FINAL REPORT

Assessment and Management of Stormwater Impacts on Sediment Recontamination

SERDP Project ER-2428

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ACRONYMS

ASTM	American Society for Testing and Materials
CH3D	Curvilinear Hydrodynamics in 3-Dimensions
CWA	Clean Water Act
DGT	Diffusive Gradients in Thin Film
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DoD	Department of Defense
EPA	Environmental Protection Agency
ESTCP	Environmental Security Technology Certification Program
FSW	Filtered Seawater
GPS	Global Positioning System
HDPE	High density polyethylene
HOC	Hydrophobic organic compounds
IMF	Intermediate Maintenance Facility
MLLW	Mean Lower Low Water
NBSD	Naval Base San Diego
NPDES	National Pollutant Discharge Elimination System
OF	Outfall
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PSD	Passive Sampling Device
RPM	Revolutions Per Minute
SEA Ring	Sediment Ecotoxicity Assessment Ring
SEAP	Sediment Ecosystem Assessment Protocol
SERDP	Strategic Environmental Research and Development Program
SOP	Standard Operating Procedure
SPAWAR	US Navy Space and Naval Warfare Command
SSC Pac	Space and Naval Warfare Systems Center Pacific
SPME	Solid Phase Microextraction
SWI	Sediment-Water Interface
TM	Trace Metal
USEPA	United States Environmental Protection Agency
WC	Water Column
WinSLAMM	Source Loading and Management Model for Windows

1. EXECUTIVE SUMMARY

1.1. DESCRIPTION OF PROJECT

A research project was conducted to develop, test and assess the effectiveness of a comprehensive set of laboratory, field, and modeling approaches in characterizing the role of urban stormwater in contamination of sediments and remediated sites. The bulk of the method development, testing and data acquisition was conducted at Paleta Creek, an urban watershed partially encompassing Naval Base San Diego and draining to San Diego Bay. Stormwater discharges at a secondary site at Puget Sound Naval Shipyard were also studied to identify whether the methods were applicable and whether general characteristics noted at Paleta Creek were reproduced at an additional site.

The studies were conducted in four phases including baseline sampling under dry weather condtions, stormwater assessment by direct sampling under selected storm events, receiving water assessment to link stormwater loads to stormwater recontamination and modeling of both stormwater discharges and receiving water conditions to interpret and extend the measurements. The research was conducted by four collaborating groups

- Texas Tech University – overall project planning and chemical analysis of stormwater and receiving water samples
- SPAWAR Systems Center Pacific – Stormwater and receiving water sampling design and implementation, biological assays
- Geosyntec, Inc. – Stormwater sampling design and implementation and modeling of stormwater behavior using WinSLAMM. This effort was conducted in cooperation with Dr. Robert Pitt (U. Alabama, Ret.)
- University of Michigan – *in-situ* toxicity identification evaluation (*in-situ* TIE) development and testing

This executive summary outlines the report and highlights the key learnings from the project. The full report includes a description of the projects rationale and objectives and descriptions of the sites sampled. This is followed by a section detailing materials and methods for stormwater sampling, receiving water and receiving sediment sampling, chemical analyses procedures, biological assay methods (both *in-situ* and *ex-situ*) and modeling of stormwater discharges using WinSLAMM (Source Loading and Management Model for Windows) and modeling of the hydrodynamics of the receiving waters using CH3D (Curvilinear Hydrodynamics in 3-Dimensions). This is followed by a discussion of the key project measurements and the conclusions drawn from those measurements. Since the primary goal of the effort is evaluation of the tools used to assess stormwater impacts on sediment recontamination, this report is organized by those tools and measurements and attempts to relate the understanding gained by use of those tools. Appendix II provides more detailed discussion of many of these measurements and is organized chronologically such that measurements by the various tools are discussed together for specific events or periods. The main body of this report ends with a section summarizing the results and conclusions of the project and the key data used to arrive at those results and conclusions. The complete results and details of individual components of the project are summarized in Appendices. These appendices include

- Appendix I – A series of Excel spreadsheets containing chemical and physical measurements for stormwater, ambient receiving waters and receiving water sediments. Stormwater measurements include measurements of solids and chemical constituents (Raw data) followed by additional spreadsheets that show data derived from these measurements (Processed data). The processed data includes solids concentrations within particular size fractions in stormwater, chemical concentrations in those size fractions, as well as chemical concentrations on those solids. Summary data sheets for all data other than stormwater (e.g. sediment, sediment traps, porewater, tissue) is included for both Paleta Creek and PSNS.
- Appendix II – A report detailing results of stormwater and receiving water chemical, physical and biological monitoring with an emphasis on the biological significance of the collected data. This Appendix also includes 5 subappendices (Appendix II-1 through II-5) that detail test data and statistical summaries and a glossary of qualifier codes
- Appendix III – A report detailing the stormwater monitoring, data analysis and WinSLAMM modeling conducted by Dr. Robert Pitt and Geosyntec. This Appendix includes a number of supporting subappendices Appendix III-1 through III-15)
- Appendix IV – A report detailing the *in-Situ* TIE studies conducted by the University of Michigan in support of the project
- Appendix V – A report specifically on the estuary model of the study area including portions of San Diego Bay by SSC Pac, based upon CH3D.
- Appendix VI- Detailed Standard Operating Procedures (SOPs) and Analytical Methods
- Appendix VII- Stormwater Sediment Recontamination Assessment Recommendations

1.2. <u>PROJECT ACTIVITIES</u>

The Paleta Creek watershed and associated receiving waters were sampled before and after the winter wet season during 2015-2016 and 2016-2017. The sampling included a combination of sediment collections, stormwater collections, settling traps, as well as associated water physical parameters. The sediments and water collected were subjected to a variety of chemical analyses and biological assessment.

Intensive stormwater sampling was conducted during two rain events at Paleta Creek in NBSD, January 5-7, 2016 (Storm event 1 - 1.87 inches of rain) and January 30- February 1, 2016 (Storm event 2 - 0.16 inches of rain). Although together these storms represented only about 28% of the total precipitation in San Diego during the 2015-2016 year, one or the other were essentially equivalent to about 75% of the storms observed. In addition, the two storms represented about 80% of the precipitation during deployment of sediment traps and SEARings in the study area. Sampling of the stormwater was conducted by collecting approximately 10 L samples of water from various outfalls in the watershed via autosampler triggered only during storm water outflow.

Flow velocity was also measured by the sampler providing total stormwater flow. The flow measurement and triggering was less accurate during the low rainfall event in late January 2016 and samples at lower watershed outfalls showed a greater influence of saline waters from the bay. Samples were collected both at the mouth of Paleta Creek and at various outfalls of NBSD as well as upstream in outfalls influenced primarily by the residential areas in the upper watershed. The NBSD makes up about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges.

Stormwater sampling was conducted at Puget Sound Naval Station (PSNS) on March 30, 2017 following sediment collections on December 6, 2016 and March 29, 2017. The much more limited sampling conducted at PSNS precluded any modeling or further analyses other than looking at key issues such as contaminant associations with particles compared to the observations at Paleta Creek.

Stormwater samples collected during the monitored events were split via Dekaport splitter into 10 replicate 1 L samples, some in HDPE for metals analysis and some in glass for organics analysis. For the purposes of sediment recontamination, the size segregated concentrations were required in order to establish settling characteristics. The 1 L replicate samples were filtered and the filtered water was analyzed for solids as well as individual chemical constituents. In this manner the "raw data" of solids and chemical concentrations in bulk (unfiltered) samples and in size ranges <63 µm, <20 µm, <5 µm (<2.7 for organics), and <0.45 µm (0.7 for organics). By subtracting concentration values in adjacent filtered size ranges, the "processed data" of concentrations (proportional to stormwater loads) in respective fractions could be obtained, i.e. >63 µm (sand fraction), >20 µm and <63 µm (coarse silt), >5 (2.7 for organics) µm and <20 µm (fine silt), >0.45 (0.7 for organics) µm and <5 (2.7 for organics) µm (clays), and <0.45 (0.7 for organics) (operationally "dissolved"). Where sufficient solids were collected in a particular size fraction, a concentration on those solids was determined by dividing the contaminant concentration by the concentration of solids in that size fraction. The sediment particle size distributions for the Paleta Creek samples were similar for both events with a relatively small fraction associated with larger particles although as will be noted below, this fraction contained a substantial amount of certain key contaminants. Samples collected in ambient waters during low flow storm events (the second storm at Paleta Creek and at PSNS) often contained high salinity and this led to substantial salts being trapped on fine particle filters when the filters were dried for weighing. This limited the estimation of solids content and concentration on solids in those samples although not chemical loads in contaminant mass per volume stormwater. A recommendation for rinsing solids which are not subjected to further chemical analysis is included in the recommendations for future stormwater characterizations.

This summary will focus initially on the data collected in the large volume event (event 1) and then contrast the behaviors during low flow events and at the secondary site. The work at Paleta Creek watershed at NBSD showed a variety of characteristics associated with the stormwater loads and sediment recontamination. The stormwater discharge data showed that much of the initial contaminant load discharged from Paleta Creek into the receiving waters is associated with large particles (coarse silts and larger) but that late in a storm event, the amount and contaminant load of these larger particles decreased. The bulk of the stormwater flow in the watershed was associated with Paleta Creek itself and discharges from NBSD from other outfalls were relatively small. Among organic contaminants, PAHs were shown to be associated with the largest size fraction >63 μm and the amount of PAHs discharged decreased as the amount of these particles decreased. A statistical analysis (Appendix III) showed strong correlations of most of the PAHs with suspended solids concentrations and that the PAHs were likely all from the same or similar sources. Examination of these large particles and their distribution in the watershed suggested that PAHs were found predominantly in carbon-rich particles (e.g. asphalt, coal tar or tire fragments) and were primarily from the upper urban portion of the watershed. These large particles, >20 and >63 μm particles would settle quickly in the region around the Paleta Creek outfall. The presence of these PAHs in large rapidly settling particles was reflected in settling traps close to the Paleta Creek discharge location, P11 and P17. Sediment recontamination was observed to be best indicated by settling traps placed at various locations in the receiving waters over the rainy season. Sediment cores were also collected but exhibited long term settling or sediment redistribution and did not provide a strong indication of stormwater sediment recontamination by themselves. The stormwater samples collected at PSNS also showed a strong association of PAHs for the largest particles suggesting that this observation may be commonly observed in mixed residential/Naval Base watersheds.

The elevated PAHs in sediments depositing close to the Paleta Creek outfall led to no observable increases in porewater concentrations or toxicity. PCBs were found to be associated with finer silt particles and correspondingly were shown to lead to recontamination in sediments over larger distances from the Paleta Creek discharge. The PCBs were more strongly associated with NBSD than PAHs with approximately 40% of the PCBs estimated to have originated in NBSD stormwater despite NBSD comprising about 13.5% of the water shed area (see Appendix III). Congeners 092, 110, 153, and 101 were generally the most abundant in the samples. Settling traps also showed less distinct depositional patterns of PCBs and deposition over much of the receiving water study area. In general, sediment traps showed more distinct patterns and were more clearly linked to wet seasons and stormwater discharges than time integrated behavior of sediment cores or even surficial sediment samples.

Metals showed varying behaviors depending upon the metal. Much of the metal contaminants in stormwater was associated with solids as indicated by bulk (unfiltered) water samples showing considerably higher metals concentration than dissolved fractions. A statistical analysis (discussed in Appendix III) indicated that Cu, Zn, Cd, Pb and Hg were all correlated with suspended solids concentration. Cd was associated with coarse particles and was observed to lead to substantial sediment recontamination close to the Paleta Creek outfall. Cu, however, was associated with finer particles and no clear indication of sediment recontamination from the stormwater releases could be observed. Instead, the measurements suggested that significant amounts of Cu was being transported into the study area from other sources. Stormwater influence on metal recontamination of sediments was also assessed by comparing concentrations on particles in the discharge versus bulk solid concentration in sediment traps. Cd showed higher concentrations in solids in stormwater than the sediments collecting in sediment traps as would be expected if the stormwater was the primary source of Cd and the sediment traps showed some dilution due to sediment from other sources. Cu concentrations on solids in sediment traps, however, were actually higher than concentrations estimated on solids in the stormwater suggesting again that the stormwater was not the primary source of Cu to the sediments. The concentration of Cu in sediment traps also increased with distance from the stormwater discharge suggesting other sources, either other stormwater sources or bay sediment resuspension, are likely significant sources of Cu in the study area. Moreover Pb showed behavior similar to Cd while Hg showed behavior more similar to Cu. The assessment of these differing sources and contributions was largely possible through the size segregated stormwater sampling and the sediment collection through sediment traps.

The importance of the stormwater discharges and resulting sediment recontamination on organisms was assessed through *in-situ* and *ex-situ* bioaccumulation and toxicity studies on stormwater, sediment and sediment trap material. Stormwater samples showed substantial toxicity in a sea urchin embryo bioassay. Ambient concentrations of metals, even in receiving waters close to the Paleta Creek discharge, however, showed no evidence of toxicity due to dilution by the receiving waters. Bioaccumulation studies with clams (*Macoma* nasuta), both *in-situ* (using SEA Rings, SERDP #ER-1550, ESTCP #ER-201130) and *ex-situ* (using intact cores) were used to show bioaccumulation of total PCBs and chlordane in clam tissue concentrations by factors of 3 to 10 at locations away from the Paleta Creek discharge between pre-storm (dry season) and post-storm (wet season). This is consistent with the presence of these contaminants in finer sediment fractions that did not settle immediately close to the discharge point. Metal and total PAH concentrations in clam tissues, which were largely associated with larger particles and settled quickly, did not vary among pre-storm, pre-storm + sediment trap material, or post-storm treatments, and were similar in magnitude across sediments near the Paleta Creek discharge and at distances far away from the discharge. The lack of an increase in bioaccumulation, particularly at locations near the discharge point which did exhibit sediment recontamination for PAHs and large particle associated metals such as Cd, indicates that the contaminants were largely unavailable from these large particles. This is an important learning in that it indicates sediment recontamination, as measured by bulk solid concentrations, may not necessarily lead to adverse ecological effects. Elevated PAH bioaccumulation was noted at a receiving sediment location close to an outfall with elevated PAH levels (but much lower total flows) indicating some elevated bioavailability of the PAHs at that location. The *in-situ* and *ex-situ* bioaccumulation assays also provided very similar results (typically less than 20% difference) suggesting that *ex-situ* bioaccumulation assays with intact core material can be used as a replacement for *in-situ* bioaccumulation assays. Sediment trap material was added in some *ex-situ* core bioassays and this led to an increased bioaccumulation of PCBs and Chlordane. This was particularly noted from locations distant from the Paleta Creek stormwater discharge location suggesting the potential for other sources to be contributing to this observation.

One noticeable observation with sediment trap and post-storm sediment samples was a spatial and temporal trend of increasing synthetic pyrethroid pesticide concentration with increasing proximity to the mouth of Paleta Creek. Acute toxicity to marine amphipods *Eohaustorius estuarius* was observed in bioassays with wet season sediment samples but not dry season sediment samples. The toxicity during wet periods and apparent ability for amphipods to bounce back during dry periods was ultimately attributed to pyrethroid pesticide which is commonly used in urban portions of the watershed. This represents one of the most significant lines of evidence for seasonal/stormwater impacts to San Diego Bay sediments although one that is most likely tied to residential areas in the upper Paleta Creek watershed.

Efforts to employ *in-situ* toxicity identification evaluation (*iTIE)* to evaluate bioavailability of stormwater contaminants led to the recognition that additional development of the technique was necessary. A portion of the project efforts were devoted to that development and it was employed at Paleta Creek in a preliminary demonstration. Due to the need to detect pyrethroids at very low concentrations in order to identify it as a source of toxicity, it was not possible to use iTIE to determine that pyrethroids were the source of toxicity. The efforts as part of this project did identify appropriate sorbents and operational parameters that helped move iTIE toward successful application but at this point iTIE remains a promising but not yet fully functional approach to assessing toxicity in a sediment system. Appendix IV contains more complete information on the iTIE efforts in this project.

Stormwater modeling using WinSLAMM is described in Appendix III. This project used the flow calculations from the model (calibrated using the detailed land use and development characteristics for the modeled areas in the Paleta Creek watershed, along with long-term local rain data and the event specific contaminant data) to predict annual or long-term average discharges of flow, suspended solids and contaminants. This stormwater modeling enables calculations of stormwater discharge characteristics as determined by specific drainage area characteristics and activities in the Paleta Creek watershed. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. These stormwater loading predictions, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and related settling rates), were used to quantify the recontamination potential of the sediments by stormwater discharges and to compare the monitored data with tentative TMDL allocations. The California Regional Water Quality Control Board, San Diego, prepared a tentative resolution in 2013 to establish TMDL limits for toxic pollutants in sediments at the mouths of several creeks draining into San Diego Bay. Although not yet adopted for Paleta Creek, the NBSD total PAH particulate strength values would have to be reduced by about 80% to meet the tentative criterion, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about 22% if all particle sizes were considered. If only the critical settleable portion (>63 um) in order to project the bottom sediments near the creek mouth were compared to this particle strength criterion, any reductions would be much less. As noted previously, however, the bioavailability of the PAHs on these larger particles is low and their reduction will not appreciably reduce toxicity or bioaccumulation near the creek mouth.

Estuary receiving water modeling with CH3D is described in Appendix V. The general characteristics assumed in Appendix III were supported with sand size particles expected to deposit close to the mouth of Paleta Creek. Fine-grained silts and clays were also expected to settle close to the Paleta Creek discharge but in total mass amounts much less than sand size particles. The estuary model provided generally good agreement between predicted deposition rates and sediment trap measured deposition rates over the period of deployment. The model was also used to predict deposition during the two specific events which represented more than 80% of the precipitation volume observed during the period of sediment trap placement. A key conclusion of the model is that the stormwater discharges do not account for a significant fraction of the mass of sediment collected in the sediment traps away from the mouth of Paleta Creek and that additional sediment from other sources and or resuspension of bay sediments was necessary to account for the accumulation in these traps. This also supports the earlier stated conclusion that sediment recontamination of several contaminants such as Cu was significantly affected by sources other than Paleta Creek.

Note that neither the stormwater modeling with WinSLAMM nor estuary modeling with CH3D considers the bioavailability of contaminants. Predictions of stormwater loading and sediment recontamination is based upon bulk solids and does not predict organism effects. In addition, however, TMDL comparisons also do not directly consider contaminant bioavailability. In particular, sediment recontamination does not necessarily equate to negative sediment effects on benthic or other organisms.

1.3. CONCLUSIONS RELATIVE TO THE ASSESSMENT OF SEDIMENT RECONTAMINATION

The primary goal of the project was to identify the best methods to assess sediment recontamination as a result of stormwater discharges. A separate memo was prepared and submitted entitled "Stormwater Sediment Recontamination Assessment Recommendations" . This memo is included as Appendix VII of this report. In short the following were key methods needed to assess sediment recontamination.

- Assessing stormwater loads requires collecting stormwater during storms of different intensity and at different stages during the storm. The specific requirements will differ depending upon the frequency, duration and intensity of events in a particular location but storms representative of an area are needed. Sampling should be automated in such a manner that the effect of non-stormwater flows, e.g. tides, can be excluded from the samples. In general, it is believed that intensive monitoring of a few representative events (as outlined below including size segregated loads of a broad range of contaminants and monitoring at different locations in the watershed and in receiving waters) is more useful that more modest monitoring efforts of a large number of events.

- Equivalent sampling of stormwater entering and exiting the naval base portion of a watershed can provide differentiation between Navy and other sources of stormwater contaminants.
- Assessing the potential for sediment recontamination requires that the stormwater contaminant loads in collected samples be characterized as a function of settling characteristics or particle size. The memo provides a description of the methods used in this project to determine contaminant distribution in key suspended solid size ranges. The measurements collected during this project indicate that contaminants may often be associated with relative coarse particles that settle quickly and the solids distribution and contaminant distribution do not necessarily correlate.
- Receiving water sampling is best conducted using settling traps during storm events or over a period of storm events. Segments of sediment cores are influenced by a variety of long-term processes and do not necessarily indicate the effects of recent storm events.
- Sediment recontamination as indicated by stormwater loads and collection of contaminants in sediment traps does not necessarily indicate the ecological effects of the contaminants. In particular, contaminants associated with large, rapidly settling particles may contribute to rapid recontamination of sediment bulk solid concentration but may contribute little to negative effects on benthic or other organisms
- Stormwater and receiving water modeling provide opportunities to better link stormwater discharge measurements with source areas and the discharges to sediment recontamination. These models are most useful to calibrate to a finite set of measurements and then used to extrapolate to other conditions or to predict longer term average discharges or sediment recontamination rates.

2. INTRODUCTION

This study addressed SERDP Statement of Need (SON) ERSON-14-03, “Improved Understanding of the Impact of Ongoing, Low Level Contaminant Influx to Aquatic Sediment Site Restoration”. Our goal was to develop and evaluate tools to help examine recontamination of sediments by evaluating the impacts of an urban watershed, Paleta Creek, on San Diego Bay. One concern is the impacts of stormwater from Naval Base sources. Another concern is the potential upstream urban impacts on sediments that are of potential responsibility to the Navy. A number of innovative tools were identified and used in this project to examine wet and dry season creek inputs and receiving water impacts to address the SON. A subset of these tools was employed at Puget Sound Naval Shipyard. The work conducted directly addressed the SON by characterizing episodic stormwater inputs and their effects on adjacent sediments.

2.1. OBJECTIVE

The goal of this project was to develop, test and assess the effectiveness of a comprehensive set of laboratory, field, and modeling approaches in characterizing the role of urban stormwater in contamination of sediments and remediated sites. The research focused on the development and application of techniques to assess the magnitude and characteristics of episodic distributed sources (i.e., stormwater) and the effects of these sources on sediments and benthos. The work considered baseline conditions, discharges of contaminants during storm events, relationship of these loads to other potential sources of sediment contamination, and the potential for recontamination following remediation. The bulk chemical contamination was integrated with site-specific bioavailability, the potential for bioaccumulation, and identification of key stressors and ecological risk of stormwater and stormwater–related sediment contaminants. This provides a foundation for a decision-making framework for identifying stormwater sources and their consequences, designing effective source controls, and identifying the remedial goals realistically achievable without such controls.

The study efforts were conducted in four coupled and integrated phases:

1. Baseline sampling to characterize dry weather condtions
2. Stormwater loading assessment by direct sampling
3. Receiving waters assessment to link stormwater loads to sediment recontamination
4. Stormwater and receiving water modeling to predict stormwater loading over time

2.2. BACKGROUND

Cleanup at contaminated sediment sites has often been initiated before background sources have been fully identified, quantified and/or controlled. Under such conditions, remediated sites have become recontaminated by continued inputs from off-site sources, including permitted discharges, transport from upstream areas, or from stormwater discharges. Stormwater sources are particularly difficult to understand and manage because of the generally poor characterization of the irregular, event-driven inputs from such sources and the difficulty of managing diffuse sources of large volumes of runoff. DoD policy is that off-site sources must be identified and controlled prior to implementing cleanup, but the tools available to quantify event-driven irregular sources and their characteristics are limited, as is the ability to relate those sources to resulting chemical and biological impacts in sediments. As noted by the statement of need "this requires better scientific and technical capabilities to understand releases from these sources and how these source levels relate to potential recontamination of the sediment bed." This calls specifically for studies providing better characterization of the sources (i.e. the low-level intermittent sources associated with events, including how these sources are affected by drainage systems) and the potential chemical and biological effects in the sediment sinks. These methodologies can then be integrated with models to identify impacts on remedies and, specifically, to identify the resilience of proposed and/or implemented remedies.

2.3. SITE DESCRIPTIONS

Studies at two sites, Naval Base San Diego (NBSD) and Puget Sound Naval Shipyard (PSNS), were conducted with extensive evaluation at NBSD and very limited sampling and analysis at PSNS . Their history, hydrological conditions and contaminant distributions are described below and further description of the sites is in Appendix II.

2.3.1. *NAVAL BASE SAN DIEGO*

The mouth of Paleta Creek site is located on the eastern shoreline in the central portion of San Diego Bay and flows directly through Naval Base San Diego (Figure 2-1). The creek mouth emerges into the bay in a relatively constricted channel area which then expands into a broader area bounded to the north by Pier 8 and to the south by the Mole Pier. The TMDL program refers to these as the inner and outer creek mouth areas with an estimated impaired area of 9 acres as estimated on the 303(d) List of Water Quality Limited Segments. In evaluation of stormwater impacts this area is recognized as the inner portion of the receiving waters.

Paleta Creek itself is a channelized urban/industrial creek with the highest flow rates associated with flashy winter storm events and low and highly variable dry weather flows for the rest of year. Extended periods with no surface flows occur during dry weather and particularly during drought conditions. The watershed encompasses approximately 2,161 acres in the Pueblo San Diego hydrologic unit including portions of the cities of San Diego and National City and a small portion of the tidelands immediately adjacent to San Diego Bay under the jurisdiction of the U.S. Navy. The watershed is highly urbanized with land uses dominated by residential, with some commercial and military uses. A significant portion of the remaining watershed area is dominated by roadways. The State Water Board identified the 7th Street Channel/Paleta Creek as a high priority candidate toxic hot spot due to repeat amphipod sediment toxicity findings and the presence of multiple degraded benthic communities in the Consolidated Toxic Hotspots Cleanup Plan.

Toxicity and chemistry of wet weather runoff have been routinely measured in outfalls and receiving water off NBSD for compliance with NPDES storm water discharge permits. Copper and zinc frequently exceed benchmark concentrations for the protection of aquatic life in storm water samples from NBSD and have been found to cause acute toxicity to the mysid shrimp *Americamysis bahia* in end-of-pipe storm water samples using Toxicity Identification Evaluation (TIE) procedures.

Many areas of San Diego Bay's shoreline have been listed as impaired water bodies under Clean Water Act (CWA) 303[d] by the State Water Resources Control Board (SWRCB) due to identified pollutants. The most recent list was approved by the USEPA in June 2007. Pollutants include bacteria, pesticides, heavy metals, and organic compounds while areas of concern continue to be marinas, shipyards, and outlets of creeks. As a result of these listings, the Regional and State Water Boards are required to prepare a TMDL technical report and action plan for each site and pollutant. Five sites were considered to be "toxic hot spots" in San Diego Bay due to multiple pollutants and toxic effects that require immediate clean-up (Seventh St. Channel, Paleta Creek, Naval Station San Diego, B Street/Broadway Piers, and the Downtown Anchorage).

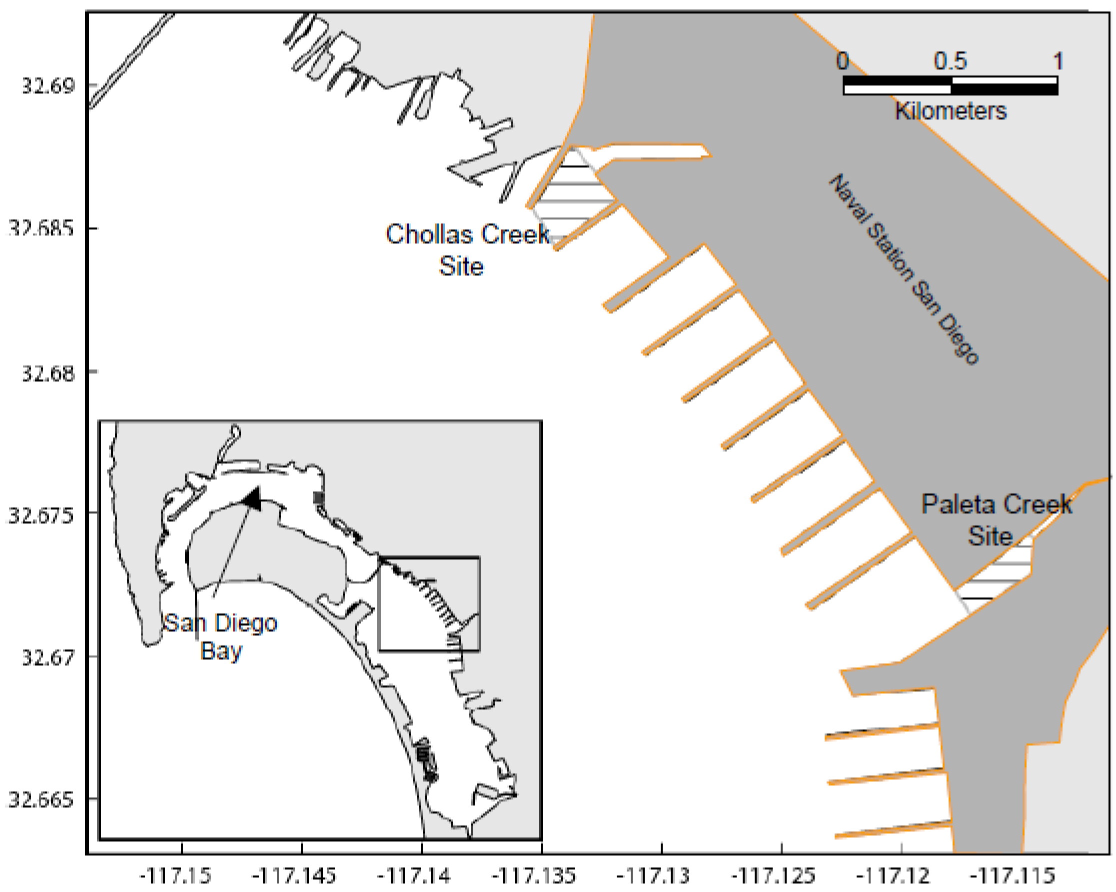


Figure 2-1 Naval Base San Diego and vicinity

The NBSD is located at the downstream end of the Paleta Creek Watershed (PCW). The PCW is approximately 2,000 acres and primarily consists of single-family residential land uses upstream of Interstate 5, while most of the portion of the watershed downstream of Interstate 5 is associated with NBSD. Figure 2-2 shows the land use breakdown within the PCW. The majority of the tributary area is categorized as single-family detached residential (42%), followed next by roads (20%), and third by military lands (11%). More than 96% of the watershed is developed (i.e., not characterized as recreation or open space parks). The distribution of land uses in the PCW is shown in Figure 2-3.

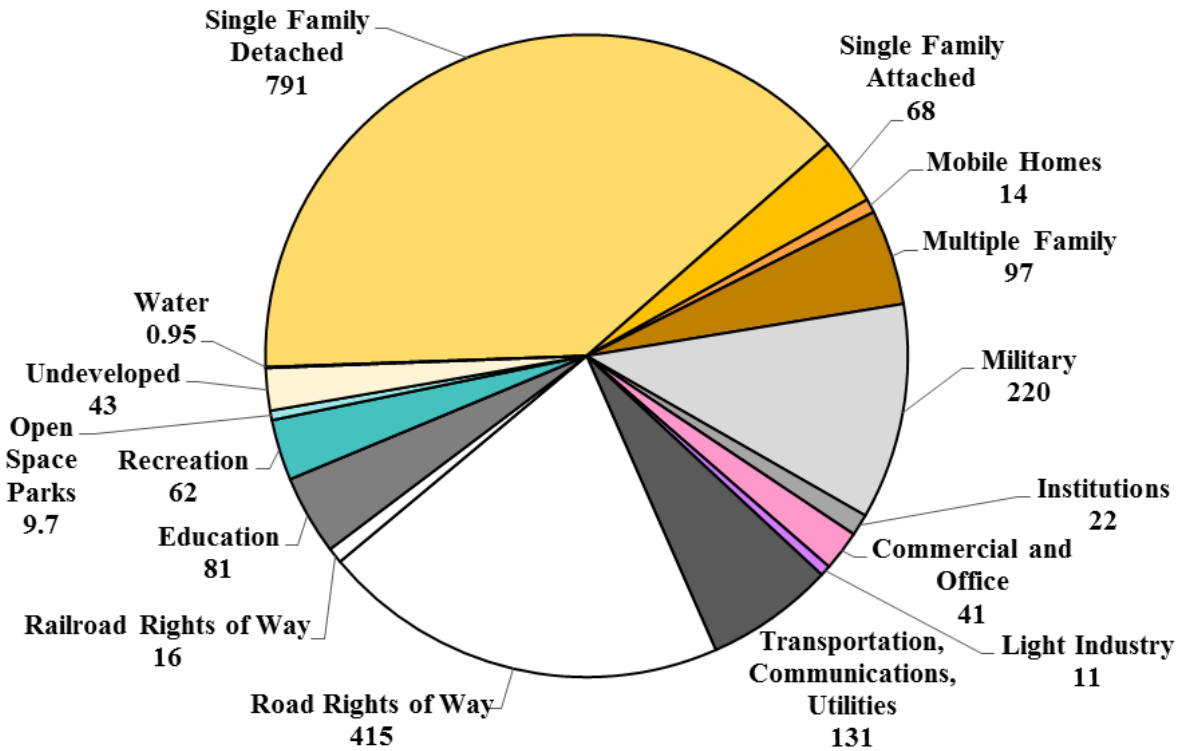


Figure 2-2 Paleta Creek Watershed Land Uses (in acres)

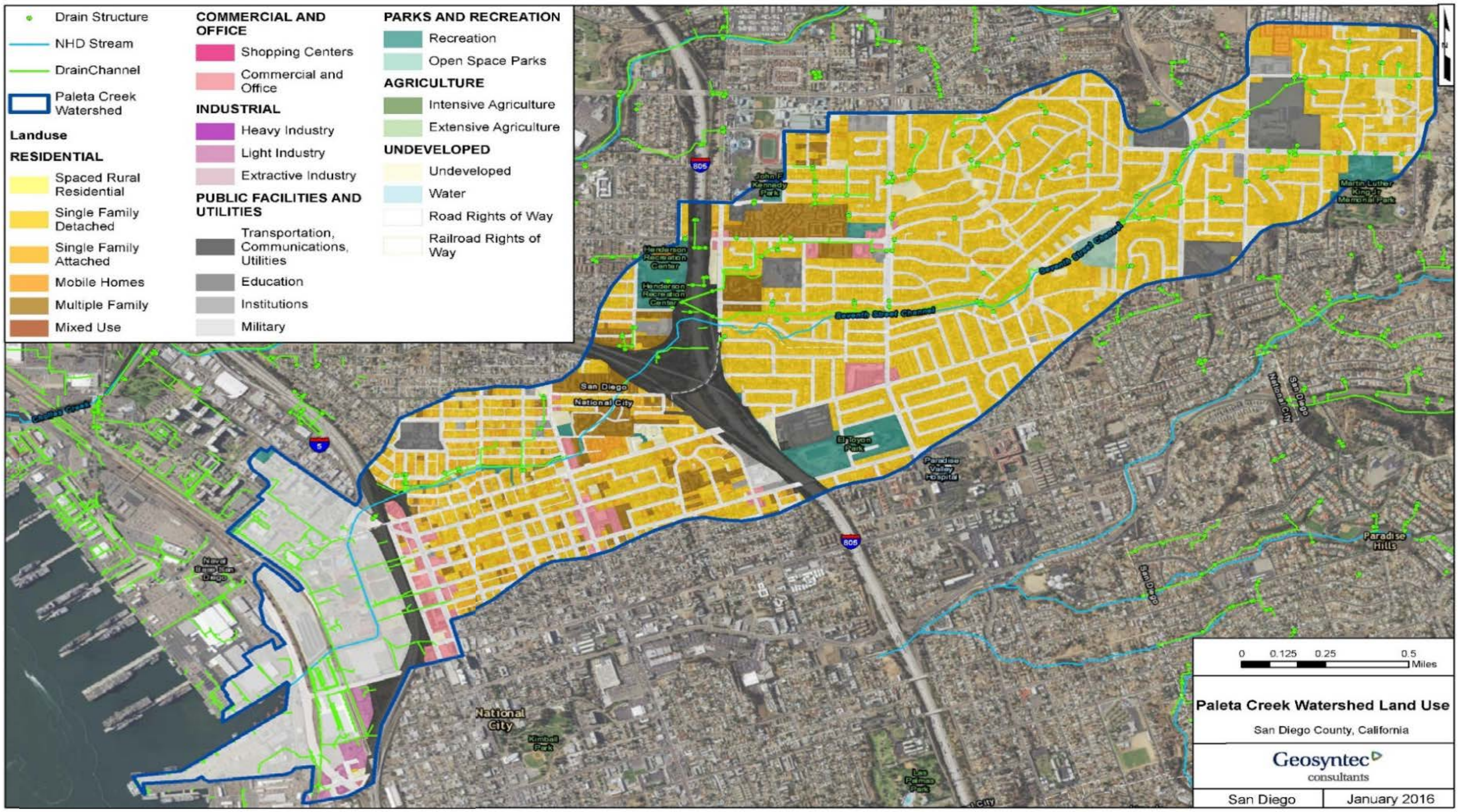


Figure 2-3 Paleta Creek Watershed Land Uses

2.3.2. *PUGET SOUND NAVAL SHIPYARD*

A secondary site was selected for collection of sediment, stormwater effluent discharges and ambient waters in the Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS&IMF) which are part of the Bremerton Naval Complex (BNC; Bremerton, WA). PSNS has six dry docks, eight piers and moorings, and numerous industrial shops to support the industrial operations (Figure 2-4). The complex covers approximately 350 acres of land and an additional 340 acres of tidelands along 11,000 feet of shoreline and contains over 300 buildings and structures consisting of industrial, supply and base facilities, a steam plant, six dry docks, piers and numerous moorings. The predominant land cover within the Shipyard is rooftops, paved areas (roads, parking areas, sidewalks, and concrete working areas), and piers.

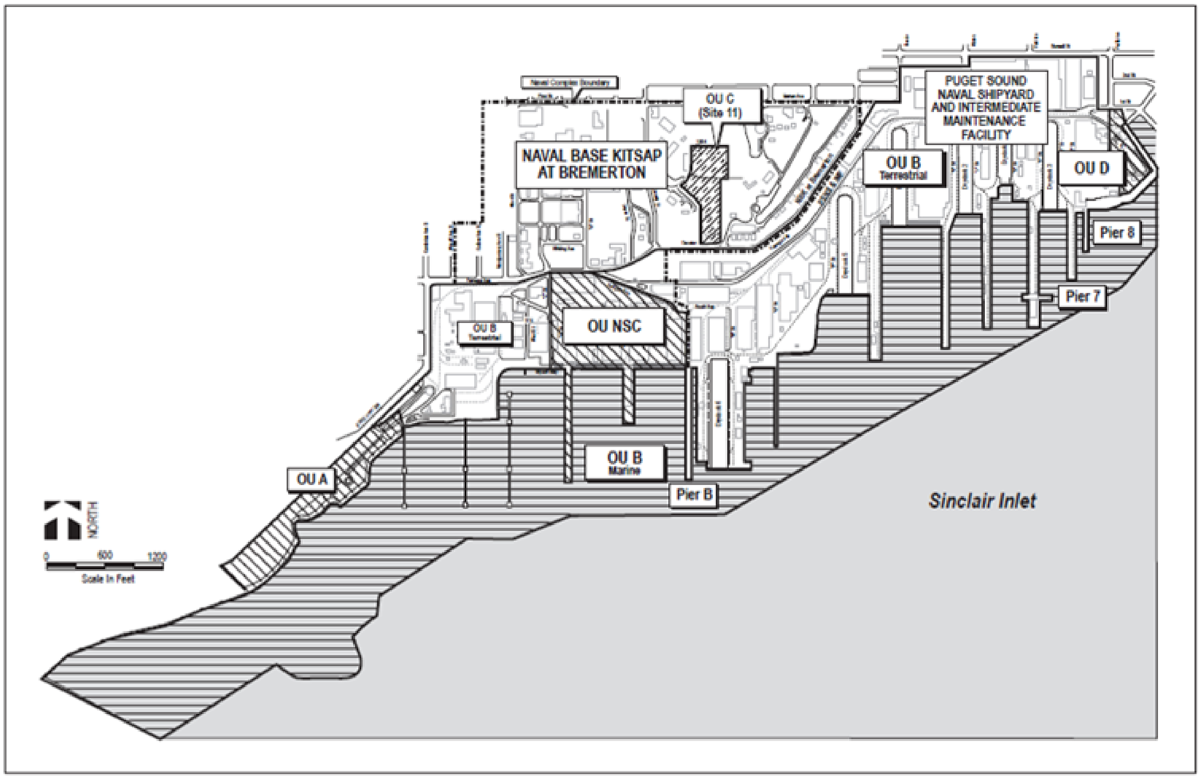


Figure 2-4. Bremerton Naval Complex Operable Units (Kirtay et al. 2016).

The stormwater system draining the BNC includes over 150 storm drainage systems with more than 1,000 catch basins and track drains leading to the Sinclair Inlet. Industrial and municipal stormwater runoff from this area contains a broad variety of pollutants whose concentrations can vary widely depending on storm event size and other local and regional factors. Stormwater runoff from non-dry dock locations within the BNC all drain directly into the adjacent receiving environment and many of these drainage locations are also tidally influenced. Discharge of stormwater from Shipyard operations is permitted by the USEPA Region 10 under the CWA (NPDES permit WA-00206-2). Under the NPDES program, the Shipyard is required to implement Best Management Practices (BMPs) designed to reduce, treat, and control discharges of contaminants from operations to the adjacent receiving environment.

The sampling at PSNS was much more limited than at NBSD and was designed primarily to identify similarities or differences in the character (i.e. size distribution) of key contaminants. Stormwater contaminant loads at PSNS were also substantially less than at NBSD and Paleta Creek limiting the ability to conduct a full analysis of sources, strengths and sediment recontamination. Sediment recontamination, in particular, was particularly difficult to ascertain given the small contaminant concentrations in the stormwater discharges. It was, however, possible to compare the size distribution of contaminants in stormwater at PSNS to that seen at NBSD and the results suggest that a mixed residential Navy base watershed has some significant similarities in high contaminants are distributed by particle size.

WinSLAMM modeling had been calibrated previously at PSNS site and is the subject of other reports to the sponsoring organization. It was originally planned to employ detailed information from NBSD to predict size segregated behavior at the PSNS site but the lack of data precluded any efforts to do that beyond the past calibration efforts and model simulation runs. Instead the data collected at PSNS was simply used to identify key characteristics and compare to key characteristics observed in Paleta Creek data.

3. MATERIALS AND METHODS

This section provides a description of the experimental design, sampling and analytical methods used to characterize the role of urban stormwater in contamination of sediments and remediated sites for two different sites and types of hydrological environments.

3.1. STORMWATER COLLECTIONS

3.1.1. *MONITORING SITE SELECTION- NBSD*

A land development survey of the area above the naval base (Interstate 5) was conducted on December 18, 2014. Ten neighborhoods were surveyed to determine building along with road and pavement characteristics. Parking conditions and street widths were also noted. Appendix I-B includes photographs and summaries of this survey. This information was used to determine expected stormwater loads and to define monitoring locations.

Six monitoring locations were selected within the lower Paleta Creek watershed (PCW) representing NBSD land uses, the upper urbanized watershed, and a downstream creek location affected by mixed flows from both NBSD and the upper watershed area. Stormwater samples were collected ISCO automatic samplers during storm events and supplemented with grab samples.

Site selection was also based on sampling crew safety and equipment access. The sample locations are described below in Table 3-1 and their locations shown on Figure 3-1. C1W and C2W are receiving water sites within Paleta Creek, while the remaining four locations are NBSD stormdrain outfalls just upstream of their confluence with Paleta Creek. Photographs and descriptions of each sampling location are included in Appendix III-1, as compiled during the initial site reconnaissance.

Table 3-1 Monitoring Locations

Site ID	Site ID Description	Location	Type	Approx. Drainage Area (acres)	Tidal	Drainage Area Description
C1W	Downstream Creek	Paleta Creek at Cummings Road	Receiving water	2,000	Yes	Downstream end of Paleta Creek
C2W	Upstream Creek	Paleta Creek at Main Street	Receiving water	1,660	No	Within Paleta Creek, upstream of tidal influence and upstream of NBSD outfalls
O1W	North of Harbor	NBSD outfall #23	Outfall	3.5	Yes	Industrial areas on the west side of NBSD

Site ID	Site ID Description	Location	Type	Approx. Drainage Area (acres)	Tidal	Drainage Area Description
O2W	South of Harbor	NBSD outfall #33	Outfall	3.4	Yes	Industrial areas on the east side of NBSD which has been shown to have high copper and zinc concentrations during previous sampling activities
O3W	Auto Skills Center	NBSD outfall north of railroad crossing	Outfall	36	Yes	Large, central, mixed used portion of the NBSD facility, including residential areas, parking, and an auto shop
O4W	Guard Gate	NBSD outfall at Paunack and Division Streets	Outfall	29	Yes[1]	Large, central, mixed use portion of the NBSD facility, including apartment buildings, activity fields, and parking lots

1. O4W was not observed to be tidally influenced during the initial site reconnaissance, subsequent siting follow-up visits, or before Event #1. However, it can be surmised that based on the high salinity of the sample collected for Event #2, this location was in fact tidally influenced. This is discussed in more detail later in this report.

The outfall locations and associated drainage areas are shown Figure 3-1. Detailed GIS maps showing the land surface characteristics for the drainage areas for each of the monitored outfalls are presented in Appendix III-2. Appendix III-2 also contains field survey notes and surface area measurements for the Paleta Creek watershed conducted to support WinSLAMM analyses. The lower part of the watershed has a completely lined concrete channel. However, substantial vegetation is present in the channel, including moderate-sized palm trees. Stable sediment in the channel with vegetation, even with the large amounts of rain in the previous two weeks before the survey. Reasonably stable areas are adjacent to, and along, the channel. At other locations in the channel, bare earth and poor vegetation can be erosion sources. There was some scoured silt/clay on bottom of channel evident with new erosion on bank side. Near the top of the watershed, the creek splits with the main channel (unlined) extending further. The other branch is an unlined dry drainage. Adjacent poorly vegetated areas provide sediment via erosion. Erosion in channel is evident (grey silty material). There are 10 grassy swale areas along Paleta Creek that would serve to modulate stormwater contaminant flows. 3 are located upstream of outfall O4W, 2 are located between O4W and O3W, and 5 are located between O3W and the Creek outlet at C1W. There are no other stormwater management practices in use along the creek itself.

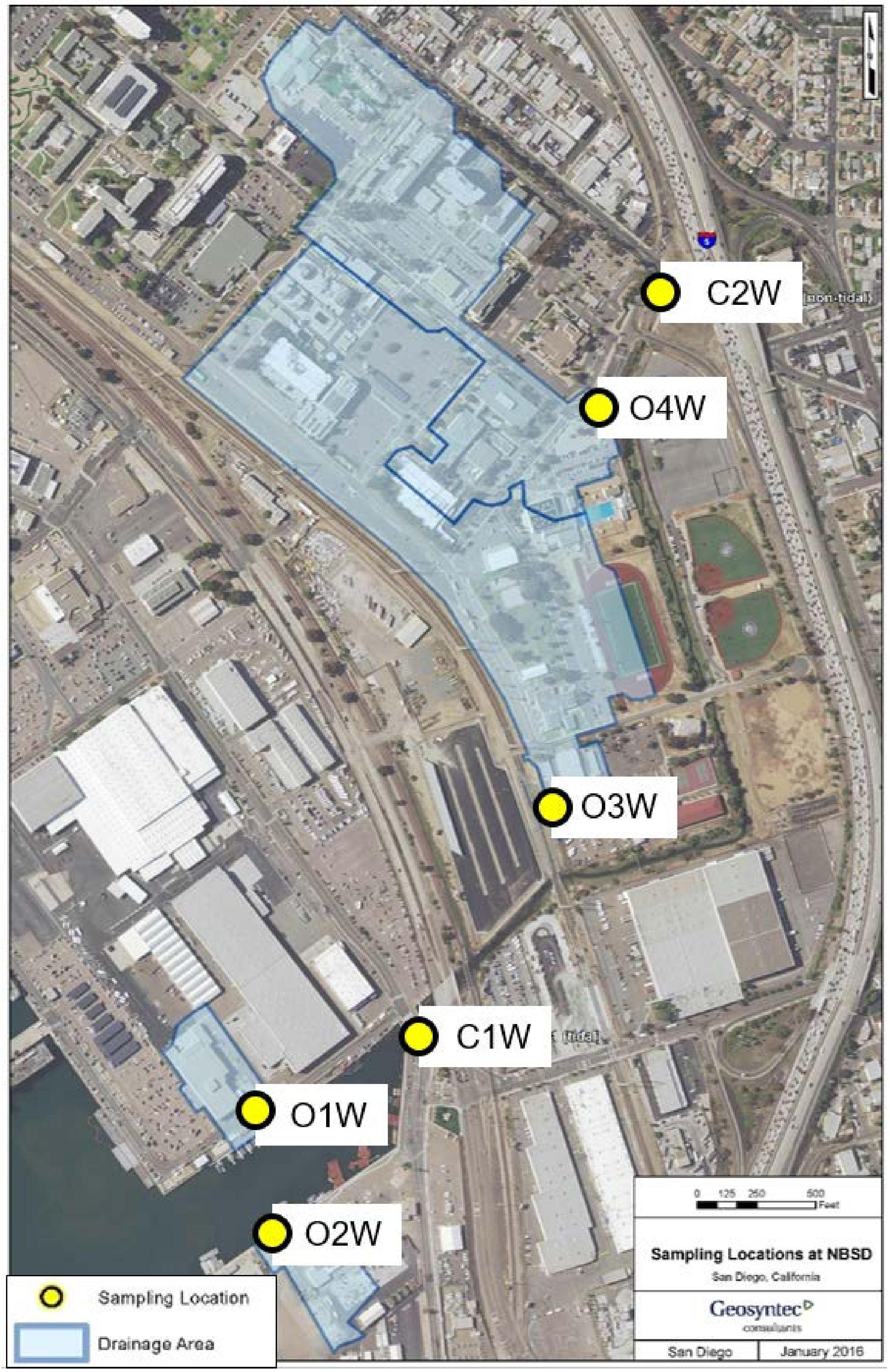


Figure 3-1 Drainage Area Characteristics for NBSD Outfalls

3.1.2. *MONITORING SITE SELECTION- PSNS*

Two outfalls were monitored at the secondary site, Puget Sound Naval Station, by grab samples during storm events as identified in Table 3-2.

Table 3-2 Sampling locations, Puget Sound Naval Station

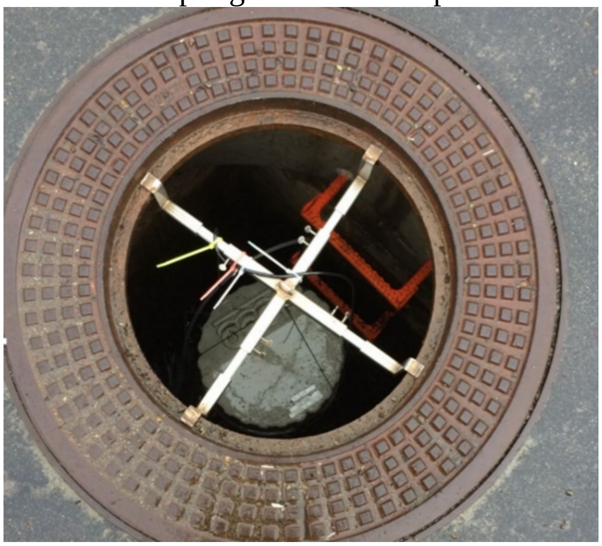
PSNS Outfall #	Outfall Location	Total Basin Area (acres)	Basin Impervious Surface Area (acres)	Basin Pervious Surface Areas (acres)	Geographical Area	Primary Work Activity
PS096	47°33’35”N, 122°38’11”W	16.48	15.99	0.49	Mid CIA, west of DD4, southeast of Bldg 457 along “N” St	Vessel maintenance
PS081.1	47°33’21”N, 122°38’31”W	22.16	21.51	0.65	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	Non-aircraft carrier support services

Figure 3-2 Stormwater sampling locations -PSNS

3.2. STORMWATER SAMPLING

ISCO 6712 automatic water samplers were deployed at all monitoring locations at Paleta Creek for the collection of time-spaced composite samples. ISCO AQ702 multi-parameter meters were also deployed at tidally influenced monitoring locations (C1W, O1W, O2W, and O3W) to measure salinity and target the collection of freshwater samples. ISCO 750 area-velocity (AV) meters were deployed at flow or depth-triggered monitoring locations (C2W, O1W, O2W, O3W, and O4W). Figure 3-3 shows typical installations of automatic water samplers at manhole and surface locations. Intensive stormwater sampling was conducted during two storms in January 2016. The first event was on January 5 to 7, 2016 and had 1.87 inches of rain. The second event was on January 31 to February 1, 2016 and had 0.16 inches or rain. These two rains therefore represented both small and large rains for the area. Approximately 75% of the storms during the 2015-2016 were similar in duration and intensity of the two selected events.

Manhole sampling location example



Surface sampling example

Figure 3-3 Example Automatic water sampler installations.

Samples were collected in 10L pre-cleaned glass jars. Once samples were collected, bottles were wrapped carefully and transported by Geosyntec personnel to the SSC Bioassay Laboratory. Ambient samples were collected by SSC Pac personnel. Composited samples from each event were split by SSC Pac personnel using a Teflon™ Dekaport splitter. The sample splitting process is illustrated in Figure 3-5. An aliquot of approximately 100mL was retained from each sample prior to sample splitting for toxicity evaluation. Briefly, the Dekaport splitter was placed level on the laboratory workbench. The Dekaport was rinsed a minimum of 3 times with Milli-Q DI water. Two analytical blank samples were collected by pouring Milli-Q DI water through the sampler into a HDPE and an Amber glass bottle. Next, 7 Amber glass and 3 HDPE bottles were placed under the Dekaport and 10L of thoroughly mixed stormwater sample was poured into the

Dekaport. Samples were poured through a 0.5mm sieve to remove debris and were poured at rate that would allow for constant pressure and thus consistent flow through all the tubing of the Dekaport. All 7 Amber glass bottles and one HDPE bottle were capped and placed in two plastic Ziploc. The remaining 2 HDPE bottles were then passed through the Dekaport again (approximately 2L of sample) into 5 HDPE bottles; each of which would receive approximately 400mL. These bottles were then capped and placed in two plastic Ziploc bags. For the second stormwater collection event where 20L were collected, these methods were duplicated for the additional 10L of sample volume that was collected. The Dekaport was thoroughly rinsed with Milli-Q DI water between samples. All bottles were shipped on ice to TTU for further processing and analytical measurement.

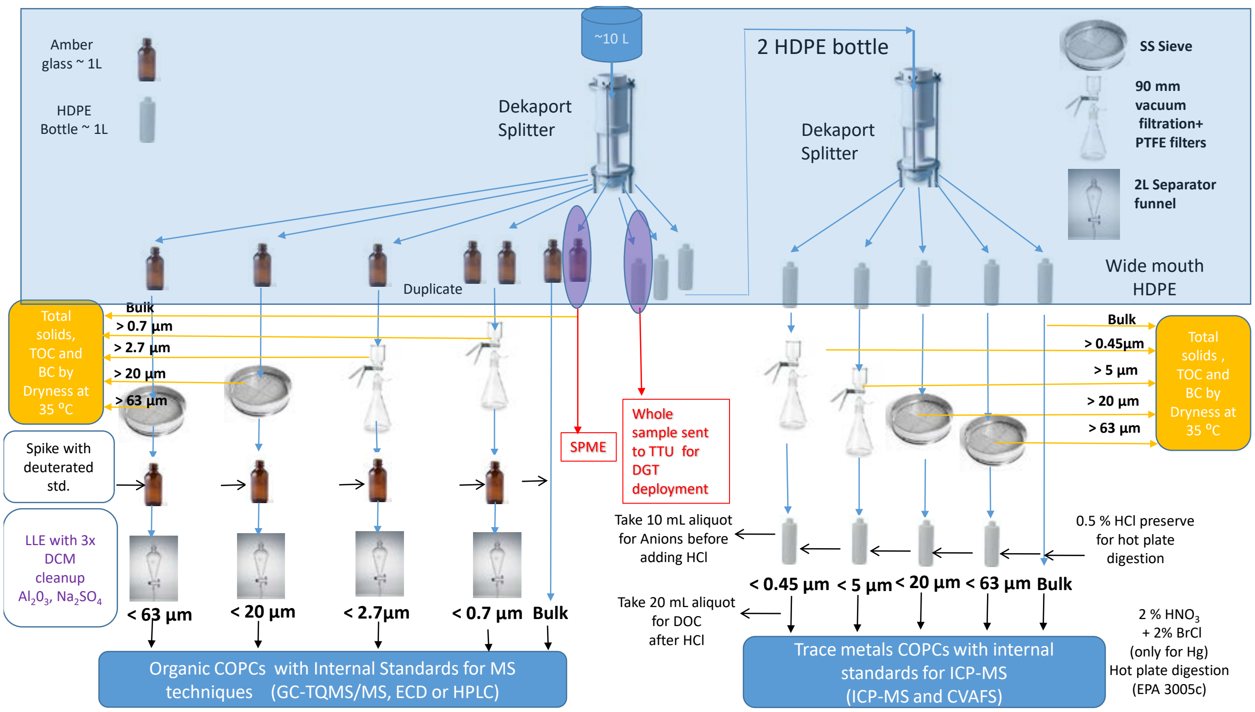


Figure 3-4 Composite sample splitting schematic for stormwater samples

At the analysis laboratory, the bulk water samples in the amber and HDPE bottles were filtered with 63, 20, 5 (2.7 for organics) and 0.45µm (0.7 for organics) sieves and glass fiber (organics) and PFTE (metals) membrane filters to provide raw samples for chemical analysis by particle size fraction. The different size fractions for organics and metals were based upon commercial availability of appropriate filters for metals and/or organic contaminants to allow efficient filtration and minimal analyte sorption and loss. After passing through the sieves/filters the water filtrate fractions from the amber bottles were subjected to liquid-liquid extraction using a separatory funnel (EPA method 3510). The solvent extracted fractions were then concentrated using a Thermo Scientific Rocket™ Evaporator to low level volumes to obtain desirable detection of persistent organic pollutants (POPs). Deuterated polycyclic aromatic compounds (PAHs) were employed to check the extraction efficiencies. The samples from the HDPE bottles were subjected to metal extraction using hot plate digestion (modified EPA method 3005A). The detailed analytical procedures are described in Appendix VI.

A similar approach can be used for chemicals of concern, in this case measuring the contaminant concentration in the filtrate. The calculations for a chemical within a specific size range are illustrated in Figure 3-5. In short, one of the replicate samples was filtered to remove any contributions from particle sizes larger than that filter and the filtrate was analyzed. The mass of any contaminant or total solids in a particular size fraction was determined by difference (e.g. the total solids or contaminant mass in the >20 to <63 µm size fraction was determined by difference between the <20 and the 63 µm filtrate). The specific calculations are summarized below and the calculated results are included in the processed data files in Appendix I-3 and I-5.

The same methods were employed at the secondary site at PSNS although all samples, both baseline and stormwater samples were collected in 10L grab samples. Water samples were collected from two locations at PSNS&IMF. Two dry dock discharge samples, OF18AB and OF19, and adjacent receiving waters, PS09 and PS06, respectively, were collected 6-Dec-2016 and 30-Mar-2017. Dry dock effluent samples were collected by autosamplers with approximately 10L of sample sent to TTU for processing and analysis and 10L of sample used for toxicity and other analyses as part of the ENVironmental InVESTment (ENVVEST) Ambient Monitoring Program. Ambient receiving water samples were collected from approximately 1m depth with a pole collection device fitted with a 1L glass bottle. Multiple grabs with the bottle were necessary to collect the required 10L volume for processing and toxicity evaluations. Additionally, on 29-Mar-2017, two stormwater samples were collected from stations PS096 and PS081.1 using a pump to collect the required 10L of sample into the glass jars. Toxicity samples were hand couriered to the SSC Pac Bioassay Laboratory in San Diego, CA. The much more limited sampling conducted at PSNS preluded extensive evaluation of this site or the ability to use WinSLAMM beyond what had been done previously during calibration efforts that included PSNS and supported and reported on other projects. The data was used to evaluate whether contaminants associated with large particles were also associated with these particles at PSNS and to evaluate toxicity as noted above.

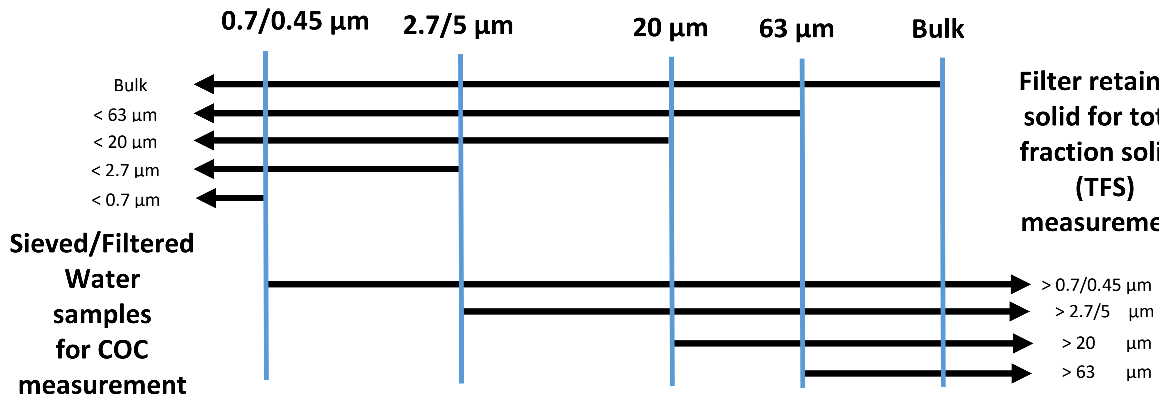


Figure 3-5 Fractionation of stormwater samples to determine total solids or contaminant mass within a particular size fraction by difference between different filtrate measurements

3.2.1. *STORMWATER SOLID AND CHEMICAL LOADING CALCULATIONS*

Solids*:*

$$TFS_{0.7-2.7\mu m} = TFS_{>0.7um} - TFS_{>2.7\mu m}$$

$$TFS_{2.7-20\mu m} = TFS_{>2.7um} - TFS_{>20\mu m}$$

$$TFS_{20-63\mu m} = TFS_{>20um} - TFS_{>63\mu m}$$

As an example, during storm 1 in location C2W, solids concentration in the >2.7µm fraction was 247.7mg/L while in the >20µm fraction was 100.8mg/L. In this case, the solids concentration in the 2.7-20µm range is:

$$TFS_{2.7-20\mu m} = 247.7\frac{mg}{L} - 100.8\frac{mg}{L} = 146.9\frac{mg}{L}$$

Solids for normalizing the metal aqueous measurements:

$$TFS_{0.45-5\mu m} = TFS_{>0.45um} - TFS_{>5\mu m}$$

$$TFS_{5-20\mu m} = TFS_{>5um} - TFS_{>20\mu m}$$

$$TFS_{20-63\mu m} = TFS_{>20um} - TFS_{>63\mu m}$$

Example of calculating the solid concentration (mg/L), TFS, in the coarse silt interval (20-63µm) in location C1W of event 1:

TFS in the fraction >20µm is 171.8mg/L and TFS in the fraction >63µm is 63.5mg/L.
The TFS in the (20-63µm) interval is:

$$TFS_{20-63\mu m} = 171.8\frac{mg}{L} - 63.5\frac{mg}{L} = 108.3\frac{mg}{L}$$

In the cases that the TFS calculation gives negative value, the solid concentration is reported as 0.0 with the flag “TFS<0”.

TOC:

$$\%TOC_{0.7-2.7\mu m} = \frac{(\%TOC_{>0.7\mu m} * TFS_{>0.7um}) - (\%TOC_{>2.7\mu m} * TFS_{>2.7um})}{TFS_{>0.7um} - TFS_{>2.7\mu m}}$$

$$St.\ Dev\ (\%TOC_{0.7-2.7\mu m}) = \frac{\sqrt{((St.Dev.\ (\%TOC_{>0.7\mu m}) * TFS_{>0.7um})^2 + ((St.Dev.\ (\%TOC_{>2.7\mu m}) * TFS_{>2.7um})^2}}{|TFS_{>0.7um} - TFS_{>2.7\mu m}|}$$

$$\%TOC_{2.7-20\mu m} = \frac{(\%TOC_{>2.7\mu m} * TFS_{>2.7um}) - (\%TOC_{>20\mu m} * TFS_{>20um})}{TFS_{>2.7um} - TFS_{>20\mu m}}$$

$$St.\ Dev\ (\%TOC_{2.7-20\mu m}) = \frac{\sqrt{((St.Dev.\ (\%TOC_{>2.7\mu m}) * TFS_{>2.7um})^2 + ((St.Dev.\ (\%TOC_{>20\mu m}) * TFS_{>20um})^2}}{|TFS_{>2.7um} - TFS_{>20\mu m}|}$$

$$\%TOC_{20-63\mu m} = \frac{(\%TOC_{>20\mu m} * TFS_{>20um}) - (\%TOC_{>63\mu m} * TFS_{>63um})}{TFS_{>20um} - TFS_{>63\mu m}}$$

$$St.\ Dev\ (\%TOC_{20-63\mu m}) = \frac{\sqrt{((St.Dev.\ (\%TOC_{>20\mu m}) * TFS_{>20um})^2 + ((St.Dev.\ (\%TOC_{>63\mu m}) * TFS_{>63um})^2}}{|TFS_{>20um} - TFS_{>63\mu m}|}$$

As in the previous example, during storm 1 in location C2W, solids concentration in the >2.7µm fraction was 247.7mg/L while in the >20µm fraction was 100.8mg/L. The %TOC of the solids collected on the 2.7µm filter was 11.9±0.8 and on the 20µm sieve was 15.8±2.4. In this case, the %TOC of the solids in the 2.7-20µm range is:

$$\%TOC_{2.7-20\mu m} = \frac{(10.0 * 247.7\frac{mg}{L}) - (6.4 * 100.8\frac{mg}{L})}{247.7\frac{mg}{L} - 100.8\frac{mg}{L}} = 9.2$$

and the standard deviation is:

$$St.\ Dev\ (\%TOC_{2.7-20\mu m}) = \frac{\sqrt{\left(0.8 * 247.7\frac{mg}{L}\right)^2 + \left(2.4 * 100.8\frac{mg}{L}\right)^2}}{\left|247.7\frac{mg}{L} - 100.8\frac{mg}{L}\right|} = 2.1$$

There are instances where the %TOC in a size range is calculated as negative due to the numerator being negative (eg 0.7-2.7µm size range in C2W during storm 1) or the denominator being negative (eg. 0.7-2.7µm size range in O3W during storm 1). There are also 3 instances for both storms where both the numerator and the denominator are negative (eg. 0.7-2.7µm size range in A1W during storm 1) leading to a false positive value. Finally, there is one instance where the %TOC calculation leads to a value greater than 100% (eg. 0.7-2.7µm size range in A3W during storm 1). In all above cases, the %TOC value is reported as 0.0 with NA St.Dev.

Organics:

$$C_{>0.7\mu m} = \frac{C_{Bulk} - C_{<0.7\mu m}\ (\frac{ng}{L})}{TFS_{>0.7um}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

$$C_{0.7-2.7\mu m} = \frac{C_{<2.7\mu m} - C_{<0.7\mu m}\ (\frac{ng}{L})}{TFS_{>0.7um} - TFS_{>2.7\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

$$C_{2.7-20\mu m} = \frac{C_{<20\mu m} - C_{<2.7\mu m}\ (\frac{ng}{L})}{TFS_{>2.7um} - TFS_{>20\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\ (\frac{ng}{L})}{TFS_{>20um} - TFS_{>63\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\ (\frac{ng}{L})}{TFS_{>63um}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

Following the previous examples, during storm 1 in location C2W, naphthalene water concentration in the <2.7µm fraction was 10.3ng/L while in the >20µm fraction was 24.7ng/L. Solids concentration in the >2.7µm fraction was 247.7mg/L and in the >20µm fraction was 100.8mg/L. In this case, the concentration of naphthalene on particles in the 2.7-20µm range is:

$$C_{2.7-20\mu m} = \frac{24.7\frac{ng}{L} - 10.3\frac{ng}{L}}{247.7\frac{mg}{L} - 100.8\frac{mg}{L}} * 1000\frac{mg}{g} = 97.9\frac{\mu g}{kg}$$

There are a lot of examples where either the numerator, the denominator or both are negative. In those cases, the concentration value is reported as 0.0 with a <0 qualifier.

Where,

"C" represents the concentration of the bulk, filtered or sieved water with the representative size fraction in the subscript.

"TFS" represents the total fraction solids (in mass per volume of processed water) as captured on the filter membrane or sieve for the size fraction represented in the subscript.

"%TOC" represents the % total organic carbon content of solids (in mass per mass) captured on the filter membrane or sieve for the size fraction represented in the subscript

Metals:

Equations involved in the calculation of aqueous concentrations of metals, C(µg/L), in the corresponding size intervals:

For the C(>0.45µm):

$$C_{>0.45\mu m} = C_{Bulk} - C_{<0.45\mu m}(\frac{\mu g}{L}) \qquad Stdev_{(>0.45)\mu m} = \sqrt{(Stdev_{Bulk})^2 + (Stdev_{<0.45\mu m})^2}$$

For the C(0.45-5µm):

$$C_{0.45-5\mu m} = C_{<5um} - C_{<0.45\mu m}(\frac{\mu g}{L}) \qquad Stdev_{(0.45-5)\mu m} = \sqrt{(Stdev_{<5\mu m})^2 + (Stdev_{<0.45\mu m})^2}$$

For the C(5-20µm):

$$C_{5-20\mu m} = C_{<20um} - C_{<5\mu m}(\frac{\mu g}{L}) \qquad Stdev_{(5-20)\mu m} = \sqrt{(Stdev_{<20\mu m})^2 + (Stdev_{<5\mu m})^2}$$

For the C(20-63µm):

$$C_{20-63\mu m} = C_{<63um} - C_{<20\mu m}(\frac{\mu g}{L}) \qquad Stdev_{(20-63)\mu m} = \sqrt{(Stdev_{<63\mu m})^2 + (Stdev_{<20\mu m})^2}$$

For the C(>63µm):

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m}(\frac{\mu g}{L}) \qquad Stdev_{(>63)\mu m} = \sqrt{(Stdev_{Bulk})^2 + (Stdev_{<63\mu m})^2}$$

Example of calculating the Cu aqueous concentration (µg/L), C, in the coarse silt interval (20-63µm) in location C1W of event 1:

C in the fraction <63µm is 15.05±0.2 µg/L and C in the fraction <20µm is 9.88±0.3 µg/L.

The C in the interval (20-63µm) for Cu is:

$$C_{20-63\mu m} = 15.05\frac{\mu g}{L} - 9.88\frac{\mu g}{L} = 5.17\frac{\mu g}{L}$$

And the standard deviation is:

$$Stdev_{(20-63)\mu m} = \sqrt{(0.2)^2 + (0.3)^2} = 0.4$$

In the cases that the C calculation gives negative value, the metal aqueous concentration is reported as 0.0 with standard deviation “NA” and the flag “M<0”.

Equations involved in the calculation of metal concentrations on solids, C(mg/kg), in the corresponding size intervals:

For the C(>0.45µm):

$$C_{>0.45\mu m} = \frac{C_{Bulk} - C_{<0.45\mu m}\ (\frac{\mu g}{L})}{TFS_{>0.45um}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(>0.45)\mu m} = \frac{\sqrt{(Stdev_{\mathrm{Bulk}})^2 + (Stdev_{<0.45\mu m})^2}}{TFS_{>0.45\mu m}}$$

For the C(0.45-5µm):

$$C_{0.45-5\mu m} = \frac{C_{<5\mu m} - C_{<0.45\mu m}\ (\frac{\mu g}{L})}{TFS_{>0.45um} - TFS_{>5\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(0.45-5)\mu m} = \frac{\sqrt{(Stdev_{<5\mathrm{\mu m}})^2 + (Stdev_{<0.45\mu m})^2}}{TFS_{>0.45\mu m} - TFS_{>5\mathrm{\mu m}}}$$

For the C(5-20µm):

$$C_{5-20\mu m} = \frac{C_{<20\mu m} - C_{<5\mu m}\ (\frac{\mu g}{L})}{TFS_{>5um} - TFS_{>20\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(5-20)\mu m} = \frac{\sqrt{(Stdev_{<20\mathrm{\mu m}})^2 + (Stdev_{<5\mu m})^2}}{TFS_{>5\mu m} - TFS_{>20\mathrm{\mu m}}}$$

For the C(20-63µm):

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\ (\frac{\mu g}{L})}{TFS_{>20um} - TFS_{>63\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(20-63)\mu m} = \frac{\sqrt{(Stdev_{<63\mathrm{\mu m}})^2 + (Stdev_{<20\mu m})^2}}{TFS_{>20\mu m} - TFS_{>63\mathrm{\mu m}}}$$

For the C(>63µm):

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\,(\frac{\mu g}{L})}{TFS_{>63um}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(>63)\mu m} = \frac{\sqrt{(Stdev_{\text{Bulk}})^2 + (Stdev_{<63\mu m})^2}}{TFS_{>63\text{µm}}}$$

Example of calculating the Cu concentration on the solids (mg/kg), C, in the coarse silt interval (20-63µm) in location C1W of event 1:

$$C_{20-63\mu m} = \frac{15.05\frac{\mu g}{L} - 9.88\frac{\mu g}{L}}{171.8\frac{mg}{L} - 63.5\frac{mg}{L}} * 1000\frac{mg}{g} = 47.8\ \frac{mg}{kg}$$

And the standard deviation is:

$$Stdev_{(20-63)\mu m} = \frac{\sqrt{(0.2)^2 + (0.3)^2}}{108.3} = 0.004$$

In the cases that the numerator is negative, the metal concentration on solids is reported as 0.0 with Stdev "NA" and the flag "M<0". In the cases that the denominator is negative, the metal concentration on solids is reported as the metal aqueous concentration with the standard deviation of the metal aqueous concentration and the flag "µg/L".

3.3. WINSLAMM MODELING AND PALETA CREEK WATERSHED SUBAREAS

Paleta Creek stormwater monitoring data was used with the WinSLAMM stormwater quality model that was calibrated for the area during previous NBSD projects. The model description and use are described later in this report and in the documents prepared during the prior NBSD projects.

This project used the flow calculations from the model (calibrated using the detailed land use and development characteristics for the modeled areas in the Paleta Creek watershed, along with long-term regional rain data). The flow data was used in conjunction with the monitored metal and PAH data for several particle size ranges to allow better predictions of the fates of the discharged stormwater particulates after discharge to the receiving waters. The monitoring data and the modeled results were coupled with measurements of receiving sediment impacts and ecological effects. The stormwater modeling enabled calculations of stormwater discharge characteristics as determined by specific drainage area characteristics and activities in the Paleta Creek watershed allowing extrapolation of individual monitored storm events. These stormwater loading predictions, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and related settling rates), were used to quantify the recontamination potential of the sediments by stormwater discharges.

3.3.1. *BRIEF DESCRIPTION OF WINSLAMM*

WinSLAMM was developed to evaluate stormwater runoff volumes and pollutant loadings in developed areas during a wide range of rain conditions, not just very large storms that are the focus of conventional drainage design models. WinSLAMM determines the runoff based on local rain records and calculates runoff volumes and pollutant loadings from each individual source area within each land use category for each rain. Examples of source areas include: roofs, streets, paved storage areas, loading docks, small landscaped areas, large landscaped areas, sidewalks, and parking lots.

WinSLAMM can use any length of rainfall record as determined by the user, from single rainfall events to several decades of rains. Besides determining the main sources of the stormwater contaminants of concern, the model can calculate the benefits for a series of stormwater control practices, including rain barrels and water tanks for stormwater irrigation, pavement and roof disconnections, roof rain gardens, infiltration/biofiltration in parking lots and as curb-cut biofilters, street cleaning, wet detention ponds, grass swales, porous pavement, catchbasins, media filters, hydrodynamic devices, selected proprietary devices, and combinations of these practices located throughout the watersheds and at the outfalls. The model evaluates the practices through engineering calculations of the unit processes based on the actual designs and sizes of the controls specified and determines how effectively these practices remove runoff volume and pollutants.

WinSLAMM does not use a percent imperviousness or a curve number to generate runoff volume or pollutant loadings. The model applies volumetric runoff coefficients to each “source area” within a land use category depending on site and rainfall characteristics. Each source area has a different runoff coefficient equation based on factors such as: slope, type and condition of surface, soil properties, etc., and calculates the runoff expected for each rain. The runoff coefficients were developed using monitoring data from typical examples of each site type under a broad range of conditions.

Each source area also has a unique pollutant concentration (event mean concentrations - EMCs - and a probability distribution) assigned to it. The EMCs for a specific source area vary depending on the rain depth. The source area’s EMCs are based on extensive monitoring conducted in North America by the USGS, Wisconsin DNR, University of Alabama, and other groups. These monitoring efforts isolated source areas (roofs, lawns, streets, etc.) for different land uses and examined long term data on the runoff quality. The pollutant concentrations are also continuously updated as new research data become available, including information collected from source areas at naval facilities. Nationwide regional calibrations based on the National Stormwater Quality Database are available as initial background that can be supported and modified by local monitoring data (as was done for the Navy).

For each rainfall event in a data set, WinSLAMM calculates the runoff volume and pollutant load (randomized EMC x runoff volume) for each source area. The model then sums the loads from the source areas to generate a land use or drainage basin subtotal load. The model continues this process for the entire rain series described in the rain file. It is important to note that WinSLAMM does not apply a “unit load” to a land use. Each rainfall produces a unique load from a modeled area based on the specific source areas in that modeled area.

The model’s output is comprehensive and customizable, and typically includes:

1. Runoff volume, pollutant loadings and EMCs for a period of record or each event.
2. The above data pre- and post- for each stormwater management practice.
3. Removal by particle size from stormwater management practices
4. Other results can be selected related to flow-duration relationships for the study area, impervious cover model, biological receiving water conditions, and life-cycle costs of the controls.

A full explanation of the model’s capabilities, calibration, functions, and applications can be found at www.winslamm.com. For this project, the parameter files were calibrated using the local San Diego naval facility monitoring data (http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Site_Descriptions_Calibration_and_Sources_Feb_17_2014.pdf), supplemented by additional information from regional data from the National Stormwater Quality Database (NSQD), available at: http://bmpdatabase.org/nsqd.html as described in the following report describing regional calibrations of WinSLAMM using NSQD information:

http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Standard_Land_Use_file_descriptions_final_April_18_2011.pdf.

3.4. SEDIMENT SAMPLING

3.4.1. *SAMPLING EVENTS*

Several sediment sampling efforts were associated with precipitation events at the primary site of Paleta Creek at NBSD. These sampling efforts are depicted in Figure 3-7 and included

- Sediment cores and surficial sediment collection
  - Preliminary dry weather surficial sediment collection, Oct and Nov 2014
  - Dry weather surficial sediment collection, Jul 15, 2015
  - Pre-storm season cores collection – Oct 19, 2015
  - Post-storm season cores collection – Feb 23, 2016
  - Dry weather (pre-storm season) cores collection, Sep 8, 2016
  - Wet weather (post-storm season) cores collection, Mar 8, 2017
- Sediment deposition traps
  - Dry weather sediment traps, Jul 15-Aug 12, 2015
  - Storm season sediment traps, Oct 19, 2015- Feb 22, 2016

3.4.2. *2014 Dry Weather – NBSD*

On 29-Oct-2014, 6-Nov and 7-Nov-2014, sediment samples were collected from five compartments representing potential contaminant sources and receiving environments (Figure 3-6). These samples were not linked to specific stormwater and sediment recontamination events and were primarily used to evaluate methods and identify sampling locations for subsequent work. These samples will not be described further. Sample locations and designations were changed for subsequent sampling events as well as methods of analysis based upon the initial efforts.

Figure 3-6 2014 Dry weather sampling sites within the five sampling compartments of Paleta Creek watershed and receiving environment. Upstream sample – purple; Tidal Creek – blue; Conveyance system – light blue; Inner Creek – green; Outer Creek – yellow.

The analysis of these samples also involved a wet sieving technique and attempts to directly measure contaminants on the size segregated solids samples. The wet sieving technique apparently led to loss of contaminants that was identified as a result of mass balance errors. This led to the modified analysis approach described in the method section and again suggested that the results from the initial dry weather samples in 2014 could not be relied upon.

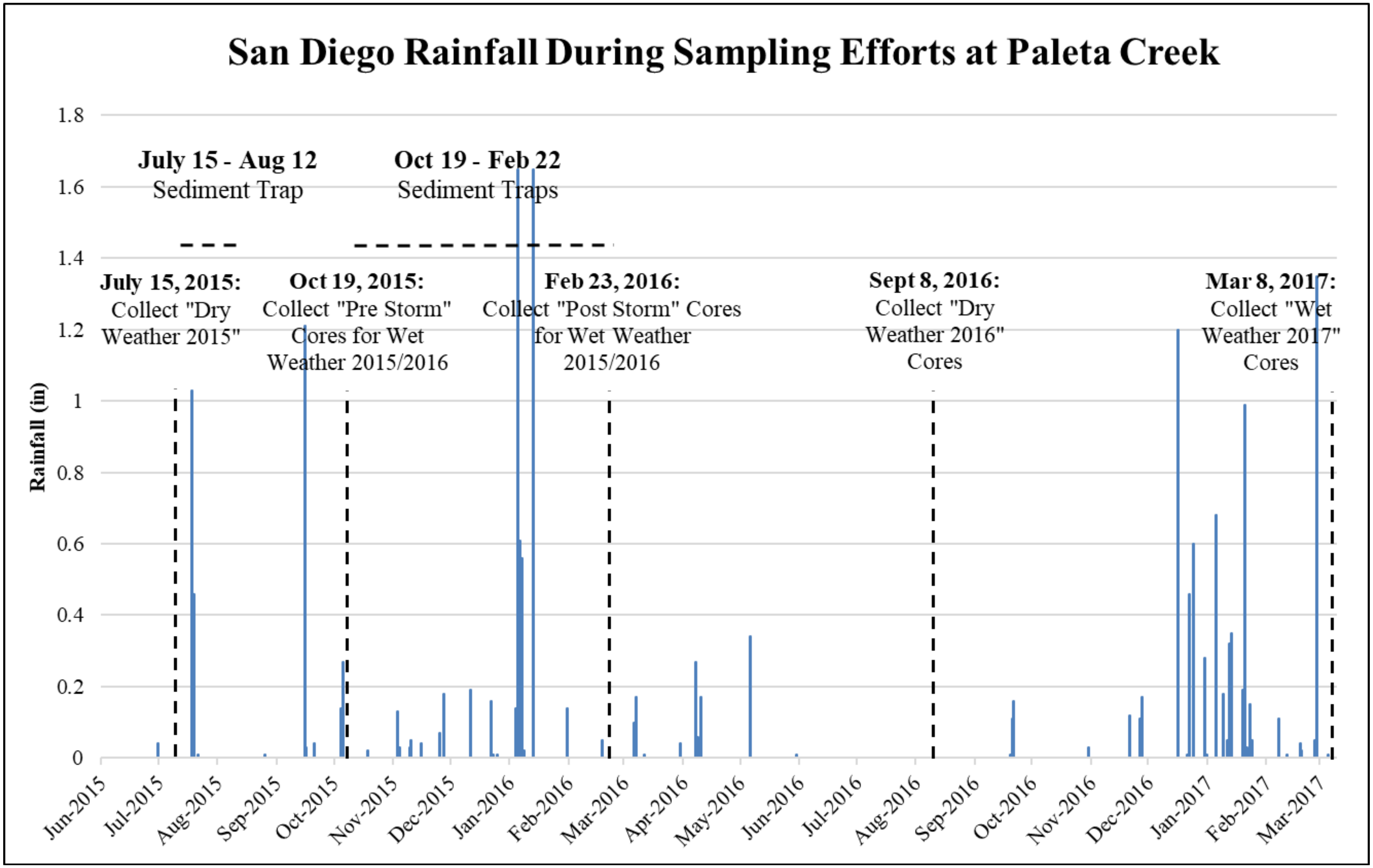


Figure 3-7 San Diego rainfall observed during field sampling efforts at Paleta Creek

3.4.3. *2015/2016 DRY & WET WEATHER – NBSD*

Sediment sample collections occurred throughout the dry and wet weather seasons starting in July-2015 through Feb-2016. Sampling locations are shown in Figure 3-8. For all sampling events, intact sediment cores were hand-collected by SCUBA divers. Once the research vessel (R/V) Ecos arrived on station, GPS was used to mark the stations with a surface float with attached weight. Divers then descended and pushed a core liner into the sediment approximately 5” and then carefully capped the core on both sides. Once at the surface, cores were decanted of overlying water and the caps secured with electrical tape. Cores were then placed in a cooler with blue ice until transport to the SSC Bioassay Laboratory for processing. Specific receiving water locations referenced later include P01, far from the Paleta Creek discharge, P08, P11 and P17, progressively closer to the Paleta Creek discharge. P08 is in the outer creek area of the 2014 dry samples while P11 and P17 are in the inner creek area. Receiving water grab samples (A1W and A2W and a third sample A3W during the first storm event) were also collected over the period of stormwater events at a location approximately 45-50 m off the mouth of Paleta Creek, C1W)

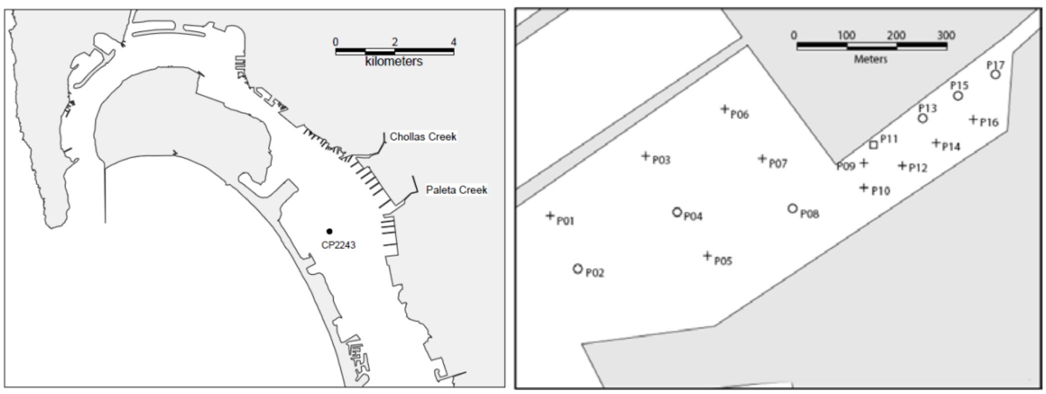


Figure 3-8 2015/2016 Dry and Wet weather sampling sites, reference station, CP2243 (left), and Paleta Creek stations at NBSD (right)

3.4.4. *2016/2017 DRY & WET WEATHER – NBSD*

Sediment sampling was conducted on 8-Sep-2016 to represent “Dry Weather” or pre-storm sampling event prior to the 2016-2017 wet season. Additionally, sediment sampling was conducted on 9-Mar-2017 to represent a second “Wet Weather” or post-storm season sampling event. For both events, sediment samples were collected with a Van Veen grab sampler, and from within the sample, several intact cores were sub-sampled. Multiple core samples were collected with the Van Veen grab from each station to obtain sufficient material to collect intact cores. The sediment sampler was rinsed thoroughly between stations to avoid cross-contamination, and sediment touching the sampler itself was avoided. Sampling dates and times are included in Appendix II.

3.4.5. *2016/2017 DRY & WET WEATHER – PSNS*

Sediment sampling was conducted on 5-Dec-2016 and 30-Mar-2017. Sampling locations are shown in Figure 3-9 and sample collection dates and times are included in Appendix II. For the first event, sediment grab samples were collected with a petite Ponar grab sampler and sub-sampled into six 500 mL glass jars for each station. For the second event, divers collected grab samples adjacent to pre-deployed sediment traps into two 1L glass jars. The sediment sampler was rinsed thoroughly between stations to avoid cross-contamination. Sample jars were wrapped, carefully packed and shipped on ice to TTU for further processing and analysis.

Figure 3-9 PSNS&IMF sampling locations PS06 & PS09 (sediment and water samples) and the adjacent outfalls (OF19 & OF18) that were monitored Dec-2016 through Mar-2017 (circled in red).

3.4.6. *PASSIVE SAMPLING*

Solid Phase Micro-Extraction (SPME) fibers were used to measure sediment porewater organic contaminants. SPMEs were provided by TTU and were impregnated with performance reference compounds (PRCs) to infer the fraction steady-state achieved after termination of the exposure period. For *ex*-situ exposures a single 5cm SPME fiber was placed into a septa and then three such fibers were placed vertically into test chambers for a 28-d exposure period.

Upon termination of the exposure period, SPME fibers were recovered and wiped gently with a Milli-Q deionized water (DI) dampened Kimwipe tissue. For SPMEs deployed with septas attached, the bottom 4cm (sediment exposed portions) of each SPME were sectioned into 1cm segments and placed into corresponding, pre-filled (i.e. Hexane or acetonitrile solvents) autosampler vials. Otherwise, the entire SPME fiber was sectioned and placed into pre-filled vials. Vials were then placed in the freezer and analyzed at TTU for both PAHs and PCBs.

3.5. SEDIMENT TRAPS

Sediment traps were deployed at Paleta Creek, NBSD during the Dry and Wet Weather seasons as shown in Figure 3-7. For the Dry Weather deployment, single standard cylindrical sediment traps were deployed at stations, P11 and P17, from 16-Jul-2015 to 12-Aug-2015 and a reference location near P01. For the Wet Weather deployment, three standard cylindrical sediment traps were deployed at each of the stations, P01, P08, P11 and P17, from 19-Oct-2015 through 23-Feb-2016.

Each sediment trap was prefilled with hyper-saline brine and topped off with ambient seawater. Traps were capped and lowered into the water to divers whom secured the traps to pre-deployed posts on the sediment surface. Once dive activities were completed, divers carefully removed caps from each sediment trap. Sediment traps were capped when any diving related activities occurred on station to avoid potential deposition from those efforts. At the termination of sediment trap deployment period, divers placed caps back on the traps and recovered and transferred to the surface crew with the assistance of a boat-mounted davit. Traps were transported back to the SSC Pac laboratory and allowed to settle. Once trap material sufficiently settled, overlying water was removed and the remaining material was subjected to chemical analysis and also used as part of bioassays (mixed with other sediment to make a sufficient volume for the assays). All three traps at a given location were combined prior to analysis. Sediment trap samples were not size segregated since these may not be the same sizes at the stormwater discharge due to aggregation.

Sediment traps were also deployed at the PSNS&IMF. Similar to the above, three sediment traps were deployed at two stations, PS06 and PS09, within 200ft of outfall locations OF19 and OF18AB (Figure 3-10Figure 3-10 Sediment trap deployment locations adjacent to outfalls OF19 (left) and OF18AB (right) at the PSNS&IMF.). Traps were deployed 4-Feb-2017 and recovered 30-Mar-2017. In the same fashion as above, traps were decanted and remaining material was collected for shipment to TTU for further processing.

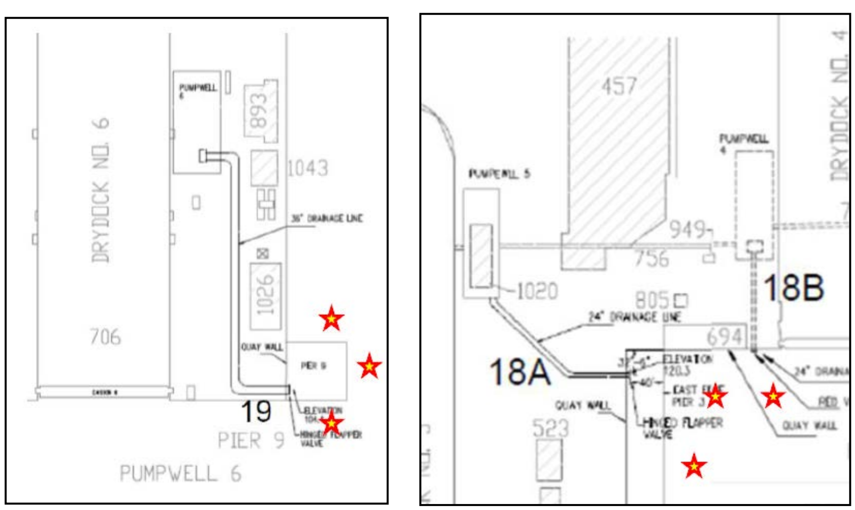


Figure 3-10 Sediment trap deployment locations adjacent to outfalls OF19 (left) and OF18AB (right) at the PSNS&IMF.

3.6. RECEIVING WATER QUALITY CHARACTERIZATION

Field conditions were monitored through a combination of deployed sensors and publicly available data for San Diego Bay and Puget Sound areas. Sensors that were deployed included acoustic backscatter and water velocities from Acoustic Doppler Current Profilers (ADCP), water temperature and dissolved oxygen (DO) from HOBO loggers, and optical backscatter from OBS sensors. Publicly available data include tide elevations from the NOAA Broadway Pier station and daily precipitation from the NWS Lindberg Field station.

Water velocities were measured using a Teledyne RD Instruments Workhorse Sentinel 600 kHz ADCP mounted on a stainless-steel cage deployed at station P17. The ADCP was deployed for Dry Weather monitoring from 15-July-2015 through 12-Aug-2015. Wet weather monitoring was conducted from 19-Oct-2015 through 23-Feb-2016, with an equipment check and sensor cleaning on 8-Dec-2015. Under both deployments, the profiler was setup to measure currents and acoustic backscatter at 1-meter intervals between 2 meters above the bottom and the water surface at 5-minute intervals. Data were collected during the entire duration of the deployment. Data collection was terminated when the ADCP was retrieved and the data were truncated to represent only the measurements made underwater on station.

Optical backscatter (OBS) or turbidity was measured using a Campbell Scientific OBS-3 system mounted to the same cage as the ADCP. The OBS sensor was launched with a 5-minute interval concurrently with the ADCP sensor. Data were collected during the entire duration of the deployment. The data were truncated to represent only the measurements made underwater while on station.

Temperature and dissolved oxygen (DO) were measured *in situ* using HOBO loggers (Onset© U26-001) mounted directly onto the SEA Ring within a single exposure chamber to measure water quality conditions experienced by the organisms while deployed (Figure 3-11). For Dry Weather monitoring, the HOBO loggers were launched with a 5-minute interval on 15-Jul-2015 through 12-Aug-2015. For the Wet Weather monitoring period, HOBO loggers were launched with a 5-minute interval on 26-Jan-2016 through 23-Feb-2016. For both deployments, data were truncated to represent only the measurements made underwater on station.

3.7. *IN-SITU* MONITORING

3.7.1. *IN-SITU* BIOACCUMULATION MONITORING

Bioaccumulation exposures were conducted both *in situ* and *ex situ* for different phases of the project. *In situ* bioaccumulation involved the use of Sediment Ecosystem Assessment Rings (SEA Rings) and subsequent processing of tissue samples. For the Dry and Wet weather deployment, Version 1.0 and Version 3.0 SEA Rings were used, respectively (Figure 3-11). Details of the deployment can be found in Appendix II Section 2.3.4.

The dry weather deployments served as a proof-of-concept and baseline assessment for characterization of contamination at Paleta Creek. Version 1.0 SEA Rings allowed for the passive settlement of particulate matter into the exposure chambers where organisms were housed.

Wet weather deployments utilized the Version 3.0 SEA Rings (ESTCP ER-201130), which consisted of ten exposure chambers with integrated, multifunctional caps. Caps include both water intake and outlet ports, and an organism delivery port. The intake ports connect to a series of low power individual centrifugal pumps that are programmable. For this deployment, SEA Rings were programmed to pump at a rate that would allow for maximum water exchanges over the course of the deployment period which was calculated to be approximately 138 turnovers of overlying water per day. For each station, 8 of the 10 potential replicates on a given SEA Ring were initiated with 5 clams each. Four of the eight replicates were equipped with an 80µm pre-filter and the remaining four replicates were equipped with a 500µm pre-filter. Additionally, an open cage with 15 clams were deployed adjacent to the SEA Ring. The purpose of the filters or lack of filter was to potentially isolate depositing particle fraction contribution to certain exposure chambers.

Figure 3-11. Version 1.0 (left) and Version 3.0 (right) SEA Rings that were deployed at Paleta Creek for *in situ* bioaccumulation studies.

SEA Rings were deployed for dry-weather/baseline characterization and for a wet weather characterization of the bioavailability of contaminants associated with the sediments at Paleta Creek. Organisms were either purchased from commercial vendors or field collected and acclimated to site conditions prior deployment. For the Dry Weather evaluation beginning July 2015, SEA Rings were deployed for 14-d and 28-d. at locations P11 and P17. For the Wet Weather evaluation beginning in January 2016, SEA Rings were deployed at all four receiving water locations (P17, P11, P08 and P01) for 28-d. The locations were chosen to represent before and after conditions for locations close to the stormwater discharge and to characterize the outer areas for reference. Each SEA Ring consisted of ten exposure chambers with organisms for bioaccumulation analysis. For the Dry Weather evaluation, five chambers contained the bivalve *Macoma nasuta* (bent-nosed clam) and five chambers contained the bivalve *Musculista senhousia* (Asian mussel) (Figure 3-12). For the Wet weather evaluation, all ten chambers contained the clam *Macoma nasuta*. On the day of deployment, five clams or mussels were directly loaded into exposure chambers with coarse stainless-steel mesh fastened to the bottom (to aid in recovery of organisms). Stainless steel mesh was also fastened to the top of each exposure chamber to allow for passive settling of particulate matter and to allow for flushing of ambient water conditions. SEA Rings were held in 17-gallon plastic Chemtainers in site water and lowered to the water surface where divers removed them from the container while underwater. Divers then pushed the SEA Rings gently into the sediment to a depth where the base plate of the unit became flush with the sediment surface, embedding exposure chambers to a depth of approximately 5 inches. SEA Rings were secured to nearby deployed plastic-coated fence stakes to further secure them and to assist with locating the SEA Rings upon recovery.

Figure 3-12 *Macoma nasuta* (bent-nosed clam, left) and *Musculista senhousia* (Asian mussel (source: http://sandiegobayenvtl.yolasite.com/nonnative-species.php, right) used for *in situ* bioaccumulation studies.

Following the 14- or 28-d exposure, SEA Rings were recovered by divers. Following an initial visual assessment of each SEA Ring, the device was gently lifted out of the sediment. Each SEA Ring was then brough to the surface and placed into a Chemtainer while underwater prior to transfer to the surface. Once at the surface, the stainless-steel mesh was removed and clams and mussels were recovered by hand and enumerated for survival. Organisms were depurated overnight in clean seawater and prepared for analysis.

Following recovery, clams and mussels were purged in clean seawater overnight, and the soft-body portion saved for tissue analysis. Wet tissue weights were assessed on a per-replicate basis for both organism types, then typically composited on a per-station basis, and tissues were frozen and shipped on blue ice to TTU chemistry laboratory, where digestion, extraction and analysis were conducted. Further details are provided in Appendix II.

3.7.2. *EX-SITU* BIOASSAYS

Laboratory-based exposures were conducted at the SSC Pacific Bioassay Laboratory. Figure *3-12* Macoma nasuta *(bent-nosed* clam, left) *and* Musculista senhousia (Asian mussel (source: http://sandiegobayenvtl.*yolasite*.com/nonnative-species.php, right) used for *in situ* bioaccumulation studies. For samples collected during the dry weather monitoring event in Oct/Nov-2014, composited, <63µm (when sufficient volume was present) and >63µm fraction sediment samples were used for *ex Situ* bioavailability studies. Approximately 100g of each sediment type was placed into 1L glass mason jars with 750mL of overlying uncontaminated 0.45µm filtered seawater (FSW).

For all other monitoring events, the intact cores that were collected by divers or by Van Veen were stored at 4°C until test initiations. For *ex situ* exposures, cores were placed into 1L glass mason jars and 0.45µm FSW was gently introduced for an approximate overlying water volume of 500mL.

In addition to the whole sediment samples collected from Paleta Creek at NBSD, sediment trap material collected over the course of the wet season was used in *ex situ* exposures. Trap material was tested by itself as well as in additive treatment where sediment trap material was introduced to the corresponding intact core sample collected at the beginning of the wet season. The amount of trap material added to the intact cores was proportional to the volume of sediment trap material recovered from each station.

Overlying water in all exposures was continuously aerated with filtered laboratory air delivered through Pasteur pipettes at a rate of approximately 100 bubbles per minute. A 24-h equilibration period with the overlying water was allowed prior to the introduction of test organisms or passive sample devices (Day 0).

Further details of the bioassays can be found in Appendix II.

3.7.3. HOC PASSIVE SAMPLING

SPMEs provided by TTU were used to measure sediment porewater organic contaminants. SPMEs were received pre-encased in a Henry Sampling Rod (Figure 3-13) and stored at 4°C until deployment. Rods were hand deployed by divers adjacent to SEA Ring units (Figure 3-13) to measure porewater and overlying water organic contaminant concentrations. For the Dry Weather deployment, three 60cm SPME rods were deployed approximately 15cm into the sediments with the remaining 45cm in the overlying water column. For the Wet Weather deployments, 30cm SPMEs were used with a deployment depth of approximately 15cm with the remaining 15cm in the overlying water column. SPME samplers were pre-loaded with performance reference compounds to assist in the analytical and partitioning analysis to report final porewater and overlying concentrations.

SPMEs were retrieved by divers and processed immediately by TTU personnel. Upon recovery, the depth of each sampler in the sediment was noted. Debris was removed from SPME fibers with deionized water wetted Kimwipes® and blotted dry prior to segmentation. Using ceramic cutters, the SMPE fibers were segmented at predetermined locations corresponding to specific depths of interest from the sediment-water interface. Segments were then transferred to 2mL amber vials pre-filled with appropriate solvent. Vials were stored at -17°C prior to shipping to TTU for analysis. Appropriate laboratory, field and PRC blanks were processed in a similar fashion for quality control and method performance.

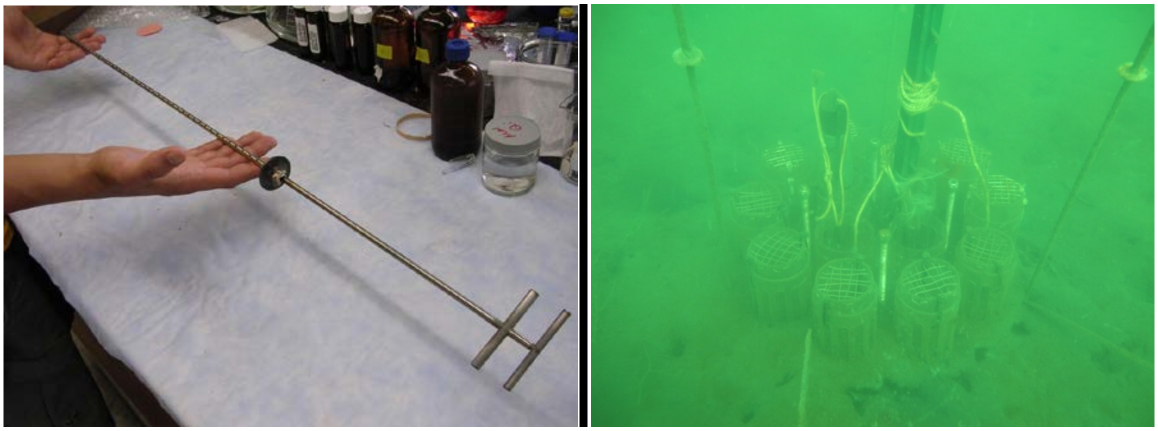


Figure 3-13 SPME rod used for measuring porewater and overlying water organic contaminant concentrations (left); deployment of SPME rods adjacent to SEA Ring (right).

Ex-situ passive sampling exposures were also conducted in the *ex-situ* bioassays using the methods described under *ex-situ* porewater sampling in sediments.

3.7.4. Inorganic Passive Sampling

Trace metal Diffusive Gradients in Thin-films (DGTs) were acquired from DGT Research, Lancashire, UK. The disk-style LSNM DGT (Figure 3-14) was used for measurement of cationic metals including Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn. The DGTs consisted of a plastic molded base (2.5 cm diameter) and a plastic top with a 3.14 cm^2 diameter window which allows for exposure to a layered setup of a polyethersulphone filter-membrane, 0.78mm thick polyacrylamide diffusive gel and 0.4 mm Chelex binding resin gel. When deployed either in solution or into sediments, metal ions diffuse through the filter membrane and diffusive gel and bind to the resin gel which continues to accumulate ions over the course of a deployment. In sediment applications, the DGT measures the mean flux of labile metals at the interface between the device and the sediment, or the labile pore-water concentrations. DGTs were stored in sealed, clean plastic bags at >0 to 4°C prior to deployment. Each bag contained a few drops of 0.01M $NaNO_3$ solution and was maintained moist throughout storage periods. DGTs were deployed in the same exposure chamber as the SPME fibers. The DGTs were pressed gently into the surface of the sediments to ensure full contact between the sediment and the exposure window/membrane of the DGT.

Figure 3-14 Diffusive Gradients in Thin-film (DGT) device

DGTs for the measurement of Hg were provided by TTU and under-went pre-treatment prior to use by purging in a 10mM solution of $NaNO_3$ with polyacrylamide resin strips. The solution, strips and DGTs were placed in a N_2 glove box and were bubbled with N_2 overnight. On exposure Day 0, Hg DGTs were removed from the N_2 box and immediately deployed into the exposure chambers in the same manner as the trace metal DGTs.

DGTs were exposed for 2 or 3-d and deployment and recovery times were recorded to the minute. Upon termination of exposure periods, DGTs were rinsed immediately with Milli-Q DI water to remove sediment. DGTs were placed in a labeled and clean plastic bag with minimal airspace and stored at >0 to 4°C until processed or shipped to TTU.

Trace metal DGTs were processed by SSC Pacific, while DGTs for the measurement of Hg were processed by TTU. Briefly, DGTs were disassembled and the Chelex resin gels removed and placed in clean micro-centrifuge tubes. All laboratory manipulation and analysis were done in <0.2µm High Efficiency particulate air (HEPA) filtered working stations, using acid-cleaned material, following trace metal clean techniques. The resin gel was exposed to 1000 µL quartz-still grade nitric acid (Q-HNO_3) for 24 hours before analysis. This was done to dissolve the metals back in solution, allowing the resin gel to stay as a solid membrane, instead of partially dissolving in solution.

Metals were quantified in the acidic solution by inductively coupled plasma with detection by mass spectrometry (ICP-MS) after dilution. The acidic solution was diluted in metal-free water (18 MΩ/cm H_2O) acidified to pH 2 with Q-HNO_3 and analyzed with a Perkin-Elmer SCIEX ELAN DRC II ICP-MS following USEPA method 200.8, Revision 5.4.

The mass of the metal accumulated in the resin gel layer (M) is calculated using:

$$M = Ce\,(V_{HNO3} + V_{gel})/fe$$

where Ce is the concentration of metals in the 1M HNO3 elution solution (in µg/l), V_{HNO3} is the volume of HNO_3 added to the resin gel, V_{gel} is the volume of the resin gel, typically 0.15 ml, and fe is the elution factor for each metal, typically 0.8.

The concentration of metal measured by DGT (CDGT) was calculated using:

$$C_{DGT} = M\Delta g/(DtA)$$

where Δg is the thickness of the diffusive gel (0.8 mm) plus the thickness of the filter membrane (typically 0.14 mm), D is the diffusion coefficient of metal in the gel, t is deployment time and A is exposure area (A=3.14 cm^2).

4. RESULTS

4.1. NBSD DRY WEATHER SAMPLING-2014

Some preliminary dry weather sampling was conducted in 2014 to identify and test methods of sample collection and analysis. This was initially planned as a year for wet weather sampling but due to an extended drought in Southern California stormwater sampling could not be conducted. The data was not employed in subsequent analysis since it could not be linked to storm events and sediment recontamination assessments and the preliminary nature of some of the methods employed. Some of these methods were not consistent with the modified methods used later and described below.

4.2. DRY WEATHER SAMPLING-2015

Dry weather sampling was conducted during July 2015. These samples were collected in the receiving waters, in particular at a reference location (close to location P1 employed in subsequent sampling) and P11 and P17 (see Figure 3-8). P11 and P17 are in the inner creek and P17 is closest to the stormwater discharge location C1W (and location CS above). Sediment cores were collected July 15, 2015 and sediment traps were deployed July 15-Aug 12, 2015. Although conducted during the traditionally dry season and after a long period of drought, a small rainfall occurred immediately prior to the July 15 sampling date and two days of more substantial rains (totaling approximately 1.5 inches) occurred during the sediment trap deployment. Collected sediment was also subjected to *ex-situ* bioassays and porewater analysis via passive sampling. Appendix II summarizes all data collected during this sampling effort.

The sediment samples (shown in Table 4-1, Table 4-2) indicated substantial elevation in concentration close to the stormwater discharge location (P11 and P17 relative to the reference station P1) for most chemical constituents. Although bulk surficial sediment samples indicated higher concentrations near the discharge of Paleta Creek, sediment traps, which indicate current depositing sediment often showed different trends (Table 4-3, Table 4-4). This is illustrated for Cu in Figure 4-1. As, Hg and Ni also showed sediment trap concentrations higher at P11 rather than the P17 location closer to Paleta Creek discharge despite showing surficial sediment concentrations higher at P17. Cd, Pb and Zn, however, showed both higher surficial sediment and sediment trap concentrations at location P17. Among organic compounds both PCBs and pyrethroids showed behavior similar to Cu with surficial sediment showing high concentrations at P17 while sediment traps exhibited higher concentrations at P11. PAHs, however, showed the anomalous behavior of higher concentrations at P11 in both surficial sediments and sediment traps (Figure 4-2). The distribution of the contaminants is undoubtedly related to the source and settling characteristics of the contaminants both over time and in the stormwater associated with the events observed during sampling.

Table 4-1 2015 Dry Weather Bulk Sediment Chemistry Results – NBSD (inorganics).

Compartment ID	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/g DW)	Pb (µg/g DW)	Ni (µg/g DW)	Zn (µg/g DW)
Reference Station	3.6 (0.2)	0.1 (0.0)	61.1 (2.2)	0.3	22.7 (0.2)	7.7 (0.1)	113.1 (1.2)
P11	5.3 (0.1)	1.5 (0.1)	161.0	0.71	138.8 (30.0)	18.1 (2.3)	387.7 (18.8)
P17	9.1 (0.1)	1.8 (0.1)	334.8 (50.2)	0.8	141.6 (17.9)	23.5 (0.5)	674.6 (12.7)

Table 4-2 2015 Dry Weather Bulk Sediment Chemistry Results – NBSD (organics).

Compartment ID	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/g OC)	Total PCBs (µg/kg)	Total PCBs (µg/g OC)	Pyrethroid Pesticides (µg/kg)	Pyrethroid Pesticides (µg/g OC)
Reference Station	1.75	0.17	225.5	14.3	8.1	0.5	0.8	0.05
P11	2.76	0.17	1717.4	66.4	221.9	8.6	6.1	0.2
P17	1.63	0.15	1290.8	87.2	233.5	15.8	46.0	3.1

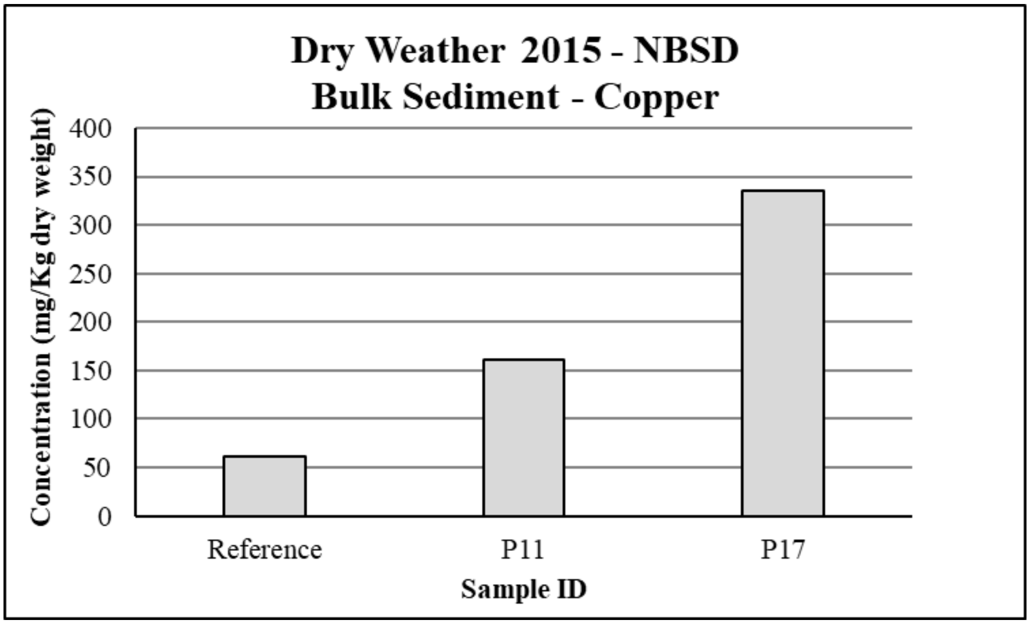
Table 4-3 2015 Dry Weather Sediment Trap Chemistry Results – NBSD (inorganics).

Sample ID	As (µg/g)	Cd (µg/g)	Cu (µg/g)	Hg (µg/g)	Pb (µg/g)	Ni (µg/g)	Zn (µg/g)
P11	12.9 (0.4)	0.5	310.1	0.73 (0.1)	127.6 (3.6)	31.6 (5.4)	412.8 (57.7)
P17	9.4 (0.4)	1.3 (0.3)	255.5	0.49 (0.0)	263.3 (8.7)	28.1 (1.3)	666.0 (91.3)

Table 4-4 2015 Dry Weather Sediment Trap Chemistry Results – NBSD (organics).

Sample ID	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/g OC)	Total PCBs (µg/kg)	Total PCBs (µg/g OC)	Pyrethroid Pesticides (µg/g)	Pyrethroid Pesticides (µg/g OC)
P11	3.51 (0.06)	0.13 (0.02)	4576.6	135.4	384.9	11.4	363.2	10.7
P17	6.25 (0.24)	0.2 (0.05)	4239.6	69.7	178.1	2.9	29.2	0.48

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect



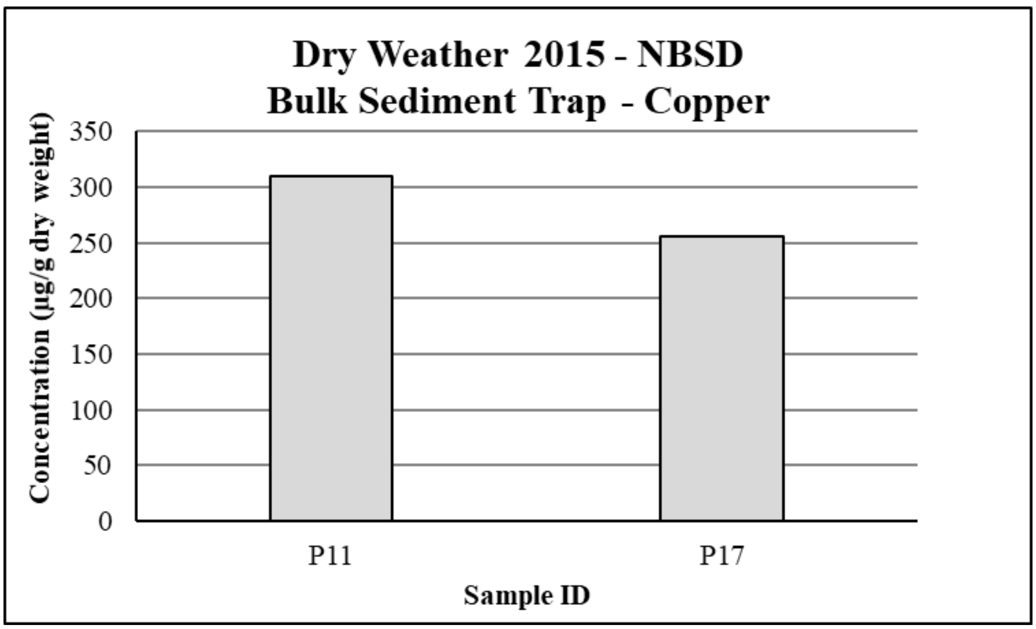
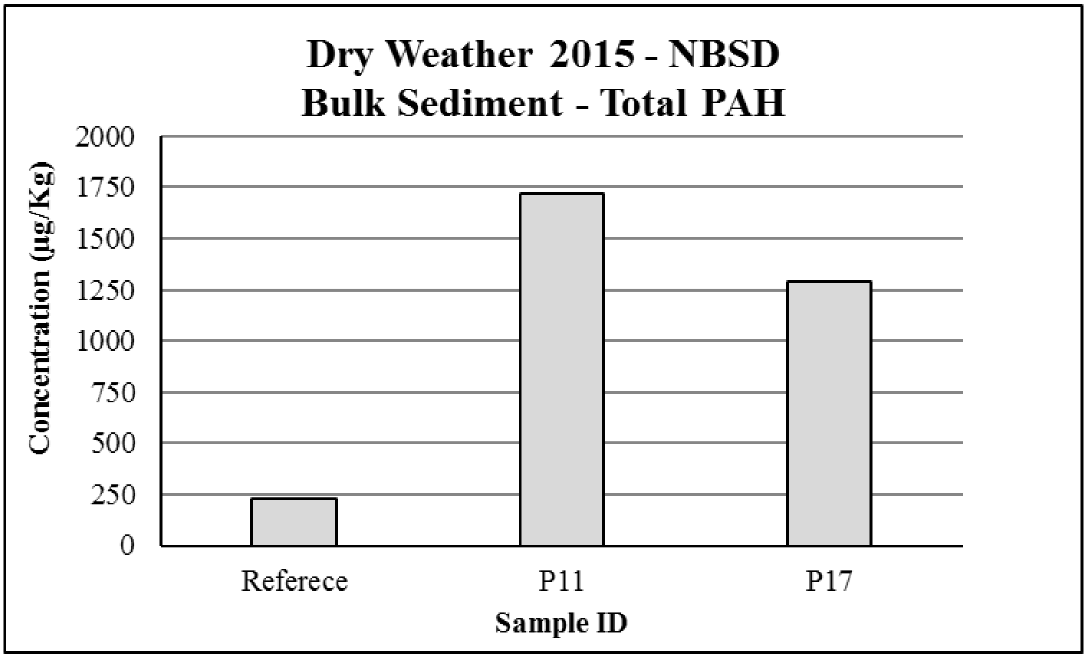


Figure 4-1 Cu surficial sediment and sediment trap concentrations during dry weather sampling in July-August 2015



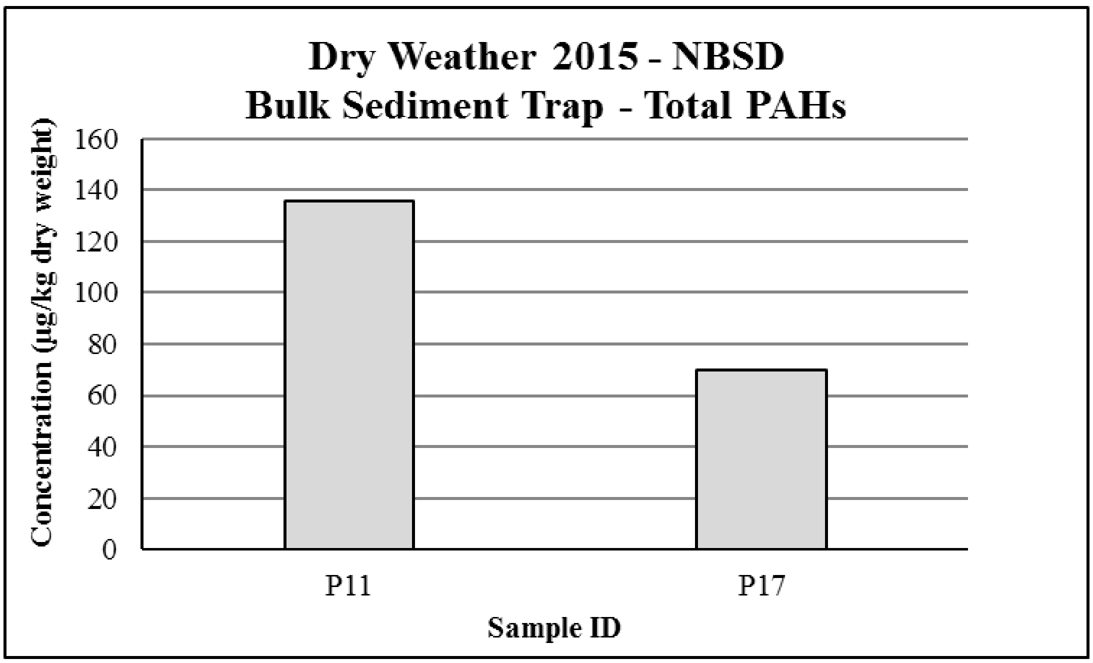


Figure 4-2 Surficial sediment and sediment trap concentrations of Total PAHs during dry weather sampling in July-August 2015

Although sediment concentrations indicated elevated concentrations near the confluence of the stormwater conveyance system and the receiving waters, the samples cannot indicate whether the elevated levels were due to

- Recent storm events immediately before and during the period of sampling despite the typically limited rainfall historically during this period.
- Historical sources that have led to accumulation of contaminants.
- Ongoing sources in the stormwater system, particularly local to the zone of accumulation
- Continuing sources on the receiving waters that leads to settling and accumulation in the relatively quiescent and tidal zones near the confluence with the stormwater conveyance system

In summary, dry weather sediment sampling in 2015 showed elevated concentrations of many contaminants and some evidence of toxicity in the lower reaches of the stormwater conveyance system. Sediment samples, by themselves, are unlikely to allow identification of the relationship of stormwater releases to sediment recontamination. The sediment traps collected during July – August 2015 are likely more informative but represent unusual storm events occurring during the dry season after a long period of drought. Sampling before, during and after the wet season in 2015-2016 and 2016-2017 was planned to better understand stormwater and contaminant behavior.

4.3. <u>STORMWATER SAMPLING</u>

4.3.1. *NBSD STORMWATER SAMPLING 2015-2016*

Intensive stormwater sampling was conducted at NBSD during the 2015/16 wet season. Equipment was deployed on October 13, 2015, but due to unusually dry weather, the onset of the wet season was delayed. Two qualifying monitoring events were sampled on January 5-7, 2016 (Storm event 1 - 1.87 inches of rain) and January 31-February 1, 2016 (Storm event 2 - 0.16 inches of rain). Although together these storms represented only about 28% of the total precipitation in San Diego during the 2015-2016 year, one or the other were essentially equivalent to about 75% of the storms observed. The remaining 25% were storms in the range of 0.5 inch of total precipitation, intermediate between the two types of storms monitored. The monitored storms also represented about 80% of the precipitation that occurred in January and February, 2016 while sediment traps were placed in the receiving waters. Thus the monitoring program was judged to provide storms representative of the conditions normally expected in San Diego.

The monitoring program was able to successfully collect stormwater from the targeted locations, despite significant challenges associated with a highly tidally influenced water body, multi-leveled complex sampling triggers to target freshwater sample collection, and unusually flashy hydrologic patterns. The sampler was designed to trigger only during outflow as defined by flow direction and salinity. Because of the highly variable flow velocities and tidal fluctuations, the total outflow measured by the sampler at the Paleta Creek discharge point (C1W) is somewhat uncertain, particularly during the low flow event Jan 31- February 1, 2016. The contaminant loads and solid normalized loads, however, are unaffected by the total flows and will be the focus of this analysis.

The collected flow information at discharging ourfalls is shown in Table 4-5 and information recorded at an automatic sampler is illustrated in Figure 4-3. Flows at all outfalls and upstream locations are small relative to that at C1W, the discharge of Paleta Creek into the receiving waters, and the stormwater related sediment recontamination will be assessed primarily by comparing loads at location C1W to contaminants settling or deposited at sediment sampling locations in the receiving waters.

As indicated under methods, 10 L samples of stormwater were collected at each of the stormwater sampling locations identified in Figure 3-1 and processed according to the schematic Figure 3-4 to define contaminant distribution by particle size. Two key sets of stormwater samples were collected, automatic collected samples at each of the fixed locations in the stormwater conveyance system (channel samples C1W and C2W and outfalls, O1W-O4W) and 10 L grab samples collected in the receiving waters near the C1W Paleta Creek discharge (A1W-A3W). Results are reported in two ways, as contaminant mass per volume in a particular particle size interval and as contaminant mass per mass of solids in that particle size interval. The first is proportional to total contaminant stormwater load at that sampling location (Load=mass/volume x stormwater volumetric flow). The second is related to the contaminant strength or the potential sediment recontamination concentrations in the settled sediment.

Table 4-5 Total outflow in watershed outfalls for the two storm events.

Event	Location	Total Outflow (ft^3)	Total Outflow (m^3)
Storm - I	C1W	3,478,000	98,490
	O1W	6,151	174.2
	O2W	22,325	632.2
Storm-II	C1W	4,280,000*	121,200*
	O1W	1,176	33.3
	O2W	16,209	459

*Flow during the smaller storm event 2 at Paleta Creek discharge location C1W is likely significantly overestimated due to difficulties separating Creek outflow from waves and tides

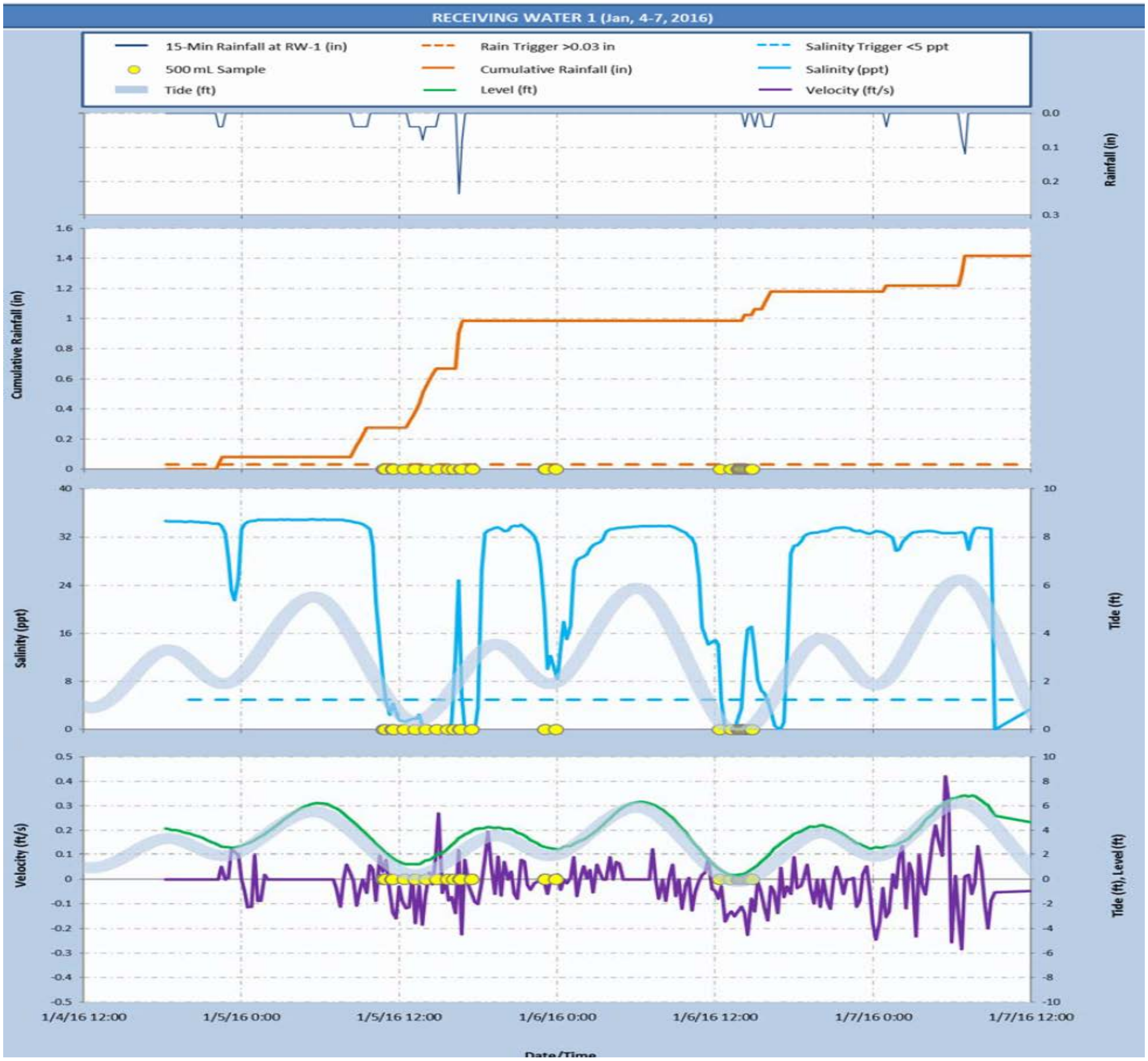


Figure 4-3 Recorded precipitation, flow and salinity at an automatic sampler (Receiving water 1- Sampler C1W shown during storm event 1 – Jan 4-7, 2016)

The behavior of the stormwater conveyance system will be illustrated by examining the contaminants Cd, Cu, Total PAHs and Total PCBs. All collected data for all contaminants monitored can be found in Appendix I and further discussion of contaminant behavior can be found in Appendix II and III. Values of solids, Cd and Cu concentrations in specific solid fractions and equivalent concentration on the solids at each stormwater sampling point can be found in Table 4-6 for Event 1 and in Table 4-7 for Event 2.

Table 4-6 Size interval based concentration of solids, aqueous and particle normalized concentration of Cd and Cu in sampled locations from the first storm event

Location ID	Particle size interval (µm)	Solids (mg/L)	Cd-water (µg/L)	Cu-water (µg/L)	Cd-particle (mg/Kg)	Cu-particle (mg/Kg)
C2W	Bulk	NA	0.94 (0.02)	75.3 (4.2)	NA	NA
	Total (>0.45)	269.0	0.94 (0.02)	69.8 (4.2)	3.5 (0)	259.5 (0)
	< 0.45	NA	0.00	5.5 (0.1)	NA	NA
	0.45-5	1.1	0.00	0.8 (0.2)	NA	NA
	5-20	114.3	0.21 (0.01)	13.4 (4.1)	1.84 (0)	116.9 (0)
	20-63	99.2	0.15 (0.01)	13.5 (4.2)	1.46 (0)	136.2 (0)
	> 63	54.4	0.59 (0.02)	42.1 (4.3)	10.79 (0)	773.8 (0.1)
O4W	Bulk	NA	0.19 (0)	24.1 (0.4)	NA	NA
	Total (>0.45)	184.4	0.19 (0)	18.4 (0.4)	1.06 (0)	99.6 (0)
	< 0.45	NA	0.00	5.7 (0.1)	NA	NA
	0.45-5	2.0	0.00	0.9 (0.2)	0.00	NA
	5-20	159.5	0.00	4.6 (2.9)	0.00	28.5 (0)
	20-63	13.8	0.00	8.4 (6.4)	0.00	608.8 (0.5)
	> 63	9.2	0.19	4.6 (5.7)	NA	NA
O3W	Bulk	NA	0.4 (0.02)	21 (2.1)	NA	NA
	Total (>0.45)	N	0.19 (0.02)	6.2 (2.1)	N	N
	< 0.45	NA	0.21	14.8 (0.1)	NA	NA
	0.45-5	N	0.00	0.3 (0.8)	0.0	N
	5-20	N	0.01	0.0	N	N
	20-63	0.0	0.03 (0.01)	5.2 (0.9)	0.03 (0.01)	5.2 (0.9)
	> 63	5.4	0.16 (0.02)	0.8 (2.3)	NA	NA
C1W	Bulk	NA	0.41 (0.01)	32.7 (0.6)	NA	NA
	Total (>0.45)	241.6	0.41 (0.01)	25 (1)	1.68 (0)	103.3 (0)
	< 0.45	NA	0.00	7.8 (0.9)	NA	NA
	0.45-5	23.5	0.00	5.3 (4.3)	0.00	226.5 (0.2)
	5-20	46.3	0.00	0.0	0.00	0.0
	20-63	108.3	0.00	5.2 (0.4)	0.00	47.8 (0)
	> 63	63.5	0.41 (0.01)	17.7 (0.6)	6.38 (0)	278.2 (0)

Location ID	Particle size interval (µm)	Solids (mg/L)	Cd-water (µg/L)	Cu-water (µg/L)	Cd-particle (mg/Kg)	Cu-particle (mg/Kg)
O1W	Bulk	NA	0.54 (NA)	16.8	NA	NA
	Total (>0.45)	125.3	0.13 (0.01)	10.5 (0.2)	1.01 (0)	83.8 (0)
	< 0.45	NA	0.41 (0.01)	6.3 (0.2)	NA	NA
	0.45-5	0.0	0.00	0.0	0.0	0.0
	5-20	38.7	0.01 (0.01)	2.2 (0.1)	0.15 (0)	55.7 (0)
	20-63	39.0	0.08 (0.02)	5 (0.3)	2.12 (0)	128.4 (0)
	> 63	47.5	0.15 (0.01)	4.6 (0.3)	3.19 (0)	96.6 (0)
O2W	Bulk	NA	2.65 (0.08)	144.5 (4.1)	NA	NA
	Total (>0.45)	1067.0	1.86 (0.09)	110 (4.4)	1.74 (0)	103.1 (0)
	< 0.45	NA	0.79 (0.04)	34.4 (1.6)	NA	NA
	0.45-5	87.8	0.00	0.1 (2.5)	0.0	1.2 (0)
	5-20	969.1	1.39 (0.06)	73.7 (2)	1.43 (0)	76 (0)
	20-63	5.3	0.00	0.0	0.0	0.0
	> 63	4.7	0.78 (0.11)	41.5 (4.8)	NA	NA
A1W	Bulk	NA	0.62 (0.02)	50.9 (0.6)	NA	NA
	Total (>0.45)	229.7	0.42 (0.02)	38 (0.7)	1.81 (0)	165.2 (0)
	< 0.45	NA	0.2 (0)	12.9 (0.4)	NA	NA
	0.45-5	0.0	0 (0.01)	0.4 (1.4)	0 (0.01)	0.4 (1.4)
	5-20	121.7	0.14 (0.02)	18.7 (1.7)	1.15 (0)	154.1 (0)
	20-63	79.1	0.1 (0.02)	13.3 (1.2)	1.23 (0)	168.1 (0)
	> 63	28.9	0.17 (0.02)	5.6 (0.9)	6.04 (0)	192 (0)
A2W	Bulk	NA	0.29 (0.01)	23 (0.5)	NA	NA
	Total (>0.45)	230.7	0.29 (0.01)	15.5 (0.5)	1.24 (0)	67.2 (0)
	< 0.45	NA	0.00	7.5 (0.1)	NA	NA
	0.45-5	0.0	0.00	1.6 (0.4)	0.0	1.6 (0.4)
	5-20	199.0	0.19	9.2 (1.2)	0.9	46.4 (0)
	20-63	31.6	0.01 (0.02)	1 (1.3)	0.32 (0)	31.7 (0)
	> 63	0.0	0.09 (0.02)	3.7 (0.7)	0.09 (0.02)	3.7 (0.7)
A3W	Bulk	NA	0.00	12.5 (1.0)	0.00	NA
	Total (>0.45)	N	0.00	0.00	0.00	0.0
	< 0.45	NA	0.00	12.7 (1.2)	0.00	NA
	0.45-5	N	0.00	0.00	0.00	0.0
	5-20	26.0	0.00	0.00	0.00	0.0
	20-63	0.0	0.00	0.6 (1.0)	0.00	0.6 (0.1)
	> 63	1.2	0.00	0.4 (1.4)	0.00	NA

Table 4-7 Size interval based concentration of solids, aqueous and particle normalized concentration of Cd and Cu in sampled locations from the second storm event

Location ID	Particle size interval (µm)	Solids (mg/L)	Cd-water (µg/L)	Cu-water (µg/L)	Cd-particle (mg/Kg)	Cu-particle (mg/Kg)
C2W	Bulk	NA	0.39	60.4	NA	NA
	Total (>0.45)	722.5	0.39	48.8 (1.6)	0.54	67.6 (0)
	< 0.45	NA	0.00	11.6 (1.6)	NA	NA
	0.45-5	0.0	0.00	0	0.00	0.0
	5-20	143.3	0.00	17.6 (1)	0.00	122.9 (0)
	20-63	128.4	0.20	4.0	1.55	30.9
	> 63	450.8	0.19	28.0	0.43	62.1
O4W	Bulk	NA	0.00	49.1 (0.3)	NA	NA
	Total (>0.45)	N	0.00	6.4 (0.3)	0.0	N
	< 0.45	NA	0.00	42.8	NA	NA
	0.45-5	N	0.00	3.4 (3.5)	0.0	N
	5-20	N	0.00	0.4 (4.6)	0.0	N
	20-63	3.5	0.00	19.1 (3)	0.0	NA
	> 63	1.5	0.00	0.0	0.0	0.0
C1W	Bulk	NA	0.23	29.6 (1.8)	NA	NA
	Total (>0.45)	121.9	0.23	15.8 (4.6)	1.87	129.8 (0)
	< 0.45	NA	0.00	13.8 (4.3)	NA	NA
	0.45-5	5.4	0.00	0	0.00	0.0
	5-20	68.9	0.00	13.1 (2.3)	0.00	190 (0)
	20-63	39.1	0.22	3.1 (2.8)	5.66	78.3 (0.1)
	> 63	8.5	0.01	1.4 (2.7)	NA	NA
O2W	Bulk	NA	0.00	64.6 (4.2)	NA	NA
	Total (>0.45)	N	0.00	14.5 (5.3)	0.0	N
	< 0.45	NA	0.00	50.1 (3.2)	NA	NA
	0.45-5	N	0.00	3.8 (4.8)	0.0	N
	5-20	N	0.00	3 (3.8)	0.0	N
	20-63	9.4	0.00	2.7 (6)	0.0	NA
	> 63	4.6	0.00	5 (7.2)	0.0	NA

Location ID	Particle size interval (µm)	Solids (mg/L)	Cd-water (µg/L)	Cu-water (µg/L)	Cd-particle (mg/Kg)	Cu-particle (mg/Kg)
A1W	Bulk	NA	0.00	76.2 (5)	NA	NA
	Total (>0.45)	N	0.00	2.4 (11.8)	0.0	N
	< 0.45	NA	0.00	73.8 (10.6)	NA	NA
	0.45-5	N	0.00	0.0	0.0	0.0
	5-20	N	0.00	0.0	0.0	0.0
	20-63	20.8	0.00	4.9 (14)	0.0	234.7 (0.7)
	> 63	5.2	0.00	4.4 (12)	0.0	NA
A2W	Bulk	NA	0.00	62.5 (1)	NA	NA
	Total (>0.45)	N	0.00	1.4 (3.1)	0.0	N
	< 0.45	NA	0.00	61.1 (3)	NA	NA
	0.45-5	N	0.00	0.0	0.0	0.0
	5-20	N	0.00	3.4 (5.2)	0.0	N
	20-63	1.2	0.00	5.3 (5.9)	0.0	NA
	> 63	1.4	0.00	1.7 (3.8)	0.0	NA

The average contaminant loads of cadmium segregated by particle size at the various sampling locations are shown in Figure 4-4.

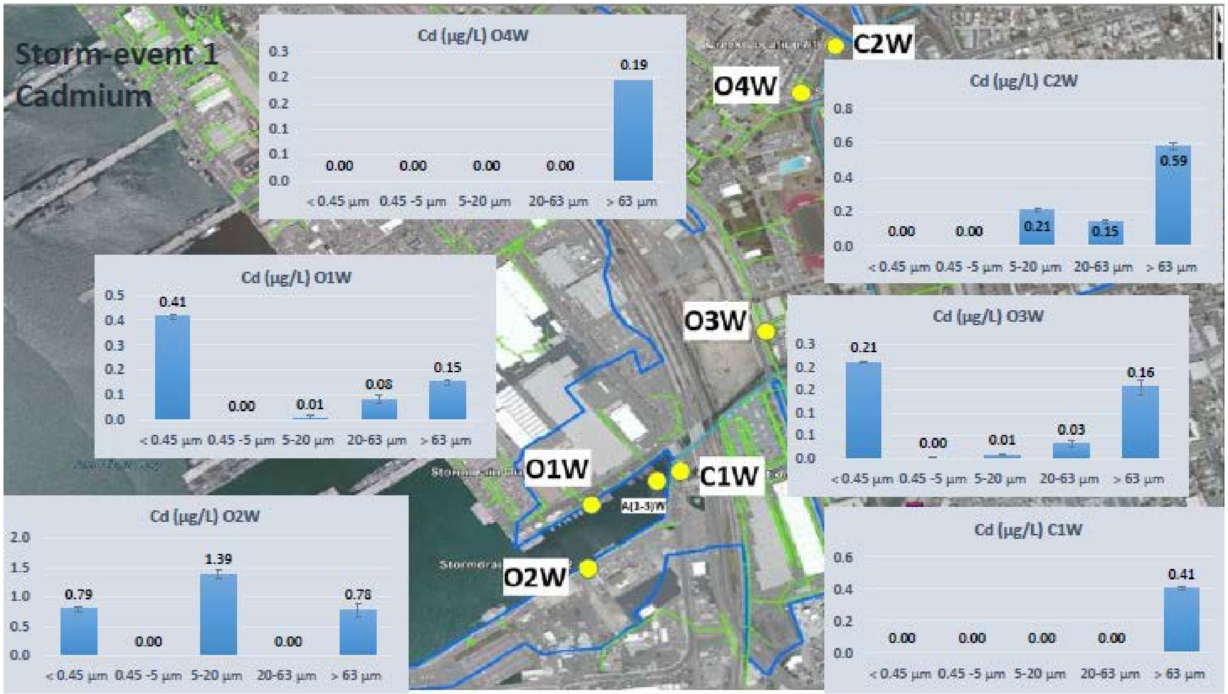


Figure 4-4 Cd loads in outfall and Paleta Creek locations – Storm event 1

As shown in Figure 4-4, cadmium is largely associated with larger particles (>63 µm) except in relatively low volume outfalls (O1W-O3W). Most importantly, the vast majority of the outflow at the mouth of Paleta Creek (C1W) is almost entirely in larger particles that would be expected to settle quickly leading to high concentrations in the sediment in near-receiving waters. Cd on fine particles is present in other outfalls but they contribute fairly small amounts of mass to the receiving waters and therefore pose minimal sediment recontamination risks.

Error! Reference source not found. shows that the Cd concentrations size fractions do not track with the suspended solids size distribution. For example, in the Paleta Creek discharge at location C1W, suspended solids are predominantly found in smaller sizes than the Cd which is found almost entirely in the >63 µm fraction.

Error! Reference source not found. also shows that the Cd concentration on the solids in outfall O2W are much higher than at any other sampling location. This may suggest a location appropriate for controls of Cd releases but the low volume discharged from O2W relative to C1W suggests that its contribution is minimal to receiving water sediment recontamination.

The measurements during Event 2 also show that Cd is primarily associated with larger particles (>20 µm) even in the lower flow event although not in the largest particles (>63 µm) as in Event 1 (Figure 4-5).

Contrasting with the behavior of Cd is that of Cu. As shown in Figure 4 7 approximately 50% of the Cu discharged from C1W is associated with particles smaller than 63 µm with a substantial fraction passing a 0.45 µm filter and considered operationally dissolved. In the second lower volume storm event, there is essentially no copper associated with larger particles except in the upstream portion of the stormwater conveyance system (Figure 4-7).

Figure 4-5 Cd loads in outfall and Paleta Creek locations – Storm event 2. Cd loads from outfalls O1W and O2W were not significant.

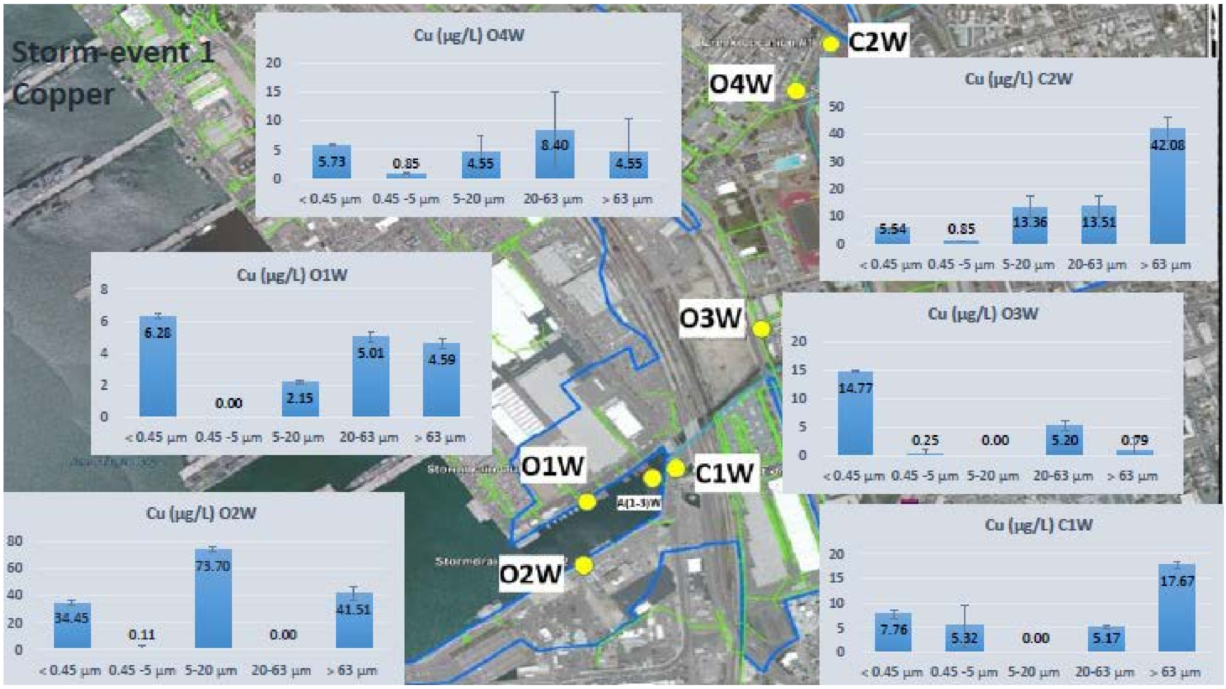


Figure 4-6 Cu loads in outfall and Paleta Creek locations – Storm event 1

Figure 4-7 Cu loads in outfall and Paleta Creek locations – Storm event 2

Organic contaminants also show differences in the degree of association with readily settling large particles. Total PAHs are strongly associated with large particles as indicated by Table 4-8, Table 4-9, Figure 4-8 and Figure 4-9

Table 4-8 Size interval based concentration of solids, aqueous and particle normalized concentration of tPAHs and tPCBs in sampled locations from the first storm event

Location ID	Particle size interval (µm)	Solids (mg/L)	tPAH-water (ng/L)	tPCB-water (ng/L)	tPAH-particle (µg/Kg)	tPCB-particle (µg/Kg)
C2W	Bulk	NA	1282	3.16	NA	NA
	Total (>0.7)	259	1226	1.11	4730	4.29
	< 0.7	NA	99.1	2.27	NA	NA
	0.7-2.7	11.4	38.4	0.24	3372	21.3
	2.7-20	147	337	0.73	2293	4.97
	20-63	45.1	299	10.6	6621	235
	> 63	55.7	795	0.00	14252	0.02
O4W	Bulk	NA	378	5.79	NA	NA
	Total (>0.7)	186.6	334	4.32	1790	23.2
	< 0.7	NA	43.9	1.50	NA	NA
	0.7-2.7	58.4	10.5	1.35	180	23.1
	2.7-20	95.1	59.2	1.98	623	20.8
	20-63	33.1	90.7	1.31	2738	39.5
	> 63	0.0	194	0.58	NA	NA
O3W	Bulk	NA	692	NA	NA	NA
	Total (>0.7)	N	654	NA	N	NA
	< 0.7	NA	38.6	1.86	NA	NA
	0.7-2.7	N	33.1	1.76	N	N
	2.7-20	N	85.1	4.01	N	N
	20-63	2.8	14.2	0.14	NA	NA
	> 63	1.8	529	NA	NA	NA
C1W	Bulk	NA	1213	31.8	NA	NA
	Total (>0.7)	268	1144	27.0	4272	101
	< 0.7	NA	71.1	5.08	NA	NA
	0.7-2.7	12.5	14.3	0.64	1142	51.6
	2.7-20	158	401	16.1	2537	102
	20-63	46.6	433	13.1	9294	281
	> 63	50.7	370	0.78	7291	15.4

Location ID	Particle size interval (µm)	Solids (mg/L)	tPAH-water (ng/L)	tPCB-water (ng/L)	tPAH-particle (µg/Kg)	tPCB-particle (µg/Kg)
O1W	Bulk	NA	835	5.25	NA	NA
	Total (>0.7)	120.1	758	2.33	6314	19.4
	< 0.7	NA	77.2	3.35	NA	NA
	0.7-2.7	0.0	1.7	0.70	0.0	0.00
	2.7-20	29.6	121	0.14	4086	4.66
	20-63	58.6	161	2.63	2750	44.9
	> 63	31.9	493	1.25	15482	39.24
O2W	Bulk	NA	3028	124	NA	NA
	Total (>0.7)	1110.7	2759	87.2	2484	78.5
	< 0.7	NA	272	36.8	NA	NA
	0.7-2.7	28.8	1.6	14.4	56.7	499
	2.7-20	1053.4	491	282	466	267
	20-63	20.6	8.8	0.00	426	0.00
	> 63	7.9	2389	0.32	NA	NA
A1W	Bulk	NA	3588	17.9	NA	NA
	Total (>0.7)	241.8	3566	15.5	14750	63.9
	< 0.7	NA	21.4	2.54	NA	NA
	0.7-2.7	0.0	12.6	1.01	0.0	0.00
	2.7-20	115.9	812	29.4	7007	254
	20-63	101.7	679	27.1	6670	266
	> 63	24.1	2086	0.34	86513	14.1
A2W	Bulk	NA	581	6.76	NA	NA
	Total (>0.7)	246.5	526	5.32	2135	21.6
	< 0.7	NA	103	1.54	NA	NA
	0.7-2.7	38.1	30.3	1.87	794	49.0
	2.7-20	200.3	169	4.44	843	22.2
	20-63	8.1	35.3	4.32	NA	NA
	> 63	0.0	316	0.17	NA	NA
A3W	Bulk	NA	148	NA	NA	NA
	Total (>0.7)	N	40.9	NA	N	NA
	< 0.7	NA	113	1.54	NA	NA
	0.7-2.7	N	27.5	1.18	N	N
	2.7-20	N	13.3	1.15	N	N
	20-63	6.2	9.7	0.25	NA	NA
	> 63	1.5	20.8	NA	NA	NA

Table 4-9 Size interval based concentration of solids, aqueous and particle normalized concentration of tPAHs and tPCBs in sampled locations from the second storm event

Location ID	Particle size interval (µm)	Solids (mg/L)	tPAH-water (ng/L)	tPCB-water (ng/L)	tPAH-particle (µg/Kg)	tPCB-particle (µg/Kg)
C2W	Bulk	NA	1217	70.3	NA	NA
	Total (>0.7)	784.4	1188	66.6	1515	84.9
	< 0.7	NA	28.9	3.91	NA	NA
	0.7-2.7	0.0	2.5	0.35	0.0	0.00
	2.7-20	62.9	203	3.1	3230	49.2
	20-63	190.7	752	4.42	3944	23.2
	> 63	530.7	647	60.1	1219	113
O4W	Bulk	NA	46.4	3.59	NA	NA
	Total (>0.7)	N	20.8	0.86	N	N
	< 0.7	NA	26.8	3.30	NA	NA
	0.7-2.7	N	0.3	0.30	N	N
	2.7-20	N	9.6	0.69	N	N
	20-63	1.9	5.0	0.87	NA	NA
	> 63	1.1	15.9	0.92	NA	NA
C1W	Bulk	NA	280	11.1	NA	NA
	Total (>0.7)	116.8	252	8.94	2160	76.6
	< 0.7	NA	27.1	2.80	NA	NA
	0.7-2.7	0.0	2.1	0.60	0.0	0.00
	2.7-20	63.6	53.9	1.57	848	24.6
	20-63	27.6	126	4.78	4577	173
	> 63	25.6	82.8	2.49	3229	97.2
O2W	Bulk	NA	184	6.73	NA	NA
	Total (>0.7)	N	144	5.65	N	N
	< 0.7	NA	42.5	1.16	NA	NA
	0.7-2.7	N	4.0	1.06	N	N
	2.7-20	N	30.5	3.92	N	N
	20-63	9.8	26.0	5.97	NA	NA
	> 63	5.9	107	6.73	NA	NA

Location ID	Particle size interval (µm)	Solids (mg/L)	tPAH-water (ng/L)	tPCB-water (ng/L)	tPAH-particle (µg/Kg)	tPCB-particle (µg/Kg)
A1W	Bulk	NA	203	4.59	NA	NA
	Total (>0.7)	N	188	3.70	N	N
	< 0.7	NA	15.2	0.91	NA	NA
	0.7-2.7	N	5.5	0.34	N	N
	2.7-20	N	50.9	1.07	N	N
	20-63	18.6	55.9	3.25	2999	174
	> 63	4.5	86.7	0.11	NA	NA
A2W	Bulk	NA	66.9	2.10	NA	NA
	Total (>0.7)	N	48.3	1.32	N	N
	< 0.7	NA	36.4	0.86	NA	NA
	0.7-2.7	N	7.5	0.14	N	N
	2.7-20	N	29.2	3.42	N	N
	20-63	3.9	6.9	0.10	NA	NA
	> 63	0.0	16.0	0.08	NA	NA

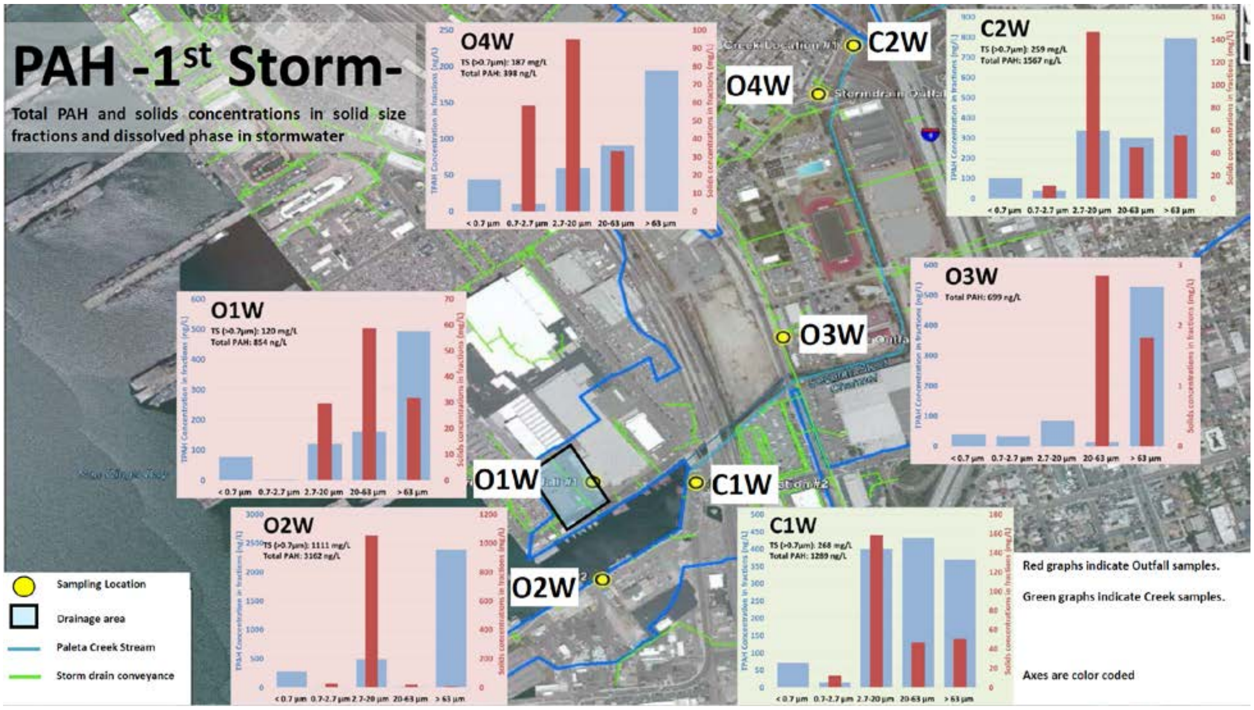


Figure 4-8 Total PAH and suspended solid loads in outfall and Paleta Creek locations – Storm event 1. Suspended solids <20 µm in outfall O3W were low and not reliably measured due to salinity interferences. (Shown as 0)

Note that PAH loading is not distributed in the same manner as the particle size distribution which exhibits a greater fraction in smaller particle sizes. In the lower volume 2nd storm event the total PAHs were not as strongly associated with the largest particles although the results were similar.

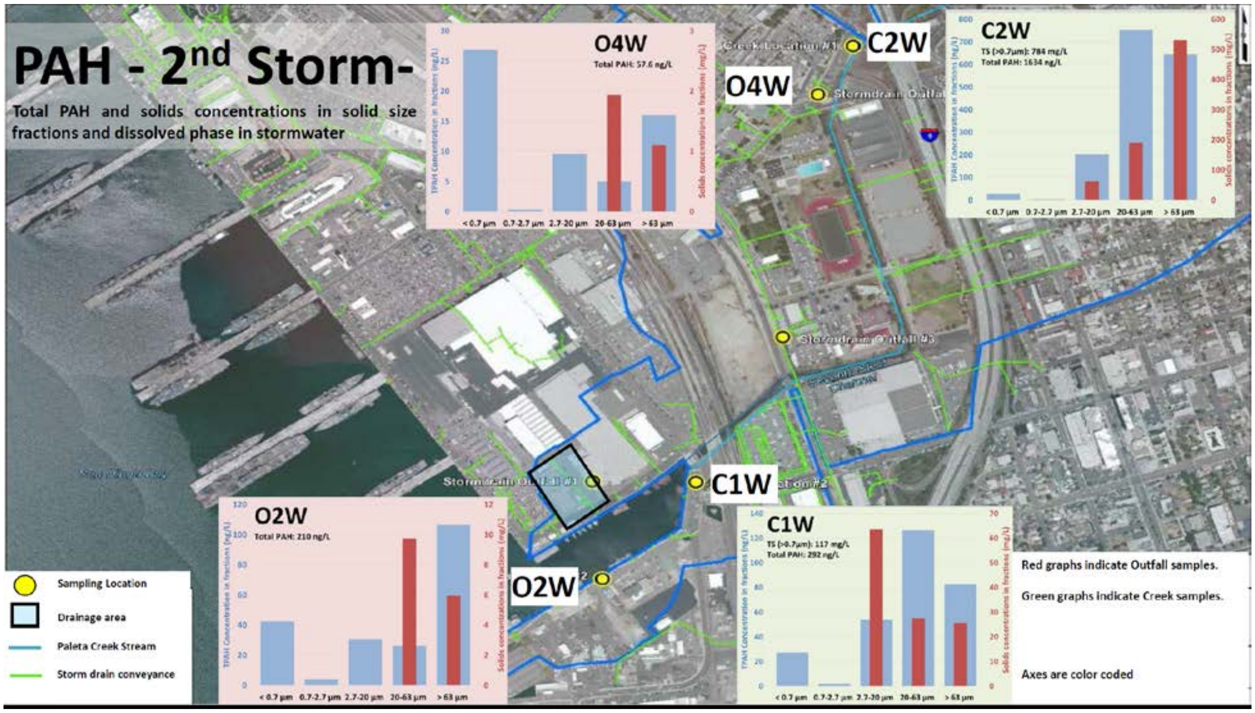


Figure 4-9 Total PAH and suspended solid loads in outfall and Paleta Creek locations – Storm event 2. Suspended solids <20 µm in outfalls O2W and O4W were low and not reliably measured due to salinity interferences (shown as 0).

The largest particles are associated with the early phases of an event as shown in Figure 4-10.

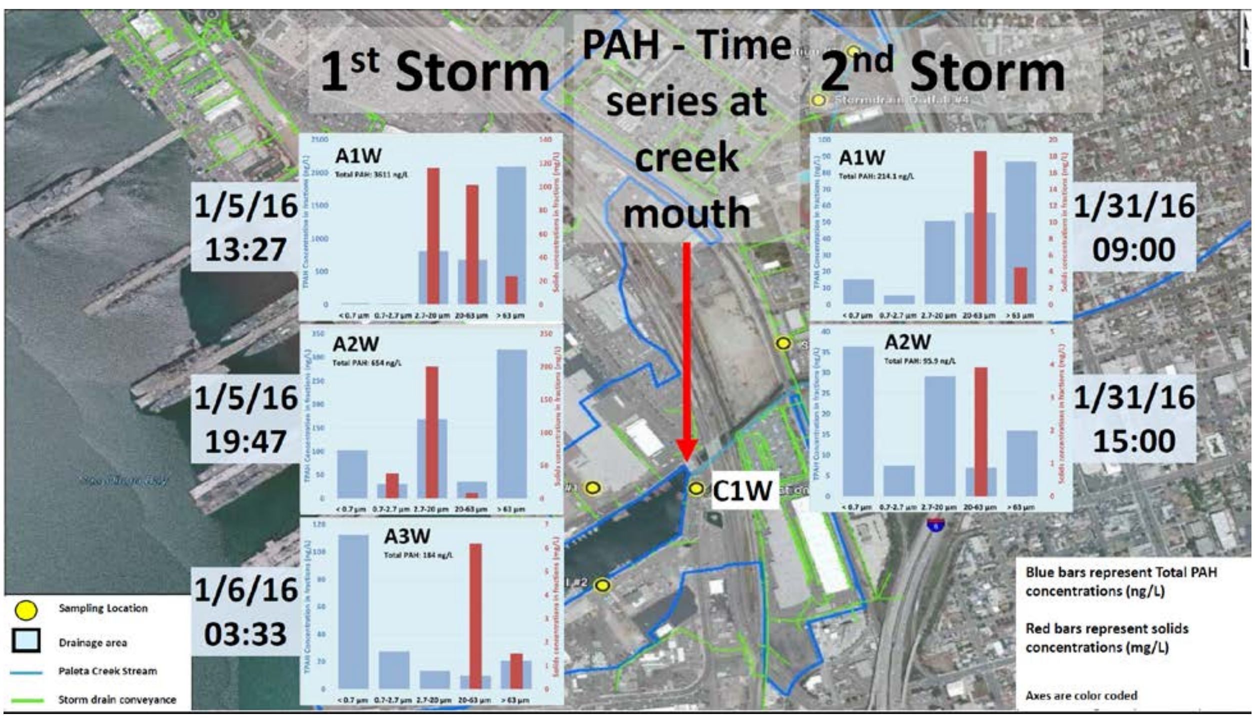


Figure 4-10 Total PAHs as a function of time in ambient water samples at the mouth of Paleta Creek during storm events 1 and 2. Suspended solids <20 µm in samples A3W from Event 1 and both samples from Event 2 were low and not reliably measured due to salinity interferences. (Shown as 0)

The strong association of PAHs with large particles was investigated further and appears to be result of large carbon-rich particles that would be associated with chips of asphalt or tire rubber or coal tire sealants (see Figure 4-11). It was not possible to positively identify the source of the elevated PAHs in the large particles but the measured concentrations and PAH distribution were consistent with these sources and the products of fossil fuel combustion (pyrolytic PAHs) as indicated by fluoranthene to pyrene ≤1, anthracene/(anthracene + phenanthrene)~0.4-0.5, benzo[a]anthrance/(benzo[a]anthracene+chrysene)>0.35, phenanthrene/anthracene<10. Figure 4-12 shows the ratio of benzo[a]anthracene to chrysene versus fluoranthene to pyrene indicating that the PAHs are closest to expectations for urban PAH background.

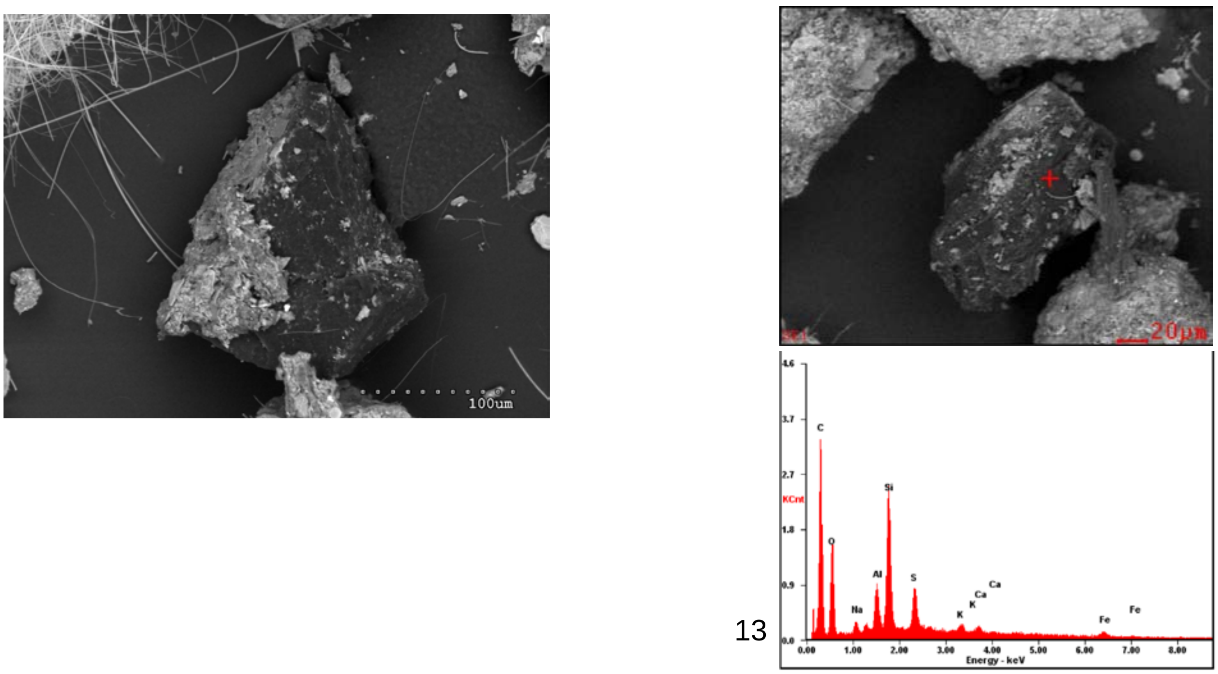


Figure 4-11 SEM photographs and elemental distribution in selected large particles from sediment samples showing carbon-rich particles that are likely the source of the elevated PAH concentrations in stormwater

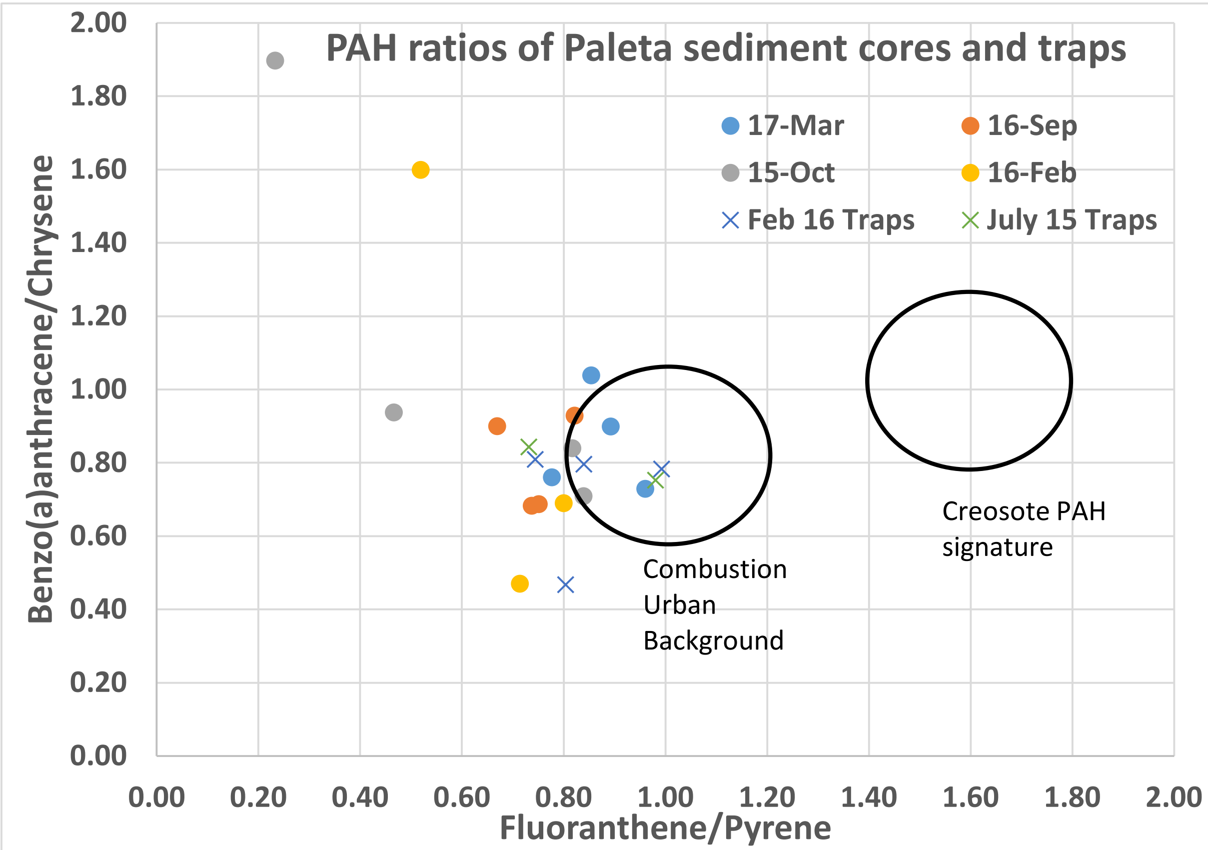


Figure 4-12 PAH ratios of Paleta sediment cores and traps

The behavior of PAHs can be contrasted with that of PCBs which are distributed similarly to particles. Table 4-8 and Table 4-9 also include the size interval based concentration of tPCBs in Events 1 and 2 and compares the total PCBs and suspended solids in outfall and Paleta Creek locations during Event 1. The particle-associated PCBs track the suspended solids concentrations almost exactly except for upstream locations.

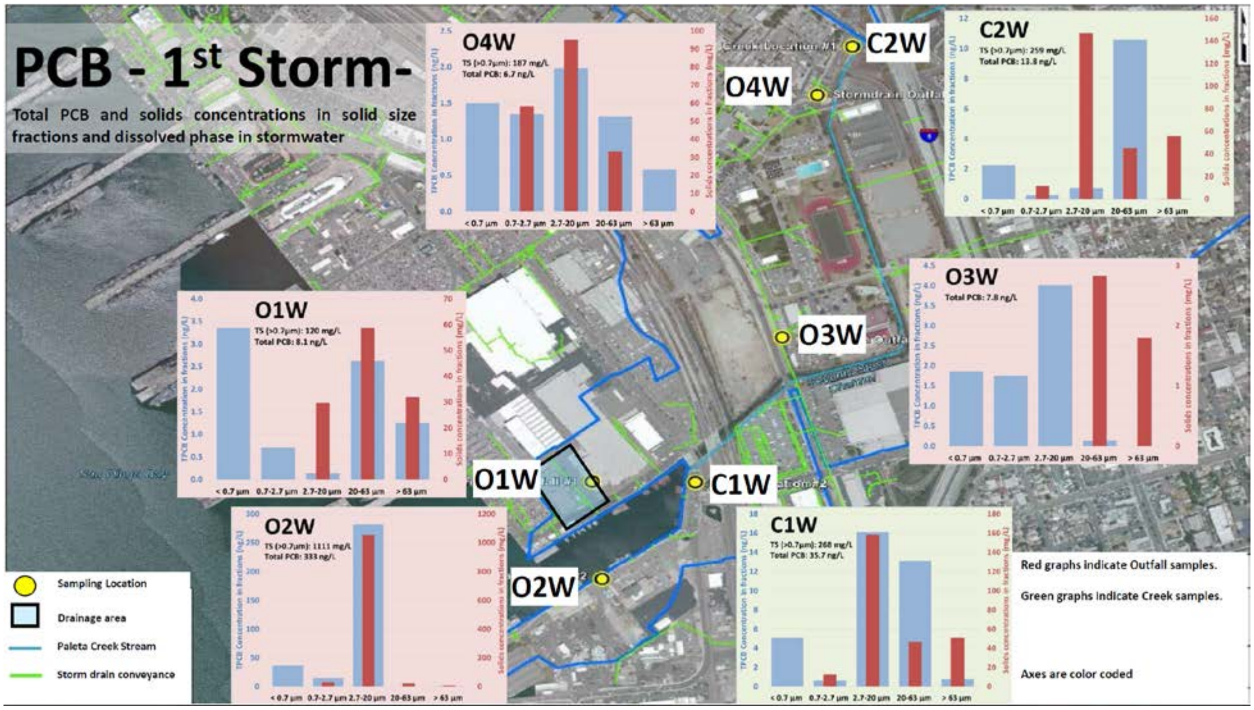


Figure 4-13 Total PCBs and suspended solid loads in outfall and Paleta Creek locations – Storm event 1. Suspended solids <20 µm in outfall O3W were low and not reliably measured due to salinity interferences. (Shown as 0)

The characterization of the stormwater releases by particle sizes provides a great deal of insight into the potential for sediment recontamination. A few of the largest particle size (>63 µm) for the NBSD sites had much larger concentrations for many constituents than other particle size ranges, indicating an increased importance of the large particle sizes. More than 75% of many metals and PAHs analyzed are associated with the largest particle size that would have near field effects on receiving water sediments. This has been noted in other industrial area stormwater monitoring as some large oily and/or metallic debris are periodically present. The NBSD makes up about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and suspended sediment load (described later, based upon WinSLAMM modeling). The NBSD contributions for the analyzed pollutants ranged from about 13% to as high as about 60%. The unit area pollutant loading rates (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area. The large particle size material from the upper watershed are likely from erosion sources in the watershed and from sediment scour in the upper, unchannelized natural bottom creek during runoff events. If deposited uniformly across the 9 acre area of impact at the creek mouth, and conservatively assuming zero export from the slip, this would equate to about one inch sediment accumulation over a 25 year period. These particles would require about 20 minutes to settle 10 m in the receiving water. Far field effects (20 to 63 µm particles) would require about 15 hours to settle 10 m, while the smallest particles would require more than 150 hours to settle to this depth, and therefore both particle size categories might represent de minimus risk to local sediment cleanup efforts.

4.3.2. *PSNS STORMWATER SAMPLING*

Stormwater sampling at PSNS was limited to a single event and grab samples collected from the outfall locations shown in Figure 3-2. Baseline sampling showed very low concentrations of contaminants of concern as noted in Appendix I. The stormwater sample from PS96 stormwater discharge during the rain event showed substantially higher concentrations than detected previously at the site. Most importantly, the PAH data supported the observation at NBSD that the PAHs were associated with the largest particle sizes (

Table 4-10, Figure 4-14). This suggests that at least for PAHs, the conclusions relative to settling and likely biological significance also apply to PSNS. Cu and Cd also showed behavior similar to Paleta Creek with Cd associated with the larger particle sizes (20-63 µm in this case) than copper (dominated by 5-20 µm). The relative contribution of the sampled sources compared to other sources was not assessed at PSNS but the consistency of the size distribution of important contaminants suggest that these behaviors may be commonly observed in mixed residential/Naval Base watersheds. Appendices I and II contains a summary and evaluation of all data collected at PSNS.

Table 4-10 Concentrations of tPAHs in the PS 96 stormwater sample location collected in March 2017 at PSNS secondary site

Size fraction (microns)	tPAH (µg/L)
Bulk	27.8
< 0.7	0.051
>0.7, <2.7	0.022
>2/7, < 20	0.150
>20, < 63	1.460
>63	26.3

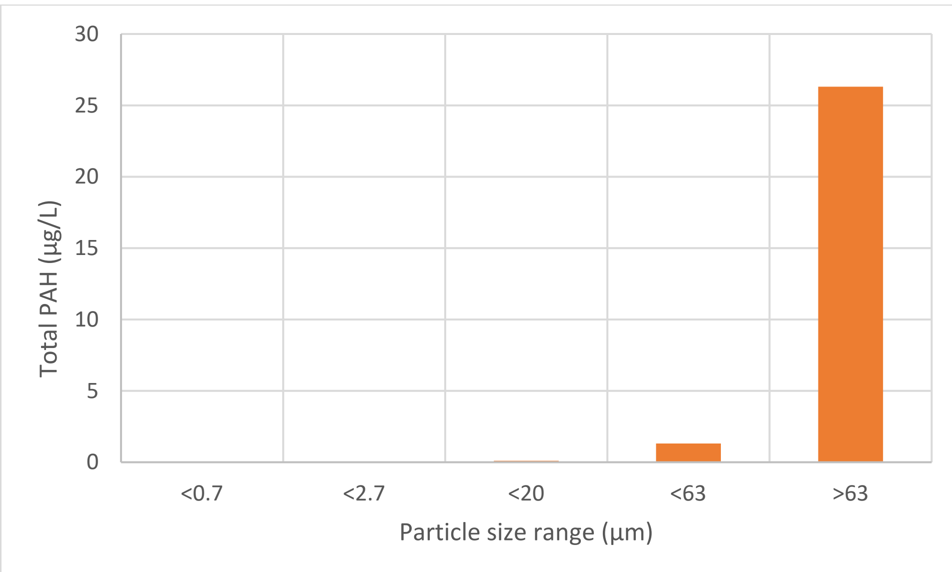


Figure 4-14 Distribution of Total PAH_{15} by particle size fraction at location PS96 at PSNS during storm sampling event.

4.4. SEDIMENT RECONTAMINATION

4.4.1. *NBSD 2015-2016*

Our primary concern is the effect of the stormwater releases on sediment recontamination. As noted in Appendix V, substantial deposition would be expected to occur near the outfall of Paleta Creek. Figure 4-15 shows the predicted deposition of clay (0.45-5 µm, modeled as 5 µm), silt (5-63 µm, modeled as 20 µm) and sand (>63 µm, modeled as 65 µm) during storm event 1. Note that maximum deposition is approximately 0.0002 g/cm^2 for clay, 0.02 g/cm^2 for silt and 0.1-0.15 g/cm^2 for sand-sized particles. The deposition is close to the mouth of Paleta Creek due to the rapid settling of sand size particles and flocculating clay particles and the relatively shallow depths near the mouth of Paleta Creek (1-3m).

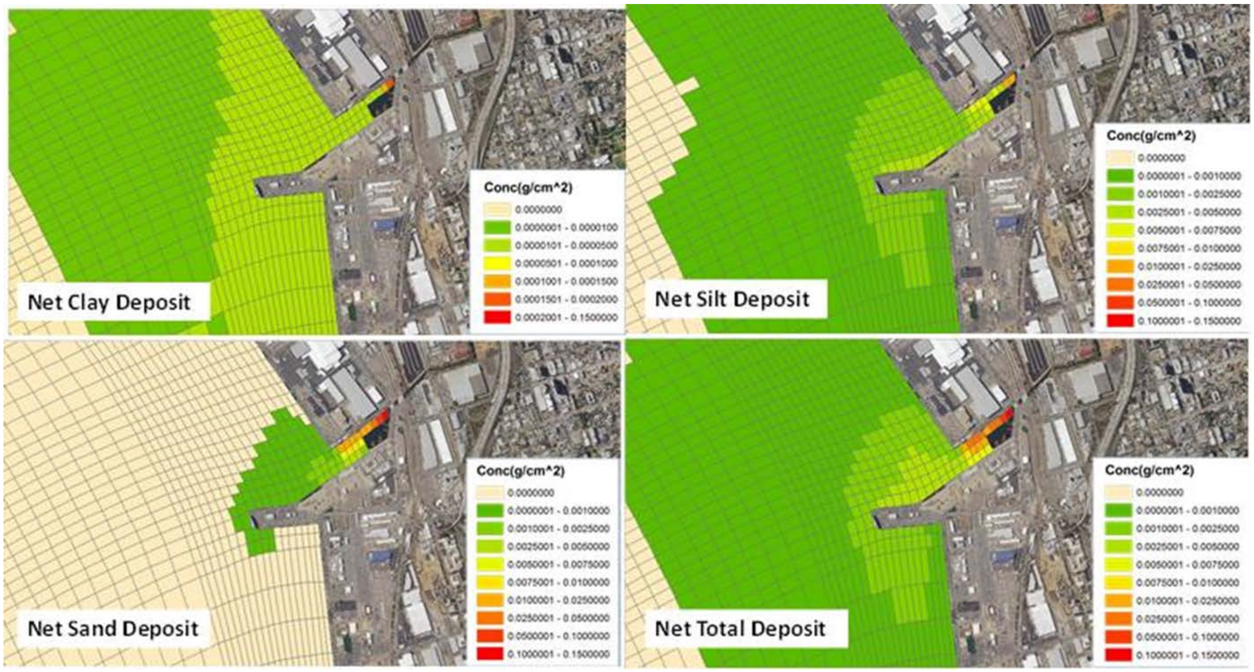


Figure 4-15 Model simulated net sediment depositions for clay, silt, sand and total particles for Wet Weather Event 1 (5 Jan 2016). Note that due to different scales, maximum mass deposition rate of silts is approximately 100 times that of clays and approximately 0.1 of sands.

Sediment monitoring pre and post storm season and sediment traps located in the receiving waters were used to measure the sediment recontamination. Pre-storm sediment samples were collected in October, 2015 and Post-storm samples were collected in February, 2016, after both storm event intensive sampling programs in January, 2016. Pre- and Post-storm intact sediment cores were analyzed on a bulk fraction basis for total organic carbon (TOC) and black carbon (BC), trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and pyrethroid pesticides. Table 4-11 summarizes pre and post wet season surficial sediment chemistry for inorganic constituents and Table 4-12 summarizes pre and post wet season surficial sediment chemistry for organic constituents. Locations P01 was furthest from the Paleta Creek discharge location and P17 the closest. Pb, Ni, Zn, and pyrethroids increased substantially between the October 2015 and February 2016 sampling efforts at all locations. As and Cu concentrations in February 2016 were similar to those measured in October 2015 and showed little variation with the different sampling locations. This would suggest that stormwater may have relatively little impact on As and Cu in the area.

All constituents shown in Table 4-11 and Table 4-12 increased substantially in concentration at location P11. This increased concentration at location P11 was typically a factor of two over the course of the wet season while much more modest increases or even decreases were noted at other sampling locations. The concentrations at P11 were highest among the post-storm sample stations.

Concentrations of the trace metals As, Cd, Cu and Hg all decreased over the course of the season at location P17 and were lower at P17 than at P11. Organic constituents increased over the course of the season at location P17 but were still lower than concentrations at P11. The decrease in concentration of organics at P17 was especially large on an organic carbon normalized basis since the highest organic carbon concentrations in the sediment were at location P17.

As indicated by the dry season sampling of sediments in 2015, bulk sediment measurements based upon cores or simply surface grab samples provide a cumulative picture of past and ongoing releases and it is difficult to link increases in sediment concentration with stormwater discharges. Storm events may simply lead to resuspension of deeper more contaminated sediments leading to elevated concentrations at the surface at the end of the wet season. This resuspension can also occur during other events throughout the year, both natural and human-driven, leading to masking of the effects of stormwater and the wet weather season. A much more sensitive indicator of stormwater impacts is through settling traps that represent current deposition and contamination of the sediments. As indicated previously the primary stormwater discharges are from the mouth of Paleta Creek due to the large amount of discharge volume after a storm event. Therefore the discharges during the first storm event from C1W location will be compared to settling trap contaminant masses to attempt to connect stormwater with the apparent sediment recontamination.

Table 4-11 2015/2016 Bulk Sediment Chemistry Results – NBSD (inorganic constituents).

Compartment ID	Sampling Season	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/g DW)	Pb (µg/g DW)	Ni (µg/g DW)	Zn (µg/g DW)
P01	Pre-Storm	8.1 (0.3)	0.46 (0.0)	207.5 (10.0)	0.46 (0.0)	52.1 (1.5)	16.1 (0.6)	272 (14.3)
	Post-Storm	NT	NT	NT	NT	NT	NT	NT
P08	Pre-Storm	9.26 (0.4)	0.24 (0.0)	237.7 (5.7)	0.55 (0.1)	76.5 (2.2)	16.9 (0.2)	315.7 (13.8)
	Post-Storm	10.83 (0.2)	0.19 (0.0)	257.3 (9.8)	0.55 (0.0)	82 (3.3)	18.8 (0.2)	328 (11.1)
P11	Pre-Storm	8.26 (0.1)	1.55 (0.1)	244 (7.7)	0.97 (0.1)	158.8 (7.6)	18.4 (0.5)	491.9 (17.6)
	Post-Storm	9.61 (0.7)	4.63 (0.2)	253.8 (17.6)	1.61 (0.1)	431 (27.9)	27 (1.1)	939.7 (91.8)
P17	Pre-Storm	8.74 (0.4)	1.56 (0.1)	268.9 (29.8)	0.46 (0.1)	143.2 (20.9)	17.8 (0.9)	611.8 (70.9)
	Post-Storm	8.39 (0.0)	1.53 (0.03)	245.9 (14.7)	0.34 (0.0)	157.8 (19.4)	19.5 (0.8)	681.2 (19.8)

Values in ( ) are SD of duplicate samples tested. NT – not tested. ND – non-detect.

