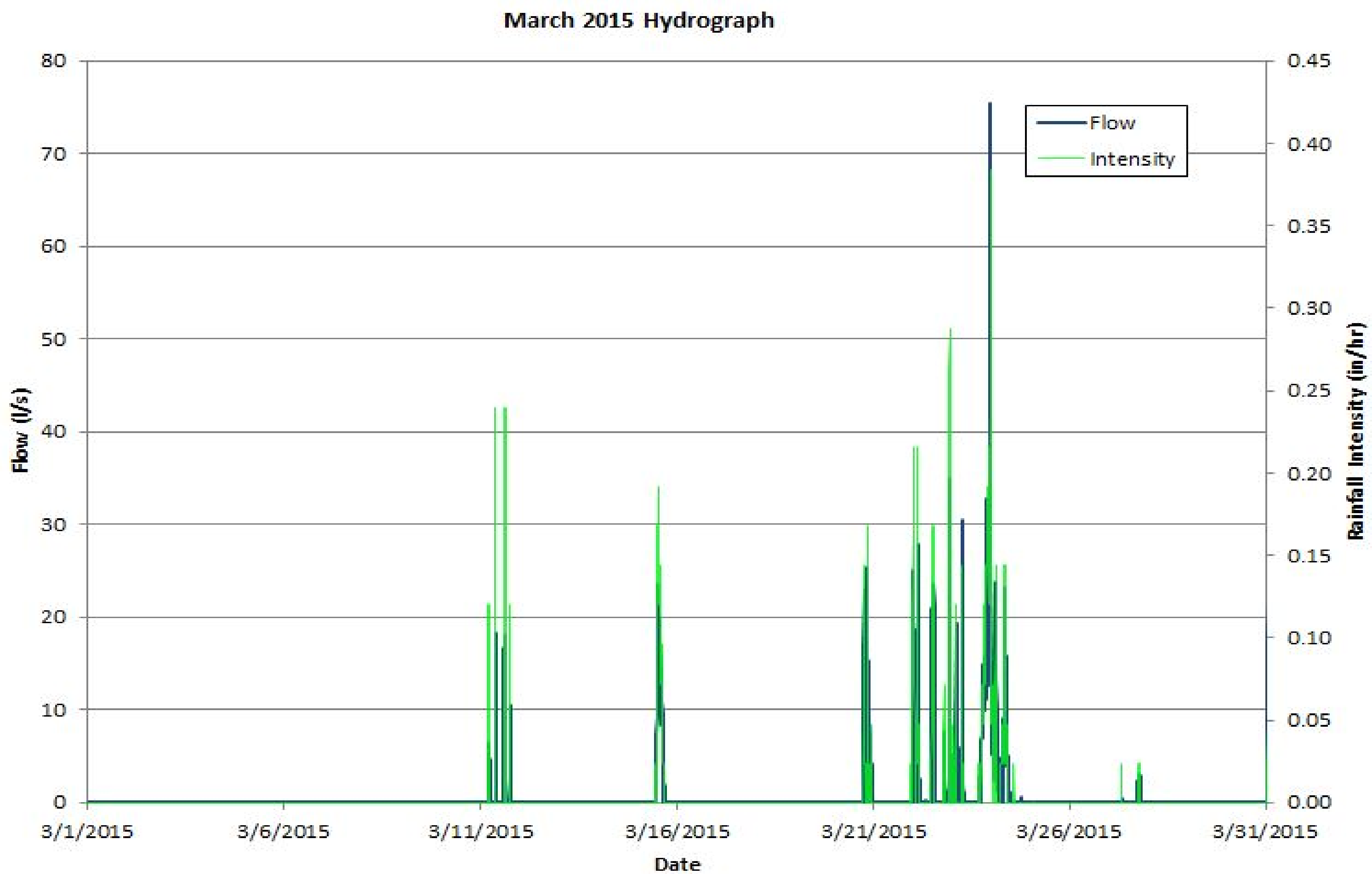
Rain Data			Runoff Data
Monthly Rain (in.)	1.69	Total Flow Volume (L)	728258
Max Intensity (in/hr)	0.72	Peak Flow (L/s)	40

Figure A-17 Monthly Hydrograph for February 2015; City of Trinidad Stormwater Discharge



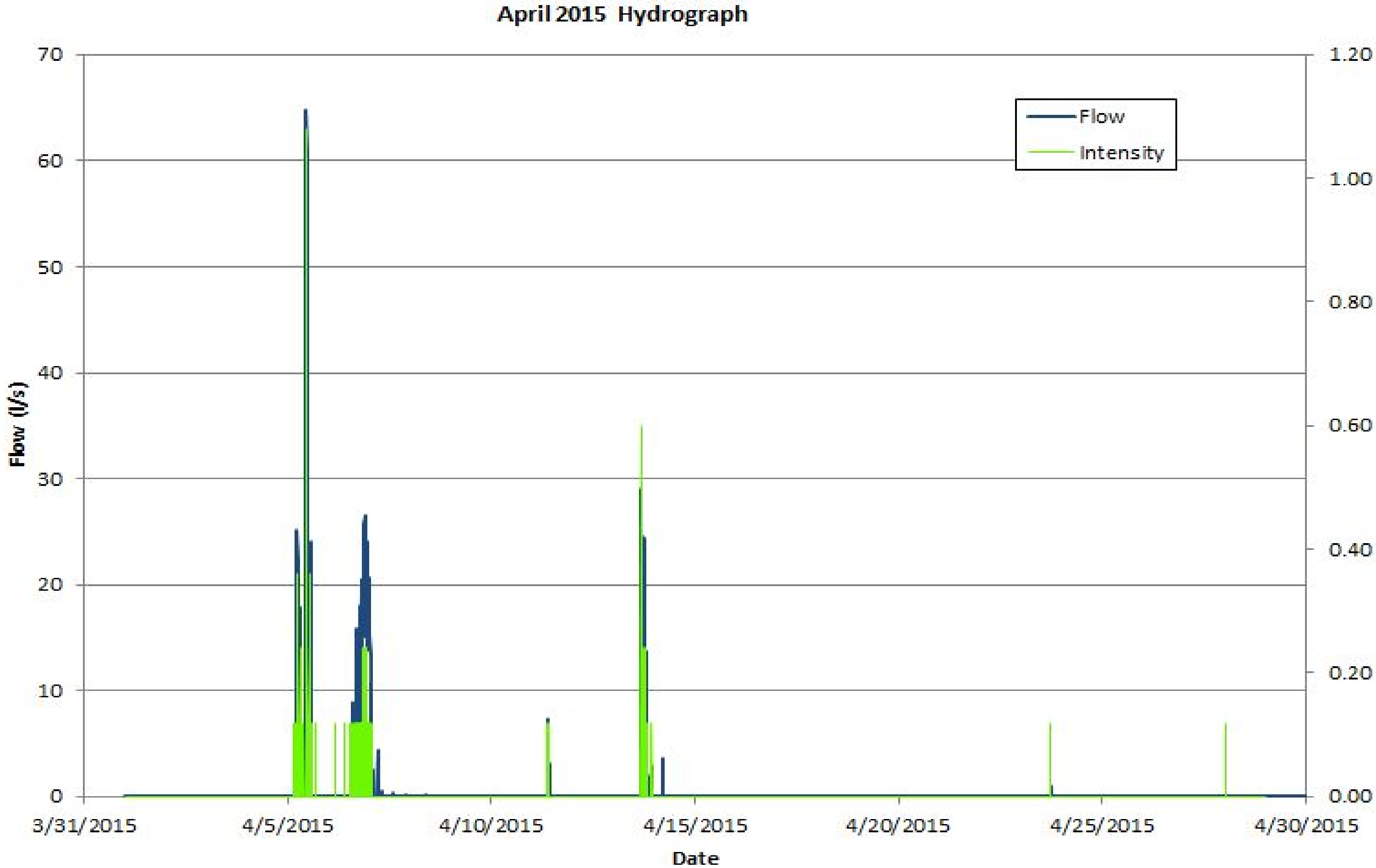
Rain Data		Runoff Data	
Monthly Rain (in.)	3.72	Total Flow Volume (L)	1968973
Max Intensity (in/hr)	0.84	Peak Flow (L/s)	63

Figure A-18 Monthly Hydrograph for March 2015; City of Trinidad Stormwater Discharge



Rain Data			Runoff Data	
Monthly Rain (in.)	3.35		Total Flow Volume (L)	1433143
Max Intensity (in/hr)	0.38		Peak Flow (L/s)	76

Figure A-19 Monthly Hydrograph for April 2015; City of Trinidad Stormwater Discharge



Rain Data		Runoff Data	
Monthly Rain (in.)	2.42	Total Flow Volume (L)	996785
Max Intensity (in/hr)	1.08	Peak Flow (L/s)	65

APPENDIX B: ANALYTICAL DATA TABLES – WATER QUALITY

List of Analytical Data Tables – Water Quality

Table B-1a. Pre-Construction Water Quality Data Results
Table B-1b. Post-Construction Water Quality Data Results
Table B-2a. Pre-Construction Water Toxicity Data Results
Table B-2b. Post-Construction Water Toxicity Data Results

Notations for the following tables:

D	The analyte was analyzed at a secondary dilution; the number in parentheses is the dilution factor.
H	A holding time violation occurred.
i	The MRL/MDL is elevated due to a chromatographic interference.
J	The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
PJM	The result is from a re-extraction and re-analysis to confirm original result.
U	The compound was analyzed for, but was not detected at or above the associated MDL.
NR	Not Reported
NT	Not Tested
ORW	Ocean Receiving Water
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
SVOCs	Semi-Volatile Organic Compounds
TRI-032	Trinidad ASBS stormwater discharge

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Indicator Bacteria (MPN/100ml)									
Total Coliforms	>24,196	10,462	7,701	809, NT	>24,196	4611	NT	NT	10,000
E. coli	9,208	350	341	41, NT	185	20	NT	NT	400
Enterococcus	14,136	1,119	1,106	253, NT	305	63	NT	NT	104
Conventionals & Hydrocarbons									
Turbidity (NTU)	32.5, 39.0	18.0	12	26, 7.6	19	7.2	NT	9.81, 9.75	-
TSS (mg/L)	85.5, 152	95.0, 95.0	40	120, 120	60	71	20.2	41, 52.8	-
Settleable Solids (ml/L/hr)	0.2	0.1	0.1	0.3, 0.3	0.1	0.15	NT	0.1 U, 0.1 U	-
Ammonia as N (mg/L)	0.068	0.07	0.22	0.048 U, 0.053 J	0.20	0.048 U	0.04 J	0.03 J, 0.03 J	0.6, 2.4, 6 [b]
Nitrate as N (mg/L)	0.264	NT	0.041 U	NT	0.37	NT	0.24	0.24, 0.21	-
Nitrate+Nitrite as N (mg/L)	NT	0.094	NT	0.27, 0.43	NT	0.13	NT	NT	-
Total Phosphorus (mg/L)	0.328	0.116	0.073	0.12, 0.14	0.17	0.094	NT	NT	-
Orthophosphate (mg/L)	NT	NT	NT	NT	NT	NT	0.05	0.06, 0.06	-
Total Cyanide (µg/L)	NT	3 U	2.7 U	2.7 U	2.7 U	2.7 U	NT	NT	1, 4, 10 [b]
MBAS (mg/L)	0.050 U	0.054	0.033 J	0.027 J, 0.030 J	0.066	0.043 J	NT	NT	-
TOC (mg/L)	5.3	2.1	120 D (200x)	2.1, 1.6	3.7	66 D(40x)	NT	NT	-
Oil & Grease (mg/L)	0.8 J	0.8 U	1.3 U	2.2 J, 1.3 U	1.3 U	1.3 U	1.0 U	1.0 U, 1.0 U	-
Diesel Range Organics (mg/L)	0.42 H1	0.028 J	0.098 J	0.024 U	0.24 U D(10x)	0.055 J	NT	NT	-
Oil Range Organics (mg/L)	NT	NT	0.33 U	0.33 U	3.3 U D(10x)	0.33 U	NT	NT	-
Gas Range Organics (mg/L)	NT	NT	0.044 U	0.044 U	0.044 U	0.044 U	NT	NT	-
Total Metals (µg/L)									
Antimony	0.39	2.04	0.11 J	0.15 J, 0.14 J	0.098 J	0.14 J	NT	NT	1,200 [c]
Arsenic	0.70	1.83 N	0.36	1.4, 1.4	0.22	1.4	1.593	1.388, 1.256	8, 32, 80 [b]
Beryllium	0.038	0.0316	0.039 U	0.039 U, 0.078	0.039 U	0.039 U	NT	NT	0.033 [c]
Cadmium	0.081	0.103	0.034	0.071, 0.077	0.061	0.063	0.048	0.0476, 0.0499	1, 4, 10 [b]
Total Chromium	4.78	3.75	3.4	5.7, 5.7	2.5	2.2	2.864	2.764, 2.1357	2, 8, 20 [b]
Chromium VI	0.004 U	0.008 J,H	NT	NT	NT	NT	NT	NT	2, 8, 20 [b]
Copper	12.8	2.380	3.5	2.5, 2.9	4.2	2.9	0.989	1.178, 1.365	3, 12, 30 [b]

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Lead	5.360	0.874	2.6	1.1, 1.3	3.1	0.73	0.2872	0.3127, 0.2866	2, 8, 20 [b]
Mercury	0.0154	0.0049	0.0024 H	0.0053 H, 0.0061 H	0.013	0.013	0.0012 U	0.0012 U, 0.0012 U	0.04, 0.16, 0.4 [b]
Nickel	6.75	6.40	2.5	7.3, 8.1	1.4	5.4	3.0634	2.6327, 3.2059	5, 20, 50 [b]
Selenium	0.2 U	0.2 U	0.034 U	0.045 J, 0.044 J	0.034 U	0.060 J	0.018	0.016, 0.025	15, 60, 150 [b]
Silver	0.30	0.014 J	0.018 U	0.018 U, 0.018 U	0.038 J	0.018 U	0.01 U	0.01 U, 0.01 J	0.7, 2.8, 7 [b]
Thallium	0.024	0.010 J	0.011 U	0.015 J, 0.014 J	0.011 U	0.011 J	NT	NT	2 [c]
Zinc	53.0	5.87	21	6.4, 6.7	25	5.4	13.6612	2.7661, 2.4869	20, 80, 200 [b]
Polycyclic Aromatic Hydrocarbons (µg/L)									
Acenaphthene	0.031 U	0.029 U	0.020 U,H	0.020 U,H,PJM 0.038 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Acenaphthylene	0.029 J	0.017 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Anthracene	0.037 J	0.017 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	NR		0.0088 [d]
Benzo(a)anthracene	0.030 J	0.020 U	0.024 J H	0.020 U,H,PJM 0.035 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(a)pyrene	0.037 U	0.035 U	0.020 U,H	0.020 U,H,PJM 0.033 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(b)fluoranthene	0.050 J	0.019 U	0.020 U,H	0.020 U,H,PJM 0.039 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(e)pyrene	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Benzo(g,h,i)perylene	0.056 J	0.022 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Benzo(k)fluoranthene	0.046 J	0.027 U	0.020 U,H	0.020 U,H,PJM 0.039 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Biphenyl	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Chrysene	0.061 J	0.032 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Dibenzo(a,h)anthracene	0.021 U	0.019 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Dibenzothiophene	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Dimethylnaphthalene, 2,6-	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Fluoranthene	0.078 J	0.023 J	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	NR	NR	15 [d]
Fluorene	0.033 U	0.030 U	0.020 U,H	0.020 U,H,PJM 0.027 J,H,PJM	0.10 U	0.10 U	0.0016 J	0.0035 J, 0.0039 J	0.0088 [d]
Indeno(1,2,3-c,d)pyrene	0.025 U	0.024 U	0.020 U,H	0.020 U,H,PJM 0.031 J,H,PJM	0.10 U	0.10 U	0.001 U		0.0088 [d]
Methylnaphthalene, 1-	NR	NR	0.02 H,PJM	0.020 U,H,PJM 0.020 U,H,PJM	0.1000 U	0.1000 U	NR	NR	0.0088 [d]
Methylnaphthalene, 2-	0.040 J	0.029 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.1000 U	0.1000 U	NR	NR	0.0088 [d]
Methylphenanthrene, 1-	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Naphthalene	0.068 J	0.025 U	0.020 U,H	0.020 U,H,PJM 0.020 U,H,PJM	0.10 U	0.10 U	NR	NR	0.0088 [d]
Perylene	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Phenanthrene	0.056 J	0.036 J	0.020 U,H	0.024 J,H,PJM 0.065 J,H,PJM	0.10 U	0.10 U	0.0029 J	0.0059, 0.0065	0.0088 [d]
Pyrene	0.078 J	0.029 J	0.020 U,H	0.020 U,H,PJM 0.025 J,H,PJM	0.10 U	0.10 U	0.001 U	0.001 U	0.0088 [d]
Trimethylnaphthalene, 2,3,5-	NR	NR	NR	NR	NR	NR	NR	NR	0.0088 [d]
Total Detectable PAHs	*0.629*	*0.089*	*0.024*	*0.0, 0.332*	*0.0*	*0.0*	*0.0045*	*0.0094*	-
Organochlorine Pesticides (ng/L)									
2,4-DDD	NT	NT	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	0.17 [c]
4,4-DDD	0.21 U	0.21 U	3.0 U	3.0 U	3.0 U	3.0 U	NT	NT	
2,4-DDE	NT	NT	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	
4,4-DDE	0.19 U	0.19 U	2.5 U	2.5 U	2.5 U	2.5 U	NT	NT	
2,4-DDT	NT	NT	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	
4,4-DDT	1.3 Ui	0.17 U	3.1 U	3.1 U	3.1 U	3.1 U	NT	NT	
Aldrin	0.11 U	0.11 U	1.5 U	1.5 U	1.5 U	1.5 U	NT	NT	0.022 [c]

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
alpha-BHC	0.21 U	0.21 U	1.8 U	1.8 U	1.8 U	1.8 U	NT	NT	4, 8, 12 [b]
beta-BHC	0.41 U	0.41 U	3.1 U	3.1 U	3.1 U	3.1 U	NT	NT	
gamma-BHC (Lindane)	0.47 U	0.47 U	2.1 U	2.1 U	2.1 U	2.1 U	NT	NT	
delta-BHC	1.7 Ui	0.56 Ui	2.5 U	2.5 U	2.5 U	2.5 U	NT	NT	
alpha-Chlordane	0.27 U	0.27 U	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	0.023 [c]
gamma-Chlordane	0.31 U	0.31 U	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	
Dieldrin	0.66 Ui	0.37 U	2.1 U	2.1 U	2.1 U	2.1 U	NT	NT	0.04 [c]
Endosulfan I	0.25 U	0.25 U	1.7 U	1.7 U	1.7 U	1.7 U	NT	NT	9, 18, 27 [b]
Endosulfan II	0.55 Ui	0.35 U	1.9 U	1.9 U	1.9 U	1.9 U	NT	NT	
Endosulfan Sulfate	2.5 Ui	0.28 U	5.9	5.0 U	5.0 U	5.0 U	NT	NT	
Endrin	0.49 U	0.49 U	2.8 U	2.8 U	2.8 U	2.8 U	NT	NT	2, 4, 6 [b]
Endrin Aldehyde	0.21 U	1.9 Ui	3.0 U	3.0 U	3.0 U	3.0 U	NT	NT	-
Endrin Ketone	0.98 Ui	0.32 U	NR	NR	NR	NR	NT	NT	-
Heptachlor	0.50 Ui	0.18 U	1.7 U	1.7 U	1.7 U	1.7 U	NT	NT	0.05 [c]
Heptachlor Epoxide	0.21 U	3.2 Ui	1.9 U	1.9 U	1.9 U	1.9 U	NT	NT	0.02 [c]
Methoxychlor	3.2 Ui	3.2 U	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	-
Mirex	NR	NR	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	-
Toxaphene	110 Ui	110 Ui	120 U	120 U	120 U	120 U	NT	NT	0.21 [c]
Trans-Nonachlor	NR	NR	5.0 U	5.0 U	5.0 U	5.0 U	NT	NT	-
PCBs (ng/L)									
Aroclor 1016	0.96 U	4.4 U	50 U	50 U	50 U	50 U	NT	NT	0.019 [c]
Aroclor 1221	0.96 U	47 U	60 U	60 U	60 U	60 U	NT	NT	
Aroclor 1232	0.96 U	39 U	100 U	100 U	100 U	100 U	NT	NT	
Aroclor 1242	0.96 U	12 U	70 U	70 U	70 U	70 U	NT	NT	
Aroclor 1248	0.96 U	12 U	60 U	60 U	60 U	60 U	NT	NT	
Aroclor 1254	0.96 U	0.96 U	40 U	40 U	40 U	40 U	NT	NT	
Aroclor 1260	0.96 U	0.96 U	40 U	40 U	40 U	40 U	NT	NT	

Table B-1a	Pre-Construction Water Quality Data Results								
	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
Parameter	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Organophosphorus Pesticides (µg/L)									
Azinphos-methyl	0.030 U	0.075 U	0.0055 U	0.0055 U 0.0055 U,H	0.0055 U	0.0055 U	NT	NT	-
Bolstar	0.014 U	0.035 U	0.0046 U	0.0046 U 0.0046 U,H	0.0046 U	0.0046 U	NT	NT	-
Chlorpyrifos	0.036 U	0.090 U	0.0069 U	0.0069 U 0.0069 U,H	0.0069 U	0.0069 U	0.0005 U	0.0005 U, 0.0005 U	-
Coumaphos	0.021 U	0.053 U	0.0051 U	0.0051 U 0.0051 U,H	0.0051 U	0.0051 U	NT	NT	-
Demeton-O & S	0.16 U	0.40 U	0.010 U	0.010 U 0.010 U,H	0.010 U	0.010 U	NT	NT	-
Diazinon	0.025 U	0.50 U	0.0052 U	0.0052 U 0.0052 U,H	0.0052 U	0.0052 U	0.0005 U	0.0005 U, 0.0005 U	-
Dichlorvos	0.043 U	1.3 U	0.0029 U	0.0029 U 0.0029 U,H	0.0029 U	0.0029 U	NT	NT	-
Dimethoate	0.049 U	1.3 U	0.0062 U	0.0062 U 0.0062 U,H	0.0062 U	0.0062 U	0.005 U	0.005 U, 0.005 U	-
Disulfoton	0.030 U	0.075 U	0.010 U	0.010 U 0.010 U,H	0.010 U	0.010 U	0.001 U	0.001 U, 0.001 U	-
Ethoprop	0.033 U	0.083 U	0.0067 U	0.0067 U 0.0067 U,H	0.0067 U	0.0067 U	NT	NT	-
Ethyl Parathion	0.011 U	0.028 U	0.0054 U	0.0054 U 0.0054 U,H	0.0054 U	0.0054 U	NT	NT	-
Fensulfothion	0.036 U	0.090 U	0.0029 U	0.0029 U 0.0029 U,H	0.0029 U	0.0029 U	NT	NT	-
Fenthion	0.015 U	0.038 U	0.0038 U	0.0038 U 0.0038 U,H	0.0038 U	0.0038 U	NT	NT	-
Malathion	0.017 U	0.043 U	0.0076 U	0.0076 U 0.0076 U,H	0.0076 U	0.0076 U	0.003 U	0.003 U, 0.003 U	-
Merphos	0.033 U	0.083 U	0.0058 U	0.0058 U 0.0058 U,H	0.0058 U	0.0058 U	NT	NT	-

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Methyl Parathion	0.020 U	0.050 U	0.0063 U	0.0063 U 0.0063 U,H	0.0063 U	0.0063 U	0.001 U	0.001 U, 0.001 U	-
Mevinphos	0.039 U	0.098 U	0.0042 U	0.0042 U 0.0042 U,H	0.0042 U	0.0042 U	NT	NT	-
Naled	NR	NR	0.0076 U	0.0076 U 0.0076 U,H	0.0076 U	0.0076 U	NT	NT	-
Phorate	0.025 U	0.063 U	0.0030 U	0.0030 U 0.0030 U,H	0.0030 U	0.0030 U	0.005 U	0.005 U, 0.005 U	-
Phosmet	NT	NT	NT	NT	NT	NT	0.005 U	0.005 U, 0.005 U	-
Ronnel	0.024 U	0.060 U	0.0041 U	0.0041 U 0.0055 H	0.0041 U	0.0041 U	NT	NT	-
Sulfotep	0.013 U	0.033 U	NR	NR	NR	NR	NT	NT	-
Tetrachlorovinphos	0.035 U	0.088 U	0.0031 U	0.0031 U 0.0031 U,H	0.0031 U	0.0031 U	NT	NT	-
Tokuthion (Prothiofos)	0.015 U	0.038 U	0.0078 U	0.0078 U 0.0078 U,H	0.0078 U	0.0078 U	NT	NT	-
Trichloronate	0.029 U	0.073 U	0.0067 U	0.0067 U 0.0067 U,H	0.0067 U	0.0067 U	NT	NT	-
Pyrethroid Pesticides (ng/L)									
Allethrin	0.1 U	0.1 U	0.85 U	0.85 U	310 D(5)	0.85 U	NT	NT	-
Bifenthrin	19	2.9	0.79 U	0.79 U	0.79 U	0.79 U	0.0005 U	0.0005 U, 0.0005 U	-
Cyfluthrin	0.2 U	0.2 U	0.83 U	0.83 U	0.83 U	0.83 U	0.0005 U	0.0005 U, 0.0005 U	-
Cypermethrin	0.2 U	0.2 U	0.66 U	0.66 U	0.66 U	0.66 U	0.0005 U	0.0005 U, 0.0005 U	-
Deltamethrin/Tralomethrin	0.2 U	0.2 U	1.9 U	1.9 U	1.9 U	1.9 U	0.0005 U	0.0005 U, 0.0005 U	-
Dichloran	NR	NR	0.80 U	0.80 U	0.80 U	0.80 U	NT	NT	-
Esfenvalerate/Fenvalerate	0.2 U	0.2 U	0.98 U	0.98 U	0.98 U	0.98 U	0.0005 U	0.0005 U, 0.0005 U	-

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011 TRI-032	Storm Event #1 10/03/2011 ORW	Storm Event #2 01/20/2012 TRI-032	Storm Event #2 01/20/2012 ORW *	Storm Event #3 04/13/2012 TRI-032	Storm Event #3 04/13/2012 ORW	Storm Event #4 01/11/2014 Pre-Storm ORW	Storm Event #4 01/11/2014 During-Storm ORW	California Ocean Plan Criteria [a]
Fenpropathrin	0.2 U	0.2 U	NR	NR	NR	NR	0.0005 U	0.0005 U, 0.0005 U	-
Lambda-Cyhalothrin	0.2 U	0.2 U	1.2 U	1.2 U	1.2 U	1.2 U	0.0005 U	0.0005 U, 0.0005 U	-
Pendimethalin	NR	NR	0.50 U	0.50 U	0.50 U	0.50 U	NT	NT	-
Permethrin, cis- & trans-	2 U	2 U	5.0 U	5.0 U	5.0 U	5.0 U	0.005 U	0.005 U, 0.005 U	-
Prallethrin	NR	NR	0.92 U	0.92 U	0.92 U	0.92 U	NT	NT	-
Sumithrin	NR	NR	2.4 U	2.4 U	2.4 U	2.4 U	NT	NT	-
Tau-Fluvalinate	0.2 U	0.2 U	NR	NR	NR	NR	NT	NT	-
Tefluthrin	NR	NR	0.93 U	0.93 U	0.93 U	0.93 U	NT	NT	-
Tetramethrin	0.2 U	0.2 U	NR	NR	NR	NR	NT	NT	
Other SVOCs, including Phenols and Phthalates (µg/L)									
Aniline	NR	NR	0.32 U,H,PJM	0.32 U,H,PJM, 0.32 U,H,PJM	0.32 U	0.32 U	NT	NT	-
Benzidine	NR	NR	3.7 U,H, PJM	3.7 U,H,PJM 3.7 U,H,PJM	3.7 U	3.7 U	NT	NT	-
Benzoic Acid	1.6 J	1.3 U	8.6 U,H,PJM	8.6 U,H,PJM 8.6 U,H,PJM	8.6 U	8.6 U	NT	NT	-
Benzyl Alcohol	0.17 J	0.082 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	-
Bis(2-chloroethoxy)methane	0.029 U	0.027 U	0.25 U,H,PJM	0.25 U,H,PJM 0.25 U,H,PJM	0.25 U	0.25 U	NT	NT	4.4 [d]
Bis(2-chloroethyl) Ether	0.042 U	0.039 U	0.27 U,H,PJM	0.27 U,H,PJM 0.27 U,H,PJM	0.27 U	0.27 U	NT	NT	0.045 [d]
Bis(2-chloroisopropyl) Ether	0.031 U	0.029 U	0.38 U,H,PJM	0.38 U,H,PJM 0.38 U,H,PJM	0.38 U	0.38 U	NT	NT	1,200 [d]
Bis(2-ethylhexyl) Phthalate	1.10 J	0.30 J	2.3 U,H,PJM	2.3 U,H,PJM 2.9 J,H,PJM	2.3 U	2.3 U	NT	NT	-
Bromophenyl Phenyl Ether, 4-	0.031 U	0.029 U	0.36 U,H,PJM	0.36 U,H,PJM 0.36 U,H,PJM	0.36 U	0.36 U	NT	NT	-

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Butyl Benzyl Phthalate	0.17 J	0.041 J	0.18 U,H,PJM	0.18 U,H,PJM 0.18 U,H,PJM	0.18 U	0.18 U	NT	NT	-
Carbazole	NR	NR	0.20 U,H,PJM	0.20 U,H,PJM 0.20 U,H,PJM	0.20 U	0.20 U	NT	NT	-
Chloro-3-methylphenol, 4-	0.045 U	0.042 U	0.23 U,H,PJM	0.20 U,H,PJM 0.23 U,H,PJM	0.23 U	0.23 U	NT	NT	-
Chloroaniline, 4-	0.030 U	0.028 U	0.19 U,H,PJM	0.23 U,H,PJM 0.19 U,H,PJM	0.19 U	0.19 U	NT	NT	-
Chloronaphthalene, 2-	0.049 U	0.046 U	0.45 U,H,PJM	0.45 U,H,PJM 0.45 U,H,PJM	0.45 U	0.45 U	NT	NT	-
Chlorophenol, 2-	0.065 U	0.060 U	0.28 U,H,PJM	0.28 U,H,PJM 0.28 U,H,PJM	0.28 U	0.28 U	NT	NT	-
Chlorophenyl-4-Phenyl Ether	0.033 U	0.030 U	0.41 U,H,PJM	0.41 U,H,PJM 0.41 U,H,PJM	0.41 U	0.41 U	NT	NT	-
Dibenzofuran	0.039 J	0.020 U	0.37 U,H,PJM	0.37 U,H,PJM 0.37 U,H,PJM	0.37 U	0.37 U	NT	NT	-
Dichlorobenzene, 1,2-	0.027 U	0.025 U	0.57 U,H,PJM	0.57 U,H,PJM 0.57 U,H,PJM	0.57 U	0.57 U	NT	NT	5,100 [c]
Dichlorobenzene, 1,3-	0.025 U	0.024 U	0.53 U,H,PJM	0.53 U,H,PJM 0.53 U,H,PJM	0.53 U	0.53 U	NT	NT	-
Dichlorobenzene, 1,4-	0.035 U	0.033 U	0.55 U,H,PJM	0.55 U,H,PJM 0.55 U,H,PJM	0.55 U	0.55 U	NT	NT	18 [c]
Dichlorobenzidine, 3,3'-	0.51 U	0.48 U	1.2 U,H,PJM	1.2 U,H,PJM 1.2 U,H,PJM	1.2 U	1.2 U	NT	NT	0.0081 [c]
Dichlorophenol, 2,4-	0.060 J	0.053 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	-
Diethyl Phthalate	0.81	0.051 J	0.40 J,H,PJM	0.15 U,H,PJM 0.25 U,H,PJM	0.58 J	0.15 U	NT	NT	33,000 [c]
Dimethyl Phthalate	0.8	0.028 J	0.18 U,H,PJM	0.18 U,H,PJM 0.18 U,H,PJM	0.18 U	0.18 U	NT	NT	820,000 [c]
Dimethylphenol, 2,4-	2.7 U	2.5 U	0.30 U,H,PJM	0.30 U,H,PJM 0.30 U,H,PJM	0.30 U	0.30 U	NT	NT	-

Table B-1a Pre-Construction Water Quality Data Results

Parameter	Storm Event #1 10/03/2011 TRI-032	Storm Event #1 10/03/2011 ORW	Storm Event #2 01/20/2012 TRI-032	Storm Event #2 01/20/2012 ORW *	Storm Event #3 04/13/2012 TRI-032	Storm Event #3 04/13/2012 ORW	Storm Event #4 01/11/2014 Pre-Storm ORW	Storm Event #4 01/11/2014 During-Storm ORW	California Ocean Plan Criteria [a]
Di-n-butyl Phthalate	**0.11 J**	**0.034 J**	0.24 U,H,PJM	0.24 U,H,PJM 0.24 U,H,PJM	0.24 U	0.24 U	NT	NT	3,500 [c]
Dinitro-2-methylphenol, 4,6-	0.030 U	0.028 U	1.7 U,H,PJM	1.7 U,H,PJM 1.7 U,H,PJM	1.7 U	1.7 U	NT	NT	220 [c]
Dinitrophenol, 2,4-	0.21 U	0.19 U	1.6 U,H,PJM	1.6 U,H,PJM 1.6 U,H,PJM	1.6 U	1.6 U	NT	NT	4.0 [c]
Dinitrotoluene, 2,4-	0.022 U	0.020 U	0.18 U,H,PJM	0.18 U,H,PJM 0.18 U,H,PJM	0.18 U	0.18 U	NT	NT	2.6 [c]
Dinitrotoluene, 2,6-	0.040 U	0.037 U	0.27 U,H,PJM	0.27 U,H,PJM 0.27 U,H,PJM	0.27 U	0.27 U	NT	NT	-
Di-n-octyl Phthalate	**0.11 J**	0.020 U	0.19 U,H,PJM	0.19 U,H,PJM 0.19 U,H,PJM	0.19 U	0.19 U	NT	NT	-
Azobenzene/1,2-Diphenylhydrazine	NR	NR	0.25 U,H,PJM	0.25 U,H,PJM 0.25 U,H,PJM	0.25 U	0.25 U	NT	NT	-
Hexachlorobenzene	0.027 U	0.025 U	0.49 U,H,PJM	0.49 U,H,PJM 0.49 U,H,PJM	0.49 U	0.49 U	NT	NT	0.00021 [c]
Hexachlorobutadiene	0.033 U	0.030 U	0.47 U,H,PJM	0.47 U,H,PJM 0.47 U,H,PJM	0.47 U	0.47 U	NT	NT	14 [c]
Hexachlorocyclopentadiene	0.23 U	0.22 U	1.5 U,H,PJM	1.5 U,H,PJM 1.5 U,H,PJM	1.5 U	1.5 U	NT	NT	58 [c]
Hexachloroethane	0.029 U	0.027 U	0.52 U,H,PJM	0.52 U,H,PJM 0.52 U,H,PJM	0.52 U	0.52 U	NT	NT	2.5 [c]
Isophorone	**0.087 J**	0.018 U	0.21 U,H,PJM	0.21 U,H,PJM 0.21 U,H,PJM	0.21 U	0.21 U	NT	NT	730 [c]
Methylphenol, 2- (Ortho-Cresol)	0.14 U	0.13 U	0.21 U,H,PJM	0.21 U,H,PJM 0.21 U,H,PJM	0.21 U	0.21 U	NT	NT	-
Methylphenol, 4- (Para-Cresol)	0.15 U	0.14 U	NR	NR	0.22 U	0.22 U	NT	NT	-
Nitroaniline, 2-	0.029 U	0.027 U	0.19 U,H,PJM	0.19 U,H,PJM 0.19 U,H,PJM	0.19 U	0.19 U	NT	NT	-
Nitroaniline, 3-	0.035 U	0.033 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	-

Table B-1a Pre-Construction Water Quality Data Results									
	Storm Event #1 10/03/2011		Storm Event #2 01/20/2012		Storm Event #3 04/13/2012		Storm Event #4 01/11/2014		California Ocean Plan Criteria [a]
Parameter	TRI-032	ORW	TRI-032	ORW *	TRI-032	ORW	Pre-Storm ORW	During-Storm ORW	
Nitroaniline, 4-	0.023 U	0.022 U	0.16 U,H,PJM	0.16 U,H,PJM 0.16 U,H,PJM	0.16 U	0.16 U	NT	NT	-
Nitrobenzene	0.034 U	0.032 U	0.36 U,H,PJM	0.36 U,H,PJM 0.36 U,H,PJM	0.36 U	0.36 U	NT	NT	4.9 [c]
Nitrophenol, 2-	0.075 U	0.070 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	-
Nitrophenol, 4-	0.34 U	0.32 U	0.45 U,H,PJM	0.45 U,H,PJM 0.45 U,H,PJM	0.45 U	0.45 U	NT	NT	-
N-Nitrosodimethylamine	NR	NR	0.14 U,H,PJM	0.14 U,H,PJM 0.14 U,H,PJM	0.14 U	0.14 U	NT	NT	-
N-Nitrosodi-n-propylamine	0.045 U	0.042 U	0.26 U,H,PJM	0.26 U,H,PJM 0.26 U,H,PJM	0.26 U	0.26 U	NT	NT	0.38 [c]
N-Nitrosodiphenylamine	0.058 U	0.054 U	0.19 U,H,PJM	0.19 U,H,PJM 0.19 U,H,PJM	0.19 U	0.19 U	NT	NT	2.5 [c]
Pentachlorophenol	0.55 J	0.38 U	0.19 U,H,PJM	0.19 U,H,PJM 0.19 U,H,PJM	1.2	0.19 U	NT	NT	1, 4, 10 [b]
Phenol	1.4	0.070 U	0.16 U,H,PJM	0.16 U,H,PJM 0.16 U,H,PJM	0.16 U	0.16 U	NT	NT	3, 120, 300 [b]
Pyridine	NR	NR	2.6 U,H,PJM	2.6 U,H,PJM 2.6 U,H,PJM	2.6 U	2.6 U	NT	NT	-
Trichlorobenzene, 1,2,4-	0.020 U	0.018 U	0.55 U,H,PJM	0.55 U,H,PJM 0.55 U,H,PJM	0.55 U	0.55 U	NT	NT	-
Trichlorophenol, 2,4,5-	0.037 U	0.035 U	0.23 U,H,PJM	0.23 U,H,PJM 0.23 U,H,PJM	0.23 U	0.23 U	NT	NT	-
Trichlorophenol, 2,4,6-	0.070 U	0.065 U	0.22 U,H,PJM	0.22 U,H,PJM 0.22 U,H,PJM	0.22 U	0.22 U	NT	NT	0.29 [c]

1 The high conductivity values are likely due to residual seawater inside the outfall pipe, which is nearly full with rocks and sand.
* Results presented are for the original sample and a field duplicate sample.
a California Ocean Plan (COP) water quality objectives for receiving waters; objectives for protection of marine aquatic life and objectives for protection of human health.
b 6-Month Median, Daily Maximum and Instantaneous Maximum concentrations (x, x, x).
c 30-day Average Concentration.
d 30-day Average Concentration for the sum of all PAHs, excluding fluoranthene.

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Indicator Bacteria (MPN/100ml)							
Total Coliforms	NT	NT	NT	NT	NT	NT	10,000
E. coli	NT	NT	NT	NT	NT	NT	400
Enterococcus	NT	NT	NT	NT	NT	NT	104
Conventionals							
Turbidity (NTU)	43.6	5.3	33.9	7.44	37.7	4.88, 5.96	-
TSS (mg/L)	197.3	95.7	68.6	123	109.5	66.8, 44.1	-
Settleable Solids (ml/L/hr)							-
Ammonia as N (mg/L)	0.02 U	0.02 U	0.03 J	0.03 J	0.07	0.02 U, 0.02 U	0.6, 2.4, 6 [b]
Nitrate as N (mg/L)	13.27	0.35	0.29	0.14	0.39	0.15, 0.16	-
Nitrate+Nitrite as N (mg/L)	NT	NT	NT	NT	NT	NT	-
Total Phosphorus (mg/L)	NT	NT	NT	NT	NT	NT	-
Orthophosphate (mg/L)	0.22	0.05	0.1	0.06	0.03	0.05, 0.05	-
Total Cyanide (µg/L)	NT	NT	NT	NT	NT	NT	1, 4, 10 [b]
MBAS (mg/L)	NT	NT	NT	NT	NT	NT	-
TOC (mg/L)	8.6	NR	1.7	1.4	8.2	1.0, 1.1	-
Oil & Grease (mg/L)	3	1 U	1.2	1 U	2.4	1 U, 1 U	-
Diesel Range Organics (mg/L)	0.17	0.04 U	0.064 J	0.0412 U	0.064 J	0.0436 U, 0.0436 U	-
Oil Range Organics (mg/L)	0.23 J	0.07 U	0.097 J	0.0721 U	0.097 J	0.0763 U, 0.0763 U	-
Gas Range Organics (mg/L)	0.06 U	0.06 U	0.0636 U	0.0618 U	0.0636 U	0.0654 U, 0.0654 U	-
Total Metals (µg/L)							
Antimony	0.32	0.11	0.09	0.08	NT	NT	1,200 [c]
Arsenic	0.723	1.989	0.321	1.949	0.611	1.952, 1.902	8, 32, 80 [b]
Beryllium	0.064	0.023	0.017	0.024	NT	NT	0.033 [c]
Cadmium	0.1325	0.0988	0.0396	0.0335	0.0704	0.0712, 0.0421	1, 4, 10 [b]
Total Chromium	7.9536	4.5834	3.5094	2.8689	9.1029	4.6273, 5.482	2, 8, 20 [b]
Chromium VI	NT	NT	NT	NT	NT	NT	2, 8, 20 [b]
Copper	18.601	4.12	5.948	2.156	11.276	1.572, 1.75	3, 12, 30 [b]
Lead	10.8805	1.2462	5.442	1.1372	4.7526	0.4108, 0.4803	2, 8, 20 [b]