Table 4-12 2015/2016 Bulk Sediment Chemistry Results – NBSD (organic constituents).

Compartment ID	Sampling Season	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/g OC)	Total PCBs (µg/kg)	Total PCBs (µg/g OC)	Pyrethroid Pesticides (µg/kg)	Pyrethroid Pesticides (µg/g OC)
P01	Pre-Storm	0.79 (0)	0.1 (0)	1961.3	284.2	113.4	16.4	5.9	0.86
	Post-Storm	NT	NT	NT	NT	NT	NT	NT	NT
P08	Pre-Storm	1.17 (0)	0.11 (0)	1459.0	137.6	86.2	8.1	17.8	1.68
	Post-Storm	1.51 (0)	0.13 (0)	1219.4	88.4	92.7	6.7	50.7	3.58
P11	Pre-Storm	1.75 (0.1)	0.17 (0)	3769.0	238.5	618.8	39.2	69.3	4.39
	Post-Storm	2.06 (0.1)	0.21 (0)	9508.3	514.0	1350.5	73.0	164.5	8.77
P17	Pre-Storm	3.63 (0.1)	0.23 (0)	2930.2	86.2	206.5	6.1	228.2	6.71
	Post-Storm	3.86 (0.2)	0.24 (0)	4640.3	128.2	212.5	5.9	359.5	9.82

Values in ( ) are SD of duplicate samples tested. NT – not tested. ND – non-detect.

Sediment traps were placed through the entire storm season of 2015-2016 (Oct 19, 2015- Feb 22, 2016). Table 4-13 summarizes the Cd and Cu collected in these sediment traps which can be compared to concentrations measured in the stormwater events (Table 4-6 and Table 4-7). Figure 4-16 compares the Paleta Creek discharges of Cd during storm event 1 to the storm season accumulation of Cd in the sediment traps at the locations P01 (furthest into receiving waters), P08, P11 and P17 (closest to the Paleta creek discharge). Storm event 1 constituted approximately 80% of the volume of rain (and likely stormwater) experienced in the Paleta Creek watershed during the period of trap placement and thus should dominate the trap sediments. The Cd discharges were observed only in sizes >63 µm and 75% of the mass accumulation of Cd in the settling traps was in location P17 with essentially no Cd accumulation in the furthest trap. The total discharge of >63 µm associated Cd during event was (98,490 m^3)(0.41mg/m^3)=40 g and 1.5 mg was collected in the P17 sediment trap or 0.0038%.

Table 4-13 Mass inventory of Cu, Cd, in the traps sampled in February 2016 and their corresponding solid normalized concentration

Location	Cd-trap (mg)	Cu-trap (mg)	Cd-trap (mg/Kg)	Cu-trap (mg/Kg)
P17	1.5	274.3	1.15	212.4
P08	0.3	167.4	0.51	315.7
P11	0.2	191.7	0.31	299.8
P01	0.0	295.1	0.00	306.1

Figure 4-16 Cd discharges during storm event 1 compared to Cd accumulation in sediment traps placed during the 2015-2016 storm season

In the case of Cu, however, approximately 70 % of accumulation in sediment was distributed across the more distant receiving water locations (P11, P8, P1) while only 37% of the solid associated Cu was in the silt and clay particle ranges. (Figure 4-17). If it is assumed that P17 deposition is largely controlled by the >63 µm fraction, the discharge of Cu in this fraction from the mouth of Paleta Creek (C1W) during Event 1 was (98,490 m^3)(17.67mg/m^3)=1.74 kg. 274 mg or 0.016% was collected in the P17 sediment trap or about 4.2 times greater than the ratio observed for Cd. The concentration of Cu in the bulk solids settling in the most distant sediment trap is also higher than observed on the particles discharged from Paleta Creek during the storm events (discussed later). Thus all sediment traps contain more Cu than appear to be associated with stormwater releases and additional sources of Cu are likely.

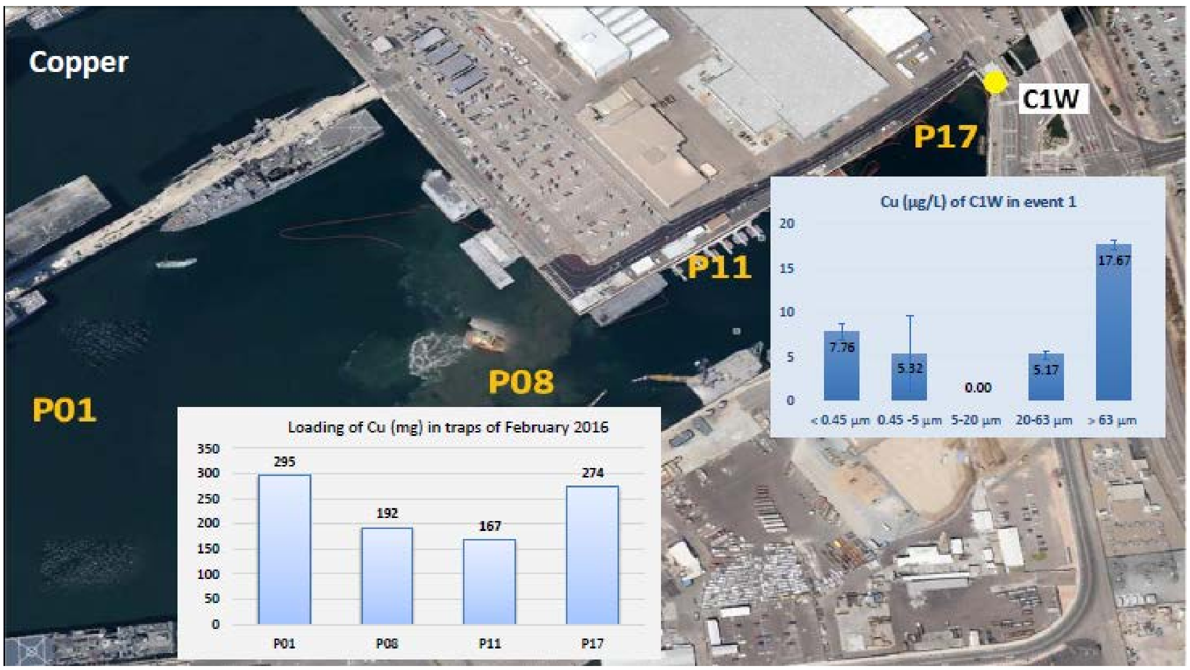


Figure 4-17 Cu discharges during storm event 1 compared to Cu accumulation in sediment traps placed during the 2015-2016 storm season

Figure 4-18 shows that the estuary model (Appendix V) suggests that a substantial fraction of sediment in sediment traps is likely due to settling from other sources (yellow bar) with the proportion from other sources increasing with distance from the Paleta Creek mouth (closest to P17). It appears that there is little Cd in the study area from sources other than Paleta Creek while Cu deposition is dominated by other sources.

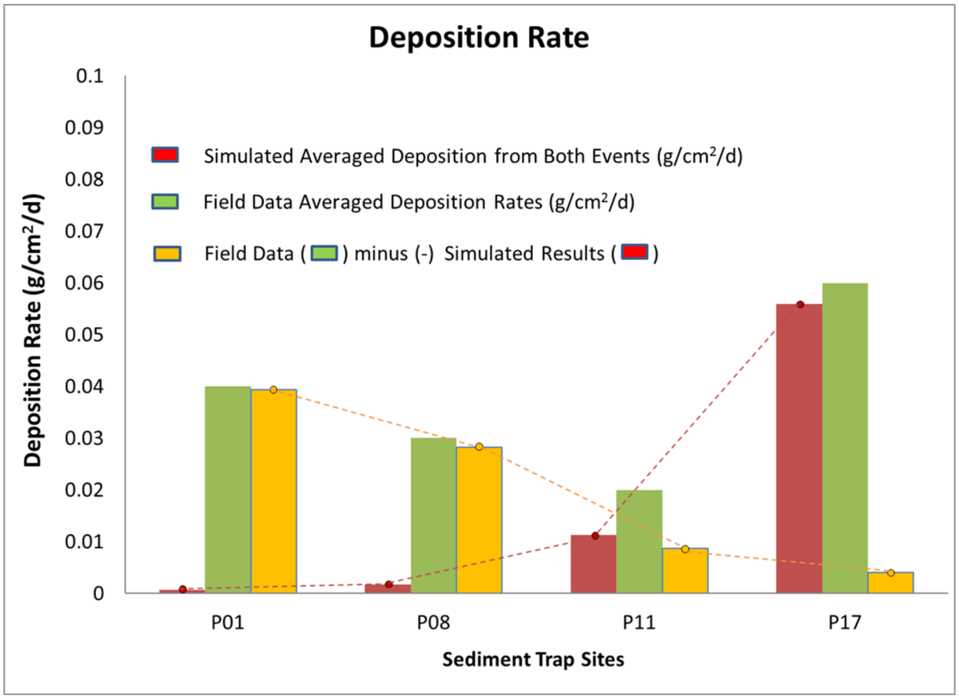


Figure 4-18 Simulated and measured averaged deposition rates (g/cm2/d) at the four sediment trap locations (the two dashed lines denote the two-source theory with one source from the Paleta Creek (red line) and the other source presumably from out-of-the mouth region (e.g., P01).

A relatively simple indicator of the significance of a particular contaminant in stormwater for this system is the ratio of the proportion of the contaminant in the larger particles sizes (20-63µm and >63 µm) to the proportion of the contaminants in the sediment traps close to the mouth of Paleta Creek (P11 and P17). For Cd, with a strong relationship to the stormwater discharges from Paleta Creek, this ratio is 0.9, while for Cu, with a weak relationship to the stormwater discharges at Paleta Creek, this ratio is 0.58. These and other inorganic contaminants are summarized in Table 4-14.

Table 4-14 Diagnostic ratios for indicating Paleta Creek stormwater dominated sediment recontamination

Contaminant	Proportion >20µm in stormwater	Proportion in P11, P17 sediment traps	Deposition to Stormwater Load Ratio	Paleta Creek Stormwater dominated
Cd	1	0.9	0.9	X
Cu	0.81	0.47	0.58	
As	0.98	0.43	0.44	
Hg	0.83	0.43	0.52	
Ni	0.69	0.74	0.74	X
Pb	0.71	0.63	0.89	X
Zn	0.85	0.56	0.66	mixed

A similar analysis was also conducted on PAHs and PCBs, looking at the distribution of specific contaminants in the stormwater loads (in ng/L) in the Paleta Creek discharge (C1W) during Event

1 and the sediment accumulation in sediment traps during the 2015-2016 wet season. Table 4-15 shows the stormwater concentrations of the selected PAHs and PCBs.

Table 4-16 shows the sediment trap accumulations of each compound. The deposition to stormwater load ratio for PAHs is 0.99, 1.1, 0.95 and 0.97 for phenanthrene, pyrene, benzo[a]pyrene and total PAHs (TOC normalized for total PAHs), respectively. This suggests that essentially all of the bulk sediment recontamination is due to the stormwater load of PAHs on larger particles. For PCBs, the ratio is always ≥ 1 for both measured concentrations and TOC normalized concentrations suggesting as well that the bulk sediment recontamination is due to stormwater loads rather than other sources. A ratio >1 is possible when dissolved organics are partitioning onto larger solids and settling. This may also occur due to the flocculation and growth of colloidal organic matter at the salt-water interface since the highly hydrophobic PCBs are strongly associated with colloidal organic matter.

Table 4-15 Aqueous concentration of select PAHs (phenanthrene (Phe), pyrene (Pyr) and benzo(a)pyrene (BaP)) by size intervals in location C1W in Event 1 and in the receiving water sediment traps during 2015-2016 wet season

Size Interval (μm)	Phenanthrene (ng/L)	Pyrene (ng/L)	Benzo(a)pyrene (ng/L)
< 0.7	13.82	9.08	0.41
0.7-2.7	0.00	1.61	1.07
2.7-20	14.92	58.89	29.06
20-63	12.82	54.17	29.06
> 63	71.80	103.55	15.66
Trap location	Phenanthrene (μg)	Pyrene (μg)	Benzo(a)pyrene (μg)
P01	40.1	100.3	160.8
P08	26.6	66.0	109.8
P11	48.3	128.2	164.8
P17	305.2	513.2	194.0

Table 4-16 Total solid mass of selected PCB congeners by size intervals in location C1W in Event 1 and in the receiving water sediment traps during 2015-2016 wet season

Size Interval (μm)	PCB-52 (ng/L)	PCB-110 (ng/L)	PCB-153 (ng/L)	PCB-180 (ng/L)
< 0.7	0.21	0.30	0.19	0.08
0.7-2.7	0.00	0.00	0.01	0.09
2.7-20	0.23	0.86	1.09	1.29
20-63	0.14	0.93	0.77	0.81
> 63	0.01	0.00	0.16	0.00

Trap location	TPCB-52 (μg)	PCB-110 (μg)	PCB-153 (μg)	PCB-180 (μg)
P01	0.97	3.49	6.30	3.51
P08	0.79	2.75	3.77	2.37
P11	1.30	4.47	5.40	3.59
P17	2.72	11.39	7.56	6.00

Figure 4-19 illustrates the distribution of selected PAHs in the larges particles in the stormwater discharge and in the near field sediment trap, P17. The pyrene distribution is particularly dominated by the largest particles in the Paleta Creek discharge during storm event 1 and the accumulation in sediment traps is dominated by the closest location P17.

PCB accumulation in the various sediment traps are also indicated by the size distribution in the Paleta Creek discharge during storm event 1 (Figure 4-20). The PCBs are found in intermediate sizes (2.7-63μm particles) and are more uniformly distributed across sediment traps from the mouth of Paleta Creek to the bay location P01. Again specific congeners are shown in Figure 4-20 showing that all congeners illustrate similar behavior.

The direct correlation between the discharge of contaminants in large particles during the storm event 1 and the seasonal accumulation in the near-source settling traps indicated that the combination is a powerful tool to indicate the potential for stormwater to lead to sediment recontamination. The ratio of the contaminant accumulation in the distant settling trap (P01) to that in the near-field directly influenced by the stormwater discharges (P11/P17) also provide a tool to determine the relative contribution of the Paleta Creek discharges to sediment redistribution or other sources contributing to bay contaminant deposition.

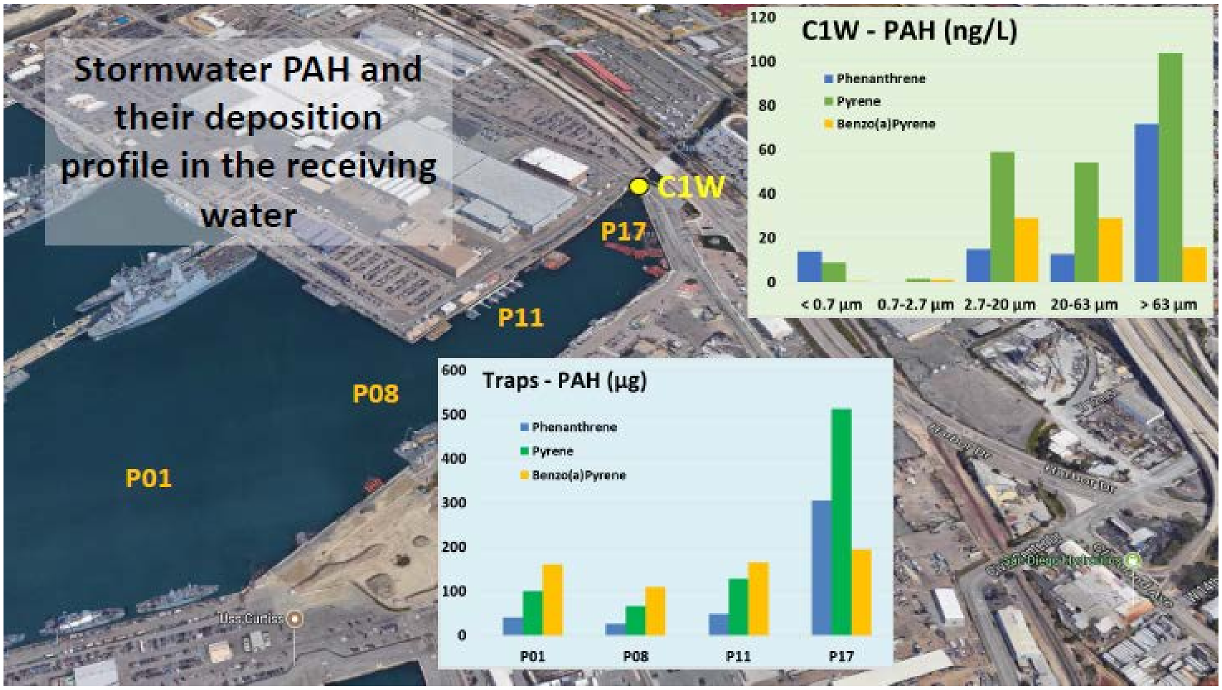


Figure 4-19 Selected PAH discharges during storm event 1 compared to PAH accumulation in sediment traps placed during the 2015-2016 storm season

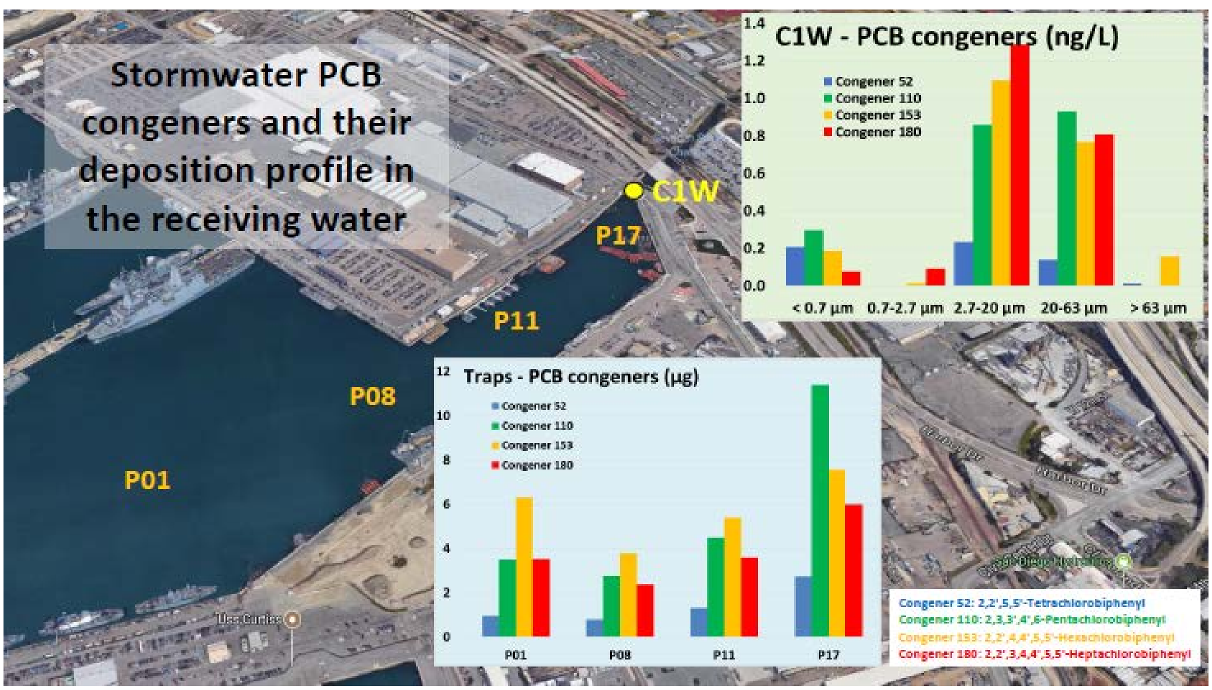


Figure 4-20 Selected PCB congener discharges during storm event 1 compared to PCB accumulation in sediment traps placed during the 2015-2016 storm season

The concentration on solids of contaminants discharged from the mouth of Paleta Creek can also be compared to the concentration on solids accumulating in the sediment traps. If the first storm event indicates the likely maximum concentrations in the Paleta Creek discharge, the sediment traps should all exhibit contaminant concentrations less than in the discharge sediments. For PAHs, the concentrations at the discharge of Paleta Creek are all well above the concentrations measured in the sediment traps. For example, the concentrations of phenanthrene, pyrene and benzo[a]pyrene at C1W during the first storm event in the >20μm particle fraction are 3-4 times higher than the concentrations measured in the P17 sediment trap where these particles would likely settle. Total PAH concentrations on the >63μm particle size fraction at C1W in the first storm event was 6.36 mg/kg and the total PAH concentration on sediments depositing in the P17 sediment trap over the 2015-2016 wet season was 2.13 mg/kg. PCB concentrations, however, are similar in magnitude to concentrations measured in traps. Thus the PAHs could easily lead to the observed sediment recontamination as indicated by the sediment traps. For PCBs the results are somewhat more ambiguous because some decrease in concentration in sediment traps would be expected as a result of dilution with resuspended bay sediments if stormwater particles were the dominant source of the PCBs to the receiving waters.

Figure 4-21 shows that the metals Cd and Pb are more concentrated in the stormwater discharge during storm event 1 than observed in sediment traps but the metals Cu and Hg are more concentrated in the sediment traps than in the stormwater discharge. To the extent that storm event 1 is reasonably representative of stormwater discharges from Paleta Creek, these data suggest that stormwater is not the major source of Cu and Hg sediment recontamination, particularly at locations away from the mouth of the creek. The conclusion based upon concentration on solids is consistent with the apparent increased sediment deposition in traps for Cu and Hg as indicated previously.

The combination of size segregated contaminant discharges mass and concentration with the mass accumulation and concentration of the same contaminants in sediment traps at varying distances from the mouth of the stormwater source represents the most direct information on the link between stormwater discharge and sediment recontamination. These are recommended at any site to define the relationship between stormwater discharges and sediment recontamination.

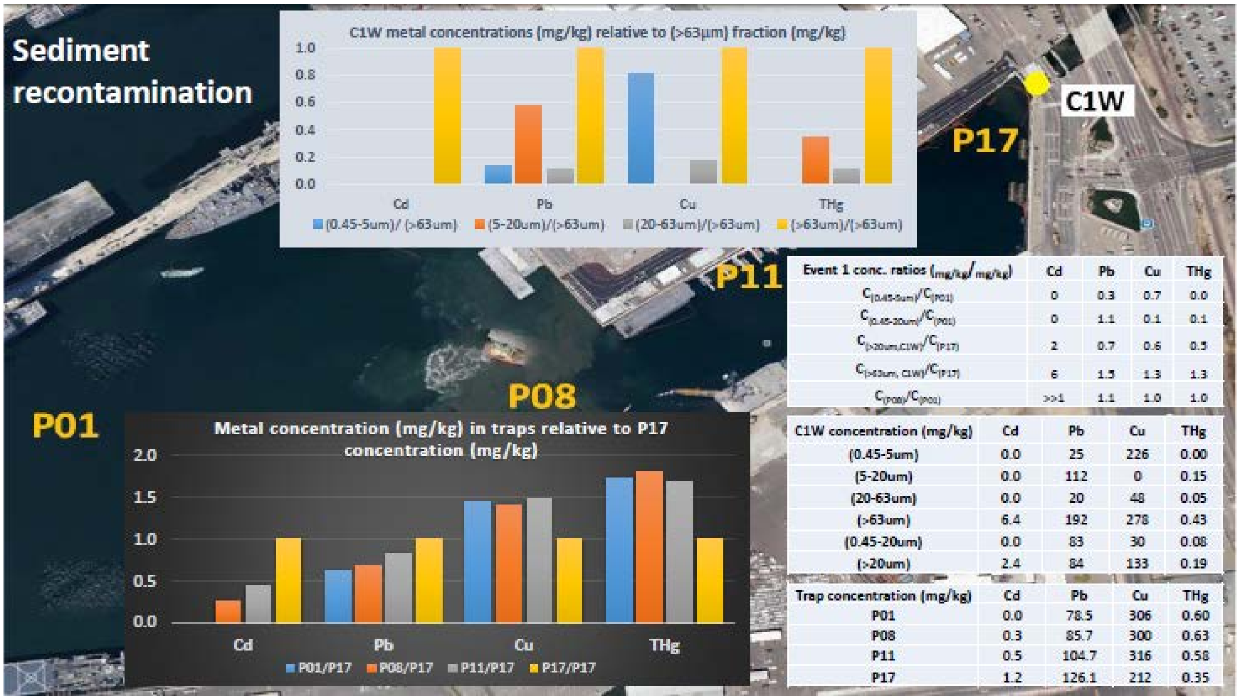


Figure 4-21 Concentration of metals on particles in C1W Paleta Creek discharge compared to concentrations in sediment traps of the same metals. Concentrations are normalized to the >63 µm fraction in the stormwater discharge and to the P17 concentration in the sediment traps.

4.4.2. *NBSD 2016-2017*

Sediment core samples were collected prior to the 2016/2017 Wet Weather season on 8-Sep-2016 to represent a second "Dry Weather" or pre-storm sampling event. Additionally, sediment sampling was conducted on 9-Mar-2017 to represent a second "Wet Weather" or post-storm season. Automated stormwater sampling and sediment trap sampling was not conducted. The initial delays associated with the long drought prior to the 2015-2016 year limited resources for this year of sampling.

Pre- and Post-storm season intact sediment cores were analyzed on a bulk fraction basis for total organic carbon (TOC) and black carbon (BC), trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and pyrethroid pesticides. Results are summarized in Table 4-17 and Table 4-18.

Table 4-17 2016/2017 Wet Weather Bulk Sediment Chemistry Results – NBSD.

Compartment ID	Sampling Season	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/g DW)	Pb (µg/g DW)	Ni (µg/g DW)	Zn (µg/g DW)
P01	Pre-Storm	8.4 (0.3)	ND	152.6 (8.5)	0.39 (0.01)	42.8 (1.9)	17.4 (0.8)	196.9 (13.1)
	Post-Storm	4.9 (0.6)	0.09 (0.01)	108 (8.8)	0.26 (0.04)	27.6 (1.3)	11.4 (0.8)	144.6 (11.5)
P08	Pre-Storm	8.9 (0.3)	ND	188.6 (9.1)	0.54 (0.03)	80.1 (27.2)	16.4 (1.1)	246.6 (12)
	Post-Storm	12.3 (1.5)	0.24 (0.02)	260.5 (5.1)	0.57 (0.02)	87.2 (2.1)	22.4 (0.5)	350.3 (10.2)
P11	Pre-Storm	11.5 (3.5)	ND	235.1 (13.6)	0.51 (0.04)	80.3 (2.1)	17.5 (1.4)	309.7 (16.6)
	Post-Storm	8.2 (0.1)	0.4 (0.03)	220.9 (12.5)	0.52 (0.08)	83.7 (0.4)	18.6 (0.5)	308.7 (11.2)
P17	Pre-Storm	7.5 (0.1)	1.4 (0.1)	177.6 (4.5)	0.44 (0.05)	107.1 (4.2)	14.4 (0.4)	425.3 (5.4)
	Post-Storm	8.1 (0.3)	1.36 (0.27)	184.7 (17)	0.37 (0.05)	110.4 (4.9)	18.6 (1.8)	496.7 (61.3)

Values in ( ) are SD of duplicate samples tested. "-" – not tested. ND – non-detect.

Table 4-18 2016/2017 Wet Weather Bulk Sediment Chemistry Results – NBSD (cont'd).

Compartment ID	Sampling Season	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/g OC)	Total PCBs (µg/kg)	Total PCBs (µg/g OC)	Pyrethroid Pesticides (µg/kg)	Pyrethroid Pesticides (µg/g OC)
P01	Pre-Storm	0.98 (0.12)	0.10 (0.0)	464.7	52.7	27.0	3.07	8.6	0.99
	Post-Storm	0.72 (0.03)	0.07 (0.0)	635.4	97.8	-	-	4.0	0.62
P08	Pre-Storm	1.25 (0.03)	0.12 (0.01)	1007.9	88.8	59.6	5.25	20.2	1.78
	Post-Storm	1.96 (0.02)	0.17 (0.0)	1939.2	108.3	-	-	62.5	3.49
P11	Pre-Storm	1.93 (0.04)	0.15 (0.0)	1191.4	66.8	91.6	5.14	49.9	2.80
	Post-Storm	1.87 (0.04)	0.13 (0.0)	2187.9	125.8	-	-	96.8	5.56
P17	Pre-Storm	3.94 (0.17)	0.24 (0.01)	2182.2	58.9	118.7	6.66	ND	ND
	Post-Storm	5.16 (0.06)	0.27 (0.02)	3240.5	66.3	-	-	345.7	7.07

Values in ( ) are SD of duplicate samples tested. "-" – not tested. ND – non-detect.

Concentrations of the trace metal Cd were higher in the post-season compared to the pre-season samples for all station except P17, where Cd concentrations were almost the same. Cd and Pb decreased with distance from the Paleta Creek discharge (i.e. P01<P08<P11<P17) and showed the influence of stormwater inputs as in 2015-2016. Cu, As, and Hg showed highest concentrations at the end of the wet weather season at the more distant P08 station, again indicating the importance of sources other than Paleta Creek stormwater discharge for these constituents. Zn and Ni also showed higher porewater concentration post-storm season at the P08 station, also repeating the more mixed behavior as in 2015-2016.

Organic constituents, including PAHs, PCBs and pyrethroids all decreased substantially with distance from the Paleta Creek discharge, consistent with the 2015-2016 behavior and the observation that stormwater significantly contributes to the sediment concentrations. The concentrations of pyrethroids as well as PAHs were also elevated in the samples collected in Mar-2017 compared to Sep-2016. The increases in organics were consistent with increases of organic carbon content of the sediments both with proximity to the Paleta Creek discharge and between the pre and post wet season samples.

4.5. PASSIVE SAMPLING

4.5.1. IN-*SITU POREWATER SAMPLING NBSD 2015 -2016*

SPMEs were exposed to sediments and adjacent overlying waters in two deployments of the SeaRing. The deployments in Oct-2015 and Jan-2016 were designated “Pre-storm” and “Post-storm” samples, respectively. SPMEs deployed *in situ* were sectioned in 10cm sections for the portion of the SPME fiber that was exposed to the overlying water. For the sections of the SPMEs that were deployed in the sediment, the fiber was sectioned into 5cm sections. Total PAH concentrations in the overlying and pore waters as derived from SPMEs for stations P01, P08, P11 and P17 are summarized in Table 4-19.

For both deployments, concentrations of PAHs were higher in sediment porewaters than in the overlying water. On average, the Post-storm concentrations of PAHs were higher than those observed for Pre-storm for both overlying water and sediment pore water concentrations as derived from SPME although the differences were modest and there were relatively small differences by location. Consistent with the solid concentrations, the highest porewater concentration of PAHs was at location P11. Concentrations at P11, concentrations in the porewaters increased with depth, whereas at stations P01, P08 and P17, concentrations of PAHs tended to decrease with depth.

4.5.2. EX-SITU *POREWATER SAMPLING NBSD 2015-2016*

Intact cores collected on 19-Oct-2015 and 23-Feb-2016 were tested at the SSC Pac Bioassay Laboratory as described in section 2.4. Samples collected collect in Oct-2015 and Feb-2016 were designated “Pre-storm” and “Post-storm” samples, respectively. SPME exposures were conducted from 1-Mar-2016 and 29-Mar-2016.

Table 4-19 2015 -2016 NBSD *In Situ* SPME Total PAH Results for Receiving Waters.

Station ID	Placement	Oct-2015 to Jan-2016 Pre-storm		Jan-2016 to Feb-2016 Post-storm	
		Depth Section (cm)	Total PAHs (ng/L)	Depth Section (cm)	Total PAHs (ng/L)
P01	Overlying Water	NA		33-41	407.5
				20-30	360.9
				10-20	363.0
				0-10	339.7
	Sediment	NA		0-5	545.2
				5-10	562.3
				10-15	477.4
				15-20	541.9
				20-26	439.9
P08	Overlying Water	33-42	186.8 (132.8)	33-41	-
		23-33	254.1 (166.9)	20-30	294.5
		13-23	370.7 (138.5)	10-20	240.1
		0-12	267.2 (95.7)	0-10	324.3
	Sediment	0-5	541.4 (212)	0-5	517.2
		5-10	344.2 (42.7)	5-10	464.7
		10-16	345.4 (190.5)	10-15	472.4
		-	-	15-20	406.4
		-	-	20-26	283.2
P11	Overlying Water	33-42	110.2	33-41	-
		23-33	101.8	20-30	348.1
		13-23	88.0	10-20	282.4
		0-12	166.1	0-10	381.6
	Sediment	0-5	428.8	0-5	479.9
		5-10	674.3	5-10	599.1
		10-16	599.0 (25.8)	10-15	682.1
		-	-	15-20	760.0
		-	-	20-26	885.9
P17	Overlying Water	33-42	302 (11.7)	33-41	-
		23-33	246.2 (43.8)	20-30	-
		13-23	298.7 (161.3)	10-20	439.7
		0-12	196.2 (55.7)	0-10	278.2
	Sediment	0-5	326.8 (200.7)	0-5	490.8
		5-10	334.4 (213.7)	5-10	451.2
		10-16	362.2 (161.9)	10-15	499.0
		-	-	15-20	442.5
		-	-	20-26	316.6

NA – Not available. Values in ( ) are SD of duplicate samples

As with *in-situ* samples, the highest concentrations in the *ex-situ* porewater samples were noted in the post storm sampling and at location P11 (Table 4-20). Total PAH concentrations in porewater tend to increase over the course of the storm season for stations P01, P08 and P11, but not for P17, where they seem to decrease. These trends are generally as expected considering the concentrations that were observed in the bulk sediments. As noted in Table 4-15, however, the sediment traps show the greatest PAH and PCB concentrations at P17 and thus the deposition from storm events is not clearly reflected in either bulk sediment concentrations or the porewater samples based upon bulk sediment collections.

In general, the *in-situ* samples exhibited higher concentrations than the collected samples with porewater measured *ex-situ*. This is unusual and likely indicates that the *ex-situ* samples did not represent the same sediments that were sampled *in-situ*. Normally, *in-situ* samples would be lower than *ex-situ* due to the potential for dilution by hyporheic exchange in the *in-situ* samples and the potential for greater equilibration in the *ex-situ* samples. The addition of sediment trap material to the *ex-situ* assays did not reduce the different between *in-situ* and *ex-situ,* likely indicating that the *in-situ s*amples were likely exposed to deeper, more contaminated sediments. Thus the use of either *in-situ* or *ex-situ* sediments for sampling likely show the more significant influences of stormwater recontamination but these other factors make it difficult to draw quantitative conclusions about the effects of stormwater on sediment recontamination based upon either bulk chemistry or porewater chemistry from sediment cores or surficial sediment samples.

Table 4-20 2015/2016 Wet Weather NBSD *Ex-situ* SPME Results.

Sample ID	Sampling Season/Treatment	Total Chlordane (ng/L)	Total PAH (ng/L)	Total PCB (ng/L)
P01	Pre-Storm	0.03 (0.00)	135.4 (51)	0.72 (0.18)
	Pre-Storm Plus Sed. Trap	NT	NT	NT
	Post-Storm	0.03 (0.00)	170.5 (46.7)	1.03 (0.68)
P08	Pre-Storm	0.03 (0.00)	226.4 (159.1)	0.83 (0.26)
	Pre-Storm Plus Sed. Trap	0.03 (0.01)	125.9 (57.7)	0.76 (0.16)
	Post-Storm	0.03 (0.01)	307 (300.8)	0.69 (0.10)
P11	Pre-Storm	0.11 (0.01)	155.6 (116.1)	4.16 (1.96)
	Pre-Storm Plus Sed. Trap	0.07 (0.00)	197.6 (112.1)	5.73 (3.41)
	Post-Storm	0.08 (0.00)	355.5 (382.2)	8.67 (4.37)
P17	Pre-Storm	0.1 (0.00)	305.2 (270.0)	1.1 (0.38)
	Pre-Storm Plus Sed. Trap	NR	149.1 (32.4)	NR
	Post-Storm	0.07 (0.01)	213.2 (154.5)	1.01 (0.06)

NT – Not tested. NR – Not recorded.

Pre-storm and post-storm season sediments were also passively sampled for porewater concentrations of inorganic constituents via DGTs as shown in Table 4-21. These results suggest that the porewater concentration of many of the inorganic species actually decreased during the storm season. The initial effects of the deposition of stormwater solids is reduction in the fraction of available inorganic contaminants, perhaps through the deposition of largely insoluble metal precipitates. There is also likely an effect of dilution of inert solids with the stormwater. The relatively high prestorm porewater concentrations suggest that weathering effects on the sediment during the dry season or other resuspension and redistribution events (winds, waves and navigation influences) may lead to greater contamination in terms of porewater concentration at the start of a wet season.

Table 4-21 2015/2016 Wet Weather NBSD DGT Results.

Sample ID	Sampling Season/ Treatment	Ag (µg/L)	Cd (µg/L)	Cu (µg/L)	Ni (µg/L)	Pb (µg/L)	Zn (µg/L)	Hg (ng/L)
P01	Pre-Storm	0.01	0.11 (0.06)	6.2 (1.3)	1.5 (0.5)	0.1 (0.0)	31.2 (4.0)	190.6 (24.3)
	Pre-Storm Plus Sed. Trap	NT	NT	NT	NT	NT	NT	NT
	Post-Storm	ND	0.11	3.4 (1.9)	1.0 (0.2)	0.1 (0.1)	14.4 (7.3)	19.7 (6.7)
P08	Pre-Storm	0.01	0.13 (0.01)	9.1 (4.8)	1.8 (0.0)	0.4 (0.4)	38.1 (3.3)	183.7 (29.0)
	Pre-Storm Plus Sed. Trap	ND	ND	1.7 (0.8)	1.0 (0.2)	0.3 (0.1)	4.6 (1.6)	9.38 (0.7)
	Post-Storm	ND	ND	3.8 (1.0)	0.6 (0.0)	0.4 (0.0)	16.5 (4.0)	23.5 (8.3)
P11	Pre-Storm	0.02 (0)	0.55 (0.20)	14 (6.5)	5.2 (1.8)	1.2 (0.4)	247 (106)	279.6 (74.3)
	Pre-Storm Plus Sed. Trap	ND	0.07	4.0 (2.2)	1.6 (0.7)	0.7 (0.6)	25.3 (28.)	7.55 (6.3)
	Post-Storm	ND	0.04 (0.02)	5.6 (2.4)	0.6 (0.1)	0.3 (0.1)	19.9 (8.6)	23.2 (6.1)
P17	Pre-Storm	0.01	0.11 (0.01)	14.5 (1.0)	2.1 (0.0)	1.4 (0.3)	126.6 (0.2)	89.4 (29.5)
	Pre-Storm Plus Sed. Trap	ND	ND	1.0 (0.4)	0.9 (0.2)	0.1 (0.0)	3.0 (0.4)	0.54 (0.2)
	Post-Storm	ND	0.09	1.3 (0.5)	0.6 (0.1)	0.1 (0.0)	6.6 (3.4)	2.62 (0.6)

NT – not tested.

4.5.3. *EX-SITU POREWATER SAMPLING NBSD 2016-2017*

SPMEs were exposed to sediment cores ex situ for the Pre- and Post-season sediment cores on 12-Sep-2016 to 11-Oct-2016 and 14-Mar-2017 to 7-Apr-2017, respectively.

Table 4-22 2016/2017 Wet Weather NBSD SPME Results.

Sample ID	Sampling Season/Treatment	Total Chlordane (ng/L)	Total PAH (ng/L)	Total PCB (ng/L)
P01	Pre-Storm	0.03 (0.00)	29.1 (13.8)	0.41 (0.13)
	Post-Storm	0.06 (0.00)	66.4 (2.91)	1.28 (0.03)
P08	Pre-Storm	0.05 (0.01)	28.8 (0.19)	0.50 (0.02)
	Post-Storm	0.08 (0.01)	64.0 (2.55)	1.23 (0.11)
P11	Pre-Storm	0.06 (0.00)	30.8 (1.14)	0.47 (0.01)
	Post-Storm	0.14 (0.03)	40.4 (7.20)	1.20 (0.15)
P17	Pre-Storm	0.10 (0.02)	56.5 (3.41)	0.38 (0.05)
	Post-Storm	0.26 (0.01)	56.7 (11.5)	0.97 (0.04)

As shown in Table 4-22, the organic passive sampling with SPMEs showed generally lower concentrations that in 2015-2016 and porewater concentrations that were highest at locations P08 and P11, consistent with the higher bulk solids concentrations noted there. The effect of stormwater discharges appears to be diluted by historical trend and other sources/resuspension. No measurements were conducted using sediment traps to identify storm season specific inputs.

DGT measurements (see Appendix II) showed generally lower porewater metal concentrations post-storm than pre-storm and also show little apparent connection to stormwater inputs.

Unlike other constituents, chlordane shows a rapid decrease with distance from the mouth of Paleta Creek showing that stormwater inputs can be discerned from other sources, event in *ex-situ* mixed samples, if sufficiently strong.

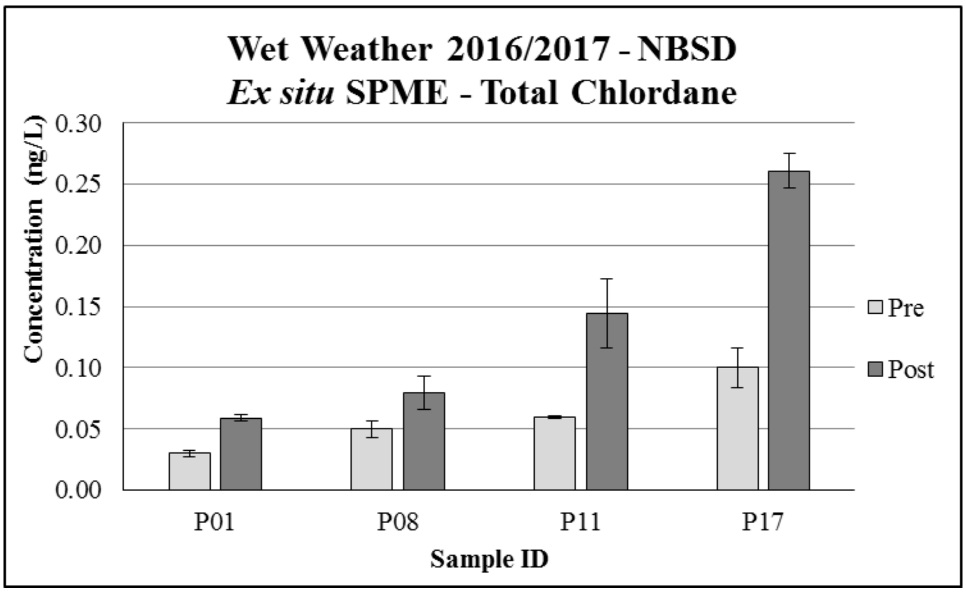


Figure 4-22 Total Chlordane concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2016/2017 Wet Weather sampling effort at NBSD.

4.6. SEDIMENT BIOASSAYS

Although chemistry showed potential links between specific contaminants and sediment recontamination, the primary concern is potential for biological effects in the sediment ecosystem as a result of the stormwater releases. This was assessed through both sediment toxicity and bioaccumulation assays, both *in-situ* and *ex-situ.* Based upon a comparison of bulk sediment and sediment deposition trap measurements, it is expected that the bulk sediment would not be a sensitive indicator of stormwater inputs. Volume requirements, however, preclude, direct use of the sediment collected in traps as the sole media in bioassays. In some cases, however, sediment from sediment traps were added to bioassays and differential behavior compared to bulk sediment was noted.

In-situ Sea Rings assays were employed as well as *in-situ* toxicity identification evaluation assays (conducted by University of Michigan). These are discussed in more detail in Appendix II and

Appendix IV, respectively. In many situations, the *in-situ* information may be invaluable and necessary to understand the toxicity of in-place sediments. The *in*-situ approaches were used to assess the effect of the normal suite of contaminants (PAHs, PCBs and metals) but the assays suggested that other contaminants may be the primary concern relative to biological effects. The usefulness of *in*-situ assays are limited to the effects of contaminants for which they are designed. *Ex*-situ assays, however, are more flexible and may be more easily redirected on the basis of preliminary information. In the current work, a contaminant not part of the *in-situ* monitoring efforts was ultimately judged to play a significant role in toxicity of the sediments. As a result, our discussion here will focus on *ex-situ* bioassays that allowed evaluation of biological behavior of both surficial sediment and sediment from traps and a broader range of contaminants. Full bioassay results can be found in Appendix II.

4.6.1. *SEDIMENT TOXICITY ASSAYS*

Preliminary dry weather sampling in 2014 showed potential toxicity of sediment samples collected in the tidal creek and at the Paleta Creek discharge into receiving waters. There were no signs of toxicity in the receiving water sediments (P1-P17). As the storm season progressed in both 2015-2016 and 2016-2017, however, toxicity tests with the marine amphipod, *E. Estuarius*, showed increasing toxicity in surficial sediments. This is detailed in Appendix II and illustrated in Figure 4-23. Toxicity tests on surficial sediments collected from locations P01, P08, P11 and P17 before the wet season in both years showed no toxicity. After several storms in late summer 2015, however, surfical sediments showed significant toxicity at P11 and P17. After additional storms, some toxicity was evident at all locations except the most distant from the Paleta Creek outfall. The same behavior occurred over the wet season of 2016-2017. The behavior suggests that toxicity is moderated during the dry season as a result of dilution or fate mechanisms and then increases as a result of stormwater releases.

Mortality was greatest when the stormwater-associated particles from the sediment traps were added to the moderately toxic Oct-2015/ “pre-storm” cores. These results suggest that stormwater-associated particulates are contributing to the observed ephemeral toxicity (Figure 4-24).

Correlation analyses were performed on the amphipod survival against the constituents of concern in the bulk sediments to assess possible drivers of toxicity. Measured pore water concentrations of metals (Cd, Cu, Ni. Pb, Zn, Hg), PAHs, PCBs, DDE, and chlordane are well below literature LC_{50} for *Eohaustorius estaurius.* Pyrethroids have been observed in stormwater runoff from residential areas and further evaluation of the effects of these contaminants was conducted. Using literature-based concentrations LC_{50}, toxic units were also calculated by summing the individual pyrethroid constituents. Pyrethroid summed TUs showed a significant correlation to amphipod toxicity (Figure 4-25; $r = -0.83$, $p = <0.001$). The TU analysis suggests that pyrethroids are the dominant factor but not solely responsible for the observed toxicity (correlation with pyrethroid toxic units estimates explained 68% of the variance in the data) and it is likely that a mixture of unmeasured contaminants are contributing to toxicity.

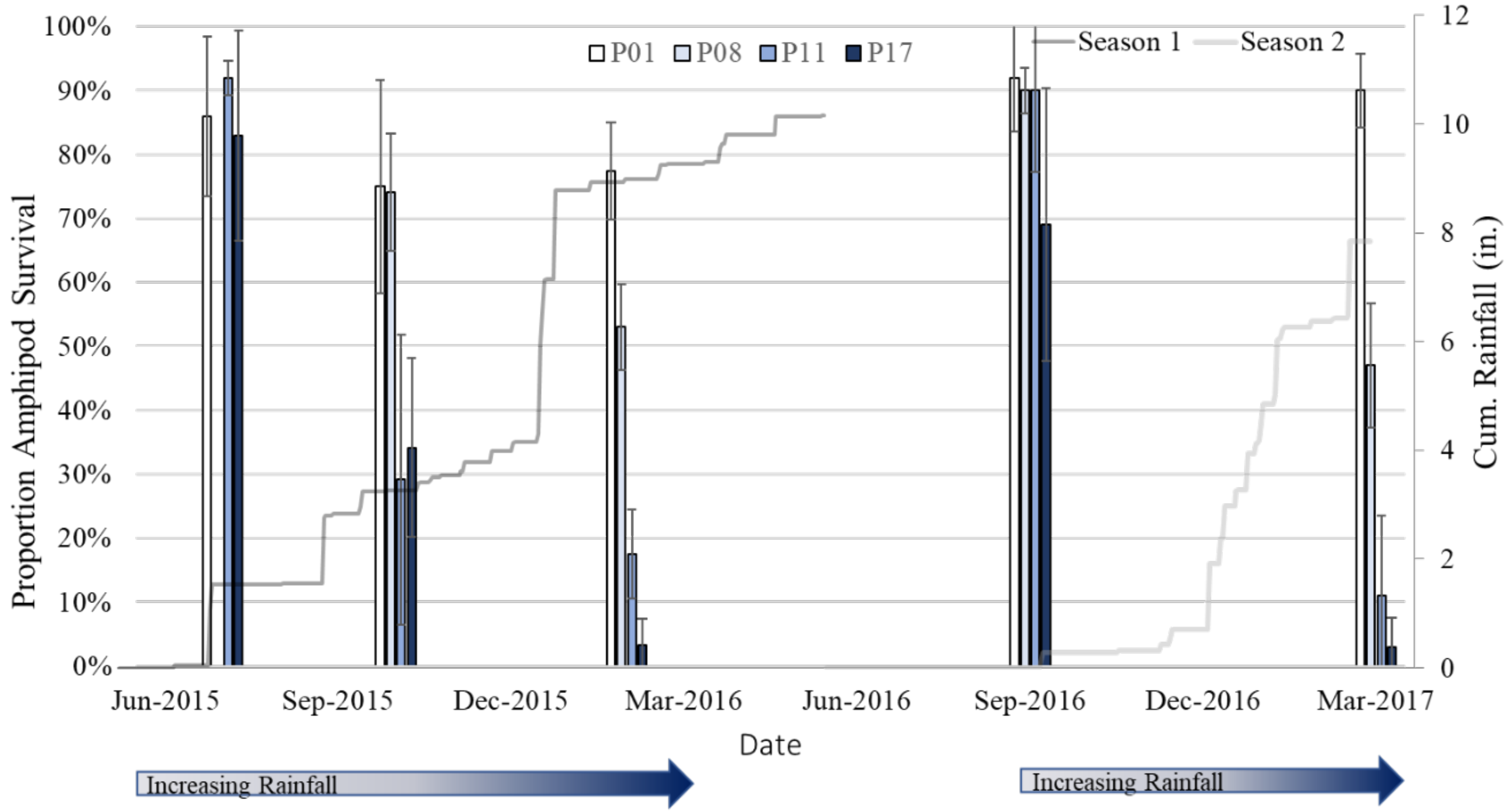


Figure 4-23 Survival of the marine amphipod, *E. estuarius*, over time along with cumulative precipitation for each storm season monitored for NBSD.

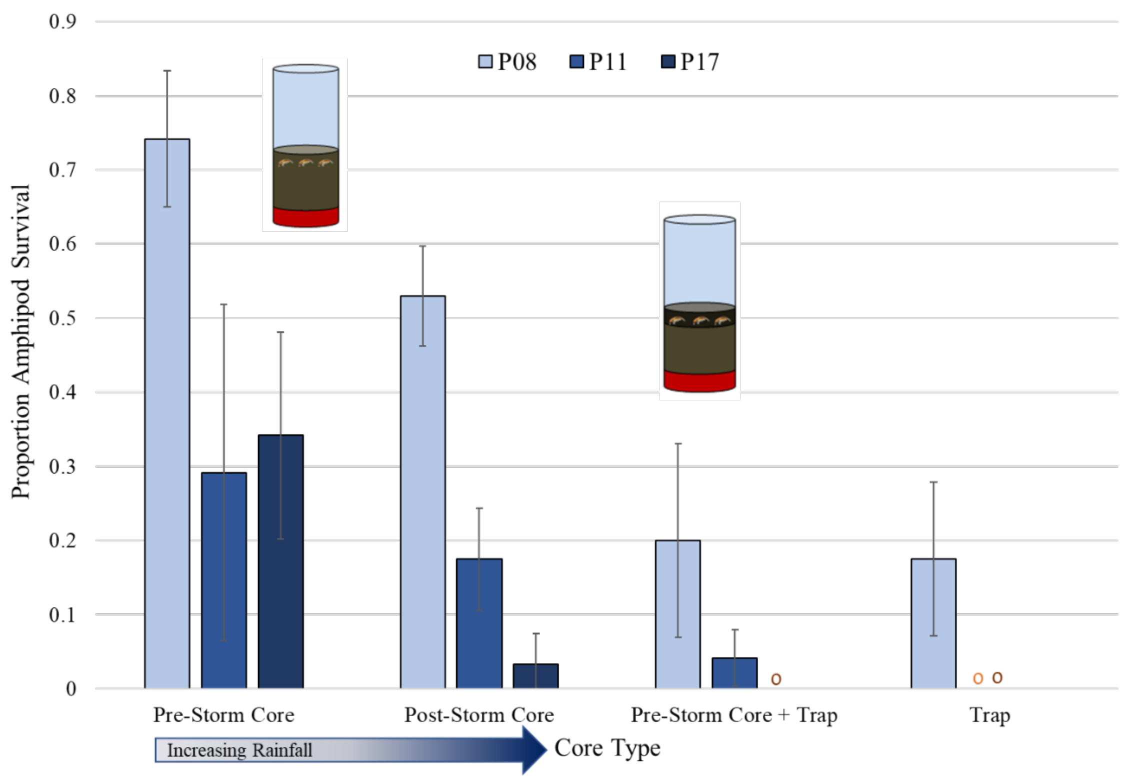


Figure 4-24 Survival of the marine amphipod, *E. estuarius*, for the 2015/2016 sampling season using intact sediment cores and sediment trap material treatments. Note that the pre-storm core is from September 2015 and is influenced by the initial storms of the 2015-2016 season.

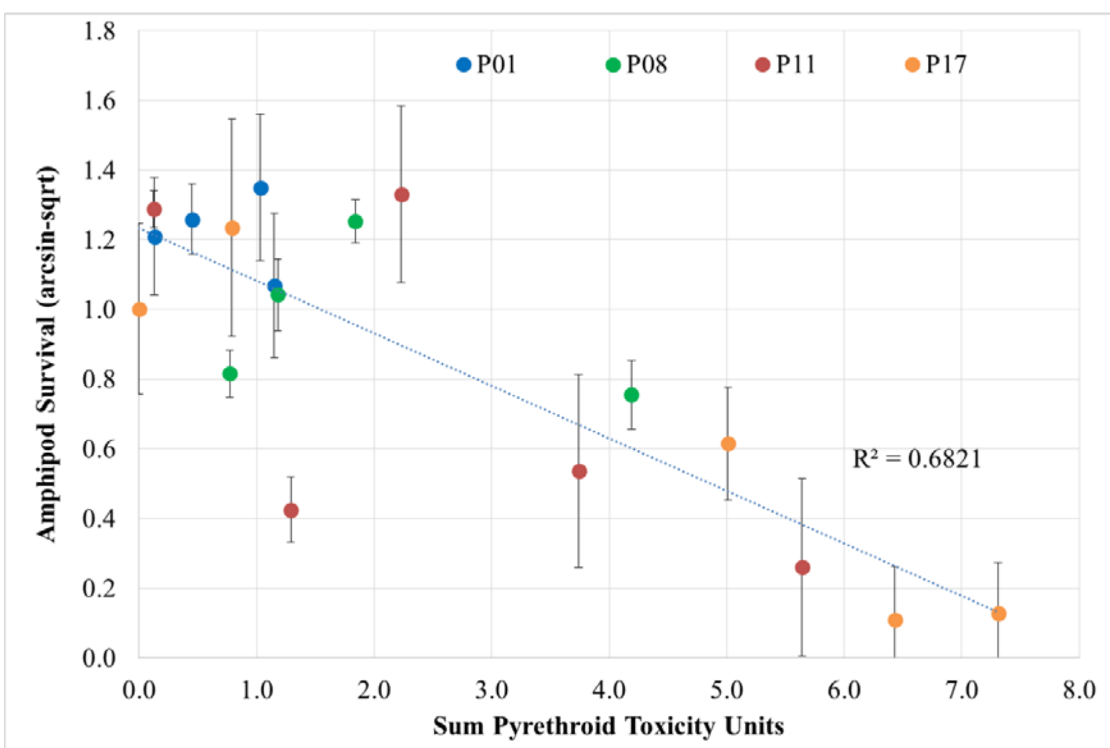


Figure 4-25 Amphipod survival versus summed toxic units (TUs) for pyrethroid pesticides.

4.6.2. *BIOACCUMULATION TESTING*

Concentrations of constituents of concern associated with the tissues of the clam *Macoma nasuta* were evaluated over the course of the sampling efforts. Detailed results are in Appendix II. Spatial patterns existed within a given sampling event for several metals. For example, for copper, nickel and lead, bioaccumulation increased towards the mouth of Paleta Creek for the Sep-2016 sampling event, but this trend was not as strong or wasn't present for other sampling efforts. There was no significant trend in bioaccumulation of cadmium despite the substantial deposition of cadmium observed near the stormwater discharge. This suggests that the cadmium associated with the large particles at the mouth of Paleta Creek does not contribute significantly to bioaccumulation in this clam. For total mercury, the spatial trend of *decreasing* accumulation towards the mouth of Paleta Creek was observed for almost all of the sampling efforts suggesting again that the stormwater does not contribute substantially to the effects of mercury in the system.

Total PAH bioaccumulation in clam tissue generally increased over time for all stations except for P11, which had a high concentration in early sampling events (i.e. Jul-2015; Figure 4-26). Station P08 showed PAH accumulation that increased over time, with a slight decrease during the Sep-2016 sampling event and then an increase for the final sampling event in Mar-2017. Note that although the clam tissue concentrations generally increased with time, the largest increases were at position P08 while the stormwater contributions to solid concentrations were strongest at P17. The PAHs in the large particles that deposited at P17 do not appear to lead to bioaccumulation suggesting a relatively low bioavailability of the PAHs in these particles. There was elevated bioaccumulation of PAHs

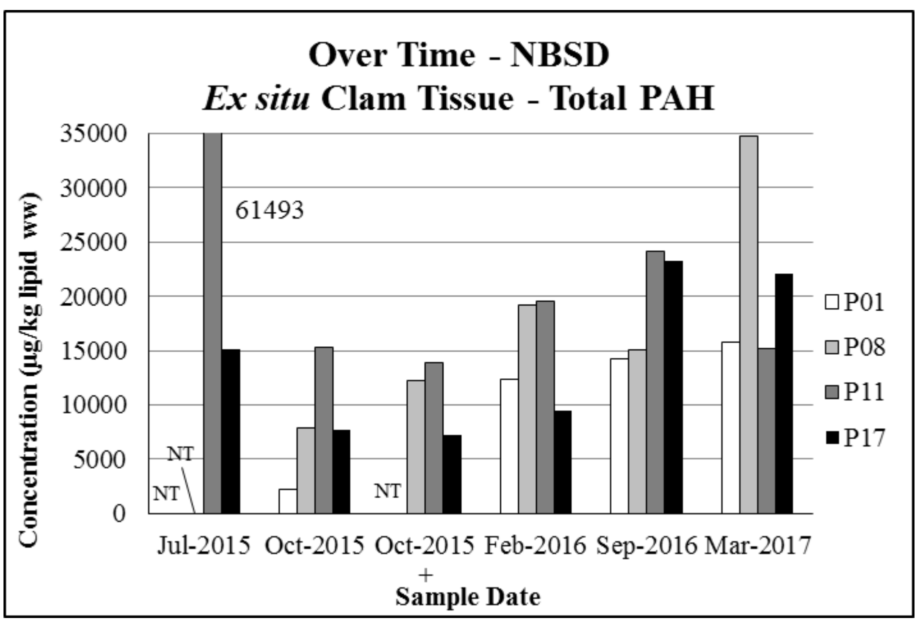


Figure 4-26 Concentrations of PAHs associated with the tissues of the bent-nosed clam *Macoma nasuta* over time at NBSD from *ex situ* exposures. Note: "+" below Oct-2015 date indicates the sediment trap material additive treatment.

PCB bioaccumulation peaked in Feb 2016 at position P08 (Figure 4-27). The observed PCB bioaccumulation was approximately consistent with the TOC normalized PCB concentrations (Figure 4-28).

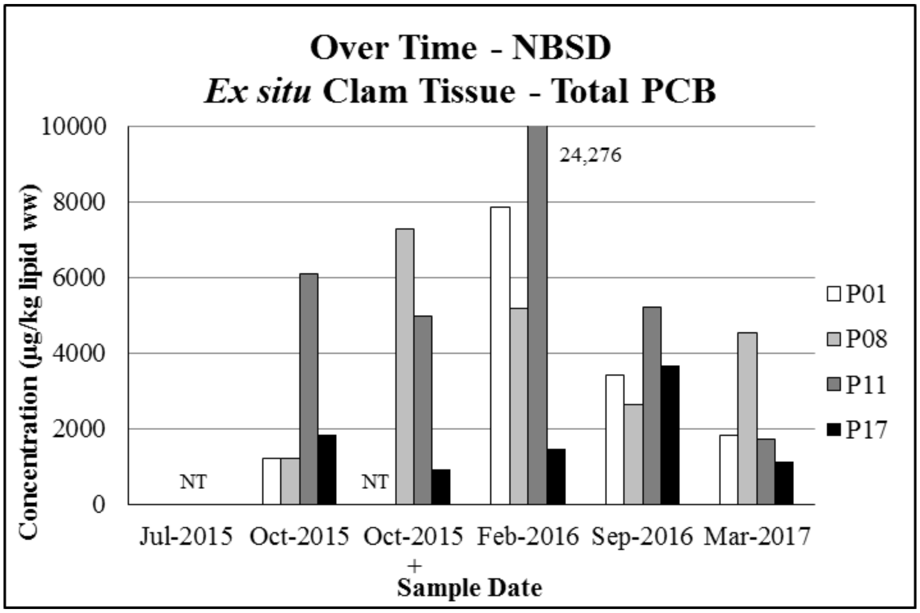


Figure 4-27 Concentrations of PCBs associated with the tissues of the bent-nosed clam *Macoma nasuta* over time at NBSD from *ex situ* exposures. Note: "+" below Oct-2015 date indicates the sediment trap material additive treatment.

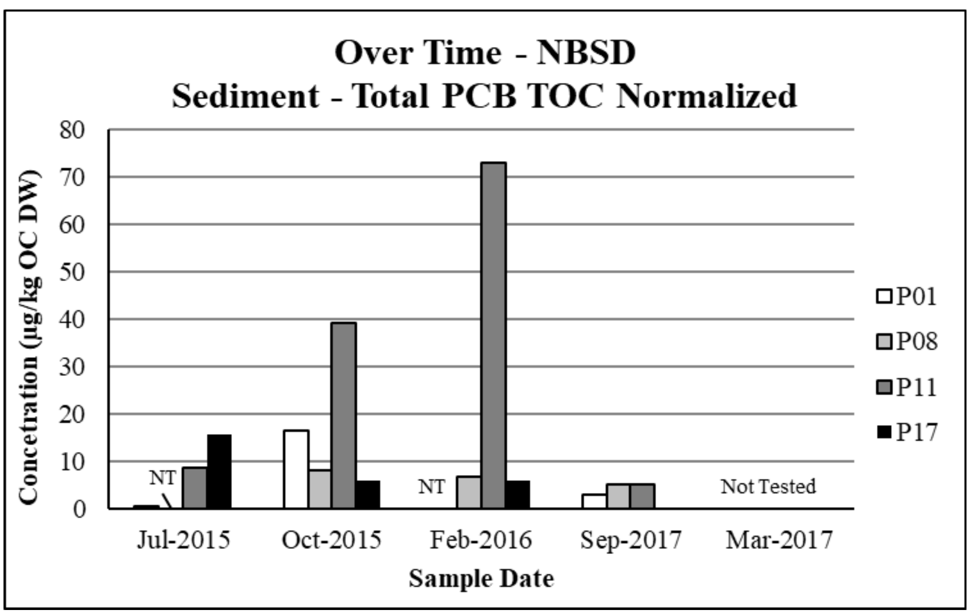


Figure 4-28 Concentrations of PCBs normalized to total organic carbon in bulk sediment over time at NBSD.

4.6.3. *Bioassays PSNS*

Toxicity testing was conducted on sediment collected 7-Dec-2016 and 29-Mar-2017 using the sea urchin embryo-larval development test as described in Appendix II. Test results met test acceptability criteria of ≥80% normal larval development for the sea urchin tests for both testing periods. All water quality parameters measured were within the recommended ranges for the duration of the tests. Raw test data and bench water quality sheets are provided in Appendix II E.

Using the USEPA TST method for analysis, no toxicity was observed in either the effluent or ambient samples compared to their respective brine controls.

4.7. PASSIVE SAMPLING

PDMS passive sampling was conducted on bioassay sediment samples and compared to tissue bioaccumulation in *Macoma nasuta*. As described previously, location P17 showed substantial deposition of stormwater-related particles with elevated levels of PAHs although no related increase in PAH bioaccumulation was noted during the 2015-2016 wet season. PCBs, however, showed substantial increases at location P11 and corresponding increases in PCB bioaccumulation during the 2015-2016 season. Bulk solids and SPME measurement in *in-situ* and *ex-situ* samples did not indicate the likelihood of this behavior. Instead, passive sampling measurements were made in the specific *ex*-situ bioassay experiments were evaluated to determine if these trends were suggested by the porewater concentrations of PAHs and PCBs in these experiments. Complete data is shown in Appendix I and II. For the purposes of the current analysis, the ratio of the post-season bioaccumulation to pre-season bioaccumulation tests to ratio of the porewater concentrations between the same sediments were evaluated. In these figures, clustering around unity on both axes suggests little or no change in tissue accumulation or porewater concentration. Data in the upper right quadrant shows increases in both tissue accumulation and porewater concentration. Data in the upper left or lower right quadrant indicate tissue accumulation that is inconsistent with the porewater concentration changes. Data in the lower left quadrant implies decreases in both tissue accumulation and porewater concentration.

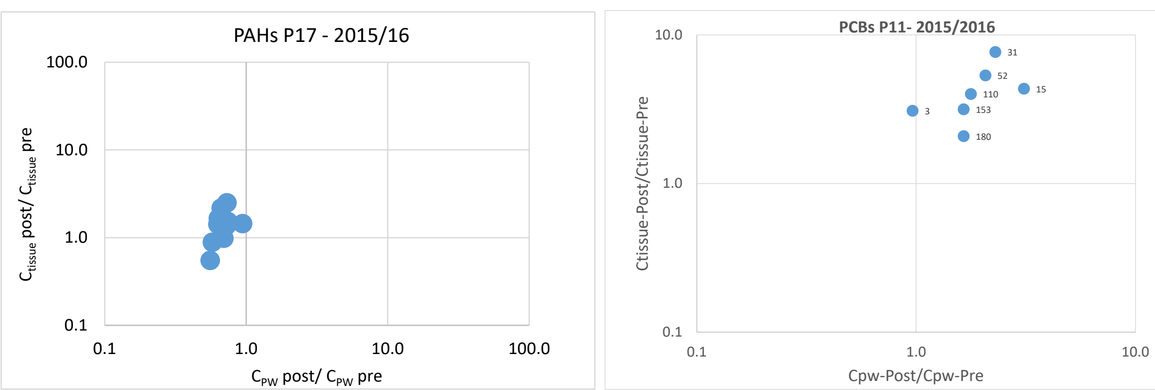


Figure 4-29 Individual PAHs at P17 and PCBs at P11 before and after 2015-2016 wet season

As shown in Figure 4-29, neither PAH bioaccumulation in tissues nor porewater concentrations (left figure) changed significantly between the pre and post 2015-2016 sediment samples (Post/Pre concentrations~unity) at P17 where the greatest accumulation of stormwater-related PAHs occurred. Each data point on this figure represents a specific PAH. PCBs at P11 (right figure), however, show significant increases in both tissue accumulation and porewater concentrations. That is, bulk solid deposits of stormwater-related PCBs led to increased concentrations in the P11 sediments and a corresponding increase in porewater concentrations and bioaccumulation. The bulk solid deposits of stormwater-related PAHs, however, led to no increases in porewater concentration or bioaccumulation. The conclusions are the porewater concentration as measured by passive sampling is an approximate indicator of bioavailability but also that stormwater-related increases in bulk solid concentrations does not necessarily lead to increases in the bioavailable concentrations and biological measures such as bioaccumulation. The lack of a direct correlation between bulk solids and bioaccumulation or porewater concentration is common in PAHs.

4.8. WINSLAMM MODELING

A significant limitation of the physical, chemical and biological measurements of the stormwater is that they are limited to the small number of events that can be intensively monitored. The primary focus were on two events that were representative of a large fraction of the events that occurred, at least during the sampling year. Long term behavior and assessment of stormwater water loads and impacts on receiving waters under wet years and dry years, however, requires extrapolation from these individual events to annual and longer periods. In this work, WinSLAMM modeling is used for this purpose. Detailed modeling results are included in Appendix III and only a summary is presented here.

The Paleta Creek watershed survey was used with WinSLAMM for stormwater analyses of the watershed. The watershed drainage area was updated during the field survey and the land use breakdowns were also obtained from aerial photographs for each site. These neighborhood surveys were used to describe the land development conditions for the land uses in the area, and the creek survey was used to describe the channel modeling conditions. Aerial photographs were used to measure the areas for each surface type in each neighborhood. The NBSD areas comprise about 13.5% of the total watershed area (located west of I5). More than 96% of the total watershed is developed.

Two qualifying stormwater monitoring events were sampled during this project, on January 4-8, 2016 (2.48 inches) and on January 30-31, 2016 (0.18 inches), at up to six locations in the Paleta Creek watershed. A total of 15 samples were collected during the two events. Four outfalls were sampled at the NBSD during the first event and two were sampled during the second event. The second event had much less rain and the incoming tide affected the other sampling locations, so fewer samples were available during the second event. The Paleta Creek station at Main Street is the main channel and represents the upper watershed flows. This location was sampled during each event. The other Paleta Creek and ambient water samples represent mixed flows in the creek mouth, with four locations during the first event and three locations during the second event.

Whole samples were analyzed for total and filterable forms of the contaminants. In addition, each of the 15 samples were also separated into four particle size ranges for analyses. A number of statistical tests were conducted on these data to identify significant associations between related constituents and significant differences associated with sampling locations. The constituents having significant correlations with SSC (suspended sediment concentration) were:

- Metals: Cu, Zn, Cd, Pb, and Hg
- PAHs: fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, and benzo[k]fluoranthene

Cluster analyses were used to identify strong relationships between different constituents. The sampling program included many different constituents (in total, filtered, and particulate strength forms). The cluster analyses for particulate strength concentrations indicated five data groups, with the following group having the strongest relationships (shortest branches on the dendogram), comprised of most of the detected PAHs: phenanthrene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, benzo[k]fluoranthene, pyrene, benzo[ghi]perylene+indeno, and dibenzo[a,h]anthracene. These statistical results indicate that the PAHs are likely from similar sources and would be transported in a similar manner through the watershed. Their control and fate after discharge would also be similar.

The multivariate analyses supports common sources for most of these PAHs. The Pearson Correlations listed a set of HMW PAHs having significant correlations with the SSC, indicating their strong association with particulates. In contrast, no LMW PAHs were significantly correlated with SSC. The principle component and cluster analyses also found that the mostly strongly correlated PAHs were all HMW PAHs, with the periodic exception of phenanthrene (shown to be associated with both petrogenic and pyrogenic sources). Therefore, it is expected that most of the Paleta Creek PAHs are of similar petrogenic sources, most likely strongly influenced by the high vehicle activity in the area. Regional industrial and wildfire emissions may also be important PAH sources, but these project PAH data cannot distinguish them from the obvious vehicle sources. Being highly associated with particulates, their control through sedimentation practices should be efficient. Discharged PAHs will travel with their associated particulates, with a greater amount associated with large particles than small particles. Finally, the HMW PAHs do not have high volatilities or short biodegradation rates, so they are likely to be persistent in receiving water sediments relatively close to the Paleta Creek discharge.

There were no statistically significant differences observed between total, filtered, and particulate strength concentrations for the different sampling location groups (upper watershed, mostly residential; NBSD, and Paleta Creek mouth mixed flows), most likely due to the relatively small number of samples available. It is estimated that differences as small as 50% would be found to be significant for the number of samples available, indicating smaller concentration differences actually occurring.

The sediment particle size distributions (PSDs) for the NBSD samples were similar for both events, and typical for most stormwater from paved areas (<10% greater than 100 µm). The upper watershed PSDs have a greater abundance of larger particles, likely associated with erosion from the steeper undeveloped areas in the watershed and channel scour (15 and 40% greater than 100 µm, for the first and second storms respectively). However, a few of the NBSD large particle fractions had very large contributions, most likely associated with infrequent discharges of large oily or metallic debris material sometimes found in industrial area stormwater. These particles had a tendency to shift the importance of the pollutant contributions to the larger particle size range. As an example, about 60% of the zinc was associated with the largest size range analyzed (>63 µm). This large particle size is the most important when considering near-field deposition after discharge, with less zinc sedimentation occurring at greater depths and distances from the discharge location. This particle size can also be targeted for stormwater control to reduce the near-field contamination potential. The SSC mass from the NBSD areas in the lower watershed area has most of the material in the 5 to 20 µm size range, while the upper watershed SSC mass was more evenly distributed with particle size, but with more material in the largest particle size range.

The previously calibrated WinSLAMM stormwater quality model was used to calculate the expected discharges per month throughout the year for the Paleta Creek watershed subareas using long-term San Diego rainfall and watershed development characteristics, and for total annual conditions. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. The NBSD comprises about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges. The NBSD contributions for the other constituents ranged from about 13% to as high as about 63%. The unit area discharges (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area (by up to about five times). These increased unit area discharges were mostly associated with a few very high pollutant strength values for some of the NBSD samples (such as outfall #33 for the large sample size fraction). In contrast, some of the upper watershed pollutant strengths had relatively small values associated with the large particle size range. The high values for the large particles from the NBSD samples may be associated with periodic large debris having high metal and PAH values (as also found in industrial stormwater from other areas), while the large particles from the upper watershed area may be more associated with less contaminated bank erosion material and sediment scour in the creek, rather than from contaminated large particles.

WinSLAMM discharges were calculated based upon a calibrated model for NBSD (http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Site_Descriptions_Calibration_and_Sources_Feb_17_2014.pdf).
Long-term San Diego airport rainfall data were used for these calculations. The dramatic variation throughout the year is obvious, as very little rainfall occurs during the summer months. WinSLAMM was used to calculate the expected discharges per month throughout the year, as summarized below in Figure 4-30. Only about ten percent of the total annual flows and particulate

discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. The model can also be used to separate discharges by originating land use area which allows connecting the volumetric discharges to contaminant discharges (e.g particulate discharges in Figure 4-31) .

The WinSLAMM model using this information along with current San Diego calibration information was then compared to more complete stormwater monitoring results for the area. Appendix III-2 contains the land development characteristics for all of the subareas in the Paleta Creek watershed that were used in the WinSLAMM modeling analyses, while Appendix III-3 contains the detailed model input information used for these analyses.

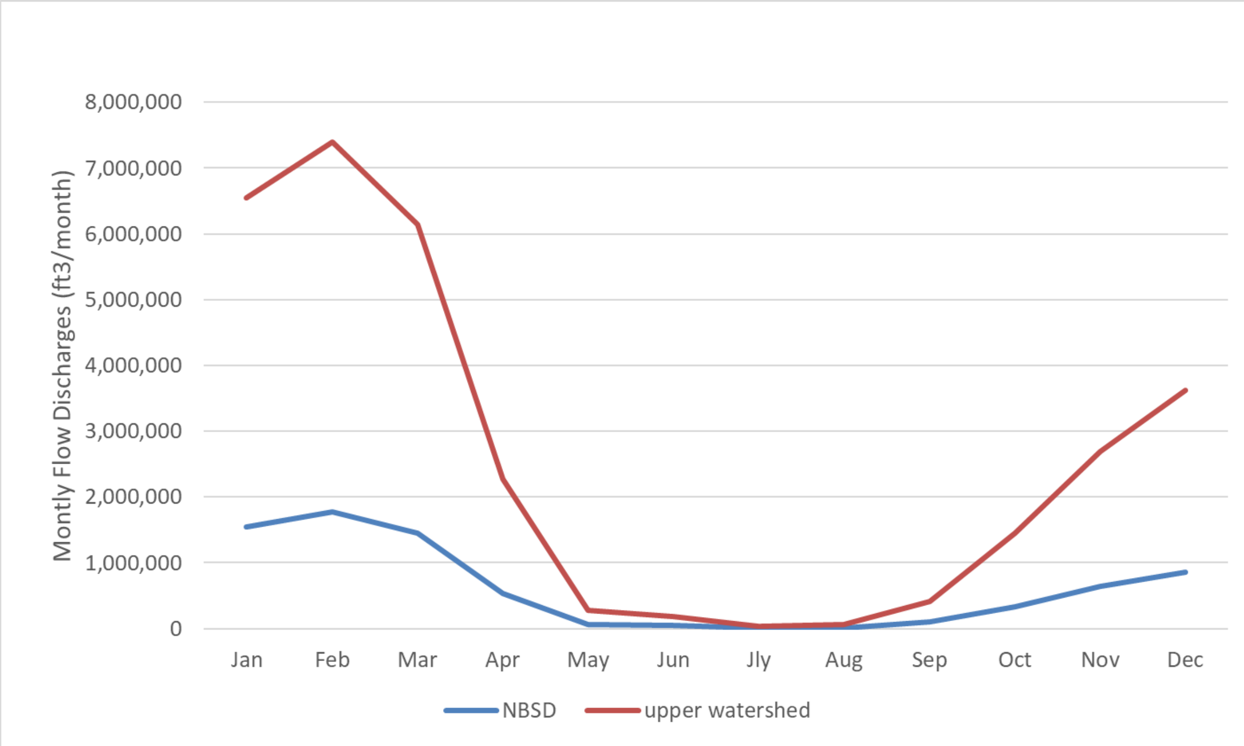


Figure 4-30 Monthly stormwater discharges for the Paleta Creek watershed

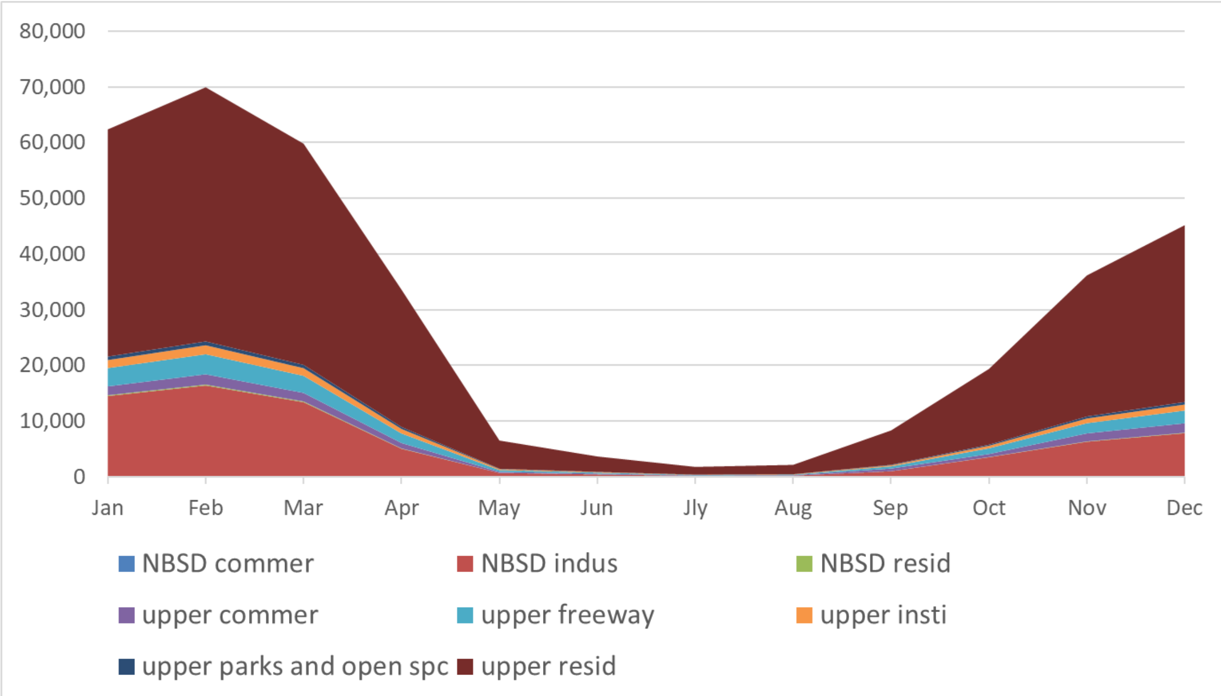


Figure 4-31 Particulate discharges (kg/month) by month and land use

Figure 4-32 and Figure 4-33 are example plots illustrating the particulate solids mass contributions by particle range for some of the monitored constituents. These are averaged for the six NBSD and two upper watershed samples obtained during the two monitored events. The constituents were weighted based on the amount of total particulates found in each size range times the constituent concentrations. The SSC mass has most of the material in the 5 to 20 µm size range, while the upper watershed SSC are more evenly distributed, with substantially more material in the largest particle size. The individual plots indicate that much of the constituents are in the large particle size range which would settle to the receiving water sediments near the discharge location. For the NBSD sites, periodic high concentrations were noted in this large size range, likely associated with some large oily debris from the active industrial sites. The upper watershed area was likely affected by watershed erosion and channel scour, with small concentrations. The weighting factors resulted in similarly high contributions for the large size range for both watershed areas for many of the constituents shown below.

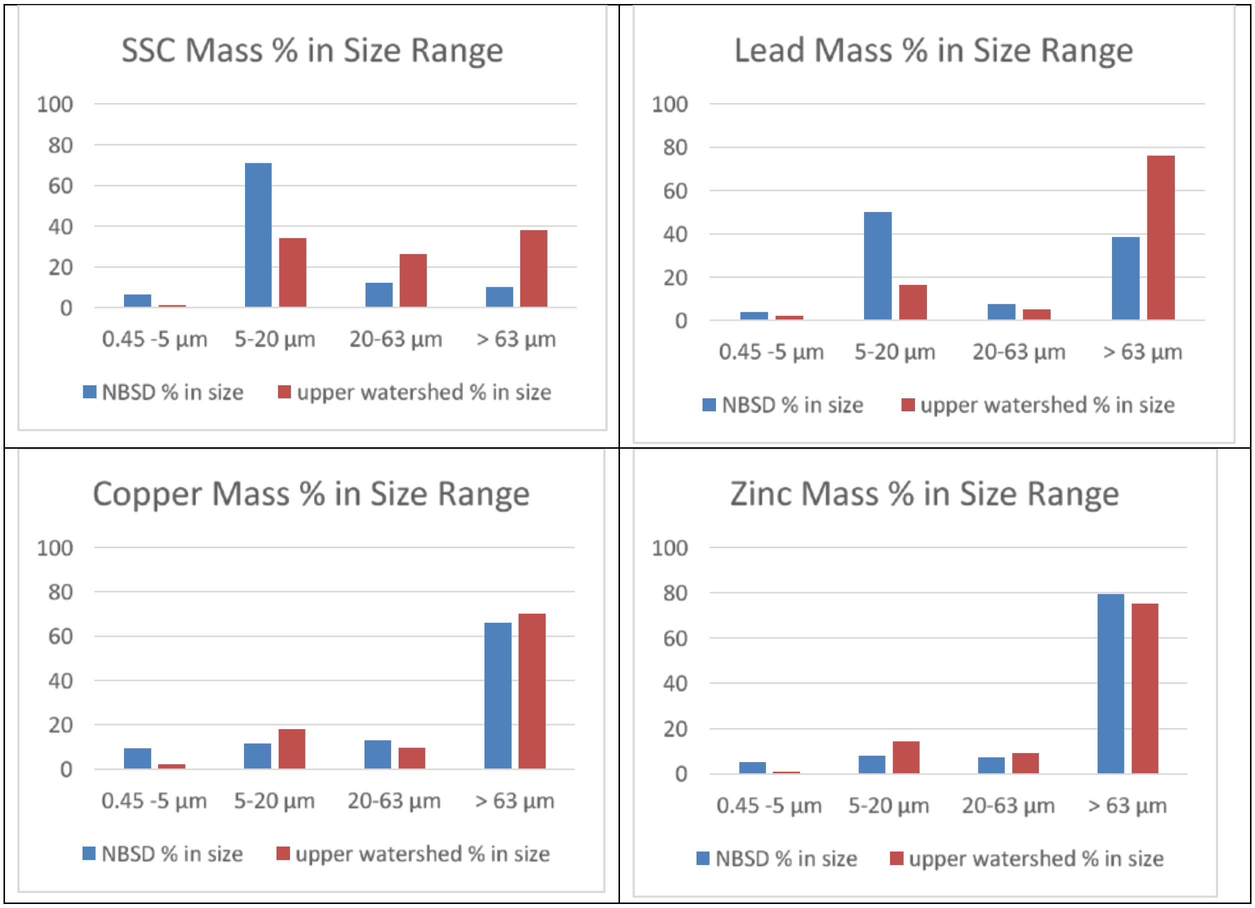


Figure 4-32 Particulate metal mass contributions by particle size and land use.

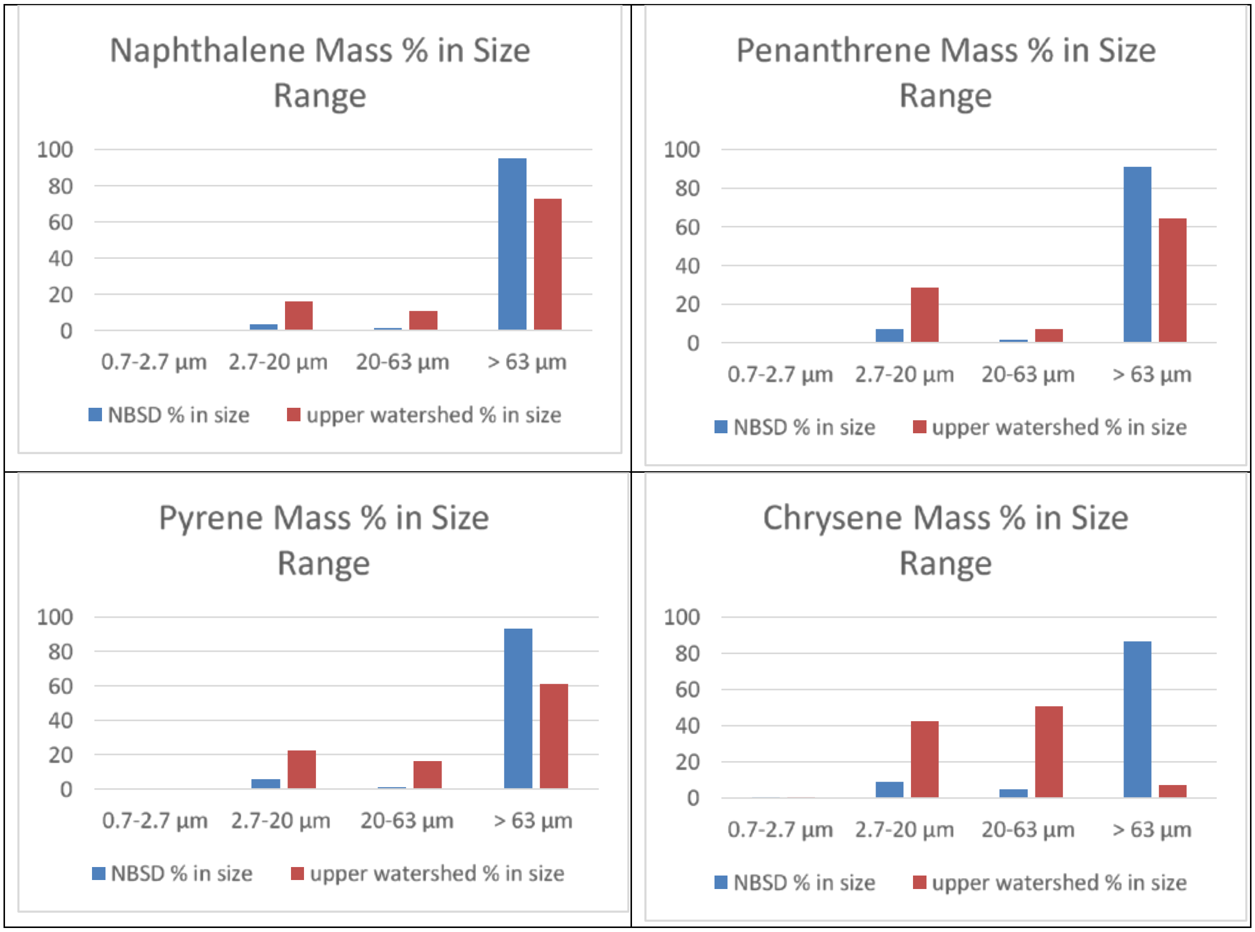


Figure 4-33 Particulate PAH mass contributions by land use and size range.

The NBSD makes up about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges. The NBSD contributions for the other constituents ranged from about 13% to as high as about 63%. The unit area discharges (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area (by up to about 5 times). These increased unit area discharges were mostly associated with a few very high pollutant strength values for some of the NBSD samples. In contrast, some of the upper watershed pollutant strengths had relatively small values associated with the large particle size. The high values for the large particles from the NBSD samples may be associated with periodic large debris having high metal and PAH values (as also found in industrial stormwater from other areas), while the large particles from the upper watershed area may be more associated with bank erosion and scour in the creek than from contaminated large particles. A substantial number of contaminants are expected to be associated with particles greater than 63 µm on an annual basis (Table 4-23). About 90% of these annual stormwater discharges are expected to occur during the six month October through March period, with very little stormwater discharges occurring during the typically dry summer months.

Table 4-23 NBSD Particulate Constituents having more than 75% of Expected Annual Mass Discharges in >63 µm Particle Size Category

Cd
Ni
Zn
Acenaphthene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Chrysene
Dibenzo[a,h]anthracene
Fluoranthene
Naphthalene
Phenanthrene

Previous stormwater data from the NBSD were analyzed during prior studies that examined pollutant discharge distributions with time (event first-flush and seasonal first-flush, where concentrations are assumed to be larger at the beginning of a rain event and at the beginning of the seasonal rainy period). The 2013 stormwater quality data from the NBSD were reviewed, comparing TSS, total and dissolved copper, and total and dissolved zinc concentrations obtained during event first flushes to the same event sampled as a whole event composite. Only the dry side sites (mostly residential and commercial areas) had these concurrent data. No paired first flush and total storm composite data were available for the base industrial locations for this time period. The first flush TSS concentrations averaged about 3.6 times the total storm composite values, with a moderate significance ($p = 0.06$). The copper data also have marginal p values of 0.06 with first flush concentration increases over the total storm composite concentrations of about 3.1 and 2.6 for total and dissolved copper, respectively. The total and dissolved zinc paired concentration values had significant p values of 0.01, with all of the observed first flush concentrations greater than the composite concentrations. The concentration ratios for zinc were higher than for copper, being about 4.1 and 5.3 for total and dissolved zinc respectively. As found during many stormwater monitoring projects, first-flush effects can be significant for small paved areas, while areas having mostly landscaped surfaces (or large complex areas) have fewer and/or less extreme first-flushes. These observations also vary for different constituents and are rarely seen for large watersheds.

Southern California stormwater managers frequently observe significant “seasonal first-flushes” when the initial rains of the year have larger concentrations compared to rains later in the rainy season, and may account for much of the total rain year stormwater discharges. Prior stormwater quality data from NBSD monitoring locations collected over many years for October and November were statistically compared to the other months. Based on these data, it is likely that the dry side (residential, commercial, and institutional land uses) have significant seasonal first flush conditions. However, there is no supporting information in the data from the naval industrial areas supporting seasonal first-flushes from this land use. It is thought that the highly varying industrial site activities during the different monitoring years caused a greater variability than the seasonal differences, effectively obscuring any seasonal first flush patterns.

Determining the recontamination potential of previously dredged areas with discharged stormwater particulates is a primary objective of this research. As indicated previously, much of the mass of particles in the > 63 µm size range and in the >20 and <63 µm size are expected to settle relatively quickly in the relatively shallow waters near the Paleta Creek outfall, specifically receiving locations P11 and P17. About 24% of the stormwater particulates from the creek are in the >63um particle size range, affecting the near zone after discharge. The Tentative TMDL report for the site indicates a 9 acre area of impairment for sediment toxicants. This most settleable portion of the stormwater discharges would result in about an inch of sedimentation over about a 25 year period, if evenly distributed. Obviously, sediment deposition would vary depending on water velocities and depth.

A more detailed discussion of flow and deposition in the receiving waters is included in Appendix V. The detailed modeling results in Appendix V are in general agreement with the conclusions outlined above and illustrate that larger particles (>63 µm) will settle close to the mouth of Paleta Creek. The modeling also suggests that significant fine particles will also settle close to the outfall although that depends upon the rate of flocculation and growth of the fine particles. The predicted sediment deposition rates were also in good agreement with sediment trap deposition rate measurements (see Appendix V). As with WinSLAMM modeling, the CH3D model is expected to be most useful in the predictions of the effects of specific events for which there are no measurements or long-term average sediment deposition.

During prior NBSD projects, WinSLAMM was also used to make preliminary evaluations for a selection of stormwater controls that may be suitable for NBSD use, including: street cleaning, catchbasins, proprietary media filters, biofilters (NBSD currently is monitoring a biofilter pilot facility at a site parking area to obtain local performance measurements), porous pavement (NBSD is also currently monitoring a pilot porous pavement facility to obtain local performance information), and possibly grass filter and swales at selected locations. The Tentative TMDL allocation report includes several target numeric criteria (not yet officially set for Paleta Creek, but used here for comparison with the expected creek discharges). The NBSD total PAH particulate strength values would have to be reduced by about 80% to meet the tentative criterion, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about

22%, if all particle sizes are subject to this criterion. One-third of the NBSD samples and one-half of the upper watershed area stormwater samples exceeded the tentative benzo(a)pyrene criterion, when all particle sizes are considered. The maximum concentration observed at the NBSD would require about 70% reductions, while the maximum concentration observed at the upper watershed area would only require about 4% reductions. The NBSD would need to reduce the total PAH stormwater mass discharges by about 25%, while the upper watershed area stormwater PAH mass discharges are below the tentative discharge limit. The total watershed calculated stormwater total PAH mass discharges are also barely below the TMDL tentative limit for the entire watershed. If only the settleable portion of these compounds are compared to the tentative criteria to project the critical bottom sediments near the creek mouth, much smaller stormwater concentration reductions would be needed. Chlordane and total PCB discharges were calculated and compared to the tentative limits separately in sections 9 and 10 as, those data become available from the laboratory after the other data was available.

Most naval facilities are located adjacent to the receiving waters with stormwater from adjacent mixed land use areas contributing to the total watershed discharges. The characteristics of these stormwaters are different due to the varying land uses and site activities, requiring a mixture of types of stormwater controls located in different locations. Numerous stormwater controls are available that can address particulate-associate toxicants, but the varying stormwater characteristics and source contribution complexities require a more complete decision analysis process to determine the best stormwater controls to be used than is typical. It is recommended that future work address stormwater controls that are suitable to meet likely treatment needs and that the cost of these controls be evaluated against their relative benefit, expressed in terms of reducing sediment recontamination risk, as defined in this study. Additional information should also be obtained concerning the unique characteristics of naval facility stormwater (especially particulate-bound organic compounds associated with different particle size ranges).

It is also recommended that any applicable criteria for the stormwater discharges focus on the pollutant forms of importance in protecting the receiving water sediments. For example, only the settleable portions of the pollutants (generally >63 μm) would affect the near zone bottom sediments of concern near the mouth of Paleta Creek, and any numeric criteria should therefore focus on these larger size particles. Also, any criteria should address the PAH compounds of concern that are affecting the receiving waters. The sum of the PAH compounds is very misleading as it is possible for less problematic PAHs in high concentrations to mask the significance of more important PAH compounds in smaller concentrations. Criteria focusing on total PAH concentrations is similar to a nonsensical criteria that would address total heavy metal concentrations. The results of the toxicological tests being conducted as part of this project would be an excellent tool to identify the critical PAH compounds for consideration for criteria development. The tentative criteria lists benzo(a)pyrene separately; therefore any other important PAH compound identified should also have a separate and meaningful criterion.

5. SUMMARY AND CONCLUSIONS

This section will summarize the data collected and key results and end with the primary conclusions which are related to the recommended tools and approaches to best assess the relationship between stormwater inputs and the sediment recontamination of adjacent receiving waters.

The work at Paleta Creek watershed at NBSD showed a variety of characteristics associated with the stormwater loads and sediment recontamination. The stormwater discharge data showed that much of the initial contaminant load discharged from Paleta Creek into the receiving waters were associated with large particles (coarse silts and larger) but that late in a storm event, the amount and contaminant load of these larger particles decreased. The bulk of the stormwater flow in the watershed was associated with Paleta Creek itself and discharges directly from NBSD through other outfall was small, even considering that the concentrations of contaminants from some of those outfalls were elevated relative to the Paleta Creek discharge. Among organic contaminants, PAHs were shown to be associated with the largest size fraction >63 μm and the amount of PAHs discharged decreased as the amount of these particles decreased. A statistical analysis (Appendix III) showed strong correlations of most of the PAHs with suspended solids concentrations and that the PAHs were likely all from the same or similar sources. Examination of these large particles and their distribution in the watershed suggested that PAHs were found predominantly in carbon-rich particles (e.g. asphalt, coal tar or tire fragments) and were likely from the upper urban portion of the watershed These large particles, >20 and >63 μm particles would settle quickly in the region around the Paleta Creek outfall. The presence of these PAHs in large rapidly settling particles was reflected in settling traps close to the Paleta Creek discharge location, P11 and P17.

The rapid deposition of PAHs into settling traps and sediments close to the mouth of Paleta Creek led to no observable increases in porewater concentrations, toxicity or, generally bioaccumulation. PCBs were found to be associated with finer silt particles and correspondingly were shown to lead to recontamination in sediments over larger distances from the Paleta Creek discharge. The PCBs were more strongly associated with NBSD than PAHs with approximately 40% of the PCBs estimated to have originated in NBSD stormwater despite NBSD comprising about 13.5% of the water shed area (see Appendix III). Congeners 092, 110, 153, and 101 were generally the most abundant in the samples. Settling traps also showed less distinct depositional patterns of PCBs and deposition over much of the receiving water study area. In general, sediment traps showed more distinct patterns and were more clearly linked to wet seasons and stormwater discharges than time integrated behavior of sediment cores or even surficial sediment samples. Sediment cores were also collected but exhibited long term settling or sediment redistribution and was not a useful indicator of stormwater sediment recontamination by themselves.

Metals showed varying behaviors depending upon the metal but much of the metals were associated with solids as indicated by bulk (unfiltered) water samples showing considerably higher metals concentration than dissolved fractions. A statistical analysis (discussed in Appendix III) indicated that Cu, Zn, Cd, Pb and Hg were all correlated with suspended solids concentration. Cd was associated with coarse particles and was observed to lead to substantial sediment recontamination close to the Paleta Creek outfall. Cu, however, was associated with finer particles and no clear indication of sediment recontamination from the stormwater releases could be observed. Instead, the measurements suggested that significant amounts of Cu was being transported into the study area from other sources. Stormwater influence on metals recontamination of sediments was also assessed by comparing concentrations on particles in the discharge versus bulk solid concentration in sediment traps. Cd showed higher concentrations in solids in stormwater than the sediments collecting in sediment traps. This would be expected if the stormwater was the primary source of Cd and the sediment traps showed some dilution due to sediment from other sources. Cu concentrations on solids in sediment traps, however, were actually higher than concentrations estimated on solids in the stormwater suggesting again that the stormwater was not the only or primary source of Cu to the sediments. The concentration of Cu in sediment traps also increased with distance from the stormwater discharge suggesting other sources, either other stormwater sources or bay sediment resuspension, are likely sources of Cu in the settling sediments. Moreover Pb showed behavior similar to Cd while Hg showed behavior more similar to Cu.

The importance of the stormwater discharges and resulting sediment recontamination on organisms was assessed through *in-situ* and *ex-situ* bioaccumulation and toxicity studies on stormwater, sediment and sediment trap material. Stormwater samples showed substantial toxicity in a sea urchin embryo bioassay. Ambient concentrations of metals, even in receiving waters close to the Paleta Creek discharge, however, showed no evidence of toxicity due to dilution by the receiving waters. Bioaccumulation studies with clams (*Macoma* nasuta), both *in-situ* (using SEA Rings, SERDP #ER-1550, ESTCP #ER-201130) and *ex-situ* (using intact cores) were used to show bioaccumulation of total PCBs and chlordane in clam tissue concentrations by factors of 3 to 10 at locations away from the Paleta Creek discharge between pre-storm (dry season) and post-storm (wet season. This is consistent with the presence of these contaminants in finer sediment fractions that did not settle immediately close to the discharge point. Metal and total PAH concentrations in clam tissues, which were largely associated with larger particles and settled quickly, did not vary among pre-storm, pre-storm + sediment trap material, or post-storm treatments, and were similar in magnitude across sediments near the Paleta Creek discharge and at distances far away from the discharge. The lack of an increase in bioaccumulation, particularly at locations near the discharge point which did exhibit sediment recontamination for PAHs and large particle associated metals such as Cd, indicates that the contaminants were largely unavailable from these large particles. This indicates that sediment recontamination, as measured by bulk solid concentrations, may not necessarily lead to adverse ecological effects. Elevated PAH bioaccumulation was noted at a receiving sediment location close to an outfall with elevated PAH levels (but much lower total flows) indicating some elevated bioavailability of the PAHs at that location. The *in-situ* and *ex-situ* bioaccumulation assays also provided very similar results (typically less than 20% difference) suggesting that *ex-situ* bioaccumulation assays with intact core material can be used as a replacement for *in-situ* bioaccumulation assays. Sediment trap material was added in some *ex-situ* core bioassays and this led to an increased bioaccumulation PCBs and Chlordane. This was particularly noted from locations distant from the Paleta Creek stormwater discharge location suggesting the potential for other sources to be the cause of this observation.

One noticeable observation with sediment trap and post-storm sediment samples was a spatial and temporal trend of increasing synthetic pyrethroid pesticide concentration with increasing proximity to the mouth of Paleta Creek. Acute toxicity to marine amphipods *Eohaustorius estuarius* was observed in bioassays with wet season sediment samples but not dry season sediment samples. The toxicity during wet periods and apparent ability for amphipods to bounce back during dry periods was ultimately attributed to pyrethroid pesticide which is commonly used in urban portions of the watershed above NBSD.

Efforts to employ *in-situ* toxicity identification evaluation (*iTIE)* to evaluate bioavailability of stormwater contaminants led to the recognition that additional development was necessary. A portion of the project efforts were devoted to that development and it was employed at Paleta Creek in a preliminary demonstration. Due to the need to detect pyrethroids at very low concentrations in order to identify it as a source of toxicity, it was not possible to use iTIE to determine that pyrethroids were a potential source of toxicity. The efforts as part of this project did identify appropriate sorbents and operational parameters that helped move iTIE toward successful application but at this point iTIE remains a promising but not yet fully functional approach to assessing toxicity in a sediment system. Appendix IV contains more complete information on the iTIE efforts in this project.

Stormwater modeling using WinSLAMM is described in Appendix III. This project used the flow calculations from the model (calibrated using the detailed land use and development characteristics for the modeled areas in the Paleta Creek watershed, along with long-term local rain data and the event specific contaminant data) to predict annual or long-term average discharges of flow, suspended solids and contaminants. This stormwater modeling enables calculations of stormwater discharge characteristics as determined by specific drainage area characteristics and activities in the Paleta Creek watershed. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. These stormwater loading predictions, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and related settling rates), were used to quantify the recontamination potential of the sediments by stormwater discharges and to compare the monitored data with tentative TMDL allocations.

Estuary receiving water modeling with CH3D is described in Appendix V. The general characteristics assumed in Appendix III were supported with sand size particles expected to deposit close to the mouth of Paleta Creek. Fine-grained silts and clays were also expected to settle close to the Paleta Creek discharge but in total mass amounts much less than sand size particles. The estuary model provided generally good agreement between predicted deposition rates and sediment trap measured deposition rates over the period of deployment. The model was also used to predict deposition during the two specific events which represented more than 80% of the precipitation volume observed during the period of sediment trap placement. A key conclusion of the model is that the stormwater discharges do not account for the mass of sediment collected in the sediment traps and that additional sediment from other sources and or resuspension of bay sediments was necessary to account for the accumulation in sediment traps. This also supports the earlier stated conclusion that Cu accumulation in sediments was significant affected by sources other than Paleta Creek.

Note that neither the stormwater modeling with WinSLAMM nor estuary modeling with CH3D considers the bioavailability of contaminants. Predictions of stormwater loading and sediment recontamination is based upon bulk solids and does not predict organism effects. In addition, however, TMDL comparisons also do not directly consider contaminant bioavailability. In particular, sediment recontamination does not necessarily equate to negative sediment effects on benthic or other organisms.

The primary goal of the project was to identify the best methods to assess sediment recontamination as a result of stormwater discharges. A separate memo was prepared and submitted entitled "Stormwater Sediment Recontamination Assessment Recommendations". This memo is included as Appendix VII of this report. In short the following were key methods needed to assess sediment recontamination.

- Assessing stormwater loads requires collecting stormwater during storms of different intensity and at different stages during the storm. The specific requirements will differ depending upon the frequency, duration and intensity of events in a particular location but storms representative of an area are needed. Sampling should be automated in such a manner that the effect of non-stormwater flows, e.g. tides, can be excluded from the samples. In general, it is believed that intensive monitoring of a few representative events (as outlined below including size segregated loads of a broad range of contaminants and monitoring at different locations in the watershed and in receiving waters) is more useful that more modest monitoring efforts of a large number of events.
- Equivalent sampling of stormwater entering and exiting the naval base portion of a watershed can provide differentiation between Navy and other sources of stormwater contaminants.
- Assessing the potential for sediment recontamination requires that the stormwater contaminant loads in collected samples be characterized as a function of settling characteristics or particle size. The memo provides a description of the methods used in this project to determine contaminant distribution in key suspended solid size ranges. The measurements collected during this project indicate that contaminants are often associated with relative coarse particles that settle quickly and the solids distribution and contaminant distribution do not necessarily correlate.

- Receiving water sampling is best conducted using settling traps during storm events or over a period of storm events. Segments of sediment cores are influenced by a variety of long-term processes and do not necessarily indicate the effects of recent storm events.
- Sediment recontamination as indicated by stormwater loads and collection of contaminants in sediment traps does not necessarily indicate the ecological effects of the contaminants. In particular, contaminants associated with large, rapidly settling particles may contribute to rapid recontamination of sediment bulk solid concentration but may contribute little to negative effects on benthic or other organisms
- Stormwater and receiving water modeling provide opportunities to better link stormwater discharge measurements with source areas and the discharges to sediment recontamination. These models are most useful to calibrate to a finite set of measurements and then used to extrapolate to other conditions or to predict longer term average discharges or sediment recontamination rates.

Appendix I

Summary of Data

Stormwater Event I – January 5th to 7th 2016

Data Summary of Bulk and Particulate Water Size Fractions for Metals and Persistent Organic Pollutants (POPs)

Table B1. Explanation of qualifiers used for metals and POPs data summary

Flags	
NA	Not Applicable
J	The reported value was obtained from a reading that was less than the CRQL but greater than or equal to the MDL.
A	The reported value was obtained from a reading that was above the calibration range.
E	Estimated value, exceeds the upper calibration range
U	The reading value was less than the MDL.
*	Missing Data
<0	The subtraction of the fraction concentrations gave value below zero.
µg/L	The contaminant was in the water phase. No solids in the fraction. Value unit in µg/L.
ng/L	The contaminant was in the water phase. No solids in the fraction. Value unit in ng/L.
S	Solids mass has potentially >20% contibution from precipitated salt on the filter

Table B2. Solid mass and organic carbon (OC) particle size distribution of HDPE bottles at locations C2W, O4W, O3W, and C1W for the stormwater event -I samples collected from January 5th to 7th 2016.

Location	Solids/ OC	Filtered Water (< 0.45 µm)	Total solids (>0.45µm)		Solids fraction (0.45-5 µm)		Solids fraction (5-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
		mg/L	mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)	
C2W	Solids	-	269.0	*	1.1	*	114.3	*	99.2	*	54.4	*
	OC	8.4±0.0	10.614		NA	> 100	2.0± 2.2	<0	10.9±5.9		19.8±1.8	
O4W	Solids	-	184.4		2.0		159.5		13.8		9.2	
	OC	7.9±0.5	4.7		NA		2.5		0.0	<0	47.2	
O3W	Solids	-	36.2	S	0.0	<0, S	30.8	S	0.0	<0	5.4	
	OC	11.7±0.1	NA		NA		6.7		NA		NA	
C1W	Solids	-	241.6		23.5		46.3		108.3		63.5	
	OC	5.5±0.0	12.1		40.5		4.9±0.3		6.2±0.7		21.3	
O1W	Solids	-	125.3		0.0	<0	38.7		39.0		47.5	
	OC	2.6±0.1	25.1		NA		15.8±4.3		19.9±2.6		23.7	

Table B3. Solid mass and organic carbon particle size distribution of HDPE bottles at locations O2W, A1W, A2W, and A3W for the stormwater event-I samples collected from January 5th to 7th 2016.

Location	Solids/ OC	Filtered Water (< 0.45 µm)	Total solids (>0.45µm)	Solids fraction (0.45-5 µm)	Solids fraction (5-20 µm)	Solids Fraction (20-63 µm)	Solids Fraction (> 63 µm)
		mg/L	mg/L (%TOC)	mg/L (%TOC)	mg/L (%TOC)	mg/L (%TOC)	mg/L (%TOC)
O2W	Solids	-	1067.0	87.8	969.1	5.3	4.7
	OC	47.6±0.4	3.3±0.2	8.9±2.8	2.7±0.1	4.5	23.7
A1W	Solids	-	229.7	0.0	<0 121.7	79.1	28.9
	OC	5.6±0.0	12.9	NA	10.9±1.6	15.9	20.3
A2W	Solids	-	230.7	0.0	199.0	31.6	0.0
	OC	5.2±0.0	3.3±0.2	NA	3.0	8.1	NA
A3W	Solids	-	32.6	S 5.4	S 26.0	S 0.0	<0 1.2
	OC	6.4±0.0	3.0	0.7	0.0	<0 39.9	NA

Table B4. Solid mass and organic carbon (OC) particle size distribution of Amber bottles at locations C2W, O4W, O3W, and C1W for the stormwater event-I samples collected from January 5th to 7th 2016.

Location	Solids/ OC	Filtered Water (<0.7 µm)	Total solids (>0.7 µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
		mg/L	mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)
C2W	Solids	-	259.1		11.4		146.9		45.1		55.7
	OC	-	10.4±0.7		0.0	<0	9.2±2.1		10.9±5.9		19.8±1.8
O4W	Solids	-	186.6		58.4		95.1		33.1		0.0
	OC	-	3.5±0.1		0.0	<0	4.3±0.2		0.0	<0	47.2
O3W	Solids	-	61.8	S	0	<0,S	57.2	S	2.8		1.8
	OC	-	4.8±0.1		0.0	<0	2.2±0.4		NA		NA
C1W	Solids	-	267.8		12.5		158.1		46.6		50.7
	OC	-	8.3±0.7		7.8±16.6		4.8±0.7		6.2±0.7		2E+01
O1W	Solids	-	120.1		0	<0	29.6		58.6		31.9
	OC	-	19.2±4.8		0	<0	0.0	<0	19.9±2.6		8.3±0.7

Table B5. Solid mass and organic carbon particle size distribution of Amber bottles at locations O2W, A1W, A2W, and A3W for the stormwater event-I samples collected from January 5th to 7th 2016.

Location	Solids/ OC	Filtered Water (< 0.7 µm)	Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)	Solids Fraction (> 63 µm)
		mg/L	mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)		mg/L (%TOC)	mg/L (%TOC)
O2W	Solids	-	1110.7		28.8		1053.4		20.6	23.7
	OC	-	3.4		26.2±5.3		2.7±0.1		4.5	10.1
A1W	Solids	-	241.8		0	<0	115.9		101.7	24.1
	OC	-	13.9±0.8		0.0	<0	9.8±1.4		15.9	20.3
A2W	Solids	-	246.5		38.1		200.3		8.1	0.0
	OC	-	3.5±0.1		5.9±1.5		2.8±0.3		8.1	NA
A3W	Solids	-	37.3	S	0.9	S	28.6	S	6.2	1.5
	OC	-	3.8±0.1		NA	> 100	0.0	<0	4.0	NA

Table B6. Trace metals in bulk and particulate fractions of location C2W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Paleta Creek at Main Street (C2W)							
Metals	Bulk water	Filtered Water (<0.45)	Total solids (>0.45)	Solids fraction (0.45-5)	Solids fraction (5-20)	Solids Fraction (20-63)	Solids Fraction (> 63)
	µg/L (ng/L)	µg/L (ng/L)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)
As	34.5 ± 0.94	1.1 ± 0.1	124 ± 0.0	50.4 ± 0.1	16.9 ± 0.0	18 ± 0.0	544 ± 0.0
Cr	34.8 ± 5.33	0.0 U	129 ± 0.0	0.0 U	48.7 ± 0.0	56.5 ± 0.0	434 ± 0.1
Cu	75.3 ± 4.23	5.54 ± 0.0	260 ± 0.0	753 ± 0.1	117 ± 0.0	136 ± 0.0	774 ± 0.0
Ni	19.1 ± 2.67	1.99 ± 0.0	63.5 ± 0.0	175 ± 0.0	22.1 ± 0.0	37.8 ± 0.0	195 ± 0.0
Zn	419 ± 11.8	21.7 ± 0.6	1480 ± 0.0	2170 ± 0.7	544 ± 0.0	659 ± 0.0	4920 ± 0.2
Cd	0.9 ± 0.0 J	0.0 U	3.5 ± 0.0 J	0.0 U	1.84 ± 0.0 J	1.46 ± 0.0 J	10.8 ± 0.0 J
Pb	45.5 ± 1.89	1.05 ± 0.0 J	165 ± 0.0	485 ± 0.2	78 ± 0.0	44.1 ± 0.0	563 ± 0.2
Hg	77.9 ± 13.6	3.30	277 ± 0.0	0.0 < 0	116 ± 0.0	113 ± 0.0	933 ± 0.3

Table B7. Trace metals in bulk and particulate fractions of location O4W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

NBSD outfall at Paunack and Division Streets (O4W)														
Metals	**Bulk water**		**Filtered Water (<0.45)**		**Total solids (>0.45)**		**Solids fraction (0.45-5)**		**Solids fraction (5-20)**		**Solids Fraction (20-63)**		**Solids Fraction (> 63)**	
	µg/L (ng/L)		**µg/L (ng/L)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**	
As	6.03 ± 0.37		2.22 ± 0.1		20.6 ± 0		0.0	< 0	5.2 ± 0		134 ± 0		126 ± 0	
Cr	11 ± 1.17		0.0	U	59.8 ± 0		1160 ± 0	J	27.2 ± 0		316.3		6.53 ± 0.2	
Cu	24.1 ± 0.4		5.73 ± 0.1		99.6 ± 0		436 ± 0		28.5 ± 0		609 ± 0.5		497 ± 0.6	
Ni	16.7 ± 0.4		9.47 ± 0		39 ± 0		34.8 ± 0		0.0	< 0	356 ± 0		516 ± 0	
Zn	92.3 ± 1.69		5.08 ± 0.3		473 ± 0		2670 ± 0.2		146 ± 0		1610 ± 0.2		3970 ± 0.2	
Cd	0.195 ± 0	J	0.0	U	1.06 ± 0	J	0.0	U	0.0	U	0.0	U	21.2 ± 0	J
Pb	5.22 ± 0		0.554 ± 0	J	25.3 ± 0		396 ± 0		14.1 ± 0		0.0	< 0	273 ± 0.2	
Hg	188 ± 60.2		6.3		986 ± 0.3		1610 ± 0.3		138 ± 0		4800 ± 1.93		9870 ± 7.18	

Table B8. Trace metals in bulk and particulate fractions of location O3W for stormwater event-I (January 5^{th} to 7^{th} 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

NBSD outfall north of railroad crossing (O3W)														
Metals	**Bulk water**		**Filtered Water (<0.45)**		**Total solids (>0.45)**		**Solids fraction (0.45-5)**		**Solids fraction (5-20)**		**Solids Fraction (20-63)**		**Solids Fraction (> 63)**	
	µg/L (ng/L)		**µg/L (ng/L)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**	
As	28.1 ± 15.43		4.13 ± 0		661 ± 0.43		0.172 ± 0.1	µg/L	1.4 ± 0		16.1 ± 13.42	µg/L	1420 ± 3.786	
Cr	5.51 ± 0.25		0.0	U	152 ± 0		0.0	U	86.1 ± 0	J	0.936 ± 0.38	µg/L	356 ± 0.1	
Cu	21 ± 2.07		14.8 ± 0.1		171 ± 0		0.251 ± 0.8	µg/L	0.0	< 0	5.2 ± 0.9	µg/L	146 ± 0.4	
Ni	15.1 ± 0.3		14.1 ± 0.3		28.7 ± 0		0.0	< 0	0.0	< 0	1.14 ± 0.4	µg/L	597 ± 0.1	
Zn	83.2 ± 8.54		4.27 ± 0.2		2180 ± 0.2		5.33 ± 3.43	µg/L	575 ± 0.1		8.32 ± 3.82	µg/L	8800 ± 1.73	
Cd	0.401 ± 0	J	0.211 ± 0	J	5.24 ± 0	J	0.0	< 0	0.244 ± 0	J	0.0319 ± 0	J, µg/L	29.1 ± 0	
Pb	3.79 ± 0		0.461 ± 0	J	91.8 ± 0		0.381 ± 0	µg/L	109 ± 0		0.0	< 0	68.3 ± 0	
Hg	49 ± 3.56		9.99 ± 1.17		1080 ± 0.1		0.0		508 ± 0		0.01 ± 6.3	ng/L	2800 ± 1.33	

Table B9. Trace metals in bulk and particulate fractions of location C1W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Paleta Creek at Cummings Road (C1W)														
Metals	**Bulk water**		**Filtered Water (<0.45)**		**Total solids (>0.45)**		**Solids fraction (0.45-5)**		**Solids fraction (5-20)**		**Solids Fraction (20-63)**		**Solids Fraction (> 63)**	
	µg/L (ng/L)		**µg/L (ng/L)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**	
As	38.1 ± 4.1		1.48 ± 0.1		152 ± 0		25.6 ± 0		0.0	< 0	7.31 ± 0		560 ± 0.1	
Cr	13.3 ± 0.97		0.0	U	55 ± 0		0.0	U	54.2	J	37.4 ± 0		106 ± 0	
Cu	32.7 ± 0.6		7.76 ± 0.9		103 ± 0		226 ± 0.2		0.0	< 0	47.8 ± 0		278 ± 0	
Ni	11.2 ± 0.2		6.26 ± 0.3		20.5 ± 0		95.3 ± 0		0.0	< 0	0.0	< 0	78.4 ± 0	
Zn	152 ± 9.19		6.81 ± 0		599 ± 0		415 ± 0		265 ± 0		161 ± 0		1660 ± 0.1	
Cd	0.405 ± 0	J	0.0	U	1.68 ± 0	J	0.0	U	0.0	U	0.0	U	6.38 ± 0	J
Pb	20.8 ± 2.5		0.624 ± 0.2	J	83.3 ± 0		24.7 ± 0		112 ± 0		20.3 ± 0		192 ± 0	
Hg	43.4 ± 5.29		5.10		159 ± 0		0.0	< 0	147 ± 0		47.3 ± 0		433 ± 0	

Table B10. Trace metals in bulk and particulate fractions of location O1W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

NBSD Outfall #23 (O1W)														
Metals	Bulk water		Filtered Water (<0.45)		Total solids (>0.45)		Solids fraction (0.45-5)		Solids fraction (5-20)		Solids Fraction (20-63)		Solids Fraction (> 63)	
	µg/L (ng/L)		µg/L (ng/L)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)	
As	2.3		0.817 ± 0	J	12 ± 0		0.0	<0	6.17 ± 0	J	655 ± 0		0.0	<0
Cr	12.6 ± 2.347		2.6	J	79.2 ± 0		0.0	<0,U	58.0	J	158 ± 0.1		87.8 ± 0.1	
Cu	16.8		6.28 ± 0.2		83.8 ± 0		0.0	<0	55.7 ± 0		128 ± 0		96.6 ± 0	
Ni	7.3		6.27 ± 0.2		7.9 ± 0		0.0	<0	14.5 ± 0		36 ± 0		10.2 ± 0	
Zn	207.5		53.9 ± 1		1230 ± 0		0.0	<0	42.6 ± 0		1100 ± 0		2510 ± 0	
Cd	0.5	J	0.413 ± 0	J	1.01 ± 0	J	0.0	<0	0.148 ± 0	J	2.12 ± 0	J	3.19 ± 0	J
Pb	18.8		1.23 ± 0		140 ± 0		0.251 ± 0	µg/L	173 ± 0		12.9 ± 0		213 ± 0	
Hg	8.55 ± 0.9		2.00		51.9 ± 0		0.003 ± 1.03	ng/L	0.0	<0	31 ± 0		91.7 ± 0	

Table B11. Trace metals in bulk and particulate fractions of location O2W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

NBSD Outfall#33 (O2W)							
Metals	Bulk water	Filtered Water (<0.45)	Total solids (>0.45)	Solids fraction (0.45-5)	Solids fraction (5-20)	Solids Fraction (20-63)	Solids Fraction (> 63)
	µg/L (ng/L)	µg/L (ng/L)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)
As	22.4 ± 0.76	3.22 ± 0.16	18 ± 0	0.0 <0	16.9 ± 0	0.0 <0	1110 ± 0.22
Cr	93.9 ± 4.455 A	3.5 ± 0.16	84.7 ± 0 A	15.8 ± 0	85.5 ± 0 A	0.0 A,<0	3340 ± 1.02 A
Cu	144 ± 4.07	34.4 ± 1.61	103 ± 0	1.22 ± 0	76 ± 0	0.0 <0	8750 ± 1.01
Ni	25.4 ± 0.4	9.47 ± 0.5	15 ± 0	0.0 <0	13.6 ± 0	0.0 <0	1080 ± 0.1
Zn	309 ± 5.99	15 ± 1.79	275 ± 0	0.0 <0	174 ± 0	0.0 <0	29000 ± 1.5
Cd	2.65 ± 0	0.795 ± 0	1.74 ± 0	0.0 <0	1.43 ± 0	0.0 <0	165 ± 0
Pb	67.9 ± 3.01	1.85 ± 0.1	61.9 ± 0	0.122 ± 0	78.1 ± 0	0.0 <0	1260 ± 0.8
Hg	776 ± 84.5	24.80	704 ± 0	0.0 <0	781 ± 0	0.0 <0	22100 ± 20.5

Table B12. Trace metals in bulk and particulate fractions of location A1W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Metals	Bulk water µg/L (ng/L)		Filtered Water (<0.45) µg/L (ng/L)		Total solids (>0.45) µg/Kg (ng/Kg)		Solids fraction (0.45-5) µg/Kg (ng/Kg)		Solids fraction (5-20) µg/Kg (ng/Kg)		Solids Fraction (20-63) µg/Kg (ng/Kg)		Solids Fraction (> 63) µg/Kg (ng/Kg)	
	Ambient Receiving water sample (A1W)													
As	8.57 ± 0.62		1.91 ± 0		29 ± 0		0.0323 ± 0.11	µg/L	24.7 ± 0		19.6 ± 0		71.5 ± 0	
Cr	15.4 ± 0.51		0.0	U	67 ± 0		0.0	U	79.3 ± 0		47.5 ± 0		68 ± 0	
Cu	50.9 ± 0.6		12.9 ± 0.4		165 ± 0		0.358 ± 1.43	µg/L	154 ± 0		168 ± 0		192 ± 0	
Ni	11 ± 0.3		7.65 ± 0		14.6 ± 0		0.165 ± 0.2	µg/L	23.5 ± 0		23.7 ± 0		0.0	<0
Zn	234 ± 0.6		34.6 ± 0.5		867 ± 0		5.95 ± 1.33	µg/L	590 ± 0		1230 ± 0		842 ± 0.1	
Cd	0.619 ± 0	J	0.202 ± 0	J	1.81 ± 0	J	0.00394 ± 0	J, µg/L	1.15 ± 0	J	1.23 ± 0	J	6.04 ± 0	J
Pb	32.3 ± 1.06		0.661 ± 0	J	138 ± 0		0.342 ± 0	J, µg/L	159 ± 0		24.9 ± 0		342 ± 0	
Hg	95.2 ± 18.5		2.70		403 ± 0		0.0	<0	381 ± 0		240 ± 0.1		962 ± 0.7	

Table B13. Trace metals in bulk and particulate fractions of location A2W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Metals	Bulk water µg/L (ng/L)		Filtered Water (<0.45) µg/L (ng/L)		Total solids (>0.45) µg/Kg (ng/Kg)		Solids fraction (0.45-5) µg/Kg (ng/Kg)		Solids fraction (5-20) µg/Kg (ng/Kg)		Solids Fraction (20-63) µg/Kg (ng/Kg)		Solids Fraction (> 63) µg/Kg (ng/Kg)	
	Ambient Receiving water sample (A2W)													
As	43.3 ± 8.979		2.61 ± 0		177 ± 0		0.337 ± 0.1	µg/L	17.8 ± 0		13.8 ± 0		36.4 ± 9.005	µg/L
Cr	12.7 ± 0.34		0.0	U	55.1 ± 0		0.0	U	51.1 ± 0		0.0	<0	2.79 ± 0.41	µg/L
Cu	23 ± 0.5		7.54 ± 0.1		67.2 ± 0		1.57 ± 0.4	µg/L	46.4 ± 0		31.7 ± 0		3.68 ± 0.7	µg/L
Ni	7.5 ± 0.2		5.51 ± 0		8.65 ± 0		0.807 ± 0.1	µg/L	4.68 ± 0		15.2 ± 0		0.0	<0
Zn	85.8 ± 2.92		11.6 ± 12.7		322 ± 0		0.0	<0	211 ± 0		86.1 ± 0		31.7 ± 2.98	µg/L
Cd	0.287 ± 0	J	0.0	U	1.24 ± 0	J	0.0	U	0.9	J	0.317 ± 0	J	0.0889 ± 0	J, µg/L
Pb	11.7 ± 0.3		0.558 ± 0.6	J	48.2 ± 0		0.0	<0	46.2 ± 0		0.0	<0	3.48 ± 0.4	µg/L
Hg	28.1 ± 2.02		2.30		112 ± 0		0.0	<0	76.3 ± 0		0.0	<0	0.011 ± 2.49	ng/L

Table B14. Trace metals in bulk and particulate fractions of location A3W for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Ambient Receiving water sample (A3W)														
Metals	**Bulk water**		**Filtered Water (<0.45)**		**Total solids (>0.45)**		**Solids fraction (0.45-5)**		**Solids fraction (5-20)**		**Solids Fraction (20-63)**		**Solids Fraction (> 63)**	
	µg/L (ng/L)		**µg/L (ng/L)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**	
As	6.12 ± 0.19		3.14 ± 0.1		91.4 ± 0		17.8 ± 0		0.0	<0	0.197 ± 0.54	µg/L	2340 ± 0.49	
Cr	3.5		0.0	U	106.2		0.0	U	0.0	U	0.0	U	2984.7	
Cu	12.5 ± 1.03		12.7 ± 1.24		0.0	<0	0.0	<0	0.0	<0	0.609 ± 1	µg/L	371 ± 1.22	
Ni	7.76 ± 0.4		11.1 ± 3.95		0.0	<0	0.0	<0	0.0	<0	0.0	<0	327 ± 0.7	
Zn	28 ± 1		9.71 ± 0.2		561 ± 0		533 ± 0		134 ± 0		0.036 ± 1.62	µg/L	10300 ± 1.53	
Cd	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U
Pb	2.36 ± 0		0.547 ± 0	J	55.4 ± 0		21.5 ± 0	J	90.5 ± 0		0.0	<0	358 ± 0.1	
Hg	7.98 ± 0.7		2.70		161 ± 0		213 ± 0.2		68.1 ± 0		0.0	<0	2310 ± 0.6	

Table B15. Trace metals in bulk and particulate fractions of travel blanks processed identical to samples for stormwater event-I (January 5th to 7th 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Metals	Bulk water		Filtered Water (<20)		Sieved Water (<63µm)	
	µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)	
As	0.0		0.0		0.0	
Cr	0.0	U	0.0	U	0.0	U
Cu	0.87 ± 0.7	J	0.56 ± 0.2	J	0.83 ± 0.4	J
Ni	0.0		0.0		0.38 ± 0.2	J
Zn	0.0		1.7		1.81 ± 0.3	
Cd	0.0	U	0.0	U	0.0	U
Pb	0.47 ± 0.1	J	0.53 ± 0.1	J	0.50 ± 0.1	J
Hg	2.44 ± 0.7	J	3.19 ± 0.4	J	2.32 ± 1.25	J

Table B16. Chlordanes in bulk and particulate fractions of locations C2W, O4W, O3W, and C1W for stormwater event-I (January 5th to 7th 2016).

Location	Chlordanes	Bulk water	Filtered Water (< 0.7 µm)	Total solids (>0.7 µm)	Solids fraction (0.7-2.7 µm)	Solids fraction (2.7-20 µm)	Solids Fraction (20-63 µm)	Solids Fraction (> 63 µm)
		µg/L	µg/L	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
C2W	Transchlordane	1.0E-03	4E-04	2.6	15.6	1.9	140.5	0.0 ND
	Cischlordanes	9.5E-04	4E-04	2.2	11.2	1.0	145.6	0.0 ND
O4W	Transchlordane	1.9E-03	2E-04	9.6	4.3	7.5	4.5	0.0 ND
	Cischlordanes	2.0E-03	1E-04	0.0	4.8	7.5	4.2	0.0 ND
O3W	Transchlordane	NA	2E-04	NA	0.0 ND	9.6	0.0 ND	NA
	Cischlordanes	NA	2E-04	NA	0.0 ND	11.4	0.0 ND	NA
C1W	Transchlordane	7.3E-03	3E-04	26.2	25.3	15.5	68.2	21.3
	Cischlordanes	7.3E-03	4E-04	25.9	17.6	15.3	70.4	20.2

Table B17. Chlordanes in bulk and particulate fractions of locations C2W, O4W, O3W, and C1W for stormwater event-I (January 5th to 7th 2016).

Location	Chlordanes	Bulk water		Filtered Water (< 0.7 µm)	Total solids (>0.7 µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
		µg/L		µg/L	µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg	
O1W	Transchlordane	2.4E-03		3E-04	17.7	0.0	<0	2.0		11.9		44.6	
	Cischlordanes	1.7E-03		1E-04	13.7	0.0	<0	1.5		7.9		36.4	
O2W	Transchlordane	0.0E+00	ND	4E-04	0.0	5.1		1.5		0.0		0.0	ND
	Cischlordanes	0.0E+00	ND	3E-04	0.0	0.0		1.1		0.0		0.0	ND
A1W	Transchlordane	0.0E+00	ND	2E-04	0.0	0.0		19.7		36.8		0.0	ND
	Cischlordanes	0.0E+00	ND	9E-05	0.0	0.0		17.9		35.0		0.0	ND
A2W	Transchlordane	3.1E-03		2E-04	11.7	13.0		11.9		256.2		0.0	ND
	Cischlordanes	3.1E-03		2E-04	11.8	0.0	ND	15.6		293.5		0.0	ND
A3W	Transchlordane	NA		2E-04	NA	238.1		0.0	ND	0.0	ND	NA	
	Cischlordanes	NA		2E-04	NA	214.6		0.0	ND	0.0	ND	NA	

Table B18. PAH in bulk and particulate fractions of location C2W for stormwater event-I (January 5th to 7th 2016).

PAH	Bulk water		Filtered Water (< 0.7 µm)	Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	Paleta Creek at Main Street (C2W)												
	ng/L		ng/L	µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
Naphthalene	32.3		12.6	75.9		0.0	<0	97.9		0.0	<0	391.5	
Fluorene	0.0	U	39.1	0.0	U	0.0	<0	35.6		0.0	<0	0.0	U
Acenaphthene	0.0	U	1.1	0.0	U	0.0	<0	29.8		0.0	<0	0.0	U
Phenanthrene	40.2		19.0	81.7		0.0	<0	260.7		86.5		0.0	<0
Anthracene	0.0	U	2.1	0.0	U	0.0	<0	0.0	U	212.1		0.0	U
Fluoranthene	599.2		9.1	2277.3		1587.0		382.0		1169.9		8307.8	
Pyrene	249.4		8.6	929.2		504.6		511.4		685.3		2314.2	
Chrysene	31.6		1.2	117.2		165.0		132.8		397.5		0.0	<0
Benzo[a]anthracene	50.6		1.1	190.9		90.1		95.2		400.6		294.2	
Benzo[b]fluoranthene	240.6		1.2	923.8		300.0		182.6		997.1		2944.6	
Benzo[k]fluoranthene	10.1		0.3	37.9		83.3		68.1		344.1		0.0	<0
Benzo[a]pyrene	18.1		0.8	67.1		148.2		117.2		591.8		0.0	<0
Dibenzo[a,h]anthracene	4.2		0.5	14.3		34.0		52.7		137.7		0.0	<0
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	6.2		2.3	15.0		459.9		326.5		1597.8		0.0	<0

Table B19. PAH in bulk and particulate fractions of location O4W for stormwater event-I (January 5th to 7th 2016).

NBSD Outfall at Paunack and Division Streets (O4W)							
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**	**Total solids (>0.7µm)**	**Solids fraction (0.7-2.7 µm)**	**Solids fraction (2.7-20 µm)**	**Solids Fraction (20-63 µm)**	**Solids Fraction (> 63 µm)**
	ng/L	**ng/L**	**µg/Kg**	**µg/Kg**	**µg/Kg**	**µg/Kg**	**µg/Kg**
Naphthalene	25.2	9.6	84.0	24.7	0.0 <0	27.3	19.0
Fluorene	11.3	1.9	50.1	20.3	0.0 <0	0.0 <0	9.8
Acenaphthene	1.9	0.8	6.1	6.0	0.0 <0	98.6	0.0 <0
Phenanthrene	37.3	5.6	169.9	45.8	0.0 <0	120.6	25.2
Anthracene	10.2	1.5	46.3	6.6	0.0 <0	0.0 <0	9.9
Fluoranthene	83.6	13.8	374.3	0.0 <0	186.0	1467.6	11.4
Pyrene	80.1	6.8	392.8	20.4	114.1	65.0	59.1
Chrysene	18.1	0.7	93.2	8.7	34.4	328.8	2.7
Benzo[a]anthracene	8.7	0.5	43.6	0.0 <0	22.4	193.0	0.0 <0
Benzo[b]fluoranthene	27.4	0.2	145.4	18.9	78.2	144.8	13.8
Benzo[k]fluoranthene	8.2	0.2 J	42.8	2.4	20.9	20.7	5.2
Benzo[a]pyrene	16.8	0.6	86.8	0.2	39.3	45.0	10.9
Dibenzo[a,h]anthracene	5.9	0.8	27.1	0.0 <0	11.7	52.6	2.8
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	43.2	0.8	227.27	26.02	116.02	174.47	24.08

Table B20. PAH in bulk and particulate fractions of location O3W for stormwater event-I (January 5th to 7th 2016).

NBSD Outfall Noeth of Railroad Crossing (O3W)											
PAH	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
	ng/L	ng/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg
Naphthalene	35.9	8.5		444.3		0.2	ng/L	0.0	<0	0.0	<0	16755.8
Fluorene	2.3	3.3		0.0	<0	0.0	<0	0.0	<0	36.7		136.7
Acenaphthene	3.5	2.6		14.2		0.3	ng/L	0.0	<0	254.5		627.8
Phenanthrene	43.9	9.9		550.8		0.0	<0	0.0	<0	109.2		19198.1
Anthracene	34.8	1.2		545.1		0.2	ng/L	0.0	<0	493.4		18310.1
Fluoranthene	285.0	5.1		4530.6		6.5	ng/L	385.6		1403.2		137838.0
Pyrene	85.4	6.0		1286.4		6.1	ng/L	230.0		0.0	<0	33845.9
Chrysene	20.8	0.4		328.9		2.2	ng/L	91.1		230.5		6837.6
Benzo[a]anthracene	23.4	0.5		370.6		1.2	ng/L	68.0		159.0		9652.5
Benzo[b]fluoranthene	59.5	0.3		957.9		4.6	ng/L	203.8		833.1		22596.2
Benzo[k]fluoranthene	17.6	0.1	J	283.2		1.8	ng/L	86.0		229.3		5641.4
Benzo[a]pyrene	35.4	0.2		570.2		3.6	ng/L	183.5		546.1		10906.8
Dibenzo[a,h]anthracene	14.0	0.2		222.1		0.6	ng/L	37.0		54.8		6018.2
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	30.5	0.4		486.55		5.71	ng/L	203.61		681.57		6010.87

Table B21. PAH in bulk and particulate fractions of location C1W for stormwater event-I (January 5th to 7th 2016).

Paleta Creek at Cummings Road (C1W)							
PAH	Bulk water	Filtered Water (< 0.7 µm)	Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)	Solids fraction (2.7-20 µm)	Solids Fraction (20-63 µm)	Solids Fraction (> 63 µm)
	ng/L	ng/L	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Naphthalene	23.3	17.0	23.5	0.0 <0	15.6	4.4	182.4
Fluorene	4.3	6.7	0.0 <0	0.0 <0	8.8	0.0 <0	29.6
Acenaphthene	26.3	3.1	86.5	148.5	9.9	0.0 <0	453.1
Phenanthrene	112.3	13.8	367.6	0.0 <0	94.4	275.3	1416.5
Anthracene	18.3	0.9	65.0	30.0	19.8	169.8	118.3
Fluoranthene	227.2	16.1	788.2	0.0 <0	645.0	3645.6	0.0 <0
Pyrene	227.3	9.1	814.7	129.0	372.4	1163.5	2042.8
Chrysene	105.8	1.1	390.7	152.2	171.7	343.3	1175.8
Benzo[a]anthracene	55.3	0.5	204.6	68.7	125.5	464.6	246.0
Benzo[b]fluoranthene	130.7	0.6	485.8	191.5	343.8	1347.1	210.2
Benzo[k]fluoranthene	41.4	0.3	153.5	58.3	119.2	430.3	29.5
Benzo[a]pyrene	75.2	0.4	279.4	85.5	183.8	624.1	308.8
Dibenzo[a,h]anthracene	20.3	0.6	73.4	44.6	63.6	34.3	147.2
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	145.2	0.9	539.0	233.2	363.1	791.9	930.6

Table B22. PAH in bulk and particulate fractions of location O1W for stormwater event-I (January 5th to 7th 2016).

NBSD Outfall #23 (O1W)											
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**	**Total solids (>0.7µm)**	**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	ng/L	**ng/L**	**µg/Kg**	**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
Naphthalene	29.9	18.2	97.0	0.0	<0	47.2		0.0	<0	528.5	
Fluorene	23.9	10.2	114.1	0.0	<0	0.0	<0	20.4		474.3	
Acenaphthene	45.6	2.4	359.4	0.0	<0	0.0	<0	56.6		1255.3	
Phenanthrene	109.9	16.7	776.3	0.0	<0	359.9		296.0		2125.6	
Anthracene	3.9	2.3	13.2	0.0	<0	32.3		48.2		0.0	<0
Fluoranthene	119.8	5.7	950.6	1.7	ng/L	810.0		579.0		1710.2	
Pyrene	49.9	6.1	364.7	0.0	<0	433.1		163.1		686.8	
Chrysene	48.9	3.1	381.6	0.0	<0	264.9		170.1		892.5	
Benzo[a]anthracene	66.3	1.8	537.1	0.0	<0	266.2		174.8		1468.2	
Benzo[b]fluoranthene	127.4	3.1	1035.5	0.0	<0	492.5		507.5		2514.0	
Benzo[k]fluoranthene	25.5	1.3	201.6	0.0	<0	150.8		90.0		461.7	
Benzo[a]pyrene	80.3	2.1	651.4	0.0	<0	330.2		260.8		1687.5	
Dibenzo[a,h]anthracene	4.2	1.5	21.9	0.0	<0	119.7		0.0	<0	33.2	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	99.8	2.6	809.2	0.0	<0	779.1		383.1		1644.4	

Table B23. PAH in bulk and particulate fractions of location O2W for stormwater event-I (January 5th to 7th 2016).

	NBSD Outfall #33 (O2W)										
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**	**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**	**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	ng/L	**ng/L**	**µg/Kg**		**µg/Kg**		**µg/Kg**	**µg/Kg**		**µg/Kg**	
Naphthalene	2.6	0.5	1.9		0.0	<0	2.0	0.0	<0	116.8	
Fluorene	1.1	4.6	0.0	<0	0.0	<0	0.9	0.0	<0	0.0	<0
Acenaphthene	62.4	5.3	51.4		0.0	<0	1.5	0.0	<0	7203.6	
Phenanthrene	102.8	14.6	79.4		0.0	<0	13.8	6.5		10098.4	
Anthracene	25.4	5.0	18.3		0.0	<0	4.8	419.5		985.9	
Fluoranthene	970.7	74.4	807.0		0.0	<0	94.8	0.0	<0	105345.6	
Pyrene	688.1	68.6	557.8		0.0	<0	110.6	0.0	<0	67884.2	
Chrysene	213.2	17.8	175.9		0.0	<0	43.6	0.0	<0	20093.8	
Benzo[a]anthracene	158.9	10.4	133.7		50.0		32.0	0.0	<0	15188.9	
Benzo[b]fluoranthene	339.6	33.2	275.9		0.0	<0	74.0	0.0	<0	30989.9	
Benzo[k]fluoranthene	146.0	13.1	119.6		0.0	<0	31.0	0.0	<0	13632.4	
Benzo[a]pyrene	154.7	12.4	128.1		0.0	<0	31.4	0.0	<0	14676.3	
Dibenzo[a,h]anthracene	58.8	3.3	49.9		2.8		6.4	0.0	<0	6254.6	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	103.3	9.1	84.8		3.8		18.9	0.0	<0	9990.3	

Table B24. PAH in bulk and particulate fractions of location A1W for stormwater event-I (January 5th to 7th 2016).

Ambient Receiving Water (A1W)											
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**	**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**
	ng/L	**ng/L**		**µg/Kg**	**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**
Naphthalene	17.0	4.7		51.1	0.0	<0	16.6		68.4		144.6
Fluorene	5.4	0.0	U	22.3	0.0	U	0.0	U	0.0	U	223.7
Acenaphthene	23.9	0.0	U	98.7	0.5	ng/L	12.4		0.0	<0	911.9
Phenanthrene	273.3	3.5		1116.1	0.0	<0	405.7		829.5		5757.7
Anthracene	41.6	0.0	U	172.1	0.5	ng/L	47.8		79.2		1141.4
Fluoranthene	780.4	5.0		3207.2	2.5	ng/L	1187.5		2269.8	E	16768.0
Pyrene	613.7	4.0		2521.8	3.0	ng/L	933.8		307.0	E	19374.1
Chrysene	283.2	1.5		1164.9	0.0	<0	458.8		150.2		8843.3
Benzo[a]anthracene	196.1	0.9		807.5	0.0	<0	490.2		0.0	<0	6350.0
Benzo[b]fluoranthene	421.3	0.5		1740.6	2.3	ng/L	1105.2		0.0	<0	12385.3
Benzo[k]fluoranthene	158.0	0.2		652.9	0.7	ng/L	412.1		593.5		2032.2
Benzo[a]pyrene	274.9	0.2		1135.9	1.0	ng/L	662.3		1022.1		3851.1
Dibenzo[a,h]anthracene	72.7	0.4		299.2	0.3	ng/L	193.8		53.5		1828.9
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	426.1	0.6		1759.9	1.8	ng/L	1081.3		1296.9		6900.6

Table B25. PAH in bulk and particulate fractions of location A2W for stormwater event-I (January 5th to 7th 2016).

Ambient Receiving Water (A2W)												
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**	**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	ng/L	**ng/L**	**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
Naphthalene	24.7	13.3	46.3		0.0	<0	0.0	<0	0.0	<0	15.7	
Fluorene	7.3	55.5	0.0	<0	0.0	<0	0.0	<0	0.0	<0	5.8	
Acenaphthene	12.4	3.1	37.5		65.2		0.0	<0	207.8		6.0	
Phenanthrene	35.7	10.0	104.1		0.0	<0	17.2		0.0	<0	25.0	
Anthracene	9.9	0.8	36.7		0.0	<0	4.5		0.0	<0	8.8	
Fluoranthene	225.6	11.4	868.8		95.3		171.5		3443.9		148.2	
Pyrene	128.5	5.0	501.2		115.0		145.5		320.2		87.4	
Chrysene	16.5	0.9	63.5		48.6		65.4		249.0		0.0	<0
Benzo[a]anthracene	10.9	0.5	41.9		36.5		43.9		22.3		0.0	<0
Benzo[b]fluoranthene	38.7	0.5	154.9		160.9		146.6		17.8		2.6	
Benzo[k]fluoranthene	14.0	0.2	55.8		51.0		50.9		0.0	<0	3.2	
Benzo[a]pyrene	22.1	0.4	88.1		71.6		68.9		0.0	<0	8.8	
Dibenzo[a,h]anthracene	10.8	0.2	42.7		18.4		21.2		77.6		4.9	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	24.0	0.9	93.5		131.6		107.2		0.0	<0	0.0	<0

Table B26. PAH in bulk and particulate fractions of location A3W for stormwater event-I (January 5th to 7th 2016).

Ambient Receiving Water (A3W)							
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**	**Total solids (>0.7µm)**	**Solids fraction (0.7-2.7 µm)**	**Solids fraction (2.7-20 µm)**	**Solids Fraction (20-63 µm)**	**Solids Fraction (> 63 µm)**
	ng/L	**ng/L**	**µg/Kg**	**µg/Kg**	**µg/Kg**	**µg/Kg**	**µg/Kg**
Naphthalene	35.3	38.5	0.0 <0	0.0 <0	0.0 <0	0.0 <0	4388.3
Fluorene	10.4	11.1	0.0 <0	572.7	0.0 <0	0.0 <0	1399.9
Acenaphthene	15.7	17.4	0.0 <0	3420.4	0.0 <0	0.0 <0	995.8
Phenanthrene	21.7	19.9	47.5	0.0 <0	0.0 <0	0.0 <0	4971.3
Anthracene	1.9	1.8	3.1	0.0 <0	35.6	184.6	0.0 <0
Fluoranthene	20.5	10.2	274.3	7636.4	141.6	838.9	0.0 <0
Pyrene	12.9	7.2	154.0	3336.0	58.0	217.0	0.0 <0
Chrysene	3.2	1.0	60.6	1546.0	6.1	99.4	11.1
Benzo[a]anthracene	3.3	0.8	66.1	1166.0	23.6	23.7	361.9
Benzo[b]fluoranthene	7.0	1.3	152.7	3769.7	72.2	104.3	0.0 <0
Benzo[k]fluoranthene	2.4	0.5	53.0	1332.6	25.3	24.5	0.0 <0
Benzo[a]pyrene	4.9	0.8	110.9	2190.0	38.7	18.1	570.4
Dibenzo[a,h]anthracene	0.9	0.5	11.4	782.1	18.0	54.7	0.0 <0
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	7.4	1.3	163.6	3568.6	45.1	0.0 <0	1094.6

Table B27. PCB in bulk and particulate fractions of location C2W for stormwater event-I (January 5^{th} to 7^{th} 2016).

Paleta Creek at Main Street (C2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	1.3E-05	J	5.9E-06	J	2.7E-02	J	0.0		1.1E-02	J	1.2E-01		2.4E-02	
2	8.0E-06	J	7.1E-06	J	3.6E-03	J	0.0	ND	1.8E-02	J	1.5E-01	J	0.0	
3	1.7E-05	J	1.6E-05		5.7E-03		0.0	ND	3.6E-02	J	2.8E-01		0.0	ND
4	2.6E-06	J	1.4E-05	J	0.0	ND	0.0	ND	0.0	ND	3.9E-01	J	0.0	ND
10	3.8E-06	J	5.2E-06	J	0.0	ND	0.0	ND	5.9E-04	J	1.8E-01	J	0.0	ND
9	4.2E-06	J	3.7E-06	J	1.9E-03	J	0.0	ND	0.0	ND	1.2E-01	J	0.0	ND
7	6.0E-06	J	5.6E-06	J	1.9E-03	J	0.0	ND	0.0	ND	1.4E-01	J	0.0	ND
6	6.8E-07	J	9.4E-07	J	0.0	ND	1.9E-02	J	0.0	ND	1.3E-01	J	0.0	ND
8	2.4E-05		3.2E-05		0.0	ND	0.0	ND	0.0	ND	1.2E+00		0.0	ND
5	1.8E-05		2.4E-05		0.0	ND	0.0	ND	0.0	ND	9.5E-01		0.0	ND
19	2.0E-06	J	1.0E-05	J	0.0	ND	0.0	ND	0.0	ND	2.1E+00		0.0	ND
18	2.5E-05		3.4E-05		0.0	ND	0.0	ND	0.0	ND	2.1E+00		0.0	ND
17	5.5E-06	J	8.4E-06	J	0.0	ND	0.0	ND	0.0	ND	4.6E-01	J	0.0	ND
15	3.6E-05		3.4E-05		7.0E-03		3.2E-01		0.0	ND	1.1E+00		0.0	ND
27	5.8E-06	J	3.4E-06	J	9.4E-03	J	0.0	ND	1.2E-02	J	9.0E-02	J	0.0	ND
24	7.5E-06	J	5.5E-06	J	7.7E-03	J	0.0	ND	1.4E-02	J	1.1E-01	J	0.0	ND
32	1.2E-05	J	1.5E-05	J	0.0	ND	0.0	ND	4.0E-02	J	5.8E-01		0.0	ND
16	1.3E-05	J	1.6E-05		0.0	ND	0.0	ND	2.9E-02	J	6.3E-01		0.0	ND
34	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
29	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
26	2.4E-05		2.1E-05		1.2E-02		2.2E-01		0.0	ND	8.5E-01		0.0	ND
25	1.2E-05	J	1.8E-05		0.0	ND	0.0	ND	1.2E-01		2.0E-01		0.0	ND
31	4.1E-05		5.0E-05		0.0	ND	0.0	ND	5.7E-03		3.6E+00		0.0	ND
28	2.9E-05		3.2E-05		0.0	ND	0.0	ND	9.6E-03		2.6E+00		0.0	ND
20	2.2E-05		2.7E-05		0.0	ND	0.0	ND	3.0E-02		2.6E+00		0.0	ND
22	1.6E-05	J	1.6E-05		1.6E-03		0.0	ND	3.7E-02	J	1.4E+00		0.0	ND

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	Paleta Creek at Main Street (C2W)													
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	1.2E-05	J	1.5E-05	J	0.0	ND	6.5E-02		0.0	ND	9.1E-01		0.0	ND
46	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
69	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
52	8.6E-05		9.0E-05		0.0	ND	0.0	ND	2.8E-01		3.7E+00		0.0	ND
47	2.1E-05		2.5E-05		0.0	ND	2.6E-01		0.0	ND	8.9E-01		0.0	ND
48	8.1E-06	J	7.5E-06	J	2.5E-03	J	1.9E-02	J	2.2E-02	J	8.0E-01		0.0	ND
44	5.6E-05		4.6E-05		3.7E-02		0.0	ND	1.8E-01		3.4E+00		0.0	ND
42	1.2E-05	J	1.7E-05		0.0	ND	0.0	ND	3.1E-02	J	1.2E+00		0.0	ND
37	5.0E-05		4.9E-05		1.4E-03		0.0		1.3E-01		8.6E-01		0.0	ND
71	1.4E-05	J	1.3E-05	J	4.1E-03	J	0.0	ND	2.0E-02	J	1.0E+00		0.0	ND
41	3.8E-05		3.8E-05		1.3E-04		0.0	ND	6.1E-02		5.6E+00		0.0	ND
103	1.2E-04		9.1E-05		1.1E-01		0.0	ND	4.1E-01		3.5E+00		0.0	ND
40	1.6E-05	J	2.9E-05		0.0		0.0	ND	1.6E-02		9.7E-01		0.0	ND
67	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
74	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
70	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
66	5.3E-05		4.3E-05		3.8E-02		0.0		1.6E-01		4.2E+00		0.0	ND
95	7.8E-05		4.9E-05		1.1E-01		2.4E+00		2.2E-02		1.5E+00		0.0	ND
93	7.8E-05		4.9E-05		1.1E-01		0.0		3.1E-01		1.3E+00		0.0	ND
56	2.9E-05		2.4E-05		2.1E-02		0.0		6.8E-02		2.9E+00		0.0	ND
60	2.6E-05		2.1E-05		2.0E-02		0.0		6.1E-02		2.9E+00		0.0	ND
92	4.1E-05		3.5E-05		2.3E-02		0.0	ND	1.0E-01		1.9E+00		0.0	ND
84	3.9E-05		4.2E-05		0.0		0.0		5.4E-02		2.1E+00		0.0	ND
101	2.0E-04		1.4E-04		2.4E-01		0.0	ND	3.6E-01		9.3E+00		0.0	ND
99	7.6E-05		5.3E-05		9.0E-02		0.0		7.1E-02		4.1E+00		0.0	
119	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND

Paleta Creek at Main Street (C2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
83	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
87	1.2E-04		7.7E-05		1.7E-01		0.0	ND	1.1E-01		6.7E+00		0.0	ND
81	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
115	7.4E-05		4.2E-05		1.2E-01		0.0	ND	1.7E-01		3.6E+00		0.0	ND
136	2.9E-05		2.6E-05		1.2E-02		0.0	ND	4.2E-02		1.6E+00		0.0	ND
110	2.1E-04		1.1E-04		3.7E-01		0.0	ND	2.2E-01		1.6E+01		0.0	ND
77	4.2E-05		3.6E-05		2.3E-02		0.0	ND	4.9E-02		3.3E+00		0.0	ND
82	5.1E-05		2.7E-05		9.5E-02		1.2E-01		8.7E-02		1.7E+00		0.0	ND
151	5.5E-05		3.6E-05		7.0E-02		0.0		6.0E-02		2.6E+00		0.0	ND
135	2.3E-05		1.6E-05		2.7E-02		0.0	ND	2.3E-02	J	1.2E+00		0.0	ND
144	1.6E-05	J	9.2E-06	J	2.7E-02	J	2.0E-01	J	0.0	ND	2.0E+00		0.0	ND
147	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
107	2.7E-05		1.4E-04		0.0	ND	4.8E+00		0.0	ND	6.1E-01		0.0	ND
123	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
149	1.4E-04		7.9E-05		2.4E-01		0.0	ND	1.3E-01		1.1E+01		0.0	ND
118	9.5E-05		4.1E-05		2.0E-01		1.9E+00		4.2E-02		7.5E+00		0.0	ND
134	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
114	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
131	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
146	3.0E-05		1.4E-05	J	5.9E-02	J	1.9E-01		4.4E-02		2.5E+00		0.0	ND
153	1.3E-04		6.8E-05		2.5E-01		0.0	ND	2.1E-01		1.5E+01		0.0	ND
132	5.7E-05		3.3E-05		9.1E-02		1.4E-01		5.7E-02		5.8E+00		0.0	ND
105	8.5E-05		4.2E-05		1.7E-01		3.2E-01		1.2E-01		7.6E+00		0.0	ND
141	4.7E-05		3.2E-05		5.8E-02		0.0	ND	3.9E-02		4.1E+00		0.0	ND
179	1.7E-05	J	1.9E-06	J	5.9E-02	J	1.6E-01	J	0.0	ND	1.3E+00		0.0	ND
163	9.2E-05		2.7E-05		2.5E-01		1.2E+00		1.0E-01		1.0E+01		0.0	ND

Paleta Creek at Main Street (C2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
138	9.0E-05		1.7E-05		2.8E-01		1.9E+00		9.5E-02		1.0E+01		0.0	ND
158	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
178	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
126	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
187	6.6E-05		1.5E-05		1.9E-01		5.6E-01		5.8E-02		4.6E+00		0.0	ND
183	3.9E-06	J	0.0	ND	1.5E-02	J	2.8E-01	J	7.7E-02	J	1.6E+00		0.0	ND
128	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
167	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
174	2.3E-05		1.1E-05	J	4.7E-02	J	1.2E-02	J	4.8E-02	J	4.4E+00		0.0	ND
177	1.1E-05	J	1.0E-05	J	2.3E-03	J	0.0	ND	4.9E-02	J	2.5E+00		0.0	ND
171	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
156	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
157	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
173	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
172	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
197	0.0	ND	2.7E-06	J	0.0	ND	0.0	ND	7.4E-03	J	1.4E-02	J	0.0	ND
180	7.5E-05		4.2E-05		1.3E-01		5.7E-01		1.7E-01		1.2E+01		0.0	ND
193	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
191	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
169	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
170	8.1E-05		0.0	ND	3.1E-01	J	3.2E+00		0.0	ND	7.7E+00		0.0	ND
190	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
198	1.3E-05	J	7.0E-06	J	2.3E-02	J	5.5E-01	J	5.9E-02		3.2E+00		0.0	ND
203	1.3E-05	J	6.4E-06	J	2.6E-02	J	1.9E-01	J	4.7E-02	J	1.8E+00		0.0	ND
196	1.2E-05	J	5.3E-06	J	2.6E-02	J	2.0E-01	J	4.4E-02	J	1.8E+00		0.0	ND
189	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND

Paleta Creek at Main Street (C2W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
208	1.3E-06	J	2.3E-07	J	4.0E-03	J	4.4E-02	J	0.0	ND	7.0E-01		0.0	ND
195	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
207	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
194	1.4E-05	J	0.0	ND	5.4E-02		9.6E-02	J	7.2E-02	J	3.6E+00		0.0	ND
205	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
206	0.0	ND	1.8E-06	J	0.0	J	5.6E-01	J	3.8E-02	J	9.9E-01		0.0	ND
209	6.8E-06	J	6.3E-06	J	1.9E-03	J	8.8E-01		0.0	ND	3.1E-01	J	0.0	J

Table B28. PCB in bulk and particulate fractions of location O4W for stormwater event-I (January 5th to 7th 2016).

NBSD Outfall at Paunack and Division Streets (O4W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
1	5.9E-06	J	5.4E-06	J	2.6E-03	J	5.7E-02	J	0.0	J	1.2E-02	J	0.0	ND
2	1.2E-05	J	4.6E-06	J	0.0	ND	5.7E-02	J	0.0	J	0.0	J	0.0	ND
3	1.8E-05		9.6E-06	J	0.0	ND	8.0E-02	J	1.7E-03	J	0.0	ND	0.0	ND
4	3.3E-05		1.1E-05	J	0.0	ND	2.6E-01		0.0	ND	4.5E-01		0.0	ND
10	1.7E-05		6.6E-06	J	0.0	ND	9.3E-02	J	0.0	ND	6.1E-02	J	0.0	ND
9	4.2E-06	J	2.3E-06	J	0.0	ND	2.4E-02	J	6.3E-03	J	2.2E-02	J	0.0	ND
7	4.8E-06	J	3.4E-06	J	0.0	ND	1.7E-02	J	6.1E-03	J	2.0E-02	J	0.0	ND
6	2.0E-05		5.7E-06	J	0.0	ND	7.7E-02	J	0.0	ND	4.7E-02	J	0.0	ND
8	8.3E-05		2.5E-05		0.0	ND	2.7E-01		2.8E-02		4.4E-01		0.0	ND
5	6.4E-05		1.9E-05		0.0	ND	2.0E-01		2.2E-02		3.4E-01		0.0	ND
19	1.1E-05	J	3.1E-06	J	0.0	ND	2.0E-02	J	1.5E-02	J	1.1E-01	J	0.0	ND
18	9.5E-05		2.6E-05		0.0	ND	3.1E-01		2.2E-01		6.7E-01		0.0	ND
17	3.7E-05		7.8E-06	J	0.0	ND	5.8E-02	J	1.3E-01		2.8E-01		0.0	ND
15	8.4E-05		2.1E-05		0.0	ND	5.9E-01		3.2E-02		2.0E-01		0.0	ND
27	6.9E-06	J	6.8E-06	J	0.0	ND	0.0	ND	1.2E-02	J	2.7E-02	J	0.0	ND
24	8.1E-06	J	3.4E-06	J	0.0	ND	2.0E-02	J	1.4E-02	J	2.3E-02	J	0.0	ND
32	3.8E-05		9.8E-06	J	0.0	ND	1.5E-01		9.9E-02		0.0	ND	0.0	ND
16	4.0E-05		1.0E-05		0.0	ND	1.5E-01		8.7E-02		1.6E-01		0.0	ND
34	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
29	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
26	4.2E-05		1.4E-05		0.0	ND	2.3E-01		3.3E-02		2.2E-01		0.0	ND
25	1.8E-05		8.1E-06	J	0.0	ND	8.2E-02	J	1.9E-02	J	4.7E-02		0.0	ND
31	1.8E-04		3.1E-05		0.0	ND	7.1E-01		5.3E-01		1.4E+00		0.0	ND
28	1.4E-04		1.7E-05		0.0	ND	5.8E-01		4.7E-01		7.6E-01		0.0	ND
20	1.5E-04		1.6E-05		0.0	ND	5.1E-01		4.6E-01		6.8E-01		0.0	ND
22	7.5E-05		1.2E-05		0.0	ND	2.0E-01		3.4E-01		2.7E-02		0.0	ND

NBSD Outfall at Paunack and Division Streets (O4W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	3.0E-05		6.8E-06	J	0.0	ND	1.4E-01	J	5.9E-02		2.1E-01		0.0	ND
46	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
69	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
52	1.5E-04		6.1E-05		0.0		9.3E-01		3.2E-01		1.2E+00		0.0	ND
47	5.4E-05		1.6E-05		0.0		5.1E-01		0.0	ND	3.3E-01		0.0	
48	4.8E-05		4.8E-06	J	0.0	ND	2.1E-01		1.6E-01		3.3E-01		0.0	ND
44	1.6E-04		2.7E-05		0.0	ND	8.1E-01		5.1E-01		7.2E-01		0.0	ND
42	5.7E-05		6.7E-06	J	0.0	J	2.5E-01		2.7E-01		2.9E-01		0.0	ND
37	1.4E-04		2.2E-05		0.0		5.0E-01		4.2E-01		9.6E-01		0.0	ND
71	4.6E-05		7.7E-06	J	0.0	ND	1.4E-01		2.4E-01		1.7E-01		0.0	ND
41	1.8E-04		1.9E-05		0.0	ND	7.9E-01		8.2E-01		4.0E-01		0.0	ND
103	1.1E-04		3.0E-05		0.0	ND	1.6E+00		0.0		2.8E+00		0.0	ND
40	4.0E-05		1.0E-05	J	0.0	ND	1.9E-01		1.2E-01		7.1E-02		0.0	ND
67	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
74	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
70	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
66	2.5E-04		2.5E-05		0.0	ND	1.0E+00		1.3E+00		0.0	ND	0.0	ND
95	7.9E-05		4.2E-05		0.0	ND	7.4E-01		5.4E-02		6.1E+00		0.0	ND
93	7.9E-05		4.5E-05		0.0	ND	6.9E-01		5.4E-02		6.1E+00		0.0	ND
56	1.3E-04		1.7E-05		0.0	ND	4.8E-01		5.7E-01		3.5E-01		0.0	ND
60	1.3E-04		1.5E-05		0.0		4.6E-01		5.7E-01		3.5E-01		0.0	ND
92	5.0E-05		2.4E-05		0.0		1.6E-01		2.0E-01		0.0	ND	0.0	ND
84	5.8E-05		2.3E-05		0.0	ND	2.0E-01		1.5E-01		1.7E-01		0.0	ND
101	2.5E-04		1.1E-04		0.0		7.6E-01		1.1E+00		0.0	ND	0.0	ND
99	1.2E-04		3.9E-05		0.0		3.4E-01		5.8E-01		1.3E-01		0.0	
119	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND

NBSD Outfall at Paunack and Division Streets (O4W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
83	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
87	1.8E-04		7.1E-05		0.0	ND	0.0	ND	1.1E+00		6.7E-01		0.0	ND
81	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
115	1.0E-04		4.4E-05		0.0	ND	4.3E-02		6.8E-01		0.0	ND	0.0	ND
136	2.8E-05		1.7E-05		0.0	ND	8.3E-02		6.4E-02		1.2E-01		0.0	ND
110	3.2E-04		7.8E-05		0.0	ND	7.4E-01		1.5E+00		9.1E-01		0.0	ND
77	9.5E-05		2.1E-05		0.0	ND	3.5E-01		2.5E-01		4.6E-01		0.0	ND
82	6.3E-05		1.6E-05		0.0	ND	3.3E-01		1.7E-01		4.9E-01		0.0	ND
151	4.2E-05		2.5E-05		0.0	ND	7.2E-02		1.8E-01		1.4E-01		0.0	ND
135	2.2E-05		9.2E-06	J	0.0	ND	3.9E-02	J	6.8E-02		1.3E-01		0.0	ND
144	1.5E-05		1.0E-05	J	0.0	ND	0.0	ND	1.3E-01		0.0	ND	0.0	ND
147	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
107	3.2E-05		1.8E-05		0.0	ND	2.3E+00		0.0	ND	4.0E-01		0.0	ND
123	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
149	1.5E-04		4.3E-05		0.0	ND	2.6E-01		6.6E-01		1.1E+00		0.0	ND
118	1.8E-04		3.1E-05		0.0	ND	6.5E-01		6.2E-01		1.6E+00		0.0	ND
134	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
114	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
131	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
146	3.7E-05		1.3E-05		0.0	ND	5.3E-02		8.1E-02		1.5E-01		0.0	ND
153	1.7E-04		4.0E-05		0.0	ND	3.3E-01		8.0E-01		9.0E-01		0.0	ND
132	6.9E-05		2.3E-05		0.0	ND	5.2E-02		3.9E-01		2.4E-01		0.0	ND
105	1.7E-04		2.8E-05		0.0	ND	5.9E-01		9.1E-01		3.6E-01		0.0	ND
141	5.8E-05		1.6E-05		0.0	ND	2.1E-01		2.4E-01		2.2E-01		0.0	ND
179	1.4E-05		4.9E-06	J	0.0	ND	0.0	ND	6.5E-02	J	1.2E-01	J	0.0	ND
163	1.2E-04		6.2E-06	J	0.0	ND	3.1E-01		5.7E-01		6.2E-01		0.0	ND

NBSD Outfall at Paunack and Division Streets (O4W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
138	1.2E-04		4.9E-06	J	0.0	ND	3.0E-01		5.8E-01		6.2E-01		0.0	ND
158	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
178	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
126	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
187	5.1E-05		2.7E-06	J	0.0	ND	0.0	ND	2.5E-01		3.2E-01		0.0	ND
183	1.9E-05		0.0	ND	0.0	ND	0.0	ND	0.0	ND	1.9E-01	J	0.0	ND
128	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	
167	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
174	4.0E-05		7.0E-06	J	0.0	ND	1.2E-01	J	1.1E-01		2.0E-01		0.0	ND
177	2.9E-05		5.8E-05		1.6E-01		0.0	ND	3.4E-02	J	6.6E-01		0.0	ND
171	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
156	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
157	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
173	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	
172	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
197	0.0	ND	1.1E-06	J	5.9E-03	J	1.1E-02	J	0.0	ND	0.0	ND	0.0	ND
180	1.2E-04		2.2E-05		0.0	ND	1.8E-01		5.5E-01		7.5E-01		0.0	ND
193	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
191	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
169	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
170	5.6E-05		2.7E-05		0.0	ND	0.0	ND	4.9E-01		4.8E-01		0.0	ND
190	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
198	3.2E-05		8.4E-06	J	0.0	ND	0.0	ND	1.7E-01		5.5E-03		0.0	ND
203	2.0E-05		5.6E-06	J	0.0	ND	5.1E-02	J	9.8E-02		0.0	ND	0.0	ND
196	1.9E-05		4.9E-06	J	0.0	ND	4.5E-02	J	1.0E-01		0.0	ND	0.0	ND
189	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND

PCB	Bulk water µg/L		Filtered Water (< 0.7 µm) µg/L		Total solids (>0.7µm) µg/Kg		Solids fraction (0.7-2.7 µm) µg/Kg		Solids fraction (2.7-20 µm) µg/Kg		Solids Fraction (20-63 µm) µg/Kg		Solids Fraction (> 63 µm) µg/Kg	
	NBSD Outfall at Paunack and Division Streets (O4W)													
208	3.9E-06	J	2.5E-07	J	0.0	ND	1.7E-02	J	8.3E-03	J	0.0	ND	0.0	ND
195	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
207	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
194	3.9E-05		0.0	ND	0.0	ND	2.0E-01	J	0.0	ND	7.9E-01		0.0	ND
205	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0E+00	ND	0.0	ND
206	8.4E-06	J	1.1E-06	J	0.0	ND	1.7E-02	J	9.9E-04	J	4.7E-02	J	0.0	ND
209	1.4E-05		3.2E-06	J	0.0	J	3.7E-02	J	0.0	J	8.0E-02	J	0.0	ND

Table B29. PCB in bulk and particulate fractions of location O3W for stormwater event-I (January 5th to 7th 2016).

NBSD Outfall at Railroad Crossing (O3W)											
PCB	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
	µg/L	µg/L		µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg
1	NA	8.9E-06	J	NA	0.0	ND	7.9E-03	J	0.0	J	NA
2	NA	8.5E-06	J	NA	0.0	ND	1.8E-03	J	0.0	ND	NA
3	NA	1.3E-05	J	NA	0.0	ND	0.0	ND	0.0	ND	NA
4	NA	4.2E-05		NA	0.0	ND	1.7E-01		0.0	ND	NA
10	NA	2.3E-05		NA	0.0	ND	7.3E-02		0.0	ND	NA
9	NA	3.6E-06	J	NA	0.0	ND	0.0	ND	4.9E-01	J	NA
7	NA	4.8E-06	J	NA	0.0	ND	0.0	ND	4.4E-01	J	NA
6	NA	1.3E-05	J	NA	0.0	ND	1.0E-01		0.0	ND	NA
8	NA	5.5E-05		NA	0.0	ND	1.7E-01		0.0	ND	NA
5	NA	4.2E-05		NA	0.0	ND	1.3E-01		0.0	ND	NA
19	NA	1.1E-05	J	NA	0.0	ND	1.0E-01		0.0	ND	NA
18	NA	5.8E-05		NA	0.0	ND	4.4E-01		0.0	ND	NA
17	NA	2.0E-05		NA	0.0	ND	1.9E-01		0.0	ND	NA
15	NA	3.6E-05		NA	0.0	ND	3.6E-01		0.0	ND	NA
27	NA	3.8E-06	J	NA	0.0	ND	3.3E-02	J	0.0	ND	NA
24	NA	5.1E-06	J	NA	0.0	ND	8.1E-02	J	0.0	ND	NA
32	NA	2.2E-05		NA	0.0	ND	1.4E-01		0.0	ND	NA
16	NA	2.3E-05		NA	0.0	ND	1.5E-01		0.0	ND	NA
34	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
29	NA	0.0	ND	NA	0.0		0.0	ND	0.0	ND	NA
26	NA	1.8E-05		NA	0.0	ND	0.0	ND	0.0	ND	NA
25	NA	1.3E-05	J	NA	0.0	ND	3.9E-02		0.0	ND	NA
31	NA	5.1E-05		NA	0.0	ND	6.9E-01		0.0	ND	NA
28	NA	3.3E-05		NA	0.0	ND	6.8E-01		0.0	ND	NA
20	NA	3.2E-05		NA	0.0	ND	5.5E-01		0.0	ND	NA
22	NA	1.4E-05		NA	0.0	ND	0.0	ND	7.6E+00		NA

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	NBSD Outfall at Railroad Crossing (O3W)													
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	NA		1.3E-05	J	NA		0.0	ND	2.4E-02		0.0	ND	NA	
46	NA		0.0	ND	NA		0.0	ND	0.0	ND	0.0	ND	NA	
69	NA	ND	0.0	ND	NA	ND	0.0	ND	0.0	ND	0.0	ND	NA	ND
52	NA		6.8E-05		NA		0.0	ND	2.4E+00		0.0	ND	NA	
47	NA		2.0E-05		NA		0.0	ND	0.0	ND	0.0	ND	NA	
48	NA		7.6E-06	J	NA		0.0	ND	8.0E-02		0.0	ND	NA	
44	NA		3.4E-05		NA		0.0	ND	2.0E+00		0.0	ND	NA	
42	NA		1.1E-05	J	NA		0.0	ND	3.4E-01		0.0	ND	NA	
37	NA		3.3E-05		NA		0.0	ND	5.3E-01		0.0	ND	NA	
71	NA		5.6E-06	J	NA		0.0	ND	2.1E-01		0.0	ND	NA	
41	NA		2.1E-05		NA		0.0	ND	6.9E-01		0.0		NA	
103	NA		5.0E-05		NA		0.0	ND	2.8E+00		0.0	ND	NA	
40	NA		1.5E-05		NA		0.0	ND	1.5E-01		0.0	ND	NA	
67	NA		0.0	ND	NA		0.0	ND	0.0	ND	0.0	ND	NA	
74	NA	ND	0.0	ND	NA	ND	0.0	ND	0.0	ND	0.0	ND	NA	ND
70	NA	ND	0.0	ND	NA	ND	0.0	ND	0.0	ND	0.0	ND	NA	ND
66	NA		2.7E-05		NA		0.0	ND	1.1E+00		0.0	ND	NA	
95	NA		4.2E-05		NA		0.0	ND	1.6E+00		0.0		NA	
93	NA		4.3E-05		NA		0.0	ND	1.6E+00		0.0	ND	NA	
56	NA		1.6E-05		NA		0.0	ND	5.7E-01		0.0	ND	NA	
60	NA		1.4E-05		NA		0.0	ND	5.8E-01		0.0	ND	NA	
92	NA		2.1E-05		NA		0.0	ND	3.2E+00		0.0	ND	NA	
84	NA		3.2E-05		NA		0.0	ND	8.9E-01		0.0		NA	
101	NA		1.2E-04		NA		0.0	ND	2.8E+00		0.0	ND	NA	
99	NA		4.9E-05		NA		0.0		8.5E-01		0.0		NA	
119	NA		0.0	ND	NA		0.0	ND	0.0	ND	0.0	ND	NA	

NBSD Outfall at Railroad Crossing (O3W)											
PCB	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
	µg/L	µg/L		µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg
83	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
87	NA	4.5E-05		NA	0.0	ND	1.4E+00		0.0	ND	NA
81	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
115	NA	3.2E-05		NA	0.0	ND	9.7E-01		0.0	ND	NA
136	NA	1.7E-05		NA	0.0	ND	5.5E-01		0.0		NA
110	NA	7.3E-05		NA	0.0	ND	2.9E+00		0.0	ND	NA
77	NA	2.5E-05		NA	0.0	ND	1.7E-01		0.0	ND	NA
82	NA	2.6E-05		NA	0.0	ND	4.4E-01		0.0	ND	NA
151	NA	3.0E-05		NA	0.0	ND	8.6E-01		0.0	ND	NA
135	NA	1.1E-05	J	NA	0.0	ND	2.6E-01		0.0	ND	NA
144	NA	5.8E-06	J	NA	0.0	ND	2.5E-01		0.0	ND	NA
147	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
107	NA	9.5E-05		NA	0.0	ND	5.4E-01		0.0	ND	NA
123	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
149	NA	4.9E-05		NA	0.0	ND	3.0E+00		0.0	ND	NA
118	NA	2.7E-05		NA	0.0	ND	1.3E+00		0.0	ND	NA
134	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
114	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
131	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
146	NA	1.3E-05		NA	0.0	ND	5.0E-01		0.0	ND	NA
153	NA	3.9E-05		NA	0.0	ND	3.1E+00		0.0	ND	NA
132	NA	2.5E-05		NA	0.0	ND	1.0E+00		0.0	ND	NA
105	NA	2.6E-05		NA	0.0	ND	8.2E-01		0.0	ND	NA
141	NA	2.3E-05		NA	0.0	ND	8.2E-01		0.0	ND	NA
179	NA	6.4E-06	J	NA	0.0	ND	6.0E-01		0.0	ND	NA
163	NA	1.6E-05		NA	0.0	ND	2.3E+00		0.0	ND	NA

NBSD Outfall at Railroad Crossing (O3W)											
PCB	**Bulk water**	**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**	**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**
	µg/L	**µg/L**		**µg/Kg**	**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**
138	NA	9.8E-06	J	NA	0.0	ND	2.1E+00		0.0	ND	NA
158	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
178	NA	0.0	ND	NA	0.0		0.0	ND	0.0	ND	NA
126	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
187	NA	4.5E-06	J	NA	0.0		2.5E+00		0.0	ND	NA
183	NA	0.0	ND	NA	0.0	ND	1.1E+00		0.0	ND	NA
128	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
167	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
174	NA	7.9E-07	J	NA	0.0	ND	1.6E+00		0.0	ND	NA
177	NA	0.0	ND	NA	0.0	ND	8.1E-01		0.0	ND	NA
171	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
156	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
157	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
173	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
172	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
197	NA	1.6E-06	J	NA	0.0	ND	2.3E-02	J	0.0	ND	NA
180	NA	2.8E-05		NA	0.0	ND	4.5E+00		0.0	ND	NA
193	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
191	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
169	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
170	NA	3.2E-06	J	NA	0.0	ND	2.2E+00		0.0	ND	NA
190	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA
198	NA	5.3E-06	J	NA	0.0	ND	1.6E+00		0.0	ND	NA
203	NA	6.6E-06	J	NA	0.0	ND	8.3E-01		0.0	ND	NA
196	NA	5.6E-06	J	NA	0.0	ND	8.3E-01		0.0	ND	NA
189	NA	0.0	ND	NA	0.0	ND	0.0	ND	0.0	ND	NA

NBSD Outfall at Railroad Crossing (O3W)													
PCB	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L	µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
208	NA	2.0E-07	J	NA		0.0	ND	4.6E-01		0.0	ND	NA	
195	NA	0.0	ND	NA		0.0	ND	0.0	ND	0.0	ND	NA	
207	NA	0.0	ND	NA		0.0	ND	0.0	ND	0.0	ND	NA	
194	NA	0.0	ND	NA		0.0	ND	1.7E+00		0.0	ND	NA	
205	NA	0.0	ND	NA		0.0	ND	0.0	ND	0.0	ND	NA	
206	NA	4.9E-06	J	NA		0.0	ND	2.6E-01		1.4E+01		NA	
209	NA	5.0E-06	J	NA		0.0	ND	1.1E+00		2.7E+01		NA	

Table B30. PCB in bulk and particulate fractions of location C1W for stormwater event-I (January 5th to 7th 2016).

Paleta Creek at Cummings Road (C1W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
1	9.3E-06	J	8.2E-06	J	4.0E-03	J	0.0	ND	4.3E-02	J	0.0	ND	0.0	ND
2	1.4E-05	J	9.3E-06	J	1.8E-02	J	4.9E-01	J	1.6E-02	J	0.0	ND	0.0	ND
3	2.5E-05		1.9E-05		2.2E-02		3.1E-01		9.1E-02	J	0.0	ND	0.0	ND
4	2.2E-05	J	1.8E-05	J	1.5E-02	J	0.0	ND	5.0E-02	J	0.0	ND	1.3E-01	J
10	1.3E-05	J	7.0E-06	J	2.3E-02	J	1.7E-01	J	2.2E-02	J	4.0E-02	J	0.0	ND
9	6.0E-06	J	7.6E-06	J	0.0	ND	3.9E-02	J	2.9E-02	J	0.0	ND	0.0	ND
7	7.0E-06	J	4.9E-06	J	7.7E-03	J	2.6E-01	J	3.4E-02	J	0.0	ND	0.0	ND
6	1.9E-05	J	1.2E-05	J	2.7E-02	J	0.0	ND	3.1E-03	J	2.0E-01	J	1.5E-02	J
8	9.9E-05		4.4E-05		2.0E-01		3.8E-01		2.2E-01		2.4E-01		6.9E-02	
5	7.6E-05		3.3E-05		1.6E-01		2.9E-01		1.7E-01		2.0E-01		6.3E-02	
19	1.6E-05	J	4.0E-06	J	4.6E-02	J	8.1E-02	J	3.5E-02	J	1.5E-01	J	0.0	ND
18	1.5E-04		4.9E-05		3.8E-01		6.2E-01		4.6E-01		8.0E-01		0.0	ND
17	6.2E-05		1.4E-05	J	1.8E-01	J	2.8E-01	J	2.1E-01		6.2E-03		2.3E-01	
15	1.6E-04		5.1E-05		4.2E-01		0.0	ND	4.7E-01		8.7E-01		1.5E-02	
27	2.3E-05		3.6E-06	J	7.3E-02	J	1.3E-01	J	6.6E-02	J	6.2E-02	J	9.0E-02	
24	2.5E-05		5.5E-06	J	7.3E-02	J	1.0E-01	J	5.0E-02	J	1.2E-01	J	9.2E-02	
32	6.5E-05		1.9E-05		1.7E-01		1.3E-01		2.2E-01		4.9E-01		0.0	ND
16	6.6E-05		2.1E-05		1.7E-01		1.8E-01		2.1E-01		4.4E-01		0.0	ND
34	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
29	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
26	6.8E-05		3.3E-05		1.3E-01		4.2E+00		0.0	ND	0.0	ND	8.5E-02	
25	3.0E-05		2.0E-05		3.8E-02		4.3E+00		0.0	ND	1.9E-01		0.0	ND
31	2.9E-04		6.4E-05		8.3E-01		1.4E+00		9.2E-01		1.8E+00		0.0	ND
28	2.5E-04		4.8E-05		7.6E-01		2.9E-01		8.4E-01		2.2E+00		0.0	ND
20	2.1E-04		3.8E-05		6.3E-01		3.7E-01		5.7E-01		2.3E+00		0.0	ND
22	1.2E-04		2.5E-05		3.4E-01		2.8E-01		4.2E-01		1.1E+00		0.0	ND

Paleta Creek at Cummings Road (C1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	5.9E-05		1.8E-05	J	1.5E-01		2.8E-01		2.1E-01		3.0E-01		0.0	ND
46	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
69	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
52	5.2E-04		2.1E-04		1.2E+00		0.0	ND	1.5E+00		3.0E+00		1.8E-01	
47	1.2E-04		3.8E-05		3.1E-01		0.0	ND	4.0E-01		1.1E+00		0.0	ND
48	6.6E-05		1.2E-05	J	2.0E-01	J	4.6E-01	J	1.3E-01	J	1.3E+00		0.0	ND
44	4.0E-04		1.1E-04		1.1E+00		0.0	ND	1.1E+00		4.3E+00		0.0	ND
42	1.3E-04		1.9E-05	J	4.3E-01		2.5E-01		4.2E-01		1.4E+00		0.0	ND
37	2.3E-04		5.5E-05		6.4E-01		0.0E+00		8.0E-01		2.4E+00		0.0	ND
71	1.1E-04		1.3E-05	J	3.7E-01		6.0E-01		3.7E-01		5.5E-01		1.4E-01	
41	4.1E-04		6.6E-05		1.3E+00		0.0	ND	1.4E+00		4.8E+00		0.0	ND
103	7.5E-04		2.4E-04		1.9E+00		0.0	ND	0.0		1.4E+01		0.0	ND
40	8.1E-05		2.8E-05		2.0E-01		0.0	ND	3.1E-01		6.9E-01		0.0	ND
67	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
74	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
70	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
66	3.4E-04		4.8E-05		1.1E+00		1.5E+00		1.5E+00		2.9E+00		0.0	ND
95	4.6E-04		1.7E-04		1.1E+00		0.0		1.5E+00		3.4E+00		0.0	ND
93	4.6E-04		1.6E-04		1.1E+00		0.0		1.7E+00		3.4E+00		0.0	ND
56	1.6E-04		4.3E-05		4.5E-01		0.0	ND	6.7E-01		1.7E+00		0.0	ND
60	1.6E-04		4.0E-05		4.5E-01		0.0	ND	6.5E-01		1.7E+00		0.0	ND
92	2.5E-04		8.0E-05		6.4E-01		0.0	ND	6.7E-01		2.6E+00		0.0	ND
84	2.6E-04		8.4E-05		6.5E-01		0.0	ND	9.0E-01		2.5E+00		0.0	ND
101	1.3E-03		3.9E-04		3.5E+00		0.0	ND	4.7E+00		1.2E+01		0.0	ND
99	4.8E-04		1.5E-04		1.2E+00		0.0		1.7E+00		4.9E+00		0.0	
119	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND

Paleta Creek at Cummings Road (C1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
83	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
87	9.3E-04		2.0E-04		2.7E+00		0.0	ND	2.7E+00		1.0E+01		0.0	ND
81	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
115	4.9E-04		1.1E-04		1.4E+00		0.0	ND	1.7E+00		4.2E+00		0.0	ND
136	2.6E-04		5.1E-05		7.6E-01		0.0	ND	9.2E-01		2.2E+00		0.0	ND
110	1.9E-03		3.0E-04		6.0E+00		0.0	ND	5.4E+00		2.0E+01		0.0	ND
77	2.3E-04		5.2E-05		6.6E-01		2.3E-01		7.7E-01		2.3E+00		0.0	ND
82	2.4E-04		5.6E-05		6.9E-01		0.0	ND	6.5E-01		2.3E+00		0.0	ND
151	4.6E-04		6.8E-05		1.5E+00		5.0E-01		1.6E+00		5.0E+00		0.0	ND
135	1.8E-04		2.8E-05		5.5E-01		0.0	ND	5.9E-01		1.9E+00		0.0	ND
144	1.9E-04		2.2E-05		6.2E-01		4.2E-02		0.0		2.2E+00		0.0	ND
147	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
107	1.3E-04		4.1E-04		0.0	ND	0.0	ND	0.0	ND	1.1E+00		0.0	ND
123	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
149	1.6E-03		1.9E-04		5.5E+00		3.0E-01		5.6E+00		1.9E+01		0.0	ND
118	9.3E-04		1.4E-04		2.9E+00		0.0	ND	2.6E+00		7.2E+00		1.5E+00	
134	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
114	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
131	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
146	3.3E-04		3.7E-05		1.1E+00		4.4E-01		9.1E-01		2.8E+00		2.0E-01	
153	2.2E-03		1.9E-04		7.6E+00		1.1E+00		6.9E+00		1.6E+01		3.1E+00	
132	8.0E-04		6.5E-05		2.7E+00		1.4E+00		2.5E+00		5.3E+00		1.4E+00	
105	7.0E-04		9.4E-05		2.3E+00		1.9E-01		2.1E+00		5.2E+00		4.4E-01	
141	6.5E-04		5.3E-05		2.2E+00		1.3E+00		2.2E+00		4.8E+00		2.9E-01	
179	2.1E-04		1.4E-05	J	7.4E-01	ND	2.7E-01	J	7.6E-01		1.9E+00		0.0	ND
163	1.6E-03		8.5E-05		5.5E+00		2.1E+00		4.3E+00		1.3E+01		3.6E+00	

Paleta Creek at Cummings Road (C1W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
138	1.6E-03		8.3E-05		5.5E+00		2.1E+00		4.3E+00		1.3E+01		3.6E+00	
158	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
178	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
126	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
187	7.2E-04		4.9E-05		2.5E+00		0.0	ND	2.8E+00		6.0E+00		0.0	ND
183	4.0E-04		2.2E-06	J	1.5E+00		1.7E+00		1.6E+00		3.4E+00		0.0	ND
128	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
167	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
174	7.4E-04		1.4E-05	J	2.7E+00		3.8E+00		2.8E+00		7.4E+00		0.0	ND
177	4.5E-04		1.6E-05	J	1.6E+00		2.5E+00		1.4E+00		4.5E+00		0.0	ND
171	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
156	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
157	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
173	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
172	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
197	1.4E-05	J	2.7E-06	J	4.0E-02	ND	0.0	ND	2.8E-02	J	2.7E-01	J	0.0	ND
180	2.2E-03		7.6E-05		7.9E+00		7.3E+00		8.1E+00		1.7E+01		0.0	ND
193	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
191	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
169	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
170	1.3E-03		1.2E-04		4.5E+00		0.0	ND	5.5E+00		8.5E+00		0.0	ND
190	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
198	4.1E-04		1.3E-05	J	1.5E+00		1.9E+00		1.6E+00		3.7E+00		0.0	ND
203	2.6E-04		9.8E-06	J	9.4E-01		1.4E+00		1.0E+00		1.9E+00		0.0	ND
196	2.6E-04		8.4E-06	J	9.4E-01		1.4E+00		1.0E+00		1.9E+00		0.0	ND
189	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND

Paleta Creek at Cummings Road (C1W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
208	3.3E-05		5.7E-07	J	1.2E-01	J	1.5E-01	J	1.6E-01	J	2.1E-01		0.0	ND
195	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
207	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
194	5.6E-04		0.0	ND	2.1E+00		2.7E+00		2.1E+00		4.0E+00		2.2E-01	
205	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND
206	1.8E-04		5.2E-06	J	6.5E-01	J	7.7E-01	J	8.2E-01		1.4E+00		0.0	ND
209	7.6E-05		5.7E-06	J	2.6E-01	J	5.4E-01	J	1.2E-01	J	1.2E+00		0.0	ND

Table B31. PCB in bulk and particulate fractions of location O1W for stormwater event-I (January 5th to 7th 2016).