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Mercury	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U, 0.0012 U	0.04, 0.16, 0.4 [b]
Nickel	12.2502	4.7174	4.8522	5.0047	10.1367	5.1077, 5.8688	5, 20, 50 [b]
Selenium	0.054	0.005 U	0.022	0.016	0.042	0.023, 0.028	15, 60, 150 [b]
Silver	0.05	0.05	0.03	0.05	0.01 U	0.01 U, 0.01 U	0.7, 2.8, 7 [b]
Thallium	0.013	0.005 U	0.005 U	0.005 U	NT	NT	2 [c]
Zinc	107.8856	8.9982	27.7458	3.6612	82.9803	4.1125, 3.7111	20, 80, 200 [b]
Polycyclic Aromatic Hydrocarbons (µg/L)							
Acenaphthene	0.0038	0.0021 J	0.0062	0.0017 J	0.001 U	0.001 U, 0.001 U	0.0088 [d]
Acenaphthylene	0.0084	0.001 U	0.003 J	0.001 U	0.0106	0.001 U, 0.001 U	0.0088 [d]
Anthracene	0.0054	0.0018 J	0.0092	0.001 U	0.0115	0.001 U, 0.001 U	0.0088 [d]
Benzo(a)anthracene	0.0267	0.0025 J	0.0297	0.001 U	0.0282	0.0016 J, 0.0013 J	0.0088 [d]
Benzo(a)pyrene	0.0411	0.0031 J	0.119	0.001 U	0.0366	0.001 U, 0.001 U	0.0088 [d]
Benzo(b)fluoranthene	0.0966	0.0064	0.0623	0.0018 J	0.1162	0.0061, 0.0054	0.0088 [d]
Benzo(e)pyrene	0.1002	0.0067	0.1088	0.0014 J	0.163	0.0059, 0.0045 J	0.0088 [d]
Benzo(g,h,i)perylene	0.0817	0.0048 J	0.1461	0.0033 J	0.0459	0.001 U, 0.001 U	0.0088 [d]
Benzo(k)fluoranthene	0.0594	0.0053	0.0115	0.001 U	0.0171	0.001 U, 0.001 U	0.0088 [d]
Biphenyl	0.0154	0.0086	0.0197	0.0092	0.0138	0.0058, 0.0079	0.0088 [d]
Chrysene	0.1635	0.01	0.124	0.0034 J	0.0935	0.0031 J, 0.0029 J	0.0088 [d]
Dibenzo(a,h)anthracene	0.0085	0.001 U	0.0425	0.001 U	0.001 U	0.001 U, 0.001 U	0.0088 [d]
Dibenzothiophene	0.0076	0.0026 J	0.0155	0.001 U	0.0082	0.001 U, 0.001 U	0.0088 [d]
Dimethylnaphthalene, 2,6-	0.0176	0.012	0.0279	0.0107	0.011	0.0088, 0.0112	0.0088 [d]
Fluoranthene	0.0989	0.0133	0.1069	0.0049 J	0.0963	0.004 J, 0.0034 J	15 [h]
Fluorene	0.0096	0.0087	0.014	0.0105	0.0101	0.0062, 0.0093	0.0088 [d]
Indeno(1,2,3-c,d)pyrene	0.0279	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0088 [d]
Methylnaphthalene, 1-	0.015	0.012	0.0285	0.0116	0.0122	0.0067, 0.011	0.0088 [d]
Methylnaphthalene, 2-	0.0324	0.0222	0.0559	0.0196	0.0215	0.0102, 0.0164	0.0088 [d]
Methylphenanthrene, 1-	0.0218	0.0081	0.0237	0.0054	0.0199	0.0035 J, 0.005 J	0.0088 [d]
Naphthalene	0.0396	0.0217	0.0386	0.0128	0.0322	0.0068, 0.0096	0.0088 [d]
Perylene	0.0227	0.0048 J	0.0902	0.001 U	0.0132	0.001 U, 0.001 U	0.0088 [d]

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Phenanthrene	0.0863	0.0259	0.1269	0.0195	0.0624	0.0098, 0.0127	0.0088 [d]
Pyrene	0.1212	0.0136	0.1058	0.0045 J	0.1366	0.0045 J, 0.0038 J	0.0088 [d]
Trimethylnaphthalene, 2,3,5-	0.0045 J	0.002 J	0.0062	0.0022 J	0.001 U	0.0015 J, 0.0022 J	0.0088 [d]
Total Detectable PAHs	*1.1159*	*0.1982*	*1.3221*	*0.1225*	*0.96*	*0.0845*	*0.0088* [d]
Organochlorine Pesticides (µg/L)							
2,4-DDD							0.00017 [c]
4,4-DDD	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
2,4-DDE	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
4,4-DDE	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
2,4-DDT	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
4,4-DDT	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
Aldrin	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.000022 [c]
alpha-BHC	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	4, 8, 12 [b]
beta-BHC	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
gamma-BHC (Lindane)	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
delta-BHC	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
alpha-Chlordane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.000023 [c]
gamma-Chlordane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
Dieldrin	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.00004 [c]
Endosulfan I	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.009, 0.018, 0.027 [b]
Endosulfan II	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
Endosulfan Sulfate	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	
Endrin	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.002, 0.004, 0.006 [b]
Endrin Aldehyde	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Endrin Ketone	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Heptachlor	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.00005 [c]
Heptachlor Epoxide	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	0.00002 [c]
Methoxychlor	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Mirex	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Toxaphene	NT	NT	NT	NT	NT	NT	0.00021 [c]
Trans-Nonachlor	0.001 U	0.001 U	0.0013 J	0.001 U	0.001 U	0.001 U, 0.001 U	-
Polychlorinated Biphenyls (PCBs) (µg/L)							
Aroclor 1016	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	0.019 [c]
Aroclor 1221	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	
Aroclor 1232	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	
Aroclor 1242	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	
Aroclor 1248	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	
Aroclor 1254	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	
Aroclor 1260	NR	NR	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	
PCB 003 through PCB 209 (includes 53 PCBs)	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Organophosphorus Pesticides (µg/L)							
Azinphos-methyl	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-
Bolstar	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	-
Chlorpyrifos	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	-
Coumaphos	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	-
Demeton-O & S	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Diazinon	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U, 0.0005 U	-
Dichlorvos	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U, 0.003 U	-
Dimethoate	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.005 U	-
Disulfoton	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Ethoprop	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Ethyl Parathion	NT	NT	NT	NT	NT	NT	-
Fensulfothion	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Fenthion	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U, 0.002 U	-
Malathion	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U, 0.003 U	-
Merphos	NT	NT	NT	NT	NT	NT	-
Methidathion	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.005 U	-
Methyl Parathion	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Mevinphos	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.005 U	-
Naled	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.005 U	-
Phorate	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.005 U	-
Phosmet	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.005 U	-
Ronnel	NT	NT	NT	NT	NT	NT	-
Stirophos (Tetrachlorovinphos)	NT	NT	NT	NT	NT	NT	-
Sulfotep	NT	NT	NT	NT	NT	NT	-
Tetrachorvinphos	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U, 0.002 U	-
Tokuthion (Prothiofos)	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U, 0.003 U	-
Trichloronate	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U, 0.001 U	-
Pyrethroid Pesticides (ng/L)							
Allethrin	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U, 0.0005 U	-
Bifenthrin	0.0071	0.0005 U	0.0005 U	0.0005 U	0.0068	0.0005 U, 0.0005 U	-
Cyfluthrin	0.0005 U	0.0005 U	0.0141	0.0005 U	0.0316	0.0005 U, 0.0005 U	-
Cypermethrin	0.0005 U	0.0005 U	0.0248	0.0005 U	0.007	0.0005 U, 0.0005 U	-
Deltamethrin/Tralomethrin	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U, 0.0005 U	-
Dichloran	NT	NT	NT	NT	NT	NT	-
Esfenvalerate/Fenvalerate	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U, 0.0005 U	-
Fenpropathrin	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U, 0.0005 U	-
Lambda-Cyhalothrin	0.0005 U	0.0005 U	0.0546	0.0005 U	0.0336	0.0005 U, 0.0005 U	-
Pendimethalin	NT	NT	NT	NT	NT	NT	-
Permethrin, cis- & trans-	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.0005 U	-
Prallethrin	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U, 0.0005 U	-
Sumithrin	NT	NT	NT	NT	NT	NT	-
Tau-Fluvalinate	NT	NT	NT	NT	NT	NT	-
Tefluthrin	NT	NT	NT	NT	NT	NT	-
Tetramethrin	NT	NT	NT	NT	NT	NT	-
Other SVOCs, including Phenols and Phthalates (µg/L)							
Aniline	NR	NR	NR	NR	NR	NR	-

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Benzidine	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	0.000069 [c]
Benzoic Acid	0.436927	0.341916	0.1 U	0.1 U	1.277471	0.229079, 0.19406 J	2.6 [c]
Benzyl Alcohol	0.480109	0.1 U	0.1 U	0.1 U	0.240501	0.1 U, 0.1 U	-
Bis(2-chloroethoxy)methane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	4.4 [c]
Bis(2-chloroethyl) Ether	0.05 U	0.05 U	0.05 U	0.05 U	0.09041	0.05 U, 0.05787 J	0.045 [c]
Bis(2-chloroisopropyl) Ether	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	1,200 [c]
Bis(2-ethylhexyl) Phthalate	1.34322	0.14746	0.7806	0.13012	5.41392	0.15797, 0.96696	3.5 [c]
Bromophenyl Phenyl Ether, 4-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Butyl Benzyl Phthalate	0.62612	0.16999	0.82372	0.79946	0.86663	0.31408, 0.25579	-
Carbazole	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Chloro-3-methylphenol, 4-	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	-
Chloroaniline, 4-	NR	NR	NR	NR	NR	NR	-
Chloronaphthalene, 2-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Chlorophenol, 2-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Chlorophenyl Phenyl Ether, 4-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Dibenzofuran	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Dibutyl phthalate	0.16329	0.06181	0.08491001	0.07712001	0.20054	0.04256, 0.03387	
Dichlorobenzene, 1,2-	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	-
Dichlorobenzene, 1,3-	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	-
Dichlorobenzene, 1,4-	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	18 [c]
Dichlorobenzidine, 3,3'-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	0.0081 [c]
Dichlorophenol, 2,4-	0.06206 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Diethyl Phthalate	1.26321	0.13965	1.26182	0.20401	1.14628	0.19255, 0.21569	33,000 [c]
Dimethyl Phthalate	0.20744	0.01354 J	0.17188	0.03171	0.16682	0.03053, 0.03448	820,000 [c]
Dimethylphenol, 2,4-	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	-
Di-n-butyl Phthalate	NR	NR	NR	NR	NR	NR	3,500 [c]
Dinitro-2-methylphenol, 4,6-	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	220 [c]
Dinitrophenol, 2,4-	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	4.0 [c]
Dinitrotoluene, 2,4-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	2.6 [c]

Table B-1b Post-Construction Water Quality Data Results

Parameter	Storm Event #1 10/15/2014		Storm Event #2 02/03/2015		Storm Event #3 03/12/2015		California Ocean Plan Criteria[a]
	TRI-032	ORW	TRI-032	ORW	TRI-032	ORW*	
Dinitrotoluene, 2,6-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Di-n-octyl Phthalate	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U, 0.01 U	-
Diphenylhydrazine, 1,2-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	0.16 [c]
Hexachlorobenzene	0.001 U	0.001 U	**0.0058**	0.001 U	0.001 U	0.001 U, 0.001 U	0.00021 [c]
Hexachlorobutadiene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	14 [c]
Hexachlorocyclopentadiene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	58 [c]
Hexachloroethane	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	2.5 [c]
Isophorone	**0.07041001 J**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	730 [c]
Methylphenol, 2- (Ortho-Cresol)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	-
Methylphenol, 4- (Para-Cresol)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	-
Nitroaniline, 2-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Nitroaniline, 3-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Nitroaniline, 4-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Nitrobenzene	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	4.9 [c]
Nitrophenol, 2-	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	-
Nitrophenol, 4-	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U, 0.1 U	-
N-Nitrosodimethylamine	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	7.3 [c]
N-Nitrosodi-n-propylamine	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	0.38 [c]
N-Nitrosodiphenylamine	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	2.5 [c]
Pentachlorophenol	**0.25174**	0.05 U	0.05 U	0.05 U	**0.09733**	0.05 U, 0.05 U	-
Phenol	**0.237658**	0.1 U	**0.104919 J**	0.1 U	**0.151753**	0.1 U, 0.1 U	-
Pyridine	NR	NR	NR	NR	NR	NR	-
Trichlorobenzene, 1,2,4-	0.01 U	0.01 U	0.01 U	0.01 U	**0.02614**	0.01 U, 0.01 U	-
Trichlorophenol, 2,4,5-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	-
Trichlorophenol, 2,4,6-	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U, 0.05 U	0.29 [c]

Bolded values indicate the constituent was detected at or above the method detection limit (MDL)

* Results presented for ocean receiving water are for the original sample and a field duplicate sample.

a California Ocean Plan (COP) water quality objectives for receiving waters; objectives for protection of marine aquatic life and objectives for protection of human health.

b 6-Month Median, Daily Maximum and Instantaneous Maximum concentrations (x, x, x).

c 30-day Average Concentration.

d 30-day Average Concentration for the sum of all PAHs, excluding fluoranthene.

Table B-2a Pre-Construction Water Toxicity Data Results

Site	Sample Date	Organism	Parameter	Test Dilution	# of Replicates	Field Sample Mean % Response	% of Control	TST Test Result (Pass/Fail)
TRI-032	01/11/2014	Sea Urchin	Egg Fertilization (%)	100%	4	95.75	104	Pass
ORW	01/11/2014	Sea Urchin	Egg Fertilization (%)	100%	4	95.5	104	Pass
ORW	01/11/2014	Mussel	Embryo Survival/Development (%)	100%	5	92.89	106	Pass
ORW	01/11/2014	Kelp	Germination (%)	100%	5	94.8	104	Pass
ORW	01/11/2014	Kelp	Growth (µm)	100%	5	14.58	103	Pass
TRI-032	03/26/2014	Sea Urchin	Egg Fertilization (%)	100%	4	96.0	105	Pass
TRI-032	03/26/2014	Mussel	Embryo Survival/Development (%)	100%	5	97.39	103	Pass
TRI-032	03/26/2014	Kelp	Germination (%)	100%	5	92.0	102	Pass
TRI-032	03/26/2014	Kelp	Growth (µm)	100%	5	14.64	103	Pass

Table B-2b Post-Construction Water Toxicity Data Results

Site	Sample Date	Organism	Parameter	Test Dilution	# of Replicates	Field Sample Mean % Response	% of Control	TST Test Result (Pass/Fail)
TRI-032	10/15/2014	Sea Urchin	Egg Fertilization (%)	100%	4	96.25	101.6	Pass
ORW		Sea Urchin	Egg Fertilization (%)	100%	4	96.25	101.6	Pass
		Mussel	Embryo Survival/Development (%)	100%	5	96.73	101.6	Pass
		Kelp	Germination (%)	100%	5	94.8	102.1	Pass
			Growth (µm)	100%	5	14.44	100	Pass
TRI-032	02/03/2015	Sea Urchin	Egg Fertilization (%)	100%	4	93.0	101	Pass
ORW		Sea Urchin	Egg Fertilization (%)	100%	4	95.25	102	Pass
		Mussel	Embryo Survival/Development (%)	100%	5	95.36	104	Pass
		Kelp	Germination (%)	100%	5	93.0	102	Pass
			Growth (µm)	100%	5	14.72	102	Pass
ORW	03/12/2015	Sea Urchin	Egg Fertilization (%)	100%	4	95.75	102	Pass
		Mussel	Embryo Survival/Development (%)	100%	5	97.67	100	Pass
		Kelp	Germination (%)	100%	5	94.2	103	Pass
			Growth (µm)	100%	5	14.66	102	Pass

APPENDIX C: ANALYTICAL DATA TABLES – SUBTIDAL SEDIMENT

Table C-1 Pre-Construction Sediment Quality Data Results

Parameter	Subtidal Sediment (05/08/12)		NOAA Guideline
	Field Sample	Field Duplicate Sample	ERL/ERM[1]
Total Solids (%; CAS)	73.4	74.1	None
Total Solids (%; Caltest)	95	94	None
*Sediment Particle Size (%)**			
Total Sand (0.0625-2.0 mm)	84.26	81.64	None
Gravel (>2 mm)	0.06	0.06	None
Sand, very coarse (1.00-2.00 mm)	0.34	0.39	None
Sand, coarse (0.500-1.00 mm)	0.96	0.94	None
Sand, medium (0.250-0.500 mm)	2.39	2.11	None
Sand, fine (0.125-0.250 mm)	39.46	39.19	None
Sand, very fine (0.0625-0.125 mm)	41.05	38.95	None
Silt (0.0039-0.0625 mm)	12.89	12.21	None
Clay (<0.0039 mm)	2.41	2.31	None
Conventionals & Hydrocarbons			
Ammonia as Nitrogen (mg/kg)	12.1	14.2	None
Total Organic Carbon (%)	0.364	0.363	None
Total Cyanide	0.27 D	0.27 D	None
Oil & Grease (mg/kg)	110 U	110 J	None
TPH-Diesel (mg/kg)	2.5 J	3.7 FDP,J	None
TPH Oil (mg/kg)	12 J	16 FDP,J	None
Total Metals (mg/kg)			
Antimony	0.127 D	0.245 D,FDP	None
Arsenic	4.15 D	3.70 D	8.2/70
Beryllium	0.200 D	0.169 D	None
Cadmium	0.073 D	0.071 D	1.2/9.6
Total Chromium	57.1 D	51.4 D	81/370
Chromium VI	0.44 J D	0.22 D,FDP,J	None
Copper	14.9 D	12.2 D	34/270
Lead	4.270 D	4.020 D	8.0/218
Mercury	0.0203 D	0.0229 D	0.15/0.71
Nickel	65.8 D	60.4 D	20.9/51.6
Selenium	0.07 D,J	0.06 D,J	None
Silver	0.032 D	0.048 D	1.0/3.7
Thallium	0.0583 D	0.0585 D	None
Zinc	42.1 D	39.8 D,FDP	150/410
Organochlorine Pesticides (µg/kg)			
2,4-DDD	0.69 Ui	0.13 U	None
4,4-DDD	0.11 U	0.11 U	None
2,4-DDE	0.16 U	0.16 U	None
4,4-DDE	0.11 U	0.11 U	None
2,4-DDT	0.058 U	0.058 U	None
4,4-DDT	0.17 U	0.17 U	None
Aldrin	0.16 U	0.16 U	None
alpha-BHC8	0.11 U	0.11 U	None

Table C-1 Pre-Construction Sediment Quality Data Results

Parameter	Subtidal Sediment (05/08/12)		NOAA Guideline ERL/ERM[1]
	Field Sample	Field Duplicate Sample	
beta- BHC8	0.18 U	0.18 U	None
gamma-BHC (Lindane)	0.69 Ui	0.67 Ui	None
delta-BHC4	**0.01 J**	0.074 U	None
alpha-Chlordane	0.10 U	0.10 U	None
gamma-Chlordane2	0.090 U	0.090 U	None
Dieldrin	0.14 U	0.14 U	None
Endosulfan I	0.063 U	0.063 U	None
Endosulfan II	0.14 U	0.14 U	None
Endosulfan Sulfate	0.11 U	0.11 U	None
Endrin	0.094 U	**0.12 J**	None
Endrin Aldehyde	0.12 U	0.12 U	None
Endrin Ketone	0.093 U	0.093 U	None
Heptachlor	0.12 U	0.12 U	None
Heptachlor Epoxide	**0.12 J**	**0.27 FDP,J**	None
Methoxychlor	0.19 U	0.19 U	None
Toxaphene	4.8 U	4.8 U	None
Polychlorinated Biphenyls (PCBs) (µg/kg)			
Aroclor 1016	2.1 U	2.1 U	None
Aroclor 1221	2.1 U	2.1 U	None
Aroclor 1232	2.1 U	2.1 U	None
Aroclor 1242	2.1 U	2.1 U	None
Aroclor 1248	2.1 U	2.1 U	None
Aroclor 1254	2.1 U	2.1 U	None
Aroclor 1260	2.1 U	2.1 U	None
Organophosphorus Pesticides (µg/kg)			
Azinphos-methyl (Guthion)	4.9 U	4.9 U	None
Bolstar (Sulprofos)	4.1 U	4.1 U	None
Chlorpyrifos (CAS)	3.4 U	3.4 U	None
Chlorpyrifos (Caltest)	0.38 U	0.38 U	None
Coumaphos	4.1 U	4.1 U	None
Demeton-O,S	17 D,U	17 D,U	None
Diazinon (CAS)	3.4 U	3.4 U	None
Diazinon(Caltest)	0.29 U	0.29 U	None
Dichlorvos	3.2 U	3.1 U	None
Dimethoate	6.2 U	6.1 U	None
Disulfoton	2.2 U	2.2 U	None
EPN	4.0 U	3.9 U	None
Ethoprop (Prophos)	2.4 U	2.3 U	None
Ethyl Parathion	2.8 U	2.7 U	None
Fensulfothion	3.4 U	3.4 U	None
Fenthion	4.0 U	3.9 U	None
Malathion	2.5 U	2.5 U	None
Merphos	2.9 U	2.9 U	None

Table C-1 Pre-Construction Sediment Quality Data Results			
	Subtidal Sediment (05/08/12)		NOAA Guideline
Parameter	Field Sample	Field Duplicate Sample	ERL/ERM[1]
Methyl Parathion	4.0 U	3.9 U	None
Mevinphos	3.7 U	3.7 U	None
Phorate	3.4 U	3.4 U	None
Ronnel	3.7 U	3.7 U	None
Stirophos (Tetrachlorovinphos)	4.3 U	4.2 U	None
Sulfotep	1.8 U	1.8 U	None
Tokuthion (Prothiofos)	2.9 U	2.9 U	None
Trichloronate	4.3 U	4.2 U	None
Pyrethroid Pesticides (µg/kg)			
Allethrin	0.16 U	0.16 U	None
Bifenthrin	0.32 U	0.32 U	None
Cyfluthrin	0.35 U	0.35 U	None
Cypermethrin	0.32 U	0.32 U	None
Deltamethrin:Tralomethrin	0.38 U	0.38 U	None
Esfenvalerate:Fenvalerate	0.41 U	0.41 U	None
Fenpropathrin	0.22 U	0.22 U	None
Lambda-Cyhalothrin	0.19 U	0.19 U	None
Permethrin	0.35 U	0.35 U	None
Tau-Fluvalinate	0.13 U	0.13 U	None
Tetramethrin	0.19 U	0.19 U	None
Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg)			
1-Methylnaphthalene	4.7 J	5.3 J	None
2-Methylnaphthalene	9.1	9.1	70/670
Acenaphthene	3.2 U	3.2 U	16/500
Acenaphthylene	2.6 U	2.6 U	44/640
Anthracene	3.2 U	3.2 U	85.3/1100
Benz(a)anthracene	3.6 U	3.6 U	261/2100
Benzo(a)pyrene	3.6 U	3.6 U	430/1600
Benzo(b)fluoranthene	3.4 U	3.4 U	None
Benzo(g,h,i)perylene	3.7 U	3.7 U	None
Benzo(k)fluoranthene	4.0 U	4.0 U	None
Chrysene	4.1 U	4.1 U	384/2800
Dibenz(a,h)anthracene	3.0 U	3.0 U	63.4/260
Fluoranthene	3.7 U	3.7 U	600/5100
Fluorene	4.2 J	4.1 J	19/540
Indeno(1,2,3-c,d)pyrene	3.2 U	3.2 U	None
Naphthalene	5.6 J	5.6 J	160/2100
Phenanthrene	8.8	8.3	240/1500
Pyrene	3.7 U	3.7 U	665/2600
Total Detectable PAHs	*18.6*	*18.0*	*4022/44792*
Other SVOCs, including Phenols and Phthalates (µg/kg)			
1,2,4-Trichlorobenzene	2.6 U	2.6 U	None
1,2-Dichlorobenzene	2.4 U	2.4 U	None

Table C-1 Pre-Construction Sediment Quality Data Results

Parameter	Subtidal Sediment (05/08/12)		NOAA Guideline
	Field Sample	Field Duplicate Sample	ERL/ERM[1]
1,3-Dichlorobenzene	2.3 U	2.3 U	None
1,4-Dichlorobenzene	2.5 U	2.5 U	None
2,4,5-Trichlorophenol	3.0 U	3.0 U	None
2,4,6-Trichlorophenol	3.0 U	3.0 U	None
2,4-Dichlorophenol	2.6 U	2.6 U	None
2,4-Dimethylphenol	6.3 U	6.3 U	None
2,4-Dinitrophenol	29 U	29 U	None
2,4-Dinitrotoluene	2.5 U	2.5 U	None
2,6-Dinitrotoluene	2.9 U	2.9 U	None
2-Chloronaphthalene	3.2 U	3.2 U	None
2-Chlorophenol	3.0 U	3.0 U	None
2-Methyl-4,6-dinitrophenol	27 U	27 U	None
2-Methylphenol (Ortho-Cresol)	4.1 U	4.1 U	None
2-Nitroaniline	3.3 U	3.3 U	None
2-Nitrophenol	4.0 U	4.0 U	None
3,3'-Dichlorobenzidine	4.1 U	4.1 U	None
3-Nitroaniline	4.4 U	4.4 U	None
4-Bromophenyl Phenyl Ether	3.1 U	3.1 U	None
4-Chloro-3-methylphenol	2.9 U	2.9 U	None
4-Chloroaniline	2.6 U	2.6 U	None
4-Chlorophenyl Phenyl Ether	3.2 U	3.2 U	None
4-Methylphenol (Para-Cresol)	4.5 U	4.5 U	None
4-Nitroaniline	3.8 U	3.8 U	None
4-Nitrophenol	7.7 U	7.7 U	None
Benzoic Acid	96 U	96 U	None
Benzyl Alcohol	4.9 U	4.9 U	None
Bis(2-chloroethoxy)methane	2.8 U	2.8 U	None
Bis(2-chloroethyl) Ether	3.1 U	3.1 U	None
Bis(2-chloroisopropyl) Ether	2.8 U	2.8 U	None
Bis(2-ethylhexyl) Phthalate	8.9 U	8.9 U	None
Butyl Benzyl Phthalate	3.7 U	3.7 U	None
Dibenzofuran	3.4 U	3.4 U	None
Diethyl Phthalate	3.7 U	3.7 U	None
Dimethyl Phthalate	4.0 U	4.0 U	None
Di-n-butyl Phthalate	6.0 J	6.4 J	None
Di-n-octyl Phthalate	3.2 U	3.2 U	None
Hexachlorobenzene	3.3 U	3.3 U	None
Hexachlorobutadiene	3.0 U	3.0 U	None
Hexachlorocyclopentadiene	4.0 U	4.0 U	None
Hexachloroethane	2.5 U	2.5 U	None
Isophorone	2.8 U	2.8 U	None
Nitrobenzene	3.4 U	3.4 U	None
N-Nitrosodi-n-propylamine	3.3 U	3.3 U	None

Table C-1 Pre-Construction Sediment Quality Data Results

Parameter	Subtidal Sediment (05/08/12)		NOAA Guideline
	Field Sample	Field Duplicate Sample	ERL/ERM[1]
N-Nitrosodiphenylamine	3.2 U	3.2 U	None
Pentachlorophenol	5.3 U	5.3 U	None
Phenol	**12 J**	**7.5 FDP,J**	None
Butyltins (µg/kg)			
Monobutyltin	**0.53 J**	0.36 U	None
Dibutyltin	0.26 U	**0.28 J**	None
Tributyltin	0.58 U	0.58U	None
Tetrabutyltin	0.60 U	0.60 U	None

Bolded values indicate the constituent was detected at or above the method detection limit (MDL)
* Values are normalized to 100 percent recovery.
D Analyte analyzed at a secondary dilution.
FDP Field duplicate RPD above QC limit.
J The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
U The compound was analyzed for, but was not detected at or above the associated method detection limit.
Caltest Caltest Analytical Laboratories
CAS Columbia Analytical Services
ERL Effects Range Low
ERM Effects Range Median
SVOCs Semi-Volatile Organic Compounds

APPENDIX D: ANALYTICAL DATA TABLES – CALIFORNIA MUSSEL TISSUE

Table D-1 Pre-Construction California Mussel Tissue Chemistry

Parameter	California Mussel Tissue (04/10/2013)	
	Field Sample	Field Duplicate Sample
Total Solids (%)	17.10	17.10
Total Lipids (%)	0.81	0.99
Total Metals (mg/Kg dw)		
Aluminum	36.5 N	34.8 N
Antimony	0.0031 D (5x), J	0.0020 D (5x), J
Arsenic	1.830 D (5x)	1.88 D (5x)
Beryllium	NT	NT
Cadmium	1.130 D (5x)	1.38 D (5x)
Total Chromium	0.28 D (5x)	0.31 D (5x)
Copper	1.04 D (5x)	1.11 D (5x)
Lead	0.18 D (5x)	0.20 D (5x)
Manganese	1.26	1.23
Mercury (ng/g na)	21.7000 D (100x)	23.600 D (100x)
Nickel	0.42 D (5x)	0.45 D (5x)
Selenium	0.49 D (5x)	0.57 D (5x)
Silicon	30.10	33.60
Silver	0.01 D (5x)	0.01 D (5x)
Thallium	0.0010 D (5x)	0.0011 D (5x)
Tin	0.0510 U	0.0510 U
Zinc	20.00 D (5x)	23.40 D (5x)
Polycyclic Aromatic Hydrocarbons & Carbazole (µg/L)		
Acenaphthene	1.9000 U	1.8000 U
Acenaphthylene	0.0460 U	0.1600 U
Anthracene	0.0640 U	0.0850 U
Benzo(a)anthracene	0.1100 U	0.0850 U
Benzo(a)pyrene	0.29 J	0.44 J
Benzo(b)fluoranthene	0.0660 U	0.0660 U
Benzo(e)pyrene	NT	NT
Benzo(g,h,i)perylene	1.3000 U	0.0950 U
Benzo(k)fluoranthene	0.0570 U	0.0570 U
Biphenyl	0.54 IP,J	0.45 IP,J
Chrysene	0.2800 U	0.3200 U
Dibenzo(a,h)anthracene	0.0860 U	0.0860 U
Dibenzothiophene	0.0860 U	0.0860 U
Dimethylnaphthalene, 2,6-	1.60	2.7
Fluoranthene	0.19 IP,J	0.23 IP,J
Fluorene	0.16 J	0.15 J
Indeno(1,2,3-c,d)pyrene	0.0960 U	0.0960 U
Methylnaphthalene, 1-	1.8000 U	4.1000 U
Methylnaphthalene, 2-	0.42 J	0.1200 U
Methylphenanthrene, 1-	4.600 U	5.6000 U
Naphthalene	0.64 J	0.76 J
Perylene	0.38 J	0.52

Table D-1 Pre-Construction California Mussel Tissue Chemistry

Parameter	California Mussel Tissue (04/10/2013)	
	Field Sample	Field Duplicate Sample
Phenanthrene	0.55 IP	0.56 IP
Pyrene	0.14 J	0.15 J
Trimethylnaphthalene, 2,3,5-	0.0530 U	0.26 J
Total Detectable PAHs	*4.91*	*6.22*
Carbazole	1.40	2.00
Organochlorine Pesticides (ng/L)		
2,4-DDD	0.7300 U	0.7300 U
4,4-DDD	0.5500 U	0.5500 U
2,4-DDE	0.3700 U	0.3700 U
4,4-DDE	0.4500 U	0.4500 U
2,4-DDT	0.1600 U	0.1600 U
4,4-DDT	0.4900 U	0.4900 U
alpha-BHC	0.23 J	0.39 J
beta-BHC	0.4100 U	0.4100 U
gamma-BHC (Lindane)	0.2100 U	0.2100 U
delta-BHC	0.32 J	0.29 J
alpha-Chlordane	0.49 J	0.43 J
gamma-Chlordane	0.2600 U	0.2600 U
Oxychlordane	0.3900 U	0.3900 U
Dieldrin	0.46 J	0.55 J
Chlorpyrifos	0.53 J	0.61 J
Heptachlor	0.2700 U	0.2700 U
Heptachlor Epoxide	4.50	4.40
Toxaphene	13.0000 U	30.0000 U
Trans-Nonachlor	0.2700 U	0.2700 U
Polychlorinated Biphenyls (PCBs) (ng/L)		
PCB 001	1.8000 U	1.5000 U
PCB 005	0.1000 U	0.1000 U
PCB 008	0.5900 U	0.5000 U
PCB 018	0.1500 U	0.2200 U
PCB 028	0.1300 U	0.1300 U
PCB 031	0.1100 U	0.1100 U
PCB 033	0.4900 U	0.5000 U
PCB 037	0.1000 U	0.1000 U
PCB 044	0.3500 U	0.3500 U
PCB 049	0.1100 U	0.1100 U
PCB 052	0.3900 U	0.3900 U
PCB 056	0.3600 U	0.3600 U
PCB 060	0.0970 U	0.0970 U
PCB 066	0.5900 U	0.7700 U
PCB 070	0.2800 U	0.2800 U
PCB 074	0.2900 U	0.2900 U
PCB 077	0.1200 U	0.1200 U

Table D-1 Pre-Construction California Mussel Tissue Chemistry		
	California Mussel Tissue (04/10/2013)	
Parameter	Field Sample	Field Duplicate Sample
PCB 081	0.1600 U	0.1600 U
PCB 087	0.1600 U	0.1600 U
PCB 090	0.1100 U	0.1100 U
PCB 095	0.21 J	0.2800 U
PCB 097	0.1800 U	0.1800 U
PCB 099	0.1400 U	0.1400 U
PCB 101	0.3900 U	0.3900 U
PCB 105	0.1000 U	0.1000 U
PCB 110	0.3400 U	0.3400 U
PCB 114	0.0890 U	0.0890 U
PCB 118	0.1100 U	0.1100 U
PCB 119	0.1200 U	0.1200 U
PCB 123	0.0830 U	0.0830 U
PCB 126	0.1400 U	0.1400 U
PCB 128	0.1600 U	0.1600 U
PCB 132	0.2000 U	0.2000 U
PCB 138	0.0910 U	0.0910 U
PCB 141	0.4900 U	0.5000 U
PCB 149	0.1200 U	0.1200 U
PCB 151	0.0890 U	0.0890 U
PCB 153	0.1300 U	0.1300 U
PCB 156	0.5600 U	0.5600 U
PCB 157	0.2100 U	0.2100 U
PCB 158	0.0960 U	0.0960 U
PCB 167	0.4900 U	0.5000 U
PCB 168	0.1000 U	0.1000 U
PCB 169	0.0890 U	0.0890 U
PCB 170	0.3800 U	0.3800 U
PCB 174	0.1300 U	0.1300 U
PCB 177	0.3800 U	0.3800 U
PCB 180	0.4800 U	0.4900 U
PCB 183	0.1500 U	0.1500 U
PCB 187	0.0830 U	0.0830 U
PCB 189	0.1800 U	0.1800 U
PCB 194	0.0700 U	0.0700 U
PCB 195	0.3300 U	0.3300 U
PCB 201	0.1400 U	0.1400 U
PCB 203	0.2900 U	0.2900 U
PCB 206	0.2000 U	0.2000 U
PCB 209	0.1500 U	0.1500 U
Polybrominated Diphenyl Ethers (PBDEs) (ng/L)		
PBDE 017	0.0110 U	0.0110 U
PBDE 028	0.0200 U	0.0200 U

Table D-1 Pre-Construction California Mussel Tissue Chemistry

Parameter	California Mussel Tissue (04/10/2013)	
	Field Sample	Field Duplicate Sample
PBDE 047	0.0560 U	0.0560 U
PBDE 066	0.0180 U	0.0180 U
PBDE 071	0.0071 U	0.0071 U
PBDE 085	0.0160 U	0.0160 U
PBDE 099	0.0067 U	0.0067 U
PBDE 100	0.0064 U	0.0064 U
PBDE 128	0.0170 U	0.0170 U
PBDE 138	0.0075 U	0.0075 U
PBDE 153	0.0160 U	0.0160 U
PBDE 154	0.0110 U	0.0110 U
PBDE 183	0.0075 U	0.0075 U
PBDE 190	0.0180 U	0.0180 U
PBDE 203	0.0280 U	0.0280 U
PBDE 206	0.0330 U	0.0330 U
PBDE 209	0.0230 U	0.0230 U

D Dilution

IP The analyte was detected in the lab generated blank.
J The result is an estimated concentration that is less than the method reporting limit (MRL) but greater than or equal to the method detection limit (MDL).
N Tentatively Identified Compound
NT Not Tested
U The compound was analyzed for, but was not detected at or above the associated MDL.

APPENDIX E: QUALITY ASSURANCE / QUALITY CONTROL

E.1 Quality Assurance / Quality Control

This appendix presents the results from field and laboratory quality assurance/quality control (QA/QC) analyses performed during the Improvement Project. Where applicable, results are separated by the sample matrix: water, sediment and mussel tissue. Two types of QA/QC analyses are discussed in separate subsections below: field-generated blank and duplicate samples, and laboratory-generated QA/QC. Additional subsections address conformance with sample holding time requirements, method detection and reporting limits, and completeness.

E.2 Field QA/QC

Field QA/QC performed during the Improvement Project monitoring include the generation of equipment blank samples, blind field blank samples, and blind field duplicate samples.

Field blank samples were collected for water quality only and were submitted, along with a field sample, to the laboratory "blind" (i.e., their sample IDs appeared to the laboratory as simple field grab samples). These samples were analyzed to assess the possibility of contamination introduced by sampling equipment or field sampling methods. Individual QA/QC results for equipment blank and field blank samples in which analytes were detected are presented in Table E-1. Except for instances in which the field blank samples were insignificant relative to the field sample results (less than ten times the field blank result), no action was taken. In those isolated instances in which field blank sample results were not less than ten times the field sample results, the data have been qualified with an "IP", indicating the field blank was detected at a similar concentration to the actual field sample.

Field duplicate samples were also collected and submitted to the laboratory "blind" for analysis to evaluate potential contamination or sampling error that may have occurred in the field, as well as potential analytical error or contamination introduced by the laboratory. All water field duplicate samples were from single ORW composite samples. Both the subtidal sediment and mussel tissue field duplicate samples were also from composite samples.

Table E-1 Equipment and Field Blank Samples with Detected Analytes

Sample ID	Blank Type	Constituent	Units	Result	MDL	RL	Field Result
Pre-Construction Equipment Blank (09/22/2011)							
TSIP-SW-092211-EB	Equipment Blank	Beryllium	µg/L	0.003 J	0.002	0.02	-
TSIP-SW-092211-EB	Equipment Blank	Chromium	µg/L	0.13 J	0.04	0.2	-
TSIP-SW-092211-EB	Equipment Blank (Lab Dup)	Chromium	µg/L	0.09 J	0.04	0.2	-
TSIP-SW-092211-EB	Equipment Blank	Lead	µg/L	0.005 J	0.005	0.02	-
TSIP-SW-092211-EB	Equipment Blank	Mercury	µg/L	0.00021 J	0.00006	0.0001	-
TSIP-SW-092211-EB	Equipment Blank (Lab Dup)	Nickel	µg/L	0.06 J	0.03	0.2	-
TSIP-SW-092211-EB	Equipment Blank	Thallium	µg/L	0.003 J	0.002	0.02	-
TSIP-SW-092211-EB	Equipment Blank	Zinc	µg/L	0.29 J	0.2	0.5	-
TSIP-SW-092211-EB	Equipment Blank (Lab Dup)	Zinc	µg/L	0.22 J	0.2	0.5	-

Table E-1 Equipment and Field Blank Samples with Detected Analytes

Sample ID	Blank Type	Constituent	Units	Result	MDL	RL	Field Result
TSIP-SW-092211-EB	Equipment Blank	Benzyl Alcohol	µg/L	0.34 J	0.08	0.57	-
TSIP-SW-092211-EB	Equipment Blank	Butyl benzyl phthalate	µg/L	0.04 J	0.02	0.23	-
TSIP-SW-092211-EB	Equipment Blank	Diethyl phthalate	µg/L	0.25	0.01	0.23	-
TSIP-SW-092211-EB	Equipment Blank	Di-n-butyl phthalate	µg/L	0.12 J	0.03	0.23	-
TSIP-SW-092211-EB	Equipment Blank	Naphthalene	µg/L	0.04 J	0.03	0.23	-
TSIP-SW-092211-EB	Equipment Blank	Phenol	µg/L	0.08 J	0.07	0.57	-
Post-Construction Equipment Blank (09/10/2014)							
TSIP-SW-091014-EB	Equipment Blank	Antimony	µg/L	0.02	0.01	0.015	-
TSIP-SW-091014-EB	Equipment Blank	Arsenic	µg/L	0.022	0.005	0.015	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Cadmium	µg/L	0.0046 J	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank	Chromium	µg/L	0.0381	0.0125	0.025	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Chromium	µg/L	0.0269	0.0125	0.025	-
TSIP-SW-091014-EB	Equipment Blank	Lead	µg/L	0.0694	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Lead	µg/L	0.0365	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank	Nickel	µg/L	0.0421	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Nickel	µg/L	0.0432	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank	Selenium	µg/L	0.016	0.005	0.015	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Selenium	µg/L	0.008 J	0.005	0.015	-
TSIP-SW-091014-EB	Equipment Blank	Zinc	µg/L	16.3655	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Zinc	µg/L	16.5139	0.0025	0.005	-
TSIP-SW-091014-EB	Equipment Blank	Benzylbutyl Phthalate	µg/L	0.10364	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Benzylbutyl Phthalate	µg/L	0.12871	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank	Bis(2-ethylhexyl) phthalate	µg/L	0.06791	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Bis(2-ethylhexyl) phthalate	µg/L	0.09685	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank	Dibutyl Phthalate	µg/L	0.05279	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Dibutyl Phthalate	µg/L	0.05827	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank	Diethyl phthalate	µg/L	2.41139	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Diethyl phthalate	µg/L	2.90808	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank	Dimethyl phthalate	µg/L	0.19603	0.01	0.02	-
TSIP-SW-091014-EB	Equipment Blank (Lab Dup)	Dimethyl phthalate	µg/L	0.25382	0.01	0.02	-
Pre-Construction Field Blank (01/11/2014)							
TRI-REC-110114-D3	Field Blank	Copper	µg/L	0.015	0.005	0.01	1.178 (1.365)
TRI-REC-110114-D3	Field Blank	Silver	µg/L	0.01 J	0.01	0.02	ND (0.01 J)
TRI-REC-110114-D3	Field Blank	Zinc	µg/L	0.1342	0.0025	0.005	2.7661 (2.49)

Table E-1	Equipment and Field Blank Samples with Detected Analytes						
Sample ID	Blank Type	Constituent	Units	Result	MDL	RL	Field Result
TRI-REC-110114-D3	Field Blank	Cyfluthrin, total	µg/L	0.0013 J	0.0005	0.002	ND (ND)
Post-Construction Field Blank (03/12/2015)							
TSIP-RW-031215-D3	Field Blank	Turbidity	NTU	0.15	0.02	0.02	4.88
TSIP-RW-031215-D3	Field Blank	Nitrate as N	mg/L	0.01 J	0.01	0.05	0.15
TSIP-RW-031215-D3	Field Blank	Chromium	µg/L	0.0405	0.0125	0.025	4.6273
TSIP-RW-031215-D3	Field Blank	Nickel	µg/L	0.0138	0.0025	0.005	5.1077
TSIP-RW-031215-D3	Field Blank	Zinc	µg/L	0.2534	0.0025	0.005	4.1125
TSIP-RW-031215-D3	Field Blank	Acenaphthene	µg/L	0.0011 J	0.001	0.005	ND
TSIP-RW-031215-D3	Field Blank	Benzoic Acid	µg/L	0.158239 J	0.1	0.2	0.229079
TSIP-RW-031215-D3	Field Blank	Bis(2-ethylhexyl) phthalate	µg/L	0.11354	0.01	0.02	0.15797
TSIP-RW-031215-D3	Field Blank	Butyl Benzyl Phthalate	µg/L	0.21555	0.01	0.02	0.31408
TSIP-RW-031215-D3	Field Blank	Dibutyl Phthalate	µg/L	0.04358	0.01	0.02	0.04256
TSIP-RW-031215-D3	Field Blank	Diethyl phthalate	µg/L	0.14524	0.01	0.02	0.19255
TSIP-RW-031215-D3	Field Blank	Methylnaphthalene, 2-	µg/L	0.0012 J	0.001	0.005	0.0102
TSIP-RW-031215-D3	Field Blank	Naphthalene	µg/L	0.0027 J	0.001	0.005	0.0068

E.2.1 Equipment Blank Samples

Prior to use and installation, all 20-liter composite sample bottles, Teflon intake hose and peristaltic silicon tubing were protocol cleaned and representative blank samples were collected and submitted to the laboratory for analysis. This was done prior to both the pre- and post-construction monitoring seasons to verify the equipment was not a source of contamination.