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	9.8E-06	J	1.5E-05	J	0.0E+00	ND	0.0E+00		0.0E+00	J	5.7E-02	J	0.0E+00	ND
2	1.4E-05	J	1.6E-05	J	0.0E+00	ND	0.0E+00	ND	7.3E-02	J	0.0E+00	ND	2.4E-02	J
3	2.5E-05		3.6E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	9.6E-02	J	0.0E+00	ND
4	1.3E-05	J	8.4E-06	J	4.1E-02	J	0.0E+00	ND	9.4E-02	J	3.7E-02	J	1.5E-01	J
10	9.5E-06	J	7.0E-06	J	2.1E-02	J	0.0E+00	ND	0.0E+00	ND	7.7E-02	J	2.4E-02	J
9	3.8E-06	J	2.0E-05	J	0.0E+00	ND	0.0E+00	ND	3.8E-02	J	5.0E-02	J	0.0E+00	ND
7	4.8E-06	J	2.2E-05	J	0.0E+00	ND	0.0E+00	ND	2.6E-02	J	5.4E-02	J	0.0E+00	ND
6	1.2E-05	J	4.7E-06	J	6.5E-02	J	0.0E+00	ND	0.0E+00	ND	8.9E-02	J	1.8E-01	J
8	4.9E-05		4.9E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	4.0E-01		6.7E-02	
5	3.7E-05		3.1E-05	J	4.7E-02		0.0E+00	ND	0.0E+00	ND	3.1E-01		6.1E-02	
19	6.0E-06	J	0.0E+00	ND	5.0E-02	J	0.0E+00	ND	0.0E+00	ND	5.1E-01		0.0E+00	ND
18	5.1E-05		3.2E-05	J	1.6E-01	J	0.0E+00	ND	0.0E+00	ND	6.3E-01		5.2E-02	
17	9.3E-06	J	0.0E+00	ND	7.7E-02	J	0.0E+00	ND	4.8E-02	J	1.5E-01	J	0.0E+00	ND
15	5.5E-05		6.3E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	4.2E-01		0.0E+00	ND
27	4.2E-06	J	7.2E-06	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	6.1E-02	J	0.0E+00	ND
24	6.4E-06	J	1.0E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.3E-02	J	0.0E+00	ND
32	1.9E-05	J	1.6E-05	J	2.9E-02	J	0.0E+00	ND	0.0E+00	ND	1.9E-01	J	0.0E+00	ND
16	2.0E-05	J	1.8E-05	J	1.4E-02	J	0.0E+00	ND	0.0E+00	ND	2.1E-01	J	0.0E+00	ND
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	3.2E-05		4.3E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.6E-01		0.0E+00	ND
25	1.8E-05	J	2.8E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.4E-01	J	0.0E+00	ND
31	6.6E-05		4.8E-05		1.5E-01		0.0E+00	ND	0.0E+00	ND	6.7E-01		0.0E+00	ND
28	4.6E-05		2.5E-05	J	1.7E-01	J	0.0E+00	ND	0.0E+00	ND	3.9E-01		1.5E-01	
20	4.0E-05		2.1E-05	J	1.6E-01	J	0.0E+00	ND	0.0E+00	ND	3.6E-01		1.8E-01	
22	3.0E-05		2.2E-05	J	7.1E-02	J	0.0E+00	ND	0.0E+00	ND	2.1E-01	J	2.2E-01	

NBSD Outfall #23 (O1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	1.8E-05	J	1.7E-05	J	1.2E-02	J	0.0E+00	ND	0.0E+00	J	1.0E-01	J	9.4E-02	J
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	1.1E-04		1.4E-04		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	2.3E+00		0.0E+00	ND
47	3.8E-05		3.4E-05	J	3.5E-02	J	0.0E+00	ND	0.0E+00	ND	3.4E-01		1.2E-01	
48	1.5E-05	J	1.2E-05	J	2.5E-02	J	0.0E+00	ND	0.0E+00	ND	1.1E-01	J	1.6E-01	J
44	6.3E-05		7.4E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.1E+00		0.0E+00	ND
42	1.8E-05	J	2.6E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.2E-01	J	1.3E-01	J
37	7.7E-05		8.2E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	4.8E-01		8.9E-02	
71	2.2E-05	J	1.8E-05	J	3.2E-02	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	4.8E-01	J
41	5.9E-05		3.0E-05	J	2.4E-01	J	0.0E+00	ND	0.0E+00	ND	6.6E-01		3.7E-01	
103	1.4E-04		1.8E-04		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	3.6E+00	
40	2.4E-05		3.0E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	2.5E-01		0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
70	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
66	7.8E-05		6.6E-05		9.5E-02		0.0E+00	ND	0.0E+00	ND	8.6E-01		0.0E+00	ND
95	1.1E-04		1.3E-04		0.0E+00	ND	0.0E+00	ND	3.9E-02		1.2E+00		0.0E+00	ND
93	1.1E-04		1.3E-04		0.0E+00	ND	0.0E+00	ND	3.7E-02		1.2E+00		0.0E+00	ND
56	4.3E-05		3.8E-05		3.8E-02	J	0.0E+00	ND	0.0E+00	ND	2.8E-01		1.2E-01	
60	4.0E-05		3.3E-05	J	5.8E-02	J	0.0E+00	ND	0.0E+00	ND	2.7E-01		1.4E-01	
92	5.3E-05		6.2E-05		0.0E+00		0.0E+00	ND	0.0E+00	ND	6.8E-01		0.0E+00	
84	4.8E-05		8.3E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	9.3E-01		0.0E+00	ND
101	2.3E-04		2.1E-04		2.1E-01		0.0E+00	ND	0.0E+00	ND	3.7E+00		0.0E+00	ND
99	9.8E-05		7.4E-05		2.0E-01		0.0E+00		0.0E+00		1.2E+00		0.0E+00	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

NBSD Outfall #23 (O1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	1.2E-04		8.9E-05		2.9E-01		0.0E+00	ND	4.7E-01		1.5E+00		0.0E+00	ND
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	7.8E-05		7.1E-05		6.2E-02		0.0E+00	ND	0.0E+00	ND	7.9E-01		0.0E+00	ND
136	3.9E-05		3.6E-05	J	2.7E-02		0.0E+00	ND	0.0E+00	ND	5.0E-01		0.0E+00	ND
110	2.4E-04		1.2E-04		9.4E-01		0.0E+00	ND	0.0E+00	ND	2.9E+00		0.0E+00	ND
77	6.9E-05		6.8E-05		6.5E-03		0.0E+00	ND	0.0E+00	ND	5.1E-01		0.0E+00	ND
82	5.5E-05		4.6E-05		7.4E-02		0.0E+00	ND	0.0E+00	ND	1.1E-01		2.1E-01	
151	7.2E-05		5.2E-05		1.6E-01		0.0E+00	ND	0.0E+00	ND	6.3E-01		0.0E+00	ND
135	2.8E-05		3.0E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.7E-01	J	5.9E-02	
144	4.0E-05		4.3E-06	J	2.9E-01	J	0.0E+00	ND	0.0E+00	ND	1.2E-01	J	7.7E-01	
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	6.8E-05		1.4E-04		0.0E+00	ND	0.0E+00	ND	1.7E+00		0.0E+00	ND	1.4E-01	
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	2.1E-04		6.6E-05		1.2E+00		0.0E+00	ND	0.0E+00	ND	1.8E+00		7.3E-01	
118	1.6E-04		3.0E-05	J	1.1E+00		0.0E+00	ND	0.0E+00	ND	1.4E+00		1.4E+00	
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	5.6E-05		2.5E-05	J	2.6E-01	J	0.0E+00	ND	0.0E+00	ND	4.1E-01		3.2E-01	
153	2.9E-04		5.6E-05		2.0E+00		0.0E+00	ND	2.2E-01		2.0E+00		3.2E+00	
132	8.8E-05		2.4E-05	J	5.3E-01		0.0E+00	ND	0.0E+00	ND	6.5E-01		3.5E-01	
105	1.3E-04		4.8E-05		6.5E-01		0.0E+00	ND	0.0E+00	ND	8.3E-01		9.2E-01	
141	9.0E-05		4.5E-05		3.7E-01		0.0E+00	ND	0.0E+00	ND	6.5E-01		4.8E-01	
179	2.9E-05		0.0E+00	ND	2.4E-01	J	0.0E+00	ND	4.8E-02	J	2.8E-01	J	3.5E-01	
163	1.7E-04		1.4E-05	J	1.3E+00	J	0.0E+00	ND	1.8E-01	J	1.3E+00		2.3E+00	

NBSD Outfall #23 (O1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
138	1.6E-04		8.8E-06	J	1.3E+00	J	0.0E+00	ND	2.1E-01	J	1.3E+00		2.3E+00	
158	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	1.3E-04		1.1E-05	J	1.0E+00	J	0.0E+00	ND	8.2E-01		4.4E-01		2.4E+00	
183	4.5E-05		0.0E+00	ND	3.7E-01	J	0.0E+00	ND	0.0E+00	ND	1.5E-01	J	1.1E+00	
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	1.0E-04		1.4E-04		0.0E+00	ND	0.0E+00	ND	3.8E-01	J	6.0E-01		1.7E+00	
177	1.0E-04		1.2E-04		0.0E+00	ND	0.0E+00	ND	5.7E-02	J	1.8E-02	J	3.0E+00	
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
197	0.0E+00	ND	4.0E-06	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.0E-02	J	0.0E+00	ND
180	2.9E-04		3.6E-05	J	2.1E+00		0.0E+00	ND	0.0E+00	ND	1.9E+00		3.9E+00	
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	2.0E-04		0.0E+00	ND	1.6E+00	J	0.0E+00	ND	0.0E+00	ND	7.8E-01		4.7E+00	
190	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
198	6.9E-05		1.0E-05	J	4.9E-01	J	0.0E+00	ND	1.5E-01	J	4.7E-01		9.0E-01	
203	4.0E-05		1.3E-05	J	2.3E-01	J	0.0E+00	ND	1.1E-02	J	3.4E-01		3.4E-01	
196	3.9E-05		1.0E-05	J	2.4E-01	J	0.0E+00		0.0E+00	J	3.6E-01		3.5E-01	
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

NBSD Outfall #23 (O1W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
208	1.9E-06	J	0.0E+00	J	1.6E-02	J	0.0E+00	ND	0.0E+00	J	2.8E-02	J	7.2E-03	J
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	6.0E-05		0.0E+00	ND	5.0E-01		0.0E+00	ND	0.0E+00	ND	5.3E-01		9.2E-01	
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	8.8E-06	J	3.0E-06	J	4.8E-02	J	0.0E+00	ND	1.2E-02	J	2.6E-01	J	0.0E+00	ND
209	8.3E-06	J	1.1E-05	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	6.6E-02	J	0.0E+00	ND

Table B32. PCB in bulk and particulate fractions of location O2W for stormwater event-I (January 5th to 7th 2016).

NBSD Outfall #33 (O2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	6.0E-05	J	4.0E-05	J	1.8E-02	J	2.0E-01	J	5.8E-02		0.0E+00	ND	0.0E+00	ND
2	4.6E-05	J	4.6E-05	J	0.0E+00	J	1.4E-01	J	8.0E-02		0.0E+00	ND	0.0E+00	ND
3	1.2E-04		6.8E-05		4.8E-02		2.8E-01		8.1E-02		0.0E+00	ND	3.4E-01	
4	5.5E-05	J	6.0E-05		0.0E+00	ND	0.0E+00	ND	8.2E-02		0.0E+00	ND	0.0E+00	ND
10	4.4E-05	J	3.0E-05	J	1.2E-02	J	6.6E-02	J	4.6E-02		0.0E+00	ND	0.0E+00	ND
9	2.7E-05	J	1.2E-05	J	1.4E-02	J	1.9E-01	J	1.7E-02	J	0.0E+00	ND	0.0E+00	ND
7	3.5E-05	J	1.5E-05	J	1.9E-02	J	2.0E-01	J	1.7E-02	J	0.0E+00	ND	6.2E-01	J
6	3.4E-05	J	2.0E-05	J	1.3E-02	J	1.8E-01	J	9.5E-02		0.0E+00	ND	0.0E+00	ND
8	2.6E-04		1.4E-04		1.0E-01		1.0E+00		3.9E-01		0.0E+00	ND	0.0E+00	ND
5	1.9E-04		1.1E-04		7.6E-02		7.8E-01		3.0E-01		0.0E+00	ND	0.0E+00	ND
19	4.4E-05	J	4.3E-05	J	8.1E-04	J	1.8E-01	J	1.6E-01		0.0E+00	ND	0.0E+00	ND
18	2.3E-04		1.6E-04		6.2E-02		0.0E+00	ND	4.4E-01		0.0E+00	ND	0.0E+00	ND
17	9.4E-05	J	6.9E-05		2.2E-02		4.6E-02		2.5E-01		0.0E+00	ND	0.0E+00	ND
15	4.6E-04		2.0E-04		2.3E-01		2.0E+00		6.5E-01		0.0E+00	ND	0.0E+00	ND
27	3.7E-05	J	1.7E-05	J	1.8E-02	J	1.7E-01	J	7.9E-02		0.0E+00	ND	0.0E+00	J
24	4.7E-05	J	2.2E-05	J	2.2E-02	J	1.3E-01	J	8.0E-02		0.0E+00	ND	0.0E+00	J
32	1.6E-04		7.8E-05		7.7E-02		7.1E-01		2.6E-01		0.0E+00	ND	0.0E+00	
16	1.8E-04		8.4E-05		8.4E-02		8.2E-01		2.7E-01		0.0E+00	ND	0.0E+00	
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	2.9E-04		1.3E-04		1.4E-01		4.2E-01		4.9E-01		0.0E+00	ND	0.0E+00	ND
25	1.4E-04		5.5E-05		7.4E-02		7.3E-01		1.5E-01		0.0E+00	ND	0.0E+00	ND
31	5.0E-04		2.1E-04		2.6E-01		1.2E+00		7.9E-01		0.0E+00	ND	0.0E+00	ND
28	4.2E-04		1.6E-04		2.4E-01		1.4E+00		8.5E-01		0.0E+00	ND	0.0E+00	ND
20	2.4E-04		1.0E-04		1.2E-01		9.9E-01		4.6E-01		0.0E+00	ND	0.0E+00	ND
22	1.6E-04		6.0E-05		9.1E-02		6.6E-01		1.8E-01		0.0E+00	ND	0.0E+00	ND

NBSD Outfall #33 (O2W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
45	1.3E-04		6.6E-05		6.2E-02		4.0E-01		1.9E-01		0.0E+00	ND	0.0E+00	ND
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	3.7E-03		1.3E-03		2.1E+00		2.0E+01		7.9E+00		0.0E+00	ND	0.0E+00	ND
47	7.5E-04		3.2E-04		3.8E-01		3.9E+00		2.0E+00		0.0E+00	ND	0.0E+00	ND
48	9.2E-04		9.7E-05		7.5E-01		4.5E+00		1.9E+00		0.0E+00	ND	0.0E+00	ND
44	1.8E-03		6.4E-04		1.1E+00		9.9E+00		3.7E+00		0.0E+00	ND	0.0E+00	ND
42	5.6E-04		1.7E-04		3.5E-01		1.9E+00		8.4E-01		0.0E+00	ND	0.0E+00	ND
37	3.4E-04		1.4E-04		1.8E-01		0.0E+00	ND	5.7E-01		0.0E+00	ND	0.0E+00	ND
71	5.5E-04		2.0E-04		3.1E-01		1.7E+00		9.8E-01		0.0E+00	ND	0.0E+00	ND
41	1.5E-03		4.4E-04		9.9E-01		1.2E+01		3.2E+00		0.0E+00	ND	0.0E+00	ND
103	1.9E-04		8.5E-05		9.7E-02		6.2E-01		4.1E-01		0.0E+00	ND	0.0E+00	ND
40	2.5E-04		1.1E-04		1.3E-01		8.8E-01		3.9E-01		0.0E+00	ND	0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
70	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
66	2.4E-03		6.5E-04		1.6E+00		8.1E+00		5.2E+00		0.0E+00	ND	0.0E+00	ND
95	2.7E-03		8.6E-04		1.7E+00		1.4E+01		5.8E+00		0.0E+00	ND	0.0E+00	ND
93	2.7E-03		8.6E-04		1.7E+00		1.4E+01		5.8E+00		0.0E+00	ND	0.0E+00	ND
56	5.8E-04		1.8E-04		3.6E-01		2.2E+00		1.1E+00		0.0E+00	ND	0.0E+00	ND
60	5.6E-04		1.7E-04		3.6E-01		2.2E+00		1.1E+00		0.0E+00	ND	0.0E+00	ND
92	1.6E-03		4.6E-04		1.0E+00		5.3E+00		3.2E+00		0.0E+00	ND	0.0E+00	ND
84	1.7E-03		5.3E-04		1.1E+00		9.1E+00		3.0E+00		0.0E+00	ND	0.0E+00	ND
101	9.3E-03		2.6E-03		6.1E+00		3.8E+01		1.9E+01	E	0.0E+00	ND	0.0E+00	ND
99	5.3E-03		1.4E-03		3.5E+00		2.2E+01		1.1E+01	E	0.0E+00		0.0E+00	
119	5.1E-04		1.1E-04		3.6E-01		1.1E+00		7.4E-01		0.0E+00	ND	0.0E+00	ND

NBSD Outfall #33 (O2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
83	4.0E-04	ND	6.6E-04	ND	0.0E+00	ND	0.0E+00	ND	1.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	4.0E-03		1.1E-03		2.5E+00		1.8E+01		8.5E+00		0.0E+00	ND	0.0E+00	ND
81	4.4E-04		1.6E-04		2.5E-01		2.4E+00		4.1E-01		0.0E+00	ND	0.0E+00	ND
115	2.1E-03		6.1E-04		1.3E+00		9.6E+00		4.3E+00		0.0E+00	ND	0.0E+00	ND
136	8.2E-04		2.8E-04		4.9E-01		4.1E+00		1.8E+00		0.0E+00	ND	0.0E+00	ND
110	9.7E-03		2.7E-03		6.3E+00		3.8E+01		2.1E+01	E	0.0E+00	ND	0.0E+00	ND
77	6.1E-04		2.1E-04		3.6E-01		2.7E+00		1.2E+00		0.0E+00	ND	0.0E+00	ND
82	8.9E-04		3.0E-04		5.3E-01		2.9E+00		1.7E+00		0.0E+00	ND	0.0E+00	ND
151	1.4E-03		4.5E-04		8.9E-01		4.6E+00		3.2E+00		0.0E+00	ND	0.0E+00	ND
135	5.4E-04		1.7E-04		3.3E-01		2.3E+00		1.2E+00		0.0E+00	ND	0.0E+00	ND
144	6.1E-04		2.2E-04		3.5E-01		5.7E-01		1.2E+00		0.0E+00	ND	0.0E+00	ND
147	3.5E-04		1.2E-04		2.1E-01		2.1E+00		7.9E-01		0.0E+00	ND	0.0E+00	ND
107	7.3E-04		2.3E-04		4.5E-01		2.7E+00		1.6E+00		0.0E+00	ND	0.0E+00	ND
123	3.8E-04		1.5E-04		2.1E-01		1.4E+00		7.7E-01		0.0E+00	ND	0.0E+00	ND
149	5.6E-03		1.5E-03		3.7E+00		2.3E+01		1.3E+01	E	0.0E+00	ND	0.0E+00	ND
118	6.0E-03		1.8E-03		3.8E+00		1.9E+01		1.3E+01	E	0.0E+00	ND	0.0E+00	ND
134	4.1E-04		9.0E-05		2.9E-01		1.9E+00		6.2E-01		0.0E+00	ND	0.0E+00	ND
114	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	1.1E-03		3.3E-04		6.9E-01		4.8E+00		2.4E+00		0.0E+00	ND	0.0E+00	ND
153	7.2E-03		2.0E-03		4.7E+00		2.8E+01		1.7E+01	E	0.0E+00	ND	0.0E+00	ND
132	1.7E-03		5.4E-04		1.0E+00		6.7E+00		3.9E+00		0.0E+00	ND	0.0E+00	ND
105	3.3E-03		9.5E-04		2.1E+00		1.4E+01		6.9E+00		0.0E+00	ND	0.0E+00	ND
141	1.2E-03		3.6E-04		7.9E-01		5.3E+00		2.5E+00		0.0E+00	ND	0.0E+00	ND
179	6.1E-04		1.8E-04		3.8E-01		2.1E+00		1.4E+00		0.0E+00	ND	0.0E+00	ND
163	3.7E-03		1.0E-03		2.4E+00		1.6E+01		8.5E+00		0.0E+00	ND	0.0E+00	ND

NBSD Outfall #33 (O2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
138	3.7E-03		1.0E-03		2.4E+00		1.6E+01		8.5E+00		0.0E+00	ND	0.0E+00	ND
158	8.9E-04		2.6E-04		5.6E-01		3.5E+00		1.8E+00		0.0E+00	ND	0.0E+00	ND
178	8.7E-04		1.3E-04		6.7E-01		5.5E-01		7.1E-01		0.0E+00	ND	2.7E+01	
126	3.7E-04		1.7E-04		1.8E-01		1.1E+00		2.0E-01		0.0E+00	ND	3.7E+00	
187	2.5E-03		7.3E-04		1.6E+00		6.0E+00		5.8E+00		0.0E+00	ND	0.0E+00	ND
183	7.7E-04		2.3E-04		4.9E-01		3.5E+00		2.2E+00		0.0E+00	ND	0.0E+00	ND
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	1.1E-03		3.9E-04		6.7E-01		4.0E+00		2.8E+00		0.0E+00	ND	0.0E+00	ND
177	8.0E-04		1.6E-04		5.7E-01		4.1E+00		1.6E+00		0.0E+00	ND	0.0E+00	ND
171	3.2E-04		8.2E-05		2.1E-01		1.2E+00		9.2E-01		0.0E+00	ND	0.0E+00	ND
156	1.3E-03		3.9E-04		8.2E-01		2.9E+00		2.9E+00		0.0E+00	ND	0.0E+00	ND
157	3.1E-04		9.8E-05		1.9E-01		1.7E+00		6.0E-01		0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	5.0E-04		8.0E-05		3.7E-01		5.1E-01		4.5E-01		0.0E+00	ND	8.7E+00	
197	3.3E-05	J	9.8E-06	J	2.1E-02	J	1.1E-01	J	1.1E-01		0.0E+00	ND	0.0E+00	ND
180	3.9E-03		9.7E-04		2.6E+00		1.4E+01		9.3E+00		0.0E+00	ND	0.0E+00	ND
193	2.7E-04		9.6E-05		1.6E-01		5.9E+00		2.1E-01		0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	1.6E-03		4.2E-04		1.1E+00		6.1E+00		4.1E+00		0.0E+00	ND	0.0E+00	ND
190	3.5E-04		8.8E-05		2.3E-01		9.3E-01		6.7E-01		0.0E+00	ND	0.0E+00	ND
198	1.7E-03		4.3E-04		1.1E+00		8.3E+00		4.2E+00		0.0E+00	ND	0.0E+00	ND
203	9.2E-04		2.3E-04		6.2E-01		3.5E+00		2.2E+00		0.0E+00	ND	0.0E+00	ND
196	9.2E-04		2.3E-04		6.2E-01		3.4E+00		2.2E+00		0.0E+00	ND	0.0E+00	ND
189	1.2E-05	J	5.1E-06	J	5.9E-03	J	2.6E-01	J	1.4E-01		0.0E+00	ND	0.0E+00	ND

NBSD Outfall #33 (O2W)												
PCB	**Bulk water**	**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**	**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L	**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**	**µg/Kg**		**µg/Kg**	
208	2.8E-04	7.0E-05		1.8E-01		2.7E-01		7.3E-01	0.0E+00	ND	0.0E+00	ND
195	2.2E-04	7.5E-05		1.3E-01		1.9E+00		7.9E-01	0.0E+00	ND	0.0E+00	ND
207	1.1E-04	2.1E-05	J	8.3E-02	J	2.9E-02	J	3.5E-01	0.0E+00	ND	0.0E+00	ND
194	1.4E-03	2.9E-04		9.6E-01		6.5E+00		3.6E+00	0.0E+00	ND	0.0E+00	ND
205	1.1E-03	2.6E-04		7.9E-01		0.0E+00	ND	3.1E+00	0.0E+00	ND	0.0E+00	ND
206	1.2E-03	2.5E-04		8.6E-01		5.2E+00		3.2E+00	0.0E+00	ND	0.0E+00	ND
209	5.7E-04	7.0E-05		4.5E-01		1.5E+00		1.4E+00	0.0E+00	ND	0.0E+00	ND

Table B33. PCB in bulk and particulate fractions of location A1W for stormwater event-I (January 5th to 7th 2016).

Ambient Receiving Water Sample (A1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	7.8E-06	J	5.5E-06	J	9.2E-03	J	0.0E+00	ND	3.4E-02	J	3.9E-02	J	0.0E+00	ND
2	1.0E-05	J	5.9E-06	J	1.7E-02	J	0.0E+00	ND	6.6E-02	J	8.9E-03	J	0.0E+00	ND
3	2.2E-05	J	1.4E-05		3.3E-02		0.0E+00	ND	1.0E-01		6.6E-02		0.0E+00	ND
4	1.2E-05	J	2.3E-05		0.0E+00	ND	0.0E+00	ND	5.7E-02	J	2.3E-01		0.0E+00	ND
10	9.3E-06	J	9.1E-06	J	7.3E-04	J	0.0E+00	ND	7.3E-02	J	8.6E-02	J	0.0E+00	ND
9	4.5E-06	J	6.7E-06	J	0.0E+00	ND	0.0E+00	ND	1.9E-02	J	4.5E-02	J	0.0E+00	ND
7	5.4E-06	J	8.9E-06	J	0.0E+00	ND	0.0E+00	ND	2.2E-02	J	6.5E-02	J	0.0E+00	ND
6	7.9E-06	J	3.8E-06	J	1.7E-02	J	0.0E+00	ND	3.2E-02	J	1.6E-01	J	0.0E+00	ND
8	6.4E-05		3.8E-05		1.1E-01		0.0E+00	ND	3.7E-01		6.5E-01		0.0E+00	ND
5	4.8E-05		2.9E-05		8.2E-02		0.0E+00	ND	2.9E-01		5.0E-01		0.0E+00	ND
19	7.1E-06	J	7.1E-06	J	7.6E-05	J	0.0E+00	ND	7.6E-02	J	2.4E-01		0.0E+00	ND
18	1.2E-04		5.5E-05		2.7E-01		0.0E+00	ND	1.3E+00		2.4E+00		0.0E+00	ND
17	4.5E-05		1.7E-05		1.2E-01		0.0E+00	ND	5.8E-01		1.1E+00		0.0E+00	ND
15	1.1E-04		3.6E-05		3.0E-01		0.0E+00	ND	1.5E+00		1.7E+00		0.0E+00	ND
27	9.6E-06	J	3.7E-06	J	2.5E-02	J	0.0E+00	ND	1.3E-01	J	1.2E-01		0.0E+00	ND
24	1.2E-05	J	5.7E-06	J	2.7E-02	J	0.0E+00	ND	1.3E-01	J	1.3E-01		0.0E+00	ND
32	5.3E-05		2.2E-05		1.3E-01		0.0E+00	ND	6.0E-01		8.9E-01		0.0E+00	ND
16	5.5E-05		2.2E-05		1.4E-01		0.0E+00	ND	6.1E-01		8.7E-01		0.0E+00	ND
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	6.5E-05		1.9E-05		1.9E-01		0.0E+00	ND	7.6E-01		5.8E-01		0.0E+00	ND
25	3.0E-05		1.0E-05	J	8.2E-02	J	0.0E+00	ND	3.4E-01		2.1E-01		0.0E+00	ND
31	2.5E-04		6.1E-05		8.0E-01		0.0E+00	ND	2.9E+00		4.3E+00		0.0E+00	ND
28	2.3E-04		4.6E-05		7.7E-01		0.0E+00	ND	3.1E+00		3.7E+00		0.0E+00	ND
20	1.9E-04		3.7E-05		6.5E-01		0.0E+00	ND	2.0E+00		3.1E+00		0.0E+00	ND
22	3.0E-05		2.1E-05		3.4E-02		0.0E+00	ND	1.3E+00		2.2E+00		0.0E+00	ND

Ambient Receiving Water Sample (A1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	5.4E-05		1.6E-05		1.6E-01		0.0E+00	ND	6.6E-01		8.5E-01		0.0E+00	ND
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	4.3E-04		1.3E-04		1.2E+00		0.0E+00	ND	5.2E+00		7.2E+00		0.0E+00	ND
47	1.1E-04		2.3E-05		3.5E-01		0.0E+00	ND	1.3E+00		1.7E+00		0.0E+00	ND
48	6.5E-05		1.4E-05		2.1E-01		0.0E+00	ND	7.7E-01		1.3E+00		0.0E+00	ND
44	3.5E-04		6.0E-05		1.2E+00		0.0E+00	ND	4.6E+00		5.6E+00		0.0E+00	ND
42	1.0E-04		1.5E-05		3.7E-01		0.0E+00		1.5E+00		2.2E+00		0.0E+00	ND
37	2.4E-04		3.2E-05		8.6E-01		0.0E+00	ND	2.8E+00		3.8E+00		0.0E+00	ND
71	7.9E-05		1.2E-05	J	2.7E-01	J	0.0E+00	ND	1.3E+00		1.7E+00		0.0E+00	ND
41	3.5E-04		3.5E-05		1.3E+00		0.0E+00		4.8E+00		6.0E+00		0.0E+00	ND
103	6.7E-05		7.9E-05		0.0E+00	ND	0.0E+00	ND	2.3E-01		1.2E+01		0.0E+00	ND
40	6.8E-05		2.5E-05		1.8E-01		0.0E+00	ND	9.1E-01		9.5E-01		0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
70	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
66	2.9E-04		3.5E-05		1.0E+00		0.0E+00	ND	3.9E+00		4.4E+00		0.0E+00	ND
95	2.7E-04		5.1E-05		8.9E-01		0.0E+00	ND	3.2E+00		4.1E+00		0.0E+00	ND
93	2.7E-04		5.1E-05		8.9E-01		0.0E+00	ND	3.2E+00		4.1E+00		0.0E+00	ND
56	1.4E-04		1.9E-05		4.8E-01		0.0E+00	ND	1.8E+00		2.2E+00		0.0E+00	ND
60	1.3E-04		1.7E-05		4.8E-01		0.0E+00	ND	1.8E+00		2.2E+00		0.0E+00	ND
92	1.4E-04		2.8E-05		4.8E-01		0.0E+00	ND	1.7E+00		2.0E+00		0.0E+00	ND
84	1.8E-04		2.3E-05		6.3E-01		0.0E+00	ND	1.8E+00		2.7E+00		0.0E+00	ND
101	7.4E-04		1.1E-04		2.6E+00		0.0E+00	ND	9.0E+00		1.1E+01		0.0E+00	ND
99	3.2E-04		3.9E-05		1.1E+00		0.0E+00		3.7E+00		4.7E+00		0.0E+00	
119	2.6E-05		2.8E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	3.0E-01		0.0E+00	ND

	Ambient Receiving Water Sample (A1W)													
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
83	9.3E-05	ND	8.3E-05	ND	4.2E-02		0.0E+00	ND	1.1E+00		0.0E+00	ND	0.0E+00	ND
87	5.1E-04		4.1E-05		1.9E+00		0.0E+00	ND	6.6E+00		7.8E+00		0.0E+00	ND
81	8.6E-05		3.6E-05		2.1E-01		0.0E+00	ND	5.8E-01		4.7E-01		0.0E+00	ND
115	2.7E-04		3.1E-05		1.0E+00		0.0E+00	ND	3.4E+00		4.0E+00		0.0E+00	ND
136	1.1E-04		1.7E-05		4.0E-01		0.0E+00	ND	1.4E+00		1.8E+00		0.0E+00	ND
110	9.5E-04		8.3E-05		3.6E+00		0.0E+00	ND	1.2E+01		1.5E+01		0.0E+00	ND
77	1.6E-04		3.0E-05		5.5E-01		0.0E+00	ND	1.8E+00		1.9E+00		0.0E+00	ND
82	1.4E-04		1.8E-05		5.0E-01		0.0E+00	ND	1.8E+00		2.2E+00		0.0E+00	ND
151	2.2E-04		2.6E-05		8.1E-01		0.0E+00	ND	2.5E+00		3.3E+00		0.0E+00	ND
135	8.9E-05		1.0E-05	J	3.3E-01	J	0.0E+00	ND	1.0E+00		1.1E+00		0.0E+00	ND
144	6.2E-05		1.1E-05	J	2.1E-01	J	0.0E+00	ND	8.6E-01		1.5E+00		0.0E+00	ND
147	1.5E-04		5.0E-05		4.1E-01		0.0E+00	ND	0.0E+00	ND	3.6E-01		3.2E+00	
107	7.7E-05		1.2E-04		0.0E+00	ND	0.0E+00	ND	9.7E-01		9.3E-01		0.0E+00	ND
123	5.5E-05		7.1E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	5.4E-01		0.0E+00	ND
149	7.5E-04		4.8E-05		2.9E+00		0.0E+00	ND	9.6E+00		1.1E+01		0.0E+00	ND
118	5.6E-04		3.4E-05		2.2E+00		0.0E+00	ND	7.5E+00		9.1E+00		0.0E+00	ND
134	7.9E-05		1.7E-06	J	3.2E-01	J	0.0E+00	ND	1.1E+00		4.1E-01		0.0E+00	ND
114	2.4E-04		0.0E+00	ND	9.9E-01	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	9.9E+00	
131	2.3E-05		0.0E+00	ND	9.7E-02	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	9.7E-01	
146	1.6E-04		1.3E-05		6.0E-01		0.0E+00	ND	2.3E+00		2.1E+00		0.0E+00	ND
153	1.0E-03		4.9E-05		3.9E+00		0.0E+00	ND	1.6E+01		1.3E+01		0.0E+00	ND
132	3.4E-04		2.2E-05		1.3E+00		0.0E+00	ND	5.7E+00		4.4E+00		0.0E+00	ND
105	4.1E-04		3.2E-05		1.6E+00		0.0E+00		6.4E+00		5.6E+00		0.0E+00	ND
141	2.8E-04		2.1E-05		1.1E+00		0.0E+00	ND	4.6E+00		3.6E+00		0.0E+00	ND
179	8.5E-05		4.3E-06	J	3.3E-01	J	0.0E+00	ND	1.5E+00		1.2E+00		0.0E+00	ND
163	6.2E-04		2.0E-05		2.5E+00		0.0E+00	ND	1.1E+01		8.9E+00		0.0E+00	ND

PCB	Ambient Receiving Water Sample (A1W) Bulk water µg/L		Filtered Water (< 0.7 µm) µg/L		Total solids (>0.7µm) µg/Kg		Solids fraction (0.7-2.7 µm) µg/Kg		Solids fraction (2.7-20 µm) µg/Kg		Solids Fraction (20-63 µm) µg/Kg		Solids Fraction (> 63 µm) µg/Kg	
138	6.2E-04		1.8E-05		2.5E+00		0.0E+00		1.1E+01		8.9E+00		0.0E+00	ND
158	1.5E-04		7.8E-06	J	5.9E-01	J	0.0E+00		2.6E+00		2.0E+00		0.0E+00	ND
178	5.8E-05		1.8E-05		1.6E-01		0.0E+00	ND	8.8E-01		9.3E-01		0.0E+00	ND
126	9.6E-05		4.6E-05		2.1E-01		0.0E+00	ND	9.9E-01		6.2E-01		0.0E+00	ND
187	2.8E-04		1.2E-05	J	1.1E+00	J	0.0E+00	ND	5.0E+00		4.4E+00		0.0E+00	ND
183	1.4E-04		0.0E+00	ND	6.0E-01	J	0.0E+00	ND	2.8E+00		2.2E+00		0.0E+00	ND
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	3.0E-04		1.1E-05	J	1.2E+00	J	0.0E+00	ND	5.5E+00		3.7E+00		0.0E+00	ND
177	1.6E-04		1.2E-05	J	6.3E-01	J	0.0E+00	ND	3.3E+00		2.6E+00		0.0E+00	ND
171	8.8E-05		0.0E+00	ND	3.6E-01	J	0.0E+00	ND	1.9E+00		1.3E+00		0.0E+00	ND
156	2.0E-04		4.3E-05		6.7E-01		0.0E+00	ND	3.4E+00		2.5E+00		0.0E+00	ND
157	5.5E-05		3.4E-05		8.9E-02		0.0E+00	ND	2.3E+00		0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	7.5E-05		1.0E-05	J	2.7E-01	J	0.0E+00		1.1E+00		6.4E-01		0.0E+00	ND
197	2.9E-06	J	1.3E-06	J	6.8E-03	J	0.0E+00	ND	3.6E-02	J	1.6E-03	J	0.0E+00	ND
180	8.5E-04		2.6E-05		3.4E+00		0.0E+00	ND	1.4E+01		1.2E+01		0.0E+00	ND
193	5.8E-05		3.3E-05		1.0E-01		0.0E+00	ND	1.9E-02		5.4E-01		0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	4.8E-04		9.9E-06	J	1.9E+00	J	0.0E+00	ND	8.9E+00		6.9E+00		0.0E+00	ND
190	8.4E-05		4.0E-06	J	3.3E-01	J	0.0E+00	ND	1.5E+00		1.3E+00		0.0E+00	ND
198	1.8E-04		7.3E-06	J	7.2E-01	J	0.0E+00	ND	3.2E+00		2.4E+00		0.0E+00	ND
203	1.1E-04		6.0E-06	J	4.4E-01	J	0.0E+00	ND	1.8E+00		1.3E+00		0.0E+00	ND
196	1.1E-04		6.6E-06	J	4.3E-01	J	0.0E+00	ND	1.8E+00		1.3E+00		0.0E+00	ND
189	7.9E-06	J	1.4E-06	J	2.7E-02	J	0.0E+00	ND	1.4E-01	J	1.9E-01		0.0E+00	ND

Ambient Receiving Water Sample (A1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
208	1.9E-05	J	1.3E-08	J	8.0E-02	J	0.0E+00	ND	2.5E-01		3.4E-01		0.0E+00	ND
195	6.6E-05		6.2E-06	J	2.5E-01	J	0.0E+00	ND	7.6E-01		1.4E+00		0.0E+00	ND
207	1.2E-05	J	2.0E-06	J	4.3E-02	J	0.0E+00	ND	1.2E-01	J	1.8E-01		0.0E+00	ND
194	2.1E-04		0.0E+00	ND	8.7E-01	J	0.0E+00	ND	3.8E+00		2.4E+00		0.0E+00	ND
205	1.8E-05	J	8.8E-06	J	4.0E-02	J	0.0E+00	ND	3.3E+00		0.0E+00	ND	0.0E+00	ND
206	8.7E-05		1.9E-06	J	3.5E-01	J	0.0E+00	ND	1.7E+00		1.0E+00		0.0E+00	ND
209	2.4E-05		4.1E-06	J	8.0E-02	J	0.0E+00	ND	6.0E-01		1.1E+00		0.0E+00	ND

Table B34. PCB in bulk and particulate fractions of location A2W for stormwater event-I (January 5^{th} to 7^{th} 2016).

Ambient Receiving Water Sample (A2W)

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	6.3E-06	J	4.3E-06	J	8.3E-03	J	8.4E-02	J	4.1E-03	J	0.0E+00	ND	0.0E+00	ND
2	8.0E-06	J	6.5E-06	J	5.9E-03	J	7.9E-02	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
3	1.9E-05		1.3E-05		2.5E-02		1.4E-01	J	1.7E-02		0.0E+00	ND	0.0E+00	ND
4	9.3E-06	J	1.3E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	2.0E+00		0.0E+00	ND
10	8.6E-06	J	5.6E-06	J	1.2E-02	J	8.7E-02	J	0.0E+00	ND	4.8E-01	J	0.0E+00	ND
9	8.0E-06	J	2.6E-06	J	2.2E-02	J	5.5E-02	J	4.1E-03	J	1.2E-01	J	0.0E+00	ND
7	8.8E-06	J	2.4E-06	J	2.6E-02	J	6.4E-02	J	1.1E-02	J	0.0E+00	ND	0.0E+00	ND
6	4.1E-06	J	4.5E-06	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	4.3E-01	J	0.0E+00	ND
8	2.9E-05		2.2E-05		2.8E-02		2.1E-01		1.3E-02		1.7E+00		0.0E+00	ND
5	2.1E-05		1.6E-05		2.0E-02		1.6E-01		9.4E-03		1.4E+00		0.0E+00	ND
19	3.8E-06	J	5.3E-06	J	0.0E+00	ND	0.0E+00	ND	9.9E-03	J	1.1E-03	J	0.0E+00	ND
18	2.6E-05		1.8E-05		3.5E-02		3.3E-01		5.6E-02		1.7E+00		0.0E+00	ND
17	4.1E-06	J	4.6E-06	J	0.0E+00	ND	1.1E-01	J	0.0E+00	ND	1.1E+00	J	0.0E+00	ND
15	4.5E-05		3.1E-05		5.7E-02		2.3E-01		6.7E-02		2.9E-01		0.0E+00	ND
27	6.0E-06	J	3.3E-06	J	1.1E-02	J	1.7E-02	J	1.0E-02	J	0.0E+00	ND	0.0E+00	ND
24	7.0E-06	J	4.0E-06	J	1.2E-02	J	5.5E-02	J	7.5E-03	J	2.1E-02	J	0.0E+00	ND
32	1.6E-05	J	1.0E-05	J	2.3E-02	J	6.3E-02	J	3.0E-02	J	1.2E+00		0.0E+00	ND
16	1.7E-05	J	9.0E-06	J	3.2E-02	J	1.3E-01	J	3.1E-02	J	8.5E-01		0.0E+00	ND
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	2.4E-05		1.9E-05		2.0E-02		1.0E-01		3.2E-02		3.7E-01		0.0E+00	ND
25	1.5E-05	J	1.1E-05	J	1.5E-02	J	5.9E-02	J	1.1E-02	J	1.4E-01	J	0.0E+00	ND
31	5.3E-05		2.6E-05		1.1E-01		4.6E-01		7.0E-02		5.2E+00		0.0E+00	ND
28	3.9E-05		1.7E-05		9.0E-02		3.1E-01		1.0E-01		3.0E+00		0.0E+00	ND
20	2.3E-05		1.2E-05	J	4.3E-02	J	2.2E-01		3.5E-02		1.8E+00		0.0E+00	ND
22	2.2E-05		7.4E-06	J	5.8E-02	J	2.4E-01	J	5.1E-02		8.9E-01		0.0E+00	ND

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	1.9E-05		8.1E-06	J	4.4E-02	J	1.4E-01	J	4.0E-02		2.2E+00		0.0E+00	ND
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	1.6E-04		5.0E-05		4.5E-01		2.2E+00		3.9E-01		1.8E+01		0.0E+00	ND
47	3.8E-05		1.6E-05		9.1E-02		4.5E-01		1.4E-02		2.6E+00		0.0E+00	ND
48	1.8E-05	J	6.8E-06	J	4.5E-02	J	1.4E-01	J	1.1E-02	J	1.9E+00		0.0E+00	ND
44	1.1E-04		2.6E-05		3.6E-01		1.4E+00		2.9E-01		1.1E+01		0.0E+00	ND
42	2.5E-05		7.7E-06	J	7.0E-02	J	2.5E-01	J	8.2E-02		2.0E+00		0.0E+00	ND
37	7.4E-05		3.1E-05		1.7E-01		4.7E-01		5.0E-02		2.6E+00		0.0E+00	ND
71	2.9E-05		1.9E-06	J	1.1E-01	J	2.9E-01	J	7.4E-02		1.5E+00		0.0E+00	ND
41	1.0E-04		2.4E-05		3.2E-01		5.8E-01		2.9E-01		9.0E+00		0.0E+00	ND
103	1.7E-04		5.6E-05		4.5E-01		2.4E+00		2.3E-01		0.0E+00	ND	0.0E+00	ND
40	2.8E-05		1.2E-05	J	6.3E-02	J	1.9E-01		5.8E-02		1.7E+00		0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
70	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
66	8.9E-05		2.7E-05		2.5E-01		7.5E-01		1.6E-01		8.1E+00		0.0E+00	ND
95	1.0E-04		3.9E-05		2.6E-01		1.7E+00		1.9E-01		9.8E+00		0.0E+00	ND
93	1.0E-04		4.6E-05		2.3E-01		1.5E+00		1.7E-01		1.0E+01		0.0E+00	ND
56	4.9E-05		1.5E-05		1.4E-01		3.6E-01		1.2E-01		2.5E+00		0.0E+00	ND
60	4.6E-05		1.3E-05		1.3E-01		3.4E-01		1.2E-01		2.6E+00		0.0E+00	ND
92	5.9E-05		2.7E-05		1.3E-01		3.9E-01		1.8E-01		2.4E+00		0.0E+00	ND
84	7.0E-05		2.6E-05		1.8E-01		8.2E-01		1.9E-01		4.7E+00		0.0E+00	ND
101	2.8E-04		1.2E-04		6.3E-01		2.1E+00		6.9E-01		2.3E+01		0.0E+00	ND
99	1.2E-04		4.3E-05		3.0E-01		6.3E-01		4.1E-01		7.3E+00		0.0E+00	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

Ambient Receiving Water Sample (A2W)

Ambient Receiving Water Sample (A2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	1.9E-04		4.8E-05		5.9E-01		1.2E+00		6.1E-01		1.6E+01		0.0E+00	ND
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	1.1E-04		3.3E-05		3.2E-01		7.4E-01		3.2E-01		8.1E+00		0.0E+00	ND
136	5.3E-05		1.4E-05		1.6E-01		2.9E-01		8.1E-02		6.5E+00		0.0E+00	ND
110	3.7E-04		7.9E-05		1.2E+00		2.5E+00		1.4E+00		3.3E+01		0.0E+00	ND
77	5.9E-05		2.6E-05		1.3E-01		2.5E-01		2.1E-01		3.9E-01		0.0E+00	ND
82	7.5E-05		2.6E-05		2.0E-01		2.5E-01		1.1E-01		4.1E+00		0.0E+00	ND
151	9.2E-05		2.6E-05		2.7E-01		6.4E-01		3.1E-01		7.7E+00		0.0E+00	ND
135	3.8E-05		1.0E-05	J	1.2E-01	J	1.9E-01	J	1.3E-01		2.7E+00		0.0E+00	ND
144	3.1E-05		4.8E-06	J	1.1E-01	J	1.7E-01	J	1.9E-01		4.0E+00		0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	2.8E-05		1.2E-04		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.4E+00		0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	3.1E-04		5.4E-05		1.0E+00		2.0E+00		1.2E+00		2.8E+01		0.0E+00	ND
118	1.7E-04		3.4E-05		5.6E-01		1.2E+00		4.2E-01		1.9E+01		0.0E+00	ND
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	6.8E-05		9.0E-06	J	2.4E-01	J	5.1E-01		2.5E-01		4.6E+00		0.0E+00	ND
153	3.9E-04		3.9E-05		1.4E+00		2.5E+00		1.5E+00		3.2E+01		0.0E+00	ND
132	1.4E-04		1.9E-05		5.0E-01		8.6E-01		5.7E-01		1.2E+01		0.0E+00	ND
105	1.5E-04		3.0E-05		4.7E-01		8.6E-01		5.6E-01		9.3E+00		0.0E+00	ND
141	1.2E-04		1.8E-05		4.0E-01		8.4E-01		4.7E-01		8.4E+00		0.0E+00	ND
179	3.6E-05		1.4E-06	J	1.4E-01	J	3.1E-01	J	1.6E-01		4.6E+00		0.0E+00	ND
163	2.5E-04		6.9E-06	J	9.9E-01	J	1.4E+00		1.1E+00		2.2E+01		0.0E+00	ND

	Ambient Receiving Water Sample (A2W)													
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
138	2.5E-04		1.0E-05	J	9.7E-01	J	1.3E+00		1.2E+00		2.1E+01		0.0E+00	ND
158	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	1.7E-04		4.6E-06	J	6.5E-01	J	1.4E+00		5.1E-01		1.6E+01		0.0E+00	ND
183	5.7E-05		0.0E+00	J	2.3E-01	J	2.7E-01	J	3.5E-01		7.3E+00		0.0E+00	ND
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	1.4E-04		4.9E-06	J	5.4E-01	J	1.1E+00		6.1E-01		1.3E+01		0.0E+00	ND
177	8.5E-05		1.7E-06	J	3.4E-01	J	4.1E-01	J	3.7E-01		6.1E+00		0.0E+00	ND
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	
172	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
197	2.8E-06	J	1.1E-06	J	7.2E-03	J	1.4E-02	J	4.1E-03	J	1.9E-01	J	0.0E+00	ND
180	3.9E-04		1.9E-05		1.5E+00		2.2E+00		1.9E+00		3.4E+01		0.0E+00	ND
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	2.7E-04		0.0E+00	ND	1.1E+00	J	9.0E-01		5.9E-01		3.4E+01		0.0E+00	ND
190	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
198	1.4E-04		5.4E-06	J	5.5E-01	J	1.0E+00		6.8E-01		1.0E+01		0.0E+00	ND
203	7.6E-05		4.6E-06	J	2.9E-01	J	6.0E-01		3.5E-01		5.9E+00		0.0E+00	ND
196	7.5E-05		3.9E-06	J	2.9E-01	J	5.8E-01		3.5E-01		5.9E+00		0.0E+00	ND
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

Ambient Receiving Water Sample (A2W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
208	1.6E-05	J	3.2E-07	J	6.3E-02	J	1.6E-01	J	8.7E-02		1.5E+00		0.0E+00	ND
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	1.8E-04		1.0E-05	J	6.8E-01	J	1.0E+00		5.7E-01		0.0E+00	ND	0.0E+00	ND
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	1.0E-04		1.4E-06	J	4.2E-01	J	8.7E-01		4.9E-01		7.7E+00		0.0E+00	ND
209	3.1E-05		3.8E-06	J	1.1E-01	J	1.2E-01	J	1.4E-01		0.0E+00	ND	0.0E+00	ND

Table B35. PCB in bulk and particulate fractions of location A3W for stormwater event-I (January 5th to 7th 2016).

Ambient Receiving Water Sample (A3W)											
PCB	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
	µg/L	µg/L		µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg
1	NA	5.7E-06	J	NA	1.2E+00	J	0.0E+00	ND	1.2E-01	J	NA
2	NA	6.4E-06	J	NA	1.8E+00	J	0.0E+00	ND	0.0E+00	ND	NA
3	NA	1.0E-05	J	NA	8.0E+00		0.0E+00	ND	3.5E-01		NA
4	NA	1.1E-05		NA	0.0E+00	ND	9.7E-02	J	0.0E+00	ND	NA
10	NA	5.9E-06	J	NA	7.2E-01	J	9.7E-03	J	0.0E+00	ND	NA
9	NA	3.1E-06	J	NA	0.0E+00	ND	1.9E-02	J	2.9E-02	J	NA
7	NA	2.6E-06	J	NA	6.8E-01	J	4.9E-02	J	0.0E+00	ND	NA
6	NA	5.8E-06	J	NA	0.0E+00	ND	4.5E-02	J	0.0E+00	ND	NA
8	NA	2.5E-05		NA	1.4E+00		0.0E+00	ND	4.1E-01		NA
5	NA	1.9E-05		NA	8.8E-01		0.0E+00	ND	3.1E-01		NA
19	NA	1.2E-06	J	NA	2.7E+00	J	0.0E+00	ND	0.0E+00	ND	NA
18	NA	1.9E-05		NA	2.4E+00		0.0E+00	ND	3.1E+00		NA
17	NA	5.1E-06	J	NA	0.0E+00	ND	0.0E+00	ND	1.5E+00	J	NA
15	NA	2.5E-05		NA	1.4E+01		0.0E+00	ND	2.4E-01		NA
27	NA	2.3E-06	J	NA	1.0E+00	J	1.0E-02	J	2.4E-02	J	NA
24	NA	3.5E-06	J	NA	1.1E+00	J	1.1E-02	J	1.2E-01	J	NA
32	NA	9.2E-06	J	NA	2.1E+00	J	4.8E-02	J	0.0E+00	ND	NA
16	NA	1.0E-05	J	NA	0.0E+00	ND	1.9E-01	J	5.5E-02	J	NA
34	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
29	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
26	NA	1.6E-05		NA	2.5E+00		0.0E+00	ND	3.3E-01		NA
25	NA	7.4E-06	J	NA	3.6E+00	J	0.0E+00	ND	5.5E-02	J	NA
31	NA	2.6E-05		NA	9.7E+00		0.0E+00	ND	3.6E-01		NA
28	NA	1.7E-05		NA	5.5E+00		0.0E+00	ND	3.9E-01		NA
20	NA	1.4E-05		NA	3.6E+00		1.2E-02		0.0E+00		NA
22	NA	9.7E-06	J	NA	3.7E+00	J	8.3E-02		0.0E+00	ND	NA

Ambient Receiving Water Sample (A3W)													
PCB	**Bulk water**	**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L	**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
45	NA	8.8E-06	J	NA		8.8E-02	J	5.1E-02	J	1.4E-01	J	NA	
46	NA	0.0E+00	ND	NA		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	
69	NA	0.0E+00	ND	NA		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	
52	NA	6.7E-05		NA		4.6E+01		0.0E+00	ND	1.7E+00		NA	
47	NA	1.2E-05		NA		8.6E+00		0.0E+00	ND	9.3E-02		NA	
48	NA	3.5E-06	J	NA		9.5E+00	J	0.0E+00	ND	1.8E-01	J	NA	
44	NA	3.2E-05		NA		3.6E+01		0.0E+00	ND	1.4E+00		NA	
42	NA	6.8E-06	J	NA		7.1E+00	J	0.0E+00	ND	2.8E-01	J	NA	
37	NA	2.5E-05		NA		1.6E+01		0.0E+00	ND	1.2E+00		NA	
71	NA	7.1E-06	J	NA		3.4E+00	J	5.5E-02	J	3.0E-02	J	NA	
41	NA	1.5E-05		NA		6.1E+00		5.4E-01		6.2E-01		NA	
103	NA	5.7E-05		NA		6.8E+01		0.0E+00	ND	0.0E+00	ND	NA	
40	NA	9.2E-06	J	NA		5.5E+00	J	2.1E-03		3.8E-01		NA	
67	NA	0.0E+00	ND	NA		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	
74	NA	0.0E+00	ND	NA		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	ND
70	NA	0.0E+00	ND	NA	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	ND
66	NA	2.3E-05		NA		2.4E+01		0.0E+00	ND	0.0E+00	ND	NA	
95	NA	3.9E-05		NA		6.5E+01		0.0E+00	ND	4.3E+00		NA	
93	NA	3.9E-05		NA		6.5E+01		0.0E+00	ND	1.2E+00		NA	
56	NA	1.5E-05		NA		4.9E+00		1.4E-01		1.4E-01		NA	
60	NA	1.3E-05		NA		4.2E+00		1.5E-01		9.5E-02		NA	
92	NA	2.4E-05		NA		9.7E+00		1.9E-01		9.7E-03		NA	
84	NA	2.2E-05		NA		2.9E+01		0.0E+00		6.8E-01		NA	
101	NA	1.1E-04		NA		5.9E+01		1.2E+00		9.7E-01		NA	
99	NA	3.7E-05		NA		2.3E+01		3.9E-01		0.0E+00		NA	
119	NA	0.0E+00	ND	NA		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	

PCB	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
	µg/L	µg/L		µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg
	Ambient Receiving Water Sample (A3W)										
83	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
87	NA	4.3E-05		NA	0.0E+00	ND	1.5E+00		1.3E+00		NA
81	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
115	NA	2.9E-05		NA	3.1E+01		3.4E-01		0.0E+00	ND	NA
136	NA	1.6E-05		NA	1.6E+01		3.3E-01		0.0E+00	ND	NA
110	NA	8.8E-05		NA	3.3E+01		2.4E+00		0.0E+00	ND	NA
77	NA	2.2E-05		NA	9.9E+00		2.4E-01		5.5E-01		NA
82	NA	1.4E-05		NA	6.7E+00		8.2E-01		1.5E-01		NA
151	NA	2.3E-05		NA	3.1E+01		7.3E-01		0.0E+00	ND	NA
135	NA	1.3E-05		NA	3.4E+00		2.7E-01		0.0E+00	ND	NA
144	NA	7.0E-06	J	NA	2.3E+01		1.9E-01		5.6E-01		NA
147	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
107	NA	2.5E-05		NA	0.0E+00		7.9E+00		0.0E+00	ND	NA
123	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
149	NA	6.4E-05		NA	6.2E+01		2.7E+00		0.0E+00	ND	NA
118	NA	3.4E-05		NA	3.5E+00		1.6E+00		0.0E+00	ND	NA
134	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
114	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
131	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
146	NA	8.8E-06	J	NA	1.2E+01		5.9E-01		0.0E+00	ND	NA
153	NA	6.9E-05		NA	6.2E+01		2.9E+00		0.0E+00	ND	NA
132	NA	2.4E-05		NA	1.6E+01		2.9E-01		4.1E+00		NA
105	NA	3.1E-05		NA	1.7E+01		6.0E-01		0.0E+00	ND	NA
141	NA	2.5E-05		NA	1.5E+01		5.5E-01		1.3E+00		NA
179	NA	6.0E-06	J	NA	9.6E+00		1.7E-01		8.5E-01		NA
163	NA	2.7E-05		NA	3.9E+01		1.9E+00		0.0E+00	ND	NA

	Ambient Receiving Water Sample (A3W)										
PCB	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)
	µg/L	µg/L		µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg
138	NA	2.6E-05		NA	3.9E+01		1.9E+00		0.0E+00	ND	NA
158	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
178	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
126	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
187	NA	1.5E-05		NA	2.9E+01		1.1E+00		0.0E+00	ND	NA
183	NA	2.6E-06	J	NA	1.2E+01	J	6.7E-01		0.0E+00	ND	NA
128	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
167	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
174	NA	1.6E-05		NA	3.2E+01		9.3E-01		0.0E+00	ND	NA
177	NA	8.6E-06	J	NA	2.3E+01		4.9E-01		1.8E+00		NA
171	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
156	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
157	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
173	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
172	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
197	NA	9.5E-07	J	NA	8.0E-01	J	0.0E+00	ND	5.0E-04	J	NA
180	NA	4.7E-05		NA	5.5E+01		3.3E+00		1.2E+00		NA
193	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
191	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
169	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
170	NA	5.4E-06	J	NA	5.7E+01		4.4E-01		4.4E+00		NA
190	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA
198	NA	5.5E-06	J	NA	1.7E+01		6.1E-01		0.0E+00	ND	NA
203	NA	4.8E-06	J	NA	1.2E+01		3.0E-01		0.0E+00	ND	NA
196	NA	7.4E-06	J	NA	7.5E+00	J	3.0E-01		0.0E+00	ND	NA
189	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA

PCB	Ambient Receiving Water Sample (A3W)											
	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L	µg/L		µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg	
208	NA	1.8E-07	J	NA	1.3E+00	J	2.6E-02	J	3.6E-01	J	NA	
195	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	
207	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	
194	NA	4.5E-06	J	NA	1.6E+01		5.3E-01		9.6E-01		NA	
205	NA	0.0E+00	ND	NA	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	NA	
206	NA	2.7E-06	J	NA	0.0E+00	ND	9.6E-02	J	1.3E+00	J	NA	
209	NA	3.7E-06	J	NA	5.4E+00	J	0.0E+00	ND	1.5E+00		NA	

Stormwater Event II – January 31st to February 1st 2016

Data Summary of Bulk and Particulate Water Size Fractions for Metals and POPs

Table B36. Solid mass and organic carbon (OC) particle size distribution of HDPE bottles at all locations for the stormwater event -II samples collected from January 31st to February 1st 2016.

Location	Solids/ Organic Carbon (OC)	Filtered Water (< 0.45 µm)	Total solids (>0.45µm)	Solids fraction (0.45-5 µm)	Solids fraction (5-20 µm)	Solids Fraction (20-63 µm)	Solids Fraction (> 63 µm)
		mg/L	mg/L (%TOC)	mg/L (%TOC)	mg/L (%TOC)	mg/L (%TOC)	mg/L (%TOC)
C2W	Solids	-	722.5	0	<0 143.3	128.4	450.8
	OC	8.1±0.1	9.8±1.3	NA	0.0	<0 18.1±6.1	2.2±0.9
O4W	Solids		40.8	S 2.1	S 33.7	S 3.5	1.5
	OC	26.9±0.4	NA	NA	NA	NA	NA
C1W	Solids	-	122.0±3.0	5.4±5.4	68.9±2.4	39.1±0.3	8.5±0.3
	OC	6.8±0.1	8.7	0.0	<0 9.1	2.6	16.2
O2W	Solids	-	59.4±4.5	13.7±5.1	31.6	9.4±1.2	4.6±1.8
	OC	6E+00	5.6	0.0	2.0	15.2	21.6
A1W	Solids	-	77.1±5.5	0	51.1±7.5	20.8±0.9	5.2±1.1
	OC	19.2±0.3	7.2	NA	2.2	12	19.1
A2W	Solids	-	63.3±13.0	14.1±14.1	46.6±1.1	1.2±0.6	1.4±0.6
	OC	3.4±0.2	2.1	5.1	0.8	10.5	NA

Table B37. Solid mass and organic carbon (OC) particle size distribution of Amber bottles at all locations for the stormwater event -II samples collected from January 31st to February 1st 2016.

Location	Solids/ Organic Carbon (OC)	Filtered Water (< 0.7 µm) mg/L	Total solids (>0.7µm) mg/L (%TOC)		Solids fraction (0.7-2.7 µm) mg/L (%TOC)		Solids fraction (2.7-20 µm) mg/L (%TOC)		Solids Fraction (20-63 µm) mg/L (%TOC)	Solids Fraction (> 63 µm) mg/L (%TOC)
C2W	Solids	-	784.4		0.0	<0	62.9		190.7	530.7
	OC	8.1	11.0±0.8		NA		50.8±17.2		18.1±6.1	2.2±0.9
O4W	Solids	-	149.2	S	0.0	<0,S	146.1	S	1.9	1.1
	OC	26.9±0.4	1.9±0.1		NA		0.7±0.1		NA	NA
C1W	Solids	-	117.7±7.0		0.9±0.9		63.6±12.7		27.6±1.0	25.6±5.9
	OC	6.8±0.1	9.3±0.4		0.0	<0	10.0±2.9		2.6	16.2
O2W	Solids	-	108.1±3.9	S	0	<0,S	92.4±2.3	S	9.8±1.3	5.9±0.3
	OC	5.9	5.0±0.7		NA		1.2±0.7		15.1	21.6
A1W	Solids	-	328.1±43.5	S	63.4±63.4	S	241.6±106.7	S	18.6±0.1	4.5±0.2
	OC	19.2±0.3	6.1±5.3		23.6±27.9		0.9±0.9		11.8	19.1
A2W	Solids	-	117.2±2.4	S	0.0	<0,S	113.1±2.6	S	4.1	0
	OC	3.4±0.2	2.9±0.3		NA		0.8±0.1		10.5	NA

Table B38. Trace metals in bulk and particulate fractions of location C2W for stormwater event-II (January 31st to February 1st 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg

Paleta Creek at Main Street (C2W)										
Metals	**Bulk water**	**Filtered Water (< 0.45 µm)**		**Total solids (>0.45µm)**	**Solids fraction (0.45-5 µm)**		**Solids fraction (5-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**
	µg/L (ng/L)	**µg/L (ng/L)**		**µg/Kg (ng/Kg)**	**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**
As	6.39 ± 0.1	*		*	*		*		6.31 ± 0		4.35 ± 0
Cu	60	12		68	0	<0	123		31		62
Ni	13.9 ± 1.115	2.24 ± 0.24		16	0	<0	33		4		14
Zn	335 ± 38.43	47.2 ± 7.118		398 ± 0.1	0	<0	595 ± 0.1		275 ± 0		376 ± 0.1
Cd	0	0	U	0	0	U	0	U	0	J	0
Pb	30	1.19 ± 0.46		39.9 ± 0	0.284 ± 0.46	µg/L	67.5 ± 0		15		37
Hg	46.1 ± 4.393	3		60.1 ± 0	0.415 ± 0	ng/L	101 ± 0		75 ± 0		42.1 ± 0

Table B39. Trace metals in bulk and particulate fractions of location O4W for stormwater event-II (January 31st to February 1st 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg.

NBSD outfall at Paunack and Division Streets (O4W)														
Metals	Bulk water		Filtered Water (< 0.45 µm)		Total solids (>0.45µm)		Solids fraction (0.45-5 µm)		Solids fraction (5-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L (ng/L)		µg/L (ng/L)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)	
As	0	U	*		*		*		*		0	U	0	J
Cu	49.1 ± 0.32		43		156 ± 0		1640 ± 1.669		12 ± 0.14		715 ± 0.86		0	
Ni	23		23		0		0		0		0		0	
Zn	36 ± 10.43		10		628 ± 0.26		2996		0		0		13100 ± 7.064	
Cd	0		0		0		0		0		0		0	
Pb	1.35 ± 0.1	J	1.55 ± 0.53	J	0	<0	0	<0	9.9 ± 0	J	0	<0	143 ± 0.1	J
Hg	19.5 ± 0.39		3		398 ± 0		310 ± 0		189 ± 0		1860 ± 0.2		1790 ± 0.29	

Table B40. Trace metals in bulk and particulate fractions of location C1W for stormwater event-II (January 31st to February 1st 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg.

Metals	Bulk water	Filtered Water (< 0.45 µm)	Total solids (>0.45µm)	Solids fraction (0.45-5 µm)	Solids fraction (5-20 µm)	Solids Fraction (20-63 µm)	Solids Fraction (> 63 µm)
Paleta Creek at Cummings Road (C1W)							
	µg/L (ng/L)	µg/L (ng/L)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)	µg/Kg (ng/Kg)
As	3.74 ± 0.31	*	*	*	*	0 <0	22.5 ± 0
Cu	29.6 ± 1.776	13.8 ± 4.25	130 ± 0	0 <0	190 ± 0	78.3 ± 0.1	164 ± 0.32
Ni	6.8 ± 0.14	3.36 ± 0.3	28	0 <0	57 ± 0	0 <0	0 <0
Zn	141 ± 11.22	52.2 ± 12.29	724 ± 0.14	1340 ± 2.852	503 ± 0.19	523 ± 0.35	3050 ± 1.735
Cd	0.5 ± 0.19	0 U	2	0 U	0 U	2.36 ± 0	12.3 ± 0
Pb	13.6 ± 0.74	1.07 ± 0.22	103 ± 0	42.4 ± 0	116 ± 0	98.7 ± 0	47.5 ± 0.22
Hg	26 ± 2.243	2.64 ± 0.68	191 ± 0	46.6 ± 0.13	250 ± 0	124 ± 0.11	115 ± 0.51

Table B41. Trace metals in bulk and particulate fractions of location O2W for stormwater event-II (January 31st to February 1st 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg.

	NBSD outfall #33 (O2W)													
Metals	**Bulk water**		**Filtered Water (< 0.45 µm)**		**Total solids (>0.45µm)**		**Solids fraction (0.45-5 µm)**		**Solids fraction (5-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L (ng/L)		**µg/L (ng/L)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**	
As	0	U	*		*		*		*		0	U	0	U
Cu	64.6 ± 4.247		50.1 ± 3.158		244 ± 0.1		278 ± 0.35		94.3 ± 0.12		287 ± 0.64		1080 ± 2	
Ni	15		15		0	U	0	U	0	U	0	U	0	U
Zn	78.4 ± 17.01		44.5 ± 8.047		571 ± 0.32		454 ± 1.418		0	<0	2040 ± 2		3880 ± 5	
Cd	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Pb	11.2 ± 1.101		1.63 ± 0.19		162 ± 0		4.1 ± 0	J	98.3 ± 0		401 ± 0.12		577 ± 0.3	
Hg	21.7 ± 1.59		4.51 ± 0.25		289 ± 0		75.7 ± 0		237 ± 0.1		728 ± 0.23		384 ± 0.45	

Table B42. Trace metals in bulk and particulate fractions of location A1W for stormwater event-II (January 31st to February 1st 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg.

Ambient Receiving water sample (A1W)														
Metals	Bulk water		Filtered Water (< 0.45 µm)		Total solids (>0.45µm)		Solids fraction (0.45-5 µm)		Solids fraction (5-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L (ng/L)		µg/L (ng/L)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)		µg/Kg (ng/Kg)	
As	0		*		*		*		0	U	0	U	0	U
Cu	71		71		0		0	U	0	U	0	U	0	U
Ni	23		23		0		0	U	0	U	0	U	0	U
Zn	71		13.1 ± 5.01		754 ± 0.1		5.64 ± 17.12	µg/L	726 ± 0.39		750 ± 0.93		0	<0
Cd	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Pb	5.33 ± 0.34		1.25 ± 0		52.9 ± 0		).688 ± 2.146	µg/L	20.4 ± 0		91.6 ± 0.1		86.9 ± 0.24	
Hg	19.5 ± 5.192		1.54 ± 0.38		233 ± 0.1		0.76 ± 0.4	ng/L	84 ± 0		659 ± 0.52		0	<0

Table B43. Trace metals in bulk and particulate fractions of location A2W for stormwater event-II (January 31st to February 1st 2016). All metals except Hg are in units of µg/L or µg/Kg. Mercury is represented in units of ng/L or ng/Kg.

	Ambient Receiving water sample (A2W)													
Metals	**Bulk water**		**Filtered Water (< 0.45 µm)**		**Total solids (>0.45µm)**		**Solids fraction (0.45-5 µm)**		**Solids fraction (5-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L (ng/L)		**µg/L (ng/L)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**		**µg/Kg (ng/Kg)**	
As	0	U	*		*		*		0	U	0	U	0	U
Cu	62.5 ± 1.0		52		165 ± 0		0	U	73.3 ± 0.11		4510 ± 5.1		1260 ± 2.8	
Ni	23		23		0		0	U	0	U	0	U	0	U
Zn	80		21.8 ± 6.6		925 ± 0.1		3140 ± 7.5		298 ± 2.0		394 ± 22.4		0	U
Cd	0	U	0	U	0	U	0	U	0	U	0	U	0	U
Pb	3.21 ± 1.6		1		33.5 ± 0		6.63 ± 0	J	33.7 ± 0		106 ± 0.3		239 ± 1.2	
Hg	14.5 ± 1.3		3.61 ± 1.3		173 ± 0		0	<0	118 ± 0		2.36 ± 1.1		2850 ± 1.3	

Table B44. PAHs in bulk and particulate fractions of location C2W for stormwater event-II (January 31st to February 1st 2016).

Paleta Creek at Main Street (C2W)														
PAH	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	ng/L		**ng/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
Naphthalene	15.5		7.6		10.1		0.0	<0	60.7		274.0		0.0	<0
Fluorene	30.1		1.7		36.2		0.0	<0	896.1		1575.5		0.0	<0
Acenaphthene	46.2		10.6		45.4		0.0	<0	0.0	<0	9.4		82.5	
Phenanthrene	287.2		0.0	U	366.1		0.0	<0	0.0	U	0.0	U	541.1	
Anthracene	0.0	U	0.0	U	0.0	U	0.0	<0	0.0	U	0.0	U	0.0	U
Fluoranthene	219.2		2.5		276.2		0.0	<0	349.3		707.7		112.6	
Pyrene	170.9		3.4		213.5		0.0	<0	479.3		266.7		162.3	
Chrysene	57.7		0.5		73.0		0.0	<0	182.6		105.0		48.5	
Benzo[a]anthracene	41.5		0.3		52.6		0.0	<0	92.8		40.9		51.9	
Benzo[b]fluoranthene	118.1		0.6		149.7		0.0	<0	279.5		182.0		122.9	
Benzo[k]fluoranthene	27.6		0.1	J	35.1		0.0	<0	75.6		53.8		23.6	
Benzo[a]pyrene	50.9		0.2		64.7		0.0	<0	163.6		119.7		32.7	
Dibenzo[a,h]anthracene	0.0	U	0.5		0.0	U	0.0	<0	42.1		133.1		0.0	U
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	151.7		0.9		192.2		0.0	<0	608.5		476.4		40.8	

Table B45. PAHs in bulk and particulate fractions of location O4W for stormwater event-II (January 31st to February 1st 2016).

NBSD Outfall at Paunack and Division Streets (O4W)														
PAH	Bulk water	Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	ng/L	ng/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
Naphthalene	17.9	14.2		25.0		0.0	<0	9.9		0.0	<0	5837.3	
Fluorene	1.6	1.9		0.0	<0	0.0	<0	3.0		0.0	<0	0.0	<0
Acenaphthene	2.3	1.5		5.6		0.0	<0	11.7		0.0	<0	672.3	
Phenanthrene	5.7	6.6		0.0	<0	0.0	<0	11.2		0.0	<0	997.1	
Anthracene	1.3	0.0	U	8.8		0.0	<0	0.0	U	0.0	U	1190.9	
Fluoranthene	4.3	0.0	U	28.9		0.0	<0	22.7		0.0	<0	1395.1	
Pyrene	4.4	2.6		12.1		0.0	<0	4.8		506.9		279.1	
Chrysene	1.9	0.0	U	12.8		0.0	<0	0.0	U	559.4		749.9	
Benzo[a]anthracene	0.9	0.0	U	6.4		0.0	<0	0.0	U	276.0		377.3	
Benzo[b]fluoranthene	1.8	0.0	U	11.9		0.0	<0	0.0	U	477.5		777.6	
Benzo[k]fluoranthene	0.2	0.0	U	1.5		0.0	<0	0.4		59.5		47.8	
Benzo[a]pyrene	0.5	0.0	U	3.1		0.0	<0	0.0	U	248.4		0.0	<0
Dibenzo[a,h]anthracene	1.7	0.0	U	11.7		0.0	<0	0.0	U	0.0	U	1585.4	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	1.8	0.0	U	11.9		0.0	<0	1.9		441.7		577.6	

Table B46. PAHs in bulk and particulate fractions of location C1W for stormwater event-II (January 31st to February 1st 2016).

Paleta Creek at Cummings Road (C1W)														
PAH	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	ng/L		ng/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
Naphthalene	6.9		6.6		3.1		309.9		0.0	<0	86.3		14.5	
Fluorene	5.1		1.2		33.6		0.0	<0	0.0	<0	0.4		168.7	
Acenaphthene	12.0		1.9		86.0		0.0	<0	0.0	<0	0.0	<0	449.5	
Phenanthrene	28.9		7.9		177.8		0.0	<0	0.1		357.0		442.7	
Anthracene	0.0	U	0.0	U	0.0	U	0.0	U	4.8		13.6		0.0	U
Fluoranthene	25.1		3.7		181.8		714.6		134.2		708.9		0.0	<0
Pyrene	47.2		3.5		371.4		487.8		158.7		601.3		647.7	
Chrysene	27.7		0.6		230.9		74.0		60.1		233.4		657.8	
Benzo[a]anthracene	18.6		0.5		154.1		0.0	<0	39.1		167.4		431.1	
Benzo[b]fluoranthene	26.7		0.3		224.1		241.6		124.9		624.1		38.9	
Benzo[k]fluoranthene	10.1		0.1		84.8		45.6		41.5		214.1		54.3	
Benzo[a]pyrene	18.6		0.1		157.2		190.5		71.5		397.9		109.5	
Dibenzo[a,h]anthracene	4.5		0.3		35.0		45.6		19.3		74.1		31.2	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	47.9		0.4		404.1		292.5		193.3		1098.2		183.4	

Table B47. PAHs in bulk and particulate fractions of location O2W for stormwater event-II (January 31st to February 1st 2016).

NBSD Outfall # 33 (O2W)											
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**	**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**
	ng/L	**ng/L**	**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**
Naphthalene	5.8	3.1	25.1		0.0	<0	10.4		0.0	<0	191.9
Fluorene	4.2	5.2	0.0	<0	0.0	<0	30.1		0.0	<0	0.0 <0
Acenaphthene	5.4	5.4	0.1		0.0	<0	58.5		319.0		0.0 <0
Phenanthrene	14.8	7.6	66.2		0.0	<0	0.0	U	0.0	U	2489.7
Anthracene	0.8	1.7	0.0	<0	0.0	<0	0.0	U	0.0	U	134.8
Fluoranthene	23.7	9.2	135.0		0.0	<0	35.3		437.9		1248.7
Pyrene	35.2	6.5	265.4		0.0	<0	29.8		299.0		3949.9
Chrysene	21.2	0.7	189.2		0.0	<0	17.8		123.7		2926.1
Benzo[a]anthracene	8.4	0.4	74.1		0.0	<0	10.1		103.1		1001.8
Benzo[b]fluoranthene	22.1	1.2	193.3		0.0	<0	57.7		584.5		1662.8
Benzo[k]fluoranthene	9.6	0.4	85.3		0.0	<0	20.2		156.4		971.9
Benzo[a]pyrene	11.9	0.3	107.9		0.0	<0	20.0		220.1		1287.4
Dibenzo[a,h]anthracene	4.1	0.5	33.0		0.0	<0	7.5		19.1		448.4
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	17.3	0.4	156.0		0.0	<0	32.7		401.6		1638.1

Table B48. PAHs in bulk and particulate fractions of location A1W for stormwater event-II (January 31st to February 1st 2016).

Ambient Receiving Water Sample (A1W)											
PAH	Bulk water	Filtered Water (< 0.7 µm)	Total solids (>0.7µm)	Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	ng/L	ng/L	µg/Kg	µg/Kg		µg/Kg		µg/Kg		µg/Kg	
Naphthalene	4.7	4.0	2.0	0.0	<0	5.0		0.0	<0	222.9	
Fluorene	2.5	1.1	4.4	0.0	<0	20.9		0.0	<0	5.5	
Acenaphthene	4.9	1.9	9.2	1.5		13.1		0.0	<0	296.6	
Phenanthrene	28.9	3.8	76.6	15.7		44.3		0.0	<0	3070.2	
Anthracene	1.0	0.0	3.0	41.5		0.0	<0	0.0	<0	0.0	U
Fluoranthene	41.0	1.7	119.8	9.3		32.0		677.7		4061.8	
Pyrene	33.8	2.5	95.4	0.0		24.5		493.9		3730.6	
Chrysene	13.0	0.0	39.6	4.6		11.9		183.0		1418.1	
Benzo[a]anthracene	7.6	0.0	23.1	2.6		7.6		112.6		766.1	
Benzo[b]fluoranthene	17.5	0.0	53.4	2.8		18.6		312.2		1554.1	
Benzo[k]fluoranthene	5.6	0.0	17.0	1.2		5.4		106.2		496.4	
Benzo[a]pyrene	10.3	0.0	31.3	2.8		8.4		197.6		968.5	
Dibenzo[a,h]anthracene	2.8	0.0	8.4	4.5		2.5		166.3		0.0	<0
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	29.5	0.2	89.2	0.0	<0	16.4		749.7		2512.1	

Table B49. PAHs in bulk and particulate fractions of location A2W for stormwater event-II (January 31st to February 1st 2016).

Paleta Creek at Main Street (A2W)													
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	ng/L	**ng/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
Naphthalene	6.8	1.8		42.4		0.0	<0	8.1		450.8		2.5	
Fluorene	2.8	12.0		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.9	
Acenaphthene	4.2	12.7		0.0	<0	0.0	<0	10.5		0.0	<0	0.1	
Phenanthrene	8.2	0.2		67.7		0.0	<0	20.5		0.0	<0	2.1	
Anthracene	0.3	0.0	U	2.8		0.0	<0	17.5		0.0	U	0.3	
Fluoranthene	7.1	5.7		12.7		0.0	<0	46.2		0.0	<0	0.0	<0
Pyrene	8.1	3.3		40.9		0.0	<0	33.4		162.4		0.0	<0
Chrysene	2.6	0.0	U	22.2		0.0	<0	15.2		58.4		0.2	
Benzo[a]anthracene	1.9	0.0	U	16.0		0.0	<0	12.8		106.3		0.0	<0
Benzo[b]fluoranthene	8.8	0.2		73.4		0.0	<0	31.2		356.8		3.5	
Benzo[k]fluoranthene	2.2	0.0	J	19.0		0.0	<0	9.0		108.6		0.7	
Benzo[a]pyrene	4.7	0.1		39.3		0.0	<0	13.7		153.0		2.3	
Dibenzo[a,h]anthracene	2.8	0.3		21.6		0.0	<0	5.4		0.0	<0	2.3	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	6.5	0.1		54.3		0.0	<0	34.3		290.1		1.1	

Table B50. PCBs in bulk and particulate fractions of location C2W for stormwater event-II (January 31st to February 1st 2016).

Paleta Creek at Main Street (C2W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
1	3.5E-04	J	1.8E-05	J	4.3E-01	J	0	ND	1.4E-01	J	3.0E-02	J	6.1E-01	J
2	5.6E-04	J	2.7E-05	J	6.8E-01	J	0	ND	5.1E-01		0.0E+00	ND	9.4E-01	J
3	6.9E-04		2.9E-05	J	8.4E-01	J	0	ND	4.7E-01		6.4E-02		1.2E+00	
4	3.4E-04	J	3.5E-05		3.8E-01		0	ND	0.0E+00	ND	1.3E-01	J	5.5E-01	J
10	0.0E+00	ND	1.3E-06	J	0.0E+00	J	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
9	3.6E-05	J	5.1E-06	J	3.9E-02	J	0	ND	3.3E-03	J	0.0E+00	ND	5.5E-02	J
7	3.7E-05	J	3.3E-06	J	4.3E-02	J	0	ND	0.0E+00	ND	0.0E+00	ND	6.3E-02	J
6	1.8E-04	J	1.1E-05	J	2.1E-01	J	0	ND	2.5E-02	J	0.0E+00	ND	3.1E-01	J
8	0.0E+00	ND	1.3E-05	J	0.0E+00	J	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
5	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
19	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
18	6.2E-04	J	9.3E-05		6.7E-01		0	ND	0.0E+00	ND	0.0E+00	ND	1.1E+00	J
17	8.4E-04		2.4E-04		7.6E-01		0	ND	1.2E-02		0.0E+00	ND	1.3E+00	
15	1.4E-03		1.4E-04		1.6E+00		0	ND	1.2E+00		0.0E+00	ND	2.3E+00	
27	2.5E-04	J	1.2E-04		1.6E-01		0	ND	0.0E+00	ND	4.1E-01		1.4E-01	J
24	9.1E-04		1.5E-04		9.7E-01		0	ND	4.0E-01		4.7E-01		1.3E+00	
32	1.1E-05	J	1.9E-05	J	0.0E+00	J	0	ND	2.1E-01	J	2.6E-02	J	0.0E+00	ND
16	2.7E-05	J	1.5E-05	J	1.5E-02	J	0	ND	2.2E-01	J	0.0E+00	ND	0.0E+00	ND
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
25	1.6E-03		1.1E-04		1.8E+00		0	ND	1.2E+00		0.0E+00	ND	2.7E+00	
31	1.7E-03		3.5E-04		1.8E+00		0	ND	8.5E-01		3.5E-01		2.5E+00	
28	5.4E-04	J	6.1E-05		6.1E-01		0	ND	7.2E-01		9.2E-02		7.6E-01	J
20	1.2E-03		2.3E-04		1.3E+00		0	ND	3.7E-01		6.4E-01		1.6E+00	

Paleta Creek at Main Street (C2W)

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
22	3.1E-04	J	9.3E-05		2.8E-01		0	ND	8.0E-01		0.0E+00	ND	4.5E-01	J
45	0.0E+00	ND	3.2E-05		0.0E+00		0	ND	4.6E-01		0.0E+00	ND	0.0E+00	ND
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	6.1E-04	J	8.6E-05		6.7E-01		0	ND	1.2E+00		1.4E-01		8.6E-01	J
47	0.0E+00	ND	1.6E-05	J	0.0E+00	J	0	ND	0.0E+00	ND	1.7E-01	J	0.0E+00	ND
48	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
44	3.9E-04	J	3.1E-05		4.5E-01		0	ND	8.1E-01		1.5E-01		5.4E-01	J
42	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
37	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
71	6.1E-04	J	5.0E-05		7.1E-01		0	ND	2.8E-01	J	2.1E-01		9.9E-01	J
41	6.8E-04		6.7E-05		7.9E-01		0	ND	0.0E+00	ND	5.2E-01		1.1E+00	
103	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
40	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	2.6E-04	J	2.2E-05	J	3.0E-01	J	0	ND	2.8E-01	J	1.1E-01	J	3.8E-01	J
70	9.6E-04		7.7E-05		1.1E+00		0	ND	1.3E+00		0.0E+00	ND	1.6E+00	
66	9.9E-04		3.7E-05		1.2E+00		0	ND	1.2E+00		2.0E-01		1.6E+00	
95	5.7E-04	J	3.8E-05		6.8E-01		0	ND	1.9E+00		0.0E+00	ND	7.9E-01	J
93	5.7E-04	J	3.8E-05		6.8E-01		0	ND	2.2E+00		0.0E+00	ND	7.9E-01	J
56	7.7E-04		6.6E-05		9.0E-01		0	ND	7.4E-01		1.5E-01		1.2E+00	
60	7.8E-04		6.7E-05		9.1E-01		0	ND	4.2E-01		2.6E-01		1.2E+00	
92	9.1E-03		1.0E-04		1.1E+01		0	ND	9.3E-01		1.8E-01		1.7E+01	
84	2.8E-04	J	1.8E-05	J	3.4E-01	J	0	ND	5.2E-01	J	0.0E+00	ND	4.6E-01	J
101	2.1E-03		1.3E-04		2.5E+00		0	ND	2.0E+00		8.0E-01		3.1E+00	

Paleta Creek at Main Street (C2W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
99	1.5E-03		1.9E-04		1.7E+00		0	ND	2.2E+00		2.8E-01		2.2E+00	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	7.6E-04		3.2E-05		9.3E-01		0	ND	7.5E-01		3.3E-01		1.1E+00	
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
136	5.3E-05	J	7.8E-07	J	6.6E-02	J	0	ND	1.6E-01	J	9.5E-02	J	3.9E-02	J
110	3.9E-03		1.2E-04		4.8E+00		0	ND	3.0E+00		1.6E+00		6.1E+00	
77	1.6E-03		8.4E-05		1.9E+00		0	ND	1.4E+00		3.6E-01		2.6E+00	
82	3.9E-03		4.0E-05		4.9E+00		0	ND	3.6E-02		2.5E-01		7.2E+00	
151	7.0E-04		3.8E-05		8.5E-01		0	ND	5.1E-01		3.0E-01		1.1E+00	
135	3.0E-04	J	0.0E+00	ND	3.8E-01	ND	0	ND	3.1E-01	J	4.5E-02	J	5.0E-01	J
144	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	2.5E-03		6.2E-05		3.1E+00		0	ND	2.0E+00		1.2E+00		3.9E+00	
118	7.6E-04		0.0E+00	ND	9.8E-01	ND	0	ND	8.4E-01		1.2E+00		9.0E-01	
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	6.8E-04	J	1.6E-05	J	8.4E-01	J	0	ND	5.6E-01	J	3.0E-01		1.1E+00	J
153	3.5E-03		8.1E-05		4.4E+00		0	ND	2.9E+00		1.6E+00		5.6E+00	
132	1.2E-03		2.8E-05	J	1.5E+00	J	0	ND	9.6E-01		5.2E-01		1.9E+00	
105	1.4E-03		1.4E-04		1.6E+00		0	ND	1.7E+00		6.1E-01		2.2E+00	

Paleta Creek at Main Street (C2W)

PCB	Bulk water µg/L		Filtered Water (< 0.7 µm) µg/L		Total solids (>0.7µm) µg/Kg		Solids fraction (0.7-2.7 µm) µg/Kg		Solids fraction (2.7-20 µm) µg/Kg		Solids Fraction (20-63 µm) µg/Kg		Solids Fraction (> 63 µm) µg/Kg	
141	1.0E-03		3.0E-05		1.3E+00		0	ND	6.4E-01		3.8E-01		1.7E+00	
179	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
163	2.4E-03		3.7E-05		3.1E+00		0	ND	1.7E+00		1.1E+00		3.9E+00	
138	2.8E-03		5.2E-05		3.5E+00		0	ND	1.9E+00		1.2E+00		4.5E+00	
158	0.0E+00	ND	1.1E-04		0.0E+00		0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	1.5E-03		1.9E-05	J	1.9E+00	J	0	ND	6.4E-01	J	5.8E-01		2.5E+00	
183	5.9E-04	J	4.7E-06	J	7.4E-01	J	0	ND	3.0E-01	J	1.8E-01	J	9.8E-01	J
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	5.2E-04	J	6.8E-06	J	6.6E-01	J	0	ND	3.0E-01	J	5.2E-01		7.6E-01	J
177	3.9E-04	J	0.0E+00	ND	5.0E-01	ND	0	ND	0.0E+00	ND	2.0E-01	J	6.7E-01	J
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	6.0E-04	J	1.5E-05	J	7.4E-01	J	0	ND	2.0E-01	J	4.0E-01		9.3E-01	J
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	1.8E-03		9.9E-05		2.2E+00		0	ND	0.0E+00	ND	6.7E-01		3.2E+00	
197	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
180	2.4E-03		4.3E-05		3.0E+00		0	ND	1.8E+00		1.1E+00		3.8E+00	
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	8.0E-04		4.1E-06	J	1.0E+00	J	0	ND	8.0E-01		5.6E-01		1.2E+00	
190	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	6.1E-02	J	0.0E+00	ND

Paleta Creek at Main Street (C2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
198	5.2E-04	J	0.0E+00	ND	6.6E-01	ND	0	ND	5.0E-01	J	3.7E-01		7.9E-01	J
203	1.9E-04		0.0E+00	ND	2.5E-01	ND	0	ND	1.6E-01		1.7E-01		2.8E-01	
196	1.6E-04		0.0E+00	ND	2.1E-01	ND	0	ND	1.3E-01		1.7E-01		2.3E-01	
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
208	4.2E-05		0.0E+00	ND	5.3E-02	ND	0	ND	0.0E+00	ND	1.1E-01		4.1E-02	
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	1.1E-03		0.0E+00	ND	1.3E+00	ND	0	ND	1.1E+00		3.8E-01		1.7E+00	
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	4.0E-04	J	1.7E-05	J	4.8E-01	J	0	ND	3.4E-01	J	8.7E-01		3.7E-01	J
209	3.8E-05		0.0E+00	ND	4.9E-02	ND	0	ND	9.1E-02		5.1E-01		0.0E+00	ND

Table B51. PCBs in bulk and particulate fractions of location O4W for stormwater event-II (January 31st to February 1st 2016).

NBSD Outfall at Paunack and Division Streets (O4W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	1.5E-05	J	2.1E-05	J	0.0E+00	ND	0		9.1E-02	J	0.0E+00	ND	0.0E+00	ND
2	2.4E-05	J	2.7E-05	J	0.0E+00	ND	0		0.0E+00	ND	4.7E+00	J	0.0E+00	ND
3	2.7E-05	J	3.3E-05		0.0E+00	ND	0		7.1E-03		4.2E+00	J	0.0E+00	ND
4	3.0E-05		3.4E-05		0.0E+00	ND	0		2.0E-01		0.0E+00	ND	0.0E+00	ND
10	0.0E+00	ND	8.7E-06	J	0.0E+00	ND	0		5.6E-02	J	0.0E+00	ND	0.0E+00	ND
9	5.2E-06	J	1.0E-05	J	0.0E+00	ND	0		6.5E-05	J	0.0E+00	ND	0.0E+00	ND
7	3.1E-06	J	7.1E-07	J	2.0E-02	J	0		1.6E-02	J	0.0E+00	ND	0.0E+00	ND
6	9.0E-06	J	1.4E-05	J	0.0E+00	ND	0		1.9E-02	J	3.5E-02	J	0.0E+00	ND
8	1.0E-05	J	1.5E-05	J	0.0E+00	ND	0		1.1E-01		0.0E+00	ND	0.0E+00	ND
5	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		2.0E-02	J	0.0E+00	ND	0.0E+00	ND
19	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
18	7.1E-05		1.4E-04		0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	1.1E+01	
17	2.0E-04		2.0E-04		4.6E-02		0		3.8E-01		0.0E+00	ND	8.4E+01	
15	5.7E-05		1.4E-04		0.0E+00	ND	0		1.4E-01		1.9E-01		0.0E+00	ND
27	7.8E-05		1.2E-04		0.0E+00	ND	0		1.3E-01		0.0E+00	ND	0.0E+00	ND
24	1.1E-04		1.5E-04		0.0E+00	ND	0		1.5E-01		0.0E+00	ND	0.0E+00	ND
32	2.0E-05	J	2.1E-05	J	0.0E+00	ND	0		1.1E-01		0.0E+00	ND	6.1E-01	J
16	3.1E-05		2.4E-05	J	6.0E-02	J	0		2.8E-02	J	0.0E+00	ND	1.9E+01	
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
25	1.1E-04		1.1E-04		1.1E-02		0		4.5E-02		0.0E+00	ND	3.1E+01	
31	2.4E-04		2.3E-04		7.6E-02		0		0.0E+00	ND	1.9E+01		0.0E+00	ND
28	1.9E-04		4.4E-05		1.2E+00		0		4.1E-02		0.0E+00	ND	1.3E+02	
20	1.9E-04		1.3E-04		4.5E-01		0		2.2E-01		0.0E+00	ND	2.3E+01	
22	9.3E-05		9.4E-05		0.0E+00	ND	0		2.0E-02		0.0E+00	ND	1.1E+01	

NBSD Outfall at Paunack and Division Streets (O4W)													
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**	**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**	**µg/Kg**		**µg/Kg**		**µg/Kg**	
45	3.3E-05		3.5E-05		0.0E+00	ND	0	6.0E-02		0.0E+00	ND	2.2E+01	
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	5.6E-05		3.8E-05		1.5E-01		0	0.0E+00	ND	0.0E+00	ND	3.2E+00	
47	0.0E+00	ND	1.8E-05	J	0.0E+00	J	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
48	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
44	1.4E-05	J	8.5E-06	J	4.4E-02	J	0	0.0E+00	ND	2.1E+01		0.0E+00	ND
42	2.8E-06	J	0.0E+00	ND	2.4E-02	ND	0	2.0E-02	J	0.0E+00	ND	1.1E+00	J
37	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
71	9.3E-06	J	3.2E-05		0.0E+00	ND	0	0.0E+00	ND	4.6E+01		0.0E+00	ND
41	2.2E-05	J	2.6E-05	J	0.0E+00	ND	0	0.0E+00	ND	1.3E+01	J	0.0E+00	ND
103	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
40	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	1.8E-05	J	2.7E-05	J	0.0E+00	J	0	5.3E-02	J	6.2E+00	ND	0.0E+00	ND
70	2.4E-05	J	7.5E-05		0.0E+00	ND	0	4.8E-02		1.6E+01		0.0E+00	ND
66	3.0E-05		2.6E-05	J	3.0E-02	J	0	0.0E+00	ND	1.0E+01		0.0E+00	ND
95	5.3E-05		5.2E-05		1.0E-02		0	0.0E+00	ND	2.2E+00		0.0E+00	ND
93	5.3E-05		5.2E-05		1.0E-02		0	0.0E+00	ND	2.2E+00		0.0E+00	ND
56	5.6E-05		5.6E-05		1.2E-03		0	0.0E+00	ND	2.8E+00		0.0E+00	ND
60	5.7E-05		5.6E-05		7.3E-04		0	0.0E+00	ND	2.9E+00		0.0E+00	ND
92	1.0E-04		1.1E-04		0.0E+00	ND	0	3.7E-01		1.4E+02		0.0E+00	ND
84	3.1E-05		2.3E-05	J	7.6E-02	J	0	0.0E+00	ND	6.8E+00	J	8.5E-01	
101	9.2E-05		1.1E-04		0.0E+00	ND	0	0.0E+00	ND	1.5E+01		0.0E+00	ND
99	1.7E-04		1.4E-04		2.5E-01		0	0.0E+00	ND	1.5E+01		1.0E+01	

NBSD Outfall at Paunack and Division Streets (O4W)													
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)	Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg	µg/Kg		µg/Kg		µg/Kg	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	3.9E-05		4.2E-05		0.0E+00	ND	0	1.9E-01		0.0E+00	ND	2.3E+00	
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
136	5.4E-06	J	2.3E-06	J	2.6E-02	J	0	0.0E+00	ND	2.2E+00	J	1.1E+00	J
110	1.0E-04		9.4E-05		8.3E-02		0	0.0E+00	ND	2.7E+00		1.7E+01	
77	5.6E-05		7.5E-05		0.0E+00	ND	0	5.4E-02		4.2E+00		0.0E+00	ND
82	4.2E-05		4.0E-05		2.0E-02		0	0.0E+00	ND	0.0E+00	ND	5.2E+00	
151	2.1E-05	J	2.3E-05	J	0.0E+00	J	0	0.0E+00	ND	2.4E+00	J	8.5E-01	J
135	2.3E-06	J	0.0E+00	ND	2.0E-02	ND	0	1.0E-01	J	0.0E+00	ND	2.1E+00	J
144	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	4.1E-05		3.9E-05		1.2E-02		0	9.8E-02		0.0E+00	ND	2.6E+00	
118	3.3E-06	J	6.7E-06	J	0.0E+00	ND	0	3.2E-01		0.0E+00	ND	1.2E-01	J
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	5.2E-05		3.5E-05		1.5E-01		0	3.6E-01		0.0E+00	ND	3.4E+01	
153	7.3E-05		6.3E-05		7.9E-02		0	1.4E-01		0.0E+00	ND	0.0E+00	ND
132	2.9E-05		2.0E-05	J	7.6E-02	J	0	6.0E-02	J	0.0E+00	ND	1.7E+01	
105	2.0E-05	J	2.0E-05	J	0.0E+00	ND	0	5.6E-04	J	3.1E+00	J	0.0E+00	ND
141	1.8E-05	J	2.7E-05	J	0.0E+00	J	0	1.0E-01		0.0E+00	ND	0.0E+00	ND

NBSD Outfall at Paunack and Division Streets (O4W)													
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)	Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg	µg/Kg		µg/Kg		µg/Kg	
179	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
163	3.9E-05		2.5E-05	J	1.2E-01	J	0	0.0E+00	ND	1.5E+01	J	9.9E+00	
138	5.3E-05		4.1E-05		1.0E-01		0	0.0E+00	ND	2.8E+00		5.5E+00	
158	1.1E-04		6.9E-05		3.3E-01		0	2.4E-01		2.0E+01		3.1E+01	
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	7.6E-06	J	0.0E+00	ND	6.5E-02		0	0.0E+00	ND	0.0E+00	ND	6.9E+00	J
183	1.8E-05	J	8.2E-06	J	8.6E-02	J	0	1.1E-02	J	0.0E+00	J	1.0E+01	J
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	3.3E-04		0.0E+00	ND	2.8E+00		0	7.6E-02	J	0.0E+00	ND	3.0E+02	
177	5.1E-05		0.0E+00	ND	4.3E-01		0	0.0E+00	ND	0.0E+00	ND	4.6E+01	
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	1.5E-05	J	1.6E-05	J	0.0E+00	ND	0	1.6E-02	J	8.4E-01	J	0.0E+00	ND
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	0.0E+00	ND	1.2E-04		0.0E+00	ND	0	4.8E-01		2.1E+01		0.0E+00	ND
197	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
180	2.0E-05	J	1.5E-05	J	4.1E-02	J	0	8.3E-02		0.0E+00	ND	0.0E+00	ND
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	5.3E-05		2.2E-05	J	2.6E-01	J	0	0.0E+00	ND	2.8E+01		0.0E+00	ND
190	2.5E-05	J	1.1E-05	J	1.2E-01	J	0	0.0E+00	ND	1.3E+01	J	2.1E-01	J
198	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

NBSD Outfall at Paunack and Division Streets (O4W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
203	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
196	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
208	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	1.4E-05	J	1.5E-05	J	0.0E+00	J	0		1.1E-02	J	4.0E+00	J	0.0E+00	ND
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	1.8E-05	J	1.7E-05	J	3.7E-03	J	0		0.0E+00	ND	2.3E+00	J	0.0E+00	ND
209	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

Table B52. PCBs in bulk and particulate fractions of location C1W for stormwater event-II (January 31st to February 1st 2016).

Paleta Creek at Cummings Road (C1W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
1	8.4E-06	J	6.0E-06	J	2.0E-02	J	2.6E+00	J	0.0E+00	ND	1.4E-02	J	4.8E-01	J
2	1.4E-05	J	1.2E-05		1.9E-02		5.0E+00		0.0E+00	ND	3.2E-02	J	5.1E-01	J
3	1.9E-05		1.3E-05		5.7E-02		5.4E+00		2.4E-01		0.0E+00	ND	5.5E-01	
4	3.2E-05		3.7E-05		0.0E+00	ND	0.0E+00	ND	1.6E-01		0.0E+00	ND	8.6E-02	
10	6.2E-06	J	9.5E-06	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	9.7E-02	J
9	4.7E-06	J	5.5E-06	J	0.0E+00	ND	1.9E+00	J	0.0E+00	ND	2.7E-02	J	2.2E-01	J
7	2.3E-06	J	2.0E-06	J	2.7E-03	J	4.8E+00	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
6	7.7E-06	J	6.0E-06	J	1.5E-02	J	3.4E+00	J	0.0E+00	ND	1.2E-01	J	2.5E-01	J
8	3.6E-05		2.4E-05		1.0E-01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
5	1.6E-05		1.4E-05		2.3E-02		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
19	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
18	6.1E-05		8.8E-05		0.0E+00	ND	0.0E+00	ND	2.7E-01		1.1E+00		2.9E+00	
17	1.6E-05		1.5E-04		0.0E+00	ND	0.0E+00	ND	3.8E-01		3.5E+00		7.0E+00	
15	7.3E-05		2.1E-05		4.4E-01		3.1E+01		0.0E+00	ND	0.0E+00	ND	2.8E+00	
27	3.8E-06	J	7.0E-05		0.0E+00	ND	1.2E+01		0.0E+00	ND	1.4E+00		4.5E+00	J
24	1.9E-05		8.0E-05		0.0E+00	ND	1.8E+01		0.0E+00	ND	1.5E+00		5.0E+00	
32	2.3E-05		2.0E-05		2.1E-02		0.0E+00	ND	6.3E-02		0.0E+00	ND	0.0E+00	ND
16	2.2E-05		2.5E-05		0.0E+00	ND	4.3E-01		0.0E+00	ND	7.3E-02		9.6E-02	
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
25	1.4E-05	J	7.8E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	1.7E+00		3.8E+00	J
31	1.2E-04		2.6E-04		0.0E+00	ND	0.0E+00	ND	3.1E-01		3.9E+00		4.2E+00	
28	1.1E-04		4.4E-05		5.3E-01		3.3E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
20	8.5E-05		1.8E-04		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	3.1E+00		1.9E+00	
22	4.5E-05		7.5E-05		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	3.7E-01		1.9E+00	

Paleta Creek at Cummings Road (C1W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
45	2.3E-05		4.3E-05		0.0E+00	ND	0.0E+00	ND	2.2E-02		7.4E-01		4.7E-01	
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	2.4E-04		9.4E-05		1.2E+00		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
47	4.3E-05		9.8E-06	J	2.8E-01	J	1.8E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
48	4.5E-06	J	9.3E-07	J	3.0E-02	J	1.4E+01	J	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
44	1.7E-04		4.0E-05		1.1E+00		2.6E+00		4.5E-02		0.0E+00		0.0E+00	
42	4.4E-05		1.0E-06	J	3.6E-01	J	0.0E+00	ND	4.8E-02	J	0.0E+00	ND	0.0E+00	ND
37	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
71	4.8E-05		1.8E-05		2.6E-01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
41	2.0E-04		3.8E-05		1.3E+00		0.0E+00	ND	2.3E-01		0.0E+00	ND	0.0E+00	ND
103	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
40	4.0E-05		6.8E-06	J	2.8E-01	J	0.0E+00	ND	1.3E-01	J	0.0E+00	ND	0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	8.4E-05		3.1E-05		4.5E-01		8.6E+00		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
70	2.6E-04		6.3E-05		1.6E+00		4.9E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
66	1.7E-04		2.3E-05		1.2E+00		1.5E+01		2.2E-01		0.0E+00	ND	0.0E+00	ND
95	1.8E-04		7.0E-05		9.2E-01		1.8E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
93	1.8E-04		6.3E-05		9.7E-01		3.3E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
56	9.3E-05		4.9E-05		3.8E-01		3.4E+00		1.1E-01		0.0E+00	ND	0.0E+00	ND
60	9.3E-05		4.9E-05		3.8E-01		3.6E+00		1.1E-01		0.0E+00	ND	0.0E+00	ND
92	1.1E-04		4.5E-05		5.6E-01		2.4E+00		5.2E-02		0.0E+00	ND	5.5E-02	
84	1.1E-04		2.6E-05		7.3E-01		3.1E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
101	5.7E-04		1.3E-04		3.7E+00		5.8E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
99	2.3E-04		1.3E-04		8.7E-01		1.9E+01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

Paleta Creek at Cummings Road (C1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	3.9E-04		5.2E-05		2.8E+00		6.0E+01		3.0E-01		0.0E+00	ND	0.0E+00	ND
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
136	7.6E-05		1.3E-05		5.3E-01		3.0E+00	J	1.5E-01		0.0E+00	ND	0.0E+00	ND
110	8.4E-04		1.3E-04		6.1E+00		6.0E+01		1.4E+00		0.0E+00	ND	0.0E+00	ND
77	1.2E-04		1.9E-05		9.0E-01		2.6E+01		5.6E-02		0.0E+00	ND	0.0E+00	ND
82	1.1E-04		1.8E-05		7.4E-01		1.6E+01		2.7E-01		2.7E-01		0.0E+00	ND
151	1.4E-04		2.4E-05		9.7E-01		1.5E+01		1.8E-01		0.0E+00	ND	0.0E+00	ND
135	6.5E-05		9.9E-06	J	4.7E-01	J	0.0E+00	J	2.8E-01		0.0E+00	ND	0.0E+00	ND
144	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	5.8E-04		7.2E-05		4.3E+00		2.8E+01		1.3E+00		0.0E+00	ND	0.0E+00	ND
118	3.9E-04		2.3E-05		3.1E+00		2.1E+01		1.3E+00		0.0E+00	ND	0.0E+00	ND
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	1.1E-04		1.4E-05		8.4E-01		2.8E+00		2.5E-01		0.0E+00	ND	0.0E+00	ND
153	6.7E-04		6.1E-05		5.2E+00		2.2E+01		2.0E+00		0.0E+00	ND	0.0E+00	ND
132	2.8E-04		2.5E-05		2.1E+00		5.9E+00		7.8E-01		0.0E+00	ND	0.0E+00	ND
105	2.9E-04		2.4E-05		2.3E+00		2.6E+00		9.3E-01		0.0E+00	ND	0.0E+00	ND
141	1.9E-04		2.0E-05		1.4E+00		0.0E+00		7.2E-01		0.0E+00	ND	0.0E+00	ND

Paleta Creek at Cummings Road (C1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
179	4.8E-05		0.0E+00	ND	4.0E-01	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
163	5.1E-04		3.3E-05		4.0E+00		2.0E+00		1.8E+00		0.0E+00	ND	0.0E+00	ND
138	5.1E-04		3.9E-05		4.0E+00		5.3E+00		1.8E+00		0.0E+00	ND	0.0E+00	ND
158	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	2.7E+00	ND
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	2.0E-04		4.9E-06	J	1.7E+00	J	0.0E+00	J	8.6E-01		0.0E+00	ND	0.0E+00	ND
183	1.0E-04		9.1E-06	J	7.9E-01	J	1.2E+00	J	3.6E-01		0.0E+00	ND	0.0E+00	ND
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	1.9E-04		7.4E-06	J	1.5E+00	J	0.0E+00	ND	7.7E-01		0.0E+00	ND	0.0E+00	ND
177	1.1E-04		0.0E+00	ND	9.0E-01		0.0E+00	ND	4.9E-01		0.0E+00	ND	0.0E+00	ND
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	1.5E-04		0.0E+00	ND	1.2E+00		0.0E+00	ND	5.3E-01		0.0E+00	ND	0.0E+00	ND
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	3.5E-05		0.0E+00	ND	3.0E-01		0.0E+00	ND	2.4E-02	J	0.0E+00	ND	3.3E+00	
197	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
180	5.1E-04		1.8E-05		4.1E+00		4.6E+00		2.1E+00		0.0E+00	ND	0.0E+00	ND
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	3.2E-04		1.9E-05		2.5E+00		0.0E+00	ND	1.2E+00		0.0E+00	ND	0.0E+00	ND
190	7.4E-05		0.0E+00	ND	6.3E-01		0.0E+00	ND	2.8E-01		0.0E+00	ND	0.0E+00	ND
198	1.1E-04		6.0E-07	J	9.2E-01	J	0.0E+00	ND	5.3E-01		0.0E+00	ND	0.0E+00	ND

Paleta Creek at Cummings Road (C1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
203	6.2E-05		0.0E+00	ND	5.2E-01	ND	0.0E+00	ND	2.9E-01		0.0E+00	ND	0.0E+00	ND
196	6.1E-05		0.0E+00	ND	5.2E-01	ND	0.0E+00	ND	2.8E-01		0.0E+00	ND	0.0E+00	ND
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
208	1.3E-05		0.0E+00	ND	1.1E-01	ND	0.0E+00	ND	2.1E-02		0.0E+00	ND	0.0E+00	ND
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	1.5E-04		1.3E-05		1.1E+00		4.3E+00		6.0E-01		1.1E-01		0.0E+00	ND
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	8.0E-05		0.0E+00	ND	6.8E-01	ND	1.0E+01	J	3.5E-01		5.3E-02		0.0E+00	ND
209	3.2E-05		1.1E-06		2.6E-01		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

Table B53. PCBs in bulk and particulate fractions of location O2W for stormwater event-II (January 31st to February 1st 2016).

NBSD Outfall #33 (O2W)														
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**		**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
1	7.2E-06	J	4.8E-06	J	2.2E-02	J	0	ND	0.0E+00	ND	1.2E-01	J	0.0E+00	ND
2	1.2E-05	J	6.7E-06	J	4.6E-02	J	0	ND	0.0E+00	ND	2.8E-01	J	3.1E-01	J
3	1.3E-05	J	7.6E-06		4.6E-02		0	ND	0.0E+00	ND	4.3E-01		7.3E-02	
4	2.0E-05		6.8E-06		1.2E-01		0	ND	1.8E-01	J	6.2E-01		0.0E+00	ND
10	6.7E-07	J	0.0E+00	ND	6.2E-03	J	0	ND	4.2E-02	ND	4.0E-01	J	0.0E+00	ND
9	2.9E-06	J	2.0E-06	J	8.2E-03	J	0	ND	0.0E+00	ND	2.0E-01	J	0.0E+00	ND
7	1.7E-06	J	1.5E-06	J	2.1E-03	J	0	ND	0.0E+00	ND	6.0E-02	J	1.0E-02	J
6	4.8E-06	J	4.4E-06	J	3.1E-03	J	0	ND	2.8E-02	J	2.7E-01	J	0.0E+00	ND
8	7.7E-06	J	3.6E-06		3.8E-02		0	ND	1.8E-01	J	7.0E-01		0.0E+00	ND
5	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	9.2E-02	ND	4.6E-01		0.0E+00	ND
19	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
18	1.4E-05		1.2E-05		1.7E-02		0	ND	5.9E-01	J	0.0E+00	ND	0.0E+00	ND
17	1.9E-06	J	2.7E-06	J	0.0E+00	ND	0	ND	1.0E+00	ND	4.6E-01		0.0E+00	ND
15	3.6E-05		1.9E-05		1.5E-01		0	ND	0.0E+00	ND	1.5E+00		3.1E-01	
27	1.2E-05	J	9.5E-07	J	1.0E-01	J	0	ND	4.2E-01	J	3.0E-01		0.0E+00	ND
24	2.4E-05		8.8E-06		1.4E-01		0	ND	3.9E-01		6.9E-02		0.0E+00	ND
32	5.9E-06	J	2.3E-06	J	3.3E-02	J	0	ND	1.4E-01	J	9.3E-01		0.0E+00	ND
16	6.5E-06	J	2.4E-06	J	3.8E-02	J	0	ND	1.3E-01	J	3.9E-01		0.0E+00	ND
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
25	4.9E-06	J	1.8E-05	J	0.0E+00	ND	0	ND	2.6E-01	J	1.9E+00		0.0E+00	ND
31	4.0E-05		1.4E-05		2.4E-01		0	ND	5.6E-01		1.2E+01		0.0E+00	ND
28	2.5E-05		1.3E-05		1.1E-01		0	ND	3.7E-01	J	0.0E+00	ND	0.0E+00	ND
20	2.4E-05		8.1E-06		1.5E-01		0	ND	7.2E-01	J	8.9E+00		0.0E+00	ND

NBSD Outfall #33 (O2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
22	5.5E-06	J	1.1E-07	J	4.9E-02	J	0	ND	4.8E-01	ND	2.4E+00		0.0E+00	ND
45	1.1E-06	J	0.0E+00	ND	1.0E-02	J	0	ND	1.9E-01	J	1.1E+00		0.0E+00	ND
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	1.4E-04		5.0E-05		8.2E-01		0	ND	7.2E-01		8.5E-01		5.6E+00	
47	4.2E-05		9.2E-06		3.0E-01		0	ND	1.1E-01	J	2.1E+00		1.6E+00	
48	3.4E-05		0.0E+00	ND	3.2E-01	ND	0	ND	0.0E+00	ND	1.7E+00		3.0E+00	
44	6.9E-05		2.6E-05		4.0E-01		0	ND	3.4E-01		5.0E-02		3.9E+00	
42	1.8E-05		5.6E-06	J	1.2E-01	J	0	ND	7.7E-02	ND	0.0E+00	ND	2.9E+00	J
37	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
71	2.2E-05		6.3E-06		1.5E-01		0	ND	1.1E-01	J	1.5E+00		0.0E+00	ND
41	8.1E-05		1.3E-05		6.2E-01		0	ND	2.8E-01		0.0E+00	ND	6.8E+00	
103	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
40	1.6E-05		9.7E-06		5.8E-02		0	ND	1.0E-02	J	0.0E+00	ND	1.7E+00	J
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	4.5E-05		1.2E-05		3.1E-01		0	ND	1.6E-01		9.3E-01		1.4E+00	
70	1.3E-04		3.7E-05		8.4E-01		0	ND	6.3E-01		4.2E+00		8.6E-01	
66	1.0E-04		2.0E-05		7.5E-01		0	ND	4.0E-01	J	2.4E+00		5.0E+00	
95	1.1E-04		3.6E-05		7.1E-01		0	ND	7.6E-01		0.0E+00	ND	3.2E+00	
93	1.1E-04		3.6E-05		7.1E-01		0	ND	7.5E-01		0.0E+00	ND	3.2E+00	
56	3.1E-05		6.5E-06		2.2E-01		0	ND	3.3E-01	J	1.8E+00		0.0E+00	ND
60	3.1E-05		6.6E-06		2.3E-01		0	ND	3.1E-01	J	1.8E+00		0.0E+00	ND
92	6.4E-05		1.7E-05		4.4E-01		0	ND	3.6E-01		2.3E+00		0.0E+00	ND
84	5.9E-05		1.6E-05		3.9E-01		0	ND	1.9E-01	J	2.3E+00		1.1E+00	
101	3.9E-04		8.8E-05		2.8E+00		0	ND	1.2E+00		1.4E+01		1.1E+01	

NBSD Outfall #33 (O2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
99	2.0E-04		3.5E-05		1.6E+00		0	ND	1.1E+00		9.5E+00		0.0E+00	ND
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	1.9E-04		3.6E-05		1.4E+00		0	ND	7.9E-01		1.8E+00		1.0E+01	
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
136	3.8E-05		7.6E-06		2.8E-01		0	ND	1.7E-01	J	1.3E+00		4.2E-01	
110	4.6E-04		8.1E-05		3.5E+00		0	ND	1.9E+00		1.3E+01		1.5E+01	
77	4.8E-05		2.1E-05		2.5E-01		0	ND	1.2E-01		1.4E+00		0.0E+00	ND
82	4.5E-05		1.8E-05		2.4E-01		0	ND	2.0E-01		2.0E+00		0.0E+00	ND
151	8.0E-05		1.6E-05		5.9E-01		0	ND	2.2E-01		2.8E+00		2.5E+00	
135	3.0E-05		3.1E-06	J	2.4E-01	J	0	ND	0.0E+00	ND	7.3E-01		1.4E+00	
144	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	3.3E-04		4.7E-05		2.6E+00		0	ND	1.3E+00		1.0E+01		9.6E+00	
118	3.0E-04		3.2E-05		2.5E+00		0	ND	1.3E+00		5.8E+00		1.7E+01	
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	4.7E-05		1.0E-04		0.0E+00	ND	0	ND	3.1E-01	J	6.1E+00		0.0E+00	ND
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	7.2E-05		9.0E-06	J	5.8E-01	J	0	ND	2.4E-01	J	2.2E+00		2.9E+00	
153	4.7E-04		4.6E-05		3.9E+00		0	ND	1.6E+00		1.4E+01		2.3E+01	
132	1.2E-04		1.4E-05		9.4E-01		0	ND	4.2E-01		2.8E+00		5.6E+00	
105	1.8E-04		2.2E-05		1.4E+00		0	ND	5.6E-01		5.3E+00		8.7E+00	

NBSD Outfall #33 (O2W)

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
141	7.9E-05		1.3E-05		6.1E-01		0	ND	2.6E-01	J	2.6E+00		3.0E+00	
179	1.9E-05		0.0E+00	ND	1.8E-01		0	ND	0.0E+00	ND	9.8E-01		1.6E+00	J
163	2.6E-04		1.9E-05		2.2E+00		0	ND	9.5E-01		8.1E+00		1.1E+01	
138	2.6E-04		2.3E-05		2.2E+00		0	ND	9.1E-01		8.1E+00		1.1E+01	
158	2.8E-05		0.0E+00	ND	2.6E-01	ND	0	ND	7.7E-02	ND	8.0E-01	J	2.3E+00	
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	1.9E-04		7.8E-06		1.7E+00		0	ND	7.2E-01	J	5.6E+00		1.1E+01	
183	7.1E-05		5.2E-06		6.1E-01		0	ND	2.4E-01	J	2.2E+00		3.9E+00	
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	1.1E-04		6.3E-06		9.6E-01		0	ND	4.1E-01	J	3.3E+00		6.0E+00	
177	5.2E-05		0.0E+00	ND	4.8E-01	J	0	ND	2.3E-01	J	2.1E+00		1.2E+00	
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	8.9E-05		6.0E-06		7.6E-01		0	ND	0.0E+00	ND	2.4E+00		5.0E+00	
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	5.1E-05		1.3E-06		4.6E-01		0	ND	1.5E-01		0.0E+00		8.1E+00	J
197	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
180	3.2E-04		1.8E-05		2.8E+00		0	ND	1.3E+00		8.9E+00		1.6E+01	
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	1.5E-04		3.1E-06		1.4E+00		0	ND	7.3E-01	J	4.8E+00		5.6E+00	
190	2.5E-05		0.0E+00	ND	2.3E-01	J	0	ND	1.5E-01		1.6E-01		1.6E+00	

NBSD Outfall #33 (O2W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
198	1.4E-04		6.5E-06		1.3E+00		0	ND	5.6E-01	J	3.6E+00		8.1E+00	
203	8.9E-05		1.4E-06		8.1E-01		0	ND	3.2E-01		2.0E+00		6.2E+00	
196	8.8E-05		2.2E-06		8.0E-01		0	ND	3.2E-01		2.0E+00		6.2E+00	
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
208	2.6E-05		0.0E+00	ND	2.4E-01	ND	0	ND	9.1E-02	ND	6.0E-01		2.0E+00	
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	1.5E-04		1.2E-05		1.2E+00		0	ND	5.4E-01		4.4E+00		6.0E+00	
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	1.3E-04		5.6E-06		1.2E+00		0	ND	4.6E-01	J	3.5E+00		7.5E+00	
209	3.4E-05		2.9E-07		3.1E-01		0	ND	2.3E-01		1.4E+00		0.0E+00	ND

Table B54. PCBs in bulk and particulate fractions of location A1W for stormwater event-II (January 31st to February 1st 2016).

Ambient Receiving Water (A1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
1	6.8E-06	J	5.1E-06	J	5.2E-03	J	2.8E-02	J	0.0E+00	ND	0.0E+00	ND	1.5E-01	J
2	9.9E-06	J	8.5E-06	J	4.1E-03	J	5.8E-03	J	8.9E-03	J	0.0E+00	ND	0.0E+00	ND
3	1.3E-05		1.0E-05		9.3E-03		1.7E-03		8.6E-03		0.0E+00	ND	4.0E-01	
4	1.7E-05		1.1E-05		1.7E-02		2.4E-02		6.7E-03		4.6E-02		3.4E-01	
10	2.4E-06	J	1.3E-06	J	3.4E-03	J	1.1E-02	J	0.0E+00	ND	1.7E-01	J	0.0E+00	ND
9	2.7E-06	J	1.7E-06	J	3.0E-03	J	1.8E-02	J	4.1E-03	J	0.0E+00	ND	0.0E+00	ND
7	2.0E-06	J	1.2E-06	J	2.5E-03	J	1.7E-02	J	3.8E-03	J	0.0E+00	ND	0.0E+00	ND
6	7.5E-06	J	4.3E-06	J	9.9E-03	J	2.5E-02	J	6.2E-03	J	2.3E-01		0.0E+00	ND
8	3.0E-05		1.1E-05		5.7E-02		1.3E-01		1.6E-02		1.5E+00		0.0E+00	ND
5	1.4E-05		1.4E-06	J	3.8E-02	J	9.1E-02	J	5.6E-03	J	1.3E+00		0.0E+00	ND
19	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
18	3.6E-05		1.0E-05		7.8E-02		2.4E-01		1.5E-02		2.4E+00		0.0E+00	ND
17	8.6E-06	J	5.2E-07	J	2.5E-02	J	9.8E-02	J	0.0E+00	ND	1.1E+00		0.0E+00	ND
15	5.3E-05		1.8E-05		1.1E-01		1.8E-01		5.6E-02		7.6E-01		0.0E+00	ND
27	4.2E-06	J	2.5E-07	J	1.2E-02	J	5.3E-03	J	5.9E-03	J	7.0E-02	J	1.8E-01	J
24	1.6E-05		9.6E-06		2.0E-02		1.6E-02		1.3E-02		0.0E+00	ND	9.4E-01	
32	1.0E-05	J	1.9E-06	J	2.6E-02	J	4.8E-02	J	2.3E-02	J	5.5E-01		0.0E+00	ND
16	1.0E-05	J	1.7E-06	J	2.6E-02	J	6.0E-02	J	2.0E-02	J	5.3E-01		0.0E+00	ND
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
26	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
25	8.7E-06	J	7.3E-06	J	4.4E-03	J	0.0E+00	ND	0.0E+00	ND	6.4E-01		0.0E+00	ND
31	7.4E-05		2.2E-05		1.6E-01		8.7E-02		1.0E-01		2.0E+00		0.0E+00	ND
28	5.5E-05		1.4E-05		1.3E-01		7.9E-03		8.4E-02		1.9E+00		0.0E+00	ND
20	5.2E-05		1.0E-05		1.3E-01		1.3E-01		6.5E-02		1.6E+00		0.0E+00	ND
22	1.8E-05		1.5E-06	J	5.0E-02	J	3.4E-02	J	3.4E-02		1.0E+00		0.0E+00	ND

PCB	Ambient Receiving Water (A1W)													
	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
45	5.0E-06	J	2.9E-06	J	6.3E-03	J	0.0E+00	ND	8.2E-03	J	6.4E-01		0.0E+00	ND
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	1.2E-04		3.7E-05		2.6E-01		5.0E-01		2.6E-02		4.8E+00		0.0E+00	ND
47	2.4E-05		1.5E-06	J	6.9E-02	J	7.1E-02	J	2.1E-02	J	1.0E+00		0.0E+00	ND
48	2.9E-05		0.0E+00	ND	8.9E-02		0.0E+00	ND	0.0E+00	ND	3.0E-01	J	5.2E+00	
44	8.1E-05		1.3E-05		2.1E-01		3.6E-01		4.3E-02		2.8E+00		0.0E+00	ND
42	2.8E-05		5.2E-06	J	6.9E-02	J	0.0E+00	ND	2.8E-02	J	8.2E-01		7.1E-01	
37	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
71	2.4E-05		1.0E-06	J	7.0E-02	J	8.2E-02	J	3.3E-02		7.7E-01		0.0E+00	ND
41	9.3E-05		1.0E-05		2.5E-01		2.0E-01		5.8E-02		3.3E+00		0.0E+00	ND
103	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
40	2.3E-05		8.9E-06	J	4.3E-02	J	3.1E-02		2.1E-02		4.4E-01		0.0E+00	ND
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	5.3E-05		1.1E-05		1.3E-01		3.9E-02		5.0E-02		1.3E+00		5.4E-01	
70	1.3E-04		2.5E-05		3.1E-01		2.4E-01		1.2E-01		3.6E+00		0.0E+00	ND
66	8.7E-05		1.4E-05		2.2E-01		1.0E-01		9.1E-02		2.8E+00		0.0E+00	ND
95	1.1E-04		2.0E-05		2.7E-01		3.9E-01		1.3E-01		1.4E+00		1.9E+00	
93	1.1E-04		2.0E-05		2.7E-01		3.9E-01		1.3E-01		1.4E+00		1.9E+00	
56	4.1E-05		5.8E-06	J	1.1E-01	J	4.2E-02	J	3.5E-02		1.5E+00		0.0E+00	ND
60	4.1E-05		6.0E-06	J	1.1E-01	J	4.4E-02	J	3.5E-02		1.5E+00		0.0E+00	ND
92	4.3E-05		3.9E-05		9.9E-03		0.0E+00	ND	4.8E-02		1.3E+00		0.0E+00	ND
84	3.7E-05		1.1E-05		8.0E-02		8.9E-03		9.4E-02		1.9E+00		0.0E+00	ND
101	2.4E-04		6.4E-05		5.3E-01		2.8E-01		3.7E-01		7.3E+00		0.0E+00	ND
99	1.1E-04		2.6E-05		2.5E-01		4.4E-02		1.4E-01		3.6E+00		0.0E+00	ND

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	1.4E-04		2.8E-05		3.4E-01		1.4E-01		1.8E-01		6.5E+00		0.0E+00	ND
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
136	2.8E-05		4.2E-06	J	7.4E-02	J	3.9E-02	J	4.8E-02		1.2E+00		0.0E+00	ND
110	3.0E-04		5.7E-05		7.4E-01		2.3E-01		3.3E-01		1.3E+01		0.0E+00	ND
77	5.9E-05		1.6E-05		1.3E-01		9.6E-02		3.2E-02		9.0E-01		2.8E+00	
82	4.2E-05		5.8E-05		0.0E+00	ND	0.0E+00	ND	5.4E-02		1.5E+00		0.0E+00	ND
151	5.9E-05		1.6E-05		1.3E-01		0.0E+00	ND	7.1E-02		2.0E+00		0.0E+00	ND
135	2.7E-05		0.0E+00	ND	8.2E-02	ND	1.1E-01	J	2.7E-02		7.4E-01		0.0E+00	ND
144	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	2.2E-04		2.9E-05		5.8E-01		9.6E-02		2.5E-01		7.9E+00		0.0E+00	ND
118	1.4E-04		9.2E-06	J	4.0E-01	J	1.5E-01		1.2E-01		5.6E+00		0.0E+00	ND
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	1.0E-04		4.7E-05		1.7E-01		0.0E+00	ND	0.0E+00	ND	3.5E+00		4.1E+00	
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
146	4.1E-05		5.9E-06	J	1.1E-01	J	2.5E-02	J	3.3E-02		1.8E+00		0.0E+00	ND
153	2.4E-04		2.3E-05		6.6E-01		1.2E-01		2.2E-01		1.0E+01		0.0E+00	ND
132	8.8E-05		7.1E-06	J	2.5E-01	J	1.3E-01		7.8E-02		3.7E+00		0.0E+00	ND
105	1.1E-04		1.4E-05		3.0E-01		0.0E+00	ND	1.0E-01		4.3E+00		0.0E+00	ND
141	6.0E-05		9.3E-06	J	1.6E-01	J	1.3E-02	J	4.2E-02		2.3E+00		0.0E+00	ND

Ambient Receiving Water (A1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
179	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	2.0E-01	J	0.0E+00	ND
163	1.6E-04		1.0E-05		4.7E-01		0.0E+00	ND	1.5E-01		7.4E+00		0.0E+00	ND
138	1.7E-04		1.5E-05		4.7E-01		0.0E+00	ND	1.6E-01		7.1E+00		0.0E+00	ND
158	7.5E-06	J	0.0E+00	ND	2.3E-02		0.0E+00	ND	0.0E+00	ND	1.2E+00		0.0E+00	ND
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	7.2E-05		0.0E+00	ND	2.2E-01		0.0E+00	ND	7.5E-02		3.5E+00		0.0E+00	ND
183	3.8E-05		2.8E-06	J	1.1E-01	J	6.3E-03	J	3.1E-02	J	1.6E+00		0.0E+00	ND
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	6.3E-05		1.2E-05		1.5E-01		0.0E+00	ND	5.0E-02		3.3E+00		0.0E+00	ND
177	1.5E-05		1.2E-05		9.8E-03		0.0E+00	ND	0.0E+00	ND	2.5E+00		0.0E+00	
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	4.4E-05		4.3E-06	J	1.2E-01	J	1.7E-02	J	8.2E-03	J	2.0E+00		3.9E-02	
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	2.5E-05		3.0E-05		0.0E+00		0.0E+00		0.0E+00	ND	6.4E-01		2.9E+00	
197	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
180	1.8E-04		8.5E-06	J	5.3E-01	J	6.1E-03	J	1.5E-01		7.7E+00		0.0E+00	
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
170	1.0E-04		7.8E-06	J	2.9E-01	J	0.0E+00	ND	1.2E-01		4.6E+00		0.0E+00	ND
190	1.3E-05		0.0E+00	ND	3.9E-02		0.0E+00	ND	9.0E-03	J	6.7E-01		0.0E+00	
198	4.5E-05		0.0E+00	ND	1.4E-01		0.0E+00	ND	3.3E-02	J	2.2E+00		0.0E+00	ND

Ambient Receiving Water (A1W)														
PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
203	2.5E-05		0.0E+00	ND	7.7E-02		0.0E+00	ND	1.5E-02		1.1E+00		9.8E-02	
196	2.5E-05		0.0E+00	ND	7.5E-02		0.0E+00	ND	1.3E-02		1.1E+00		6.3E-02	
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
208	4.8E-06		0.0E+00	ND	1.5E-02		0.0E+00	ND	0.0E+00	ND	2.7E-01		0.0E+00	
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	1.2E-05	J	0.0E+00	ND	3.6E-02		7.3E-02	J	5.0E-02		2.2E+00		0.0E+00	ND
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	3.5E-05		4.9E-06	J	9.1E-02	J	4.1E-03	J	3.9E-02		9.3E-01		6.5E-01	
209	1.9E-05		0.0E+00	ND	5.6E-02		0.0E+00	ND	1.3E-02		7.0E-01		5.0E-01	

Table B55. PCBs in bulk and particulate fractions of location A2W for stormwater event-II (January 31st to February 1st 2016).

Ambient Receiving Water (A2W)

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)	Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg	µg/Kg		µg/Kg		µg/Kg	
1	7.5E-06	J	5.0E-06	J	2.2E-02	J	0	1.1E-02	J	1.8E-01	J	0.0E+00	
2	1.0E-05	J	7.5E-06	J	2.1E-02		0	0.0E+00	J	6.2E-01	J	0.0E+00	
3	1.3E-05		8.5E-06	J	3.9E-02		0	2.1E-02		9.6E-01		0.0E+00	
4	1.5E-05		1.3E-05		2.1E-02		0	8.3E-02		2.1E-01		0.0E+00	
10	2.6E-06	J	1.3E-06	J	1.1E-02	J	0	2.7E-02	J	0.0E+00	ND	0.0E+00	J
9	2.2E-06	J	1.8E-06	J	3.3E-03	J	0	4.1E-03	J	9.0E-02	J	0.0E+00	J
7	1.4E-06	J	1.3E-06	J	1.1E-03	J	0	2.7E-03	J	2.5E-01	J	0.0E+00	J
6	5.3E-06	J	5.3E-06	J	0.0E+00	ND	0	3.3E-02	J	0.0E+00	ND	0.0E+00	ND
8	1.5E-05		1.5E-05		0.0E+00	ND	0	1.5E-01		0.0E+00	ND	0.0E+00	
5	3.0E-06	J	5.4E-06	J	0.0E+00	ND	0	9.7E-02		0.0E+00	ND	0.0E+00	
19	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
18	1.8E-05		1.2E-05		4.7E-02		0	2.4E-01		0.0E+00	ND	0.0E+00	
17	3.0E-06	J	1.6E-06	J	1.2E-02	J	0	1.3E-01		0.0E+00	ND	0.0E+00	J
15	3.2E-05		5.5E-05		0.0E+00	ND	0	1.0E+01		0.0E+00	ND	0.0E+00	
27	5.1E-07	J	4.2E-07	J	8.2E-04	J	0	1.1E-01		0.0E+00	ND	0.0E+00	J
24	1.2E-05		9.0E-06		2.9E-02		0	1.3E-01		0.0E+00	ND	0.0E+00	
32	4.0E-06	J	3.0E-06	J	8.4E-03	J	0	8.6E-02		0.0E+00	ND	0.0E+00	J
16	3.6E-06	J	2.4E-06	J	1.0E-02	J	0	8.1E-02		0.0E+00	ND	0.0E+00	J
34	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
29	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	#DIV/0!	ND
26	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	#DIV/0!	ND
25	3.5E-06	J	4.4E-06	J	0.0E+00	ND	0	4.4E-02	J	0.0E+00	ND	0.0E+00	J
31	3.3E-05		2.0E-05		1.1E-01		0	3.7E-01		0.0E+00	ND	0.0E+00	
28	2.1E-05		1.1E-05		7.7E-02		0	2.6E-01		0.0E+00	ND	0.0E+00	
20	1.9E-05		1.1E-05		6.9E-02		0	2.5E-01		0.0E+00	ND	0.0E+00	
22	5.5E-06	J	3.2E-06	J	2.0E-02	J	0	1.6E-01		0.0E+00	ND	0.0E+00	J

Ambient Receiving Water (A2W)													
PCB	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-2.7 µm)**	**Solids fraction (2.7-20 µm)**		**Solids Fraction (20-63 µm)**		**Solids Fraction (> 63 µm)**	
	µg/L		**µg/L**		**µg/Kg**		**µg/Kg**	**µg/Kg**		**µg/Kg**		**µg/Kg**	
45	1.5E-06	J	0.0E+00	ND	1.3E-02	J	0	5.7E-02	J	0.0E+00	ND	0.0E+00	J
46	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
69	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
52	4.6E-05		4.4E-05		1.1E-02		0	4.5E-01		0.0E+00	ND	0.0E+00	
47	1.2E-05		4.7E-06	J	6.4E-02	J	0	1.2E-01		0.0E+00	ND	0.0E+00	
48	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	7.4E-02	J	0.0E+00	ND	0.0E+00	ND
44	3.5E-05		2.2E-05		1.1E-01		0	3.6E-01		0.0E+00	ND	0.0E+00	
42	4.5E-06	J	1.7E-07	J	3.7E-02	J	0	7.3E-02		0.0E+00	ND	0.0E+00	J
37	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
71	1.5E-05		6.2E-06	J	7.1E-02	J	0	1.2E-01		0.0E+00	ND	0.0E+00	
41	2.8E-05		1.2E-05		1.4E-01		0	2.9E-01		1.1E+00		0.0E+00	
103	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
40	1.6E-05		9.0E-06		6.0E-02		0	1.2E-01		0.0E+00	ND	0.0E+00	
67	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
74	2.0E-05		2.9E-05		0.0E+00	ND	0	2.3E-01		0.0E+00	ND	0.0E+00	
70	5.7E-05		2.6E-05		2.7E-01		0	5.3E-01		0.0E+00	ND	0.0E+00	
66	3.6E-05		1.4E-05		1.9E-01		0	3.9E-01		0.0E+00	ND	0.0E+00	
95	4.0E-05		2.1E-05		1.6E-01		0	3.7E-01		0.0E+00	ND	0.0E+00	
93	4.0E-05		2.1E-05		1.6E-01		0	3.7E-01		0.0E+00	ND	0.0E+00	
56	1.6E-05		4.4E-06	J	9.8E-02	J	0	1.7E-01		0.0E+00	ND	0.0E+00	
60	1.6E-05		4.6E-06	J	9.8E-02	J	0	1.7E-01		0.0E+00	ND	0.0E+00	
92	7.6E-05		1.5E-05		5.2E-01		0	2.4E-01		0.0E+00	ND	0.0E+00	
84	2.6E-05		8.6E-06	J	1.5E-01		0	3.3E-01		0.0E+00	ND	0.0E+00	
101	1.3E-04		5.8E-05		6.2E-01		0	1.5E+00		0.0E+00	ND	0.0E+00	
99	5.6E-05		2.2E-05		3.0E-01		0	5.9E-01		0.0E+00	ND	0.0E+00	

PCB	Ambient Receiving Water (A2W) Bulk water µg/L		Filtered Water (< 0.7 µm) µg/L		Total solids (>0.7µm) µg/Kg		Solids fraction (0.7-2.7 µm) µg/Kg	Solids fraction (2.7-20 µm) µg/Kg		Solids Fraction (20-63 µm) µg/Kg		Solids Fraction (> 63 µm) µg/Kg	
119	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
83	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
87	5.6E-05		2.6E-05		2.5E-01		0	9.6E-01		0.0E+00	ND	0.0E+00	
81	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
115	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
136	1.3E-05		5.4E-06	J	6.8E-02		0	1.7E-01		0.0E+00	ND	0.0E+00	
110	1.5E-04		4.8E-05		8.8E-01		0	1.8E+00		0.0E+00	ND	0.0E+00	
77	3.2E-05		1.9E-05		1.1E-01		0	2.2E-01		0.0E+00	ND	0.0E+00	
82	2.6E-05		4.7E-05		0.0E+00		0	2.0E-01		1.0E+00		0.0E+00	
151	3.0E-05		7.2E-06	J	2.0E-01		0	2.7E-01		0.0E+00	ND	0.0E+00	
135	3.0E-06	J	0.0E+00	ND	2.5E-02	J	0	1.0E-01		0.0E+00	ND	0.0E+00	J
144	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
147	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
107	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
123	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
149	1.0E-04		2.4E-05		6.6E-01		0	1.3E+00		0.0E+00	ND	0.0E+00	
118	5.0E-05		9.5E-06		3.5E-01		0	6.4E-01		0.0E+00	ND	0.0E+00	
134	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
114	2.3E-05		5.1E-05		0.0E+00	ND	0	2.0E-01		1.3E+00		0.0E+00	
131	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
146	1.1E-05	J	3.1E-06	J	7.0E-02	J	0	1.5E-01		3.6E-01		0.0E+00	J
153	1.2E-04		1.5E-05		8.9E-01		0	9.4E-01		1.5E+00		0.0E+00	
132	3.9E-05		7.6E-06	J	2.7E-01		0	3.5E-01		0.0E+00	ND	0.0E+00	
105	4.0E-05		1.3E-05		2.3E-01		0	3.8E-01		0.0E+00	ND	0.0E+00	
141	2.9E-05		8.2E-06	J	1.8E-01		0	2.6E-01		0.0E+00	ND	0.0E+00	

PCB	Ambient Receiving Water (A2W)												
	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)	Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg	µg/Kg		µg/Kg		µg/Kg	
179	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
163	7.4E-05		7.7E-06	J	5.7E-01		0	5.7E-01		5.9E-01		0.0E+00	
138	8.0E-05		1.2E-05		5.7E-01		0	5.9E-01		1.1E+00		0.0E+00	
158	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
178	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
126	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
187	3.2E-05		0.0E+00	ND	2.7E-01	J	0	2.3E-01		1.9E+00		0.0E+00	
183	1.6E-05		1.1E-06	J	1.3E-01	J	0	1.4E-01		9.1E-01		0.0E+00	
128	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
167	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
174	2.1E-05		0.0E+00	ND	1.8E-01	J	0	2.4E-01		6.6E-01		0.0E+00	
177	8.1E-06	J	0.0E+00	ND	6.9E-02	J	0	1.4E-01		0.0E+00	ND	0.0E+00	J
171	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
156	1.7E-05		3.9E-06	J	1.1E-01	J	0	1.4E-01		7.2E-01		0.0E+00	
157	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
173	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
172	3.4E-05		0.0E+00	ND	2.9E-01		0	4.6E-02	J	9.5E-02	J	0.0E+00	
197	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
180	7.0E-05		3.3E-06	J	5.7E-01		0	5.2E-01		5.2E+00		0.0E+00	
193	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
191	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
169	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0	0.0E+00	ND	0.0E+00	ND	0.0E+00	
170	4.1E-05		0.0E+00	J	3.5E-01	J	0	3.1E-01		3.6E+00		0.0E+00	
190	1.1E-05	J	0.0E+00	ND	9.3E-02		0	4.3E-02	J	0.0E+00	ND	0.0E+00	J
198	1.4E-05		0.0E+00	ND	1.2E-01		0	1.5E-01		5.5E-01		0.0E+00	

PCB	Bulk water		Filtered Water (< 0.7 µm)		Total solids (>0.7µm)		Solids fraction (0.7-2.7 µm)		Solids fraction (2.7-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	µg/L		µg/L		µg/Kg		µg/Kg		µg/Kg		µg/Kg		µg/Kg	
203	3.7E-06		0.0E+00	ND	3.2E-02		0		6.9E-02		8.0E-02		0.0E+00	
196	6.2E-06		0.0E+00	ND	5.3E-02		0		6.6E-02		4.0E-02		0.0E+00	
189	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
208	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
195	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
207	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
194	3.1E-05		2.1E-05		9.0E-02	J	0		1.7E-01		1.8E+00		0.0E+00	
205	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND
206	1.3E-05		4.5E-06	J	7.3E-02	J	0		5.8E-02		1.4E-01	J	0.0E+00	
209	0.0E+00	ND	0.0E+00	ND	0.0E+00	ND	0		0.0E+00	ND	0.0E+00	ND	0.0E+00	ND

Table title: **Ambient Receiving Water (A2W)**

The data set below represents the physio-chemical characterization of the sediment core and trap materials.

Table 56. Sediment normalized concentration of trace metals in the receiving water cores (0-0.4 cm sectioned and non-sectioned) collected in July 16th 2015 (dry weather).

Metals (mg/Kg-dry weight)	P11 (0-0.5cm)	P17 (0-0.5cm)	P11	P17	Reference
As	6.4-7.6	7.1-7.3	5.34±0.13	9.13±0.08	3.63±0.16
Cd	0.69-0.83	1.5	1.54±0.06	1.83±0.1	0.10±0.00
Pb	94.1-102.1	153.8-179.0	138.8±30.0	141.6±17.9	22.7±0.2
Zn	374.4-418.1	569.9-592.4	387.7±18.8	684.6±12.7	113.1±1.2
Cu	191.8-230.4	242.2-243.4	159.5-162.4	334.8±50.2	61.1±2.2
Ni	17.2-18.4	19.4-20.6	18.1±2.3	23.5±0.5	7.7±0.1
THg	0.64	0.49-0.50	0.71-0.72	0.79±0.25	0.29±0.01

Table B57. Sediment normalized concentration of PAHs (µg/Kg-dry weight), water, total organic carbon (TOC), and black carbon (BC) in the receiving water sediment cores collected in July 16th 2015 (dry weather).

Constituent (% or µg/Kg-dry weight)	P11 (0-0.5cm)	P17 (0-0.5cm)	P11	P17	Reference
Water (%)	59.8	63.8	47.0	63.5	37.5
TOC (%)	2.00±0.16	5.07±0.11	1.38±0.02	4.46±0.29	0.49±0.08
BC (%)	0.14±0.00	0.33±0.01	0.12±0.00	0.28±0.01	0.05±0.00
Napthalene	123.8	120.8	64.0	84.3	63.2
Fluorene	15.8	15.0	6.8	8.2	7.2
Acenapthene	U	U	U	U	U
Phenanthrene	93.9	143.8	39.6	65.6	22.9
Anthracene	18.0	19.5	13.2	10.9	1.6
Fluoranthene	228.3	289.0	126.0	119.8	19.3
Pyrene	376.9	399.9	298.9	210.1	28.1
Chrysene	160.3	152.0	138.8	75.6	6.7
Benzo[a]anthracene	140.3	121.5	108.4	60.3	5.4
Benzo[b]fluoranthene	537.4	353.6	295.5	224.8	19.4
Benzo[k]fluoranthene	226.4	147.3	152.2	91.8	7.1
Benzo[a]pyrene	409.2	252.9	245.0	155.9	16.0
Dibenzo[a,h]anthracene	63.2	45.6	42.6	25.0	3.9
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	298.9	273.8	188.5	158.5	24.8
Bifenthrin	-	-	2.2	5.8	ND
Cyfluthrin	-	-	ND	ND	ND
Cypermethrin	-	-	ND	0.8	ND
Deltamethrin/Tralomethrin	-	-	ND	ND	ND
Dichloran	-	-	ND	1.8	ND
Fenpropathrin (Danitol)	-	-	ND	ND	ND
Fenvalerate/ Esfenvalerate	-	-	ND	ND	ND
L-Cyhalothrin	-	-	ND	ND	ND
Pendimethalin	-	-	ND	ND	ND
Permethrin	-	-	3.9	37.6	0.8
Prallehrin	-	-	ND	ND	ND
Sumithrin (Phenothrin)	-	-	ND	ND	ND
Tefluthrin	-	-	ND	ND	ND

Table B58. Sediment normalized concentration of PCB congeners (µg/Kg-dry weight) in the receiving water cores collected in July 16th 2015 (dry weather).

PCB	P11	P17	Reference
1	0.04-0.05	0.04-0.05	0.02-0.02
2	0.06-0.07	0.06-0.08	0.02-0.02
3	0.02-0.03	0	0
4	0	0	0
10	0	0	0
9	0	0	0
7	0	0	0
6	0-0.12	0	0
8	0.11-0.46	0.15-0.4	0.02-0.03
5	0	0	0
19	0	0	0
18	0.45-3.02	0.57-2.99	0.05-0.07
17	0	0	0
15	0.24-0.75	0.27-0.68	0
27	0	0	0
24	0	0	0
32	0	0	0
16	0.13-0.6	0.19-0.6	0.02-0.03
34	0	0	0
29	0	0	0
26	0	0	0
25	0.04-0.53	0	0
31	0.29-2.37	0.42-4.63	0-0.04
28	0.82-3.66	0.94-3.43	0.06-0.09
20	0.53-2.8	0.56-2.78	0.04-0.06
22	0	0	0
45	0-0.75	0-0.5	0-0.42
46	0	0	0
69	0	0	0
52	1.74-12.76	2.42-12.16	0.11-0.17
47	0.73-3.03	0.99-2.86	0.1-0.12
48	0.21-1.67	0.2-1.32	0.01-0.02
44	1.09-8.21	1.26-7.99	0.02-0.06
42	0.42-2.59	0.5-2.53	0.02-0.04
37	0.58-2.54	0.69-2.67	0.1-0.15
71	0	0	0

PCB	P11	P17	Reference
41	1.29-9.35	1.54-9.03	0.06-0.09
103	0-0.33	0-0.14	0-0
40	0.22-1.73	0.23-1.6	0
67	0	0	0
74	0.69-5.96	0.89-5.41	0.02-0.02
70	1.81-14.84	2.07-13.76	0.05-0.18
66	2.02-12.06	2.3-10.17	0.17-0.19
95	1.35-5.71	1.8-6.48	0.08-0.1
93	1.55-6.63	2.02-6.52	0-0.18
56	0.57-4.8	0.63-4.5	0-0.03
60	0.63-4.83	0.75-4.48	0.02-0.05
92	0.69-3.31	0.92-3.4	0-0
84	2.43-10.63	3.14-10.3	0.17-0.17
101	2.41-10.53	3.12-10.21	0.18-0.18
99	2.76-12.33	3.48-11.04	0.32-0.39
119	0	0	0
83	0.86-6.93	0.87-8.85	0-0
87	1.88-9.43	2.24-20.93	0-0
81	0.16-0.34	0.18-0.44	0
115	0	0	0
136	0.54-2.18	0.6-2.24	0
110	5.37-21.38	6.97-20.7	0.26-0.33
77	0.41-2.08	0.5-1.63	0.02-0.03
82	0.65-2.94	0.88-2.96	0.0-0.02
151	1.26-4.07	1.66-3.91	0-0.03
135	0.41-1.59	0.43-1.28	0
144	0.44-1.4	0.62-1.41	0
147	0.17-17.41	0.12-0.45	0
107	0.22-1.85	0.27-1.73	0-0.07
123	0	0	0
149	5.55-16.96	7.18-15.49	0.56-0.58
118	0.62-4.27	0.85-5.44	0.06-0.75
134	0.4-1.02	0.34-0.96	0
114	0	0	0
131	0.09-0.18	0-0.16	0
146	1.04-2.49	1.42-2.45	0.08-0.11

PCB	P11	P17	Reference
153	6.67-16.61	9.27-17.69	1.01-1.12
132	1.56-4.06	2.35-4.73	0.06-0.08
105	1.66-6.08	2.31-7.04	0.1-0.14
141	1.19-3	1.55-3.49	0.09-0.11
179	0.6-1.64	0.85-1.84	0.1-0.11
163	0	0	0
138	7.49-17.44	10.34-18.41	0.75-0.78
158	0.57-1.5	0.83-1.63	0-0.02
178	0.34-1.07	0.39-0.92	0.02-0.02
126	0.21-0.47	0.23-0.5	0.02-0.04
187	2.3-6.21	3.28-6.96	0.38-0.44
183	0.78-2.36	1.04-2.61	0.04-0.04
128	0.55-1.48	0.94-1.49	0
167	0.53-1.31	0.81-1.36	0.02-0.03
174	1.46-3.17	2.31-2.33	0.21-0.23
177	0.82-2.38	1.07-2.54	0.07-0.11
171	0.62-1.4	0.97-1.16	0.13-0.18
156	0.76-2.23	1.03-1.71	0.14-0.14
157	0.08-0.3	0.08-0.26	0
173	0	0	0
172	0.27-0.74	0.34-0.85	0.01-0.08
197	0	0	0
180	3.88-10.49	5.53-11.49	0.34-0.38
193	0.18-0.39	0.29-0.5	0.02-0.03
191	0.17-0.24	0.33-0.41	0.04-0.06
169	0	0	0
170	1.93-4.64	2.97-4.89	0.24-0.28
190	0.31-0.98	0.45-1.03	0
198	1.03-3.51	1.53-3.69	0.02-0.13
203	0.5-1.67	0.73-1.75	0
196	0.46-1.66	0.64-1.75	0
189	0	0	0
208	0.12-2	0.67-1.01	0
195	0.26-0.82	0.32-0.93	0
207	0.19-0.51	0.27-0.5	0.08-0.08
194	0.71-2.45	1.24-2.82	0.13-0.17

PCB	P11	P17	Reference
205	0	0	0
206	0.6-5.8	2.3-3.4	0-0.04
209	0.61-10.69	3.4-6.66	0.05-0.11

Table B59. Particle size distribution and trace metal concentrations of sediment material retrieved from the receiving water traps that were deployment during the time period of July 15th 2015 to August 12th 2015.

Size in %/ Metals in mg/Kg-dry weight	P11	P17
Clay	37.1±4.3	22.6-23.8
Fine Silt	38.5±1.5	34.2-29.6
Coarse Silt	10.2±0.6	13.4-7.2
Sand	14.1±2.7	34.8-34.4
As	12.9±0.4	9.4±0.4
Cd	0.4-0.5	1.3±0.3
Pb	127.6±3.6	263.3±8.7
Zn	412.8±57.5	666±91.3
Cu	310.1±10.1	255.5±20.3
Ni	31.6±5.4	28.1±1.3
THg	0.7±0.1	28.9±1.3

Table B60. Sediment normalized concentration of PAHs (µg/Kg-dry weight), water, total organic carbon (TOC), and black carbon (BC) in the receiving water traps deployment during the time period of July 15th 2015 to August 12th 2015.

Constituent (% or µg/Kg-dry weight)	P11	P17
Water (%)	53.0	47.9
TOC (%)	3.5±0.1	6.3
BC (%)	0.13±0.02	0.20±0.10
Napthalene	156.4	135.5
Fluorene	U	U
Acenapthene	U	U
Phenanthrene	265.2	515.7
Anthracene	117.4	52.5
Fluoranthene	410.3	680.6
Pyrene	560.9	693.9
Chrysene	235.9	310.0
Benzo[a]anthracene	199.0	233.2
Benzo[b]fluoranthene	906.1	529.9
Benzo[k]fluoranthene	393.0	209.4
Benzo[a]pyrene	616.0	322.7
Dibenzo[a,h]anthracene	117.5	65.4
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	598.9	490.7
4,4'-DDE	2.6	ND
gamma-Chlordane	ND	ND
Allethrin	ND	ND
Bifenthrin	23.8	4.6
Cyfluthrin	6.0	1.7
Cypermethrin	19.7	1.3
Deltamethrin/Tralomethrin	ND	4.0
Dichloran	0.6	0.2
Fenpropathrin (Danitol)	ND	ND
Fenvalerate/ Esfenvalerate	1.5	0.4
L-Cyhalothrin	8.6	1.9
Pendimethalin	0.9	0.2
Permethrin	302.1	14.9
Prallehrin	ND	ND
Sumithrin (Phenothrin)	ND	ND
Tefluthrin	ND	ND

Table 61. Sediment normalized concentration of PCB congeners (µg/Kg-dry weight) in the receiving water traps deployed during the time period from July 15th 2015 to August 12th 2015.

PCB (µg/Kg-dry weight)	P11	P17
1	0.15	0.04
2	0.31	0.15
3	0.21	0.07
4	0.15	0.11
10	0.09	0.05
9	0.01	0.01
7	0.00	0.00
6	0.07	0.03
8	0.59	0.21
5	0.40	0.14
19	0.00	0.00
18	2.80	0.88
17	0.58	0.16
15	1.73	0.68
27	0.20	0.01
24	0.22	0.02
32	0.40	0.14
16	0.47	0.14
34	0.00	0.00
29	0.00	0.00
26	0.48	0.23
25	0.00	0.00
31	2.67	0.96
28	2.33	0.76
20	1.64	0.57
22	0.57	0.27
45	0.33	0.15
46	0.00	0.00
69	0.00	0.00
52	6.01	1.86
47	3.89	0.54
48	0.00	0.00
44	3.69	1.29
42	1.78	0.40
37	0.00	0.00
71	2.06	0.39
41	5.85	1.33
103	0.00	0.00

PCB (µg/Kg-dry weight)	P11	P17
40	0.71	0.25
67	0.00	0.00
74	0.00	0.00
70	2.73	0.77
66	7.54	1.50
95	5.97	3.33
93	6.00	3.34
56	2.57	0.72
60	2.57	0.72
92	3.85	1.90
84	2.93	1.92
101	22.52	8.88
99	14.81	3.79
119	1.14	0.21
83	2.06	3.21
87	11.42	6.42
81	0.49	0.37
115	5.68	3.18
136	2.69	1.48
110	24.70	14.57
77	2.13	1.33
82	2.19	1.44
151	6.46	2.39
135	2.38	1.12
144	2.35	1.10
147	1.13	0.41
107	2.79	0.89
123	1.80	0.53
149	25.99	11.55
118	14.48	6.27
134	0.88	0.52
114	2.94	1.16
131	0.00	0.00
146	4.66	1.88
153	27.89	11.23
132	5.47	4.49
105	6.78	3.74
141	3.71	2.89

PCB (µg/Kg-dry weight)	P11	P17
179	2.02	0.72
163	9.24	7.56
138	14.06	10.55
158	2.32	2.02
178	1.34	0.45
126	0.52	0.41
187	9.04	2.79
183	3.69	1.59
128	0.00	0.00
167	0.00	0.00
174	5.46	2.84
177	4.00	1.58
171	1.78	0.87
156	3.20	2.43
157	0.90	0.69
173	0.00	0.00
172	1.16	0.59
197	0.06	0.02
180	17.68	8.47
193	0.65	0.37
191	0.00	0.00
169	0.00	0.00
170	9.00	5.41
190	1.44	0.78
198	4.03	1.58
203	2.16	0.91
196	2.18	0.92
189	0.00	0.00
208	0.91	0.16
195	1.28	0.49
207	0.27	0.06
194	5.13	1.36
205	0.00	0.00
206	3.62	1.03
209	3.69	0.40

Table B62. Sediment normalized concentration of trace metals in the receiving water cores collected on October 19th 2015 (Pre-storm) and February 23rd 2016 (Post-storm).

Metals (mg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P08	Post-Storm P11	Post-Storm P17
As	8.10±0.20	9.26±0.40	8.26±0.10	8.74±0.36	10.83±0.20	9.61±0.72	8.39±0.04
Cd	0.46±0.01	0.24±0.03	1.55±0.07	1.56±0.05	0.19±0.00	4.63±0.24	1.53±0.03
Pb	52.06±1.52	76.53±2.15	158.81±7.63	143.21±20.85	82.01±3.29	431.01±27.88	157.78±19.37
Zn	271.97±14.26	315.69±13.83	491.94±17.56	611.81±70.94	328.02±11.10	939.69±91.81	681.23±19.82
Cu	207.46±10.04	237.70±5.67	244.00±7.67	268.89±29.83	257.33±9.81	253.76±17.63	245.87±14.72
Ni	16.09±0.62	16.86±0.21	18.35±0.53	17.80±0.92	18.78±0.22	26.97±1.08	19.51±0.84
THg	0.46±0.01	0.55±0.05	0.97±0.13	0.46±0.08	0.55±0.01	1.61±0.07	0.34±0.01

Table B63. Sediment normalized concentration of PAHs (µg/Kg-dry weight), water, total organic carbon (TOC), and black carbon (BC) in in the receiving water cores collected on October 19th 2015 (Pre-storm) and February 23rd 2016 (Post-storm).

Constituent (% or µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P08	Post-Storm P11	Post-Storm P17
% water content	38.1	44.2	44.4	45.2	46.5	51.9	40.3
% TOC solids	0.79±0.04	1.17±0.01	1.75±0.06	3.63±0.10	1.51±0.03	2.06±0.12	3.86±0.15
% BC solids	0.10±0.00	0.11±0.00	0.17±0.00	0.23±0.01	0.13±0.00	0.21±0.00	0.24±0.01
Napthalene	73.8	85.2	84.0	90.5	80.0	159.8	70.2
Fluorene	U	U	U	U	U	U	U
Acenapthene	U	U	U	U	U	U	U
Phenanthrene	66.8	79.7	80.7	143.8	73.8	156.6	306.1
Anthracene	45.3	25.0	52.3	59.1	24.0	U	U
Fluoranthene	58.8	87.9	221.1	240.2	83.0	1409.1	384.4
Pyrene	72.0	104.8	949.5	515.1	103.7	2713.3	538.4
Chrysene	63.4	64.5	81.9	147.3	68.0	437.4	558.6
Benzo[a]anthracene	53.2	45.7	155.4	138.1	46.9	699.5	262.6
Benzo[b]fluoranthene	568.8	340.4	813.8	596.6	263.2	1599.6	702.5
Benzo[k]fluoranthene	261.5	140.9	332.6	219.4	107.4	624.8	350.3
Benzo[a]pyrene	397.0	241.7	519.2	384.7	188.2	914.2	591.2
Dibenzo[a,h]anthracene	59.8	35.4	61.7	41.8	22.8	88.3	274.7
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	240.9	207.9	416.6	353.6	158.4	705.8	601.4
Bifenthrin	5.9	8.8	42.4	71.6	4.9	7.4	79.0
Cyfluthrin	ND	ND	ND	17.5	ND	ND	14.3
Cypermethrin	ND	ND	3.2	15.2	ND	ND	39.2
Deltamethrin/Tralomet hrin	ND	ND	ND	ND	ND	ND	ND
Dichloran	ND	1.6	ND	2.6	ND	ND	1.3
Fenpropathrin (Danitol)	ND	ND	ND	ND	ND	ND	ND
Fenvalerate/ Esfenvalerate	ND	ND	ND	ND	ND	ND	6.3
L-Cyhalothrin	ND	ND	ND	ND	ND	ND	28.4
Pendimethalin	ND	ND	ND	5.9	1.3	2.3	2.7
Permethrin	0.0	7.4	23.8	115.4	44.5	154.8	188.3
Prallehrin	ND	ND	ND	ND	ND	ND	ND
Sumithrin (Phenothrin)	ND	ND	ND	ND	ND	ND	ND
Tefluthrin	ND	ND	ND	ND	ND	ND	ND

Table B64. Sediment normalized concentration of PCB congeners (µg/Kg-dry weight) in the receiving water cores collected on October 19th 2015 (Pre-storm) and February 23rd 2016 (Post-storm).

PCBs (µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P08	Post-Storm P11	Post-Storm P17
1	0.07	0.07	0.07	0.08	0.07	0.12	0.08
2	0.19	0.20	0.23	0.26	0.24	0.25	0.26
3	0.09	0.10	0.13	0.14	0.13	0.18	0.16
4	0.09	0.10	0.38	0.19	0.11	0.82	0.21
10	0.05	0.05	0.26	0.08	0.06	0.58	0.07
9	0.01	0.00	0.04	0.03	0.00	0.13	0.02
7	0.00	0.00	0.03	0.01	0.00	0.09	0.01
6	0.03	0.03	0.34	0.07	0.02	0.83	0.09
8	0.24	0.18	0.94	0.44	0.17	2.79	0.53
5	0.17	0.12	0.70	0.30	0.11	2.20	0.36
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	2.38	1.92	6.35	3.22	2.09	9.15	1.22
17	0.06	0.08	1.24	0.42	0.14	3.58	0.40
15	0.68	0.69	4.01	1.42	0.74	6.21	1.31
27	0.05	0.07	1.33	0.25	0.03	0.62	0.12
24	0.21	0.09	0.35	0.20	0.05	3.62	0.14
32	0.08	0.14	1.33	0.31	0.09	2.69	0.40
16	0.09	0.15	1.36	0.32	0.16	2.96	0.41
34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.21	0.17	1.36	0.38	0.34	2.91	0.39
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.85	0.82	10.53	2.45	0.97	23.81	2.71
28	0.63	0.63	6.96	2.05	0.86	15.43	2.05
20	0.64	0.57	5.02	1.36	0.66	14.99	1.62
22	0.29	0.14	2.74	0.66	0.20	6.45	0.89
45	0.05	0.05	1.67	0.29	0.02	4.18	0.46
46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
52	1.74	1.38	19.10	4.46	1.44	50.08	3.83
47	0.79	0.94	6.91	2.00	1.08	16.28	1.68
48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
44	0.76	0.68	15.80	2.82	0.74	39.22	3.00
42	0.36	0.23	6.82	0.91	0.22	16.41	1.34
37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
71	0.58	0.55	5.05	1.19	0.38	12.00	1.32
41	1.45	0.94	17.62	3.93	0.69	44.32	4.65
103	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PCBs (µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P08	Post-Storm P11	Post-Storm P17
40	0.22	0.20	2.89	0.61	0.25	6.48	0.60
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	0.49	0.52	12.67	2.02	0.61	30.86	2.14
66	1.94	1.85	24.04	4.45	1.78	52.91	4.23
95	1.60	1.07	9.99	3.37	1.16	28.78	4.18
93	1.63	1.11	9.43	3.36	1.20	28.71	4.20
56	0.47	0.46	12.66	1.95	0.51	30.90	2.10
60	0.47	0.45	12.66	1.94	0.50	30.91	2.10
92	1.04	0.72	6.36	1.97	0.78	13.67	2.26
84	0.87	0.57	7.11	1.74	0.54	15.52	1.99
101	6.82	4.54	36.09	11.32	5.18	72.45	11.80
99	4.08	3.42	21.57	6.30	3.70	42.80	5.89
119	0.35	0.27	1.51	0.41	0.28	2.57	0.37
83	1.52	0.57	8.06	1.48	0.76	19.09	1.95
87	1.40	0.98	11.28	6.35	2.19	47.51	7.40
81	0.25	0.23	1.29	0.55	0.74	2.63	0.53
115	1.27	0.74	11.77	2.96	0.89	23.65	3.65
136	0.88	0.51	3.45	1.39	0.53	6.65	1.53
110	6.17	4.48	42.95	13.69	4.80	90.46	15.89
77	0.69	0.68	6.41	1.51	0.79	11.51	1.57
82	0.70	0.39	6.34	2.06	0.63	13.57	1.99
151	2.01	1.32	6.60	3.14	1.44	12.91	3.25
135	0.85	0.69	2.41	1.20	0.60	4.75	1.32
144	0.83	0.53	2.38	1.11	0.54	4.73	1.30
147	0.47	0.34	1.02	0.44	0.38	1.59	0.47
107	0.65	0.62	3.27	1.39	0.66	7.23	1.38
123	0.51	0.26	1.53	0.65	0.43	2.66	0.62
149	8.04	5.14	26.31	12.39	5.71	50.18	12.84
118	2.79	2.77	23.52	6.92	3.08	48.33	7.01
134	0.20	0.13	0.73	0.85	0.07	2.19	0.56
114	2.31	2.02	9.19	3.48	2.02	21.18	2.99
131	0.00	0.00	0.00	0.00	0.00	0.00	0.00
146	1.35	0.96	3.76	1.73	1.10	7.20	1.86
153	8.44	6.27	24.26	11.41	6.85	46.45	11.18
132	1.54	0.77	6.63	2.94	0.90	13.19	3.46
105	1.52	1.07	13.39	3.87	1.23	30.48	4.37
141	1.01	0.52	4.83	2.21	0.61	10.02	2.45

PCBs (μg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P08	Post-Storm P11	Post-Storm P17
179	0.72	0.48	2.18	0.90	0.50	4.35	0.91
163	3.65	3.63	9.79	6.13	3.13	18.30	4.64
138	3.64	3.12	12.62	6.41	3.01	30.10	7.92
158	0.57	0.34	2.56	1.14	0.38	5.28	1.48
178	0.44	0.36	1.27	0.62	0.38	2.34	0.57
126	0.06	0.10	0.52	0.09	0.00	1.30	0.31
187	3.09	2.49	8.28	4.00	2.57	15.15	3.45
183	1.25	0.82	3.94	1.89	0.89	7.51	1.63
128	0.00	0.00	0.00	0.00	0.00	0.00	0.00
167	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174	1.76	1.17	6.31	2.98	1.14	12.75	2.85
177	1.30	0.99	3.69	1.83	1.06	7.07	1.76
171	0.70	0.40	1.71	0.99	0.58	3.08	0.88
156	0.82	0.61	3.41	1.67	0.65	7.04	1.87
157	0.28	0.24	0.77	0.48	0.34	1.32	0.54
173	0.00	0.00	0.00	0.00	0.00	0.00	0.00
172	0.17	0.00	1.03	0.29	0.00	2.18	0.43
197	0.00	0.00	0.06	0.00	0.00	0.21	0.00
180	5.57	3.16	19.62	8.35	2.95	39.11	8.26
193	0.34	0.20	0.83	0.46	0.27	1.43	0.40
191	0.00	0.00	0.00	0.00	0.00	0.00	0.00
169	0.00	0.00	0.00	0.00	0.00	0.00	0.00
170	2.84	1.96	8.83	4.55	2.03	16.66	4.17
190	0.57	0.27	1.17	0.70	0.36	2.65	0.84
198	1.56	1.20	4.85	1.83	1.16	9.02	1.77
203	0.79	0.56	2.70	1.00	0.58	5.05	1.03
196	0.79	0.57	2.71	1.01	0.59	5.06	1.04
189	0.00	0.00	0.00	0.00	0.00	0.00	0.00
208	0.35	0.36	1.72	0.26	0.30	2.32	0.26
195	0.16	0.27	1.34	0.41	0.25	3.09	0.52
207	0.06	0.05	0.33	0.04	0.02	0.67	0.06
194	1.07	1.66	5.28	2.52	1.66	10.09	2.39
205	0.00	0.00	0.00	0.00	0.00	0.00	0.00
206	1.32	1.31	6.09	1.45	1.19	8.86	1.37
209	1.31	1.65	8.17	1.06	1.43	10.90	0.00

Table B65. Particle size distribution and trace metal concentrations of sediment material retrieved from the receiving water traps that were deployment during the time period of October 19th 2015 (Pre-storm) and February 22nd 2016 (Post-storm).

Metals (mg/Kg-dry Weight)	P01	P08	P11	P17
Clay	15.2	18.2	12.4	12.9
Fine Silt	71.8	63.7	70.8	31.2
Coarse Silt	6.1	8.5	6.7	9.5
Sand	6.9	9.7	10.2	46.3
As	13.1 ± 0	12.5 ± 0.3	12.5 ± 0.2	7.1 ± 0.4
Cd	ND	0.31 ± 0.10	0.51 ± 0.10	1.2 ± 0.0
Pb	78.5 ± 5	85.7 ± 3	105 ± 3	126 ± 3
Zn	446 ± 91	407 ± 37	450 ± 47	562 ± 7
Cu	306 ± 30.5	300 ± 12.5	316 ± 34.1	212 ± 11.2
Ni	26.2 ± 1.3	28.2 ± 0.9	29.1 ± 0.6	23.2 ± 1.23
THg	0.60 ± 0.01	0.63 ± 0.05	0.58 ± 0.04	0.35 ± 0.20

Table B66. Sediment normalized concentration of PAHs (µg/Kg-dry weight), water, total organic carbon (TOC), and black carbon (BC) in the receiving water traps deployment during the time period of October 19th 2015 (Pre-storm) and February 22nd 2016 (Post-storm).

Constituent (% or µg/Kg-dry weight)	P01	P08	P11	P17
% water content	65.9	60.4	61.8	48.6
% TOC solids	2.4±0.0	2.4±0.2	3.1±0.2	4.5±0.3
% BC solids	0.16±0.00	0.15±0.02	0.19±0.02	0.41±0.02
Napthalene	19.0	13.1	27.3	23.6
Fluorene	U	U	U	22.3
Acenapthene	U	U	2.4	13.5
Phenanthrene	41.2	41.2	91.2	233.4
Anthracene	34.1	23.9	50.1	56.7
Fluoranthene	86.2	76.3	194.1	389.8
Pyrene	102.6	102.6	241.3	392.6
Chrysene	72.7	65.2	206.4	159.3
Benzo[a]anthracene	57.8	52.8	96.5	124.7
Benzo[b]fluoranthene	198.7	215.5	464.9	220.5
Benzo[k]fluoranthene	92.1	101.8	198.0	96.8
Benzo[a]pyrene	164.0	170.1	309.9	148.3
Dibenzo[a,h]anthracene	32.0	36.1	71.3	20.8
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	156.5	160.2	298.7	225.5
4,4'-DDE	ND	2.1	ND	ND
gamma-Chlordane	ND	ND	ND	2.1
Allethrin	ND	ND	ND	ND
Bifenthrin	2.4	5.0	14.4	25.0
Cyfluthrin	3.9	4.5	11.2	21.7
Cypermethrin	0.9	2.2	9.1	16.4
Deltamethrin/Tralomethrin	ND	ND	ND	9.2
Dichloran	0.1	0.2	0.3	0.6
Fenpropathrin (Danitol)	ND	ND	ND	ND
Fenvalerate/ Esfenvalerate	ND	0.5	1.9	2.9
L-Cyhalothrin	2.1	3.0	7.5	10.1
Pendimethalin	ND	0.5	1.1	2.3
Permethrin	14.8	18.4	32.5	52.6
Prallehrin	ND	ND	ND	ND
Sumithrin (Phenothrin)	ND	ND	ND	ND
Tefluthrin	ND	ND	ND	ND

Table B67. Sediment normalized concentration of PCB congeners (µg/Kg-dry weight) in the receiving water traps deployed during the time period of October 19th 2015 (Pre-storm) and February 22nd 2016 (Post-storm).

PCB (µg/Kg-dry weight)	P01	P08	P11	P17
1	0.02	0.03	0.02	0.02
2	0.05	0.04	0.04	0.07
3	0.04	0.03	0.03	0.06
4	0.02	0.04	0.04	0.09
10	0.01	0.02	0.02	0.04
9	0.01	0.01	0.01	0.01
7	0.00	0.01	0.01	0.01
6	0.02	0.03	0.02	0.06
8	0.12	0.17	0.16	0.34
5	0.09	0.12	0.11	0.23
19	0.00	0.00	0.00	0.00
18	0.26	0.43	0.52	0.74
17	0.06	0.09	0.22	0.33
15	0.27	0.31	0.43	0.75
27	0.02	0.09	0.04	0.04
24	0.02	0.09	0.05	0.04
32	0.06	0.12	0.12	0.21
16	0.08	0.12	0.14	0.24
34	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00
26	0.06	0.07	0.19	0.26
25	0.00	0.00	0.00	0.00
31	0.28	0.45	0.80	1.42
28	0.37	0.48	0.78	1.22
20	0.29	0.27	0.40	0.76
22	0.12	0.09	0.19	0.43
45	0.04	0.06	0.11	0.25
46	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00
52	1.00	1.49	2.04	2.10
47	0.88	0.98	1.45	0.80
48	0.00	0.00	0.00	0.00
44	0.43	0.69	1.10	1.55
42	0.23	0.31	0.41	0.53
37	0.00	0.00	0.00	0.00
71	0.27	0.33	0.46	0.54
41	0.80	0.94	1.25	1.28
103	0.00	0.00	0.00	0.00
40	0.09	0.13	0.20	0.28
67	0.00	0.00	0.00	0.00
74	0.00	0.00	0.00	0.00
70	0.34	0.51	0.91	0.99
66	1.47	1.65	2.59	2.01

PCB (µg/Kg-dry weight)	P01	P08	P11	P17
95	0.92	1.32	1.90	2.18
93	0.92	1.32	1.90	2.17
56	0.33	0.50	0.91	0.97
60	0.33	0.50	0.91	0.97
92	0.62	0.86	1.13	1.14
84	0.40	0.68	0.92	1.15
101	4.26	5.43	6.60	5.85
99	3.36	4.04	4.59	2.97
119	0.23	0.26	0.35	0.17
83	0.27	0.24	0.92	0.39
87	1.43	2.24	3.12	4.09
81	0.08	0.14	0.17	0.21
115	0.71	1.11	1.55	2.03
136	0.51	0.61	0.83	0.89
110	3.59	5.20	7.00	8.79
77	0.34	0.41	0.62	0.84
82	0.31	0.35	0.65	0.99
151	1.23	1.32	1.78	1.62
135	0.44	0.48	0.63	0.65
144	0.44	0.48	0.63	0.65
147	0.31	0.35	0.37	0.22
107	0.51	0.60	0.72	0.56
123	0.28	0.27	0.37	0.29
149	5.01	5.72	7.23	6.80
118	2.97	3.76	4.74	3.58
134	0.16	0.20	0.27	0.22
114	1.82	1.76	2.18	1.37
131	0.00	0.00	0.00	0.00
146	1.09	1.21	1.46	0.97
153	6.48	7.14	8.45	5.84
132	0.84	1.10	1.55	1.88
105	1.08	1.56	2.19	2.16
141	0.55	0.76	1.07	1.35
179	0.50	0.53	0.65	0.45
163	2.93	2.89	3.06	3.13
138	3.40	4.09	5.47	4.78
158	0.36	0.46	0.64	0.83
178	0.39	0.38	0.45	0.29
126	0.13	0.16	0.17	0.19
187	2.46	2.61	3.16	1.82
183	0.80	0.88	1.10	0.86
128	0.00	0.00	0.00	0.00
167	0.00	0.00	0.00	0.00

PCB (µg/Kg-dry weight)	P01	P08	P11	P17
174	1.05	1.22	1.59	1.52
177	1.06	1.09	1.28	0.90
171	0.34	0.38	0.48	0.80
156	0.55	0.69	0.93	0.98
157	0.15	0.19	0.23	0.25
173	0.00	0.00	0.00	0.00
172	0.20	0.26	0.35	0.32
197	0.04	0.04	0.05	0.02
180	3.62	4.49	5.62	4.63
193	0.21	0.21	0.26	0.23
191	0.00	0.00	0.00	0.00
169	0.00	0.00	0.00	0.00
170	1.85	2.11	2.68	2.38
190	0.34	0.34	0.46	0.35
198	1.03	1.14	1.39	0.91
203	0.52	0.61	0.74	0.51
196	0.52	0.61	0.74	0.52
189	0.00	0.00	0.00	0.00
208	0.25	0.33	0.37	0.13
195	0.31	0.38	0.44	0.34
207	0.09	0.11	0.12	0.05
194	1.22	1.35	1.64	1.09
205	0.00	0.00	0.00	0.00
206	0.92	1.20	1.40	0.59
209	1.05	1.27	1.41	0.35

Table B68. Sediment normalized concentration of trace metals in the receiving water cores collected on September 8th 2016 (Pre-storm) and March 9th 2017 (Post-storm).

Metals (mg/Kg-dry Weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P01	Post-Storm P08	Post-Storm P11	Post-Storm P17
As	8.4 ± 0.287	8.91 ± 0.265	11.5 ± 3.5249	7.53 ± 0.137	4.92 ± 0.578	12.3 ± 1.4589	8.15 ± 0.138	8.13 ± 0.308
Cd	ND	ND	ND	1.36 ± 0.132	0.0851 ± 0.01	0.242 ± 0.02	0.396 ± 0.03	1.36 ± 0.275
Pb	42.8 ± 1.86	80.1 ± 27.23	80.3 ± 2.08	107 ± 4.23	27.6 ± 1.34	87.2 ± 2.15	83.7 ± 0.45	110 ± 4.91
Zn	197 ± 13.07	247 ± 11.97	310 ± 16.57	425 ± 5.44	145 ± 11.49	350 ± 10.19	309 ± 11.23	497 ± 61.26
Cu	153 ± 8.49	188 ± 9.11	235 ± 13.6	178 ± 4.48	108 ± 8.84	260 ± 5.05	221 ± 12.5	185 ± 17
Ni	14.7 ± 0.8	16.4 ± 1.11	17.5 ± 1.35	14.4 ± 0.4	11.4 ± 0.8	22.4 ± 0.5	18.6 ± 0.5	18.6 ± 1.77
THg	0.39 ± 0.01	0.54 ± 0.03	0.51 ± 0.04	0.44 ± 0.05	0.258 ± 0.04	0.566 ± 0.02	0.52 ± 0.08	0.373 ± 0.05

Table B69. Sediment PAHs (µg/Kg-dry weight), water, total organic carbon (TOC), and black carbon (BC) in in the cores collected on September 8th 2016 (Pre-storm) and March 9th 2017 (Post-storm).