Low levels of metals contamination were detected in the pre-construction equipment blank. Of the 14 metals analyzed for, seven were detected. However, all field sample results (detects) were more than ten times the levels detected in the equipment blank sample. In addition, only two of the detected metals were also detected in the laboratory duplicate sample.

SVOC contamination was also detected in the pre-construction equipment blank. Of 65 SVOCs analyzed for, six were detected, including three phthalates which are considered ubiquitous and are common contaminants. Benzyl alcohol, naphthalene, and phenol were detected in the equipment blank at a similar concentration to the field samples in which they were detected and the field results were flagged to indicate this.

Low levels of metals contamination were detected in the post-construction equipment blank. Of the 14 metals analyzed for, eight were detected, four of which were also detected in the laboratory duplicate sample. However, field sample results (detects) for six of these metals were more than ten times the levels detected in the equipment blank sample. Antimony and selenium were detected in some field samples at concentrations below, but relatively similar to, the equipment blank, and the field results for these metals have been qualified to indicate this.

SVOC contamination was also detected in the pre-construction equipment blank. Of 79 SVOCs analyzed for, just five phthalates were detected.

E.2.2 Field Blank Samples

Low levels of metals contamination were detected in the pre-construction field blank. Of the 14 metals analyzed for, three were detected. However, all field sample results (detects) were more than ten times the levels detected in the field blank sample. In addition, none of the three metals were also detected in the laboratory duplicate sample.

The pyrethroid pesticide cyfluthrin was also detected at a low level in the pre-construction field blank. Cyfluthrin was not detected in any field samples.

Low levels of metals contamination was detected in the post-construction equipment blank. Of the 14 metals analyzed for, three were detected. However, except for silver, all field sample results (detects) were more than ten times the levels detected in the field blank sample. The field results for silver have been qualified to indicate this.

SVOC contamination was also detected in the post-construction equipment blank. Of 76 SVOCs analyzed for, eight were detected, including four phthalates, three PAHs, and benzoic acid. Naphthalene and 2-methylnaphthalene were detected in field samples at more than ten times the levels detected in the field blank, but acenaphthene was not and has been qualified to indicate this.

E.2.3 Field Duplicate Samples

Field duplicate samples were collected and submitted blind to the laboratory. Field duplicate samples provide a measure of analytical precision, calculated as the relative percent difference (RPD), which is the absolute value of the difference of the two values divided by their average expressed as a percentage. When an analyte was detected at a level between the MDL and RL, it was qualified with a “J”, indicating the result was an estimate. When an analyte was not detected above the MDL, it was qualified with a “U”. No RPD was calculated in instances in which one value was a detect (including J qualified values) and one was a non-detect. The RPD was assumed to be zero for instances in which both values were a non-detect. The data qualifiers for this project are defined in Section E.4. Field duplicate results for water, subtidal sediment and mussel tissue are presented in Tables E-2a, E-2b, and E-2c.

Due to the small number of field duplicate samples collected (1 to 3), the percent of success was either 100%, 67%, 50%, 33%, or 0%. Those constituents whose duplicate samples did not achieve 67% or greater include:

Water Field Duplicate Samples

Except for nitrate + nitrite, TOC, TSS, cadmium, chromium, selenium, and zinc, the percent of acceptable RPDs for all conventionals and metals was 100%. The percent of acceptable RPDs for just ten of the 214 organic compounds analyzed for were less than 100% (Table E-2a).

Subtidal Sediment Field Duplicate Samples

Except for diesel, motor oil, antimony, chromium IV, and silver, the percent of acceptable RPDs for conventionals and metals was 100%. The percent of RPDs for only two of the 137 organic compounds analyzed for were less than 100% (Table E-2b).

Mussel Tissue Field Duplicate Samples

Except for aluminum and antimony, the percent of acceptable RPDs for all metals was 100%. The percent of acceptable RPDs for just five of the 119 organic compounds analyzed were less than 100% (Table E-2c).

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Conventionals & Hydrocarbons						
Ammonia as N	3	25%	2	3	0	100%
MBAS	1	25%	1	1	0	100%
Nitrate + Nitrite as N	1	25%	0	0	1	0%
Nitrate as N	2	25%	0	2	0	100%
OilandGrease; HEM	3	25%	0	3	0	100%
OrthoPhosphate as P	3	25%	0	3	0	100%
Phosphorus as P	1	25%	0	1	0	100%
Settleable Solids	1	25%	0	1	0	100%
Total Organic Carbon	2	25%	0	1	1	50%
Total Suspended Solids	3	25%	0	2	1	67%
TPH as Diesel C10-C22	1	25%	0	1	0	100%
TPH as Diesel C10-C28	1	25%	0	1	0	100%
TPH as Gasoline C6-C10	2	25%	0	2	0	100%
TPH as Motor Oil C18-C26	1	25%	0	1	0	100%
TPH as Motor Oil C22-C36	1	25%	0	1	0	100%
Turbidity	3	25%	0	2	1	67%
Total Metals						
Antimony	1	25%	1	1	0	100%
Arsenic	3	25%	0	3	0	100%
Beryllium	1	25%	0	1	0	100%
Cadmium	3	25%	0	1	2	33%
Chromium	3	25%	0	2	1	67%
Copper	3	25%	0	3	0	100%
Lead	3	25%	0	3	0	100%
Mercury	3	25%	0	3	0	100%
Nickel	3	25%	0	3	0	100%
Selenium	3	25%	1	2	1	67%
Silver	3	25%	1	3	0	100%
Thallium	1	25%	1	1	0	100%
Zinc	3	25%	0	2	1	67%
Organic Compounds						
Acenaphthene	2	25%	1	2	0	100%
Acenaphthylene	2	25%	0	2	0	100%
Aldrin	2	25%	0	2	0	100%

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Allethrin	2	25%	0	2	0	100%
Aniline	1	25%	0	1	0	100%
Anthracene	2	25%	0	2	0	100%
Azinphos methyl	2	25%	0	2	0	100%
Benz(a)anthracene	2	25%	2	2	0	100%
Benzidine	2	25%	0	2	0	100%
Benzo(a)pyrene	2	25%	1	2	0	100%
Benzo(b)fluoranthene	2	25%	1	2	0	100%
Benzo(e)pyrene	1	25%	1	0	1	0%
Benzo(g,h,i)perylene	2	25%	0	2	0	100%
Benzo(k)fluoranthene	2	25%	1	2	0	100%
Benzoic Acid	2	25%	1	2	0	100%
Benzyl Alcohol	2	25%	0	2	0	100%
Bifenthrin	3	25%	0	3	0	100%
Biphenyl	1	25%	0	0	1	0%
Bis(2-chloroethoxy)methane	2	25%	0	2	0	100%
Bis(2-chloroethyl)ether	2	25%	1	2	0	100%
Bis(2-chloroisopropyl) ether	2	25%	0	2	0	100%
Bis(2-ethylhexyl)phthalate	2	25%	1	1	1	50%
Bolstar	2	25%	0	2	0	100%
Bromophenyl phenyl ether, 4-	2	25%	0	2	0	100%
Butyl benzyl phthalate	2	25%	0	2	0	100%
Carbazole	2	25%	0	2	0	100%
Chlordane, cis-	2	25%	0	2	0	100%
Chlordane, trans-	2	25%	0	2	0	100%
Chloro-3-methylphenol, 4-	2	25%	0	2	0	100%
Chloroaniline, 4-	1	25%	0	1	0	100%
Chloronaphthalene, 2-	2	25%	0	2	0	100%
Chlorophenol, 2-	2	25%	0	2	0	100%
Chlorophenyl phenyl ether, 4-	2	25%	0	2	0	100%
Chlorpyrifos	3	25%	0	3	0	100%
Chrysene	2	25%	1	2	0	100%
Coumaphos	2	25%	0	2	0	100%
Cyanide	1	25%	0	1	0	100%
Cyfluthrin, total	3	25%	0	3	0	100%
Cyhalothrin, Total lambda-	3	25%	0	3	0	100%
Cypermethrin, Total	3	25%	0	3	0	100%
DDD(o,p')	2	25%	0	2	0	100%
DDD(p,p')	2	25%	0	2	0	100%
DDE(o,p')	2	25%	0	2	0	100%
DDE(p,p')	2	25%	0	2	0	100%

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
DDT(o,p')	2	25%	0	2	0	100%
DDT(p,p')	2	25%	0	2	0	100%
Deltamethrin/Tralomethrin	3	25%	0	3	0	100%
Demeton, Total	2	25%	0	2	0	100%
Diazinon	3	25%	0	3	0	100%
Dibenz(a,h)anthracene	2	25%	0	2	0	100%
Dibenzofuran	2	25%	0	2	0	100%
Dibenzothiophene	1	25%	0	1	0	100%
Dibutyl Phthalate	1	25%	0	1	0	100%
Dichlorobenzene, 1,2-	2	25%	0	2	0	100%
Dichlorobenzene, 1,3-	2	25%	0	2	0	100%
Dichlorobenzene, 1,4-	2	25%	0	2	0	100%
Dichlorobenzidine, 3,3'-	2	25%	0	2	0	100%
Dichlorophenol, 2,4-	2	25%	0	2	0	100%
Dichlorvos	2	25%	0	2	0	100%
Dieldrin	2	25%	0	2	0	100%
Diethyl phthalate	2	25%	0	2	0	100%
Dimethoate	3	25%	0	3	0	100%
Dimethyl phthalate	2	25%	0	2	0	100%
Dimethylnaphthalene, 2,6-	1	25%	0	1	0	100%
Dimethylphenol, 2,4-	2	25%	0	2	0	100%
Di-n-butyl phthalate	1	25%	0	1	0	100%
Dinitro-2-methylphenol, 4,6-	2	25%	0	2	0	100%
Dinitrophenol, 2,4-	2	25%	0	2	0	100%
Dinitrotoluene, 2,4-	2	25%	0	2	0	100%
Dinitrotoluene, 2,6-	2	25%	0	2	0	100%
Di-n-octyl phthalate	2	25%	0	2	0	100%
Diphenylhydrazine, 1,2-	1	25%	0	1	0	100%
Disulfoton	3	25%	0	3	0	100%
Endosulfan I	2	25%	0	2	0	100%
Endosulfan II	2	25%	0	2	0	100%
Endosulfan sulfate	2	25%	0	2	0	100%
Endrin	2	25%	0	2	0	100%
Endrin Aldehyde	2	25%	0	2	0	100%
Endrin Ketone	1	25%	0	1	0	100%
Esfenvalerate/Fenvalerate, Total	3	25%	0	3	0	100%
Ethoprop	2	25%	0	2	0	100%
Fenchlorphos	1	25%	1	0	1	0%
Fenpropathrin	2	25%	0	2	0	100%
Fensulfothion	2	25%	0	2	0	100%
Fenthion	2	25%	0	2	0	100%

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Fenvalerate	1	25%	0	1	0	100%
Fluoranthene	2	25%	1	2	0	100%
Fluorene	2	25%	1	1	1	50%
HCH, alpha-	2	25%	0	2	0	100%
HCH, beta-	2	25%	0	2	0	100%
HCH, delta-	2	25%	0	2	0	100%
HCH, gamma-	2	25%	0	2	0	100%
Heptachlor	2	25%	0	2	0	100%
Heptachlor epoxide	2	25%	0	2	0	100%
Hexachlorobenzene	2	25%	0	2	0	100%
Hexachlorobutadiene	2	25%	0	2	0	100%
Hexachlorocyclopentadiene	2	25%	0	2	0	100%
Hexachloroethane	2	25%	0	2	0	100%
Indeno(1,2,3-c,d)pyrene	2	25%	1	2	0	100%
Isophorone	2	25%	0	2	0	100%
Malathion	3	25%	0	3	0	100%
Merphos	1	25%	0	1	0	100%
Methidathion	2	25%	0	2	0	100%
Methoxychlor	2	25%	0	2	0	100%
Methylnaphthalene, 1-	2	25%	0	1	1	50%
Methylnaphthalene, 2-	2	25%	0	1	1	50%
Methylphenanthrene, 1-	1	25%	1	0	1	0%
Methylphenol, 2-	2	25%	0	2	0	100%
Methylphenol, 3/4-	2	25%	0	2	0	100%
Mevinphos	2	25%	0	2	0	100%
Mirex	2	25%	0	2	0	100%
Naled	2	25%	0	2	0	100%
Naphthalene	2	25%	0	1	1	50%
Nitroaniline, 2-	2	25%	0	2	0	100%
Nitroaniline, 3-	2	25%	0	2	0	100%
Nitroaniline, 4-	2	25%	0	2	0	100%
Nitrobenzene	2	25%	0	2	0	100%
Nitrophenol, 2-	2	25%	0	2	0	100%
Nitrophenol, 4-	2	25%	0	2	0	100%
Nitrosodimethylamine, N-	2	25%	0	2	0	100%
Nitrosodi-n-propylamine, N-	2	25%	0	2	0	100%
Nitrosodiphenylamine, N-	2	25%	0	2	0	100%
Nonachlor, cis-	2	25%	0	2	0	100%
Nonachlor, trans-	2	25%	0	2	0	100%
Oxychlordane	2	25%	0	2	0	100%
Parathion, Ethyl	1	25%	0	1	0	100%

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Parathion, Methyl	3	25%	0	3	0	100%
PCB 003	1	25%	0	1	0	100%
PCB 008	1	25%	0	1	0	100%
PCB 018	1	25%	0	1	0	100%
PCB 028	1	25%	0	1	0	100%
PCB 031	1	25%	0	1	0	100%
PCB 033	1	25%	0	1	0	100%
PCB 037	1	25%	0	1	0	100%
PCB 044	1	25%	0	1	0	100%
PCB 049	1	25%	0	1	0	100%
PCB 052	1	25%	0	1	0	100%
PCB 056/60	1	25%	0	1	0	100%
PCB 066	1	25%	0	1	0	100%
PCB 070	1	25%	0	1	0	100%
PCB 074	1	25%	0	1	0	100%
PCB 077	1	25%	0	1	0	100%
PCB 081	1	25%	0	1	0	100%
PCB 087	1	25%	0	1	0	100%
PCB 095	1	25%	0	1	0	100%
PCB 097	1	25%	0	1	0	100%
PCB 099	1	25%	0	1	0	100%
PCB 101	1	25%	0	1	0	100%
PCB 105	1	25%	0	1	0	100%
PCB 110	1	25%	0	1	0	100%
PCB 114	1	25%	0	1	0	100%
PCB 118	1	25%	0	1	0	100%
PCB 119	1	25%	0	1	0	100%
PCB 123	1	25%	0	1	0	100%
PCB 126	1	25%	0	1	0	100%
PCB 128	1	25%	0	1	0	100%
PCB 138	1	25%	0	1	0	100%
PCB 141	1	25%	0	1	0	100%
PCB 149	1	25%	0	1	0	100%
PCB 151	1	25%	0	1	0	100%
PCB 153	1	25%	0	1	0	100%
PCB 156	1	25%	0	1	0	100%
PCB 157	1	25%	0	1	0	100%
PCB 158	1	25%	0	1	0	100%
PCB 167	1	25%	0	1	0	100%
PCB 168	1	25%	0	1	0	100%
PCB 169	1	25%	0	1	0	100%

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
PCB 170	1	25%	0	1	0	100%
PCB 174	1	25%	0	1	0	100%
PCB 177	1	25%	0	1	0	100%
PCB 180	1	25%	0	1	0	100%
PCB 183	1	25%	0	1	0	100%
PCB 187	1	25%	0	1	0	100%
PCB 189	1	25%	0	1	0	100%
PCB 194	1	25%	0	1	0	100%
PCB 195	1	25%	0	1	0	100%
PCB 198/199	1	25%	0	1	0	100%
PCB 201	1	25%	0	1	0	100%
PCB 206	1	25%	0	1	0	100%
PCB 209	1	25%	0	1	0	100%
PCB AROCLOR 1016	2	25%	0	2	0	100%
PCB AROCLOR 1221	2	25%	0	2	0	100%
PCB AROCLOR 1232	2	25%	0	2	0	100%
PCB AROCLOR 1242	2	25%	0	2	0	100%
PCB AROCLOR 1248	2	25%	0	2	0	100%
PCB AROCLOR 1254	2	25%	0	2	0	100%
PCB AROCLOR 1260	2	25%	0	2	0	100%
Pendimethalin	1	25%	0	1	0	100%
Pentachlorophenol	2	25%	0	2	0	100%
Permethrin, cis-	2	25%	0	2	0	100%
Permethrin, Total	1	25%	0	1	0	100%
Permethrin, trans-	2	25%	0	2	0	100%
Perthane	1	25%	0	1	0	100%
Perylene	1	25%	0	1	0	100%
Phenanthrene	2	25%	1	0	2	0%
Phenol	2	25%	0	2	0	100%
Phenothrin	1	25%	0	1	0	100%
Phorate	3	25%	0	3	0	100%
Phosmet	2	25%	0	2	0	100%
Prallethrin	2	25%	0	2	0	100%
Pyrene	2	25%	2	2	0	100%
Ronnel	1	25%	1	1	0	100%
Tetrachlorvinphos	2	25%	0	2	0	100%
Tokuthion	2	25%	0	2	0	100%
Toxaphene	1	25%	0	1	0	100%
Trichlorobenzene, 1,2,4-	2	25%	0	2	0	100%
Trichloronate	2	25%	0	2	0	100%
Trichlorophenol, 2,4,5-	2	25%	0	2	0	100%

Table E-2a. Field Duplicate Sample Results Summary – Water Samples

Constituent	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Trichlorophenol, 2,4,6-	2	25%	0	2	0	100%
Trimethylnaphthalene, 2,3,5-	1	25%	1	0	1	0%

Table E-2b. Field Duplicate Sample Results Summary- Subtidal Sediment

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Conventionals & Hydrocarbons						
Ammonia as N	1	25%	0	1	0	100%
Oil & Grease; HEM	1	25%	1	1	0	100%
Total Organic Carbon	1	25%	0	1	0	100%
Total Solids	1	25%	0	1	0	100%
TPH as Diesel C10-C28	1	25%	1	0	1	0%
TPH as Motor Oil C25-C36	1	25%	1	0	1	0%
Total Metals						
Antimony	1	25%	0	0	1	0%
Arsenic	1	25%	0	1	0	100%
Beryllium	1	25%	0	1	0	100%
Cadmium	1	25%	0	1	0	100%
Chromium	1	25%	0	1	0	100%
Chromium VI	1	25%	1	0	1	0%
Lead	1	25%	0	1	0	100%
Mercury	1	25%	0	1	0	100%
Nickel	1	25%	0	1	0	100%
Selenium	1	25%	1	1	0	100%
Silver	1	25%	0	0	1	0%
Thallium	1	25%	0	1	0	100%
Zinc	1	25%	0	1	0	100%
Organic Compounds						
Acenaphthene	1	25%	0	1	0	100%
Acenaphthylene	1	25%	0	1	0	100%
Aldrin	1	25%	0	1	0	100%
Allethrin	1	25%	0	1	0	100%
Anthracene	1	25%	0	1	0	100%
Azinphos methyl	1	25%	0	1	0	100%
Benz(a)anthracene	1	25%	0	1	0	100%
Benzo(a)pyrene	1	25%	0	1	0	100%

Table E-2b. Field Duplicate Sample Results Summary- Subtidal Sediment

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Benzo(b)fluoranthene	1	25%	0	1	0	100%
Benzo(g,h,i)perylene	1	25%	0	1	0	100%
Benzo(k)fluoranthene	1	25%	0	1	0	100%
Benzoic Acid	1	25%	0	1	0	100%
Benzyl Alcohol	1	25%	0	1	0	100%
Bifenthrin	1	25%	0	1	0	100%
Bis(2-chloroethoxy)methane	1	25%	0	1	0	100%
Bis(2-chloroethyl)ether	1	25%	0	1	0	100%
Bis(2-chloroisopropyl) ether	1	25%	0	1	0	100%
Bis(2-ethylhexyl)phthalate	1	25%	0	1	0	100%
Bolstar	1	25%	0	1	0	100%
Bromophenyl phenyl ether, 4-	1	25%	0	1	0	100%
Butyl benzyl phthalate	1	25%	0	1	0	100%
Carbazole	1	25%	0	1	0	100%
Chlordane, cis-	1	25%	0	1	0	100%
Chlordane, trans-	1	25%	0	1	0	100%
Chloro-3-methylphenol, 4-	1	25%	0	1	0	100%
Chloroaniline, 4-	1	25%	0	1	0	100%
Chloronaphthalene, 2-	1	25%	0	1	0	100%
Chlorophenol, 2-	1	25%	0	1	0	100%
Chlorophenyl phenyl ether, 4-	1	25%	0	1	0	100%
Chlorpyrifos	2	25%	0	2	0	100%
Chrysene	1	25%	0	1	0	100%
Coumaphos	1	25%	0	1	0	100%
Cyanide	1	25%	0	1	0	100%
Cyfluthrin, total	1	25%	0	1	0	100%
Cyhalothrin, Total lambda-	1	25%	0	1	0	100%
Cypermethrin, total	1	25%	0	1	0	100%
DDD(o,p')	1	25%	0	1	0	100%
DDD(p,p')	1	25%	0	1	0	100%
DDE(O,P')	1	25%	0	1	0	100%
DDE(p,p')	1	25%	0	1	0	100%
DDT(o,p')	1	25%	0	1	0	100%
DDT(p,p')	1	25%	0	1	0	100%
Deltamethrin/Tralomethrin	1	25%	0	1	0	100%
Demeton, Total	1	25%	0	1	0	100%
Diazinon	2	25%	0	2	0	100%
Dibenz(a,h)anthracene	1	25%	0	1	0	100%
Dibenzofuran	1	25%	0	1	0	100%
Dibutyltin as Sn	1	25%	1	1	0	100%
Dichlorobenzene, 1,2-	1	25%	0	1	0	100%

Table E-2b. Field Duplicate Sample Results Summary- Subtidal Sediment

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Dichlorobenzene, 1,3-	1	25%	0	1	0	100%
Dichlorobenzene, 1,4-	1	25%	0	1	0	100%
Dichlorobenzidine, 3,3'-	1	25%	0	1	0	100%
Dichlorophenol, 2,4-	1	25%	0	1	0	100%
Dichlorvos	1	25%	0	1	0	100%
Dieldrin	1	25%	0	1	0	100%
Diethyl phthalate	1	25%	0	1	0	100%
Dimethoate	1	25%	0	1	0	100%
Dimethyl phthalate	1	25%	0	1	0	100%
Dimethylnaphthalene, 1,2-	1	25%	1	1	0	100%
Dimethylphenol, 2,4-	1	25%	0	1	0	100%
Di-n-butyl phthalate	1	25%	1	1	0	100%
Dinitrophenol, 2,4-	1	25%	0	1	0	100%
Dinitrotoluene, 2,4-	1	25%	0	1	0	100%
Dinitrotoluene, 2,6-	1	25%	0	1	0	100%
Di-n-octyl phthalate	1	25%	0	1	0	100%
Disulfoton	1	25%	0	1	0	100%
Endosulfan I	1	25%	0	1	0	100%
Endosulfan II	1	25%	0	1	0	100%
Endosulfan sulfate	1	25%	0	1	0	100%
Endrin	1	25%	0	1	0	100%
Endrin Aldehyde	1	25%	0	1	0	100%
Endrin Ketone	1	25%	0	1	0	100%
EPN	1	25%	0	1	0	100%
Esfenvalerate/Fenvalerate Total	1	25%	0	1	0	100%
Ethoprop	1	25%	0	1	0	100%
Fenchlorphos	1	25%	0	1	0	100%
Fenpropathrin	1	25%	0	1	0	100%
Fensulfothion	1	25%	0	1	0	100%
Fenthion	1	25%	0	1	0	100%
Fluoranthene	1	25%	0	1	0	100%
Fluorene	1	25%	1	1	0	100%
HCH, alpha-	1	25%	0	1	0	100%
HCH, beta-	1	25%	0	1	0	100%
HCH, delta-	1	25%	0	1	0	100%
HCH, gamma-	1	25%	0	1	0	100%
Heptachlor	1	25%	0	1	0	100%
Heptachlor epoxide	1	25%	1	0	1	0%
Hexachlorobenzene	1	25%	0	1	0	100%
Hexachlorobutadiene	1	25%	0	1	0	100%
Hexachlorocyclopentadiene	1	25%	0	1	0	100%

Table E-2b. Field Duplicate Sample Results Summary- Subtidal Sediment

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Hexachloroethane	1	25%	0	1	0	100%
Indeno(1,2,3-c,d)pyrene	1	25%	0	1	0	100%
Isophorone	1	25%	0	1	0	100%
Malathion	1	25%	0	1	0	100%
Merphos	1	25%	0	1	0	100%
Methoxychlor	1	25%	0	1	0	100%
Methylnaphthalene, 2-	1	25%	0	1	0	100%
Methylphenol, 2-	1	25%	0	1	0	100%
Methylphenol, 3/4-	1	25%	0	1	0	100%
Mevinphos	1	25%	0	1	0	100%
Naphthalene	1	25%	1	1	0	100%
Nitroaniline, 2-	1	25%	0	1	0	100%
Nitroaniline, 3-	1	25%	0	1	0	100%
Nitroaniline, 4-	1	25%	0	1	0	100%
Nitrobenzene	1	25%	0	1	0	100%
Nitrophenol, 2-	1	25%	0	1	0	100%
Nitrophenol, 4-	1	25%	0	1	0	100%
Nitrosodi-n-propylamine, N-	1	25%	0	1	0	100%
Nitrosodiphenylamine, N-	1	25%	0	1	0	100%
Parathion, Ethyl	1	25%	0	1	0	100%
Parathion, Methyl	1	25%	0	1	0	100%
PCB AROCLOR 1016	1	25%	0	1	0	100%
PCB AROCLOR 1221	1	25%	0	1	0	100%
PCB AROCLOR 1232	1	25%	0	1	0	100%
PCB AROCLOR 1242	1	25%	0	1	0	100%
PCB AROCLOR 1248	1	25%	0	1	0	100%
PCB AROCLOR 1254	1	25%	0	1	0	100%
PCB AROCLOR 1260	1	25%	0	1	0	100%
Pentachlorophenol	1	25%	0	1	0	100%
Permethrin, Total	1	25%	0	1	0	100%
Phenanthrene	1	25%	0	1	0	100%
Phenol	1	25%	1	0	1	0%
Phorate	1	25%	0	1	0	100%
Pyrene	1	25%	0	1	0	100%
Sulfotep	1	25%	0	1	0	100%
Tetrabutyltin as Sn	1	25%	0	1	0	100%
Tetrachlorvinphos	1	25%	0	1	0	100%
Tetramethrin	1	25%	0	1	0	100%
T-Fluvalinate	1	25%	0	1	0	100%
Tokuthion	1	25%	0	1	0	100%
Toxaphene	1	25%	0	1	0	100%

Table E-2b. Field Duplicate Sample Results Summary- Subtidal Sediment

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Tributyltin as Sn	1	25%	0	1	0	100%
Trichlorobenzene, 1,2,4-	1	25%	0	1	0	100%
Trichloronate	1	25%	0	1	0	100%
Trichlorophenol, 2,4,5-	1	25%	0	1	0	100%
Trichlorophenol, 2,4,6-	1	25%	0	1	0	100%

Table E-2c. Field Duplicate Sample Results Summary - Mussel Tissue Samples

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Total Metals						
Aluminum	1	25%	0	0	1	0%
Antimony	1	25%	1	0	1	0%
Arsenic	1	25%	0	1	0	100%
Cadmium	1	25%	0	1	0	100%
Chromium	1	25%	0	1	0	100%
Copper	1	25%	0	1	0	100%
Lead	1	25%	0	1	0	100%
Manganese	1	25%	0	1	0	100%
Mercury	1	25%	0	1	0	100%
Nickel	1	25%	0	1	0	100%
Selenium	1	25%	0	1	0	100%
Silicon	1	25%	0	1	0	100%
Silver	1	25%	0	1	0	100%
Thallium	1	25%	1	1	0	100%
Tin	1	25%	0	1	0	100%
Zinc	1	25%	0	1	0	100%
Organic Compounds						
Acenaphthene	1	25%	0	1	0	100%
Acenaphthylene	1	25%	0	1	0	100%
Anthracene	1	25%	0	1	0	100%
Benz(a)anthracene	1	25%	0	1	0	100%
Benzo(a)pyrene	1	25%	1	0	1	0%
Benzo(b)fluoranthene	1	25%	0	1	0	100%
Benzo(g,h,i)perylene	1	25%	0	1	0	100%
Benzo(k)fluoranthene	1	25%	0	1	0	100%
Biphenyl	1	25%	1	1	0	100%

Table E-2c. Field Duplicate Sample Results Summary - Mussel Tissue Samples						
Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
Carbazole	1	25%	0	0	1	0%
Chlordane, cis-	1	25%	1	1	0	100%
Chlordane, trans-	1	25%	0	1	0	100%
Chlorpyrifos	1	25%	1	1	0	100%
Chrysene	1	25%	0	1	0	100%
DDD(o,p')	1	25%	0	1	0	100%
DDD(p,p')	1	25%	0	1	0	100%
DDE(o,p')	1	25%	0	1	0	100%
DDE(p,p')	1	25%	0	1	0	100%
DDT(o,p')	1	25%	0	1	0	100%
DDT(p,p')	1	25%	0	1	0	100%
Dibenz(a,h)anthracene	1	25%	0	1	0	100%
Dibenzothiophene	1	25%	0	1	0	100%
Dieldrin	1	25%	1	1	0	100%
Dimethylnaphthalene, 2,6-	1	25%	0	0	1	0%
Fluoranthene	1	25%	1	1	0	100%
Fluorene	1	25%	1	1	0	100%
HCH, alpha-	1	25%	1	0	1	0%
HCH, beta-	1	25%	0	1	0	100%
HCH, delta-	1	25%	1	1	0	100%
HCH, gamma-	1	25%	0	1	0	100%
Heptachlor	1	25%	0	1	0	100%
Heptachlor epoxide	1	25%	0	1	0	100%
Indeno(1,2,3-c,d)pyrene	1	25%	0	1	0	100%
Methylnaphthalene, 1-	1	25%	0	1	0	100%
Methylnaphthalene, 2-	1	25%	1	1	0	100%
Methylphenanthrene, 1-	1	25%	0	1	0	100%
Naphthalene	1	25%	1	1	0	100%
Nonachlor, cis-	1	25%	0	1	0	100%
Nonachlor, trans-	1	25%	0	1	0	100%
Oxychlordane	1	25%	0	1	0	100%
PBDE 017	1	25%	0	1	0	100%
PBDE 028	1	25%	0	1	0	100%
PBDE 047	1	25%	0	1	0	100%
PBDE 066	1	25%	0	1	0	100%
PBDE 071	1	25%	0	1	0	100%
PBDE 085	1	25%	0	1	0	100%
PBDE 099	1	25%	0	1	0	100%
PBDE 100	1	25%	0	1	0	100%
PBDE 128	1	25%	0	1	0	100%
PBDE 138	1	25%	0	1	0	100%

Table E-2c. Field Duplicate Sample Results Summary - Mussel Tissue Samples

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
PBDE 153	1	25%	0	1	0	100%
PBDE 154	1	25%	0	1	0	100%
PBDE 183	1	25%	0	1	0	100%
PBDE 190	1	25%	0	1	0	100%
PBDE 203	1	25%	0	1	0	100%
PBDE 206	1	25%	0	1	0	100%
PBDE 209	1	25%	0	1	0	100%
PCB 001	1	25%	0	1	0	100%
PCB 005	1	25%	0	1	0	100%
PCB 008	1	25%	0	1	0	100%
PCB 018	1	25%	0	1	0	100%
PCB 028	1	25%	0	1	0	100%
PCB 031	1	25%	0	1	0	100%
PCB 033	1	25%	0	1	0	100%
PCB 037	1	25%	0	1	0	100%
PCB 044	1	25%	0	1	0	100%
PCB 049	1	25%	0	1	0	100%
PCB 052	1	25%	0	1	0	100%
PCB 056	1	25%	0	1	0	100%
PCB 060	1	25%	0	1	0	100%
PCB 066	1	25%	0	1	0	100%
PCB 070	1	25%	0	1	0	100%
PCB 074	1	25%	0	1	0	100%
PCB 077	1	25%	0	1	0	100%
PCB 081	1	25%	0	1	0	100%
PCB 087	1	25%	0	1	0	100%
PCB 090	1	25%	0	1	0	100%
PCB 095	1	25%	0	1	0	100%
PCB 097	1	25%	0	1	0	100%
PCB 099	1	25%	0	1	0	100%
PCB 101	1	25%	0	1	0	100%
PCB 105	1	25%	0	1	0	100%
PCB 110	1	25%	0	1	0	100%
PCB 114	1	25%	0	1	0	100%
PCB 118	1	25%	0	1	0	100%
PCB 119	1	25%	0	1	0	100%
PCB 123	1	25%	0	1	0	100%
PCB 126	1	25%	0	1	0	100%
PCB 128	1	25%	0	1	0	100%
PCB 132	1	25%	0	1	0	100%
PCB 138	1	25%	0	1	0	100%

Table E-2c. Field Duplicate Sample Results Summary - Mussel Tissue Samples

Parameter	Duplicate Pairs Analyzed	QA/QC RPD Criteria	Duplicate Pairs with One or Both Values Qualified as U, J, or R	Duplicate Pairs Satisfying QA/QC Criteria	Duplicate Pairs Exceeding QA/QC Criteria	Percent of Duplicate Pairs Satisfying QA/QC Criteria
PCB 141	1	25%	0	1	0	100%
PCB 149	1	25%	0	1	0	100%
PCB 151	1	25%	0	1	0	100%
PCB 153	1	25%	0	1	0	100%
PCB 156	1	25%	0	1	0	100%
PCB 157	1	25%	0	1	0	100%
PCB 158	1	25%	0	1	0	100%
PCB 167	1	25%	0	1	0	100%
PCB 168	1	25%	0	1	0	100%
PCB 169	1	25%	0	1	0	100%
PCB 170	1	25%	0	1	0	100%
PCB 174	1	25%	0	1	0	100%
PCB 177	1	25%	0	1	0	100%
PCB 180	1	25%	0	1	0	100%
PCB 183	1	25%	0	1	0	100%
PCB 187	1	25%	0	1	0	100%
PCB 189	1	25%	0	1	0	100%
PCB 194	1	25%	0	1	0	100%
PCB 195	1	25%	0	1	0	100%
PCB 201	1	25%	0	1	0	100%
PCB 203	1	25%	0	1	0	100%
PCB 206	1	25%	0	1	0	100%
PCB 209	1	25%	0	1	0	100%
Perylene	1	25%	0	0	1	0%
Phenanthrene	1	25%	0	1	0	100%
Pyrene	1	25%	1	1	0	100%
Toxaphene	1	25%	0	1	0	100%
Trimethylnaphthalene, 2,3,5-	1	25%	1	1	0	100%

E.3 Laboratory QA/QC

Laboratory-generated QA/QC samples provide information needed to assess analytical precision and accuracy, and serve as a check on laboratory procedures. In general, the analytical laboratories performed the appropriate internal QA/QC measures. QA/QC analyses were performed using one or more of the following quality control procedures, depending on the analytical method requirements, at a frequency of at least once per batch of 20 or fewer samples (5 percent):

- Method Blank samples
- Laboratory duplicate samples (replicate samples)
- Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

- Matrix Spike/Matrix Spike Duplicate (MS/MSD)
- Surrogates

Overall, results of all QA/QC procedures show that, although there were a number of exceedances of some control parameters, it was demonstrated through other QA/QC tests the analyses were performed under adequately controlled conditions.

Table E-3a. Laboratory QA/QC Results Summary – Water Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness: Completeness
Conventionals, and Hydrocarbons									
Ammonia as N	100%	80-120%	100%	100%	25%	93%	14	14	100%
MBAS	100%	80-120%	100%	100%	25%	100%	5	5	100%
Nitrate + Nitrite as N	50%	80-120%	100%	100%	25%	100%	4	4	100%
Nitrate as N	100%	80-120%	75%	100%	25%	100%	10	10	100%
OilandGrease; HEM	89%	80-120%	100%	95%	25%	100%	14	14	100%
OrthoPhosphate as P	100%	80-120%	100%	100%	25%	100%	8	8	100%
Phosphorus as P	100%	80-120%	100%	100%	25%	100%	6	6	100%
Settleable Solids	100%	NA	NA 2	NA	25%	NA	1	1	100%
Total Organic Carbon	83%	80-120%	100%	100%	25%	100%	10	10	100%
Total Suspended Solids	100%	NA	NA	100%	25%	100%	14	14	100%
TPH as Diesel C10-C22	100%	80-120%	NP	100%	25%	100%	5	5	100%
TPH as Diesel C10-C28	100%	80-120%	100%	100%	25%	100%	6	6	100%
TPH as Gasoline C6-C10	100%	80-120%	100%	100%	25%	100%	9	9	100%
TPH as Motor Oil C18-C26	100%	80-120%	NP	NP	25%	NP	4	4	100%
TPH as Motor Oil C22-C36	100%	80-120%	NP	NP	25%	100%	5	5	100%
Turbidity	86%	NA	NA	100%	25%	100%	13	13	100%
Total Metals									
Antimony	100%	75-125%	100%	92%	25%	92%	10	10	100%
Arsenic	83%	75-125%	100%	95%	25%	94%	14	14	100%
Beryllium	89%	75-125%	100%	85%	25%	100%	10	10	100%
Cadmium	100%	75-125%	100%	100%	25%	100%	14	14	100%
Chromium	67%	75-125%	100%	100%	25%	100%	14	14	100%
Chromium VI	100%	75-125%	100%	100%	25%	100%	1	1	100%
Copper	100%	75-125%	89%	100%	25%	100%	14	14	100%
Lead	100%	75-125%	100%	100%	25%	100%	14	14	100%
Mercury	87%	75-125%	100%	100%	25%	100%	14	14	100%
Nickel	92%	75-125%	78%	100%	25%	100%	14	14	100%
Selenium	91%	75-125%	80%	94%	25%	94%	14	14	100%
Silver	100%	75-125%	100%	100%	25%	100%	14	14	100%
Thallium	89%	75-125%	100%	92%	25%	91%	10	10	100%
Zinc	92%	75-125%	100%	100%	25%	100%	14	14	100%

Table E-3a. Laboratory QA/QC Results Summary – Water Samples

		Accuracy			Precision		Completeness		
Constituent	Method Blank Non-Detects (%)	Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Organic Compounds [1]									
Acenaphthene	100%	50-150%	100%	100%	25%	100%	12	12	100%
Acenaphthylene	100%	50-150%	100%	89%	25%	100%	12	12	100%
Aldrin	100%	50-150%	100%	100%	25%	100%	12	12	100%
Allethrin	100%	50-150%	50%	100%	25%	83%	12	12	100%
Aniline	100%	50-150%	NP	NP	25%	NA	2	2	100%
Anthracene	100%	50-150%	100%	87%	25%	100%	12	12	100%
Azinphos methyl	100%	50-150%	0%	86%	25%	100%	12	12	100%
Benz(a)anthracene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Benzidine	100%	50-150%	NP	100%	25%	100%	10	10	100%
Benzo(a)pyrene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Benzo(b)fluoranthene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Benzo(e)pyrene	100%	50-150%	100%	100%	25%	100%	6	6	100%
Benzo(g,h,i)perylene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Benzo(k)fluoranthene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Benzoic Acid	100%	50-150%	NP	70%	25%	100%	12	12	100%
Benzyl Alcohol	100%	50-150%	NP	90%	25%	100%	12	12	100%
Bifenthrin	100%	50-150%	100%	100%	25%	100%	14	14	100%
Biphenyl	100%	50-150%	100%	100%	25%	100%	6	6	100%
Bis(2-chloroethoxy)methane	100%	50-150%	NP	92%	25%	100%	12	12	100%
Bis(2-chloroethyl)ether	100%	50-150%	NP	100%	25%	100%	12	12	100%
Bis(2-chloroisopropyl) ether	100%	50-150%	NP	100%	25%	100%	12	12	100%
Bis(2-ethylhexyl)phthalate	50%	50-150%	NP	92%	25%	100%	12	12	100%
Bolstar	100%	50-150%	100%	93%	25%	100%	12	12	100%
Bromophenyl phenyl ether, 4-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Butyl benzyl phthalate	43%	50-150%	NP	92%	25%	100%	12	12	100%
Carbazole	100%	50-150%	NP	100%	25%	100%	10	10	100%
Chlordane, cis-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Chlordane, trans-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Chloro-3-methylphenol, 4-	100%	50-150%	100%	92%	25%	86%	12	12	100%
Chloroaniline, 4-	100%	50-150%	NA	50%	25%	100%	6	6	100%
Chloronaphthalene, 2-	100%	50-150%	NA	100%	25%	100%	12	12	100%
Chlorophenol, 2-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Chlorophenyl phenyl ether, 4-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Chlorpyrifos	100%	50-150%	100%	100%	25%	100%	16	16	100%
Chrysene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Coumaphos	100%	50-150%	0%	93%	25%	100%	12	12	100%