Constituent (% or µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre-Storm P17	Post-Storm P01	Post-Storm P08	Post-Storm P11	Post-Storm P17
% water content	43.5	47.0	48.1	50.0	34.2	50.6	50.0	54.4
% TOC solids	0.98± 0.12	1.25± 0.03	1.93± 0.04	3.94± 0.17	0.72± 0.03	1.96± 0.02	1.87± 0.04	5.16± 0.06
% BC solids	0.10± 0.00	0.12± 0.00	0.15± 0.00	0.24± 0.01	0.07± 0.00	0.17± 0.00	0.13± 0.00	0.27± 0.02
Napthalene	11.1	12.8	15.9	17.1	58.2	82.4	125.6	163.6
Fluorene	U	U	U	U	7.2	14.9	14.8	20.5
Acenapthene	U	U	U	8.0	U	U	U	U
Phenanthrene	18.9	29.3	34.0	98.7	30.5	67.1	107.6	208.7
Anthracene	6.7	22.8	11.3	42.7	7.4	22.8	24.7	36.3
Fluoranthene	44.1	86.6	100.0	345.8	41.3	156.1	216.5	497.7
Pyrene	45.9	97.1	128.7	404.8	54.9	233.1	293.5	605.7
Chrysene	31.5	64.8	72.1	134.7	33.0	118.0	137.3	206.9
Benzo[a]anthracene	23.0	58.2	54.8	139.9	22.6	106.1	93.7	192.0
Benzo[b]fluoranthene	83.7	189.6	248.8	311.6	117.2	376.4	411.4	436.4
Benzo[k]fluoranthene	41.8	97.5	117.8	144.1	54.5	166.1	173.7	179.3
Benzo[a]pyrene	72.6	170.3	197.5	240.9	101.7	295.4	276.7	314.0
Dibenzo[a,h]anthracene	14.6	35.1	35.5	33.6	20.6	54.7	53.8	55.7
Benzo[ghi]perylene+	70.9	143.8	174.9	260.5	86.3	246.1	258.8	323.7
Bifenthrin	5.8	9.6	7.7	ND	2.1	23.1	29.3	80.9
Cyfluthrin	ND	1.8	2.9	ND	0.0	5.9	8.3	28.5
Cypermethrin	0.7	1.6	2.3	ND	0.0	4.1	8.5	56.2
Deltamethrin/	ND	ND	6.9	ND	ND	ND	ND	ND
Dichloran	ND	ND	0.2	ND	0.5	0.6	0.9	2.2
Fenpropathrin (Danitol)	ND	ND	ND	ND	ND	ND	ND	ND
Fenvalerate/	0.6	0.7	0.6	ND	ND	ND	2.4	7.9
L-Cyhalothrin	ND	ND	3.3	ND	ND	9.8	9.6	26.1
Pendimethalin	ND	0.5	0.4	ND	ND	ND	ND	3.8
Permethrin	1.6	6.0	25.6	ND	1.4	19.1	37.8	140.1
Prallehrin	ND	ND	ND	ND	ND	ND	ND	ND
Sumithrin (Phenothrin)	ND	ND	ND	ND	ND	ND	ND	ND
Tefluthrin	ND	ND	ND	ND	ND	ND	ND	ND

Table B70. Sediment normalized concentration of PCB congeners (µg/Kg-dry weight) in the receiving water cores collected on September 8th 2016 (Pre-storm). No PCB data is available on the post-storm sediment cores.

PCBs (µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre - Storm P17
1	0.01	0.01	0.02	0.01-0.03
2	0.03	0.03	0.05	0.01-0.04
3	0.03	0.03	0.03	0.01-0.04
4	0.02	0.03	0.04	0.36-1.04
10	0.01	0.01	0.01	0.02-0.03
9	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.51-2.90
6	0.01	0.01	0.01	0.02-0.05
8	0.08	0.09	0.08	0.10-0.22
5	0.06	0.06	0.06	0.10-0.22
19	0.00	0.00	0.00	0.00
18	0.15	0.30	0.42	0.28-0.55
17	0.03	0.04	0.06	0.15-0.22
15	0.21	0.23	0.35	0.15-0.34
27	0.03	0.07	0.08	0.06-0.08
24	0.03	0.07	0.08	0.05-0.06
32	0.02	0.05	0.12	0.08-0.24
16	0.04	0.06	0.10	0.09-0.20
34	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00
26	0.06	0.10	0.17	0.07-0.15
25	0.00	0.00	0.00	0.00
31	0.16	0.29	0.56	0.42-0.88
28	0.16	0.27	0.55	0.43-0.97
20	0.11	0.23	0.49	0.32-0.73
22	0.05	0.04	0.18	0.19-0.39
45	0.01	0.04	0.08	0.07-0.20
46	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00
52	0.31	0.83	1.39	1.29-2.45
47	0.34	0.52	0.82	0.36-0.79
48	0.00	0.00	0.00	0.00
44	0.16	0.41	0.79	0.63-1.27
42	0.08	0.22	0.38	0.23-0.45
37	0.00	0.00	0.00	0.00
71	0.12	0.32	0.47	0.23-0.45
41	0.11	0.32	0.64	0.77-1.44
103	0.00	0.00	0.00	0.00
40	0.04	0.09	0.15	0.14-0.26

PCBs (µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre - Storm P17
67	0.00	0.00	0.00	0.00
74	0.00	0.00	0.00	0.00
70	0.13	0.34	0.66	0.77-1.14
66	0.54	1.14	1.76	0.87-1.78
95	0.35	0.80	1.29	1.32-2.44
93	0.36	0.80	1.29	1.38-2.61
56	0.13	0.33	0.63	0.33-0.54
60	0.13	0.33	0.63	0.32-0.62
92	0.21	0.54	0.82	0.65-1.26
84	0.12	0.38	0.60	1.81-3.86
101	1.34	3.30	4.66	1.88-3.88
99	1.11	2.53	3.35	1.78-3.64
119	0.09	0.18	0.24	1.61-3.87
83	0.07	0.62	0.32	0.67-1.72
87	0.52	1.17	2.26	1.67-3.23
81	0.03	0.07	0.15	0.09-0.17
115	0.25	0.58	1.12	1.15-2.26
136	0.16	0.38	0.52	0.60-1.15
110	1.17	3.17	4.71	4.52-8.83
77	0.15	0.29	0.47	0.33-0.66
82	0.11	0.18	0.36	0.66-1.42
151	0.39	0.82	1.18	0.94-2.07
135	0.16	0.30	0.42	0.43-0.87
144	0.16	0.30	0.41	0.40-0.85
147	0.11	0.21	0.22	0.15-0.28
107	0.18	0.38	0.52	0.30-0.71
123	0.09	0.15	0.19	4.21-8.99
149	1.65	3.67	4.63	3.97-8.56
118	1.06	2.59	3.81	3.39-7.74
134	0.12	0.09	0.19	0.37-0.98
114	0.28	1.79	1.88	0.58-4.51
131	0.00	0.00	0.00	0.00
146	0.41	0.82	1.18	0.81-1.98
153	2.36	4.62	7.48	5.26-12.08
132	0.30	0.68	1.21	1.63-3.49
105	0.39	0.97	1.86	1.53-3.38
141	0.19	0.46	0.84	1.08-2.47
179	0.17	0.36	0.51	0.44-1.06
163	1.05	1.58	2.62	6.02-14.29

PCBs (µg/Kg-dry weight)	Pre-Storm P01	Pre-Storm P08	Pre-Storm P11	Pre - Storm P17
138	1.25	2.69	4.83	6.24-14.98
158	0.13	0.32	0.54	0.61-1.43
178	0.14	0.26	0.35	0.26-0.63
126	0.08	0.10	0.19	0.18-0.41
187	0.92	1.71	2.37	1.63-3.99
183	0.29	0.59	0.87	0.77-1.86
128	0.00	0.00	0.00	0.00
167	0.00	0.00	0.00	0.00
174	0.35	0.78	1.33	1.09-2.61
177	0.35	0.69	1.08	0.76-1.79
171	0.14	0.26	0.42	0.39-0.85
156	0.20	0.48	0.78	0.46-0.73
157	0.06	0.12	0.21	0.19-0.38
173	0.00	0.00	0.00	0.00
172	0.06	0.16	0.27	0.24-0.49
197	0.01	0.02	0.03	0.04-0.08
180	1.30	2.83	4.42	3.10-7.14
193	0.08	0.14	0.21	0.12-0.25
191	0.00	0.00	0.00	0.00
169	0.00	0.00	0.00	0.00
170	0.65	1.34	2.10	1.30-2.80
190	0.10	0.20	0.30	0.24-0.50
198	0.39	0.78	1.09	0.68-1.47
203	0.20	0.42	0.58	0.40-0.86
196	0.20	0.42	0.59	0.42-0.94
189	0.00	0.00	0.00	0.00
208	0.10	0.25	0.47	0.10-0.23
195	0.11	0.24	0.37	0.20-0.49
207	0.03	0.08	0.11	0-0.11
194	0.52	0.96	1.30	0.72-1.58
205	0.00	0.00	0.00	0.00
206	0.38	0.97	1.77	0.49-0.86
209	0.47	1.13	1.87	0.58-0.88

The data set below represents the physio-chemical characterization of the biota samples

Table B71. Trace metal concentrations in clam (*Macoma nasuta*- Mn) and mussel (*Musculista senhousia*- Ms) obtained from exsitu deployment in the receiving sediment during the time period July 16th 2015 to August 12th 2015.

Sample ID	Sample Collection Date	Mositure content g-water/g-wet tissue (%)	Average Lipids Content in g-lipid/g-wet tissue (%)	As	Cu	Ni	Zn	Cd	Pb	Total Hg
				(µg/g-dw)						(µg/Kg-dw)
Ms TØ	8/14/2015	91.1	1.1	0.83	2.43	0.33	9.40	0.04	0.27	232.0
Ms Ref	8/14/2015	89.3	1.1	1.65	2.62	0.70	12.09	0.13	0.57	287.5
Ms P11	8/14/2015	89.2	1.1	1.67	2.62	0.96	15.38	0.18	0.77	264.8
Ms P17	8/14/2015	89.5	1.0	1.94	3.21	1.17	15.59	0.21	1.43	237.2
Mn TØ A	8/14/2015	86.9	1.0	3.01	2.18	0.30	14.65	0.04	0.13	90.4
Mn TØ B	8/14/2015	86.1	1.0	3.21	2.48	0.48	13.26	0.05	0.11	93.9
Mn TØ C	8/14/2015	86.6	0.9	2.83	2.63	0.37	17.96	0.05	0.11	83.7
Mn Ref A	8/14/2015	81.4	0.9	6.24	5.76	0.63	23.54	0.05	1.04	143.7
Mn Ref B	8/14/2015	82.7	0.9	5.85	4.83	0.46	18.36	0.06	0.49	173.3
Mn Ref C	8/14/2015	82.0	1.0	5.81	6.97	0.64	29.71	0.09	1.00	144.0
Mn Ref D	8/14/2015	83.0	0.9	5.41	4.14	0.65	18.71	0.05	0.75	129.9
Mn Ref E	8/14/2015	81.0	1.0	5.14	6.81	0.63	19.74	0.06	0.88	128.5
Mn P11 A	8/14/2015	81.0	1.0	7.14	6.13	0.80	28.81	0.13	3.09	140.5
Mn P11 B	8/14/2015	81.3	1.0	5.05	5.61	0.51	23.77	0.09	2.28	115.1
Mn P11 C	8/14/2015	81.6	1.0	6.24	3.47	0.89	21.99	0.05	0.68	121.3
Mn P11 D	8/14/2015	81.0	0.9	5.28	5.20	0.65	27.18	0.16	1.77	116.5
Mn P11 E	8/14/2015	80.6	1.0	6.46	7.38	0.75	29.47	0.08	3.06	143.6
Mn P17 A	8/14/2015	81.4	1.1	7.10	6.23	0.65	19.26	0.10	1.62	109.5
Mn P17 B	8/14/2015	80.5	0.9	5.94	6.10	0.69	19.72	0.06	1.29	81.7
Mn P17 C	8/14/2015	82.0	0.9	6.30	8.71	0.95	25.91	0.09	2.12	96.8
Mn P17 D	8/14/2015	79.8	0.9	8.59	11.04	1.06	26.41	0.09	4.32	79.5

Table B72. Trace metal concentrations in clam (*Macoma nasuta*) obtained from insitu deployment in the receiving water during the time period January 26th to February 23rd 2016.

Sample ID	Sample Collection Date	Mositure content g-water/g-wet tissue (%)	Average Lipids Content in g-lipid/g-wet tissue(%)	As	Cu	Ni	Zn	Cd	Pb	Total Hg
				(µg/g-dw)						(µg/Kg-dw)
T0-Rep	1/26/2016	87.8	1.7	1.81-1.41	0.88-1.10	0.16	10.8-10.9	0.02-0.03	0.06	32.9-34.8
P01-Open -Rep	2/23/2016	81.1	1.7	6.96	5.21	0.58	28.52	0.07	0.61	89.8
P01-80µm-Rep	2/23/2016	80.4	1.4	4.80	2.28	0.36	27.06	0.05	0.52	68.3
P01-500µm-Rep	2/23/2016	81.6	0.9	4.18	2.59	0.39	21.50	0.06	0.71	65.5
P08-Open -Rep	2/23/2016	78.8	0.6	3.81	4.49	0.69	21.86	0.06	0.77	66.1
P08-80µm-Rep	2/23/2016	86.5	1.0	1.99	2.30	0.25	17.71	0.03	0.40	67.4
P08-500µm-Rep	2/23/2016	81.7	0.7	9.96	4.28	0.40	25.50	0.06	0.94	79.3
P11-Open -Rep	2/23/2016	81.8	0.7	4.11	3.46	0.66	23.56	0.06	0.99	73.9
P11-80µm-Rep	2/23/2016	78.2	1.2	7.91	3.42	0.38	24.23	0.06	1.38	60.3
P11-500µm-Rep	2/23/2016	82.5	1.3	3.24	2.81	0.26	18.93	0.05	0.87	55.9
P17-Open-Rep	2/23/2016	82.7	1.5	3.9-3.6	3.6-3.7	0.6-0.6	18.1-16.7	0.04	).82-0.83	37.4-49.4
P17-80µm-Rep	2/23/2016	81.7	0.9	4.22	2.65	0.29	16.35	0.05	0.75	52.3-50.8
P17-500µm-Rep	2/23/2016	80.4	1.7	5.57	3.10	0.37	20.50	0.06	0.99	48.6

Table B73. Trace metal concentration in clam (deployed on March 1st 2016 and retrieved on 29th March 2016) obtained from exsitu deployment in pre and post-storm sediments collected for the season 2015/16.

Sample ID	Sample Collection Date	Mositure content g-water/g-wet tissue (%)	Average Lipids Content in g-lipid/g-wet tissue(%)	As	Cu	Ni	Zn	Cd	Pb	Total Hg
				(µg/g-dw)						(µg/Kg-dw)
PØ1-Pre A	3/30/2016	81.1	2.3	4.47	4.44	0.35	27.9	0.08	0.49	100.5
PØ1-Post A	3/30/2016	82.0	1.0	5.23	3.49	0.49	19.8	0.05	0.71	99.8
PØ8-Pre A	3/30/2016	84.6	1.7	4.25	3.57	0.44	18.4	0.05	0.83	66.9-73.4
PØ8-Post A	3/30/2016	79.2	0.8	5.22	3.34	0.36	19.8	0.06	0.72	88.9
PØ8-Pre + A	3/30/2016	80.9	0.5	4.26-	3.14-	0.42-	16.7	0.03	0.63	62.6
P11-Pre A	3/30/2016	83.0	1.5	3.81	2.29	0.30	16.1	0.05	1.16	1586.5
P11-Post A	3/30/2016	79.6	1.7	0.48	2.29	0.31	23.2	0.09	1.17	55.1
P11-Pre + A	3/30/2016	83.3	1.4	4.63	3.04	0.44	19.8	0.05	1.17	73.4
P17-Pre A	3/30/2016	86.0	0.7	3.11	2.73	0.28	16.0	0.04	0.97	65.0
P17-Post A	3/30/2016	88.9	0.8	3.68	2.50	0.37	17.3	0.04	0.95	58.4
P17-Pre + A	3/30/2016	85.4	1.0	3.58	2.80	0.46	15.6	0.06	1.00	46.2
Control A	3/30/2016	79.6	1.3	5.14	1.87	0.50	20.7	0.09	0.12	44.3
NBH A	3/30/2016	86.0	0.9	3.83	4.83	0.60	17.5	0.07	1.04	69.0
Time Ø A	3/30/2016	86	1.3	2.67	1.30	0.27	13.8	0.06	0.10	59.4

Table B74. Trace metal concentration in clam (bioaccumulation study initiated on September 13th 2016 for 28 days) obtained from exsitu deployment in the pre-storm sediments collected for the season 2016/17.

Sample ID	Sample Collection Date	Mositure content g-water/g-wet tissue (%)	As	Cu	Ni	Zn	Cd	Pb	Total Hg
			(µg/g-dw)						(µg/Kg-dw)
DB-Mn-101216-A	10/12/2016	85.1	2.70	2.38	0.53	9.71	0.03	0.14	86.4
P01-Mn-101216-A	10/12/2016	84.5	5.40	4.98	0.63	24.02	0.07	0.60	141.8
P08-Mn-101216-A	10/12/2016	82.4	4.61-4.72	6.62-7.39	0.61-0.63	19.93-20.89	0.05	1.08-1.20	117.5-142.1
P11-Mn-101216-A	10/12/2016	80.3	7.44	9.51	0.74	25.00	0.07	1.19	117.3
P17-Mn-101216-A	10/12/2016	82.0	5.02	10.64	0.82	25.75	0.07	1.79	110.3
Time 0-Mn-091216	9/12/2016	89.5	2.15	3.02	0.35	13.44	0.04	0.13	105.4

Table B75. Trace metal concentration in clam (deployed on March 10th 2017 and retrieved on April 7th 2017) obtained from exsitu deployment in the post-storm sediments collected for the season 2016/17.

Sample ID	Sample Collection Date	Mositure content g-water/g-wet tissue (%)	As	Cu	Ni	Zn	Cd	Pb	Total Hg
			(µg/g-dw)						(µg/Kg-dw)
T0A	3/10/2017	83.9	3.18	2.40	0.35	20.55	0.05	0.11	72.46
T0B	3/10/2017	82.7	3.60	3.24	0.46	20.08	0.05	0.10	68.55
T0C	3/10/2017	82.2	3.31	2.87	0.42	18.57	0.04	0.08	76.49
DB	4/8/2017	85.7	2.66	2.63	0.35	14.70	0.03	0.09	76.65
P01	4/8/2017	85.7	2.13	3.26	0.30	18.30	0.03	0.34	85.09
P08	4/8/2017	84.7	3.03	3.49	0.24	17.69	0.02	0.47	74.34
P11	4/8/2017	84.8	3.42	3.53	0.28	18.86	0.03	0.58	73.25
P17-1	4/8/2017	85.8	2.71	3.86	0.37	18.03	0.03	0.70	65.23
P17-2	4/8/2017	85.8	3.69	3.48	0.35	16.36	0.03	0.64	61.84

Table B76. PAHs in clam (*Macoma nasuta*- Mn) and mussel (*Musculista senhousia*- Ms) obtained from exsitu deployment in the receiving sediment during the time period July 16th 2015 to August 12th 2015.

PAHs (µg/kg-lipids)	Ms TØ	Ms Ref	Ms P11	Ms P17	AVG Mn TØ	AVG Mn Ref	AVG Mn P11	AVG Mn P17
Naphthalene	4642	3608	1743	2664	1318	1618	978	675
Fluorene	1304	1002	790	1081	614	424	1956	335
Acenaphthene	2822	2548	4078	8736	2922	4198	6513	2456
Phenanthrene	4540	3804	2889	6386	4205	5990	3634	1610
Anthracene	84	54	62	57	35	77	36	60
Fluoranthene	722	590	727	977	460	824	6275	1218
Pyrene	1093	937	383	276	1332	1865	13163	739
Chrysene	93	119	676	1742	413	658	4009	1009
Benz[a]anthracene	151	170	851	1746	486	822	4147	982
Benzo[b]fluoranthene	168	229	1203	2012	273	755	9067	2652
Benzo[k]fluoranthene	70	107	524	832	226	388	3418	1056
Benzo[a]pyrene	223	275	1460	3021	792	1398	6902	1841
Dibenz[a,h]anthracene	0	0	0	0	0	0	0	0
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	64	73	233	181	0	183	1397	523

Table B77. PAHs in in clam (*Macoma nasuta*) obtained from insitu deployment in the receiving water during the time period January 26th to February 23rd 2016.

PAHs (µg/kg-lipids)	T0-Rep	P01-Open-Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open-Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open-Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Naphthalene	111	306	164	123	206	194	161	189	211	310	62	91	89
Fluorene	443	869	1160	640	571	1334	1162	715	800	1017	179	451	4829
Acenaphthene	144	61	49	37	72	53	55	393	6	174	21	27	242
Phenanthrene	334	600	854	589	829	1006	811	400	341	247	769	676	435
Anthracene	338	403	137	935	475	1152	286	419	1653	1870	889	171	126
Fluoranthene	171	675	724	608	1354	621	1030	3902	667	2118	1405	1521	852
Pyrene	144	881	585	844	1730	789	1475	18833	1469	8233	2112	2807	1451
Chrysene	31	159	253	198	566	207	351	1561	1949	1887	243	307	171
Benz[a]anthracene	23	308	436	468	694	326	618	2725	2816	1388	311	402	209
Benzo[b]fluoranthene	43	2786	3945	5282	6231	4166	8163	10456	7633	6773	1132	1527	878
Benzo[k]fluoranthene	18	971	1389	2019	1951	1463	2746	3082	1784	1921	309	419	239
Benzo[a]pyrene	24	1471	2192	3106	2944	2173	4113	5671	4706	3587	514	659	393
Dibenz[a,h]anthracene	ND	118	163	243	216	157	318	261	148	145	ND	ND	ND
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	23	409	609	797	859	578	1197	1137	865	614	227	389	183

Table B78. PAHs in in clam (deployed on March 1st 2016 and retrieved on 29th March 2016) obtained from exsitu deployment in pre and post-storm sediments collected for the season 2015/16.

PAHs (µg/kg-lipids)	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11-Pre-Rep B	PØ11-Post-Rep B	PØ11-Pre + -Rep B	PØ17-Pre-Rep B	PØ17-Post-Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Naphthalene	92	84	140	87	144	149	179	194	235	346	249	155	107	145
Fluorene	316	289	828	558	1132	880	383	599	396	359	287	277	298	895
Acenaphthene	110	38	595	43	449	109	132	275	111	106	132	126	105	49
Phenanthrene	259	418	538	588	1317	778	209	317	289	527	620	629	251	872
Anthracene	111	151	343	159	966	908	486	624	464	268	546	506	114	735
Fluoranthene	124	73	772	487	919	663	753	1457	933	625	279	372	122	427
Pyrene	146	51	1109	964	1745	1113	4476	7926	4295	2102	2933	2220	95	532
Chrysene	66	63	762	610	1946	720	657	364	599	332	371	239	12	102
Benz[a]anthracene	10	152	583	171	679	394	846	417	658	287	331	236	47	127
Benzo[b]fluoranthene	36	230	2248	2001	4316	3533	4163	3070	3758	1105	1493	1210	50	44
Benzo[k]fluoranthene	12	244	1549	841	1864	961	1217	2704	1008	489	497	453	10	17
Benzo[a]pyrene	20	161	1977	1014	2600	1302	1299	1254	996	896	1582	739	12	26
Dibenz[a,h]anthracene	ND	ND	254	61	216	ND	209	168	ND	112	50	ND	ND	24
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	4	218	695	332	873	767	266	167	193	142	157	107	14	17

Table B79. PAHs in clam (bioaccumulation study initiated on September 13th 2016 for 28 days) obtained from exsitu deployment in the pre-storm sediments collected for the season 2016/17.

PAHs (µg/kg-lipids)	DB	P01	P08	P11	P17	T0
Naphthalene	1373	1192	1143	2561	2537	2314
Fluorene	884	1239	1142	2400	1534	1463
Acenaphthene	80	66	61	122	143	132
Phenanthrene	1561	1275	1168	2501	2704	3568
Anthracene	126	516	430	841	273	153
Fluoranthene	751	736	735	1512	3365	763
Pyrene	498	798	1143	3090	4161	527
Chrysene	95	382	406	630	763	69
Benz[a]anthracene	88	416	464	677	967	131
Benzo[b]fluoranthene	146	3524	3861	4518	3150	149
Benzo[k]fluoranthene	44	1347	1526	1728	1047	44
Benzo[a]pyrene	65	1850	2029	2307	1524	70
Dibenz[a,h]anthracene	50	206	205	241	178	31
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	23	700	710	993	869	27

Table B80. PAHs in clam (deployed on March 10th 2017 and retrieved on April 7th 2017) obtained from exsitu deployment in the post-storm sediments collected for the season 2016/17.

PAHs (µg/kg-lipid)	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Naphthalene	23327	5104	7289	3542	3232	5570	4402	1769
Fluorene	1575	316	446	169	284	372	273	110
Acenaphthene	1882	484	811	343	2416	475	454	168
Phenanthrene	8093	1368	2230	1089	1079	1905	1330	475
Anthracene	251	103	203	79	594	67	62	36
Fluoranthene	1486	903	2275	812	3445	423	540	314
Pyrene	1807	1016	4177	2023	4588	466	561	354
Chrysene	64	464	1044	499	671	44	105	162
Benz[a]anthracene	135	493	1266	512	2577	56	84	172
Benzo[b]fluoranthene	60	2425	7144	2900	1391	34	113	846
Benzo[k]fluoranthene	31	939	2622	1035	528	14	38	327
Benzo[a]pyrene	74	1364	3805	1580	883	24	53	475
Dibenz[a,h]anthracene	30	178	340	115	189	19	31	6
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	22	580	1162	544	157	12	32	20

Table B81. Chlordane concentration in clam (*Macoma nasuta*) obtained from insitu deployment in the receiving water during the time period January 26th to February 23rd 2016.

Pesticides (µg/Kg-lipids)	T0-Rep	P01-Open -Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open -Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open -Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Transchlordane	3.13	22.23	25.55	23.12	75.49	45.57	56.67	310.22	185.58	148.63	142.85	186.69	103.64
Cischlordane	2.60	23.46	23.88	22.59	80.29	39.40	55.39	193.01	114.97	100.45	165.51	207.79	116.46

Table B82. Chlordane concentration in clam (deployed on March 1st 2016 and retrieved on 29th March 2016) obtained from exsitu deployment in pre and post-storm sediments collected for the season 2015/16.

Pesticides (µg/Kg-lipids)	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11-Pre-Rep B	PØ11-Post-Rep B	PØ11-Pre + -Rep B	PØ17-Pre-Rep B	PØ17-Post-Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Transchlordane	0.00	1.49	20.09	9.80	22.44	14.97	9.73	3.01	2.52	3.37	0.38	1.01	0.00	4.07
Cischlordane	0.30	2.80	23.44	8.89	23.86	46.86	2.54	26.66	11.85	70.45	48.16	46.54	0.14	7.57

Table B83. Chlordane concentration in clam obtained from exsitu deployment in the pre and post-storm sediments collected for the season 2016/17.

Pesticides (µg/Kg-lipids)	Pre DB	Pre P01	Pre P08	Pre P11	Pre P17	Pre T0-A	Pre T0-B	Pre T0-C	Post DB	Post P01	Post P08	Post P11	Post P17	Post T0
Transchlordane	34.34	29.68	146.58	111.80	207.38	5.78	2.94	2.27	8.3	28.2	47.4	172.4	310.2	11.4
Cischlordane	22.02	30.50	139.25	106.19	223.71	4.43	3.13	1.82	6.9	27.3	43.7	166.3	354.8	8.2

Table B84. PCBs in clam (*Macoma nasuta*) obtained from insitu deployment in the receiving water during the time period January 26th to February 23rd 2016.

PCB (µg/Kg-Lipids)	PØ1-Open-Rep A 1	PØ1-80 µm-Rep A 1	PØ1-500 µm-Rep A 1	PØ8-Open-Rep A 1	PØ8-80 µm-Rep A 1	PØ8-500 µm-Rep A 1	PØ11-Open-Rep A 1	PØ11-80 µm-Rep A 1	PØ11-500 µm-Rep A 1	PØ17-Open-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-500 µm-Rep A 1	T01-Rep A 1
1	0.570	0.614	0.622	0.853	4.935	1.316	0.380	1.058	0.254	0.190	0.383	28.007	27.492
2	0.213	0.302	0.256	0.176	0.175	0.165	0.119	0.151	0.139	0.143	0.167	0.194	0.093
3	0.304	0.410	0.337	0.679	0.690	0.676	0.446	0.233	0.192	0.154	0.280	0.230	0.350
4	9.409	9.654	6.202	7.789	6.429	5.733	31.827	55.685	57.995	4.260	3.058	10.925	2.155
10	1.093	0.917	0.830	0.811	0.330	0.606	1.895	1.354	0.971	0.299	0.265	0.366	0.172
9	ND	ND	ND	0.901	1.281	1.028	0.909	ND	ND	ND	0.545	ND	0.413
7	ND	ND	ND	6.993	7.889	10.205	42.893	ND	ND	ND	29.677	ND	1.471
6	0.832	0.787	0.791	1.510	1.411	1.484	4.357	2.537	1.678	0.451	0.572	0.299	0.364
8	6.374	6.453	7.745	3.375	2.130	2.448	6.183	7.672	5.120	2.153	1.614	1.963	0.673
5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	1.500	1.210	1.088	2.552	1.397	2.065	4.873	2.755	1.863	0.624	0.633	0.610	0.004
18	7.358	4.428	8.632	11.028	5.865	8.415	46.324	29.492	18.657	3.928	3.894	3.208	1.063
17	7.368	7.288	9.832	10.739	6.521	8.048	31.267	16.736	11.890	3.203	3.782	2.980	0.779
15	2.897	3.201	3.457	4.808	2.792	3.655	44.325	25.154	14.732	1.901	2.137	1.597	0.695
27	ND	ND	ND	0.000	0.000	0.000	0.977	ND	ND	ND	0.000	ND	ND
24	ND	ND	ND	2.280	0.956	1.972	3.081	ND	ND	ND	0.564	ND	ND
32	8.381	9.215	10.361	12.808	6.962	9.886	27.489	16.191	11.578	3.193	3.678	2.807	0.649
16	7.019	6.881	7.801	10.424	5.393	7.793	26.574	14.407	9.961	2.826	3.404	2.452	0.452
34	2.074	2.711	4.391	ND	ND	ND	ND	9.813	4.873	2.977	2.050	1.827	ND
29	1.518	4.206	2.464	ND	ND	ND	ND	10.933	8.013	2.239	3.423	1.931	ND
26	2.135	1.860	2.725	6.628	3.983	4.561	15.697	10.051	7.317	1.991	2.769	1.457	0.862
25	3.394	4.364	3.549	5.728	2.889	3.688	8.545	5.583	4.192	1.513	1.674	1.025	0.402
31	13.858	13.148	15.253	20.766	11.755	13.823	124.561	80.231	56.405	10.664	15.728	8.818	2.015
28	28.809	29.027	37.358	38.092	20.778	30.506	122.997	84.606	64.677	15.986	19.007	13.179	2.355
20	13.726	13.972	17.604	15.943	11.761	15.918	81.749	52.488	36.048	7.252	8.986	6.316	1.114
22	3.645	4.236	4.979	5.280	4.184	4.656	36.960	25.133	16.998	4.293	5.155	3.506	0.796

PCB (µg/Kg-Lipids)	PØ1-Open-Rep A 1	PØ1-80 µm-Rep A 1	PØ1-500 µm-Rep A 1	PØ8-Open-Rep A 1	PØ8-80 µm-Rep A 1	PØ8-500 µm-Rep A 1	PØ11-Open-Rep A 1	PØ11-80 µm-Rep A 1	PØ11-500 µm-Rep A 1	PØ17-Open-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-500 µm-Rep A 1	T01-Rep A 1
45	4.577	3.175	5.597	5.881	4.269	5.726	28.486	20.283	13.109	2.148	2.535	1.621	7.919
46	ND	ND	ND	10.277	6.263	9.814	18.655	ND	ND	ND	1.427	ND	6.488
69	ND	ND	ND	ND	ND	ND	256.178	ND	ND	ND	ND	ND	ND
52	147.002	71.210	90.040	116.871	58.223	94.669	325.080	211.536	170.871	25.110	31.439	23.210	4.376
47	53.934	51.280	58.141	80.802	46.727	69.372	111.924	65.731	60.945	12.069	13.783	10.509	1.950
48	ND	ND	ND	5.350	5.368	5.250	48.295	ND	ND	ND	5.047	ND	0.214
44	66.000	65.962	81.588	ND	ND	ND	ND	86.161	69.254	10.766	21.288	15.939	ND
42	23.357	24.254	29.044	ND	ND	ND	ND	58.466	49.046	5.406	8.492	6.233	ND
37	6.742	6.942	6.626	7.372	6.023	6.846	38.437	30.827	22.021	4.573	5.356	3.537	1.081
71	23.342	24.270	29.031	34.282	18.903	28.882	89.880	58.422	49.039	7.049	8.290	6.229	0.700
41	62.008	48.290	62.107	55.631	34.252	47.996	297.164	212.213	162.185	23.853	27.181	20.468	2.410
103	5.940	6.112	6.774	8.827	5.275	7.271	6.463	3.290	4.139	0.728	0.883	0.453	2.922
40	9.662	7.117	8.566	9.321	5.801	8.113	52.193	43.419	31.383	4.188	3.714	2.885	0.231
67	2.023	2.544	2.978	3.227	2.405	3.157	7.037	265.358	222.823	0.798	1.183	0.920	1.568
74	35.598	29.594	40.120	38.078	22.576	37.476	155.356	107.774	90.529	11.309	13.049	10.335	1.053
70	83.717	53.664	67.596	73.414	44.227	69.860	333.465	245.791	208.010	22.878	26.512	21.474	2.587
66	84.912	80.742	103.048	106.253	64.035	95.671	279.306	202.902	176.646	22.460	24.501	19.626	1.699
95	81.930	63.393	76.227	79.315	46.072	67.740	138.474	96.066	85.548	14.886	17.885	13.059	2.173
93	86.152	65.521	80.274	83.077	53.013	72.121	146.907	97.725	87.439	15.883	19.879	14.477	3.156
56	14.987	13.304	18.962	18.366	10.912	18.419	124.395	97.321	75.782	8.273	9.082	6.781	0.777
60	14.522	13.342	18.322	18.016	10.622	17.734	121.472	94.389	73.172	8.096	8.940	6.701	0.583
92	33.475	29.759	36.282	40.128	25.509	35.535	52.068	36.144	35.771	6.471	7.814	6.448	1.396
84	119.627	102.620	126.689	133.037	77.621	114.211	187.047	120.301	113.536	20.678	25.241	19.595	2.767
101	159.190	152.676	182.451	133.611	78.481	115.316	187.153	165.931	151.119	45.197	35.278	55.990	2.709
99	141.637	143.469	172.011	201.924	121.685	175.385	182.798	121.979	127.785	23.061	26.948	22.270	3.482
119	19.245	26.950	22.273	24.991	40.969	30.524	44.118	35.420	35.522	8.689	2.506	12.410	0.999

PCB (µg/Kg-Lipids)	PØ1-Open-Rep A 1	PØ1-80 µm-Rep A 1	PØ1-500 µm-Rep A 1	PØ8-Open-Rep A 1	PØ8-80 µm-Rep A 1	PØ8-500 µm-Rep A 1	PØ11-Open-Rep A 1	PØ11-80 µm-Rep A 1	PØ11-500 µm-Rep A 1	PØ17-Open-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-500 µm-Rep A 1	T01-Rep A 1
83	22.564	23.737	24.208	24.830	22.418	23.549	39.145	29.333	27.360	4.698	6.016	4.937	1.399
87	80.750	62.304	77.449	33.544	18.548	31.542	85.493	118.651	104.651	20.377	15.070	18.520	1.650
81	4.035	3.090	4.064	3.540	1.947	3.690	8.769	6.742	5.975	1.039	1.152	0.955	0.309
115	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
136	23.067	23.939	29.994	30.541	17.664	25.896	33.344	22.526	21.241	4.777	4.418	4.096	0.447
110	226.051	194.214	234.764	228.177	143.963	221.562	385.400	264.061	251.082	51.401	60.500	50.091	4.753
77	10.348	9.641	12.191	12.399	7.643	12.475	38.978	33.510	27.607	4.566	4.845	3.950	0.469
82	18.118	14.821	18.567	18.596	11.080	18.942	53.271	38.985	34.140	5.662	6.517	5.420	0.537
151	36.409	32.323	51.538	51.351	31.044	42.948	46.603	28.766	32.036	6.505	8.212	7.106	0.876
135	15.633	19.936	19.311	17.639	11.884	14.091	16.931	14.825	19.871	0.887	2.226	0.000	0.030
144	15.723	19.697	19.983	15.812	10.087	13.344	15.138	11.107	12.677	2.378	2.662	1.927	0.483
147	6.936	8.119	9.713	9.670	7.054	9.010	6.235	3.679	4.374	1.058	1.173	1.382	0.170
107	14.822	15.845	18.168	18.967	12.203	17.324	20.172	14.692	16.051	2.923	3.008	2.878	0.898
123	140.517	227.739	261.826	ND	ND	ND	ND	229.517	234.815	49.505	55.077	59.999	ND
149	149.307	168.888	210.716	198.208	124.762	176.551	177.684	109.394	122.637	26.923	31.954	27.716	3.042
118	118.368	111.189	150.709	179.126	134.847	177.294	228.508	141.554	144.133	33.116	37.202	36.796	9.429
134	7.034	6.745	8.826	11.382	6.023	9.292	10.877	6.580	7.079	1.727	1.761	1.417	0.271
114	2.534	105.171	174.867	ND	ND	ND	ND	185.524	195.328	35.363	44.518	37.301	ND
131	ND	ND	ND	2.027	1.380	1.849	2.047	ND	ND	ND	ND	ND	ND
146	21.439	22.339	29.852	38.252	21.931	29.473	23.665	14.565	18.345	4.642	5.216	4.027	0.744
153	163.352	176.173	237.262	264.181	164.670	210.937	168.479	111.110	134.543	36.120	38.491	34.450	3.482
132	37.470	39.000	54.987	53.364	30.608	47.200	70.364	47.279	45.354	13.611	15.953	12.663	0.947
105	45.758	42.840	62.205	60.579	33.467	56.461	120.521	89.866	82.172	16.445	18.156	15.116	1.722
141	16.161	18.132	27.791	23.238	11.802	18.711	28.486	20.234	21.752	6.015	7.221	6.329	0.819
179	9.619	11.090	14.918	15.393	9.268	11.868	12.928	8.306	9.152	2.159	2.483	2.257	0.268
163	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

PCB (µg/Kg-Lipids)	PØ1-Open-Rep A 1	PØ1-80 µm-Rep A 1	PØ1-500 µm-Rep A 1	PØ8-Open-Rep A 1	PØ8-80 µm-Rep A 1	PØ8-500 µm-Rep A 1	PØ11-Open-Rep A 1	PØ11-80 µm-Rep A 1	PØ11-500 µm-Rep A 1	PØ17-Open-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-500 µm-Rep A 1	T01-Rep A 1
138	151.071	168.451	226.422	106.075	63.178	85.614	86.258	127.435	142.275	43.773	32.174	43.275	1.405
158	9.830	10.811	14.791	14.355	9.661	12.749	16.117	11.941	13.275	3.657	4.398	4.135	0.902
178	5.360	5.900	7.189	8.754	5.441	6.533	5.527	3.680	4.509	1.242	1.426	1.344	0.435
126	1.334	1.302	1.809	2.694	2.702	2.817	2.502	1.655	1.647	0.544	0.703	0.618	0.812
187	35.375	38.251	49.678	55.602	34.108	41.614	35.187	22.839	28.800	7.718	7.781	7.442	0.557
183	11.863	13.499	18.519	15.734	10.342	12.244	13.272	10.188	12.061	3.266	3.243	3.246	0.361
128	15.670	16.087	21.864	19.884	11.304	16.022	16.862	14.197	15.353	5.113	4.431	4.308	0.000
167	15.684	16.107	18.120	17.137	10.514	14.138	14.485	14.207	15.364	5.128	4.159	4.323	0.263
174	15.317	18.358	24.854	20.365	11.116	15.456	22.453	16.572	12.046	4.651	4.784	4.535	0.021
177	13.686	16.102	19.647	20.826	13.116	15.901	15.889	10.529	12.521	3.692	3.999	3.598	0.273
171	7.066	7.966	10.056	9.585	6.170	7.011	7.754	5.591	6.647	1.960	2.302	1.880	0.125
156	10.261	12.181	16.613	15.058	8.745	12.504	13.786	10.399	11.980	3.299	3.614	3.536	0.462
157	2.094	2.467	3.044	3.079	1.809	2.288	2.253	1.822	2.141	0.502	0.616	0.488	0.334
173	1.150	1.408	3.881	0.439	0.176	0.106	0.440	1.796	2.661	0.169	0.040	0.561	0.000
172	2.337	2.634	3.312	3.280	2.166	2.347	2.652	1.976	2.108	0.577	0.651	0.978	0.018
197	0.221	0.204	0.167	0.280	0.109	0.158	0.179	0.095	0.207	0.040	0.000	0.000	0.000
180	33.192	36.761	48.733	42.930	24.607	28.733	37.042	27.349	31.896	8.532	8.418	8.775	0.572
193	1.979	2.097	2.690	2.661	1.812	1.809	1.714	1.366	1.566	0.326	0.350	0.310	0.000
191	0.567	0.827	0.580	ND	ND	ND	ND	0.606	0.537	0.282	0.000	0.430	ND
169	ND	ND	ND	0.000	0.000	0.000	0.000	ND	ND	ND	0.000	ND	ND
170	12.470	15.966	19.179	21.328	12.886	16.200	18.599	10.564	12.786	3.822	4.609	4.267	0.611
190	2.254	3.303	3.398	4.419	3.956	4.174	4.408	2.194	2.827	0.929	1.340	0.945	0.847
198	6.497	6.800	8.377	9.603	5.821	6.047	7.436	5.321	6.616	1.704	1.496	1.788	0.017
203	3.537	3.929	4.808	4.287	2.776	3.079	3.721	2.928	3.495	0.997	1.019	1.333	0.053
196	3.154	3.593	4.371	4.535	3.443	3.570	4.022	2.719	3.444	0.965	1.158	1.093	0.446
189	0.631	0.418	3.832	0.865	0.636	0.726	0.681	12.142	13.934	3.142	0.285	4.870	0.003

PCB (µg/Kg-Lipids)	PØ1-Open-Rep A 1	PØ1-80 µm-Rep A 1	PØ1-500 µm-Rep A 1	PØ8-Open-Rep A 1	PØ8-80 µm-Rep A 1	PØ8-500 µm-Rep A 1	PØ11-Open-Rep A 1	PØ11-80 µm-Rep A 1	PØ11-500 µm-Rep A 1	PØ17-Open-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-500 µm-Rep A 1	T01-Rep A 1
208	2.147	2.455	2.014	2.543	2.897	2.193	1.638	1.042	1.371	0.421	0.689	0.538	0.392
195	1.626	2.111	2.696	3.143	2.754	2.814	2.549	1.574	1.741	0.573	0.833	0.760	0.815
207	0.108	0.062	0.142	0.431	0.326	0.342	0.316	0.103	0.157	0.000	0.061	0.000	0.000
194	4.908	5.475	6.514	5.599	3.588	3.563	4.217	3.684	4.745	1.505	1.287	2.024	0.105
205	1.826	1.991	2.120	0.151	0.000	0.005	0.110	2.378	2.960	0.649	0.393	0.623	0.000
206	2.081	0.885	0.813	3.485	2.874	2.848	2.553	1.251	1.730	0.253	0.586	0.295	0.260
209	1.749	1.494	1.540	3.374	3.055	2.692	2.114	1.650	2.709	0.381	0.905	0.387	0.714

Table B85. PCBs in clam (deployed on March 1st 2016 and retrieved on 29th March 2016) obtained from exsitu deployment in pre and post-storm sediments collected for the season 2015/16.

PCB (µg/Kg-Lipids)	PØ1-Pre-Rep B 1	PØ1-Post-Rep B 1	PØ8-Pre - Rep B 1	PØ8-Post-Rep B 1	PØ8-Pre + -Rep B 1	PØ11-Pre-Rep B 3	PØ11-Post-Rep B 1	PØ11-Pre + -Rep B 1	PØ17-Pre-Rep B 1	PØ17-Post-Rep B 1	PØ17-Pre-Rep + B 1	T0 B 1	Control B 1	NBH B 1
1	2.4	7.9	2.0	2.1	2.3	7.2	1.7	9.0	3.8	8.6	22.7	20.9	5.3	9.6
2	0.1	0.4	0.1	0.4	0.6	0.1	0.5	0.2	0.3	0.3	0.2	0.1	0.1	13.3
3	0.2	0.8	0.6	0.8	0.8	0.4	1.1	0.3	0.8	0.7	0.5	0.2	0.3	35.4
4	5.1	94.2	2.9	26.5	22.7	29.3	196.3	142.9	12.1	12.0	7.4	3.3	2.0	430.4
10	0.3	1.1	0.4	1.1	1.5	1.6	10.3	1.2	0.4	0.3	0.4	0.1	0.1	334.8
9	ND	ND	0.6	ND	ND	ND	ND	ND	1.1	0.9	0.6	0.3	0.4	165.3
7	ND	ND	14.4	ND	ND	ND	ND	ND	41.0	42.5	28.5	10.7	11.9	182.3
6	0.5	1.4	1.2	1.7	1.9	14.3	175.0	2.4	1.9	3.0	5.5	0.4	0.9	7101.0
8	2.3	8.2	2.4	7.5	8.1	9.9	116.1	6.8	2.9	2.9	2.8	0.5	0.8	2117.6
5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	0.4	2.2	0.5	2.3	2.3	3.7	19.3	2.4	0.5	0.5	0.6	0.2	0.1	689.7
18	6.7	33.6	10.4	22.9	29.2	70.9	459.1	40.5	27.5	18.8	28.3	8.6	10.4	15813.0
17	2.5	9.6	4.0	8.5	11.7	38.0	258.0	12.3	7.6	8.5	8.5	1.3	2.2	10532.7
15	1.5	5.5	2.6	5.2	5.7	22.0	84.2	12.5	3.6	3.7	4.3	0.6	0.9	1901.1
27	ND	ND	0.0	ND	ND	ND	ND	ND	0.0	0.0	0.0	0.0	0.0	1250.3
24	ND	ND	0.6	ND	ND	ND	ND	ND	1.2	1.0	1.1	0.2	0.2	1231.6
32	2.6	11.4	4.4	11.5	13.1	25.7	148.3	14.3	6.8	6.1	5.0	0.7	1.3	5156.3
16	2.1	9.1	3.8	8.7	10.2	24.2	140.1	11.6	5.7	5.5	4.8	0.6	1.2	4890.5
34	1.4	2.6	ND	3.5	5.5	21.5	120.4	6.8	ND	ND	ND	ND	ND	ND
29	0.5	2.9	ND	1.9	9.3	117.1	1485.6	19.9	ND	ND	ND	ND	ND	ND
26	1.3	4.3	2.9	6.5	8.1	114.4	1384.5	16.4	6.9	17.9	28.1	1.0	6.2	44497.5
25	1.1	5.2	2.2	7.2	8.2	65.0	842.2	10.6	4.0	10.9	15.7	0.4	3.6	28839.2
31	6.7	27.4	10.7	21.4	26.2	193.4	1305.6	75.1	28.1	34.7	34.8	3.3	8.8	40876.0
28	10.2	46.6	16.1	43.8	56.9	168.4	1297.8	85.9	30.7	37.1	32.7	3.1	7.4	41056.7
20	5.8	31.7	7.9	17.6	21.1	56.3	264.4	37.0	16.4	15.1	10.3	1.8	2.7	6237.9
22	1.9	8.8	2.9	7.0	7.6	51.4	316.4	22.9	9.2	10.2	9.4	1.0	2.4	10749.7
45	1.5	8.7	1.7	6.4	6.3	28.0	91.9	16.9	4.9	4.1	3.2	0.6	0.9	2306.5
46	ND	ND	1.3	ND	ND	ND	ND	ND	1.8	1.7	1.1	0.1	0.1	1128.9

PCB (µg/Kg-Lipids)	PØ1-Pre-Rep B 1	PØ1-Post-Rep B 1	PØ8-Pre - Rep B 1	PØ8-Post-Rep B 1	PØ8-Pre + -Rep B 1	PØ11-Pre-Rep B 3	PØ11-Post-Rep B 1	PØ11-Pre + -Rep B 1	PØ17-Pre-Rep B 1	PØ17-Post-Rep B 1	PØ17-Pre-Rep + B 1	T0 B 1	Control B 1	NBH B 1
69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
52	33.4	457.5	44.7	121.9	163.7	383.3	1800.5	218.2	77.3	75.1	60.7	9.9	15.7	48979.2
47	20.3	109.1	31.0	88.4	122.5	110.5	512.7	70.2	34.4	28.5	19.2	3.0	6.2	15308.6
48	ND	ND	4.5	ND	ND	ND	ND	ND	11.2	8.8	3.8	0.7	0.6	1203.0
44	18.1	142.9	ND	117.7	159.8	154.5	703.1	110.9	ND	ND	ND	ND	ND	ND
42	7.4	68.1	ND	34.7	44.8	62.8	214.2	49.4	ND	ND	ND	ND	ND	ND
37	3.5	11.4	3.9	10.3	11.8	39.0	90.7	27.7	8.5	8.4	5.6	1.4	1.5	1593.4
71	7.4	68.0	10.6	34.6	44.8	66.3	214.0	49.5	16.3	11.3	6.8	0.8	1.4	4564.0
41	16.8	142.6	22.2	66.1	91.4	304.6	1182.0	192.4	55.8	51.9	32.4	4.2	7.9	26150.3
103	2.3	11.2	2.9	9.6	12.6	5.8	32.1	4.6	2.9	2.0	1.6	0.3	0.4	978.5
40	2.1	15.9	2.5	10.6	12.5	47.3	163.4	34.4	6.8	5.1	3.5	0.3	0.6	2930.7
67	0.9	4.0	1.2	3.4	5.2	11.8	88.6	4.7	2.5	2.7	2.4	0.4	0.7	2864.7
74	9.8	78.7	14.3	45.3	64.8	140.9	366.7	102.6	28.6	24.2	11.7	1.9	2.6	6568.4
70	21.4	235.8	29.4	87.7	128.5	250.5	546.2	210.3	58.9	47.7	22.3	5.0	5.8	5543.4
66	28.2	177.0	35.2	122.4	174.2	223.9	506.3	183.9	48.6	35.5	17.4	2.4	3.4	6842.2
95	26.4	185.5	29.0	87.2	114.5	128.6	430.8	96.3	48.4	37.6	21.9	3.8	5.0	11054.3
93	27.0	191.8	32.2	96.1	120.5	134.8	464.9	102.0	51.8	41.0	24.1	5.0	6.3	10452.7
56	4.6	26.1	6.6	21.3	28.6	98.1	232.3	78.6	16.7	12.6	6.4	1.0	1.4	2750.8
60	4.4	25.8	6.2	20.7	28.1	95.5	224.5	75.8	16.0	12.3	6.1	0.9	1.2	2701.7
92	14.1	67.2	15.0	48.2	61.9	50.5	212.8	39.3	21.8	16.9	10.1	2.1	2.4	5302.6
84	40.2	273.8	46.8	149.5	204.5	147.9	439.7	130.6	69.2	51.5	26.7	5.3	6.2	9528.7
101	66.9	403.3	47.3	221.3	349.9	167.6	525.2	179.4	69.8	52.1	26.8	5.5	6.2	9536.3
99	57.7	334.7	65.2	231.6	345.0	159.2	598.8	144.6	74.1	53.5	27.5	4.4	6.2	13356.4
119	11.5	83.1	8.6	61.9	120.6	34.7	111.8	48.6	13.0	7.7	4.9	1.7	1.8	1897.9
83	12.4	38.0	9.8	29.3	48.1	32.2	83.8	32.3	14.3	12.1	7.4	1.8	2.4	1679.3
87	26.3	145.1	12.8	93.0	124.7	97.5	325.6	123.4	29.8	22.6	8.9	1.8	2.2	2286.9
81	1.3	7.4	1.5	4.3	6.0	7.8	17.2	7.1	3.6	2.4	1.3	0.3	0.3	224.3
115	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

PCB (µg/Kg-Lipids)	PØ1-Pre-Rep B 1	PØ1-Post-Rep B 1	PØ8-Pre - Rep B 1	PØ8-Post-Rep B 1	PØ8-Pre + -Rep B 1	PØ11-Pre-Rep B 3	PØ11-Post-Rep B 1	PØ11-Pre + -Rep B 1	PØ17-Pre-Rep B 1	PØ17-Post-Rep B 1	PØ17-Pre-Rep + B 1	T0 B 1	Control B 1	NBH B 1
136	10.3	42.6	9.7	35.4	44.9	27.5	88.0	26.0	14.7	10.4	5.8	0.9	1.0	1822.1
110	72.0	499.2	83.2	283.7	390.5	340.0	1196.1	272.9	153.8	113.1	59.5	7.7	11.2	25465.2
77	3.6	18.5	4.4	16.2	24.0	36.0	83.4	29.5	9.7	7.1	3.6	0.7	0.9	1020.8
82	5.8	30.0	6.6	22.3	41.6	42.0	78.0	34.5	15.3	10.3	4.6	1.1	1.5	757.4
151	17.8	61.1	18.5	60.0	78.7	36.2	96.5	40.6	25.2	16.9	10.0	1.8	3.8	1844.9
135	5.9	26.3	6.7	18.8	26.0	13.6	61.2	12.9	9.9	5.7	3.1	0.5	0.4	798.9
144	8.2	37.0	5.9	28.2	35.5	16.2	42.2	14.2	8.4	5.8	3.3	0.7	0.7	706.7
147	3.6	13.8	3.6	11.8	18.3	6.1	34.3	5.6	3.4	2.3	1.6	0.2	0.2	842.7
107	6.1	32.2	6.7	24.6	36.5	16.3	50.1	16.3	8.2	5.8	3.1	0.7	0.9	934.4
123	25.4	520.4	ND	392.6	568.2	258.5	456.6	250.6	ND	ND	ND	ND	ND	ND
149	68.6	302.5	70.9	234.6	333.9	142.1	471.8	137.5	88.5	61.5	32.7	4.8	5.4	11112.5
118	44.2	327.0	76.0	249.4	353.0	189.8	435.7	164.9	102.6	74.9	53.2	18.1	47.9	8572.0
134	3.7	16.4	4.2	12.7	16.7	10.0	35.3	8.7	5.7	4.1	2.3	0.4	0.4	805.5
114	47.5	465.2	ND	298.4	433.1	226.5	610.4	223.4	ND	ND	ND	ND	ND	ND
131	5.1	33.5	1.1	29.5	36.2	5.5	6.1	12.1	1.1	0.9	0.4	0.0	0.0	157.5
146	12.1	52.8	15.0	45.0	57.7	19.0	53.7	18.8	13.4	9.1	5.1	0.9	0.9	1169.7
153	82.4	423.2	102.8	334.9	488.4	143.8	399.4	167.6	95.2	63.6	30.0	4.2	5.0	7897.8
132	16.4	91.2	21.9	61.7	84.5	54.8	105.6	52.2	36.0	24.9	10.5	1.1	1.7	1613.2
105	16.8	110.8	24.2	76.3	103.4	97.2	176.9	89.2	35.7	26.7	11.2	1.8	2.5	1838.0
141	8.2	50.7	10.0	31.8	47.7	23.4	43.4	25.0	18.8	14.9	5.3	1.2	0.9	486.6
179	5.4	20.9	6.2	18.5	24.6	9.8	17.9	11.2	6.2	4.1	2.0	0.3	0.4	220.2
163	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
138	78.3	403.8	42.4	296.8	433.8	102.5	371.0	165.8	48.7	33.0	16.5	2.3	2.0	3150.8
158	4.9	29.1	6.7	19.4	28.0	15.4	45.1	14.9	11.0	8.3	4.3	0.9	1.0	866.3
178	3.0	12.6	3.4	10.5	13.8	4.4	8.1	5.4	3.5	2.3	1.2	0.4	0.4	97.0
126	0.6	3.5	1.1	1.7	3.0	1.9	3.8	2.0	2.8	2.4	1.3	0.8	0.8	43.4
187	20.3	79.8	22.3	69.7	96.9	28.5	54.9	36.3	18.4	10.1	5.5	0.7	0.7	634.1
183	6.9	28.9	6.5	22.3	32.7	12.3	24.2	15.3	7.7	5.2	2.4	0.4	0.5	223.3

PCB (µg/Kg-Lipids)	PØ1-Pre-Rep B 1	PØ1-Post-Rep B 1	PØ8-Pre - Rep B 1	PØ8-Post-Rep B 1	PØ8-Pre + -Rep B 1	PØ11-Pre-Rep B 3	PØ11-Post-Rep B 1	PØ11-Pre + -Rep B 1	PØ17-Pre-Rep B 1	PØ17-Post-Rep B 1	PØ17-Pre-Rep + B 1	T0 B 1	Control B 1	NBH B 1
128	7.5	39.7	7.6	31.0	42.8	14.2	46.1	17.0	9.3	6.0	2.3	0.0	0.0	717.3
167	7.6	39.7	6.8	31.0	42.9	12.8	46.1	17.0	8.3	5.9	2.7	0.2	0.3	616.3
174	8.6	38.9	7.9	27.4	39.8	18.3	32.2	21.2	11.1	7.4	2.8	0.1	0.2	236.5
177	7.8	33.8	8.3	26.6	37.7	12.5	21.9	15.0	8.0	5.1	2.5	0.5	0.3	197.7
171	3.5	15.0	4.0	12.6	20.0	7.0	14.1	8.4	4.4	3.2	1.5	0.3	0.2	154.5
156	5.0	34.3	6.1	22.1	33.8	11.9	34.8	13.4	8.9	7.3	2.7	0.5	0.5	592.7
157	1.1	6.4	1.1	4.0	6.0	1.9	5.7	2.3	1.7	1.5	0.8	0.2	0.2	89.7
173	0.7	5.3	0.3	5.1	5.4	0.4	5.1	2.0	0.1	0.1	0.1	0.1	0.0	7.4
172	1.2	5.6	1.3	4.0	5.4	1.9	4.2	2.2	1.4	1.3	0.4	0.1	0.1	44.0
197	0.1	0.5	0.1	0.5	0.6	0.1	0.4	0.2	0.0	0.0	0.0	0.0	0.0	2.8
180	17.7	83.7	17.1	59.0	88.7	34.1	62.4	36.7	20.8	15.4	6.7	0.6	0.6	549.2
193	17.7	83.7	1.1	59.0	88.7	12.8	62.4	36.7	0.8	0.6	0.2	0.0	0.0	31.0
191	1.1	4.3	ND	3.7	4.5	1.2	2.9	2.0	ND	ND	ND	ND	ND	ND
169	0.0	0.7	0.0	4.0	2.5	0.2	0.9	1.7	0.0	0.0	0.0	0.0	0.0	0.2
170	7.3	33.2	8.7	25.2	38.7	14.7	27.0	14.0	11.8	9.1	3.6	0.4	0.5	351.2
190	1.3	7.1	2.0	5.1	7.2	3.1	4.9	3.2	3.8	3.1	1.5	0.6	0.7	60.9
198	3.6	15.3	3.7	13.1	17.1	6.4	10.5	7.7	3.9	2.6	1.0	0.0	0.0	68.2
203	2.1	8.4	1.8	6.8	10.1	3.6	6.2	4.3	2.2	1.4	0.6	0.0	0.0	38.2
196	1.9	8.1	2.0	6.5	9.5	3.6	6.1	4.2	2.8	2.0	1.1	0.3	0.3	37.5
189	0.1	5.5	0.3	72.4	42.4	5.4	2.7	28.0	0.5	0.4	0.2	0.1	0.1	15.1
208	0.6	2.7	1.0	2.5	3.6	1.2	1.8	1.5	1.1	0.9	0.5	0.2	0.3	10.4
195	1.0	5.0	1.6	3.8	5.4	2.3	3.6	2.1	2.4	1.8	1.0	0.5	0.5	24.0
207	0.1	0.3	0.2	0.3	0.6	0.2	0.3	0.2	0.2	0.2	0.1	0.0	0.0	3.1
194	2.7	12.8	2.3	9.5	14.1	4.4	8.1	5.2	2.5	2.1	0.8	0.1	0.1	48.4
205	1.9	7.3	0.0	2.8	3.1	0.8	2.5	0.5	0.0	0.0	0.0	0.0	0.0	2.2
206	0.7	2.1	1.8	4.5	3.3	2.5	3.3	2.1	2.2	1.7	0.9	0.3	0.3	25.5
209	0.8	4.1	1.7	4.9	7.2	2.4	3.5	2.3	2.4	1.9	1.1	0.5	0.6	7.3

Table B86. PCBs in clam (bioaccumulation study initiated on September 13th 2016 for 28 days) obtained from exsitu deployment in the pre-storm sediments collected for the season 2016/17.

PCB (µg/Kg-Lipids)	PØ1-Mn-101216-B-1	PØ8-Mn-101216-B-1	PØ11-Mn-101216-B-1	PØ17-Mn-101216-B-1	DB B-1	T0 1
1	0.967	1.036	1.401	1.622	0.865	0.653
2	0.754	0.235	1.175	1.129	0.372	0.277
3	0.862	0.971	1.197	1.261	1.265	1.070
4	16.714	7.537	31.650	34.067	9.159	31.758
10	1.233	0.412	1.860	1.865	0.143	0.225
9	ND	1.295	ND	ND	2.149	1.569
7	ND	53.906	ND	ND	68.803	118.134
6	2.018	1.311	1.322	1.146	1.393	1.575
8	5.449	2.183	6.054	4.632	1.927	2.133
5	ND	ND	ND	ND	ND	ND
19	1.294	0.332	2.142	1.542	0.000	0.000
18	86.983	85.379	199.939	227.633	120.075	349.311
17	6.603	6.748	7.892	8.609	4.443	3.046
15	3.918	3.102	7.003	5.935	2.847	2.525
27	ND	ND	ND	ND	ND	ND
24	ND	1.300	ND	ND	80.775	234.381
32	7.478	6.574	11.887	8.761	3.944	4.104
16	5.726	5.490	8.232	7.501	2.958	2.651
34	4.779	4.247	1.999	2.140	4.692	2.405
29	3.830	ND	8.096	6.277	ND	ND
26	4.656	5.644	4.510	3.821	5.114	3.276
25	4.345	3.299	5.985	2.925	1.662	1.437
31	12.896	15.722	24.322	28.521	12.399	11.256
28	26.139	28.519	41.681	40.442	13.506	11.256
20	11.219	12.312	20.494	21.479	6.050	6.970
22	4.262	5.182	9.214	10.876	4.727	3.784
45	3.418	4.021	5.863	5.885	2.917	2.405
46	130.512	3.193	257.369	233.564	0.000	0.092

PCB (µg/Kg-Lipids)	PØ1-Mn-101216-B-1	PØ8-Mn-101216-B-1	PØ11-Mn-101216-B-1	PØ17-Mn-101216-B-1	DB B-1	T0 1
69	71.279	ND	138.878	126.267	ND	ND
52	91.506	104.738	179.812	163.174	75.600	136.736
47	46.702	56.453	65.675	32.536	8.058	6.898
48	13.026	5.234	18.137	12.897	1.319	1.207
44	60.807	ND	88.629	39.287	ND	ND
42	12.802	ND	31.775	16.134	ND	ND
37	9.423	6.942	12.740	12.390	5.882	4.109
71	17.527	20.651	31.028	16.191	3.517	2.768
41	32.353	39.552	72.507	65.307	14.501	12.100
103	5.087	6.314	4.550	0.293	21.340	17.174
40	4.534	4.516	11.821	7.885	1.376	0.805
67	2.819	3.204	61.216	93.997	2.012	1.434
74	24.479	28.888	50.197	39.116	5.689	4.736
70	46.396	56.251	100.423	74.864	15.255	14.594
66	70.410	72.830	110.439	62.227	9.131	7.303
95	40.243	51.892	64.036	45.600	12.056	13.059
93	47.433	59.188	69.939	51.765	16.357	14.499
56	9.569	13.610	30.258	21.229	4.269	3.289
60	9.866	13.078	29.701	20.642	3.609	2.642
92	25.141	31.383	40.549	23.170	5.825	5.550
84	83.515	99.871	116.907	74.703	17.038	16.828
101	147.447	101.068	248.392	178.355	18.261	17.399
99	148.056	149.793	162.507	84.668	12.707	12.521
119	61.365	29.952	49.343	107.997	7.624	8.647
83	22.693	25.777	26.233	21.358	10.363	11.183
87	41.493	23.505	83.642	73.442	7.887	5.660
81	1.422	2.947	3.391	2.506	1.177	1.154
115	ND	ND	ND	ND	ND	ND

PCB (µg/Kg-Lipids)	PØ1-Mn-101216-B-1	PØ8-Mn-101216-B-1	PØ11-Mn-101216-B-1	PØ17-Mn-101216-B-1	DB B-1	T0 1
136	14.252	20.304	25.668	13.521	2.698	2.636
110	144.827	172.135	233.282	164.242	22.692	21.607
77	9.132	10.161	17.383	10.429	3.187	3.080
82	22.409	14.493	23.284	17.648	3.187	3.444
151	35.289	40.892	38.515	26.268	5.138	7.560
135	0.000	11.620	6.694	1.672	0.371	0.500
144	11.625	13.316	16.837	6.242	2.326	1.915
147	9.030	8.306	9.883	4.509	0.687	0.521
107	15.129	15.433	20.290	11.100	2.889	2.530
123	256.021	ND	368.715	249.088	ND	ND
149	155.363	161.476	178.505	104.970	12.505	11.663
118	155.471	161.936	254.305	105.757	62.144	44.918
134	5.083	8.507	14.663	2.956	0.455	1.004
114	171.818	ND	388.138	117.528	ND	ND
131	ND	0.194	ND	ND	0.000	0.000
146	31.009	31.634	36.134	19.303	2.417	2.011
153	238.635	208.634	231.671	123.878	9.442	8.422
132	37.214	39.787	51.970	38.430	3.807	4.170
105	43.003	45.105	66.705	47.579	6.485	5.350
141	17.991	21.318	29.290	27.430	2.986	2.959
179	13.797	12.645	15.025	8.575	1.050	0.889
163	ND	ND	ND	ND	ND	ND
138	206.831	89.981	216.387	145.413	3.310	3.401
158	12.118	13.060	18.544	14.488	5.580	2.918
178	8.775	8.421	9.552	4.675	1.766	1.231
126	0.714	4.973	1.617	2.387	3.929	3.524
187	57.306	48.879	56.609	30.163	0.825	0.838
183	19.104	14.163	22.063	14.222	1.389	0.948

PCB (µg/Kg-Lipids)	PØ1-Mn-101216-B-1	PØ8-Mn-101216-B-1	PØ11-Mn-101216-B-1	PØ17-Mn-101216-B-1	DB B-1	T0 1
128	14.516	13.875	18.709	10.682	0.000	0.000
167	14.611	13.399	18.812	10.783	0.581	0.575
174	20.547	17.723	24.392	16.810	0.000	0.000
177	20.257	17.966	23.840	13.656	0.090	0.280
171	9.791	8.677	9.088	7.837	0.110	0.288
156	16.743	14.725	18.713	15.456	1.593	1.630
157	2.294	2.917	2.085	1.857	1.206	0.811
173	0.098	0.000	0.000	1.387	0.000	0.000
172	6.115	3.107	3.235	2.701	0.000	0.000
197	0.107	0.106	0.000	0.000	0.000	0.000
180	46.544	38.208	51.874	39.760	0.890	1.137
193	2.739	2.462	3.027	0.790	0.000	0.000
191	0.530	-	1.337	2.425	-	-
169	0.000	0.000	0.000	0.000	0.000	0.000
170	20.145	20.590	23.570	18.646	1.921	1.588
190	4.742	5.277	4.824	5.489	3.689	2.656
198	11.295	10.060	13.754	8.945	0.000	0.000
203	6.702	4.418	8.760	7.116	0.000	0.013
196	6.021	5.836	8.101	5.826	1.906	1.285
189	0.778	1.005	19.746	21.186	0.019	0.122
208	2.166	2.577	3.980	2.545	1.280	0.903
195	2.741	4.417	4.380	4.226	2.738	1.906
207	0.000	0.669	0.000	0.000	0.000	0.000
194	11.287	6.441	13.568	11.528	0.064	0.143
205	2.520	0.000	7.584	2.788	0.000	0.000
206	1.951	5.587	3.988	1.341	1.153	0.801
209	3.148	7.302	6.929	4.239	3.086	2.214

Table B87. PCBs in clam (deployed on March 10th 2017 and retrieved on April 7th 2017) obtained from exsitu deployment in the post-storm sediments collected for the season 2016/17.

PCB (μg/Kg-Lipids)	**DB_1_04 2017**	**P01_1_04 2017**	**P08_1_04 2017**	**P11_1_04 2017**	**P17_1_04 2017**	**T0A_1_04 2017**	**T0B_1_04 2017**	**T0C_1_04 2017**
1	1.905	0.797	1.514	0.632	0.854	0.531	0.644	0.279
2	0.999	0.328	0.676	0.341	0.508	0.236	0.303	0.120
3	2.863	1.253	2.214	0.990	1.292	0.873	1.047	0.438
4	63.311	8.690	14.608	6.503	11.029	13.672	10.262	4.085
10	1.486	0.197	0.586	0.146	0.240	0.150	0.012	0.020
9	ND	ND	ND	1.264	5.488	5.744	8.062	2.672
7	ND	ND	ND	51.614	94.285	74.708	77.371	26.862
6	5.017	1.393	3.077	1.206	1.753	1.127	1.157	0.443
8	7.468	1.720	3.960	1.560	2.400	1.362	1.065	0.415
5	ND	ND	ND	ND	ND	ND	ND	ND
19	0.082	0.000	0.244	0.000	0.000	0.000	0.000	0.000
18	78.282	19.645	37.038	13.756	19.730	18.165	14.656	10.059
17	9.091	4.694	12.419	5.572	5.324	2.035	2.224	0.998
15	7.105	2.437	5.111	3.228	3.149	1.514	1.630	0.685
27	ND	ND	ND	0.000	0.000	0.000	0.000	0.000
24	ND	ND	ND	0.831	0.921	0.383	0.493	0.264
32	6.427	4.024	10.129	4.716	5.044	1.505	1.602	0.854
16	6.410	3.124	8.809	4.151	4.080	1.275	1.210	0.435
34	ND	ND	ND	ND	ND	ND	ND	ND
29	ND	ND	ND	ND	ND	ND	ND	ND
26	5.884	4.264	9.138	3.979	5.084	2.379	3.199	1.439
25	3.052	1.799	5.782	1.843	2.128	0.796	1.227	0.454
31	27.074	9.831	27.489	13.677	17.762	6.276	7.024	3.073
28	25.739	16.513	46.429	20.991	22.343	6.411	7.543	3.179
20	18.486	6.595	20.038	11.248	12.335	3.779	3.699	1.678
22	9.777	3.768	9.321	4.818	6.141	2.280	2.177	0.993
45	4.235	3.172	8.318	4.363	3.462	1.309	1.698	0.703
46	ND	ND	ND	2.389	0.213	0.039	0.000	0.015

PCB (µg/Kg-Lipids)	DB_1_04 2017	P01_1_04 2017	P08_1_04 2017	P11_1_04 2017	P17_1_04 2017	T0A_1_04 2017	T0B_1_04 2017	T0C_1_04 2017
69	ND	ND	ND	ND	ND	Nd	ND	ND
52	80.629	48.247	133.105	55.996	39.375	17.239	16.688	7.247
47	16.883	38.291	95.474	33.781	16.490	4.289	4.853	2.070
48	ND	ND	ND	5.892	5.155	0.603	0.619	0.152
44	ND	ND	ND	ND	ND	ND	ND	ND
42	ND	ND	ND	ND	ND	ND	ND	ND
37	8.253	5.290	12.719	6.540	6.876	4.536	5.461	2.005
71	5.757	12.971	35.353	17.622	9.155	1.611	1.868	0.738
41	27.362	25.223	75.686	44.583	32.312	7.072	7.664	3.271
103	45.411	4.775	12.391	3.655	2.190	12.083	12.531	3.513
40	2.669	2.924	9.465	5.692	3.447	0.787	0.610	0.239
67	2.124	2.777	5.443	2.497	2.169	0.811	1.183	0.564
74	12.102	17.208	49.259	28.344	17.095	2.921	3.061	1.019
70	36.635	33.802	93.205	53.412	33.279	9.108	8.803	3.709
66	16.499	47.179	119.086	51.218	26.263	4.256	4.527	1.822
95	34.773	36.088	87.642	35.317	21.311	7.736	5.743	2.629
93	42.334	50.264	109.586	38.503	24.878	11.221	10.042	4.044
56	6.627	8.066	23.326	16.031	10.012	1.846	2.347	0.937
60	5.832	7.234	22.781	15.207	9.164	1.481	1.933	0.788
92	15.173	20.581	53.278	18.339	11.145	3.905	4.051	1.816
84	40.913	67.035	165.939	61.191	34.320	9.461	9.904	3.725
101	40.636	67.723	168.090	62.069	35.130	9.582	10.024	3.708
99	28.828	117.175	252.386	81.220	40.012	7.780	9.377	3.915
119	10.591	19.088	48.881	17.562	9.006	3.581	6.151	3.777
83	15.751	13.911	32.405	13.595	12.615	4.561	6.607	2.839
87	15.595	16.911	49.100	22.214	14.200	3.186	3.252	1.400
81	2.108	2.297	5.609	2.651	2.115	0.662	0.863	0.386
115	ND	ND	ND	ND	ND	ND	ND	ND

PCB (µg/Kg-Lipids)	DB_1_04 2017	P01_1_04 2017	P08_1_04 2017	P11_1_04 2017	P17_1_04 2017	T0A_1_04 2017	T0B_1_04 2017	T0C_1_04 2017
136	7.642	15.073	33.905	12.584	6.741	1.602	1.572	0.557
110	59.326	110.535	284.928	114.288	77.356	13.232	14.779	5.464
77	3.803	7.767	18.000	8.016	6.570	1.151	1.601	0.697
82	6.442	9.321	24.420	11.502	8.218	1.835	2.553	1.132
151	12.516	29.001	67.053	21.915	11.973	2.857	3.596	1.283
135	2.315	7.405	23.224	4.992	2.539	0.410	1.485	0.574
144	4.320	10.151	21.820	7.072	4.349	1.194	1.575	0.637
147	1.237	6.913	14.459	3.548	2.108	0.337	0.432	0.178
107	3.480	10.954	26.478	8.168	5.262	1.332	1.728	0.892
123	-	-	-	ND	ND	-	-	-
149	30.256	120.003	270.935	84.301	48.716	7.341	9.515	3.749
118	42.741	131.643	317.272	99.550	66.827	21.585	32.529	13.109
134	2.205	6.694	13.204	4.263	2.821	0.385	0.427	0.080
114	-	-	-	ND	ND	-	-	-
131	ND	ND	ND	0.189	0.056	0.000	0.000	0.000
146	4.380	26.973	64.826	17.052	7.259	1.362	1.912	0.738
153	22.170	174.050	424.832	116.942	50.317	6.409	7.833	3.477
132	11.169	29.230	84.173	31.087	20.207	2.737	3.027	1.174
105	11.785	32.699	93.275	38.159	21.172	3.488	4.517	1.875
141	5.499	14.912	42.761	17.585	11.937	1.818	2.635	1.045
179	1.932	9.506	24.402	7.569	3.172	0.607	0.841	0.332
163	ND	ND	ND	ND	ND	ND	ND	ND
138	10.933	68.149	205.000	50.471	22.045	2.586	3.400	1.463
158	4.895	12.136	29.350	11.185	8.438	2.013	2.904	1.143
178	1.955	7.669	17.139	5.164	2.943	0.991	1.366	0.555
126	4.005	5.044	9.248	4.569	5.751	1.960	3.407	1.578
187	2.882	41.341	98.965	28.601	12.120	0.825	1.209	0.499
183	1.966	11.575	29.026	9.524	5.107	0.711	0.929	0.417

PCB (µg/Kg-Lipids)	DB_1_04 2017	P01_1_04 2017	P08_1_04 2017	P11_1_04 2017	P17_1_04 2017	T0A_1_04 2017	T0B_1_04 2017	T0C_1_04 2017
128	0.000	10.096	29.449	8.106	4.389	0.000	0.000	0.000
167	1.437	10.852	28.055	8.385	5.084	0.369	0.508	0.190
174	0.522	11.557	33.631	11.977	5.087	0.053	0.114	0.042
177	1.622	15.061	37.779	11.977	7.201	0.171	0.202	0.153
171	1.616	7.447	18.879	5.277	3.202	0.344	0.260	0.166
156	2.415	11.617	29.283	10.631	6.820	0.878	1.316	0.628
157	1.155	2.432	5.281	1.789	1.730	0.552	0.821	0.351
173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	0.055	1.768	6.698	1.998	1.063	0.055	0.000	0.000
197	0.000	0.000	0.069	0.000	0.000	0.000	0.000	0.000
180	3.441	29.028	79.127	25.828	14.826	0.931	1.509	0.559
193	0.101	1.795	5.013	1.223	0.339	0.011	0.000	0.000
191	ND	ND	ND	ND	ND	ND	ND	ND
169	ND	ND	ND	0.000	0.000	0.000	0.000	0.000
170	1.966	18.866	44.561	13.936	5.457	0.646	1.727	0.731
190	3.474	6.527	10.840	3.736	4.515	1.880	2.738	1.113
198	0.000	6.186	18.137	5.131	2.278	0.000	0.000	0.000
203	0.013	3.085	8.619	2.883	1.582	0.010	0.024	0.013
196	1.779	4.837	10.915	3.829	2.944	0.949	1.412	0.591
189	0.352	0.756	1.828	0.584	0.457	0.023	0.006	0.000
208	2.869	2.282	4.931	1.773	1.674	1.028	1.148	0.503
195	2.483	4.574	7.144	3.582	3.809	1.328	2.052	0.783
207	0.404	0.315	0.901	0.353	0.090	0.020	0.000	0.000
194	0.196	4.143	12.267	3.548	2.250	0.122	0.171	0.050
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	1.173	4.159	11.201	3.360	2.720	0.764	1.123	0.486
209	2.735	4.790	10.117	3.931	3.762	1.507	2.297	0.963

Table B88. Average in-situ porewater (PW) and overlying water (OW) concentration of PAH at station P11 of the receiving water body as measured by the SPME based passive sampler that was recovered on August 12th 2015.

PAHs (ng/L)	30-40cm OW	20-30cm OW	10-20cm OW	0-10cm OW	0-5cm PW	5-10cm PW	10-15cm PW	15-20cm PW	20-25cm PW	25-30cm PW	30-35cm PW	35-40cm PW	40-45cm PW
Naphthalene	10.4	10.9	6.3	6.1	2.6	3.9	20.5	4.7	4.0	3.6	4.6	5.4	3.7
2-methylnaphthalene	15.2	16.1	13.3	12.0	17.9	18.5	28.9	19.7	17.6	18.1	20.8	19.5	17.6
1-methylnaphthalene	3.8	4.4	2.5	2.2	2.0	1.9	7.1	2.5	1.4	2.5	3.9	2.2	1.9
2-ethylnaphthalene	3.5	3.5	3.0	3.0	5.4	5.6	6.9	5.7	5.1	5.9	6.8	6.0	6.2
1-ethylnaphthalene	0.0	0.0	0.7	0.2	0.0	0.5	1.1	0.9	0.0	0.0	0.4	0.3	0.9
2.6-dimethylnaphthalene	5.0	5.2	4.5	3.9	7.2	7.3	10.0	8.9	7.5	7.8	8.2	8.5	7.6
1.3-dimethylnaphthalene	5.4	5.6	4.6	4.0	7.5	8.4	10.1	8.6	7.2	7.6	8.5	8.2	7.6
2-isopropylnaphthalene	1.1	1.1	1.1	1.1	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
acenaphthylene	8.7	9.3	8.9	9.4	17.2	17.5	17.1	17.4	17.2	17.1	18.6	18.7	19.1
1.2-dimethylnaphthalene	3.2	3.1	3.1	3.5	7.6	7.0	6.5	6.2	6.3	7.3	9.4	10.4	11.0
1.8-dimethylnaphthalene	2.8	4.0	3.2	4.2	6.4	9.5	6.3	6.1	6.3	6.9	8.1	6.8	8.3
acenaphthene	3.3	4.0	3.3	2.9	3.5	5.6	9.9	4.5	3.9	5.0	7.6	7.0	7.3
2.3.5-trimethylnaphthalene	1.7	1.7	1.6	1.2	2.8	3.5	4.0	3.6	2.9	3.3	3.8	4.2	3.3
fluorene	6.8	7.6	6.8	6.8	11.4	13.5	20.1	12.7	12.4	13.5	17.8	15.3	16.8
1-methylfluorene	4.7	4.5	4.3	4.4	10.3	10.8	11.5	9.6	7.9	10.3	13.2	10.5	10.1
phenanthrene	7.5	10.1	9.6	13.4	16.5	17.2	31.9	14.7	17.2	24.8	30.9	24.8	28.9
anthracene	1.5	2.3	2.6	2.4	6.6	4.8	8.6	4.4	4.9	6.9	9.5	4.9	9.4
2-methylphenanthrene	0.9	1.1	1.0	1.1	1.7	2.0	2.8	2.0	1.8	2.4	3.1	3.1	3.5
2-methylanthracene	1.3	1.7	1.5	2.8	5.2	3.0	4.1	2.6	2.6	3.2	3.9	4.3	5.0
1-methylphenanthrene	0.7	1.0	0.9	1.0	1.7	2.0	2.6	1.8	1.8	2.8	3.8	4.0	4.9
9-methylanthracene	0.3	0.4	0.3	0.6	1.2	1.9	0.8	1.0	1.3	0.8	1.0	1.5	1.7
2-ethylanthracene	0.6	0.5	0.5	0.7	2.3	2.0	1.1	1.0	1.0	1.3	1.9	2.9	2.4
fluoranthene	3.4	4.2	4.1	6.4	10.4	8.1	5.8	5.6	5.7	14.5	29.0	26.0	32.5
pyrene	3.4	4.6	5.0	21.3	49.5	39.6	25.5	23.8	24.6	49.5	76.4	105.6	136.9
9.10-dimethylanthracene	0.6	2.2	1.6	1.2	3.0	3.2	6.0	1.9	1.3	1.2	1.6	2.6	2.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
1-methylpyrene	0.6	0.7	0.7	1.4	3.7	3.4	2.6	2.7	3.0	3.7	4.7	5.8	6.6
benz(a)anthracene	0.5	0.6	0.6	1.0	2.7	2.4	1.8	1.8	2.0	2.9	4.1	4.4	6.0

PAHs (ng/L)	30-40cm OW	20-30cm OW	10-20cm OW	0-10cm OW	0-5cm PW	5-10cm PW	10-15cm PW	15-20cm PW	20-25cm PW	25-30cm PW	30-35cm PW	35-40cm PW	40-45cm PW
chrysene	0.5	0.6	0.7	1.1	2.8	2.4	1.8	1.8	1.8	2.4	3.7	3.9	5.5
benzo(b)fluoranthene	0.4	0.6	0.6	0.7	2.0	2.1	1.7	2.0	1.8	2.2	2.7	3.2	3.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
benzo(k)fluoranthene	0.4	0.5	0.6	0.7	1.9	1.7	1.4	1.4	1.6	1.7	2.1	2.7	2.9
benzo(e)pyrene	0.2	0.2	0.2	0.3	0.8	0.9	0.7	0.8	0.8	0.9	1.0	1.3	1.3
benzo(a)pyrene	0.4	0.5	0.5	0.7	2.1	2.2	1.9	2.1	2.1	2.3	2.8	3.5	3.7
perylene	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B89. Average in-situ porewater (PW) and overlying water (OW) concentration of PAH at station P17 of the receiving water body as measured by the SPME based passive sampler that was recovered on August 12th 2015.

PAHs (ng/L)	30-40cm OW	20-30cm OW	10-20cm OW	0-10cm OW	0-5cm PW	5-10cm PW	10-15cm PW	15-20cm PW	20-25cm PW	25-30cm PW	30-35cm PW	35-40cm PW	40-45cm PW
naphthalene	9.6	13.0	13.0	13.3	5.3	4.6	5.0	4.4	3.9	1.9	3.3	1.9	5.3
2-methylnaphthalene	12.6	17.5	15.1	14.8	17.1	17.6	17.1	14.9	15.3	15.7	18.2	16.6	17.0
1-methylnaphthalene	3.2	5.4	3.6	4.0	1.5	1.5	1.2	0.5	0.4	0.7	1.8	1.2	1.4
2-ethylnaphthalene	3.2	3.7	3.4	3.5	6.2	6.7	6.3	5.6	6.0	5.5	6.1	5.9	5.6
1-ethylnaphthalene	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.5	0.8	1.4	0.0
2.6-dimethylnaphthalene	4.1	6.1	5.2	5.3	7.6	8.2	7.1	6.2	6.1	7.1	8.5	7.3	7.3
1.3-dimethylnaphthalene	4.8	7.1	5.3	5.4	7.5	8.1	7.7	6.3	7.0	7.4	8.2	6.8	7.8
2-isopropylnaphthalene	1.1	1.1	1.2	1.2	2.3	2.4	2.3	2.3	2.3	2.4	2.3	2.3	2.3
acenaphthylene	7.7	8.7	8.3	8.2	15.7	15.7	15.2	15.2	15.9	15.4	15.5	15.8	15.4
1.2-dimethylnaphthalene	3.3	3.5	3.2	3.3	6.3	6.3	5.8	5.8	5.9	6.1	6.1	6.0	6.0
1.8-dimethylnaphthalene	3.5	3.7	3.5	4.2	6.2	5.8	7.3	6.2	6.1	5.9	6.2	5.9	7.0
acenaphthene	2.0	4.8	4.0	4.3	5.7	6.2	6.3	4.0	5.9	3.4	5.7	7.2	4.7
2.3.5-trimethylnaphthalene	1.6	2.3	1.8	1.8	3.7	3.4	3.3	2.9	3.2	2.9	3.2	3.2	3.2
fluorene	5.4	8.5	6.8	7.7	14.3	16.5	14.4	13.1	15.3	12.9	14.5	16.4	13.7
1-methylfluorene	3.5	5.2	4.1	4.5	11.6	11.1	8.5	9.5	11.6	11.2	10.2	11.0	8.5
phenanthrene	6.8	11.2	7.1	7.2	22.1	26.1	22.3	20.0	24.1	21.3	25.6	36.4	26.5
anthracene	1.1	2.6	1.6	2.1	3.2	6.0	3.4	1.8	2.7	4.1	3.2	4.0	4.8
2-methylphenanthrene	0.9	1.5	0.9	1.1	2.9	3.0	2.2	2.3	2.5	2.4	2.6	3.4	2.6
2-methylanthracene	1.4	2.5	1.4	2.5	5.7	5.8	4.4	4.5	4.9	6.6	7.2	8.8	7.1
1-methylphenanthrene	0.7	1.3	0.8	0.9	2.5	2.7	2.0	1.9	2.0	2.1	2.0	2.6	1.9
9-methylanthracene	0.2	0.4	0.4	0.9	0.8	1.0	0.8	0.9	0.7	2.3	1.6	2.0	1.8
2-ethylanthracene	0.4	0.6	0.4	0.4	1.7	1.3	1.0	1.2	0.9	1.3	1.0	1.1	0.9
fluoranthene	2.8	5.4	3.8	4.2	6.0	5.9	4.4	4.0	4.2	5.1	5.6	6.6	5.2
pyrene	2.9	5.4	4.1	8.3	15.1	17.6	16.7	17.2	17.1	16.8	17.2	16.4	14.3
9.10-dimethylanthracene	0.4	2.2	1.5	1.5	3.1	2.7	7.7	1.6	1.9	2.5	2.1	2.8	1.7
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1-methylpyrene	0.4	0.6	0.6	0.8	1.4	1.6	1.4	1.4	1.5	1.6	1.4	1.5	1.4
benz(a)anthracene	0.4	0.6	0.5	0.6	1.3	1.3	1.2	1.2	1.3	1.2	1.2	1.2	1.1

PAHs (ng/L)	**30-40cm OW**	**20-30cm OW**	**10-20cm OW**	**0-10cm OW**	**0-5cm PW**	**5-10cm PW**	**10-15cm PW**	**15-20cm PW**	**20-25cm PW**	**25-30cm PW**	**30-35cm PW**	**35-40cm PW**	**40-45cm PW**
chrysene	0.4	0.7	0.6	0.8	1.4	1.4	1.2	1.1	1.3	1.2	1.3	1.2	1.2
benzo(b)fluoranthene	0.2	0.4	0.3	0.4	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.7
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.1	0.3	0.2	0.4	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7
benzo(e)pyrene	0.1	0.2	0.1	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
benzo(a)pyrene	0.2	0.3	0.3	0.4	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
perylene	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B90. Average ex-situ porewater (PW) concentration of PAH for stations P11 and P17 dry weather sediment core (July 2015) as measured by the SPME based passive sampler that was recovered on August 14th 2015.

PAHs	P17 A 1-1_comb	P17 B 2-1_comb	P17 C 3-1_comb	P11 A 4-1_comb	P11 B 5-1_comb	P11 C 6-1_comb	P11 B_5-4	REF A 7-1_comb	REF B 8-1_comb	REF C 9-1_comb
naphthalene	35.5	34.4	40.1	31.3	40.4	35.7	31.4	54.0	37.9	25.6
2-methylnaphthalene	18.2	21.9	23.1	16.9	21.4	18.2	18.3	26.0	19.3	14.9
1-methylnaphthalene	6.7	8.5	9.7	6.2	7.9	5.7	3.9	11.0	7.0	4.9
2-ethylnaphthalene	3.0	3.5	3.3	3.5	3.9	3.2	3.8	3.8	3.3	2.7
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.6-dimethylnaphthalene	4.4	4.9	6.4	4.2	5.0	3.9	2.4	5.6	4.5	3.4
1.3-dimethylnaphthalene	5.4	6.1	7.0	5.7	6.5	5.4	5.1	7.2	6.0	4.6
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	0.0	0.0	0.5	2.1	1.5	2.3	0.0	0.0	0.0	0.0
1.2-dimethylnaphthalene	1.2	1.3	1.7	1.7	1.4	1.3	1.0	1.7	1.3	1.0
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
acenaphthene	5.4	7.1	7.2	8.0	6.3	6.4	5.0	6.4	7.0	5.1
2.3.5-trimethylnaphthalene	2.2	2.7	2.9	2.9	2.9	2.3	2.1	2.7	2.6	2.0
fluorene	7.5	12.2	13.1	13.3	10.9	8.8	12.5	13.0	12.6	8.3
1-methylfluorene	3.8	6.5	7.2	10.1	5.9	6.5	11.1	6.0	5.9	5.7
phenanthrene	8.2	13.4	15.8	21.6	12.4	9.7	16.9	13.7	13.2	8.6
anthracene	2.0	3.6	4.3	4.7	3.9	2.8	3.3	3.1	3.0	1.6
2-methylphenanthrene	0.8	1.2	1.6	2.4	1.3	1.0	1.7	1.3	1.2	0.7
2-methylanthracene	2.9	5.2	7.0	4.2	2.4	1.4	2.7	2.0	1.9	1.1
1-methylphenanthrene	0.5	0.8	1.0	1.8	1.3	0.9	1.2	1.0	1.0	0.5
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	2.4	2.7	4.3	5.6	2.4	2.0	2.3	1.6	1.3	1.3
pyrene	6.3	7.0	11.9	25.6	11.2	13.5	7.3	1.2	0.9	0.8
9.10-dimethylanthracene	0.8	1.1	0.8	1.8	0.9	0.9	0.9	1.3	1.0	1.2
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.8	1.1	2.4	1.2	1.9	1.3	0.3	0.2	0.2

PAHs	P17 A 1-1_comb	P17 B 2-1_comb	P17 C 3-1_comb	P11 A 4-1_comb	P11 B 5-1_comb	P11 C 6-1_comb	P11 B_5-4	REF A 7-1_comb	REF B 8-1_comb	REF C 9-1_comb
benz(a)anthracene	0.3	0.4	0.6	1.3	0.5	0.7	0.5	0.2	0.2	0.2
chrysene	0.5	0.5	0.7	1.4	0.6	0.8	0.5	0.1	0.1	0.1
benzo(b)fluoranthene	0.4	0.5	0.6	1.5	1.0	1.4	0.8	0.2	0.2	0.1
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.4	0.6	1.3	0.9	1.4	0.7	0.1	0.2	0.1
benzo(e)pyrene	0.1	0.2	0.2	0.5	0.4	0.5	0.3	0.0	0.0	0.0
benzo(a)pyrene	0.2	0.3	0.3	1.0	0.7	1.0	0.6	0.1	0.1	0.1
perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B91. Average ex-situ porewater (PW) concentration of PCBs at P11, P17 and reference dry weather sediment cores (July 2015) as measured by the SPME based passive sampler that was recovered on August 14th 2015.

PCBs (ng/L)	P17 A 1-1_comb	P17 B 2-1_comb	P17 C 3-1_comb	P11 B 5-1_comb	P11 C 6-1_comb	REF A 7-1_comb	REF B 8-1_comb	REF C 9-1_comb
1	0.026	0.034	0.040	0.019	0.016	0.022	0.017	0.017
2	0.002	0.006	0.009	0.002	0.000	0.002	0.000	0.000
3	0.016	0.026	0.032	0.010	0.005	0.012	0.005	0.006
4	0.471	0.649	0.733	0.631	0.278	0.335	0.311	0.433
10	0.014	0.020	0.020	0.013	0.010	0.011	0.010	0.009
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.009	0.015	0.013	0.010	0.006	0.006	0.006	0.006
8	0.041	0.068	0.063	0.047	0.031	0.034	0.036	0.032
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.007	0.016	0.013	0.009	0.008	0.003	0.004	0.001
18	0.061	0.092	0.087	0.072	0.041	0.045	0.047	0.037
17	0.033	0.045	0.055	0.048	0.026	0.029	0.030	0.024
15	0.017	0.016	0.018	0.017	0.011	0.009	0.013	0.008
27	0.026	0.028	0.027	0.019	0.020	0.018	0.018	0.017
24	0.023	0.028	0.038	0.028	0.028	0.025	0.023	0.020
32	0.036	0.025	0.030	0.020	0.039	0.012	0.018	0.011
16	0.026	0.046	0.044	0.034	0.022	0.021	0.023	0.020
34	0.014	0.005	0.005	0.008	0.011	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.029	0.057	0.048	0.039	0.017	0.028	0.019	0.012
28	0.035	0.046	0.047	0.031	0.025	0.024	0.023	0.016
20	0.021	0.039	0.041	0.029	0.016	0.020	0.022	0.015
22	0.010	0.017	0.024	0.012	0.007	0.005	0.008	0.006
45	0.003	0.008	0.010	0.010	0.005	0.002	0.002	0.001
46	0.002	0.006	0.006	0.006	0.006	0.002	0.002	0.001
69	0.021	0.040	0.039	0.036	0.002	0.017	0.017	0.012
52	0.036	0.070	0.068	0.063	0.045	0.030	0.029	0.020
47	0.008	0.017	0.015	0.017	0.013	0.008	0.007	0.007
48	0.010	0.018	0.014	0.016	0.012	0.007	0.007	0.006
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
71	0.006	0.009	0.009	0.009	0.008	0.005	0.004	0.003
41	0.026	0.043	0.038	0.043	0.035	0.019	0.017	0.011
103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	P17 A 1-1_comb	P17 B 2-1_comb	P17 C 3-1_comb	P11 B 5-1_comb	P11 C 6-1_comb	REF A 7-1_comb	REF B 8-1_comb	REF C 9-1_comb
67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.005	0.007	0.008	0.008	0.007	0.004	0.003	0.002
70	0.008	0.016	0.015	0.017	0.015	0.006	0.006	0.004
66	0.011	0.016	0.017	0.015	0.014	0.008	0.009	0.007
95	0.023	0.013	0.020	0.015	0.026	0.011	0.008	0.007
93	0.013	0.017	0.017	0.016	0.013	0.007	0.007	0.006
56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.004	0.006	0.006	0.006	0.006	0.003	0.003	0.001
92	0.003	0.005	0.004	0.005	0.004	0.003	0.002	0.002
84	0.008	0.016	0.019	0.016	0.015	0.007	0.007	0.006
101	0.005	0.010	0.011	0.009	0.009	0.004	0.004	0.003
99	0.006	0.010	0.012	0.009	0.009	0.006	0.006	0.007
119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
83	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
87	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
81	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
115	0.004	0.004	0.008	0.004	0.005	0.003	0.003	0.003
136	0.003	0.004	0.004	0.003	0.003	0.002	0.002	0.002
110	0.009	0.016	0.020	0.014	0.013	0.005	0.005	0.004
77	0.002	0.003	0.002	0.002	0.002	0.001	0.001	0.001
82	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001
135	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001
144	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001
147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
149	0.003	0.007	0.008	0.006	0.006	0.004	0.003	0.003
118	0.005	0.003	0.004	0.003	0.005	0.003	0.002	0.001
134	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
153	0.002	0.004	0.005	0.005	0.005	0.003	0.004	0.003
132	0.002	0.004	0.004	0.003	0.003	0.002	0.002	0.001
105	0.002	0.004	0.003	0.003	0.003	0.001	0.001	0.001
141	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000
179	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
163	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	P17 A 1-1_comb	P17 B 2-1_comb	P17 C 3-1_comb	P11 B 5-1_comb	P11 C 6-1_comb	REF A 7-1_comb	REF B 8-1_comb	REF C 9-1_comb
138	0.001	0.004	0.005	0.004	0.003	0.001	0.001	0.001
158	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
178	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
183	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
177	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
193	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
191	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
190	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
189	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table B92. Average ex-situ porewater (PW) concentration of chlordanes at P11, P17 and dry weather sediment cores (July 2015) as measured by the SPME based passive sampler that was recovered on August 14th 2015.

	transchlordane Results ng/L	cischlordane Results ng/L
P17 A 1-1_comb_exsitu	0.02	0.02
P17 B 2-1_comb	0.03	0.03
P17 C 3-1_comb	0.04	0.04
P11 B 5-1_comb	0.01	0.01
P11 C 6-1_comb	0.01	0.01
REF A 7-1_comb	0.01	0.01
REF B 8-1_comb	0.01	0.01
REF C 9-1_comb	0.01	0.01

Table B93. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in January 26th 2016.

PAHs (ng/L)	P08-1-OW-33-42	P08-1-OW-23-33	P08-1-OW-13-23	P08-1-OW-0-12	P08-1-PW-0-5	P08-1-PW-5-10	P08-1-PW-10-16
naphthalene	224.1	303.2	222.1	285.2	577.2	244.3	153.7
2-methylnaphthalene	24.5	24.1	23.0	20.0	44.4	27.2	24.4
1-methylnaphthalene	7.6	7.5	8.7	6.7	10.8	5.1	4.4
2-ethylnaphthalene	2.4	1.8	1.4	0.9	2.8	1.9	2.2
1-ethylnaphthalene	0.9	0.6	0.6	0.5	1.0	1.2	1.1
2.6-dimethylnaphthalene	3.5	2.9	2.1	2.1	3.5	2.6	2.5
1.3-dimethylnaphthalene	1.5	2.0	1.5	1.3	2.0	1.3	0.3
2-isopropylnaphthalene	1.1	0.9	1.0	0.8	1.8	1.8	1.4
acenaphthylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.8-dimethylnaphthalene	0.0	3.3	0.0	0.0	0.0	0.0	0.0
acenaphthene	0.0	1.6	0.8	0.0	0.9	3.9	0.2
2.3.5-trimethylnaphthalene	0.6	0.8	0.3	0.3	1.1	0.1	0.0
fluorene	3.2	5.7	2.5	3.0	9.6	6.4	5.4
1-methylfluorene	4.9	4.1	1.8	1.9	6.5	3.3	1.2
phenanthrene	2.1	6.0	1.0	2.6	12.6	3.1	1.8
anthracene	0.0	1.3	0.6	1.1	3.6	1.6	1.6
2-methylphenanthrene	0.3	0.4	0.3	0.3	0.8	0.3	0.1
2-methylanthracene	0.6	0.8	0.6	0.5	1.3	0.8	0.6
1-methylphenanthrene	0.2	0.4	0.3	0.2	0.8	0.2	0.2
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	0.9	1.7	1.4	2.5	2.2	1.6	2.1
pyrene	0.6	1.3	0.9	2.6	4.0	3.1	3.7
9.10-dimethylanthracene	0.5	0.2	0.5	0.2	0.0	0.1	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.0	0.1	0.1	0.2	0.6	0.5	0.4
benz(a)anthracene	0.4	0.4	0.4	0.4	0.9	0.8	0.7
chrysene	0.3	0.4	0.4	0.4	0.8	0.7	0.7
benzo(b)fluoranthene	0.2	0.2	0.3	0.3	0.6	0.7	0.5
7.12-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.3	0.2	0.4	0.7	0.7	0.7
benzo(e)pyrene	0.0	0.1	0.0	0.1	0.2	0.3	0.2
benzo(a)pyrene	0.0	0.0	0.1	0.2	0.4	0.4	0.4
perylene	0.0	0.0	0.0	0.0	0.0	0.1	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B94. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in January 26th 2016.

PAHs (ng/L)	P08-02-OW-33-42	P08-02-OW-23-33	P08-02-OW-13-23	P08-02-OW-0-12	P08-02-PW-0-5	P08-02-PW-5-10	P08-02-PW-10-16
naphthalene	62.8	90.0	401.5	152.3	296.8	275.7	406.7
2-methylnaphthalene	8.3	11.5	24.3	16.6	37.5	27.6	28.7
1-methylnaphthalene	0.0	0.4	4.9	5.5	9.0	1.6	3.1
2-ethylnaphthalene	1.1	1.0	1.3	0.8	1.7	1.6	1.1
1-ethylnaphthalene	0.5	0.6	0.5	0.6	1.0	1.1	0.8
2.6-dimethylnaphthalene	0.1	0.6	0.8	1.5	3.2	0.8	1.7
1.3-dimethylnaphthalene	0.0	0.0	0.0	1.1	1.5	0.0	0.0
2-isopropylnaphthalene	0.0	0.9	0.9	0.7	1.7	1.6	1.4
acenaphthylene	0.0	0.0	0.0	0.3	0.0	0.0	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.8-dimethylnaphthalene	0.0	0.0	1.5	0.0	2.4	0.0	0.0
acenaphthene	0.0	0.0	2.2	2.8	1.4	0.0	0.0
2.3.5-trimethylnaphthalene	0.0	0.5	0.6	0.5	1.1	1.2	0.5
fluorene	2.9	5.5	4.5	3.1	7.3	9.5	5.4
1-methylfluorene	4.1	3.7	6.2	2.3	9.1	12.6	7.9
phenanthrene	7.3	12.9	8.3	2.6	5.7	22.3	13.5
anthracene	0.9	0.6	0.7	1.5	0.3	1.2	0.5
2-methylphenanthrene	0.6	0.9	0.7	0.3	0.8	2.3	1.3
2-methylanthracene	1.2	1.4	1.2	0.6	1.3	3.4	2.2
1-methylphenanthrene	0.4	0.7	0.6	0.2	0.5	2.0	1.2
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	0.9	1.8	2.1	1.7	2.3	2.6	1.1
pyrene	0.5	1.4	1.7	2.3	3.5	3.9	1.4
9.10-dimethylanthracene	0.5	0.4	2.2	0.2	0.2	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.0	0.1	0.2	0.2	0.3	0.4	0.1
benz(a)anthracene	0.3	0.4	0.4	0.4	0.8	0.7	0.5
chrysene	0.3	0.4	0.4	0.4	0.7	0.7	0.4
benzo(b)fluoranthene	0.1	0.2	0.3	0.3	0.5	0.5	0.2
7.12-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.1	0.2	0.3	0.3	0.5	0.4	0.2
benzo(e)pyrene	0.0	0.0	0.1	0.1	0.1	0.2	0.0
benzo(a)pyrene	0.0	0.0	0.1	0.2	0.3	0.3	0.0
perylene	0.0	0.0	0.1	0.0	0.0	0.1	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B95. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in January 26th 2016.

PAHs (ng/L)	P11-03-OW-33-42	P11-03-OW-23-33	P11-03-OW-13-23	P11-03-OW-0-12	P11-03-PW-0-5	P11-03-PW-5-10	P11-03-PW-10-16	P11-02-PW-10-16
naphthalene	53.3	49.5	41.3	45.0	156.5	304.6	99.8	72.1
2-methylnaphthalene	18.7	16.1	15.5	15.1	36.4	45.8	22.6	29.7
1-methylnaphthalene	9.5	4.4	3.8	5.0	15.2	15.7	5.0	9.6
2-ethylnaphthalene	1.9	1.5	1.0	1.2	2.3	4.2	2.3	4.9
1-ethylnaphthalene	0.7	0.7	0.5	0.4	2.1	4.5	3.6	5.6
2.6-dimethylnaphthalene	3.0	2.9	2.2	2.2	5.9	7.9	3.9	5.9
1.3-dimethylnaphthalene	3.2	2.0	2.1	3.2	7.3	6.8	2.2	5.7
2-isopropylnaphthalene	1.0	1.0	0.9	0.7	2.0	2.1	1.8	2.2
acenaphthylene	0.0	0.0	0.0	0.0	2.2	1.4	2.1	7.5
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.7
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.1	0.7	2.5	2.8	6.3
acenaphthene	1.9	2.9	5.7	1.9	8.0	5.7	7.0	10.1
2.3.5-trimethylnaphthalene	0.7	0.4	0.6	0.9	1.9	2.0	2.8	6.0
fluorene	5.9	4.3	3.2	5.1	7.5	7.5	10.1	12.2
1-methylfluorene	1.6	3.3	3.3	6.2	10.7	11.5	12.6	22.0
phenanthrene	2.2	6.8	1.2	5.2	4.6	5.1	9.3	9.1
anthracene	0.0	0.2	0.3	1.0	2.9	1.8	1.7	5.1
2-methylphenanthrene	0.3	0.3	0.4	0.6	0.8	1.9	2.0	1.8
2-methylanthracene	0.8	0.7	0.8	0.9	1.6	2.1	2.2	6.5
1-methylphenanthrene	0.2	0.2	0.3	0.8	2.6	5.4	6.4	7.8
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	1.7	1.4	1.6	3.7	24.7	41.1	72.9	101.4
pyrene	1.4	1.6	1.6	11.3	113.1	170.3	269.2	255.4
9.10-dimethylanthracene	0.8	0.1	0.1	1.9	0.0	0.1	0.7	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.1	0.2	0.1	0.6	4.7	5.8	7.9	6.9
benz(a)anthracene	0.4	0.3	0.4	0.7	4.0	6.3	7.3	8.1
chrysene	0.4	0.4	0.4	0.9	4.9	6.4	7.8	7.0
benzo(b)fluoranthene	0.2	0.2	0.2	0.4	1.7	1.4	2.1	2.0
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
benzo(k)fluoranthene	0.3	0.2	0.3	0.5	1.8	1.9	2.3	2.3
benzo(e)pyrene	0.0	0.1	0.1	0.2	0.8	0.8	1.1	1.2
benzo(a)pyrene	0.1	0.1	0.0	0.3	1.4	1.2	2.4	2.1
perylene	0.0	0.0	0.0	0.0	0.3	0.1	0.2	0.2
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B96. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in January 26th 2016.

PAHs (ng/L)	P17-1-OW-33-42	P17-1-OW-23-33	P17-1-OW-13-23	P17-1-OW-0-12	P17-1-PW-0-5	P17-1-PW-5-10	P17-1-PW-10-16
naphthalene	177.1	222.9	131.1	90.5	79.6	108.0	143.6
2-methylnaphthalene	18.5	18.2	17.9	15.9	25.9	25.7	29.7
1-methylnaphthalene	5.0	6.4	5.2	4.5	5.3	5.7	7.5
2-ethylnaphthalene	1.4	1.2	1.3	1.6	2.3	3.0	2.8
1-ethylnaphthalene	0.6	0.6	0.5	0.6	1.5	1.5	1.3
2.6-dimethylnaphthalene	1.8	1.3	2.8	2.5	4.0	3.4	3.4
1.3-dimethylnaphthalene	0.9	0.7	1.9	2.1	2.9	2.3	4.6
2-isopropylnaphthalene	1.0	0.9	1.0	0.8	2.0	1.9	1.8
acenaphthylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.8-dimethylnaphthalene	0.0	0.1	0.0	0.0	0.0	0.0	0.0
acenaphthene	3.0	0.0	0.1	1.9	4.7	1.9	4.5
2.3.5-trimethylnaphthalene	0.1	0.7	0.5	0.1	1.4	0.5	1.2
fluorene	3.9	4.0	5.1	5.7	12.1	5.7	8.1
1-methylfluorene	2.1	6.4	1.5	2.2	11.9	2.7	5.8
phenanthrene	3.6	5.7	4.4	10.2	9.6	2.9	8.4
anthracene	0.2	0.5	0.9	2.1	1.1	0.3	0.9
2-methylphenanthrene	0.2	0.7	0.4	1.1	0.8	0.5	0.7
2-methylanthracene	0.6	1.0	0.7	1.7	2.7	1.3	1.5
1-methylphenanthrene	0.1	0.3	0.2	0.9	0.7	0.4	0.7
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	0.8	2.4	3.5	5.0	4.7	3.5	3.4
pyrene	0.6	2.0	3.4	5.3	8.8	9.3	13.8
9.10-dimethylanthracene	0.8	0.0	0.5	0.4	0.0	0.4	1.3
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.0	0.1	0.1	0.3	0.4	0.5	0.5
benz(a)anthracene	0.3	0.4	0.4	0.4	0.8	0.8	0.7
chrysene	0.2	0.4	0.5	0.6	0.8	0.7	0.7
benzo(b)fluoranthene	0.1	0.1	0.2	0.2	0.3	0.3	0.3
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.1	0.1	0.2	0.2	0.4	0.4	0.4
benzo(e)pyrene	0.0	0.0	0.0	0.1	0.1	0.1	0.1
benzo(a)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
perylene	0.0	0.0	0.0	0.0	0.1	0.0	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B97. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in January 26th 2016.

PAHs (ng/L)	P17-02-OW-33-42	P17-02-OW-23-33	P17-02-OW-13-23	P17-02-OW-0-12	P17-02-PW-0-5	P17-02-PW-5-10	P17-02-PW-10-16
naphthalene	329.4	161.0	347.1	183.6	353.9	350.6	383.2
2-methylnaphthalene	23.7	17.2	24.7	15.9	42.8	45.5	34.8
1-methylnaphthalene	6.2	5.0	7.2	4.4	13.5	13.4	9.8
2-ethylnaphthalene	1.3	1.4	1.5	1.1	2.8	2.7	3.5
1-ethylnaphthalene	0.6	0.7	0.6	0.5	1.1	1.6	0.8
2.6-dimethylnaphthalene	2.9	2.4	1.8	2.4	7.6	7.1	3.2
1.3-dimethylnaphthalene	0.9	2.8	1.0	1.3	4.7	5.6	1.3
2-isopropylnaphthalene	1.0	1.0	0.9	0.7	2.0	2.0	1.6
acenaphthylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	0.9	4.4	0.6	2.1	0.3	11.9	0.0
2.3.5-trimethylnaphthalene	0.4	0.7	0.5	0.7	0.6	1.7	0.6
fluorene	3.2	4.9	4.7	4.5	6.2	10.3	5.3
1-methylfluorene	2.7	3.0	5.6	3.7	6.6	5.5	9.0
phenanthrene	2.2	3.1	6.6	4.8	4.4	7.8	4.8
anthracene	0.0	0.1	0.4	0.2	0.0	0.7	0.1
2-methylphenanthrene	0.4	0.4	0.7	0.5	0.5	0.7	0.7
2-methylanthracene	0.8	0.7	1.2	1.0	2.4	2.2	1.4
1-methylphenanthrene	0.2	0.3	0.6	0.4	0.5	0.5	0.7
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	1.5	2.5	2.8	2.6	3.0	3.3	1.4
pyrene	1.3	2.1	2.3	3.6	12.4	10.0	11.4
9.10-dimethylanthracene	0.5	0.1	0.6	0.6	0.6	0.0	1.1
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.1	0.1	0.1	0.1	0.4	0.4	0.5
benz(a)anthracene	0.3	0.4	0.4	0.3	0.8	0.7	0.5
chrysene	0.3	0.4	0.4	0.4	0.9	0.8	0.6
benzo(b)fluoranthene	0.1	0.1	0.1	0.1	0.3	0.3	0.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.1	0.1	0.1	0.1	0.3	0.3	0.2
benzo(e)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(a)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B98. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in February 23rd 2016.

PAHs (ng/L)	P01 33-41cm OW	P01 20-30cm OW	P01 10-20cm OW	P01 0-10cm OW	P01 0-5cm PW	P01 5-10cm PW	P01 10-15cm PW	P01 15-20cm PW	P01 20-26cm PW
naphthalene	119.0	99.4	99.2	92.4	157.3	165.7	147.2	156.9	132.8
2-methylnaphthalene	57.6	52.4	54.1	48.4	73.9	78.4	65.8	67.7	63.1
1-methylnaphthalene	26.9	23.3	25.4	22.7	31.8	35.9	28.8	30.7	27.8
2-ethylnaphthalene	12.5	9.9	10.5	9.3	14.8	15.0	12.9	13.4	11.4
1-ethylnaphthalene	0.1	0.1	0.5	0.4	0.0	0.1	0.1	0.0	0.2
2.6-dimethylnaphthalene	14.8	14.3	15.6	14.1	19.5	21.0	17.0	16.9	15.5
1.3-dimethylnaphthalene	16.6	15.7	17.0	14.8	20.5	22.3	18.4	18.7	18.0
2-isopropylnaphthalene	1.0	0.9	0.9	0.8	1.4	1.5	1.3	1.3	1.1
acenaphthylene	28.2	24.1	23.4	21.9	41.3	41.3	36.8	40.4	31.7
1.2-dimethylnaphthalene	5.0	4.4	4.4	4.0	6.5	6.9	5.7	5.9	5.6
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	34.4	28.3	28.2	24.5	45.1	38.0	31.7	39.3	31.9
2.3.5-trimethylnaphthalene	6.0	5.5	5.4	4.9	8.3	8.2	7.1	7.7	6.5
fluorene	38.7	33.7	31.5	30.6	49.5	45.6	40.3	51.7	37.2
1-methylfluorene	3.0	3.9	3.2	3.1	5.2	8.6	3.9	4.8	4.7
phenanthrene	13.5	16.4	15.4	17.8	20.9	25.3	17.4	35.0	13.1
anthracene	6.2	6.0	6.0	6.4	11.1	11.2	9.6	12.2	8.4
2-methylphenanthrene	3.2	2.9	2.7	2.7	4.5	4.6	4.1	4.4	3.5
2-methylanthracene	3.8	3.4	3.3	3.3	4.9	5.1	4.4	4.8	4.0
1-methylphenanthrene	4.7	4.1	3.8	3.7	6.8	6.8	6.0	6.7	5.3
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	4.3	4.4	4.7	5.0	5.1	4.8	4.7	5.8	4.3
pyrene	4.0	4.2	3.9	4.3	5.7	5.3	5.0	7.9	4.9
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.8	0.7	0.7	0.8	1.9	1.8	1.6	1.6	1.5
benz(a)anthracene	1.4	1.3	1.2	1.2	2.2	2.2	2.0	2.3	1.7
chrysene	1.1	1.0	1.0	0.9	1.7	1.6	1.5	1.8	1.2
benzo(b)fluoranthene	0.3	0.3	0.4	0.6	1.5	1.6	1.4	1.3	1.5
7.12-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.3	0.3	0.5	1.7	1.6	1.3	1.3	1.4
benzo(e)pyrene	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
benzo(a)pyrene	0.1	0.1	0.2	0.5	1.6	1.3	1.0	0.9	1.1
perylene	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B99. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in February 23rd 2016.

PAHs	P08 20-30cm OW	P08 10-20cm OW	P08 0-10cm OW	P08 0-5cm PW	P08 5-10cm PW	P08 10-15cm PW	P08 15-20cm PW	P08 20-28cm PW
naphthalene	83.5	71.2	92.2	146.9	131.7	139.1	119.4	84.4
2-methylnaphthalene	37.0	29.9	39.2	63.6	59.5	62.2	51.7	35.4
1-methylnaphthalene	16.2	12.7	17.8	28.5	25.8	26.3	20.4	14.5
2-ethylnaphthalene	7.0	5.8	7.4	11.5	10.9	11.0	11.0	6.9
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2.6-dimethylnaphthalene	7.8	6.8	8.6	13.9	13.0	12.4	10.6	8.2
1.3-dimethylnaphthalene	9.2	7.3	10.2	16.2	15.1	14.7	12.3	8.6
2-isopropylnaphthalene	0.8	0.7	0.8	1.3	1.3	1.3	1.1	0.8
acenaphthylene	23.5	21.4	26.3	41.4	41.3	41.4	37.0	23.5
1.2-dimethylnaphthalene	3.1	2.8	3.5	5.5	5.2	5.0	4.8	3.2
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	25.3	20.2	27.3	48.1	41.9	41.1	34.4	25.4
2.3.5-trimethylnaphthalene	4.4	3.8	4.3	7.2	7.1	7.0	6.1	4.1
fluorene	31.7	23.2	33.8	55.9	47.7	45.9	38.1	30.8
1-methylfluorene	3.6	2.2	3.4	4.4	4.1	4.5	4.7	2.1
phenanthrene	13.7	7.9	16.0	27.1	17.3	16.2	15.0	11.2
anthracene	6.0	5.0	7.3	10.6	10.0	10.3	9.6	6.1
2-methylphenanthrene	2.6	2.5	2.6	4.4	4.2	4.3	3.8	2.4
2-methylanthracene	2.9	2.6	2.6	4.8	4.6	4.6	4.1	2.6
1-methylphenanthrene	4.0	3.6	3.9	6.6	6.4	6.5	5.8	3.7
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	4.0	3.3	4.4	4.9	4.3	4.5	4.0	2.3
pyrene	4.0	3.4	6.6	7.3	6.0	6.3	5.7	3.1
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.7	1.1	1.4	1.5	1.5	1.3	0.8
benz(a)anthracene	1.3	1.2	1.4	2.0	2.0	2.1	1.9	1.1
chrysene	1.0	0.9	1.2	1.5	1.5	1.6	1.4	0.9
benzo(b)fluoranthene	0.3	0.3	0.8	0.7	0.7	0.8	0.7	0.4
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.2	0.7	0.6	0.6	0.7	0.6	0.3
benzo(e)pyrene	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.1
benzo(a)pyrene	0.1	0.1	0.4	0.3	0.4	0.5	0.3	0.2
perylene	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PAHs	P11 20-30cm OW	P11 10-20cm OW	P11 0-10cm OW	P11 0-5cm PW	P11 6-11cm PW	P11 11-16cm PW	P11 16-21cm PW	P11 21-26cm PW
naphthalene	97.1	78.9	89.2	105.5	137.1	143.4	124.9	157.4
2-methylnaphthalene	40.9	32.1	39.8	43.4	60.5	61.7	53.0	66.4
1-methylnaphthalene	17.4	13.8	17.2	16.8	26.1	27.4	24.0	28.2
2-ethylnaphthalene	7.6	7.9	9.2	9.9	12.3	14.0	10.4	9.9
1-ethylnaphthalene	0.0	0.0	0.3	0.0	0.8	1.2	2.0	2.6
2.6-dimethylnaphthalene	9.4	7.9	9.4	9.6	13.3	15.7	13.4	15.6
1.3-dimethylnaphthalene	11.1	8.9	10.4	11.9	15.0	15.5	14.0	18.1
2-isopropylnaphthalene	0.9	0.7	0.8	1.4	1.4	1.4	1.4	1.7
acenaphthylene	26.4	19.8	24.5	40.6	41.7	42.6	35.8	45.3
1.2-dimethylnaphthalene	3.8	3.1	4.4	5.4	5.6	10.0	9.7	13.4
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	29.5	23.7	26.8	31.9	41.0	40.9	42.5	42.0
2.3.5-trimethylnaphthalene	4.9	4.0	4.7	7.0	7.2	8.0	8.3	10.3
fluorene	40.9	28.7	27.3	36.4	48.9	42.1	46.9	52.1
1-methylfluorene	2.5	3.5	3.1	5.7	4.8	12.9	14.1	11.7
phenanthrene	22.9	13.0	11.4	12.8	21.4	15.8	24.3	27.5
anthracene	6.8	5.2	7.8	9.9	16.2	11.4	13.1	15.0
2-methylphenanthrene	3.0	2.4	3.1	4.8	4.6	4.9	5.0	6.9
2-methylanthracene	3.5	2.8	3.6	5.0	4.9	5.3	4.9	6.4
1-methylphenanthrene	4.5	3.6	5.2	8.1	8.1	9.6	10.8	14.3
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	4.2	5.6	16.7	20.5	21.7	47.7	83.1	97.9
pyrene	5.8	12.0	54.6	74.5	86.5	125.7	183.9	198.5
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.9	0.9	2.6	4.3	5.1	5.9	7.7	8.9
benz(a)anthracene	1.4	1.3	3.0	4.6	4.5	6.5	9.9	12.8
chrysene	1.3	1.1	2.6	4.1	4.0	5.7	8.4	10.7
benzo(b)fluoranthene	0.5	0.4	1.0	1.6	1.9	2.0	2.3	3.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.3	1.1	1.8	1.9	2.0	2.5	3.8
benzo(e)pyrene	0.2	0.1	0.4	0.7	0.8	0.8	1.0	1.3
benzo(a)pyrene	0.0	0.2	0.9	1.3	1.4	1.6	2.3	3.3
perylene	0.3	0.1	0.2	0.4	0.3	0.3	0.4	0.4
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B100. In-situ overlying (OW) and porewater (PW) PAH concentrations in the receiving water as measured by the SPME based passive sampler retrieved in February 23rd 2016.

PAHs	P17 10-16cm OW	P17 0-10cm OW	P17 0-5cm OW	P17 5-10cm PW	P17 11-16cm PW	P17 11-16cm PW	P17 20-30cm PW
naphthalene	136.9	75.4	142.6	138.5	154.7	141.2	83.8
2-methylnaphthalene	58.6	34.6	62.7	59.2	61.9	57.3	35.4
1-methylnaphthalene	25.9	15.5	25.6	25.4	25.7	24.1	15.7
2-ethylnaphthalene	11.4	7.6	12.7	11.7	12.3	9.7	5.5
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.6-dimethylnaphthalene	12.0	8.0	15.3	11.9	13.0	11.3	8.1
1.3-dimethylnaphthalene	13.8	9.8	15.4	14.1	15.1	14.0	8.9
2-isopropylnaphthalene	1.1	0.7	1.3	1.3	1.3	1.2	0.7
acenaphthylene	35.3	20.6	37.5	37.0	37.7	36.3	21.3
1.2-dimethylnaphthalene	4.6	3.2	5.4	5.0	4.7	3.8	3.1
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	39.0	23.7	40.6	37.6	40.7	35.1	25.6
2.3.5-trimethylnaphthalene	6.7	4.3	7.1	6.8	7.1	6.7	3.9
fluorene	35.6	26.1	46.1	38.1	45.0	37.5	32.4
1-methylfluorene	4.3	3.2	4.8	4.2	6.5	4.1	3.1
phenanthrene	13.7	12.5	19.8	13.9	21.1	15.1	19.1
anthracene	8.3	4.9	9.2	9.3	9.8	8.5	7.3
2-methylphenanthrene	4.1	2.8	4.9	4.3	4.6	4.2	2.6
2-methylanthracene	4.7	3.4	6.7	4.9	5.3	4.8	3.5
1-methylphenanthrene	6.1	3.8	6.9	6.4	6.8	6.3	3.8
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	6.2	6.5	7.6	5.5	5.8	5.5	5.0
pyrene	6.1	7.6	12.1	10.2	13.3	9.8	22.0
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	1.0	0.8	1.4	1.3	1.5	1.4	1.7
benz(a)anthracene	1.8	1.2	2.0	1.9	2.0	1.9	1.2
chrysene	1.4	1.1	1.8	1.6	1.7	1.6	1.1
benzo(b)fluoranthene	0.3	0.3	0.4	0.4	0.5	0.4	0.6
7.12-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.2	0.4	0.4	0.4	0.3	0.5
benzo(e)pyrene	0.1	0.1	0.2	0.1	0.2	0.1	0.2
benzo(a)pyrene	0.0	0.1	0.0	0.0	0.1	0.0	0.3
perylene	0.2	0.1	0.2	0.3	0.3	0.2	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B101. Average pre-storm and post-storm ex-situ sediment porewater (PW) PAH concentrations as measured by the SPME based passive sampler (retrieved on March 29th 2016) for the season 2015/16.

PAHs	P01-PRE B	P01-POST B	P01-PRE C	P01-POST C	P01-PRE D	P01-POST D	P08-PRE B	P08-POST B	P08-PRE+ B sed	P08-PRE C	P08-POST C	P08-PRE+ C sed
naphthalene	27.9	40.4	36.6	46.2	46.7	7.1	8.3	19.5	4.1	10.7	36.8	44.2
2-methylnaphthalene	16.0	22.1	19.3	24.8	26.3	9.2	11.8	14.9	5.8	10.1	22.4	22.6
1-methylnaphthalene	4.9	6.9	6.8	10.0	11.2	1.3	1.8	7.6	0.0	2.2	6.2	9.3
2-ethylnaphthalene	2.1	2.2	1.4	3.5	3.8	2.2	4.4	6.4	1.1	1.3	3.0	3.0
1-ethylnaphthalene	0.3	0.7	0.0	2.3	2.9	2.6	5.5	11.3	0.0	0.0	0.0	2.1
2.6-dimethylnaphthalene	2.5	3.6	2.9	4.1	5.4	0.8	2.1	2.8	0.8	2.1	4.0	5.0
1.3-dimethylnaphthalene	3.1	3.7	3.5	4.6	6.0	2.0	1.9	2.8	2.0	3.3	4.5	5.2
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	6.2	6.3	6.6	6.4	7.5	4.5	7.1	14.5	0.4	1.1	7.7	5.1
1.2-dimethylnaphthalene	0.4	0.4	0.3	0.7	1.0	5.8	7.4	12.0	0.0	0.9	0.2	0.2
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0
acenaphthene	7.1	14.2	10.5	13.3	19.6	3.9	7.3	16.0	3.2	8.6	12.4	14.5
2.3.5-trimethylnaphthalene	0.1	0.5	0.3	0.5	0.2	1.2	0.0	2.6	0.8	1.9	0.4	0.5
fluorene	6.4	10.2	7.2	11.1	22.5	5.6	6.4	9.2	4.1	9.1	11.3	15.2
1-methylfluorene	0.9	1.4	1.4	1.8	1.0	4.8	5.4	12.6	2.3	5.6	1.3	2.6
phenanthrene	2.8	4.8	3.4	4.2	14.5	11.0	10.9	16.3	5.7	16.6	5.1	10.8
anthracene	2.9	3.0	3.5	3.6	4.6	7.2	8.5	13.3	1.4	3.6	5.0	3.7
2-methylphenanthrene	0.2	0.3	0.2	0.3	0.4	1.3	1.5	3.2	0.9	2.7	0.2	0.3
2-methylanthracene	0.6	0.9	0.8	0.7	1.6	2.8	3.0	5.1	1.9	13.9	0.8	0.8
1-methylphenanthrene	0.4	0.4	0.5	0.5	0.7	3.2	3.2	10.3	1.4	2.4	0.5	0.6
9-methylanthracene	0.7	0.7	0.7	0.7	0.7	1.1	1.3	2.7	0.9	4.0	0.7	1.3
2-ethylanthracene	0.0	0.8	0.9	0.9	0.8	3.8	4.4	5.7	1.2	1.7	0.8	0.8
fluoranthene	0.8	1.9	2.7	3.5	3.7	19.0	9.9	57.4	4.7	11.6	1.6	4.6
pyrene	0.8	2.2	5.7	5.5	5.9	97.6	255.8	348.1	11.4	19.4	2.0	5.0
9.10-dimethylanthracene	0.0	0.3	0.3	0.2	0.0	1.5	0.5	1.4	0.4	0.3	0.0	0.3
2-tertbutylanthracene	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0
1-methylpyrene	1.1	0.8	1.2	0.8	0.8	6.2	11.8	13.2	1.0	1.3	2.0	0.6
benz(a)anthracene	0.4	0.5	0.7	0.8	0.6	4.0	6.9	10.6	0.6	1.0	0.6	0.7
chrysene	0.4	0.5	0.6	0.8	0.7	4.4	5.9	12.0	0.8	1.5	0.5	0.7
benzo(b)fluoranthene	1.0	1.1	1.4	1.1	0.8	2.6	5.3	6.2	0.4	0.6	2.3	0.8

PAHs	P01-PRE B	P01-POST B	P01-PRE C	P01-POST C	P01-PRE D	P01-POST D	P08-PRE B	P08-POST B	P08-PRE+ B sed	P08-PRE C	P08-POST C	P08-PRE+ C sed
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	1.0	1.1	1.3	1.0	0.8	2.6	5.3	6.1	0.4	0.5	2.6	0.7
benzo(e)pyrene	0.2	0.1	0.4	0.3	0.3	1.1	2.1	2.6	0.1	0.2	0.1	0.2
benzo(a)pyrene	0.9	0.9	1.0	0.8	0.6	1.9	4.0	5.1	0.3	0.4	1.9	0.5
perylene	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.1	0.1	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PAHs	P08-PRE D	P08-POST D	P08-PRE+ sed D	P11-PRE B	P11-POST B	P11-PRE+ B	P11 PRE C	P11 POST C	P11 PRE+ C	P11 PRE D	P11 PRE+ D	P11 POST D
naphthalene	37.0	37.8	36.6	9.0	7.8	11.5	8.1	11.2	40.2	29.7	39.8	48.5
2-methylnaphthalene	19.9	21.3	20.6	9.4	7.3	11.1	8.6	9.7	22.1	16.6	21.5	23.7
1-methylnaphthalene	7.0	7.3	7.0	2.3	5.3	3.8	1.0	1.7	7.9	5.4	7.3	8.6
2-ethylnaphthalene	2.9	2.9	2.9	1.9	6.4	0.0	2.1	2.6	2.9	1.2	2.7	3.1
1-ethylnaphthalene	0.0	0.0	2.3	0.0	18.0	0.0	0.7	2.1	2.5	0.0	0.0	1.6
2.6-dimethylnaphthalene	3.6	3.6	4.4	2.1	2.7	6.4	0.7	1.5	3.8	2.5	2.5	4.2
1.3-dimethylnaphthalene	4.3	4.2	4.5	2.0	3.3	4.7	1.4	2.1	4.4	3.2	3.8	4.3
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	6.1	5.5	6.6	5.0	16.7	4.7	0.9	0.5	5.4	3.6	6.1	6.2
1.2-dimethylnaphthalene	0.3	0.6	0.7	2.5	8.3	3.4	0.3	0.4	0.4	0.1	0.3	0.4
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	13.4	11.3	16.3	5.4	15.6	10.6	2.9	6.1	13.4	8.3	10.3	11.1
2.3.5-trimethylnaphthalene	0.4	0.6	0.6	1.4	2.2	1.9	1.3	1.6	0.5	0.2	0.3	0.3
fluorene	12.7	9.5	18.0	5.2	6.8	6.5	3.8	5.3	14.8	5.9	7.2	8.5
1-methylfluorene	1.3	2.0	1.8	4.7	13.0	7.7	3.6	4.5	0.7	0.9	1.0	1.0
phenanthrene	5.0	4.2	10.4	12.5	17.1	10.2	9.2	12.4	8.2	2.4	3.4	4.2
anthracene	2.7	3.0	4.9	8.2	14.7	4.4	2.3	3.3	2.7	2.1	3.0	2.6
2-methylphenanthrene	0.2	0.3	0.3	1.3	4.2	1.7	1.3	2.1	0.2	0.2	0.3	0.3
2-methylanthracene	0.7	0.7	1.3	2.5	6.3	3.1	2.7	10.1	0.6	0.6	0.8	0.9
1-methylphenanthrene	0.5	0.6	0.7	3.2	11.7	5.4	1.9	2.3	0.4	0.4	0.5	0.5
9-methylanthracene	1.0	0.7	0.9	2.0	4.0	2.3	1.4	3.3	0.7	0.7	0.7	0.7
2-ethylanthracene	0.8	0.8	1.1	4.8	8.5	1.6	1.4	1.1	0.8	0.8	0.9	0.8
fluoranthene	2.3	2.8	3.9	20.9	109.3	56.0	5.5	11.7	1.2	1.5	3.0	2.2
pyrene	3.6	4.9	6.0	151.3	423.5	137.7	18.5	23.7	1.9	1.7	5.3	4.1
9.10-dimethylanthracene	0.2	0.2	0.2	0.8	0.3	1.0	0.8	0.4	0.2	0.2	0.2	0.5
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.9	0.9	8.0	17.5	6.7	1.4	1.5	0.4	0.6	1.2	1.0
benz(a)anthracene	0.6	0.6	0.7	5.4	20.4	7.3	0.6	0.9	0.5	0.5	0.8	0.6
chrysene	0.6	0.7	0.8	6.6	16.0	6.9	0.8	1.5	0.5	0.5	0.7	0.6
benzo(b)fluoranthene	0.9	0.8	1.0	3.4	8.4	3.0	0.7	0.5	0.4	0.7	1.2	1.3

PAHs	P08-PRE D	P08-POST D	P08-PRE+ sed D	P11-PRE B	P11-POST B	P11-PRE+ B	P11 PRE C	P11 POST C	P11 PRE+ C	P11 PRE D	P11 PRE+ D	P11 POST D
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.8	0.8	0.9	3.5	8.5	2.7	0.6	0.5	0.3	0.6	1.2	1.2
benzo(e)pyrene	0.3	0.2	0.3	1.5	3.4	1.2	0.3	0.2	0.1	0.1	0.4	0.4
benzo(a)pyrene	0.6	0.6	0.6	2.5	6.6	2.3	0.5	0.5	0.4	0.5	0.9	0.8
perylene	0.1	0.1	0.1	0.2	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PAHs	P17-PRE B	P17-POST B	P17 PRE+B	P17 PRE+ C	P17 POST C	P17 PRE+C	P17 PRE D	P17 POST D	P17 PRE+D	NBH B	NBH C	NBH D
naphthalene	38.1	12.0	10.7	11.9	14.7	18.2	14.3	10.4	12.7	12.4	16.6	7.3
2-methylnaphthalene	21.7	10.1	9.1	13.5	10.4	11.2	11.6	9.8	11.3	9.5	12.6	10.3
1-methylnaphthalene	6.4	2.4	1.3	5.8	2.4	2.0	3.5	2.6	3.4	2.1	3.2	1.6
2-ethylnaphthalene	3.1	3.4	1.7	4.8	1.8	2.3	2.2	2.1	2.5	1.4	1.9	1.2
1-ethylnaphthalene	0.0	4.4	0.0	7.6	0.9	0.7	0.0	1.0	0.9	0.0	0.0	0.0
2.6-dimethylnaphthalene	3.2	0.7	0.4	3.5	1.5	1.6	3.2	2.6	4.5	0.7	1.7	1.5
1.3-dimethylnaphthalene	4.1	2.4	2.3	3.6	2.6	2.9	5.6	4.5	6.2	2.3	2.7	2.6
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	5.8	4.6	2.8	9.5	1.2	0.8	0.8	0.8	1.4	1.2	1.0	1.0
1.2-dimethylnaphthalene	0.3	7.8	2.8	13.3	0.4	0.8	0.9	0.6	0.9	0.6	0.9	0.1
1.8-dimethylnaphthalene	0.0	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	12.0	12.0	4.0	13.7	4.7	4.2	16.7	14.8	19.0	2.2	3.3	2.7
2.3.5-trimethylnaphthalene	0.4	1.9	1.1	4.4	1.2	1.1	2.3	1.9	2.3	0.9	1.2	1.2
fluorene	9.2	5.7	4.4	6.0	4.8	5.1	16.8	11.7	16.7	4.2	6.0	4.5
1-methylfluorene	0.9	12.6	5.5	18.7	4.2	3.1	3.9	5.9	1.4	4.6	2.6	4.8
phenanthrene	4.4	9.0	10.3	13.9	12.6	12.5	24.1	18.5	26.0	14.0	12.7	11.3
anthracene	2.6	8.7	4.9	11.1	2.9	4.3	6.4	3.1	5.9	4.2	3.7	3.5
2-methylphenanthrene	0.3	1.6	1.2	2.5	1.6	1.7	3.5	2.8	3.6	2.0	1.8	1.6
2-methylanthracene	1.1	2.5	2.9	3.5	3.2	5.1	5.9	4.4	6.2	3.8	2.8	2.2
1-methylphenanthrene	0.5	5.9	1.8	8.5	2.1	2.1	3.3	2.9	3.4	3.5	2.7	2.7
9-methylanthracene	0.7	2.4	1.5	3.3	1.1	1.0	1.7	1.5	1.2	1.0	0.9	1.0
2-ethylanthracene	0.9	1.5	1.7	4.8	1.6	1.6	1.8	1.6	2.2	2.1	1.9	2.0
fluoranthene	3.3	48.2	12.0	109.5	9.7	8.3	16.7	14.2	15.8	9.0	8.2	8.3
pyrene	4.7	175.8	69.4	285.9	16.9	16.0	18.2	16.9	16.1	49.3	44.4	40.0
9.10-dimethylanthracene	0.3	0.4	0.0	0.8	0.3	0.2	0.6	0.9	0.3	0.3	0.3	1.1
2-tertbutylanthracene	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1
1-methylpyrene	0.9	7.9	4.2	11.8	1.1	1.3	1.1	1.1	0.9	2.7	2.6	2.1
benz(a)anthracene	0.8	8.7	2.3	15.0	0.9	0.8	1.1	1.1	1.1	2.2	2.3	1.8
chrysene	0.7	8.1	2.8	12.5	1.1	1.2	1.8	1.8	1.6	3.3	2.8	2.4
benzo(b)fluoranthene	1.2	3.4	1.9	5.4	0.6	0.5	0.4	0.4	0.4	1.2	1.2	1.1

PAHs	P17-PRE B	P17-POST B	P17 PRE+B	P17 PRE+C	P17 POST C	P17 PRE+C	P17 PRE D	P17 POST D	P17 PRE+D	NBH B	NBH C	NBH D
7.12-methylbenz(a)anthracene	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0
benzo(k)fluoranthene	1.0	3.4	1.7	4.8	0.6	0.5	0.4	0.3	0.3	1.3	1.1	1.0
benzo(e)pyrene	0.3	1.4	0.8	2.2	0.2	0.2	0.2	0.1	0.1	0.6	0.6	0.5
benzo(a)pyrene	0.8	2.8	1.2	4.3	0.4	0.5	0.3	0.4	0.3	0.9	0.8	0.7
perylene	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B102. Average pre-storm and post-storm ex-situ sediment porewater (PW) PCB concentrations as measured by the SPME based passive sampler (retrieved on March 29th 2016) for the season 2015/16.

PCBs	P01-PreB	P01-PreD	P08-PreB	P08-PreC	P08-PreD	P11-PreB	P11-PreC	P11-PreD	P17-PreB	P17-PreC
1	0.007	0.018	0.042	0.017	0.112	0.000	0.005	0.005	0.000	0.004
2	0.018	0.018	0.033	0.012	0.038	0.002	0.003	0.005	0.002	0.003
3	0.013	0.015	0.024	0.011	0.032	0.006	0.006	0.003	0.002	0.004
4	0.196	0.306	0.113	0.122	0.219	1.022	1.193	3.797	0.243	0.325
10	0.024	0.024	0.033	0.014	0.038	0.039	0.030	0.045	0.024	0.026
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.008	0.007	0.011	0.005	0.016	0.014	0.019	0.022	0.007	0.010
8	0.024	0.027	0.039	0.021	0.062	0.045	0.055	0.070	0.027	0.033
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.005	0.006	0.010	0.005	0.014	0.032	0.026	0.024	0.006	0.005
18	0.019	0.035	0.032	0.024	0.041	0.105	0.139	0.160	0.040	0.047
17	0.013	0.017	0.016	0.011	0.023	0.051	0.048	0.050	0.018	0.022
15	0.004	0.005	0.006	0.003	0.009	0.040	0.038	0.048	0.005	0.006
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.002	0.009	0.011	0.006	0.016	0.042	0.049	0.058	0.007	0.011
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.009	0.015	0.013	0.009	0.022	0.063	0.081	0.100	0.021	0.025
28	0.017	0.017	0.025	0.022	0.035	0.051	0.082	0.074	0.031	0.021
20	0.013	0.015	0.016	0.012	0.020	0.050	0.062	0.082	0.016	0.030
22	0.003	0.006	0.004	0.007	0.007	0.019	0.037	0.032	0.004	0.016
45	0.000	0.000	0.000	0.000	0.000	0.008	0.024	0.024	0.000	0.000
46	0.001	0.002	0.005	0.002	0.004	0.012	0.017	0.018	0.001	0.003
69	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	0.019	0.033	0.037	0.021	0.047	0.139	0.158	0.174	0.027	0.033
47	0.005	0.010	0.014	0.007	0.014	0.036	0.031	0.036	0.005	0.009
48	0.000	0.001	0.001	0.000	0.002	0.011	0.021	0.021	0.000	0.000
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
71	0.003	0.005	0.007	0.004	0.008	0.028	0.026	0.028	0.003	0.005
41	0.016	0.020	0.023	0.013	0.030	0.126	0.133	0.143	0.024	0.030
103	0.004	0.004	0.004	0.002	0.004	0.005	0.003	0.004	0.004	0.004
40	0.000	0.000	0.000	0.000	0.000	0.020	0.025	0.027	0.000	0.000
67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.002	0.004	0.005	0.003	0.006	0.029	0.030	0.037	0.004	0.006
70	0.004	0.009	0.011	0.007	0.012	0.069	0.067	0.094	0.008	0.012

PCBs	P01-PreB	P01-PreD	P08-PreB	P08-PreC	P08-PreD	P11-PreB	P11-PreC	P11-PreD	P17-PreB	P17-PreC
66	0.008	0.012	0.015	0.009	0.016	0.056	0.054	0.072	0.009	0.012
95	0.005	0.010	0.021	0.012	0.011	0.055	0.042	0.063	0.008	0.030
93	0.008	0.011	0.024	0.007	0.016	0.047	0.046	0.054	0.019	0.070
56	0.005	0.005	0.006	0.004	0.006	0.029	0.031	0.033	0.007	0.007
60	0.004	0.005	0.006	0.003	0.006	0.029	0.031	0.033	0.006	0.008
92	0.003	0.004	0.004	0.003	0.004	0.009	0.012	0.013	0.003	0.003
84	0.010	0.016	0.020	0.010	0.018	0.045	0.052	0.056	0.007	0.012
101	0.028	0.032	0.034	0.024	0.036	0.147	0.066	0.078	0.016	0.031
99	0.010	0.015	0.018	0.010	0.017	0.030	0.029	0.041	0.006	0.010
119	0.000	0.006	0.034	0.017	0.003	0.041	0.020	0.021	0.008	0.049
83	0.001	0.004	0.019	0.018	0.008	0.080	0.024	0.088	0.012	0.041
87	0.004	0.005	0.008	0.004	0.008	0.024	0.029	0.033	0.005	0.007
81	0.000	0.000	0.002	0.001	0.000	0.000	0.001	0.002	0.000	0.002
115	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
136	0.003	0.004	0.004	0.003	0.004	0.007	0.006	0.008	0.003	0.003
110	0.010	0.015	0.019	0.011	0.020	0.054	0.063	0.077	0.010	0.016
77	0.001	0.002	0.002	0.001	0.002	0.008	0.009	0.007	0.002	0.002
82	0.001	0.003	0.001	0.002	0.003	0.013	0.012	0.016	0.000	0.011
151	0.003	0.004	0.004	0.003	0.004	0.007	0.005	0.007	0.002	0.002
135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
149	0.006	0.010	0.011	0.008	0.012	0.016	0.020	0.018	0.002	0.004
118	0.008	0.007	0.013	0.006	0.011	0.129	0.027	0.392	0.008	0.135
134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.000	0.000
153	0.006	0.012	0.013	0.009	0.013	0.015	0.014	0.019	0.002	0.004
132	0.000	0.001	0.002	0.001	0.002	0.005	0.006	0.009	0.000	0.001
105	0.002	0.003	0.004	0.003	0.004	0.013	0.013	0.021	0.002	0.004
141	0.001	0.001	0.002	0.001	0.002	0.005	0.004	0.005	0.001	0.001
179	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000
163	0.001	0.001	0.002	0.001	0.001	0.005	0.002	0.004	0.002	0.005
138	0.008	0.011	0.013	0.007	0.011	0.022	0.016	0.024	0.005	0.011
158	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.000	0.001
178	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	0.001	0.003	0.003	0.002	0.003	0.003	0.003	0.004	0.000	0.001
183	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.003	0.001	0.001

PCBs	P01-PreB	P01-PreD	P08-PreB	P08-PreC	P08-PreD	P11-PreB	P11-PreC	P11-PreD	P17-PreB	P17-PreC
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.000	0.000
174	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.003	0.000	0.000
177	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.000
171	0.005	0.001	0.001	0.001	0.001	0.003	0.001	0.006	0.002	0.002
156	0.001	0.000	0.001	0.000	0.001	0.002	0.001	0.001	0.000	0.000
157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001
172	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	0.000	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.000	0.000
193	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000
191	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.015	0.000	0.000
169	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001
170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	0.002	0.002	0.003	0.001	0.002	0.003	0.002	0.002	0.002	0.002
189	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs	P17-PreD	P01-PostB	P01-PostD	P01-PostC	P08-PostB	P08-PostC	P08-PostD	P11-PostB	P11-PostC	P11-PostD
1	0.000	0.017	0.013	0.016	0.023	0.026	0.025	0.000	0.008	0.006
2	0.003	0.017	0.024	0.014	0.025	0.031	0.031	0.003	0.016	0.006
3	0.000	0.012	0.017	0.014	0.025	0.025	0.018	0.001	0.010	0.003
4	0.540	0.215	0.154	0.188	0.196	0.157	0.252	0.910	7.305	5.137
10	0.025	0.032	0.022	0.018	0.025	0.016	0.023	0.071	0.142	0.073
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.009	0.008	0.006	0.005	0.007	0.006	0.008	0.037	0.074	0.045
8	0.039	0.037	0.020	0.022	0.024	0.025	0.029	0.084	0.186	0.105
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.006	0.027	0.004	0.004	0.007	0.008	0.008	0.061	0.064	0.064
18	0.052	0.081	0.019	0.024	0.019	0.021	0.025	0.248	0.417	0.266
17	0.028	0.018	0.011	0.011	0.013	0.011	0.015	0.105	0.156	0.108
15	0.007	0.005	0.004	0.002	0.003	0.004	0.005	0.130	0.168	0.092
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.017	0.015	0.004	0.005	0.002	0.008	0.011	0.095	0.162	0.090
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.039	0.018	0.011	0.010	0.005	0.008	0.011	0.142	0.273	0.145
28	0.051	0.023	0.017	0.015	0.015	0.021	0.019	0.111	0.239	0.148
20	0.032	0.031	0.011	0.011	0.008	0.012	0.013	0.142	0.202	0.115
22	0.016	0.005	0.003	0.001	0.002	0.003	0.001	0.040	0.107	0.052
45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.055	0.030
46	0.002	0.028	0.001	0.002	0.002	0.002	0.004	0.027	0.037	0.020
69	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	0.045	0.314	0.022	0.024	0.019	0.021	0.027	0.240	0.434	0.300
47	0.011	0.029	0.007	0.010	0.006	0.008	0.009	0.048	0.090	0.057
48	0.003	0.007	0.000	0.000	0.000	0.000	0.000	0.039	0.056	0.033
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
71	0.007	0.024	0.004	0.004	0.004	0.003	0.005	0.042	0.068	0.041
41	0.034	0.071	0.018	0.015	0.015	0.013	0.017	0.206	0.354	0.220
103	0.004	0.005	0.004	0.002	0.004	0.002	0.004	0.005	0.006	0.004
40	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.040	0.071	0.043
67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.006	0.014	0.004	0.003	0.003	0.003	0.004	0.047	0.087	0.049
70	0.014	0.060	0.006	0.007	0.006	0.006	0.008	0.123	0.228	0.139

PCBs	P17-PreD	P01-PostB	P01-PostD	P01-PostC	P08-PostB	P08-PostC	P08-PostD	P11-PostB	P11-PostC	P11-PostD
66	0.012	0.033	0.010	0.011	0.010	0.009	0.013	0.093	0.158	0.097
95	0.011	0.065	0.016	0.008	0.008	0.012	0.011	0.056	0.101	0.084
93	0.017	0.083	0.018	0.008	0.016	0.007	0.011	0.057	0.112	0.075
56	0.007	0.008	0.005	0.004	0.005	0.004	0.004	0.049	0.081	0.050
60	0.007	0.008	0.005	0.004	0.005	0.003	0.004	0.047	0.079	0.049
92	0.004	0.012	0.003	0.003	0.003	0.003	0.004	0.014	0.028	0.017
84	0.013	0.067	0.012	0.012	0.011	0.009	0.017	0.062	0.122	0.080
101	0.008	0.106	0.030	0.027	0.051	0.027	0.033	0.136	0.136	0.083
99	0.009	0.042	0.012	0.012	0.010	0.008	0.016	0.035	0.071	0.050
119	0.008	0.017	0.024	0.005	0.004	0.018	0.003	0.019	0.035	0.477
83	0.017	0.014	0.025	0.004	0.005	0.007	0.006	0.042	0.045	0.055
87	0.007	0.021	0.004	0.005	0.006	0.003	0.008	0.040	0.082	0.043
81	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.004	0.003
115	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
136	0.004	0.008	0.004	0.003	0.003	0.002	0.004	0.009	0.018	0.010
110	0.016	0.081	0.013	0.013	0.012	0.011	0.018	0.079	0.162	0.103
77	0.002	0.003	0.002	0.001	0.001	0.001	0.002	0.012	0.019	0.014
82	0.001	0.005	0.004	0.000	0.001	0.004	0.002	0.019	0.027	0.027
151	0.003	0.005	0.003	0.003	0.003	0.002	0.004	0.009	0.016	0.010
135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
149	0.005	0.021	0.009	0.009	0.007	0.005	0.013	0.029	0.054	0.026
118	0.249	0.037	0.006	0.008	0.009	0.005	0.009	0.040	0.082	0.466
134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
146	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.002
153	0.005	0.017	0.010	0.011	0.008	0.005	0.013	0.019	0.039	0.021
132	0.001	0.005	0.001	0.001	0.000	0.001	0.002	0.009	0.018	0.009
105	0.006	0.007	0.003	0.003	0.002	0.002	0.004	0.019	0.039	0.027
141	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.006	0.010	0.005
179	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001
163	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.003	0.004
138	0.007	0.014	0.010	0.009	0.008	0.005	0.011	0.023	0.037	0.026
158	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.002	0.004	0.002
178	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	0.001	0.002	0.002	0.002	0.002	0.001	0.003	0.004	0.008	0.004
183	0.001	0.002	0.002	0.001	0.001	0.001	0.002	0.003	0.004	0.003

PCBs	P17-PreD	P01-PostB	P01-PostD	P01-PostC	P08-PostB	P08-PostC	P08-PostD	P11-PostB	P11-PostC	P11-PostD
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	0.001	0.002	0.001	0.001	0.001	0.000	0.001	0.002	0.003	0.002
174	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.002
177	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.001
171	0.001	0.003	0.002	0.001	0.002	0.001	0.001	0.002	0.002	0.006
156	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.002	0.004	0.002
157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
173	0.000	0.001	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
172	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	0.000	0.001	0.001	0.001	0.000	0.000	0.001	0.003	0.008	0.004
193	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002
191	0.011	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.009
169	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001
170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.003	0.003	0.003
189	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs	P17-PostB	P17-PostC	P17-PostD	P08-Pre +B	P08-Pre+C	P08-Pre+D	P11-Pre+B	P11-Pre+C	P11-Pre+D
1	0.000	0.001	0.000	0.019	0.020	0.018	0.008	0.010	0.000
2	0.003	0.005	0.002	0.018	0.014	0.017	0.005	0.009	0.002
3	0.006	0.006	0.000	0.013	0.013	0.008	0.006	0.009	0.002
4	0.484	0.350	0.299	0.233	0.190	0.261	5.296	3.785	0.908
10	0.025	0.026	0.025	0.027	0.012	0.019	0.079	0.046	0.030
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.008	0.009	0.007	0.009	0.005	0.006	0.043	0.025	0.011
8	0.037	0.036	0.040	0.031	0.019	0.024	0.134	0.088	0.041
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.008	0.007	0.006	0.006	0.005	0.005	0.081	0.026	0.026
18	0.048	0.046	0.051	0.022	0.022	0.023	0.275	0.167	0.085
17	0.025	0.026	0.027	0.015	0.010	0.011	0.116	0.066	0.041
15	0.009	0.009	0.010	0.005	0.004	0.004	0.110	0.042	0.025
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.012	0.016	0.017	0.007	0.007	0.007	0.103	0.062	0.030
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.029	0.034	0.033	0.012	0.006	0.012	0.186	0.110	0.048
28	0.040	0.034	0.038	0.014	0.015	0.015	0.165	0.103	0.048
20	0.021	0.032	0.033	0.014	0.009	0.012	0.149	0.088	0.041
22	0.007	0.010	0.009	0.011	0.003	0.004	0.052	0.039	0.014
45	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.018	0.004
46	0.002	0.002	0.003	0.003	0.002	0.002	0.025	0.017	0.011
69	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	0.036	0.039	0.049	0.025	0.021	0.026	0.277	0.187	0.116
47	0.009	0.010	0.011	0.009	0.009	0.010	0.054	0.034	0.027
48	0.000	0.002	0.002	0.000	0.000	0.001	0.039	0.006	0.009
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
71	0.005	0.005	0.006	0.004	0.004	0.004	0.043	0.029	0.017
41	0.032	0.034	0.035	0.015	0.011	0.015	0.246	0.156	0.087
103	0.004	0.004	0.004	0.004	0.002	0.003	0.007	0.004	0.015

PCBs	P17-PostB	P17-PostC	P17-PostD	P08-Pre +B	P08-Pre+C	P08-Pre+D	P11-Pre+B	P11-Pre+C	P11-Pre+D
40	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.027	0.012
67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.006	0.006	0.007	0.004	0.003	0.003	0.057	0.035	0.018
70	0.012	0.013	0.016	0.007	0.007	0.008	0.143	0.086	0.041
66	0.012	0.012	0.014	0.012	0.009	0.010	0.103	0.068	0.035
95	0.013	0.013	0.017	0.006	0.014	0.009	0.077	0.059	0.030
93	0.006	0.007	0.009	0.008	0.009	0.010	0.068	0.049	0.029
56	0.008	0.007	0.008	0.005	0.004	0.004	0.054	0.035	0.017
60	0.007	0.007	0.007	0.005	0.003	0.004	0.053	0.034	0.018
92	0.004	0.003	0.003	0.003	0.003	0.003	0.016	0.014	0.008
84	0.012	0.012	0.013	0.012	0.012	0.012	0.076	0.052	0.033
101	0.031	0.029	0.032	0.054	0.015	0.028	0.111	0.083	0.047
99	0.007	0.007	0.009	0.013	0.013	0.013	0.044	0.031	0.023
119	0.024	0.001	0.010	0.005	0.015	0.003	0.058	0.037	0.009
83	0.014	0.013	0.012	0.005	0.013	0.005	0.085	0.083	0.009
87	0.007	0.005	0.006	0.004	0.005	0.004	0.054	0.028	0.020
81	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.001	0.000
115	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
136	0.003	0.003	0.004	0.004	0.003	0.004	0.012	0.008	0.006
110	0.015	0.016	0.019	0.014	0.014	0.014	0.097	0.065	0.040
77	0.002	0.002	0.002	0.002	0.001	0.001	0.014	0.010	0.004
82	0.001	0.005	0.003	0.000	0.002	0.001	0.018	0.016	0.004
151	0.002	0.002	0.002	0.004	0.003	0.003	0.011	0.008	0.005
135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
149	0.005	0.002	0.006	0.008	0.010	0.008	0.032	0.023	0.014
118	0.006	0.080	0.011	0.009	0.008	0.213	0.050	0.031	0.016
134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	0.000	0.000	0.000	0.001	0.002	0.001	0.002	0.002	0.001
153	0.003	0.003	0.004	0.008	0.011	0.011	0.023	0.017	0.012
132	0.001	0.000	0.000	0.001	0.002	0.002	0.010	0.006	0.004
105	0.003	0.003	0.003	0.003	0.003	0.006	0.022	0.017	0.009
141	0.001	0.001	0.002	0.001	0.001	0.001	0.007	0.004	0.002

PCBs	P17-PostB	P17-PostC	P17-PostD	P08-Pre +B	P08-Pre+C	P08-Pre+D	P11-Pre+B	P11-Pre+C	P11-Pre+D
179	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
163	0.002	0.002	0.002	0.002	0.001	0.001	0.005	0.005	0.002
138	0.008	0.007	0.008	0.009	0.008	0.008	0.029	0.021	0.013
158	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001
178	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	0.001	0.000	0.001	0.002	0.002	0.002	0.005	0.003	0.002
183	0.001	0.001	0.002	0.001	0.001	0.001	0.003	0.003	0.002
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.003	0.001
174	0.000	0.000	0.000	0.000	0.001	0.000	0.003	0.002	0.000
177	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.001
171	0.001	0.003	0.002	0.005	0.001	0.001	0.006	0.006	0.002
156	0.000	0.000	0.000	0.001	0.001	0.000	0.002	0.001	0.000
157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
173	0.000	0.001	0.000	0.003	0.000	0.000	0.000	0.000	0.000
172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	0.000	0.000	0.000	0.000	0.002	0.001	0.004	0.003	0.001
193	0.000	0.000	0.000	0.000	0.001	0.012	0.000	0.000	0.000
191	0.000	0.004	0.000	0.001	0.000	0.009	0.001	0.000	0.001
169	0.001	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001
170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	0.002	0.002	0.002	0.002	0.001	0.002	0.003	0.003	0.002
189	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table B103. Average pre-storm and post-storm ex-situ sediment porewater (PW) trace metal concentrations as measured by the DGT based passive sampler (retrieved on March 5th 2016) for the season 2015/16.

Metals µg/L (ng/L)	P01 Pre Storm A	P01 Pre Storm E	P01 Pre Storm F	P01 Post Storm A	P01 Post Storm E	P01 Post Storm F	P08 Pre Storm A	P08 Pre Storm E	P08 Pre Storm F	P08 Post Storm A	P08 Post Storm E	P08 Post Storm F
Ag	0.0	0.0	0.0	ND	ND	ND	0.0	0.0	0.0	ND	ND	ND
Cd	0.1	0.2	0.1	0.1	ND	ND	0.1	0.1	0.1	ND	ND	ND
Cu	4.8	6.4	7.4	5.6	2.5	2.0	14.7	5.4	7.4	2.6	4.5	4.1
Ni	1.1	2.1	1.4	1.2	0.8	1.1	1.8	1.8	1.8	0.6	0.7	0.6
Pb	0.1	0.1	0.1	0.1	0.3	0.0	1.0	0.1	0.2	0.1	0.1	0.1
Zn	30.0	35.8	27.9	22.9	10.3	10.0	37.3	35.2	41.8	11.8	18.6	19.0
Hg	202.0	207.3	162.7	20.2	12.8	26.3	153.4	186.3	211.4	17.2	33.0	20.5

Table B104. Average pre-storm and post-storm ex-situ sediment porewater (PW) trace metal concentrations as measured by the DGT based passive sampler (retrieved on March 5th 2016) for the season 2015/16.

Metals µg/L (ng/L)	P08 Pre Storm + Trap Material A	P08 Pre Storm + Trap Material E	P08 Pre Storm + Trap Material F	P11 Pre Storm A	P11 Pre Storm E	P11 Pre Storm F	P11 Post Storm A	P11 Post Storm E	P11 Post Storm F	P11 Pre Storm + Trap Material A	P11 Pre Storm + Trap Material E	P11 Pre Storm + Trap Material F
Ag	0.0	ND	0.0	0.0	0.0	0.0	ND	ND	ND	0.0	ND	ND
Cd	ND	ND	ND	0.6	0.3	0.7	0.1	0.0	0.0	0.1	ND	ND
Cu	1.9	0.7	2.5	19.0	6.5	16.4	4.0	4.3	8.4	3.5	6.4	2.0
Ni	0.9	1.2	0.8	6.1	3.0	6.4	0.7	0.5	0.5	2.3	1.8	0.8
Pb	0.4	0.1	0.4	1.3	0.8	1.6	0.4	0.3	0.1	0.5	1.3	0.2
Zn	6.5	3.8	3.5	331.1	127.0	282.8	29.9	14.9	14.9	57.6	13.0	5.4
Hg	8.7	10.2	9.2	194.7	311.7	332.5	16.1	25.9	27.6	14.8	4.6	3.3

Table B105. Average pre-storm and post-storm ex-situ sediment porewater (PW) trace metal concentrations as measured by the DGT based passive sampler (retrieved on March 5th 2016) for the season 2015/16.

Metals µg/L (ng/L)	P17 Pre Storm A	P17 Pre Storm E	P17 Pre Storm F	P17 Post Storm A	P17 Post Storm E	P17 Post Storm F	P17 Pre Storm + Trap Material A	P17 Pre Storm + Trap Material E	P17 Pre Storm + Trap Material F	New Bedford Sediment A	New Bedford Sediment B	New Bedford Sediment C
Ag	0.0	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0
Cd	0.1	-	0.1	ND	0.1	ND	ND	ND	ND	0.1	0.1	0.4
Cu	15.2	-	13.7	2.0	1.2	0.8	0.5	1.3	1.2	3.0	2.6	5.1
Ni	2.2	-	2.1	0.4	0.6	0.7	1.2	0.9	0.7	2.9	2.5	3.7
Pb	1.2	-	1.7	0.2	0.1	0.1	ND	0.2	0.1	0.5	0.5	0.8
Zn	126.8	-	126.4	3.9	5.5	10.5	2.9	3.4	2.5	24.3	21.1	45.5
Hg	64.3	82.2	122.0	2.1	2.4	3.4	0.5	0.4	0.8	6.3	6.0	3.3

Table B106. Porewater concentrations in the travel control DGTs.

Metals µg/L (ng/L)	Blank A	Blank B	Blank C	Blank D
Ag	ND	-	ND	ND
Cd	ND	-	ND	ND
Cu	0.2	-	0.3	0.4
Ni	ND	-	ND	ND
Pb	ND	-	ND	ND
Zn	ND	-	3.2	0.8
Hg	1.5	2.5	1.7	3.3

Table B107. Average pre-storm ex-situ sediment porewater (PW) PAH concentrations as measured by the SPME based passive sampler (retrieved on October 11th 2016) for the season 2016/17.

PAHs	DB-SPME_101116_B	DB-SPME_101116_C	P01-SPME_101116_B	P01-SPME_101116_C	P08-SPME_101116_B	P08-SPME_101116_C	P17-SPME_101116_B
naphthalene	10.9	6.7	7.7	7.6	8.0	10.7	7.7
2-methylnaphthalene	1.1	1.1	1.1	1.0	1.4	1.8	1.8
1-methylnaphthalene	2.0	1.9	1.7	1.7	2.1	2.5	2.5
2-ethylnaphthalene	0.2	0.4	0.3	0.5	0.3	0.7	0.9
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.6-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.6
1.3-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	1.0
2-isopropylnaphthalene	0.0	0.3	0.0	0.0	0.0	0.0	0.0
acenaphthylene	0.0	0.0	6.1	0.0	1.3	0.0	0.1
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.1	0.0	0.1	0.2
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.4
acenaphthene	0.0	0.0	0.0	0.0	0.0	0.0	3.7
2.3.5-trimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.5
fluorene	0.7	0.7	0.6	0.5	1.1	1.2	1.2
1-methylfluorene	0.0	0.0	0.0	0.0	0.0	0.0	0.4
phenanthrene	0.9	0.5	0.1	0.0	0.3	0.1	0.6
anthracene	0.0	0.0	1.5	0.3	1.4	0.3	1.2
2-methylphenanthrene	0.1	0.0	0.2	0.1	0.1	0.2	0.6
2-methylanthracene	0.0	0.0	0.1	0.0	0.0	0.0	0.2
1-methylphenanthrene	0.2	0.1	0.5	0.2	0.3	0.3	1.0
9-methylanthracene	0.1	0.1	0.2	0.1	0.2	0.2	0.2
2-ethylanthracene	0.2	0.2	0.2	0.2	0.2	0.3	0.5
fluoranthene	1.3	1.0	3.8	2.2	3.0	2.9	10.4
pyrene	0.5	0.4	6.1	2.5	4.6	4.2	14.7

9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.1	0.1	1.1	0.4	0.8	0.6	0.8
benz(a)anthracene	0.2	0.2	1.5	0.4	0.5	0.5	0.7
chrysene	0.2	0.2	1.5	0.3	0.5	0.5	0.8
benzo(b)fluoranthene	0.1	0.1	1.3	0.4	0.8	0.6	0.4
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.1	0.0
benzo(k)fluoranthene	0.0	0.0	1.1	0.3	0.5	0.4	0.3
benzo(e)pyrene	0.0	0.0	0.9	0.2	0.4	0.3	0.3
benzo(a)pyrene	0.1	0.1	1.1	0.2	0.4	0.3	0.2
perylene	0.1	0.1	0.1	0.0	0.3	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table B108. Average pre-storm ex-situ sediment porewater (PW) PAH concentrations as measured by the SPME based passive sampler (retrieved on October 11th 2016) for the season 2016/17.

PAHs	P11-SPME_101116_B	P11-SPME_101116_C	P17-SPME_101116_B	P17-SPME_101116_C
naphthalene	11.8	8.2	7.7	9.4
2-methylnaphthalene	1.3	1.8	1.8	1.6
1-methylnaphthalene	2.0	2.5	2.5	2.1
2-ethylnaphthalene	0.3	0.5	0.9	1.0
1-ethylnaphthalene	0.0	0.0	0.0	0.1
2.6-dimethylnaphthalene	0.0	0.0	0.6	0.3
1.3-dimethylnaphthalene	0.0	0.0	1.0	0.8
2-isopropylnaphthalene	0.0	0.0	0.0	0.0
acenaphthylene	0.6	0.6	0.1	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.2	0.4
1.8-dimethylnaphthalene	0.0	0.0	0.4	0.1
acenaphthene	0.0	0.0	3.7	5.1
2.3.5-trimethylnaphthalene	0.0	0.0	0.5	0.5
fluorene	0.3	0.9	1.2	1.9
1-methylfluorene	0.0	0.0	0.4	0.0
phenanthrene	0.0	0.6	0.6	0.4
anthracene	0.5	0.7	1.2	0.9
2-methylphenanthrene	0.1	0.2	0.6	0.7
2-methylanthracene	0.0	0.0	0.2	0.2
1-methylphenanthrene	0.2	0.2	1.0	1.0
9-methylanthracene	0.1	0.5	0.2	0.2
2-ethylanthracene	0.2	0.2	0.5	0.7
fluoranthene	2.2	3.5	10.4	12.9
pyrene	6.6	7.3	14.7	15.1
9.10-dimethylanthracene	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.8	0.8	0.8
benz(a)anthracene	0.5	0.5	0.7	0.7
chrysene	0.6	0.6	0.8	0.8
benzo(b)fluoranthene	0.6	0.6	0.4	0.3
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.5	0.3	0.2
benzo(e)pyrene	0.3	0.4	0.3	0.2
benzo(a)pyrene	0.3	0.3	0.2	0.2
perylene	0.1	0.2	0.1	0.1

indeno(123-cd)pyrene	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0

Table B109. Average post-storm ex-situ sediment porewater (PW) PAH concentrations as measured by the SPME based passive sampler (retrieved on April 7th 2017) for the season 2016/17.

PAHs	SERDP P01 A_Mar17	SERDP P01 B_Mar17	SERDP P08 A_Mar17	SERDP P08 B_Mar17	SERDP P11 A_Mar17	SERDP P11 B_Mar17
naphthalene	3.49	1.33	0.72	1.17	0.00	0.00
2-methylnaphthalene	2.80	3.18	2.24	2.59	0.17	0.26
1-methylnaphthalene	25.39	22.30	14.48	7.40	2.66	3.46
2-ethylnaphthalene	0.80	0.63	0.78	0.58	0.38	0.41
1-ethylnaphthalene	0.40	0.22	0.52	0.26	0.13	0.20
2.6-dimethylnaphthalene	0.83	1.10	0.79	0.75	0.79	0.54
1.3-dimethylnaphthalene	0.00	0.03	0.00	0.02	0.00	0.00
2-isopropylnaphthalene	0.00	0.00	0.00	0.00	0.00	0.00
acenaphthylene	8.99	11.06	12.92	12.12	7.63	10.27
1.2-dimethylnaphthalene	1.08	1.15	1.01	1.40	1.08	0.99
1.8-dimethylnaphthalene	0.00	0.00	0.00	0.00	0.00	0.00
acenaphthene	0.00	0.00	0.00	0.00	0.00	0.00
2.3.5-trimethylnaphthalene	0.73	0.83	0.65	0.79	0.61	0.71
fluorene	4.19	4.24	3.63	4.38	3.63	4.00
1-methylfluorene	0.00	0.00	0.00	0.00	0.00	0.00
phenanthrene	1.86	1.96	1.80	2.37	1.56	2.51
anthracene	4.21	4.12	5.11	4.77	2.53	4.06
2-methylphenanthrene	0.40	0.49	0.35	0.58	0.42	0.64
2-methylanthracene	1.09	1.04	1.28	1.26	0.90	1.09
1-methylphenanthrene	0.31	0.35	0.43	0.47	0.25	0.38
9-methylanthracene	0.32	0.39	0.42	0.37	0.40	0.46
2-ethylanthracene	0.00	0.00	0.00	0.00	0.00	0.00
fluoranthene	3.50	2.71	4.09	4.78	1.27	3.36
pyrene	3.97	3.11	8.40	9.99	7.24	7.51
9.10-dimethylanthracene	0.00	0.00	0.00	0.00	0.00	0.00
2-tertbutylanthracene	0.00	0.00	0.00	0.00	0.00	0.00
1-methylpyrene	0.48	0.46	0.91	0.96	0.71	0.78
benz(a)anthracene	0.57	0.49	0.64	0.71	0.36	0.49
chrysene	0.60	0.52	0.75	0.83	0.47	0.73
benzo(b)fluoranthene	0.69	0.71	1.14	1.09	0.64	0.77

7.12-methylbenz(a)anthracene	0.00	0.00	0.00	0.00	0.00	0.00
benzo(k)fluoranthene	0.62	0.71	1.16	0.98	0.45	0.66
benzo(e)pyrene	0.39	0.48	0.65	0.68	0.45	0.53
benzo(a)pyrene	0.38	0.37	0.55	0.52	0.34	0.38
perylene	0.00	0.00	0.00	0.00	0.00	0.00
indeno(123-cd)pyrene	0.16	0.16	0.20	0.19	0.14	0.17
dibenzo(ah)anthracene	0.00	0.00	0.00	0.00	0.00	0.00
benzo(ghi)perylene	0.15	0.17	0.18	0.17	0.14	0.16

PAHs	SERDP P17 A_Mar17	SERDP P17 B_Mar17
naphthalene	2.74	0.33
2-methylnaphthalene	1.98	2.95
1-methylnaphthalene	5.93	4.14
2-ethylnaphthalene	0.44	0.69
1-ethylnaphthalene	0.21	0.22
2.6-dimethylnaphthalene	1.24	2.24
1.3-dimethylnaphthalene	0.35	0.26
2-isopropylnaphthalene	0.00	0.00
acenaphthylene	5.61	5.45
1.2-dimethylnaphthalene	1.24	1.12
1.8-dimethylnaphthalene	0.00	0.00
acenaphthene	0.00	0.00
2.3.5-trimethylnaphthalene	1.35	0.98
fluorene	4.37	3.75
1-methylfluorene	0.00	0.00
phenanthrene	3.55	2.15
anthracene	2.86	2.05
2-methylphenanthrene	1.54	1.27
2-methylanthracene	1.10	1.08
1-methylphenanthrene	0.75	0.45
9-methylanthracene	0.41	0.32
2-ethylanthracene	0.00	0.00
fluoranthene	11.33	5.60
pyrene	14.05	10.36
9.10-dimethylanthracene	0.00	0.00
2-tertbutylanthracene	0.00	0.00
1-methylpyrene	0.72	0.65
benz(a)anthracene	0.66	0.43
chrysene	0.84	0.56
benzo(b)fluoranthene	0.40	0.37
7.12-methylbenz(a)anthracene	0.00	0.00
benzo(k)fluoranthene	0.31	0.29
benzo(e)pyrene	0.34	0.31
benzo(a)pyrene	0.25	0.24
perylene	0.00	0.00
indeno(123-cd)pyrene	0.12	0.11

dibenzo(ah)anthracene	0.00	0.00
benzo(ghi)perylene	0.12	0.12

Table B110. Average pre-storm ex-situ sediment porewater (PW) PCB concentrations as measured by the SPME based passive sampler (retrieved on October 11th 2016) for the season 2016/17.

PCBs (ng/L)	DB-SPME_101116_B	DB-SPME_101116_C	P01-SPME_101116_B	P01-SPME_101116_C	P08-SPME_101116_B	P08-SPME_101116_C	P11-SPME_101116_B	P11-SPME_101116_C	P17-SPME_101116_B	P17-SPME_101116_C
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.004	0.006	0.007	0.005	0.009	0.009	0.005	0.006	0.006	0.006
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.001	0.003	0.002	0.003	0.003	0.001	0.002	0.002	0.001
8	0.007	0.007	0.018	0.010	0.015	0.011	0.008	0.004	0.010	0.007
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.010	0.009	0.023	0.013	0.022	0.027	0.021	0.018	0.023	0.020
17	0.007	0.008	0.015	0.009	0.019	0.017	0.015	0.013	0.016	0.014
15	0.004	0.005	0.007	0.005	0.007	0.009	0.007	0.007	0.007	0.006
27	0.021	0.023	0.024	0.018	0.028	0.041	0.023	0.022	0.024	0.024
24	0.017	0.018	0.020	0.014	0.021	0.032	0.018	0.018	0.020	0.019
32	0.002	0.002	0.008	0.004	0.007	0.005	0.006	0.006	0.006	0.005
16	0.003	0.003	0.013	0.007	0.012	0.012	0.012	0.011	0.009	0.009
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.001	0.002	0.009	0.005	0.010	0.007	0.008	0.008	0.010	0.010
28	0.004	0.004	0.014	0.009	0.014	0.014	0.013	0.014	0.015	0.011
20	0.004	0.002	0.011	0.005	0.009	0.009	0.010	0.010	0.012	0.008
22	0.002	0.002	0.003	0.003	0.005	0.004	0.004	0.004	0.005	0.004

PCBs (ng/L)	DB-SPME_101116_B	DB-SPME_101116_C	P01-SPME_101116_B	P01-SPME_101116_C	P08-SPME_101116_B	P08-SPME_101116_C	P11-SPME_101116_B	P11-SPME_101116_C	P17-SPME_101116_B	P17-SPME_101116_C
45	0.000	0.000	0.001	0.000	0.001	0.000	0.002	0.001	0.001	0.000
46	0.012	0.010	0.003	0.001	0.003	0.003	0.003	0.003	0.001	0.001
69	0.004	0.004	0.002	0.011	0.022	0.022	0.002	0.022	0.016	0.013
52	0.007	0.006	0.030	0.018	0.035	0.035	0.036	0.035	0.026	0.020
47	0.000	0.000	0.013	0.005	0.014	0.010	0.015	0.012	0.007	0.005
48	0.002	0.002	0.008	0.007	0.009	0.007	0.012	0.011	0.008	0.005
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
71	0.001	0.001	0.005	0.003	0.006	0.005	0.007	0.006	0.004	0.004
41	0.001	0.001	0.015	0.008	0.018	0.017	0.021	0.019	0.020	0.014
103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.001	0.000	0.004	0.002	0.005	0.004	0.006	0.005	0.005	0.003
70	0.002	0.002	0.010	0.005	0.011	0.010	0.012	0.012	0.011	0.007
66	0.006	0.006	0.016	0.009	0.018	0.016	0.015	0.015	0.014	0.009
95	0.002	0.002	0.015	0.009	0.012	0.008	0.015	0.012	0.008	0.006
93	0.002	0.004	0.020	0.012	0.016	0.018	0.025	0.020	0.015	0.011
56	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.001	0.001	0.003	0.001	0.004	0.004	0.004	0.004	0.004	0.003
92	0.001	0.001	0.005	0.003	0.005	0.005	0.005	0.004	0.004	0.004
84	0.002	0.001	0.020	0.011	0.019	0.015	0.018	0.017	0.012	0.008
101	0.002	0.000	0.015	0.007	0.013	0.010	0.012	0.012	0.009	0.006
99	0.001	0.001	0.022	0.009	0.019	0.014	0.015	0.015	0.009	0.006
119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	DB-SPME_101116_B	DB-SPME_101116_C	P01-SPME_101116_B	P01-SPME_101116_C	P08-SPME_101116_B	P08-SPME_101116_C	P11-SPME_101116_B	P11-SPME_101116_C	P17-SPME_101116_B	P17-SPME_101116_C
83	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
87	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
81	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
115	0.003	0.003	0.005	0.003	0.007	0.008	0.007	0.006	0.006	0.004
136	0.002	0.002	0.005	0.003	0.005	0.005	0.004	0.004	0.002	0.002
110	0.001	0.001	0.020	0.009	0.021	0.015	0.020	0.019	0.016	0.009
77	0.001	0.001	0.003	0.002	0.002	0.003	0.003	0.003	0.002	0.002
82	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
151	0.000	0.000	0.004	0.001	0.003	0.002	0.003	0.003	0.002	0.001
135	0.001	0.001	0.003	0.001	0.003	0.003	0.002	0.002	0.002	0.002
144	0.001	0.002	0.003	0.002	0.003	0.004	0.003	0.002	0.002	0.002
147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
149	0.005	0.000	0.018	0.007	0.014	0.011	0.012	0.011	0.008	0.005
118	0.005	0.000	0.009	0.037	0.010	0.005	0.010	0.005	0.010	0.035
134	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
153	0.000	0.001	0.017	0.007	0.014	0.008	0.010	0.010	0.006	0.003
132	0.002	0.003	0.005	0.003	0.005	0.004	0.004	0.005	0.004	0.003
105	0.001	0.001	0.003	0.003	0.004	0.002	0.005	0.004	0.004	0.003
141	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
179	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
163	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	DB-SPME_101116_B	DB-SPME_101116_C	P01-SPME_101116_B	P01-SPME_101116_C	P08-SPME_101116_B	P08-SPME_101116_C	P11-SPME_101116_B	P11-SPME_101116_C	P17-SPME_101116_B	P17-SPME_101116_C
138	0.000	0.000	0.009	0.004	0.007	0.003	0.007	0.006	0.004	0.002
158	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
178	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	0.000	0.000	0.003	0.001	0.001	0.000	0.001	0.001	0.000	0.000
183	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
174	0.001	0.002	0.003	0.002	0.003	0.003	0.002	0.002	0.002	0.002
177	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	0.000	0.007	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
193	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
191	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	0.003	0.003	0.004	0.003	0.005	0.006	0.004	0.003	0.004	0.003
190	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
189	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	DB-SPME_101116_B	DB-SPME_101116_C	P01-SPME_101116_B	P01-SPME_101116_C	P08-SPME_101116_B	P08-SPME_101116_C	P11-SPME_101116_B	P11-SPME_101116_C	P17-SPME_101116_B	P17-SPME_101116_C
208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table B111. Average post-storm ex-situ sediment porewater (PW) PCB concentrations as measured by the SPME based passive sampler (retrieved on April 7th 2017) for the season 2016/17.

PCBs (ng/L)	P01A_ mar2017	P01B_ mar2017	P08A_ mar2017	P08B_ mar2017	P11A_ mar2017	P11B_ mar2017	P17A_ mar2017	P17B_ mar2017
1	0.022	0.022	0.022	0.024	0.022	0.023	0.023	0.025
2	0.010	0.010	0.010	0.010	0.009	0.010	0.009	0.010
3	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.049	0.051	0.048	0.049	0.049	0.050	0.049	0.049
9	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.010	0.011	0.009	0.010	0.010	0.010	0.011	0.010
8	0.026	0.024	0.023	0.027	0.026	0.026	0.027	0.024
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.044	0.047	0.049	0.046	0.047	0.049	0.044	0.043
18	0.152	0.087	0.095	0.133	0.097	0.092	0.064	0.079
17	0.025	0.033	0.036	0.032	0.031	0.028	0.026	0.025
15	0.019	0.019	0.019	0.020	0.021	0.019	0.019	0.018
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.020	0.021	0.021	0.022	0.022	0.025	0.023	0.020
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31	0.012	0.013	0.016	0.015	0.018	0.020	0.020	0.018
28	0.017	0.014	0.020	0.018	0.021	0.022	0.019	0.016
20	0.027	0.027	0.030	0.027	0.034	0.034	0.030	0.029
22	0.025	0.023	0.024	0.024	0.025	0.026	0.027	0.026

PCBs (ng/L)	P01A_ mar2017	P01B_ mar2017	P08A_ mar2017	P08B_ mar2017	P11A_ mar2017	P11B_ mar2017	P17A_ mar2017	P17B_ mar2017
45	0.000	0.000	0.000	0.000	0.000	0.012	0.051	0.043
46	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
69	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	0.071	0.066	0.080	0.064	0.064	0.076	0.046	0.043
47	0.033	0.035	0.036	0.031	0.028	0.036	0.020	0.017
48	0.017	0.017	0.013	0.013	0.017	0.017	0.015	0.013
44	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
71	0.011	0.012	0.015	0.012	0.014	0.014	0.008	0.008
41	0.029	0.033	0.041	0.032	0.043	0.048	0.036	0.030
103	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.000	0.009	0.000	0.000	0.000	0.029	0.062	0.059
67	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
74	0.009	0.010	0.011	0.009	0.012	0.013	0.008	0.007
70	0.018	0.018	0.024	0.018	0.024	0.026	0.017	0.013
66	0.027	0.031	0.034	0.028	0.030	0.034	0.020	0.019
95	0.026	0.027	0.034	0.022	0.023	0.029	0.015	0.013
93	0.029	0.033	0.036	0.023	0.028	0.035	0.017	0.007
56	0.006	0.008	0.008	0.007	0.010	0.009	0.007	0.007
60	0.007	0.007	0.008	0.008	0.010	0.010	0.008	0.007
92	0.012	0.013	0.013	0.010	0.009	0.012	0.006	0.005
84	0.036	0.043	0.045	0.032	0.028	0.038	0.018	0.015
101	0.028	0.032	0.033	0.024	0.021	0.028	0.013	0.011
99	0.044	0.052	0.044	0.034	0.028	0.038	0.018	0.017
119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	P01A_ mar2017	P01B_ mar2017	P08A_ mar2017	P08B_ mar2017	P11A_ mar2017	P11B_ mar2017	P17A_ mar2017	P17B_ mar2017
83	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
87	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
81	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
115	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
136	0.010	0.013	0.012	0.010	0.009	0.011	0.007	0.006
110	0.036	0.044	0.051	0.035	0.035	0.047	0.027	0.023
77	0.008	0.009	0.008	0.008	0.008	0.008	0.007	0.006
82	0.015	0.017	0.017	0.014	0.014	0.014	0.012	0.014
151	0.011	0.014	0.012	0.009	0.008	0.010	0.006	0.005
135	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
147	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
123	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
149	0.039	0.050	0.046	0.030	0.028	0.038	0.020	0.018
118	0.032	0.035	0.031	0.028	0.012	0.030	0.013	0.013
134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
131	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
146	0.014	0.017	0.014	0.013	0.011	0.013	0.009	0.009
153	0.045	0.058	0.045	0.033	0.020	0.034	0.012	0.011
132	0.014	0.017	0.016	0.013	0.011	0.015	0.010	0.010
105	0.009	0.012	0.012	0.009	0.009	0.011	0.007	0.007
141	0.011	0.012	0.012	0.011	0.010	0.012	0.009	0.009
179	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
163	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	P01A_ mar2017	P01B_ mar2017	P08A_ mar2017	P08B_ mar2017	P11A_ mar2017	P11B_ mar2017	P17A_ mar2017	P17B_ mar2017
138	0.038	0.049	0.040	0.029	0.024	0.034	0.018	0.017
158	0.003	0.003	0.003	0.003	0.002	0.003	0.002	0.002
178	0.033	0.008	0.008	0.007	0.007	0.008	0.006	0.007
126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
187	0.012	0.016	0.011	0.008	0.005	0.009	0.003	0.003
183	0.003	0.004	0.003	0.002	0.001	0.002	0.001	0.001
128	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
167	0.004	0.004	0.004	0.003	0.002	0.003	0.002	0.002
174	0.004	0.006	0.005	0.003	0.003	0.004	0.002	0.002
177	0.005	0.006	0.005	0.003	0.002	0.004	0.002	0.002
171	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
156	0.004	0.005	0.004	0.004	0.003	0.004	0.003	0.003
157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
173	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
172	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
197	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180	0.010	0.011	0.009	0.007	0.005	0.009	0.004	0.004
193	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
191	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
169	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
190	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
198	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
203	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
196	0.002	0.002	0.002	0.002	0.001	0.002	0.001	0.001
189	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PCBs (ng/L)	P01A_ mar2017	P01B_ mar2017	P08A_ mar2017	P08B_ mar2017	P11A_ mar2017	P11B_ mar2017	P17A_ mar2017	P17B_ mar2017
208	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
207	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
194	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
205	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
206	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table B112. Average pre-storm ex-situ sediment porewater (PW) PCB concentrations as measured by the DGT based passive sampler (retrieved on September 15th 2016) for the season 2016/17.