Table E-3a. Laboratory QA/QC Results Summary – Water Samples									
		Accuracy			Precision		Completeness		
Constituent	Method Blank Non-Detects (%)	Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Cyanide	100%	50-150%	100%	100%	25%	100%	5	5	100%
Cyfluthrin, total	100%	50-150%	50%	100%	25%	100%	14	14	100%
Cyhalothrin, Total lambda-	100%	50-150%	75%	100%	25%	88%	14	14	100%
Cypermethrin, Total	100%	50-150%	50%	100%	25%	100%	14	14	100%
DDD(o,p')	100%	50-150%	NP	100%	25%	100%	10	10	100%
DDD(p,p')	100%	50-150%	100%	100%	25%	100%	12	12	100%
DDE(o,p')	100%	50-150%	NP	100%	25%	100%	10	10	100%
DDE(p,p')	100%	50-150%	100%	100%	25%	100%	12	12	100%
DDT(o,p')	100%	50-150%	NP	100%	25%	100%	10	10	100%
DDT(p,p')	100%	50-150%	100%	100%	25%	100%	12	12	100%
Deltamethrin/Tralomethrin	100%	50-150%	75%	100%	25%	75%	14	14	100%
Demeton, Total	100%	50-150%	100%	71%	25%	100%	12	12	100%
Diazinon	100%	50-150%	100%	100%	25%	100%	16	16	100%
Dibenz(a,h)anthracene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Dibenzofuran	100%	50-150%	NP	100%	25%	100%	12	12	100%
Dibenzothiophene	100%	50-150%	100%	100%	25%	100%	6	6	100%
Dibutyl Phthalate	0%	50-150%	NP	100%	25%	100%	6	6	100%
Dichlorobenzene, 1,2-	100%	50-150%	NP	100%	25%	83%	12	12	100%
Dichlorobenzene, 1,3-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Dichlorobenzene, 1,4-	100%	50-150%	100%	100%	25%	86%	12	12	100%
Dichlorobenzidine, 3,3'-	100%	50-150%	NP	80%	25%	100%	10	10	100%
Dichlorophenol, 2,4-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Dichlorvos	100%	50-150%	100%	100%	25%	100%	12	12	100%
Dieldrin	100%	50-150%	100%	100%	25%	100%	12	12	100%
Diethyl phthalate	38%	50-150%	NP	92%	25%	100%	12	12	100%
Dimethoate	100%	50-150%	100%	94%	25%	89%	14	14	100%
Dimethyl phthalate	100%	50-150%	NP	100%	25%	100%	12	12	100%
Dimethylnaphthalene, 2,6-	100%	50-150%	100%	100%	25%	100%	6	6	100%
Dimethylphenol, 2,4-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Di-n-butyl phthalate	100%	50-150%	NP	83%	25%	100%	6	6	100%
Dinitro-2-methylphenol, 4,6-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Dinitrophenol, 2,4-	100%	50-150%	NP	83%	25%	100%	12	12	100%
Dinitrotoluene, 2,4-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Dinitrotoluene, 2,6-	100%	50-150%	NP	92%	25%	100%	12	12	100%
Di-n-octyl phthalate	100%	50-150%	NP	92%	25%	100%	12	12	100%
Diphenylhydrazine, 1,2-	100%	50-150%	NP	100%	25%	100%	8	8	100%
Disulfoton	100%	50-150%	100%	89%	25%	100%	14	14	100%
Endosulfan I	100%	50-150%	100%	100%	25%	100%	12	12	100%
Endosulfan II	100%	50-150%	100%	100%	25%	100%	12	12	100%
Endosulfan sulfate	100%	50-150%	100%	100%	25%	100%	12	12	100%

Table E-3a. Laboratory QA/QC Results Summary – Water Samples									
		Accuracy			Precision		Completeness		
Constituent	Method Blank Non-Detects (%)	Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Endrin	100%	50-150%	100%	100%	25%	100%	12	12	100%
Endrin Aldehyde	100%	50-150%	100%	100%	25%	86%	12	12	100%
Endrin Ketone	100%	50-150%	100%	100%	25%	100%	8	8	100%
EPN	100%	50-150%	NP	100%	25%	100%	2	2	100%
Esfenvalerate/Fenvalerate, Total	100%	50-150%	50%	100%	25%	63%	15	15	100%
Ethoprop	100%	50-150%	100%	100%	25%	100%	12	12	100%
Fenchlorphos	100%	50-150%	100%	100%	25%	100%	6	6	100%
Fenpropathrin	100%	50-150%	NP	100%	25%	100%	11	11	100%
Fensulfothion	100%	50-150%	100%	79%	25%	100%	12	12	100%
Fenthion	100%	50-150%	100%	100%	25%	100%	12	12	100%
Fenvalerate	100%	50-150%	NP	100%	25%	100%	6	6	100%
Fluoranthene	100%	50-150%	100%	87%	25%	100%	12	12	100%
Fluorene	100%	50-150%	100%	100%	25%	100%	12	12	100%
HCH, alpha-	100%	50-150%	100%	100%	25%	100%	12	12	100%
HCH, beta-	100%	50-150%	100%	100%	25%	100%	12	12	100%
HCH, delta-	100%	50-150%	100%	100%	25%	100%	12	12	100%
HCH, gamma-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Heptachlor	100%	50-150%	100%	100%	25%	100%	12	12	100%
Heptachlor epoxide	100%	50-150%	100%	100%	25%	100%	12	12	100%
Hexachlorobenzene	100%	50-150%	NP	100%	25%	100%	12	12	100%
Hexachlorobutadiene	100%	50-150%	NP	100%	25%	83%	12	12	100%
Hexachlorocyclopentadiene	100%	50-150%	NP	92%	25%	100%	12	12	100%
Hexachloroethane	100%	50-150%	NP	100%	25%	100%	12	12	100%
Indeno(1,2,3-c,d)pyrene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Isophorone	100%	50-150%	NP	100%	25%	100%	12	12	100%
Malathion	100%	50-150%	100%	94%	25%	100%	14	14	100%
Merphos	100%	50-150%	100%	100%	25%	100%	6	6	100%
Methidathion	100%	50-150%	NP	100%	25%	100%	8	8	100%
Methoxychlor	100%	50-150%	100%	100%	25%	100%	12	12	100%
Methylnaphthalene, 1-	100%	50-150%	100%	100%	25%	100%	10	10	100%
Methylnaphthalene, 2-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Methylphenanthrene, 1-	100%	50-150%	100%	100%	25%	100%	6	6	100%
Methylphenol, 2-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Methylphenol, 3/4-	100%	50-150%	NP	88%	25%	100%	12	12	100%
Mevinphos	100%	50-150%	100%	93%	25%	100%	12	12	100%
Mirex	100%	50-150%	NP	100%	25%	100%	10	10	100%
Naled	100%	50-150%	0%	83%	25%	100%	10	10	100%
Naphthalene	100%	50-150%	100%	100%	25%	100%	12	12	100%
Nitroaniline, 2-	100%	50-150%	NP	90%	25%	100%	12	12	100%

Table E-3a. Laboratory QA/QC Results Summary – Water Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness: Completeness
Nitroaniline, 3-	100%	50-150%	NP	80%	25%	100%	12	12	100%
Nitroaniline, 4-	100%	50-150%	NP	90%	25%	100%	12	12	100%
Nitrobenzene	100%	50-150%	NP	100%	25%	100%	12	12	100%
Nitrophenol, 2-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Nitrophenol, 4-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Nitrosodimethylamine, N-	100%	50-150%	NP	100%	25%	100%	10	10	100%
Nitrosodi-n-propylamine, N-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Nitrosodiphenylamine, N-	100%	50-150%	NP	90%	25%	100%	10	10	100%
Nonachlor, cis-	100%	50-150%	NP	100%	25%	100%	8	8	100%
Nonachlor, trans-	100%	50-150%	NP	100%	25%	100%	10	10	100%
Oxychlordane	100%	50-150%	NP	100%	25%	100%	8	8	100%
Parathion, Ethyl	100%	50-150%	100%	75%	25%	100%	6	6	100%
Parathion, Methyl	100%	50-150%	100%	89%	25%	100%	14	14	100%
PCB 003	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 008	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 018	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 028	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 031	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 033	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 037	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 044	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 049	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 052	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 056	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 056/60	100%	50-150%	NP	100%	25%	100%	4	4	100%
PCB 066	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 070	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 074	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 077	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 081	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 087	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 095	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 097	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 099	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 101	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 105	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 110	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 114	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 118	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 119	100%	50-150%	NP	100%	25%	100%	6	6	100%

Table E-3a. Laboratory QA/QC Results Summary – Water Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness: Completeness
PCB 123	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 126	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 128	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 138	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 141	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 149	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 151	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 153	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 156	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 157	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 158	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 167	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 168	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 169	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 170	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 174	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 177	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 180	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 183	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 187	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 189	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 194	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 195	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 198/199	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 201	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 206	100%	50-150%	NP	100%	25%	100%	6	6	100%
PCB 209	100%	50-150%	100%	100%	25%	100%	6	6	100%
PCB AROCLOR 1016	100%	50-150%	100%	100%	25%	100%	10	10	100%
PCB AROCLOR 1221	100%	50-150%	NP	NP	25%	NP	10	10	100%
PCB AROCLOR 1232	100%	50-150%	NP	NP	25%	NP	10	10	100%
PCB AROCLOR 1242	100%	50-150%	NP	NP	25%	NP	10	10	100%
PCB AROCLOR 1248	100%	50-150%	NP	NP	25%	NP	10	10	100%
PCB AROCLOR 1254	100%	50-150%	NP	NP	25%	NP	10	10	100%
PCB AROCLOR 1260	100%	50-150%	100%	100%	25%	100%	10	10	100%
Pendimethalin	100%	50-150%	75%	100%	25%	50%	4	4	100%
Pentachlorophenol	100%	50-150%	100%	100%	25%	100%	12	12	100%
Permethrin, cis-	100%	50-150%	NA	100%	25%	80%	8	8	100%
Permethrin, Total	100%	50-150%	50%	100%	25%	100%	6	6	100%
Permethrin, trans-	100%	50-150%	NP	100%	25%	100%	8	8	100%
Perthane	100%	50-150%	NP	100%	25%	100%	6	6	100%

Table E-3a. Laboratory QA/QC Results Summary – Water Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness
Perylene	100%	50-150%	100%	100%	25%	100%	6	6	100%
Phenanthrene	100%	50-150%	100%	100%	25%	100%	12	12	100%
Phenol	100%	50-150%	100%	100%	25%	86%	12	12	100%
Phenothrin	100%	50-150%	50%	100%	25%	100%	4	4	100%
Phorate	100%	50-150%	100%	100%	25%	67%	14	14	100%
Phosmet	100%	50-150%	NP	100%	25%	100%	8	8	100%
Prallethrin	100%	50-150%	75%	100%	25%	80%	10	10	100%
Pyrene	100%	50-150%	100%	95%	25%	100%	12	12	100%
Ronnel	100%	50-150%	NP	100%	25%	100%	2	2	100%
Sulfotep	100%	50-150%	NP	100%	25%	100%	2	2	100%
Tetrachlorvinphos	100%	50-150%	0%	83%	25%	100%	12	12	100%
Tetramethrin	100%	50-150%	NP	100%	25%	100%	2	2	100%
T-Fluvalinate	100%	50-150%	NP	100%	25%	100%	2	2	100%
Tokuthion	100%	50-150%	100%	100%	25%	100%	12	12	100%
Toxaphene	100%	50-150%	100%	100%	25%	100%	6	6	100%
Trichlorobenzene, 1,2,4-	100%	50-150%	100%	100%	25%	100%	12	12	100%
Trichloronate	100%	50-150%	100%	100%	25%	100%	12	12	100%
Trichlorophenol, 2,4,5-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Trichlorophenol, 2,4,6-	100%	50-150%	NP	100%	25%	100%	12	12	100%
Trimethylnaphthalene, 2,3,5-	100%	50-150%	100%	100%	25%	100%	6	6	100%

[1] Spike recovery QC limits for organic compounds are either 50-150% or, more often, is based on 3x the standard deviation of the laboratory's actual method recoveries.
LCS/LCSD Laboratory Control Sample / Laboratory Control Sample Duplicate
MS/MSD Matrix Spike / Matrix Spike Duplicate
NA Not Applicable
NP Not Performed. No spike was performed for this analyte.
RPD Relative Percent Difference

Table E-3b. Laboratory QA/QC Results Summary – Subtidal Sediment Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness
Conventionals and Hydrocarbons									
Ammonia as N	100%	80-120%	100%	100%	25%	100%	2	2	100%
Oil & Grease; HEM	100%	80-120%	100%	100%	25%	50%	2	2	100%
Total Organic Carbon	100%	80-120%	100%	100%	25%	100%	2	2	100%

Table E-3b. Laboratory QA/QC Results Summary – Subtidal Sediment Samples									
		Accuracy			Precision		Completeness		
Constituent	Method Blank Non-Detects (%)	Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Total Solids	NA	80-120%	100%	NA	25%	0%	2	2	100%
TPH as Diesel C10-C28	100%	80-120%	100%	100%	25%	100%	2	2	100%
TPH as Motor Oil C25-C36	100%	80-120%	100%	100%	25%	100%	2	2	100%
Total Metals									
Antimony	100%	75-125%	100%	100%	25%	100%	2	2	100%
Arsenic	100%	75-125%	100%	100%	25%	100%	2	2	100%
Beryllium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Cadmium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Chromium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Chromium VI	0%	75-125%	100%	100%	25%	100%	2	2	100%
Lead	100%	75-125%	100%	100%	25%	100%	2	2	100%
Mercury	0%	75-125%	NP	NP	25%	NP	2	2	100%
Nickel	0%	75-125%	100%	100%	25%	100%	2	2	100%
Selenium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Silver	100%	75-125%	100%	100%	25%	100%	2	2	100%
Thallium	0%	75-125%	100%	100%	25%	100%	2	2	100%
Zinc	0%	75-125%	100%	100%	25%	100%	2	2	100%
Organic Compounds [1]									
Acenaphthene	100%	50-150%	100%	100%	25%	50%	2	2	100%
Acenaphthylene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Aldrin	100%	50-150%	100%	100%	25%	0%	2	2	100%
Allethrin	NA	50-150%	NP	NP	25%	NP	2	2	100%
Anthracene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Azinphos methyl	100%	50-150%	100%	100%	25%	100%	2	2	100%
Benz(a)anthracene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Benzo(a)pyrene	100%	50-150%	NP	100%	25%	50%	2	2	100%
Benzo(b)fluoranthene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Benzo(g,h,i)perylene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Benzo(k)fluoranthene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Benzoic Acid	100%	50-150%	NP	100%	25%	100%	2	2	100%
Benzyl Alcohol	100%	50-150%	NP	100%	25%	100%	2	2	100%
Bifenthrin	100%	50-150%	50%	100%	25%	100%	2	2	100%
Bis(2-chloroethoxy)methane	100%	50-150%	NP	100%	25%	100%	2	2	100%
Bis(2-chloroethyl)ether	100%	50-150%	NP	100%	25%	100%	2	2	100%
Bis(2-chloroisopropyl) ether	100%	50-150%	NP	100%	25%	100%	2	2	100%
Bis(2-ethylhexyl)phthalate	100%	50-150%	NP	100%	25%	100%	2	2	100%
Bolstar	100%	50-150%	100%	100%	25%	100%	2	2	100%

Table E-3b. Laboratory QA/QC Results Summary – Subtidal Sediment Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness
Bromophenyl phenyl ether, 4-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Butyl benzyl phthalate	100%	50-150%	NP	100%	25%	100%	2	2	100%
Carbazole	100%	50-150%	NP	100%	25%	100%	2	2	100%
Chlordane, cis-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chlordane, trans-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chloro-3-methylphenol, 4-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chloroaniline, 4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Chloronaphthalene, 2-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Chlorophenol, 2-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Chlorophenyl phenyl ether, 4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Chlorpyrifos	100%	50-150%	50%	100%	25%	100%	2	2	100%
Chrysene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Coumaphos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Cyanide	100%	50-150%	100%	100%	25%	100%	2	2	100%
Cyfluthrin, total	100%	50-150%	100%	100%	25%	100%	2	2	100%
Cyhalothrin, Total lambda-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Cypermethrin, total	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDD(o,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDD(p,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDE(O,P')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDE(p,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDT(o,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDT(p,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
Deltamethrin/Tralomethrin	100%	50-150%	100%	100%	25%	100%	2	2	100%
Demeton, Total	100%	50-150%	100%	100%	25%	100%	2	2	100%
Diazinon	100%	50-150%	100%	100%	25%	100%	2	2	100%
Dibenz(a,h)anthracene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dibenzofuran	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dibutyltin as Sn	100%	50-150%	100%	100%	25%	100%	2	2	100%
Dichlorobenzene, 1,2-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dichlorobenzene, 1,3-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dichlorobenzene, 1,4-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Dichlorobenzidine, 3,3'-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dichlorophenol, 2,4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dichlorvos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Dieldrin	100%	50-150%	100%	100%	25%	100%	2	2	100%
Diethyl phthalate	100%	50-150%	100%	100%	25%	50%	2	2	100%
Dimethoate	100%	50-150%	100%	100%	25%	100%	2	2	100%

Table E-3b. Laboratory QA/QC Results Summary – Subtidal Sediment Samples

		Accuracy			Precision		Completeness		
Constituent	Method Blank Non-Detects (%)	Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Dimethyl phthalate	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dimethylnaphthalene, 1,2-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dimethylphenol, 2,4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Di-n-butyl phthalate	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dinitrophenol, 2,4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Dinitrotoluene, 2,4-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Dinitrotoluene, 2,6-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Di-n-octyl phthalate	100%	50-150%	NP	100%	25%	100%	2	2	100%
Disulfoton	100%	50-150%	100%	100%	25%	100%	2	2	100%
Endosulfan I	100%	50-150%	100%	100%	25%	100%	2	2	100%
Endosulfan II	100%	50-150%	100%	100%	25%	100%	2	2	100%
Endosulfan sulfate	100%	50-150%	100%	100%	25%	100%	2	2	100%
Endrin	100%	50-150%	100%	100%	25%	100%	2	2	100%
Endrin Aldehyde	100%	50-150%	100%	100%	25%	100%	2	2	100%
Endrin Ketone	100%	50-150%	100%	100%	25%	100%	2	2	100%
EPN	100%	50-150%	100%	100%	25%	100%	2	2	100%
Esfenvalerate/Fenvalerate, Total	100%	50-150%	100%	100%	25%	100%	2	2	100%
Ethoprop	100%	50-150%	100%	100%	25%	100%	2	2	100%
Fenchlorphos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Fenpropathrin	100%	50-150%	100%	100%	25%	100%	2	2	100%
Fensulfothion	100%	50-150%	100%	100%	25%	100%	2	2	100%
Fenthion	100%	50-150%	100%	100%	25%	100%	2	2	100%
Fluoranthene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Fluorene	100%	50-150%	NP	100%	25%	100%	2	2	100%
HCH, alpha-	100%	50-150%	100%	100%	25%	0%	2	2	100%
HCH, beta-	100%	50-150%	100%	100%	25%	100%	2	2	100%
HCH, delta-	100%	50-150%	100%	100%	25%	0%	2	2	100%
HCH, gamma-	100%	50-150%	100%	100%	25%	0%	2	2	100%
Heptachlor	100%	50-150%	100%	100%	25%	0%	2	2	100%
Heptachlor epoxide	100%	50-150%	100%	100%	25%	100%	2	2	100%
Hexachlorobenzene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Hexachlorobutadiene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Hexachlorocyclopentadiene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Hexachloroethane	100%	50-150%	100%	100%	25%	50%	2	2	100%
Indeno(1,2,3-c,d)pyrene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Isophorone	100%	50-150%	NP	100%	25%	100%	2	2	100%
Malathion	100%	50-150%	100%	100%	25%	100%	2	2	100%
Merphos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Methoxychlor	100%	50-150%	100%	100%	25%	100%	2	2	100%

Table E-3b. Laboratory QA/QC Results Summary – Subtidal Sediment Samples

Constituent	Method Blank Non-Detects (%)	Accuracy			Precision		Completeness		
		Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Methylnaphthalene, 2-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Methylphenol, 2-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Methylphenol, 3/4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Mevinphos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Naphthalene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Nitroaniline, 2-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Nitroaniline, 3-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Nitroaniline, 4-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Nitrobenzene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Nitrophenol, 2-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Nitrophenol, 4-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Nitrosodi-n-propylamine, N-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Nitrosodiphenylamine, N-	100%	50-150%	NP	100%	25%	100%	2	2	100%
Parathion, Ethyl	100%	50-150%	100%	100%	25%	100%	2	2	100%
Parathion, Methyl	100%	50-150%	100%	100%	25%	100%	2	2	100%
PCB AROCLOR 1016	100%	50-150%	100%	100%	25%	100%	2	2	100%
PCB AROCLOR 1221	100%	50-150%	NP	NP	25%	NP	2	2	100%
PCB AROCLOR 1232	100%	50-150%	NP	NP	25%	NP	2	2	100%
PCB AROCLOR 1242	100%	50-150%	NP	NP	25%	NP	2	2	100%
PCB AROCLOR 1248	100%	50-150%	NP	NP	25%	NP	2	2	100%
PCB AROCLOR 1254	100%	50-150%	NP	NP	25%	NP	2	2	100%
PCB AROCLOR 1260	100%	50-150%	100%	100%	25%	100%	2	2	100%
Pentachlorophenol	100%	50-150%	100%	100%	25%	50%	2	2	100%
Permethrin, Total	100%	50-150%	0%	0%	25%	100%	2	2	100%
Phenanthrene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Phenol	100%	50-150%	100%	100%	25%	50%	2	2	100%
Phorate	100%	50-150%	100%	100%	25%	100%	2	2	100%
Pyrene	100%	50-150%	100%	100%	25%	50%	2	2	100%
Sulfotep	100%	50-150%	100%	100%	25%	100%	2	2	100%
Tetrabutyltin as Sn	100%	50-150%	100%	100%	25%	100%	2	2	100%
Tetrachlorvinphos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Tetramethrin	NA	50-150%	NP	NP	25%	NP	2	2	100%
T-Fluvalinate	NA	50-150%	NP	NP	25%	NP	2	2	100%
Tokuthion	100%	50-150%	100%	100%	25%	100%	2	2	100%
Toxaphene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Tributyltin as Sn	100%	50-150%	100%	100%	25%	100%	2	2	100%
Trichlorobenzene, 1,2,4-	100%	50-150%	100%	100%	25%	50%	2	2	100%
Trichloronate	100%	50-150%	100%	100%	25%	100%	2	2	100%
Trichlorophenol, 2,4,5-	100%	50-150%	NP	100%	25%	100%	2	2	100%

Table E-3b. Laboratory QA/QC Results Summary – Subtidal Sediment Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness
Trichlorophenol, 2,4,6-	100%	50-150%	NP	100%	25%	100%	2	2	100%

[1] Spike recovery QC limits for organic compounds are either 50-150% or, more often, is based on 3x the standard deviation of the laboratory's actual method recoveries.
LCS/LCSD Laboratory Control Sample / Laboratory Control Sample Duplicate
MS/MSD Matrix Spike / Matrix Spike Duplicate
NA Not Applicable
NP Not Performed. No spike or no duplicate was performed for this analyte.
RPD Relative Percent Difference