Metals µg/L (ng/L)	P01-TM-F	P01-TM-G	P08-TM-F	P08-TM-G	P11-TM-F	P11-TM-G	P17-TM-F	P17-TM-G	Blank-TM-A	Blank-TM-B
Ag	0.01	0.01	0.00	0.00	0.01	0.02	ND	ND	ND	ND
Cd	ND	ND	0.07	ND	ND	0.07	ND	ND	ND	ND
Cu	4.12	4.89	27.99	5.77	6.07	30.84	1.58	0.74	0.54	0.22
Ni	0.87	0.88	1.78	0.92	1.05	1.49	0.62	1.16	0.45	ND
Pb	0.22	0.15	0.34	0.21	0.36	2.35	0.34	0.26	0.05	0.02
Zn	24.03	23.98	53.29	29.62	34.65	77.47	5.60	13.43	1.15	1.70
Hg	150.92	110.13	139.16	183.05	68.02	108.49	12.29	22.60	6.64	6.11

Table B113. Average post-storm ex-situ sediment porewater (PW) PCB concentrations as measured by the DGT based passive sampler (retrieved on March 13th 2017) for the season 2016/17.

Metals µg/L (ng/L)	P01 A G1	P01 B G2	P08 A G2	P08 B G1	P11 A G1	P11 B G2	P17 A G2	P17 B G1	Blank A	Blank B
Ag	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND
Cd	ND	ND	ND	ND	0.04	ND	0.03	0.01	ND	ND
Cu	1.97	2.73	20.21	21.52	16.04	5.44	3.46	3.00	0.33	0.27
Ni	0.36	0.65	1.00	1.50	0.86	0.66	0.71	0.56	0.07	0.03
Pb	0.11	0.15	0.36	1.03	1.07	0.28	0.36	0.41	0.01	0.01
Zn	6.97	52.60	42.48	111.01	30.15	15.18	15.57	4.86	0.89	1.00
Hg	24.31	33.11	116.56	144.08	22.21	24.96	4.03	2.86	83.08	6.41

Table B114. Trace metal concentrations in the pre-storm water samples from PSNS received on December 6th 2016. The concentrations of all trace metals except Hg are in µg/L or µg/Kg-dry weight. The concentration of Hg is in ng/L or ng/Kg.

Metals	PS09				NPDES 18				NPDES 19				Trip Blank			
	Bulk water		Filtered Water (< 0.45 µm)		Bulk water		Filtered Water (< 0.45 µm)		Bulk water		Filtered Water (< 0.45 µm)		Bulk water		Filtered Water (< 0.45 µm)	
	µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)		µg/L (ng/L)	
As	ND		ND		ND		ND		ND		ND		ND		ND	
Cu	94.0		83.7±2.9		72.00		66.5±1.7		51.70		45.9±0.5		1.2±0.3	J	2.6±0.7	J
Ni	11.20		11.30		13.20		13.1±0.3		7.80	J	7.1±0.3	J	ND		ND	
Zn	10.70		6.2±0.5	J	31.90		12.6±2.0		12.90		5.10	J	2.7±5.7	J	11.4±2.4	J
Cd	ND		ND		ND		ND		ND		ND		ND		ND	
Pb	ND		ND		ND		ND		ND		ND		ND		ND	
Hg	5.4±0.2		5.4±0.3		12.6±1.9		7.3±0.7		11.0±0.7		7.3±0.4		2.4±0.2	J	6.5	

Table B115. PAH concentrations in the pre-storm water samples from PSNS collected on December 6th 2016. The concentrations of all PAHs are in ng/L.

PAH	PS09						NPDES 18					
	Bulk water		Filtered Water (< 20 µm)		Filtered Water (< 0.7 µm)		Bulk water		Filtered Water (< 20 µm)		Filtered Water (< 0.7 µm)	
	ng/L		ng/L		ng/L		ng/L		ng/L		ng/L	
Naphthalene	1.09		0.00	U	0.00	U	2.02		0.69	B	0.85	
Fluorene	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U
Acenaphthene	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U
Phenanthrene	0.74		0.00	U	0.00	U	1.11		0.43	B	0.60	B
Anthracene	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U
Fluoranthene	1.43		1.00		1.04		1.16		0.99		0.52	B
Pyrene	1.00		0.70		0.59		1.75		1.35		1.17	
Chrysene	0.00	U	0.00	U	0.00	U	0.15		0.23		0.00	U
Benzo[a]anthracene	0.00	U	0.00	U	0.00	U	0.11		0.14		0.08	J
Benzo[b]fluoranthene	0.45		0.33		0.00	U	0.23		0.24		0.00	U
Benzo[k]fluoranthene	0.10		0.06	J	0.01	J,B	0.03	J	0.03	J	0.00	U
Benzo[a]pyrene	0.26		0.20		0.00	U	0.11		0.14		0.00	U
Dibenzo[a,h]anthracene	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U	0.00	U
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	0.26		0.25		0.08	J	0.13		0.15		0.00	U

Table B116. PAH concentrations in the water samples from PSNS collected on December 6th 2016. The concentrations of all PAHs are in ng/L.

PAH	NPDES 19					
	Bulk water		Filtered Water (< 20 µm)		Filtered Water (< 0.7 µm)	
	ng/L		ng/L		ng/L	
Naphthalene	1.56		0.85	B	0.00	U
Fluorene	0.00	U	0.00	U	0.00	U
Acenaphthene	0.00	U	0.00	U	0.00	U
Phenanthrene	0.67		0.35		0.33	
Anthracene	0.00	U	0.00	U	0.00	U
Fluoranthene	2.20		2.12		1.62	
Pyrene	5.99		4.90		4.18	
Chrysene	0.00	U	0.00	U	0.00	U
Benzo[a]anthracene	0.11		0.11		0.10	J
Benzo[b]fluoranthene	0.00	U	0.00	U	0.00	U
Benzo[k]fluoranthene	0.03	J	0.00	U	0.00	U
Benzo[a]pyrene	0.13		0.00	U	0.00	U
Dibenzo[a,h]anthracene	0.00	U	0.00	U	0.00	U
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	0.16		0.12		0.00	U

Table B117. Trace metal concentrations in stormwater samples collected on March 29th 2017. The concentrations of all trace metals except Hg are in µg/L or µg/Kg-dry weight. The concentration of Hg is in ng/L or ng/Kg.

Metals	Stormwater sample (PS081.1)													
	Bulk water		Filtered Water (< 0.45 µm)		Total solids (>0.45µm)		Solids fraction (0.45-5 µm)		Solids fraction (5-20 µm)		Solids Fraction (20-63 µm)		Solids Fraction (> 63 µm)	
	mg/L or µg/L (ng/L)		mg/L or µg/L (ng/L)		mg/L or µg/Kg (ng/Kg)		mg/L or µg/Kg (ng/Kg)		mg/L or µg/Kg (ng/Kg)		mg/L or µg/Kg (ng/Kg)		mg/L or µg/Kg (ng/Kg)	
TFS	NA		NA		5.9		1.1		4.0		0.6		0.3	
As	2		1.4±0.1		52.1±0.0		5.2		0.0	<0	2770.7		455.8	
Cu	19.0±0.4		17.3±0.3		292.2±0.1		0.0	<0	14739.6±0.3	+	0.0	<0,+	0.0	<0,+
Ni	4.4±0.2		2.8±0.0		270.5±0.0		68.0±0.2		761.4±0.1		6756.2±0.5		0.0	<0
Zn	143.5±4.5		109.0±2.7		5807.0±0.9		0.0	<0	8991.4±1.8		6742.5±6.2		0.0	<0
Cd	0.0	U	0.24±0.01		0.0	U	0.64±0.01		0.0	<0	1202.28±0.08		0.0	<0
Pb	3.3±0.1		1.7±0.1		274.9±0.0		203.4±0.1		8659.8±0.1	+	108908.6±3.9	+	0.0	<0,+
Hg	5.3±1.1		2.7±0.2		435.4±0.2		552.0		940.6±0.2		0.0	<0	1364.7±4.4	

Table B118. Trace metal concentrations in stormwater samples collected on March 29th 2017. The concentrations of all trace metals except Hg are in µg/L. The concentration of Hg is in ng/L.

Metals	PS06		PS09		NPDES 18		NPDES 19	
	Bulk water	Filtered Water (< 0.45 µm)	Bulk water	Filtered Water (< 0.45 µm)	Bulk water	Filtered Water (< 0.45 µm)	Bulk water	Filtered Water (< 0.45 µm)
	µg/L (ng/L)	µg/L (ng/L)	µg/L (ng/L)	µg/L (ng/L)	µg/L (ng/L)	µg/L (ng/L)	µg/L (ng/L)	µg/L (ng/L)
As	ND	ND	ND	ND	ND	ND	ND	ND
Cu	99.9±6.7	83.4±0.7	94.6±7.2	79.9±3.3	78.4±7.6	89.9±22.4	42.7±1.9	38.0±0.9
Ni	11.8	10.3±0.1 J	10.0±0.5 J	10.1±0.3 J	9.3±0.1 J	9.6±0.4 J	6.8±0.2 J	6.2±0.1 J
Zn	14.3	11	12	11	38.6±9.8	32.8±1.9	11	13
Cd	ND	ND	ND	ND	ND	ND	ND	ND
Pb	ND	ND	ND	ND	ND	ND	ND	ND
Hg	5.3±0.2	3.5±0.1	4.7±0.4	5.0±0.4	8.7±0.2	3.5±0.1	8.6±0.1	5.2±0.3

Table B119. PAH concentrations in the post-storm water samples from PSNS collected on March 29th 2017. The concentrations of all PAHs are in ng/L or µg/Kg.

PSNS Stormwater (PS96)						
PAH	**Bulk water**	**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**	**Solids fraction (0.7-63 µm)**	**Solids Fraction (> 63 µm)**
	ng/L	**ng/L**		**µg/Kg**	**µg/Kg**	**µg/Kg**
Naphthalene	431.0	0.0	U	10779.8	2346.0	12010.2
Fluorene	674.1	0.0	U	16861.9	4443.3	18673.6
Acenaphthene	727.8	9.6		17964.9	4365.7	19948.9
Phenanthrene	5064.5	5.8		126530.9	44623.6	138480.1
Anthracene	795.2	0.0	U	19889.8	5324.0	22014.8
Fluoranthene	5581.0	22.5		139033.0	54592.7	151351.8
Pyrene	4629.3	10.6		115523.4	46451.1	125600.2
Chrysene	1627.5	2.5		40645.0	19736.4	43695.3
Benzo[a]anthracene	1648.9	0.0	U	41243.7	17316.3	44734.4
Benzo[b]fluoranthene	2129.5	0.0	U	53264.5	24646.3	57439.5
Benzo[k]fluoranthene	958.0	0.0	U	23962.8	11212.8	25822.8
Benzo[a]pyrene	2028.5	0.0	U	50738.8	22969.3	54790.0
Dibenzo[a,h]anthracene	367.2	0.0	U	9185.0	4663.3	9844.6
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	1104.2	0.0	U	27618.3	13754.9	29640.7

Table B120. PAH concentrations in the post-storm water samples from PSNS collected on March 29th 2017. The concentrations of all PAHs are in ng/L or µg/Kg.

PSNS Stormwater (PS81.1)										
PAH	**Bulk water**		**Filtered Water (< 0.7 µm)**		**Total solids (>0.7µm)**		**Solids fraction (0.7-63 µm)**		**Solids Fraction (> 63 µm)**	
	ng/L		**ng/L**		**µg/Kg**		**µg/Kg**		**µg/Kg**	
Naphthalene	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U
Fluorene	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U
Acenaphthene	3.4		0.0	U	995.3		0.0	U	1901.6	
Phenanthrene	3.2		1.5		507.7		1133.7		0.0	<0
Anthracene	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U
Fluoranthene	9.0		2.0		2056.5		6176.2		0.0	<0
Pyrene	4.8		1.0		1102.0		2846.5		0.0	<0
Chrysene	5.0		0.0	U	1464.0		2820.4		228.9	
Benzo[a]anthracene	4.5		0.0	U	1329.9		2101.9		626.8	
Benzo[b]fluoranthene	18.9		1.6		5053.2		16919.2		0.0	<0
Benzo[k]fluoranthene	6.7		0.0	U	1957.8		5505.7		0.0	<0
Benzo[a]pyrene	11.5		0.0	U	3373.9		10233.1		0.0	<0
Dibenzo[a,h]anthracene	0.9		0.0	U	268.4		1010.7		0.0	<0
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	6.9		1.5		1579.39		5572.89		0.00	<0

Table B121. PAH concentrations in the water samples from PSNS collected on March 29th 2017. The concentrations of all PAHs are in ng/L or µg/Kg.

PAH	PS06				PS09			
	Bulk water		Filtered Water (< 0.7 µm)		Bulk water		Filtered Water (< 0.7 µm)	
	ng/L		ng/L		ng/L		ng/L	
Naphthalene	0.22	J	0.00	U	0.33	J	0.00	U
Fluorene	0.00	U	0.00	U	0.00	U	0.00	U
Acenaphthene	0.00	U	0.00	U	0.00	U	0.00	U
Phenanthrene	1.01		0.00	U	1.32		0.00	U
Anthracene	0.00	U	0.00	U	0.00	U	0.00	U
Fluoranthene	3.70		1.70		3.57		1.55	
Pyrene	1.87		0.85		2.14		0.73	
Chrysene	0.61		0.00	U	1.06		0.00	U
Benzo[a]anthracene	0.10	J	0.00	U	0.50		0.00	U
Benzo[b]fluoranthene	0.62		0.00	U	1.30		0.00	U
Benzo[k]fluoranthene	0.04	J	0.00	U	0.23	J	0.00	U
Benzo[a]pyrene	0.00	U	0.00	U	0.41		0.00	U
Dibenzo[a,h]anthracene	0.00	U	0.00	U	0.00	U	0.00	U
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	0.00	U	0.00	U	0.54		0.00	U

Table B122. PAH concentrations in the post-storm water samples from PSNS received on March 29th 2017. The concentrations of all PAHs are in ng/L.

PAH	NPDES 18				NPDES 19			
	Bulk water		Filtered Water (< 0.7 µm)		Bulk water		Filtered Water (< 0.7 µm)	
	ng/L		ng/L		ng/L		ng/L	
Naphthalene	0.38	J	0.00	U	0.42		0.00	U
Fluorene	0.00	U	0.00	U	0.00	U	0.00	U
Acenaphthene	0.00	U	0.70		0.60		0.69	
Phenanthrene	0.55		0.32	J,B	0.42		0.27	J,B
Anthracene	0.00	U	0.00	U	0.00	U	0.00	U
Fluoranthene	0.69		0.20	J	0.00	U	0.00	U
Pyrene	1.60		0.54		2.28		0.78	
Chrysene	0.17	J	0.00	U	0.00	U	0.00	U
Benzo[a]anthracene	0.00	U	0.00	U	0.00	U	0.00	U
Benzo[b]fluoranthene	0.02	J	0.00	U	0.00	U	0.00	U
Benzo[k]fluoranthene	0.00	U	0.00	U	0.00	U	0.00	U
Benzo[a]pyrene	0.00	U	0.00	U	0.00	U	0.00	U
Dibenzo[a,h]anthracene	0.37	J	0.22	J	0.37	J	0.18	J
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	0.26	J	0.00	U	0.00	U	0.00	U

Table B123. Sediment based trace metal concentration (mg/Kg-dry weight) and water content (%) for samples received in December 2016. Samples 3-5,3-7 and 3-9 represent sample from pier 3 and sample ids 9-1, 9-2, and 9-3 represent sample from pier 9. Sample with subscript "Δ" were sieved (2mm opening) before processing.

Constituent (%/mg/Kg-dry weight)	PS06	PS09$^{\Delta}$	3_5	3_7	3_9$^{\Delta}$	9_1$^{\Delta}$	9_2$^{\Delta}$	9_3$^{\Delta}$
Water (%)	31.1	78.5	41.3	37.1	33.0	50.1	52.9	37.9
As	11.4±2.5	121.4±13.4	7.3±0.6	5	49.7±20.5	6.9±3.7	6.0±2.6	13.2±7.4
Cu	86.0±25.5	1107.7±545.4	113.7±7.2	77.1±15.3	479.8±172.2	86.1±51.7	108.1±36.2	82.5±30.6
Ni	30.8±5.6	76.0±12.7	21.1±0.5	17.9±3.6	35.0±10.2	15.1±7.7	19.9±5.2	30.9±6.6
Zn	126.1±6.8	2632.7±124.7	154.2±10.5	117.8±24.8	663.3±257.7	184.7±123.9	191.9±108.1	157.5±57.1
Cd	0.3	3.03±0.13	0.86	ND	0.98±0.27	0.80±0.05	0.89±0.14	ND
Pb	39.0±3.1	477.1±95.5	32.7±2.5	22.7±5.1	141.8±83.2	60.5±40.3	58.8±36.7	43.3±14.9
Hg	0.09±0.02	1.27±0.28	0.41±0.06	0.33±0.16	1.18±0.27	0.29±0.26	0.33±0.23	0.11±0.02

Table B124. Sediment based trace metal concentration (mg/Kg-dry weight) and water content (%) for samples received in December 2016. Samples 3-5, 3-7 and 3-9 represent sample from pier 3 and sample ids 9-1, 9-2, and 9-3 represent sample from pier 9. Sample with subscript "Δ" were sieved (2mm opening) before processing.

PAH (% or µg/Kg-dry weight)	PS06A	PS06B	PS06C	PS09$^{\Delta}$C	PS09$^{\Delta}$D	PS09$^{\Delta}$E
TOC (%)		0.36±0.06			2.93±0.31	
BC (%)		0.03±0.00			0.20±0.07	
Naphthalene	51.2±9.8	28.8±14.3	79.2±7.1	345.3±154.5	167.8±16.9	270.3±57.3
Fluorene	10.3±1.6	4.5±0.9	19.2±12.4	317.3±174.9	76.0±16.0	78.3±19.3
Acenaphthene	3.7±1.1	1.5±0.4	10.4±10.0	319.7±226.8	74.7±19.8	72.6±27.9
Phenanthrene	54.2±11.6	23.1±4.0	103.2±77.6	2098.3±1080.2	713.1±309.8	659.8±97.7
Anthracene	11.4±8.8	3.5±0.2	18.2±18.0	503.5±288.4	123.4±45.4	100.8±13.8
Fluoranthene	52.6±13.2	45.4±21.4	115.0±65.2	2324.2±1104.6	988.5±353.2	837.5±176.1
Pyrene	60.7±4.2	47.5±18.2	108.0±48.3	2169.1±886.1	969.8±260.8	841.8±131.3
Chrysene	36.7±39.8	14.5±5.4	30.9±18.9	747.3±302.5	355.7±127.7	297.0±22.7
Benzo[a]anthracene	30.3±11.1	14.9±5.0	40.0±31.4	822.1±363.8	344.5±103.5	289.5±47.6
Benzo[b]fluoranthene	36.2±10.1	26.1±5.4	57.1±32.0	1046.1±300.1	546.8±96.8	449.1±45.3
Benzo[k]fluoranthene	15.2±7.1	11.2±3.3	22.7±13.3	462.9±145.0	232.2±47.6	190.6±22.2
Benzo[a]pyrene	30.4±13.6	21.8±6.2	44.2±26.4	953.4±365.0	448.1±114.8	384.9±43.9
Dibenzo[a,h]anthracene	2.4±1.2	1.6±0.3	3.7±1.9	175.7±107.8	68.0±14.5	58.7±8.2
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	25.3±8.5	17.1±3.6	34.0±11.3	580.7±169.0	291.7±61.2	268.3±24.9

Table B125. Sediment based trace metal concentration (mg/Kg-dry weight) and water content (%) for samples received in March 2017. Samples 3-5,3-7 and 3-9 represent sample from pier 3 and sample ids 9-1, 9-2, and 9-3 represent sample from pier 9. Sample with subscript "Δ" were sieved (2mm opening) before processing.

PAH (% or µg/Kg-dry weight)	9-1$^{\Delta}$ B		9-2$^{\Delta}$ A		9-3$^{\Delta}$ B		3-5 A		3-7 A		3-9$^{\Delta}$ A	
TOC (%)	2.21±0.11		3.21±0.20		0.63±0.08		3.61±0.04		3.63±0.02		3.26±0.32	
BC (%)	0.17±0.03		0.18±0.02		0.03±0.00		0.22±0.01		0.23±0.00		0.16±0.01	
Naphthalene	191.7±19.8		120.5±17.6		63.3±4.0		280.3±22.2		355.2±34.7		109.7±13.4	
Fluorene	35.0±18.1		19.4±1.7		8.6±1.3		48.3±2.7		47.9±3.6		29.5±7.7	
Acenaphthene	0	U	0	U	0	U	0	U	0	U	0	U
Phenanthrene	168.1±69.5		92.6±6.7		36.6±7.1		191.7±8.9		206.0±3.4		183.4±53.4	
Anthracene	39.1±33.8		19.0±11.2		2.7±0.7		27.8±7.2		23.7±4.6		33.0±10.7	
Fluoranthene	249.3±35.7		164.6±23.0		43.8±8.0		223.5±38.0		252.1±14.5		252.1±65.6	
Pyrene	265.4±22.7		181.5±12.2		51.4±5.1		283.5±33.0		299.4±15.7		268.1±41.1	
Chrysene	172.6±71.0		144.2±66.4		15.6±5.6		121.0±15.4		97.9±6.1		102.1±31.6	
Benzo[a]anthracene	88.5±21.1		81.8±16.1		12.3±2.7		116.9±36.9		83.3±3.2		107.2±15.7	
Benzo[b]fluoranthene	159.9±17.0		126.9±10.5		23.5±3.2		190.0±11.5		167.1±4.2		174.0±44.0	
Benzo[k]fluoranthene	67.5±7.0		55.3±6.2		8.3±1.7		72.0±11.8		63.2±1.3		72.7±13.0	
Benzo[a]pyrene	96.0±13.5		87.4±5.7		14.1±2.4		136.3±23.7		121.7±5.3		130.9±13.2	
Dibenzo[a,h]anthracene	14.2±1.9		12.9±1.1		2.6±0.5		22.5±3.4		20.9±5.4		16.9±2.8	
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	86.9±7.3		68.1±8.6		15.8±0.4		116.7±14.3		117.9±11.0		100.6±8.6	

Table B126. Water content and trace metal concentrations in the sediment trap samples (deployed from February 4th to March 30th 2017) from pier 3 and pier 9.

Constituent (%/mg/Kg-dry weight)	3_5	3_7	3_9	9_1	9_2	9_3
Water (%)	54.5	58.8	66.7	66.6	62.7	51.2
As	10.0±0.9	12.1±0.6	11.0±1.2	9.8±0.5	11.6±0.8	7.7±0.3
Cu	115.0±3.8	131.9±4.7	134.4±9.0	103.3±7.2	134.5±11.9	89.0±1.3
Ni	34.2±1.1	41.8±0.4	40.9±2.1	35.3±0.2	45.5±4.9	33.7±0.5
Zn	155.0±5.6	182.8±2.5	186.7±18.0	146.4±16.9	176.0±4.1	124.8±1.5
Cd	0.94	1.03±0.05	1.20±0.13	ND	1.11±0.09	1
Pb	44.8±1.1	53.4±2.0	55.2±7.9	43.6±1.1	55.9±4.1	42.2±0.8
Hg	0.49±0.05	0.58±0.10	0.55±0.02	0.45±0.03	0.56±0.02	0.40±0.04

Table B127. Water content and trace metal concentrations in the sediment trap (deployed from February 4th to March 30th 2017) samples from pier 3 and pier 9. The TOC and BC concentrations are expressed in % whereas the PAH concentrations are in µg/Kg-dry weight.

Constituent	Pier 9-1	Pier 9-2	Pier 9-3	Pier 3-5	Pier 3-7	Pier 3-9
TOC (%)	3.99±0.03	3.88±0.03	4.67±0.07	3.80±0.07	3.83±0.01	4.07±0.03
BC (%)	0.29±0.01	0.27±0.00	0.28±0.03	0.27±0.01	0.24±0.01	0.29±0.02
Naphthalene	233.7±60.5	189.7±20.0	205.7±60.8	204.9±22.5	162.0±14.2	171.3±16.4
Fluorene	35.0±6.4	27.8±2.7	37.4±9.1	44.7±2.5	33.1±0.5	45.6±8.5
Acenaphthene	0 U	0 U	0 U	22.6±4.6 U	18.2±4.7 U	30.8±11.9 U
Phenanthrene	155.8±13.3	142.1±12.8	179.6±11.3	284.9±25.2	186.5±19.5	231.6±36.0
Anthracene	19.4±5.9	30.7±17.8	29.6±7.2	70.7±20.3	45.2±10.1	39.6±5.9
Fluoranthene	197.5±17.2	220.4±42.6	229.4±20.7	333.0±21.0	236.9±17.9	286.8±47.2
Pyrene	233.6±17.8	249.3±32.0	243.2±27.0	374.8±13.7	266.3±16.0	307.6±43.3
Chrysene	95.9±20.3	119.6±20.3	114.8±8.9	196.0±47.0	158.1±39.9	141.4±10.9
Benzo[a]anthracene	71.2±13.5	82.1±5.5	88.2±8.7	144.7±20.3	101.9±10.2	110.2±10.9
Benzo[b]fluoranthene	147.6±13.1	163.7±14.8	163.3±12.4	250.2±41.7	177.1±20.2	181.2±9.6
Benzo[k]fluoranthene	54.1±7.6	66.3±5.8	62.5±4.2	102.9±10.2	76.2±7.3	77.2±3.3
Benzo[a]pyrene	104.0±19.8	121.7±11.5	116.4±9.6	202.3±18.8	148.1±18.9	156.1±5.4
Dibenzo[a,h]anthracene	15.6±1.4	16.9±1.7	16.8±1.8	27.9±6.9	21.7±4.2	23.6±4.1
Benzo[ghi]perylene+ Indeno[1,2,3-cd]pyrene	113.1±4.3	115.1±4.5	112.6±13.8	173.9±22.0	126.9±13.0	129.5±11.3

Table B127. Water content, TOC, BC and trace metal concentrations in the pre-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P01.

Paletta Creek Site Location	P01				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	23.58	15.81	15.85	13.42	16.21
% TOC	0.558 ± 0.106	0.123 ± 0.02	0.099 ± 0.01	0.0547 ± 0.01	0.319 ± 0.161
% BC	0.0553 ± 0	0.025 ± 0	0.0227 ± 0	0.0173 ± 0	0.0223 ± 0
THg	0.14	0.07	0.03	0.02	0.04
As (mg/Kg-dry)	3.30	3.00	0.86-1.21	0.97	1.14
Cd (mg/Kg-dw)	ND	ND	ND	ND	ND
Pb (mg/Kg-dw)	12.33	8.49	2.28-2.46	2.26	3.38
Zn (mg/Kg-dw)	87.57	52.77	25.3-33.2	35.15	42.91
Cu (mg/Kg-dw)	53.11	27.27	9.1-10.3	9.80	14.45
Ni (mg/Kg-dw)	ND	ND	ND	ND	ND

Table B128. Water content, TOC, BC and trace metal concentrations in the pre-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P08.

Paletta Creek Site Location	P08				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	52.76	45.88	44.87	42.50	37.85
% TOC	1.71 ± 0.05	1.46 ± 0.214	1.8 ± 0.105	1.08 ± 0.03	0.716 ± 0.04
% BC	0.134 ± 0	0.121 ± 0	0.12 ± 0	0.093 ± 0	0.0697 ± 0
THg	0.60	0.54	0.64	0.46	0.42
As (mg/Kg-dry)	11.13	8.72-8.99	8.34	6.50	5.15
Cd (mg/Kg-dw)	0.23	0.21	ND	0.20	ND
Pb (mg/Kg-dw)	75.22	63.5-72.0	71.11	76.92	55.00
Zn (mg/Kg-dw)	352.01	307.6-318.7	300.74	273.42	236.44
Cu (mg/Kg-dw)	279.65	228.9-244.5	229.49	201.97	232.71
Ni (mg/Kg-dw)	22.13	18.6-19.7	19.02	15.97	14.07

Table B129. Water content, TOC, BC and trace metal concentrations in the pre-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P11.

Paletta Creek Site Location	P11				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	58.48	49.14	47.25	49.79	47.07
% TOC	2.38 ± 0.04	2.36 ± 0.172	2.06 ± 0.05	2.07 ± 0.146	2.33 ± 0.17
% BC	0.188 ± 0.03	0.161 ± 0	0.149 ± 0	0.185 ± 0	0.147 ± 0
THg	1.05	0.82	1.62	1.00	1.16
As (mg/Kg-dry)	8.74	7.33-7.40	7.09	7.43	7.43
Cd (mg/Kg-dw)	1.14	1.00-1.24	0.90	1.86	2.12
Pb (mg/Kg-dw)	141.45	137.4-145.4	128.26	143.03	140.01
Zn (mg/Kg-dw)	519.23	475.7-547.2	418.15	488.68	461.80
Cu (mg/Kg-dw)	279.16	247.7-283.7	217.50	225.91	198.45
Ni (mg/Kg-dw)	21.90	20.7-22.8	19.94	21.33	21.18

Table B130. Water content, TOC, BC and trace metal concentrations in the pre-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P17.

Paletta Creek Site Location	P17				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	64.74	49.40	54.17	53.31	51.73
% TOC	4.96 ± 0.143	5.09 ± 0.295	4.7 ± 0.23	5.03 ± 0.227	5.24 ± 0.257
% BC	0.388 ± 0.02	0.35 ± 0	0.379 ± 0.01	0.388 ± 0.01	0.379 ± 0.02
THg	0.41	0.32	0.40	0.58	0.47
As (mg/Kg-dry)	7.59-7.82	5.90	7.35	7.96	7.78
Cd (mg/Kg-dw)	1.33-1.59	0.91	1.15	1.46	1.73
Pb (mg/Kg-dw)	134.7-140.1	159.96	133.07	128.48	121.34
Zn (mg/Kg-dw)	578.2-640.9	415.47	525.10	514.47	621.71
Cu (mg/Kg-dw)	250.3-282.9	191.31	241.03	225.32	228.86
Ni (mg/Kg-dw)	19.6-22.3	17.08	19.25	17.69	20.00

Table B131. Water content, TOC, BC and trace metal concentrations in the post-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P08.

Paletta Creek Site Location	P08				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	58.83	47.89	45.53	47.11	37.86
% TOC	1.97 ± 0.04	1.61 ± 0.03	1.5 ± 0.02	1.53 ± 0.03	0.923 ± 0.06
% BC	0.147 ± 0	0.14 ± 0	0.129 ± 0	0.135 ± 0	0.0917 ± 0
THg	1.48	0.57-0.62	0.54-0.60	0.60	0.37-0.38
As (mg/Kg-dry)	11.81	9.08-9.71	8.07	7.47	5.53
Cd (mg/Kg-dw)	ND	0.19-0.20	0.20	0.18	0.20
Pb (mg/Kg-dw)	74.54	61.2-72.9	71.72	66.30	48.21
Zn (mg/Kg-dw)	324.95	311.1-322.9	288.50	298.02	237.86
Cu (mg/Kg-dw)	255.10	240.0-244.1	232.09	235.83	154.35
Ni (mg/Kg-dw)	21.53	20.10	20.27	20.21	17.15

Table B132. Water content, TOC, BC and trace metal concentrations in the post-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P11.

Paletta Creek Site Location	P11				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	50.87	40.18	37.30	46.99	51.73
% TOC	2.64 ± 0.203	2.41 ± 0.325	1.33 ± 0.134	2.21 ± 0.185	2.56 ± 0.01
% BC	0.174 ± 0	0.136 ± 0	0.11 ± 0	0.197 ± 0	0.241 ± 0
THg	0.70	0.52	0.50	1.51	2.50
As (mg/Kg-dry)	9.66	5.51	6.11	7.91-8.09	8.65
Cd (mg/Kg-dw)	0.67	0.55	1.17	3.55-3.82	5.17
Pb (mg/Kg-dw)	100.45	87.00	79.74	230.0-263.3	358.37
Zn (mg/Kg-dw)	394.49	369.57	331.62	779.1-866.9	1225.39
Cu (mg/Kg-dw)	243.24	224.36	155.97	214.1-236.9	291.77
Ni (mg/Kg-dw)	19.26	16.64	14.02	23.8-27.2	32.93

Table B133. Water content, TOC, BC and trace metal concentrations in the post-storm 2015/16 season sediment core sections (1cm each) from Paleta Creek receiving water location P17.

Paletta Creek Site Location	P17				
Core section (1 cm)	0-1	1-2	2-3	3-4	4-5
% water content	48.87	43.86	45.38	44.50	44.68
% TOC	5.85 ± 0.442	4.24 ± 0.06	4.12 ± 0.364	4.33 ± 0.504	3.83 ± 0.735
% BC	0.389 ± 0.04	0.288 ± 0	0.299 ± 0	0.33 ± 0.02	0.305 ± 0.02
THg	0.45	0.38	0.34	0.46	0.41
As (mg/Kg-dry)	5.25	5.99	6.36	6.31	5.61-6.32
Cd (mg/Kg-dw)	1.10	1.11	1.50	0.94	0.92-1.37
Pb (mg/Kg-dw)	108.83	104.95	112.49	112.67	112.6-140.2
Zn (mg/Kg-dw)	559.03	524.93	527.66	491.68	538.3-568.3
Cu (mg/Kg-dw)	186.21	211.64	215.75	203.46	192.9-248.4
Ni (mg/Kg-dw)	17.85	17.83	17.33	16.71	17.2-20.7

Notations: †Samples shipped overnight and received the next day at TTU unless specified
"U" represents the potential presence of analyte but could not quantified using HPLC

Sl. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	µg/Kg-dry sediment weight POLYCYLIC AROMATIC HYDROCARBONS (PAH-14)														
										Napthalene	Fluorene	Acenapthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAHs-15
1	P11	P11-Sediment Cores (0-0.5 cm section)	8/13/2015	8/18/2015	59.8	2.00	0.16	0.137	0.001	123.8	15.8	U	93.9	18.0	228.3	376.9	160.3	140.3	537.4	226.4	409.2	63.2	298.9	2692.5
2	P17	P17-Sediment Cores (0-0.5 cm section)	8/13/2015	8/18/2015	63.8	5.07	0.11	0.331	0.009	120.8	15.0	U	143.8	19.5	289.0	399.9	152.0	121.5	353.6	147.3	252.9	45.6	273.8	2334.9

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug-15-Ex-situ cores-Org

Notations: All pesticide analysis was done by Weck Laboratory
†Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
"U" represents the potential presence of analyte but could not quantified using HPLC

µg/Kg-dry sediment weight — POLYCYLIC AROMATIC HYDROCARBONS (PAH-14)

Sl. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	Napthalene	Fluorene	Acenapthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene
1	P11	P11-Ex-situ Bioassay Cores	8/12/2015	8/18/2015	47.0	1.38	0.02	0.120	0.007	64.0	6.8	U	39.6	13.2	126.0	298.9	138.8	108.4	295.5	152.2	[illegible]
2	P17	P17-Ex-situ Bioassay Cores	8/12/2015	8/18/2015	63.5	4.46	0.29	0.279	0.010	84.3	8.2	U	65.6	10.9	119.8	210.1	75.6	60.3	224.8	91.8	[illegible]
3	Reference	Ref-Ex-situ Bioassay Cores	8/12/2015	8/18/2015	37.5	0.49	0.08	0.045	0.002	63.2	7.2	U	22.9	1.6	19.3	28.1	6.7	5.4	19.4	7.1	[illegible]

[illegible] (from Benzo[a]pyrene on: remaining PAH columns, µg/kg-dry sediment weight columns and first PCB columns)

µg/kg-dry sediment

Sl. No.	PCB 005	PCB 019	PCB 018	PCB 017	PCB 015	PCB 027	PCB 024	PCB 032	PCB 016	PCB 034	PCB 029	PCB 026	PCB 025	PCB 031	PCB 028	PCB 020	PCB 022	PCB 045	PCB 046	PCB 069	PCB 052	PCB 047	PCB 048	PCB 044	PCB 042	PCB 037	PCB 071	PCB 041	PCB 103	PCB 040	PCB 067
1	[illegible] ND	0 ND	0.45-3.02	0 ND	0.24-0.75	0 ND	0 ND	0 ND	0.13-0.6 J	0 ND	0 ND	0 ND	0.04-0.53 J	0.29-2.37	0.82-3.66	0.53-2.8	0 ND	0-0.75	0 ND	0 ND	1.74-12.76	0.73-3.03	0.21-1.67	1.09-8.21	0.42-2.59	0.58-2.54	0 ND	1.29-9.35	0-0.33	0.22-1.73	0 ND
2	[illegible] ND	0 ND	0.57-2.99	0 ND	0.27-0.68	0 ND	0 ND	0 ND	0.19-0.6 J	0 ND	0 ND	0 ND	0 ND	0.42-4.63	0.94-3.43	0.56-2.78	0 ND	0-0.5	0 ND	0 ND	2.42-12.16	0.99-2.86	0.2-1.32 J	1.26-7.99	0.5-2.53	0.69-2.67	0 ND	1.54-9.03	0-0.14 J	0.23-1.6	0 ND
3	[illegible] ND	0 ND	0.05-0.07 J	0 ND	0 ND	0 ND	0 ND	0 ND	0.02-0.03 J	0 ND	0 ND	0 ND	0 ND	0-0.04 J	0.06-0.09 J	0.04-0.06 J	0 ND	0-0.42	0 ND	0 ND	0.11-0.17	0.1-0.12	0.01-0.02 J	0.02-0.06 J	0.02-0.04 J	0.1-0.15	0 ND	0.06-0.09 J	0-0 ND	0 ND	0 ND

Sl. No.	PCB 074	PCB 070	PCB 066	PCB 095	PCB 093	PCB 056	PCB 060	PCB 092	PCB 084	PCB 101	PCB 099	PCB 119	PCB 083	PCB 087	PCB 081	PCB 115	PCB 136	PCB 110	PCB 077	PCB 082	PCB 151	PCB 135	PCB 144	PCB 147	PCB 107	PCB 123
1	0.69-5.96	1.81-14.84	2.02-12.06	1.35-5.71	1.55-6.63	0.57-4.8	0.63-4.83	0.69-3.31	2.43-10.63	2.41-10.53	2.76-12.33	0 ND	0.86-6.93	1.88-9.43	0.16-0.34	0 ND	0.54-2.18	5.37-21.38	0.41-2.08	0.65-2.94	1.26-4.07	0.41-1.59	0.44-1.4	3.17-17.41	0.22-1.85	0 ND
2	0.89-5.41	2.07-13.76	2.3-10.17	1.8-6.48	2.02-6.52	0.63-4.5	0.75-4.48	0.92-3.4	3.14-10.3	3.12-10.21	3.48-11.04	0 ND	0.87-8.85	2.24-20.93	0.18-0.44	0 ND	0.6-2.24	6.97-20.7	0.5-1.63	0.88-2.96	1.66-3.91	0.43-1.28	0.62-1.41	0.12-0.45	0.27-1.73	0 ND
3	0.02-0.02 J	0.05-0.18 J	0.17-0.19	0.08-0.1 J	0-0.18	0-0.03 J	0.02-0.05 J	0-0 ND	0.17-0.17	0.18-0.18	0.32-0.39	0 ND	0-0 ND	0-0 ND	0 ND	0 ND	0 ND	0.26-0.33	0.02-0.03 J	0.0-0.02 J	0-0.03 J	0 ND	0 ND	0 ND	0-0.07 J	0 ND

PCB 149	PCB 118	PCB 134	PCB 114	PCB 131	PCB 146	PCB 153	PCB 132	PCB 105	PCB 141	PCB 179	PCB 163	PCB 138	PCB 158	PCB 178
5.55-16.96	0.62-4.27	0.4-1.02	0 ND	0.09-0.18	1.04-2.49	6.67-16.61	1.56-4.06	1.66-6.08	1.19-3	0.6-1.64	0 ND	7.49-17.44	0.57-1.5	0.34-1.07
7.18-15.49	0.85-5.44	0.34-0.96	0 ND	0-0.16 J	1.42-2.45	9.27-17.69	2.35-4.73	2.31-7.04	1.55-3.49	0.85-1.84	0 ND	10.34-18.41	0.83-1.63	0.39-0.92
0.56-0.58	0.06-0.75	0 ND	0 ND	0 ND	0.08-0.11 J	1.01-1.12	0.06-0.08 J	0.1-0.14	0.09-0.11	0.1-0.11	0 ND	0.75-0.78	0-0.02 J	0.02-0.02 J

PCB 126	PCB 187	PCB 183	PCB 128	PCB 167	PCB 174	PCB 177	PCB 171	PCB 156	PCB 157	PCB 153	PCB 172	PCB 197	PCB 180	PCB 193
0.21-0.47	2.3-6.21	0.78-2.36	0.55-1.48	0.53-1.31	1.46-3.17	0.82-2.38	0.62-1.4	0.76-2.23	0.08-0.3 J	0 ND	0.27-0.74	0 ND	3.88-10.49	0.18-0.39
0.23-0.5	3.28-6.96	1.04-2.61	0.94-1.49	0.81-1.36	2.31-2.33	1.07-2.54	0.97-1.16	1.03-1.71	0.08-0.26 J	0 ND	0.34-0.85	0 ND	5.53-11.49	0.29-0.5
0.02-0.04 J	0.38-0.44	0.04-0.04 J	0 ND	0.02-0.03 J	0.21-0.23	0.07-0.11 J	0.13-0.18	0.14-0.14	0 ND	0 ND	0.01-0.08 J	0 ND	0.34-0.38	0.02-0.03 J

PCB 191	PCB 169	PCB 170	PCB 190	PCB 198	PCB 203	PCB 196	PCB 189	PCB 208	PCB 195	PCB 207	PCB 194	PCB 205	PCB 206	PCB 209	Sum of PCBs
0.17-0.24	0 ND	1.93-4.64	0.31-0.98	1.03-3.51	0.5-1.67	0.46-1.66	0 ND	0.12-2 J	0.26-0.82	0.19-0.51	0.71-2.45	0 ND	0.6-5.8	0.61-10.69	89.09-361.23
0.33-0.41	0 ND	2.97-4.89	0.45-1.03	1.53-3.69	0.73-1.75	0.64-1.75	0 ND	0.67-1.01	0.32-0.93	0.27-0.5	1.24-2.82	0 ND	2.3-3.4	3.4-6.66	122.56-347.47
0.04-0.06 J	0 ND	0.24-0.28	0 ND	0.02-0.13 J	0 ND	0 ND	0 ND	0 ND	0 ND	0.08-0.08 J	0.13-0.17	0 ND	0-0.04 J	0.05-0.11 J	7.65-8.87

Notations: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
ND is "Non detects"

Sl. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	THg (mg/Kg-dry weight)	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P11	P11-Sediment Cores (0-0.5 cm section)	8/13/2015	8/18/2015	56.9	2.00	0.16	0.137	0.001	0.64	NA	6.4-7.6	NA	0.69-0.83	NA	94.1-102.1	NA	374.4-418.1	NA	191.8-230.4	NA	17.2-18.4	NA
2	P17	P17-Sediment Cores (0-0.5 cm section)	8/13/2015	8/18/2015	60.9	5.07	0.11	0.331	0.009	0.49-0.50	NA	7.1-7.3	NA	1.53	NA	153.8-179.0	NA	569.9-592.4	NA	242.2-243.4	NA	19.4-20.6	NA

Notations: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
ND is "Non detects"

SI. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	THg (mg/Kg-dry weight)	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P11	P11-Ex-situ Bioassay Cores	8/12/2015	8/18/2015	29.6	1.38	0.02	0.120	0.007	0.71-0.72	NA	5.34	0.13	1.54	0.06	138.8	30.0	387.7	18.8	159.5-162.4	NA	18.1	2.3
2	P17	P17-Ex-situ Bioassay Cores	8/12/2015	8/18/2015	41.2	4.46	0.29	0.279	0.010	0.79	0.25	9.13	0.08	1.83	0.11	141.6	17.9	684.6	12.7	334.8	50.2	23.5	0.5
3	Reference	Ref-Ex-situ Bioassay Cores	8/12/2015	8/18/2015	60.2	0.49	0.08	0.045	0.002	0.29	0.01	3.63	0.16	0.10	0.00	22.7	0.2	113.1	1.2	61.1	2.2	7.7	0.1

[illegible]

Notations: All pesticide analysis was done by Weck Laboratory
†Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
values in the round brackets of the ug/Kg wet sediment analysis by Weck lab represents their method reporting limit and is dependent on the sample dilution before analysis
E is Estimated value, exceeds the upper limit of calibration
B is Found in associated blank as well as sample
J is Estimated value, below quantitation limit.
NR is not resolved -qualifier not meeting criteria

Sl. No.	Paletta Creek Site Location	NP is "Not provided"	Date sampled collected in SPAWAR	Storage temperature conditions	Date sediment sent to TTU†	Dry Sediment Mass (g)	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	4,4'-DDE	gamma-Chlordane	Allethrin	Bifenthrin	[illegible]
1	P11	P11 Sediment traps (D)	8/12/2015	stored at 4°C	8/18/2015	108.6	53.0	3.51	0.06	0.13	0.02	2.6	ND	ND	23.8	[illegible]
2	P17	P17 Sediment traps (D)	8/12/2015	stored at 4°C	8/18/2015	165.5	47.9	6.28	0.24	0.20	0.05	ND	ND	ND	4.6	[illegible]

Sl. No.	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAHs-14	PCB 001	PCB 002	PCB 003	PCB 004	PCB 010	PCB 009	PCB 007	PCB 006	PCB 008	PCB 005	PCB 019	PCB 018	PCB 017	PCB 015
1	117.5	598.9	4576.6	0.15 J	0.31 J	0.21 J	0.15 J	0.09 NR	0.01 NR	0.00 ND	0.07 NR	0.59 NR	0.40 J	0.00 ND	2.80	0.58	1.73
2	65.4	490.7	4239.6	0.04 J	0.15 J	0.07 J	0.11 NR	0.05 NR	0.01 NR	0.00 ND	0.03 NR	0.21 NR	0.14 J	0.00 ND	0.88	0.16 J	0.68

Sl. No.	PCB 027	PCB 024	PCB 032	PCB 016	PCB 034	PCB 029	PCB 026	PCB 025	PCB 031	PCB 028	PCB 020	PCB 022	PCB 045	PCB 046	PCB 069	PCB 052	PCB 047
1	0.20 NR	0.22 NR	0.40 J	0.47	0.00 ND	0.00 ND	0.48 NR	0.00 ND	2.67	2.33	1.64	0.57	0.33 J	0.00 ND	0.00 ND	6.01	3.89
2	0.01 NR	0.02 NR	0.14 J	0.14 J	0.00 ND	0.00 ND	0.23	0.00 ND	0.96	0.76	0.57	0.27	0.15 J	0.00 ND	0.00 ND	1.86	0.54

Sl. No.	PCB 048	PCB 044	PCB 042	PCB 037	PCB 071	PCB 041	PCB 103	PCB 040	PCB 067	PCB 074	PCB 070	PCB 066	PCB 095	PCB 093	PCB 056	PCB 060	PCB 092	PCB 084	PCB 101	[illegible]
1	0.00 ND	3.69	1.78	0.00 ND	2.06	5.85 NR	0.00 ND	0.71 NR	0.00 ND	0.00 ND	2.73	7.54	5.97	6.00	2.57	2.57	3.85	2.93	22.52	14.81
2	0.00 ND	1.29	0.40	0.00 ND	0.39	1.33 NR	0.00 ND	0.25	0.00 ND	0.00 ND	0.77	1.50	3.33	3.34	0.72	0.72	1.90	1.92	8.88	3.79

Particle Size Measurement

Sl. No.	Paletta Creek Site Location	Particle class	Fraction mass average (%)	Stdev	Range
1	P11	Clay (<2um)	37.1	4.3	NA
		Fine silt (2-20)	38.5	1.5	NA
		Course silt (20-63)	10.2	0.6	NA
		Sand (>63)	14.1	2.7	NA
2	P17	Clay (<2um)	23.2	NA	0.6
		Fine silt (2-20)	31.9	NA	2.3
		Course silt (20-63)	10.3	NA	3.1
		Sand (>63)	34.6	NA	0.2

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug-15-Sediment Traps-Org

135	PCB 144	PCB 147	PCB 107	PCB 123	PCB 149	PCB 118	PCB 134	PCB 114	PCB 131	PCB 146	PCB 153	PCB 132	PCB 105	PCB 141	PCB 179	PCB 163
	2.35	1.13	2.79	1.80	25.99	14.48	0.88	2.94 NR	0.00 ND	4.66	27.89	5.47	6.78	3.71	2.02	9.24
	1.10	0.41	0.89	0.53	11.55	6.27	0.52	1.16 NR	0.00 ND	1.88	11.23	4.49	3.74	2.89	0.72	7.56

PCB 138	PCB 158	PCB 178	PCB 126	PCB 187	PCB 183	PCB 128	PCB 167	PCB 174	PCB 177	PCB 171	PCB 156	PCB 157	PCB 153	PCB 172	PCB 197	PCB 180
14.06	2.32	1.34	0.52	9.04	3.69	0.00 ND	0.00 ND	5.46	4.00	1.78	3.20	0.90	0.00 ND	1.16	0.06 ND	17.68
10.55	2.02	0.45	0.41	2.79	1.59	0.00 ND	0.00 ND	2.84	1.58	0.87	2.43	0.69	0.00 ND	0.59	0.02 ND	8.47

PCB 193	PCB 191	PCB 169	PCB 170	PCB 190	PCB 198	PCB 203	PCB 196	PCB 189	PCB 208	PCB 195	PCB 207	PCB 194	PCB 205	PCB 206	PCB 209	Sum of PCBs
0.65	0.00 ND	0.00 ND	9.00	1.44	4.03	2.16	2.18	0.00 ND	0.91	1.28	0.27 J	5.13	0.00 ND	3.62	3.69	384.97
0.37	0.00 ND	0.00 ND	5.41	0.78	1.58	0.91	0.92	0.00 ND	0.16 J	0.49	0.06 J	1.36	0.00 ND	1.03	0.40	178.11

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug 15-Tissue PAH

	Tissue Concentration (µg/kg-wet weight basis)																					
PAHs	Ms TØ	Ms Ref	Ms P11	Ms P17	Mn TØ A	Mn TØ B	Mn TØ C	Mn Ref A	Mn Ref B	Mn Ref C	Mn Ref D	Mn Ref E	Mn P11 A	Mn P11 B	Mn P11 C	Mn P11 D	Mn P11 E	Mn P17 A	Mn P17 B	Mn P17 C	Mn P17 D	Mn P17 E
Naphthalene	50.5	40.1	19.8	26.6	14.1	11.2	13.0	12.9	14.3	13.0	19.8	16.5	9.4	12.4	12.3	7.9	5.8	6.6	8.6	6.9	4.6	5.9
Fluorene	14.2	11.1	9.0	10.8	6.0	6.2	5.6	4.5	3.1	6.0	3.6	2.9	64.3	20.0	6.8	3.2	1.2	2.5	3.6	4.3	2.2	3.6
Acenaphthene	30.7	28.3	46.3	87.4	24.2	27.4	33.3	32.3	38.6	49.0	42.8	35.5	129.5	66.9	59.7	33.3	28.8	17.8	23.2	28.1	26.4	23.0
Phenanthrene	49.4	42.3	32.8	63.9	38.3	42.1	41.7	50.8	56.4	70.7	55.9	49.0	59.8	31.7	39.6	23.7	22.8	11.6	13.9	16.9	19.4	15.7
Anthracene	0.9	0.6	0.7	0.6	0.3	0.3	0.3	0.3	0.4	0.4	2.1	0.4	0.0	0.6	0.3	0.7	0.2	0.4	0.6	0.7	0.5	0.6
Fluoranthene	7.8	6.6	8.3	9.8	3.8	4.7	4.9	12.9	5.6	8.2	6.0	6.2	111.4	54.9	24.3	76.4	39.7	9.3	11.3	19.6	8.9	9.7
Pyrene	11.9	10.4	4.4	2.8	11.7	13.4	13.6	17.5	15.3	22.9	17.8	14.5	285.8	279.0	6.8	50.0	21.7	9.8	12.6	5.3	2.6	5.4
Chrysene	1.0	1.3	7.7	17.4	3.4	4.0	4.7	6.1	6.6	7.4	5.2	5.7	68.1	43.5	16.4	43.9	24.0	5.6	9.2	13.3	10.2	10.3
Benz[a]anthracene	1.6	1.9	9.7	17.5	4.2	4.6	5.4	7.4	8.4	9.9	6.2	6.9	56.1	49.9	19.3	48.0	29.5	6.9	9.7	11.2	9.8	9.8
Benzo[b]fluoranthene	1.8	2.5	13.7	20.1	2.4	2.6	2.8	6.9	7.1	7.9	6.5	7.1	116.9	152.0	48.2	73.6	52.4	20.9	33.8	27.4	20.0	25.8
Benzo[k]fluoranthene	0.8	1.2	6.0	8.3	2.1	1.9	2.6	3.8	3.8	3.8	3.2	3.7	39.2	53.3	21.7	30.2	22.6	8.0	12.8	11.3	8.4	10.5
Benzo[a]pyrene	2.4	3.1	16.6	30.2	6.5	9.0	7.6	11.6	13.7	17.4	11.8	11.6	80.7	102.8	44.4	65.1	44.3	13.8	20.6	19.5	16.0	18.8
Dibenz[a,h]anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Benzo[ghi]perylene + Indeno[1,2,3-cd]pyrene	0.7	0.8	2.6	1.8	0.0	0.0	0.0	2.4	2.0	1.4	1.3	1.5	9.1	18.1	12.7	15.9	12.5	3.3	6.7	5.6	4.0	5.7

	Average Concentration (µg/kg-tissue wet weight basis)							
PAHs	*Ms TØ*	*Ms Ref*	*Ms P11*	*Ms P17*	*AVG Mn TØ*	*AVG Mn Ref*	*AVG Mn P11*	*AVG Mn P17*
Naphthalene	50.45	40.09	19.81	26.64	12.76	15.28	9.55	6.51
Fluorene	14.18	11.13	8.97	10.81	5.94	4.00	19.11	3.24
Acenaphthene	30.67	28.31	46.34	87.36	28.29	39.64	63.65	23.69
Phenanthrene	49.35	42.27	32.83	63.86	40.71	56.55	35.51	15.53
Anthracene	0.91	0.60	0.70	0.57	0.34	0.73	0.35	0.58
Fluoranthene	7.85	6.56	8.26	9.77	4.46	7.78	61.33	11.74
Pyrene	11.88	10.41	4.35	2.76	12.89	17.61	128.64	7.13
Chrysene	1.01	1.32	7.68	17.42	4.00	6.21	39.18	9.73
Benz[a]anthracene	1.65	1.89	9.66	17.46	4.71	7.76	40.53	9.47
Benzo[b]fluoranthene	1.82	2.54	13.67	20.12	2.64	7.12	88.61	25.58
Benzo[k]fluoranthene	0.76	1.19	5.95	8.32	2.19	3.67	33.40	10.19
Benzo[a]pyrene	2.43	3.06	16.59	30.21	7.67	13.20	67.45	17.75
Dibenz[a,h]anthracene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.70	0.81	2.65	1.81	0.00	1.73	13.65	5.05

	% Average fraction (g-lipid or water /g-tissue wet weight basis)							
	Ms TØ	*Ms Ref*	*Ms P11*	*Ms P17*	*AVG Mn TØ*	*AVG Mn Ref*	*AVG Mn P11*	*AVG Mn P17*
Tissue Lipid Fraction	1.09	1.11	1.14	1.00	0.97	0.94	0.98	0.96
Tissue Water content	91.11	89.29	89.16	89.47	86.55	82.01	81.09	80.78

	Average Concentration (µg/kg-lipids)							
PAHs	*Ms TØ*	*Ms Ref*	*Ms P11*	*Ms P17*	*AVG Mn TØ*	*AVG Mn Ref*	*AVG Mn P11*	*AVG Mn P17*
Naphthalene	4642	3608	1743	2664	1318	1618	978	675
Fluorene	1304	1002	790	1081	614	424	1956	335
Acenaphthene	2822	2548	4078	8736	2922	4198	6513	2456
Phenanthrene	4540	3804	2889	6386	4205	5990	3634	1610
Anthracene	84	54	62	57	35	77	36	60

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug 15-Tissue PAH

Fluoranthene	722	590	727	977	460	824	6275	1218
Pyrene	1093	937	383	276	1332	1865	13163	739
Chrysene	93	119	676	1742	413	658	4009	1009
Benz[a]anthracene	151	170	851	1746	486	822	4147	982
Benzo[b]fluoranthene	168	229	1203	2012	273	755	9067	2652
Benzo[k]fluoranthene	70	107	524	832	226	388	3418	1056
Benzo[a]pyrene	223	275	1460	3021	792	1398	6902	1841
Dibenz[a,h]anthracene	0	0	0	0	0	0	0	0
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	64	73	233	181	0	183	1397	523

Notations: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
ND is "Non detects"

SI. No.	Paletta Creek Site Location	NP is "Not provided"	Date sampled collected in SPAWAR	Storage temperature conditions	Date sediment sent to TTU†	Dry Sediment Mass (g)	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	THg (mg/Kg-dry	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P11	P11 Sediment traps (D)	8/12/2015	stored at 4ºC	8/18/2015	108.6	52.3	3.51	0.06	0.13	0.02	0.7	0.1	12.9	0.4	0.4-0.5	NA	127.6	3.6	412.8	57.5	310.1	10.1	31.6	5.4
2	P17	P17 Sediment traps (D)	8/12/2015	stored at 4ºC	8/18/2015	165.5	48.9	6.28	0.24	0.20	0.05	0.5	0.0	9.4	0.4	1.3	0.3	263.3	8.7	666.0	91.3	255.5	20.3	28.1	1.3

Particle Size Measurement

SI. No.	Paletta Creek Site Location	Particle class	Fraction mass average (%)	Stdev	Range
1	P11	Clay (<2um)	37.1	4.3	NA
		Fine silt (2-20)	38.5	1.5	NA
		Coarse silt (20-63)	10.2	0.6	NA
		Sand (>63)	14.1	2.7	NA
2	P17	Clay (<2um)	23.2	NA	0.6
		Fine silt (2-20)	31.9	NA	2.3
		Coarse silt (20-63)	10.3	NA	3.1
		Sand (>63)	34.6	NA	0.2

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug-15-Insitu_SPMES_PAH

"0" indicates "Non Detect"	P11 30-40cm_ow	P11 20-30cm_ow	P11 10-20cm_ow	P11 0-10cm_ow	P11 0-5cm	P11 5-10cm	P11 10-15cm	P11 15-20cm	P11 20-25cm	P11 25-30cm	P11 30-35cm	P11 35-40cm	P11 40-45cm
	Cow ng/L	Cow ng/L	Cow ng/L	Cow ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L
naphthalene	10.4	10.9	6.3	6.1	2.6	3.9	20.5	4.7	4.0	3.6	4.6	5.4	3.7
2-methylnaphthalene	15.2	16.1	13.3	12.0	17.9	18.5	28.9	19.7	17.6	18.1	20.8	19.5	17.6
1-methylnaphthalene	3.8	4.4	2.5	2.2	2.0	1.9	7.1	2.5	1.4	2.5	3.9	2.2	1.9
2-ethylnaphthalene	3.5	3.5	3.0	3.0	5.4	5.6	6.9	5.7	5.1	5.9	6.8	6.0	6.2
1-ethylnaphthalene	0.0	0.0	0.7	0.2	0.0	0.5	1.1	0.9	0.0	0.0	0.4	0.3	0.9
2.6-dimethylnaphthalene	5.0	5.2	4.5	3.9	7.2	7.3	10.0	8.9	7.5	7.8	8.2	8.5	7.6
1.3-dimethylnaphthalene	5.4	5.6	4.6	4.0	7.5	8.4	10.1	8.6	7.2	7.6	8.5	8.2	7.6
2-isopropylnaphthalene	1.1	1.1	1.1	1.1	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
acenaphthylene	8.7	9.3	8.9	9.4	17.2	17.5	17.1	17.4	17.2	17.1	18.6	18.7	19.1
1.2-dimethylnaphthalene	3.2	3.1	3.1	3.5	7.6	7.0	6.5	6.2	6.3	7.3	9.4	10.4	11.0
1.8-dimethylnaphthalene	2.8	4.0	3.2	4.2	6.4	9.5	6.3	6.1	6.3	6.9	8.1	6.8	8.3
acenaphthene	3.3	4.0	3.3	2.9	3.5	5.6	9.9	4.5	3.9	5.0	7.6	7.0	7.3
2.3.5-trimethylnaphthalene	1.7	1.7	1.6	1.2	2.8	3.5	4.0	3.6	2.9	3.3	3.8	4.2	3.3
fluorene	6.8	7.6	6.8	6.8	11.4	13.5	20.1	12.7	12.4	13.5	17.8	15.3	16.8
1-methylfluorene	4.7	4.5	4.3	4.4	10.3	10.8	11.5	9.6	7.9	10.3	13.2	10.5	10.1
phenanthrene	7.5	10.1	9.6	13.4	16.5	17.2	31.9	14.7	17.2	24.8	30.9	24.8	28.9
anthracene	1.5	2.3	2.6	2.4	6.6	4.8	8.6	4.4	4.9	6.9	9.5	4.9	9.4
2-methylphenanthrene	0.9	1.1	1.0	1.1	1.7	2.0	2.8	2.0	1.8	2.4	3.1	3.1	3.5
2-methylanthracene	1.3	1.7	1.5	2.8	5.2	3.0	4.1	2.6	2.6	3.2	3.9	4.3	5.0
1-methylphenanthrene	0.7	1.0	0.9	1.0	1.7	2.0	2.6	1.8	1.8	2.8	3.8	4.0	4.9
9-methylanthracene	0.3	0.4	0.3	0.6	1.2	1.9	0.8	1.0	1.3	0.8	1.0	1.5	1.7
2-ethylanthracene	0.6	0.5	0.5	0.7	2.3	2.0	1.1	1.0	1.0	1.3	1.9	2.9	2.4
fluoranthene	3.4	4.2	4.1	6.4	10.4	8.1	5.8	5.6	5.7	14.5	29.0	26.0	32.5
pyrene	3.4	4.6	5.0	21.3	49.5	39.6	25.5	23.8	24.6	49.5	76.4	105.6	136.9
9.10-dimethylanthracene	0.6	2.2	1.6	1.2	3.0	3.2	6.0	1.9	1.3	1.2	1.6	2.6	2.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
1-methylpyrene	0.6	0.7	0.7	1.4	3.7	3.4	2.6	2.7	3.0	3.7	4.7	5.8	6.6
benz(a)anthracene	0.5	0.6	0.6	1.0	2.7	2.4	1.8	1.8	2.0	2.9	4.1	4.4	6.0
chrysene	0.5	0.6	0.7	1.1	2.8	2.4	1.8	1.8	1.8	2.4	3.7	3.9	5.5
benzo(b)fluoranthene	0.4	0.6	0.6	0.7	2.0	2.1	1.7	2.0	1.8	2.2	2.7	3.2	3.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
benzo(k)fluoranthene	0.4	0.5	0.6	0.7	1.9	1.7	1.4	1.4	1.6	1.7	2.1	2.7	2.9
benzo(e)pyrene	0.2	0.2	0.2	0.3	0.8	0.9	0.7	0.8	0.8	0.9	1.0	1.3	1.3
benzo(a)pyrene	0.4	0.5	0.5	0.7	2.1	2.2	1.9	2.1	2.1	2.3	2.8	3.5	3.7
perylene	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**99**	**113**	**98**	**122**	**219**	**215**	**264**	**185**	**178**	**235**	**317**	**330**	**381**

	P17 30-40cm_ow	P17 20-30cm_ow	P17 10-20cm_ow	P17 0-10cm_ow	P17 0-5cm	P17 5-10cm	P17 10-15cm	P17 15-20cm	P17 20-25cm	P17 25-30cm	P17 30-35cm	P17 35-40cm	P17 40-45cm
	Cow ng/L	Cow ng/L	Cow ng/L	Cow ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L
naphthalene	9.6	13.0	13.0	13.3	5.3	4.6	5.0	4.4	3.9	1.9	3.3	1.9	5.3
2-methylnaphthalene	12.6	17.5	15.1	14.8	17.1	17.6	17.1	14.9	15.3	15.7	18.2	16.6	17.0
1-methylnaphthalene	3.2	5.4	3.6	4.0	1.5	1.5	1.2	0.5	0.4	0.7	1.8	1.2	1.4
2-ethylnaphthalene	3.2	3.7	3.4	3.5	6.2	6.7	6.3	5.6	6.0	5.5	6.1	5.9	5.6
1-ethylnaphthalene	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.5	0.8	1.4	0.0
2.6-dimethylnaphthalene	4.1	6.1	5.2	5.3	7.6	8.2	7.1	6.2	6.1	7.1	8.5	7.3	7.3
1.3-dimethylnaphthalene	4.8	7.1	5.3	5.4	7.5	8.1	7.7	6.3	7.0	7.4	8.2	6.8	7.8
2-isopropylnaphthalene	1.1	1.1	1.2	1.2	2.3	2.4	2.3	2.3	2.3	2.4	2.3	2.3	2.3
acenaphthylene	7.7	8.7	8.3	8.2	15.7	15.7	15.2	15.2	15.9	15.4	15.5	15.8	15.4
1.2-dimethylnaphthalene	3.3	3.5	3.2	3.3	6.3	6.3	5.8	5.8	5.9	6.1	6.1	6.0	6.0
1.8-dimethylnaphthalene	3.5	3.7	3.5	4.2	6.2	5.8	7.3	6.2	6.1	5.9	6.2	5.9	7.0
acenaphthene	2.0	4.8	4.0	4.3	5.7	6.2	6.3	4.0	5.9	3.4	5.7	7.2	4.7
2.3.5-trimethylnaphthalene	1.6	2.3	1.8	1.8	3.7	3.4	3.3	2.9	3.2	2.9	3.2	3.2	3.2
fluorene	5.4	8.5	6.8	7.7	14.3	16.5	14.4	13.1	15.3	12.9	14.5	16.4	13.7
1-methylfluorene	3.5	5.2	4.1	4.5	11.6	11.1	8.5	9.5	11.6	11.2	10.2	11.0	8.5
phenanthrene	6.8	11.2	7.1	7.2	22.1	26.1	22.3	20.0	24.1	21.3	25.6	36.4	26.5
anthracene	1.1	2.6	1.6	2.1	3.2	6.0	3.4	1.8	2.7	4.1	3.2	4.0	4.8
2-methylphenanthrene	0.9	1.5	0.9	1.1	2.9	3.0	2.2	2.3	2.5	2.4	2.6	3.4	2.6
2-methylanthracene	1.4	2.5	1.4	2.5	5.7	5.8	4.4	4.5	4.9	6.6	7.2	8.8	7.1
1-methylphenanthrene	0.7	1.3	0.8	0.9	2.5	2.7	2.0	1.9	2.0	2.1	2.0	2.6	1.9
9-methylanthracene	0.2	0.4	0.4	0.9	0.8	1.0	0.8	0.9	0.7	2.3	1.6	2.0	1.8
2-ethylanthracene	0.4	0.6	0.4	0.4	1.7	1.3	1.0	1.2	0.9	1.3	1.0	1.1	0.9
fluoranthene	2.8	5.4	3.8	4.2	6.0	5.9	4.4	4.0	4.2	5.1	5.6	6.6	5.2
pyrene	2.9	5.4	4.1	8.3	15.1	17.6	16.7	17.2	17.1	16.8	17.2	16.4	14.3
9.10-dimethylanthracene	0.4	2.2	1.5	1.5	3.1	2.7	7.7	1.6	1.9	2.5	2.1	2.8	1.7
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1-methylpyrene	0.4	0.6	0.6	0.8	1.4	1.6	1.4	1.4	1.5	1.6	1.4	1.5	1.4
benz(a)anthracene	0.4	0.6	0.5	0.6	1.3	1.3	1.2	1.2	1.3	1.2	1.2	1.2	1.1
chrysene	0.4	0.7	0.6	0.8	1.4	1.4	1.2	1.1	1.3	1.2	1.3	1.2	1.2
benzo(b)fluoranthene	0.2	0.4	0.3	0.4	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.7
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.1	0.3	0.2	0.4	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7
benzo(e)pyrene	0.1	0.2	0.1	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
benzo(a)pyrene	0.2	0.3	0.3	0.4	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
perylene	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**85**	**127**	**103**	**114**	**181**	**193**	**179**	**159**	**173**	**171**	**186**	**200**	**179**

Stdev	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/L
naphthalene	1.0	6.2	4.5	1.9	4.4	4.4	28.8	3.2	2.3	3.0	3.8	5.4	3.2
2-methylnaphthalene	0.2	2.8	2.1	2.7	3.7	4.4	16.2	2.3	1.4	3.0	1.8	4.0	3.4
1-methylnaphthalene	0.5	1.5	1.0	1.2	2.6	2.4	7.7	1.6	1.1	2.0	1.1	1.2	2.0
2-ethylnaphthalene	0.0	0.6	0.4	0.7	0.2	0.4	1.1	0.9	0.5	1.2	0.3	0.4	0.7
1-ethylnaphthalene	0.0	0.4	0.7	0.0	0.0	0.9	2.0	1.6	0.0	0.0	0.6	0.5	1.6
2.6-dimethylnaphthalene	0.4	1.0	0.4	1.0	0.5	1.0	2.7	0.9	1.1	0.8	0.8	1.1	1.1
1.3-dimethylnaphthalene	0.4	1.3	0.4	0.9	1.5	1.6	3.3	1.7	0.3	1.3	0.6	1.9	1.6
2-isopropylnaphthalene	0.0	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1
acenaphthylene	1.2	0.6	0.9	1.3	0.5	1.5	0.6	0.2	0.5	0.4	1.7	1.2	1.9
1.2-dimethylnaphthalene	0.3	0.4	0.2	0.3	1.1	0.5	0.8	0.7	0.3	0.8	1.0	2.4	1.6
1.8-dimethylnaphthalene	0.1	0.7	0.6	0.4	0.5	2.5	0.7	0.5	0.8	0.9	1.7	0.1	0.6
acenaphthene	0.8	0.3	0.3	1.1	0.8	1.7	1.1	1.1	1.6	2.2	1.4	1.3	1.5
2.3.5-trimethylnaphthalene	0.3	0.6	0.2	0.3	0.1	0.5	1.0	0.3	0.1	0.6	1.1	1.1	0.9
fluorene	1.1	0.9	0.6	2.1	1.6	4.1	1.4	1.2	3.5	2.3	1.0	1.3	2.8
1-methylfluorene	0.1	0.7	1.2	0.6	3.0	3.8	0.7	2.7	1.2	1.5	0.2	6.3	3.0

	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/l	Stdev ng/L
naphthalene		2.1	2.9	0.9	1.3	2.2	2.6	2.7	1.1	2.7	2.9	1.7	3.4
2-methylnaphthalene		4.2	3.7	1.1	1.3	2.3	2.6	2.1	0.3	2.7	2.0	0.5	1.1
1-methylnaphthalene		2.4	1.8	0.5	0.4	0.9	0.8	0.8	0.2	1.2	1.1	0.4	1.4
2-ethylnaphthalene		1.2	0.6	0.3	0.5	0.8	0.6	0.5	0.6	0.2	0.5	0.4	1.1
1-ethylnaphthalene		0.0	0.7	0.0	0.0	0.0	0.3	0.0	0.0	0.8	1.0	1.2	0.0
2.6-dimethylnaphthalene		1.6	1.1	1.1	1.0	1.0	1.0	1.1	0.6	1.3	0.7	1.1	1.4
1.3-dimethylnaphthalene		1.9	1.1	0.7	1.5	0.3	0.8	0.6	0.6	1.3	0.4	0.4	1.1
2-isopropylnaphthalene		0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1
acenaphthylene		1.0	0.8	0.3	0.7	0.4	0.2	0.4	1.2	0.5	0.2	0.2	1.0
1.2-dimethylnaphthalene		0.3	0.4	0.1	0.3	0.1	0.4	0.4	0.2	0.1	0.1	0.5	0.3
1.8-dimethylnaphthalene		0.4	0.3	0.3	0.2	0.3	0.6	1.1	0.6	0.5	0.2	0.5	0.6
acenaphthene		2.0	1.5	2.5	1.7	0.9	2.3	1.0	1.6	3.0	1.0	1.4	2.6
2.3.5-trimethylnaphthalene		0.7	0.3	0.1	0.4	0.5	0.8	0.3	0.2	0.6	0.4	0.2	0.0
fluorene		1.6	1.4	1.5	1.7	5.2	4.3	0.9	3.1	3.7	0.4	2.8	3.7
1-methylfluorene		1.0	0.5	0.9	2.0	0.5	0.5	1.1	1.9	2.0	2.1	0.7	0.5

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug-15-Insitu_SPMES_PAH

phenanthrene	2.5	6.0	1.1	1.3	9.9	10.8	11.3	4.5	10.4	7.2	9.4	5.7	5.4	3.5	0.8	0.1	9.6	17.1	17.1	2.4	8.1	9.4	3.3	14.5	13.5
anthracene	0.5	0.8	0.7	0.5	4.3	1.4	1.8	3.4	2.3	1.0	5.3	1.9	5.8	1.3	0.6	0.8	0.9	1.1	1.9	0.5	1.1	1.9	1.5	1.2	1.7
2-methylphenanthrene	0.2	0.2	0.3	0.2	0.4	1.0	1.0	0.7	0.5	0.4	0.6	0.3	1.4	0.3	0.2	0.1	0.4	1.0	0.9	0.4	0.3	0.6	0.3	0.5	1.0
2-methylanthracene	0.2	0.6	0.6	0.3	3.7	1.5	1.8	1.0	1.1	1.0	1.6	0.6	2.8	0.7	0.3	0.3	1.5	1.4	2.3	1.5	1.5	2.6	1.3	0.4	4.2
1-methylphenanthrene	0.2	0.1	0.3	0.1	0.1	1.0	0.7	0.6	0.7	0.9	1.5	1.2	3.0	0.4	0.1	0.1	0.6	0.9	0.9	0.4	0.5	0.5	0.3	0.3	0.6
9-methylanthracene	0.1	0.4	0.2	0.1	0.8	1.5	0.0	0.5	1.3	0.3	0.3	1.0	0.9	0.1	0.2	0.6	0.1	0.2	0.2	0.4	0.1	1.2	1.1	1.7	2.1
2-ethylanthracene	0.3	0.1	0.2	0.1	0.2	2.0	0.3	0.4	0.1	0.5	0.7	1.2	1.9	0.1	0.1	0.2	0.2	0.3	0.3	0.1	0.2	0.8	0.4	0.1	0.2
fluoranthene	0.8	0.4	0.4	0.4	2.6	5.3	1.9	2.3	4.1	10.6	29.0	22.1	32.3	1.3	0.8	0.4	0.6	0.9	2.2	1.5	1.6	1.6	0.1	0.6	1.3
pyrene	1.0	2.2	0.8	0.3	17.3	27.6	14.4	13.9	17.2	30.1	31.0	20.4	55.8	1.0	0.6	1.2	1.3	0.9	2.3	2.4	2.9	2.0	2.2	2.8	5.3
9.10-dimethylanthracene	0.2	0.5	0.4	0.9	3.3	3.5	4.8	0.8	0.4	0.4	1.1	0.7	1.1	1.8	0.7	0.9	3.0	2.2	6.8	0.6	0.6	1.2	0.6	1.0	0.9
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.2	0.0	0.2	0.2	0.4	1.3	0.9	0.7	0.8	0.7	1.0	0.4	2.2	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.4
benz(a)anthracene	0.1	0.1	0.1	0.1	0.8	1.3	0.7	0.8	0.9	1.9	2.1	1.9	4.4	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2
chrysene	0.2	0.1	0.1	0.1	0.7	1.2	0.6	0.7	1.0	1.8	1.8	1.5	3.3	0.2	0.1	0.1	0.1	0.2	0.2	0.0	0.3	0.2	0.1	0.3	0.2
benzo(b)fluoranthene	0.2	0.1	0.3	0.3	0.1	0.6	0.4	0.4	0.4	0.1	0.3	0.3	0.9	0.2	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.2	0.1	0.1	0.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.1	0.3	0.3	0.1	0.9	0.5	0.5	0.6	0.3	0.4	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.3
benzo(e)pyrene	0.1	0.0	0.1	0.1	0.0	0.3	0.2	0.2	0.2	0.0	0.1	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.1
benzo(a)pyrene	0.2	0.1	0.2	0.2	0.1	0.8	0.5	0.5	0.4	0.1	0.3	0.2	1.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug-15-Exsitu_SPMEs_PAH

comb means 3 fibers were pooled in 1 vial

"0" indicates "Non Detect"	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L
Sample ID	**P17 A 1-1_comb_exsitu**	**P17 B 2-1_comb**	**P17 C 3-1_comb**	**P11 A 4-1_comb**	**P11 B 5-1_comb**	**P11 C 6-1_comb**	**P11 B_5-4**	**REF A 7-1_comb**	**REF B 8-1_comb**	**REF C 9-1_comb**
naphthalene	35.5	34.4	40.1	31.3	40.4	35.7	31.4	54.0	37.9	25.6
2-methylnaphthalene	18.2	21.9	23.1	16.9	21.4	18.2	18.3	26.0	19.3	14.9
1-methylnaphthalene	6.7	8.5	9.7	6.2	7.9	5.7	3.9	11.0	7.0	4.9
2-ethylnaphthalene	3.0	3.5	3.3	3.5	3.9	3.2	3.8	3.8	3.3	2.7
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.6-dimethylnaphthalene	4.4	4.9	6.4	4.2	5.0	3.9	2.4	5.6	4.5	3.4
1.3-dimethylnaphthalene	5.4	6.1	7.0	5.7	6.5	5.4	5.1	7.2	6.0	4.6
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	0.0	0.0	0.5	2.1	1.5	2.3	0.0	0.0	0.0	0.0
1.2-dimethylnaphthalene	1.2	1.3	1.7	1.7	1.4	1.3	1.0	1.7	1.3	1.0
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
acenaphthene	5.4	7.1	7.2	8.0	6.3	6.4	5.0	6.4	7.0	5.1
2.3.5-trimethylnaphthalene	2.2	2.7	2.9	2.9	2.9	2.3	2.1	2.7	2.6	2.0
fluorene	7.5	12.2	13.1	13.3	10.9	8.8	12.5	13.0	12.6	8.3
1-methylfluorene	3.8	6.5	7.2	10.1	5.9	6.5	11.1	6.0	5.9	5.7
phenanthrene	8.2	13.4	15.8	21.6	12.4	9.7	16.9	13.7	13.2	8.6
anthracene	2.0	3.6	4.3	4.7	3.9	2.8	3.3	3.1	3.0	1.6
2-methylphenanthrene	0.8	1.2	1.6	2.4	1.3	1.0	1.7	1.3	1.2	0.7
2-methylanthracene	2.9	5.2	7.0	4.2	2.4	1.4	2.7	2.0	1.9	1.1
1-methylphenanthrene	0.5	0.8	1.0	1.8	1.3	0.9	1.2	1.0	1.0	0.5
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	2.4	2.7	4.3	5.6	2.4	2.0	2.3	1.6	1.3	1.3
pyrene	6.3	7.0	11.9	25.6	11.2	13.5	7.3	1.2	0.9	0.8
9.10-dimethylanthracene	0.8	1.1	0.8	1.8	0.9	0.9	0.9	1.3	1.0	1.2
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.8	1.1	2.4	1.2	1.9	1.3	0.3	0.2	0.2
benz(a)anthracene	0.3	0.4	0.6	1.3	0.5	0.7	0.5	0.2	0.2	0.2
chrysene	0.5	0.5	0.7	1.4	0.6	0.8	0.5	0.1	0.1	0.1
benzo(b)fluoranthene	0.4	0.5	0.6	1.5	1.0	1.4	0.8	0.2	0.2	0.1
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.4	0.6	1.3	0.9	1.4	0.7	0.1	0.2	0.1
benzo(e)pyrene	0.1	0.2	0.2	0.5	0.4	0.5	0.3	0.0	0.0	0.0
benzo(a)pyrene	0.2	0.3	0.3	1.0	0.7	1.0	0.6	0.1	0.1	0.1

perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM PAH ng/L	**119.8**	**147.0**	**173.1**	**183.2**	**155.3**	**141.0**	**137.5**	**163.9**	**132.0**	**94.9**

comb means 3 fibers were pooled in 1 vial
"0" indicates "Non Detect"

PCBs

Data File	001 Results ng/L	Qual	002 Results ng/L	Qual	003 Results ng/L	Qual	004 Results ng/L	Qual	010 Results ng/L	Qual	009 Results ng/L	Qual	007 Results ng/L	Qual	006 Results ng/L	Qual	008 Results ng/L	Qual	005 Results ng/L	Qual	019 Results ng/L	Qual	018 Results ng/L	Qual	017 Results ng/L	Qual
P17 A 1-1 comb ex	0.03	J	0.00	ND	0.02	J	0.47		0.01	J	0.00	ND	0.00	ND	0.01	J	0.04		0.00	ND	0.01	J	0.06		0.03	[illegible]
P17 B 2-1 comb	0.03	J	0.01	ND	0.03	J	0.65		0.02	J	0.00	ND	0.00	ND	0.01	J	0.07		0.00	ND	0.02	J	0.09		0.05	[illegible]
P17 C 3-1 comb	0.04	J	0.01	J	0.03	J	0.73		0.02	J	0.00	ND	0.00	ND	0.01	J	0.06		0.00	ND	0.01	J	0.09		0.06	[illegible]
P11 B 5-1 comb	0.02	J	0.00	ND	0.01	J	0.63		0.01	J	0.00	ND	0.00	ND	0.01	J	0.05		0.00	ND	0.01	J	0.07		0.05	[illegible]
P11 C 6-1 comb	0.02	J	0.00	ND	0.01	ND	0.28		0.01	J	0.00	ND	0.00	ND	0.01	J	0.03		0.00	ND	0.01	J	0.04		0.03	[illegible]
REF A 7-1 comb	0.02	J	0.00	ND	0.01	J	0.34		0.01	J	0.00	ND	0.00	ND	0.01	J	0.03		0.00	ND	0.00	J	0.04		0.03	[illegible]
REF B 8-1 comb	0.02	J	0.00	ND	0.00	ND	0.31		0.01	J	0.00	ND	0.00	ND	0.01	J	0.04		0.00	ND	0.00	J	0.05		0.03	[illegible]
REF C 9-1 comb	0.02	J	0.00	ND	0.01	J	0.43		0.01	J	0.00	ND	0.00	ND	0.01	J	0.03		0.00	ND	0.00	ND	0.04		0.02	[illegible]

Data File	[illegible]
P17 A 1-1 comb ex	[illegible]
P17 B 2-1 comb	[illegible]
P17 C 3-1 comb	[illegible]
P11 B 5-1 comb	[illegible]
P11 C 6-1 comb	[illegible]
REF A 7-1 comb	[illegible]
REF B 8-1 comb	[illegible]
REF C 9-1 comb	[illegible]

Data File	123 Results ng/L	Qual	149 Results ng/L	Qual	118 Results ng/L	Qual	134 Results ng/L	Qual	114 Results ng/L	Qual	131 Results ng/L	Qual	146 Results ng/L	Qual	153 Results ng/L	Qual	132 Results ng/L	Qual	105 Results ng/L	Qual	141 Results ng/L	Qual	179 Results ng/L	Qual	163 Results ng/L	Qual	138 Results ng/L	Qual
P17 A 1-1 comb ex	0.00	ND	0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	
P17 B 2-1 comb	0.00	ND	0.01		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.00		0.00	J	0.00	ND	0.00	ND	0.00	
P17 C 3-1 comb	0.00	ND	0.01		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01		0.00		0.00		0.00	J	0.00	ND	0.00	ND	0.01	
P11 B 5-1 comb	0.00	ND	0.01		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01		0.00		0.00		0.00	J	0.00	ND	0.00	ND	0.00	
P11 C 6-1 comb	0.00	ND	0.01		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01		0.00		0.00		0.00	J	0.00	ND	0.00	ND	0.00	
REF A 7-1 comb	0.00	ND	0.00		0.00		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	
REF B 8-1 comb	0.00	ND	0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	
REF C 9-1 comb	0.00	ND	0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	

Data File	158 Results ng/L	Qual	178 Results ng/L	Qual	126 Results ng/L	Qual	187 Results ng/L	Qual	183 Results ng/L	Qual	128 Results ng/L	Qual	167 Results ng/L	Qual	174 Results ng/L	Qual	177 Results ng/L	Qual	171 Results ng/L	Qual	156 Results ng/L	Qual	157 Results ng/L	Qual	173 Results ng/L	Qual	172 Results ng/L	Qual	197 Results ng/L	Qual	180 Results ng/L	Qual	193 Results ng/L	Qual
P17 A 1-1 comb ex	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND
P17 B 2-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND
P17 C 3-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND
P11 B 5-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND
P11 C 6-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND
REF A 7-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND
REF B 8-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND
REF C 9-1 comb	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND

Pesticides

Data File	transchlordane Results ng/L	Qual	cischlordane Results ng/L	Qual	SUM ng/L
P17 A 1-1 comb ex	0.02		0.02		0.05
P17 B 2-1 comb	0.03		0.03		0.05
P17 C 3-1 comb	0.04		0.04		0.08
P11 B 5-1 comb	0.01		0.01		0.03
P11 C 6-1 comb	0.01		0.01		0.02
REF A 7-1 comb	0.01		0.01		0.02
REF B 8-1 comb	0.01		0.01		0.02
REF C 9-1 comb	0.01		0.01		0.01

191 Results		169 Results		170 Results		190 Results		198 Results		203 Results		196 Results		189 Results		208 Results		195 Results		207 Results		194 Results		205 Results		206 Results		209 Results		SUM ng/L
ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	ng/L	Qual	
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	1.16
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	1.67
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	1.79
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	1.47
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.91
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.84
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.80
0.00	ND	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.82

Notations: A,B,C = indicative of DGT replicates.
Control DGTs were not shipped with samples, but shipped and received on August 05, 2015.
TØ Hg DGT B had a big air bubble and the ziploc bag was not tightly sealed.
For control samples the minimum field/lab deployment time is used to calculate the representative concentration.
Represents potentially anomalous porewater value based on comparison among the replicates
Temperature not reported. It is assumed to be identical to those reported in the aubsquent bioassay studies

$D_{eff,25C}$ =	5.3E-06	cm2/s	c_{THgDGT} = $Dd*m_{resin}/(A_{exposure}*t*D_{eff})$
Deployment temp., T =	15	ºC	pg/ml=ng/l= cm*pg/(cm2*s*cm2/s)
$D_{eff,T=}$	3.8E-06	cm2/s	c_{THgDGT}

DGT Exposure Timeline

Name/ID	Sample Name	mTHg,DGT Final Result (pg)	Deployment date	Deployment time	Retrieval date	Retrieval time	Exposure time h	Exposure time s	$A_{exposure}$ cm^2	Dd Diffusive thickness cm	$c_{THg\ DGT\ (porewater)}$ ng/L	verage C_{Hg-D} ng/L	St. Dev. C_{Hg-DGT} ng/L
TØ Hg DGT A	Travel Control DGT	12809					70.000	252000	3.14	0.1	424		
TØ Hg DGT B	Travel Control DGT	809					70.000	252000	3.14	0.1	27	161	228
TØ Hg DGT C	Travel Control DGT	923					70.000	252000	3.14	0.1	31		
Ref A	Reference Site Within San Diego Bay	156730	07/17/2015	4:05:00 PM	07/20/2015	1:12:00 PM	69.117	248820	3.14	0.1	5256		
Ref B	Reference Site Within San Diego Bay	7631	07/17/2015	4:09:00 PM	07/20/2015	1:20:00 PM	69.183	249060	3.14	0.1	256	1969	2847
Ref C	Reference Site Within San Diego Bay	11848	07/17/2015	4:11:00 PM	07/20/2015	1:26:00 PM	69.250	249300	3.14	0.1	397		
P11 A	Paleta Creek Location 11	4442	07/17/2015	4:21:00 PM	07/20/2015	1:31:00 PM	69.167	249000	3.14	0.1	149		
P11 B	Paleta Creek Location 11	4565	07/17/2015	4:15:00 PM	07/20/2015	1:37:00 PM	69.367	249720	3.14	0.1	153	140	18
P11 C	Paleta Creek Location 11	3581	07/17/2015	4:19:00 PM	07/20/2015	1:26:00 PM	69.117	248820	3.14	0.1	120		
P17 A	Paleta Creek Location 17	1365	07/17/2015	4:13:00 PM	07/20/2015	1:31:00 PM	69.300	249480	3.14	0.1	46		
P17 B	Paleta Creek Location 17	3472	07/17/2015	4:23:00 PM	07/20/2015	1:51:00 PM	69.467	250080	3.14	0.1	116	293	370
P17 C	Paleta Creek Location 17	21611	07/17/2015	4:16:00 PM	07/20/2015	1:58:00 PM	69.700	250920	3.14	0.1	719		

Appendix I-1: Paleta Sediment Tissue Porewater Summary
JulAug-15-Tissue_TM

Notations: All tissues values were obtained from a single extraction.

				(µg/g-dw)						(µg/Kg-dw)
Sample ID	Sample Collection Date	Mositure content in g-water/g-wet tissue (%)	Average Lipids Content in g-lipid/g-wet tissue(%)	**As**	**Cu**	**Ni**	**Zn**	**Cd**	**Pb**	**Total Hg**
Ms TØ	8/14/2015	91.1	1.1	0.83	2.43	0.33	9.40	0.04	0.27	232.0
Ms Ref	8/14/2015	89.3	1.1	1.65	2.62	0.70	12.09	0.13	0.57	287.5
Ms P11	8/14/2015	89.2	1.1	1.67	2.62	0.96	15.38	0.18	0.77	264.8
Ms P17	8/14/2015	89.5	1.0	1.94	3.21	1.17	15.59	0.21	1.43	237.2
Mn TØ A	8/14/2015	86.9	1.0	3.01	2.18	0.30	14.65	0.04	0.13	90.4
Mn TØ B	8/14/2015	86.1	1.0	3.21	2.48	0.48	13.26	0.05	0.11	93.9
Mn TØ C	8/14/2015	86.6	0.9	2.83	2.63	0.37	17.96	0.05	0.11	83.7
Mn Ref A	8/14/2015	81.4	0.9	6.24	5.76	0.63	23.54	0.05	1.04	143.7
Mn Ref B	8/14/2015	82.7	0.9	5.85	4.83	0.46	18.36	0.06	0.49	173.3
Mn Ref C	8/14/2015	82.0	1.0	5.81	6.97	0.64	29.71	0.09	1.00	144.0
Mn Ref D	8/14/2015	83.0	0.9	5.41	4.14	0.65	18.71	0.05	0.75	129.9
Mn Ref E	8/14/2015	81.0	1.0	5.14	6.81	0.63	19.74	0.06	0.88	128.5
Mn P11 A	8/14/2015	81.0	1.0	7.14	6.13	0.80	28.81	0.13	3.09	140.5
Mn P11 B	8/14/2015	81.3	1.0	5.05	5.61	0.51	23.77	0.09	2.28	115.1
Mn P11 C	8/14/2015	81.6	1.0	6.24	3.47	0.89	21.99	0.05	0.68	121.3
Mn P11 D	8/14/2015	81.0	0.9	5.28	5.20	0.65	27.18	0.16	1.77	116.5
Mn P11 E	8/14/2015	80.6	1.0	6.46	7.38	0.75	29.47	0.08	3.06	143.6
Mn P17 A	8/14/2015	81.4	1.1	7.10	6.23	0.65	19.26	0.10	1.62	109.5
Mn P17 B	8/14/2015	80.5	0.9	5.94	6.10	0.69	19.72	0.06	1.29	81.7
Mn P17 C	8/14/2015	82.0	0.9	6.30	8.71	0.95	25.91	0.09	2.12	96.8
Mn P17 D	8/14/2015	79.8	0.9	8.59	11.04	1.06	26.41	0.09	4.32	79.5

Mn P17 E	8/14/2015	80.2	1.1	7.02	6.45	0.63	24.56	0.08	1.54	71.9

Appendix I-1: Paleta Sediment Tissue Porewater Summary
Jan-Feb.16_Insitu_Tissue_TM

Notations: Contaminant tissue values that contain a "-" represents range from duplicate extracts
All other tissues values were obtained from a single extraction

					(µg/g-dw)						(µg/Kg-dw)
Sample ID	Sample Collection Date	Mositure content in g-water/g-wet tissue (%)	Average Lipids Content in g-lipid/g-wet tissue(%)	Stdev	**As**	**Cu**	**Ni**	**Zn**	**Cd**	**Pb**	**Total Hg**
T0-Rep	1/26/2016	87.8	1.7	0.4	1.81-1.41	0.88-1.10	0.16	10.8-10.9	0.02-0.03	0.06	32.9-34.8
P01-Open -Rep	2/23/2016	81.1	1.7	0.4	6.96	5.21	0.58	28.52	0.07	0.61	89.8
P01-80µm-Rep	2/23/2016	80.4	1.4	0.0	4.80	2.28	0.36	27.06	0.05	0.52	68.3
P01-500µm-Rep	2/23/2016	81.6	0.9	0.4	4.18	2.59	0.39	21.50	0.06	0.71	65.5
P08-Open -Rep	2/23/2016	78.8	0.6	0.0	3.81	4.49	0.69	21.86	0.06	0.77	66.1
P08-80µm-Rep	2/23/2016	86.5	1.0	0.0	1.99	2.30	0.25	17.71	0.03	0.40	67.4
P08-500µm-Rep	2/23/2016	81.7	0.7	0.0	9.96	4.28	0.40	25.50	0.06	0.94	79.3
P11-Open -Rep	2/23/2016	81.8	0.7	0.3	4.11	3.46	0.66	23.56	0.06	0.99	73.9
P11-80µm-Rep	2/23/2016	78.2	1.2	0.4	7.91	3.42	0.38	24.23	0.06	1.38	60.3
P11-500µm-Rep	2/23/2016	82.5	1.3	0.4	3.24	2.81	0.26	18.93	0.05	0.87	55.9
P17-Open-Rep	2/23/2016	82.7	1.5	0.1	3.9-3.62	3.6-3.73	0.64-0.60	18.14-16.73	0.04	0.82-0.83	37.4-49.4
P17-80µm-Rep	2/23/2016	81.7	0.9	0.4	4.22	2.65	0.29	16.35	0.05	0.75	52.3-50.8
P17-500µm-Rep	2/23/2016	80.4	1.7	0.5	5.57	3.10	0.37	20.50	0.06	0.99	48.6

Appendix I-1: Paleta Sediment Tissue Porewater Summary
Jan 16 Insitu SPMEs-PAH

"0" indicates "Non Detect"	P08-1-OW-33-42 Cow ng/L	P08-1-OW-23-33 Cow ng/L	P08-1-OW-13-23 Cow ng/L	P08-1-OW-0-12 Copw ng/	P08-1-PW-0-5 Cpw ng/L	P08-1-PW-5-10 Cpw ng/L	P08-1-PW-10-16 Cpw ng/L	P08-02-OW-33-42 Cow ng/L	P08-02-OW-23-33 Cow ng/L	P08-02-OW-13-23 Cow ng/L	P08-02-OW-0-12 Copw ng/	P08-02-PW-0-5 Cpw ng/L	P08-02-PW-5-10 Cpw ng/L	P08-02-PW-10-16 Cpw ng/L
naphthalene	224.1	303.2	222.1	285.2	577.2	244.3	153.7	62.8	90.0	401.5	152.3	296.8	275.7	406.7
2-methylnaphthalene	24.5	24.1	23.0	20.0	44.4	27.2	24.4	8.3	11.5	24.3	16.6	37.5	27.6	28.7
1-methylnaphthalene	7.6	7.5	8.7	6.7	10.8	5.1	4.4	0.0	0.4	4.9	5.5	9.0	1.6	3.1
2-ethylnaphthalene	2.4	1.8	1.4	0.9	2.8	1.9	2.2	1.1	1.0	1.3	0.8	1.7	1.6	1.1
1-ethylnaphthalene	0.9	0.6	0.6	0.5	1.0	1.2	1.1	0.5	0.6	0.5	0.6	1.0	1.1	0.8
2.6-dimethylnaphthalene	3.5	2.9	2.1	2.1	3.5	2.6	2.5	0.1	0.6	0.8	1.5	3.2	0.8	1.7
1.3-dimethylnaphthalene	1.5	2.0	1.5	1.3	2.0	1.3	0.3	0.0	0.0	0.0	1.1	1.5	0.0	0.0
2-isopropylnaphthalene	1.1	0.9	1.0	0.8	1.8	1.8	1.4	0.0	0.9	0.9	0.7	1.7	1.6	1.4
acenaphthylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.8-dimethylnaphthalene	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	2.4	0.0	0.0
acenaphthene	0.0	1.6	0.8	0.0	0.9	3.9	0.2	0.0	0.0	2.2	2.8	1.4	0.0	0.0
2.3.5-trimethylnaphthalene	0.6	0.8	0.3	0.3	1.1	0.1	0.0	0.0	0.5	0.6	0.5	1.1	1.2	0.5
fluorene	3.2	5.7	2.5	3.0	9.6	6.4	5.4	2.9	5.5	4.5	3.1	7.3	9.5	5.4
1-methylfluorene	4.9	4.1	1.8	1.9	6.5	3.3	1.2	4.1	3.7	6.2	2.3	9.1	12.6	7.9
phenanthrene	2.1	6.0	1.0	2.6	12.6	3.1	1.8	7.3	12.9	8.3	2.6	5.7	22.3	13.5
anthracene	0.0	1.3	0.6	1.1	3.6	1.6	1.6	0.9	0.6	0.7	1.5	0.3	1.2	0.5
2-methylphenanthrene	0.3	0.4	0.3	0.3	0.8	0.3	0.1	0.6	0.9	0.7	0.3	0.8	2.3	1.3
2-methylanthracene	0.6	0.8	0.6	0.5	1.3	0.8	0.6	1.2	1.4	1.2	0.6	1.3	3.4	2.2
1-methylphenanthrene	0.2	0.4	0.3	0.2	0.8	0.2	0.2	0.4	0.7	0.6	0.2	0.5	2.0	1.2
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	0.9	1.7	1.4	2.5	2.2	1.6	2.1	0.9	1.8	2.1	1.7	2.3	2.6	1.1
pyrene	0.6	1.3	0.9	2.6	4.0	3.1	3.7	0.5	1.4	1.7	2.3	3.5	3.9	1.4
9.10-dimethylanthracene	0.5	0.2	0.5	0.2	0.0	0.1	0.0	0.5	0.4	2.2	0.2	0.2	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.0	0.1	0.1	0.2	0.6	0.5	0.4	0.0	0.1	0.2	0.2	0.3	0.4	0.1
benz(a)anthracene	0.4	0.4	0.4	0.4	0.9	0.8	0.7	0.3	0.4	0.4	0.4	0.8	0.7	0.5
chrysene	0.3	0.4	0.4	0.4	0.8	0.7	0.7	0.3	0.4	0.4	0.4	0.7	0.7	0.4
benzo(b)fluoranthene	0.2	0.2	0.3	0.3	0.6	0.7	0.5	0.1	0.2	0.3	0.3	0.5	0.5	0.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.3	0.2	0.4	0.7	0.7	0.7	0.1	0.2	0.3	0.3	0.5	0.4	0.2
benzo(e)pyrene	0.0	0.1	0.0	0.1	0.2	0.3	0.2	0.0	0.0	0.1	0.1	0.1	0.2	0.0
benzo(a)pyrene	0.0	0.0	0.1	0.2	0.4	0.4	0.4	0.0	0.0	0.1	0.2	0.3	0.3	0.0
perylene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**281**	**372**	**273**	**335**	**691**	**314**	**211**	**93**	**136**	**469**	**199**	**391**	**374**	**480**

"0" indicates "Non Detect"	P11-03-OW-33-42 Cow ng/L	P11-03-OW-23-33 Cow ng/L	P11-03-OW-13-23 Cow ng/L	P11-03-OW-0-12 Copw ng/	P11-03-PW-0-5 Cpw ng/L	P11-03-PW-5-10 Cpw ng/L	P11-03-PW-10-16 Cpw ng/L	P11-02-PW-10-16 Cpw ng/L	P17-1-OW-33-42 Cow ng/L	P17-1-OW-23-33 Cow ng/L	P17-1-OW-13-23 Cow ng/L	P17-1-OW-0-12 Copw ng/	P17-1-PW-0-5 Cpw ng/L	P17-1-PW-5-10 Cpw ng/L	P17-1-PW-10-16 Cpw ng/L	P17-02-O Cow ng/L	P17-02-O Cow ng/L	P17-02-O Cow ng/L	P17-02-O Copw ng/	P17-02-P Cpw ng/L	P17-02-P Cpw ng/L	P17-02-PW-10-16 Cpw ng/L
naphthalene	53.3	49.5	41.3	45.0	156.5	304.6	99.8	72.1	177.1	222.9	131.1	90.5	79.6	108.0	143.6	329.4	161.0	347.1	183.6	353.9	350.6	383.2
2-methylnaphthalene	18.7	16.1	15.5	15.1	36.4	45.8	22.6	29.7	18.5	18.2	17.9	15.9	25.9	25.7	29.7	23.7	17.2	24.7	15.9	42.8	45.5	34.8
1-methylnaphthalene	9.5	4.4	3.8	5.0	15.2	15.7	5.0	9.6	5.0	6.4	5.2	4.5	5.3	5.7	7.5	6.2	5.0	7.2	4.4	13.5	13.4	9.8
2-ethylnaphthalene	1.9	1.5	1.0	1.2	2.3	4.2	2.3	4.9	1.4	1.2	1.3	1.6	2.3	3.0	2.8	1.3	1.4	1.5	1.1	2.8	2.7	3.5
1-ethylnaphthalene	0.7	0.7	0.5	0.4	2.1	4.5	3.6	5.6	0.6	0.6	0.5	0.6	1.5	1.5	1.3	0.6	0.7	0.6	0.5	1.1	1.6	0.8
2.6-dimethylnaphthalene	3.0	2.9	2.2	2.2	5.9	7.9	3.9	5.9	1.8	1.3	2.8	2.5	4.0	3.4	3.4	2.9	2.4	1.8	2.4	7.6	7.1	3.2
1.3-dimethylnaphthalene	3.2	2.0	2.1	3.2	7.3	6.8	2.2	5.7	0.9	0.7	1.9	2.1	2.9	2.3	4.6	0.9	2.8	1.0	1.3	4.7	5.6	1.3
2-isopropylnaphthalene	1.0	1.0	0.9	0.7	2.0	2.1	1.8	2.2	1.0	0.9	1.0	0.8	2.0	1.9	1.8	1.0	1.0	0.9	0.7	2.0	2.0	1.6
acenaphthylene	0.0	0.0	0.0	0.0	2.2	1.4	2.1	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.1	0.7	2.5	2.8	6.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	1.9	2.9	5.7	1.9	8.0	5.7	7.0	10.1	3.0	0.0	0.1	1.9	4.7	1.9	4.5	0.9	4.4	0.6	2.1	0.3	11.9	0.0
2.3.5-trimethylnaphthalene	0.7	0.4	0.6	0.9	1.9	2.0	2.8	6.0	0.1	0.7	0.5	0.1	1.4	0.5	1.2	0.4	0.7	0.5	0.7	0.6	1.7	0.6
fluorene	5.9	4.3	3.2	5.1	7.5	7.5	10.1	12.2	3.9	4.0	5.1	5.7	12.1	5.7	8.1	3.2	4.9	4.7	4.5	6.2	10.3	5.3
1-methylfluorene	1.6	3.3	3.3	6.2	10.7	11.5	12.6	22.0	2.1	6.4	1.5	2.2	11.9	2.7	5.8	2.7	3.0	5.6	3.7	6.6	5.5	9.0
phenanthrene	2.2	6.8	1.2	5.2	4.6	5.1	9.3	9.1	3.6	5.7	4.4	10.2	9.6	2.9	8.4	2.2	3.1	6.6	4.8	4.4	7.8	4.8
anthracene	0.0	0.2	0.3	1.0	2.9	1.8	1.7	5.1	0.2	0.5	0.9	2.1	1.1	0.3	0.9	0.0	0.1	0.4	0.2	0.0	0.7	0.1
2-methylphenanthrene	0.3	0.3	0.4	0.6	0.8	1.9	2.0	1.8	0.2	0.7	0.4	1.1	0.8	0.5	0.7	0.4	0.4	0.7	0.5	0.5	0.7	0.7
2-methylanthracene	0.8	0.7	0.8	0.9	1.6	2.1	2.2	6.5	0.6	1.0	0.7	1.7	2.7	1.3	1.5	0.8	0.7	1.2	1.0	2.4	2.2	1.4
1-methylphenanthrene	0.2	0.2	0.3	0.8	2.6	5.4	6.4	7.8	0.1	0.3	0.2	0.9	0.7	0.4	0.7	0.2	0.3	0.6	0.4	0.5	0.5	0.7
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	1.7	1.4	1.6	3.7	24.7	41.1	72.9	101.4	0.8	2.4	3.5	5.0	4.7	3.5	3.4	1.5	2.5	2.8	2.6	3.0	3.3	1.4
pyrene	1.4	1.6	1.6	11.3	113.1	170.3	269.2	255.4	0.6	2.0	3.4	5.3	8.8	9.3	13.8	1.3	2.1	2.3	3.6	12.4	10.0	11.4
9.10-dimethylanthracene	0.8	0.1	0.1	1.9	0.0	0.1	0.7	0.0	0.8	0.0	0.5	0.4	0.0	0.4	1.3	0.5	0.1	0.6	0.6	0.6	0.0	1.1
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.1	0.2	0.1	0.6	4.7	5.8	7.9	6.9	0.0	0.1	0.1	0.3	0.4	0.5	0.5	0.1	0.1	0.1	0.1	0.4	0.4	0.5
benz(a)anthracene	0.4	0.3	0.4	0.7	4.0	6.3	7.3	8.1	0.3	0.4	0.4	0.4	0.8	0.8	0.7	0.3	0.4	0.4	0.3	0.8	0.7	0.5
chrysene	0.4	0.4	0.4	0.9	4.9	6.4	7.8	7.0	0.2	0.4	0.5	0.6	0.8	0.7	0.7	0.3	0.4	0.4	0.4	0.9	0.8	0.6
benzo(b)fluoranthene	0.2	0.2	0.2	0.4	1.7	1.4	2.1	2.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.3	0.3	0.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.2	0.3	0.5	1.8	1.9	2.3	2.3	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.1	0.1	0.1	0.1	0.3	0.3	0.2
benzo(e)pyrene	0.0	0.1	0.1	0.2	0.8	0.8	1.1	1.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(a)pyrene	0.1	0.1	0.0	0.3	1.4	1.2	2.4	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
perylene	0.0	0.0	0.0	0.0	0.3	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**110**	**102**	**88**	**116**	**429**	**674**	**581**	**617**	**223**	**277**	**185**	**157**	**185**	**183**	**248**	**381**	**215**	**413**	**236**	**469**	**486**	**477**

Appendix I-1: Paleta Sediment Tissue Porewater Summary
Feb 16 Insitu SPMEs-PAH

"0" indicates "Non Detect"	P01 33-41cm_ow Cow ng/L	P01 20-30cm_ow Cow ng/L	P01 10-20cm_ow Cow ng/L	P01 0-10cm_ow Cow ng/L	P01 0-5cm Cpw ng/L	P01 5-10cm Cpw ng/L	P01 10-15cm Cpw ng/L	P01 15-20cm Cpw ng/L	P01 20-26cm Cpw ng/L
naphthalene	119.0	99.4	99.2	92.4	157.3	165.7	147.2	156.9	132.8
2-methylnaphthalene	57.6	52.4	54.1	48.4	73.9	78.4	65.8	67.7	63.1
1-methylnaphthalene	26.9	23.3	25.4	22.7	31.8	35.9	28.8	30.7	27.8
2-ethylnaphthalene	12.5	9.9	10.5	9.3	14.8	15.0	12.9	13.4	11.4
1-ethylnaphthalene	0.1	0.1	0.5	0.4	0.0	0.1	0.1	0.0	0.2
2.6-dimethylnaphthalene	14.8	14.3	15.6	14.1	19.5	21.0	17.0	16.9	15.5
1.3-dimethylnaphthalene	16.6	15.7	17.0	14.8	20.5	22.3	18.4	18.7	18.0
2-isopropylnaphthalene	1.0	0.9	0.9	0.8	1.4	1.5	1.3	1.3	1.1
acenaphthylene	28.2	24.1	23.4	21.9	41.3	41.3	36.8	40.4	31.7
1.2-dimethylnaphthalene	5.0	4.4	4.4	4.0	6.5	6.9	5.7	5.9	5.6
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	34.4	28.3	28.2	24.5	45.1	38.0	31.7	39.3	31.9
2.3.5-trimethylnaphthalene	6.0	5.5	5.4	4.9	8.3	8.2	7.1	7.7	6.5
fluorene	38.7	33.7	31.5	30.6	49.5	45.6	40.3	51.7	37.2
1-methylfluorene	3.0	3.9	3.2	3.1	5.2	8.6	3.9	4.8	4.7
phenanthrene	13.5	16.4	15.4	17.8	20.9	25.3	17.4	35.0	13.1
anthracene	6.2	6.0	6.0	6.4	11.1	11.2	9.6	12.2	8.4
2-methylphenanthrene	3.2	2.9	2.7	2.7	4.5	4.6	4.1	4.4	3.5
2-methylanthracene	3.8	3.4	3.3	3.3	4.9	5.1	4.4	4.8	4.0
1-methylphenanthrene	4.7	4.1	3.8	3.7	6.8	6.8	6.0	6.7	5.3
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	4.3	4.4	4.7	5.0	5.1	4.8	4.7	5.8	4.3
pyrene	4.0	4.2	3.9	4.3	5.7	5.3	5.0	7.9	4.9
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.8	0.7	0.7	0.8	1.9	1.8	1.6	1.6	1.5
benz(a)anthracene	1.4	1.3	1.2	1.2	2.2	2.2	2.0	2.3	1.7
chrysene	1.1	1.0	1.0	0.9	1.7	1.6	1.5	1.8	1.2
benzo(b)fluoranthene	0.3	0.3	0.4	0.6	1.5	1.6	1.4	1.3	1.5
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.3	0.3	0.5	1.7	1.6	1.3	1.3	1.4
benzo(e)pyrene	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
benzo(a)pyrene	0.1	0.1	0.2	0.5	1.6	1.3	1.0	0.9	1.1
perylene	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**407.5**	**360.9**	**363.0**	**339.7**	**545.2**	**562.3**	**477.4**	**541.9**	**439.9**

	P08 20-30cm ow Cow ng/L	P08 10-20cm ow Cow ng/L	P08 0-10cm ow Cow ng/L	P08 0-5cm Cpw ng/L	P08 5-10cm Cpw ng/L	P08 10-15cm Cpw ng/L	P08 15-20cm Cpw ng/L	P08 20-28cm Cpw ng/L
naphthalene	83.5	71.2	92.2	146.9	131.7	139.1	119.4	84.4
2-methylnaphthalene	37.0	29.9	39.2	63.6	59.5	62.2	51.7	35.4
1-methylnaphthalene	16.2	12.7	17.8	28.5	25.8	26.3	20.4	14.5
2-ethylnaphthalene	7.0	5.8	7.4	11.5	10.9	11.0	11.0	6.9
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2.6-dimethylnaphthalene	7.8	6.8	8.6	13.9	13.0	12.4	10.6	8.2
1.3-dimethylnaphthalene	9.2	7.3	10.2	16.2	15.1	14.7	12.3	8.6
2-isopropylnaphthalene	0.8	0.7	0.8	1.3	1.3	1.3	1.1	0.8
acenaphthylene	23.5	21.4	26.3	41.4	41.3	41.4	37.0	23.5
1.2-dimethylnaphthalene	3.1	2.8	3.5	5.5	5.2	5.0	4.8	3.2
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	25.3	20.2	27.3	48.1	41.9	41.1	34.4	25.4
2.3.5-trimethylnaphthalene	4.4	3.8	4.3	7.2	7.1	7.0	6.1	4.1
fluorene	31.7	23.2	33.8	55.9	47.7	45.9	38.1	30.8
1-methylfluorene	3.6	2.2	3.4	4.4	4.1	4.5	4.7	2.1
phenanthrene	13.7	7.9	16.0	27.1	17.3	16.2	15.0	11.2
anthracene	6.0	5.0	7.3	10.6	10.0	10.3	9.6	6.1
2-methylphenanthrene	2.6	2.5	2.6	4.4	4.2	4.3	3.8	2.4
2-methylanthracene	2.9	2.6	2.6	4.8	4.6	4.6	4.1	2.6
1-methylphenanthrene	4.0	3.6	3.9	6.6	6.4	6.5	5.8	3.7
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	4.0	3.3	4.4	4.9	4.3	4.5	4.0	2.3
pyrene	4.0	3.4	6.6	7.3	6.0	6.3	5.7	3.1
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.7	1.1	1.4	1.5	1.5	1.3	0.8
benz(a)anthracene	1.3	1.2	1.4	2.0	2.0	2.1	1.9	1.1
chrysene	1.0	0.9	1.2	1.5	1.5	1.6	1.4	0.9
benzo(b)fluoranthene	0.3	0.3	0.8	0.7	0.7	0.8	0.7	0.4
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.2	0.2	0.7	0.6	0.6	0.7	0.6	0.3
benzo(e)pyrene	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.1
benzo(a)pyrene	0.1	0.1	0.4	0.3	0.4	0.5	0.3	0.2
perylene	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**294.5**	**240.1**	**324.3**	**517.2**	**464.7**	**472.4**	**406.4**	**283.2**

	P11 20-30cm ow Cow ng/L	P11 10-20cm ow Cow ng/L	P11 0-10cm ow Cow ng/L	P11 0-5cm Cpw ng/L	P11 6-11cm Cpw ng/L	P11 11-16cm Cpw ng/L	P11 16-21cm Cpw ng/L	P11 21-26cm Cpw ng/L
naphthalene	97.1	78.9	89.2	105.5	137.1	143.4	124.9	157.4
2-methylnaphthalene	40.9	32.1	39.8	43.4	60.5	61.7	53.0	66.4
1-methylnaphthalene	17.4	13.8	17.2	16.8	26.1	27.4	24.0	28.2
2-ethylnaphthalene	7.6	7.9	9.2	9.9	12.3	14.0	10.4	9.9
1-ethylnaphthalene	0.0	0.0	0.3	0.0	0.8	1.2	2.0	2.6
2.6-dimethylnaphthalene	9.4	7.9	9.4	9.6	13.3	15.7	13.4	15.6
1.3-dimethylnaphthalene	11.1	8.9	10.4	11.9	15.0	15.5	14.0	18.1
2-isopropylnaphthalene	0.9	0.7	0.8	1.4	1.4	1.4	1.4	1.7
acenaphthylene	26.4	19.8	24.5	40.6	41.7	42.6	35.8	45.3
1.2-dimethylnaphthalene	3.8	3.1	4.4	5.4	5.6	10.0	9.7	13.4
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	29.5	23.7	26.8	31.9	41.0	40.9	42.5	42.0
2.3.5-trimethylnaphthalene	4.9	4.0	4.7	7.0	7.2	8.0	8.3	10.3
fluorene	40.9	28.7	27.3	36.4	48.9	42.1	46.9	52.1
1-methylfluorene	2.5	3.5	3.1	5.7	4.8	12.9	14.1	11.7
phenanthrene	22.9	13.0	11.4	12.8	21.4	15.8	24.3	27.5
anthracene	6.8	5.2	7.8	9.9	16.2	11.4	13.1	15.0
2-methylphenanthrene	3.0	2.4	3.1	4.8	4.6	4.9	5.0	6.9
2-methylanthracene	3.5	2.8	3.6	5.0	4.9	5.3	4.9	6.4
1-methylphenanthrene	4.5	3.6	5.2	8.1	8.1	9.6	10.8	14.3
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	4.2	5.6	16.7	20.5	21.7	47.7	83.1	97.9
pyrene	5.8	12.0	54.6	74.5	86.5	125.7	183.9	198.5
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.9	0.9	2.6	4.3	5.1	5.9	7.7	8.9
benz(a)anthracene	1.4	1.3	3.0	4.6	4.5	6.5	9.9	12.8
chrysene	1.3	1.1	2.6	4.1	4.0	5.7	8.4	10.7
benzo(b)fluoranthene	0.5	0.4	1.0	1.6	1.9	2.0	2.3	3.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.3	1.1	1.8	1.9	2.0	2.5	3.8
benzo(e)pyrene	0.2	0.1	0.4	0.7	0.8	0.8	1.0	1.3
benzo(a)pyrene	0.0	0.2	0.9	1.3	1.4	1.6	2.3	3.3
perylene	0.3	0.1	0.2	0.4	0.3	0.3	0.4	0.4
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**348.1**	**282.4**	**381.6**	**479.9**	**599.1**	**682.1**	**760.0**	**885.9**

	P17 10-16cm ow Cow ng/L	P17 0-10cm ow Cow ng/L	P17 0-5cm Cpw ng/L	P17 5-10cm Cpw ng/L	P17 11-16cm Cpw ng/L	P17 11-16cm Cpw ng/L	P17 20-30cm Cpw ng/L
naphthalene	136.9	75.4	142.6	138.5	154.7	141.2	83.8
2-methylnaphthalene	58.6	34.6	62.7	59.2	61.9	57.3	35.4
1-methylnaphthalene	25.9	15.5	25.6	25.4	25.7	24.1	15.7
2-ethylnaphthalene	11.4	7.6	12.7	11.7	12.3	9.7	5.5
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.6-dimethylnaphthalene	12.0	8.0	15.3	11.9	13.0	11.3	8.1
1.3-dimethylnaphthalene	13.8	9.8	15.4	14.1	15.1	14.0	8.9
2-isopropylnaphthalene	1.1	0.7	1.3	1.3	1.3	1.2	0.7
acenaphthylene	35.3	20.6	37.5	37.0	37.7	36.3	21.3
1.2-dimethylnaphthalene	4.6	3.2	5.4	5.0	4.7	3.8	3.1
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	39.0	23.7	40.6	37.6	40.7	35.1	25.6
2.3.5-trimethylnaphthalene	6.7	4.3	7.1	6.8	7.1	6.7	3.9
fluorene	35.6	26.1	46.1	38.1	45.0	37.5	32.4
1-methylfluorene	4.3	3.2	4.8	4.2	6.5	4.1	3.1
phenanthrene	13.7	12.5	19.8	13.9	21.1	15.1	19.1
anthracene	8.3	4.9	9.2	9.3	9.8	8.5	7.3
2-methylphenanthrene	4.1	2.8	4.9	4.3	4.6	4.2	2.6
2-methylanthracene	4.7	3.4	6.7	4.9	5.3	4.8	3.5
1-methylphenanthrene	6.1	3.8	6.9	6.4	6.8	6.3	3.8
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	6.2	6.5	7.6	5.5	5.8	5.5	5.0
pyrene	6.1	7.6	12.1	10.2	13.3	9.8	22.0
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	1.0	0.8	1.4	1.3	1.5	1.4	1.7
benz(a)anthracene	1.8	1.2	2.0	1.9	2.0	1.9	1.2
chrysene	1.4	1.1	1.8	1.6	1.7	1.6	1.1
benzo(b)fluoranthene	0.3	0.3	0.4	0.4	0.5	0.4	0.6
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.2	0.4	0.4	0.4	0.3	0.5
benzo(e)pyrene	0.1	0.1	0.2	0.1	0.2	0.1	0.2
benzo(a)pyrene	0.0	0.1	0.0	0.0	0.1	0.0	0.3
perylene	0.2	0.1	0.2	0.3	0.3	0.2	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sum	**439.7**	**278.2**	**490.8**	**451.2**	**499.0**	**442.5**	**316.6**

	Stdev ng/L (P01 33-41cm_ow)	Stdev ng/L (P01 20-30cm_ow)	Stdev ng/L (P01 10-20cm_ow)	Stdev ng/L (P01 0-10cm_ow)	Stdev ng/L (P01 0-5cm)	Stdev ng/L (P01 5-10cm)	Stdev ng/L (P01 10-15cm)	Stdev ng/L (P01 15-20cm)	Stdev ng/L (P01 20-26cm)
naphthalene	21.2	10.4	9.6	4.9	10.9	24.8	12.3	15.7	16.3
2-methylnaphthalene	13.8	5.1	1.4	2.8	3.1	12.2	2.5	4.6	13.9
1-methylnaphthalene	6.8	2.3	0.4	1.0	4.3	6.1	0.2	5.0	4.0
2-ethylnaphthalene	3.1	1.3	0.4	1.5	1.1	2.7	0.8	0.8	3.3
1-ethylnaphthalene	0.0	0.2	0.2	0.3	0.0	0.2	0.2	0.0	0.3
2.6-dimethylnaphthalene	4.6	1.3	0.4	1.4	4.0	5.3	1.0	1.9	4.0
1.3-dimethylnaphthalene	4.7	1.3	0.2	1.8	2.9	4.3	2.4	3.9	4.1
2-isopropylnaphthalene	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.2
acenaphthylene	1.9	2.4	0.5	1.0	0.2	1.9	5.6	1.9	5.9
1.2-dimethylnaphthalene	1.1	0.5	0.2	0.3	0.4	0.8	0.2	0.5	1.3
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	8.5	4.6	4.6	3.6	8.8	5.3	7.2	8.1	12.5
2.3.5-trimethylnaphthalene	1.3	0.6	0.2	0.3	0.4	1.0	0.4	0.7	1.5
fluorene	8.5	3.3	3.4	2.1	8.1	15.8	2.8	14.2	12.2
1-methylfluorene	0.6	0.2	0.9	0.4	1.4	0.8	0.6	1.6	0.6
phenanthrene	2.2	7.1	4.8	5.3	5.8	20.6	5.4	25.5	1.9
anthracene	0.0	0.5	0.4	1.0	0.4	1.8	1.3	2.7	2.6
2-methylphenanthrene	0.4	0.3	0.0	0.6	0.1	0.3	0.7	0.1	0.4
2-methylanthracene	0.6	0.3	0.1	0.9	0.3	0.4	0.7	0.2	0.4
1-methylphenanthrene	0.5	0.5	0.0	0.5	0.1	0.1	1.3	0.1	0.7
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	0.1	0.2	0.4	2.7	0.6	0.1	0.5	0.9	1.1
pyrene	1.1	0.9	0.3	1.9	0.7	0.3	0.9	1.5	1.2
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.1	0.1	0.0	0.2	0.4	0.2	0.0	0.3	0.5
benz(a)anthracene	0.0	0.1	0.0	0.1	0.1	0.0	0.4	0.2	0.1
chrysene	0.1	0.0	0.0	0.1	0.1	0.0	0.3	0.2	0.1
benzo(b)fluoranthene	0.3	0.0	0.1	0.5	0.5	0.2	0.2	0.5	0.7
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.3	0.0	0.1	0.6	0.7	0.2	0.3	0.8	0.7
benzo(e)pyrene	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
benzo(a)pyrene	0.2	0.1	0.1	0.5	0.9	0.3	0.2	0.8	0.9
perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	Stdev ng/L (P08 20-30cm ow)	Stdev ng/L (P08 10-20cm ow)	Stdev ng/L (P08 0-10cm ow)	Stdev ng/L (P08 0-5cm)	Stdev ng/L (P08 5-10cm)	Stdev ng/L (P08 10-15cm)	Stdev ng/L (P08 15-20cm)	Stdev ng/L (P08 20-28cm)
naphthalene	16.7	28.7	12.4	12.5	6.4	6.5	21.2	10.5
2-methylnaphthalene	7.7	12.2	5.0	7.4	0.9	3.8	11.3	5.5
1-methylnaphthalene	3.0	7.0	3.4	3.6	0.8	1.2	6.6	3.9
2-ethylnaphthalene	1.3	1.8	0.8	2.3	0.9	1.2	2.2	0.9
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2.6-dimethylnaphthalene	1.5	3.2	1.1	0.9	1.7	0.5	2.3	1.0
1.3-dimethylnaphthalene	1.7	2.8	1.2	2.3	0.2	0.6	2.6	0.8
2-isopropylnaphthalene	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.1
acenaphthylene	3.9	2.4	1.5	0.5	2.0	1.7	7.1	2.6
1.2-dimethylnaphthalene	0.6	0.7	0.4	0.5	0.3	0.1	1.1	0.2
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	8.5	7.1	9.2	6.7	5.2	2.4	9.3	1.4
2.3.5-trimethylnaphthalene	0.7	0.6	0.4	0.5	0.5	0.2	1.2	0.4
fluorene	13.8	6.6	14.9	12.7	9.5	4.7	9.7	5.2
1-methylfluorene	1.7	0.3	0.5	1.2	0.9	0.2	1.0	0.1
phenanthrene	10.2	2.7	10.4	15.2	4.8	1.5	6.7	3.4
anthracene	1.4	0.3	1.2	1.7	0.8	1.4	2.0	0.5
2-methylphenanthrene	0.4	0.2	0.2	0.3	0.3	0.1	0.8	0.3
2-methylanthracene	0.5	0.2	0.3	0.4	0.4	0.1	0.9	0.3
1-methylphenanthrene	0.6	0.1	0.2	0.2	0.2	0.1	1.1	0.5
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene	1.9	0.9	0.3	0.8	0.8	0.9	0.5	0.4
pyrene	1.8	0.7	0.9	1.4	1.2	1.2	0.5	0.5
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1
benz(a)anthracene	0.2	0.1	0.1	0.1	0.1	0.2	0.3	0.2
chrysene	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.1
benzo(b)fluoranthene	0.1	0.1	0.2	0.3	0.4	0.3	0.1	0.2
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.2
benzo(e)pyrene	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1
benzo(a)pyrene	0.1	0.1	0.1	0.2	0.3	0.3	0.1	0.2
perylene	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	Stdev ng/L (P11 20-30cm ow)	Stdev ng/L (P11 10-20cm ow)	Stdev ng/L (P11 0-10cm ow)	Stdev ng/L (P11 0-5cm)	Stdev ng/L (P11 6-11cm)	Stdev ng/L (P11 11-16cm)	Stdev ng/L (P11 16-21cm)	(P11 21-26cm)
naphthalene	19.7	19.8	17.9	32.5	21.0	19.0	48.6	
2-methylnaphthalene	7.3	3.8	8.5	14.9	6.8	5.0	19.0	
1-methylnaphthalene	1.7	1.9	5.0	7.5	2.6	4.2	8.1	
2-ethylnaphthalene	1.8	1.1	2.8	1.7	0.6	1.6	6.1	
1-ethylnaphthalene	0.0	0.0	0.4	0.0	0.7	0.9	3.5	
2.6-dimethylnaphthalene	2.6	0.5	1.3	2.5	2.1	2.4	5.4	
1.3-dimethylnaphthalene	3.2	0.3	2.5	2.5	2.1	1.1	4.9	
2-isopropylnaphthalene	0.2	0.1	0.1	0.3	0.1	0.1	0.7	
acenaphthylene	6.7	2.7	3.1	4.4	1.4	0.7	12.7	
1.2-dimethylnaphthalene	0.6	0.2	1.5	1.0	1.5	3.7	6.6	
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
acenaphthene	8.8	0.8	3.3	9.2	11.0	3.3	19.9	
2.3.5-trimethylnaphthalene	1.3	0.3	0.6	1.1	0.7	0.9	3.9	
fluorene	20.8	1.4	3.5	5.8	20.1	2.7	27.0	
1-methylfluorene	0.1	0.8	1.1	0.6	1.0	7.6	9.1	
phenanthrene	18.1	3.6	1.3	1.0	16.4	0.3	19.9	
anthracene	2.9	0.6	2.6	0.9	8.1	2.0	1.9	
2-methylphenanthrene	0.8	0.3	0.3	0.8	0.3	0.0	2.2	
2-methylanthracene	0.9	0.5	0.4	0.9	0.3	0.5	2.0	
1-methylphenanthrene	1.1	0.4	1.1	2.3	0.7	0.6	3.7	
9-methylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2-ethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
fluoranthene	2.0	2.7	13.4	19.9	8.1	9.5	39.2	
pyrene	3.1	8.5	42.8	55.5	20.7	20.0	57.7	
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1-methylpyrene	0.4	0.3	1.8	2.2	0.1	0.1	1.3	
benz(a)anthracene	0.4	0.2	2.1	2.8	1.0	0.6	4.0	
chrysene	0.6	0.2	1.7	2.7	0.9	0.3	3.4	
benzo(b)fluoranthene	0.4	0.2	0.9	1.0	0.1	0.4	0.2	
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
benzo(k)fluoranthene	0.2	0.2	0.9	1.4	0.2	0.4	0.3	
benzo(e)pyrene	0.2	0.1	0.4	0.4	0.0	0.1	0.0	
benzo(a)pyrene	0.1	0.1	1.0	1.0	0.2	0.3	0.3	
perylene	0.2	0.0	0.1	0.1	0.0	0.0	0.1	
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

	(P17 10-16cm ow)	Stdev ng/L (P17 0-10cm ow)	Stdev ng/L (P17 0-5cm)	Stdev ng/L (P17 5-10cm)	Stdev ng/L (P17 11-16cm)	Stdev ng/L (P17 11-16cm)	Stdev ng/L (P17 20-30cm)
naphthalene		10.9	13.6	5.7	23.9	22.3	21.3
2-methylnaphthalene		3.9	3.5	3.1	7.8	0.3	10.7
1-methylnaphthalene		1.9	1.6	3.8	2.6	0.0	4.6
2-ethylnaphthalene		1.3	1.4	1.4	0.8	1.3	2.1
1-ethylnaphthalene		0.0	0.0	0.0	0.0	0.0	0.0
2.6-dimethylnaphthalene		1.1	2.3	0.6	1.8	0.7	1.3
1.3-dimethylnaphthalene		1.5	0.8	0.8	2.1	0.8	2.4
2-isopropylnaphthalene		0.1	0.1	0.1	0.2	0.0	0.2
acenaphthylene		2.4	0.7	0.9	6.4	0.3	3.5
1.2-dimethylnaphthalene		0.5	0.3	0.4	0.8	1.1	1.0
1.8-dimethylnaphthalene		0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene		2.4	0.7	1.6	9.7	2.2	8.4
2.3.5-trimethylnaphthalene		0.4	0.1	0.4	0.9	0.2	1.0
fluorene		1.5	3.7	1.2	9.1	6.2	11.4
1-methylfluorene		0.9	0.8	0.4	2.4	0.2	0.5
phenanthrene		0.6	4.9	2.1	6.4	4.2	8.9
anthracene		0.5	1.2	1.9	0.1	0.2	2.0
2-methylphenanthrene		0.3	0.7	0.2	0.8	0.2	0.6
2-methylanthracene		0.5	1.8	0.4	0.9	0.2	0.4
1-methylphenanthrene		0.4	0.5	0.2	1.2	0.1	0.7
9-methylanthracene		0.0	0.0	0.0	0.0	0.0	0.0
2-ethylanthracene		0.0	0.0	0.0	0.0	0.0	0.0
fluoranthene		1.1	3.1	1.8	1.0	0.4	1.3
pyrene		0.2	1.9	1.6	5.3	0.8	18.1
9.10-dimethylanthracene		0.0	0.0	0.0	0.0	0.0	0.0
2-tertbutylanthracene		0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene		0.0	0.1	0.0	0.2	0.0	0.8
benz(a)anthracene		0.1	0.0	0.0	0.3	0.0	0.1
chrysene		0.1	0.2	0.2	0.3	0.0	0.1
benzo(b)fluoranthene		0.0	0.1	0.1	0.2	0.0	0.4
7.12-methylbenz(a)anthracene		0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene		0.0	0.1	0.1	0.2	0.0	0.4
benzo(e)pyrene		0.0	0.0	0.0	0.1	0.0	0.2
benzo(a)pyrene		0.1	0.1	0.0	0.2	0.0	0.4
perylene		0.0	0.0	0.0	0.0	0.0	0.0
indeno(123-cd)pyrene		0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene		0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene		0.0	0.0	0.0	0.0	0.0	0.0

Concentration (µg/kg-wet weight basis)

PAHs	PØ1-Open-Rep A 1	PØ1-Open-Rep A 2	PØ1-Open-Rep A 3	PØ1-80 µm-Rep A 1	PØ1-80 µm-Rep A 2	PØ1-80 µm-Rep A 3	PØ1- 500 µm-Rep A 1	PØ1- 500 µm-Rep A 2	PØ1- 500 µm-Rep A 3	PØ8-Open-Rep A 1	PØ8-Open-Rep A 2	PØ8-Open-Rep A 3	PØ8-80 µm-Rep A 1	PØ8-80 µm-Rep A 2	PØ8-80 µm-Rep A 3	PØ8- 500 µm-Rep A 1	PØ8- 500 µm-Rep A 2	PØ8- 500 µm-Rep A 3
Naphthalene	4.6	2.2	9.2	2.2	2.3	2.3	1.1	1.3	1.1	1.2	0.9	1.7	2.5	1.3	1.8	1.2	1.2	0.8
Fluorene	15.3	15.1	15.0	11.3	18.4	17.9	6.1	5.0	7.0	3.5	2.1	5.0	18.2	9.9	10.6	10.7	4.2	7.9
Acenaphthene	0.8	0.6	1.8	0.7	0.7	0.7	0.3	0.4	0.3	0.5	0.4	0.5	ND	0.5	0.5	0.4	0.4	0.2
Phenanthrene	11.3	9.9	10.2	10.9	12.3	11.9	5.2	6.2	5.2	4.9	4.7	5.8	10.2	9.2	9.8	6.5	6.1	3.3
Anthracene	4.0	10.7	6.4	2.0	1.9	1.8	6.9	11.2	8.3	1.2	4.3	3.2	12.2	12.3	8.9	0.8	0.8	4.0
Fluoranthene	14.0	9.7	11.7	9.6	10.2	9.9	6.4	5.2	5.6	7.5	7.6	10.0	5.9	5.7	6.4	7.3	7.6	5.2
Pyrene	16.5	13.7	15.9	6.9	8.7	8.5	9.0	5.5	9.3	9.4	9.7	13.0	8.0	6.9	8.0	10.0	10.6	8.4
Chrysene	3.3	2.3	2.7	2.9	3.8	3.7	1.9	1.8	1.9	4.3	2.6	3.5	2.0	1.9	2.1	2.5	2.5	1.9
Benz[a]anthracene	6.5	4.5	5.2	5.2	6.4	6.3	4.6	4.2	4.4	4.0	3.7	5.1	3.4	2.9	3.1	4.1	4.5	3.5
Benzo[b]fluoranthene	59.5	40.6	45.7	49.1	57.3	55.8	53.0	46.4	49.8	32.6	33.5	49.4	42.7	39.6	38.5	50.4	62.0	47.8
Benzo[k]fluoranthene	20.7	14.1	16.0	17.3	20.2	19.6	20.6	17.8	18.6	10.3	10.4	15.5	15.8	13.5	13.1	17.7	20.1	16.1
Benzo[a]pyrene	31.2	21.4	24.4	27.2	31.9	31.0	31.4	27.5	28.8	15.6	15.8	23.1	23.5	19.9	19.6	26.6	30.1	23.9
Dibenz[a,h]anthracene	2.6	1.6	2.0	2.0	2.4	2.3	2.6	2.1	2.2	1.1	1.1	1.8	1.6	1.5	1.5	2.1	2.3	1.8
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	8.7	5.7	7.0	7.4	8.9	8.7	8.3	6.8	7.4	4.3	4.4	7.2	5.9	5.3	5.5	7.7	8.8	7.0

PAHs	PØ11-Open-Rep A 1	PØ11-Open-Rep A 2	PØ11-Open-Rep A 3	PØ11-80 µm-Rep A 1	PØ11-80 µm-Rep A 2	PØ11-80 µm-Rep A 3	PØ11-500 µm-Rep A 1	PØ11-500 µm-Rep A 2	PØ11-500 µm-Rep A 3	PØ17-Open-Rep A 1	PØ17-Open-Rep A 2	PØ17-Open-Rep A 3	PØ17-80 µm-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-80 µm-Rep A 3	PØ17-500 µm-Rep A 1	PØ17-500 µm-Rep A 2	PØ17-500 µm-Rep A 3	TØ-Rep A 1	TØ-Rep A 2	TØ-Rep A 3
Naphthalene	0.5	3.1	0.5	1.9	2.3	3.4	4.8	3.5	3.4	1.3	0.7	0.7	0.8	1.0	0.6	1.7	0.9	2.0	1.3	0.3	0.8
Fluorene	3.8	0.1	11.3	9.1	12.7	7.3	11.9	15.5	11.2	2.3	2.9	2.6	3.3	4.3	4.0	90.1	82.1	71.3	3.8	1.4	4.6
Acenaphthene	0.3	7.6	0.6	0.1	0.1	0.0	6.3	0.1	0.3	0.3	0.3	0.4	0.2	0.3	0.2	6.0	5.8	0.4	2.7	0.2	0.2
Phenanthrene	4.0	0.3	4.3	4.9	3.8	3.7	2.3	3.3	3.8	10.3	10.9	12.4	5.8	6.2	5.3	7.5	6.9	7.5	2.9	1.3	3.2
Anthracene	2.4	ND	3.6	14.7	20.2	25.2	10.7	45.2	15.1	25.9	9.5	3.5	1.6	1.5	1.2	2.5	2.0	1.8	2.0	3.7	1.8
Fluoranthene	29.9	26.2	27.4	8.0	7.5	8.7	27.1	25.9	27.4	19.6	19.7	22.1	12.5	14.5	12.1	14.2	14.9	13.9	1.4	1.0	1.3
Pyrene	149.6	113.6	139.7	17.6	18.4	17.5	71.0	107.0	134.4	27.9	30.6	33.8	22.9	26.4	22.7	24.0	25.6	23.5	1.4	0.5	1.3
Chrysene	12.5	10.3	10.6	23.0	25.0	22.9	48.4	10.2	13.1	3.2	3.4	4.0	2.4	2.9	2.6	3.0	3.1	2.5	0.2	0.1	0.4
Benz[a]anthracene	21.5	18.4	18.4	33.5	35.8	33.1	13.8	17.2	21.7	4.1	4.4	5.1	3.3	3.8	3.2	3.4	3.8	3.3	0.2	0.1	0.3
Benzo[b]fluoranthene	90.9	77.2	55.7	97.6	93.7	86.3	92.8	72.3	92.1	15.2	15.9	18.4	12.5	14.6	12.0	14.4	16.9	12.9	0.4	0.1	0.4
Benzo[k]fluoranthene	24.9	21.4	19.6	29.8	32.0	3.0	26.3	20.5	26.1	4.2	4.3	5.0	3.4	4.0	3.3	3.9	4.6	3.5	0.2	0.1	0.1
Benzo[a]pyrene	46.3	39.2	35.9	55.4	60.7	55.0	49.1	38.2	48.8	6.9	7.2	8.3	5.4	6.3	5.2	6.4	7.4	6.0	0.3	0.1	0.2
Dibenz[a,h]anthracene	1.9	1.5	2.3	1.7	2.2	1.5	2.1	1.4	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	8.3	7.1	8.9	11.1	10.7	9.6	8.5	6.1	8.7	3.1	3.1	3.7	3.2	3.8	3.0	3.0	3.6	2.7	0.2	0.1	0.2

Average Concentration (µg/kg-tissue wet weight basis)

PAHs	T0-Rep	P01-Open -Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open -Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open -Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Naphthalene	0.82	5.34	2.24	1.16	1.27	1.88	1.05	1.35	2.55	3.92	0.90	0.78	1.50
Fluorene	3.25	15.16	15.89	6.02	3.53	12.89	7.60	5.10	9.70	12.86	2.61	3.86	81.18
Acenaphthene	1.05	1.06	0.67	0.35	0.45	0.51	0.36	2.80	0.07	2.20	0.31	0.23	4.07
Phenanthrene	2.45	10.46	11.70	5.54	5.12	9.72	5.30	2.86	4.13	3.13	11.21	5.78	7.31
Anthracene	2.48	7.04	1.88	8.80	2.93	11.13	1.87	2.99	20.04	23.66	12.95	1.46	2.11
Fluoranthene	1.25	11.78	9.92	5.72	8.36	6.00	6.73	27.82	8.09	26.80	20.47	13.01	14.33
Pyrene	1.05	15.37	8.02	7.95	10.69	7.63	9.65	134.31	17.81	104.17	30.78	24.02	24.39
Chrysene	0.23	2.77	3.46	1.86	3.50	2.00	2.29	11.13	23.63	23.88	3.54	2.63	2.87
Benz[a]anthracene	0.17	5.38	5.98	4.41	4.28	3.15	4.04	19.43	34.13	17.56	4.53	3.44	3.51
Benzo[b]fluoranthene	0.32	48.61	54.04	49.73	38.48	40.25	53.37	74.57	92.52	85.70	16.50	13.06	14.75
Benzo[k]fluoranthene	0.13	16.95	19.03	19.01	12.05	14.13	17.96	21.98	21.62	24.30	4.51	3.59	4.02
Benzo[a]pyrene	0.18	25.67	30.03	29.24	18.18	21.00	26.89	40.45	57.04	45.38	7.49	5.64	6.61
Dibenz[a,h]anthracene	ND	2.06	2.23	2.29	1.34	1.51	2.08	1.86	1.80	1.84	ND	ND	ND
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.17	7.14	8.34	7.51	5.31	5.58	7.83	8.11	10.48	7.77	3.31	3.33	3.08

% Average fraction (g-lipid or water /g-tissue wet weight basis)

	T0-Rep	P01-Open -Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open -Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open -Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Tissue Lipid Fraction	0.733	1.745	1.370	0.942	0.618	0.966	0.654	0.713	1.212	1.265	1.458	0.856	1.681
Tissue Water content	87.755	81.132	80.357	81.633	78.846	86.538	81.667	81.818	78.182	82.456	82.692	81.667	80.357

Average Concentration (µg/kg-lipids)

PAHs	T0-Rep	P01-Open -Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open -Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open -Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Naphthalene	111	306	164	123	206	194	161	189	211	310	62	91	89
Fluorene	443	869	1160	640	571	1334	1162	715	800	1017	179	451	4829
Acenaphthene	144	61	49	37	72	53	55	393	6	174	21	27	242
Phenanthrene	334	600	854	589	829	1006	811	400	341	247	769	676	435
Anthracene	338	403	137	935	475	1152	286	419	1653	1870	889	171	126
Fluoranthene	171	675	724	608	1354	621	1030	3902	667	2118	1405	1521	852
Pyrene	144	881	585	844	1730	789	1475	18833	1469	8233	2112	2807	1451
Chrysene	31	159	253	198	566	207	351	1561	1949	1887	243	307	171
Benz[a]anthracene	23	308	436	468	694	326	618	2725	2816	1388	311	402	209
Benzo[b]fluoranthene	43	2786	3945	5282	6231	4166	8163	10456	7633	6773	1132	1527	878
Benzo[k]fluoranthene	18	971	1389	2019	1951	1463	2746	3082	1784	1921	309	419	239
Benzo[a]pyrene	24	1471	2192	3106	2944	2173	4113	5671	4706	3587	514	659	393
Dibenz[a,h]anthracene	ND	118	163	243	216	157	318	261	148	145	ND	ND	ND
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	23	409	609	797	859	578	1197	1137	865	614	227	389	183

Appendix I-1: Paleta Sediment Tissue Porewater Summary
Feb 16 Insitu Tissue PCB

Concentration (µg/kg-wet weight basis)

15	27	24	32	16	34	29	26	25	31	28	20	22	45
.047	ND	ND	0.144	0.126	0.016	0.029	0.031	0.066	0.233	0.489	0.229	0.051	0.082
.065	ND	ND	0.184	0.153	0.024	0.024	0.049	0.076	0.309	0.621	0.299	0.089	0.096
.040	ND	ND	0.111	0.089	0.068	0.027	0.032	0.036	0.183	0.398	0.191	0.050	0.061
.038	ND	ND	0.099	0.076	0.056	0.013	0.022	0.043	0.135	0.305	0.141	0.053	0.036
.062	ND	ND	0.194	0.138	0.029	0.123	0.035	0.098	0.275	0.601	0.302	0.081	0.059
.032	ND	ND	0.086	0.068	0.026	0.037	0.020	0.039	0.130	0.288	0.131	0.040	0.036
.033	ND	ND	0.107	0.080	0.021	0.026	0.029	0.038	0.157	0.374	0.196	0.054	0.051
.027	ND	ND	0.081	0.062	0.012	0.025	0.021	0.026	0.125	0.311	0.129	0.035	0.043
.037	ND	ND	0.104	0.078	0.091	0.019	0.028	0.036	0.149	0.370	0.172	0.051	0.064
.024	0.000	0.010	0.060	0.052	ND	ND	0.028	0.024	0.102	0.178	0.075	0.027	0.030
.019	0.000	0.011	0.048	0.038	ND	ND	0.028	0.023	0.088	0.143	0.063	0.019	0.023
.046	0.000	0.020	0.129	0.103	ND	ND	0.067	0.059	0.195	0.385	0.157	0.052	0.056
.023	0.000	0.006	0.058	0.045	ND	ND	0.031	0.029	0.116	0.194	0.098	0.032	0.038
.022	0.000	0.010	0.057	0.048	ND	ND	0.038	0.025	0.095	0.182	0.099	0.028	0.036
.036	0.000	0.011	0.086	0.063	ND	ND	0.046	0.030	0.130	0.226	0.144	0.062	0.050
.025	0.000	0.013	0.069	0.054	ND	ND	0.032	0.026	0.088	0.210	0.102	0.031	0.037
.029	0.000	0.016	0.075	0.059	ND	ND	0.031	0.029	0.098	0.224	0.120	0.034	0.045
.018	0.000	0.010	0.050	0.040	ND	ND	0.027	0.017	0.085	0.165	0.090	0.026	0.031

0.660	0.306	1.251	0.071	ND	0.238	2.751	0.358	0.430	0.317	0.215	0.112
0.265	0.402	1.575	0.091	ND	0.299	3.518	0.438	0.509	0.380	0.136	0.153
0.364	0.359	1.489	0.083	ND	0.282	3.332	0.422	0.479	0.350	0.187	0.138
0.348	0.396	1.429	0.081	ND	0.281	3.317	0.361	0.440	0.437	0.262	0.183
0.225	0.213	1.006	0.055	ND	0.209	2.431	0.272	0.352	0.302	0.093	0.106
0.776	0.430	1.538	0.091	ND	0.317	3.783	0.415	0.503	0.478	0.399	0.193
0.064	0.045	0.179	0.010	ND	0.045	0.482	0.043	0.048	0.064	0.000	0.016
0.093	0.094	0.410	0.022	ND	0.096	1.049	0.094	0.116	0.124	0.031	0.044
0.223	0.066	0.302	0.014	ND	0.068	0.717	0.063	0.084	0.096	0.008	0.044
0.018	0.059	0.090	0.010	ND	0.046	0.507	0.039	0.056	0.069	0.027	0.025
0.016	0.041	0.202	0.010	ND	0.017	0.535	0.046	0.059	0.071	0.000	0.019
0.030	0.054	0.095	0.010	ND	0.050	0.511	0.040	0.053	0.070	0.030	0.025
0.189	0.062	0.274	0.014	ND	0.060	0.755	0.058	0.090	0.114	0.000	0.028
0.213	0.092	0.353	0.019	ND	0.082	0.997	0.076	0.103	0.134	0.000	0.040
0.224	0.095	0.307	0.015	ND	0.064	0.774	0.064	0.080	0.110	0.000	0.029
0.011	0.012	0.012	0.002	ND	0.005	0.052	0.004	0.005	0.009	0.001	0.005
0.005	0.008	0.011	0.002	ND	0.002	0.023	0.003	0.003	0.004	0.000	0.003
0.006	0.011	0.013	0.002	ND	0.003	0.030	0.003	0.004	0.006	0.000	0.003

Average PCB Concentration (µg/kg-wet weight basis)

119	83	87	81	115	136	110	77	82	151	135	144
0.336	0.394	1.409	0.070	ND	0.403	3.945	0.181	0.316	0.635	0.273	0.274
0.369	0.325	0.854	0.042	ND	0.328	2.661	0.132	0.203	0.443	0.273	0.270
0.210	0.228	0.729	0.038	ND	0.282	2.211	0.115	0.175	0.485	0.182	0.188
0.154	0.153	0.207	0.022	ND	0.189	1.409	0.077	0.115	0.317	0.109	0.098
0.396	0.217	0.179	0.019	ND	0.171	1.391	0.074	0.107	0.300	0.115	0.097
0.200	0.154	0.206	0.024	ND	0.169	1.449	0.082	0.124	0.281	0.092	0.087
0.315	0.279	0.610	0.063	ND	0.238	2.749	0.278	0.380	0.332	0.121	0.108
0.429	0.356	1.438	0.082	ND	0.273	3.201	0.406	0.473	0.349	0.180	0.135
0.449	0.346	1.324	0.076	ND	0.269	3.177	0.349	0.432	0.405	0.251	0.160
0.127	0.068	0.297	0.015	ND	0.070	0.749	0.067	0.083	0.095	0.013	0.035
0.021	0.051	0.129	0.010	ND	0.038	0.518	0.041	0.056	0.070	0.019	0.023
0.209	0.083	0.311	0.016	ND	0.069	0.842	0.066	0.091	0.119	0.000	0.032
0.007	0.010	0.012	0.002	ND	0.003	0.035	0.003	0.004	0.006	0.000	0.004

Average PCB Concentration (µg/kg-Lipids)

119	83	87	81	115	136	110	77	82	151	135	144
19.245	22.564	80.750	4.035	ND	23.067	226.051	10.348	18.118	36.409	15.633	15.723
26.950	23.737	62.304	3.090	ND	23.939	194.214	9.641	14.821	32.323	19.936	19.697
22.273	24.208	77.449	4.064	ND	29.994	234.764	12.191	18.567	51.538	19.311	19.983
24.991	24.830	33.544	3.540	ND	30.541	228.177	12.399	18.596	51.351	17.639	15.812
40.969	22.418	18.548	1.947	ND	17.664	143.963	7.643	11.080	31.044	11.884	10.087
30.524	23.549	31.542	3.690	ND	25.896	221.562	12.475	18.942	42.948	14.091	13.344
44.118	39.145	85.493	8.769	ND	33.344	385.400	38.978	53.271	46.603	16.931	15.138
35.420	29.333	118.651	6.742	ND	22.526	264.061	33.510	38.985	28.766	14.825	11.107
35.522	27.360	104.651	5.975	ND	21.241	251.082	27.607	34.140	32.036	19.871	12.677
8.689	4.698	20.377	1.039	ND	4.777	51.401	4.566	5.662	6.505	0.887	2.378
2.506	6.016	15.070	1.152	ND	4.418	60.500	4.845	6.517	8.212	2.226	2.662
12.410	4.937	18.520	0.955	ND	4.096	50.091	3.950	5.420	7.106	0.000	1.927
0.999	1.399	1.650	0.309	ND	0.447	4.753	0.469	0.537	0.876	0.030	0.483

Appendix I-1: Paleta Sediment Tissue Porewater Summary
Feb 16 Insitu Tissue Pest.

Concentration (µg/kg-wet weight basis)

Pesticides	PØ1-Open-Rep A 1	PØ1-Open-Rep A 2	PØ1-Open-Rep A 3	PØ1-80 µm-Rep A 1	PØ1-80 µm-Rep A 2	PØ1-80 µm-Rep A 3	PØ1- 500 µm-Rep A 1	PØ1- 500 µm-Rep A 2	PØ1- 500 µm-Rep A 3	PØ8-Open-Rep A 1	PØ8-Open-Rep A 2	PØ8-Open-Rep A 3	PØ8-80 µm-Rep A 1	PØ8-80 µm-Rep A 2	PØ8-80 µm-Rep A 3	PØ8- 500 µm-Rep A 1	PØ8- 500 µm-Rep A 2	PØ8- 500 µm-Rep A 3
Transchlordane	0.4	0.5	0.3	0.3	0.5	0.2	0.2	0.2	0.2	0.3	0.3	0.8	0.4	0.4	0.5	0.3	0.4	0.3
Cischlordane	0.4	0.5	0.3	0.2	0.5	0.2	0.2	0.2	0.2	0.3	0.3	0.9	0.3	0.3	0.5	0.4	0.4	0.3

Pesticides	PØ11-Open-Rep A 1	PØ11-Open-Rep A 2	PØ11-Open-Rep A 3	PØ11-80 µm-Rep A 1	PØ11-80 µm-Rep A 2	PØ11-80 µm-Rep A 3	PØ11-500 µm-Rep A 1	PØ11-500 µm-Rep A 2	PØ11-500 µm-Rep A 3	PØ17-Open-Rep A 1	PØ17-Open-Rep A 2	PØ17-Open-Rep A 3	PØ17-80 µm-Rep A 1	PØ17-80 µm-Rep A 2	PØ17-80 µm-Rep A 3	PØ17-500 µm-Rep A 1	PØ17-500 µm-Rep A 2	PØ17-500 µm-Rep A 3	TØ-Rep A 1	TØ-Rep A 2	TØ-Rep A 3
Transchlordane	2.7	2.4	1.5	1.9	2.5	2.3	2.0	1.5	2.2	1.7	2.8	1.7	1.5	1.5	1.7	1.6	2.2	1.4	0.035	0.014	0.020
Cischlordane	1.6	1.5	1.0	1.2	1.5	1.4	1.3	1.0	1.5	2.0	3.3	1.9	1.7	1.7	1.9	1.8	2.4	1.7	0.028	0.010	0.019

Average Concentration (µg/kg-tissue wet weight basis)

Pesticides	T0-Rep	P01-Open-Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open-Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open-Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Transchlordane	0.02	0.39	0.35	0.22	0.47	0.44	0.37	2.21	2.25	1.88	2.08	1.60	1.74
Cischlordane	0.02	0.41	0.33	0.21	0.50	0.38	0.36	1.38	1.39	1.27	2.41	1.78	1.96

% Average fraction (g-lipid or water /g-tissue wet weight basis)

	T0-Rep	P01-Open-Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open-Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open-Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Tissue Lipid Fraction	0.733	1.745	1.370	0.942	0.618	0.966	0.654	0.713	1.212	1.265	1.458	0.856	1.681
Tissue Water content	87.755	81.132	80.357	81.633	78.846	86.538	81.667	81.818	78.182	82.456	82.692	81.667	80.357

Average Concentration (µg/kg-lipids)

Pesticides	T0-Rep	P01-Open-Rep	P01-80µm-Rep	P01-500µm-Rep	P08-Open-Rep	P08-80µm-Rep	P08-500µm-Rep	P11-Open-Rep	P11-80µm-Rep	P11-500µm-Rep	P17-Open-Rep	P17-80µm-Rep	P17-500µm-Rep
Transchlordane	3.13	22.23	25.55	23.12	75.49	45.57	56.67	310.22	185.58	148.63	142.85	186.69	103.64
Cischlordane	2.60	23.46	23.88	22.59	80.29	39.40	55.39	193.01	114.97	100.45	165.51	207.79	116.46

[illegible]

Notations:

All pesticide analysis was done by Weck Laboratory
†Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
"ND" represents non-detects as reported by Weck Lab
"U" represents the potential presence of analyte but could not quantified using HPLC
E is Estimated value, exceeds the upper limit of calibration
B is Found in associated blank as well as sample
J is Estimated value, below quantitation limit.
NR is not resolved -qualifier not meeting criteria

Sl. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	Dry Sediment Mass (g)	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	4,4'-DDE	gamma-Chlordane	Allethrin	[illegible]
1	P01	P01-Sed. trap material	2/23/2016	3/30/2016	971.7	65.9	2.39	0.02	0.16	0.01	ND	ND	ND	[illegible]
2	P08	P08-Sed. trap material	2/23/2016	3/30/2016	639.2	60.4	2.38	0.16	0.15	0.02	2.1	ND	ND	[illegible]
3	P11	P11-Sed. trap material	2/23/2016	3/30/2016	528.3	61.8	3.14	0.17	0.19	0.02	ND	ND	ND	[illegible]
4	P17	P17-Sed. trap material	2/23/2016	3/30/2016	1295.7	48.6	4.45	0.26	0.41	0.02	ND	2.1	ND	[illegible]

µg/kg-dry sediment

Sl. No.	PCB 001	PCB 002	PCB 003	PCB 004	PCB 010	PCB 009	PCB 007	PCB 006	PCB 008	PCB 005	PCB 019	PCB 018	PCB 017	PCB 015	PCB 027	PCB 024
1	0.02 J	0.05	0.04 J	0.02 J	0.01 J	0.01 NR	0.00 NR	0.02 NR	0.12 NR	0.09	0.00 ND	0.26 NR	0.06 NR	0.27	0.02 NR	0.02 NR
2	0.03 J	0.04	0.03 J	0.04 NR	0.02 J	0.01 NR	0.01 NR	0.03 NR	0.17 NR	0.12	0.00 ND	0.43	0.09 NR	0.31	0.09 NR	0.09 NR
3	0.02 J	0.04	0.03	0.04 NR	0.02 J	0.01 NR	0.01 NR	0.02 NR	0.16 NR	0.11	0.00 ND	0.52	0.22	0.43	0.04 NR	0.05 NR
4	0.02 J	0.07	0.06	0.09	0.04 J	0.01 NR	0.01 NR	0.06 NR	0.34 NR	0.23	0.00 ND	0.74	0.33	0.75	0.04 NR	0.04 NR

Sl. No.	PCB 032	PCB 016	PCB 034	PCB 029	PCB 026	PCB 025	PCB 031	PCB 028	PCB 020	PCB 022	PCB 045	PCB 046	PCB 069	PCB 052	PCB 047	PCB 048
1	0.06	0.08 NR	0.00 ND	0.00 ND	0.06 NR	0.00 ND	0.28	0.37	0.29	0.12	0.04	0.00 ND	0.00 ND	1.00	0.88	0.00 ND
2	0.12	0.12 NR	0.00 ND	0.00 ND	0.07 NR	0.00 ND	0.45	0.48	0.27	0.09	0.06	0.00 ND	0.00 ND	1.49	0.98	0.00 ND
3	0.12	0.14 NR	0.00 ND	0.00 ND	0.19	0.00 ND	0.80	0.78	0.40	0.19	0.11	0.00 ND	0.00 ND	2.04	1.45	0.00 ND
4	0.21	0.24	0.00 ND	0.00 ND	0.26	0.00 ND	1.42	1.22	0.76	0.43	0.25	0.00 ND	0.00 ND	2.10	0.80	0.00 ND

Sl. No.	PCB 044	PCB 042	PCB 037	PCB 071	PCB 041	PCB 103	PCB 040	PCB 067	PCB 074	PCB 070	PCB 066	PCB 095	PCB 093	PCB 056	PCB 060	PCB 092
1	0.43	0.23	0.00 ND	0.27	0.80 NR	0.00 ND	0.09	0.00 ND	0.00 ND	0.34	1.47	0.92	0.92	0.33 NR	0.33 NR	0.62
2	0.69	0.31	0.00 ND	0.33	0.94 NR	0.00 ND	0.13	0.00 ND	0.00 ND	0.51	1.65	1.32	1.32	0.50 NR	0.50 NR	0.86
3	1.10	0.41	0.00 ND	0.46	1.25 NR	0.00 ND	0.20	0.00 ND	0.00 ND	0.91	2.59	1.90	1.90	0.91 NR	0.91 NR	1.13
4	1.55	0.53	0.00 ND	0.54	1.28 NR	0.00 ND	0.28	0.00 ND	0.00 ND	0.99	2.01	2.18	2.17	0.97	0.97	1.14

Sl. No.	PCB 084	PCB 101	PCB 099	PCB 119	PCB 083	PCB 087	PCB 081	PCB 115	PCB 136	PCB 110	PCB 077	PCB 082	PCB 151	PCB 135	PCB 144
1	0.40	4.26	3.36	0.23 NR	0.27 NR	1.43 NR	0.08	0.71	0.51	3.59	0.34 NR	0.31	1.23	0.44	0.44
2	0.68	5.43 E	4.04	0.26 NR	0.24 NR	2.24 NR	0.14	1.11	0.61	5.20 E	0.41	0.35	1.32	0.48	0.48
3	0.92	6.60 E	4.59	0.35 NR	0.92 NR	3.12 NR	0.17	1.55	0.83	7.00 E	0.62	0.65	1.78	0.63	0.63
4	1.15	5.85 E	2.97	0.17 NR	0.39 NR	4.09 NR	0.21	2.03	0.89	8.79 E	0.84	0.99	1.62	0.65	0.65

Particle Size Measurement

Sl. No.	Paletta Creek Site Location	Particle class	Fraction mass average (%)	Stdev
1	P01	Clay (<2um)	15.2	3.2
		Fine silt (2-20)	71.8	1.6
		Course silt (20-63)	6.1	2.1
		Sand (>63)	6.9	2.3
2	P08	Clay (<2um)	18.2	1.7
		Fine silt (2-20)	63.7	1.5
		Course silt (20-63)	8.5	1.6
		Sand (>63)	9.7	1.8
3	P11	Clay (<2um)	12.4	0.4
		Fine silt (2-20)	70.8	2.0
		Course silt (20-63)	6.7	1.5
		Sand (>63)	10.2	0.1
4	P17	Clay (<2um)	12.9	1.2
		Fine silt (2-20)	31.2	4.9
		Course silt (20-63)	9.5	6.1
		Sand (>63)	46.3	2.4

PCB 147	PCB 107	PCB 123	PCB 149	PCB 118	PCB 134	PCB 114	PCB 131	PCB 146	PCB 153	PCB 132	PCB 105
0.31	0.51	0.28	5.01	2.97	0.16	1.82 NR	0.00 ND	1.09	6.48 E	0.84	1.08
0.35	0.60	0.27	5.72	3.76 E	0.20	1.76 NR	0.00 ND	1.21	7.14 E	1.10	1.56
0.37	0.72	0.37 NR	7.23	4.74 E	0.27	2.18 NR	0.00 ND	1.46	8.45 E	1.55	2.19
0.22	0.56	0.29 NR	6.80	3.58	0.22	1.37 NR	0.00 ND	0.97	5.84 E	1.88	2.16

PCB 141	PCB 179	PCB 163	PCB 138	PCB 158	PCB 178	PCB 126	PCB 187	PCB 183	PCB 128	PCB 167	PCB 174
0.55	0.50	2.93	3.40	0.36	0.39	0.13	2.46	0.80	0.00 ND	0.00 ND	1.05
0.76	0.53	2.89	4.09 E	0.46	0.38	0.16	2.61	0.88	0.00 ND	0.00 ND	1.22
1.07	0.65	3.06 E	5.47 E	0.64	0.45	0.17	3.16 E	1.10	0.00 ND	0.00 ND	1.59
1.35	0.45	3.13	4.78 E	0.83	0.29	0.19	1.82	0.86	0.00 ND	0.00 ND	1.52

PCB 177	PCB 171	PCB 156	PCB 157	PCB 153	PCB 172	PCB 197	PCB 180	PCB 193	PCB 191	PCB 169	PCB 170
1.06	0.34	0.55	0.15	0.00 ND	0.20	0.04	3.62	0.21	0.00 ND	0.00 ND	1.85
1.09	0.38	0.69	0.19	0.00 ND	0.26	0.04	4.49 E	0.21	0.00 ND	0.00 ND	2.11
1.28	0.48	0.93	0.23	0.00 ND	0.35	0.05	5.62 E	0.26	0.00 ND	0.00 ND	2.68
0.90	0.80	0.98	0.25	0.00 ND	0.32	0.02 J	4.63 E	0.23	0.00 ND	0.00 ND	2.38

PCB 190	PCB 198	PCB 203	PCB 196	PCB 189	PCB 208	PCB 195	PCB 207	PCB 194	PCB 205	PCB 206	PCB 209	Sum of PCBs
0.34	1.03	0.52	0.52	0.00 ND	0.25	0.31	0.09	1.22	0.00 ND	0.92	1.05	75.92
0.34	1.14	0.61	0.61	0.00 ND	0.33	0.38	0.11	1.35	0.00 ND	1.20	1.27	92.13
0.46	1.39	0.74	0.74	0.00 ND	0.37	0.44	0.12	1.64	0.00 ND	1.40	1.41	119.45
0.35	0.91	0.51	0.52	0.00 ND	0.13	0.34	0.05	1.09	0.00 ND	0.59	0.35	110.90

Notations: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
"ND" represents non-detects

SI. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	Dry Sediment Mass (g)	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	THg (mg/Kg-dry	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P01	P01-Sed. trap material	2/23/2016	3/30/2016	971.7	65.9	2.39	0.02	0.16	0.01	0.60	0.01	13.1	0.1	ND	NA	78.5	5.2	445.9	91.2	306.1	30.5	26.2	1.3
2	P08	P08-Sed. trap material	2/23/2016	3/30/2016	639.2	60.4	2.38	0.16	0.15	0.02	0.63	0.05	12.5	0.3	0.3	0.1	85.7	3.4	406.9	36.6	299.8	12.5	28.2	0.9
3	P11	P11-Sed. trap material	2/23/2016	3/30/2016	528.3	61.8	3.14	0.17	0.19	0.02	0.58	0.04	12.5	0.2	0.5	0.1	104.7	2.8	450.4	46.7	315.7	34.1	29.1	0.6
4	P17	P17-Sed. trap material	2/23/2016	3/30/2016	1295.7	48.6	4.45	0.26	0.41	0.02	0.35	0.18	7.1	0.4	1.2	0.0	126.1	2.5	561.9	7.1	212.4	11.2	23.2	1.2

Particle Size Measurement

SI. No.	Paletta Creek Site Location	Particle class	Fraction mass average (%)	Stdev
1	P01	Clay (<2um)	15.2	3.2
		Fine silt (2-20)	71.8	1.6
		Coarse silt (20-63)	6.1	2.1
		Sand (>63)	6.9	2.3
2	P08	Clay (<2um)	18.2	1.7
		Fine silt (2-20)	63.7	1.5
		Coarse silt (20-63)	8.5	1.6
		Sand (>63)	9.7	1.8
3	P11	Clay (<2um)	12.4	0.4
		Fine silt (2-20)	70.8	2.0
		Coarse silt (20-63)	6.7	1.5
		Sand (>63)	10.2	0.1
4	P17	Clay (<2um)	12.9	1.2
		Fine silt (2-20)	31.2	4.9
		Coarse silt (20-63)	9.5	6.1
		Sand (>63)	46.3	2.4

Appendix I-1: Paleta Sediment Tissue Porewater Summary
PrePost_15-16_Exsitu_Tissue_TM

Notations: Contaminant tissue values that contain a "-" represents range from duplicate extracts
All other tissues values were obtained from a single extraction

Sample ID	Sample Collection Date	Mositure content in g-water/g-wet tissue (%)	Average Lipids Content in g-lipid/g-wet tissue(%)	Stdev	As (µg/g-dw)	Cu	Ni	Zn	Cd	Pb	Total Hg (µg/Kg-dw)
PØ1-Pre A	3/30/2016	81.1	2.3	0.4	4.47	4.44	0.35	27.9	0.08	0.49	100.5
PØ1-Post A	3/30/2016	82.0	1.0	0.7	5.23	3.49	0.49	19.8	0.05	0.71	99.8
PØ8-Pre A	3/30/2016	84.6	1.7	0.0	4.25	3.57	0.44	18.4	0.05	0.83	66.9-73.4
PØ8-Post A	3/30/2016	79.2	0.8	0.4	5.22	3.34	0.36	19.8	0.06	0.72	88.9
PØ8-Pre + A	3/30/2016	80.9	0.5	0.0	4.26-4.35	3.14-3.08	0.42-0.37	16.7	0.03	0.63	62.6
P11-Pre A	3/30/2016	83.0	1.5	0.0	3.81	2.29	0.30	16.1	0.05	1.16	1586.5
P11-Post A	3/30/2016	79.6	1.7	0.2	0.48	2.29	0.31	23.2	0.09	1.17	55.1
P11-Pre + A	3/30/2016	83.3	1.4	0.6	4.63	3.04	0.44	19.8	0.05	1.17	73.4
P17-Pre A	3/30/2016	86.0	0.7	0.4	3.11	2.73	0.28	16.0	0.04	0.97	65.0
P17-Post A	3/30/2016	88.9	0.8	0.3	3.68	2.50	0.37	17.3	0.04	0.95	58.4
P17-Pre + A	3/30/2016	85.4	1.0	0.0	3.58	2.80	0.46	15.6	0.06	1.00	46.2
Control A	3/30/2016	79.6	1.3	0.6	5.14	1.87	0.50	20.7	0.09	0.12	44.3
NBH A	3/30/2016	86.0	0.9	0.0	3.83	4.83	0.60	17.5	0.07	1.04	69.0
Time Ø A	3/30/2016	86	1.3	0.6	2.67	1.30	0.27	13.8	0.06	0.10	59.4

"0" indicates "non detect"	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L
Sample ID	P01-PRE B (3292016)	P01-POST B (3292016)	P01-PRE C (3292016)	P01-POST C (3292016)	P01-PRE D (3292016)	P01-POST D (3292016)	P08-PRE B (3292016)	P08-POST B (3292016)	P08-PRE+ B sed (3292016)	P08-PRE C (3292016)	P08-POST C (3292016)	P08-PRE+ C sed (3292016)
naphthalene	27.9	40.4	36.6	46.2	46.7	7.1	8.3	19.5	4.1	10.7	36.8	44.2
2-methylnaphthalene	16.0	22.1	19.3	24.8	26.3	9.2	11.8	14.9	5.8	10.1	22.4	22.6
1-methylnaphthalene	4.9	6.9	6.8	10.0	11.2	1.3	1.8	7.6	0.0	2.2	6.2	9.3
2-ethylnaphthalene	2.1	2.2	1.4	3.5	3.8	2.2	4.4	6.4	1.1	1.3	3.0	3.0
1-ethylnaphthalene	0.3	0.7	0.0	2.3	2.9	2.6	5.5	11.3	0.0	0.0	0.0	2.1
2.6-dimethylnaphthalene	2.5	3.6	2.9	4.1	5.4	0.8	2.1	2.8	0.8	2.1	4.0	5.0
1.3-dimethylnaphthalene	3.1	3.7	3.5	4.6	6.0	2.0	1.9	2.8	2.0	3.3	4.5	5.2
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	6.2	6.3	6.6	6.4	7.5	4.5	7.1	14.5	0.4	1.1	7.7	5.1
1.2-dimethylnaphthalene	0.4	0.4	0.3	0.7	1.0	5.8	7.4	12.0	0.0	0.9	0.2	0.2
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0
acenaphthene	7.1	14.2	10.5	13.3	19.6	3.9	7.3	16.0	3.2	8.6	12.4	14.5
2.3.5-trimethylnaphthalene	0.1	0.5	0.3	0.5	0.2	1.2	0.0	2.6	0.8	1.9	0.4	0.5
fluorene	6.4	10.2	7.2	11.1	22.5	5.6	6.4	9.2	4.1	9.1	11.3	15.2
1-methylfluorene	0.9	1.4	1.4	1.8	1.0	4.8	5.4	12.6	2.3	5.6	1.3	2.6
phenanthrene	2.8	4.8	3.4	4.2	14.5	11.0	10.9	16.3	5.7	16.6	5.1	10.8
anthracene	2.9	3.0	3.5	3.6	4.6	7.2	8.5	13.3	1.4	3.6	5.0	3.7
2-methylphenanthrene	0.2	0.3	0.2	0.3	0.4	1.3	1.5	3.2	0.9	2.7	0.2	0.3
2-methylanthracene	0.6	0.9	0.8	0.7	1.6	2.8	3.0	5.1	1.9	13.9	0.8	0.8
1-methylphenanthrene	0.4	0.4	0.5	0.5	0.7	3.2	3.2	10.3	1.4	2.4	0.5	0.6
9-methylanthracene	0.7	0.7	0.7	0.7	0.7	1.1	1.3	2.7	0.9	4.0	0.7	1.3
2-ethylanthracene	0.0	0.8	0.9	0.9	0.8	3.8	4.4	5.7	1.2	1.7	0.8	0.8
fluoranthene	0.8	1.9	2.7	3.5	3.7	19.0	9.9	57.4	4.7	11.6	1.6	4.6
pyrene	0.8	2.2	5.7	5.5	5.9	97.6	255.8	348.1	11.4	19.4	2.0	5.0
9.10-dimethylanthracene	0.0	0.3	0.3	0.2	0.0	1.5	0.5	1.4	0.4	0.3	0.0	0.3
2-tertbutylanthracene	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0
1-methylpyrene	1.1	0.8	1.2	0.8	0.8	6.2	11.8	13.2	1.0	1.3	2.0	0.6
benz(a)anthracene	0.4	0.5	0.7	0.8	0.6	4.0	6.9	10.6	0.6	1.0	0.6	0.7
chrysene	0.4	0.5	0.6	0.8	0.7	4.4	5.9	12.0	0.8	1.5	0.5	0.7
benzo(b)fluoranthene	1.0	1.1	1.4	1.1	0.8	2.6	5.3	6.2	0.4	0.6	2.3	0.8
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	1.0	1.1	1.3	1.0	0.8	2.6	5.3	6.1	0.4	0.5	2.6	0.7
benzo(e)pyrene	0.2	0.1	0.4	0.3	0.3	1.1	2.1	2.6	0.1	0.2	0.1	0.2
benzo(a)pyrene	0.9	0.9	1.0	0.8	0.6	1.9	4.0	5.1	0.3	0.4	1.9	0.5
perylene	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.1	0.1	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM PAH ng/L	**92.3**	**133.3**	**122.3**	**155.5**	**191.7**	**222.8**	**410.1**	**654.3**	**58.2**	**138.7**	**137.1**	**162.2**

"0" indicates "non detect"	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L
Sample ID	P08-PRE D (3292016)	P08-POST D (3292016)	P08-PRE+ sed D (3292016)	P11-PRE B (3292016)	P11-POST B (3292016)	P11-PRE+ B (3292016)	P11 PRE C (3292016)	P11 POST C (3292016)	P11 PRE+ C (3292016)	P11 PRE D (3292016)	P11 PRE+ D (3292016)	P11 POST D (3292016)
naphthalene	37.0	37.8	36.6	9.0	7.8	11.5	8.1	11.2	40.2	29.7	39.8	48.5
2-methylnaphthalene	19.9	21.3	20.6	9.4	7.3	11.1	8.6	9.7	22.1	16.6	21.5	23.7
1-methylnaphthalene	7.0	7.3	7.0	2.3	5.3	3.8	1.0	1.7	7.9	5.4	7.3	8.6
2-ethylnaphthalene	2.9	2.9	2.9	1.9	6.4	0.0	2.1	2.6	2.9	1.2	2.7	3.1
1-ethylnaphthalene	0.0	0.0	2.3	0.0	18.0	0.0	0.7	2.1	2.5	0.0	0.0	1.6
2.6-dimethylnaphthalene	3.6	3.6	4.4	2.1	2.7	6.4	0.7	1.5	3.8	2.5	2.5	4.2
1.3-dimethylnaphthalene	4.3	4.2	4.5	2.0	3.3	4.7	1.4	2.1	4.4	3.2	3.8	4.3
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	6.1	5.5	6.6	5.0	16.7	4.7	0.9	0.5	5.4	3.6	6.1	6.2
1.2-dimethylnaphthalene	0.3	0.6	0.7	2.5	8.3	3.4	0.3	0.4	0.4	0.1	0.3	0.4
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	13.4	11.3	16.3	5.4	15.6	10.6	2.9	6.1	13.4	8.3	10.3	11.1
2.3.5-trimethylnaphthalene	0.4	0.6	0.6	1.4	2.2	1.9	1.3	1.6	0.5	0.2	0.3	0.3
fluorene	12.7	9.5	18.0	5.2	6.8	6.5	3.8	5.3	14.8	5.9	7.2	8.5
1-methylfluorene	1.3	2.0	1.8	4.7	13.0	7.7	3.6	4.5	0.7	0.9	1.0	1.0
phenanthrene	5.0	4.2	10.4	12.5	17.1	10.2	9.2	12.4	8.2	2.4	3.4	4.2
anthracene	2.7	3.0	4.9	8.2	14.7	4.4	2.3	3.3	2.7	2.1	3.0	2.6
2-methylphenanthrene	0.2	0.3	0.3	1.3	4.2	1.7	1.3	2.1	0.2	0.2	0.3	0.3
2-methylanthracene	0.7	0.7	1.3	2.5	6.3	3.1	2.7	10.1	0.6	0.6	0.8	0.9
1-methylphenanthrene	0.5	0.6	0.7	3.2	11.7	5.4	1.9	2.3	0.4	0.4	0.5	0.5
9-methylanthracene	1.0	0.7	0.9	2.0	4.0	2.3	1.4	3.3	0.7	0.7	0.7	0.7
2-ethylanthracene	0.8	0.8	1.1	4.8	8.5	1.6	1.4	1.1	0.8	0.8	0.9	0.8
fluoranthene	2.3	2.8	3.9	20.9	109.3	56.0	5.5	11.7	1.2	1.5	3.0	2.2
pyrene	3.6	4.9	6.0	151.3	423.5	137.7	18.5	23.7	1.9	1.7	5.3	4.1
9.10-dimethylanthracene	0.2	0.2	0.2	0.8	0.3	1.0	0.8	0.4	0.2	0.2	0.2	0.5
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
1-methylpyrene	0.7	0.9	0.9	8.0	17.5	6.7	1.4	1.5	0.4	0.6	1.2	1.0
benz(a)anthracene	0.6	0.6	0.7	5.4	20.4	7.3	0.6	0.9	0.5	0.5	0.8	0.6
chrysene	0.6	0.7	0.8	6.6	16.0	6.9	0.8	1.5	0.5	0.5	0.7	0.6
benzo(b)fluoranthene	0.9	0.8	1.0	3.4	8.4	3.0	0.7	0.5	0.4	0.7	1.2	1.3
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(k)fluoranthene	0.8	0.8	0.9	3.5	8.5	2.7	0.6	0.5	0.3	0.6	1.2	1.2
benzo(e)pyrene	0.3	0.2	0.3	1.5	3.4	1.2	0.3	0.2	0.1	0.1	0.4	0.4
benzo(a)pyrene	0.6	0.6	0.6	2.5	6.6	2.3	0.5	0.5	0.4	0.5	0.9	0.8
perylene	0.1	0.1	0.1	0.2	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM PAH ng/L	**130.5**	**129.5**	**157.3**	**289.7**	**796.8**	**326.9**	**85.2**	**125.5**	**138.3**	**91.9**	**127.6**	**144.2**

"0" indicates "non detect"	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L
Sample ID	P17-PRE B (3292016)	P17-POST B (3292016)	P17 PRE+B (3292016)	P17 PRE+ C (3292016)	P17 POST C (3292016)	P17 PRE+C (3292016)	P17 PRE D (3292016)	P17 POST D (3292016)	P17 PRE+D (3292016)	NBH B (3292016)	NBH C (3292016)	NBH D (3292016)
naphthalene	38.1	12.0	10.7	11.9	14.7	18.2	14.3	10.4	12.7	12.4	16.6	7.3
2-methylnaphthalene	21.7	10.1	9.1	13.5	10.4	11.2	11.6	9.8	11.3	9.5	12.6	10.3
1-methylnaphthalene	6.4	2.4	1.3	5.8	2.4	2.0	3.5	2.6	3.4	2.1	3.2	1.6
2-ethylnaphthalene	3.1	3.4	1.7	4.8	1.8	2.3	2.2	2.1	2.5	1.4	1.9	1.2
1-ethylnaphthalene	0.0	4.4	0.0	7.6	0.9	0.7	0.0	1.0	0.9	0.0	0.0	0.0
2.6-dimethylnaphthalene	3.2	0.7	0.4	3.5	1.5	1.6	3.2	2.6	4.5	0.7	1.7	1.5
1.3-dimethylnaphthalene	4.1	2.4	2.3	3.6	2.6	2.9	5.6	4.5	6.2	2.3	2.7	2.6
2-isopropylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthylene	5.8	4.6	2.8	9.5	1.2	0.8	0.8	0.8	1.4	1.2	1.0	1.0
1.2-dimethylnaphthalene	0.3	7.8	2.8	13.3	0.4	0.8	0.9	0.6	0.9	0.6	0.9	0.1
1.8-dimethylnaphthalene	0.0	18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
acenaphthene	12.0	12.0	4.0	13.7	4.7	4.2	16.7	14.8	19.0	2.2	3.3	2.7
2.3.5-trimethylnaphthalene	0.4	1.9	1.1	4.4	1.2	1.1	2.3	1.9	2.3	0.9	1.2	1.2
fluorene	9.2	5.7	4.4	6.0	4.8	5.1	16.8	11.7	16.7	4.2	6.0	4.5
1-methylfluorene	0.9	12.6	5.5	18.7	4.2	3.1	3.9	5.9	1.4	4.6	2.6	4.8
phenanthrene	4.4	9.0	10.3	13.9	12.6	12.5	24.1	18.5	26.0	14.0	12.7	11.3
anthracene	2.6	8.7	4.9	11.1	2.9	4.3	6.4	3.1	5.9	4.2	3.7	3.5
2-methylphenanthrene	0.3	1.6	1.2	2.5	1.6	1.7	3.5	2.8	3.6	2.0	1.8	1.6
2-methylanthracene	1.1	2.5	2.9	3.5	3.2	5.1	5.9	4.4	6.2	3.8	2.8	2.2
1-methylphenanthrene	0.5	5.9	1.8	8.5	2.1	2.1	3.3	2.9	3.4	3.5	2.7	2.7
9-methylanthracene	0.7	2.4	1.5	3.3	1.1	1.0	1.7	1.5	1.2	1.0	0.9	1.0
2-ethylanthracene	0.9	1.5	1.7	4.8	1.6	1.6	1.8	1.6	2.2	2.1	1.9	2.0
fluoranthene	3.3	48.2	12.0	109.5	9.7	8.3	16.7	14.2	15.8	9.0	8.2	8.3
pyrene	4.7	175.8	69.4	285.9	16.9	16.0	18.2	16.9	16.1	49.3	44.4	40.0
9.10-dimethylanthracene	0.3	0.4	0.0	0.8	0.3	0.2	0.6	0.9	0.3	0.3	0.3	1.1
2-tertbutylanthracene	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1
1-methylpyrene	0.9	7.9	4.2	11.8	1.1	1.3	1.1	1.1	0.9	2.7	2.6	2.1
benz(a)anthracene	0.8	8.7	2.3	15.0	0.9	0.8	1.1	1.1	1.1	2.2	2.3	1.8
chrysene	0.7	8.1	2.8	12.5	1.1	1.2	1.8	1.8	1.6	3.3	2.8	2.4
benzo(b)fluoranthene	1.2	3.4	1.9	5.4	0.6	0.5	0.4	0.4	0.4	1.2	1.2	1.1
7.12-methylbenz(a)anthracene	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0
benzo(k)fluoranthene	1.0	3.4	1.7	4.8	0.6	0.5	0.4	0.3	0.3	1.3	1.1	1.0
benzo(e)pyrene	0.3	1.4	0.8	2.2	0.2	0.2	0.2	0.1	0.1	0.6	0.6	0.5
benzo(a)pyrene	0.8	2.8	1.2	4.3	0.4	0.5	0.3	0.4	0.3	0.9	0.8	0.7
perylene	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM PAH ng/L	**129.8**	**390.7**	**166.8**	**616.1**	**107.8**	**111.8**	**169.6**	**141.2**	**168.8**	**143.7**	**144.6**	**122.1**

Appendix F-1. Paleta Sediment Tissue Porewater Summary
PrePost_15-16_Exsitu_SPMEs_PCB