Table E-3c. Laboratory QA/QC Results Summary – Mussel Tissue Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness
Percent Total Solids and Lipids									
Lipids	100%	NA	NA	100%	25%	100%	2	2	100%
Total Solids	NA	NP	100%	NP	25%	33%	2	2	100%
Total Metals									
Aluminum	0%	75-125%	100%	100%	25%	100%	2	2	100%
Antimony	100%	75-125%	100%	100%	25%	100%	2	2	100%
Arsenic	100%	75-125%	100%	100%	25%	100%	2	2	100%
Cadmium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Chromium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Copper	100%	75-125%	100%	100%	25%	100%	2	2	100%
Lead	0%	75-125%	100%	100%	25%	100%	2	2	100%
Manganese	100%	75-125%	100%	100%	25%	100%	2	2	100%
Mercury	100%	75-125%	100%	NP	25%	100%	2	2	100%
Nickel	100%	75-125%	100%	100%	25%	100%	2	2	100%
Selenium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Silicon	100%	75-125%	100%	100%	25%	100%	2	2	100%
Silver	100%	75-125%	100%	100%	25%	100%	2	2	100%
Thallium	100%	75-125%	100%	100%	25%	100%	2	2	100%
Tin	100%	75-125%	100%	100%	25%	100%	2	2	100%
Zinc	100%	75-125%	100%	100%	25%	100%	2	2	100%
Organic Compounds [1]									
Acenaphthene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Acenaphthylene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Anthracene	100%	50-150%	100%	100%	25%	100%	2	2	100%

Table E-3c. Laboratory QA/QC Results Summary – Mussel Tissue Samples

Constituent	Method Blank Non-Detects (%)	Accuracy			Precision		Completeness		
		Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
Benz(a)anthracene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Benzo(a)pyrene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Benzo(b)fluoranthene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Benzo(g,h,i)perylene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Benzo(k)fluoranthene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Biphenyl	0%	50-150%	100%	100%	25%	100%	2	2	100%
Carbazole	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chlordane, cis-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chlordane, trans-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chlorpyrifos	100%	50-150%	100%	100%	25%	100%	2	2	100%
Chrysene	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDD(o,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDD(p,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDE(o,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDE(p,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDT(o,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
DDT(p,p')	100%	50-150%	100%	100%	25%	100%	2	2	100%
Dibenz(a,h)anthracene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Dibenzothiophene	100%	50-150%	100%	0%	25%	100%	2	2	100%
Dieldrin	100%	50-150%	100%	100%	25%	100%	2	2	100%
Dimethylnaphthalene, 2,6-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Fluoranthene	0%	50-150%	100%	100%	25%	100%	2	2	100%
Fluorene	100%	50-150%	100%	100%	25%	100%	2	2	100%
HCH, alpha-	100%	50-150%	100%	100%	25%	100%	2	2	100%
HCH, beta-	100%	50-150%	100%	100%	25%	100%	2	2	100%
HCH, delta-	100%	50-150%	100%	100%	25%	100%	2	2	100%
HCH, gamma-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Heptachlor	100%	25-125%	100%	100%	25%	100%	2	2	100%
Heptachlor epoxide	100%	50-150%	100%	100%	25%	100%	2	2	100%
Indeno(1,2,3-c,d)pyrene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Methylnaphthalene, 1-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Methylnaphthalene, 2-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Methylphenanthrene, 1-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Naphthalene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Nonachlor, cis-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Nonachlor, trans-	100%	50-150%	100%	100%	25%	100%	2	2	100%
Oxychlordane	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 017	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 028	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 047	100%	50-150%	100%	100%	25%	100%	2	2	100%

Table E-3c. Laboratory QA/QC Results Summary – Mussel Tissue Samples

Constituent	Method Blank Non-Detects (%)	Accuracy: Spike Recovery QC Limits [1]	Accuracy: MS/MSD Spike Recovery Success Rate	Accuracy: LCS/LCSD Spike Recovery Success Rate	Precision: Duplicate RPD QC Limit	Precision: Duplicate RPD Success Rate	Completeness: Number of Samples Collected	Completeness: Total Number of Analyses	Completeness: Completeness
PBDE 066	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 071	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 085	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 099	0%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 100	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 128	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 138	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 153	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 154	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 183	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 190	100%	50-150%	100%	50%	25%	100%	2	2	100%
PBDE 203	100%	50-150%	100%	100%	25%	100%	2	2	100%
PBDE 206	100%	50-150%	100%	50%	25%	100%	2	2	100%
PBDE 209	100%	50-150%	100%	0%	25%	100%	2	2	100%
PCB 001	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 005	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 008	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 018	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 028	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 031	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 033	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 037	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 044	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 049	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 052	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 056	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 060	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 066	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 070	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 074	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 077	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 081	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 087	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 090	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 095	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 097	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 099	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 101	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 105	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 110	100%	50-150%	NP	100%	25%	100%	2	2	100%

Table E-3c. Laboratory QA/QC Results Summary – Mussel Tissue Samples

Constituent	Method Blank Non-Detects (%)	Accuracy			Precision		Completeness		
		Spike Recovery QC Limits [1]	MS/MSD Spike Recovery Success Rate	LCS/LCSD Spike Recovery Success Rate	Duplicate RPD QC Limit	Duplicate RPD Success Rate	Number of Samples Collected	Total Number of Analyses	Completeness
PCB 114	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 118	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 119	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 123	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 126	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 128	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 132	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 138	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 141	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 149	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 151	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 153	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 156	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 157	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 158	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 167	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 168	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 169	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 170	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 174	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 177	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 180	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 183	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 187	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 189	100%	50-150%	NP	50%	25%	100%	2	2	100%
PCB 194	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 195	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 201	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 203	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 206	100%	50-150%	NP	100%	25%	100%	2	2	100%
PCB 209	100%	50-150%	NP	100%	25%	100%	2	2	100%
Perylene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Phenanthrene	0%	50-150%	100%	100%	25%	100%	2	2	100%
Pyrene	100%	50-150%	100%	100%	25%	100%	2	2	100%
Toxaphene	100%	50-150%	NP	100%	25%	100%	2	2	100%
Trimethylnaphthalene, 2,3,5-	100%	50-150%	100%	100%	25%	100%	2	2	100%

[1] Spike recovery QC limits for organic compounds are either 50-150% or, more often, are based on 3x the standard deviation of the laboratory's actual method recoveries.
LCS/LCSD Laboratory Control Sample / Laboratory Control Sample Duplicate
MS/MSD Matrix Spike / Matrix Spike Duplicate
NA Not Applicable
NP Not Performed. No spike or no duplicate was performed for this analyte.
RPD Relative Percent Difference

E.3.1 Method Blank Samples

Method blank samples are used to identify the presence and potential source of laboratory contamination. Method blank sample results for water, sediment and tissue samples are presented in Tables E-3a, E-3b, and E-3c, respectively.

Method Blanks for Water Samples

Method blank results for conventional parameters and hydrocarbons were reported as non-detects for 12 of 16 analytes in 100% of samples. Of 14 metals analyzed for, arsenic, beryllium, chromium, mercury, nickel, selenium, thallium and zinc were all detected at low levels the method blank; the levels in the blank samples were insignificant compared to the related field sample results and no action was taken.

Method blank results for organic compounds were reported as non-detects for 210 of 214 analytes in 100% of samples. Four phthalates, known as common laboratory contaminants, were detected in one or more method blanks.

Method Blanks for Subtidal Sediment Samples

Method blank results for conventionals and hydrocarbons were reported as non-detects for all analytes in 100% of samples. Of 13 metals analyzed for, chromium VI, mercury, nickel, thallium and zinc were all detected at low levels in the method blank; the levels in the blank sample were insignificant compared to the related field sample results and no action was taken.

Method blank results for organic compounds were reported as non-detects for all 132 analytes in 100% of samples.

Method Blanks for Mussel Tissue Samples

Method blank results for metals were reported as non-detects for 14 of 16 analytes in 100% of samples. Aluminum and lead were detected at low levels in the method blank; the levels in the blank sample were insignificant compared to the related field sample results and no action was taken.

Method blank results for organic compounds were reported as non-detects for 115 of 119 analytes in 100% of samples. Biphenyl, fluoranthene, PBDE 099, and phenanthrene were detected at low levels in the method blank. PBDE 099 was not detected in the field samples and no action was taken. The other three organic compounds were detected at low levels in the field samples; these values have been flagged to indicate the analyte was also detected in the method blank.

E.3.2 Laboratory Duplicate Samples

Laboratory duplicate samples provide a measure of data precision (reproducibility) attributable to sample splitting and laboratory analytical procedures. A laboratory generates three types of duplicate samples:

- Laboratory duplicate: A field sample that is split and both portions are analyzed
- MS/MSD: A field sample that is spiked and split and both portions are analyzed

- LCS/LCSD: A clean laboratory water that is spiked and split and both portions are analyzed

The acceptable RPD between the source sample and duplicate sample cannot exceed 25%. The success rate (percent) for acceptable RPDs for all analytes in water, sediment, and tissue samples are presented in Tables E-3a, E-3b, and E-3c. All duplicate values that were greater than 25% were flagged "IL" in the database to indicate this.

Laboratory Duplicates for Water Samples

The success rate for laboratory duplicate RPDs was 90% to 100% for all conventional parameters, hydrocarbons, and metals. The RPD success rate for nearly all organic compounds was 100%. Just 14 compounds had lower success rates; six were above 85% and seven were below.

Laboratory Duplicates for Sediment Samples

The success rate for laboratory duplicate RPDs was 90% to 100% for all conventional parameters, hydrocarbons, and metals. Of the 132 organic compounds, only 19 had a duplicate success rate of less than 100%. In 15 of these instances at least one duplicate RPD result was within QC limits, indicating the analysis was in control; no action was taken. In four instances (the organochlorine pesticides alpha-HCH, delta-HCH, gamma-HCH, and heptachlor) none of the duplicate RPD results were acceptable.

E.3.3 Spiked Samples

Accuracy is defined as the degree of agreement of a measurement to an accepted reference of a true value. Accuracy is measured as the percent recovery (PR) of the analyte in a spiked sample. Standard spike recovery QC limits for each parameter are presented in Tables E-3a, E-3b, and E-3b. However, for organic compounds the actual QC limits are often different from the standard 50-150% limit in these tables. This is because the QAPP allows for individual laboratories to use their own in-house limits that are based on 3-times the standard deviation of the laboratory's actual method recoveries.

Except as described in the subsections below, QA/QC procedures for measuring accuracy were generally performed at the appropriate frequency for all water, sediment, and mussel tissue analytes. Although some of these results were reported as out of the acceptable QC limits for either the MS or LCS spikes, at least one measure of accuracy was within QC limits, indicating the analysis was in control; therefore, none of the sample results were rejected and all data measurements are considered acceptable. Sample results that were outside the acceptable QC limits for percent recovery were flagged "EUM" (LCS samples) or "GB" (MS samples).

Laboratory Spikes for Water Samples

Except for motor oil hydrocarbons (TPH as motor oil C18-C26, and C22-C36) and the SVOC aniline, an MS and/or LCS were performed for all analytes in water samples. The sub-contracted laboratory performing hydrocarbons analyses did not perform all required QA/QC procedures for due to insufficient sample volume. Field results for hydrocarbons for the October 2014, February 2015 and March 2015 storm events were flagged "BS" to indicate this. Aniline was not detected in any field sample so no action was taken.

Laboratory Spikes for Sediment Samples

Except for mercury and the pyrethroid pesticides allethrin, tetrafluthrin and tau-fluvalinate, an MS and/or LCS was performed for all analytes in subtidal sediment samples. No explanation was provided by the laboratory for why no accuracy QA/QC procedures for mercury were performed. No pyrethroids were detected in any tissue sample and nearly all QA/QC procedures for accuracy that were performed and were within QC limits; no actions were taken.

Laboratory Spikes for Mussel Tissue Samples

For all analytes in mussel tissue samples, QA/QC procedures for measuring accuracy were performed at the appropriate frequency. As previously mentioned, although some of these results were outside acceptable QC limits, at least one measure of accuracy was within limits indicating the analysis was in control.

E.3.4 Completeness

Water, Sediment and Mussel Tissue Samples

Project Improvement data quality objectives require 90% completeness for all samples collected. For the length of the entire project, all field samples submitted to the laboratory were analyzed and the data were reported as valid values. Therefore, completeness was 100% for the Improvement Project.

E.4 Data Validation

At the time the Improvement Project began in the fall of 2011 and through 2013, many laboratories were not familiar with producing EDDs using the CEDEN templates. So, early in the program the EDDs that were submitted were in the SWAMP template. These EDDs did not use the SWAMP or CEDEN QA codes to qualify the data, but instead used their own internal QA codes. Data processing therefore included the transformation of SWAMP EDDs to CEDEN EDDs, and then again from the old CEDEN EDD template into the new CEDEN EDD template (which just came online in late June 2015), and then converting of QA codes. Thus, it has been a lengthy process to reformat the data and bring it up to the current CEDEN requirements.

That said, many analytical results have been appropriately assigned certain critical qualifier codes, as specified by CEDEN, after manual analysis of the data. Since CEDEN has a multitude of data qualifier QA codes, not all of these have been evaluated and applied to the data.

Three databases have been generated for this project, based on sample matrix. These include a complete CEDEN EDD each for water samples (stormwater, ORW, and equipment blanks), subtidal sediment samples, and mussel tissue samples. These three EDDs were created because it was not efficient to process each laboratory EDD separately.

It is important to point out that not all laboratory data reports (PDF reports) will necessarily match what is in the CEDEN EDDs created for this project. The sample and laboratory QA/QC results will certainly match, but because so many QA code issues were discovered so late in the data validation process, there was no way to go back to the laboratories and request the changes to their deliverables. The time involved was prohibitive in itself. Thus, the CEDEN EDDs included with this data report are the most vetted, accurate and appropriately qualified data resource for the Improvement Project. Other QA/QC details not included in this report or the EDDs are included in the Case Narratives provided in the PDF data reports by the laboratories.

Data Validation

Project data was generally validated and qualified according to the 2011 SWAMP SOP *Verification of the Surface Water Ambient Monitoring Program Database*. Where necessary, the analytical results were assigned qualifiers as specified by CEDEN after manual analysis. The following definitions provide explanations for those qualifiers. Note that the report tables do not necessarily include all of the CEDEN qualifiers that were applied to the project EDDs.

AY	Matrix interference suspected
BBM	Sample >2x but less than 4x spike concentration
BE	Low surrogate recovery; analyzed twice
BS	Insufficient sample available to follow standard QC procedures
BV	Sample received after holding time
BZ	Sample preserved improperly
CS	QC criteria not met due to analyte concentration near RL
CT	QC criteria not met due to high level of analyte concentration
D	Analyte analyzed at a secondary dilution
EUM	LCS is outside of control limits
FDP	Field Duplicate RPD above QC limit
FX	Analyte present in the instrument blank
GB	Matrix spike recovery not within control limits
GN	Surrogate recovery is outside of control limits
H	A holding time violation has occurred
HB	Result is positively biased
IL	RPD exceeds laboratory control limit
IP	Analyte detected in field or lab generated blank
J	The result is an estimated concentration that is less than the RL but greater than or equal to the MDL.
M	A matrix effect is present
PJM	Result from re-extract/re-analysis to confirm original result
RQ	Spike recovery not calculated due to high concentration of analyte
QAX	When the native sample for the MS/MSD or DUP is not included in the batch reported

REL Reporting limits elevated above QAPP targets due to change in identified lab capabilities over course of project implementation

VCQ Analyte concentration >10X blank concentration

E.5 Sample Holding Time Issues

Several sample holding time issues occurred over the course of the Improvement Project. Some were due to the inability of the field sampling crew to ship samples with to the laboratory in time. Others were due to errors on the part of the laboratory.

E.5.1 Chemistry

Chromium VI

Chromium VI has a very short holding time of 24- hours. The pre-construction October 3, 2011 sample was not delivered to the laboratory in time and was analyzed out of holding time. The data has been flagged to indicate there was a holding time violation. Because of the unlikelihood that the holding time would ever be met for chromium VI field samples, monitoring for it was discontinued.

Mercury

The pre-construction January 20, 2012 mercury samples were delivered (unpreserved) to the laboratory on a Saturday. No arrangement had been made to have a chemist available to properly preserve the sample within the 48-hour holding time. The data has been flagged to indicate there was a holding time violation.

Organophosphorus Pesticides

Due to an oversight, the laboratory failed to analyze the pre-construction January 20, 2012 field duplicate sample for OP pesticides. The archived sample water was later extracted out of holding time and analyzed. The data has been flagged to indicate there was a holding time violation.

PAHs and SVOCs

Initial PAH data results for the pre-construction January 20, 2012 samples looked suspicious to the consultant, who asked the laboratory to investigate. It was determined that laboratory carry-over cross contamination from the LCS samples had affected the field sample results. Therefore, a re-analysis of the archived sample water was performed out of holding time. The data has been flagged to indicate there was a holding time violation.

Orthophosphate and Nitrate

The post-construction October 11, 2014 orthophosphate and nitrate samples were delivered to the laboratory past their holding time of 48- hours. The consultant asked that they be analyzed out of holding time. The data has been flagged to indicate there was a holding time violation.

Subtidal Sediment and Mussel Tissue Samples

No holding time violations occurred with any sediment or tissue samples.

E.5.2 Toxicity

The EPA 48-hour holding time criterion was not exceeded in any water samples.

E.6 Reporting Limit Issues

Due to the use of different laboratories for water sample analyses over the course of the Improvement Project, reporting limits were not consistent. The project QAPP provided only the original laboratory's (Columbia Analytical Services; now ALS Environmental) RLs and compared these to SWAMP. So it is difficult to say whether the RLs in the QAPP were exceeded when the QAPP should have been revised to include RLs from the second laboratory (Weck Labs). However, although there were variations in RLs, all the laboratories achieved quite low RLs and no SWAMP recommended RL values were exceeded.

PAHs

The constituent group for which the differences between the laboratory RLs most affected the ability to fairly analyze the data is the SVOCs, specifically PAHs. For PAHs, in order of laboratory sensitivity, CAS achieved RLs of 0.20-.024 ug/L; Weck Labs achieved an RL of 0.1 ug/L; and Physis achieved an RL of 0.005 ug/L. This discrepancy resulted in more PAHs detected in the Physis samples (January 2014 through March 2015) and at a higher frequency, making a comparison of the data difficult.

Also, for the pre-construction April 13, 2012 PAH samples, the laboratory MDL was elevated to the RL (0.10 ug/L) for reasons still not explained. This practically eliminated PAH results from this storm event because nearly all PAH concentrations that were detected during other storm events were less than 0.10 ug/L.

APPENDIX F: ANALYTICAL DATA REPORTS AND EDDS ON CD

F.1 LABORATORY ANALYTICAL DATA ON CD

Laboratory data reports and consolidated electronic data deliverable (EDD) files for all water, sediment and tissue samples collected throughout the life of the Project (2011-2015) are provided on the Sampling and Analysis Final Report compact disc (CD), but are not included in the hardcopy of the Final Report. This appendix is a listing of the folders containing the laboratory reports and EDDs on the Final Report CD. All individual water chemistry EDDs and water toxicity EDDs were consolidated into single comprehensive EDDs, respectively.

F.1.1 Data Folder Structure

The folder structure for all data files is as follows:

- Appendix F - Analytical Data
  - Sediment Chemistry Data
  - Tissue Chemistry Data
  - Water Chemistry Data
    - Pre-construction Water Chemistry Data
      - 2011-09-22_EquipmentBlank
      - 2011-10-03_StormEvent#1
      - 2012-01-20_StormEvent#2
      - 2012-04-13_StormEvent#3
      - 2014-01-10_StormEvent#4
    - Post-Construction Water Chemistry Data
      - 2014-09-10_EquipmentBlank
      - 2014-10-15_StormEvent#1
      - 2015-02-03_StormEvent#2
      - 2015-03-12_StormEvent#3
  - Water Toxicity Data
    - Pre-Construction Water Toxicity Data
      - 2014-01-10_StormEvent#4
      - 2014-03-26_StormEvent#5
    - Post-Construction Water Toxicity Data
      - 2014-10-15_StormEvent#1
      - 2015-02-03_StormEvent#2
      - 2015-03-12_StormEvent#3

APPENDIX G: MAINTENANCE AND FIELD LOG FORMS

G.1 FIELD LOG FORMS ON CD

All log forms from field work are provided on the Sampling and Analysis Final Report compact disc (CD), and are not included in the hardcopy of the Final Report. The following is a list of the sub-appendices within Appendix G which contain the field log forms. Appendix G appears in PDF format on the Final Report CD.

Appendix G – Field Log Forms

- Appendix G-1 Pre-Construction Monitoring (2011-2012 Wet Season)
  - Appendix G-1.1 Station Maintenance Field Log Forms
  - Appendix G-1.2 Storm Event #1, October 3, 2011 Field Log Forms
  - Appendix G-1.3 Storm Event #2, January 20, 2012 Field Log Forms
  - Appendix G-1.4 Storm Event #3, April 12, 2012 Field Log Forms
  - Appendix G-1.5 Subtidal Sediment Sampling, May 8, 2012 Field Log Forms
  - Appendix G-1.6 Mussel Tissue Sampling, April 12, 2013 Field Log Forms
- Appendix G-2 Pre-Construction Monitoring (2013-2014 Wet Season)
  - Appendix G-2.1 Storm Event #1, January 11, 2014 Field Log Forms
  - Appendix G-2.2 Storm Event #2, March 26, 2014 Field Log Forms
- Appendix G-3 Post-Construction Monitoring (2014-2015 Wet Season)
  - Appendix G-3.1 Station Maintenance Field Log Forms
  - Appendix G-3.2 Storm Event #1, October 5, 2014 Field Log Forms
  - Appendix G-3.3 Storm Event #2, February 3, 2015 Field Log Forms
  - Appendix G-3.4 Storm Event #3, March 12, 2015 Field Log Forms