Sample ID as represented extrac	Sediment Description	001 Results Final Conc. ng/L	Qual	002 Results Final Conc. ng/L	Qual	003 Results Final Conc. ng/L	Qual	004 Results Final Conc. ng/L	Qual	010 Results Final Conc. ng/L	Qual	009 Results Final Conc. ng/L	Qual
P01-PreB 032916	P01 Pre storm cores	0.01	ND	0.02	J	0.01	J	0.20		0.02	J	0.00	ND
P01-PreD 032916	P01 Pre storm cores	0.02	J	0.02	J	0.01	J	0.31		0.02	J	0.00	ND
P08-PreB 032916	P08 Pre storm cores	0.04	J	0.03	J	0.02	J	0.11		0.03		0.00	ND
P08-PreC 032916	P08 Pre storm cores	0.02	J	0.01	J	0.01	J	0.12		0.01		0.00	ND
P08-PreD 032916	P08 Pre storm cores	0.11		0.04		0.03		0.22		0.04		0.00	ND
P11-PreB 032916	P11 Pre storm cores	0.00	ND	0.00	ND	0.01	ND	1.02		0.04		0.00	ND
P11-PreC 032916	P11 Pre storm cores	0.01	ND	0.00	ND	0.01	J	1.19		0.03		0.00	ND
P11-PreD 032916	P11 Pre storm cores	0.01	ND	0.00	ND	0.00	ND	3.80		0.04		0.00	ND
P17-PreB 032916	P17 Pre storm cores	0.00	ND	0.00	ND	0.00	ND	0.24		0.02	J	0.00	ND
P17-PreC 032916	P17 Pre storm cores	0.00	ND	0.00	ND	0.00	ND	0.33		0.03	J	0.00	ND
P17-PreD 032916	P17 Pre storm cores	0.00	ND	0.00	ND	0.00	ND	0.54		0.02	J	0.00	ND
P01-PostB 032916	P01 Post storm cores	0.02	J	0.02	J	0.01	J	0.22		0.03		0.00	ND
P01-PostD 032916	P01 Post storm cores	0.01	J	0.02	J	0.02	J	0.15		0.02	J	0.00	ND
P01-PostC 032916	P01 Post storm cores	0.02	J	0.01	J	0.01	J	0.19		0.02		0.00	ND
P08-PostB 032916	P08 Post storm cores	0.02	J	0.03	J	0.02	J	0.20		0.03	J	0.00	ND
P08-PostC 032916	P08 Post storm cores	0.03	J	0.03		0.02		0.16		0.02		0.00	ND
P08-PostD 032916	P08 Post storm cores	0.02	J	0.03		0.02	J	0.25		0.02		0.00	ND
P11-PostB 032916	P11 Post storm cores	0.00	ND	0.00	ND	0.00	ND	0.91		0.07		0.00	ND
P11-PostC 032916	P11 Post storm cores	0.01	ND	0.02	J	0.01	J	7.30		0.14		0.00	ND
P11-PostD 032916	P11 Post storm cores	0.01	ND	0.01	ND	0.00	ND	5.14		0.07		0.00	ND
P17-PostB 032916	P17 Post storm cores	0.00	ND	0.00	ND	0.01	ND	0.48		0.02	J	0.00	ND
P17-PostC 032916	P17 Post storm cores	0.00	ND	0.00	ND	0.01	ND	0.35		0.03	J	0.00	ND
P17-PostD 032916	P17 Post storm cores	0.00	ND	0.00	ND	0.00	ND	0.30		0.02	J	0.00	ND
P08-Pre +Bsed032916	P08 Pre storm cores + traps	0.02	J	0.02	J	0.01	J	0.23		0.03		0.00	ND
P08-Pre+Csed 032916	P08 Pre storm cores + traps	0.02		0.01		0.01		0.19		0.01		0.00	ND
P08-Pre +Dsed032916	P08 Pre storm cores + traps	0.02	J	0.02	J	0.01	J	0.26		0.02		0.00	ND
P11-Pre+B 032916	P11 Pre storm cores + traps	0.01	ND	0.01	ND	0.01	ND	5.30		0.08		0.00	ND
P11-Pre+C 032916	P11 Pre storm cores + traps	0.01	ND	0.01	J	0.01	J	3.79		0.05		0.00	ND
P11-Pre+D 032916	P11 Pre storm cores + traps	0.00	ND	0.00	ND	0.00	ND	0.91		0.03		0.00	ND

Sample ID as represented extrac	007 Results Final Conc. ng/L	Qual	006 Results Final Conc. ng/L	Qual	008 Results Final Conc. ng/L	Qual	005 Results Final Conc. ng/L	Qual	019 Results Final Conc. ng/L	Qual	018 Results Final Conc. ng/L	Qual	017 Results Final Conc. ng/L	Qual	015 Results Final Conc. ng/L	Qual	027 Results Final Conc. ng/L	Qual	024 Results Final Conc. ng/L	Qual	032 Results Final Conc. ng/L	Qual	016 Results Final Conc. ng/L	Qual	034 Results Final Conc. ng/L	Qual	029 Results Final Conc. ng/L	Qual	026 Results Final Conc. ng/L	Qual	025 Results Final Conc. ng/L	Qual	031 Results Final Conc. ng/L	Qual
P01-PreB 032916	0.00	ND	0.01	J	0.02		0.00	ND	0.00	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P01-PreD 032916	0.00	ND	0.01	J	0.03		0.00	ND	0.01	J	0.04		0.02		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.02	
P08-PreB 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.01	J	0.03		0.02		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P08-PreC 032916	0.00	ND	0.00	J	0.02		0.00	ND	0.01	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P08-PreD 032916	0.00	ND	0.02		0.06		0.00	ND	0.01	J	0.04		0.02		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.02		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.02	
P11-PreB 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.03		0.11		0.05		0.04		0.00	ND	0.00	ND	0.00	ND	0.04		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.06	
P11-PreC 032916	0.00	ND	0.02		0.06		0.00	ND	0.03		0.14		0.05		0.04		0.00	ND	0.00	ND	0.00	ND	0.05		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.08	
P11-PreD 032916	0.00	ND	0.02		0.07		0.00	ND	0.02		0.16		0.05		0.05		0.00	ND	0.00	ND	0.00	ND	0.06		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.10	
P17-PreB 032916	0.00	ND	0.01	J	0.03		0.00	ND	0.01	J	0.04		0.02		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.02	
P17-PreC 032916	0.00	ND	0.01	J	0.03		0.00	ND	0.00	J	0.05		0.02		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.03	
P17-PreD 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.01	J	0.05		0.03		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.02		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.04	
P01-PostB 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.03		0.08		0.02		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.02	
P01-PostD 032916	0.00	ND	0.01	J	0.02		0.00	ND	0.00	J	0.02		0.01	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P01-PostC 032916	0.00	ND	0.01	J	0.02		0.00	ND	0.00	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P08-PostB 032916	0.00	ND	0.01	J	0.02		0.00	ND	0.01	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	J
P08-PostC 032916	0.00	ND	0.01	J	0.03		0.00	ND	0.01	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P08-PostD 032916	0.00	ND	0.01	J	0.03		0.00	ND	0.01	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P11-PostB 032916	0.00	ND	0.04		0.08		0.00	ND	0.06		0.25		0.11		0.13		0.00	ND	0.00	ND	0.00	ND	0.10		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.14	
P11-PostC 032916	0.00	ND	0.07		0.19		0.00	ND	0.06		0.42		0.16		0.17		0.00	ND	0.00	ND	0.00	ND	0.16		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.27	
P11-PostD 032916	0.00	ND	0.04		0.11		0.00	ND	0.06		0.27		0.11		0.09		0.00	ND	0.00	ND	0.00	ND	0.09		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.14	
P17-PostB 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.01	J	0.05		0.03		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.03	
P17-PostC 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.01	J	0.05		0.03		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.02		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.03	
P17-PostD 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.01	J	0.05		0.03		0.01	J	0.00	ND	0.00	ND	0.00	ND	0.02		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.03	
P08-Pre +Bsed032916	0.00	ND	0.01	J	0.03		0.00	ND	0.01	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P08-Pre+Csed 032916	0.00	ND	0.01	J	0.02		0.00	ND	0.01	J	0.02		0.01		0.00		0.00	ND	0.00	ND	0.00	ND	0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P08-Pre +Dsed032916	0.00	ND	0.01	J	0.02		0.00	ND	0.00	J	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01	
P11-Pre+B 032916	0.00	ND	0.04		0.13		0.00	ND	0.08		0.28		0.12		0.11		0.00	ND	0.00	ND	0.00	ND	0.10		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.19	
P11-Pre+C 032916	0.00	ND	0.02		0.09		0.00	ND	0.03		0.17		0.07		0.04		0.00	ND	0.00	ND	0.00	ND	0.06		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.11	
P11-Pre+D 032916	0.00	ND	0.01	J	0.04		0.00	ND	0.03		0.08		0.04		0.03		0.00	ND	0.00	ND	0.00	ND	0.03		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.05	

Sample ID as represented extrac	028 Results Final Conc. ng/L	Qual	020 Results Final Conc. ng/L	Qual	022 Results Final Conc. ng/L	Qual	045 Results Final Conc. ng/L	Qual	046 Results Final Conc. ng/L	Qual	069 Results Final Conc. ng/L	Qual	052 Results Final Conc. ng/L	Qual	047 Results Final Conc. ng/L	Qual	048 Results Final Conc. ng/L	Qual	044 Results Final Conc. ng/L	Qual	042 Results Final Conc. ng/L	Qual	037 Results Final Conc. ng/L	Qual	071 Results Final Conc. ng/L	Qual	041 Results Final Conc. ng/L	Qual
P01-PreB 032916	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.02		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02	
P01-PreD 032916	0.02		0.02		0.01	J	0.00	ND	0.00	J	0.00	ND	0.03		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.02	
P08-PreB 032916	0.03		0.02		0.00	J	0.00	ND	0.01	J	0.00	ND	0.04		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01		0.02	
P08-PreC 032916	0.02		0.01		0.01		0.00	ND	0.00	J	0.00	ND	0.02		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.01	
P08-PreD 032916	0.04		0.02		0.01		0.00	ND	0.00	J	0.00	ND	0.05		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.03	
P11-PreB 032916	0.05		0.05		0.02		0.01	J	0.01		0.00	ND	0.14		0.04		0.01		0.00	ND	0.00	ND	0.00	ND	0.03		0.13	
P11-PreC 032916	0.08		0.06		0.04		0.02		0.02		0.00	ND	0.16		0.03		0.02		0.00	ND	0.00	ND	0.00	ND	0.03		0.13	
P11-PreD 032916	0.07		0.08		0.03		0.02		0.02		0.00	ND	0.17		0.04		0.02		0.00	ND	0.00	ND	0.00	ND	0.03		0.14	
P17-PreB 032916	0.03		0.02		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02	
P17-PreC 032916	0.02		0.03		0.02		0.00	ND	0.00	J	0.00	ND	0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01		0.03	
P17-PreD 032916	0.05		0.03		0.02		0.00	ND	0.00	J	0.00	ND	0.04		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.03	
P01-PostB 032916	0.02		0.03		0.00	J	0.00	ND	0.03		0.00	ND	0.31		0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.02		0.07	
P01-PostD 032916	0.02		0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.02		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.02	
P01-PostC 032916	0.02		0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.02		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.02	
P08-PostB 032916	0.01		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.02		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02	
P08-PostC 032916	0.02		0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.02		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.01	
P08-PostD 032916	0.02		0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.01		0.02	
P11-PostB 032916	0.11		0.14		0.04		0.03		0.03		0.00	ND	0.24		0.05		0.04		0.00	ND	0.00	ND	0.00	ND	0.04		0.21	
P11-PostC 032916	0.24		0.20		0.11		0.05		0.04		0.00	ND	0.43		0.09		0.06		0.00	ND	0.00	ND	0.00	ND	0.07		0.35	
P11-PostD 032916	0.15		0.12		0.05		0.03		0.02		0.00	ND	0.30		0.06		0.03		0.00	ND	0.00	ND	0.00	ND	0.04		0.22	
P17-PostB 032916	0.04		0.02		0.01	J	0.00	ND	0.00	J	0.00	ND	0.04		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.03	
P17-PostC 032916	0.03		0.03		0.01		0.00	ND	0.00	J	0.00	ND	0.04		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.03	
P17-PostD 032916	0.04		0.03		0.01		0.00	ND	0.00	J	0.00	ND	0.05		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.01		0.03	
P08-Pre +Bsed032916	0.01		0.01		0.01		0.00	ND	0.00	J	0.00	ND	0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02	
P08-Pre+Csed 032916	0.01		0.01		0.00		0.00	ND	0.00	J	0.00	ND	0.02		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.01	
P08-Pre +Dsed032916	0.02		0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.03		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.02	
P11-Pre+B 032916	0.17		0.15		0.05		0.03		0.02		0.00	ND	0.28		0.05		0.04		0.00	ND	0.00	ND	0.00	ND	0.04		0.25	
P11-Pre+C 032916	0.10		0.09		0.04		0.02		0.02		0.00	ND	0.19		0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.03		0.16	
P11-Pre+D 032916	0.05		0.04		0.01		0.00	J	0.01		0.00	ND	0.12		0.03		0.01		0.00	ND	0.00	ND	0.00	ND	0.02		0.09	

Sample ID as represented extrac	103 Results Final Conc. ng/L	Qual	040 Results Final Conc. ng/L	Qual	067 Results Final Conc. ng/L	Qual	074 Results Final Conc. ng/L	Qual	070 Results Final Conc. ng/L	Qual	066 Results Final Conc. ng/L	Qual	095 Results Final Conc. ng/L	Qual	093 Results Final Conc. ng/L	Qual	056 Results Final Conc. ng/L	Qual	060 Results Final Conc. ng/L	Qual	092 Results Final Conc. ng/L	Qual	084 Results Final Conc. ng/L	Qual	101 Results Final Conc. ng/L	Qual
P01-PreB 032916	0.00		0.00	ND	0.00	ND	0.00	J	0.00		0.01		0.01		0.01		0.00		0.00		0.00	J	0.01		0.03	
P01-PreD 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.01		0.01		0.00		0.02		0.03	
P08-PreB 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.02		0.02		0.01		0.01		0.00		0.02		0.03	
P08-PreC 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.00		0.00		0.00		0.01		0.02	
P08-PreD 032916	0.00		0.00	ND	0.00	ND	0.01		0.01		0.02		0.01		0.02		0.01		0.01		0.00		0.02		0.04	
P11-PreB 032916	0.00		0.02		0.00	ND	0.03		0.07		0.06		0.05		0.05		0.03		0.03		0.01		0.04		0.15	
P11-PreC 032916	0.00		0.02		0.00	ND	0.03		0.07		0.05		0.04		0.05		0.03		0.03		0.01		0.05		0.07	
P11-PreD 032916	0.00		0.03		0.00	ND	0.04		0.09		0.07		0.06		0.05		0.03		0.03		0.01		0.06		0.08	
P17-PreB 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.02		0.01		0.01		0.00	J	0.01		0.02	
P17-PreC 032916	0.00		0.00	ND	0.00	ND	0.01		0.01		0.01		0.03		0.07		0.01		0.01		0.00	J	0.01		0.03	
P17-PreD 032916	0.00		0.00	ND	0.00	ND	0.01		0.01		0.01		0.01		0.02		0.01		0.01		0.00		0.01		0.01	
P01-PostB 032916	0.01		0.01	J	0.00	ND	0.01		0.06		0.03		0.06		0.08		0.01		0.01		0.01		0.07		0.11	
P01-PostD 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.02		0.02		0.00		0.00		0.00		0.01		0.03	
P01-PostC 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.00		0.00		0.00		0.01		0.03	
P08-PostB 032916	0.00		0.00	ND	0.00	ND	0.00	J	0.01		0.01		0.01		0.02		0.00		0.00		0.00	J	0.01		0.05	
P08-PostC 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.00		0.00		0.00		0.01		0.03	
P08-PostD 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.00		0.00		0.00		0.02		0.03	
P11-PostB 032916	0.00		0.04		0.00	ND	0.05		0.12		0.09		0.06		0.06		0.05		0.05		0.01		0.06		0.14	
P11-PostC 032916	0.01		0.07		0.00	ND	0.09		0.23		0.16		0.10		0.11		0.08		0.08		0.03		0.12		0.14	
P11-PostD 032916	0.00		0.04		0.00	ND	0.05		0.14		0.10		0.08		0.08		0.05		0.05		0.02		0.08		0.08	
P17-PostB 032916	0.00		0.00	ND	0.00	ND	0.01		0.01		0.01		0.01		0.01		0.01		0.01		0.00		0.01		0.03	
P17-PostC 032916	0.00		0.00	ND	0.00	ND	0.01		0.01		0.01		0.01		0.01		0.01		0.01		0.00		0.01		0.03	
P17-PostD 032916	0.00		0.00	ND	0.00	ND	0.01		0.02		0.01		0.02		0.01		0.01		0.01		0.00	J	0.01		0.03	
P08-Pre +Bsed032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.01		0.01		0.00		0.01		0.05	
P08-Pre+Csed 032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.00		0.00		0.00		0.01		0.02	
P08-Pre +Dsed032916	0.00		0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.01		0.00		0.00		0.00		0.01		0.03	
P11-Pre+B 032916	0.01		0.04		0.00	ND	0.06		0.14		0.10		0.08		0.07		0.05		0.05		0.02		0.08		0.11	
P11-Pre+C 032916	0.00		0.03		0.00	ND	0.04		0.09		0.07		0.06		0.05		0.04		0.03		0.01		0.05		0.08	
P11-Pre+D 032916	0.01		0.01		0.00	ND	0.02		0.04		0.03		0.03		0.03		0.02		0.02		0.01		0.03		0.05	

Sample ID as represented extrac	099 Results Final Conc. ng/L	Qual	119 Results Final Conc. ng/L	Qual	083 Results Final Conc. ng/L	Qual	087 Results Final Conc. ng/L	Qual	81 Results Final Conc. ng/L	Qual	115 Results Final Conc. ng/L	Qual	136 Results Final Conc. ng/L	Qual	110 Results Final Conc. ng/L	Qual	77 Results Final Conc. ng/L	Qual	082 Results Final Conc. ng/L	Qual	151 Results Final Conc. ng/L	Qual	135 Results Final Conc. ng/L	Qual	144 Results Final Conc. ng/L	Qual
P01-PreB 032916	0.01		0.00	ND	0.00	J	0.00		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P01-PreD 032916	0.02		0.01		0.00		0.01		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P08-PreB 032916	0.02		0.03		0.02		0.01		0.00	J	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P08-PreC 032916	0.01		0.02		0.02		0.00		0.00	J	0.00	ND	0.00		0.01		0.00	J	0.00		0.00		0.00	ND	0.00	ND
P08-PreD 032916	0.02		0.00		0.01		0.01		0.00	ND	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P11-PreB 032916	0.03		0.04		0.08		0.02		0.00	ND	0.00	ND	0.01		0.05		0.01		0.01		0.01		0.00	ND	0.00	ND
P11-PreC 032916	0.03		0.02		0.02		0.03		0.00	J	0.00	ND	0.01		0.06		0.01		0.01		0.01		0.00	ND	0.00	ND
P11-PreD 032916	0.04		0.02		0.09		0.03		0.00	J	0.00	ND	0.01		0.08		0.01		0.02		0.01		0.00	ND	0.00	ND
P17-PreB 032916	0.01		0.01		0.01		0.00		0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P17-PreC 032916	0.01		0.05		0.04		0.01		0.00	J	0.00	ND	0.00	J	0.02		0.00	J	0.01		0.00	J	0.00	ND	0.00	ND
P17-PreD 032916	0.01		0.01		0.02		0.01		0.00	ND	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P01-PostB 032916	0.04		0.02		0.01		0.02		0.00	J	0.00	ND	0.01		0.08		0.00	J	0.01		0.01		0.00	ND	0.00	ND
P01-PostD 032916	0.01		0.02		0.02		0.00		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00		0.00		0.00	ND	0.00	ND
P01-PostC 032916	0.01		0.00		0.00		0.00		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	ND	0.00		0.00	ND	0.00	ND
P08-PostB 032916	0.01		0.00		0.00		0.01		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P08-PostC 032916	0.01		0.02		0.01		0.00		0.00	J	0.00	ND	0.00		0.01		0.00	J	0.00		0.00		0.00	ND	0.00	ND
P08-PostD 032916	0.02		0.00		0.01		0.01		0.00	ND	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P11-PostB 032916	0.04		0.02		0.04		0.04		0.00	J	0.00	ND	0.01		0.08		0.01		0.02		0.01		0.00	ND	0.00	ND
P11-PostC 032916	0.07		0.04		0.04		0.08		0.00		0.00	ND	0.02		0.16		0.02		0.03		0.02		0.00	ND	0.00	ND
P11-PostD 032916	0.05		0.48		0.05		0.04		0.00	J	0.00	ND	0.01		0.10		0.01		0.03		0.01		0.00	ND	0.00	ND
P17-PostB 032916	0.01		0.02		0.01		0.01		0.00	ND	0.00	ND	0.00	J	0.02		0.00	J	0.00	ND	0.00		0.00	ND	0.00	ND
P17-PostC 032916	0.01		0.00	J	0.01		0.01		0.00	ND	0.00	ND	0.00	J	0.02		0.00	J	0.00		0.00	J	0.00	ND	0.00	ND
P17-PostD 032916	0.01		0.01		0.01		0.01		0.00	ND	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00	J	0.00	ND	0.00	ND
P08-Pre +Bsed032916	0.01		0.01		0.00		0.00		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	ND	0.00		0.00	ND	0.00	ND
P08-Pre+Csed 032916	0.01		0.01		0.01		0.00		0.00		0.00	ND	0.00		0.01		0.00		0.00		0.00		0.00	ND	0.00	ND
P08-Pre +Dsed032916	0.01		0.00		0.00		0.00		0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00		0.00	ND	0.00	ND
P11-Pre+B 032916	0.04		0.06		0.09		0.05		0.00	J	0.00	ND	0.01		0.10		0.01		0.02		0.01		0.00	ND	0.00	ND
P11-Pre+C 032916	0.03		0.04		0.08		0.03		0.00	J	0.00	ND	0.01		0.07		0.01		0.02		0.01		0.00	ND	0.00	ND
P11-Pre+D 032916	0.02		0.01		0.01		0.02		0.00	ND	0.00	ND	0.01		0.04		0.00		0.00		0.00		0.00	ND	0.00	ND

Sample ID as represented extrac	147 Results Final Conc. ng/L	Qual	107 Results Final Conc. ng/L	Qual	123 Results Final Conc. ng/L	Qual	149 Results Final Conc. ng/L	Qual	118 Results Final Conc. ng/L	Qual	134 Results Final Conc. ng/L	Qual	114 Results Final Conc. ng/L	Qual	131 Results Final Conc. ng/L	Qual	146 Results Final Conc. ng/L	Qual	153 Results Final Conc. ng/L	Qual	132 Results Final Conc. ng/L	Qual	105 Results Final Conc. ng/L	Qual	141 Results Final Conc. ng/L	Qual
P01-PreB 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	J	0.00	J	0.01		0.00	ND	0.00		0.00	J
P01-PreD 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00		0.00	J
P08-PreB 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00		0.00	J
P08-PreC 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00		0.01		0.00		0.00		0.00	
P08-PreD 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00		0.00	J
P11-PreB 032916	0.00	ND	0.00	ND	0.00	ND	0.02		0.13		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00		0.01		0.00	
P11-PreC 032916	0.00	ND	0.00	ND	0.00	ND	0.02		0.03		0.00	ND	0.00	ND	0.00	ND	0.00		0.01		0.01		0.01		0.00	
P11-PreD 032916	0.00	ND	0.00	ND	0.00	ND	0.02		0.39		0.00	J	0.00	ND	0.00	ND	0.00		0.02		0.01		0.02		0.01	
P17-PreB 032916	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J
P17-PreC 032916	0.00	ND	0.00	ND	0.00	ND	0.00		0.13		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	J	0.00		0.00	J
P17-PreD 032916	0.00	ND	0.00	ND	0.00	ND	0.00		0.25		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	J	0.01		0.00	J
P01-PostB 032916	0.00	ND	0.00	ND	0.00	ND	0.02		0.04		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02		0.00		0.01		0.00	J
P01-PostD 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00		0.00	J
P01-PostC 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00		0.00	J
P08-PostB 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	J	0.00	J	0.01		0.00	ND	0.00	J	0.00	J
P08-PostC 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00		0.00	J
P08-PostD 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00		0.00		0.00	J
P11-PostB 032916	0.00	ND	0.00	ND	0.00	ND	0.03		0.04		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02		0.01		0.02		0.01	
P11-PostC 032916	0.00	ND	0.00	ND	0.00	ND	0.05		0.08		0.00	J	0.00	ND	0.00	ND	0.00		0.04		0.02		0.04		0.01	
P11-PostD 032916	0.00	ND	0.00	ND	0.00	ND	0.03		0.47		0.00	J	0.00	ND	0.00	ND	0.00		0.02		0.01		0.03		0.00	
P17-PostB 032916	0.00	ND	0.00	ND	0.00	ND	0.00		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	J	0.00		0.00	J
P17-PostC 032916	0.00	ND	0.00	ND	0.00	ND	0.00		0.08		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00		0.00	J
P17-PostD 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00		0.00	J
P08-Pre +Bsed032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.00		0.00	J
P08-Pre+Csed 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.01		0.00	ND	0.00	ND	0.00	J	0.00		0.01		0.00		0.00		0.00	
P08-Pre +Dsed032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.21		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00	J	0.01		0.00	J
P11-Pre+B 032916	0.00	ND	0.00	ND	0.00	ND	0.03		0.05		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02		0.01		0.02		0.01	
P11-Pre+C 032916	0.00	ND	0.00	ND	0.00	ND	0.02		0.03		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.02		0.01		0.02		0.00	
P11-Pre+D 032916	0.00	ND	0.00	ND	0.00	ND	0.01		0.02		0.00	ND	0.00	ND	0.00	ND	0.00	J	0.01		0.00		0.01		0.00	

Sample ID as represented extrac	179 Results Final Conc. ng/L	Qual	163 Results Final Conc. ng/L	Qual	138 Results Final Conc. ng/L	Qual	158 Results Final Conc. ng/L	Qual	178 Results Final Conc. ng/L	Qual	126 Results Final Conc. ng/L	Qual	187 Results Final Conc. ng/L	Qual	183 Results Final Conc. ng/L	Qual	128 Results Final Conc. ng/L	Qual	167 Results Final Conc. ng/L	Qual	174 Results Final Conc. ng/L	Qual	177 Results Final Conc. ng/L	Qual
P01-PreB 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00	J	0.00		0.00	ND	0.00	J	0.00	ND	0.00	ND
P01-PreD 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	ND	0.00	ND
P08-PreB 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	ND	0.00	ND
P08-PreC 032916	0.00	ND	0.00		0.01		0.00	J	0.00		0.00	ND	0.00		0.00		0.00	ND	0.00		0.00	J	0.00	J
P08-PreD 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	ND	0.00	ND
P11-PreB 032916	0.00	ND	0.01		0.02		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	J	0.00	J
P11-PreC 032916	0.00	J	0.00		0.02		0.00		0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00		0.00		0.00	J
P11-PreD 032916	0.00	J	0.00		0.02		0.00		0.00		0.00	ND	0.00		0.00		0.00	ND	0.00		0.00		0.00	J
P17-PreB 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND
P17-PreC 032916	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND
P17-PreD 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P01-PostB 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00		0.00	ND	0.00	J
P01-PostD 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	ND	0.00	ND
P01-PostC 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	ND	0.00	J
P08-PostB 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P08-PostC 032916	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P08-PostD 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	J	0.00	J
P11-PostB 032916	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	J	0.00	J
P11-PostC 032916	0.00		0.00		0.04		0.00		0.00		0.00	ND	0.01		0.00		0.00	ND	0.00		0.00		0.00	
P11-PostD 032916	0.00	J	0.00		0.03		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00		0.00		0.00	J
P17-PostB 032916	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND
P17-PostC 032916	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P17-PostD 032916	0.00	ND	0.00		0.01		0.00	J	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P08-Pre +Bsed032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND
P08-Pre+Csed 032916	0.00	J	0.00		0.01		0.00	J	0.00		0.00	ND	0.00		0.00		0.00	ND	0.00		0.00		0.00	
P08-Pre +Dsed032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00		0.00	ND	0.00	J
P11-Pre+B 032916	0.00	J	0.01		0.03		0.00	J	0.00		0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00		0.00	J
P11-Pre+C 032916	0.00	ND	0.00		0.02		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00		0.00	J	0.00	J
P11-Pre+D 032916	0.00	ND	0.00	J	0.01		0.00	J	0.00	J	0.00	ND	0.00		0.00		0.00	ND	0.00	J	0.00	ND	0.00	J

Sample ID as represented extrac	Sediment Description	transchlordane Results Final Conc. ng/L	Qual	cischlordane Results ng/L	Qual	SUM ng/L
P01-PreB 032916	P01 Pre storm cores	0.01	J	0.02	J	**0.03**
P01-PreD 032916	P01 Pre storm cores	0.01	J	0.02	J	**0.03**
P08-PreB 032916	P08 Pre storm cores	0.01	J	0.02	J	**0.03**
P08-PreC 032916	P08 Pre storm cores	0.01		0.01		**0.02**
P08-PreD 032916	P08 Pre storm cores	0.01	J	0.02	J	**0.03**
P11-PreB 032916	P11 Pre storm cores	0.04		0.04		**0.08**
P11-PreC 032916	P11 Pre storm cores	0.04		0.03		**0.08**
P11-PreD 032916	P11 Pre storm cores	0.04		0.03		**0.07**
P17-PreB 032916	P17 Pre storm cores	0.03		0.04		**0.06**
P17-PreC 032916	P17 Pre storm cores	0.03		0.04		**0.07**
P17-PreD 032916	P17 Pre storm cores	0.03		0.05		**0.08**
P01-PostB 032916	P01 Post storm cores	0.01	J	0.02	J	**0.03**
P01-PostD 032916	P01 Post storm cores	0.01	J	0.01		**0.02**
P01-PostC 032916	P01 Post storm cores	0.01	J	0.02	J	**0.03**
P08-PostB 032916	P08 Post storm cores	0.01	ND	0.02	J	**0.03**
P08-PostC 032916	P08 Post storm cores	0.01	J	0.01	J	**0.02**
P08-PostD 032916	P08 Post storm cores	0.01	J	0.02	J	**0.03**
P11-PostB 032916	P11 Post storm cores	0.06		0.05		**0.11**
P11-PostC 032916	P11 Post storm cores	0.07		0.05		**0.12**
P11-PostD 032916	P11 Post storm cores	0.05		0.04		**0.09**
P17-PostB 032916	P17 Post storm cores	0.04		0.06		**0.10**
P17-PostC 032916	P17 Post storm cores	0.04		0.06		**0.10**
P17-PostD 032916	P17 Post storm cores	0.04		0.06		**0.10**
P08-Pre +Bsed032916	P08 Pre storm cores + traps	0.01	J	0.02	J	**0.03**
P08-Pre+Csed 032916	P08 Pre storm cores + traps	0.01	J	0.01	J	**0.02**
P08-Pre +Dsed032916	P08 Pre storm cores + traps	0.01		0.01		**0.02**
P11-Pre+B 032916	P11 Pre storm cores + traps	0.05		0.04		**0.09**
P11-Pre+C 032916	P11 Pre storm cores + traps	0.04		0.04		**0.08**
P11-Pre+D 032916	P11 Pre storm cores + traps	0.03		0.04		**0.07**

171 Results		156 Results		157 Results		173 Results		172 Results		197 Results		180 Results		193 Results		191 Results		169 Results		170 Results		190 Results		198 Results		203 Results		196 Results		189 Results		208 Results		195 Results		207 Results		194 Results		205 Results		206 Results		209 Results		Sum ng/L
al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	al Conc. n	Qual	
0.00		0.00	J	0.00	ND	0.00		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.58**
0.00	J	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.85**
0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.85**
0.00	J	0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.55**
0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**1.09**
0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**2.98**
0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**3.06**
0.01		0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00		0.01		0.01		0.00	E	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**6.43**
0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.68**
0.00		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**1.18**
0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.01		0.00	J	0.00	ND	0.01		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**1.44**
0.00		0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**1.82**
0.00		0.00	J	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.65**
0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	E	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.61**
0.00		0.00	J	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.67**
0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.61**
0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.80**
0.00	J	0.00		0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00		0.00	J	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**3.99**
0.00		0.00		0.00	ND	0.00	ND	0.00	J	0.00	ND	0.01		0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**12.65**
0.01		0.00		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.01		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**9.35**
0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**1.07**
0.00		0.00	J	0.00	ND	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**1.02**
0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.95**
0.00		0.00	J	0.00	ND	0.00		0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.74**
0.00		0.00		0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00		0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.61**
0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.01		0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**0.93**
0.01		0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	J	0.00	E	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**8.94**
0.01		0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00		0.00	ND	0.00	J	0.00	E	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**6.11**
0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	J	0.00	ND	0.00	J	0.00	J	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	0.00	ND	**2.13**

Appendix I-1: Paleta Sediment Tissue Porewater Summary
PrePost_15-16-ExsituTissue-PCB

Concentration (µg/kg-wet weight basis)

	119	83	87	81	115	136	110	77	82	151	135
	0.167	0.192	0.640	0.032	ND	0.232	1.615	0.078	0.133	0.281	0.132
	0.237	0.491	0.817	0.040	ND	0.337	2.329	0.111	0.186	0.660	0.236
	0.377	0.162	0.339	0.016	ND	0.133	0.963	0.059	0.076	0.271	0.034
	1.718	0.577	1.976	0.105	ND	0.595	6.864	0.223	0.432	0.901	0.415
	0.237	0.251	1.095	0.053	ND	0.302	3.539	0.156	0.214	0.282	0.117
	0.529	0.307	1.265	0.065	ND	0.374	4.518	0.174	0.252	0.644	0.255
	0.131	0.163	0.179	0.024	ND	0.152	1.306	0.062	0.098	0.282	0.104
	0.134	0.142	0.186	0.022	ND	0.140	1.215	0.068	0.099	0.260	0.093
	0.183	0.207	0.304	0.033	ND	0.216	1.820	0.100	0.150	0.423	0.152
	0.515	0.239	0.712	0.034	ND	0.275	2.260	0.132	0.171	0.500	0.143
	0.432	0.192	0.658	0.032	ND	0.245	1.948	0.109	0.152	0.381	0.135
	0.474	0.242	0.765	0.032	ND	0.293	2.306	0.130	0.189	0.496	0.153
	0.368	0.161	0.461	0.022	ND	0.170	1.494	0.084	0.125	0.287	0.069
	0.507	0.185	0.534	0.029	ND	0.185	1.599	0.102	0.120	0.311	0.103
	0.858	0.345	0.798	0.035	ND	0.290	2.521	0.160	0.354	0.534	0.202
	0.659	0.533	1.046	0.111	ND	0.386	4.795	0.496	0.605	0.508	0.203
	0.523	0.463	1.173	0.121	ND	0.433	5.430	0.548	0.646	0.572	0.212
	0.353	0.426	2.095	0.114	ND	0.397	4.819	0.550	0.606	0.523	0.186
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	0.206	0.275	1.230	0.066	ND	0.261	2.722	0.301	0.361	0.365	0.080
	0.072	0.080	0.176	0.021	ND	0.076	0.880	0.055	0.096	0.149	0.059
	0.057	0.102	0.199	0.023	ND	0.100	0.995	0.064	0.091	0.167	0.065
	0.142	0.115	0.244	0.030	ND	0.129	1.320	0.083	0.130	0.208	0.082
	0.075	0.105	0.240	0.021	ND	0.102	1.103	0.068	0.093	0.150	0.044
	0.070	0.102	0.199	0.024	ND	0.086	0.952	0.055	0.099	0.148	0.051
	0.052	0.100	0.136	0.018	ND	0.076	0.828	0.059	0.071	0.133	0.050
	0.057	0.092	0.104	0.015	ND	0.069	0.701	0.043	0.055	0.127	0.037
	0.058	0.080	0.096	0.014	ND	0.068	0.683	0.042	0.049	0.103	0.036
	0.034	0.053	0.067	0.010	ND	0.039	0.409	0.026	0.034	0.072	0.020
	0.018	0.027	0.026	0.004	ND	0.012	0.108	0.010	0.016	0.024	0.006
	0.020	0.022	0.021	0.004	ND	0.012	0.096	0.008	0.013	0.023	0.006
	0.027	0.022	0.023	0.004	ND	0.012	0.099	0.009	0.014	0.022	0.008
	0.018	0.026	0.032	0.004	ND	0.013	0.133	0.011	0.018	0.061	0.006
	0.024	0.036	0.029	0.005	ND	0.018	0.193	0.014	0.022	0.048	0.008
	0.029	0.033	0.026	0.004	ND	0.011	0.120	0.010	0.021	0.040	0.003
	19.637	16.410	23.610	2.164	ND	17.381	250.053	9.964	7.241	18.562	8.262
	19.184	17.175	23.659	2.334	ND	18.668	254.102	10.223	7.954	19.142	8.186
	11.791	11.199	13.716	1.483	ND	12.540	174.930	7.034	5.003	11.495	4.857

Average PCB Concentration (µg/kg-tissue wet weight basis)

	119	83	87	81	115	136	110	77	82	151	135
	0.260	0.282	0.599	0.029	ND	0.234	1.635	0.082	0.132	0.404	0.134
	0.828	0.378	1.446	0.074	ND	0.424	4.974	0.184	0.299	0.609	0.262
	0.150	0.170	0.223	0.026	ND	0.169	1.447	0.077	0.116	0.322	0.117
	0.474	0.224	0.712	0.033	ND	0.271	2.171	0.124	0.171	0.459	0.144
	0.578	0.230	0.598	0.029	ND	0.215	1.871	0.115	0.200	0.377	0.125
	0.512	0.474	1.438	0.115	ND	0.405	5.014	0.531	0.619	0.534	0.200
	1.874	1.405	5.457	0.288	ND	1.476	20.047	1.398	1.307	1.618	1.026
	0.699	0.465	1.775	0.103	ND	0.374	3.924	0.425	0.496	0.584	0.186
	0.090	0.099	0.206	0.025	ND	0.102	1.065	0.067	0.106	0.175	0.069
	0.066	0.102	0.192	0.021	ND	0.088	0.961	0.061	0.088	0.143	0.048
	0.049	0.075	0.089	0.013	ND	0.058	0.598	0.037	0.046	0.101	0.031
	0.022	0.024	0.023	0.004	ND	0.012	0.101	0.009	0.014	0.023	0.006
	0.024	0.032	0.029	0.004	ND	0.014	0.149	0.012	0.020	0.050	0.006
	16.870	14.928	20.328	1.993	ND	16.197	226.362	9.074	6.733	16.400	7.102

Average PCB Concentration (µg/kg-Lipids)

	119	83	87	81	115	136	110	77	82	151	135
	11.458	12.404	26.338	1.287	ND	10.303	71.959	3.627	5.787	17.776	5.899
	83.105	37.982	145.088	7.449	ND	42.562	499.239	18.493	30.041	61.086	26.344
	8.599	9.796	12.813	1.504	ND	9.731	83.158	4.412	6.645	18.494	6.705
	61.869	29.327	93.010	4.271	ND	35.435	283.726	16.172	22.322	59.980	18.785
	120.563	48.093	124.749	6.020	ND	44.861	390.511	24.031	41.649	78.745	26.036
	34.694	32.156	97.498	7.810	ND	27.477	340.047	36.022	41.962	36.228	13.593
	111.780	83.817	325.555	17.187	ND	88.050	1196.069	83.396	77.982	96.513	61.195
	48.575	32.343	123.396	7.139	ND	26.007	272.862	29.531	34.484	40.625	12.902
	13.031	14.266	29.792	3.579	ND	14.671	153.802	9.710	15.267	25.246	9.933
	7.736	12.050	22.612	2.445	ND	10.353	113.117	7.148	10.313	16.889	5.702
	4.919	7.449	8.857	1.274	ND	5.814	59.459	3.648	4.602	10.025	3.095
	1.650	1.827	1.782	0.309	ND	0.912	7.737	0.681	1.074	1.769	0.494
	1.793	2.395	2.207	0.335	ND	1.049	11.240	0.884	1.531	3.750	0.422
	1898	1679	2287	224	ND	1822	25465	1021	757	1845	799

Concentration (µg/kg-wet weight basis)

PAHs	PØ1-Pre-Rep B 1	PØ1-Pre-Rep B 2	PØ1-Pre-Rep B 3	PØ1-Post-Rep B 1	PØ1-Post-Rep B 2	PØ1-Post-Rep C 3	PØ8-Pre-Rep B 1	PØ8-Pre-Rep B 2	PØ8-Pre-Rep B 3	PØ8-Post-Rep B 1	PØ8-Post-Rep B 2	PØ8-Post-Rep B 3	PØ8- Pre + -Rep B 1	PØ8- Pre + -Rep B 2	PØ8- Pre + -Rep B 3	PØ11-Pre-Rep B 1	PØ11-Pre-Rep B 2	PØ11-Pre-Rep B 3
Naphthalene	3.5	1.2	1.0	1.0	1.7	1.5	1.3	1.3	2.0	1.3	1.1	1.0	0.7	0.6	0.8	2.5	1.9	3.6
Fluorene	11.9	4.3	3.5	8.4	9.6	6.7	7.6	7.6	13.8	9.6	8.9	7.5	4.2	4.0	4.4	3.8	6.2	6.9
Acenaphthene	1.5	0.6	0.5	5.7	7.1	5.0	0.6	0.5	1.1	4.2	3.1	2.9	0.5	0.5	0.6	1.6	1.6	2.6
Phenanthrene	14.3	8.2	6.0	5.3	6.4	4.4	7.3	8.9	14.4	11.1	9.4	9.8	3.2	3.3	4.6	2.1	3.1	4.0
Anthracene	6.8	1.2	2.3	1.7	6.0	2.5	1.5	3.4	3.4	7.6	7.3	7.3	3.6	4.3	5.1	7.3	5.7	8.5
Fluoranthene	1.7	1.7	1.7	7.1	10.6	5.4	3.4	9.0	12.9	6.5	7.6	7.0	2.7	3.2	3.6	9.8	9.3	14.2
Pyrene	1.7	0.9	0.8	9.9	13.8	9.4	12.8	14.0	23.6	14.3	12.5	13.2	4.6	5.1	6.2	56.0	56.9	85.1
Chrysene	2.2	1.0	1.1	7.2	8.5	7.1	8.5	8.7	14.6	16.4	13.8	14.6	2.9	2.9	4.5	8.3	8.5	12.3
Benz[a]anthracene	3.8	3.1	3.4	5.5	6.8	5.2	2.3	2.6	4.1	5.6	4.8	5.2	1.7	1.7	2.2	10.7	10.9	15.8
Benzo[b]fluoranthene	5.4	5.1	5.3	21.8	27.6	17.8	26.6	30.3	47.5	35.7	30.9	32.5	14.7	16.0	20.1	48.3	48.2	87.7
Benzo[k]fluoranthene	5.6	5.4	5.6	15.0	18.5	12.8	11.4	12.7	19.9	15.3	13.2	14.3	4.1	4.3	5.4	15.5	15.6	22.7
Benzo[a,h]anthracene	3.7	3.6	3.7	22.0	21.0	16.1	13.6	15.7	23.6	21.3	18.9	19.5	5.6	5.9	7.2	16.8	16.6	24.1
Dibenz[a,h]anthracene	ND	ND	ND	2.5	ND	ND	0.0	ND	2.1	ND	1.6	ND	ND	ND	ND	ND	2.5	3.6
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	5.0	4.9	5.0	6.6	8.6	5.6	4.3	4.9	8.1	7.2	6.3	6.6	3.2	3.7	4.1	3.4	3.4	5.0

PAHs	PØ11-Post-Rep B 1	PØ11-Post-Rep B 2	PØ11-Post-Rep B 3	PØ11-Pre + -Rep B 1	PØ11-Pre + -Rep B 2	PØ11-Pre + -Rep B 3	PØ17-Pre-Rep B 1	PØ17-Pre-Rep B 2	PØ17-Pre-Rep B 3	PØ17-Post-Rep B 1	PØ17-Post-Rep B 2	PØ17-Post-Rep B 3	PØ17-Pre + -Rep B 1	PØ17-Pre + -Rep B 2	PØ17-Pre + -Rep A 3	TØ-Rep B 1	TØ-Rep B 2	TØ-Rep B 3	Control-Rep B 1	Control-Rep B 2	Control-Rep B 3	NBH-Rep B 1	NBH-Rep B 2	NBH-Rep B 3
Naphthalene	1.6	4.7	3.5	3.5	3.1	3.5	2.7	1.8	2.6	2.0	2.3	2.1	1.7	1.6	1.4	1.2	1.2	1.2	2.2	1.0	1.1	1.2	1.7	1.0
Fluorene	9.9	9.6	10.6	5.3	5.9	5.9	2.3	2.1	3.0	2.4	2.6	2.4	2.3	2.5	3.6	4.1	2.9	5.3	5.9	2.7	3.2	7.7	10.2	6.0
Acenaphthene	4.3	4.2	5.4	1.7	1.5	1.6	0.6	0.8	0.8	1.0	1.2	1.2	1.1	1.4	1.3	1.2	1.3	1.7	1.9	1.0	1.2	0.5	0.5	0.3
Phenanthrene	4.7	5.9	5.4	5.1	3.8	3.6	3.5	3.1	4.4	5.0	5.6	5.3	5.8	6.0	7.2	3.8	3.1	3.2	4.6	2.8	2.6	8.6	8.4	6.2
Anthracene	9.5	10.0	11.9	6.6	6.5	7.0	1.6	1.7	2.2	4.5	4.4	4.9	4.6	4.9	5.7	1.0	2.3	1.1	2.4	1.0	1.1	5.7	6.3	7.6
Fluoranthene	24.2	21.0	28.1	14.8	13.8	11.6	4.5	3.2	5.3	2.1	2.6	2.4	2.8	3.5	4.9	1.2	2.1	1.6	2.2	1.3	1.3	4.1	1.0	6.2
Pyrene	122.9	120.6	155.0	65.8	59.1	60.4	13.9	11.5	18.3	22.7	26.8	25.2	19.7	22.2	25.1	1.5	1.8	2.4	1.9	0.9	0.9	4.7	3.9	5.6
Chrysene	4.2	6.1	8.1	9.2	8.2	8.5	2.4	1.6	2.9	2.9	3.4	3.1	2.9	1.9	2.5	0.7	0.8	1.1	0.2	0.1	0.1	1.0	0.7	1.0
Benz[a]anthracene	5.6	15.3	0.0	10.4	9.0	9.0	2.0	1.6	2.4	2.4	3.1	2.9	2.1	2.4	2.6	0.1	0.1	0.1	0.7	0.6	0.6	1.3	0.5	1.6
Benzo[b]fluoranthene	49.1	45.0	60.3	51.4	54.7	56.1	7.2	6.6	9.1	11.8	13.7	12.5	10.7	11.7	14.1	0.4	0.4	0.6	1.1	0.4	0.6	0.2	0.4	0.6
Benzo[k]fluoranthene	43.4	40.6	52.0	15.6	13.8	14.0	3.2	2.8	4.2	4.0	4.6	4.1	4.1	4.4	5.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Benzo[a,h]anthracene	19.8	19.0	24.2	15.4	13.7	13.9	5.9	5.1	7.6	12.7	14.4	13.2	5.9	6.0	10.4	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.3	0.2
Dibenz[a,h]anthracene	2.9	2.8	ND	ND	ND	ND	0.9	0.7	ND	0.4	0.5	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	0.2	0.4
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	2.7	2.4	3.3	3.1	2.3	2.9	1.0	0.7	1.2	1.3	1.4	1.3	1.0	1.0	1.2	0.1	0.0	0.1	0.3	0.1	0.2	0.2	0.1	0.2

Average Concentration (µg/kg-tissue wet weight basis)

PAHs	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11- Pre-Rep B	PØ11-Post Rep B	PØ11-Pre + -Rep B	PØ17- Pre-Rep B	PØ17-Post Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Naphthalene	1.20	1.90	1.40	1.51	1.11	0.71	2.63	3.25	3.38	2.40	2.12	1.56	1.42	1.29
Fluorene	4.13	6.58	8.25	9.70	8.67	4.22	5.64	10.03	5.69	2.49	2.44	2.78	3.94	7.96
Acenaphthene	1.43	0.87	5.93	0.74	3.44	0.52	1.95	4.61	1.59	0.74	1.12	1.26	1.39	0.43
Phenanthrene	3.38	9.50	5.36	10.22	10.08	3.73	3.08	5.32	4.15	3.65	5.27	6.33	3.33	7.75
Anthracene	1.45	3.44	3.42	2.76	7.40	4.35	7.17	10.46	6.67	1.86	4.63	5.09	1.50	6.53
Fluoranthene	1.62	1.67	7.70	8.47	7.03	3.18	11.11	24.42	13.42	4.32	2.37	3.73	1.61	3.79
Pyrene	1.91	1.15	11.05	16.77	13.36	5.33	66.01	132.85	61.77	14.55	24.92	22.31	1.26	4.73
Chrysene	0.86	1.44	7.60	10.62	14.90	3.45	9.69	6.10	8.62	2.30	3.15	2.40	0.16	0.91
Benz[a]anthracene	0.13	3.44	5.81	2.97	5.20	1.89	12.47	6.98	9.46	1.99	2.81	2.38	0.63	1.13
Benzo[b]fluoranthene	0.47	5.23	22.39	34.80	33.03	16.93	61.39	51.45	54.05	7.65	12.68	12.16	0.66	0.39
Benzo[k]fluoranthene	0.16	5.54	15.43	14.64	14.27	4.61	17.95	45.33	14.49	3.38	4.23	4.56	0.14	0.15
Benzo[a]pyrene	0.26	3.67	19.70	17.63	19.90	6.24	19.16	21.02	14.33	6.20	13.44	7.43	0.15	0.23
Dibenz[a,h]anthracene	ND	ND	2.53	1.06	1.65	ND	3.08	2.82	ND	0.77	0.42	ND	ND	0.22
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.05	4.96	6.93	5.78	6.68	3.68	3.92	2.81	2.78	0.98	1.33	1.07	0.19	0.15

% Average fraction (g-lipid or water /g-tissue wet weight basis)

	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11- Pre-Rep B	PØ11-Post Rep B	PØ11-Pre + -Rep B	PØ17- Pre-Rep B	PØ17-Post Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Tissue Lipid Fraction	1.30	2.27	1.00	1.74	0.77	0.48	1.47	1.68	1.44	0.69	0.85	1.01	1.32	0.89
Tissue Water content	86.00	81.13	82.00	84.62	79.17	80.85	83.02	79.63	83.33	86.00	88.89	85.42	79.59	86.00

Average Concentration (µg/kg-lipids)

PAHs	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11- Pre-Rep B	PØ11-Post Rep B	PØ11-Pre + -Rep B	PØ17- Pre-Rep B	PØ17-Post Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Naphthalene	92	84	140	87	144	149	179	194	235	346	249	155	107	145
Fluorene	316	289	828	558	1132	880	383	599	396	359	287	277	298	895
Acenaphthene	110	38	595	43	449	109	132	275	111	106	132	126	105	49
Phenanthrene	259	418	538	588	1317	778	209	317	289	527	620	629	251	872
Anthracene	111	151	343	159	966	908	486	624	464	268	546	506	114	735
Fluoranthene	124	73	772	487	919	663	753	1457	933	625	279	372	122	427
Pyrene	146	51	1109	964	1745	1113	4476	7926	4295	2102	2933	2220	95	532
Chrysene	66	63	762	610	1946	720	657	364	599	332	371	239	12	102
Benz[a]anthracene	10	152	583	171	679	394	846	417	658	287	331	236	47	127
Benzo[b]fluoranthene	36	230	2248	2001	4316	3533	4163	3070	3758	1105	1493	1210	50	44
Benzo[k]fluoranthene	12	244	1549	841	1864	961	1217	2704	1008	489	497	453	10	17
Benzo[a]pyrene	20	161	1977	1014	2600	1302	1299	1254	996	896	1582	739	12	26
Dibenz[a,h]anthracene	ND	ND	254	61	216	ND	209	168	ND	112	50	ND	ND	24
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	4	218	695	332	873	767	266	167	193	142	157	107	14	17

	Concentration (µg/kg-wet weight basis)														
Pesticides	***PØ1-Pre-Rep B 1***	***PØ1-Pre-Rep B 2***	***PØ1-Pre-Rep B 3***	***PØ1-Post-Rep B 1***	***PØ1-Post-Rep B 2***	***PØ1-Post-Rep C 3***	***PØ8-Pre-Rep B 1***	***PØ8-Pre-Rep B 2***	***PØ8-Pre-Rep B 3***	***PØ8-Post-Rep B 1***	***PØ8-Post-Rep B 2***	***PØ8-Post-Rep B 3***	***PØ8- Pre + -Rep B 1***	***PØ8- Pre + -Rep B 2***	***PØ8- Pre + -Rep B 3***
Transchlordane	0.045	0.033	0.024	0.505	0.054	0.041	0.000	0.007	0.504	0.032	0.454	0.028	0.023	0.150	0.043
Cischlordane	0.106	0.045	0.041	0.557	0.086	0.058	0.023	0.008	0.433	0.045	0.449	0.053	0.034	0.296	0.344

	Concentration (µg/kg-wet weight basis)																	
Pesticides	***PØ11-Pre-Rep B 1***	***PØ11-Pre-Rep B 2***	***PØ11-Pre-Rep B 3***	***PØ11-Post-Rep B 1***	***PØ11-Post-Rep B 2***	***PØ11-Post-Rep B 3***	***PØ11-Pre + -Rep B 1***	***PØ11-Pre + -Rep B 2***	***PØ11-Pre + -Rep B 3***	***PØ17-Pre-Rep B 1***	***PØ17-Pre-Rep B 2***	***PØ17-Pre-Rep B 3***	***PØ17-Post-Rep B 1***	***PØ17-Post-Rep B 2***	***PØ17-Post-Rep B 3***	***PØ17-Pre + -Rep B 1***	***PØ17-Pre + -Rep B 2***	***PØ17-Pre + -Rep A 3***
Transchlordane	0.430	0.001	0.000	0.041	0.053	0.057	0.041	0.033	0.034	0.000	0.070	0.000	0.002	0.008	0.000	0.018	0.012	0.000
Cischlordane	0.071	0.026	0.016	0.102	0.966	0.272	0.413	0.036	0.062	0.055	1.380	0.028	0.104	0.321	0.802	0.654	0.507	0.242

	Concentration (µg/kg-wet weight basis)								
Pesticides	***TØ-Rep B 1***	***TØ-Rep B 2***	***TØ-Rep B 3***	***Control-Rep B 1***	***Control-Rep B 2***	***Control-Rep B 3***	***NBH-Rep B 1***	***NBH-Rep B 2***	***NBH-Rep B 3***
Transchlordane	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.037	0.029
Cischlordane	0.004	0.006	0.002	0.000	0.004	0.002	0.137	0.054	0.010

	Average Concentration (µg/kg-tissue wet weight basis)													
Pesticides	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11- Pre-Rep B	PØ11-Post Rep B	PØ11-Pre + -Rep B	PØ17- Pre Rep B	PØ17-Post Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Transchlordane	0.000	0.034	0.200	0.170	0.172	0.072	0.143	0.050	0.036	0.023	0.003	0.010	0.000	0.036
Cischlordane	0.004	0.064	0.233	0.155	0.183	0.225	0.037	0.447	0.170	0.488	0.409	0.468	0.002	0.067

	% Average fraction (g-lipid or water /g-tissue wet weight basis)													
	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11- Pre-Rep B	PØ11-Post Rep B	PØ11-Pre + -Rep B	PØ17- Pre Rep B	PØ17-Post Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Tissue Lipid Fraction	1.304	2.273	0.996	1.740	0.765	0.479	1.475	1.676	1.438	0.692	0.849	1.005	1.324	0.889
Tissue Water content	86.00	81.13	82.00	84.62	79.17	80.85	83.02	79.63	83.33	86.00	88.89	85.42	79.59	86.00

	Average Concentration (µg/kg-lipids)													
Pesticides	TØ-Rep B	PØ1-Pre-Rep B	PØ1-Post-Rep B	PØ8-Pre-Rep B	PØ8-Post-Rep B	PØ8-Pre + -Rep B	PØ11- Pre-Rep B	PØ11-Post Rep B	PØ11-Pre + -Rep B	PØ17- Pre Rep B	PØ17-Post Rep B	PØ17-Pre + -Rep B	Control-Rep B	NBH-Rep B
Transchlordane	0.00	1.49	20.09	9.80	22.44	14.97	9.73	3.01	2.52	3.37	0.38	1.01	0.00	4.07
Cischlordane	0.30	2.80	23.44	8.89	23.86	46.86	2.54	26.66	11.85	70.45	48.16	46.54	0.14	7.57

Notations:

- Represents values between MDL and lowest calibration
- Represents values that is greater than the highest calibration
- Represents the column containing the calculated DGT pore water values
- "ND" represents values less than the MDL
- QA/QC issues during the first analysis. However, these samples could not be re-analyzed due to insufficient sample extracts

V_{gel} - Volume of the resin gel (typically 0.16ml = 0.00016L): 0.00016 L

2. Average Temperature of Deployment (°C) used in determining the diffusion: 15

D - Diffusion coefficient of metal in the resin gel (temperature and metal specific) - this is pulled from a look up caluclation in columns AC:AM row 6.

Sample ID	Sample Description	1a. Deployment Date	1a. Deployment Time	Deployment Date/Time	1b. Recovery Date/Time	1b. Recovery Date/Time	Collection Date/Time	Exposure (Days)	Exposure (sec)	Trace Metal Concentration in the Extracts (µg/L)						Total Extraction Volume (L)
										Ag	Cd	Cu	Ni	Pb	Zn	
P01 Pre Storm A	Pre-Storm Season 2015/16	3/3/2016	9:31	3/3/16 9:31	3/5/2016	10:25	3/5/16 10:25	2.04	176040	0.1	0.4	25.4	5.0	0.6	153.2	0.005
P01 Pre Storm E	Pre-Storm Season 2015/16	3/3/2016	9:28	3/3/16 9:28	3/5/2016	10:27	3/5/16 10:27	2.04	176340	0.1	0.9	34.0	10.1	0.8	183.2	0.005
P01 Pre Storm F	Pre-Storm Season 2015/16	3/3/2016	9:33	3/3/16 9:33	3/5/2016	10:29	3/5/16 10:29	2.04	176160	0.1	0.4	39.4	6.5	0.6	143.0	0.005
P01 Post Storm A	Post-Storm Season 2015/16	3/3/2016	9:35	3/3/16 9:35	3/5/2016	10:31	3/5/16 10:31	2.04	176160	ND	0.3	15.1	2.8	0.5	59.4	0.01
P01 Post Storm E	Post-Storm Season 2015/16	3/3/2016	9:37	3/3/16 9:37	3/5/2016	10:33	3/5/16 10:33	2.04	176160	ND	ND	6.8	1.9	0.9	26.7	0.01
P01 Post Storm F	Post-Storm Season 2015/16	3/3/2016	9:40	3/3/16 9:40	3/5/2016	10:35	3/5/16 10:35	2.04	176100	ND	ND	5.4	2.7	0.1	26.1	0.01
P08 Pre Storm A	Pre-Storm Season 2015/16	3/3/2016	9:50	3/3/16 9:50	3/5/2016	10:45	3/5/16 10:45	2.04	176100	0.3	0.7	78.2	8.5	6.9	191.0	0.005
P08 Pre Storm E	Pre-Storm Season 2015/16	3/3/2016	9:52	3/3/16 9:52	3/5/2016	10:48	3/5/16 10:48	2.04	176160	0.1	0.7	28.7	8.3	0.9	180.2	0.005
P08 Pre Storm F	Pre-Storm Season 2015/16	3/3/2016	9:54	3/3/16 9:54	3/5/2016	10:51	3/5/16 10:51	2.04	176220	0.1	0.6	39.3	8.5	1.2	213.7	0.005
P08 Post Storm A	Post-Storm Season 2015/16	3/3/2016	9:55	3/3/16 9:55	3/5/2016	10:53	3/5/16 10:53	2.04	176280	ND	ND	7.1	1.4	0.2	30.7	0.01
P08 Post Storm E	Post-Storm Season 2015/16	3/3/2016	9:56	3/3/16 9:56	3/5/2016	10:55	3/5/16 10:55	2.04	176340	ND	ND	12.3	1.7	0.3	48.3	0.01
P08 Post Storm F	Post-Storm Season 2015/16	3/3/2016	9:57	3/3/16 9:57	3/5/2016	10:57	3/5/16 10:57	2.04	176400	ND	ND	11.2	1.5	0.4	49.4	0.01
P08 Pre Storm + Trap Material A		3/3/2016	9:59	3/3/16 9:59	3/5/2016	10:59	3/5/16 10:59	2.04	176400	0.0	ND	10.1	4.3	2.8	33.3	0.005
P08 Pre Storm + Trap Material E		3/3/2016	10:00	3/3/16 10:00	3/5/2016	11:03	3/5/16 11:03	2.04	176580	ND	ND	2.0	3.0	0.3	10.0	0.01
P08 Pre Storm + Trap Material F		3/3/2016	10:01	3/3/16 10:01	3/5/2016	11:06	3/5/16 11:06	2.05	176700	0.0	ND	13.3	3.9	2.7	18.0	0.005
P11 Pre Storm A	Pre-Storm Season 2015/16	3/3/2016	10:16	3/3/16 10:16	3/5/2016	11:11	3/5/16 11:11	2.04	176100	0.1	1.6	51.5	14.6	4.5	860.0	0.01
P11 Pre Storm E	Pre-Storm Season 2015/16	3/3/2016	10:18	3/3/16 10:18	3/5/2016	11:15	3/5/16 11:15	2.04	176220	0.1	1.7	34.9	14.3	5.3	650.0	0.005
P11 Pre Storm F	Pre-Storm Season 2015/16	3/3/2016	10:20	3/3/16 10:20	3/5/2016	11:20	3/5/16 11:20	2.04	176400	0.2	1.9	44.4	15.4	5.7	736.0	0.01
P11 Post Storm A	Post-Storm Season 2015/16	3/3/2016	10:22	3/3/16 10:22	3/5/2016	11:25	3/5/16 11:25	2.04	176580	ND	0.2	10.8	1.7	1.4	78.0	0.01
P11 Post Storm E	Post-Storm Season 2015/16	3/3/2016	10:23	3/3/16 10:23	3/5/2016	11:27	3/5/16 11:27	2.04	176640	ND	0.1	11.8	1.2	1.1	38.9	0.01
P11 Post Storm F	Post-Storm Season 2015/16	3/3/2016	10:24	3/3/16 10:24	3/5/2016	11:32	3/5/16 11:32	2.05	176880	ND	0.1	22.7	1.2	0.5	38.9	0.01
P11 Pre Storm + Trap Material A		3/3/2016	10:26	3/3/16 10:26	3/5/2016	13:45	3/5/16 13:45	2.14	184740	0.0	0.2	9.9	5.7	1.7	157.0	0.01
P11 Pre Storm + Trap Material E		3/3/2016	10:28	3/3/16 10:28	3/5/2016	13:47	3/5/16 13:47	2.14	184740	ND	ND	18.2	4.6	4.9	35.5	0.01
P11 Pre Storm + Trap Material F		3/3/2016	10:30	3/3/16 10:30	3/5/2016	13:51	3/5/16 13:51	2.14	184860	ND	ND	5.6	1.9	0.6	14.7	0.01
P17 Pre Storm A	Pre-Storm Season 2015/16	3/3/2016	10:40	3/3/16 10:40	3/5/2016	13:54	3/5/16 13:54	2.13	184440	0.1	0.4	71.0	9.0	7.2	568.8	0.006
P17 Pre Storm E	Pre-Storm Season 2015/16	3/3/2016	10:41	3/3/16 10:41	3/5/2016	13:56	3/5/16 13:56	2.14	184500							
P17 Pre Storm F	Pre-Storm Season 2015/16	3/3/2016	10:42	3/3/16 10:42	3/5/2016	13:58	3/5/16 13:58	2.14	184560	ND	0.3	38.9	5.3	6.1	344.0	0.01
P17 Post Storm A	Post-Storm Season 2015/16	3/3/2016	10:44	3/3/16 10:44	3/5/2016	14:01	3/5/16 14:01	2.14	184620	ND	ND	5.6	1.1	0.7	10.7	0.01
P17 Post Storm E	Post-Storm Season 2015/16	3/3/2016	10:45	3/3/16 10:45	3/5/2016	14:02	3/5/16 14:02	2.14	184620	ND	0.2	3.3	1.4	0.3	14.9	0.01
P17 Post Storm F	Post-Storm Season 2015/16	3/3/2016	10:46	3/3/16 10:46	3/5/2016	14:04	3/5/16 14:04	2.14	184680	ND	ND	2.4	1.8	0.3	28.5	0.01
P17 Pre Storm + Trap Material A		3/3/2016	10:48	3/3/16 10:48	3/5/2016	14:15	3/5/16 14:15	2.14	185220	ND	ND	1.4	3.0	ND	8.0	0.01
P17 Pre Storm + Trap Material E		3/3/2016	10:49	3/3/16 10:49	3/5/2016	14:17	3/5/16 14:17	2.14	185280	ND	ND	3.7	2.3	0.6	9.3	0.01
P17 Pre Storm + Trap Material F		3/3/2016	10:50	3/3/16 10:50	3/5/2016	14:19	3/5/16 14:19	2.15	185340	ND	ND	3.3	1.7	0.4	6.9	0.01
New Bedford Sediment A	Reference sediment	3/3/2016	11:59	3/3/16 11:59	3/5/2016	14:25	3/5/16 14:25	2.10	181560	ND	0.7	16.4	13.9	3.5	128.2	0.005
New Bedford Sediment B	Reference sediment	3/3/2016	12:00	3/3/16 12:00	3/5/2016	14:27	3/5/16 14:27	2.10	181620	ND	0.7	14.5	12.1	3.2	111.5	0.005
New Bedford Sediment C	Reference sediment	3/3/2016	12:01	3/3/16 12:01	3/5/2016	14:29	3/5/16 14:29	2.10	181680	0.2	2.3	28.2	18.2	5.6	240.3	0.005
Blank A	DGT Blank Control			3/3/16 0:00			3/5/16 0:00	2.00	172800	ND	ND	0.6	ND	ND	ND	0.01
Blank B	DGT Blank Control			3/3/16 0:00			3/5/16 0:00	2.00	172800							
Blank C	DGT Blank Control			3/3/16 0:00			3/5/16 0:00	2.00	172800	ND	ND	0.9	ND	ND	8.1	0.01
Blank D	DGT Blank Control			3/3/16 0:00			3/5/16 0:00	2.00	172800	ND	ND	1.0	ND	ND	2.0	0.01

Sample ID	M - Mass of metal in the resin gel $M = Ce(V_{HNO3} + V_{gel})/fe$						5. Δg - thickness of the diffusive gel (typically 0.8mm)	converted to cm	Final Δg PLUS the thickness of the filter membrane (typically…	A - exposure area (see window size as labeled on container of DGTs when received; typically 3.14 or 2.54cm²):	Pore Water Trace Metal Concentration (µg/L)					
	0.984	0.987	0.977	0.935	0.974	0.963					10.59	4.57	4.68	4.33	6.03	4.56
	Ag	Cd	Cu	Ni	Pb	Zn					Ag	Cd	Cu	Ni	Pb	Zn
P01 Pre Storm A	0.00	0.00	0.13	0.03	0.00	0.82	0.78	0.078	0.092	3.14	0.01	0.08	4.77	1.06	0.09	30.0
P01 Pre Storm E	0.00	0.00	0.18	0.06	0.00	0.98	0.78	0.078	0.092	3.14	0.01	0.18	6.37	2.14	0.12	35.8
P01 Pre Storm F	0.00	0.00	0.21	0.04	0.00	0.77	0.78	0.078	0.092	3.14	0.00	0.08	7.40	1.38	0.09	27.9
P01 Post Storm A	0.00	0.00	0.16	0.03	0.01	0.63	0.78	0.078	0.092	3.14	ND	0.11	5.58	1.17	0.14	22.9
P01 Post Storm E	0.00	0.00	0.07	0.02	0.01	0.28	0.78	0.078	0.092	3.14	ND	ND	2.51	0.79	0.26	10.3
P01 Post Storm F	0.00	0.00	0.06	0.03	0.00	0.28	0.78	0.078	0.092	3.14	ND	ND	2.00	1.13	0.02	10.0
P08 Pre Storm A	0.00	0.00	0.41	0.05	0.04	1.02	0.78	0.078	0.092	3.14	0.02	0.13	14.68	1.80	1.01	37.3
P08 Pre Storm E	0.00	0.00	0.15	0.05	0.00	0.97	0.78	0.078	0.092	3.14	0.01	0.13	5.39	1.76	0.13	35.2
P08 Pre Storm F	0.00	0.00	0.21	0.05	0.01	1.15	0.78	0.078	0.092	3.14	0.00	0.11	7.37	1.80	0.18	41.8
P08 Post Storm A	0.00	0.00	0.07	0.02	0.00	0.32	0.78	0.078	0.092	3.14	ND	ND	2.62	0.58	0.06	11.8
P08 Post Storm E	0.00	0.00	0.13	0.02	0.00	0.51	0.78	0.078	0.092	3.14	ND	ND	4.54	0.71	0.09	18.6
P08 Post Storm F	0.00	0.00	0.12	0.02	0.00	0.52	0.78	0.078	0.092	3.14	ND	ND	4.13	0.63	0.11	19.0
P08 Pre Storm + Trap Material A	0.00	0.00	0.05	0.02	0.01	0.18	0.78	0.078	0.092	3.14	0.00	ND	1.89	0.91	0.41	6.5
P08 Pre Storm + Trap Material E	0.00	0.00	0.02	0.03	0.00	0.11	0.78	0.078	0.092	3.14	ND	ND	0.74	1.25	0.09	3.8
P08 Pre Storm + Trap Material F	0.00	0.00	0.07	0.02	0.01	0.10	0.78	0.078	0.092	3.14	0.00	ND	2.49	0.82	0.39	3.5
P11 Pre Storm A	0.00	0.02	0.54	0.16	0.05	9.07	0.78	0.078	0.092	3.14	0.02	0.61	19.04	6.10	1.30	331.1
P11 Pre Storm E	0.00	0.01	0.18	0.08	0.03	3.48	0.78	0.078	0.092	3.14	0.01	0.32	6.55	3.03	0.77	127.0
P11 Pre Storm F	0.00	0.02	0.46	0.17	0.06	7.77	0.78	0.078	0.092	3.14	0.02	0.71	16.39	6.42	1.64	282.8
P11 Post Storm A	0.00	0.00	0.11	0.02	0.01	0.82	0.78	0.078	0.092	3.14	ND	0.07	3.98	0.71	0.40	29.9
P11 Post Storm E	0.00	0.00	0.12	0.01	0.01	0.41	0.78	0.078	0.092	3.14	ND	0.04	4.35	0.50	0.32	14.9
P11 Post Storm F	0.00	0.00	0.24	0.01	0.01	0.41	0.78	0.078	0.092	3.14	ND	0.02	8.36	0.50	0.15	14.9
P11 Pre Storm + Trap Material A	0.00	0.00	0.10	0.06	0.02	1.66	0.78	0.078	0.092	3.14	0.00	0.07	3.49	2.27	0.47	57.6
P11 Pre Storm + Trap Material E	0.00	0.00	0.19	0.05	0.05	0.37	0.78	0.078	0.092	3.14	ND	ND	6.41	1.83	1.34	13.0
P11 Pre Storm + Trap Material F	0.00	0.00	0.06	0.02	0.01	0.16	0.78	0.078	0.092	3.14	ND	ND	1.97	0.76	0.16	5.4
P17 Pre Storm A	0.00	0.00	0.45	0.06	0.05	3.64	0.78	0.078	0.092	3.14	0.01	0.09	15.19	2.17	1.21	126.8
P17 Pre Storm E	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.078	0.092	3.14						
P17 Pre Storm F	0.00	0.00	0.40	0.06	0.06	3.63	0.78	0.078	0.092	3.14	ND	0.12	13.72	2.11	1.68	126.4
P17 Post Storm A	0.00	0.00	0.06	0.01	0.01	0.11	0.78	0.078	0.092	3.14	ND	ND	1.97	0.44	0.20	3.9
P17 Post Storm E	0.00	0.00	0.03	0.02	0.00	0.16	0.78	0.078	0.092	3.14	ND	0.09	1.16	0.56	0.08	5.5
P17 Post Storm F	0.00	0.00	0.02	0.02	0.00	0.30	0.78	0.078	0.092	3.14	ND	ND	0.85	0.72	0.08	10.5
P17 Pre Storm + Trap Material A	0.00	0.00	0.01	0.03	0.00	0.08	0.78	0.078	0.092	3.14	ND	ND	0.49	1.19	ND	2.9
P17 Pre Storm + Trap Material E	0.00	0.00	0.04	0.02	0.01	0.10	0.78	0.078	0.092	3.14	ND	ND	1.30	0.91	0.16	3.4
P17 Pre Storm + Trap Material F	0.00	0.00	0.03	0.02	0.00	0.07	0.78	0.078	0.092	3.14	ND	ND	1.16	0.67	0.11	2.5
New Bedford Sediment A	0.00	0.00	0.09	0.08	0.02	0.69	0.78	0.078	0.092	3.14	ND	0.13	2.99	2.86	0.50	24.3
New Bedford Sediment B	0.00	0.00	0.08	0.07	0.02	0.60	0.78	0.078	0.092	3.14	ND	0.13	2.64	2.49	0.45	21.1
New Bedford Sediment C	0.00	0.01	0.15	0.10	0.03	1.29	0.78	0.078	0.092	3.14	0.01	0.43	5.13	3.74	0.79	45.5
Blank A	0.00	0.00	0.01	0.00	0.00	0.00	0.78	0.078	0.092	3.14	ND	ND	0.23	ND	ND	ND
Blank B	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.078	0.092	3.14						
Blank C	0.00	0.00	0.01	0.00	0.00	0.09	0.78	0.078	0.092	3.14	ND	ND	0.34	ND	ND	3.2
Blank D	0.00	0.00	0.01	0.00	0.00	0.02	0.78	0.078	0.092	3.14	ND	ND	0.38	ND	ND	0.8

Notations: A,E,F = indicative of DGT replicates.
For control samples the minimum field/lab deployment time is used to calculate the representative concentration.

$D_{eff,25C}$ =	0.0000053	cm2/s	c_{THgDGT} = $Dd*m_{resin}/(A_{exposure}*t*D_{eff})$	
Deployment temp., T =	15	ºC	pg/ml=ng/l= cm*pg/(cm2*s*cm2/s)	
$D_{eff,T}$=	3.98E-06	cm2/s	c_{THgDGT}	

DGT Exposure Timeline

Name/ID	Sample Name	mTHg,DGT Final Result (pg)	Deployment date	Deployment time	Retrieval date	Retrieval time	Exposure time h	Exposure time s	$A_{exposure}$ cm^2	Dd Diffusive thickness cm	$c_{THg\ DGT\ (porewater)}$ ng/L	Average $C_{Hg\text{-}DGT}$ ng/L	St. Dev. $C_{Hg\text{-}DGT}$ ng/L
Blank A	Travel Control DGT	34					52.000	187200	3.14	0.1	1.5		
Blank B	Travel Control DGT	58					52.000	187200	3.14	0.1	2.5	2.2	0.8
Blank C	Travel Control DGT	40					52.000	187200	3.14	0.1	1.7		
Blank D	Travel Control DGT	77					52.000	187200	3.14	0.1	3.3		
New Bedford Sediment A	Reference Site	142	3/3/2016	11:59	3/5/2016	14:25	50.433	181560	3.14	0.1	6.3		
New Bedford Sediment E	Reference Site	135	3/3/2016	12:00	3/5/2016	14:27	50.450	181620	3.14	0.1	6.0	5.2	1.7
New Bedford Sediment F	Reference Site	74	3/3/2016	12:01	3/5/2016	14:29	50.467	181680	3.14	0.1	3.3		
P01 Pre Storm A	Paleta Creek Sediment P01	4442	3/3/2016	9:31	3/5/2016	10:25	48.900	176040	3.14	0.1	202.0		
P01 Pre Storm E	Paleta Creek Sediment P01	4565	3/3/2016	9:28	3/5/2016	10:27	48.983	176340	3.14	0.1	207.3	190.7	24.3
P01 Pre Storm F	Paleta Creek Sediment P01	3581	3/3/2016	9:33	3/5/2016	10:29	48.933	176160	3.14	0.1	162.7		
P08 Pre Storm A	Paleta Creek Sediment P08	3374	3/3/2016	9:50	3/5/2016	10:45	48.917	176100	3.14	0.1	153.4		
P08 Pre Storm E	Paleta Creek Sediment P08	4099	3/3/2016	9:52	3/5/2016	10:48	48.933	176160	3.14	0.1	186.3	183.7	29.1
P08 Pre Storm F	Paleta Creek Sediment P08	4653	3/3/2016	9:54	3/5/2016	10:51	48.950	176220	3.14	0.1	211.4		
P11 Pre Storm A	Paleta Creek Sediment P11	4282	3/3/2016	10:16	3/5/2016	11:11	48.917	176100	3.14	0.1	194.7		
P11 Pre Storm E	Paleta Creek Sediment P11	6860	3/3/2016	10:18	3/5/2016	11:15	48.950	176220	3.14	0.1	311.7	279.6	74.3
P11 Pre Storm F	Paleta Creek Sediment P11	7327	3/3/2016	10:20	3/5/2016	11:20	49.000	176400	3.14	0.1	332.5		
P17 Pre Storm A	Paleta Creek Sediment P17	1481	3/3/2016	10:40	3/5/2016	13:54	51.233	184440	3.14	0.1	64.3		
P17 Pre Storm E	Paleta Creek Sediment P17	1894	3/3/2016	10:41	3/5/2016	13:56	51.250	184500	3.14	0.1	82.2	89.5	29.5
P17 Pre Storm F	Paleta Creek Sediment P17	2812	3/3/2016	10:42	3/5/2016	13:58	51.267	184560	3.14	0.1	122.0		
P01 Post Storm A	Paleta Creek Sediment P01	445	3/3/2016	9:35	3/5/2016	10:31	48.933	176160	3.14	0.1	20.2		
P01 Post Storm E	Paleta Creek Sediment P01	282	3/3/2016	9:37	3/5/2016	10:33	48.933	176160	3.14	0.1	12.8	19.8	6.7
P01 Post Storm F	Paleta Creek Sediment P01	578	3/3/2016	9:40	3/5/2016	10:35	48.917	176100	3.14	0.1	26.3		
P08 Post Storm A	Paleta Creek Sediment P08	379	3/3/2016	9:55	3/5/2016	10:53	48.967	176280	3.14	0.1	17.2		
P08 Post Storm E	Paleta Creek Sediment P08	727	3/3/2016	9:56	3/5/2016	10:55	48.983	176340	3.14	0.1	33.0	23.6	8.3
P08 Post Storm F	Paleta Creek Sediment P08	453	3/3/2016	9:57	3/5/2016	10:57	49.000	176400	3.14	0.1	20.5		
P08 Pre Storm + Trap Material A	"Plus" – sediment trap material was added to pre-storm cores	193	3/3/2016	9:59	3/5/2016	10:59	49.000	176400	3.14	0.1	8.7		
P08 Pre Storm + Trap Material E	"Plus" – sediment trap material was added to pre-storm cores	226	3/3/2016	10:00	3/5/2016	11:03	49.050	176580	3.14	0.1	10.2	9.4	0.8
P08 Pre Storm + Trap Material F	"Plus" – sediment trap material was added to pre-storm cores	202	3/3/2016	10:01	3/5/2016	11:06	49.083	176700	3.14	0.1	9.2		
P11 Post Storm A	Paleta Creek Sediment P11	357	3/3/2016	10:16	3/5/2016	11:25	49.150	176940	3.14	0.1	16.1		
P11 Post Storm E	Paleta Creek Sediment P11	572	3/3/2016	10:18	3/5/2016	11:27	49.150	176940	3.14	0.1	25.9	23.2	6.2
P11 Post Storm F	Paleta Creek Sediment P11	611	3/3/2016	10:20	3/5/2016	11:32	49.200	177120	3.14	0.1	27.6		
P11 Pre Storm + Trap Material A	"Plus" – sediment trap material was added to pre-storm cores	342	3/3/2016	10:22	3/5/2016	13:45	51.383	184980	3.14	0.1	14.8		
P11 Pre Storm + Trap Material E	"Plus" – sediment trap material was added to pre-storm cores	106	3/3/2016	10:23	3/5/2016	13:47	51.400	185040	3.14	0.1	4.6	7.6	6.3
P11 Pre Storm + Trap Material F	"Plus" – sediment trap material was added to pre-storm cores	76	3/3/2016	10:24	3/5/2016	13:51	51.450	185220	3.14	0.1	3.3		
P17 Post Storm A	Paleta Creek Sediment P17	49	3/3/2016	10:44	3/5/2016	14:01	51.283	184620	3.14	0.1	2.1		
P17 Post Storm E	Paleta Creek Sediment P17	55	3/3/2016	10:45	3/5/2016	14:02	51.283	184620	3.14	0.1	2.4	2.6	0.7
P17 Post Storm F	Paleta Creek Sediment P17	78	3/3/2016	10:46	3/5/2016	14:04	51.300	184680	3.14	0.1	3.4		
P17 Pre Storm + Trap Material A	"Plus" – sediment trap material was added to pre-storm cores	12	3/3/2016	10:48	3/5/2016	14:15	51.450	185220	3.14	0.1	0.5		
P17 Pre Storm + Trap Material E	"Plus" – sediment trap material was added to pre-storm cores	8	3/3/2016	10:49	3/5/2016	14:17	51.467	185280	3.14	0.1	0.4	0.5	0.2
P17 Pre Storm + Trap Material F	"Plus" – sediment trap material was added to pre-storm cores	18	3/3/2016	10:50	3/5/2016	14:19	51.483	185340	3.14	0.1	0.8		

[illegible]

Notations:

All pesticide analysis was done by Weck Laboratory
†Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable" or "Not Analyzed"
"ND" represents non-detects as reported by Weck Lab
"U" represents the potential presence of analyte but could not quantified using HPLC
E is Estimated value, exceeds the upper limit of calibration
B is Found in associated blank as well as sample
J is Estimated value, below quantitation limit.
NR is not resolved -qualifier not meeting criteria

Sl. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	Estimated core depth- see note below (cm)	% water content	% TOC solids	Stdev	% BC solids	Stdev
1	P01	P01-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	5	38.1	0.79	0.04	0.10	0.00
2	P08	P08-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	6	44.2	1.17	0.01	0.11	0.00
3	P11	P11-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	4	44.4	1.75	0.06	0.17	0.01
4	P17	P17-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	7	45.2	3.63	0.10	0.23	0.01
5	P08	P08-Post-Storm Sediment Cores	2/23/2016	3/30/2016	3	46.5	1.51	0.03	0.13	0.00
6	P11	P11-Post-Storm Sediment Cores	2/23/2016	3/30/2016	9	51.9	2.06	0.12	0.21	0.00
7	P17	P17-Post-Storm Sediment Cores	2/23/2016	3/30/2016	4	40.3	3.86	0.15	0.24	0.01

µg/Kg-dry sediment weight

Sl. No.	Bifenthrin	Cyfluthrin	Cypermethrin	Deltamethrin/Tralomethrin	Dichloran	Fenpropathrin (Danitol)	Fenvalerate/ Esfenvalerate	L-Cyhalothrin	Pendimethalin	Permethrin	Prallethrin	Sumithrin (Phenothrin)	Tefluthrin	Total Pyrethroids
1	5.9	ND	ND	ND	ND	ND	ND	ND	ND	0.0	ND	ND	ND	**5.9**
2	8.8	ND	ND	ND	1.6	ND	ND	ND	ND	7.4	ND	ND	ND	**17.8**
3	42.4	ND	3.2	ND	ND	ND	ND	ND	ND	23.8	ND	ND	ND	**69.4**
4	71.6	17.5	15.2	ND	2.6	ND	ND	ND	5.9	115.4	ND	ND	ND	**228.2**
5	4.9	ND	ND	ND	ND	ND	ND	ND	1.3	44.5	ND	ND	ND	**50.7**
6	7.4	ND	ND	ND	ND	ND	ND	ND	2.3	154.8	ND	ND	ND	**164.5**
7	79.0	14.3	39.2	ND	1.3	ND	6.3	28.4	2.7	188.3	ND	ND	ND	**359.6**

µg/Kg-dry sediment weight
POLYCYCLIC AROMATIC HYDROCARBONS (PAH-14)

Sl. No.	Napthalene	Fluorene	Acenapthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAHs-14
1	73.8	U	U	66.8	45.3	58.8	72.0	63.4	53.2	568.8	261.5	397.0	59.8	240.9	1961.3
2	85.2	U	U	79.7	25.0	87.9	104.8	64.5	45.7	340.4	140.9	241.7	35.4	207.9	1459.0
3	84.0	U	U	80.7	52.3	221.1	949.5	81.9	155.4	813.8	332.6	519.2	61.7	416.6	3769.0
4	90.5	U	U	143.8	59.1	240.2	515.1	147.3	138.1	596.6	219.4	384.7	41.8	353.6	2930.2
5	80.0	U	U	73.8	24.0	83.0	103.7	68.0	46.9	263.2	107.4	188.2	22.8	158.4	1219.4
6	159.8	U	U	156.6	U	1409.1	2713.3	437.4	699.5	1599.6	624.8	914.2	88.3	705.8	9508.3
7	70.2	U	U	306.1	U	384.4	538.4	558.6	262.6	702.5	350.3	591.2	274.7	601.4	4640.3

µg/kg-dry sediment

Sl. No.	PCB 001	PCB 002	PCB 003	PCB 004	PCB 010	PCB 009	PCB 007	PCB 006	PCB 008	PCB 005	PCB 019	PCB 018	PCB 017	PCB 015	PCB 027	PCB 024	PCB 032
1	0.07 J	0.19 J	0.09 J	0.09 J	0.05 NR	0.01 J	0.00 NR	0.03 NR	0.24 NR	0.17 NR	0.00 ND	2.38	0.06 NR	0.68	0.05 NR	0.21 NR	0.08 NR
2	0.07 J	0.20 J	0.10 J	0.10 NR	0.05 NR	0.00 NR	0.00 ND	0.03 NR	0.18 NR	0.12 J	0.00 ND	1.92	0.08 NR	0.69	0.07 NR	0.09 NR	0.14 NR
3	0.07 J	0.23 J	0.13 J	0.38	0.26 J	0.04 NR	0.03 NR	0.34 NR	0.94 NR	0.70	0.00 ND	6.35	1.24	4.01	1.33 NR	0.35 NR	1.33 NR
4	0.08 J	0.26 J	0.14 J	0.19 J	0.08 NR	0.03 NR	0.01 NR	0.07 NR	0.44 NR	0.30 J	0.00 ND	3.22	0.42	1.42	0.25 NR	0.20 NR	0.31 NR
5	0.07 J	0.24 J	0.13 J	0.11 NR	0.06 NR	0.00 NR	0.00 ND	0.02 NR	0.17 NR	0.11 J	0.00 ND	2.09	0.14 J	0.74	0.03 NR	0.05 NR	0.09 NR
6	0.12 J	0.25 J	0.18 J	0.82	0.58	0.13 NR	0.09 J	0.83 NR	2.79 NR	2.20	0.00 ND	9.15	3.58	6.21	0.62 NR	3.62 NR	2.69
7	0.08 J	0.26 J	0.16 J	0.21 J	0.07 J	0.02 NR	0.01 NR	0.09 NR	0.53 NR	0.36	0.00 ND	1.22	0.40 NR	1.31	0.12 NR	0.14 NR	0.40

Sl. No.	PCB 016	PCB 034	PCB 029	PCB 026	PCB 025	PCB 031	PCB 028	PCB 020	PCB 022	PCB 045	PCB 046	PCB 069	PCB 052	PCB 047	PCB 048
1	0.09 NR	0.00 ND	0.00 ND	0.21 J	0.00 ND	0.85	0.63	0.64 NR	0.29 J	0.05 NR	0.00 ND	0.00 ND	1.74	0.79	0.00 ND
2	0.15 NR	0.00 ND	0.00 ND	0.17 J	0.00 ND	0.82	0.63	0.57 NR	0.14 J	0.05 NR	0.00 ND	0.00 ND	1.38	0.94	0.00 ND
3	1.36	0.00 ND	0.00 ND	1.36 NR	0.00 ND	10.53	6.96	5.02	2.74	1.67	0.00 ND	0.00 ND	19.10	6.91	0.00 ND
4	0.32 J	0.00 ND	0.00 ND	0.38 NR	0.00 ND	2.45	2.05	1.36	0.66	0.29 J	0.00 ND	0.00 ND	4.46	2.00	0.00 ND
5	0.16 NR	0.00 ND	0.00 ND	0.34 NR	0.00 ND	0.97	0.86	0.66	0.20 J	0.02 J	0.00 ND	0.00 ND	1.44	1.08	0.00 ND
6	2.96	0.00 ND	0.00 ND	2.91 NR	0.00 ND	23.81	15.43	14.99	6.45	4.18	0.00 ND	0.00 ND	50.08 E	16.28	0.00 ND
7	0.41	0.00 ND	0.00 ND	0.39 NR	0.00 ND	2.71	2.05	1.62	0.89	0.46	0.00 ND	0.00 ND	3.83	1.68	0.00 ND

Sl. No.	PCB 044	PCB 042	PCB 037	PCB 071	PCB 041	PCB 103	PCB 040	PCB 067	PCB 074	PCB 070	PCB 066	PCB 095	PCB 093	PCB 056	PCB 060
1	0.76 NR	0.36	0.00 ND	0.58	1.45 NR	0.00 ND	0.22 NR	0.00 ND	0.00 ND	0.49	1.94	1.60	1.63	0.47 NR	0.47 NR
2	0.68 NR	0.23 J	0.00 ND	0.55	0.94 NR	0.00 ND	0.20 NR	0.00 ND	0.00 ND	0.52	1.85	1.07	1.11	0.46 NR	0.45 NR
3	15.80	6.82	0.00 ND	5.05	17.62 NR	0.00 ND	2.89	0.00 ND	0.00 ND	12.67	24.04	9.99	9.43	12.66	12.66
4	2.82	0.91	0.00 ND	1.19	3.93 NR	0.00 ND	0.61	0.00 ND	0.00 ND	2.02	4.45	3.37	3.36	1.95	1.94
5	0.74	0.22 J	0.00 ND	0.38 J	0.69 NR	0.00 ND	0.25 NR	0.00 ND	0.00 ND	0.61	1.78	1.16	1.20	0.51 NR	0.50 NR
6	39.22	16.41	0.00 ND	12.00	44.32 NR	0.00 ND	6.48	0.00 ND	0.00 ND	30.86	52.91	28.78	28.71	30.90	30.91
7	3.00	1.34	0.00 ND	1.32	4.65 NR	0.00 ND	0.60	0.00 ND	0.00 ND	2.14	4.23	4.18	4.20	2.10	2.10

Sl. No.	PCB 092	PCB 084	PCB 101	PCB 099	PCB 119	PCB 083	PCB 087	PCB 081	PCB 115	PCB 136	PCB 110	PCB 077	PCB 082	PCB 151
1	1.04	0.87 NR	6.82	4.08	0.35 NR	1.52 NR	1.40 NR	0.25 J	1.27	0.88	6.17	0.69 NR	0.70 NR	2.01
2	0.72	0.57 NR	4.54	3.42	0.27 NR	0.57 NR	0.98 NR	0.23 NR	0.74	0.51	4.48	0.68 NR	0.39	1.32
3	6.36	7.11 NR	36.09	21.57	1.51 NR	8.06 NR	11.28 NR	1.29	11.77	3.45	42.95 E	6.41	6.34	6.60
4	1.97	1.74 NR	11.32	6.30	0.41 NR	1.48 NR	6.35 NR	0.55	2.96	1.39	13.69	1.51	2.06	3.14
5	0.78	0.54 NR	5.18	3.70	0.28 NR	0.76 NR	2.19 NR	0.74 NR	0.89	0.53	4.80	0.79 NR	0.63 NR	1.44
6	13.67	15.52	72.45 E	42.80	2.57 NR	19.09 NR	47.51 NR	2.63	23.65	6.65	90.46 E	11.51	13.57	12.91
7	2.26	1.99	11.80	5.89	0.37 NR	1.95 NR	7.40 NR	0.53	3.65	1.53	15.89	1.57	1.99	3.25

Note: The pre and post sediment homogenized cores that was used for extraction are likely not of identical depths. The exact values could not ascertained as the sediment was transferred from the plastic core tube to a glass jar before a depth measurement could be recorded. However, using the volume of the sediment and assuming no change in porosity, an estimated core depth was calculated and it ranges from 3 to 9 cm (see Column F)

PCB 135	PCB 144	PCB 147	PCB 107	PCB 123	PCB 149	PCB 118	PCB 134	PCB 114	PCB 131	PCB 146	PCB 153	PCB 132	PCB 105	PCB 141	PCB 179	PCB 163
0.85 NR	0.83	0.47	0.65 NR	0.51 NR	8.04	2.79	0.20 J	2.31 NR	0.00 ND	1.35	8.44	1.54	1.52	1.01	0.72	3.65
0.69 NR	0.53	0.34 NR	0.62 NR	0.26 NR	5.14	2.77	0.13 J	2.02 NR	0.00 ND	0.96	6.27	0.77	1.07	0.52	0.48	3.63
2.41	2.38	1.02 NR	3.27 NR	1.53 NR	26.31	23.52	0.73	9.19 NR	0.00 ND	3.76	24.26	6.63	13.39	4.83	2.18	9.79
1.20 NR	1.11	0.44 NR	1.39	0.65	12.39	6.92	0.85	3.48 NR	0.00 ND	1.73	11.41	2.94	3.87	2.21	0.90	6.13
0.60	0.54	0.38 NR	0.66 NR	0.43	5.71	3.08	0.07 J	2.02 NR	0.00 ND	1.10	6.85	0.90	1.23	0.61	0.50	3.13
4.75	4.73	1.59	7.23 NR	2.66 NR	50.18	48.33 E	2.19	21.18 NR	0.00 ND	7.20	46.45	13.19	30.48	10.02	4.35	18.30
1.32	1.30	0.47 NR	1.38	0.62	12.84	7.01	0.56	2.99 NR	0.00 ND	1.86	11.18	3.46	4.37	2.45	0.91	4.64

PCB 138	PCB 158	PCB 178	PCB 126	PCB 187	PCB 183	PCB 128	PCB 167	PCB 174	PCB 177	PCB 171	PCB 156	PCB 157	PCB 153	PCB 172	PCB 197	PCB 180
3.64	0.57	0.44 NR	0.06 NR	3.09	1.25	0.00 ND	0.00 ND	1.76	1.30	0.70	0.82	0.28 J	0.00 ND	0.17 J	0.00 ND	5.57
3.12	0.34	0.36 NR	0.10 J	2.49	0.82	0.00 ND	0.00 ND	1.17	0.99	0.40	0.61	0.24 J	0.00 ND	0.00 ND	0.00 ND	3.16
12.62	2.56	1.27	0.52 NR	8.28	3.94	0.00 ND	0.00 ND	6.31	3.69	1.71	3.41	0.77	0.00 ND	1.03	0.06 J	19.62
6.41	1.14	0.62	0.09 NR	4.00	1.89	0.00 ND	0.00 ND	2.98	1.83	0.99	1.67	0.48 NR	0.00 ND	0.29 J	0.00 ND	8.35
3.01	0.38 J	0.38 J	0.00 NR	2.57	0.89	0.00 ND	0.00 ND	1.14	1.06 NR	0.58	0.65	0.34 NR	0.00 ND	0.00 ND	0.00 ND	2.95
30.10	5.28	2.34	1.30	15.15	7.51	0.00 ND	0.00 ND	12.75	7.07	3.08	7.04	1.32	0.00 ND	2.18	0.21 J	39.11 E
7.92	1.48	0.57	0.31	3.45	1.63	0.00 ND	0.00 ND	2.85	1.76	0.88	1.87	0.54	0.00 ND	0.43	0.00 ND	8.26

PCB 193	PCB 191	PCB 169	PCB 170	PCB 190	PCB 198	PCB 203	PCB 196	PCB 189	PCB 208	PCB 195	PCB 207	PCB 194	PCB 205	PCB 206	PCB 209	Sum of PCBs
0.34	0.00 ND	0.00 ND	2.84	0.57	1.56 NR	0.79 NR	0.79 NR	0.00 ND	0.35	0.16 NR	0.06 J	1.07	0.00 ND	1.32	1.31	113.41
0.20 J	0.00 ND	0.00 ND	1.96	0.27 NR	1.20	0.56 NR	0.57 NR	0.00 ND	0.36	0.27 NR	0.05 ND	1.66	0.00 ND	1.31	1.65	86.26
0.83	0.00 ND	0.00 ND	8.83 NR	1.17 NR	4.85	2.70 NR	2.71	0.00 ND	1.72	1.34 NR	0.33 J	5.28	0.00 ND	6.09	8.17	618.84
0.46	0.00 ND	0.00 ND	4.55	0.70	1.83	1.00	1.01	0.00 ND	0.26 J	0.41 NR	0.04 J	2.52	0.00 ND	1.45	1.06	206.49
0.27 J	0.00 ND	0.00 ND	2.03	0.36 J	1.16	0.58	0.59 NR	0.00 ND	0.30 J	0.25 NR	0.02 J	1.66	0.00 ND	1.19	1.43	92.68
1.43	0.00 ND	0.00 ND	16.66	2.65	9.02	5.05	5.06	0.00 ND	2.32	3.09	0.67	10.09	0.00 ND	8.86	10.90	1350.50
0.40	0.00 ND	0.00 ND	4.17	0.84	1.77 NR	1.03	1.04	0.00 ND	0.26 J	0.52	0.06 J	2.39	0.00 ND	1.37	0.00 ND	212.50

Notation: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
"ND" represents non-detects

SI. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Date sediment sent to TTU†	Estimated core depth- see note below (cm)	% water content	% TOC solids	Stdev	% BC solids	Stdev	Average THg (mg/Kg-dry sediment)	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P01	P01-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	4.5	46.4	0.79	0.04	0.10	0.00	0.46	0.01	8.1	0.2	0.5	0.0	52.1	1.5	272.0	14.3	207.5	10.0	16.1	0.6
2	P08	P08-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	5.8	45.4	1.17	0.01	0.11	0.00	0.55	0.05	9.3	0.4	0.2	0.0	76.5	2.2	315.7	13.8	237.7	5.7	16.9	0.2
3	P11	P11-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	4.1	43.6	1.75	0.06	0.17	0.01	0.97	0.13	8.3	0.1	1.6	0.1	158.8	7.6	491.9	17.6	244.0	7.7	18.4	0.5
4	P17	P17-Pre-Strom Sediment Cores	10/19/2015	3/30/2016	7.2	44.7	3.63	0.10	0.23	0.01	0.46	0.08	8.7	0.4	1.6	0.0	143.2	20.9	611.8	70.9	268.9	29.8	17.8	0.9
5	P08	P08-Post-Storm Sediment Cores	2/23/2016	3/30/2016	2.7	47.5	1.51	0.03	0.13	0.00	0.55	0.01	10.8	0.2	0.2	0.0	82.0	3.3	328.0	11.1	257.3	9.8	18.8	0.2
6	P11	P11-Post-Storm Sediment Cores	2/23/2016	3/30/2016	9.3	52.5	2.06	0.12	0.21	0.00	1.61	0.07	9.6	0.7	4.6	0.2	431.0	27.9	939.7	91.8	253.8	17.6	27.0	1.1
7	P17	P17-Post-Storm Sediment Cores	2/23/2016	3/30/2016	4.1	47.5	3.86	0.15	0.24	0.01	0.34	0.01	8.4	0.0	1.5	0.0	157.8	19.4	681.2	19.8	245.9	14.7	19.5	0.8

Note: The pre and post sediment homogenized cores that was used for extraction are likely not of identical depths. The exact values could not ascertained as the sediment was transferred from the plastic core tube to a glass jar before a depth measurement could be recorded. However, using the volume of the sediment and assuming no change in porosity, an estimated core depth was calculated and it ranges from 3 to 9 cm (seee Column F)

Notation: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable"
"ND" represents non-detects
Red marked values are J-flagged
The pre-storm sectioned cores trace metal values are significanlty different from those measured in the bulk pre-storm P01 cores. Sample heterogeneity is suspected to be the issue in this case.

SI. No.	Paletta Creek Site Location	Sample Description	% water content	% TOC solids	Stdev	% BC solids	Stdev	Average THg (mg/Kg-dry sediment)	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P01	P01-Pre-Strom Sediment Cores_0-1cm	23.6	0.56	0.11	0.055	0.003	0.14	NA	3.30	NA	ND	NA	12.3	NA	87.6	NA	53.1	NA	ND	NA
2		P01-Pre-Strom Sediment Cores_1-2cm	15.8	0.12	0.02	0.025	0.003	0.07	NA	3.00	NA	ND	NA	8.5	NA	52.8	NA	27.3	NA	ND	NA
3		P01-Pre-Strom Sediment Cores_2-3cm	15.8	0.10	0.01	0.023	0.002	0.03	NA	0.86-1.21	NA	ND	NA	2.28-2.46	NA	25.3-33.2	NA	9.1-10.3	NA	ND	NA
4		P01-Pre-Strom Sediment Cores_3-4cm	13.4	0.05	0.01	0.017	0.002	0.02	NA	0.97	NA	ND	NA	2.3	NA	35.1	NA	9.8	NA	ND	NA
5		P01-Pre-Strom Sediment Cores_4-5cm	16.2	0.32	0.16	0.022	0.002	0.04	NA	1.14	NA	ND	NA	3.4	NA	42.9	NA	14.5	NA	ND	NA
6	P08	P08-Pre-Strom Sediment Cores_0-1cm	52.8	1.71	0.05	0.134	0.008	0.60	NA	11.13	NA	0.23	NA	75.2	NA	352.0	NA	279.7	NA	22.1	NA
7		P08-Pre-Strom Sediment Cores_1-2cm	45.9	1.46	0.21	0.121	0.004	0.54	NA	8.72-8.99	NA	0.21	NA	63.5-72.0	NA	307.6-318.7	NA	228.9-244.5	NA	18.6-19.7	NA
8		P08-Pre-Strom Sediment Cores_2-3cm	44.9	1.80	0.11	0.120	0.002	0.64	NA	8.34	NA	ND	NA	71.1	NA	300.7	NA	229.5	NA	19.0	NA
9		P08-Pre-Strom Sediment Cores_3-4cm	42.5	1.08	0.03	0.093	0.005	0.46	NA	6.50	NA	0.20	NA	76.9	NA	273.4	NA	202.0	NA	16.0	NA
10		P08-Pre-Strom Sediment Cores_4-5cm	37.9	0.72	0.04	0.070	0.003	0.42	NA	5.15	NA	ND	NA	55.0	NA	236.4	NA	232.7	NA	14.1	NA
11	P11	P11-Pre-Strom Sediment Cores_0-1cm	58.5	2.38	0.04	0.188	0.029	1.05	NA	8.74	NA	1.14	NA	141.5	NA	519.2	NA	279.2	NA	21.9	NA
12		P11-Pre-Strom Sediment Cores_1-2cm	49.1	2.36	0.17	0.161	0.003	0.82	NA	7.33-7.40	NA	1.00-1.24	NA	137.4-145.4	NA	475.7-547.2	NA	247.7-283.7	NA	20.7-22.8	NA
13		P11-Pre-Strom Sediment Cores_2-3cm	47.2	2.06	0.05	0.149	0.006	1.62	NA	7.09	NA	0.90	NA	128.3	NA	418.1	NA	217.5	NA	19.9	NA
14		P11-Pre-Strom Sediment Cores_3-4cm	49.8	2.07	0.15	0.185	0.002	1.00	NA	7.43	NA	1.86	NA	143.0	NA	488.7	NA	225.9	NA	21.3	NA
15		P11-Pre-Strom Sediment Cores_4-5cm	47.1	2.33	0.17	0.147	0.003	1.16	NA	7.43	NA	2.12	NA	140.0	NA	461.8	NA	198.5	NA	21.2	NA
16	P17	P17-Pre-Strom Sediment Cores_0-1cm	64.7	4.96	0.14	0.388	0.018	0.41	NA	7.59-7.82	NA	1.33-1.59	NA	134.7-140.1	NA	578.2-640.9	NA	250.3-282.9	NA	19.6-22.3	NA
17		P17-Pre-Strom Sediment Cores_1-2cm	49.4	5.09	0.29	0.350	0.004	0.32	NA	5.90	NA	0.91	NA	160.0	NA	415.5	NA	191.3	NA	17.1	NA
18		P17-Pre-Strom Sediment Cores_2-3cm	54.2	4.70	0.23	0.379	0.011	0.40	NA	7.35	NA	1.15	NA	133.1	NA	525.1	NA	241.0	NA	19.3	NA
19		P17-Pre-Strom Sediment Cores_3-4cm	53.3	5.03	0.23	0.388	0.014	0.58	NA	7.96	NA	1.46	NA	128.5	NA	514.5	NA	225.3	NA	17.7	NA
20		P17-Pre-Strom Sediment Cores_4-5cm	51.7	5.24	0.26	0.379	0.021	0.47	NA	7.78	NA	1.73	NA	121.3	NA	621.7	NA	228.9	NA	20.0	NA
21	P08	P08-Post-Strom Sediment Cores_0-1cm	58.8	1.97	0.04	0.147	0.002	1.48	NA	11.81	NA	ND	NA	74.5	NA	325.0	NA	255.1	NA	21.5	NA
22		P08-Post-Strom Sediment Cores_1-2cm	47.9	1.61	0.03	0.140	0.001	0.57-0.62	NA	9.08-9.71	NA	0.19-0.20	NA	61.2-72.9	NA	311.1-322.9	NA	240.0-244.1	NA	20.1	NA
23		P08-Post-Strom Sediment Cores_2-3cm	45.5	1.50	0.02	0.129	0.005	0.54-0.60	NA	8.07	NA	0.20	NA	71.7	NA	288.5	NA	232.1	NA	20.3	NA
24		P08-Post-Strom Sediment Cores_3-4cm	47.1	1.53	0.03	0.135	0.005	0.60	NA	7.47	NA	0.18	NA	66.3	NA	298.0	NA	235.8	NA	20.2	NA
25		P08-Post-Strom Sediment Cores_4-5cm	37.9	0.92	0.06	0.092	0.005	0.37-0.38	NA	5.53	NA	0.20	NA	48.2	NA	237.9	NA	154.3	NA	17.2	NA
26	P11	P11-Post-Strom Sediment Cores_0-1cm	50.9	2.64	0.20	0.174	0.004	0.70	NA	9.66	NA	0.67	NA	100.4	NA	394.5	NA	243.2	NA	19.3	NA
27		P11-Post-Strom Sediment Cores_1-2cm	40.2	2.41	0.33	0.136	0.001	0.52	NA	5.51	NA	0.55	NA	87.0	NA	369.6	NA	224.4	NA	16.6	NA
28		P11-Post-Strom Sediment Cores_2-3cm	37.3	1.33	0.13	0.110	0.004	0.50	NA	6.11	NA	1.17	NA	79.7	NA	331.6	NA	156.0	NA	14.0	NA
29		P11-Post-Strom Sediment Cores_3-4cm	47.0	2.21	0.18	0.197	0.003	1.51	NA	7.91-8.09	NA	3.55-3.82	NA	230.0-263.3	NA	779.1-866.9	NA	214.1-236.9	NA	23.8-27.2	NA
30		P11-Post-Strom Sediment Cores_4-5cm	51.7	2.56	0.01	0.241	0.003	2.50	NA	8.65	NA	5.17	NA	358.4	NA	1225.4	NA	291.8	NA	32.9	NA
31	P17	P17-Post-Strom Sediment Cores_0-1cm	48.9	5.85	0.44	0.389	0.040	0.45	NA	5.25	NA	1.10	NA	108.8	NA	559.0	NA	186.2	NA	17.8	NA
32		P17-Post-Strom Sediment Cores_1-2cm	43.9	4.24	0.06	0.288	0.009	0.38	NA	5.99	NA	1.11	NA	104.9	NA	524.9	NA	211.6	NA	17.8	NA
33		P17-Post-Strom Sediment Cores_2-3cm	45.4	4.12	0.36	0.299	0.009	0.34	NA	6.36	NA	1.50	NA	112.5	NA	527.7	NA	215.8	NA	17.3	NA
34		P17-Post-Strom Sediment Cores_3-4cm	44.5	4.33	0.50	0.330	0.021	0.46	NA	6.31	NA	0.94	NA	112.7	NA	491.7	NA	203.5	NA	16.7	NA
35		P17-Post-Strom Sediment Cores_4-5cm	44.7	3.83	0.74	0.305	0.018	0.41	NA	5.61-6.32	NA	0.92-1.37	NA	112.6-140.2	NA	538.3-568.3	NA	192.9-248.4	NA	17.2-20.7	NA

[illegible]

µg/kg-dry sediment

Row	PCB 005		PCB 019		PCB 018		PCB 017		PCB 015		PCB 027		PCB 024		PCB 032		PCB 016		PCB 034		PCB 029		PCB 026		PCB 025	
1	0.06		0.00	ND	0.15		0.03	J	0.21		0.03	NR	0.03	NR	0.02	J	0.04	J	0.00	ND	0.00	ND	0.06	NR	0.00	ND
2	0.06		0.00	ND	0.30	NR	0.04		0.23		0.07	NR	0.07	NR	0.05		0.06	NR	0.00	ND	0.00	ND	0.10	NR	0.00	ND
3	0.06	J	0.00	ND	0.42	NR	0.06		0.35		0.08	NR	0.08	NR	0.12		0.10	NR	0.00	ND	0.00	ND	0.17		0.00	ND
4	0.10-0.22		0.00	ND	0.28-0.55		0.15-0.22		0.15-0.34		0.06-0.08	NR	0.05-0.06	NR	0.08-0.24		0.09-0.20		0.00	ND	0.00	ND	0.07-0.15		0.00	ND

Row	PCB 031		PCB 028		PCB 020		PCB 022		PCB 045		PCB 046		PCB 069		PCB 052		PCB 047		PCB 048		PCB 044		PCB 042		PCB 037	
1	0.16		0.16		0.11		0.05		0.01	J	0.00	ND	0.00	ND	0.31		0.34		0.00	ND	0.16		0.08		0.00	ND
2	0.29		0.27		0.23		0.04		0.04		0.00	ND	0.00	ND	0.83		0.52		0.00	ND	0.41		0.22		0.00	ND
3	0.56		0.55		0.49		0.18		0.08		0.00	ND	0.00	ND	1.39		0.82		0.00	ND	0.79		0.38		0.00	ND
4	0.42-0.88		0.43-0.97		0.32-0.73		0.19-0.39		0.07-0.20		0.00	ND	0.00	ND	1.29-2.45		0.36-0.79		0.00	ND	0.63-1.27		0.23-0.45		0.00	ND

Row	PCB 071		PCB 041		PCB 103		PCB 040		PCB 067		PCB 074		PCB 070		PCB 066		PCB 095		PCB 093		PCB 056		PCB 060		PCB 092	
1	0.12	NR	0.11	NR	0.00	ND	0.04	NR	0.00	ND	0.00	ND	0.13		0.54		0.35		0.36		0.13	NR	0.13	NR	0.21	
2	0.32		0.32	NR	0.00	ND	0.09		0.00	ND	0.00	ND	0.34		1.14		0.80		0.80		0.33	NR	0.33	NR	0.54	
3	0.47		0.64	NR	0.00	ND	0.15		0.00	ND	0.00	ND	0.66		1.76		1.29		1.29		0.63		0.63		0.82	
4	0.23-0.45		0.77-1.44		0.00	ND	0.14-0.26		0.00	ND	0.00	ND	0.77-1.14		0.87-1.78		1.32-2.44		1.38-2.61		0.33-0.54		0.32-0.62		0.65-1.26	

Row	PCB 084		PCB 101		PCB 099		PCB 119		PCB 083		PCB 087		PCB 081		PCB 115		PCB 136		PCB 110		PCB 077		PCB[illegible]
1	0.12		1.34		1.11		0.09	NR	0.07	NR	0.52	NR	0.03	NR	0.25		0.16		1.17		0.15		0.11
2	0.38		3.30		2.53		0.18	NR	0.62	NR	1.17	NR	0.07		0.58		0.38		3.17		0.29		0.18
3	0.60		4.66		3.35		0.24	NR	0.32	NR	2.26	NR	0.15		1.12		0.52		4.71		0.47		0.36
4	1.81-3.86	E	1.88-3.88	E	1.78-3.64	E	1.61-3.87	NR	0.67-1.72		1.67-3.23		0.09-0.17		1.15-2.26		0.60-1.15		4.52-8.83	E	0.33-0.66		0.66-1.42

082	PCB 151	PCB 135	PCB 144	PCB 147	PCB 107	PCB 123	PCB 149	PCB 118	PCB 134	PCB 114	PCB 131	PCB 146	PCB 153	PCB 132	PCB 105	PCB 141	PCB 179
	0.39	0.16	0.16	0.11	0.18	0.09 NR	1.65	1.06	0.12 NR	0.28 NR	0.00 ND	0.41	2.36	0.30	0.39	0.19	0.17
	0.82	0.30	0.30	0.21	0.38	0.15 NR	3.67	2.59	0.09	1.79 NR	0.00 ND	0.82	4.62 E	0.68	0.97	0.46	0.36
	1.18	0.42	0.41	0.22	0.52	0.19 NR	4.63	3.81	0.19	1.88 NR	0.00 ND	1.18	7.48 E	1.21	1.86	0.84	0.51
	0.94-2.07	0.43-0.87	0.40-0.85	0.15-0.28	0.30-0.71	4.21-8.99 E	3.97-8.56 E	3.39-7.74	0.37-0.98	0.58-4.51 NR	0.00 ND	0.81-1.98	5.26-12.08 E	1.63-3.49	1.53-3.38	1.08-2.47	0.44-1.06

PCB 163	PCB 138	PCB 158	PCB 178	PCB 126	PCB 187	PCB 183	PCB 128	PCB 167	PCB 174	PCB 177	PCB 171	PCB 156	PCB 157	PCB 153	PCB 172	PCB 197
1.05	1.25	0.13	0.14	0.08	0.92	0.29	0.00 ND	0.00 ND	0.35	0.35 NR	0.14	0.20	0.06	0.00 ND	0.06	0.01 J
1.58	2.69	0.32	0.26	0.10	1.71	0.59	0.00 ND	0.00 ND	0.78	0.69	0.26	0.48	0.12	0.00 ND	0.16	0.02 J
2.62	4.83	0.54	0.35	0.19	2.37	0.87	0.00 ND	0.00 ND	1.33	1.08	0.42	0.78	0.21	0.00 ND	0.27	0.03 J
6.02-14.29 E	6.24-14.98 E	0.61-1.43	0.26-0.63	0.18-0.41	1.63-3.99	0.77-1.86	0.00 ND	0.00 ND	1.09-2.61	0.76-1.79	0.39-0.85	0.46-0.73	0.19-0.38	0.00 ND	0.24-0.49	0.04-0.08 J

PCB 180	PCB 193	PCB 191	PCB 169	PCB 170	PCB 190	PCB 198	PCB 203	PCB 196	PCB 189	PCB 208	PCB 195	PCB 207	PCB 194	PCB 205	PCB 206	PCB 209	Sum of PCBs
1.30	0.08	0.00 ND	0.00 ND	0.65	0.10	0.39	0.20	0.20	0.00 ND	0.10	0.11	0.03 J	0.52	0.00 ND	0.38	0.47	27.04
2.83	0.14	0.00 ND	0.00 ND	1.34	0.20	0.78	0.42	0.42	0.00 ND	0.25	0.24	0.08	0.96	0.00 ND	0.97	1.13	59.62
4.42	0.21	0.00 ND	0.00 ND	2.10	0.30	1.09	0.58	0.59	0.00 ND	0.47	0.37	0.11	1.30	0.00 ND	1.77	1.87	91.62
3.10-7.14 E	0.12-0.25	0.00 ND	0.00 ND	1.30-2.80	0.24-0.50	0.68-1.47	0.40-0.86	0.42-0.94	0.00 ND	0.10-0.23	0.20-0.49	0-0.11 J	0.72-1.58	0.00 ND	0.49-0.86	0.58-0.88	86.80-179.81

Notations: †Samples shipped overnight and received the next day at TTU unless specified
NA is "Not Applicable" or "Not Analyzed"
"ND" represents non-detects

Sl. No.	Paletta Creek Site Location	Sample Description	Date sampled collected in SPAWAR	Storage temperature conditions	Date sediment sent to TTU†	% water content	% TOC solids	Stdev	% BC solids	Stdev/ Range	THg (mg/Kg-dry	Stdev	As (mg/Kg-dry)	Stdev	Cd (mg/Kg-dw)	Stdev	Pb (mg/Kg-dw)	Stdev	Zn (mg/Kg-dw)	Stdev	Cu (mg/Kg-dw)	Stdev	Ni (mg/Kg-dw)	Stdev
1	P01	P01-Pre-Strom Sediment Cores (0-5 cm section)	9/8/2016	frozen	9/8/2016	44.8	0.98	0.12	0.10	0.00	0.39	0.01	8.4	0.3	ND	NA	42.8	1.9	196.9	13.1	152.6	8.5	14.7	0.8
2	P08	P08-Pre-Strom Sediment Cores (0-5 cm section)	9/8/2016	frozen	9/8/2016	48.4	1.25	0.03	0.12	0.01	0.54	0.03	8.9	0.3	ND	NA	80.1	27.2	246.6	12.0	188.3	9.1	16.4	1.1
3	P11	P11-Pre-Strom Sediment Cores (0-5 cm section)	9/8/2016	frozen	9/8/2016	49.0	1.93	0.04	0.15	0.00	0.51	0.04	11.5	3.5	ND	NA	80.3	2.1	309.7	16.6	235.1	13.6	17.5	1.4
4	P17	P17-Pre-Strom Sediment Cores (0-5 cm section)	9/8/2016	frozen	9/8/2016	51.2	3.94	0.17	0.24	0.01	0.44	0.05	7.5	0.1	1.36	0.13	107.1	4.2	425.3	5.4	177.6	4.5	14.4	0.4
5	P01	P01-Post-Strom Sediment Cores (0-5 cm section)	3/9/2017	frozen on 3/14/17	4/12/2017	39.3	0.72	0.03	0.066	0.004	0.26	0.04	4.9	0.6	0.09	0.01	27.6	1.3	144.6	11.5	108.0	8.8	11.4	0.8
6	P08	P08-Post-Strom Sediment Cores (0-5 cm section)	3/9/2017	frozen on 3/14/17	4/12/2017	51.3	1.96	0.02	0.168	0.002	0.57	0.02	12.3	1.5	0.24	0.02	87.2	2.1	350.3	10.2	260.5	5.1	22.4	0.5
7	P11	P11-Post-Strom Sediment Cores (0-5 cm section)	3/9/2017	frozen on 3/14/17	4/12/2017	51.3	1.87	0.04	0.129	0.002	0.52	0.08	8.2	0.1	0.40	0.03	83.7	0.4	308.7	11.2	220.9	12.5	18.6	0.5
8	P17	P17-Post-Strom Sediment Cores (0-5 cm section)	3/9/2017	frozen on 3/14/17	4/12/2017	56.8	5.16	0.06	0.272	0.018	0.37	0.05	8.1	0.3	1.36	0.27	110.4	4.9	496.7	61.3	184.7	17.0	18.6	1.8

Notations:

Contaminant tissue values that contain a "-" represents range from duplicate extracts
All other tissues values were obtained from a single extraction
"NA" represents value not available

				(µg/g-dw)						(µg/Kg-dw)
Sample ID	Sample Description	Sample Collection Date	Mositure content in g-water/g-wet tissue (%)	**As**	**Cu**	**Ni**	**Zn**	**Cd**	**Pb**	**Total Hg**
DB-Mn-101216-A	Prestorm discovery bay tissue	10/12/2016	85.1	2.70	2.38	0.53	9.71	0.03	0.14	86.4
P01-Mn-101216-A	Prestorm P01 sediment deployed tissue	10/12/2016	84.5	5.40	4.98	0.63	24.02	0.07	0.60	141.8
P08-Mn-101216-A	Prestorm P08 sediment deployed tissue	10/12/2016	82.4	4.61-4.72	6.62-7.39	0.61-0.63	19.93-20.89	0.05	1.08-1.20	117.5-142.1
P11-Mn-101216-A	Prestorm P11 sediment deployed tissue	10/12/2016	80.3	7.44	9.51	0.74	25.00	0.07	1.19	117.3
P17-Mn-101216-A	Prestorm P17 sediment deployed tissue	10/12/2016	82.0	5.02	10.64	0.82	25.75	0.07	1.79	110.3
Time 0-Mn-091216	Time zero Prestorm tissues	9/12/2016	89.5	2.15	3.02	0.35	13.44	0.04	0.13	105.4
T0A	Poststorm tissue Time Zero A	3/10/2017	83.9	3.18	2.40	0.35	20.55	0.05	0.11	72.46
T0B	Poststorm tissue Time Zero B	3/10/2017	82.7	3.60	3.24	0.46	20.08	0.05	0.10	68.55
T0C	Poststorm tissue Time Zero C	3/10/2017	82.2	3.31	2.87	0.42	18.57	0.04	0.08	76.49
DB	Poststorm Discovery bay	4/8/2017	85.7	2.66	2.63	0.35	14.70	0.03	0.09	76.65
P01	Poststorm P01 sediment deployed tissue	4/8/2017	85.7	2.13	3.26	0.30	18.30	0.03	0.34	85.09
P08	Poststorm P08 sediment deployed tissue	4/8/2017	84.7	3.03	3.49	0.24	17.69	0.02	0.47	74.34
P11	Poststorm P11 sediment deployed tissue	4/8/2017	84.8	3.42	3.53	0.28	18.86	0.03	0.58	73.25
P17-1				2.71	3.86	0.37	18.03	0.03	0.70	65.23
P17-2	Poststorm P17 sediment deployed tissue (duplicate	4/8/2017	85.8	3.69	3.48	0.35	16.36	0.03	0.64	61.84

comb means 3 fibers were pool	PRE STORM SAMPLES										
"0" indicates "Non Detect"	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	Cpw ng/L	
Sample ID as in SPAWAR CO	**DB-SPME_101116_B**	**DB-SPME_101116_C**	**P01-SPME_101116_B**	**P01-SPME_101116_C**	**P08-SPME_101116_B**	**P08-SPME_101116_(**	**P11-SPME_101116_B**	**P11-SPME_101116_C**	**P17-SPME_101116_**	**P17-SPME_101116_C**	
naphthalene	10.9	6.7	7.7	7.6	8.0	10.7	11.8	8.2	7.7	9.4	
2-methylnaphthalene	1.1	1.1	1.1	1.0	1.4	1.8	1.3	1.8	1.8	1.6	
1-methylnaphthalene	2.0	1.9	1.7	1.7	2.1	2.5	2.0	2.5	2.5	2.1	
2-ethylnaphthalene	0.2	0.4	0.3	0.5	0.3	0.7	0.3	0.5	0.9	1.0	
1-ethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
2.6-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3	
1.3-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.8	
2-isopropylnaphthalene	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
acenaphthylene	0.0	0.0	6.1	0.0	1.3	0.0	0.6	0.6	0.1	0.0	
1.2-dimethylnaphthalene	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.4	
1.8-dimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	
acenaphthene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	5.1	
2.3.5-trimethylnaphthalene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	
fluorene	0.7	0.7	0.6	0.5	1.1	1.2	0.3	0.9	1.2	1.9	
1-methylfluorene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	
phenanthrene	0.9	0.5	0.1	0.0	0.3	0.1	0.0	0.6	0.6	0.4	
anthracene	0.0	0.0	1.5	0.3	1.4	0.3	0.5	0.7	1.2	0.9	
2-methylphenanthrene	0.1	0.0	0.2	0.1	0.1	0.2	0.1	0.2	0.6	0.7	
2-methylanthracene	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.2	
1-methylphenanthrene	0.2	0.1	0.5	0.2	0.3	0.3	0.2	0.2	1.0	1.0	
9-methylanthracene	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.5	0.2	0.2	**J**
2-ethylanthracene	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.5	0.7	**J**
fluoranthene	1.3	1.0	3.8	2.2	3.0	2.9	2.2	3.5	10.4	12.9	
pyrene	0.5	0.4	6.1	2.5	4.6	4.2	6.6	7.3	14.7	15.1	
9.10-dimethylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2-tertbutylanthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**J**
1-methylpyrene	0.1	0.1	1.1	0.4	0.8	0.6	0.7	0.8	0.8	0.8	
benz(a)anthracene	0.2	0.2	1.5	0.4	0.5	0.5	0.5	0.5	0.7	0.7	
chrysene	0.2	0.2	1.5	0.3	0.5	0.5	0.6	0.6	0.8	0.8	
benzo(b)fluoranthene	0.1	0.1	1.3	0.4	0.8	0.6	0.6	0.6	0.4	0.3	
7.12-methylbenz(a)anthracene	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**J**
benzo(k)fluoranthene	0.0	0.0	1.1	0.3	0.5	0.4	0.3	0.5	0.3	0.2	
benzo(e)pyrene	0.0	0.0	0.9	0.2	0.4	0.3	0.3	0.4	0.3	0.2	
benzo(a)pyrene	0.1	0.1	1.1	0.2	0.4	0.3	0.3	0.3	0.2	0.2	
perylene	0.1	0.1	0.1	0.0	0.3	0.1	0.1	0.2	0.1	0.1	
indeno(123-cd)pyrene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
dibenzo(ah)anthracene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
benzo(ghi)perylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SUM PAH ng/L	**19.0**	**14.2**	**38.8**	**19.3**	**28.6**	**28.9**	**30.0**	**31.6**	**54.1**	**58.9**	

in all measured samples compounds:

9-methylanthracene	J
2-ethylanthracene	J
2-tertbutylanthracene	J
7.12-methylbenz(a)anthracene	J

POST STORM SAMPLES

sample name	[redacted]	*Cpw ng/L* SERDP P01 A_Mar17	*Cpw ng/L* SERDP P01 B_Mar17	*Cpw ng/L* SERDP P08 A_Mar17	*Cpw ng/L* SERDP P08 B_Mar17	*Cpw ng/L* SERDP P11 A_Mar17	*Cpw ng/L* SERDP P11 B_Mar17	*Cpw ng/L* SERDP P17 A_Mar17	*Cpw ng/L* SERDP P17 B_Mar17
naphthalene		3.49	1.33	0.72	1.17	0.00	0.00	2.74	0.33

2-methylnaphthalene	[redacted]	2.80	3.18	2.24	2.59	0.17	0.26	1.98	2.95
1-methylnaphthalene		25.39	22.30	14.48	7.40	2.66	3.46	5.93	4.14
2-ethylnaphthalene		0.80	0.63	0.78	0.58	0.38	0.41	0.44	0.69
1-ethylnaphthalene		0.40	0.22	0.52	0.26	0.13	0.20	0.21	0.22
2.6-dimethylnaphthalene		0.83	1.10	0.79	0.75	0.79	0.54	1.24	2.24
1.3-dimethylnaphthalene		0.00	0.03	0.00	0.02	0.00	0.00	0.35	0.26
2-isopropylnaphthalene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
acenaphthylene		8.99	11.06	12.92	12.12	7.63	10.27	5.61	5.45
1.2-dimethylnaphthalene		1.08	1.15	1.01	1.40	1.08	0.99	1.24	1.12
1.8-dimethylnaphthalene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
acenaphthene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.3.5-trimethylnaphthalene		0.73	0.83	0.65	0.79	0.61	0.71	1.35	0.98
fluorene		4.19	4.24	3.63	4.38	3.63	4.00	4.37	3.75
1-methylfluorene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
phenanthrene		1.86	1.96	1.80	2.37	1.56	2.51	3.55	2.15
anthracene		4.21	4.12	5.11	4.77	2.53	4.06	2.86	2.05
2-methylphenanthrene		0.40	0.49	0.35	0.58	0.42	0.64	1.54	1.27
2-methylanthracene		1.09	1.04	1.28	1.26	0.90	1.09	1.10	1.08
1-methylphenanthrene		0.31	0.35	0.43	0.47	0.25	0.38	0.75	0.45
9-methylanthracene		0.32	0.39	0.42	0.37	0.40	0.46	0.41	0.32
2-ethylanthracene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
fluoranthene		3.50	2.71	4.09	4.78	1.27	3.36	11.33	5.60
pyrene		3.97	3.11	8.40	9.99	7.24	7.51	14.05	10.36
9.10-dimethylanthracene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-tertbutylanthracene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-methylpyrene		0.48	0.46	0.91	0.96	0.71	0.78	0.72	0.65
benz(a)anthracene		0.57	0.49	0.64	0.71	0.36	0.49	0.66	0.43
chrysene		0.60	0.52	0.75	0.83	0.47	0.73	0.84	0.56
benzo(b)fluoranthene		0.69	0.71	1.14	1.09	0.64	0.77	0.40	0.37
7.12-methylbenz(a)anthracene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
benzo(k)fluoranthene		0.62	0.71	1.16	0.98	0.45	0.66	0.31	0.29
benzo(e)pyrene		0.39	0.48	0.65	0.68	0.45	0.53	0.34	0.31
benzo(a)pyrene		0.38	0.37	0.55	0.52	0.34	0.38	0.25	0.24
perylene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indeno(123-cd)pyrene		0.16	0.16	0.20	0.19	0.14	0.17	0.12	0.11
dibenzo(ah)anthracene		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
benzo(ghi)perylene		0.15	0.17	0.18	0.17	0.14	0.16	0.12	0.12
Sum (ng/L)		**68.44**	**64.33**	**65.79**	**62.19**	**35.35**	**45.53**	**64.83**	**48.51**

[illegible]

'ND' indicates "Non Detect"

Sample ID	Description	[illegible]	007 Results		006 Results		008 Results		005 Results		019 Results		018 Results		017 Results		015 Results	
			Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	al Conc.n	Qual	Final Conc.ng/L	Qual
[illegible]	[illegible]	[illegible]	0.000	ND	0.000	ND	0.007	J	0.000	ND	0.000	ND	0.010	J	0.007	J	0.004	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.001	ND	0.007	J	0.000	ND	0.000	ND	0.009	J	0.008	J	0.005	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.003	ND	0.018		0.000	ND	0.000	ND	0.023		0.015		0.007	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.002	ND	0.010	J	0.000	ND	0.000	ND	0.013		0.009		0.005	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.003	ND	0.015	J	0.000	ND	0.000	ND	0.022		0.019		0.007	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.003	ND	0.011	J	0.000	ND	0.000	ND	0.027		0.017	J	0.009	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.001	ND	0.008	J	0.000	ND	0.000	ND	0.021		0.015		0.007	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.002	ND	0.004	J	0.000	ND	0.000	ND	0.018		0.013		0.007	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.002	ND	0.010	J	0.000	ND	0.000	ND	0.023		0.016		0.007	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.001	ND	0.007	J	0.000	ND	0.000	ND	0.020		0.014		0.006	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.010	J	0.026		0.000	ND	0.044	J	0.152		0.025		0.019	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.011	J	0.024		0.000	ND	0.047		0.087		0.033		0.019	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.009	J	0.023		0.000	ND	0.049	J	0.095		0.036		0.019	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.010	J	0.027		0.000	ND	0.046	J	0.133		0.032		0.020	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.010	J	0.026		0.000	ND	0.047	J	0.097		0.031		0.021	J
[illegible]	[illegible]	[illegible]	0.000	ND	0.010	J	0.026		0.000	ND	0.049		0.092		0.028		0.019	
[illegible]	[illegible]	[illegible]	0.000	ND	0.011		0.027		0.000	ND	0.044		0.064		0.026		0.019	
[illegible]	[illegible]	[illegible]	0.000	ND	0.010		0.024		0.000	ND	0.043		0.079		0.025		0.018	

Sample ID	027 Results		024 Results		032 Results		016 Results		034 Results		029 Results		026 Results		025 Results		031 Results	
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
[illegible]	0.021		0.017		0.002	J	0.003	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.001	J
[illegible]	0.023		0.018		0.002	J	0.003	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002	J
[illegible]	0.024		0.020		0.008	J	0.013	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.009	
[illegible]	0.018		0.014		0.004	J	0.007	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.005	J
[illegible]	0.028		0.021		0.007	J	0.012	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.010	
[illegible]	0.041		0.032		0.005	J	0.012	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.007	J
[illegible]	0.023		0.018		0.006	J	0.012	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.008	
[illegible]	0.022		0.018		0.006	J	0.011	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.008	
[illegible]	0.024		0.020		0.006	J	0.009	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.010	
[illegible]	0.024		0.019		0.005	J	0.009	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.010	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.020	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.012	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.021		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.013	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.021	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.016	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.022	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.015	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.022	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.018	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.025		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.020	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.023		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.020	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.020		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.018	

Sample ID	028 Results		020 Results		022 Results		045 Results		046 Results		069 Results		052 Results		047 Results		048 Results	
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
[illegible]	0.004	J	0.004	J	0.002	J	0.000	ND	0.012		0.004		0.007		0.000	ND	0.002	J
[illegible]	0.004	J	0.002	J	0.002	J	0.000	ND	0.010		0.004	J	0.006		0.000	ND	0.002	J
[illegible]	0.014		0.011		0.003	J	0.001	ND	0.003	J	0.002	J	0.030		0.013		0.008	
[illegible]	0.009		0.005	J	0.003	J	0.000	ND	0.001	ND	0.011		0.018		0.005		0.007	
[illegible]	0.014		0.009		0.005	J	0.001	ND	0.003	J	0.022		0.035		0.014		0.009	
[illegible]	0.014		0.009	J	0.004	J	0.000	ND	0.003	J	0.022		0.035		0.010		0.007	J
[illegible]	0.013		0.010		0.004	J	0.002	J	0.003	J	0.002	J	0.036		0.015		0.012	
[illegible]	0.014		0.010		0.004	J	0.001	ND	0.003	J	0.022		0.035		0.012		0.011	
[illegible]	0.015		0.012		0.005	J	0.001	ND	0.001	ND	0.016		0.026		0.007		0.008	
[illegible]	0.011		0.008		0.004	J	0.000	ND	0.001	ND	0.013		0.020		0.005		0.005	J
[illegible]	0.017		0.027		0.025	J	0.000	ND	0.000	ND	0.000	ND	0.071		0.033	J	0.017	ND
[illegible]	0.014		0.027		0.023	J	0.000	ND	0.000		0.000	ND	0.066		0.035		0.017	
[illegible]	0.020		0.030		0.024	J	0.000	ND	0.000	J	0.000	ND	0.080		0.036		0.013	ND
[illegible]	0.018		0.027		0.024	J	0.000	ND	0.000	ND	0.000	ND	0.064		0.031		0.013	ND
[illegible]	0.021		0.034		0.025		0.000	ND	0.000	J	0.000	ND	0.064		0.028		0.017	ND
[illegible]	0.022		0.034		0.026		0.012	J	0.000		0.000	ND	0.076		0.036		0.017	
[illegible]	0.019		0.030		0.027		0.051		0.000		0.000	ND	0.046		0.020		0.015	
[illegible]	0.016		0.029		0.026		0.043		0.000		0.000	ND	0.043		0.017		0.013	

Sample ID	044 Results		042 Results		037 Results		071 Results		041 Results		103 Results		040 Results		067 Results		074 Results	
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.001	ND	0.001	J	0.000	ND	0.000	ND	0.000	ND	0.001	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.001	ND	0.001	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.005		0.015		0.000	ND	0.000	ND	0.000	ND	0.004	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.003		0.008		0.000	ND	0.000	ND	0.000	ND	0.002	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.006		0.018		0.000	ND	0.000	ND	0.000	ND	0.005	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.005	J	0.017		0.000	ND	0.000	ND	0.000	ND	0.004	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.007		0.021		0.000	ND	0.000	ND	0.000	ND	0.006	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.006		0.019		0.000	ND	0.000	ND	0.000	ND	0.005	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.004	J	0.020		0.000	ND	0.000	ND	0.000	ND	0.005	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.004	J	0.014		0.000	ND	0.000	ND	0.000	ND	0.003	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.011	J	0.029		0.000		0.000	ND	0.000	ND	0.009	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.012		0.033		0.000		0.009	J	0.000	ND	0.010	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.015		0.041		0.000		0.000	ND	0.000	ND	0.011	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.012	J	0.032		0.000		0.000	ND	0.000	ND	0.009	J
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.014	J	0.043		0.000		0.000	ND	0.000	ND	0.012	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.014		0.048		0.000		0.029		0.000	ND	0.013	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.008		0.036		0.000		0.062		0.000	ND	0.008	
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.008		0.030		0.000		0.059		0.000	ND	0.007	

Sample ID	070 Results		066 Results		095 Results		093 Results		056 Results		060 Results		092 Results		084 Results		101 Results	
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
[illegible]	0.002	J	0.006		0.002	J	0.002	J	0.000	ND	0.001	J	0.001	J	0.002	J	0.002	J
[illegible]	0.002	J	0.006		0.002	J	0.004	J	0.000	ND	0.001	J	0.001	J	0.001	ND	0.000	ND
[illegible]	0.010		0.016		0.015		0.020		0.000	ND	0.003	J	0.005		0.020		0.015	
[illegible]	0.005		0.009		0.009		0.012		0.000	ND	0.001	J	0.003		0.011		0.007	
[illegible]	0.011		0.018		0.012		0.016		0.000	ND	0.004	J	0.005		0.019		0.013	
[illegible]	0.010		0.016		0.008		0.018		0.000	ND	0.004	J	0.005		0.015		0.010	
[illegible]	0.012		0.015		0.015		0.025		0.000	ND	0.004		0.005		0.018		0.012	
[illegible]	0.012		0.015		0.012		0.020		0.000	ND	0.004		0.004		0.017		0.012	
[illegible]	0.011		0.014		0.008		0.015		0.000	ND	0.004		0.004		0.012		0.009	
[illegible]	0.007		0.009		0.006		0.011		0.000	ND	0.003	J	0.004		0.008		0.006	
[illegible]	0.018		0.027		0.026		0.029		0.006		0.007		0.012	J	0.036		0.028	
[illegible]	0.018		0.031		0.027		0.033		0.008		0.007		0.013		0.043		0.032	
[illegible]	0.024		0.034		0.034		0.036		0.008		0.008		0.013		0.045		0.033	
[illegible]	0.018		0.028		0.022		0.023		0.007		0.008		0.010	J	0.032		0.024	
[illegible]	0.024		0.030		0.023		0.028		0.010		0.010		0.009		0.028		0.021	
[illegible]	0.026		0.034		0.029		0.035		0.009		0.010		0.012		0.038		0.028	
[illegible]	0.017		0.020		0.015		0.017		0.007		0.008		0.006		0.018		0.013	
[illegible]	0.013		0.019		0.013		0.007		0.007		0.007		0.005		0.015		0.011	

Sample ID	099 Results		119 Results		083 Results		087 Results		81 Results		115 Results		136 Results		110 Results		77 Results	
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
[illegible]	0.001	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.002	J	0.001	J	0.001	J
[illegible]	0.001	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.002	J	0.001	J	0.001	J
[illegible]	0.022		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.005		0.005		0.020		0.003	J
[illegible]	0.009		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.003		0.009		0.002	J
[illegible]	0.019		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.007		0.005		0.021		0.002	J
[illegible]	0.014		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.008		0.005	J	0.015		0.003	J
[illegible]	0.015		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.007		0.004		0.020		0.003	
[illegible]	0.015		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.006		0.004		0.019		0.003	
[illegible]	0.009		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.006		0.002	J	0.016		0.002	J
[illegible]	0.006		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.004		0.002	J	0.009		0.002	J
[illegible]	0.044		0.000	ND	0.000	J	0.000		0.000	ND	0.000	ND	0.010		0.036		0.008	J
[illegible]	0.052		0.000		0.000		0.000		0.000	J	0.000	ND	0.013		0.044		0.009	J
[illegible]	0.044		0.000		0.000		0.000		0.000	J	0.000	ND	0.012		0.051		0.008	J
[illegible]	0.034		0.000		0.000		0.000		0.000	ND	0.000	ND	0.010		0.035		0.008	J
[illegible]	0.028		0.000		0.000		0.000		0.000	ND	0.000	ND	0.009		0.035		0.008	J
[illegible]	0.038		0.000		0.000		0.000		0.000	ND	0.000	ND	0.011		0.047		0.008	
[illegible]	0.018		0.000		0.000		0.000		0.000	J	0.000	ND	0.007		0.027		0.007	
[illegible]	0.017		0.000		0.000		0.000		0.000	J	0.000	ND	0.006		0.023		0.006	

Sample ID	082 Results		151 Results		135 Results		144 Results		147 Results		107 Results		123 Results		149 Results		118 Results	
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
[illegible]	0.000	ND	0.000	ND	0.001	J	0.001	J	0.000	ND	0.000	ND	0.000	ND	0.005		0.005	
[illegible]	0.000	ND	0.000	ND	0.001	J	0.002	J	0.000	ND	0.000	ND	0.000	ND	0.000	J	0.000	ND
[illegible]	0.000	ND	0.004		0.003		0.003		0.000	ND	0.000	ND	0.000	ND	0.018		0.009	
[illegible]	0.000	ND	0.001	J	0.001	J	0.002		0.000	ND	0.000	ND	0.000	ND	0.007		0.037	
[illegible]	0.000	ND	0.003		0.003		0.003		0.000	ND	0.000	ND	0.000	ND	0.014		0.010	
[illegible]	0.000	ND	0.002	J	0.003	J	0.004		0.000	ND	0.000	ND	0.000	ND	0.011		0.005	
[illegible]	0.000	ND	0.003		0.002		0.003		0.000	ND	0.000	ND	0.000	ND	0.012		0.010	
[illegible]	0.000	ND	0.003		0.002		0.002		0.000	ND	0.000	ND	0.000	ND	0.011		0.005	
[illegible]	0.000	ND	0.002	J	0.002	J	0.002		0.000	ND	0.000	ND	0.000	ND	0.008		0.010	
[illegible]	0.000	ND	0.001	J	0.002	J	0.002	J	0.000	ND	0.000	ND	0.000	ND	0.005		0.035	
[illegible]	0.015	J	0.011		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.039		0.032	
[illegible]	0.017		0.014		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.050		0.035	
[illegible]	0.017	J	0.012		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.046		0.031	
[illegible]	0.014	J	0.009		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.030		0.028	
[illegible]	0.014	ND	0.008		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.028		0.012	
[illegible]	0.014		0.010		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.038		0.030	
[illegible]	0.012		0.006		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.020		0.013	
[illegible]	0.014		0.005		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.018		0.013	

Sample ID	134 Results		114 Results		131 Results		146 Results
	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L
[illegible]	0.002	J	0.000	ND	0.000	ND	0.001
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.002	J	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.000
[illegible]	0.000	ND	0.000	ND	0.000	J	0.014
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.017
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.014
[illegible]	0.000	ND	0.000	ND	0.000	J	0.013
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.011
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.013
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.009
[illegible]	0.000	ND	0.000	ND	0.000	ND	0.009

Sample ID	Description	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	153 Results		132 Results		105 Results		141 Results		179 Results	
Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	al Conc.n	Qual
J	0.000	ND	0.002	J	0.001	J	0.000	ND	0.000	ND
ND	0.001	J	0.003		0.001	J	0.000	ND	0.000	ND
ND	0.017		0.005		0.003		0.000	ND	0.000	J
ND	0.007		0.003		0.003		0.000	ND	0.000	ND
ND	0.014		0.005		0.004		0.000	ND	0.000	ND
ND	0.008		0.004		0.002	J	0.000	ND	0.000	ND
ND	0.010		0.004		0.005		0.000	ND	0.000	ND
ND	0.010		0.005		0.004		0.000	ND	0.000	ND
ND	0.006		0.004		0.004		0.000	ND	0.000	ND
ND	0.003		0.003		0.003		0.000	ND	0.000	ND
J	0.045		0.014	ND	0.009		0.011	J	0.000	ND
J	0.058		0.017		0.012		0.012	J	0.000	ND
J	0.045		0.016	J	0.012		0.012	J	0.000	ND
J	0.033		0.013	ND	0.009	J	0.011	J	0.000	ND
J	0.020		0.011	J	0.009		0.010	J	0.000	ND
J	0.034		0.015		0.011		0.012		0.000	ND
J	0.012		0.010		0.007		0.009		0.001	ND
J	0.011		0.010		0.007		0.009		0.001	J

163 Results		138 Results		158 Results		178 Results		126 Results		187 Results	
Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	J
0.000	ND	0.009		0.000	ND	0.000	ND	0.000	ND	0.003	
0.000	ND	0.004		0.000	ND	0.000	ND	0.000	ND	0.001	J
0.000	ND	0.007		0.000	ND	0.000	ND	0.000	ND	0.001	J
0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.007		0.000	ND	0.000	ND	0.000	ND	0.001	J
0.000	ND	0.006		0.000	ND	0.000	ND	0.000	ND	0.001	J
0.000	ND	0.004		0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.002	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	J	0.038		0.003	J	0.033	J	0.000	ND	0.012	J
0.000	J	0.049		0.003	J	0.008	J	0.000	ND	0.016	
0.000	J	0.040		0.003	J	0.008	J	0.000	ND	0.011	
0.000	J	0.029		0.003	J	0.007	J	0.000	ND	0.008	
0.000	J	0.024		0.002	J	0.007	J	0.000	ND	0.005	
0.000		0.034		0.003	J	0.008	J	0.000	ND	0.009	
0.000		0.018		0.002	J	0.006	J	0.000	ND	0.003	
0.000		0.017		0.002	J	0.007		0.000	ND	0.003	

183 Results		128 Results		167 Results		174 Results		177 Results		171 Results		156 Results		157 Results		173 Results		172 Results		197 Results	
Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	ul Conc.n	Qual	al Conc.n	Qual	al Conc.n	Qual	ul Conc.n	Qual	ul Conc.n	Qual	al Conc.n	Qual
0.000	ND	0.000	ND	0.000	ND	0.001		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.002		0.001	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.003		0.000	ND	0.004	J	0.004	ND	0.005	ND	0.000		0.004	J	0.000	ND	0.000		0.000	J	0.000	ND
0.004		0.000	ND	0.004		0.006	ND	0.006	J	0.000		0.005	J	0.000	ND	0.000	J	0.000	J	0.000	ND
0.003		0.000	ND	0.004	J	0.005	ND	0.005	ND	0.000	J	0.004	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.002	J	0.000	ND	0.003	J	0.003	ND	0.003	ND	0.000		0.004	J	0.000	ND	0.000		0.000	ND	0.000	ND
0.001	J	0.000	ND	0.002	J	0.003	ND	0.002	ND	0.000		0.003	J	0.000	ND	0.000		0.000	ND	0.000	ND
0.002		0.000	ND	0.003	J	0.004	J	0.004	J	0.000		0.004		0.000	ND	0.000	ND	0.000	ND	0.000	ND
0.001		0.000	ND	0.002	J	0.002	J	0.002	J	0.000	J	0.003		0.000	ND	0.000	ND	0.000	J	0.000	ND
0.001		0.000	ND	0.002	J	0.002		0.002	J	0.000		0.003	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND

180 Results		193 Results		191 Results		169 Results		170 Results		190 Results		198 Results		203 Results		196 Results		189 Results		208 Results		195 Results		207 Results		194 Results		205 Results		206 Results		209 Results		SUM
al Conc.n	Qual	ul Conc.n	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	Final Conc.ng/L	Qual	
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.165**
0.007		0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.161**
0.001	J	0.000	ND	0.000	ND	0.000	ND	0.004		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.497**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.315**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.005		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.516**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.006		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.483**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.004		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.473**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.457**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.004		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.413**
0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.003		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.348**
0.010	ND	0.000	ND	0.000	J	0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.264**
0.011	J	0.000	ND	0.000	J	0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.305**
0.009	J	0.000	ND	0.000	J	0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.310**
0.007	ND	0.000	ND	0.000	J	0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.150**
0.005	J	0.000	ND	0.000	J	0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.001		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.094**
0.009		0.000	ND	0.000		0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.304**
0.004		0.000	J	0.000	J	0.000	J	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.001		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**1.000**
0.004		0.000	ND	0.000	J	0.000	E	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.001		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	**0.944**

Pre-storm tissue concentrations

Concentration (µg/kg-wet weight basis)

PAHs	DB-Mn-101216-B-1	DB-Mn-101216-B-2	DB-Mn-101216-B-3	PØ1-Mn-101216-B-1	PØ1-Mn-101216-B-3	PØ8-Mn-101216-B-1	PØ8-Mn-101216-B-2	PØ8-Mn-101216-B-3	PØ11-Mn-101216-B-1	PØ11-Mn-101216-B-2	PØ17-Mn-101216-B-1	PØ17-Mn-101216-B-2	PØ17-Mn-101216-B-3	TØ-Mn-091216-B-1	TØ-Mn-091216-B-2	TØ-Mn-091216-B-3
Naphthalene	11.4	6.2	9.9	10.0	12.2	12.0	11.7	10.9	16.2	15.7	18.2	17.6	14.7	35.3	6.4	29.1
Fluorene	5.7	5.3	6.6	11.1	12.0	9.4	13.3	12.0	18.7	11.1	8.4	10.2	11.9	21.0	17.7	6.0
Acenaphthene	0.6	0.4	0.6	0.6	0.7	0.7	0.7	0.5	0.9	0.7	1.0	1.0	0.8	1.5	1.2	1.3
Phenanthrene	11.9	7.9	11.4	11.2	12.6	12.5	12.0	10.9	14.6	16.5	19.0	18.4	16.4	39.2	35.1	34.8
Anthracene	0.6	1.2	0.7	5.0	4.6	4.3	5.5	3.2	5.1	5.3	1.8	1.9	1.7	1.6	1.5	1.6
Fluoranthene	5.7	4.6	4.8	6.5	7.2	7.6	7.6	7.1	10.5	8.3	23.2	22.4	21.3	7.1	9.5	6.7
Pyrene	4.0	2.8	3.1	7.0	7.9	11.4	12.1	11.2	19.9	18.5	28.0	29.1	25.7	5.6	5.1	5.4
Chrysene	0.6	0.7	0.6	3.2	4.0	4.0	4.2	4.1	4.1	3.8	5.4	5.6	4.3	0.7	0.7	0.8
Benz[a]anthracene	0.5	0.6	0.6	3.4	4.3	4.5	4.8	4.8	4.4	4.0	6.6	6.8	5.9	1.4	1.3	1.3
Benzo[b]fluoranthene	0.8	1.0	1.2	31.1	34.5	41.8	40.0	35.3	25.3	30.8	21.1	22.5	19.1	1.2	1.6	1.7
Benzo[k]fluoranthene	0.2	0.3	0.3	12.0	13.1	15.1	15.6	15.6	10.9	10.5	7.0	7.5	6.3	0.4	0.4	0.5
Benzo[a]pyrene	0.3	0.4	0.5	16.4	18.1	20.3	21.0	20.3	14.3	14.4	10.0	11.2	9.2	0.6	0.7	0.8
Dibenz[a,h]anthracene	0.2	0.4	0.4	1.9	2.0	2.0	1.9	2.3	1.5	1.5	1.2	1.5	0.8	0.3	0.3	0.3
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.1	0.2	0.2	6.4	6.7	7.0	7.3	7.3	6.4	5.9	6.3	6.2	4.9	0.3	0.3	0.3

	Average Concentration (µg/kg-tissue wet weight basis)					
PAHs	DB	P01	P08	P11	P17	T0
Naphthalene	9.2	11.1	11.6	15.9	16.8	23.6
Fluorene	5.9	11.5	11.6	14.9	10.2	14.9
Acenaphthene	0.5	0.6	0.6	0.8	0.9	1.3
Phenanthrene	10.4	11.9	11.8	15.5	17.9	36.4
Anthracene	0.8	4.8	4.4	5.2	1.8	1.6
Fluoranthene	5.0	6.9	7.4	9.4	22.3	7.8
Pyrene	3.3	7.4	11.6	19.2	27.6	5.4
Chrysene	0.6	3.6	4.1	3.9	5.1	0.7
Benz[a]anthracene	0.6	3.9	4.7	4.2	6.4	1.3
Benzo[b]fluoranthene	1.0	32.8	39.1	28.1	20.9	1.5
Benzo[k]fluoranthene	0.3	12.6	15.4	10.7	6.9	0.5
Benzo[a]pyrene	0.4	17.2	20.5	14.3	10.1	0.7
Dibenz[a,h]anthracene	0.3	1.9	2.1	1.5	1.2	0.3
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.2	6.5	7.2	6.2	5.8	0.3

	% Average fraction (g-lipid or water /g-tissue wet weight basis)					
	DB	P01	P08	P11	P17	T0-A
Tissue Lipid Fraction	0.67	0.93	1.01	0.62	0.66	1.02
Tissue Water content	85.1	84.5	82.4	80.3	82.0	89.5

	Average Concentration (µg/kg-lipids)					
PAHs	DB	P01	P08	P11	P17	T0
Naphthalene	1373	1192	1143	2561	2537	2314
Fluorene	884	1239	1142	2400	1534	1463
Acenaphthene	80	66	61	122	143	132
Phenanthrene	1561	1275	1168	2501	2704	3568
Anthracene	126	516	430	841	273	153
Fluoranthene	751	736	735	1512	3365	763
Pyrene	498	798	1143	3090	4161	527
Chrysene	95	382	406	630	763	69
Benz[a]anthracene	88	416	464	677	967	131
Benzo[b]fluoranthene	146	3524	3861	4518	3150	149
Benzo[k]fluoranthene	44	1347	1526	1728	1047	44
Benzo[a]pyrene	65	1850	2029	2307	1524	70
Dibenz[a,h]anthracene	50	206	205	241	178	31
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	23	700	710	993	869	27

Post Storm Tissue Concentrations

Concentration (µg/kg-tissue wet weight basis)

PAHs	DB-1	DB-2	DB-3	PØ1-1	PØ1-2	PØ1-3	PØ8-1	PØ8-2	PØ8-3	PØ11-1	PØ11-2	PØ11-3	PØ17-1	PØ17-2	PØ17-3	TØA-1	TØA-2	TØA-3	TØB-1	TØB-2	TØB-3	TØC-1	TØC-2	TØC-3
Naphthalene	155.8	185.1	168.7	40.8	41.5	28.3	39.5	36.9	32.3	29.0	38.8	33.4	34.2	1.8	36.0	161.7	43.2	44.2	52.1	37.1	42.2	47.3	47.3	33.5
Fluorene	10.7	12.5	11.1	3.2	1.3	2.4	3.1	1.9	1.7	2.1	1.5	1.2	2.8	2.5	1.1	11.6	2.5	2.6	3.2	2.4	2.5	3.7	1.5	2.8
Acenaphthene	12.5	15.1	13.4	4.1	3.0	3.4	4.8	3.9	3.4	3.2	3.3	3.2	4.4	45.9	3.5	12.7	4.2	4.3	5.4	3.9	4.3	4.7	3.5	4.0
Phenanthrene	55.5	63.4	57.9	10.9	9.9	8.8	12.8	11.0	9.5	9.2	11.6	10.3	10.9	1.7	11.5	59.4	12.5	13.3	15.4	11.8	12.6	12.6	11.3	10.5
Anthracene	1.7	1.9	1.9	0.9	0.5	0.8	1.1	1.0	0.9	0.8	0.8	0.6	0.8	11.5	1.0	1.9	0.5	0.6	0.6	0.5	0.7	1.0	0.6	1.0
Fluoranthene	10.0	11.7	10.8	7.8	4.7	7.1	11.4	11.7	10.9	6.4	9.9	6.9	14.9	46.6	15.2	10.3	4.2	4.4	6.1	4.9	5.2	9.0	5.4	8.4
Pyrene	12.4	14.2	12.9	8.8	4.7	8.5	20.6	22.1	19.7	16.3	22.9	18.6	19.4	62.9	19.9	12.5	4.0	4.3	6.4	4.9	5.5	10.3	5.3	10.0
Chrysene	0.5	0.5	0.4	4.5	1.8	3.8	4.9	5.7	5.0	4.1	5.5	4.8	2.6	9.8	2.6	0.6	0.7	0.7	1.1	0.9	1.0	5.2	2.0	4.5
Benz[a]anthracene	1.0	1.0	1.0	4.8	1.9	4.1	6.0	6.9	5.9	4.2	5.6	4.8	3.6	50.0	3.8	1.2	0.7	0.7	0.9	0.7	0.9	5.5	2.1	4.8
Benzo[b]fluoranthene	0.5	0.4	0.4	23.3	9.2	20.0	33.5	39.3	33.8	23.5	31.9	27.5	8.6	13.1	9.3	0.7	0.4	0.4	1.4	1.2	0.7	27.0	10.5	23.7
Benzo[k]fluoranthene	0.2	0.2	0.2	9.1	3.6	7.7	12.3	14.4	12.4	8.3	11.4	9.9	3.1	5.5	3.2	0.3	0.2	0.2	0.4	0.4	0.3	10.6	4.1	9.1
Benzo[a]pyrene	0.5	0.6	0.5	13.4	5.2	11.0	17.8	21.2	17.9	12.7	17.5	14.9	4.4	10.7	4.6	0.5	0.3	0.3	0.5	0.5	0.6	15.6	5.9	13.0
Dibenz[a,h]anthracene	0.3	0.1	0.3	1.7	0.8	1.3	1.7	1.8	1.6	0.9	0.9	1.4	0.6	3.1	0.5	0.3	0.3	0.3	0.4	0.3	0.3	0.2	0.1	0.2
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.2	0.1	0.2	6.1	2.0	4.5	5.5	6.1	5.7	3.9	6.6	5.1	1.7	0.0	1.8	0.3	0.1	0.1	0.3	0.3	0.4	0.7	0.2	0.5

	Average Concentration (µg/kg-tissue wet weight basis)							
PAHs	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Naphthalene	169.9	36.9	36.3	33.7	24.0	83.0	43.8	42.7
Fluorene	11.5	2.3	2.2	1.6	2.1	5.5	2.7	2.7
Acenaphthene	13.7	3.5	4.0	3.3	17.9	7.1	4.5	4.1
Phenanthrene	58.9	9.9	11.1	10.4	8.0	28.4	13.2	11.5
Anthracene	1.8	0.7	1.0	0.7	4.4	1.0	0.6	0.9
Fluoranthene	10.8	6.5	11.3	7.7	25.6	6.3	5.4	7.6
Pyrene	13.2	7.3	20.8	19.3	34.1	6.9	5.6	8.5
Chrysene	0.5	3.4	5.2	4.8	5.0	0.6	1.0	3.9
Benz[a]anthracene	1.0	3.6	6.3	4.9	19.1	0.8	0.8	4.2
Benzo[b]fluoranthene	0.4	17.5	35.5	27.6	10.3	0.5	1.1	20.4
Benzo[k]fluoranthene	0.2	6.8	13.0	9.9	3.9	0.2	0.4	7.9
Benzo[a]pyrene	0.5	9.9	18.9	15.1	6.6	0.4	0.5	11.5
Dibenz[a,h]anthracene	0.2	1.3	1.7	1.1	1.4	0.3	0.3	0.1
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	0.2	4.2	5.8	5.2	1.2	0.2	0.3	0.5

	% Average fraction (g-lipid or water /g-tissue wet weight basis)							
	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Tissue Lipid Fraction	0.73	0.72	0.50	0.95	0.74	1.49	1.00	2.41
Tissue Water content	85.7	85.7	84.7	84.8	85.9	83.9	82.7	82.2

	Average Concentration (µg/kg-lipid)							
PAHs	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Naphthalene	23327	5104	7289	3542	3232	5570	4402	1769
Fluorene	1575	316	446	169	284	372	273	110
Acenaphthene	1882	484	811	343	2416	475	454	168
Phenanthrene	8093	1368	2230	1089	1079	1905	1330	475
Anthracene	251	103	203	79	594	67	62	36
Fluoranthene	1486	903	2275	812	3445	423	540	314
Pyrene	1807	1016	4177	2023	4588	466	561	354
Chrysene	64	464	1044	499	671	44	105	162
Benz[a]anthracene	135	493	1266	512	2577	56	84	172
Benzo[b]fluoranthene	60	2425	7144	2900	1391	34	113	846
Benzo[k]fluoranthene	31	939	2622	1035	528	14	38	327
Benzo[a]pyrene	74	1364	3805	1580	883	24	53	475
Dibenz[a,h]anthracene	30	178	340	115	189	19	31	6
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	22	580	1162	544	157	12	32	20

Average PCB Concentration (µg/kg-tissue wet weight basis)

	% Average fraction (g-lipid or water /g-tissue wet weight basis)					
	P01-Mn-101216-B-1	P08-Mn-101216-B-1	P011-Mn-101216-B-1	P017-Mn-101216-B-1	DB B-1	T0 1
Tissue Lipid Fraction	0.932	1.010	0.622	0.663	0.670	1.020
Tissue Water content	84.52	82.35	80.28	81.97	85.14	89.49

Average PCB Concentration (µg/kg-Lipids)

Sample	1	2	3	4	10	9	7	6	8	5	19	18	17	15	27	24
P01-Mn-101216-B-1	0.967	0.754	0.862	16.714	1.233	ND	ND	2.018	5.449	ND	1.294	86.983	6.603	3.918	ND	ND
P08-Mn-101216-B-1	1.036	0.235	0.971	7.537	0.412	1.295	53.906	1.311	2.183	ND	0.332	85.379	6.748	3.102	ND	1.300
P011-Mn-101216-B-1	1.401	1.175	1.197	31.650	1.860	ND	ND	1.322	6.054	ND	2.142	199.939	7.892	7.003	ND	ND
P017-Mn-101216-B-1	1.622	1.129	1.261	34.067	1.865	ND	ND	1.146	4.632	ND	1.542	227.633	8.609	5.935	ND	ND
DB B-1	0.865	0.372	1.265	9.159	0.143	2.149	68.803	1.393	1.927	ND	0.000	120.075	4.443	2.847	ND	80.775
T0 1	0.653	0.277	1.070	31.758	0.225	1.569	118.134	1.575	2.133	ND	0.000	349.311	3.046	2.525	ND	234.381

Post Storm Tissue

Sample	1	2	3	4	10	9	7	6	8	5	19	18	17	15	27	24
DB_1_042017	0.013	0.007	0.020	0.369	0.009	0.015	2.147	0.033	0.052	ND	0.000	0.569	0.062	0.046	0.000	0.007
DB_2_042017	0.015	0.008	0.022	0.548	0.012	0.019	2.680	0.038	0.056	ND	0.000	0.582	0.080	0.057	0.000	0.014
DB_3_042017	0.014	0.007	0.021	0.466	0.011	0.020	0.682	0.038	0.055	ND	0.002	0.560	0.057	0.052	0.000	0.012
P01_1_042017	0.006	0.002	0.009	0.078	0.002	0.012	0.581	0.010	0.012	ND	0.000	0.174	0.037	0.019	0.000	0.008
P01_2_042017	0.006	0.002	0.009	0.062	0.000	0.010	0.639	0.010	0.009	ND	0.000	0.149	0.035	0.016	0.000	0.005
P01_3_042017	0.006	0.003	0.009	0.048	0.002	0.012	0.526	0.010	0.016	ND	0.000	0.103	0.030	0.018	0.000	0.007
P08_1_042017	0.008	0.004	0.012	0.078	0.003	0.012	0.682	0.017	0.025	ND	0.000	0.226	0.057	0.028	0.000	0.009
P08_2_042017	0.007	0.003	0.011	0.072	0.003	0.011	0.679	0.017	0.019	ND	0.003	0.175	0.072	0.024	0.000	0.012
P08_3_042017	0.007	0.003	0.011	0.067	0.003	0.015	0.583	0.012	0.015	ND	0.001	0.152	0.057	0.025	0.000	0.009
P11_1_042017	0.006	0.003	0.010	0.075	0.000	0.012	0.452	0.012	0.012	ND	0.000	0.108	0.056	0.027	0.000	0.009
P11_2_042017	0.006	0.004	0.009	0.055	0.002	0.010	0.549	0.012	0.019	ND	0.000	0.173	0.054	0.034	0.000	0.008
P11_3_042017	0.006	0.003	0.009	0.056	0.002	0.014	0.475	0.010	0.014	ND	0.000	0.113	0.049	0.032	0.000	0.007
P17_1_042017	0.007	0.004	0.009	0.103	0.002	0.030	0.719	0.015	0.020	ND	0.000	0.164	0.040	0.025	0.000	0.007
P17_2_042017	0.006	0.004	0.010	0.065	0.001	0.015	0.734	0.012	0.018	ND	0.000	0.125	0.039	0.021	0.000	0.006
P17_3_042017	0.006	0.004	0.010	0.078	0.002	0.077	0.647	0.011	0.015	ND	0.000	0.151	0.040	0.024	0.000	0.007
T0A_1_042017	0.011	0.005	0.019	0.418	0.007	0.022	2.015	0.028	0.044	ND	0.000	0.472	0.056	0.042	0.000	0.010
T0A_2_042017	0.006	0.003	0.010	0.082	0.000	0.028	0.633	0.009	0.008	ND	0.000	0.132	0.014	0.012	0.000	0.004
T0A_3_042017	0.006	0.003	0.010	0.111	0.000	0.206	0.691	0.014	0.008	ND	0.000	0.208	0.021	0.014	0.000	0.003
T0B_1_042017	0.007	0.004	0.011	0.110	0.000	0.104	1.097	0.013	0.014	ND	0.000	0.147	0.024	0.019	0.000	0.006
T0B_2_042017	0.006	0.002	0.009	0.074	0.000	0.073	0.542	0.008	0.007	ND	0.000	0.152	0.021	0.013	0.000	0.004
T0B_3_042017	0.006	0.003	0.010	0.123	0.000	0.064	0.671	0.013	0.010	ND	0.000	0.138	0.021	0.017	0.000	0.004
T0C_1_042017	0.006	0.003	0.010	0.081	0.000	0.079	0.696	0.011	0.009	ND	0.000	0.222	0.017	0.017	0.000	0.006
T0C_2_042017	0.008	0.003	0.011	0.110	0.001	0.091	0.530	0.012	0.013	ND	0.000	0.319	0.038	0.019	0.000	0.007
T0C_3_042017	0.006	0.003	0.010	0.105	0.000	0.023	0.719	0.009	0.008	ND	0.000	0.187	0.017	0.014	0.000	0.006

Sample	1	2	3	4	10	9	7	6	8	5	19	18	17	15	27	24
DB_1_042017	0.014	0.007	0.021	0.461	0.011	0.018	1.836	0.037	0.054	ND	0.001	0.570	0.066	0.052	0.000	0.011
P01_1_042017	0.006	0.002	0.009	0.063	0.001	0.011	0.582	0.010	0.012	ND	0.000	0.142	0.034	0.018	0.000	0.007
P08_1_042017	0.008	0.003	0.011	0.073	0.003	0.012	0.648	0.015	0.020	ND	0.001	0.184	0.062	0.025	0.000	0.010
P11_1_042017	0.006	0.003	0.009	0.062	0.001	0.012	0.492	0.011	0.015	ND	0.000	0.131	0.053	0.031	0.000	0.008
P17_1_042017	0.006	0.004	0.010	0.082	0.002	0.041	0.700	0.013	0.018	ND	0.000	0.147	0.040	0.023	0.000	0.007
T0A_1_042017	0.008	0.004	0.013	0.204	0.002	0.086	1.113	0.017	0.020	ND	0.000	0.271	0.030	0.023	0.000	0.006
T0B_1_042017	0.006	0.003	0.010	0.102	0.000	0.080	0.770	0.012	0.011	ND	0.000	0.146	0.022	0.016	0.000	0.005
T0C_1_042017	0.007	0.003	0.011	0.099	0.000	0.064	0.648	0.011	0.010	ND	0.000	0.243	0.024	0.017	0.000	0.006

	% Average fraction (g-lipid or water /g-tissue wet weight basis)							
	DB_1_042017	P01_1_042017	P08_1_042017	P11_1_042017	P17_1_042017	T0A_1_042017	T0B_1_042017	T0C_1_042017
Tissue Lipid Fraction	0.73	0.72	0.50	0.95	0.74	1.49	1.00	2.41
Tissue Water content	85.71	85.72	84.70	84.82	85.85	83.90	82.71	82.23

Sample	1	2	3	4	10	9	7	6	8	5	19	18	17	15	27	24
DB_1_042017	2.125	1.114	3.193	70.612	1.657	ND	ND	5.596	8.329	ND	0.092	87.309	10.139	7.925	ND	ND
P01_1_042017	2.079	0.854	3.266	22.656	0.513	ND	ND	3.632	4.485	ND	0.000	51.217	12.239	6.353	ND	ND
P08_1_042017	0.704	0.314	1.029	6.792	0.272	ND	ND	1.431	1.841	ND	0.113	17.222	5.775	2.377	ND	ND
P11_1_042017	0.019	0.010	0.030	0.195	0.004	0.038	1.548	0.036	0.047	ND	0.000	0.413	0.167	0.097	0.000	0.025
P17_1_042017	2.826	1.681	4.274	36.484	0.793	18.154	311.906	5.800	7.939	ND	0.000	65.269	17.613	10.418	0.000	3.047
T0A_1_042017	0.505	0.224	0.829	12.986	0.142	5.456	70.960	1.071	1.293	ND	0.000	17.253	1.933	1.438	0.000	0.364
T0B_1_042017	0.005	0.003	0.009	0.086	0.000	0.068	0.652	0.010	0.009	ND	0.000	0.123	0.019	0.014	0.000	0.004
T0C_1_042017	0.428	0.183	0.672	6.257	0.031	4.093	41.146	0.678	0.636	ND	0.000	15.408	1.529	1.049	0.000	0.405

Appendix I-1: Paleta Sediment Tissue Porewater Summary
PrePost_16-17_ExsituTissue-Pest

Pre Storm Tissues

Pesticides	Concentration (µg/kg-wet weight basis) DB-Mn-101216-B-1	DB-Mn-101216-B-2	DB-Mn-101216-B-3	PØ1-Mn-101216-B-1	PØ1-Mn-101216-B-3	PØ8-Mn-101216-B-1	PØ8-Mn-101216-B-2	PØ8-Mn-101216-B-3	PØ11-Mn-101216-B-1	PØ11-Mn-101216-B-2	PØ17-Mn-101216-B-1	PØ17-Mn-101216-B-2	PØ17-Mn-101216-B-3	TØ-Mn-091216-B-1	TØ-Mn-091216-B-2	TØ-Mn-091216-B-3
Transchlordane	0.085	0.027	0.055	0.250	0.276	0.424	0.538	0.476	1.131	1.012	2.221	2.138	1.811	0.093	0.099	0.156
Cischlordane	0.059	0.021	0.058	0.232	0.278	0.410	0.494	0.421	1.065	1.002	2.475	2.554	2.028	0.072	0.082	0.095

	Average Concentration (µg/kg-tissue wet weight basis)					
Pesticides	DB	P01	P08	P11	P17	T0
Transchlordane	0.056	0.263	0.479	1.071	2.057	0.116
Cischlordane	0.046	0.255	0.442	1.033	2.353	0.083

	% Average fraction (g-lipid or water /g-tissue wet weight basis)					
	DB	P01	P08	P11	P17	T0-A
Tissue Lipid Fraction	0.667	0.932	1.011	0.622	0.663	1.020
Tissue Water content	85.1	84.5	82.4	80.3	82.0	89.5

	Average Concentration (µg/kg-lipids)					
Pesticides	DB	P01	P08	P11	P17	T0
Transchlordane	8.3	28.2	47.4	172.4	310.2	11.4
Cischlordane	6.9	27.3	43.7	166.3	354.8	8.2

Post Storm Tissues

Pesticides	Concentration (µg/kg-tissue wet weight basis) DB-1	DB-2	DB-3	PØ1-1	PØ1-2	PØ1-3	PØ8-1	PØ8-2	PØ8-3	PØ11-1	PØ11-2	PØ11-3	PØ17-1	PØ17-2	PØ17-3	TØA-1	TØA-2	TØA-3	TØB-1	TØB-2	TØB-3	TØC-1	TØC-2	TØC-3
Transchlordane	0.244	0.251	0.256	0.279	0.135	0.229	0.818	0.718	0.652	0.922	1.178	1.096	1.605	1.544	1.472	0.205	0.029	0.025	0.019	0.030	0.039	0.037	0.081	0.047
Cischlordane	0.142	0.184	0.156	0.274	0.134	0.253	0.723	0.732	0.623	0.903	1.112	1.020	1.723	1.665	1.597	0.131	0.031	0.036	0.049	0.020	0.025	0.039	0.051	0.043

	Average Concentration (µg/kg-tissue wet weight basis)							
Pesticides	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Transchlordane	0.250	0.214	0.729	1.065	1.540	0.086	0.029	0.055
Cischlordane	0.160	0.220	0.693	1.012	1.662	0.066	0.031	0.044

	% Average fraction (g-lipid or water /g-tissue wet weight basis)							
	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Tissue Lipid Fraction	0.728	0.722	0.498	0.953	0.743	1.490	0.995	2.413
Tissue Water content	85.7	85.7	84.7	84.8	85.9	83.9	82.7	82.2

	Average Concentration (µg/kg-lipid)							
Pesticides	DB	P01	P08	P11	P17	T0-A	T0-B	T0-C
Transchlordane	34.34	29.68	146.58	111.80	207.38	5.78	2.94	2.27
Cischlordane	22.02	30.50	139.25	106.19	223.71	4.43	3.13	1.82

Notations: A,E,F = indicative of DGT replicates.
For control samples the minimum field/lab deployment time is used to calculate the representative concentration.
The travel controls are the same for pre and post-storm DGT samples

$D_{eff,25C}$ =	0.0000053	cm2/s	c_{THgDGT} = $Dd*m_{resin}/(A_{exposure}*t*D_{eff})$
Deployment temp., T =	15	ºC	pg/ml=ng/l= cm*pg/(cm2*s*cm2/s)
$D_{eff,T=}$	3.98E-06	cm2/s	c_{THgDGT}

DGT Exposure Timeline

Name/ID	Sample Name	mTHg,DGT Final Result (pg)	Deployment date	Deployment time	Retrieval date	Retrieval time	Exposure time h	Exposure time s	$A_{exposure}$ cm^2	Dd Diffusive thickness cm	$c_{THg\ DGT\ (porewater)}$ ng/L	verage C_{Hg-D} ng/L	St. Dev. C_{Hg-DGT} ng/L
Control Hg A	Travel Control DGT	155					52.000	187200	3.14	0.1	6.6	6.4	0.37
Control Hg B	Travel Control DGT	143					52.000	187200	3.14	0.1	6.1		
P01 Hg-F	Paleta Creek Sediment P01	3420	9/13/2016	10:41	9/15/2016	13:05	50.400	181440	3.14	0.1	150.9	130.5	28.8
P01 Hg-G	Paleta Creek Sediment P01	2497	9/13/2016	10:44	9/15/2016	13:10	50.433	181560	3.14	0.1	110.1		
P08 Hg-F	Paleta Creek Sediment P08	3158	9/13/2016	10:46	9/15/2016	13:14	50.467	181680	3.14	0.1	139.2	161.1	31.0
P08 Hg-G	Paleta Creek Sediment P08	4155	9/13/2016	10:48	9/15/2016	13:17	50.483	181740	3.14	0.1	183.0		
P11 Hg-F	Paleta Creek Sediment P11	1545	9/13/2016	10:50	9/15/2016	13:21	50.517	181860	3.14	0.1	68.0	88.3	28.6
P11 Hg-G	Paleta Creek Sediment P11	2467	9/13/2016	10:52	9/15/2016	13:27	50.583	182100	3.14	0.1	108.5		
P17 Hg-F	Paleta Creek Sediment P17	280	9/13/2016	10:55	9/15/2016	13:29	50.567	182040	3.14	0.1	12.3	17.4	7.3
P17 Hg-G	Paleta Creek Sediment P17	514	9/13/2016	10:57	9/15/2016	13:33	50.600	182160	3.14	0.1	22.6		

Notations: A,B = indicative of DGT replicates.
For control samples the minimum field/lab deployment time is used to calculate the representative concentration.

$D_{eff,25C}$ =	0.0000053	cm2/s	$c_{THgDGT} = Dd*m_{resin}/(A_{exposure}*t*D_{eff})$
Deployment temp., T =	15	ºC	pg/ml=ng/l= cm*pg/(cm2*s*cm2/s)
$D_{eff,T=}$	3.98E-06	cm2/s	c_{THgDGT}

DGT Exposure Timeline

Name/ID	Sample Name	mTHg,DGT **Final Result (pg)**	Deployment **date**	Deployment **time**	Retrieval **date**	Retrieval **time**	Exposure time **h**	Exposure time **s**	$A_{exposure}$ **cm^2**	Dd Diffusive thickness **cm**	$c_{THg\ DGT\ (porewater)}$ **ng/L**	verage C_{Hg-D} **ng/L**	St. Dev. C_{Hg-DGT} **ng/L**
Blank-Hg-A	Travel Control DGT	1943					52.000	187200	3.14	0.1	83.1	44.7	54.21
Blank-Hg-B	Travel Control DGT	150					52.000	187200	3.14	0.1	6.4		
P01-Hg-A-G1	Paleta Creek Sediment P01	564	3/11/2017	##########	3/13/2017	3:48:00 PM	51.633	185880	3.14	0.1	24.3	28.7	6.2
P01-Hg-B-G2	Paleta Creek Sediment P01	772	3/11/2017	##########	3/13/2017	4:00:00 PM	51.833	186600	3.14	0.1	33.1		
P08-Hg-A-G2	Paleta Creek Sediment P08	2717	3/11/2017	##########	3/13/2017	4:04:00 PM	51.850	186660	3.14	0.1	116.6	130.3	19.5
P08-Hg-B-G1	Paleta Creek Sediment P08	3360	3/11/2017	##########	3/13/2017	4:05:00 PM	51.867	186720	3.14	0.1	144.1		
P11-Hg-A-G1	Paleta Creek Sediment P11	517	3/11/2017	##########	3/13/2017	4:03:00 PM	51.783	186420	3.14	0.1	22.2	23.6	1.9
P11-Hg-B-G2	Paleta Creek Sediment P11	581	3/11/2017	##########	3/13/2017	4:04:00 PM	51.800	186480	3.14	0.1	25.0		
P17-Hg-A-G2	Paleta Creek Sediment P17	94	3/11/2017	##########	3/13/2017	3:59:00 PM	51.667	186000	3.14	0.1	4.0	3.4	0.8
P17-Hg-B-G1	Paleta Creek Sediment P17	66	3/11/2017	##########	3/13/2017	4:01:00 PM	51.700	186120	3.14	0.1	2.9		
HCl blank 1	Extract blank	< 25					NA					NA	
HCl blank 2	Extract blank	< 25					NA					NA	

Notations:

Represents values between MDL and lowest calibration

Represents values that is greater than the highest calibration

Represents the column containing the calculated DGT pore water values

"ND" represents values less than the MDL

QA/QC issues during the first analysis. However, these samples could not be re-analyzed due to insufficient sample extracts

V_{gel} - Volume of the resin gel (typically 0.16ml = 0.00016L) 0.00016 L

2. Average Temperature of Deployment (°C) 15
used in determining the diffusion
D - Diffusion coefficient of metal in the resin gel (temperature and metal specific) - this is pulled from a look up caluclation in columns AC:AM row 6.

Sample ID	Sample Description	1a. Deployment Date	1a. Deployment Time	Deployment Date/Time	1b. Recovery Date/Time	1b. Recovery Date/Time	Collection Date/Time	Exposure (Days)	Exposure (sec)	Concentration of Trace Metals in the Resin-gel Extracts (µg/L)						Total Extraction Volume (L)
										Ag	Cd	Cu	Ni	Pb	Zn	
P01-TM-F	Pre-Storm Season 2016/17	9/13/2016	10:40	9/13/16 10:40	9/15/2016	13:08	9/15/16 13:08	2.10	181680	0.4	ND	100.8	18.8	6.9	564.0	0.001
P01-TM-G	Pre-Storm Season 2016/17	9/13/2016	10:43	9/13/16 10:43	9/15/2016	13:12	9/15/16 13:12	2.10	181740	0.4	ND	119.4	19.0	4.6	563.2	0.001
P08-TM-F	Pre-Storm Season 2016/17	9/13/2016	10:45	9/13/16 10:45	9/15/2016	13:16	9/15/16 13:16	2.10	181860	0.2	1.7	684.9	38.5	10.6	1252.2	0.001
P08-TM-G	Pre-Storm Season 2016/17	9/13/2016	10:47	9/13/16 10:47	9/15/2016	13:19	9/15/16 13:19	2.11	181920	0.2	ND	141.1	19.9	6.5	696.2	0.001
P11-TM-F	Pre-Storm Season 2016/17	9/13/2016	10:49	9/13/16 10:49	9/15/2016	13:23	9/15/16 13:23	2.11	182040	0.5	ND	148.6	22.7	11.3	815.0	0.001
P11-TM-G	Pre-Storm Season 2016/17	9/13/2016	10:51	9/13/16 10:51	9/15/2016	13:28	9/15/16 13:28	2.11	182220	1.0	1.8	756.0	32.2	74.0	1824.0	0.001
P17-TM-F	Pre-Storm Season 2016/17	9/13/2016	10:54	9/13/16 10:54	9/15/2016	13:32	9/15/16 13:32	2.11	182280	ND	ND	38.7	13.4	10.6	132.0	0.001
P17-TM-G	Pre-Storm Season 2016/17	9/13/2016	10:56	9/13/16 10:56	9/15/2016	13:34	9/15/16 13:34	2.11	182280	ND	ND	18.0	25.2	8.2	316.3	0.001
Blank-TM-A	DGT Blank Control							0.00	182280	ND	ND	13.3	9.8	1.4	27.0	0.001
Blank-TM-B	DGT Blank Control							0.00	182280	ND	ND	5.4	ND	0.7	40.0	0.001

Sample ID	M - Mass of metal in the resin gel $M = Ce(V_{HNO3} + V_{gel})/fe$						5. Δg - thickness of the diffusive gel (typically 0.8mm)	converted to cm	Final Δg PLUS the thickness of the filter membrane (typically	A - exposure area (see window size as labeled on container of DGTs when received; typically 3.14 or 2.54cm²):	Pore Water Trace Metal Concentration (µg/L)					
	0.984	0.987	0.977	0.935	0.974	0.963					10.59	4.57	4.68	4.33	6.03	4.56
	Ag	Cd	Cu	Ni	Pb	Zn					Ag	Cd	Cu	Ni	Pb	Zn
P01-TM-F	0.00	0.00	0.12	0.02	0.01	0.68	0.78	0.078	0.092	3.14	0.01	ND	4.12	0.87	0.22	24.03
P01-TM-G	0.00	0.00	0.14	0.02	0.01	0.68	0.78	0.078	0.092	3.14	0.01	ND	4.89	0.88	0.15	23.98
P08-TM-F	0.00	0.00	0.81	0.05	0.01	1.51	0.78	0.078	0.092	3.14	0.00	0.07	27.99	1.78	0.34	53.29
P08-TM-G	0.00	0.00	0.17	0.02	0.01	0.84	0.78	0.078	0.092	3.14	0.00	ND	5.77	0.92	0.21	29.62
P11-TM-F	0.00	0.00	0.18	0.03	0.01	0.98	0.78	0.078	0.092	3.14	0.01	ND	6.07	1.05	0.36	34.65
P11-TM-G	0.00	0.00	0.90	0.04	0.09	2.20	0.78	0.078	0.092	3.14	0.02	0.07	30.84	1.49	2.35	77.47
P17-TM-F	0.00	0.00	0.05	0.02	0.01	0.16	0.78	0.078	0.092	3.14	ND	ND	1.58	0.62	0.34	5.60
P17-TM-G	0.00	0.00	0.02	0.03	0.01	0.38	0.78	0.078	0.092	3.14	ND	ND	0.74	1.16	0.26	13.43
Blank-TM-A	0.00	0.00	0.02	0.01	0.00	0.03	0.78	0.078	0.092	3.14	ND	ND	0.54	0.45	0.05	1.15
Blank-TM-B	0.00	0.00	0.01	0.00	0.00	0.05	0.78	0.078	0.092	3.14	ND	ND	0.22	ND	0.02	1.70

Notations:

- Represents values between MDL and lowest calibration (orange)
- Represents values that is greater than the highest calibration (yellow)
- Represents the column containing the calculated DGT pore water (green)
- "ND" represents values less than the MDL
- Represents samples whose QA/QC did not meet the requirements-will be re-analyzed. Any values that are provided are prone to revision (grey)
- Deviation in ICPMS analytical internal standard > 30% (blue)

Sample ID	Sample Description	1a. Deployment Date	1a. Deployment Time	Deployment Date/Time	1b. Recovery Date/Time	1b. Recovery Date/Time	Collection Date/Time	Exposure (Days)	Exposure (sec)	Ag	Cd	Cu	Ni	Pb	Zn	Total Extraction Volume (L)
P01 A G1	Grab Sample 1 from Location P01	3/11/2017	12:10	3/11/17 12:10	3/13/2017	15:02	3/13/17 15:02	2.12	183120	ND	ND	10.9	1.8	0.8	37.1	0.005
P01 B G2	Grab Sample 2 from Location P01	3/11/2017	12:10	3/11/17 12:10	3/13/2017	15:03	3/13/17 15:03	2.12	183180	ND	ND	15.1	3.2	1.0	279.8	0.005
P08 A G2	Grab Sample 2 from Location P08	3/11/2017	12:13	3/11/17 12:13	3/13/2017	15:06	3/13/17 15:06	2.12	183180	ND	0.2	111.9	4.9	2.6	226.0	0.005
P08 B G1	Grab Sample 1 from Location P08	3/11/2017	12:13	3/11/17 12:13	3/13/2017	15:08	3/13/17 15:08	2.12	183300	0.1	0.4	119.3	7.3	7.3	591.0	0.005
P11 A G1	Grab Sample 1 from Location P11	3/11/2017	12:16	3/11/17 12:16	3/13/2017	15:03	3/13/17 15:03	2.12	182820	0.1	0.2	88.7	4.2	7.6	160.1	0.005
P11 B G2	Grab Sample 2 from Location P11	3/11/2017	12:16	3/11/17 12:16	3/13/2017	15:05	3/13/17 15:05	2.12	182940	ND	0.1	30.1	3.2	2.0	80.7	0.005
P17 A G2	Grab Sample 2 from Location P17**	3/11/2017	12:19	3/11/17 12:19	3/13/2017	14:59	3/13/17 14:59	2.11	182400	ND	0.2	19.1	3.4	2.5	82.5	0.005
P17 B G1	Grab Sample 1 from Location P17*	3/11/2017	12:19	3/11/17 12:19	3/13/2017	15:01	3/13/17 15:01	2.11	182520	ND	0.1	16.6	2.7	2.9	25.8	0.005
Blank A	DGT Blank Control			3/11/17 0:00			3/13/17 0:00	2.00	172800	ND	ND	1.7	0.3	0.1	4.5	0.005
Blank B	DGT Blank Control			3/11/17 0:00			3/13/17 0:00	2.00	172800	ND	ND	1.4	0.1	0.1	5.0	0.005

V_{gel} - Volume of the resin gel (typically 0.16ml = 0.00016L) 0.00016 L

2. Average Temperature of Deployment (°C) used in determining the 15

Sample ID	M - Mass of metal in the resin gel $M = Ce(V_{HNO3} + V_{gel})/fe$ Ag	Cd	Cu	Ni	Pb	Zn	5. Δg - thickness of the diffusive gel (typically 0.8mm)	converted to cm	Final Δg PLUS the thickness of the filter membrane (typically 0.14mm):	A - exposure area (see window size as labeled on container of DGTs when received; typically 3.14 or 2.54 cm²)	Ag	Cd	Cu	Ni	Pb	Zn
fe / D - Diffusion coefficient of metal in the resin gel	0.984	0.987	0.977	0.935	0.974	0.963					10.59	4.57	4.68	4.33	6.03	4.56
P01 A G1	ND	ND	0.058	0.010	0.004	0.199	0.78	0.078	0.092	3.14	ND	ND	1.97	0.36	0.11	6.97
P01 B G2	ND	ND	0.080	0.018	0.006	1.499	0.78	0.078	0.092	3.14	ND	ND	2.73	0.65	0.15	52.60
P08 A G2	ND	0.001	0.591	0.027	0.014	1.211	0.78	0.078	0.092	3.14	ND	ND	20.21	1.00	0.36	42.48
P08 B G1	0.0005	0.002	0.630	0.041	0.039	3.167	0.78	0.078	0.092	3.14	ND	ND	21.52	1.50	1.03	111.01
P11 A G1	0.001	0.001	0.468	0.023	0.040	0.858	0.78	0.078	0.092	3.14	0.01	0.04	16.04	0.86	1.07	30.15
P11 B G2	ND	0.000	0.159	0.018	0.010	0.432	0.78	0.078	0.092	3.14	ND	ND	5.44	0.66	0.28	15.18
P17 A G2	ND	0.001	0.101	0.019	0.014	0.442	0.78	0.078	0.092	3.14	ND	0.03	3.46	0.71	0.36	15.57
P17 B G1	ND	0.000	0.087	0.015	0.015	0.138	0.78	0.078	0.092	3.14	ND	0.01	3.00	0.56	0.41	4.86
Blank A	ND	ND	0.009	0.002	0.000	0.024	0.78	0.078	0.092	3.14	ND	ND	0.33	0.07	0.01	0.89
Blank B	ND	ND	0.007	0.001	0.000	0.027	0.78	0.078	0.092	3.14	ND	ND	0.27	0.03	0.01	1.00

Storm 1

Calculated concentration of solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C2W	1/7/2016	Paleta Creek at Main Street	> 0.7µm	549.9	598.4	780	259.1	
				552.0	638.8			A
				550.1	616.9			
			> 2.7µm	765.3	870.4	850	247.7	
				766.2	871.6			
			> 20µm	68.0	152.7	840	100.8	A
			> 63µm	67.8	113.5	820	55.7	
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	> 0.7µm	550.8	584.5	885	186.6	
				555.6	617.8			
				552.5	621.7			
			> 2.7µm	786.6	893.6	835	128.2	
			> 20µm	67.0	96.8	900	33.1	A
			> 63µm	67.0	66.6	910	0.0	A
O3W	1/7/2016	NBSD outfall north of railroad crossing	> 0.7µm	558.1	598.3	970	41.4	S
			> 2.7µm	772.9	824.2	830	61.8	S
			> 20µm	69.2	72.5	710	4.6	
			> 63µm	59.3	60.8	830	1.8	
C1W	1/6/2016	Paleta Creek at Cummings Road	> 0.7µm	553.3	632.4	515	267.8	
				559.2	618.1			
			> 2.7µm	773.3	900.9	500	255.4	
			> 20µm	68.0	116.8	502	97.3	
			> 63µm	59.9	87.0	535	50.7	
O1W	1/7/2016	NBSD outfall #23	> 0.7µm	553.1	601.4	425	113.5	
			> 2.7µm	768.0	824.4	470	120.1	
			> 20µm	66.8	145.0	864	90.5	
			> 63µm	59.9	87.0	851	31.9	
O2W	1/7/2016	NBSD outfall #33	> 0.7µm	552.6	642.8	770	1110.7	
				552.0	638.2			A
				548.7	644.1			
				551.0	648.6			
				557.7	641.9			
				552.0	627.8			A
				554.9	636.6			
				550.7	635.7			
				554.0	633.7			
				553.3	632.8			
			> 2.7µm	764.8	899.8	845	1081.9	
				767.3	888.3			
				758.0	893.6			
				771.7	918.5			
				767.4	917.6			
				767.3	880.0			
				766.1	879.1			
			> 20µm	67.1	92.9	903	28.5	
			> 63µm	68.8	76.5	970	7.9	
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	> 0.7µm	547.1	645.7	950	217.2	
				548.8	656.6			
			> 2.7µm	778.7	895.8	980	241.8	
				766.9	886.7			
			> 20µm	67.8	176.7	865	125.9	
			> 63µm	65.0	86.0	870	24.1	
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	> 0.7µm	558.8	629.2	940	246.5	
				552.3	614.0			
				556.2	601.6			
				550.9	605.1			
			> 2.7µm	765.5	860.5	875	208.4	
				773.7	861.0			
			> 20µm	68.2	76.0	970	8.1	
			> 63µm	64.7	-	928		B
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	> 0.7µm	550.4	586.0	955	37.3	S
			> 2.7µm	772.9	806.2	915	36.3	S
			> 20µm	67.1	74.1	911	7.7	
			> 63µm	65.9	67.3	896	1.5	

Storm 1

Calculated concentration of solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
C2W	1/7/2016	0.7-2.7 µm	11.4	
		2.7-20 µm	146.9	
		20-63 µm	45.1	
		> 63 µm	55.7	
O4W	1/6/2016	0.7-2.7 µm	58.4	
		2.7-20 µm	95.1	
		20-63 µm	33.1	
		> 63 µm	0.0	
O3W	1/7/2016	0.7-2.7 µm	NA	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	2.8	LS
		> 63 µm	1.8	LS
C1W	1/6/2016	0.7-2.7 µm	12.5	
		2.7-20 µm	158.1	
		20-63 µm	46.6	
		> 63 µm	50.7	
O1W	1/7/2016	0.7-2.7 µm	0.0	TFS<0
		2.7-20 µm	29.6	
		20-63 µm	58.6	
		> 63 µm	31.9	
O2W	1/7/2016	0.7-2.7 µm	28.8	
		2.7-20 µm	1053.4	
		20-63 µm	20.6	
		> 63 µm	7.9	LS
A1W	1/5/2016	0.7-2.7 µm	0.0	TFS <0
		2.7-20 µm	115.9	
		20-63 µm	101.7	
		> 63 µm	24.1	
A2W	1/5/2016	0.7-2.7 µm	38.1	
		2.7-20 µm	200.3	
		20-63 µm	8.1	LS
		> 63 µm	0.0	
A3W	1/6/2016	0.7-2.7 µm	N	S
		2.7-20 µm	N	S
		20-63 µm	6.2	LS
		> 63 µm	1.5	LS

Storm 2

Calculated concentration of solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Bottle A					
			Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C2W	2/1/2016	Paleta Creek at Main Street	> 0.7µm	551.2	617.2	469.0	486.1	
				550.4	712.5			
			> 2.7µm	780.7	923.1	425.0	784.4	
				767.3	958.3			
			> 20µm	58.7	347.3	400.0	721.5	
			> 63µm	57.7	278.0	415.0	530.7	
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	> 0.7µm	546.5	593.6	560.0	84.1	S
			> 2.7µm	772.4	854.4	550.0	149.2	S
			> 20µm	55.2	57.0	600.0	3.0	
			> 63µm	60.4	61.0	600.0	1.1	
C1W	2/1/2016	Paleta Creek at Cummings Road	> 0.7µm	548.8	599.2	820.0	110.7	
				550.2	590.6			
			> 2.7µm	777.2	843.5	800.0	109.0	
				773.0	793.9			
			> 20µm	68.0	116.8	840.0	58.1	
			> 63µm	59.9	87.0	860.0	31.5	

Location ID	Bottle B					
	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C2W	NA					
O4W	NA					
C1W	> 0.7µm	554.5	619.2	730	107.7	
		550.3	564.2			
	> 2.7µm	770.4	859.5	715	124.7	
	> 20µm	57.7	91.5	700	48.3	
	> 63µm	56.8	72.0	770	19.7	

Average concentration of solids in water collected in the different size fractions

Location ID	Size Fraction	Average (mg/L)	Range (mg/L)	Flag
C2W	NA			
O4W	NA			
C1W	> 0.7µm	109.2	1.5	
	> 2.7µm	116.8	7.9	
	> 20µm	53.2	4.9	
	> 63µm	25.6	5.9	

Storm 2

Calculated concentration of solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
C2W	1/7/2016	0.7-2.7 µm	0.0	TFS<0
		2.7-20 µm	62.9	
		20-63 µm	190.7	
		> 63 µm	530.7	
O4W	1/6/2016	0.7-2.7 µm	NA	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	1.9	LS
		> 63 µm	1.1	LS
C1W	1/7/2016	0.7-2.7 µm	0.0	TFS<0
		2.7-20 µm	63.6	
		20-63 µm	27.6	
		> 63 µm	25.6	
O2W	1/6/2016	0.7-2.7 µm	NA	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	9.8	LS
		> 63 µm	5.9	LS
		0.7-2.7 µm	N	S

O2W	2/1/2016	NBSD outfall #33	**> 0.7µm**	553.8	622.3	985.0	69.5	S	**> 0.7µm**	552.0	611.8	1000	59.8	S		**> 0.7µm**	64.7	4.8	
			> 2.7µm	771.8	874.9	990.0	104.2	S	**> 2.7µm**	773.0	885.0	1000	112.0	S		**> 2.7µm**	108.1	3.9	
			> 20µm	58.2	72.7	1030.0	14.1		**> 20µm**	59.9	77.1	995	17.3			**> 20µm**	15.7	1.6	
			> 63µm	62.3	67.8	990.0	5.6		**> 63µm**	57.0	63.2	1000	6.3			**> 63µm**	5.9	0.3	
A1W	1/31/2016	Ambient Receiving water sample collected on 1/31/2016 at 0900 h	**> 0.7µm**	319.2	656.1	1000.0	336.9	S	**> 0.7µm**	367.6	648.0	985	284.6	S		**> 0.7µm**	310.8	26.1	
			> 2.7µm	763.8	944.1	988.0	371.6	S	**> 2.7µm**	778.7	938.1	1010	157.8	S		**> 2.7µm**	264.7	106.9	
				776.7	963.4				**> 20µm**	61.5	84.1	985	23.0			**> 20µm**	23.1	0.2	
			> 20µm	63.7	86.7	985.0	23.3		**> 63µm**	57.0	61.2	980	4.3			**> 63µm**	4.5	0.2	
			> 63µm	60.8	65.4	985.0	4.7												
A2W	1/31/2016	Ambient Receiving water sample collected on 1/31/2016 at 1500 h	**> 0.7µm**	553.6	618.0	1010.0	63.7	S	**> 0.7µm**	558.7	624.2	1010	64.8	S		**> 0.7µm**	64.3	0.5	
			> 2.7µm	772.4	883.0	965.0	114.6	S	**> 2.7µm**	771.6	888.8	981	119.4	S		**> 2.7µm**	117.0	2.4	
			> 20µm	60.0	64.1	1000.0	4.1		**> 20µm**	58.8	62.5	990	3.7			**> 20µm**	3.9	0.2	
			> 63µm	61.4	60.2	985.0	0.0		**> 63µm**	0.0	0.0	990	-			**> 63µm**	0.0	0.0	C

Flag	Description
A	Initial filter weight not noted; instead an average of the measured filter weight used
B	Final weight not measured
C	Filter from bottle B was not measured
S	Salinity of the sample <u>**potentially**</u> contributes more than 20% of solids mass as precipitating salt
N	Data not calculated. Due to salinity, there is low confidence on the calculated value.
NA	Not Available
LS	Low solids mass that corresponds to <10mg/L solids concentration
TFS<0	Calculation of TFS in the solid fraction returned a negative value

A1W	1/7/2016	2.7-20 µm	N	S
		20-63 µm	18.6	
		> 63 µm	4.5	LS
A2W	1/7/2016	0.7-2.7 µm	NA	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	3.9	LS
		> 63 µm	0.0	

Equations involved in the calculation of TFS size intervals:

0.7-2.7µm

$$TFS_{0.7-2.7\mu m} = TFS_{>0.7um} - TFS_{>2.7\mu m}$$

2.7-20µm

$$TFS_{2.7-20\mu m} = TFS_{>2.7um} - TFS_{>20\mu m}$$

20-63µm

$$TFS_{20-63\mu m} = TFS_{>20um} - TFS_{>63\mu m}$$

Storm 1

Measured concentration of the solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C2W	7-Jan-16	Paleta Creek at Main Street	0.45-5µm	214.8	215.8	890	1.1	*
			5-20µm	169.3	191.9	890	114.3	*
				169.3	199.7			
				170.0	218.7			
			20-63µm	56.2	144.5	890	99.2	*
			> 63µm	60.1	108.5	890	54.4	*
O4W	6-Jan-16	NBSD outfall at Paunack and Division Streets	> 0.45µm	224.3	241.9	380	184.4	
				222.4	240.8			
				230.5	247.4			
				218.9	236.2			
			> 5µm	183.4	203.0	365	182.5	
				182.7	206.6			
				190.1	213.1			
			> 20µm	63.6	67.3	162	23.0	
			> 63µm	55.0	58.4	370	9.2	
O3W	7-Jan-16	NBSD outfall north of railroad crossing	> 0.45µm	210.2	221.2	320	34.2	
			> 5µm	196.0	210.4	310	36.2	S
				174.6	177.7			
			> 20µm	61.0	62.3	333	3.8	
			> 63µm	61.2	63.0	335	5.4	
C1W	6-Jan-16	Paleta Creek at Cummings Road	> 0.45µm	221.0	262.1	170	241.6	
			> 5µm	191.0	221.5	140	218.1	
			> 20µm	54.0	84.0	175	171.8	
			> 63µm	62.5	73.3	170	63.5	
O1W	7-Jan-16	NBSD outfall #23	> 0.45µm	206.8	220.1	153	87.1	
			> 5µm	173.1	193.1	160	125.3	
			> 20µm	58.7	74.2	180	86.6	
			> 63µm	59.0	67.8	185	47.5	
O2W	7-Jan-16	NBSD outfall #33	> 0.45µm	224.9	277.4	380	1067.0	
				220.0	287.5			
				225.1	287.9			
				216.7	269.8			
				210.7	266.9			
				220.0	333.3			
			> 5µm	200.5	291.0	270	979.2	
				172.9	228.6			
				189.4	262.4			
				180.9	226.0			
			> 20µm	58.4	62.3	393	10.1	
			> 63µm	60.9	62.6	350	4.7	
A1W	5-Jan-16	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	> 0.45µm	216.1	247.3	405	226.9	
				215.8	276.5			
			> 5µm	180.8	220.9	355	229.7	
				182.0	223.5			
			> 20µm	67.8	106.7	360	108.1	
			> 63µm	64.9	75.3	360	28.9	
A2W	5-Jan-16	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	> 0.45µm	217.6	243.5	370	222.6	
				216.1	236.3			
				222.2	258.5			
			> 5µm	196.4	231.1	430	230.7	
				193.4	226.4			
				205.9	237.4			
			> 20µm	51.6	64.2	400	31.6	
			> 63µm	58.0	57.8	383	0.0	
A3W	6-Jan-16	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	> 0.45µm	210.4	216.8	365	32.6	S
				220.6	226.1			
			> 5µm	178.6	188.9	380	27.2	
			> 20µm	58.8	59.1	388	0.8	
			> 63µm	60.7	61.2	405	1.2	

Storm 1

Calculated concentration of the solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
C2W	7-Jan-16	Total (>0.45µm)	269.0	
		0.45-5µm	1.1	* , LS
		5-20µm	114.3	*
		20-63µm	99.2	*
		> 63µm	54.4	*
O4W	6-Jan-16	Total (>0.45µm)	184.4	
		0.45-5µm	2.0	LS
		5-20µm	159.5	
		20-63µm	13.8	
		> 63µm	9.2	LS
O3W	7-Jan-16	Total (>0.45µm)	N	S
		0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	0.0	TFS<0
		> 63µm	5.4	LS
C1W	6-Jan-16	Total (>0.45µm)	241.6	
		0.45-5µm	23.5	
		5-20µm	46.3	
		20-63µm	108.3	
		> 63µm	63.5	
O1W	7-Jan-16	Total (>0.45µm)	125.3	
		0.45-5µm	0.0	TFS<0
		5-20µm	38.7	
		20-63µm	39.0	
		> 63µm	47.5	
O2W	7-Jan-16	Total (>0.45µm)	1067.0	
		0.45-5µm	87.8	
		5-20µm	969.1	
		20-63µm	5.3	LS
		> 63µm	4.7	LS
A1W	5-Jan-16	Total (>0.45µm)	229.7	
		0.45-5µm	0.0	TFS<0
		5-20µm	121.7	
		20-63µm	79.1	
		> 63µm	28.9	
A2W	5-Jan-16	Total (>0.45µm)	230.7	
		0.45-5µm	0.0	TFS<0
		5-20µm	199.0	
		20-63µm	31.6	
		> 63µm	0.0	TFS<0
A3W	6-Jan-16	Total (>0.45µm)	N	S
		0.45-5µm	N	S
		5-20µm	26.0	**
		20-63µm	0.0	TFS<0
		> 63µm	1.2	LS

Storm 2

Measured concentration of the solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Bottle A					
			Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C2W	1-Feb-16	Paleta Creek at Main Street	> 0.45µm	215.1	250.7	180	254.8	
				215.9	226.2			
			> 5µm	197.0	312.6	160	722.5	
			> 20µm	56.5	149.2	160	579.2	
			> 63µm	58.3	134.9	170	450.8	
O4W	1-Feb-16	NBSD outfall at Paunack and Division Streets	> 0.45µm	246.4	254.6	202	40.8	S
			> 5µm	169.6	178.5	230	38.7	S
			> 20µm	59.8	60.9	225	5.0	
			> 63µm	60.5	60.9	210	1.5	
			> 0.45µm	223.5	236.6	320	124.9	
				215.9	226.2			

Storm 2

Calculated concentration of the solids in water collected in the different size intervals

Bottle A				
Location ID	Sampling Date	Size Range	TFS (mg/L)	Flag
C2W	1-Feb-16	0.45-5µm	0.0	TFS<0
		5-20µm	143.3	
		20-63µm	128.4	
		> 63µm	450.8	
O4W	1-Feb-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	3.5	LS
		> 63µm	1.5	LS
C1W	1-Feb-16	0.45-5µm	10.7	
		5-20µm	66.5	
		20-63µm	39.5	

Storm 2

Average concentration of the solids in water collected in the different size intervals

Location ID	Sampling Date	Size Range	TFS (mg/L)	Range	Flag
C2W	1-Feb-16	Total (>0.45µm)	722.5		
		0.45-5µm	0.0	NA	TFS<0
		5-20µm	143.3	NA	
		20-63µm	128.4	NA	
		> 63µm	450.8	NA	
O4W	1-Feb-16	Total (>0.45µm)	N		S
		0.45-5µm	N	NA	S
		5-20µm	N	NA	S
		20-63µm	3.5	NA	LS
		> 63µm	1.5	NA	LS
		Total (>0.45µm)	121.9		
		0.45-5µm	5.4	5.4	LS

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C1W	1-Feb-16	Paleta Creek at Cummings Road	> 0.45µm	237.7 217.0	252.0 219.3	[illegible]	[illegible]	
			> 5µm	193.0	230.1	325	114.2	
			> 20µm	62.3	73.5	236	47.6	
			> 63µm	57.7	60.3	318	8.2	
O2W	1-Feb-16	NBSD outfall #33	> 0.45µm	203.9 233.2	215.6 244.8	425	54.8	S
			> 5µm	168.5	187.0	400	46.2	S
			> 20µm	60.5	66.5	410	14.7	
			> 63µm	59.6	61.3	270	6.4	
A1W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 0900 h	> 0.45µm	210.8	243.7	520	63.2	S
			> 5µm	178.3	220.8	515	82.5	S
			> 20µm	60.5	72.6	510	23.9	
			> 63µm	60.0	62.2	550	4.0	
A2W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 1500 h	> 0.45µm	221.7	238.2	408	40.4	S
			> 5µm	180.4	202.1	430	50.3	S
			> 20µm	240.7	NA	390	NA	B
			> 63µm	59.0	59.7	390	1.9	

Location ID	Sampling Date	Description	Bottle B					
			Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
C2W	1-Feb-16	Paleta Creek at Main Street	> 0.45µm	NA				
			> 5µm					
			> 20µm					
			> 63µm					
O4W	1-Feb-16	NBSD outfall at Paunack and Division Streets	> 0.45µm	NA				
			> 5µm					
			> 20µm					
			> 63µm					
C1W	1-Feb-16	Paleta Creek at Cummings Road	> 0.45µm	240.4 235.7 217.7	251.0 246.3 233.6	340	109.3	
			> 5µm	193.8 198.3	217.6 212.6	320	118.9	
			> 20µm	NA	NA	NA	NA	C
			> 63µm	61.6	64.7	349	8.8	
O2W	1-Feb-16	NBSD outfall #33	> 0.45µm	221.8 209.8	235.6 221.5	398	63.9	S
			> 5µm	185.1	203.1	400	45.1	S
			> 20µm	61.3	67.1	425	13.5	
			> 63µm	60.9	62.1	410	2.8	
A1W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 0900 h	> 0.45	215.5	246.2	560	54.8	S
			> 5	178.2	212.6	480	71.6	S
			> 20	58.2	71.7	485	27.9	
			> 63	58.1	61.2	480	6.3	
A2W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 1500 h	> 0.45	227.6 228.4	242.6 244.6	410	76.2	S
			> 5	200.3	221.7	445	48.1	S
			> 20	59.9	60.9	410	2.6	
			> 63	58.7	59.0	410	0.8	

Flag	Description
NA	Not available
B	Final weight not measured
C	Filter from bottle B was not measurec
D	Fractioned value was used from the other replicate bottle
TFS<0	Calculation of TFS in the solid fraction returned a negative value
N	Data not calculated. Due to salinity, there is low confidence on the calculated value
LS	Low solids, the solid concentration in the size interval is less than 10mg/L
*	Sequential particle size fractionation
**	Modification of the formula to maintain the mass balance
S	Salt interference in the solid concentration (>20%

		> 63µm	8.2	LS
O2W	1-Feb-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	8.2	LS
		> 63µm	6.4	LS
A1W	31-Jan-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	19.9	
		> 63µm	4.0	LS
A2W	31-Jan-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	0.6	D, LS
		> 63µm	1.9	LS

Bottle B				
Location ID	Sampling Date	Size Range	TFS (mg/L)	Flag
C2W	1-Feb-16	0.45-5µm	NA	
		5-20µm		
		20-63µm		
		> 63µm		
O4W	1-Feb-16	0.45-5µm	NA	
		5-20µm		
		20-63µm		
		> 63µm		
C1W	1-Feb-16	0.45-5µm	0.0	TFS<0
		5-20µm	71.3	
		20-63µm	38.8	
		> 63µm	8.8	LS
O2W	1-Feb-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	10.7	
		> 63µm	2.8	LS
A1W	31-Jan-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	21.7	
		> 63µm	6.3	LS
A2W	31-Jan-16	0.45-5µm	N	S
		5-20µm	N	S
		20-63µm	1.7	LS
		> 63µm	0.8	LS

Equations involved in the calculation of TFS size intervals:

0.45-5µm

$$TFS_{0.45-5\mu m} = TFS_{>0.45um} - TFS_{>5\mu m}$$

5-20µm

$$TFS_{5-20\mu m} = TFS_{>5um} - TFS_{>20\mu m}$$

20-63µm

$$TFS_{20-63\mu m} = TFS_{>20um} - TFS_{>63\mu m}$$

C1W	1-Feb-16	5-20µm	68.9	2.4	
		20-63µm	39.1	0.3	
		> 63µm	8.5	0.3	LS
O2W	1-Feb-16	Total (>0.45µm)	N		S
		0.45-5µm	N	NA	S
		5-20µm	N	NA	S
		20-63µm	9.4	1.2	LS
		> 63µm	4.6	1.8	LS
A1W	31-Jan-16	Total (>0.45µm)	N		S
		0.45-5µm	N	NA	S
		5-20µm	N	NA	S
		20-63µm	20.8	0.9	
		> 63µm	5.2	1.1	LS
A2W	31-Jan-16	Total (>0.45µm)	N		S
		0.45-5µm	N	NA	S
		5-20µm	N	NA	S
		20-63µm	1.2	0.6	LS
		> 63µm	1.4	0.6	LS

Appendix I-2: Paleta Stormwater Raw Data

Metals

Storm 1

Triplicate aqueous concentrations of metals after sample splitting and size fractionation

Storm 1

Calculated aqueous concentrations of metals in the corresponding size interval

Storm 2

Triplicate aqueous concentrations of metals after sample splitting and size fractionation

Storm 2

Calculated aqueous concentrations of metals in the corresponding size interval

Calibration range for event 1	
For Hg	25-2,500 pg
For As	1-500 μg/L
For Cr	3-30 μg/L
For Cu	1-500 μg/L
For Ni	1-500 μg/L
For Zn	1-500 μg/L
For Cd	1-500 μg/L
For Pb	1-500 μg/L

MDL	Value	Unit
Hg	5.23	pg
As	0.69	μg/L
Cr	2.00	μg/L
Cu	0.10	μg/L
Ni	0.10	μg/L
Zn	0.79	μg/L
Cd	0.20	μg/L
Pb	0.10	μg/L

Calibration range for event 2	
For Hg	25-2,500 pg
For As	1-100 μg/L
For Ag	0.2-50 μg/L
For Cu	1-500 μg/L
For Ni	1-500 μg/L
For Zn	1-500 μg/L
For Cd	0.2-50 μg/L
For Pb	0.5-50 μg/L

MDL	Value	Unit
Hg	5.23	pg
As	0.48	μg/L
Ag	0.02	μg/L
Cu	0.08	μg/L
Ni	0.09	μg/L
Zn	0.53	μg/L
Cd	0.17	μg/L
Pb	0.04	μg/L

Equations involved in the calculation of aqueous concentrations of metals in the corresponding size interval

Total (>0.45μm)

$$C_{>0.45\mu m} = C_{Bulk} - C_{<0.45\mu m} \qquad Stdev_{(>0.45)\mu m} = \sqrt{(Stdev_{Bulk})^2 + (Stdev_{<0.45\mu m})^2}$$

0.45-5μm

$$C_{0.45-5\mu m} = C_{<5um} - C_{<0.45\mu m} \qquad Stdev_{(0.45-5)\mu m} = \sqrt{(Stdev_{<5\mu m})^2 + (Stdev_{<0.45\mu m})^2}$$

5-20μm

$$C_{5-20\mu m} = C_{<20um} - C_{<5\mu m} \qquad Stdev_{(5-20)\mu m} = \sqrt{(Stdev_{<20\mu m})^2 + (Stdev_{<5\mu m})^2}$$

20-63μm

$$C_{20-63\mu m} = C_{<63um} - C_{<20\mu m} \qquad Stdev_{(20-63)\mu m} = \sqrt{(Stdev_{<63\mu m})^2 + (Stdev_{<20\mu m})^2}$$

>63μm

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m} \qquad Stdev_{(>63)\mu m} = \sqrt{(Stdev_{Bulk})^2 + (Stdev_{<63\mu m})^2}$$

Flag	Description
M<0	Calculation returned a negative metal value
J	The reported value was obtained from a reading that was less than the lowest calibration point but greater than or equal to the MDL.
U	The reading value was less than the MDL.
E	The reading value exceeded the highest calibration point.
+	Missing data

Notes:

Bottle A and B represents duplicate splits from the same location processed through the same size filters.

For the triplicate calculations per fractions: the J-flagged values and the non-detected values as well as the E-flagged values were not used for the average calculations.

For locations involving duplicate bottle average calculations: the J-flagged values were used for the average calculations (for example Pb of event 2)

Storm 1

Measured concentrations of PAHs in the water after sample splitting and size fractionation

Measured Concentration (n g/L); each cell gives Value and Flag.

Location ID	Sampling Date	Description	Size Fraction	Naphthalene	Fluorene	Acenaphthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAH-15
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	12.6	39.1	1.1	19.0	2.1	9.1	8.6	1.2	1.1	1.2	0.3	0.8	0.5	2.3	99.1
			< 2.7 µm	10.3	4.3	1.1	15.6	1.5	27.2	14.3	3.1	2.1	4.6	1.3	2.5	0.9	7.5	96.4
			< 20 µm	24.7	9.6	5.4	53.9	0.0 U	83.3	89.4	22.6	16.1	31.4	11.3	19.7	8.6	55.5	431.6
			< 63 µm	10.5	6.6	5.4	57.8	9.6	136.1	120.4	40.5	34.2	76.4	26.8	46.4	14.8	127.5	712.9
			Bulk	32.3	0.0 U	0.0 U	40.2	0.0 U	599.2	249.4	31.6	50.6	240.6	10.1	18.1	4.2	6.2	1282.4
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	9.6	1.9	0.8	5.6	1.5	13.8	6.8	0.7	0.5	0.2	0.2 J	0.6	0.8	0.8	43.9
			< 2.7 µm	11.0	3.1	1.1	8.3	1.9	5.9	8.0	1.2	0.5	1.3	0.3	0.7	0.3	2.3	46.0
			< 20 µm	5.4	2.3	1.0	8.1	1.5	23.6	18.8	4.5	2.6	8.8	2.3	4.4	1.4	13.3	97.9
			< 63 µm	6.3	1.5	4.2	12.1	0.3	72.2	21.0	15.4	9.0	13.6	3.0	5.9	3.1	19.1	186.6
			Bulk	25.2	11.3	1.9	37.3	10.2	83.6	80.1	18.1	8.7	27.4	8.2	16.8	5.9	43.2	377.9
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	8.5	3.3	2.6	9.9	1.2	5.1	6.0	0.4	0.5	0.3	0.1 J	0.2	0.2	0.4	38.6
			< 2.7 µm	8.7	3.1	2.9	9.6	1.4	11.5	12.0	2.6	1.7	4.9	1.9	3.8	0.9	6.1	71.3
			< 20 µm	6.1	2.0	1.6	9.1	0.6	33.6	25.2	7.8	5.6	16.6	6.8	14.3	3.0	17.8	150.1
			< 63 µm	5.9	2.1	2.4	9.4	2.0	37.5	24.7	8.5	6.1	18.9	7.4	15.8	3.2	19.7	163.5
			Bulk	35.9	2.3	3.5	43.9	34.8	285.0	85.4	20.8	23.4	59.5	17.6	35.4	14.0	30.5	692.0
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	17.0	6.7	3.1	13.8	0.9	16.1	9.1	1.1	0.5	0.6	0.3	0.4	0.6	0.9	71.1
			< 2.7 µm	11.4	4.9	4.9	12.8	1.3	14.1	10.7	3.0	1.4	2.9	1.0	1.5	1.1	3.8	74.9
			< 20 µm	13.9	6.3	6.5	27.7	4.4	116.1	69.6	30.2	21.2	57.3	19.9	30.5	11.2	61.2	476.0
			< 63 µm	14.1	2.8	3.3	40.5	12.4	285.9	123.8	46.2	42.9	120.0	39.9	59.6	12.8	98.1	902.1
			Bulk	23.3	4.3	26.3	112.3	18.3	227.2	227.3	105.8	55.3	130.7	41.4	75.2	20.3	145.2	1213.0
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	18.2	10.2	2.4	16.7	2.3	5.7	6.1	3.1	1.8	3.1	1.3	2.1	1.5	2.6	77.2
			< 2.7 µm	14.1	8.8	2.3	14.2	1.8	7.4	5.6	2.7	1.4	3.0	1.0	1.5	1.2	1.9	66.9
			< 20 µm	15.5	7.6	2.2	24.8	2.8	31.4	18.4	10.5	9.3	17.6	5.5	11.3	4.8	24.9	186.6
			< 63 µm	13.0	8.8	5.5	42.2	5.6	65.3	28.0	20.5	19.5	47.3	10.8	26.6	3.1	47.4	343.5
			Bulk	29.9	23.9	45.6	109.9	3.9	119.8	49.9	48.9	66.3	127.4	25.5	80.3	4.2	99.8	835.2
O2W	1/7/2016	NBSD outfall #33	< 0.7 µm	0.5	4.6	5.3	14.6	5.0	74.4	68.6	17.8	10.4	33.2	13.1	12.4	3.3	9.1	272.4
			< 2.7 µm	0.4	3.4	4.8	8.4	3.9	66.0	62.0	17.7	11.8	29.8	12.5	11.7	3.4	9.3	245.1
			< 20 µm	2.5	4.3	6.4	22.9	8.9	165.9	178.5	63.7	45.5	107.8	45.1	44.8	10.2	29.2	735.7
			< 63 µm	1.7	4.2	5.5	23.0	17.6	138.8	152.0	54.5	38.9	94.9	38.3	38.8	9.4	24.4	642.1
			Bulk	2.6	1.1	62.4	102.8	25.4	970.7 E	688.1 E	213.2	158.9	339.6	146.0	154.7	58.8	103.3	3027.5
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	4.7	0.0 U	0.0 U	3.5	0.0 U	5.0	4.0	1.5	0.9	0.5	0.2	0.2	0.4	0.6	21.4
			< 2.7 µm	4.7	0.0 U	0.5	3.1	0.5	7.4	7.0	1.4	0.8	2.8	0.9	1.2	0.7	2.4	33.4
			< 20 µm	6.6	0.0 U	2.0	50.1	6.0	145.1	115.3	54.6	57.7	130.9	48.6	78.0	23.2	127.7	845.6
			< 63 µm	13.5	0.0 U	1.9	134.5	14.1	376.0 E	146.5 E	69.9	43.0	122.6	109.0	182.0	28.6	259.7	1501.3
			Bulk	17.0	5.4	23.9	273.3	41.6	780.4	613.7	283.2	196.1	421.3	158.0	274.9	72.7	426.1	3587.5
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	13.3	55.5	3.1	10.0	0.8	11.4	5.0	0.9	0.5	0.5	0.2	0.4	0.2	0.9	102.9
			< 2.7 µm	12.1	3.7	5.6	8.0	0.6	15.0	9.4	2.7	1.9	6.6	2.2	3.2	0.9	5.9	77.9
			< 20 µm	10.3	1.9	4.7	11.4	1.5	49.4	38.5	15.8	10.7	36.0	12.3	17.0	5.2	27.4	242.2
			< 63 µm	9.0	1.6	6.4	10.7	1.1	77.4	41.1	17.9	10.9	36.1	10.7	13.3	5.8	25.4	267.4
			Bulk	24.7	7.3	12.4	35.7	9.9	225.6	128.5	16.5	10.9	38.7	14.0	22.1	10.8	24.0	581.0
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	< 0.7 µm	38.5	11.1	17.4	19.9	1.8	10.2	7.2	1.0	0.8	1.3	0.5	0.8	0.5	1.3	112.5
			< 2.7 µm	37.1	11.7	20.7	19.3	1.5	17.4	10.3	2.4	1.9	4.8	1.7	2.9	1.3	4.7	137.8
			< 20 µm	30.0	8.7	14.7	14.3	2.5	21.5	12.0	2.6	2.6	6.9	2.4	4.0	1.8	6.0	130.0
			< 63 µm	28.7	8.3	14.2	14.2	3.7	26.7	13.3	3.2	2.8	7.5	2.6	4.1	2.1	5.8	137.2
			Bulk	35.3	10.4	15.7	21.7	1.9	20.5	12.9	3.2	3.3	7.0	2.4	4.9	0.9	7.4	147.8

Storm 2

Measured concentrations of PAHs in the water after sample splitting and size fractionation

Measured Concentration (n g/L); each cell gives Value and Flag.

Location ID	Sampling Date	Description	Size Fraction	Naphthalene	Fluorene	Acenaphthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAH-15
C2W	2/1/2016	Paleta Creek at Main Street	< 0.7 µm	7.6	1.7	10.6	0.0 U	0.0 U	2.5	3.4	0.5	0.3	0.6	0.1 J	0.2	0.5	0.9	28.9
			< 2.7 µm	6.1	1.0	12.5	0.0 U	0.0 U	2.5	3.7	0.5	0.3	0.5	0.1 J	0.4	0.5	0.9	28.9
			< 20 µm	9.9	57.4	0.6	0.0 U	0.0 U	24.5	33.9	12.0	6.1	18.1	4.9	10.7	3.1	39.2	220.3
			< 63 µm	62.2	357.9	2.5	0.0 U	0.0 U	159.4	84.8	32.0	13.9	52.8	15.1	33.5	28.5	130.1	972.6
			Bulk	15.5	30.1	46.2	287.2	0.0 U	219.2	170.9	57.7	41.5	118.1	27.6	50.9	0.0 U	151.7	1216.5
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	14.2	1.9	1.5	6.6	0.0 U	0.0 U	2.6	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	26.8
			< 2.7 µm	14.5	1.5	0.6	5.4	0.0 U	0.0 U	2.4	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	24.4
			< 20 µm	16.0	1.9	2.3	7.0	0.0 U	3.3	3.1	0.0 U	0.0 U	0.0 U	0.1	0.0 U	0.0 U	0.3	34.0
			< 63 µm	11.5	1.8	1.6	4.6	0.0 U	2.8	4.1	1.1	0.5	0.9	0.2	0.5	0.0 U	1.1	30.7
			Bulk	17.9	1.6	2.3	5.7	1.3	4.3	4.4	1.9	0.9	1.8	0.2	0.5	1.7	1.8	46.4
C1W	2/1/2016	Paleta Creek at Cummings Road	< 0.7 µm	6.6	1.2	1.9	7.9	0.0 U	3.7	3.5	0.6	0.5	0.3	0.1	0.1	0.3	0.4	27.1
			< 2.7 µm	6.8	1.0	1.3	7.7	0.0 U	4.4	4.0	0.6	0.5	0.5	0.1	0.3	0.4	0.6	28.1
			< 20 µm	4.2	0.8	0.6	7.7	0.3	12.9	14.1	4.4	2.9	8.5	2.8	4.8	1.6	12.9	78.4
			< 63 µm	6.6	0.8	0.5	17.5	0.7	32.5	30.7	10.9	7.6	25.7	8.7	15.8	3.7	43.2	204.7
			Bulk	6.9	5.1	12.0	28.9	0.0 U	25.1	47.2	27.7	18.6	26.7	10.1	18.6	4.5	47.9	279.5
O2W	2/1/2016	NBSD outfall #33	< 0.7 µm	3.1	5.2	5.4	7.6	1.7	9.2	6.5	0.7	0.4	1.2	0.4	0.3	0.5	0.4	42.5
			< 2.7 µm	6.4	4.6	4.3	7.3	1.0	8.8	6.1	1.0	0.5	1.2	0.4	0.3	0.5	0.6	43.0
			< 20 µm	7.3	7.3	9.7	0.0 U	0.0 U	12.1	8.9	2.6	1.4	6.6	2.3	2.2	1.2	3.7	65.2
			< 63 µm	4.6	7.3	12.8	0.0 U	0.0 U	16.3	11.8	3.8	2.4	12.3	3.8	4.3	1.4	7.6	88.5
			Bulk	5.8	4.2	5.4	14.8	0.8	23.7	35.2	21.2	8.4	22.1	9.6	11.9	4.1	17.3	184.4
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	4.0	1.1	1.9	3.8	0.0 U	1.7	2.5	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.2	15.2
			< 2.7 µm	2.7	1.0	2.0	4.8	2.6	2.3	1.8	0.3	0.2	0.2	0.1	0.2	0.3	0.2	18.6
			< 20 µm	3.9	6.1	5.2	15.5	1.3	10.1	7.7	3.2	2.0	4.7	1.4	2.2	0.9	4.2	68.1
			< 63 µm	3.7	2.5	3.6	15.0	0.6	22.7	16.9	6.6	4.1	10.5	3.3	5.9	4.0	18.1	117.5
			Bulk	4.7	2.5	4.9	28.9	1.0	41.0	33.8	13.0	7.6	17.5	5.6	10.3	2.8	29.5	203.0
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	1.8	12.0	12.7	0.2	0.0 U	5.7	3.3	0.0 U	0.0 U	0.2	0.0 J	0.1	0.3	0.1	36.4
			< 2.7 µm	1.5	3.2	4.5	5.0	0.6	6.1	3.7	0.5	0.3	0.3	0.1	0.1	0.3	0.3	26.5
			< 20 µm	2.4	2.4	5.6	7.3	2.6	11.3	7.5	2.2	1.7	3.8	1.1	1.7	0.9	4.2	54.8
			< 63 µm	4.3	1.9	4.1	6.1	0.0 U	11.1	8.1	2.4	2.2	5.3	1.6	2.3	0.6	5.4	55.2
			Bulk	6.8	2.8	4.2	8.2	0.3	7.1	8.1	2.6	1.9	8.8	2.2	4.7	2.8	6.5	66.9

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
E	Identifies analytes whose concentrations exceed the calibration range of the HPLC instrument for that specific analysis.
<0	Indicates a negative outcome in concentration or TFS calculations

Calibration range:	PAH-15:	0.5ug/L - 600 ug/L
	Deuterated PAH-4:	0.5ug/L - 400 ug/L

Storm 1

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Measured Concentration (n g/L); each cell gives Value and Flag.

Location ID	Sampling Date	Description	Size Interval	Naphthalene	Fluorene	Acenaphthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAH-15
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	12.6	39.1	1.1	19.0	2.1	9.1	8.6	1.2	1.1	1.2	0.3	0.8	0.5	2.3	99.1
			Total Particulate POPs (>0.7µm)	19.7	0.0 <0	0.0 <0	21.2	0.0 <0	590.1	240.8	30.4	49.5	239.4	9.8	17.4	3.7	3.9	1225.7
			0.7-2.7 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	18.1	5.8	1.9	1.0	3.4	1.0	1.7	0.4	5.2	38.4
			2.7-20 µm	14.4	5.2	4.4	38.3	0.0 <0	56.1	75.1	19.5	14.0	26.8	10.0	17.2	7.7	48.0	336.7
			20-63 µm	0.0 <0	0.0 <0	0.0 <0	3.9	9.6	52.8	30.9	17.9	18.1	45.0	15.5	26.7	6.2	72.1	298.6
			> 63 µm	21.8	0.0 <0	0.0 <0	0.0 <0	0.0 <0	463.1	129.0	0.0 <0	16.4	164.1	0.0 <0	0.0 <0	0.0 <0	0.0 <0	794.5
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	9.6	1.9	0.8	5.6	1.5	13.8	6.8	0.7	0.5	0.2	0.2 J	0.6	0.8	0.8	43.9
			Total Particulate POPs (>0.7µm)	15.7	9.4	1.1	31.7	8.6	69.8	73.3	17.4	8.1	27.1	8.0	16.2	5.1	42.4	333.9
			0.7-2.7 µm	1.4	1.2	0.3	2.7	0.4	0.0 <0	1.2	0.5	0.0 <0	1.1	0.1	0.0 <0	0.0 <0	1.5	10.5
			2.7-20 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	17.7	10.9	3.3	2.1	7.4	2.0	3.7	1.1	11.0	59.2
			20-63 µm	0.9	0.0 <0	3.3	4.0	0.0 <0	48.6	2.2	10.9	6.4	4.8	0.7	1.5	1.7	5.8	90.7
			> 63 µm	19.0	9.8	0.0 <0	25.2	9.9	11.4	59.1	2.7	0.0 <0	13.8	5.2	10.9	2.8	24.1	193.9
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	8.5	3.3	2.6	9.9	1.2	5.1	6.0	0.4	0.5	0.3	0.1 J	0.2	0.2	0.4	38.6
			Total Particulate POPs (>0.7µm)	27.5	0.0 <0	0.9	34.0	33.7	279.9	79.5	20.3	22.9	59.2	17.5	35.2	13.7	30.1	654.3
			0.7-2.7 µm	0.2	0.0 <0	0.3	0.0 <0	0.2	6.5	6.1	2.2	1.2	4.6	1.8	3.6	0.6	5.7	33.1
			2.7-20 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	22.0	13.1	5.2	3.9	11.7	4.9	10.5	2.1	11.6	85.1
			20-63 µm	0.0 <0	0.1	0.7	0.3	1.4	4.0	0.0 <0	0.7	0.4	2.4	0.6	1.5	0.2	1.9	14.2
			> 63 µm	30.1	0.2	1.1	34.5	32.9	247.4	60.8	12.3	17.3	40.6	10.1	19.6	10.8	10.8	528.5
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	17.0	6.7	3.1	13.8	0.9	16.1	9.1	1.1	0.5	0.6	0.3	0.4	0.6	0.9	71.1
			Total Particulate POPs (>0.7µm)	6.3	0.0 <0	23.2	98.5	17.4	211.1	218.2	104.6	54.8	130.1	41.1	74.8	19.7	144.4	1144.2
			0.7-2.7 µm	0.0 <0	0.0 <0	1.9	0.0 <0	0.4	0.0 <0	1.6	1.9	0.9	2.4	0.7	1.1	0.6	2.9	14.3
			2.7-20 µm	2.5	1.4	1.6	14.9	3.1	102.0	58.9	27.2	19.8	54.4	18.9	29.1	10.1	57.4	401.1
			20-63 µm	0.2	0.0 <0	0.0 <0	12.8	7.9	169.7	54.2	16.0	21.6	62.7	20.0	29.1	1.6	36.9	432.7
			> 63 µm	9.2	1.5	23.0	71.8	6.0	0.0 <0	103.6	59.6	12.5	10.7	1.5	15.7	7.5	47.2	369.6
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	18.2	10.2	2.4	16.7	2.3	5.7	6.1	3.1	1.8	3.1	1.3	2.1	1.5	2.6	77.2
			Total Particulate POPs (>0.7µm)	11.6	13.7	43.1	93.2	1.6	114.1	43.8	45.8	64.5	124.3	24.2	78.2	2.6	97.2	758.0
			0.7-2.7 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	1.7	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	1.7
			2.7-20 µm	1.4	0.0 <0	0.0 <0	10.6	1.0	24.0	12.8	7.8	7.9	14.6	4.5	9.8	3.5	23.1	120.9
			20-63 µm	0.0 <0	1.2	3.3	17.3	2.8	33.9	9.6	10.0	10.2	29.7	5.3	15.3	0.0 <0	22.5	161.2
			> 63 µm	16.8	15.1	40.0	67.7	0.0 <0	54.5	21.9	28.4	46.8	80.1	14.7	53.8	1.1	52.4	493.4
O2W	1/7/2016	NBSD outfall #33	< 0.7 µm	0.5	4.6	5.3	14.6	5.0	74.4	68.6	17.8	10.4	33.2	13.1	12.4	3.3	9.1	272.4
			Total Particulate POPs (>0.7µm)	2.2	0.0 <0	57.1	88.2	20.4	896.3 E	619.5 E	195.3	148.5	306.4	132.9	142.2	55.4	94.1	2758.5
			0.7-2.7 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	1.4	0.0 <0	0.0 <0	0.0 <0	0.1	0.1	1.6
			2.7-20 µm	2.1	0.9	1.6	14.5	5.0	99.9	116.5	45.9	33.7	78.0	32.6	33.1	6.8	19.9	490.5
			20-63 µm	0.0 <0	0.0 <0	0.0 <0	0.1	8.7	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	8.8
			> 63 µm	0.9	0.0 <0	56.9	79.7	7.8	831.9 E	536.1 E	158.7	119.9	244.7	107.7	115.9	49.4	78.9	2388.5
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	4.7	0.0 U	0.0 U	3.5	0.0 U	5.0	4.0	1.5	0.9	0.5	0.2	0.2	0.4	0.6	21.4
			Total Particulate POPs (>0.7µm)	12.3	5.4	23.9	269.8	41.6	775.4	609.7	281.6	195.2	420.8	157.8	274.6	72.3	425.5	3566.1
			0.7-2.7 µm	0.0 <0	0.0 U	0.5	0.0 <0	0.5	2.4	3.0	0.0 <0	0.0 <0	2.3	0.7	1.0	0.3	1.8	12.6
			2.7-20 µm	1.9	0.0 U	1.4	47.0	5.5	137.6	108.2	53.2	56.8	128.1	47.8	76.8	22.5	125.3	812.2
			20-63 µm	7.0	0.0 U	0.0 <0	84.4	8.1	230.9 E	31.2 E	15.3	0.0 <0	0.0 <0	60.4	104.0	5.4	132.0	678.7
			> 63 µm	3.5	5.4	22.0	138.8	27.5	404.4	467.2	213.3	153.1	298.7	49.0	92.9	44.1	166.4	2086.3
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	13.3	55.5	3.1	10.0	0.8	11.4	5.0	0.9	0.5	0.5	0.2	0.4	0.2	0.9	102.9
			Total Particulate POPs (>0.7µm)	11.4	0.0 <0	9.3	25.6	9.0	214.1	123.5	15.6	10.3	38.2	13.8	21.7	10.5	23.1	526.3
			0.7-2.7 µm	0.0 <0	0.0 <0	2.5	0.0 <0	0.0 <0	3.6	4.4	1.8	1.4	6.1	1.9	2.7	0.7	5.0	30.3
			2.7-20 µm	0.0 <0	0.0 <0	0.0 <0	3.4	0.9	34.3	29.1	13.1	8.8	29.4	10.2	13.8	4.3	21.5	168.3
			20-63 µm	0.0 <0	0.0 <0	1.7	0.0 <0	0.0 <0	28.0	2.6	2.0	0.2	0.1	0.0 <0	0.0 <0	0.6	0.0 <0	35.3
			> 63 µm	15.7	5.8	6.0	25.0	8.8	148.2	87.4	0.0 <0	0.0 <0	2.6	3.2	8.8	4.9	0.0 <0	316.4
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	< 0.7 µm	38.5	11.1	17.4	19.9	1.8	10.2	7.2	1.0	0.8	1.3	0.5	0.8	0.5	1.3	112.5
			Total Particulate POPs (>0.7µm)	0.0 <0	0.0 <0	0.0 <0	1.8	0.1	10.2	5.7	2.3	2.5	5.7	2.0	4.1	0.4	6.1	40.9
			0.7-2.7 µm	0.0 <0	0.5	3.2	0.0 <0	0.0 <0	7.2	3.1	1.5	1.1	3.5	1.3	2.1	0.7	3.3	27.5
			2.7-20 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	1.0	4.1	1.7	0.2	0.7	2.1	0.7	1.1	0.5	1.3	13.3
			20-63 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	1.1	5.2	1.3	0.6	0.1	0.6	0.2	0.1	0.3	0.0 <0	9.7
			> 63 µm	6.6	2.1	1.5	7.5	0.0 <0	0.0 <0	0.0 <0	0.0	0.5	0.0 <0	0.0 <0	0.9	0.0 <0	1.6	20.8

Storm 2

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Measured Concentration (n g/L); each cell gives Value and Flag.

Location ID	Sampling Date	Description	Size Interval	Naphthalene	Fluorene	Acenaphthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	Total PAH-15
C2W	2/1/2016	Paleta Creek at Main Street	< 0.7 µm	7.6	1.7	10.6	0.0 U	0.0 U	2.5	3.4	0.5	0.3	0.6	0.1 J	0.2	0.5	0.9	28.9
			Total Particulate POPs (>0.7µm)	7.9	28.4	35.6	287.2	0.0 U	216.7	167.5	57.2	41.3	117.5	27.5	50.7	0.0 <0	150.8	1188.2
			0.7-2.7 µm	0.0 <0	0.0 <0	1.9	0.0 U	0.0 U	0.0 <0	0.3	0.0 <0	0.0	0.0 <0	0.0	0.2	0.0 <0	0.0 <0	2.5
			2.7-20 µm	3.8	56.4	0.0 <0	0.0 U	0.0 U	22.0	30.2	11.5	5.8	17.6	4.8	10.3	2.7	38.3	203.3
			20-63 µm	52.3	300.5	1.8	0.0 U	0.0 U	135.0	50.9	20.0	7.8	34.7	10.3	22.8	25.4	90.9	752.3
			> 63 µm	0.0 <0	0.0 <0	43.8	287.2	0.0 U	59.8	86.1	25.7	27.6	65.2	12.5	17.4	0.0 <0	21.6	646.9
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	14.2	1.9	1.5	6.6	0.0 U	0.0 U	2.6	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	26.8
			Total Particulate POPs (>0.7µm)	3.7	0.0 <0	0.8	0.0 <0	1.3	4.3	1.8	1.9	0.9	1.8	0.2	0.5	1.7	1.8	20.8
			0.7-2.7 µm	0.3	0.0 <0	0.0 <0	0.0 <0	0.0 U	0.0 U	0.0 <0	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.3
			2.7-20 µm	1.4	0.4	1.7	1.6	0.0 U	3.3	0.7	0.0 U	0.0 U	0.0 U	0.1	0.0 U	0.0 U	0.3	9.6
			20-63 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 U	0.0 <0	1.0	1.1	0.5	0.9	0.1	0.5	0.0 U	0.9	5.0
			> 63 µm	6.4	0.0 <0	0.7	1.1	1.3	1.5	0.3	0.8	0.4	0.9	0.1	0.0 <0	1.7	0.6	15.9
C1W	2/1/2016	Paleta Creek at Cummings Road	< 0.7 µm	6.6	1.2	1.9	7.9	0.0 U	3.7	3.5	0.6	0.5	0.3	0.1	0.1	0.3	0.4	27.1
			Total Particulate POPs (>0.7µm)	0.4	4.0	10.1	20.9	0.0 U	21.4	43.7	27.2	18.1	26.4	10.0	18.5	4.1	47.6	252.4
			0.7-2.7 µm	0.3	0.0 <0	0.0 <0	0.0 <0	0.0 U	0.6	0.4	0.1	0.0 <0	0.2	0.0	0.2	0.0	0.3	2.1
			2.7-20 µm	0.0 <0	0.0 <0	0.0 <0	0.0	0.3	8.5	10.1	3.8	2.5	7.9	2.6	4.6	1.2	12.3	53.9
			20-63 µm	2.4	0.0	0.0 <0	9.9	0.4	19.6	16.6	6.4	4.6	17.2	5.9	11.0	2.0	30.3	126.3
			> 63 µm	0.4	4.3	11.5	11.3	0.0 <0	0.0 <0	16.6	16.9	11.0	1.0	1.4	2.8	0.8	4.7	82.8
O2W	2/1/2016	NBSD outfall #33	< 0.7 µm	3.1	5.2	5.4	7.6	1.7	9.2	6.5	0.7	0.4	1.2	0.4	0.3	0.5	0.4	42.5
			Total Particulate POPs (>0.7µm)	2.7	0.0 <0	0.0	7.2	0.0 <0	14.6	28.7	20.5	8.0	20.9	9.2	11.7	3.6	16.9	143.9
			0.7-2.7 µm	3.3	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.2	0.1	0.0	0.1	0.0	0.0	0.2	4.0
			2.7-20 µm	1.0	2.8	5.4	0.0 <0	0.0 <0	3.3	2.8	1.6	0.9	5.3	1.9	1.8	0.7	3.0	30.5
			20-63 µm	0.0 <0	0.0 <0	3.1	0.0 U	0.0 U	4.3	2.9	1.2	1.0	5.7	1.5	2.1	0.2	3.9	26.0
			> 63 µm	1.1	0.0 <0	0.0 <0	14.8	0.8	7.4	23.4	17.4	5.9	9.9	5.8	7.6	2.7	9.7	106.5
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	4.0	1.1	1.9	3.8	0.0 U	1.7	2.5	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.0 U	0.2	15.2
			Total Particulate POPs (>0.7µm)	0.7	1.4	3.0	25.1	1.0	39.3	31.3	13.0	7.6	17.5	5.6	10.3	2.8	29.3	187.8
			0.7-2.7 µm	0.0 <0	0.0 <0	0.1	1.0	2.6	0.6	0.0 <0	0.3	0.2	0.2	0.1	0.2	0.3	0.0 <0	5.5
			2.7-20 µm	1.2	5.1	3.2	10.7	0.0 <0	7.7	5.9	2.9	1.8	4.5	1.3	2.0	0.6	4.0	50.9
			20-63 µm	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	12.6	9.2	3.4	2.1	5.8	2.0	3.7	3.1	14.0	55.9
			> 63 µm	1.0	0.0	1.3	13.9	0.4	18.4	16.9	6.4	3.5	7.0	2.2	4.4	0.0 <0	11.4	86.7
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	1.8	12.0	12.7	0.2	0.0 U	5.7	3.3	0.0 U	0.0 U	0.2	0.0 J	0.1	0.3	0.1	36.4
			Total Particulate POPs (>0.7µm)	5.0	0.0 <0	0.0 <0	7.9	0.3	1.5	4.8	2.6	1.9	8.6	2.2	4.6	2.5	6.4	48.3
			0.7-2.7 µm	0.0 <0	0.0 <0	0.0 <0	4.8	0.6	0.5	0.4	0.5	0.3	0.1	0.1	0.1	0.1	0.2	7.5
			2.7-20 µm	0.9	0.0 <0	1.2	2.3	2.0	5.2	3.8	1.7	1.5	3.5	1.0	1.6	0.6	3.9	29.2
			20-63 µm	1.8	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.0 <0	0.7	0.2	0.4	1.5	0.4	0.6	0.0 <0	1.2	6.9
			> 63 µm	2.5	0.9	0.1	2.1	0.3	0.0 <0	0.0 <0	0.2	0.0 <0	3.5	0.7	2.3	2.3	1.1	16.0

Equations involved in the calculation of aqueous concentrations of PAHs in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = C_{Bulk} - C_{<0.7\mu m}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = C_{<2.7\mu m} - C_{<0.7\mu m}$$

2.7-20µm

$$C_{2.7-20\mu m} = C_{<20\mu m} - C_{<2.7\mu m}$$

20-63µm

$$C_{20-63\mu m} = C_{<63\mu m} - C_{<20\mu m}$$

>63µm

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m}$$

Storm 1

Measured concentrations of PCBs in the water after sample splitting and size fractionation

Location ID	Sampling Date	Description	Size Fraction	Values / Flags
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	NA
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
O2W	1/7/2016	NBSD outfall #33	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	NA

Storm 2

Measured concentrations of PCBs in the water after sample splitting and size fractionation

Location ID	Sampling Date	Description	Size Fraction	Values / Flags
C2W	2/1/2016	Paleta Creek at Main Street	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
C1W	2/1/2016	Paleta Creek at Cummings Road	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
O2W	2/1/2016	NBSD outfall #33	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	[illegible]
			< 2.7 µm	[illegible]
			< 20 µm	[illegible]
			< 63 µm	[illegible]
			Bulk	[illegible]

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
E	Identifies analytes whose concentrations exceed the calibration range of the HPLC instrument for that specific analysis.
<0	Indicates a negative outcome in concentration or TFS calculations
NA	Not analyzed (insufficient sample) / Not applicable

Calibration range:	PCB: 0.2ug/L - 20 ug/L

[illegible]

Storm 1

Calculated aqueous concentrations of PCBs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	1 Value	1 Flag	2 Value	2 Flag	3 Value	3 Flag	4 Value	4 Flag	10 Value	10 Flag	9 Value	9 Flag	7 Value	7 Flag	6 Value	6 Flag	8 Value	8 Flag	5 Value	5 Flag	19 Value	19 Flag	18 Value	18 Flag	17 Value	17 Flag
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	5.91E-06	J	7.07E-06	J	1.56E-05		1.38E-05	J	5.18E-06	J	3.67E-06	J	5.56E-06	J	9.43E-07	J	3.18E-05		2.40E-05		1.05E-05	J	3.45E-05		8.38E-06	J
			Total Particulate POPs (>0.7µm)	7.01E-06	J	9.37E-07	J	1.48E-06		0.00E+00	<0	0.00E+00	<0	4.96E-07	J	4.83E-07	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			0.7-2.7 µm	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	2.18E-07	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			2.7-20 µm	1.56E-06	J	2.65E-06	J	5.33E-06	J	0.00E+00	<0	8.65E-08	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			20-63 µm	5.23E-06	J	6.72E-06	J	1.27E-05		1.75E-05	J	8.22E-06	J	5.63E-06	J	6.12E-06	J	5.71E-06	J	5.59E-05		4.29E-05		9.64E-05		9.43E-05		2.06E-05	J
			> 63 µm	1.33E-06	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	5.43E-06	J	4.60E-06	J	9.56E-06	J	1.07E-05		6.56E-06	J	2.26E-06	J	3.37E-06	J	5.72E-06	J	2.49E-05		1.89E-05		3.11E-06	J	2.57E-05		7.80E-06	J
			Total Particulate POPs (>0.7µm)	4.94E-07	J	7.07E-06	J	8.56E-06	J	2.24E-05		1.06E-05	J	1.98E-06	J	1.41E-06	J	1.45E-05	J	5.83E-05		4.53E-05		7.91E-06	J	6.92E-05		2.88E-05	J
			0.7-2.7 µm	3.33E-06	J	3.32E-06	J	4.66E-06	J	1.50E-05		5.45E-06	J	1.42E-06	J	9.72E-07	J	4.50E-06	J	1.56E-05		1.19E-05		1.14E-06	J	1.83E-05		3.36E-06	J
			2.7-20 µm	0.00E+00	<0	0.00E+00	<0	1.66E-07	J	0.00E+00	<0	0.00E+00	<0	5.99E-07	J	5.84E-07	J	0.00E+00	<0	2.62E-06		2.07E-06		1.39E-06	J	2.12E-05		1.26E-05	
			20-63 µm	4.09E-07	J	0.00E+00	<0	0.00E+00	<0	1.49E-05		2.03E-06	J	7.19E-07	J	6.65E-07	J	1.56E-06	J	1.45E-05		1.14E-05		3.59E-06	J	2.22E-05		9.24E-06	
			> 63 µm	0.00E+00	<0	5.19E-06		5.12E-06		0.00E+00	<0	2.93E-06		0.00E+00	<0	0.00E+00	<0	1.02E-05		2.55E-05		1.99E-05		1.80E-06		7.52E-06		3.53E-06	
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	8.93E-06	J	8.47E-06	J	1.26E-05	J	4.24E-05		2.26E-05		3.59E-06	J	4.83E-06	J	1.31E-05	J	5.50E-05		4.21E-05		1.11E-05	J	5.76E-05		1.98E-05	
			Total Particulate POPs (>0.7µm)	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
			0.7-2.7 µm	1.71E-06		2.39E-06		5.99E-06		5.31E-06		6.68E-06		5.69E-06		5.21E-06		3.44E-06		1.85E-05		1.42E-05		0.00E+00	<0	4.01E-05		1.31E-05	
			2.7-20 µm	4.52E-07	J	1.04E-07	J	0.00E+00	<0	9.61E-06		4.20E-06		0.00E+00	<0	0.00E+00	<0	5.84E-06		9.56E-06		7.50E-06		5.77E-06		2.49E-05		1.10E-05	
			20-63 µm	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.40E-06	J	1.25E-06	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			> 63 µm	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	8.23E-06	J	9.33E-06	J	1.90E-05		1.82E-05	J	7.00E-06	J	7.61E-06	J	4.89E-06	J	1.17E-05	J	4.40E-05		3.33E-05		3.99E-06	J	4.88E-05		1.41E-05	J
			Total Particulate POPs (>0.7µm)	1.06E-06	J	4.70E-06	J	5.86E-06		3.90E-06	J	6.22E-06	J	0.00E+00	<0	2.06E-06	J	7.17E-06	J	5.47E-05		4.23E-05		1.25E-05		1.02E-04		4.80E-05	J
			0.7-2.7 µm	0.00E+00	<0	6.18E-06	J	3.84E-06		0.00E+00	<0	2.11E-06	J	4.87E-07	J	3.30E-06	J	0.00E+00	<0	4.73E-06		3.60E-06		1.02E-06	J	7.76E-06		3.46E-06	J
			2.7-20 µm	6.73E-06	J	2.56E-06	J	1.44E-05	J	7.95E-06	J	3.42E-06	J	4.63E-06	J	5.39E-06	J	4.85E-07	J	3.53E-05		2.64E-05		5.53E-06	J	7.26E-05		3.26E-05	
			20-63 µm	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.87E-06	J	0.00E+00	<0	0.00E+00	<0	9.25E-06	J	1.11E-05		9.11E-06		6.87E-06	J	3.73E-05		2.88E-07	
			> 63 µm	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	6.37E-06	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	7.59E-07	J	3.50E-06		3.20E-06		0.00E+00	<0	0.00E+00	<0	1.16E-05	
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	1.50E-05	J	1.61E-05	J	3.65E-05	J	8.42E-06	J	7.01E-06	J	2.02E-05	J	2.17E-05	J	4.68E-06	J	4.91E-05		3.14E-05	J	0.00E+00	J	3.20E-05	J	0.00E+00	J
			Total Particulate POPs (>0.7µm)	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	4.98E-06	J	2.49E-06	J	0.00E+00	<0	0.00E+00	<0	7.81E-06	J	0.00E+00	<0	5.69E-06		6.03E-06	J	1.89E-05	J	9.30E-06	J
			0.7-2.7 µm	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	2.47E-05		0.00E+00	<0	3.15E-06	J
			2.7-20 µm	0.00E+00	<0	2.17E-06	J	0.00E+00	<0	2.77E-06	J	0.00E+00	<0	1.14E-06	J	7.79E-07	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.41E-06	J
			20-63 µm	3.35E-06	J	0.00E+00	<0	5.62E-06	J	2.15E-06	J	4.50E-06	J	2.91E-06	J	3.17E-06	J	5.24E-06	J	2.36E-05		1.81E-05		3.01E-05		3.68E-05		8.70E-06	J
			> 63 µm	0.00E+00	<0	7.73E-07	J	0.00E+00	<0	4.66E-06	J	7.53E-07	J	0.00E+00	<0	0.00E+00	<0	5.72E-06	J	2.13E-06		1.93E-06		0.00E+00	<0	1.64E-06		0.00E+00	<0

[illegible]

Storm 2

Calculated aqueous concentrations of PCBs in the corresponding size intervals

[illegible]

Equations involved in the calculation of aqueous concentrations of PCBs in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = C_{Bulk} - C_{<0.7\mu m}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = C_{<2.7um} - C_{<0.7\mu m}$$

2.7-20µm

$$C_{2.7-20\mu m} = C_{<20um} - C_{<2.7\mu m}$$

20-63µm

$$C_{20-63\mu m} = C_{<63um} - C_{<20\mu m}$$

>63µm

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m}$$

[illegible]

	172		197		180		193		191		169		170		190		198		203		196		189		208		195		207		194		205		206		209		Total PCBs
Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
U	0.00E+00	U	2.75E-06	J	4.19E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	6.97E-06	J	6.44E-06	J	5.34E-06	J	0.00E+00	U	2.34E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00		0.00E+00	U	1.82E-06	J	6.31E-06	J	2.27E-03
U	0.00E+00	U	0.00E+00	<0	3.31E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	8.09E-05	J	0.00E+00	U	6.01E-06	J	6.81E-06	J	6.68E-06	J	0.00E+00	U	1.05E-06	J	0.00E+00	U	0.00E+00	U	1.41E-05		0.00E+00	U	0.00E+00	<0	5.01E-07	J	1.11E-03
U	0.00E+00	U	0.00E+00	<0	6.46E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.65E-05		0.00E+00	U	6.29E-06	J	2.14E-06	J	2.28E-06	J	0.00E+00	U	5.00E-07	J	0.00E+00	U	0.00E+00	U	1.09E-06	J	0.00E+00	U	6.40E-06	J	1.01E-05		2.43E-04
U	0.00E+00	U	1.08E-06	J	2.55E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	8.71E-06		6.83E-06	J	6.40E-06	J	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	1.06E-05	J	0.00E+00	U	5.56E-06	J	0.00E+00	<0	7.30E-04
U	0.00E+00	U	6.26E-07	J	5.40E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.48E-04		0.00E+00	U	1.43E-04		8.01E-05		7.94E-05		0.00E+00	U	3.14E-05		0.00E+00	U	0.00E+00	U	1.61E-04		0.00E+00	U	4.46E-05		1.39E-05	J	1.06E-02
U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	1.33E-06
U	0.00E+00	U	1.11E-06	J	2.23E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.75E-05		0.00E+00	U	8.40E-06	J	5.65E-06	J	4.90E-06	J	0.00E+00	U	2.46E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	1.08E-06	J	3.16E-06	J	1.50E-03
U	0.00E+00	U	0.00E+00	<0	9.72E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.89E-05		0.00E+00	U	2.38E-05	J	1.41E-05	J	1.40E-05	J	0.00E+00	U	3.63E-06	J	0.00E+00	U	0.00E+00	U	3.92E-05	J	0.00E+00	U	7.31E-06	J	1.11E-05	J	4.32E-03
U	0.00E+00	U	6.45E-07	J	1.08E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	2.98E-06	J	2.61E-06	J	0.00E+00	U	9.85E-07	J	0.00E+00	U	0.00E+00	U	1.19E-05	J	0.00E+00	U	9.67E-07	J	2.15E-06	J	1.35E-03
U	0.00E+00	U	0.00E+00	<0	5.21E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	4.68E-05		0.00E+00	U	1.65E-05		9.32E-06		9.94E-06		0.00E+00	U	7.89E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	9.37E-08	J	0.00E+00	<0	1.98E-03
U	0.00E+00	U	0.00E+00	<0	2.49E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.60E-05		0.00E+00	U	1.83E-07		0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	2.60E-05		0.00E+00	U	1.56E-06	J	2.64E-06	J	1.31E-03
	0.00E+00		0.00E+00	<0	9.42E-06		0.00E+00		0.00E+00		0.00E+00		0.00E+00	<0	0.00E+00		7.19E-06		3.57E-06		3.65E-06		0.00E+00		2.71E-06		0.00E+00		0.00E+00		1.18E-05		0.00E+00		4.68E-06		6.38E-06		5.83E-04
U	0.00E+00	U	1.56E-06	J	2.78E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.22E-06	J	0.00E+00	U	5.26E-06	J	6.55E-06	J	5.61E-06	J	0.00E+00	U	2.01E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	4.93E-06	J	5.03E-06	J	1.86E-03
	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		
	0.00E+00		6.92E-08		8.24E-05		0.00E+00		0.00E+00		0.00E+00		6.12E-05		0.00E+00		2.61E-05		1.36E-05		1.33E-05		0.00E+00		2.88E-06		0.00E+00		0.00E+00		2.01E-05		0.00E+00		0.00E+00	<0	1.76E-05		1.76E-03
U	0.00E+00	U	1.30E-06	J	2.56E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.24E-04		0.00E+00	U	9.28E-05		4.74E-05		4.76E-05		0.00E+00	U	2.63E-05		0.00E+00	U	0.00E+00	U	9.62E-05		0.00E+00	U	1.46E-05		6.54E-05		4.00E-03
U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	3.98E-05		7.59E-05		1.40E-04
	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		
U	0.00E+00	U	2.68E-06	J	7.55E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.22E-04		0.00E+00	U	1.31E-05	J	9.78E-06	J	8.44E-06	J	0.00E+00	U	5.65E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	5.22E-06	J	5.74E-06	J	5.08E-03
U	0.00E+00	U	1.08E-05	J	2.12E-03		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.21E-03		0.00E+00	U	3.99E-04		2.52E-04		2.52E-04		0.00E+00	U	3.26E-05	J	0.00E+00	U	0.00E+00	U	5.63E-04		0.00E+00	U	1.74E-04	J	7.02E-05	J	2.70E-02
U	0.00E+00	U	0.00E+00	<0	9.16E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	2.31E-05		1.75E-05		1.74E-05		0.00E+00	U	1.85E-06	J	0.00E+00	U	0.00E+00	U	3.42E-05		0.00E+00	U	9.60E-06	J	6.71E-06	J	6.44E-04
U	0.00E+00	U	4.37E-06	J	1.29E-03		0.00E+00	U	0.00E+00	U	0.00E+00	U	8.63E-04		0.00E+00	U	2.51E-04		1.59E-04		1.57E-04		0.00E+00	U	2.46E-05	J	0.00E+00	U	0.00E+00	U	3.32E-04		0.00E+00	U	1.29E-04		1.91E-05	J	1.61E-02
U	0.00E+00	U	1.27E-05	J	8.08E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.96E-04		0.00E+00	U	1.71E-04		8.82E-05		8.90E-05		0.00E+00	U	9.74E-06		0.00E+00	U	0.00E+00	U	1.87E-04		0.00E+00	U	6.34E-05		5.60E-05		1.31E-02
U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	1.09E-05		0.00E+00	U	0.00E+00	<0	0.00E+00	<0	7.80E-04
U	0.00E+00	U	3.97E-06	J	3.65E-05	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	1.01E-05	J	1.30E-05	J	1.03E-05	J	0.00E+00	U	0.00E+00	J	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	3.00E-06	J	1.08E-05	J	3.35E-03
U	0.00E+00	U	0.00E+00	<0	2.50E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.96E-04	J	0.00E+00	U	5.90E-05	J	2.74E-05	J	2.85E-05	J	0.00E+00	U	1.93E-06	J	0.00E+00	U	0.00E+00	U	6.01E-05		0.00E+00	U	5.76E-06	J	0.00E+00	<0	2.33E-03
	0.00E+00		0.00E+00	<0	4.12E-04		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00		2.71E-07		0.00E+00		0.00E+00		3.31E-05		0.00E+00		0.00E+00	<0	0.00E+00	<0	7.03E-04
U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	4.48E-06	J	3.16E-07	J	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	3.65E-07	J	0.00E+00	<0	1.38E-04
U	0.00E+00	U	6.08E-07	J	1.14E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	4.57E-05		0.00E+00	U	2.73E-05		1.98E-05		2.14E-05		0.00E+00	U	1.64E-06	J	0.00E+00	U	0.00E+00	U	3.09E-05		0.00E+00	U	1.55E-05	J	3.84E-06	J	2.63E-03
U	0.00E+00	U	0.00E+00	<0	1.34E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.50E-04		0.00E+00	U	2.87E-05		1.08E-05		1.12E-05		0.00E+00	U	2.28E-07	J	0.00E+00	U	0.00E+00	U	2.92E-05		0.00E+00	U	0.00E+00	<0	0.00E+00	<0	1.25E-03
J	7.97E-05		9.82E-06	J	9.74E-04		9.59E-05		0.00E+00	U	0.00E+00	U	4.22E-04		8.77E-05		4.28E-04		2.33E-04		2.31E-04		5.14E-06	J	7.00E-05		7.55E-05		2.08E-05	J	2.95E-04		2.59E-04		2.45E-04		6.98E-05		3.68E-02
J	4.16E-04		2.35E-05	J	2.94E-03		1.77E-04		0.00E+00	U	0.00E+00	U	1.21E-03		2.60E-04		1.24E-03		6.91E-04		6.88E-04		6.54E-06	J	2.05E-04		1.43E-04		9.24E-05	J	1.07E-03		8.77E-04		9.55E-04		4.98E-04		8.72E-02
J	1.48E-05		3.28E-06	J	3.97E-04		1.70E-04		0.00E+00	U	0.00E+00	U	1.76E-04		2.69E-05		2.38E-04		1.00E-04		9.91E-05		7.35E-06	J	7.90E-06		5.59E-05		8.35E-07	J	1.87E-04		0.00E+00	<0	1.49E-04		4.34E-05		1.44E-02
J	4.79E-04		1.13E-04		9.81E-03		2.18E-04		0.00E+00	U	0.00E+00	U	4.36E-03		7.10E-04		4.38E-03		2.32E-03		2.32E-03		1.45E-04		7.64E-04		8.33E-04		3.71E-04		3.79E-03		3.26E-03		3.33E-03		1.47E-03		2.82E-01
J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00
J	6.85E-05		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	3.15E-04
J	1.01E-05	J	1.25E-06	J	2.60E-05		3.32E-05		0.00E+00	U	0.00E+00	U	9.88E-06	J	3.95E-06	J	7.26E-06	J	6.03E-06	J	6.57E-06	J	1.39E-06	J	1.28E-08	J	6.20E-06	J	2.04E-06	J	0.00E+00	J	8.76E-06	J	1.92E-06	J	4.09E-06	J	2.54E-03
J	6.46E-05	J	1.64E-06	J	8.21E-04		2.49E-05		0.00E+00	U	0.00E+00	U	4.69E-04	J	7.96E-05	J	1.74E-04	J	1.06E-04	J	1.04E-04	J	6.48E-06	J	1.94E-05	J	5.96E-05	J	1.04E-05	J	2.11E-04	J	9.58E-06	J	8.50E-05	J	1.94E-05	J	1.54E-02
	6.98E-06		0.00E+00	<0	8.56E-05		5.13E-05		0.00E+00		0.00E+00		5.24E-05		8.52E-06		1.73E-05		9.98E-06		8.70E-06		1.92E-07		2.30E-07		1.22E-07		2.69E-07		1.24E-05		0.00E+00	<0	5.23E-06		0.00E+00	<0	1.01E-03
J	1.31E-04		4.20E-06	J	1.66E-03		2.22E-06		0.00E+00	U	0.00E+00	U	1.03E-03		1.75E-04		3.70E-04		2.07E-04		2.07E-04		1.67E-05	J	2.96E-05		8.80E-05		1.43E-05	J	4.42E-04		3.81E-04		1.96E-04		6.98E-05		2.94E-02
J	6.47E-05		1.58E-07	J	1.19E-03		5.51E-05		0.00E+00	U	0.00E+00	U	6.99E-04		1.35E-04		2.43E-04		1.35E-04		1.34E-04		1.89E-05		3.48E-05		1.43E-04		1.79E-05		2.40E-04		0.00E+00	<0	1.03E-04		1.09E-04		2.71E-02
J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	3.41E-04
U	0.00E+00	U	1.08E-06	J	1.94E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	5.42E-06	J	4.57E-06	J	3.92E-06	J	0.00E+00	U	3.18E-07	J	0.00E+00	U	0.00E+00	U	1.01E-05	J	0.00E+00	U	1.42E-06	J	3.79E-06	J	1.54E-03
U	0.00E+00	U	1.77E-06	J	3.67E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.74E-04	J	0.00E+00	U	1.36E-04	J	7.12E-05	J	7.07E-05	J	0.00E+00	U	1.55E-05	J	0.00E+00	U	0.00E+00	U	1.69E-04	J	0.00E+00	U	1.03E-04	J	2.71E-05	J	5.32E-03
U	0.00E+00	U	5.39E-07	J	8.23E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.44E-05		0.00E+00	U	3.86E-05		2.27E-05		2.21E-05		0.00E+00	U	6.06E-06	J	0.00E+00	U	0.00E+00	U	3.92E-05		0.00E+00	U	3.31E-05		4.69E-06	J	1.87E-03
U	0.00E+00	U	8.25E-07	J	3.77E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.19E-04		0.00E+00	U	1.37E-04		7.01E-05		7.01E-05		0.00E+00	U	1.73E-05		0.00E+00	U	0.00E+00	U	1.14E-04		0.00E+00	U	9.73E-05		2.89E-05		4.44E-03
U	0.00E+00	U	1.52E-06	J	2.73E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.73E-04		0.00E+00	U	8.51E-05		4.81E-05		4.83E-05		0.00E+00	U	1.20E-05		0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	6.28E-05		0.00E+00	<0	4.32E-03
	0.00E+00		0.00E+00	<0	0.00E+00	<0	0.00E+00		0.00E+00		0.00E+00		0.00E+00	<0	0.00E+00		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00		0.00E+00	<0	0.00E+00		0.00E+00		3.40E-05		0.00E+00		0.00E+00	<0	2.74E-06		1.73E-04
U	0.00E+00	U	9.54E-07	J	4.66E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	5.41E-06	J	0.00E+00	U	5.51E-06	J	4.79E-06	J	7.44E-06	J	0.00E+00	U	1.80E-07	J	0.00E+00	U	0.00E+00	U	4.50E-06	J	0.00E+00	U	2.73E-06	J	3.75E-06	J	1.54E-03
	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		
U	0.00E+00	U	7.55E-07	J	5.17E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	5.33E-05		0.00E+00	U	1.61E-05		1.08E-05		7.08E-06	J	0.00E+00	U	1.22E-06	J	0.00E+00	U	0.00E+00	U	1.54E-05		0.00E+00	U	0.00E+00	<0	5.05E-06	J	1.18E-03
U	0.00E+00	U	0.00E+00	<0	9.57E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.26E-05		0.00E+00	U	1.75E-05		8.59E-06		8.72E-06		0.00E+00	U	7.54E-07	J	0.00E+00	U	0.00E+00	U	1.51E-05		0.00E+00	U	2.76E-06	J	0.00E+00	<0	1.15E-03
U	0.00E+00	U	3.11E-09	J	7.18E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.75E-05		0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	2.21E-06	J	0.00E+00	U	0.00E+00	U	5.96E-06		0.00E+00	U	7.90E-06	J	9.53E-06		2.54E-04
	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		

	172		197		180		193		191		169		170		190		198		203		196		189		208		195		207		194		205		206		209		Total PCBs
Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
U	9.90E-05		0.00E+00	U	4.34E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	4.13E-06	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00		0.00E+00	U	1.68E-05	J	0.00E+00	U	3.91E-03
U	1.74E-03		0.00E+00	U	2.35E-03		0.00E+00	U	0.00E+00	U	0.00E+00	U	7.99E-04	J	0.00E+00	U	5.21E-04	U	1.93E-04	U	1.62E-04	U	0.00E+00	U	4.18E-05	U	0.00E+00	U	0.00E+00	U	1.05E-03		0.00E+00	U	3.79E-04	J	3.83E-05	U	6.66E-02
	0.00E+00	<0	0.00E+00		0.00E+00	<0	0.00E+00		0.00E+00		0.00E+00		1.67E-05		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		1.40E-05		0.00E+00		0.00E+00	<0	0.00E+00		3.46E-04
U	0.00E+00	U	0.00E+00	U	1.13E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	5.01E-05		0.00E+00	U	3.13E-05	J	1.03E-05		7.97E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	6.77E-05		0.00E+00	U	2.12E-05	J	5.74E-06		3.10E-03
U	1.28E-04		0.00E+00	U	2.06E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.07E-04		1.15E-05	J	7.04E-05		3.30E-05		3.24E-05		0.00E+00	U	2.01E-05		0.00E+00	U	0.00E+00	U	7.33E-05		0.00E+00	U	1.65E-04		9.78E-05		4.41E-03
U	1.72E-03		0.00E+00	U	2.04E-03		0.00E+00	U	0.00E+00	U	0.00E+00	U	6.25E-04		0.00E+00	<0	4.19E-04	J	1.49E-04		1.22E-04		0.00E+00	U	2.18E-05		0.00E+00	U	0.00E+00	U	8.96E-04		0.00E+00	U	1.95E-04	J	0.00E+00	<0	6.01E-02
U	1.19E-04		0.00E+00	U	1.53E-05	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	2.21E-05	J	1.11E-05	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.54E-05	J	0.00E+00	U	1.72E-05	J	0.00E+00	U	3.30E-03
U	0.00E+00	<0	0.00E+00	U	4.77E-06	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	3.06E-05	J	1.40E-05	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	4.38E-07	J	0.00E+00	U	8.60E-04
	0.00E+00	<0	0.00E+00		2.15E-06		0.00E+00		0.00E+00		0.00E+00		0.00E+00	<0	0.00E+00	<0	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	<0	0.00E+00		0.00E+00	<0	0.00E+00		2.95E-04
U	7.07E-05		0.00E+00	U	1.22E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.67E-06	J	0.00E+00	U	0.00E+00	<0	0.00E+00	U	6.85E-04
U	4.03E-05		0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	5.40E-05		2.48E-05	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	7.66E-06	J	0.00E+00	U	4.36E-06	J	0.00E+00	U	8.74E-04
U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	2.35E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	9.21E-04
U	0.00E+00	U	0.00E+00	U	1.80E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.91E-05		0.00E+00	U	6.00E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.25E-05		0.00E+00	U	0.00E+00	U	1.11E-06		2.79E-03
U	3.47E-05	U	0.00E+00	U	4.88E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.96E-04		7.42E-05	U	1.09E-04	J	6.16E-05	U	6.10E-05	U	0.00E+00	U	1.28E-05	U	0.00E+00	U	0.00E+00	U	1.35E-04		0.00E+00	U	7.98E-05	U	3.10E-05		8.94E-03
U	0.00E+00	U	0.00E+00	U	3.95E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	3.70E-06		0.00E+00	U	8.98E-06	J	0.00E+00	<0	5.92E-04
U	1.52E-06	J	0.00E+00	U	1.34E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	7.78E-05		1.78E-05		3.36E-05		1.81E-05		1.75E-05		0.00E+00	U	1.35E-06		0.00E+00	U	0.00E+00	U	3.79E-05		0.00E+00	U	2.24E-05		0.00E+00	U	1.57E-03
U	2.14E-05		0.00E+00	U	2.73E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.46E-04		3.78E-05		6.15E-05		3.35E-05		3.34E-05		0.00E+00	U	8.14E-06		0.00E+00	U	0.00E+00	U	9.64E-05		0.00E+00	U	4.98E-05		2.81E-05		4.77E-03
U	1.18E-05		0.00E+00	U	7.72E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	7.72E-05		1.87E-05		1.40E-05		1.00E-05		1.01E-05		0.00E+00	U	3.30E-06		0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	<0	4.03E-06		2.49E-03
U	1.26E-06		0.00E+00	U	1.84E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.08E-06		0.00E+00	J	6.50E-06		1.37E-06		2.25E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.17E-05		0.00E+00	U	5.56E-06		2.93E-07	U	1.16E-03
U	4.95E-05		0.00E+00	U	3.07E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.51E-04		2.52E-05	J	1.37E-04		8.74E-05		8.61E-05		0.00E+00	U	2.59E-05	U	0.00E+00	U	0.00E+00	U	1.35E-04		0.00E+00	U	1.24E-04		3.38E-05	U	5.65E-03
	0.00E+00		0.00E+00		2.32E-05		0.00E+00		0.00E+00		0.00E+00		7.59E-06		0.00E+00		9.34E-06		3.23E-06		2.66E-06		0.00E+00		0.00E+00		0.00E+00		0.00E+00		1.79E-05		0.00E+00		8.12E-06		0.00E+00		1.06E-03
U	1.42E-05	U	0.00E+00	U	1.44E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	7.48E-05	J	1.42E-05	U	6.14E-05	J	3.29E-05		3.26E-05		0.00E+00	U	8.42E-06	U	0.00E+00	U	0.00E+00	U	6.79E-05		0.00E+00	U	5.11E-05	J	2.10E-05	U	3.92E-03
U	2.87E-06		0.00E+00	U	2.30E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.21E-04		1.58E-05		9.60E-05		5.22E-05		5.18E-05		0.00E+00	U	1.42E-05		0.00E+00	U	0.00E+00	U	1.10E-04		0.00E+00	U	8.52E-05		3.45E-05		5.97E-03
U	5.08E-05	J	0.00E+00	U	3.25E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.54E-04		2.52E-05		1.44E-04		8.88E-05		8.83E-05		0.00E+00	U	2.59E-05		0.00E+00	U	0.00E+00	U	1.46E-04		0.00E+00	U	1.30E-04		3.41E-05		6.73E-03
U	2.98E-05		0.00E+00	U	8.51E-06	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	7.77E-06	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00		0.00E+00	U	4.94E-06	J	0.00E+00	U	9.05E-04
U	0.00E+00	<0	0.00E+00	U	1.75E-04	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	9.38E-05	J	1.28E-05	U	4.48E-05	U	2.52E-05	U	2.47E-05	U	0.00E+00	U	4.76E-06	U	0.00E+00	U	0.00E+00	U	1.18E-05		0.00E+00	U	2.98E-05	J	1.85E-05	U	3.70E-03
U	0.00E+00	<0	0.00E+00	U	3.87E-07	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	4.63E-06	J	0.00E+00	U	2.59E-07	J	0.00E+00	U	3.39E-04
U	0.00E+00	<0	0.00E+00	U	3.63E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	2.89E-05		2.18E-06	J	8.00E-06	J	3.59E-06		3.06E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.21E-05		0.00E+00	U	9.33E-06		3.15E-06		1.07E-03
U	1.19E-05		0.00E+00	U	1.44E-04		0.00E+00	U	0.00E+00	U	0.00E+00	U	8.50E-05		1.25E-05		4.04E-05		2.12E-05		2.14E-05		0.00E+00	U	5.02E-06		0.00E+00	U	0.00E+00	U	4.05E-05		0.00E+00	U	1.73E-05		1.31E-05		3.25E-03
U	1.30E-05		0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	4.43E-07		2.85E-07		0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	2.94E-06		2.26E-06		1.06E-04
U	0.00E+00	U	0.00E+00	U	3.33E-06	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	J	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	2.08E-05		0.00E+00	U	4.45E-06	J	0.00E+00	U	8.58E-04
U	3.39E-05	U	0.00E+00	U	6.65E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	4.06E-05	J	1.09E-05	U	1.39E-05	U	3.75E-06	U	6.20E-06	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.05E-05	J	0.00E+00	U	8.56E-06	J	0.00E+00	U	1.32E-03
	0.00E+00		0.00E+00		3.74E-06		0.00E+00		0.00E+00		0.00E+00		5.76E-06		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	<0	0.00E+00		0.00E+00	<0	0.00E+00		1.43E-04
U	5.20E-06	J	0.00E+00	U	5.91E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	3.56E-05		4.89E-06	J	1.68E-05		7.85E-06		7.41E-06		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	1.97E-05		0.00E+00	U	6.55E-06		0.00E+00	U	3.42E-03
U	3.91E-07	J	0.00E+00	U	2.13E-05		0.00E+00	U	0.00E+00	U	0.00E+00	U	1.47E-05		0.00E+00	<0	2.26E-06		3.30E-07		1.63E-07		0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	7.45E-06		0.00E+00	U	5.54E-07	J	0.00E+00	U	1.02E-04
U	2.83E-05		0.00E+00	U	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	1.09E-05	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	U	0.00E+00	<0	0.00E+00	U	2.30E-06		0.00E+00	U	8.35E-05

Storm 1

Measured concentrations of Chlordanes in the water after sample splitting and size fractionation

Location ID	Sampling Date	Description	Size Fraction	Measured Concentration (ng/L)				
				Transchlordane		Cischlordane		Total Chlordanes
				Value	Flag	Value	Flag	
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	0.4		0.4		0.8
			< 2.7 µm	0.6		0.5		1.1
			< 20 µm	0.8		0.7		1.5
			< 63 µm	7.2		7.2		14.4
			Bulk	1.0		1.0		2.0
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	0.2		0.1		0.3
			< 2.7 µm	0.4		0.4		0.8
			< 20 µm	1.1		1.1		2.2
			< 63 µm	1.3		1.2		2.5
			Bulk	1.9		2.0		3.9
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	0.2		0.2		0.3
			< 2.7 µm	0.4		0.4		0.8
			< 20 µm	1.0		1.0		2.0
			< 63 µm	0.7		0.7		1.4
			Bulk	NA		NA		
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	0.3		0.4		0.7
			< 2.7 µm	0.6		0.6		1.2
			< 20 µm	3.1		3.0		6.1
			< 63 µm	6.3		6.3		12.5
			Bulk	7.3		7.3		14.6
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	0.3		0.1	J	0.4
			< 2.7 µm	0.2		0.1	J	0.3
			< 20 µm	0.3		0.1		0.4
			< 63 µm	1.0		0.6		1.6
			Bulk	2.4		1.7		4.2
O2W	1/7/2016	NBSD outfall #33	< 0.7 µm	0.4		0.3		0.7
			< 2.7 µm	0.5		0.3	J	0.8
			< 20 µm	2.1		1.4		3.5
			< 63 µm	1.8		1.3		3.1
			Bulk	0.0	U	0.0	U	0.0
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	0.2		0.1		0.2
			< 2.7 µm	0.2		0.2		0.4
			< 20 µm	2.5		2.2		4.7
			< 63 µm	6.2		5.8		12.0
			Bulk	0.0	U	0.0	U	0.0
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	0.2		0.2		0.5
			< 2.7 µm	0.7		0.1	J	0.8
			< 20 µm	3.1		3.2		6.3
			< 63 µm	5.2		5.6		10.8
			Bulk	3.1		3.1		6.2
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	< 0.7 µm	0.2		0.2		0.5
			< 2.7 µm	0.5		0.4		0.9
			< 20 µm	0.6		0.6		1.3
			< 63 µm	0.6		0.6		1.3
			Bulk	NA		NA		

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
<0	Indicates a negative outcome in concentration or TFS calculations
NA	Not analyzed (Insufficient sample) / Not applicable

Calibration range:	Chlordanes: 0.2ug/L - 20 ug/L

Storm 1

Calculated aqueous concentrations of Chlordanes in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Measured Concentration (ng/L)				
				Transchlordane		Cischlordane		Total Chlordanes
				Value	Flag	Value	Flag	
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	0.4		0.4		0.8
			Total Particulate POPs (>0.7µm)	0.7		0.6		1.2
			0.7-2.7 µm	0.2		0.1		0.3
			2.7-20 µm	0.3		0.1		0.4
			20-63 µm	6.3		6.6		12.9
			> 63 µm	0.0	<0	0.0	<0	0.0
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	0.2		0.1		0.3
			Total Particulate POPs (>0.7µm)	1.8		1.9		3.7
			0.7-2.7 µm	0.3		0.3		0.5
			2.7-20 µm	0.7		0.7		1.4
			20-63 µm	0.1		0.1		0.3
			> 63 µm	0.7		0.7		1.4
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	0.2		0.2		0.3
			Total Particulate POPs (>0.7µm)	NA		NA		
			0.7-2.7 µm	0.2		0.2		0.5
			2.7-20 µm	0.5		0.6		1.2
			20-63 µm	0.0	<0	0.0	<0	0.0
			> 63 µm	NA		NA		
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	0.3		0.4		0.7
			Total Particulate POPs (>0.7µm)	7.0		6.9		14.0
			0.7-2.7 µm	0.3		0.2		0.5
			2.7-20 µm	2.4		2.4		4.9
			20-63 µm	3.2		3.3		6.5
			> 63 µm	1.1		1.0		2.1
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	0.3		0.1	J	0.4
			Total Particulate POPs (>0.7µm)	2.1		1.6		3.8
			0.7-2.7 µm	0.0	<0	0.0	<0	0.0
			2.7-20 µm	0.1		0.0	J	0.1
			20-63 µm	0.7		0.5		1.2
			> 63 µm	1.4		1.2		2.6
O2W	1/7/2016	NBSD outfall #33	< 0.7 µm	0.4		0.3		0.7
			Total Particulate POPs (>0.7µm)	0.0	<0	0.0	<0	0.0
			0.7-2.7 µm	0.1		0.0	<0	0.1
			2.7-20 µm	1.6		1.1	J	2.7
			20-63 µm	0.0	<0	0.0	<0	0.0
			> 63 µm	0.0	<0	0.0	<0	0.0
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	0.2		0.1		0.2
			Total Particulate POPs (>0.7µm)	0.0	<0	0.0	<0	0.0
			0.7-2.7 µm	0.1		0.1		0.1
			2.7-20 µm	2.3		2.1		4.4
			20-63 µm	3.7		3.6		7.3
			> 63 µm	0.0	<0	0.0	<0	0.0
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	0.2		0.2		0.5
			Total Particulate POPs (>0.7µm)	2.9		2.9		5.8
			0.7-2.7 µm	0.5		0.0	<0	0.5
			2.7-20 µm	2.4		3.1		5.5
			20-63 µm	2.1		2.4		4.5
			> 63 µm	0.0	<0	0.0	<0	0.0
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	< 0.7 µm	0.2		0.2		0.5
			Total Particulate POPs (>0.7µm)	NA		NA		
			0.7-2.7 µm	0.2		0.2		0.4
			2.7-20 µm	0.2		0.2		0.4
			20-63 µm	0.0	<0	0.0	<0	0.0
			> 63 µm	NA		NA		

Equations involved in the calculation of aqueous concentrations of Chlordanes in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = C_{Bulk} - C_{<0.7\mu m}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = C_{<2.7um} - C_{<0.7\mu m}$$

2.7-20µm

$$C_{2.7-20\mu m} = C_{<20um} - C_{<2.7\mu m}$$

20-63µm

$$C_{20-63\mu m} = C_{<63um} - C_{<20\mu m}$$

>63µm

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m}$$

Storm 1

Calculated aqueous concentrations of metals in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L)		Arsenic (μg/L)			Chromium (μg/L)			Copper (μg/L)			Nickel (μg/L)			Zinc (μg/L)			Cadmium (μg/L)			Lead (μg/L)			THg (μg/L)		
				Value	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag
C2W	7-Jan-16	Paleta Creek at Main Street	Bulk	NA		34.5	0.9		29.8	NA		75.3	4.2		19.1	2.7		419.0	11.8		0.94	0.02	J	45.5	1.9		0.0779	0.014	
			Total (>0.45 μm)	269.0		33.4	0.9		29.8	NA		69.8	4.2		17.1	2.7		397.3	11.9		0.94	0.02	J	44.5	1.9		0.0746	0.014	
			<0.45 μm	NA		1.1	0.1		0.0	NA	U	5.5	0.1		2.0	0.0		21.7	0.6		0.00	NA	U	1.1	0.0	J	0.0033	NA	
			0.45-5 μm	1.1	* , LS	0.1	0.1		0.0	NA	U	0.8	0.2		0.2	0.0		2.4	0.8		0.00	NA	U	0.5	0.2		0.0000	NA	M<0
			5-20 μm	114.3	*	1.9	0.1		5.6	0.1		13.4	4.1		2.5	0.1		62.1	0.8		0.21	0.01	J	8.9	3.4		0.0132	0.001	
			20-63 μm	99.2	*	1.8	0.3		5.6	0.9		13.5	4.2		3.7	0.1		65.4	2.2		0.15	0.01	J	4.4	8.7		0.0112	0.004	
			> 63 μm	54.4	*	29.6	1.0		18.7	0.8		42.1	4.3		10.6	2.7		267.4	12.0		0.59	0.02	J	30.6	8.2		0.0508	0.014	
O4W	6-Jan-16	NBSD outfall at Paunack and Division Streets	Bulk	NA		6.0	0.4		11.0	1.2		24.1	0.4		16.7	0.4		92.3	1.7		0.19	0.0	J	5.2	0.1		0.1881	0.060	
			Total (>0.45 μm)	184.4		3.8	0.4		11.0	1.2		18.4	0.4		7.2	0.4		87.2	1.7		0.19	0.0	J	4.7	0.1		0.1818	0.060	
			<0.45 μm	NA		2.2	0.1		0.0	NA	U	5.7	0.1		9.5	0.1		5.1	0.3		0.00	NA	U	0.6	0.0	J	0.0063	NA	
			0.45-5 μm	2.0	LS	0.0	NA	M<0	2.3	0.1	J	0.9	0.2		0.1	0.1		5.2	0.5		0.00	NA	U	0.8	0.1		0.0031	0.001	
			5-20 μm	159.5		0.8	0.2		4.3	0.4		4.6	2.9		0.0	NA	M<0	23.3	3.0		0.00	NA	U	2.3	1.4		0.0219	0.002	
			20-63 μm	13.8		1.8	0.3		4.4	0.9		8.4	6.4		4.9	0.3		22.2	3.2		0.00	NA	U	0.0	NA	M<0	0.0663	0.027	
			> 63 μm	9.2	LS	1.2	0.4		0.1	1.4		4.6	5.7		4.7	0.5		36.4	2.0		0.19	0.0	J	2.5	2.2		0.0904	0.066	
O3W	7-Jan-16	NBSD outfall north of railroad crossing	Bulk	NA		28.1	15.4		5.5	0.2		21.0	2.1		15.1	0.3		83.2	8.5		0.40	0.0	J	3.8	0.0		0.0490	0.004	
			Total (>0.45 μm)	N	S	24.0	15.4		5.5	0.2		6.2	2.1		1.0	0.5		78.9	8.5		0.19	0.02	J	3.3	0.1		0.0407	0.004	
			<0.45 μm	NA		4.1	0.0		0.0	NA	U	14.8	0.1		14.1	0.3		4.3	0.2		0.21	0.00	J	0.5	0.0	J	0.0083	0.000	
			0.45-5 μm	N	S	0.2	0.1		0.0	NA	U	0.3	0.8		0.0	NA	M<0	5.3	3.4		0.00	NA	M<0, J	0.4	0.0		0.0017	0.001	
			5-20 μm	N	S	0.0	0.2		2.7	0.3	J	0.0	NA	M<0	0.0	NA	M<0	17.7	3.5		0.01	0.00	J	3.4	0.1		0.0157	0.001	
			20-63 μm	0.0	TFS<0	16.1	13.4		0.9	0.4		5.2	0.9		1.1	0.4		8.3	3.8		0.03	0.01	J	0.0	0.1		0.0083	0.006	
			> 63 μm	5.4	LS	7.7	20.5		1.9	0.4		0.8	2.3		3.2	0.6		47.5	9.3		0.16	0.02	J	0.4	0.1		0.0151	0.007	
C1W	6-Jan-16	Paleta Creek at Cummings Road	Bulk	NA		38.1	4.1		13.3	1.0		32.7	0.6		11.2	0.2		151.6	9.2		0.41	0.0	J	20.8	2.5		0.0434	0.005	
			Total (>0.45 μm)	241.6		36.6	4.1		13.3	1.0		25.0	1.0		5.0	0.4		144.8	9.2		0.41	0.01	J	20.1	2.5		0.0384	0.005	
			<0.45 μm	NA		1.5	0.1		0.0	NA	U	7.8	0.9		6.3	0.3		6.8	0.1		0.00	NA	U	0.6	0.6	J	0.0051	NA	
			0.45-5 μm	23.5		0.6	0.1		0.0	NA	U	5.3	4.3		2.2	0.3		9.7	0.2		0.00	NA	U	0.6	0.0		0.0000	NA	M<0
			5-20 μm	46.3		0.0	NA	M<0	2.5	NA	J	0.0	NA	M<0	0.0	NA	M<0	12.3	0.4		0.00	NA	U	5.2	0.2		0.0068	0.003	
			20-63 μm	108.3		0.8	0.1		4.1	0.6		5.2	0.4		0.0	NA	M<0	17.5	0.3		0.00	NA	U	2.2	0.2		0.0051	0.004	
			> 63 μm	63.5		35.6	4.1		6.7	1.2		17.7	0.6		5.0	0.3		105.3	9.2		0.41	0.01	J	12.2	2.5		0.0275	0.006	
O1W	7-Jan-16	NBSD outfall #23	Bulk	NA		2.3	NA		12.6	2.3		16.8	NA		7.3	NA		207.5	NA		0.54	NA	J	18.8	NA		0.0086	NA	
			Total (>0.45 μm)	125.3		1.5	0.0		9.9	2.3		10.5	0.2		1.0	0.2		153.6	NA		0.13	0.01	J	17.6	0.1		0.0065	NA	
			<0.45 μm	NA		0.8	0.0	J	2.6	NA	J	6.3	0.2		6.3	0.2		53.9	1.0		0.41	0.01	J	1.2	NA		0.0020	NA	
			0.45-5 μm	0.0	TFS<0	0.0	NA	M<0, J	0.0	NA	M<0, U	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	0.00	NA	M<0, J	0.3	0.1		0.0025	0.001	
			5-20 μm	38.7		0.2	0.1	J	2.2	NA	J	2.2	0.1		1.6	0.1		1.6	1.0		0.01	0.01	J	6.7	0.0		0.0000	NA	M<0
			20-63 μm	39.0		25.6	0.8		6.2	2.8		5.0	0.3		1.4	0.3		42.9	1.6		0.08	0.02	J	0.5	0.1		0.0012	0.001	
			> 63 μm	47.5		[illegible]	[illegible]		4.2	3.6		4.6	0.3		0.5	0.2		119.0	1.3		0.15	0.01	J	10.1	0.1		0.0044	0.000	
O2W	7-Jan-16	NBSD outfall #33	Bulk	NA		22.4	0.2		93.9	4.5	E	144.5	4.1		25.4	0.4		308.6	6.0		2.65	0.1		67.9	3.0		0.7763	0.084	
			Total (>0.45 μm)	1067.0		19.2	0.8		90.4	4.5	E	110.0	4.4		16.0	0.7		293.6	6.2		1.86	0.09		66.0	3.0		0.7515	0.084	
			<0.45 μm	NA		3.2	0.2		3.5	0.1		34.4	1.6		9.5	0.5		15.0	1.8		0.79	0.04	J	1.8	0.1		0.0248	NA	
			0.45-5 μm	87.8		0.0	NA	M<0	1.4	0.8		0.1	2.5		0.0	NA	M<0	0.0	NA	M<0	0.00	NA	M<0	0.0	0.3		0.0000	NA	M<0
			5-20 μm	969.1		16.4	0.7		82.9	4.2	E	73.7	2.0		13.2	0.6		168.5	1.8		1.39	0.06		75.7	3.5		0.7571	0.022	
			20-63 μm	5.3	LS	0.0	NA	M<0	0.0	NA	M<0, E	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.00	NA	M<0	0.0	NA	M<0	0.0000	NA	M<0
			> 63 μm	4.7	LS	5.3	3.0		15.9	4.8	E	41.5	4.8		5.1	0.7		137.6	7.1		0.78	0.11		6.0	3.9		0.1050	0.097	
A1W	5-Jan-16	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Bulk	NA		8.6	0.6		15.4	0.5		50.9	0.6		11.0	0.3		233.7	0.6		0.62	0.0	J	32.3	1.1		0.0952	0.019	
			Total (>0.45 μm)	229.7		6.7	0.6		15.4	0.5		38.0	0.7		3.4	0.3		199.1	0.8		0.42	0.02	J	31.6	1.1		0.0925	0.019	
			<0.45 μm	NA		1.9	0.0		0.0	NA	U	12.9	0.4		7.6	0.0		34.6	0.5		0.20	0.00	J	0.7	0.0	J	0.0027	NA	
			0.45-5 μm	0.0	TFS<0	0.0	0.0		0.0	NA	U	0.4	1.4		0.2	0.2		6.0	1.3		0.00	0.01	J	0.3	0.1	J	0.0000	NA	M<0
			5-20 μm	121.7		3.0	0.3		9.7	0.2		18.7	1.7		2.9	0.5		71.8	5.8		0.14	0.02	J	19.4	0.9		0.0463	0.004	
			20-63 μm	79.1		1.6	0.3		3.8	0.8		13.3	1.2		1.9	0.8		97.0	6.5		0.10	0.02	J	2.0	1.0		0.0190	0.009	
			> 63 μm	28.9		2.1	0.6		2.0	0.9		5.6	0.9		0.0	NA	M<0	24.4	3.2		0.17	0.02	J	9.9	1.1		0.0279	0.020	
A2W	5-Jan-16	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Bulk	NA		43.3	9.0		12.7	0.3		23.0	0.5		7.5	0.2		85.8	2.9		0.29	0.0	J	11.7	0.3		0.0281	0.002	
			Total (>0.45 μm)	230.7		40.7	9.0		12.7	0.3		15.5	0.5		2.0	0.2		73.1	3.3		0.29	0.01	J	11.0	0.3		0.0258	0.002	
			<0.45 μm	NA		2.6	0.0		0.0	NA	U	7.5	0.1		5.5	0.0		12.7	1.6		0.00	NA	U	0.6	0.6	J	0.0023	NA	
			0.45-5 μm	0.0	TFS<0	0.0	0.0		0.0	NA	U	1.6	0.4		0.8	0.1		0.0	NA	M<0	0.00	NA	U	0.0	NA	M<0, J	0.0000	NA	M<0
			5-20 μm	199.0		3.5	0.6		10.2	0.5		9.2	1.2		0.9	0.2		42.1	2.8		0.19	NA	J	9.2	0.6		0.0152	0.000	
			20-63 μm	31.6		0.4	0.9		0.0	NA	M<0	1.0	1.3		0.5	0.5		2.7	2.9		0.01	0.02	J	0.0	NA	M<0	0.0000	NA	M<0
			> 63 μm	0.0	TFS<0	36.4	9.0		2.8	0.4		3.7	0.7		0.0	NA	M<0	31.7	3.0		0.09	0.02	J	3.5	0.4		0.0110	0.002	
A3W	6-Jan-16	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	Bulk	NA		6.1	0.2		3.5	NA		12.5	1.0		7.8	0.4		28.0	1.0		0.00	NA	U	2.4	0.0		0.0080	0.001	
			Total (>0.45 μm)	N	S	3.0	0.2		3.5	NA		0.0	NA	M<0	0.0	NA	M<0	18.3	1.0		0.00	NA	U	1.8	0.1		0.0052	0.001	
			<0.45 μm	NA		3.1	0.1		0.0	NA	U	12.7	1.2		11.1	3.9		9.7	0.2		0.00	NA	U	0.5	0.1	J	0.0027	NA	
			0.45-5 μm	N	S	0.1	0.2		0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	2.9	0.4		0.00	NA	U	0.1	0.1	J	0.0012	0.001	
			5-20 μm	26.0	**	0.0	NA	M<0	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	3.5	0.8		0.00	NA	U	2.4	0.0		0.0018	0.001	
			20-63 μm	0.0	TFS<0	0.2	0.5		0.0	NA	U	0.6	1.0		0.0	NA	M<0	0.0	1.6		0.00	NA	U	0.0	NA	M<0	0.0000	NA	M<0
			> 63 μm	1.2	LS	2.7	0.6		3.5	NA		0.4	1.4		0.4	0.9		11.9	1.8		0.00	NA	U	0.4	0.1		0.0027	0.001	

Storm 1

Calculated concentrations of metals on solids in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Arsenic			Chromium			Copper			Nickel			Zinc			Cadmium			Lead			THg			Units
				Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	
C2W	7-Jan-16	Paleta Creek at Main Street	Bulk-water	34.5	0.9		29.8	NA		75.3	4.2		19.1	2.7		419.0	11.8		0.9	0.0	J	45.5	1.9		0.0779	0.014		μg/L
			Filtered water (< 0.45 μm)	1.1	0.1		0.0	NA	U	5.5	0.1		2.0	0.0		21.7	0.6		0.0	NA	U	1.1	0.0	J	0.0033	NA		μg/L
			Total Particulate (> 0.45 μm)	124.1	0.0		110.9	0.0		259.5	0.0		63.5	0.0		1477.2	0.0		3.5	0.0	J	165.3	0.0		0.2774	0.000		mg/kg
			Particulate (0.45 -5 μm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	U	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (5-20 μm)	16.9	0.0		48.7	0.0		116.9	0.0		22.1	0.0		543.6	0.0		1.8	0.0	J	78.0	0.0		0.1158	0.000		mg/kg
			Particulate (20-63 μm)	18.0	0.0		56.5	0.0		136.2	0.0		37.8	0.0		659.0	0.0		1.5	0.0	J	44.1	0.1		0.1129	0.000		mg/kg
			Particulate (> 63 μm)	544.4	0.0		343.0	0.0		773.8	0.1		195.0	0.0		4917.1	0.2		10.8	0.0	J	563.2	0.2		0.9332	0.000		mg/kg
O4W	6-Jan-16	NBSD outfall at Paunack and Division Streets	Bulk-water	6.0	0.4		11.0	1.2		24.1	0.4		16.7	0.4		92.3	1.7		0.2	0.0	J	5.2	0.1		0.1881	0.060		μg/L
			Filtered water (< 0.45 μm)	2.2	0.1		0.0	NA	U	5.7	0.1		9.5	0.1		5.1	0.3		0.0	NA	U	0.6	0.0	J	0.0063	NA		μg/L
			Total Particulate (> 0.45 μm)	20.6	0.0		59.8	0.0		99.6	0.0		39.0	0.0		472.7	0.0		1.1	0.0	J	25.3	0.0		0.9858	0.000		mg/kg
			Particulate (0.45 -5 μm)	0.0	NA	M<0	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (5-20 μm)	5.2	0.0		27.2	0.0		28.5	0.0		0.0	NA	M<0	146.2	0.0		0.0	NA	U	14.1	0.0		0.1376	0.000		mg/kg
			Particulate (20-63 μm)	134.0	0.0		316.3	0.1		608.8	0.5		355.6	0.0		1610.3	0.2		0.0	NA	U	0.0	NA	M<0	4.8036	0.002		mg/kg
			Particulate (> 63 μm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	mg/kg
O3W	7-Jan-16	NBSD outfall north of railroad crossing	Bulk-water	28.1	15.4		5.5	0.2		21.0	2.1		15.1	0.3		83.2	8.5		0.4	0.0	J	3.8	0.0		0.0490	0.004		μg/L
			Filtered water (< 0.45 μm)	4.1	0.0		0.0	NA	U	14.8	0.1		14.1	0.3		4.3	0.2		0.2	0.0	J	0.5	0.0	J	0.0083	0.000		μg/L
			Total Particulate (> 0.45 μm)	N	NA	S	N	NA	S	N	NA	S	N	NA	S	N	NA	S	N	NA	S	N	NA	S	N	NA	S	mg/kg
			Particulate (0.45 -5 μm)	N	NA	S	N	NA	S	N	NA	S	N	NA	S	N	NA	S	0.0	NA	M<0, J	N	NA	S	N	NA	S	mg/kg
			Particulate (5-20 μm)	N	NA	S	N	NA	S	0.0	NA	M<0	0.0	NA	M<0	N	NA	S	N	NA	S	N	NA	S	N	NA	S	mg/kg
			Particulate (20-63 μm)	16.1	13.4	μg/L	0.9	0.4	μg/L	5.2	0.9	μg/L	1.1	0.4	μg/L	8.3	3.8	μg/L	0.0	0.0	μg/L, J	0.0	0.1	μg/L	0.0083	0.006	μg/L	mg/kg
			Particulate (> 63 μm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	mg/kg
C1W	6-Jan-16	Paleta Creek at Cummings Road	Bulk-water	38.1	4.1		13.3	1.0		32.7	0.6		11.2	0.2		151.6	9.2		0.4	0.0	J	20.8	2.5		0.0434	0.005		μg/L
			Filtered water (< 0.45 μm)	1.5	0.1		0.0	NA	U	7.8	0.9		6.3	0.3		6.8	0.1		0.0	NA	U	0.6	0.6	J	0.0051	NA		μg/L
			Total Particulate (> 0.45 μm)	151.6	0.0		55.0	0.0		103.3	0.0		20.5	0.0		599.3	0.0		1.7	0.0	J	83.3	0.0		0.1588	0.000		mg/kg
			Particulate (0.45 -5 μm)	25.6	0.0		0.0	NA	U	226.5	0.2		95.3	0.0		414.7	0.0		0.0	NA	U	24.7	0.0		0.0000	NA	M<0	mg/kg
			Particulate (5-20 μm)	0.0	NA	M<0	54.2	NA	J	0.0	NA	M<0	0.0	NA	M<0	265.5	0.0		0.0	NA	U	111.9	0.0		0.1472	0.000		mg/kg
			Particulate (20-63 μm)	7.3	0.0		37.4	0.0		47.8	0.0		0.0	NA	M<0	161.2	0.0		0.0	NA	U	20.3	0.0		0.0473	0.000		mg/kg
			Particulate (> 63 μm)	559.7	0.1		106.1	0.0		278.2	0.0		78.4	0.0		1657.7	0.1		6.4	0.0	J	191.6	0.0		0.4325	0.000		mg/kg
O1W	7-Jan-16	NBSD outfall #23	Bulk-water	2.3	NA		12.6	2.3		16.8	NA		7.3	NA		207.5	NA		0.5	NA	J	18.8	NA		0.0086	NA		μg/L
			Filtered water (< 0.45 μm)	0.8	0.0	J	2.6	NA	J	6.3	0.2		6.3	0.2		53.9	1.0		0.4	0.0	J	1.2	NA		0.0020	NA		μg/L
			Total Particulate (> 0.45 μm)	12.0	0.0		79.2	0.0		83.8	0.0		7.9	0.0		1226.3	NA		1.0	0.0	J	140.4	0.0		0.0519	NA		mg/kg
			Particulate (0.45 -5 μm)	0.0	NA	M<0, J	0.0	NA	M<0, U	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.3	0.1	μg/L	0.0025	0.001	μg/L	mg/kg
			Particulate (5-20 μm)	6.2	0.0	J	58.0	NA	J	55.7	0.0		14.5	0.0		42.6	0.0		0.1	0.0	J	173.0	0.0		0.0000	NA	M<0	mg/kg
			Particulate (20-63 μm)	655.0	0.0		157.7	0.1		128.4	0.0		36.0	0.0		1098.1	0.0		2.1	0.0	J	12.9	0.0		0.0310	0.000		mg/kg
			Particulate (> 63 μm)	[illegible]	[illegible]		87.8	0.1		96.6	0.0		10.2	0.0		2505.4	0.0		3.2	0.0	J	213.4	0.0		0.0917	0.000		mg/kg
O2W	7-Jan-16	NBSD outfall #33	Bulk-water	22.4	0.2		93.9	4.5	E	144.5	4.1		25.4	0.4		308.6	6.0		2.7	0.1		67.9	3.0		0.7763	0.084		μg/L
			Filtered water (< 0.45 μm)	3.2	0.2		3.5	0.1		34.4	1.6		9.5	0.5		15.0	1.8		0.8	0.0	J	1.8	0.1		0.0248	NA		μg/L
			Total Particulate (> 0.45 μm)	18.0	0.0		84.7	0.0	E	103.1	0.0		15.0	0.0		275.2	0.0		1.7	0.0		61.9	0.0		0.7043	NA		mg/kg
			Particulate (0.45 -5 μm)	0.0	NA	M<0	15.8	0.0		1.2	0.0		0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0, J	0.0000	NA	M<0	mg/kg
			Particulate (5-20 μm)	16.9	0.0		85.5	0.0	E	76.0	0.0		13.6	0.0		173.8	0.0		1.4	0.0		78.1	0.0		0.7812	0.000		mg/kg
			Particulate (20-63 μm)	0.0	NA	M<0	0.0	NA	M<0, E	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.0000	NA	M<0	mg/kg
			Particulate (> 63 μm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	mg/kg
A1W	5-Jan-16	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Bulk-water	8.6	0.6		15.4	0.5		50.9	0.6		11.0	0.3		233.7	0.6		0.6	0.0	J	32.3	1.1		0.0952	0.019		μg/L
			Filtered water (< 0.45 μm)	1.9	0.0		0.0	NA	U	12.9	0.4		7.6	0.0		34.6	0.5		0.2	0.0	J	0.7	0.0	J	0.0027	NA		μg/L
			Total Particulate (> 0.45 μm)	29.0	0.0		67.0	0.0		165.2	0.0		14.6	0.0		866.8	0.0		1.8	0.0	J	137.6	0.0		0.4026	0.000		mg/kg
			Particulate (0.45 -5 μm)	0.0	0.1	μg/L	0.0	NA	μg/L, U	0.4	1.4	μg/L	0.2	0.2	μg/L	6.0	1.3	μg/L	0.0	0.0	μg/L, J	0.3	0.1	μg/L, J	0.0000	NA	M<0	mg/kg
			Particulate (5-20 μm)	24.7	0.0		79.3	0.0		154.1	0.0		23.5	0.0		590.1	0.0		1.2	0.0	J	159.4	0.0		0.3809	0.000		mg/kg
			Particulate (20-63 μm)	19.6	0.0		47.5	NA		168.1	0.0		23.7	0.0		1226.1	0.1		1.2	0.0	J	24.9	0.0		0.2399	0.000		mg/kg
			Particulate (> 63 μm)	71.5	0.0		68.0	0.0		192.0	0.0		0.0	NA	M<0	842.1	0.1		6.0	0.0	J	341.8	0.0		0.9624	0.001		mg/kg
A2W	5-Jan-16	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Bulk-water	43.3	9.0		12.7	0.3		23.0	0.5		7.5	0.2		85.8	2.9		0.3	0.0	J	11.7	0.3		0.0281	0.002		μg/L
			Filtered water (< 0.45 μm)	2.6	0.0		0.0	NA	U	7.5	0.1		5.5	0.0		12.7	1.6		0.0	NA	U	0.6	0.6	J	0.0023	NA		μg/L
			Total Particulate (> 0.45 μm)	176.5	0.0		55.1	0.0		67.2	0.0		8.6	0.0		317.0	0.0		1.2	0.0	J	47.9	0.0		0.1118	0.000		mg/kg
			Particulate (0.45 -5 μm)	0.3	0.1	μg/L	0.0	NA	U	1.6	0.4	μg/L	0.8	0.1	μg/L	0.0	NA	M<0	0.0	NA	μg/L, U	0.0	NA	M<0, J	0.0000	NA	M<0	mg/kg
			Particulate (5-20 μm)	17.8	0.0		51.1	0.0		46.4	0.0		4.7	0.0		211.5	0.0		0.9	NA	J	46.2	0.0		0.0763	0.000		mg/kg
			Particulate (20-63 μm)	13.8	0.0		0.0	NA	M<0	31.7	0.0		15.2	0.0		86.1	0.1		0.3	0.0	J	0.0	NA	M<0	0.0000	NA	M<0	mg/kg
			Particulate (> 63 μm)	36.4	9.0	μg/L	2.8	0.4	μg/L	3.7	0.7	μg/L	0.0	NA	M<0	31.7	3.0	μg/L	0.1	0.0	μg/L, J	3.5	0.4	μg/L	0.0110	0.002	μg/L	mg/kg
A3W	6-Jan-16	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	Bulk-water	6.1	0.2		3.5	NA		12.5	1.0		7.8	0.4		28.0	1.0		0.0	NA	U	2.4	0.0		0.0080	0.001		μg/L
			Filtered water (< 0.45 μm)	3.1	0.1		0.0	NA	U	12.7	1.2		11.1	3.9		9.7	0.2		0.0	NA	U	0.5	0.1	J	0.0027	NA		μg/L
			Total Particulate (> 0.45 μm)	N	NA	S	N	NA	S	0.0	NA	M<0	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (0.45 -5 μm)	N	NA	S	N	NA	S	0.0	NA	M<0	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (5-20 μm)	0.0	NA	M<0	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	133.6	0.0		0.0	NA	U	90.5	0.0		0.0681	0.000		mg/kg
			Particulate (20-63 μm)	0.2	0.5	μg/L	0.0	NA	μg/L, U	0.6	1.0	μg/L	0.0	NA	M<0	0.0	1.6	μg/L	0.0	NA	μg/L, U	0.0	NA	M<0	0.0000	NA	M<0	mg/kg
			Particulate (> 63 μm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	0.0	NA	U	NA	NA	LS	NA	NA	LS	mg/kg

Storm 2

Calculated aqueous concentrations of metals in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L)		Arsenic (μg/L)			Silver (μg/L)			Copper (μg/L)			Nickel (μg/L)			Zinc (μg/L)			Cadmium (μg/L)			Lead (μg/L)			THg (μg/L)		
				Value	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag
C2W	1-Feb-16	Paleta Creek at Main Street	Bulk			6.4	0.1		0.15	NA	J	60.4	NA		13.9	NA		334.7	NA		0.39	NA		30.0	NA		0.0461	0.0044	
			Total (>0.45 μm)	722.5		NA	NA	+	0.12	NA	J	48.8	1.6		11.6	0.2		287.5	7.1		0.39	NA		28.8	0.5		0.0435	0.0000	
			<0.45 μm	NA		NA	NA	+	0.03	NA	J	11.6	1.6		2.2	0.2		47.2	7.1		0.00	NA	U	1.2	0.5		0.0026	NA	
			0.45-5 μm	0.0	TFS<0	NA	NA	+	0.00	0.0	J	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.00	NA	U	0.3	0.5		0.0004	0.0000	
			5-20 μm	143.3		NA	NA	+	0.06	0.0	J	17.6	1.0		4.8	0.1		85.3	9.5		0.00	NA	U	9.7	0.0		0.0144	0.0007	
			20-63 μm	128.4		0.8	NA		0.01	NA	J	4.0	NA		0.5	NA		35.3	NA		0.20	NA	J	2.0	NA		0.0096	0.0013	
			> 63 μm	450.8		2.0	0.1		0.04	NA	J	28.0	NA		6.5	NA		169.5	NA		0.19	NA		16.9	NA		0.0190	0.0045	
O4W	1-Feb-16	NBSD outfall at Paunack and Division Streets	Bulk			0.0	NA	U	0.0	NA	U	49.1	0.3		23.3	0.4		36.0	10.4		0.00	NA	U	1.4	0.1	J	0.0195	0.0004	
			Total (>0.45 μm)	N	S	NA	NA	+	0.0	NA	U	6.4	0.3		0.0	NA	M<0	25.6	10.4		0.00	NA	U	0.0	NA	M<0, J	0.0162	0.0004	
			<0.45 μm	NA		NA	NA	+	0.0	NA	U	42.8	NA		24.4	3.8		10.4	NA		0.00	NA	U	1.5	0.5	J	0.0033	NA	
			0.45-5 μm	N	S	NA	NA	+	0.0	NA	U	3.4	3.5		0.0	NA	M<0	23.0	NA		0.00	NA	U	0.0	NA	M<0, J	0.0007	0.0001	
			5-20 μm	N	S	NA	NA	+	0.0	NA	U	0.4	4.6		1.8	1.1		0.0	NA	M<0	0.00	NA	U	0.3	0.3	J	0.0064	0.0007	
			20-63 μm	3.5	LS	0.0	NA	U	0.0	NA	U	19.1	3.0		0.0	NA	M<0	7.0	NA	J	0.00	NA	U	0.0	NA	M<0, J	0.0066	0.0007	
			> 63 μm	1.5	LS	0.0	NA	U	0.0	NA	U	0.0	NA	M<0	1.0	0.4		29.0	10.4		0.00	NA	U	0.2	0.1	J	0.0026	0.0004	
C1W	1-Feb-16	Paleta Creek at Cummings Road	Bulk			3.7	0.3		0.10	0.01	J	29.6	1.8		6.8	0.1		140.5	11.2		0.23	NA		13.6	0.7		0.0260	0.0022	
			Total (>0.45 μm)	121.9		NA	NA	+	0.06	0.0	J	15.8	4.6		3.4	0.3		88.3	16.6		0.23	NA		12.5	0.8		0.0233	0.0023	
			<0.45 μm	NA		NA	NA	+	0.04	0.0	J	13.8	4.3		3.4	0.3		52.2	12.3		0.00	NA	U	1.1	0.2		0.0026	0.0007	
			0.45-5 μm	5.4	LS	NA	NA	+	0.00	NA	M<0, J	0.0	NA	M<0	0.0	NA	M<0	7.2	15.3		0.00	NA	U	0.2	0.3		0.0002	0.0007	
			5-20 μm	68.9		NA	NA	+	0.10	0.0	J	13.1	2.3		3.9	0.8		34.6	13.4		0.00	NA	U	8.0	0.4		0.0172	0.0020	
			20-63 μm	39.1		0.0	NA	M<0	0.00	NA	M<0, J	3.1	2.8		0.0	NA	M<0	20.5	13.8		0.22	NA		3.9	1.7		0.0049	0.0042	
			> 63 μm	8.5	LS	0.2	0.3		0.00	NA	M<0, J	1.4	2.7		0.0	NA	M<0	26.0	14.7		0.01	NA		0.4	1.8		0.0010	0.0043	
O2W	1-Feb-16	NBSD outfall #33	Bulk			0.0	NA	U	0.0	NA	U	64.6	4.2		14.6	1.1		78.4	17.0		0.00	NA	U	11.2	1.1		0.0217	0.0016	
			Total (>0.45 μm)	N	S	NA	NA	+	0.0	NA	U	14.5	5.3		0.0	NA	M<0	33.9	18.8		0.00	NA	U	9.6	1.1		0.0172	0.0016	
			<0.45 μm	NA		NA	NA	+	0.0	NA	U	50.1	3.2		15.6	1.2		44.5	8.0		0.00	NA	U	1.6	0.2	J	0.0045	0.0003	
			0.45-5 μm	N	S	NA	NA	+	0.0	NA	U	3.8	4.8		0.0	NA	M<0	6.2	19.5		0.00	NA	U	0.1	0.3	J	0.0010	0.0004	
			5-20 μm	N	S	NA	NA	+	0.0	NA	U	3.0	3.8		0.0	NA	M<0	0.0	NA	M<0	0.00	NA	U	3.1	0.3	J	0.0075	0.0017	
			20-63 μm	9.4	LS	0.0	NA	U	0.0	NA	U	2.7	6.0		2.1	4.3		19.3	18.6		0.00	NA	U	3.8	0.8		0.0069	0.0022	
			> 63 μm	4.6	LS	0.0	NA	U	0.0	NA	U	5.0	7.2		0.0	NA	M<0	17.9	24.3		0.00	NA	U	2.7	1.4		0.0018	0.0021	
A1W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 0900 h	Bulk			0.0	NA	U	0.0	NA	U	76.2	5.0		21.9	1.6		71.0	49.9		0.00	NA	U	5.3	0.3		0.0195	0.0052	
			Total (>0.45 μm)	N	S	NA	NA	+	0.0	NA	U	2.4	11.8		0.0	NA	M<0	55.0	50.0		0.00	NA	U	4.1	0.3		0.0179	0.0052	
			<0.45 μm	NA		NA	NA	+	0.0	NA	U	73.8	10.6		24.5	2.1		16.0	2.7		0.00	NA	U	1.3	0.0	J	0.0015	0.0001	J
			0.45-5 μm	N	S	NA	NA	+	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	6.6	16.4	J	0.00	NA	U	0.7	2.1	J	0.0008	0.0002	
			5-20 μm	N	S	0.0	NA	U	0.0	NA	U	0.0	NA	M<0	2.6	4.6		33.3	7.4		0.00	NA	U	1.0	2.2		0.0043	0.0002	
			20-63 μm	20.8		0.0	NA	U	0.0	NA	U	4.9	14.0		0.0	NA	M<0	17.6	17.4		0.00	NA	U	1.9	1.3		0.0137	0.0108	
			> 63 μm	5.2	LS	0.0	NA	U	0.0	NA	U	4.4	12.0		0.0	NA	M<0	0.0	52.4	M<0	0.00	NA	U	0.4	1.2		0.0000	NA	M<0
A2W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 1500 h	Bulk			0.0	NA	U	0.0	NA	U	62.5	1.0		22.7	11.0		53.1	65.2		0.00	NA	U	3.2	0.3	J	0.0145	0.0014	
			Total (>0.45 μm)	N	S	NA	NA	+	0.0	NA	U	1.4	3.1		0.0	NA	M<0	31.3	65.5		0.00	NA	U	2.1	1.6	J	0.0109	0.0019	
			<0.45 μm	NA		NA	NA	+	0.0	NA	U	61.1	3.0		24.1	8.0		21.8	6.6		0.00	NA	U	1.1	0.3	J	0.0036	0.0013	
			0.45-5 μm	N	S	NA	NA	+	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	44.1	26.2		0.00	NA	U	0.1	0.4	J	0.0000	NA	M<0
			5-20 μm	N	S	0.0	NA	U	0.0	NA	U	3.4	5.2		3.1	11.3		13.9	91.0		0.00	NA	U	1.6	0.4	J	0.0055	0.0003	
			20-63 μm	1.2	LS	0.0	NA	U	0.0	NA	U	5.3	5.9		0.0	NA	M<0	0.5	104.8		0.00	NA	U	0.1	0.4	J	0.0024	0.0011	
			> 63 μm	1.4	LS	0.0	NA	U	0.0	NA	U	1.7	3.8		4.1	11.0		0.0	NA	M<0	0.00	NA	U	0.3	1.6	J	0.0040	0.0017	

Storm 2

Calculated concentrations of metals on solids in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Arsenic (mg/kg)			Silver (mg/kg)			Copper (mg/kg)			Nickel (mg/kg)			Zinc (mg/kg)			Cadmium (mg/kg)			Lead (mg/kg)			THg (mg/kg)			Units
				Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	Value	STDEV	Flag	
C2W	1-Feb-16	Paleta Creek at Main Street	Bulk-water	6.4	0.1		0.15	NA	J	60.4	NA		13.9	NA		334.7	NA		0.39	NA		30.0	NA		0.0461	0.0044		μg/L
			Filtered water (< 0.45 μm)	NA	NA	+	0.03	NA	J	11.6	1.6		2.2	0.2		47.2	7.1		0.00	NA	U	1.2	0.5		0.0026	NA		μg/L
			Total Particulate (> 0.45 μm)	NA	NA	+	0.16	NA	J	67.6	0.0		16.1	0.0		398.0	0.0		0.54	NA		39.9	0.0		0.0601	0.0000		mg/kg
			Particulate (0.45 -5 μm)	NA	NA	+	0.00	0.00	μg/L, J	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	M<0	0.00	NA	μg/L, U	0.3	0.5	μg/L	0.0004	0.0000	μg/L	mg/kg
			Particulate (5-20 μm)	NA	NA	+	0.42	0.00	J	122.9	0.0		33.5	0.0		595.4	0.1		0.00	NA	U	67.5	0.0		0.1006	0.0007		mg/kg
			Particulate (20-63 μm)	6.3	NA		0.08	NA	J	30.9	NA		3.9	NA		274.5	NA		1.55	NA	J	15.2	NA		0.0750	0.0013		mg/kg
			Particulate (> 63 μm)	4.4	0.0		0.10	NA	J	62.1	NA		14.5	NA		375.9	NA		0.43	NA		37.5	NA		0.0421	0.0045		mg/kg
O4W	1-Feb-16	NBSD outfall at Paunack and Division Streets	Bulk-water	0.0	NA	U	0.00	NA	U	49.1	0.3		23.3	0.4		36.0	10.4		0.0	NA	U	1.4	0.1	J	0.0195	0.0004		μg/L
			Filtered water (< 0.45 μm)	NA	NA	+	0.00	NA	U	42.8	NA		24.4	3.8		10.4	NA		0.0	NA	U	1.5	0.5	J	0.0033	NA		μg/L
			Total Particulate (> 0.45 μm)	NA	NA	+	0.00	NA	U	N	NA	S	0.0	NA	M<0	N	NA	S	0.0	NA	U	0.0	NA	M<0, J	NA	NA	S	mg/kg
			Particulate (0.45 -5 μm)	NA	NA	+	0.00	NA	U	N	NA	S	0.0	NA	M<0	N	NA	S	0.0	NA	U	0.0	NA	M<0, J	NA	NA	S	mg/kg
			Particulate (5-20 μm)	NA	NA	+	0.00	NA	U	N	NA	S	N	NA	S	0.0	NA	M<0	0.0	NA	U	NA	NA	S	NA	NA	S	mg/kg
			Particulate (20-63 μm)	0.0	NA	U	0.00	NA	U	NA	NA	LS	0.0	NA	M<0	NA	NA	LS	0.0	NA	U	0.0	NA	M<0, J	NA	NA	LS	mg/kg
			Particulate (> 63 μm)	0.0	NA	U	0.00	NA	U	0.0	NA	M<0	NA	NA	LS	NA	NA	LS	0.0	NA	U	NA	NA	LS	NA	NA	LS	mg/kg
C1W	1-Feb-16	Paleta Creek at Cummings Road	Bulk-water	3.7	0.3		0.10	0.01	J	29.6	1.8		6.8	0.1		140.5	11.2		0.23	NA		13.6	0.7		0.0260	0.0022		μg/L
			Filtered water (< 0.45 μm)	NA	NA	+	0.04	0.02	J	13.8	4.3		3.4	0.3		52.2	12.3		0.00	NA	U	1.1	0.2		0.0026	0.0007		μg/L
			Total Particulate (> 0.45 μm)	NA	NA	+	0.52	0.00	J	129.8	0.0		28.2	0.3		724.2	0.1		1.87	NA		102.5	0.0		0.1914	0.0000		mg/kg
			Particulate (0.45 -5 μm)	NA	NA	+	0.00	NA	M<0, J	0.0	NA	M<0	0.0	NA	M<0	NA	NA	LS	0.00	NA	U	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (5-20 μm)	NA	NA	+	1.42	0.00	J	190.0	0.0		57.0	0.0		502.7	0.2		0.00	NA	U	116.2	0.0		0.2503	0.0000		mg/kg
			Particulate (20-63 μm)	0.0	NA	M<0	0.00	NA	M<0, J	78.3	0.1		0.0	NA	M<0	523.1	0.4		5.66	NA		98.7	0.0		0.1240	0.0001		mg/kg
			Particulate (> 63 μm)	NA	NA	LS	0.00	NA	M<0, J	NA	NA	LS	0.0	NA	M<0	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	mg/kg
O2W	1-Feb-16	NBSD outfall #33	Bulk-water	0.0	NA	U	0.0	NA	U	64.6	4.2		14.6	1.1		78.4	17.0		0.0	NA	U	11.2	1.1		0.0217	0.0016		μg/L
			Filtered water (< 0.45 μm)	NA	NA	+	0.0	NA	U	50.1	3.2		15.6	1.2		44.5	8.0		0.0	NA	U	1.6	0.2	J	0.0045	0.0003		μg/L
			Total Particulate (> 0.45 μm)	NA	NA	+	0.0	NA	U	N	NA	S	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	NA	NA	S	mg/kg
			Particulate (0.45 -5 μm)	NA	NA	+	0.0	NA	U	N	NA	S	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	NA	NA	S	mg/kg
			Particulate (5-20 μm)	NA	NA	+	0.0	NA	U	N	NA	S	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	U	N	NA	S	NA	NA	S	mg/kg
			Particulate (20-63 μm)	0.0	NA	U	0.0	NA	U	NA	NA	LS	NA	NA	LS	NA	NA	LS	0.0	NA	U	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (> 63 μm)	0.0	NA	U	0.0	NA	U	NA	NA	LS	0.0	NA	M<0	NA	NA	LS	0.0	NA	U	NA	NA	LS	NA	NA	LS	mg/kg
A1W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 0900 h	Bulk-water	0.0	NA	U	0.0	NA	U	76.2	5.0		21.9	1.6		71.0	49.9		0.0	NA	U	5.3	0.3		0.0195	0.0052		μg/L
			Filtered water (< 0.45 μm)	NA	NA	+	0.0	NA	U	73.8	10.6		24.5	2.1		16.0	2.7		0.0	NA	U	1.3	0.0	J	0.0015	0.0001	J	μg/L
			Total Particulate (> 0.45 μm)	NA	NA	+	0.0	NA	U	N	NA	S	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (0.45 -5 μm)	NA	NA	+	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (5-20 μm)	0.0	NA	U	0.0	NA	U	0.0	NA	M<0	N	NA	S	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (20-63 μm)	0.0	NA	U	0.0	NA	U	234.7	0.7		0.0	NA	M<0	848.9	0.8		0.0	NA	U	91.6	0.1		0.6594	0.0005		mg/kg
			Particulate (> 63 μm)	0.0	NA	U	0.0	NA	U	NA	NA	LS	0.0	NA	M<0	0.0	NA	M<0	0.0	NA	U	NA	NA	LS	0.0000	NA	M<0	mg/kg
A2W	31-Jan-16	Ambient Receiving water sample collected on 1/31/2016 at 1500 h	Bulk-water	0.0	NA	U	0.0	NA	U	62.5	1.0		22.7	11.0		53.1	65.2		0.0	NA	U	3.2	0.3	J	0.0145	0.0014		μg/L
			Filtered water (< 0.45 μm)	NA	NA	+	0.0	NA	U	61.1	3.0		24.1	8.0		21.8	6.6		0.0	NA	U	1.1	0.3	J	0.0036	0.0013		μg/L
			Total Particulate (> 0.45 μm)	NA	NA	+	0.0	NA	U	N	NA	S	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (0.45 -5 μm)	NA	NA	+	0.0	NA	U	0.0	NA	M<0	0.0	NA	M<0	N	NA	S	0.0	NA	U	N	NA	S	0.0000	NA	M<0	mg/kg
			Particulate (5-20 μm)	0.0	NA	U	0.0	NA	U	N	NA	S	N	NA	S	N	NA	S	0.0	NA	U	N	NA	S	N	NA	S	mg/kg
			Particulate (20-63 μm)	0.0	NA	U	0.0	NA	U	NA	NA	LS	0.0	NA	M<0	NA	NA	LS	0.0	NA	U	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (> 63 μm)	0.0	NA	U	0.0	NA	U	NA	NA	LS	NA	NA	LS	0.0	NA	M<0	0.0	NA	U	NA	NA	LS	NA	NA	LS	mg/kg

Flag	Description
TFS<0	Calculation of TFS in the solid fraction returned a negative value.
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
NA	Not applicable.
+	Missing Data
*	Sequential particle size fractionation.
**	Modifiction of the formula to maintain the mass balance.
LS	Low solids, the solid concentration in the size interval is less than 10mg/L.
S	Salt interference in the solid concentration (>20%).
M<0	Calculation returned a negative metal value.
J	The reported value was obtained from a reading that was less than the lowest calibration point but greater than or equal to the MDL.
U	The reading value was less than the MDL.
E	The reading value exceeded the highest calibration point.
μg/L	The contaminant was in the water phase. No solids in the fraction. Value unit in μg/L.

Calibration range for event 1	
For Hg	25-2,500 pg
For As	1-500 μg/L
For Cr	3-30 μg/L

Calibration range for event 2	
For Hg	25-2,500 pg
For As	1-100 μg/L
For Ag	0.2-50 μg/L

Equations involved in the calculation of metal concentrations on solids in the corresponding size intervals:

Total (>0.45μm)

$$C_{>0.45\mu m} = \frac{C_{Bulk} - C_{<0.45\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>0.45\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(>0.45)\mu m} = \frac{\sqrt{(Stdev_{Bulk})^2 + (Stdev_{<0.45\mu m})^2}}{TFS_{>0.45\mu m}}$$

0.45-5μm

$$C_{0.45-5\mu m} = \frac{C_{<5\mu m} - C_{<0.45\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>0.45\mu m} - TFS_{>5\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(0.45-5)\mu m} = \frac{\sqrt{(Stdev_{<5\mu m})^2 + (Stdev_{<0.45\mu m})^2}}{TFS_{>0.45\mu m} - TFS_{>5\mu m}}$$

5-20μm

For Cu	1-500 µg/L
For Ni	1-500 µg/L
For Zn	1-500 µg/L
For Cd	1-500 µg/L
For Pb	1-500 µg/L

MDL	Value	Unit
Hg	5.23	pg
As	0.69	µg/L
Cr	2.00	µg/L
Cu	0.10	µg/L
Ni	0.10	µg/L
Zn	0.79	µg/L
Cd	0.20	µg/L
Pb	0.10	µg/L

For Cu	1-500 µg/L
For Ni	1-500 µg/L
For Zn	1-500 µg/L
For Cd	0.2-50 µg/L
For Pb	0.5-50 µg/L

MDL	Value	Unit
Hg	5.23	pg
As	0.48	µg/L
Ag	0.02	µg/L
Cu	0.08	µg/L
Ni	0.09	µg/L
Zn	0.53	µg/L
Cd	0.17	µg/L
Pb	0.04	µg/L

$$C_{5-20\mu m} = \frac{C_{<20\mu m} - C_{<5\mu m}\ (\frac{\mu g}{L})}{TFS_{>5um} - TFS_{>20\mu m}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(5-20)\mu m} = \frac{\sqrt{\left(Stdev_{<20\mu m}\right)^2 + \left(Stdev_{<5\mu m}\right)^2}}{TFS_{>5\mu m} - TFS_{>20\mu m}}$$

20-63µm

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\ (\frac{\mu g}{L})}{TFS_{>20um} - TFS_{>63\mu m}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(20-63)\mu m} = \frac{\sqrt{\left(Stdev_{<63\mu m}\right)^2 + \left(Stdev_{<20\mu m}\right)^2}}{TFS_{>20\mu m} - TFS_{>63\mu m}}$$

>63µm

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\ (\frac{\mu g}{L})}{TFS_{>63um}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(>63)\mu m} = \frac{\sqrt{\left(Stdev_{Bulk}\right)^2 + \left(Stdev_{<63\mu m}\right)^2}}{TFS_{>63\mu m}}$$

Storm 1

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Measured Concentration (ng/L)																												Total PAH-15
				Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
C2W	1/7/2016	Paleta Creek at Main Street	< 0.7 µm	12.6		39.1		1.1		19.0		2.1		9.1		8.6		1.2		1.1		1.2		0.3		0.8		0.5		2.3		99.1
			Total Particulate POPs (>0.7µm)	19.7		0.0	<0	0.0	<0	21.2		0.0	<0	590.1		240.8		30.4		49.5		239.4		9.8		17.4		3.7		3.9		1225.7
			0.7-2.7 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	18.1		5.8		1.9		1.0		3.4		0.9		1.7		0.4		5.2		38.4
			2.7-20 µm	14.4		5.2		4.4		38.3		0.0	<0	56.1		75.1		19.5		14.0		26.8		10.0		17.2		7.7		48.0		336.7
			20-63 µm	0.0	<0	0.0	<0	0.0	<0	3.9		9.6		52.8		30.9		17.9		18.1		45.0		15.5		26.7		6.2		72.1		298.6
			> 63 µm	21.8		0.0	<0	0.0	<0	0.0	<0	0.0	<0	463.1		129.0		0.0	<0	16.4		164.1		0.0	<0	0.0	<0	0.0	<0	0.0	<0	794.5
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	9.6		1.9		0.8		5.6		1.5		13.8		6.8		0.7		0.5		0.2		0.2	J	0.6		0.8		0.8		43.9
			Total Particulate POPs (>0.7µm)	15.7		9.4		1.1		31.7		8.6		69.8		73.3		17.4		8.1		27.1		8.0		16.2		5.1		42.4		333.9
			0.7-2.7 µm	1.4		1.2		0.3		2.7		0.4		0.0	<0	1.2		0.5		0.0	<0	1.1		0.1		0.0		0.0	<0	1.5		10.5
			2.7-20 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	17.7		10.9		3.3		2.1		7.4		2.0		3.7		1.1		11.0		59.2
			20-63 µm	0.9		0.0	<0	3.3		4.0		0.0	<0	48.6		2.2		10.9		6.4		4.8		0.7		1.5		1.7		5.8		90.7
			> 63 µm	19.0		9.8		0.0	<0	25.2		9.9		11.4		59.1		2.7		0.0	<0	13.8		5.2		10.9		2.8		24.1		193.9
O3W	1/7/2016	NBSD outfall north of railroad crossing	< 0.7 µm	8.5		3.3		2.6		9.9		1.2		5.1		6.0		0.4		0.5		0.3		0.1	J	0.2		0.2		0.4		38.6
			Total Particulate POPs (>0.7µm)	27.5		0.0	<0	0.9		34.0		33.7		279.9		79.5		20.3		22.9		59.2		17.5		35.2		13.7		30.1		654.3
			0.7-2.7 µm	0.2		0.0	<0	0.3		0.0	<0	0.2		6.5		6.1		2.2		1.2		4.6		1.8		3.6		0.6		5.7		33.1
			2.7-20 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	22.0		13.1		5.2		3.9		11.7		4.9		10.5		2.1		11.6		85.1
			20-63 µm	0.0	<0	0.1		0.7		0.3		1.4		4.0		0.0	<0	0.7		0.4		2.4		0.6		1.5		0.2		1.9		14.2
			> 63 µm	30.1		0.2		1.1		34.5		32.9		247.4		60.8		12.3		17.3		40.6		10.1		19.6		10.8		10.8		528.5
C1W	1/6/2016	Paleta Creek at Cummings Road	< 0.7 µm	17.0		6.7		3.1		13.8		0.9		16.1		9.1		1.1		0.5		0.6		0.3		0.4		0.6		0.9		71.1
			Total Particulate POPs (>0.7µm)	6.3		0.0	<0	23.2		98.5		17.4		211.1		218.2		104.6		54.8		130.1		41.1		74.8		19.7		144.4		1144.2
			0.7-2.7 µm	0.0	<0	0.0	<0	1.9		0.0	<0	0.4		0.0	<0	1.6		1.9		0.9		2.4		0.7		1.1		0.6		2.9		14.3
			2.7-20 µm	2.5		1.4		1.6		14.9		3.1		102.0		58.9		27.2		19.8		54.4		18.9		29.1		10.1		57.4		401.1
			20-63 µm	0.2		0.0	<0	0.0	<0	12.8		7.9		169.7		54.2		16.0		21.6		62.7		20.0		29.1		1.6		36.9		432.7
			> 63 µm	9.2		1.5		23.0		71.8		6.0		0.0	<0	103.6		59.6		12.5		10.7		1.5		15.7		7.5		47.2		369.6
O1W	1/7/2016	NBSD outfall #23	< 0.7 µm	18.2		10.2		2.4		16.7		2.3		5.7		6.1		3.1		1.8		3.1		1.3		2.1		1.5		2.6		77.2
			Total Particulate POPs (>0.7µm)	11.6		13.7		43.1		93.2		1.6		114.1		43.8		45.8		64.5		124.3		24.2		78.2		2.6		97.2		758.0
			0.7-2.7 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	1.7		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	1.7
			2.7-20 µm	1.4		0.0	<0	0.0	<0	10.6		1.0		24.0		12.8		7.8		7.9		14.6		4.5		9.8		3.5		23.1		120.9
			20-63 µm	0.0	<0	1.2		3.3		17.3		2.8		33.9		9.6		10.0		10.2		29.7		5.3		15.3		0.0	<0	22.5		161.2
			> 63 µm	16.8		15.1		40.0		67.7		0.0	<0	54.5		21.9		28.4		46.8		80.1		14.7		53.8		1.1		52.4		493.4
O2W	1/7/2016	NBSD outfall #33	< 0.7 µm	0.5		4.6		5.3		14.6		5.0		74.4		68.6		17.8		10.4		33.2		13.1		12.4		3.3		9.1		272.4
			Total Particulate POPs (>0.7µm)	2.2		0.0	<0	57.1		88.2		20.4		896.3	E	619.5	E	195.3		148.5		306.4		132.9		142.2		55.4		94.1		2758.5
			0.7-2.7 µm	0.0	<0	0.0	<0	0.0		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	1.4		0.0	<0	0.0	<0	0.0	<0	0.1		0.1		1.6
			2.7-20 µm	2.1		0.9		1.6		14.5		5.0		99.9		116.5		45.9		33.7		78.0		32.6		33.1		6.8		19.9		490.5
			20-63 µm	0.0	<0	0.0	<0	0.0	<0	0.1		8.7		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	8.8
			> 63 µm	0.9		0.0	<0	56.9		79.7		7.8		831.9	E	536.1	E	158.7		119.9		244.7		107.7		115.9		49.4		78.9		2388.5
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	4.7		0.0	U	0.0	U	3.5		0.0	U	5.0		4.0		1.5		0.9		0.5		0.2		0.2		0.4		0.6		21.4
			Total Particulate POPs (>0.7µm)	12.3		5.4		23.9		269.8		41.6		775.4		609.7		281.6		195.2		420.8		157.8		274.6		72.3		425.5		3566.1
			0.7-2.7 µm	0.0	<0	0.0	U	0.5		0.0	<0	0.5		2.5		3.0		0.0	<0	0.0	<0	2.3		0.7		1.0		0.3		1.8		12.6
			2.7-20 µm	1.9		0.0	U	1.4		47.0		5.5		137.6		108.2		53.2		56.8		128.1		47.8		76.8		22.5		125.3		812.2
			20-63 µm	7.0		0.0	U	0.0	<0	84.4		8.1		230.9	E	31.2	E	15.3		0.0	<0	0.0	<0	60.4		104.0		5.4		132.0		678.7
			> 63 µm	3.5		5.4		22.0		138.8		27.5		404.4		467.2		213.3		153.1		298.7		49.0		92.9		44.1		166.4		2086.3
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	13.3		55.5		3.1		10.0		0.8		11.4		5.0		0.9		0.5		0.5		0.2		0.4		0.2		0.9		102.9
			Total Particulate POPs (>0.7µm)	11.4		0.0	<0	9.3		25.6		9.0		214.1		123.5		15.6		10.3		38.2		13.8		21.7		10.5		23.1		526.3
			0.7-2.7 µm	0.0	<0	0.0	<0	2.5		0.0	<0	0.0	<0	3.6		4.4		1.8		1.4		6.1		1.9		2.7		0.7		5.0		30.3
			2.7-20 µm	0.0	<0	0.0	<0	0.0	<0	3.4		0.9		34.3		29.1		13.1		8.8		29.4		10.2		13.8		4.3		21.5		168.8
			20-63 µm	0.0	<0	0.0	<0	1.7		0.0	<0	0.0	<0	28.0		2.6		2.0		0.2		0.1		0.0	<0	0.0	<0	0.6		0.0	<0	35.3
			> 63 µm	15.7		5.8		6.0		25.0		8.8		148.2		87.4		0.0	<0	0.0	<0	2.6		3.2		8.8		4.9		0.0	<0	316.4
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	< 0.7 µm	38.5		11.1		17.4		19.9		1.8		10.2		7.2		1.0		0.8		1.3		0.5		0.8		0.5		1.3		112.5
			Total Particulate POPs (>0.7µm)	0.0	<0	0.0	<0	0.0	<0	1.8		0.1		10.2		5.7		2.3		2.5		5.7		2.0		4.1		0.4		6.1		40.9
			0.7-2.7 µm	0.0	<0	0.5		3.2		0.0	<0	0.0	<0	7.2		3.1		1.5		1.1		3.5		1.3		2.1		0.7		3.3		27.5
			2.7-20 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	1.0		4.1		1.7		0.2		0.7		2.1		0.7		1.1		0.5		1.3		13.3
			20-63 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	1.1		5.2		1.3		0.6		0.1		0.6		0.2		0.1		0.3		0.0	<0	9.7
			> 63 µm	6.6		2.1		1.5		7.5		0.0	<0	0.0	<0	0.0	<0	0.0		0.5		0.0	<0	0.0	<0	0.9		0.0	<0	1.6		20.8

Storm 2

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Measured Concentration (ng/L)																												Total PAH-15
				Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
C2W	2/1/2016	Paleta Creek at Main Street	< 0.7 µm	7.6		1.7		10.6		0.0	U	0.0	U	2.5		3.4		0.5		0.3		0.6		0.1	J	0.2		0.5		0.9		28.9
			Total Particulate POPs (>0.7µm)	7.9		28.4		35.6		287.2		0.0	U	216.7		167.5		57.2		41.3		117.5		27.5		50.7		0.0	<0	150.8		1188.2
			0.7-2.7 µm	0.0	<0	0.0	<0	1.9		0.0	U	0.0	U	0.0	<0	0.3		0.0	<0	0.0		0.0	<0	0.0		0.2		0.0	<0	0.0	<0	2.5
			2.7-20 µm	3.8		56.4		0.0	<0	0.0	U	0.0	U	22.0		30.2		11.5		5.8		17.6		4.8		10.3		2.7		38.3		203.3
			20-63 µm	52.3		300.5		1.8		0.0	U	0.0	U	135.0		50.9		20.0		7.8		34.7		10.3		22.8		25.4		90.9		752.3
			> 63 µm	0.0	<0	0.0	<0	43.8		287.2		0.0	U	59.8		86.1		25.7		27.6		65.2		12.5		17.4		0.0	<0	21.6		646.9
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	14.2		1.9		1.5		6.6		0.0	U	0.0	U	2.6		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	26.8
			Total Particulate POPs (>0.7µm)	3.7		0.0	<0	0.8		0.0	<0	1.3		4.3		1.8		1.9		0.9		1.8		0.2		0.5		1.7		1.8		20.8
			0.7-2.7 µm	0.3		0.0	<0	0.0	<0	0.0	<0	0.0	U	0.0	U	0.0	<0	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.3
			2.7-20 µm	1.4		0.4		1.7		1.6		0.0	U	3.3		0.7		0.0	U	0.0	U	0.0	U	0.1		0.0	U	0.0	U	0.3		9.6
			20-63 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	U	0.0	<0	1.0		1.1		0.5		0.9		0.1		0.5		0.0	U	0.9		5.0
			> 63 µm	6.4		0.0	<0	0.7		1.1		1.3		1.5		0.3		0.8		0.4		0.9		0.1		0.0	<0	1.7		0.6		15.9
C1W	2/1/2016	Paleta Creek at Cummings Road	< 0.7 µm	6.6		1.2		1.9		7.9		0.0	U	3.7		3.5		0.6		0.5		0.3		0.1		0.1		0.3		0.4		27.1
			Total Particulate POPs (>0.7µm)	0.4		4.0		10.1		20.9		0.0	U	21.4		43.7		27.2		18.1		26.4		10.0		18.5		4.1		47.6		252.4
			0.7-2.7 µm	0.3		0.0	<0	0.0	<0	0.0	<0	0.0	U	0.6		0.4		0.1		0.0	<0	0.2		0.0		0.2		0.0		0.3		2.1
			2.7-20 µm	0.0	<0	0.0	<0	0.0	<0	0.0		0.3		8.5		10.1		3.8		2.5		7.9		2.6		4.6		1.2		12.3		53.9
			20-63 µm	2.4		0.0		0.0	<0	9.9		0.4		19.6		16.6		6.4		4.6		17.2		5.9		11.0		2.0		30.3		126.3
			> 63 µm	0.4		4.3		11.5		11.3		0.0	<0	0.0	<0	16.6		16.9		11.0		1.0		1.4		2.8		0.8		4.7		82.8
O2W	2/1/2016	NBSD outfall #33	< 0.7 µm	3.1		5.2		5.4		7.6		1.7		9.2		6.5		0.7		0.4		1.2		0.4		0.3		0.5		0.4		42.5
			Total Particulate POPs (>0.7µm)	2.7		0.0	<0	0.0		7.2		0.0	<0	14.6		28.7		20.5		8.0		20.9		9.2		11.7		3.6		16.9		143.9
			0.7-2.7 µm	3.3		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.2		0.1		0.0		0.1		0.0		0.0		0.2		4.0
			2.7-20 µm	1.0		2.8		5.4		0.0	<0	0.0	<0	3.3		2.8		1.6		0.9		5.3		1.9		1.8		0.7		3.0		30.5
			20-63 µm	0.0	<0	0.0	<0	3.1		0.0	U	0.0	U	4.3		2.9		1.2		1.0		5.7		1.5		2.1		0.2		3.9		26.0
			> 63 µm	1.1		0.0	<0	0.0	<0	14.8		0.8		7.4		23.4		17.4		5.9		9.9		5.8		7.6		2.7		9.7		106.5
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	4.0		1.1		1.9		3.8		0.0	U	1.7		2.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2		15.2
			Total Particulate POPs (>0.7µm)	0.7		1.4		3.0		25.1		1.0		39.3		31.3		13.0		7.6		17.5		5.6		10.3		2.8		29.3		187.8
			0.7-2.7 µm	0.0	<0	0.0	<0	0.1		1.0		2.6		0.6		0.0	<0	0.3		0.2		0.2		0.1		0.2		0.3		0.0	<0	5.5
			2.7-20 µm	1.2		5.1		3.2		10.7		0.0	<0	7.7		5.9		2.9		1.8		4.5		1.3		2.0		0.6		4.0		50.9
			20-63 µm	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	12.6		9.2		3.4		2.1		5.8		2.0		3.7		3.1		14.0		55.9
			> 63 µm	1.0		0.0		1.3		13.9		0.4		18.4		16.9		6.4		3.5		7.0		2.2		4.4		0.0	<0	11.4		86.7
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	1.8		12.0		12.7		0.2		0.0	U	5.7		3.3		0.0	U	0.0	U	0.2		0.0	J	0.1		0.3		0.1		36.4
			Total Particulate POPs (>0.7µm)	5.0		0.0	<0	0.0	<0	7.9		0.3		1.5		4.8		2.6		1.9		8.6		2.2		4.6		2.5		6.4		48.3
			0.7-2.7 µm	0.0	<0	0.0	<0	0.0	<0	4.8		0.6		0.5		0.4		0.5		0.3		0.1		0.1		0.1		0.1		0.2		7.5
			2.7-20 µm	0.9		0.0	<0	1.2		2.3		2.0		5.2		3.8		1.7		1.5		3.5		1.0		1.6		0.6		3.9		29.2
			20-63 µm	1.8		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.7		0.2		0.4		1.5		0.4		0.6		0.0	<0	1.2		6.9
			> 63 µm	2.5		0.9		0.1		2.1		0.3		0.0	<0	0.0	<0	0.2		0.0	<0	3.5		0.7		2.3		2.3		1.1		16.0

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
E	Identifies analytes whose concentrations exceed the calibration range of the HPLC instrument for that specific analysis.
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
S	Salinity of the sample potentially contributes more than 20% of solids mass as precipitating salt
LS	Low solids mass that corresponds to <10mg/L solids concentration
<0	Indicates a negative outcome in concentration or TFS calculations
NA	Not analyzed (insufficient sample) / Not applicable

Calibration range:	PAH-15:	0.5ug/L - 600 ug/L
	Deuterated PAH-4:	0.5ug/L - 400 ug/L

Storm 1

Calculated solids concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L)		Measured Concentration																														Total PAH-15	Units
						Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene			
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag		
C2W	1/7/2016	Paleta Creek at Main Street	Bulk (ng/L)	NA		32.3		0.0	U	0.0	U	40.2		0.0	U	599.2		249.4		31.6		50.6		240.6		10.1		18.1		4.2		6.2		1282.4	ng/L
			< 0.7 µm (ng/L)	NA		12.6		39.1		1.1		19.0		2.1		9.1		8.6		1.2		1.1		1.2		0.3		0.8		0.5		2.3		99.1	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	259.1		75.9		0.0	U	0.0	U	81.7		0.0	U	2277.3		929.2		117.2		190.9		923.8		37.9		67.1		14.3		15.0		4730.4	µg/kg
			0.7-2.7 µm (µg/kg)	11.4		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	1587.0		504.6		165.0		90.1		300.0		83.3		148.2		34.0		459.9		3372.2	µg/kg
			2.7-20 µm (µg/kg)	146.9		97.9		35.6		29.8		260.7		0.0	U	382.0		511.4		132.8		95.2		182.6		68.1		117.2		52.7		326.5		2292.5	µg/kg
			20-63 µm (µg/kg)	45.1		0.0	<0	0.0	<0	0.0	<0	86.5		212.1		1169.9		685.3		397.5		400.6		997.1		344.1		591.8		137.7		1597.8		6620.5	µg/kg
			> 63 µm (µg/kg)	55.7		391.5		0.0	U	0.0	U	0.0	<0	0.0	U	8307.8		2314.2		0.0	<0	294.2		2944.6		0.0	<0	0.0	<0	0.0	<0	0.0	<0	14252.4	µg/kg
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	Bulk (ng/L)	NA		25.2		11.3		1.9		37.3		10.2		83.6		80.1		18.1		8.7		27.4		8.2		16.8		5.9		43.2		377.9	ng/L
			< 0.7 µm (ng/L)	NA		9.6		1.9		0.8		5.6		1.5		13.8		6.8		0.7		0.5		0.2		0.2	J	0.6		0.8		0.8		43.9	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	186.6		84.0		50.1		6.1		169.9		46.3		374.3		392.8		93.2		43.6		145.4		42.8		86.8		27.1		227.3		1789.6	µg/kg
			0.7-2.7 µm (µg/kg)	58.4		24.7		20.3		6.0		45.8		6.6		0.0	<0	20.4		8.7		0.0	<0	18.9		2.4		0.2		0.0	<0	26.0		180.1	µg/kg
			2.7-20 µm (µg/kg)	95.1		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	186.0		114.1		34.4		22.4		78.2		20.9		39.3		11.7		116.0		623.1	µg/kg
			20-63 µm (µg/kg)	33.1		27.3		0.0	<0	98.6		120.6		0.0	<0	1467.6		65.0		328.8		193.0		144.8		20.7		45.0		52.6		174.5		2738.4	µg/kg
			> 63 µm (ng/L)	0.0		19.0		9.8		0.0	<0	25.2		9.9		11.4		59.1		2.7		0.0	<0	13.8		5.2		10.9		2.8		24.1		193.9	ng/L
O3W	1/7/2016	NBSD outfall north of railroad crossing	Bulk (ng/L)	NA		35.9		2.3		3.5		43.9		34.8		285.0		85.4		20.8		23.4		59.5		17.6		35.4		14.0		30.5		692.0	ng/L
			< 0.7 µm (ng/L)	NA		8.5		3.3		2.6		9.9		1.2		5.1		6.0		0.4		0.5		0.3		0.1	J	0.2		0.2		0.4		38.6	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-2.7 µm (µg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			20-63 µm (µg/kg)	2.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			> 63 µm (µg/kg)	1.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
C1W	1/6/2016	Paleta Creek at Cummings Road	Bulk (ng/L)	NA		23.3		4.3		26.3		112.3		18.3		227.2		227.3		105.8		55.3		130.7		41.4		75.2		20.3		145.2		1213.0	ng/L
			< 0.7 µm (ng/L)	NA		17.0		6.7		3.1		13.8		0.9		16.1		9.1		1.1		0.5		0.6		0.3		0.4		0.6		0.9		71.1	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	267.8		23.5		0.0	<0	86.5		367.6		65.0		788.2		814.7		390.7		204.6		485.8		153.5		279.4		73.4		539.0		4272.0	µg/kg
			0.7-2.7 µm (µg/kg)	12.5		0.0	<0	0.0	<0	148.5		0.0	<0	30.0		0.0	<0	129.0		152.2		68.7		191.5		58.3		85.5		44.6		233.2		1141.5	µg/kg
			2.7-20 µm (µg/kg)	158.1		15.6		8.8		9.9		94.4		19.8		645.0		372.4		171.7		125.5		343.8		119.2		183.8		63.6		363.1		2536.8	µg/kg
			20-63 µm (µg/kg)	46.6		4.4		0.0	<0	0.0	<0	275.3		169.8		3645.6		1163.5		343.3		464.6		1347.1		430.3		624.1		34.3		791.9		9294.1	µg/kg
			> 63 µm (µg/kg)	50.7		182.4		29.6		453.1		1416.5		118.3		0.0	<0	2042.8		1175.8		246.0		210.2		29.5		308.8		147.2		930.6		7290.7	µg/kg
O1W	1/7/2016	NBSD outfall #23	Bulk (ng/L)	NA		29.9		23.9		45.6		109.9		3.9		119.8		49.9		48.9		66.3		127.4		25.5		80.3		4.2		99.8		835.2	ng/L
			< 0.7 µm (ng/L)	NA		18.2		10.2		2.4		16.7		2.3		5.7		6.1		3.1		1.8		3.1		1.3		2.1		1.5		2.6		77.2	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	120.1		97.0		114.1		359.4		776.3		13.2		950.6		364.7		381.6		537.1		1035.5		201.6		651.4		21.9		809.2		6313.6	µg/kg
			0.7-2.7 µm (µg/kg)	0.0	TFS<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	0.0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	µg/kg
			2.7-20 µm (µg/kg)	29.6		47.2		0.0	<0	0.0	<0	359.9		32.3		810.0		433.1		264.9		266.2		492.5		150.8		330.2		119.7		779.1		4085.9	µg/kg
			20-63 µm (µg/kg)	58.6		0.0	<0	20.4		56.6		296.0		48.2		579.0		163.1		170.1		174.8		507.5		90.0		260.8		0.0	<0	383.1		2749.7	µg/kg
			> 63 µm (µg/kg)	31.9		528.5		474.3		1255.3		2125.6		0.0	<0	1710.2		686.8		892.5		1468.2		2514.0		461.7		1687.5		33.2		1644.4		15482.4	µg/kg
O2W	1/7/2016	NBSD outfall #33	Bulk (ng/L)	NA		2.6		1.1		62.4		102.8		25.4		970.7		688.1		213.2		158.9		339.6		146.0		154.7		58.8		103.3		3027.5	ng/L
			< 0.7 µm (ng/L)	NA		0.5		4.6		5.3		14.6		5.0		74.4		68.6		17.8		10.4		33.2		13.1		12.4		3.3		9.1		272.4	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	1110.7		1.9		0.0	<0	51.4		79.4		18.3		807.0		557.8		175.9		133.7		275.9		119.6		128.1		49.9		84.8		2483.6	µg/kg
			0.7-2.7 µm (µg/kg)	28.8		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	50.0		0.0	<0	0.0	<0	0.0	<0	2.8		3.8		56.7	µg/kg
			2.7-20 µm (µg/kg)	1053.4		2.0		0.9		1.5		13.8		4.8		94.8		110.6		43.6		32.0		74.0		31.0		31.4		6.4		18.9		465.7	µg/kg
			20-63 µm (µg/kg)	20.6		0.0	<0	0.0	<0	0.0	<0	6.5		419.5		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	426.1	µg/kg
			> 63 µm (µg/kg)	7.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Bulk (ng/L)	NA		17.0		5.4		23.9		273.3		41.6		780.4		613.7		283.2		196.1		421.3		158.0		274.9		72.7		426.1		3587.5	ng/L
			< 0.7 µm (ng/L)	NA		4.7		0.0	U	0.0	U	3.5		0.0	U	5.0		4.0		1.5		0.9		0.5		0.2		0.2		0.4		0.6		21.4	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	241.8		51.1		22.3		98.7		1116.1		172.1		3207.2		2521.8		1164.9		807.5		1740.6		652.9		1135.9		299.2		1759.9		14750.4	µg/kg
			0.7-2.7 µm (µg/kg)	0.0	TFS <0	0.0	<0	0.0	U	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	µg/kg
			2.7-20 µm (µg/kg)	115.9		16.6		0.0	U	12.4		405.7		47.8		1187.5		933.8		458.8		490.2		1105.2		412.1		662.3		193.8		1081.3		7007.3	µg/kg
			20-63 µm (µg/kg)	101.7		68.4		0.0	U	0.0	<0	829.5		79.2		2269.8	E	307.0	E	150.2		0.0	<0	0.0	<0	593.5		1022.1		53.5		1296.9		6670.1	µg/kg
			> 63 µm (µg/kg)	24.1		144.6		223.7		911.9		5757.7		1141.4		16768.0		19374.1		8843.3		6350.0		12385.3		2032.2		3851.1		1828.9		6900.6		86512.8	µg/kg
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Bulk (ng/L)	NA		24.7		7.3		12.4		35.7		9.9		225.6		128.5		16.5		10.9		38.7		14.0		22.1		10.8		24.0		581.0	ng/L
			< 0.7 µm (ng/L)	NA		13.3		55.5		3.1		10.0		0.8		11.4		5.0		0.9		0.5		0.5		0.2		0.4		0.2		0.9		102.9	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	246.5		46.3		0.0	<0	37.5		104.1		36.7		868.8		501.2		63.5		41.9		154.9		55.8		88.1		42.7		93.5		2135.1	µg/kg
			0.7-2.7 µm (µg/kg)	38.1		0.0	<0	0.0	<0	65.2		0.0	<0	0.0	<0	95.3		115.0		48.6		36.5		160.9		51.0		71.6		18.4		131.6		794.0	µg/kg
			2.7-20 µm (µg/kg)	200.3		0.0	<0	0.0	<0	0.0	<0	17.2		4.5		171.5		145.5		65.4		43.9		146.6		50.9		68.9		21.2		107.2		842.8	µg/kg
			20-63 µm (µg/kg)	8.1	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			> 63 µm (ng/L)	0.0		15.7		5.8		6.0		25.0		8.8		148.2		87.4		0.0	<0	0.0	<0	2.6		3.2		8.8		4.9		0.0	<0	316.4	ng/L
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	Bulk (ng/L)	NA		35.3		10.4		15.7		21.7		1.9		20.5		12.9		3.2		3.3		7.0		2.4		4.9		0.9		7.4		147.8	ng/L
			< 0.7 µm (ng/L)	NA		38.5		11.1		17.4		19.9		1.8		10.2		7.2		1.0		0.8		1.3		0.5		0.8		0.5		1.3		112.5	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-2.7 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			20-63 µm (µg/kg)	6.2	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			> 63 µm (µg/kg)	1.5	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg

Storm 2

Calculated solids concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L)		Measured Concentration																														Total PAH-15	Units
						Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene			
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag		
C2W	2/1/2016	Paleta Creek at Main Street	Bulk (ng/L)	NA		15.5		30.1		46.2		287.2		0.0	U	219.2		170.9		57.7		41.5		118.1		27.6		50.9		0.0	U	151.7		1216.5	ng/L
			< 0.7 µm (ng/L)	NA		7.6		1.7		10.6		0.0	U	0.0	U	2.5		3.4		0.5		0.3		0.6		0.1	J	0.2		0.5		0.9		28.9	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	784.4		10.1		36.2		45.4		366.1		0.0	U	276.2		213.5		73.0		52.6		149.7		35.1		64.7		0.0	U	192.2		1514.7	µg/kg
			0.7-2.7 µm (µg/kg)	0.0	TFS<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	µg/kg
			2.7-20 µm (µg/kg)	62.9		60.7		896.1		0.0	<0	0.0	U	0.0	U	349.3		479.3		182.6		92.8		279.5		75.6		163.6		42.1		608.5		3230.2	µg/kg
			20-63 µm (µg/kg)	190.7		274.0		1575.5		9.4		0.0	U	0.0	U	707.7		266.7		105.0		40.9		182.0		53.8		119.7		133.1		476.4		3944.3	µg/kg
			> 63 µm (µg/kg)	530.7		0.0	<0	0.0	<0	82.5		541.1		0.0	U	112.6		162.3		48.5		51.9		122.9		23.6		32.7		0.0	U	40.8		1218.9	µg/kg
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	Bulk (ng/L)	NA		17.9		1.6		2.3		5.7		1.3		4.3		4.4		1.9		0.9		1.8		0.2		0.5		1.7		1.8		46.4	ng/L
			< 0.7 µm (ng/L)	NA		14.2		1.9		1.5		6.6		0.0	U	0.0	U	2.6		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	26.8	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-2.7 µm (µg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			20-63 µm (µg/kg)	1.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			> 63 µm (µg/kg)	1.1	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
C1W	2/1/2016	Paleta Creek at Cummings Road	Bulk (ng/L)	NA		6.9		5.1		12.0		28.9		0.0	U	25.1		47.2		27.7		18.6		26.7		10.1		18.6		4.5		47.9		279.5	ng/L
			< 0.7 µm (ng/L)	NA		6.6		1.2		1.9		7.9		0.0	U	3.7		3.5		0.6		0.5		0.3		0.1		0.1		0.3		0.4		27.1	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	116.8		3.2		33.9		86.7		179.2		0.0	U	183.2		374.2		232.7		155.3		225.8		85.4		158.4		35.2		407.2		2160.4	µg/kg
			0.7-2.7 µm (µg/kg)	0.0	TFS<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	µg/kg
			2.7-20 µm (µg/kg)	63.6		0.0	<0	0.0	<0	0.0	<0	0.1		4.8		134.3		158.7		60.1		39.1		124.9		41.5		71.6		19.3		193.3		847.8	µg/kg
			20-63 µm (µg/kg)	27.6		86.3		0.4		0.0	<0	357.0		13.6		708.9		601.3		233.4		167.4		624.1		214.1		397.9		74.1		1098.2		4576.7	µg/kg
			> 63 µm (µg/kg)	25.6		14.5		168.7		449.5		442.7		0.0	U	0.0	<0	647.7		657.8		431.1		38.9		54.3		109.5		31.2		183.4		3229.4	µg/kg
O2W	2/1/2016	NBSD outfall #33	Bulk (ng/L)	NA		5.8		4.2		5.4		14.8		0.8		23.7		35.2		21.2		8.4		22.1		9.6		11.9		4.1		17.3		184.4	ng/L
			< 0.7 µm (ng/L)	NA		3.1		5.2		5.4		7.6		1.7		9.2		6.5		0.7		0.4		1.2		0.4		0.3		0.5		0.4		42.5	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-2.7 µm (µg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			20-63 µm (µg/kg)	9.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			> 63 µm (µg/kg)	5.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Bulk (ng/L)	NA		4.7		2.5		4.9		28.9		1.0		41.0		33.8		13.0		7.6		17.5		5.6		10.3		2.8		29.5		203.0	ng/L
			< 0.7 µm (ng/L)	NA		4.0		1.1		1.9		3.8		0.0	U	1.7		2.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2		15.2	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-2.7 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			20-63 µm (µg/kg)	18.6		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	677.7		493.9		183.0		112.6		312.2		106.2		197.6		166.3		749.7		2999.2	µg/kg
			> 63 µm (µg/kg)	4.5	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Bulk (ng/L)	NA		6.8		2.8		4.2		8.2		0.3		7.1		8.1		2.6		1.9		8.8		2.2		4.7		2.8		6.5		66.9	ng/L
			< 0.7 µm (ng/L)	NA		1.8		12.0		12.7		0.2		0.0	U	5.7		3.3		0.0	U	0.0	U	0.2		0.0	J	0.1		0.3		0.1		36.4	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-2.7 µm (µg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			20-63 µm (µg/kg)	3.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			> 63 µm (ng/L)	0.0		2.5		0.9		0.1		2.1		0.3		0.0	<0	0.0	<0	0.2		0.0	<0	3.5		0.7		2.3		2.3		1.1		16.0	ng/L

Equations involved in the calculation of solids concentrations of PAHs in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = \frac{C_{Bulk} - C_{<0.7\mu m}\left(\frac{ng}{L}\right)}{TFS_{>0.7\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = \frac{C_{<2.7\mu m} - C_{<0.7\mu m}\left(\frac{ng}{L}\right)}{TFS_{>0.7\mu m} - TFS_{>2.7\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

2.7-20µm

$$C_{2.7-20\mu m} = \frac{C_{<20\mu m} - C_{<2.7\mu m}\left(\frac{ng}{L}\right)}{TFS_{>2.7\mu m} - TFS_{>20\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

20-63µm

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\left(\frac{ng}{L}\right)}{TFS_{>20\mu m} - TFS_{>63\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

>63µm

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\left(\frac{ng}{L}\right)}{TFS_{>63\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

Storm 1

Calculated aqueous concentrations of PCBs in the corresponding size intervals

Storm 2

Calculated aqueous concentrations of PCBs in the corresponding size intervals

Measured Concentration (µg/L)

Location ID	Sampling Date	Description	Size Interval	1	2	3	4	10	9	7	6	8	5	19	18	17	15
C2W	2/1/2016	Paleta Creek at Main Street	< 0.7 µm	1.78E-05 J	2.66E-05 J	2.94E-05 J	3.48E-05	1.29E-06 J	5.13E-06 J	3.28E-06 J	1.10E-05 J	1.32E-05 J	0.00E+00 U	0.00E+00 U	9.34E-05	2.44E-04	1.39E-04
			Total Particulate POPs (>0.7µm)	3.37E-04 J	5.30E-04 J	6.57E-04 J	3.00E-04	0.00E+00 <0	3.07E-05 J	3.34E-05 J	1.65E-04 J	0.00E+00 <0	0.00E+00 U	0.00E+00 U	5.24E-04	5.96E-04	1.27E-03
			0.7-2.7 µm	0.00E+00 <0	0.00E+00 <0	2.40E-06	0.00E+00 <0	2.78E-06	9.86E-06	1.01E-05	0.00E+00 <0	0.00E+00 <0	0.00E+00	0.00E+00	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0
			2.7-20 µm	8.53E-06 J	3.19E-05	2.98E-05	0.00E+00 <0	0.00E+00 <0	2.10E-07 J	0.00E+00 <0	1.59E-06 J	0.00E+00 <0	0.00E+00 U	0.00E+00 U	0.00E+00 <0	7.63E-07	7.59E-05
			20-63 µm	5.66E-06 J	0.00E+00 <0	1.22E-05	2.41E-05 J	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 U	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0
			> 63 µm	3.25E-04 J	5.00E-04 J	6.13E-04	2.91E-04 J	0.00E+00 U	2.93E-05 J	3.35E-05 J	1.65E-04 J	0.00E+00 U	0.00E+00 U	0.00E+00 U	5.78E-04 J	7.15E-04	1.22E-03
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	< 0.7 µm	2.08E-05 J	2.73E-05 J	3.35E-05 J	3.41E-05 J	8.72E-06 J	1.04E-05 J	7.11E-07 J	1.41E-05 J	1.49E-05 J	0.00E+00 U	0.00E+00 U	1.36E-04	1.96E-04	1.44E-04
			Total Particulate POPs (>0.7µm)	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	2.35E-06 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 U	0.00E+00 <0	5.40E-06	0.00E+00 <0
			0.7-2.7 µm	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	7.75E-07	0.00E+00 <0	0.00E+00 <0	0.00E+00	0.00E+00	0.00E+00 <0	1.22E-05	0.00E+00 <0
			2.7-20 µm	1.33E-05 J	0.00E+00 <0	1.03E-06	2.85E-05	8.16E-06 J	9.57E-09 J	2.29E-06 J	2.79E-06 J	1.61E-05	2.97E-06 J	0.00E+00 U	0.00E+00 <0	5.60E-05	2.02E-05
			20-63 µm	0.00E+00 <0	9.05E-06 J	8.10E-06 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	6.81E-08 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	3.60E-07
			> 63 µm	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 U	1.18E-05	9.19E-05	0.00E+00 <0
C1W	2/1/2016	Paleta Creek at Cummings Road	< 0.7 µm	5.97E-06 J	1.19E-05	1.27E-05	3.73E-05	9.48E-06 J	5.49E-06 J	2.02E-06 J	6.00E-06 J	2.35E-05	1.35E-05	0.00E+00 U	8.81E-05	1.47E-04	2.08E-05
			Total Particulate POPs (>0.7µm)	2.39E-06 J	2.28E-06	6.72E-06	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	3.14E-07 J	1.72E-06 J	1.21E-05	2.75E-06	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	5.21E-05
			0.7-2.7 µm	2.25E-06 J	4.33E-06	4.63E-06	0.00E+00 <0	0.00E+00 <0	1.61E-06 J	4.13E-06 J	2.95E-06 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	2.64E-05
			2.7-20 µm	0.00E+00 <0	0.00E+00 <0	1.52E-05	1.02E-05	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	1.70E-05	2.44E-05	0.00E+00 <0
			20-63 µm	1.30E-06 J	2.28E-06 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	2.15E-07 J	5.04E-06 J	3.03E-06 J	8.44E-07 J	0.00E+00 U	2.31E-05	0.00E+00 <0	5.97E-06
			> 63 µm	0.00E+00 <0	0.00E+00 <0	2.52E-06	2.12E-05	3.69E-06 J	0.00E+00 <0	7.81E-07 J	0.00E+00 <0	2.03E-05	1.54E-05	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	2.40E-05
O2W	2/1/2016	NBSD outfall #33	< 0.7 µm	4.81E-06 J	6.71E-06 J	7.57E-06	6.82E-06	0.00E+00 J	1.99E-06 J	1.52E-06 J	4.43E-06 J	3.56E-06	0.00E+00 J	0.00E+00 U	1.24E-05	2.66E-06 J	1.93E-05
			Total Particulate POPs (>0.7µm)	2.38E-06 J	5.02E-06 J	5.00E-06	1.27E-05	6.69E-07 J	8.86E-07 J	2.27E-07 J	3.36E-07 J	4.11E-06	0.00E+00 J	0.00E+00 U	1.87E-06	0.00E+00 <0	1.64E-05
			0.7-2.7 µm	7.73E-06	1.07E-05	1.19E-05	9.24E-06	0.00E+00	2.30E-06	1.67E-06	3.41E-06	1.99E-06	0.00E+00	0.00E+00	8.38E-06	0.00E+00	2.52E-05
			2.7-20 µm	6.49E-06 J	7.14E-06 J	7.99E-06 J	2.63E-05 J	3.88E-06 U	1.55E-06 J	1.09E-06 J	6.03E-06 J	1.84E-05 J	8.48E-06 U	0.00E+00 U	6.32E-05 J	9.28E-05 U	1.93E-05
			20-63 µm	7.67E-06 J	9.88E-06 J	1.21E-05	3.24E-05	7.76E-06 J	3.51E-06 J	1.68E-06 J	8.64E-06 J	2.52E-05	1.29E-05	0.00E+00 U	5.75E-05	9.73E-05	3.39E-05
			> 63 µm	7.18E-06 J	1.17E-05 J	1.26E-05	1.95E-05	6.69E-07 J	2.88E-06 J	1.75E-06 J	4.77E-06 J	7.67E-06	0.00E+00	0.00E+00 U	1.43E-05	1.88E-06	3.57E-05
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	< 0.7 µm	5.12E-06 J	8.54E-06 J	1.03E-05	1.13E-05	1.31E-06 J	1.72E-06 J	1.16E-06 J	4.30E-06 J	1.08E-05	1.43E-06 J	0.00E+00 U	1.04E-05	5.21E-07 J	1.80E-05
			Total Particulate POPs (>0.7µm)	1.72E-06 J	1.34E-06 J	3.04E-06	5.54E-06	1.10E-06 J	9.88E-07 J	8.28E-07 J	3.24E-06 J	1.88E-05	1.24E-05 J	0.00E+00 U	2.54E-05	8.08E-06 J	3.50E-05
			0.7-2.7 µm	1.80E-06 J	3.65E-07 J	1.06E-07	1.53E-06	6.93E-07 J	1.13E-06 J	1.05E-06 J	1.56E-06 J	8.21E-06	5.78E-06 J	0.00E+00 U	1.54E-05	6.22E-06 J	1.15E-05
			2.7-20 µm	0.00E+00 <0	2.15E-06 J	2.07E-06	1.63E-06	0.00E+00 <0	9.86E-07 J	9.29E-07 J	1.49E-06 J	3.90E-06	1.36E-06 J	0.00E+00 U	3.60E-06	0.00E+00 <0	1.35E-05
			20-63 µm	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	8.65E-07	3.25E-06 J	0.00E+00 <0	0.00E+00 <0	4.26E-06	2.74E-05	2.35E-05	0.00E+00 U	4.52E-05	2.13E-05	1.42E-05
			> 63 µm	6.76E-07 J	0.00E+00 <0	1.81E-06	1.52E-06	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	< 0.7 µm	5.00E-06 J	7.52E-06 J	8.54E-06 J	1.26E-05	1.30E-06 J	1.82E-06 J	1.30E-06 J	5.35E-06 J	1.53E-05	5.42E-06 J	0.00E+00 U	1.24E-05	1.59E-06 J	5.51E-05
			Total Particulate POPs (>0.7µm)	2.53E-06 J	2.50E-06	4.60E-06	2.46E-06	1.35E-06 J	3.87E-07 J	1.31E-07 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	5.46E-06	1.44E-06 J	0.00E+00 <0
			0.7-2.7 µm	4.73E-07	1.11E-06	7.53E-07	0.00E+00 <0	1.85E-06	1.15E-07	2.31E-07	0.00E+00 <0	0.00E+00 <0	5.25E-07	0.00E+00	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0
			2.7-20 µm	1.19E-06 J	0.00E+00 <0	2.43E-06	9.41E-06	3.07E-06 J	4.64E-07 J	3.04E-07 J	3.77E-06 J	1.69E-05	1.10E-05	0.00E+00 U	2.76E-05	1.47E-05	1.13E-03
			20-63 µm	7.48E-07 J	2.53E-06 J	3.95E-06	8.52E-07	0.00E+00 <0	3.68E-07 J	1.04E-06 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	3.60E-06	0.00E+00 <0	0.00E+00 <0
			> 63 µm	1.22E-07 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	2.84E-07 J	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 <0	0.00E+00 U	0.00E+00 <0	3.75E-08 J	1.25E-06

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
E	Identifies analytes whose concentrations exceed the calibration range of the HPLC instrument for that specific analysis.
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
S	Salinity of the sample potentially contributes more than 20% of solids mass as precipitating salt
LS	Low solids mass that corresponds to <10mg/L solids concentration
<0	Indicates a negative outcome in concentration or TFS calculations
NA	Not analyzed (insufficient sample) / Not applicable

Calibration range:	PCB: 0.2ug/L - 20 ug/L

Storm 1

Calculated solids concentrations of PCBs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L) Value	TFS Flag	1 Value	1 Flag	2 Value	2 Flag	3 Value	3 Flag	4 Value	4 Flag	10 Value	10 Flag	9 Value	9 Flag	7 Value	7 Flag	6 Value	6 Flag	8 Value	8 Flag	5 Value	5 Flag	19 Value	19 Flag
C2W	1/7/2016	Paleta Creek at Main Street	Bulk (µg/L)	NA		1.29E-05	J	8.01E-06	J	1.71E-05	J	2.56E-06	J	3.78E-06	J	4.17E-06	J	6.04E-06	J	6.81E-07	J	2.43E-05		1.80E-05		2.00E-06	J
			< 0.7 µm (µg/L)	NA		5.91E-06	J	7.07E-06	J	1.56E-05		1.38E-05	J	5.18E-06	J	3.67E-06	J	5.56E-06	J	9.43E-07	J	3.18E-05		2.40E-05		1.05E-05	J
			Total Particulate POPs (>0.7µm) (mg/kg)	259.1		2.70E-05	J	3.62E-06	J	5.70E-06		0.00E+00	<0	0.00E+00	<0	1.91E-06	J	1.86E-06	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			0.7-2.7 µm (mg/kg)	11.4		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.92E-05	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			2.7-20 µm (mg/kg)	146.9		1.07E-05	J	1.80E-05	J	3.63E-05	J	0.00E+00	<0	5.89E-07	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			20-63 µm (mg/kg)	45.1		1.16E-04	J	1.49E-04	J	2.81E-04		3.89E-04	J	1.82E-04	J	1.25E-04	J	1.36E-04	J	1.27E-04	J	1.24E-03		9.52E-04		2.14E-03	
			> 63 µm (mg/kg)	55.7		2.39E-05	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	Bulk (µg/L)	NA		5.93E-06	J	1.17E-05	J	1.81E-05		3.30E-05		1.71E-05		4.23E-06	J	4.79E-06	J	2.02E-05		8.32E-05		6.41E-05		1.10E-05	J
			< 0.7 µm (µg/L)	NA		5.43E-06	J	4.60E-06	J	9.56E-06	J	1.07E-05		6.56E-06	J	2.26E-06	J	3.37E-06	J	5.72E-06	J	2.49E-05		1.89E-05		3.11E-06	J
			Total Particulate POPs (>0.7µm) (mg/kg)	186.6		2.65E-06	J	3.79E-05	J	4.58E-05	J	1.20E-04		5.67E-05	J	1.06E-05	J	7.58E-06	J	7.75E-05	J	3.13E-04		2.42E-04		4.34E-05	J
			0.7-2.7 µm (mg/kg)	58.4		5.70E-05	J	5.69E-05	J	7.98E-05	J	2.57E-04		9.33E-05	J	2.44E-05	J	1.66E-05	J	7.70E-05	J	2.68E-04		2.04E-04		1.95E-05	J
			2.7-20 µm (mg/kg)	95.1		0.00E+00	<0	0.00E+00	<0	1.75E-06	J	0.00E+00	<0	0.00E+00	<0	6.30E-06	J	6.15E-06	J	0.00E+00	<0	2.76E-05		2.18E-05		1.46E-05	J
			20-63 µm (mg/kg)	33.1		1.23E-05	J	0.00E+00	<0	0.00E+00	<0	4.49E-04		6.13E-05	J	2.17E-05	J	2.01E-05	J	4.72E-05	J	4.39E-04		3.43E-04		1.08E-04	J
			> 63 µm (mg/kg)	0.0		0.00E+00	<0	5.19E-06		5.12E-06		0.00E+00	<0	3.93E-06		0.00E+00	<0	0.00E+00	<0	1.02E-05		2.55E-05		1.99E-05		1.80E-06	
O3W	1/7/2016	NBSD outfall north of railroad crossing	Bulk (µg/L)	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
			< 0.7 µm (µg/L)	NA		8.93E-06	J	8.47E-06	J	1.26E-05	J	4.24E-05		2.26E-05		3.59E-06	J	4.83E-06	J	1.31E-05	J	5.50E-05		4.21E-05		1.11E-05	J
			Total Particulate POPs (>0.7µm) (mg/kg)	N	S	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
			0.7-2.7 µm (mg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			2.7-20 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			20-63 µm (mg/kg)	2.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
			> 63 µm (mg/kg)	1.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
C1W	1/6/2016	Paleta Creek at Cummings Road	Bulk (µg/L)	NA		9.29E-06	J	1.40E-05	J	2.49E-05		2.21E-05	J	1.32E-05	J	5.99E-06	J	6.96E-06	J	1.89E-05	J	9.87E-05		7.56E-05		1.64E-05	J
			< 0.7 µm (µg/L)	NA		8.23E-06	J	9.33E-06	J	1.90E-05		1.82E-05	J	7.00E-06	J	7.61E-06	J	4.89E-06	J	1.17E-05	J	4.40E-05		3.33E-05		3.99E-06	J
			Total Particulate POPs (>0.7µm) (mg/kg)	267.8		3.96E-06	J	1.76E-05	J	2.19E-05		1.46E-05	J	2.32E-05	J	0.00E+00	<0	7.71E-06	J	2.68E-05	J	2.04E-04		1.58E-04		4.65E-05	J
			0.7-2.7 µm (mg/kg)	12.5		0.00E+00	<0	4.95E-04	J	3.08E-04		0.00E+00	<0	1.69E-04	J	3.90E-05	J	2.64E-04	J	0.00E+00	<0	3.79E-04		2.89E-04		8.13E-05	J
			2.7-20 µm (mg/kg)	158.1		4.25E-05	J	1.62E-05	J	9.09E-05	J	5.03E-05	J	2.16E-05	J	2.93E-05	J	3.41E-05	J	3.07E-06	J	2.23E-04		1.67E-04		3.50E-05	J
			20-63 µm (mg/kg)	46.6		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	4.01E-05	J	0.00E+00	<0	0.00E+00	<0	1.99E-04	J	2.39E-04		1.96E-04		1.48E-04	J
			> 63 µm (mg/kg)	50.7		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.26E-04	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.50E-05	J	6.90E-05		6.32E-05		0.00E+00	<0
O1W	1/7/2016	NBSD outfall #23	Bulk (µg/L)	NA		9.80E-06	J	1.36E-05	J	2.50E-05		1.34E-05	J	9.50E-06	J	3.78E-06	J	4.75E-06	J	1.25E-05	J	4.91E-05		3.71E-05		6.03E-06	J
			< 0.7 µm (µg/L)	NA		1.50E-05	J	1.61E-05	J	3.65E-05	J	8.42E-06	J	7.01E-06	J	2.02E-05	J	2.17E-05	J	4.68E-06	J	4.91E-05		3.14E-05	J	0.00E+00	<0
			Total Particulate POPs (>0.7µm) (mg/kg)	120.1		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	4.15E-05	J	2.07E-05	J	0.00E+00	<0	0.00E+00	<0	6.51E-05	J	0.00E+00	<0	4.74E-05		5.02E-05	J
			0.7-2.7 µm (mg/kg)	0.0	TFS<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			2.7-20 µm (mg/kg)	29.6		0.00E+00	<0	7.33E-05	J	0.00E+00	<0	9.38E-05	J	0.00E+00	<0	3.84E-05	J	2.63E-05	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			20-63 µm (mg/kg)	58.6		5.71E-05	J	0.00E+00	<0	9.58E-05	J	3.67E-05	J	7.68E-05	J	4.96E-05	J	5.40E-05	J	8.93E-05	J	4.03E-04		3.09E-04		5.13E-04	
			> 63 µm (mg/kg)	31.9		0.00E+00	<0	2.42E-05	J	0.00E+00	<0	1.46E-04	J	2.36E-05	J	0.00E+00	<0	0.00E+00	<0	1.79E-04	J	6.69E-05		6.06E-05		0.00E+00	
O2W	1/7/2016	NBSD outfall #33	Bulk (µg/L)	NA		6.03E-05	J	4.57E-05	J	1.21E-04		5.48E-05	J	4.36E-05	J	2.74E-05	J	3.53E-05	J	3.41E-05	J	2.56E-04		1.94E-04		4.43E-05	J
			< 0.7 µm (µg/L)	NA		4.00E-05	J	4.59E-05	J	6.79E-05		6.04E-05		3.03E-05	J	1.24E-05	J	1.45E-05	J	2.01E-05	J	1.44E-04		1.10E-04		4.34E-05	J
			Total Particulate POPs (>0.7µm) (mg/kg)	1110.7		1.83E-05	J	0.00E+00	<0	4.80E-05		0.00E+00	<0	1.19E-05	J	1.35E-05	J	1.87E-05	J	1.25E-05	J	1.00E-04		7.57E-05		8.12E-07	J
			0.7-2.7 µm (mg/kg)	28.8		1.97E-04	J	1.40E-04	J	2.78E-04		0.00E+00	<0	6.56E-05	J	1.90E-04	J	2.03E-04	J	1.83E-04	J	1.03E-03		7.83E-04		1.78E-04	J
			2.7-20 µm (mg/kg)	1053.4		5.77E-05		8.01E-05		8.06E-05		8.24E-05		4.59E-05		1.67E-05	J	1.69E-05	J	9.50E-05		3.86E-04		3.00E-04		1.58E-04	
			20-63 µm (mg/kg)	20.6		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			> 63 µm (mg/kg)	7.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Bulk (µg/L)	NA		7.75E-06	J	9.97E-06	J	2.15E-05	J	1.16E-05	J	9.25E-06	J	4.48E-06	J	5.43E-06	J	7.90E-06	J	6.36E-05		4.83E-05		7.08E-06	J
			< 0.7 µm (µg/L)	NA		5.52E-06	J	5.90E-06	J	1.36E-05		2.29E-05		9.07E-06	J	6.72E-06	J	8.90E-06	J	3.81E-06	J	3.76E-05		2.86E-05		7.06E-06	J
			Total Particulate POPs (>0.7µm) (mg/kg)	241.8		9.23E-06	J	1.68E-05	J	3.29E-05		0.00E+00	<0	7.31E-07	J	0.00E+00	<0	0.00E+00	<0	1.69E-05	J	1.08E-04		8.18E-05		7.57E-08	J
			0.7-2.7 µm (mg/kg)	0.0	TFS<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			2.7-20 µm (mg/kg)	115.9		3.38E-05	J	6.61E-05	J	1.02E-04		5.68E-05	J	7.33E-05	J	1.87E-05	J	2.20E-05	J	3.20E-05	J	3.73E-04		2.86E-04		7.58E-05	J
			20-63 µm (mg/kg)	101.7		3.86E-05	J	8.95E-06	J	6.60E-05		2.30E-04		8.63E-05	J	4.47E-05	J	6.53E-05	J	1.59E-04	J	6.50E-04		5.03E-04		2.40E-04	
			> 63 µm (mg/kg)	24.1		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Bulk (µg/L)	NA		6.31E-06	J	7.96E-06	J	1.88E-05		9.33E-06	J	8.59E-06	J	8.03E-06	J	8.82E-06	J	4.14E-06	J	2.88E-05		2.15E-05		3.76E-06	J
			< 0.7 µm (µg/L)	NA		4.26E-06	J	6.50E-06	J	1.27E-05		1.28E-05		5.58E-06	J	2.58E-06	J	2.42E-06	J	4.50E-06	J	2.19E-05		1.64E-05		5.26E-06	J
			Total Particulate POPs (>0.7µm) (mg/kg)	246.5		8.31E-06	J	5.92E-06	J	2.49E-05		0.00E+00	<0	1.22E-05	J	2.21E-05	J	2.59E-05	J	0.00E+00	<0	2.77E-05		2.03E-05		0.00E+00	<0
			0.7-2.7 µm (mg/kg)	38.1		8.42E-05	J	7.94E-05	J	1.40E-04	J	0.00E+00	<0	8.66E-05	J	5.48E-05	J	6.43E-05	J	0.00E+00	<0	2.13E-04		1.58E-04		0.00E+00	<0
			2.7-20 µm (mg/kg)	200.3		4.06E-06	J	0.00E+00	<0	1.66E-05		0.00E+00	<0	0.00E+00	<0	4.08E-06	J	1.12E-05	J	0.00E+00	<0	1.29E-05		9.41E-06		9.92E-06	J
			20-63 µm (mg/kg)	8.1	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
			> 63 µm (mg/kg)	0.0		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	1.61E-06		3.24E-06		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	Bulk (µg/L)	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
			< 0.7 µm (µg/L)	NA		5.72E-06	J	6.39E-06	J	1.03E-05	J	1.08E-05		5.91E-06	J	3.15E-06	J	2.64E-06	J	5.77E-06	J	2.47E-05		1.87E-05		1.19E-06	J
			Total Particulate POPs (>0.7µm) (mg/kg)	N	S	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
			0.7-2.7 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			2.7-20 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			20-63 µm (mg/kg)	6.2	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
			> 63 µm (mg/kg)	1.5	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS

Storm 2

Calculated solids concentrations of PCBs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L) Value	TFS Flag	1 Value	1 Flag	2 Value	2 Flag	3 Value	3 Flag	4 Value	4 Flag	10 Value	10 Flag	9 Value	9 Flag	7 Value	7 Flag	6 Value	6 Flag	8 Value	8 Flag	5 Value	5 Flag	19 Value	19 Flag
C2W	2/1/2016	Paleta Creek at Main Street	Bulk (µg/L)	NA		3.55E-04	J	5.57E-04	J	6.87E-04		3.35E-04	J	0.00E+00	U	3.58E-05	J	3.67E-05	J	1.76E-04	J	0.00E+00	U	0.00E+00	U	0.00E+00	U
			< 0.7 µm (µg/L)	NA		1.78E-05	J	2.66E-05	J	2.94E-05	J	3.48E-05		1.29E-06	J	5.13E-06	J	3.28E-06	J	1.10E-05	J	1.32E-05	J	0.00E+00	U	0.00E+00	U
			Total Particulate POPs (>0.7µm) (mg/kg)	784.4		4.30E-04	J	6.76E-04	J	8.38E-04	J	3.83E-04		0.00E+00	<0	3.91E-05	J	4.25E-05	J	2.10E-04	J	0.00E+00	<0	0.00E+00	U	0.00E+00	U
			0.7-2.7 µm (mg/kg)	0.0	TFS<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0
			2.7-20 µm (mg/kg)	62.9		1.35E-04	J	5.06E-04		4.74E-04		0.00E+00	<0	0.00E+00	<0	3.34E-06	J	0.00E+00	<0	2.53E-05	J	0.00E+00	<0	0.00E+00	U	0.00E+00	U
			20-63 µm (mg/kg)	190.7		2.97E-05	J	0.00E+00	<0	6.40E-05		1.26E-04	J	0.00E+00	U	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U	0.00E+00	U	0.00E+00	U
			> 63 µm (mg/kg)	530.7		6.13E-04	J	9.42E-04	J	1.15E-03		5.49E-04	J	0.00E+00	U	5.52E-05	J	6.31E-05	J	3.11E-04	J	0.00E+00	U	0.00E+00	U	0.00E+00	U
O4W	2/1/2016	NBSD outfall at Paunack and Division Streets	Bulk (µg/L)	NA		1.47E-05	J	2.44E-05	J	2.71E-05	J	3.02E-05		0.00E+00	U	5.24E-06	J	3.06E-06	J	9.03E-06	J	1.03E-05	J	0.00E+00	U	0.00E+00	U
			< 0.7 µm (µg/L)	NA		2.08E-05	J	2.73E-05	J	3.35E-05		3.41E-05		8.72E-06	J	1.04E-05	J	7.11E-07	J	1.41E-05	J	1.49E-05	J	0.00E+00	U	0.00E+00	U
			Total Particulate POPs (>0.7µm) (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			0.7-2.7 µm (mg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			2.7-20 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			20-63 µm (mg/kg)	1.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
			> 63 µm (mg/kg)	1.1	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
C1W	2/1/2016	Paleta Creek at Cummings Road	Bulk (µg/L)	NA		8.35E-06	J	1.42E-05	J	1.95E-05		3.19E-05		6.23E-06	J	4.73E-06	J	2.34E-06	J	7.72E-06	J	3.56E-05		1.63E-05		0.00E+00	U
			< 0.7 µm (µg/L)	NA		5.97E-06	J	1.19E-05	J	1.27E-05		3.73E-05		9.48E-06	J	5.49E-06	J	2.02E-06	J	6.00E-06	J	2.35E-05		1.35E-05		0.00E+00	U
			Total Particulate POPs (>0.7µm) (mg/kg)	116.8		2.04E-05	J	1.95E-05		5.75E-05		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	2.69E-06	J	1.47E-05	J	1.03E-04		2.35E-05		0.00E+00	U
			0.7-2.7 µm (mg/kg)	0.0	TFS<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U
			2.7-20 µm (mg/kg)	63.6		0.00E+00	<0	0.00E+00	<0	2.39E-04		1.60E-04		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	U
			20-63 µm (mg/kg)	27.6		4.70E-05	J	8.25E-05	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	7.78E-06	J	1.82E-04	J	1.10E-04	J	3.06E-05	J	0.00E+00	U
			> 63 µm (mg/kg)	25.6		0.00E+00	<0	0.00E+00	<0	9.84E-05		8.27E-04		1.44E-04	J	0.00E+00	<0	3.05E-05	J	0.00E+00	<0	7.90E-04		6.02E-04		0.00E+00	U
O2W	2/1/2016	NBSD outfall #33	Bulk (µg/L)	NA		7.18E-06	J	1.17E-05	J	1.26E-05	J	1.95E-05		6.69E-07	J	2.88E-06	J	1.75E-06	J	4.77E-06	J	7.67E-06	J	0.00E+00	U	0.00E+00	U
			< 0.7 µm (µg/L)	NA		4.81E-06	J	6.71E-06	J	7.57E-06		6.82E-06		0.00E+00	U	1.99E-06	J	1.52E-06	J	4.43E-06	J	3.56E-06		0.00E+00	J	0.00E+00	U
			Total Particulate POPs (>0.7µm) (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			0.7-2.7 µm (mg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			2.7-20 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			20-63 µm (mg/kg)	9.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
			> 63 µm (mg/kg)	5.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
A1W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Bulk (µg/L)	NA		6.84E-06	J	9.88E-06	J	1.34E-05		1.68E-05		2.41E-06	J	2.71E-06	J	1.99E-06	J	7.53E-06	J	2.95E-05		1.38E-05		0.00E+00	U
			< 0.7 µm (µg/L)	NA		5.12E-06	J	8.54E-06	J	1.03E-05		1.13E-05		1.31E-06	J	1.72E-06	J	1.16E-06	J	4.30E-06	J	1.08E-05		1.43E-06	J	0.00E+00	U
			Total Particulate POPs (>0.7µm) (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			0.7-2.7 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			2.7-20 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			20-63 µm (mg/kg)	18.6		0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	4.65E-05		1.75E-04	J	0.00E+00	<0	0.00E+00	<0	2.29E-04		1.47E-03		1.26E-03		0.00E+00	U
			> 63 µm (mg/kg)	4.5	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
A2W	1/31/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Bulk (µg/L)	NA		7.53E-06	J	1.00E-05	J	1.31E-05		1.51E-05		2.65E-06	J	2.21E-06	J	1.43E-06	J	5.33E-06	J	1.52E-05		2.96E-05	J	0.00E+00	U
			< 0.7 µm (µg/L)	NA		5.00E-06	J	7.52E-06	J	8.54E-06	J	1.26E-05		1.30E-06	J	1.82E-06	J	1.30E-06	J	5.35E-06	J	1.53E-05		5.42E-06	J	0.00E+00	U
			Total Particulate POPs (>0.7µm) (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			0.7-2.7 µm (mg/kg)	N	TFS<0, S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			2.7-20 µm (mg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S
			20-63 µm (mg/kg)	3.9	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS
			> 63 µm (mg/kg)	0.0		1.22E-07	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	2.84E-07	J	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0	0.00E+00	<0

Equations involved in the calculation of solids concentrations of PCBs in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = \frac{C_{Bulk} - C_{<0.7\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>0.7um}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = \frac{C_{<2.7\mu m} - C_{<0.7\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>0.7um} - TFS_{>2.7\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

2.7-20µm

$$C_{2.7-20\mu m} = \frac{C_{<20\mu m} - C_{<2.7\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>2.7um} - TFS_{>20\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

20-63µm

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>20um} - TFS_{>63\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

>63µm

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\left(\frac{\mu g}{L}\right)}{TFS_{>63um}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

Appendix I-3: Paleta Stormwater Processed Data
PCBs

Flag	Total PCBs	Units
J	3.16E-03	µg/L
J	2.27E-03	µg/L
J	4.29E-03	mg/kg
	2.13E-02	mg/kg
<0	4.97E-03	mg/kg
J	2.35E-01	mg/kg
<0	2.39E-05	mg/kg
	5.79E-03	µg/L
J	1.50E-03	µg/L
J	2.32E-02	mg/kg
J	2.31E-02	mg/kg
<0	2.08E-02	mg/kg
J	3.95E-02	mg/kg
	5.83E-04	µg/L
		µg/L
J	1.86E-03	µg/L
		mg/kg
S		mg/kg
S		mg/kg
LS		mg/kg
LS		mg/kg
	3.18E-02	µg/L
J	5.08E-03	µg/L
J	1.01E-01	mg/kg
J	5.16E-02	mg/kg
J	1.02E-01	mg/kg
	2.81E-01	mg/kg
<0	1.54E-02	mg/kg
J	5.25E-03	µg/L
J	3.35E-03	µg/L
<0	1.94E-02	mg/kg
<0	0.00E+00	mg/kg
<0	4.66E-03	mg/kg
J	4.49E-02	mg/kg
<0	3.92E-02	mg/kg
	1.24E-01	µg/L
	3.68E-02	µg/L
	7.85E-02	mg/kg
	4.99E-01	mg/kg
	2.67E-01	mg/kg
<0	0.00E+00	mg/kg
LS		mg/kg
	1.79E-02	µg/L
J	2.54E-03	µg/L
J	6.39E-02	mg/kg
<0	0.00E+00	mg/kg
	2.54E-01	mg/kg
	2.66E-01	mg/kg
<0	1.41E-02	mg/kg
	6.76E-03	µg/L
J	1.54E-03	µg/L
J	2.16E-02	mg/kg
J	4.90E-02	mg/kg
	2.22E-02	mg/kg
LS		mg/kg
	1.73E-04	µg/L
		µg/L
J	1.54E-03	µg/L
		mg/kg
S		mg/kg
S		mg/kg
LS		mg/kg
LS		mg/kg

Flag	Total PCBs	Units
	7.03E-02	µg/L
U	3.91E-03	µg/L
U	8.49E-02	mg/kg
<0	0.00E+00	mg/kg
	4.92E-02	mg/kg
	2.31E-02	mg/kg
<0	1.13E-01	mg/kg
U	3.59E-03	µg/L
U	3.30E-03	µg/L
S		mg/kg
S		mg/kg
S		mg/kg
LS		mg/kg
LS		mg/kg
	1.11E-02	µg/L
	2.79E-03	µg/L
	7.66E-02	mg/kg
<0	0.00E+00	mg/kg
U	2.46E-02	mg/kg
	1.73E-01	mg/kg
	9.72E-02	mg/kg
	6.73E-03	µg/L
U	1.16E-03	µg/L
S		mg/kg
S		mg/kg
S		mg/kg
LS		mg/kg
LS		mg/kg
	4.59E-03	µg/L
U	9.05E-04	µg/L
S		mg/kg
S		mg/kg
S		mg/kg
	1.74E-01	mg/kg
LS		mg/kg
U	2.10E-03	µg/L
U	8.58E-04	µg/L
S		mg/kg
S		mg/kg
S		mg/kg
LS		mg/kg
U	8.35E-05	µg/L

Storm 1

Calculated aqueous concentrations of Chlordanes in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Measured Concentration (ng/L) Transchlordane Value	Transchlordane Flag	Cischlordane Value	Cischlordane Flag	Total Chlordanes
C2W	1/7/2016	Paleta Creek at Main Street	**< 0.7 µm**	0.4		0.4		0.8
			Total Particulate POPs (>0.7µm)	0.7		0.6		1.2
			0.7-2.7 µm	0.2		0.1		0.3
			2.7-20 µm	0.3		0.1		0.4
			20-63 µm	6.3		6.6		12.9
			> 63 µm	0.0	<0	0.0	<0	0.0
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	**< 0.7 µm**	0.2		0.1		0.3
			Total Particulate POPs (>0.7µm)	1.8		1.9		3.7
			0.7-2.7 µm	0.3		0.3		0.5
			2.7-20 µm	0.7		0.7		1.4
			20-63 µm	0.1		0.1		0.3
			> 63 µm	0.7		0.7		1.4
O3W	1/7/2016	NBSD outfall north of railroad crossing	**< 0.7 µm**	0.2		0.2		0.3
			Total Particulate POPs (>0.7µm)	NA		NA		
			0.7-2.7 µm	0.2		0.2		0.5
			2.7-20 µm	0.5		0.6		1.2
			20-63 µm	0.0	<0	0.0	<0	0.0
			> 63 µm	NA		NA		
C1W	1/6/2016	Paleta Creek at Cummings Road	**< 0.7 µm**	0.3		0.4		0.7
			Total Particulate POPs (>0.7µm)	7.0		6.9		14.0
			0.7-2.7 µm	0.3		0.2		0.5
			2.7-20 µm	2.4		2.4		4.9
			20-63 µm	3.2		3.3		6.5
			> 63 µm	1.1		1.0		2.1
O1W	1/7/2016	NBSD outfall #23	**< 0.7 µm**	0.3		0.1	J	0.4
			Total Particulate POPs (>0.7µm)	2.1		1.6		3.8
			0.7-2.7 µm	0.0	<0	0.0	<0	0.0
			2.7-20 µm	0.1		0.0	J	0.1
			20-63 µm	0.7		0.5		1.2
			> 63 µm	1.4		1.2		2.6
O2W	1/7/2016	NBSD outfall #33	**< 0.7 µm**	0.4		0.3		0.7
			Total Particulate POPs (>0.7µm)	0.0	<0	0.0	<0	0.0
			0.7-2.7 µm	0.1		0.0	<0	0.1
			2.7-20 µm	1.6		1.1	J	2.7
			20-63 µm	0.0	<0	0.0	<0	0.0
			> 63 µm	0.0	<0	0.0	<0	0.0
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	**< 0.7 µm**	0.2		0.1		0.2
			Total Particulate POPs (>0.7µm)	0.0	<0	0.0	<0	0.0
			0.7-2.7 µm	0.1		0.1		0.1
			2.7-20 µm	2.3		2.1		4.4
			20-63 µm	3.7		3.6		7.3
			> 63 µm	0.0	<0	0.0	<0	0.0
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	**< 0.7 µm**	0.2		0.2		0.5
			Total Particulate POPs (>0.7µm)	2.9		2.9		5.8
			0.7-2.7 µm	0.5		0.0	<0	0.5
			2.7-20 µm	2.4		3.1		5.5
			20-63 µm	2.1		2.4		4.5
			> 63 µm	0.0	<0	0.0	<0	0.0
A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	**< 0.7 µm**	0.2		0.2		0.5
			Total Particulate POPs (>0.7µm)	NA		NA		
			0.7-2.7 µm	0.2		0.2		0.4
			2.7-20 µm	0.2		0.2		0.4
			20-63 µm	0.0	<0	0.0	<0	0.0
			> 63 µm	NA		NA		

Storm 1

Calculated solids concentrations of Chlordanes in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L) Value	TFS Flag	Measured Concentration Transchlordane Value	Transchlordane Flag	Cischlordane Value	Cischlordane Flag	Total Chlordanes
C2W	1/7/2016	Paleta Creek at Main Street	**Bulk (ng/L)**	NA		1.0		1.0		2.0
			< 0.7 µm (ng/L)	NA		0.4		0.4		0.8
			Total Particulate POPs (>0.7µm) (µg/kg)	259.1		2.6		2.2		4.8
			0.7-2.7 µm (µg/kg)	11.4		15.6		11.2		26.8
			2.7-20 µm (µg/kg)	146.9		1.9		1.0		2.8
			20-63 µm (µg/kg)	45.1		140.5		145.6		286.2
			> 63 µm (µg/kg)	55.7		0.0		0.0		0.0
O4W	1/6/2016	NBSD outfall at Paunack and Division Streets	**Bulk (ng/L)**	NA		1.9		2.0		3.9
			< 0.7 µm (ng/L)	NA		0.2		0.1		0.3
			Total Particulate POPs (>0.7µm) (µg/kg)	186.6		9.6		10.0		19.6
			0.7-2.7 µm (µg/kg)	58.4		4.3		4.8		9.1
			2.7-20 µm (µg/kg)	95.1		7.5		7.5		15.1
			20-63 µm (µg/kg)	33.1		4.5		4.2		8.7
			> 63 µm (ng/L)	0.0		0.7		0.7		1.4
O3W	1/7/2016	NBSD outfall north of railroad crossing	**Bulk (ng/L)**	NA		NA		NA		
			< 0.7 µm (ng/L)	NA		0.2		0.2		0.3
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	
			0.7-2.7 µm (µg/kg)	N	TFS<0, S	N	S	N	S	
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	
			20-63 µm (µg/kg)	2.8	LS	NA	LS	NA	LS	
			> 63 µm (µg/kg)	1.8	LS	NA	LS	NA	LS	
C1W	1/6/2016	Paleta Creek at Cummings Road	**Bulk (ng/L)**	NA		7.3		7.3		14.6
			< 0.7 µm (ng/L)	NA		0.3		0.4		0.7
			Total Particulate POPs (>0.7µm) (µg/kg)	267.8		26.2		25.9		52.1
			0.7-2.7 µm (µg/kg)	12.5		25.3		17.6		42.9
			2.7-20 µm (µg/kg)	158.1		15.5		15.3		30.8
			20-63 µm (µg/kg)	46.6		68.2		70.4		138.6
			> 63 µm (µg/kg)	50.7		21.3		20.2		41.5
O1W	1/7/2016	NBSD outfall #23	**Bulk (ng/L)**	NA		2.4		1.7		4.2
			< 0.7 µm (ng/L)	NA		0.3		0.1	J	0.4
			Total Particulate POPs (>0.7µm) (µg/kg)	120.1		17.7		13.7		31.4
			0.7-2.7 µm (µg/kg)	0.0	TFS<0	0.0	<0	0.0	<0	0.0
			2.7-20 µm (µg/kg)	29.6		2.0		1.5		3.6
			20-63 µm (µg/kg)	58.6		11.9		7.9		19.7
			> 63 µm (µg/kg)	31.9		44.6		36.4		81.0
O2W	1/7/2016	NBSD outfall #33	**Bulk (ng/L)**	NA		0.0	U	0.0	U	0.0
			< 0.7 µm (ng/L)	NA		0.4		0.3		0.7
			Total Particulate POPs (>0.7µm) (µg/kg)	1110.7		0.0		0.0		0.0
			0.7-2.7 µm (µg/kg)	28.8		5.1		0.0		5.1
			2.7-20 µm (µg/kg)	1053.4		1.5		1.1		2.6
			20-63 µm (µg/kg)	20.6		0.0		0.0		0.0
			> 63 µm (µg/kg)	7.9	LS	NA	LS	NA	LS	
A1W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	**Bulk (ng/L)**	NA		0.0	U	0.0	U	0.0
			< 0.7 µm (ng/L)	NA		0.2		0.1		0.2
			Total Particulate POPs (>0.7µm) (µg/kg)	241.8		0.0		0.0		0.0
			0.7-2.7 µm (µg/kg)	0.0	TFS <0	0.0	<0	0.0	<0	0.0
			2.7-20 µm (µg/kg)	115.9		19.7		17.9		37.6
			20-63 µm (µg/kg)	101.7		36.8		35.0		71.8
			> 63 µm (µg/kg)	24.1		0.0		0.0		0.0
A2W	1/5/2016	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	**Bulk (ng/L)**	NA		3.1		3.1		6.2
			< 0.7 µm (ng/L)	NA		0.2		0.2		0.5
			Total Particulate POPs (>0.7µm) (µg/kg)	246.5		11.7		11.8		23.5
			0.7-2.7 µm (µg/kg)	38.1		13.0		0.0		13.0
			2.7-20 µm (µg/kg)	200.3		11.9		15.6		27.5
			20-63 µm (µg/kg)	8.1	LS	NA	LS	NA	LS	
			> 63 µm (ng/L)	0.0		0.0	<0	0.0	<0	0.00

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
E	Identifies analytes whose concentrations exceed the calibration range of the HPLC instrument for that specific analysis.
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
S	Salinity of the sample potentially contributes more than 20% of solids mass as precipitating salt
LS	Low solids mass that corresponds to <10mg/L solids concentration
<0	Indicates a negative outcome in concentration or TFS calculations
NA	Not analyzed (Insufficient sample) / Not applicable

Calibration range:	Chlordanes: 0.2ug/L - 20 ug/L

A3W	1/6/2016	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	**Bulk (ng/L)**	NA		NA		NA		
			< 0.7 µm (ng/L)	NA		0.2		0.2		0.5
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	
			0.7-2.7 µm (µg/kg)	N	S	N	S	N	S	
			2.7-20 µm (µg/kg)	N	S	N	S	N	S	
			20-63 µm (µg/kg)	6.2	LS	NA	LS	NA	LS	
			> 63 µm (µg/kg)	1.5	LS	NA	LS	NA	LS	

Equations involved in the calculation of solids concentrations of Chlordanes in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = \frac{C_{Bulk} - C_{<0.7\mu m}\ (\frac{ng}{L})}{TFS_{>0.7um}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = \frac{C_{<2.7\mu m} - C_{<0.7\mu m}\ (\frac{ng}{L})}{TFS_{>0.7um} - TFS_{>2.7\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

2.7-20µm

$$C_{2.7-20\mu m} = \frac{C_{<20\mu m} - C_{<2.7\mu m}\ (\frac{ng}{L})}{TFS_{>2.7um} - TFS_{>20\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

20-63µm

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\ (\frac{ng}{L})}{TFS_{>20um} - TFS_{>63\mu m}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

>63µm

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\ (\frac{ng}{L})}{TFS_{>63um}(\frac{mg}{L})} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

December 2016

Calculated concentration of solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
PS 09	12/5/2016	Pier 3	**> 0.7µm**	551.6	564.8	935	14.1	S
			> 2.7µm	791.7	860.9	940	73.6	S
			> 20µm	547.3	546.4	940	0.0	
			> 63µm	549.6	551.0	950	1.4	
NPDES 18	12/5/2016	Pier 3	**> 0.7µm**	547.7	599.3	965	53.5	S
			> 2.7µm	788.0	835.4	970	48.8	S
			> 20µm	550.1	549.8	945	0.0	
			> 63µm	545.8	547.4	950	1.7	
NPDES 19	12/5/2016	Pier 9	**> 0.7µm**	547.4	553.5	940	6.6	S
			> 2.7µm	776.1	812.2	945	38.2	S
			> 20µm	547.1	549.2	950	2.2	
			> 63µm	548.0	547.6	960	0.0	

December 2016

Calculated concentration of solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
PS 09	12/5/2016	0.7-2.7 µm	N	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	0.0	TFS<0
		> 63 µm	1.4	LS
NPDES 18	12/5/2016	0.7-2.7 µm	N	S
		2.7-20 µm	N	S
		20-63 µm	0.0	TFS<0
		> 63 µm	1.7	LS
NPDES 19	12/5/2016	0.7-2.7 µm	N	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	2.2	LS
		> 63 µm	0.0	TFS<0

March 2017

Calculated concentration of solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
PS 06	3/30/2017	Pier 9	**> 0.7µm**	538.8	601.7	928	67.8	S
			> 2.7µm	783.87	907.85	898	138.1	S
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
PS 09	3/30/2017	Pier 3	**> 0.7µm**	546.2	608.4	900	69.1	S
			> 2.7µm	786.18	914.2	930	137.7	S
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
NPDES 18	3/30/2017	Pier 3	**> 0.7µm**	538.6	584.4	940	48.8	S
			> 2.7µm	786.5	879.1	872	106.2	S
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
NPDES 19	3/30/2017	Pier 9	**> 0.7µm**	544.3	580.2	722	49.7	S
			> 2.7µm	NA	NA	NA	NA	S
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
PS 81.1	3/30/2017	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	**> 0.7µm**	543.9	546.9	888	3.4	
			> 2.7µm	787.1	789.1	866	2.3	
			> 20µm	114.7	116.2	806	1.8	
			> 63µm	113.2	113.6	834	0.4	
PS 96	3/30/2017	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	**> 0.7µm**	526.0	552.2	916	37.8	
				532.3	540.7			
			> 2.7µm	782.7	807.3	884	40.0	
				786.4	797.1			
			> 20µm	113.4	139.5	818	31.8	
			> 63µm	111.6	142.2	876	34.9	

March 2017

Calculated concentration of solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
PS 06	3/30/2017	0.7-2.7 µm	N	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	NA	
		> 63 µm	NA	
PS 09	3/30/2017	0.7-2.7 µm	N	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	NA	
		> 63 µm	NA	
NPDES 18	3/30/2017	0.7-2.7 µm	N	TFS<0, S
		2.7-20 µm	N	S
		20-63 µm	NA	
		> 63 µm	NA	
NPDES 19	3/30/2017	0.7-2.7 µm	N	S
		2.7-20 µm	N	S
		20-63 µm	NA	
		> 63 µm	NA	
PS 81.1	3/30/2017	0.7-2.7 µm	1.1	LS
		2.7-20 µm	0.5	LS
		20-63 µm	1.4	LS
		> 63 µm	0.4	LS
PS 96	3/30/2017	0.7-2.7 µm	0.0	TFS<0
		2.7-20 µm	5.1	LS
		20-63 µm	0.0	TFS<0
		> 63 µm	34.9	

Flag	Description
NA	Not available/Not analyzed
S	Salinity of the sample **potentially** contributes more than 20% of solids mass as precipitating salt
LS	Low solids mass that corresponds to <10mg/L solids concentration
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
TFS<0	Calculation of TFS in the solid fraction returned a negative value

Equations involved in the calculation of TFS size intervals:

0.7-2.7µm

$$TFS_{0.7-2.7\mu m} = TFS_{>0.7um} - TFS_{>2.7\mu m}$$

2.7-20µm

$$TFS_{2.7-20\mu m} = TFS_{>2.7um} - TFS_{>20\mu m}$$

20-63µm

$$TFS_{20-63\mu m} = TFS_{>20um} - TFS_{>63\mu m}$$

Sampling event 1 Dec-16

Measured concentration of the solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
PS09	5-Dec-16	Pier 3	> 0.45µm	215.6	225.1	410	23.0	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
NPDES 18	5-Dec-16	Pier 3	> 0.45µm	226.2	233.8	390	19.6	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
NPDES 19	5-Dec-16	Pier 9	> 0.45µm	217.8	224.4	400	16.6	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	

Sampling event 1 Dec-16

Calculated concentration of the solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
PS09	5-Dec-16	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	
NPDES 18	5-Dec-16	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	
NPDES 19	5-Dec-16	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	

Sampling event 2 Mar-17

Measured concentration of the solids in water collected in the different size fractions

Location ID	Sampling Date	Description	Size Fraction	Initial Filter weight (mg)	Final dried filter weight (mg)	Volume of sample (mL)	TFS (mg/L)	Flag
PS06	30-Mar-17	Pier 9	> 0.45µm	220.2	232.0	350	33.5	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
PS09	30-Mar-17	Pier 3	> 0.45µm	237.1	247.4	360	28.7	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
NPDES 18	30-Mar-17	Pier 3	> 0.45µm	223.3	232.5	430	21.5	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
NPDES 19	30-Mar-17	Pier 9	> 0.45µm	243.2	248.9	540	10.6	S
			> 5µm	NA	NA	NA	NA	
			> 20µm	NA	NA	NA	NA	
			> 63µm	NA	NA	NA	NA	
PS096	30-Mar-17	Mid CIA, west of DD4, southeast of Bldg 457 along “N” St	> 0.45µm	220.3	237.6	440	44.4	
				248.5	250.6			
			> 5µm	179.0	197.2	405	45.4	
				180.5	180.6			
			> 20µm	66.4	139.7	365	200.9	***
				59.3	59.4			
			> 63µm	61.5	72.5	340	33.1	
				59.5	59.7			
PS081.1	30-Mar-17	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	> 0.45µm	239.6	241.7	350	5.9	
			> 5µm	165.3	166.9	325	4.8	
			> 20µm	60.0	60.3	325	0.8	
			> 63µm	65.9	66.0	350	0.3	

Sampling event 2 Mar-17

Calculated concentration of the solids in water collected in the different size intervals

Location ID	Sampling Date	Size Interval	TFS (mg/L)	Flag
PS06	30-Mar-17	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	
PS09	30-Mar-17	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	
NPDES 18	30-Mar-17	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	
NPDES 19	30-Mar-17	Total (>0.45µm)	N	S
		0.45-5µm	NA	
		5-20µm	NA	
		20-63µm	NA	
		> 63µm	NA	
PS096	Mid CIA, west of DD4, southeast of Bldg 457 along “N” St	Total (>0.45µm)	45.4	
		0.45-5µm	0.0	TFS<0
		5-20µm	0.0	TFS<0, ***
		20-63µm	167.8	***
		> 63µm	33.1	
PS081.1	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	Total (>0.45µm)	5.9	LS
		0.45-5µm	1.1	LS
		5-20µm	4.0	LS
		20-63µm	0.6	LS
		> 63µm	0.3	LS

Flag	Description
TFS<0	Calculation of TFS in the solid fraction returned a negative value.
NA	Not applicable
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
LS	Low solids, the solid concentration in the size interval is less than 10mg/L.
S	Salt interference in the solid concentration (>20%).
***	Big particle in the >20um fraction that skewed the result.

Equations involved in the calculation of TFS size intervals:

0.45-5µm

$$TFS_{0.45-5\mu m} = TFS_{>0.45um} - TFS_{>5\mu m}$$

5-20µm

$$TFS_{5-20\mu m} = TFS_{>5um} - TFS_{>20\mu m}$$

20-63µm

$$TFS_{20-63\mu m} = TFS_{>20um} - TFS_{>63\mu m}$$

Sampling event 1 December 2016

Triplicate aqueous concentrations of metals after sample splitting and size fractionation

Location ID	Sampling Date	Description	Size Fraction	Arsenic (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag	Copper (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag
PS09	5-Dec-16	Pier 3	< 0.45µm	NA		NA		NA		NA	NA		83.1		81.1		86.8		83.7	2.9	
			< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			Bulk	0.0	U	0.0	U	0.0	U	0.00	NA	U	94.0		NA		NA		94.0	NA	
NPDES 18	5-Dec-16	Pier 3	< 0.45µm	NA		NA		NA		NA	NA		NA		NA		66.5		66.5	NA	
			< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			Bulk	0.0	U	0.0	U	0.0	U	0.00	NA	U	72.0		NA		NA		72.0	NA	
NPDES 19	5-Dec-16	Pier 9	< 0.45µm	NA		NA		NA		NA	NA		45.5		45.7		46.5		45.9	0.5	
			< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			Bulk	0.0	U	0.0	U	0.0	U	0.00	NA	U	51.7		NA		NA		51.7	NA	

Location ID	Size Fraction	Nickel (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag	Zinc (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag
PS09	< 0.45µm	11.1		NA		11.5		11.3	NA		6.4	J	5.7	J	6.6	J	6.2	0.5	J
	< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	Bulk	11.2		NA		NA		11.2	NA		10.7		NA		NA		10.7	NA	
NPDES 18	< 0.45µm	NA		NA		13.1		13.1	NA		12.6		NA		NA		12.6	NA	
	< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	Bulk	13.2		NA		NA		13.2	NA		31.9		NA		NA		31.9	NA	
NPDES 19	< 0.45µm	6.8	J	7.1	J	7.5	J	7.1	0.3	J	0.0	U	3.5	J	6.8	J	5.1	NA	J
	< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	Bulk	7.8	J	NA		NA		7.8	NA	J	12.9		NA		NA		12.9	NA	

Location ID	Size Fraction	Cadmium (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag	Lead (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag	THg (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag
PS09	< 0.45µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		0.005		0.006		0.005		0.005	0.0	
	< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	Bulk	0.0	U	0.0	U	0.0	U	0.00	NA	U	0.0	U	0.0	U	0.0	U	0.00	NA	U	0.005		0.006		0.005		0.005	0.0	
NPDES 18	< 0.45µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		0.007		0.008		0.007		0.007	0.0	
	< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	Bulk	0.0	U	0.0	U	0.0	U	0.00	NA	U	0.0	U	0.0	U	0.0	U	0.00	NA	U	0.015		0.011		0.012		0.013	0.0	
NPDES 19	< 0.45µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		0.007		0.007		0.008		0.007	0.0	
	< 5µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
	Bulk	0.0	U	0.0	U	0.0	U	0.00	NA	U	0.0	U	0.0	U	0.0	U	0.00	NA	U	0.011		0.010		0.012		0.011	0.0	

Sampling event 2 March 2017

Triplicate aqueous concentrations of metals after sample splitting and size fractionation

Location ID	Sampling Date	Description	Size Fraction	Arsenic (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag	Copper (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag
PS06	30-Mar-17	Pier 9	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 20µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 63µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			Bulk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PS09	30-Mar-17	Pier 3	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 20µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 63µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			Bulk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NPDES 18	30-Mar-17	Pier 3	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 20µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 63µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			Bulk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NPDES 19	30-Mar-17	Pier 9	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			< 20µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			< 63µm	NA		NA		NA		NA	NA		NA		NA		NA		NA	NA	
			Bulk	0.0	U	0.0	U	0.0	U	0.0	NA	U	44.8		41.1		42.2		42.7	1.9	
PS096	30-Mar-17	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	< 0.45µm	2.9		2.6		2.9		2.8	0.2		8.3		8.4		8.3		8.3	0.0	
			< 5µm	2.7		2.8		3.0		2.8	0.2		12.8		10.7		11.6		11.7	1.1	
			< 20µm	2.6		2.7		2.4		2.6	0.1		249.5	++	236.6	++	234.4	++	240.2	8.1	++
			< 63µm	2.4		2.6		2.3		2.4	0.1		95.1	++	98.7	++	94.2	++	96.0	2.4	++
			Bulk	3.1		3.1		3.0		3.1	0.1		28.6		28.0		26.5		27.7	1.1	
PS081.1	30-Mar-17	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	< 0.45µm	1.5		1.4		1.4		1.4	0.1		17.4		17.5		16.9		17.3	0.3	
			< 5µm	1.4		1.6		1.2		1.4	0.2		13.4		12.2		13.9		13.1	0.9	
			< 20µm	0.0	U	0.0	U	0.0	U	0.0	NA	U	73.0	++	72.1	++	71.2	++	72.1	0.9	++
			< 63µm	1.6		1.6		0.0	U	1.6	NA		62.8	++	67.0	++	63.1	++	64.3	2.3	++
			Bulk	1.8	J	1.6	J	0.0	U	1.7	NA	J	19.2		19.3		18.5		19.0	0.4	

Location ID	Size Fraction	Nickel (µg/L) Repricate 1	Flag	Repricate 2	Flag	Repricate 3	Flag	Average Value	STDEV	Flag
PS06	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PS09	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NPDES 18	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NPDES 19	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	NA		NA		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	NA		NA		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	6.7	J	6.7	J	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PS096	< 0.45µm	2.2		2.3		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	2.5		2.5		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	5.3		5.1		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	6.7		6.9		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	8.0		7.1		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PS081.1	< 0.45µm	2.8		2.9		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	3.0		2.7		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	6.1		5.9		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	9.7		10.1		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	4.6		4.3		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Location ID	Size Fraction	Zinc (µg/L)	Cadmium (µg/L)	Lead (µg/L)	THg (µg/L)
PS06	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]
PS09	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]
NPDES 18	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]
NPDES 19	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]
PS096	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]
PS081.1	< 0.45µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 5µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 20µm	[illegible]	[illegible]	[illegible]	[illegible]
	< 63µm	[illegible]	[illegible]	[illegible]	[illegible]
	Bulk	[illegible]	[illegible]	[illegible]	[illegible]

Flags	Description
M<0	Calculation returned a negative metal value
J	The reported value was obtained from a reading that was less than the lowest calibration point but greater than or equal to the MDL.
U	The reading value was less than the MDL.
E	The reading value exceeded the highest calibration point.
++	Potential contamination in the fractions >20,>63um that may affect the result (applies for Pb aU Cu only).

Calibration range for PSNS	
For Hg	25-2,500 pg
For As	1-100 µg/l
For Cu	1-500 µg/L
For Ni	1-500 µg/L
For Zn	1-500 µg/L
For Cd	0.2-50 µg/L
For Pb	0.5-50 µg/l

MDL	Value	Unit
Hg	5.23	pg
As	0.48	µg/L
Cu	0.08	µg/L
Ni	0.09	µg/L
Zn	0.53	µg/L
Cd	0.17	µg/L
Pb	0.04	µg/L

Notes:
For the triplicate calculations per fractions: the J-flagged values and the non-detected values were not used for the average calculations.

Equations involved in the calculation of aqueous concentrations of metals in the corresponding size intervals:

Total (>0.45µm)

$$C_{>0.45\mu m} = C_{Bulk} - C_{<0.45\mu m} \qquad Stdev_{(>0.45)\mu m} = \sqrt{(Stdev_{Bulk})^2 + (Stdev_{<0.45\mu m})^2}$$

0.45-5µm

$$C_{0.45-5\mu m} = C_{<5um} - C_{<0.45\mu m} \qquad Stdev_{(0.45-5)\mu m} = \sqrt{(Stdev_{<5\mu m})^2 + (Stdev_{<0.45\mu m})^2}$$

5-20µm

$$C_{5-20\mu m} = C_{<20um} - C_{<5\mu m} \qquad Stdev_{(5-20)\mu m} = \sqrt{(Stdev_{<20\mu m})^2 + (Stdev_{<5\mu m})^2}$$

20-63µm

$$C_{20-63\mu m} = C_{<63um} - C_{<20\mu m} \qquad Stdev_{(20-63)\mu m} = \sqrt{(Stdev_{<63\mu m})^2 + (Stdev_{<20\mu m})^2}$$

>63µm

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m} \qquad Stdev_{(>63)\mu m} = \sqrt{(Stdev_{Bulk})^2 + (Stdev_{<63\mu m})^2}$$

Sampling event 1 December 2016

Calculated aqueous concentrations of metals in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Arsenic (µg/L) Value	STDEV	Flag	Copper (µg/L) Value	STDEV	Flag	Nickel (µg/L) Value	STDEV	Flag	Zinc (µg/L) Value	STDEV	Flag	Cadmium (µg/L) Value	STDEV	Flag	Lead (µg/L) Value	STDEV	Flag	THg (µg/L) Value	STDEV	Flag
PS09	5-Dec-16	Pier 3	Bulk	0.00	NA	U	94.0	NA		11.18	NA		10.7	NA		0.00	NA	U	0.00	NA	U	0.0054	0.000	
			Total (>0.45 µm)	NA	NA		10.3	2.9		0.00	NA	M<0	4.4	0.5		NA	NA		NA	NA		0.0000	0.000	
			<0.45 µm	NA	NA		83.7	2.9		11.29	NA		6.2	0.5	J	NA	NA		NA	NA		0.0054	0.000	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 18	5-Dec-16	Pier 3	Bulk	0.00	NA	U	72.0	NA		13.23	NA		31.9	NA		0.00	NA	U	0.00	NA	U	0.0126	0.002	
			Total (>0.45 µm)	NA	NA		5.6	NA		0.11	NA		19.4	NA		NA	NA		NA	NA		0.0053	0.002	
			<0.45 µm	NA	NA		66.5	NA		13.12	NA		12.6	NA		NA	NA		NA	NA		0.0073	0.001	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 19	5-Dec-16	Pier 9	Bulk	0.00	NA	U	51.7	NA		7.83	NA		12.9	NA		0.00	NA	U	0.00	NA	U	0.0110	0.0007	
			Total (>0.45 µm)	NA	NA		5.8	0.5		0.70	0.34		7.8	NA		NA	NA		NA	NA		0.0037	0.001	
			<0.45 µm	NA	NA		45.9	0.5		7.13	0.34		5.1	NA	J	NA	NA		NA	NA		0.0073	0.0004	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	

Sampling event 2 March 2017

Calculated aqueous concentrations of metals in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Arsenic (µg/L) Value	STDEV	Flag	Copper (µg/L) Value	STDEV	Flag	Nickel (µg/L) Value	STDEV	Flag	Zinc (µg/L) Value	STDEV	Flag	Cadmium (µg/L) Value	STDEV	Flag	Lead (µg/L) Value	STDEV	Flag	THg (µg/L) Value	STDEV	Flag
PS06	30-Mar-17	Pier 9	Bulk	0.0	NA	U	99.9	6.7		11.8	NA		14.3	NA		0.00	NA	U	0.0	NA	U	0.0053	0.0002	
			Total (>0.45 µm)	NA	NA		16.5	6.7		1.5	0.1		3.2	NA		NA	NA		NA	NA		0.0018	0.0002	
			<0.45 µm	0.0	NA	U	83.4	0.7		10.3	0.1	J	11.1	NA		0.00	NA	U	0.0	NA	U	0.0035	0.0001	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
PS09	30-Mar-17	Pier 3	Bulk	0.0	NA	U	94.6	7.2		10.0	0.5	J	11.7	NA		0.00	NA	U	0.0	NA	U	0.0047	0.0004	
			Total (>0.45 µm)	NA	NA		14.7	8.0		0.0	NA	M<0, J	0.6	NA		NA	NA		NA	NA		0.0000	NA	M<0
			<0.45 µm	0.0	NA	U	79.9	3.3		10.1	0.3	J	11.1	NA		0.00	NA	U	0.0	NA	U	0.0050	0.0004	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 18	30-Mar-17	Pier 3	Bulk	0.0	NA	U	78.4	7.6		9.3	0.1	J	38.6	9.8		0.00	NA	U	0.0	NA	U	0.0087	0.0002	
			Total (>0.45 µm)	NA	NA		0.0	NA	M<0	0.0	NA	M<0, J	5.8	9.8		NA	NA		NA	NA		0.0052	0.0002	
			<0.45 µm	0.0	NA	U	89.9	NA		9.6	NA	J	32.8	NA		0.00	NA	U	0.0	NA	U	0.0035	0.0001	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 19	30-Mar-17	Pier 9	Bulk	0.0	NA	U	42.7	1.9		6.8	0.2	J	11.1	NA		0.00	NA	U	0.0	NA	U	0.0086	0.0001	
			Total (>0.45 µm)	NA	NA		4.7	2.1		0.6	0.2	J	0.0	NA	M<0	NA	NA		NA	NA		0.0034	0.0003	
			<0.45 µm	0.0	NA	U	38.0	0.9		6.2	0.1	J	13.1	NA		0.00	NA	U	0.0	NA	U	0.0052	0.0003	
			0.45-5 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
PS096	30-Mar-17	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	Bulk	3.09	0.1		27.7	1.1		7.43	0.52		122.9	4.2		0.39	0.01	J	12.7	0.5		0.0182	0.0048	
			Total (>0.45 µm)	0.27	0.19		19.4	1.1		5.21	0.5		56.7	4.3		0.14	0.02	J	11.7	0.5		0.0158	0.0048	
			<0.45 µm	2.82	0.2		8.3	0.0		2.21	0.05		66.2	0.6		0.25	0.02		1.0	0.1		0.0024	0.0002	
			0.45-5 µm	0.00	NA	M<0	3.4	1.1		0.40	0.2		24.4	3.5		0.08	0.02		2.0	0.2		0.0004	0.0003	
			5-20 µm	0.00	NA	M<0	228.4	8.2	++	2.48	0.3		13.0	5.5		0.21	0.06		113.2	1.7	E, ++	0.0046	0.0004	
			20-63 µm	0.00	NA	M<0	0.0	NA	M<0, ++	1.63	0.3		0.4	54.3		0.49	0.06		0.0	NA	M<0, ++	0.0000	NA	M<0
			> 63 µm	0.67	0.13		0.0	NA	M<0, ++	0.70	0.6		18.9	54.3		0.00	NA	M<0	0.0	NA	M<0, ++	0.0122	0.0048	
PS081.1	30-Mar-17	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	Bulk	1.71	0.1		19.0	0.4		4.44	0.15		143.5	4.5		0.00	NA	U	3.3	0.1		0.0053	0.0011	
			Total (>0.45 µm)	0.31	0.06		1.7	0.4		1.61	0.2		34.5	5.3		0.00	NA	M<0, U	1.6	0.2		0.0026	0.0011	
			<0.45 µm	1.40	0.1		17.3	0.3		2.84	0.04		109.0	2.7		0.24	NA		1.7	0.1		0.0027	0.0002	
			0.45-5 µm	0.01	0.17		0.0	0.9	M<0	0.08	0.2		0.0	NA	M<0	0.00	0.02		0.2	0.1		0.0006	0.0002	
			5-20 µm	0.00	NA	M<0	59.0	1.3	++	3.05	0.2		36.0	7.3		0.00	NA	M<0, U	34.6	0.6	++	0.0038	0.0007	
			20-63 µm	1.59	NA		0.0	2.5	M<0, ++	3.88	0.3		3.9	3.6		0.69	0.04		62.5	2.3	++	0.0000	NA	M<0
			> 63 µm	0.12	NA		0.0	2.4	M<0, ++	0.00	NA	M<0	0.0	NA	M<0	0.00	NA	M<0, U	0.0	NA	M<0, ++	0.0004	0.0011	

December 2016

Measured concentrations of PAHs in the water after sample splitting and size fractionation

Measured Concentration (ng/L)

Location ID	Sampling Date	Description	Size Fraction	Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
PS 09	12/5/2016	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.0		0.6		0.0	U	0.0	U	0.0	U	0.0	J, B	0.0	U	0.0	U	0.1	J	1.7
			< 20 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.0		0.7		0.0	U	0.0	U	0.3		0.1	J	0.2		0.0	U	0.3		2.5
			Bulk	1.1		0.0	U	0.0	U	0.7		0.0	U	1.4		1.0		0.0	U	0.0	U	0.4		0.1		0.3		0.0	U	0.3		5.3
NPDES 18	12/5/2016	Pier 3	< 0.7 µm	0.9	B	0.0	U	0.0	U	0.6	B	0.0	U	0.5	B	1.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	3.2
			< 20 µm	0.7	B	0.0	U	0.0	U	0.4	B	0.0	U	1.0		1.3		0.2		0.1		0.2		0.0	J	0.1		0.0	U	0.2		4.4
			Bulk	2.0		0.0	U	0.0	U	1.1		0.0	U	1.2		1.8		0.1		0.1		0.2		0.0	J	0.1		0.0	U	0.1		6.8
NPDES 19	12/5/2016	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.3	B	0.0	U	1.6		4.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	6.2
			< 20 µm	0.8	B	0.0	U	0.0	U	0.4	B	0.0	U	2.1		4.9		0.0	U	0.1		0.0	U	0.0	U	0.0	U	0.0	U	0.1		8.5
			Bulk	1.6		0.0	U	0.0	U	0.7		0.0	U	2.2		6.0		0.0	U	0.1		0.0	U	0.0	J	0.1		0.0	U	0.2		10.8

March 2017

Measured concentrations of PAHs in the water after sample splitting and size fractionation

Measured Concentration (ng/L)

Location ID	Sampling Date	Description	Size Fraction	Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
PS 06	3/30/2017	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.7		0.9		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.6
			Bulk	0.2	J	0.0	U	0.0	U	1.0		0.0	U	3.7		1.9		0.6		0.1	J	0.6		0.0	J	0.0	U	0.0	U	0.0	U	8.2
PS 09	3/30/2017	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.5		0.7		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.3
			Bulk	0.3	J	0.0	U	0.0	U	1.3		0.0	U	3.6		2.1		1.1		0.5		1.3		0.2	J	0.4		0.0	U	0.5		11.4
NPDES 18	3/30/2017	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.2	J	0.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	2.0
			Bulk	0.4	J	0.0	U	0.0	U	0.6		0.0	U	0.7		1.6		0.2	J	0.0	U	0.0	J	0.0	U	0.0	U	0.4	J	0.3	J	4.1
NPDES 19	3/30/2017	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.0	U	0.8		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	1.9
			Bulk	0.4		0.0	U	0.6		0.4		0.0	U	0.0	U	2.3		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.4	J	0.0	U	4.1
PS 81.1	3/30/2017	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	< 0.7 µm	0.0	U	0.0	U	0.0	U	1.5		0.0	U	2.0		1.0		0.0	U	0.0	U	1.6		0.0	U	0.0	U	0.0	U	1.5		7.5
			< 20 µm	0.0	U	0.0	U	0.0	U	3.3		0.0	U	12.1		5.6		4.6		3.4		29.2		9.0		16.7		1.6		10.6		96.1
			Bulk	0.0	U	0.0	U	3.4		3.2		0.0	U	9.0		4.8		5.0		4.5		18.9		6.7		11.5		0.9		6.9		74.8
PS 96	3/30/2017	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	< 0.7 µm	0.0	U	0.0	U	9.6		5.8		0.0	U	22.5		10.6		2.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	51.0
			< 2.7 µm	0.0	U	0.0	U	0.0	U	2.2		0.0	U	7.3		3.2		1.9		0.0	U	3.6		0.2	J	0.7		0.2	J	3.0		22.3
			< 20 µm	0.0	U	0.0	U	0.0	U	15.4		0.0	U	31.3		24.7		13.6		7.5		22.6		7.4		12.9		3.1		11.1		149.6
			< 63 µm	11.9		22.6		31.8		232.9		27.1		300.3		247.1		103.0		88.1		125.4		57.1		116.9		23.7		70.0		1458.1
			Bulk	431.0		674.1		727.8		5064.5		795.2		5581.0		4629.3		1627.5		1648.9		2129.5		958.0		2028.5		367.2		1104.2		27766.8

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
B	Indicates compound concentration is less than 3 times higher than blank concentration
<0	Indicates a negative outcome in concentration or TFS calculations

Calibration range:	PAH-15:	0.5ug/L - 600 ug/L
	Deuterated PAH-4:	0.5ug/L - 400 ug/L

December 2016

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Measured Concentration (ng/L)

Location ID	Sampling Date	Description	Size Interval	Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
PS 09	12/5/2016	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.0		0.6		0.0	U	0.0	U	0.0	U	0.0	J, B	0.0	U	0.0	U	0.1	J	1.7
			Total Particulate POPs (>0.7µm)	1.1		0.0	U	0.0	U	0.7		0.0	U	0.4		0.4		0.0	U	0.0	U	0.4		0.1	J, B	0.3		0.0	U	0.2	J	3.6
			0.7-20 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0		0.1		0.0	U	0.0	U	0.3		0.0	J, B	0.2		0.0	U	0.2	J	0.8
			>20 µm	1.1		0.0	U	0.0	U	0.7		0.0	U	0.4		0.3		0.0	U	0.0	U	0.1		0.0	J	0.1		0.0	U	0.0		2.8
NPDES 18	12/5/2016	Pier 3	< 0.7 µm	0.9	B	0.0	U	0.0	U	0.6	B	0.0	U	0.5	B	1.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	3.2
			Total Particulate POPs (>0.7µm)	1.2	B	0.0	U	0.0	U	0.5	B	0.0	U	0.6	B	0.6		0.1	U	0.0	J	0.2	U	0.0	J	0.1	U	0.0	U	0.1	U	3.6
			0.7-20 µm	0.0	<0	0.0	U	0.0	U	0.0	<0	0.0	U	0.5		0.2		0.2		0.1	J	0.2		0.0	J	0.1	U	0.0	U	0.2		1.5
			>20 µm	1.3		0.0	U	0.0	U	0.7		0.0	U	0.2		0.4		0.0	<0	0.0		0.0		0.0	J	0.0		0.0	U	0.0	<0	2.5
NPDES 19	12/5/2016	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.3	B	0.0	U	1.6		4.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	6.2
			Total Particulate POPs (>0.7µm)	1.6		0.0	U	0.0	U	0.3	B	0.0	U	0.6		1.8		0.0	U	0.0	J	0.0	U	0.0	J	0.1	U	0.0	U	0.2	U	4.6
			0.7-20 µm	0.8	B	0.0	U	0.0	U	0.0	B	0.0	U	0.5		0.7		0.0	U	0.0	J	0.0	U	0.0	U	0.0	U	0.0	U	0.1	U	2.2
			>20 µm	0.7		0.0	U	0.0	U	0.3		0.0	U	0.1		1.1		0.0	U	0.0		0.0	U	0.0	J	0.1	U	0.0	U	0.0		2.4

March 2017

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Measured Concentration (ng/L)

Location ID	Sampling Date	Description	Size Interval	Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
PS 06	3/30/2017	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.7		0.9		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.6
			Total Particulate POPs (>0.7µm)	0.2	J	0.0	U	0.0	U	1.0		0.0	U	2.0		1.0		0.6		0.1	J	0.6		0.0	J	0.0	U	0.0	U	0.0	U	5.6
PS 09	3/30/2017	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.5		0.7		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.3
			Total Particulate POPs (>0.7µm)	0.3	J	0.0	U	0.0	U	1.3		0.0	U	2.0		1.4		1.1		0.5		1.3		0.2	J	0.4		0.0	U	0.5		9.1
NPDES 18	3/30/2017	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.2	J	0.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	2.0
			Total Particulate POPs (>0.7µm)	0.4	J	0.0	U	0.0	<0	0.2	J, B	0.0	U	0.5		1.1		0.2	J	0.0	U	0.0	J	0.0	U	0.0	U	0.1	J	0.3	J	2.7
NPDES 19	3/30/2017	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.0	U	0.8		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	1.9
			Total Particulate POPs (>0.7µm)	0.4		0.0	U	0.0	<0	0.2	J, B	0.0	U	0.0	U	1.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	J	2.3
PS 81.1	3/30/2017	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	< 0.7 µm	0.0	U	0.0	U	0.0	U	1.5		0.0	U	2.0		1.0		0.0	U	0.0	U	1.6	0	0.0	U	0.0	U	0.0	U	1.5		7.5
			Total Particulate POPs (>0.7µm)	0.0	U	0.0	U	3.4		1.7		0.0	U	7.0		3.8		5.0		4.5		17.3		6.7		11.5		0.9		5.4		67.3
			0.7-20 µm	0.0	U	0.0	U	0.0	U	1.8		0.0	U	10.1		4.6		4.6		3.4		27.6		9.0		16.7		1.6		9.1		88.5
			>20 µm	0.0	U	0.0	U	3.4		0.0	<0	0.0	U	0.0	<0	0.0	<0	0.4		1.1		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	4.9
PS 96	3/30/2017	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	< 0.7 µm	0.0	U	0.0	U	9.6		5.8		0.0	U	22.5		10.6		2.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	51.0
			Total Particulate POPs (>0.7µm)	431.0		674.1		718.2		5058.7		795.2		5558.5		4618.6		1625.0		1648.9		2129.5		958.0		2028.5		367.2		1104.2		27715.8
			0.7-2.7 µm	0.0	U	0.0	U	0.0	<0	0.0	<0	0.0	U	0.0	<0	0.0	<0	0.0	<0	0.0	U	3.6		0.2	J	0.7		0.2	J	3.0		7.7
			2.7-20 µm	0.0	U	0.0	U	0.0	U	13.2		0.0	U	23.9		21.5		11.7		7.5		19.0		7.2		12.2		2.9		8.1		127.3
			20-63 µm	11.9		22.6		31.8		217.5		27.1		269.1		222.4		89.4		80.6		102.8		49.7		104.0		20.7		58.9		1308.5
			> 63 µm	419.0		651.5		696.0		4831.6		768.1		5280.7		4382.2		1524.5		1560.8		2004.1		901.0		1911.6		343.5		1034.2		26308.7

Equations involved in the calculation of aqueous concentrations of PAHs in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = C_{Bulk} - C_{<0.7\mu m}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = C_{<2.7um} - C_{<0.7\mu m}$$

2.7-20µm

$$C_{2.7-20\mu m} = C_{<20um} - C_{<2.7\mu m}$$

20-63µm

$$C_{20-63\mu m} = C_{<63um} - C_{<20\mu m}$$

>63µm

$$C_{>63\mu m} = C_{Bulk} - C_{<63\mu m}$$

December 2016

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
PS 09	12/5/2016	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.0		0.6		0.0	U	0.0	U	0.0	U	0.0	J, B	0.0	U	0.0	U	0.1	J	1.7
			Total Particulate POPs (>0.7µm)	1.1		0.0	U	0.0	U	0.7		0.0	U	0.4		0.4		0.0	U	0.0	U	0.4		0.1	J, B	0.3		0.0	U	0.2	J	3.6
			0.7-20 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0		0.1		0.0	U	0.0	U	0.3		0.0	J, B	0.2		0.0	U	0.2	J	0.8
			>20 µm	1.1		0.0	U	0.0	U	0.7		0.0	U	0.4		0.3		0.0	U	0.0	U	0.1		0.0	J	0.1		0.0	U	0.0		2.8
NPDES 18	12/5/2016	Pier 3	< 0.7 µm	0.9	B	0.0	U	0.0	U	0.6	B	0.0	U	0.5	B	1.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	3.2
			Total Particulate POPs (>0.7µm)	1.2	B	0.0	U	0.0	U	0.5	B	0.0	U	0.6	B	0.6		0.1	U	0.0	J	0.2	U	0.0	J	0.1	U	0.0	U	0.1	U	3.6
			0.7-20 µm	0.0	<0	0.0	U	0.0	U	0.0	<0	0.0	U	0.5		0.2		0.2		0.1	J	0.2		0.0	J	0.1	U	0.0	U	0.2		1.5
			>20 µm	1.3		0.0	U	0.0	U	0.7		0.0	U	0.2		0.4		0.0	<0	0.0		0.0		0.0	J	0.0		0.0	U	0.0	<0	2.5
NPDES 19	12/5/2016	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.3	B	0.0	U	1.6		4.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	6.2
			Total Particulate POPs (>0.7µm)	1.6		0.0	U	0.0	U	0.3	B	0.0	U	0.6		1.8		0.0	U	0.0	J	0.0	U	0.0	J	0.1	U	0.0	U	0.2	U	4.6
			0.7-20 µm	0.8	B	0.0	U	0.0	U	0.0	B	0.0	U	0.5		0.7		0.0	U	0.0	J	0.0	U	0.0	U	0.0	U	0.0	U	0.1	U	2.2
			>20 µm	0.7		0.0	U	0.0	U	0.3		0.0	U	0.1		1.1		0.0	U	0.0		0.0	U	0.0	J	0.1	U	0.0	U	0.0		2.4

March 2017

Calculated aqueous concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	
PS 06	3/30/2017	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.7		0.9		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.6
			Total Particulate POPs (>0.7µm)	0.2	J	0.0	U	0.0	U	1.0		0.0	U	2.0		1.0		0.6		0.1	J	0.6		0.0	J	0.0	U	0.0	U	0.0	U	5.6
PS 09	3/30/2017	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.5		0.7		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.3
			Total Particulate POPs (>0.7µm)	0.3	J	0.0	U	0.0	U	1.3		0.0	U	2.0		1.4		1.1		0.5		1.3		0.2	J	0.4		0.0	U	0.5		9.1
NPDES 18	3/30/2017	Pier 3	< 0.7 µm	0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.2	J	0.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	2.0
			Total Particulate POPs (>0.7µm)	0.4	J	0.0	U	0.0	<0	0.2	J, B	0.0	U	0.5		1.1		0.2	J	0.0	U	0.0	U	0.0	U	0.0	U	0.1	J	0.3	J	2.7
NPDES 19	3/30/2017	Pier 9	< 0.7 µm	0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.0	U	0.8		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	1.9
			Total Particulate POPs (>0.7µm)	0.4		0.0	U	0.0	<0	0.2	J, B	0.0	U	0.0	U	1.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	J	2.3
PS 81.1	3/30/2017	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	< 0.7 µm	0.0	U	0.0	U	0.0	U	1.5		0.0	U	2.0		1.0		0.0	U	0.0	U	1.6	0.0	0.0	U	0.0	U	0.0	U	1.5		7.5
			Total Particulate POPs (>0.7µm)	0.0	U	0.0	U	3.4		1.7		0.0	U	7.0		3.8		5.0		4.5		17.3		6.7		11.5		0.9		5.4		67.3
			0.7-20 µm	0.0	U	0.0	U	0.0	U	1.8		0.0	U	10.1		4.6		4.6		3.4		27.6		9.0		16.7		1.6		9.1		88.5
			>20 µm	0.0	U	0.0	U	3.4		0.0	<0	0.0	U	0.0	<0	0.0	<0	0.4		1.1		0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	4.9
PS 96	3/30/2017	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	< 0.7 µm	0.0	U	0.0	U	9.6		5.8		0.0	U	22.5		10.6		2.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	51.0
			Total Particulate POPs (>0.7µm)	431.0		674.1		718.2		5058.7		795.2		5558.5		4618.6		1625.0		1648.9		2129.5		958.0		2028.5		367.2		1104.2		27715.8
			0.7-2.7 µm	0.0	U	0.0	U	0.0	<0	0.0	<0	0.0	U	0.0	<0	0.0	<0	0.0	<0	0.0	U	3.6		0.2	J	0.7		0.2	J	3.0		7.7
			2.7-20 µm	0.0	U	0.0	U	0.0	U	13.2		0.0	U	23.9		21.5		11.7		7.5		19.0		7.2		12.2		2.9		8.1		127.3
			20-63 µm	11.9		22.6		31.8		217.5		27.1		269.1		222.4		89.4		80.6		102.8		49.7		104.0		20.7		58.9		1308.5
			>63 µm	419.0		651.5		696.0		4831.6		768.1		5280.7		4382.2		1524.5		1560.8		2004.1		901.0		1911.6		343.5		1034.2		26308.7

Flags	Description
J	Indicates an estimated value. Data indicate the presence of an analyte, but the result is below the calibration range, but greater than zero.
U	Indicates compound was analyzed for, but not detected.
N	Not calculated. Due to salinity, there is low confidence on the calculated value.
B	Indicates compound concentration is less than 3 times higher than blank concentration
S	Salinity of the sample potentially contributes more than 20% of solids mass as precipitating salt
LS	Low solids mass that corresponds to <10mg/L solids concentration
<0	Indicates a negative outcome in concentration or TFS calculations
NA	Not analyzed (insufficient sample) / Not applicable

Calibration range:	PAH-15:	0.5ug/L - 600 ug/L
	Deuterated PAH-6:	0.5ug/L - 400 ug/L

December 2016

Calculated solids concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L)		Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15	Units
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag		
PS 09	12/5/2016	Pier 3	Bulk (ng/L)	NA		1.1		0.0	U	0.0	U	0.7		0.0	U	1.4		1.0		0.0	U	0.0	U	0.4		0.1		0.3		0.0	U	0.3		5.3	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.0		0.6		0.0	U	0.0	U	0.0	U	0.0	J, B	0.0	U	0.0	U	0.1	J	1.7	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			>20 µm (µg/kg)	1.4	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
NPDES 18	12/5/2016	Pier 3	Bulk (ng/L)	NA		2.0		0.0	U	0.0	U	1.1		0.0	U	1.2		1.8		0.1		0.1		0.2		0.0	J	0.1		0.0	U	0.1		6.8	ng/L
			< 0.7 µm (ng/L)	NA		0.9	B	0.0	U	0.0	U	0.6	B	0.0	U	0.5	B	1.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	3.2	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			>20 µm (µg/kg)	1.7	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
NPDES 19	12/5/2016	Pier 9	Bulk (ng/L)	NA		1.6		0.0	U	0.0	U	0.7		0.0	U	2.2		6.0		0.0	U	0.1		0.0	U	0.0	J	0.1		0.0	U	0.2		10.8	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.0	U	0.3	B	0.0	U	1.6		4.2		0.0	U	0.1	J	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	6.2	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			0.7-20 µm (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
			>20 µm (µg/kg)	2.2	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg

March 2017

Calculated solids concentrations of PAHs in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L)		Naphthalene		Fluorene		Acenaphthene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Chrysene		Benzo[a]anthracene		Benzo[b]fluoranthene		Benzo[k]fluoranthene		Benzo[a]pyrene		Dibenzo[a,h]anthracene		Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene		Total PAH-15	Units
				Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag	Value	Flag		
PS 06	3/30/2017	Pier 9	Bulk (ng/L)	NA		0.2	J	0.0	U	0.0	U	1.0		0.0	U	3.7		1.9		0.6		0.1	J	0.6		0.0	J	0.0	U	0.0	U	0.0	U	8.2	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.7		0.9		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.6	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
PS 09	3/30/2017	Pier 3	Bulk (ng/L)	NA		0.3	J	0.0	U	0.0	U	1.3		0.0	U	3.6		2.1		1.1		0.5		1.3		0.2	J	0.4		0.0	U	0.5		11.4	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	1.5		0.7		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	2.3	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
NPDES 18	3/30/2017	Pier 3	Bulk (ng/L)	NA		0.4	J	0.0	U	0.0	U	0.6		0.0	U	0.7		1.6		0.2	J	0.0	U	0.0	J	0.0	U	0.0	U	0.4	J	0.3	J	4.1	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.2	J	0.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	2.0	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
NPDES 19	3/30/2017	Pier 9	Bulk (ng/L)	NA		0.4		0.0	U	0.6		0.4		0.0	U	0.0	U	2.3		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.4	J	0.0	U	4.1	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.7		0.3	J, B	0.0	U	0.0	U	0.8		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.2	J	0.0	U	1.9	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S	N	S		µg/kg
PS 81.1	3/30/2017	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	Bulk (ng/L)	NA		0.0	U	0.0	U	3.4		3.2		0.0	U	9.0		4.8		5.0		4.5		18.9		6.7		11.5		0.9		6.9		74.8	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	0.0	U	1.5		0.0	U	2.0		1.0		0.0	U	0.0	U	1.6		0.0	U	0.0	U	0.0	U	1.5		7.5	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	3.4	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			0.7-20 µm (µg/kg)	1.6	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			>20 µm (µg/kg)	1.8	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
PS 96	3/30/2017	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	Bulk (ng/L)	NA		431.0		674.1		727.8		5064.5		795.2		5581.0		4629.3		1627.5		1648.9		2129.5		958.0		2028.5		367.2		1104.2		27766.8	ng/L
			< 0.7 µm (ng/L)	NA		0.0	U	0.0	U	9.6		5.8		0.0	U	22.5		10.6		2.5		0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	0.0	U	51.0	ng/L
			Total Particulate POPs (>0.7µm) (µg/kg)	40.0		10780.4		16862.9		17966.1		126539.2		19891.0		139042.2		115531.0		40647.6		41246.3		53267.9		23964.3		50742.1		9185.5		27620.0		693286.5	µg/kg
			0.7-2.7 µm (µg/kg)	0.0	TFS<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	µg/kg
			2.7-20 µm (µg/kg)	5.1	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS	NA	LS		µg/kg
			20-63 µm (µg/kg)	0.0	TFS<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	<0	0.0	µg/kg
			> 63 µm (µg/kg)	34.9		12011.6		18675.8		19951.3		138496.6		22017.4		151369.8		125615.1		43700.5		44739.7		57446.4		25825.9		54796.5		9845.8		29644.3		754136.7	µg/kg

Equations involved in the calculation of solids concentrations of PAHs in the corresponding size intervals:

>0.7µm

$$C_{>0.7\mu m} = \frac{C_{Bulk} - C_{<0.7\mu m}\left(\frac{ng}{L}\right)}{TFS_{>0.7um}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

0.7-2.7µm

$$C_{0.7-2.7\mu m} = \frac{C_{<2.7\mu m} - C_{<0.7\mu m}\left(\frac{ng}{L}\right)}{TFS_{>0.7um} - TFS_{>2.7\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

2.7-20µm

$$C_{2.7-20\mu m} = \frac{C_{<20\mu m} - C_{<2.7\mu m}\left(\frac{ng}{L}\right)}{TFS_{>2.7um} - TFS_{>20\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

20-63µm

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\left(\frac{ng}{L}\right)}{TFS_{>20um} - TFS_{>63\mu m}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

>63µm

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\left(\frac{ng}{L}\right)}{TFS_{>63um}\left(\frac{mg}{L}\right)} * 1000\frac{mg}{g} = \frac{ng}{g} = \frac{\mu g}{kg}$$

Sampling event 1 December 2016

Calculated aqueous concentrations of metals in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L) Value	TFS Flag	Arsenic (µg/L) Value	Arsenic STDEV	Arsenic Flag	Copper (µg/L) Value	Copper STDEV	Copper Flag	Nickel (µg/L) Value	Nickel STDEV	Nickel Flag	Zinc (µg/L) Value	Zinc STDEV	Zinc Flag	Cadmium (µg/L) Value	Cadmium STDEV	Cadmium Flag	Lead (µg/L) Value	Lead STDEV	Lead Flag	THg (µg/L) Value	THg STDEV	THg Flag
PS09	5-Dec-16	Pier 3	Bulk			0.00	NA	U	94.0	NA		11.18	NA		10.7	NA		0.00	NA	U	0.00	NA	U	0.0054	0.000	
			Total (>0.45 µm)	N	S	NA	NA		10.3	2.9		0.00	NA	M<0	4.4	0.5		NA	NA		NA	NA		0.0000	0.000	
			<0.45 µm	NA		NA	NA		83.7	2.9		11.29	NA		6.2	0.5	J	NA	NA		NA	NA		0.0054	0.000	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 18	5-Dec-16	Pier 3	Bulk			0.00	NA	U	72.0	NA		13.23	NA		31.9	NA		0.00	NA	U	0.00	NA	U	0.0126	0.002	
			Total (>0.45 µm)	N	S	NA	NA		5.6	NA		0.11	NA		19.4	NA		NA	NA		NA	NA		0.0053	0.002	
			<0.45 µm	NA		NA	NA		66.5	NA		13.12	NA		12.6	NA		NA	NA		NA	NA		0.0073	0.001	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 19	5-Dec-16	Pier 9	Bulk			0.00	NA	U	51.7	NA		7.83	NA		12.9	NA		0.00	NA	U	0.00	NA	U	0.0110	0.0007	
			Total (>0.45 µm)	N	S	NA	NA		5.8	0.5		0.70	0.34		7.8	NA		NA	NA		NA	NA		0.0037	0.001	
			<0.45 µm	NA		NA	NA		45.9	0.5		7.13	0.34		5.1	NA	J	NA	NA		NA	NA		0.0073	0.0004	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	

Sampling event 1 December 2016

Calculated concentrations of metals on solids in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Arsenic Value	Arsenic STDEV	Arsenic Flag	Copper Value	Copper STDEV	Copper Flag	Nickel Value	Nickel STDEV	Nickel Flag	Zinc Value	Zinc STDEV	Zinc Flag	Cadmium Value	Cadmium STDEV	Cadmium Flag	Lead Value	Lead STDEV	Lead Flag	THg Value	THg STDEV	THg Flag	Units
PS09	5-Dec-16	Pier 3	Bulk-water	0.0	NA	U	94.0	NA		11.2	NA		10.7	NA		0.0	NA	U	0.0	0.0	U	0.0054	0.000		µg/L
			Filtered water (< 0.45 µm)	NA	NA		83.7	2.9		11.3	0.5		6.2	0.5	J	NA	NA		NA	NA		0.0054	0.000		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		N	NA	S	0.0	NA	M<0, µg/L	N	NA	S	NA	NA		NA	NA		N	NA	S	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
NPDES 18	5-Dec-16	Pier 3	Bulk-water	0.0	NA	U	72.0	NA		13.2	NA		31.9	NA		0.0	NA	U	0.0	NA	U	0.0126	0.002		µg/L
			Filtered water (< 0.45 µm)	NA	NA		66.5	NA		13.1	NA		12.6	NA		NA	NA		NA	NA		0.0073	0.001		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		N	NA	S	N	NA	S	N	NA	S	NA	NA		NA	NA		N	NA	S	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
NPDES 19	5-Dec-16	Pier 9	Bulk-water	0.0	NA	U	51.7	NA		7.8	NA		12.9	NA		0.0	NA	U	0.0	NA	U	0.0110	0.001		µg/L
			Filtered water (< 0.45 µm)	NA	NA		45.9	0.5		7.1	0.3		5.1	NA	J	NA	NA		NA	NA		0.0073	0.000		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		N	NA	S	N	NA	S	N	NA	S	NA	NA		NA	NA		N	NA	S	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg

Sampling event 2 March 2017

Calculated aqueous concentrations of metals in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	TFS (mg/L) Value	TFS Flag	Arsenic (µg/L) Value	Arsenic STDEV	Arsenic Flag	Copper (µg/L) Value	Copper STDEV	Copper Flag	Nickel (µg/L) Value	Nickel STDEV	Nickel Flag	Zinc (µg/L) Value	Zinc STDEV	Zinc Flag	Cadmium (µg/L) Value	Cadmium STDEV	Cadmium Flag	Lead (µg/L) Value	Lead STDEV	Lead Flag	THg (µg/L) Value	THg STDEV	THg Flag
PS06	30-Mar-17	Pier 9	Bulk			0.0	NA	U	99.9	6.7		11.8	NA		14.3	NA		0.00	NA	U	0.0	NA	U	0.0053	0.0002	
			Total (>0.45 µm)	N	S	NA	NA		16.5	6.7		1.5	0.1		3.2	NA		NA	NA		NA	NA		0.0018	0.0002	
			<0.45 µm	NA		0.0	NA	U	83.4	0.7		10.3	0.1	J	11.1	NA		0.00	NA	U	0.0	NA	U	0.0035	0.0001	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
PS09	30-Mar-17	Pier 3	Bulk			0.0	NA	U	94.6	7.2		10.0	0.5	J	11.7	NA		0.00	NA	U	0.0	NA	U	0.0047	0.0004	
			Total (>0.45 µm)	N	S	NA	NA		14.7	8.0		0.0	NA	M<0, J	0.6	NA		NA	NA		NA	NA		0.0000	NA	M<0
			<0.45 µm	NA		0.0	NA	U	79.9	3.3		10.1	0.3	J	11.1	NA		0.00	NA	U	0.0	NA	U	0.0050	0.0004	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 18	30-Mar-17	Pier 3	Bulk			0.0	NA	U	78.4	7.6		9.3	0.1	J	38.6	9.8		0.00	NA	U	0.0	NA	U	0.0087	0.0002	
			Total (>0.45 µm)	N	S	NA	NA		0.0	NA	M<0	0.0	NA	M<0, J	5.8	9.8		NA	NA		NA	NA		0.0052	0.0002	
			<0.45 µm	NA		0.0	NA	U	89.9	NA		9.6	NA	J	32.8	NA		0.00	NA	U	0.0	NA	U	0.0035	0.0001	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
NPDES 19	30-Mar-17	Pier 9	Bulk			0.0	NA	U	42.7	1.9		6.8	0.2	J	11.1	NA		0.00	NA	U	0.0	NA	U	0.0086	0.0001	
			Total (>0.45 µm)	N	S	NA	NA		4.7	2.1		0.6	0.2	J	0.0	NA	M<0	NA	NA		NA	NA		0.0034	0.0003	
			<0.45 µm	NA		0.0	NA	U	38.0	0.9		6.2	0.1	J	13.1	NA		0.00	NA	U	0.0	NA	U	0.0052	0.0003	
			0.45-5 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			5-20 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			20-63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
			> 63 µm	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA	
PS096	30-Mar-17	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	Bulk			3.09	0.1		27.7	1.1		7.4	0.5		122.9	4.2		0.39	0.01	J	12.7	0.5		0.0182	0.0048	
			Total (>0.45 µm)	45.4		0.27	0.19		19.4	1.1		5.2	0.5		56.7	4.3		0.14	0.02	J	11.7	0.5		0.0158	0.0048	
			<0.45 µm	NA		2.82	0.2		8.3	0.0		2.2	0.0		66.2	0.6		0.25	0.02		1.0	0.1		0.0024	0.0002	
			0.45-5 µm	0.0	TFS<0	0.00	NA	M<0	3.4	1.1		0.4	0.2		24.4	3.5		0.08	0.02		2.0	0.2		0.0004	0.0003	
			5-20 µm	0.0	TFS<0, ***	0.00	NA	M<0	228.4	8.2	++	2.5	0.3		13.0	5.5		0.21	0.06		113.2	1.7	E, ++	0.0046	0.0004	
			20-63 µm	167.8	***	0.00	NA	M<0	0.0	NA	M<0, ++	1.6	0.3		0.4	54.3		0.49	0.06		0.0	NA	M<0, ++	0.0000	NA	M<0
			> 63 µm	33.1		0.67	0.13		0.0	NA	M<0, ++	0.7	0.6		18.9	54.3		0.00	NA	M<0	0.0	NA	M<0, ++	0.0122	0.0048	
PS081.1	30-Mar-17	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	Bulk			1.71	0.1		19.0	0.4		4.4	0.2		143.5	4.5		0.00	NA	U	3.3	0.1		0.0053	0.0011	
			Total (>0.45 µm)	5.9	LS	0.31	0.06		1.7	0.4		1.6	0.2		34.5	5.3		0.00	NA	M<0, U	1.6	0.2		0.0026	0.0011	
			<0.45 µm	NA		1.40	0.1		17.3	0.3		2.8	0.0		109.0	2.7		0.24	NA		1.7	0.1		0.0027	0.0002	
			0.45-5 µm	1.1	LS	0.01	0.17		0.0	0.9	M<0	0.1	0.2		0.0	NA	M<0	0.00	0.02		0.2	0.1		0.0006	0.0002	
			5-20 µm	4.0	LS	0.00	NA	M<0	59.0	1.3	++	3.0	0.2		36.0	7.3		0.00	NA	M<0, U	34.6	0.6	++	0.0038	0.0007	
			20-63 µm	0.6	LS	1.59	NA		0.0	2.5	M<0, ++	3.9	0.3		3.9	3.6		0.69	0.04		62.5	2.3	++	0.0000	NA	M<0
			> 63 µm	0.3	LS	0.12	NA		0.0	2.4	M<0, ++	0.0	NA	M<0	0.0	NA	M<0	0.00	NA	M<0, U	0.0	NA	M<0, ++	0.0004	0.0011	

Sampling event 2 March 2017

Calculated concentrations of metals on solids in the corresponding size intervals

Location ID	Sampling Date	Description	Size Interval	Arsenic (mg/kg) Value	Arsenic STDEV	Arsenic Flag	Copper (mg/kg) Value	Copper STDEV	Copper Flag	Nickel (mg/kg) Value	Nickel STDEV	Nickel Flag	Zinc (mg/kg) Value	Zinc STDEV	Zinc Flag	Cadmium (mg/kg) Value	Cadmium STDEV	Cadmium Flag	Lead (mg/kg) Value	Lead STDEV	Lead Flag	THg (mg/kg) Value	THg STDEV	THg Flag	Units
PS06	30-Mar-17	Pier 9	Bulk-water	0.0	NA	U	99.9	6.7		11.8	NA		14.3	NA		0.00	NA	U	0.00	NA	U	0.0053	0.000		µg/L
			Filtered water (< 0.45 µm)	0.0	NA	U	83.4	0.7		10.3	0.1	J	11.1	NA		0.00	NA	U	0.00	NA	U	0.0035	0.000		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		N	NA	S	N	NA	S	N	NA	S	NA	NA		NA	NA		N	NA	S	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
PS09	30-Mar-17	Pier 3	Bulk-water	0.0	NA	U	94.6	7.2		10.0	NA	J	11.7	NA		0.00	NA	U	0.00	NA	U	0.0047	0.000		µg/L
			Filtered water (< 0.45 µm)	0.0	NA	U	79.9	3.3		10.1	0.3	J	11.1	NA		0.00	NA	U	0.00	NA	U	0.0050	0.000		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		N	NA	S	0.0	NA	M<0, J	N	NA	S	NA	NA		NA	NA		0.0	NA	M<0	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
NPDES 18	30-Mar-17	Pier 3	Bulk-water	0.0	NA	U	78.4	7.6		9.3	9.8	J	38.6	9.8		0.00	NA	U	0.00	NA	U	0.0087	0.000		µg/L
			Filtered water (< 0.45 µm)	0.0	NA	U	89.9	NA		9.6	NA	J	32.8	NA		0.00	NA	U	0.00	NA	U	0.0035	0.000		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		0.0	NA	µg/L	0.0	NA	M<0, J	N	NA	S	NA	NA		NA	NA		N	NA	S	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
NPDES 19	30-Mar-17	Pier 9	Bulk-water	0.0	NA	U	42.7	1.9		6.8	0.2	J	11.1	NA		0.00	NA	U	0.00	NA	U	0.0086	0.000		µg/L
			Filtered water (< 0.45 µm)	0.0	NA	U	38.0	0.9		6.2	0.1	J	13.1	NA		0.00	NA	U	0.00	NA	U	0.0052	0.000		µg/L
			Total Particulate (> 0.45 µm)	NA	NA		N	NA	S	N	NA	S	0.0	NA	M<0	NA	NA		NA	NA		N	NA	S	mg/kg
			Particulate (0.45 -5 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (5-20 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (20-63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
			Particulate (> 63 µm)	NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		NA	NA		mg/kg
PS096	30-Mar-17	Mid CIA, west of DD4, southeast of Bldg 457 along "N" St	Bulk-water	3.1	0.1		27.7	1.1		7.4	0.5		122.9	4.2		0.39	0.0	J	12.7	0.5		0.0182	0.0048		µg/L
			Filtered water (< 0.45 µm)	2.8	0.2		8.3	0.0		2.2	0.0		66.2	0.6		0.25	0.0		1.0	0.1		0.0024	0.0002		µg/L
			Total Particulate (> 0.45 µm)	5.9	0.0		426.9	0.0		114.9	0.0		1250.3	0.1		3.08	0.0	J	258.2	0.0		0.3483	0.0001		mg/kg
			Particulate (0.45 -5 µm)	0.0	NA	M<0, µg/L	3.4	1.1	µg/L	0.4	0.2	µg/L	24.4	3.5	µg/L	0.08	0.0	µg/L	2.0	0.2	µg/L	0.0004	0.0003	µg/L	mg/kg
			Particulate (5-20 µm)	0.0	NA	M<0, µg/L, ***	228.4	8.2	µg/L, ***, ++	2.5	0.3	µg/L, ***	13.0	5.5	µg/L, ***	0.21	0.1	µg/L, ***	113.2	1.7	µg/L, ***, E, ++	0.0046	0.0004	µg/L, ***	mg/kg
			Particulate (20-63 µm)	0.0	NA	M<0, ***	0.0	NA	M<0, ***, ++	9.7	0.0	***	2.1	0.3	***	2.91	0.0	***	0.0	NA	M<0, ***, ++	0.0000	NA	M<0, ***	mg/kg
			Particulate (> 63 µm)	20.1	0.0		0.0	NA	M<0, ++	21.2	0.0		572.0	1.6		0.00	NA	M<0	0.0	NA	M<0, ++	0.3702	0.0001		mg/kg
PS081.1	30-Mar-17	West CIA, NE of DD6 and NW of Pier 9, south side of Bldg 462	Bulk-water	1.7	NA		19.0	0.4		4.4	0.2		143.5	4.5		0.00	NA	U	3.3	0.1		0.0053	0.0011		µg/L
			Filtered water (< 0.45 µm)	1.4	0.1		17.3	0.3		2.8	0.0		109.0	2.7		0.24	NA		1.7	0.1		0.0027	0.0002		µg/L
			Total Particulate (> 0.45 µm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	0.00	NA	M<0, U	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (0.45 -5 µm)	NA	NA	LS	0.0	0.9	M<0	NA	NA	LS	0.0	NA	M<0	NA	NA	LS	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (5-20 µm)	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	0.00	NA	M<0, U	NA	NA	LS	NA	NA	LS	mg/kg
			Particulate (20-63 µm)	NA	NA	LS	0.0	NA	M<0, ++	NA	NA	LS	NA	NA	LS	NA	NA	LS	NA	NA	LS	0.0000	NA	M<0	mg/kg
			Particulate (> 63 µm)	NA	NA	LS	0.0	NA	M<0, ++	0.0	NA	M<0	0.0	NA	M<0	0.00	NA	M<0, U	0.0	NA	M<0, ++	NA	NA	LS	mg/kg

Flags	Description
TFS<0	Calculation of TFS in the solid fraction returned a negative value
N	Not calculated. Due to salinity there is low confidence on the calculated value.
NA	Not available
S	Salt interference in the solid concentration (>20%)
M<0	Calculation returned a negative metal value
LS	Low solids, the solid concentration in the size interval is less than 10mg/L
J	The reported value was obtained from a reading that was less than the lowest calibration point but greater than or equal to the MDL.
U	The reading value was less than the MDL.
R	The reading value had conc. RSD>100%.
E	The reading value exceeded the highest calibration point.
***	Big particle in the >20um fraction that skewed the result.
++	Potential contamination in the fractions >20,>63um that may affect the result (applies for Pb aU Cu only).

Calibration range for PSNS	
For Hg	25-2,500 pg
For As	1-100 µg/L
For Cu	1-500 µg/L
For Ni	1-500 µg/L
For Zn	1-500 µg/L
For Cd	0.2-50 µg/L
For Pb	0.5-50 µg/L

MDL	Value	Unit
Hg	5.23	pg
As	0.48	µg/L
Cu	0.08	µg/L
Ni	0.09	µg/L
Zn	0.53	µg/L
Cd	0.17	µg/L
Pb	0.04	µg/L

Equations involved in the calculation of metal concentrations on solids in the corresponding size intervals:

Total (>0.45µm)

$$C_{>0.45\mu m} = \frac{C_{Bulk} - C_{<0.45\mu m}\,(\frac{\mu g}{L})}{TFS_{>0.45um}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(>0.45)\mu m} = \frac{\sqrt{(Stdev_{Bulk})^2 + (Stdev_{<0.45\mu m})^2}}{TFS_{>0.45\mu m}}$$

0.45-5µm

$$C_{0.45-5\mu m} = \frac{C_{<5\mu m} - C_{<0.45\mu m}\,(\frac{\mu g}{L})}{TFS_{>0.45um} - TFS_{>5\mu m}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(0.45-5)\mu m} = \frac{\sqrt{(Stdev_{<5\mu m})^2 + (Stdev_{<0.45\mu m})^2}}{TFS_{>0.45\mu m} - TFS_{>5\mu m}}$$

5-20µm

$$C_{5-20\mu m} = \frac{C_{<20\mu m} - C_{<5\mu m}\,(\frac{\mu g}{L})}{TFS_{>5um} - TFS_{>20\mu m}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(5-20)\mu m} = \frac{\sqrt{(Stdev_{<20\mu m})^2 + (Stdev_{<5\mu m})^2}}{TFS_{>5\mu m} - TFS_{>20\mu m}}$$

20-63µm

$$C_{20-63\mu m} = \frac{C_{<63\mu m} - C_{<20\mu m}\,(\frac{\mu g}{L})}{TFS_{>20um} - TFS_{>63\mu m}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

$$Stdev_{(20-63)\mu m} = \frac{\sqrt{(Stdev_{<63\mu m})^2 + (Stdev_{<20\mu m})^2}}{TFS_{>20\mu m} - TFS_{>63\mu m}}$$

>63µm

$$C_{>63\mu m} = \frac{C_{Bulk} - C_{<63\mu m}\,(\frac{\mu g}{L})}{TFS_{>63um}(\frac{mg}{L})} * 1000\,\frac{mg}{g} = \frac{\mu g}{g} = \frac{mg}{kg}$$

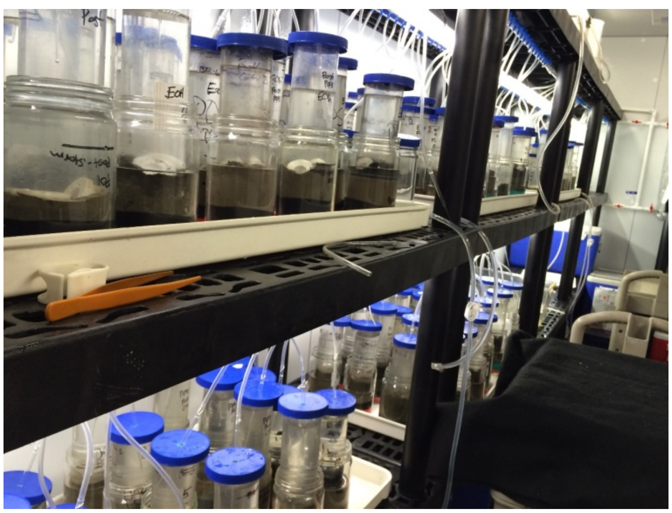
$$Stdev_{(>63)\mu m} = \frac{\sqrt{(Stdev_{Bulk})^2 + (Stdev_{<63\mu m})^2}}{TFS_{>63\mu m}}$$

APPENDIX II

Assessment and Management of Stormwater Impacts on Sediment Recontamination

SPAWAR Report

SERDP Project: ER-2428



October 2017

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ACRONYMS

ASTM	American Society for Testing and Materials
CWA	Clean Water Act
DGT	Diffusive Gradients in Thin Film
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DoD	Department of Defense
EPA	Environmental Protection Agency
ESTCP	Environmental Security Technology Certification Program
FSW	Filtered Seawater
GPS	Global Positioning System
HDPE	High density polyethylene
IMF	Intermediate Maintenance Facility
MLLW	Mean Lower Low Water
NBSD	Naval Base San Diego
NPDES	National Pollutant Discharge Elimination System
OF	Outfall
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PSD	Passive Sampling Device
RPM	Revolutions Per Minute
SEA Ring	Sediment Ecotoxicity Assessment Ring
SEAP	Sediment Ecosystem Assessment Protocol
SERDP	Strategic Environmental Research and Development Program
SOP	Standard Operating Procedure
SSC Pac	Space and Naval Warfare Systems Center Pacific
SPME	Solid Phase Microextraction
SWI	Sediment-Water Interface
TM	Trace Metal
USEPA	United States Environmental Protection Agency
WC	Water Column

1. INTRODUCTION

This study addressed SERDP Statement of Need (SON) ERSON-14-03, "Improved Understanding of the Impact of Ongoing, Low Level Contaminant Influx to Aquatic Sediment Site Restoration". Our goal was to examine such impacts primarily in San Diego Bay at the confluence between Paleta Creek (an urban watershed) and San Diego Bay. This convergence is critical to the DoD because of potential upstream urban impacts on sediments that are of potential responsibility to the Navy, specifically those located at the mouth of the creek at Naval Base San Diego. A number of innovative tools were identified and used in this project to examine wet and dry season creek inputs and receiving water impacts to address the SON. A subset of these tools was employed at Puget Sound Naval Shipyard. The work conducted directly addressed the SON by characterizing episodic stormwater inputs and their effects on adjacent sediments.

1.1. OBJECTIVE

The goal of this project was to develop, test and assess the effectiveness of a comprehensive set of laboratory, field, and modeling approaches in characterizing the role of urban stormwater in contamination of sediments and remediated sites. The research focused on the development and application of techniques to assess the magnitude and characteristics of episodic distributed sources (i.e., stormwater) and the effects of these sources on sediments and benthos. The work considered baseline conditions, loads of stormwater contaminants, relationship to other potential sources of sediment contamination, and the potential for recontamination following remediation. The bulk chemical contamination was integrated with site-specific bioavailability, the potential for bioaccumulation, and identification of key stressors and ecological risk of stormwater and stormwater–related sediment contaminants. This provided the foundation for a decision-making framework for identifying stormwater sources and their consequences, designing effective source controls, and identifying the remedial goals realistically achievable without such controls.

The study efforts were conducted in four coupled and integrated phases:

1. Stormwater loading assessment by direct sampling
2. Stormwater modeling to predict stormwater loading over time
3. Receiving waters assessment to link stormwater loads to sediment recontamination
4. Receiving water modeling to link stormwater load modeling with sediment recontamination

1.2. BACKGROUND

Cleanup at contaminated sediment sites has often been initiated before background sources have been fully identified, quantified and/or controlled. Under such conditions, remediated sites have become recontaminated by continued inputs from off-site sources, including permitted discharges, transport from upstream areas, or from stormwater discharges. Stormwater sources are particularly difficult to understand and manage because of the generally poor characterization of the irregular, event-driven inputs from such sources and the difficulty of managing diffuse sources of large volumes of runoff. DoD policy is that off-site sources must be identified and controlled prior to implementing cleanup, but the tools available to quantify event-driven irregular sources and their characteristics are limited, as is the ability to relate those sources to resulting chemical and biological impacts in sediments. As noted by the statement of need "this requires better scientific and technical capabilities to understand releases from these sources and how these source levels relate to potential recontamination of the sediment bed." This calls specifically for studies providing better characterization of the sources (i.e. the low-level intermittent sources associated with events, including how these sources are affected by drainage systems) and the potential chemical and biological effects in the sediment sinks. These methodologies can then be integrated with models to identify impacts on remedies and, specifically, to identify the resilience of proposed and/or implemented remedies.

1.3. SITE DESCRIPTIONS

Two demonstration sites, Naval Base San Diego and Puget Sound Naval Shipyard, were evaluated. Their history, hydrological conditions and contaminant distributions are described below.

1.3.1. *NAVAL BASE SAN DIEGO*

The mouth of Paleta Creek site is located on the eastern shoreline in the central portion of San Diego Bay and flows directly through Naval Base San Diego (Figure 1-1). The creek mouth emerges into the bay in a relatively constricted channel area termed the "inner creek mouth" which then expands into a broader area bounded to the north by Pier 8 and to the south by the Mole Pier termed the "outer creek mouth". The TMDL project area incorporates both the inner and outer creek mouth areas with an estimated impaired area of 9 acres as estimated on the 303(d) List of Water Quality Limited Segments (SDRWQCB 2009), and an overall study area of approximately 64.5 acres (SCCWRP and SPAWAR 2005).

Paleta Creek itself is a channelized urban/industrial creek with the highest flow rates associated with flashy winter storm events and low and highly variable dry weather flows for the rest of year. Extended periods with no surface flows occur during dry weather and particularly during drought conditions. The watershed encompasses approximately 2,161 acres in the Pueblo San Diego hydrologic unit including portions of the cities of San Diego and National City and a small portion of the tidelands immediately adjacent to San Diego Bay under the jurisdiction of the U.S. Navy. The watershed is highly urbanized with land uses dominated by residential, with some commercial and military uses. A significant portion of the remaining watershed area is dominated by roadways. The State Water Board identified the 7th Street Channel/Paleta Creek as a high priority candidate toxic hot spot due to repeat amphipod sediment toxicity findings and the presence of multiple degraded benthic communities in the Consolidated Toxic Hotspots Cleanup Plan (SDRWQCB 1999).

Toxicity and chemistry of wet weather runoff have been routinely measured in outfalls and receiving water off NBSD for compliance with NPDES storm water discharge permits. Copper and zinc frequently exceed benchmark concentrations for the protection of aquatic life in storm water samples from NBSD and have been found to cause acute toxicity to the mysid shrimp *Americamysis bahia* in end-of-pipe storm water samples using Toxicity Identification Evaluation (TIE) procedures (Katz et al. 2006).

Many areas of San Diego Bay's shoreline have been listed as impaired water bodies under Clean Water Act (CWA) 303[d] by the State Water Resources Control Board (SWRCB) due to identified pollutants. The most recent list was approved by the USEPA in June 2007. Pollutants include bacteria, pesticides, heavy metals, and organic compounds while areas of concern continue to be marinas, shipyards, and outlets of creeks. As a result of these listings, the Regional and State Water Boards are required to prepare a TMDL technical report and action plan for each site and pollutant. Five sites were considered to be "toxic hot spots" in San Diego Bay due to multiple pollutants and toxic effects that require immediate clean-up (Seventh St. Channel, Paleta Creek, Naval Station San Diego, B Street/Broadway Piers, and the Downtown Anchorage).

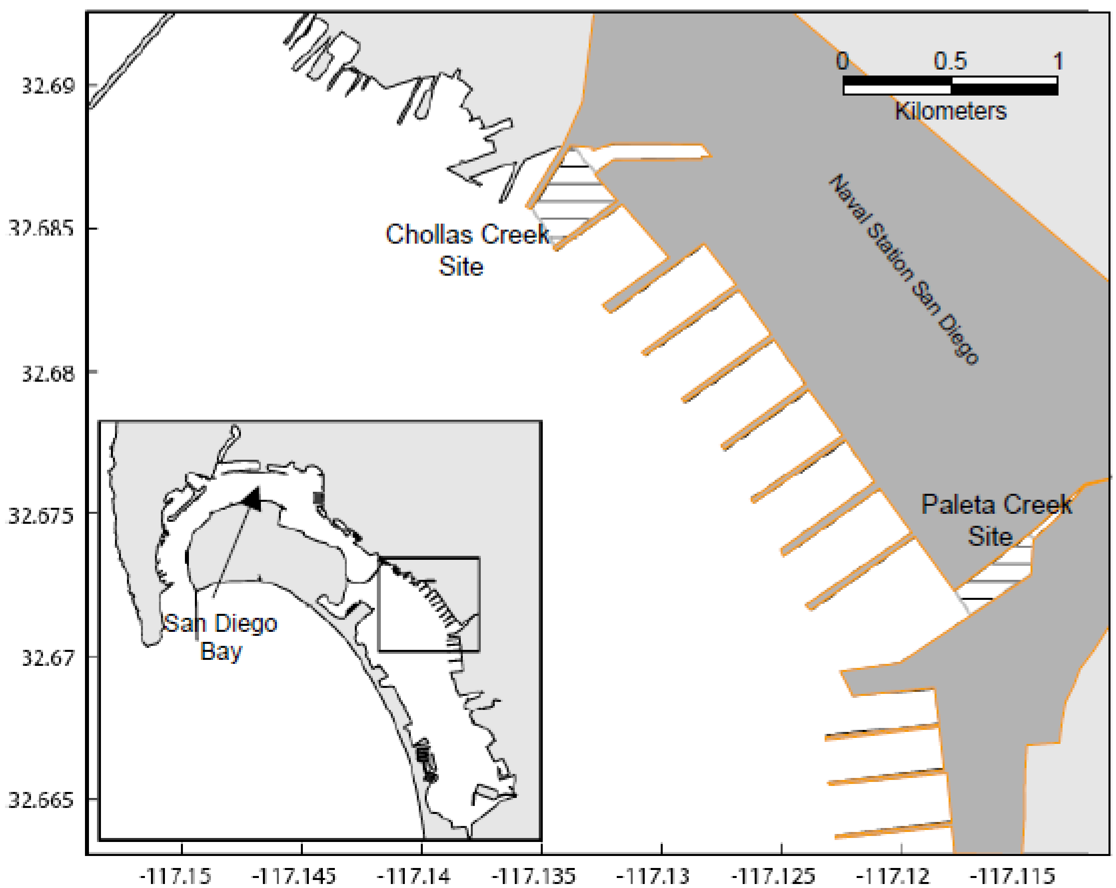


Figure 1-1. Naval Base San Diego and vicinity.

1.3.2. *PUGET SOUND NAVAL SHIPYARD*

One of the sites selected for collection of sediment, stormwater, effluent discharges and ambient was in the Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS&IMF) which are part of the Bremerton Naval Complex (BNC; Bremerton, WA). PSNS has six dry docks, eight piers and moorings, and numerous industrial shops to support the industrial operations (Figure 1-2). The complex covers approximately 350 acres of land and an additional 340 acres of tidelands along 11,000 feet of shoreline and contains over 300 buildings and structures consisting of industrial, supply and base facilities, a steam plant, six dry docks, piers and numerous moorings. The predominant land cover within the Shipyard is rooftops, paved areas (roads, parking areas, sidewalks, and concrete working areas), and piers.

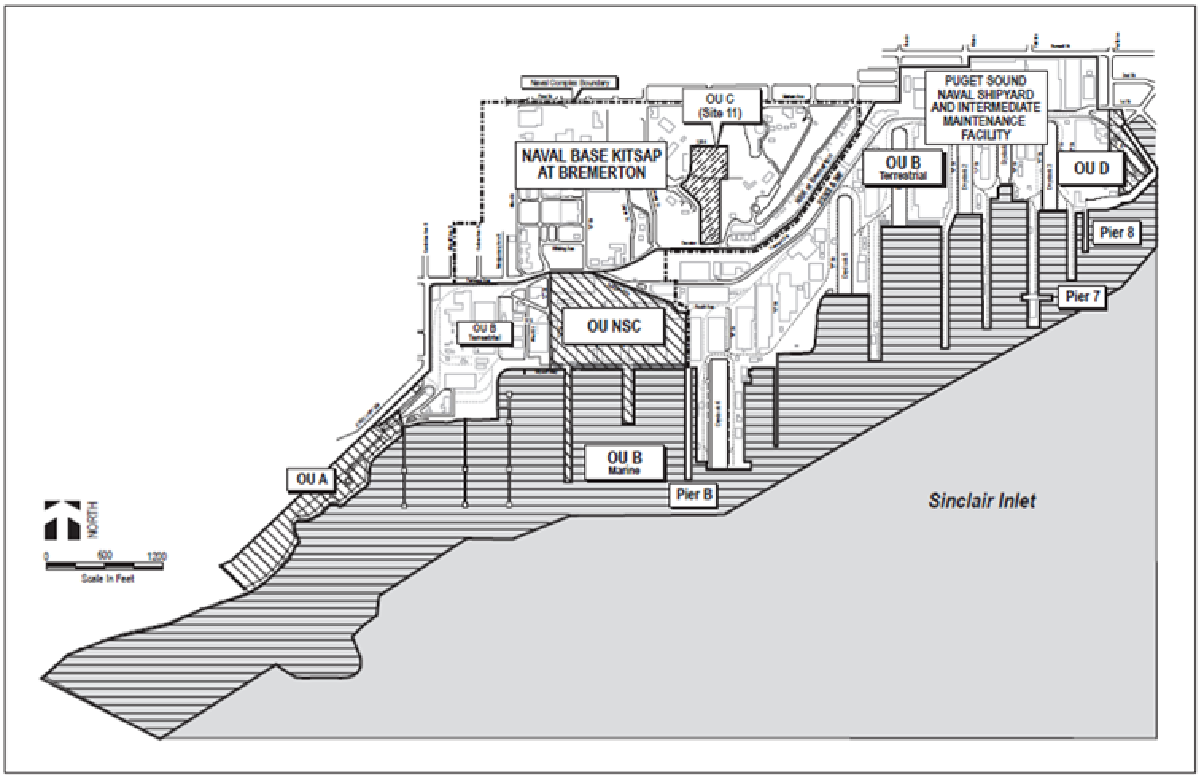


Figure 1-2. Bremerton Naval Complex Operable Units (Kirtay et al. 2016).

The stormwater system draining the BNC includes over 150 storm drainage systems with more than 1,000 catch basins and track drains leading to the Sinclair Inlet (Brandenberger et al. 2012). As reported by Brandenberger et al. (2012), industrial and municipal stormwater runoff contains a broad variety of pollutants whose concentrations can vary widely depending on storm event size and other local and regional factors. Stormwater runoff from non-dry dock locations within the BNC all drain directly into the adjacent receiving environment and many of these drainage locations are also tidally influenced. Discharge of stormwater from Shipyard operations is permitted by the USEPA Region 10 under the CWA (NPDES permit WA-00206-2, 1994). Under the NPDES program, the Shipyard is required to implement Best Management Practices (BMPs) designed to reduce, treat, and control discharges of contaminants from operations to the adjacent receiving environment.

2. MATERIALS AND METHODS

This section provides the detailed description of the experimental design, sampling and analytical methods used to characterize the role of urban stormwater in contamination of sediments and remediated sites for two different sites and types of hydrological environments. Figure 2-1 below shows graphically when field efforts took place at Paleta Creek, Naval Base San Diego (NBSD), CA in relation to precipitation events.

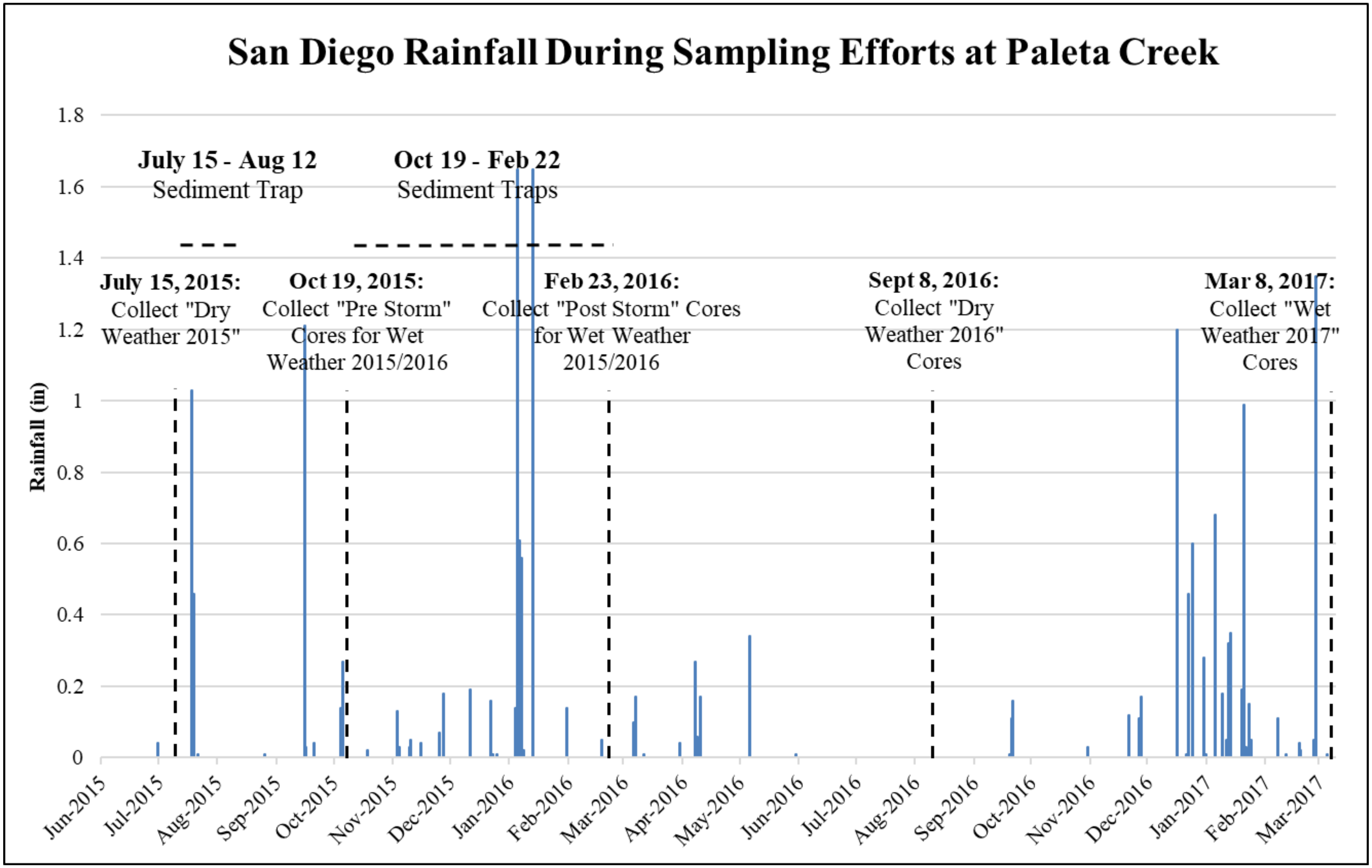


Figure 2-1. San Diego rainfall observed during field sampling efforts at Paleta Creek.

2.1. SEDIMENT COLLECTIONS

2.1.1. *2014 DRY WEATHER – NBSD*

On 29-Oct-2014, 6-Nov and 7-Nov-2014, sediment samples were collected from five compartments representing potential contaminant sources (e.g. compartments 1, 2 & 3) and receiving environments (e.g. compartments 4 & 5; Figure 2-2). Compartments 1 through 5 were designated as Upstream, Tidal Creek, Conveyance System, Inner Creek and Outer Creek, respectively. Sample collection info is shown below in Table 2-1.

Sediment samples were collected either by hand or by petite ponar into ziplock bags by SSC Pac personnel. Samples from a given compartment were then equally composited, thoroughly homogenized and then 500g portions of the homogenized samples were evaluated for physical/chemical analysis and bioassay analysis each. Remaining sediment volume underwent further grain size processing to generate the following fractions: 0-20µm, 20-63µm, <63µm, and >63µm. The resulting size fractioned portions were evaluated for physical/chemical analysis and bioassay analyses along with the unaltered, homogenized samples. Samples were stored in a refrigerator at >0 to 4°C until used.

Total and dissolved metal analysis and bioassay evaluations were conducted at SSC Pacific. Metals in sediments were analyzed by ERDC using EPA 6000/7000 series methods. Mercury was analyzed by EPA method 7474, Iron was analyzed by method SW 846/6010, and Aluminum, Cadmium, Copper, Lead and Zinc were analyzed by method SW 846/6020. Remaining analyses (i.e. grain size, total organic carbon (TOC), metals, organics) were conducted by Texas Tech University (TTU).

Figure 2-2. 2014 Dry weather sampling sites within the five sampling compartments of Paleta Creek watershed and receiving environment. Upstream sample – purple; Tidal Creek – blue; Conveyance system – light blue; Inner Creek – green; Outer Creek – yellow.

Table 2-1. 2014 Dry Weather Sediment Collection Times and Locations.

Location Designation	Sample ID	Collection Date	Collection Time	Latitude	Longitude
Upstream	US-1	5-Nov-2014	11:00	32.68575	-117.10207
	US-1A	6-Nov-2014	10:45	32.68575	-117.10207
Tidal Creek	TC-A	6-Nov-2014	14:47	32.68085	-117.11255
	TC-B		12:53	32.68018	-117.11222
	TC-C		13:08	32.67893	-117.11180
	TC-D		13:21	32.67942	-117.11195
	TC-E		13:54	32.67792	-117.11135
	TC-F		14:04	32.67753	-117.11125
	TC-G		14:17	32.67712	-117.11103
	TC-H		14:26	32.67658	-117.11162
	TC-I		14:46	32.67592	-117.11385
	TC-J		14:54	32.67528	-117.11468
Conveyance System	NS-27	5-Nov-2014	13:50	32.67492	-117.11538
	NS-27	6-Nov-2014	11:06	32.67492	-117.11538
Inner Creek	P09	29-Oct-2014	10:39	32.67248	-117.11860
	P10		11:00	32.67187	-117.11843
	P11		11:05	32.67265	-117.11822
	P12		11:12	32.67222	-117.11768
	P13		11:21	32.67308	-117.11729
	P14		11:57	32.67267	-117.11702
	P15		11:47	32.67338	-117.11673
	P16		11:33	32.67308	-117.11642
	P17		11:41	32.67378	-117.11605
Outer Creek	P01	29-Oct-2014	9:47	32.67170	-117.12395
	P02		9:56	32.67082	-117.12363
	P03		10:05	32.67245	-117.12230
	P04		10:09	32.67155	-117.12163
	P05		10:13	32.67085	-117.12120
	P06		10:22	32.67330	-117.12067
	P07		10:30	32.67235	-117.11995
	P08		10:36	32.67165	-117.11955

2.1.2. *2015/2016 Dry & Wet Weather – NBSD*

Sediment sample collections occurred throughout the dry and wet weather seasons starting in July-2015 through Feb-2016. Sampling locations and dates are described in Table 2-2 and Table 2-3. For all sampling events, intact sediment cores were hand-collected by SCUBA divers (Figure 2-3). Once the research vessel (R/V) Ecos arrived on station, GPS was used to mark the stations with a surface float with attached weight. Divers then descended and pushed a core liner into the sediment approximately 5” and then carefully capped the core on both sides. Once at the surface, cores were decanted of overlying water and the caps secured with electrical tape (Figure 2-3). Cores were then placed in a cooler with blue ice until transport to the SSC Bioassay Laboratory for processing.

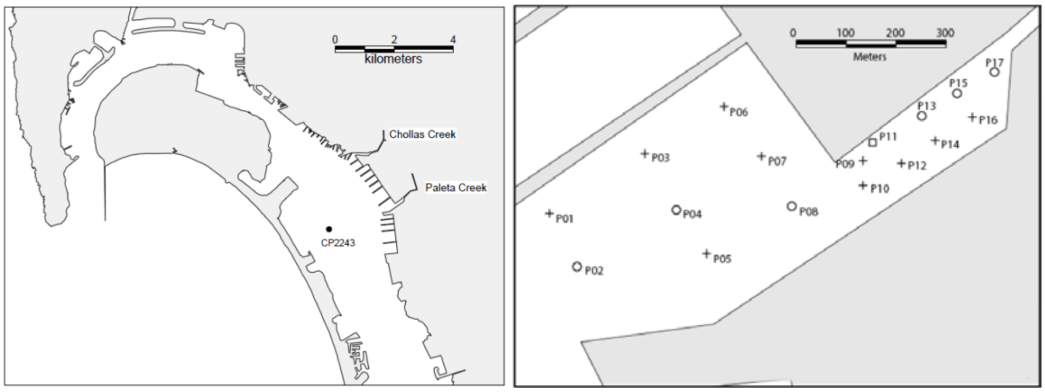


Figure 2-3. 2015/2016 Dry and Wet weather sampling sites, reference station, CP2243 (left), and Paleta Creek stations at NBSD (right).

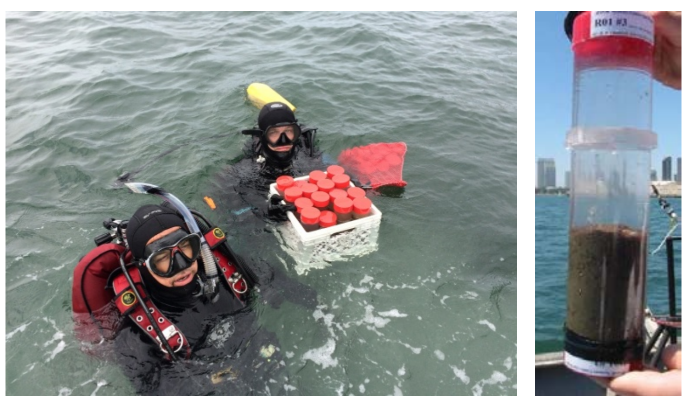


Figure 2-4. Divers returning to surface with hand-collected cores (left); example of diver collected intact sediment core (right).

Table 2-2. 2015 Dry Weather Sediment Collection Times and Locations – NBSD.

Location Designation	Sample ID	Collection Date	Collection Time	Latitude	Longitude
Reference Station	CP2243	16-Jul-2015	16:15	32.72238	-117.20919
Inner Creek	P11	16-Jul-2015	10:55	32.67265	-117.11822
	P17	16-Jul-2015	14:00	32.67378	-117.11605

Table 2-3. 2015/2016 Wet Weather Sediment Collection Times and Locations – NBSD.

Sampling Season	Location Designation	Sample ID	Collection Date	Collection Time	Latitude	Longitude
Pre-storm	Inner Creek	P11	19-Oct-2015	09:30	32.67265	-117.11822
		P17		07:24	32.67378	-117.11605
	Outer Creek	P01		11:30	32.67170	-117.12395
		P08		10:15	32.67165	-117.11955
Post-storm	Inner Creek	P11	23-Feb-2016	13:55	32.67265	-117.11822
		P17		12:30	32.67378	-117.11605
	Outer Creek	P01		09:45	32.67170	-117.12395
		P08		15:05	32.67165	-117.11955

2.1.3. *2016/2017 Dry & Wet Weather – NBSD*

Sediment sampling was conducted on 8-Sep-2016 to represent a second "Dry Weather" or pre-storm sampling event. Additionally, sediment sampling was conducted on 9-Mar-2017 to represent a second "Wet Weather" or post-storm season sampling event. For both events, sediment samples were collected with a Van Veen grab sampler, and from within the sample, several intact cores were sub-sampled (Figure 2-5). Multiple core samples were collected with the Van Veen grab from each station to obtain sufficient material to collect intact cores. The sediment sampler was rinsed thoroughly between stations to avoid cross-contamination, and sediment touching the sampler itself was avoided. Sampling dates and times are shown in Table 2-4.

Figure 2-5. Collection of intact cores from box-core collected sediment samples.

Table 2-4. 2016/2017 Dry & Wet Weather Sediment Collection Times and Locations.

Sampling Season	Location Designation	Sample ID	Collection Date	Collection Time	Latitude	Longitude
Pre-storm	Inner Creek	P11	8-Sep-2016	10:45	32.67265	-117.11822
		P17		09:55	32.67378	-117.11605
	Outer Creek	P01		12:28	32.67170	-117.12395
		P08		11:28	32.67165	-117.11955
Post-storm	Inner Creek	P11	9-Mar-2017	10:40	32.67265	-117.11822
		P17		11:15	32.67378	-117.11605
	Outer Creek	P01		09:30	32.67170	-117.12395
		P08		10:10	32.67165	-117.11955

2.1.4. *2016/2017 DRY & WET WEATHER – PSNS*

Sediment sampling was conducted on 5-Dec-2016 and 30-Mar-2017. Sampling locations are shown in Figure 2-6 and sample collection dates and times are shown in Table 2-5. For the first event, sediment grab samples were collected with a petite Ponar grab sampler and sub-sampled into six 500 mL glass jars for each station. For the second event, divers collected grab samples adjacent to pre-deployed sediment traps into two 1L glass jars. The sediment sampler was rinsed thoroughly between stations to avoid cross-contamination. Sampling dates and times are shown in Table 2-4. Sample jars were wrapped, carefully packed and shipped on ice to TTU for further processing and analysis.

Figure 2-6. PSNS&IMF sampling locations PS06 & PS09 (sediment and water samples) and the adjacent outfalls (OF19 & OF18) that were monitored Dec-2016 through Mar-2017 (circled in red).

Table 2-5. 2016/2017 Dry & Wet Weather Sediment Collection Times and Locations – PSNS.

Sampling Season	Sample ID	Collection Date	Collection Time
Pre-storm	PS06	5-Dec-2016	14:45
	PS09		13:35
Post-storm	PS06-1	30-Mar-2017	14:45
	PS06-2		15:16
	PS06-3		15:00
	PS09-1		16:02
	PS09-2		15:55
	PS09-3		16:05

2.2. STORMWATER & AMBIENT WATER COLLECTIONS

2.2.1. *NAVAL BASE SAN DIEGO*

Stormwater sampling occurred at 6 different locations within the Paleta Creek Watershed during the 2015/2016 wet season. These locations were selected to provide data to inform quantitative models, as described in the introductory section, to reflect a range of land use and discharge conditions, and represent areas that have been identified during previous sampling efforts as hot spots for pollutants of concern (POCs). The sample locations are described below and shown in Figure 2-7:

- Creek Location #1 (C2W; Paleta Creek at Main Street): This location is reflective of the Creek upstream of tidal influence and is upstream of NBSD outfall discharges.
- Creek Location #2 (C1W; Paleta Creek at Cummings Road): This location is within the tidal portion of the Creek and is representative of the entire watershed.
- Storm drain Outfall #1 (O1W; NBSD outfall #23): This outfall discharge is representative of stormwater runoff from industrial areas on the west side of NBSD.
- Storm drain Outfall #2 (O2W; NBSD outfall #33): This outfall discharge is representative of stormwater runoff from industrial areas on the east side of NBSD which has been shown to have high copper and zinc concentrations during previous sampling activities.
- Storm drain Outfall #3 (O3W; NBSD outfall north of railroad crossing): This outfall discharge is representative of a large, central, mixed used portion of the NBSD facility, including residential areas, parking, and an autoshop.
- Storm drain Outfall #4 (O4W; NBSD outfall at Paunack and Division Streets): This outfall discharge is representative of a large, central, mixed use portion of the NBSD facility, including apartment buildings, activity fields, and parking lots.

Stormwater samples were collected by Geosyntec personnel using American Sigma 900 and ISCO 6712 autosamplers installed at each monitoring location on 5-Jan-2016 and on 31-Jan-2016. Samples collection dates and times are shown in Table 2-6. For the 31-Jan-2016 stormwater sampling effort, less rain was observed than predicted, so autosamplers remained in place for approximately an additional 24hrs in order to obtain sufficient volume for toxicological and analytical analyses. Sample O3W was not collected during the 31-Jan-2016 monitoring event.

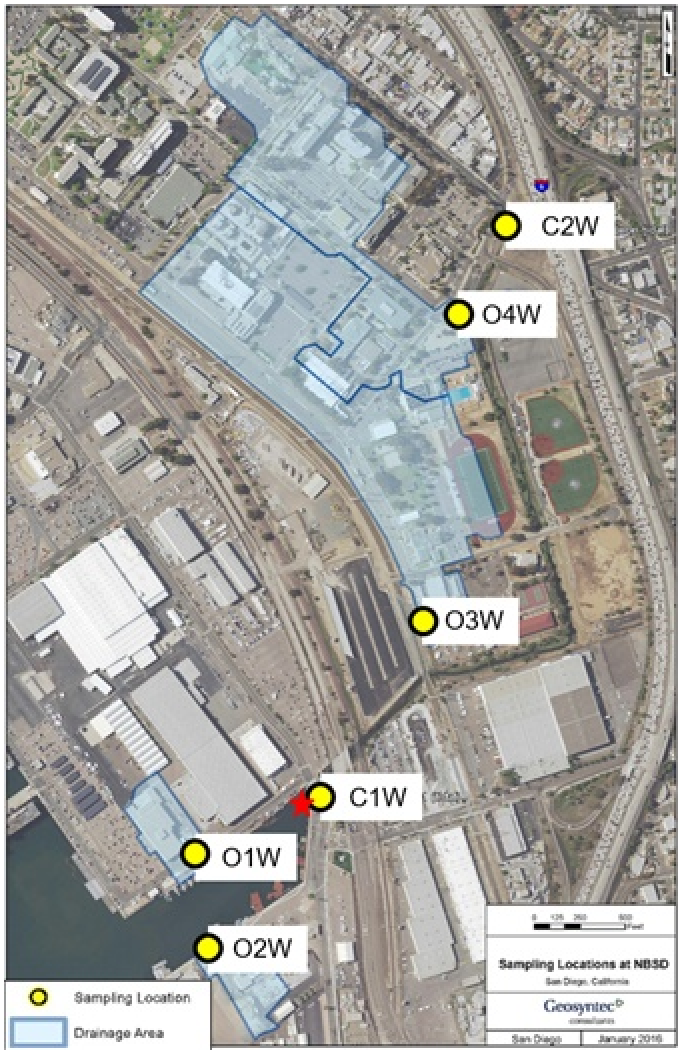


Figure 2-7. Paleta Creek watershed stormwater sampling locations. Red star indicates ambient sampling location.

Additionally, ambient water grab samples were collected at the mouth of Paleta Creek (Figure 2-7). An aliquot of each sample was taken for toxicity exposures and the remainder of the samples was processed as described below.

Table 2-6. Jan-2016 Stormwater Collection Times and Locations – NBSD.

Storm Event	Sample ID	Collection Date	Collection Time
First Storm Event 5/6-Jan-2016	A1 "First Flush"	5-Jan-2016	13:27
	A2	5-Jan-2016	19:47
	A3	6-Jan-2016	03:33
	C1	6-Jan-2016	08:30
	C2	7-Jan-2016	11:10
	O1	7-Jan-2016	09:42
	O2	7-Jan-2016	08:45
	O3	7-Jan-2016	11:50
	O4	6-Jan-2016	11:04
Second Storm Event 31-Jan-2016	A1 "First Flush"	31-Jan-2016	09:00
	A2	31-Jan-2016	15:00
	C1	1-Feb-2016	09:05
	C2	1-Feb-2016	07:35
	O1	Not Collected	
	O2	1-Feb-2016	09:25
	O3	Not Collected	
	O4	1-Feb-2016	08:20

Samples were collected in 10L pre-cleaned glass jars and transferred to the SSC Pac Bioassay Laboratory. For the 5-Jan-2016 event, a single 10L glass bottle was collected. However, it was determined that more sample volume was required for analyses, so an additional 10L glass bottle was collected for the 31-Jan-2016 sampling event. Once samples were collected, bottles were wrapped carefully and transported by Geosyntec personnel to the SSC Bioassay Laboratory. Ambient samples were collected by SSC Pac personnel. Composited samples from each event were split by SSC Pac personnel using a Teflon™ Dekaport splitter. The sample splitting process is illustrated in Figure 2-8. An aliquot of approximately 100mL was retained from each sample prior to sample splitting for toxicity evaluation as described in section 2.4.3. Briefly, the Dekaport splitter was placed level on the laboratory workbench. The Dekaport was rinsed a minimum of 3 times with Milli-Q DI water. Two analytical blank samples were collected by pouring Milli-Q DI water through the sampler into a HDPE and an Amber glass bottle. Next, 7 Amber glass and 3 HDPE bottles were placed under the Dekaport and 10L of thoroughly mixed stormwater sample was poured into the Dekaport. Samples were poured through a 0.5mm sieve to remove debris and were poured at rate that would allow for constant pressure and thus consistent flow through all the tubing of the Dekaport. All 7 Amber glass bottles and one HDPE bottle were capped and placed in two plastic Ziploc. The remaining 2 HDPE bottles were then passed through the Dekaport again (approximately 2L of sample) into 5 HDPE bottles; each of which would receive approximately 400mL. These bottles were then capped and placed in two plastic Ziploc bags. For the second stormwater collection event where 20L were collected, these methods were duplicated for the additional 10L of sample volume that was collected. The Dekaport was thoroughly rinsed with Milli-Q DI water between samples. All bottles were shipped on ice to TTU for further processing and analytical measurements.

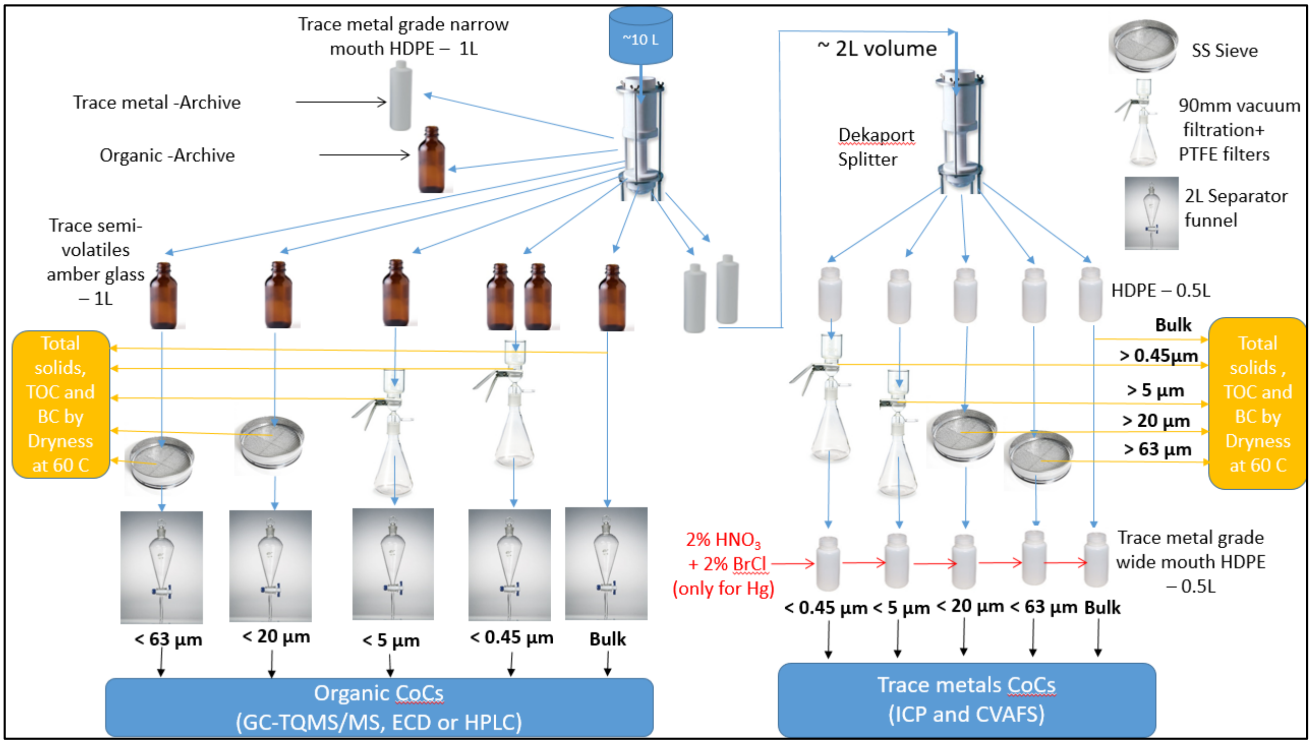


Figure 2-8. Composite sample splitting schematic for stormwater samples collected Jan-2016.

2.2.2. *PUGET SOUND NAVAL SHIPYARD*

Water samples were collected from two locations at PSNS&IMF (Figure 2-6). Two dry dock discharge samples, OF18AB and OF19, and adjacent receiving waters, PS09 and PS06, respectively, were collected 6-Dec-2016 and 30-Mar-2017 (Table 2-7). Dry dock effluent samples were collected by autosamplers with approximately 10L of sample sent to TTU for processing and analysis and 10L of sample used for toxicity and other analyses as part of the ENVironmental InVESTment (ENVVEST) Ambient Monitoring Program. Ambient samples were collected from approximately 1m depth with a pole collection device fitted with a 1L glass bottle. Multiple grabs with the bottle were necessary to collect the required 10L volume for processing and toxicity evaluations. Additionally, on 29-Mar-2017, two stormwater samples were collected from stations PS096 and PS081.1 using a pump to collect the required 10L of sample into the glass jars. Toxicity samples were hand couriered to the SSC Pac Bioassay Laboratory in San Diego, CA.

Table 2-7. 2016/2017 Effluent and Ambient Water Collection Times and Locations – PSNS.

Sampling Season	Sample ID	Collection Date	Collection Time
Pre-storm	OF18AB	6-Dec-2016	10:16
	OF19		11:51
	PS06		14:12
	PS09		09:31
Post-storm	OF18AB	30-Mar-2017	08:45
	OF19		10:29
	PS06		11:58
	PS09		12:28
Stormwater	PS096	29-Mar-2017	NR
	PS081.1		NR

NR – Not Recorded

2.3. ***IN SITU* STUDIES**

2.3.1. *SEDIMENT TRAP DEPLOYMENTS*

Sediment traps were deployed at Paleta Creek, NBSD during the Dry and Wet Weather seasons. For the Dry Weather deployment, single standard cylindrical sediment traps were deployed at stations, P11 and P17, from 16-Jul-2015 to 12-Aug-2015. For the Wet Weather deployment, three standard cylindrical sediment traps were deployed at stations, P01, P08, P11 and P17, from 19-Oct-2015 through 23-Feb-2016. For the Wet Weather deployment, traps were bound together in a set of 3 with large hose clamps (Figure 2-9).

Each sediment trap was prefilled with hyper-saline brine and topped off with ambient seawater. Traps were capped and lowered into the water to divers whom secured the traps to pre-deployed posts on the sediment surface. Once dive activities were completed, divers carefully removed caps from each sediment trap. Sediment traps were capped when any diving related activities occurred on station to avoid potential deposition from those efforts. At the termination of sediment trap deployment period, divers placed caps back on the traps and recovered and transferred to the surface crew with the assistance of a boat-mounted davit (Figure 2-9). Traps were transported back to the SSC Pac laboratory and allowed to settle. Once trap material sufficiently settled, overlying water was removed and the remaining material was collected for further processing (i.e. physical, chemical or bioassay analysis). For the Wet Weather deployment, all three traps at a given location were combined prior to analysis.

Figure 2-9. Bundled sediment traps were deployed at Paleta Creek to ensure sufficient material would be collected during the exposure period (left); recovery of the capped and bundled sediment traps by davit assistance (right).

Sediment traps were also deployed at the PSNS&IMF. Similar to above, three sediment traps were deployed at two stations, PS06 and PS09, within 200ft of outfall locations OF19 and OF18AB (Figure 2-10). Traps were deployed 4-Feb-2017 and recovered 30-Mar-2017. In the same fashion as above, traps were decanted and remaining material was collected for shipment to TTU for further processing.

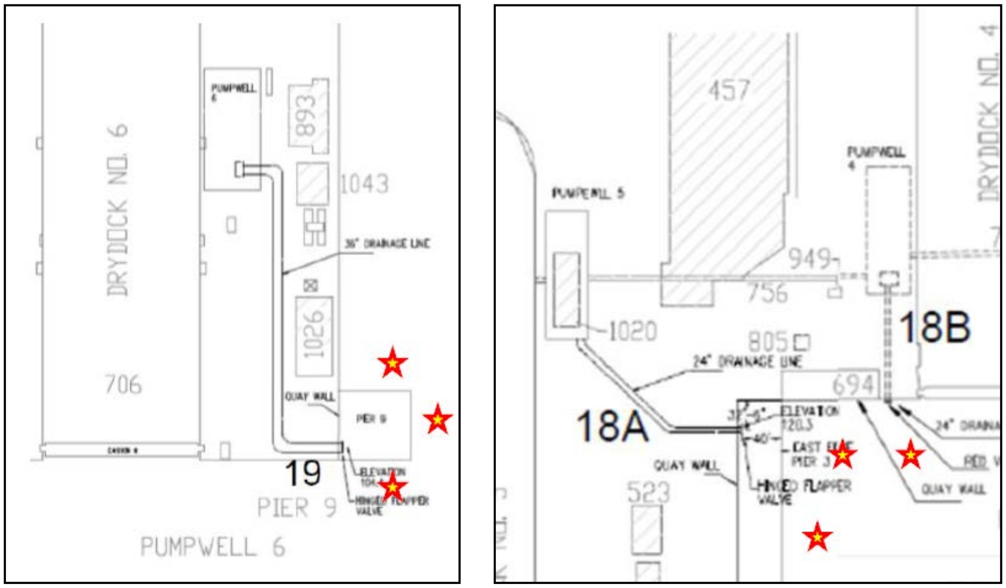


Figure 2-10. Sediment trap deployment locations adjacent to outfalls OF19 (left) and OF18AB (right) at the PSNS&IMF.

2.3.2. *WATER QUALITY CHARACTERIZATION*

Field conditions were monitored through a combination of deployed sensors and publicly available data for San Diego Bay and Puget Sound areas. Sensors that were deployed included acoustic backscatter and water velocities from Acoustic Doppler Current Profilers (ADCP), water temperature and dissolved oxygen (DO) from HOBO loggers, and optical backscatter from OBS sensors. Publicly available data include tide elevations from the NOAA Broadway Pier station and daily precipitation from the NWS Lindberg Field station.

2.3.2.1. ADCP, OBS & SEDIMETER

Water velocities were measured using a Teledyne RD Instruments Workhorse Sentinel 600 kHz ADCP mounted on a stainless-steel cage deployed at station P17. The ADCP was deployed for Dry Weather monitoring from 15-July-2015 through 12-Aug-2015. Wet weather monitoring was conducted from 19-Oct-2015 through 23-Feb-2016, with an equipment check and sensor cleaning on 8-Dec-2015. Under both deployments, the profiler was setup to measure currents and acoustic backscatter at 1-meter intervals between 2 meters above the bottom and the water surface at 5-minute intervals. Data were collected during the entire duration of the deployment. Data collection was terminated when the ADCP was retrieved and the data were truncated to represent only the measurements made underwater on station.

Optical backscatter (OBS) or turbidity was measured using a Campbell Scientific OBS-3 system mounted to the same cage as the ADCP (Figure 2-11). The OBS sensor was launched with a 5-minute interval concurrently with the ADCP sensor. Data were collected during the entire duration of the deployment. The data were truncated to represent only the measurements made underwater while on station.

Figure 2-11. Deployment of ADCP and OBS sensor mounted within a protective cage at Paleta Creek, NBSD.

A trial deployment to directly measure sediment deposition during storm events was also made using the Sedimeter (Lindorm, Inc.). The Sedimeter deposition sensor consists of 36 near infrared optical backscatter detectors spaced 1 cm apart. The active measurement length is 35 cm. Turbidity is measured at 71 levels, every second one as straight backscatter and every second one as oblique backscatter, and reported in formazin turbidity units (FTU) with no decimals. Based on the backscatter measurements, the sediment-water interface level is estimated to 0.01 mm resolution. The system was deployed during the 19-Oct-2015 field event at station P17 and was retrieved during the 8-Dec-2015 equipment check. The instrument was mounted in sediment by divers using the standard anchor and holder tube. The holder was screwed down in mud and sand with the help of a handle, and then the instrument was carefully placed inside the holder tube. Deployments were attempted during other periods as well, but equipment problems precluded the acquisition of useful data.

2.3.2.2. HOBO

Temperature and dissolved oxygen (DO) were measured *in situ* using HOBO loggers (Onset© U26-001) mounted directly onto the SEA Ring within a single exposure chamber to measure water quality conditions experienced by the organisms while deployed (Figure 2-17). For Dry Weather monitoring, the HOBO loggers were launched with a 5-minute interval on 15-Jul-2015 through 12-Aug-2015. For the Wet Weather monitoring period, HOBO loggers were launched with a 5-minute interval on 26-Jan-2016 through 23-Feb-2016. For both deployments, data were truncated to represent only the measurements made underwater on station.

2.3.3. *SPME DEPLOYMENTS*

SPMEs provided by TTU were used to measure sediment porewater organic contaminants. SPMEs were received pre-encased in a Henry Sampling Rod (Figure 2-12) and stored at 4°C until deployment. Deployment and recovery dates of SPMEs are shown in Table 2-8**.** Rods were hand deployed by divers adjacent to SEA Ring units (Figure 2-12) to measure porewater and overlying water organic contaminant concentrations. For the Dry Weather deployment, three 60cm SPME rods were deployed approximately 15cm into the sediments with the remaining 45cm in the overlying water column. For the Wet Weather deployments, 30cm SPMEs were used with a deployment depth of approximately 15cm with the remaining 15cm in the overlying water column. SPME samplers were pre-loaded with performance reference compounds to assist in the analytical and partitioning analysis to report final porewater and overlying concentrations.

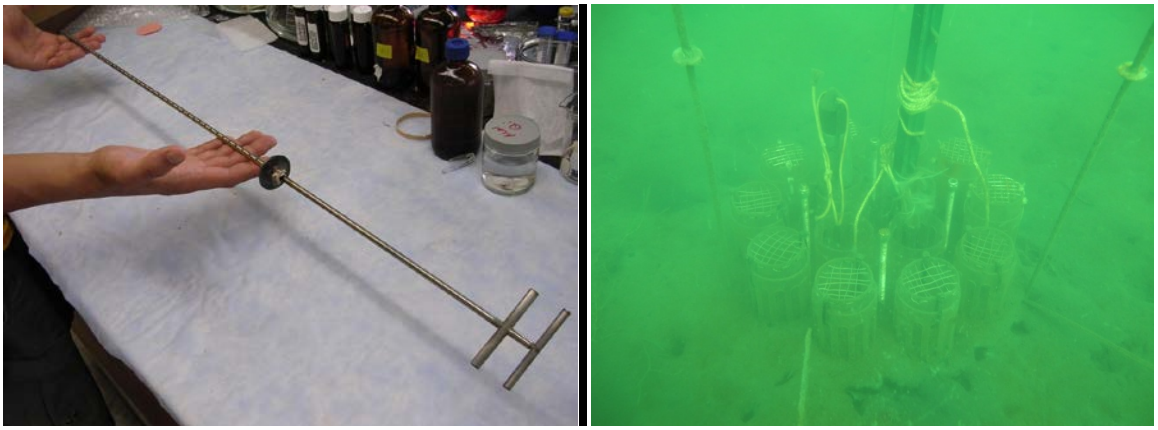


Figure 2-12. SPME rod used for measuring porewater and overlying water organic contaminant concentrations (left); deployment of SPME rods adjacent to SEA Ring (right).

Table 2-8. 2015/2016 Dry & Wet Weather SPME Deployment and Recovery Summary.

Sampling Season	Location Designation	Sample ID	Deployment Date	Deployment Time	Recovery Date	Recovery Time
Dry Weather	Inner Creek	P11	16-July-2015	10:50	12-Aug-2015	09:15
		P17		15:00		10:00
Wet Weather	Inner Creek	P11	19-Oct-2015	09:00	26-Jan-2016	11:17
		P17		08:15		09:40
	Outer Creek	P01		12:00		08:30
		P08		10:30		12:22
Wet Weather	Inner Creek	P11	26-Jan-2016	11:17	23-Feb-2016	13:35
		P17		09:40		11:45
	Outer Creek	P01		14:05		09:00
		P08		12:22		14:50

SPMEs were retrieved by divers and processed immediately by TTU personnel (Figure 2-13). Upon recovery, the depth of each sampler in the sediment was noted. Debris was removed from SPME fibers with deionized water wetted Kimwipes® and blotted dry prior to segmentation. Using ceramic cutters, the SMPE fibers were segmented at predetermined locations corresponding to specific depths of interest from the sediment-water interface. Segments were then transferred to 2mL amber vials pre-filled with appropriate solvent. Vials were stored at -17°C prior to shipping to TTU for analysis. Appropriate laboratory, field and PRC blanks were processed in a similar fashion for quality control and method performance.

Figure 2-13. SPME processing by TTU staff while on-board the research vessel during field operations.

2.3.4. *In situ Bioaccumulation Exposures*

Bioaccumulation exposures were conducted both *in situ* and *ex situ* for different phases of the project. *In situ* bioaccumulation involved the use of Sediment Ecosystem Assessment Rings (SEA Rings) and subsequent processing of tissue samples. Deployment and recovery dates of the SEA Rings are shown in Table 2-9. For the Dry and Wet weather deployment, Version 1.0 and Version 3.0 SEA Rings were used, respectively (Figure 2-14).

The Dry weather deployments served as a proof-of-concept and baseline assessment for characterization of contamination at Paleta Creek. Version 1.0 SEA Rings allowed for the passive settlement of particulate matter into the exposure chambers where organisms were housed.

Wet weather deployments utilized the Version 3.0 SEA Rings (ESTCP ER-201130), which consisted of ten exposure chambers with integrated, multifunctional caps. Caps include both water intake and outlet ports, and an organism delivery port. The intake ports connect to a series of low power individual centrifugal pumps that are programmable. For this deployment, SEA Rings were programmed to pump at a rate that would allow for maximum water exchanges over the course of the deployment period which was calculated to be approximately 138 turnovers of overlying water per day. For each station, 8 of the 10 potential replicates on a given SEA Ring were initiated with 5 clams each. Four of the eight replicates were equipped with an 80µm pre-filter and the remaining four replicates were equipped with a 500µm pre-filter. Additionally, an open cage with 15 clams were deployed adjacent to the SEA Ring. The purpose of the filters or lack of filter was to potentially isolate depositing particle fraction contribution to certain exposure chambers.

Figure 2-14. Version 1.0 (left) and Version 3.0 (right) SEA Rings that were deployed at Paleta Creek for *in situ* bioaccumulation studies.

Table 2-9. 2015/2016 Dry & Wet Weather SEA Ring Deployment and Recovery Summary.

Sampling Season	Location Designation	Sample ID	Deployment Date	Deployment Time	Recovery Date	Recovery Time
Dry Weather 14-d	Inner Creek	P11	16-July-2015	10:35	29-Jul-2015	09:23
		P17		13:42		10:20
Dry Weather 28-d	Inner Creek	P11	16-July-2015	10:45	12-Aug-2015	09:15
		P17		13:54		11:00
Wet Weather 28-d	Inner Creek	P11	26-Jan-2016	11:17	23-Feb-2016	14:00
		P17		10:10		12:35
	Outer Creek	P01		14:05		10:50
		P08		12:22		15:05

Deployment. SEA Rings were deployed for dry-weather/baseline characterization and for a wet weather characterization of the bioavailability of contaminants associated with the sediments at Paleta Creek. Organisms were either purchased from commercial vendors or field collected and acclimated to site conditions prior deployment. For the Dry Weather evaluation, SEA Rings were deployed for 14-d and 28-d. For the Wet Weather evaluation, SEA Rings were deployed for 28-d. Each SEA Ring consisted of ten exposure chambers with organisms for bioaccumulation analysis. For the Dry Weather evaluation, five chambers contained the bivalve *Macoma nasuta* (bent-nosed clam) and five chambers contained the bivalve *Musculista senhousia* (Asian mussel) (Figure 2-14). Two SEA Rings with the same configuration were deployed at each site on 16-Jul-2015, one for a 14-d deployment and the second for a 28-d deployment. For the Wet weather evaluation, all ten chambers contained the clam *Macoma nasuta*. On the day of deployment, five clams or mussels were directly loaded into exposure chambers with coarse stainless-steel mesh fastened to the bottom (to aid in recovery of organisms). Stainless steel mesh was also fastened to the top of each exposure chamber to allow for passive settling of particulate matter and to allow for flushing of ambient water conditions. SEA Rings were held in 17-gallon plastic Chemtainers in site water and lowered to the water surface where divers removed them from the container while underwater. Divers then pushed the SEA Rings gently into the sediment to a depth where the base plate of the unit became flush with the sediment surface, embedding exposure chambers to a depth of approximately 5 inches (Figure 2-16). SEA Rings were secured to nearby deployed plastic-coated fence stakes to further secure them and to assist with locating the SEA Rings upon recovery.

Figure 2-15. *Macoma nasuta* (bent-nosed clam, left) and *Musculista senhousia* (Asian mussel (source: http://sandiegobayenvtl.yolasite.com/nonnative-species.php, right) used for *in situ* bioaccumulation studies.

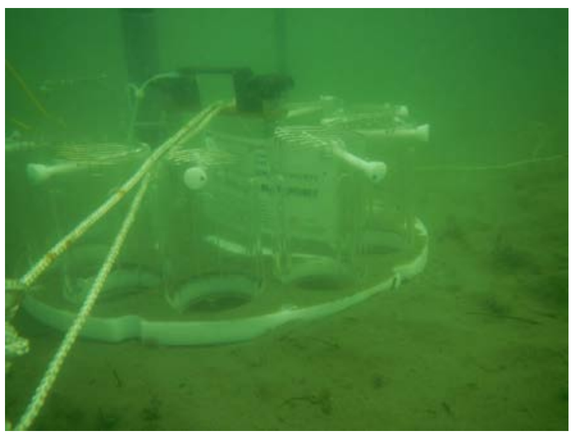


Figure 2-16. Verification of placement of SEA Ring into sediment.

Recovery. Following the 14- or 28-d exposure, SEA Rings were recovered by divers (recoveries on 29-Jul-2015 and 12-Aug-2015 for Dry weather and 23-Feb-2016 for Wet weather, respectively). Following an initial visual assessment of each SEA Ring (Figure 2-17), the device was gently lifted out of the sediment. Each SEA Ring was then brought to the surface and placed into a Chemtainer while underwater prior to transfer to the surface. Once at the surface, the stainless-steel mesh was removed and clams and mussels were recovered by hand and enumerated for survival. Organisms were depurated overnight in clean seawater and prepared for analysis.

Figure 2-17. Observations made of the SEA Rings upon recovery show evidence of deposition on the device.

Tissue Preparation and Analysis. Following recovery, clams and mussels were purged in clean seawater overnight, and the soft-body portion saved for tissue analysis. Wet tissue weights were assessed on a per-replicate basis for both organism types, then typically composited on a per-station basis, and tissues were frozen and shipped on blue ice to TTU chemistry laboratory, where digestion, extraction and analysis were conducted.

2.4. *EX SITU* STUDIES

Laboratory-based exposures were conducted at the SSC Pacific Bioassay Laboratory. For samples collected during the Dry weather monitoring event in Oct/Nov-2014, composited, <63µm (when sufficient volume was present) and >63µm fraction sediment samples were used for *ex Situ* bioavailability studies. Approximately 100g of each sediment type was placed into 1L glass mason jars with 750mL of overlying uncontaminated 0.45µm filtered seawater (FSW).

For all other monitoring events, the intact cores that were collected by divers or by Van Veen were stored at 4°C until test initiations. For *ex situ* exposures, cores were placed into 1L glass mason jars and 0.45µm FSW was gently introduced for an approximate overlying water volume of 500mL (Figure 2-18).

In addition to the whole sediment samples collected from Paleta Creek at NBSD, sediment trap material collected over the course of the wet season was used in *ex situ* exposures. Trap material was tested by itself as well as in additive treatment where sediment trap material was introduced to the corresponding intact core sample collected at the beginning of the wet season. The amount of trap material added to the intact cores was proportional to the volume of sediment trap material recovered from each station (Figure 2-19).

Overlying water in all exposures was continuously aerated with filtered laboratory air delivered through Pasteur pipettes at a rate of approximately 100 bubbles per minute. A 24-h equilibration period with the overlying water was allowed prior to the introduction of test organisms or passive sample devices (Day 0).

Figure 2-18. Experimental set up for *ex situ* exposures of intact sediment cores.

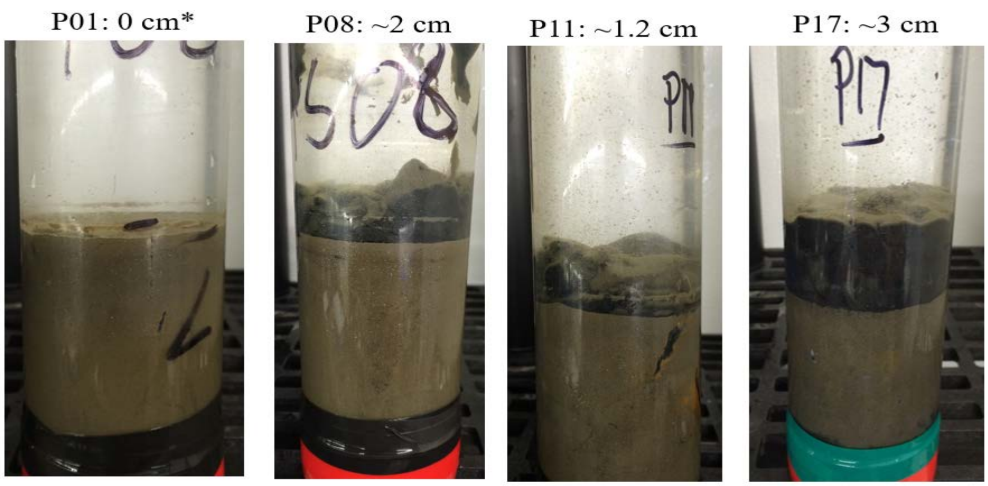


Figure 2-19. Intact cores and the addition of sediment trap material for each site. *Note: sediment traps from station P01 were lost upon recovery and therefore no sediment trap material was tested.

2.4.1. *SPME EXPOSURES*

Solid Phase Micro-Extraction (SPME) fibers were used to measure sediment porewater organic contaminants. SPMEs were provided by TTU and were impregnated with performance reference compounds (PRCs) to infer the fraction steady-state achieved after termination of the exposure period.

For each sediment sampling event, the corresponding *ex situ* SPME exposure is shown in Table 2-10. For the Dry Weather 2014 samples, a single 5cm SPME fiber was placed into a septa and then three such fibers were placed vertically into test chambers (Figure 2-20) for a 28-d exposure period.

For Dry and Wet Weather 2015-2017 samples, SPMEs were exposed to test sediments from 17-Jul-2015 through 14-Aug-2015; 1-Mar-2016 through 29-Mar-2016; 12-Sep-2016 through 11-Oct-

2016; and 14-Mar-2017 through 7-Apr-2017. Three SPME fibers were deployed directly into sediments.

Upon termination of the exposure period, SPME fibers were recovered and wiped gently with a Milli-Q deionized water (DI) dampened Kimwipe tissue. For SPMEs deployed with septas attached, the bottom 4cm (sediment exposed portions) of each SPME were sectioned into 1cm segments and placed into corresponding, pre-filled (i.e. Hexane or acetonitrile solvents) autosampler vials. Otherwise, the entire SPME fiber was sectioned and placed into pre-filled vials. Vials were then placed in the freezer until shipment to the analytical laboratory at TTU.

Table 2-10. *Ex Situ* SPME Deployment and Recovery Summary.

Sediment Sample Designation and Collection Date	Sample ID	Deployment Date	Recovery Date
Dry Weather 29-Oct-2014 & 5-6-Nov-2014	P11	22-Jan-2015	19-Feb-2015
	P17		
Dry Weather 15-July-2015	P11	17-Jul-2015	14-Aug-2015
	P17		
	P01		
	P08		
Pre-Storm/Semi-Dry Weather* 19-Oct-2015	P11	1-Mar-2016	29-Mar-2016
	P17		
	P01		
	P08		
Post-Storm/Wet Weather 23-Feb-2016	P11	1-Mar-2016	29-Mar-2016
	P17		
	P01		
	P08		
Dry-Weather 8-Sep-2016	P11	12-Sep-2016	11-Oct-2016
	P17		
	P01		
	P08		
Wet-Weather 9-Mar-2017	P11	14-Mar-2017	7-Apr-2017
	P17		
	P01		
	P08		

*A few occasional rain events occurred prior to the collection of these sediment samples (Figure 2-1).

Figure 2-20. SPME and DGT deployment in *Ex Situ* bioavailability study.

2.4.2. *DGT EXPOSURES*

Trace metal Diffusive Gradients in Thin-films (DGTs) were acquired from DGT Research, Lancashire, UK. The disk-style LSNM DGT (Figure 2-21) was used for measurement of cationic metals including Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn. The DGTs consisted of a plastic molded base (2.5 cm diameter) and a plastic top with a 3.14 cm^2 diameter window which allows for exposure to a layered setup of a polyethersulphone filter-membrane, 0.78mm thick polyacrylamide diffusive gel and 0.4 mm Chelex binding resin gel. When deployed either in solution or into sediments, metal ions diffuse through the filter membrane and diffusive gel and bind to the resin gel which continues to accumulate ions over the course of a deployment. In sediment applications, the DGT measures the mean flux of labile metals at the interface between the device and the sediment, or the labile pore-water concentrations. DGTs were stored in sealed, clean plastic bags at >0 to 4°C prior to deployment. Each bag contained a few drops of 0.01M $NaNO_3$ solution and was maintained moist throughout storage periods. DGTs were deployed in the same exposure chamber as the SPME fibers (Figure 2-20). The DGTs were pressed gently into the surface of the sediments to ensure full contact between the sediment and the exposure window/membrane of the DGT.

Figure 2-21. Commercially available Diffusive Gradients in Thin-film (DGT).

DGTs for the measurement of Hg were provided by TTU and under-went pre-treatment prior to use by purging in a 10mM solution of $NaNO_3$ with polyacrylamide resin strips. The solution, strips and DGTs were placed in a N_2 glove box and were bubbled with N_2 overnight. On exposure Day 0, Hg DGTs were removed from the N_2 box and immediately deployed into the exposure chambers in the same manner as the trace metal DGTs.

DGT deployment and recovery dates are summarized in Table 2-11. DGTs were exposed for 2 or 3-d and deployment and recovery times were recorded to the minute. Upon termination of exposure periods, DGTs were rinsed immediately with Milli-Q DI water to remove sediment. DGTs were placed in a labeled and clean plastic bag with minimal airspace and stored at >0 to 4°C until processed or shipped to TTU.

Trace metal DGTs were processed by SSC Pacific, while DGTs for the measurement of Hg were processed by TTU. Briefly, DGTs were disassembled and the Chelex resin gels removed and placed in clean micro-centrifuge tubes. All laboratory manipulation and analysis were done in <0.2µm High Efficiency particulate air (HEPA) filtered working stations, using acid-cleaned material, following trace metal clean techniques (USEPA, 1996). The resin gel was exposed to 1000 µL quartz-still grade nitric acid (Q-HNO_3) for 24 hours before analysis. This was done to dissolve the metals back in solution, allowing the resin gel to stay as a solid membrane, instead of partially dissolving in solution.

Metals were quantified in the acidic solution by inductively coupled plasma with detection by mass spectrometry (ICP-MS) after dilution. The acidic solution was diluted in metal-free water (18 MΩ/cm H_2O) acidified to pH 2 with Q-HNO_3 and analyzed with a Perkin-Elmer SCIEX ELAN DRC II ICP-MS following USEPA method 200.8, Revision 5.4 (1994).

The mass of the metal accumulated in the resin gel layer (M) is calculated using:

$$M = Ce\,(V_{HNO3} + V_{gel})/fe$$

where Ce is the concentration of metals in the 1M HNO3 elution solution (in µg/l), V_{HNO3} is the volume of HNO_3 added to the resin gel, V_{gel} is the volume of the resin gel, typically 0.15 ml, and fe is the elution factor for each metal, typically 0.8.

The concentration of metal measured by DGT (CDGT) was calculated using:

$$C_{DGT} = M\Delta g/(DtA)$$

where Δg is the thickness of the diffusive gel (0.8 mm) plus the thickness of the filter membrane (typically 0.14 mm), D is the diffusion coefficient of metal in the gel, t is deployment time and A is exposure area (A=3.14 cm^2).

Table 2-11. *Ex Situ* DGT Deployment and Recovery Summary.

Sediment Sample Designation and Collection Date	Sample ID	Deployment Date	Recovery Date
Dry Weather 29-Oct-2014 & 5-6-Nov-2014	P11	17-Jan-2015	19-Feb-2015
	P17		
Dry Weather 15-July-2015	P11	17-Jul-2015	20-Jul-2015
	P17		
	P01		
	P08		
Pre-Storm/Semi-Dry Weather* 19-Oct-2015	P11	3-Mar-2016	5-Mar-2016
	P17		
	P01		
	P08		
Post-Storm/Wet Weather 23-Feb-2016	P11	3-Mar-2016	5-Mar-2016
	P17		
	P01		
	P08		
Dry-Weather 8-Sep-2016	P11	13-Sep-2016	15-Sep-2016
	P17		
	P01		
	P08		
Wet-Weather 9-Mar-2017	P11	11-Mar-2017	13-Mar-2017
	P17		
	P01		
	P08		

*A few occasional rain events occurred prior to the collection of these sediment samples (Figure 2-1).

2.4.3. *BIOACCUMULATION & TOXICITY*

Bioaccumulation and toxicity exposures conducted on sediment and water samples collected from NBSD are summarized in Table 2-12. Toxicity exposures conducted on water samples collected from PSNS are summarized in Table 2-13. Table 2-14 below describes the series of sediment core and sediment trap samples that were tested.

Table 2-12. *Ex Situ* Bioaccumulation and Toxicity Exposure Summary – NBSD.

Sample Designation and Collection Date	Sample ID	Species Tested	Initiation Date	Termination Date
Dry Weather 29-Oct-2014 & 5-6-Nov-2014	P11	Clam	22-Jan-2015	19-Feb-2015
	P17			
Dry Weather 15-July-2015	P11	Clam, Mussel & Amphipod	17-Jul-2015	Clam & Mussel: 14-Aug-2015 Amphipod: 27-Jul-2015
	P17			
	P01			
	P08			
Pre-Storm/Semi-Dry Weather* 19-Oct-2015	P11	Clam & Amphipod	1-Mar-2016	Clam: 29-Mar-2016 Amphipod: 11-Mar-2016
	P17			
	P01			
	P08			
Stormwater 6-Jan-2016	A1W "First Flush"	Purple Urchin	7-Jan-2016	11-Jan-2016
	A2W			
	A3W			
	C1W			
	C2W			
	O1W			
	O2W			
	O3W			
	O4W			
Stormwater 31-Jan-2016	A1W "First Flush"	Purple Urchin	1-Feb-2016	5-Feb-2016
	A2W			
	C1W			
	C2W			
	O1W			
	O2W			
	O3W			
	O4W			
Post-Storm/Wet Weather 23-Feb-2016	P11	Clam & Amphipod	1-Mar-2016	Clam: 29-Mar-2016 Amphipod: 11-Mar-2016
	P17			
	P01			
	P08			
Dry-Weather 8-Sep-2016	P11	Clam & Amphipod	13-Sep-2016	Clam: 12-Sep-2016 Amphipod: 11-Oct-2016
	P17			
	P01			
	P08			
Wet-Weather 9-Mar-2017	P11	Clam & Amphipod	10-Mar-2017	Clam: 7-Apr-2017 Amphipod: 20-Mar-2017
	P17			
	P01			
	P08			

*A few occasional rain events occurred prior to the collection of these sediment samples (Figure 2-1).

Table 2-13. *Ex Situ* Toxicity Exposure Summary – PSNS.

Sample Designation and Collection Date	Sample ID	Species Tested	Initiation Date	Termination Date
Pre-Storm 6-Dec-2016	OF18AB	Purple Urchin	7-Dec-2016	11-Dec-2016
	OF19			
	PS06			
	PS09			
Post-Storm 30-Mar-2017	OF18AB	Purple Urchin	29-Mar-2017	2-Apr-2017
	OF19			
	PS06			
	PS09			

Table 2-14. Sediment Cores and Sediment Trap Material Used for *Ex Situ* Bioassay Exposures.

Sample ID	Sample Type	Collection Date
P01	"Pre-Storm" Intact Core	19-Oct-2015
	"Post-Storm" Intact Core	23-Feb-2016
	"Pre-Storm" Intact Core w/ Sed. Trap Addition	NT*
	Sed. Trap Only	NT*
P08	"Pre-Storm" Intact Core	19-Oct-2015
	"Post-Storm" Intact Core	23-Feb-2016
	"Pre-Storm" Intact Core w/ Sed. Trap Addition	19-Oct-2015/ 23-Feb-2016
	Sed. Trap Only	23-Feb-2016
P11	"Pre-Storm" Intact Core	19-Oct-2015
	"Post-Storm" Intact Core	23-Feb-2016
	"Pre-Storm" Intact Core w/ Sed. Trap Addition	19-Oct-2015/ 23-Feb-2016
	Sed. Trap Only	23-Feb-2016
P17	"Pre-Storm" Intact Core	19-Oct-2015
	"Post-Storm" Intact Core	23-Feb-2016
	"Pre-Storm" Intact Core w/ Sed. Trap Addition	19-Oct-2015/ 23-Feb-2016
	Sed. Trap Only	23-Feb-2016

*** -** Sediment trap was lost upon recover. Only enough material recovered for conducting "addition" treatment

For all sediment samples collected, the bent-nose clam, *Macoma nasuta* (Figure 2-15), was exposed to sediments for a 28-d bioaccumulation endpoint. A summary of the test conditions and test acceptability criteria for the exposure is shown in Table 2-15. Briefly, clams were received 4-6 days prior to exposure to allow for acclimation to test conditions (i.e. temperature and salinity) and to observe for mortalities. All test chambers were set up with sediment, water and aeration on the day prior to test initiation. Organisms were introduced randomly to test chambers on test Day 0 (Figure 2-22) and renewals of the overlying water were made three times per week over the course of the 28-d exposure. Upon termination of the exposure period (Day 28), surviving organisms were recovered by sieving sediment through a 500-µm mesh sieve, enumerated and then transferred to clean FSW overnight to purge digested sediment. On Day 29, the soft body portions from the clams were dissected from each replicate, rinsed with Milli-Q deionized (DI) water, weighed (for wet weight assessment), and frozen in sample collection jars until shipment to the analytical laboratory at TTU.

Table 2-15. Specifications for 28-day Whole Sediment Bioaccumulation Exposure Using the Bent-Nosed Clam, *Macoma nasuta* or the Asian mussel, *Musculista senhousia*.

Test organisms	Bent-nosed clam, *Macoma nasuta* Asian mussel, Musculista senhousia
Test organism source	Clams: J&G Gunstone Clams, Inc. (Port Townsend, WA) Mussels: Field collected (San Diego, CA)
Test organism size at initiation	Clams: ~1-inch Small Adult Mussels: ~0.5 inch
Test duration; endpoint(s)	28 days; survival, bioaccumulation
Test solution renewal	Three-times weekly with filtered seawater
Water Quality Monitoring	Daily (pH, Salinity, Dissolved Oxygen and Temperature); Ammonia at initiation and termination
Feeding	None
Test chamber	1-L glass beakers
Control sediment source	Sediment collected from clam collection site, Discovery Bay, OR
Test sediment depth	3-5 cm (~100g)
Overlying water volume	~750 mL
Test temperature	Clam: 15 ± 2 °C instantaneous Mussel: 20 ± 2 °C instantaneous
Overlying water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SPAWAR
Salinity	32 ± 2 ppt
Number of organisms/chamber	Clam: 5 Mussel: 10
Number of replicates	3
Photoperiod	16 hours light/8 hours dark, ambient laboratory lighting
Aeration	Laboratory filtered air, continuous (1-2 bubbles per second delivered through a Pasteur pipette in laboratory beaker)
Test Protocol	EPA 503/8-91/001, ASTM E-1688-10
Test acceptability criteria	≥ 90% mean survival in controls

Figure 2-22. ***Macoma nasuta*** **in bioaccumulation exposure chambers.**

Except for the Dry Weather samples collected in Oct & Nov-2014, to assess the acute toxicity of the sediments, the marine amphipod *Eohaustorius estuarius* (Figure 2-23) was also introduced to intact sediment cores for 10-d exposures. A summary of test conditions and test acceptability criteria for the exposures are shown in Table 2-16. Similar to the 28-d exposures with the clam, all test chambers were set up with sediment, water and aeration on the day prior to test initiation. Organisms were introduced randomly to test chambers on test Day 0. The 10-day exposure with the marine amphipod was conducted under static (i.e. non-renewal) conditions. Upon termination of the exposure period, surviving organisms were recovered by sieving sediment through a 500-µm mesh sieve, enumerated and then transferred to clean FSW overnight to purge digested sediment. On Day 11, all organisms from a given replicate were rinsed with Milli-Q deionized (DI) water, weighed (for wet weight assessment), and frozen in sample collection jars until shipment to the analytical laboratory at TTU.

Figure 2-23. Toxicity organism, ***Eohaustorius estuarius*** **(marine amphipod), used to assess the bioavailability of contaminants associated with sediments.**

Additionally, for the July-2015 samples, bioavailability of contaminants in the sediments was assessed using the Asian mussel, *Musculista senhousia* (Figure 2-15). Set up of the exposure chambers was conducted in the same fashion as the clam exposures (Table 2-15).

Table 2-16. Specifications for 10-day Whole Sediment Bioaccumulation Exposure Using the marine amphipod, *Eohaustorius estuarius*.

Test organism	Marine amphipod, Eohaustorius estuarius
Test organism source	Northwestern Aquatic Sciences (Newport, OR)
Test organism size at initiation	3-5mm adult
Test duration; endpoint(s)	10 days; survival
Test solution renewal	None
Water Quality Monitoring	Daily (pH, Salinity, Dissolved Oxygen and Temperature); Ammonia at initiation and termination
Feeding	None
Test chamber	1-L cellulose acetylbutyrate tubing placed in 1L glass beakers
Control sediment source	Sediment collected from amphipod collection site (Yaquina Bay, OR)
Test sediment depth	5-inch intact cores (~200g)
Overlying water volume	~500 mL
Test temperature	15 ± 2 °C instantaneous
Overlying water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SPAWAR
Salinity	32 ± 2 ppt
Number of organisms/chamber	20
Number of replicates	5
Photoperiod	24hour continuous from ambient laboratory lighting
Aeration	Laboratory filtered air, continuous (1-2 bubbles per second delivered through a Pasteur pipette in laboratory beaker)
Test Protocol	EPA 600-R-94-025 (EPA, 1994)
Test acceptability criteria	≥ 90% mean survival in controls

Chronic toxicity testing on stormwater and ambient water samples was conducted using standard USEPA methods (USEPA 1995; Table 2-17). All test dilutions were made using SSC Pacific Bioassay Laboratory filtered seawater (0.45µm FSW collected from the mouth of San Diego Bay, CA). Test concentrations were prepared by volumetric dilution of stormwater or ambient samples. Standard water quality measurements (DO, temperature, salinity and pH) were monitored daily. Concurrent reference toxicant tests using Cu were conducted as a quality control measure to assess the health of the organisms and technical performance of the method.

Table 2-17. Specifications for 4-day Water Exposure Using the Purple Sea Urchin, *Strongylocentrotus purpuratus.*

Test organism	Purple sea urchin, Strongylocentrotus purpuratus
Test organism source	Field collected off Point Loma, San Diego, CA
Test duration; endpoint(s)	96hr; Embryo-Larval Development Success (Proportion Normal)
Test solution renewal	None
Water Quality Monitoring	Daily (pH, Salinity, Dissolved Oxygen and Temperature)
Feeding	None
Test chamber	30 mL scintillation vial
Test solution volume	10 mL
Test temperature	15 ± 1 °C
Test salinity	34 ± 2 ppt
Light quality	Ambient laboratory illumination
Light intensity	10-20 µE/m2/s (Ambient laboratory levels)
Photoperiod	16 hr light/ 8 hr dark
Aeration	None
No. of organisms per chamber	250 eggs, appropriate sperm density to provide > 90% fertilization success (determined in a pre-test trial).
No. of replicates	5
Control/dilution water	Filtered (0.45 µm) natural seawater collected from near the mouth of San Diego Bay at SSC Pacific Laboratory
Additional control	Hypersaline brine
Sample manipulation	Hypersaline brine was used to increase the salinity of all samples to 34±2 ppt
Test concentrations (% of sample)	Effluent Samples: 58.5+, 50, 25, 12.5 & 6.25%, plus laboratory and brine controls Ambient Samples: 83.7+%, plus laboratory and brine controls
Test acceptability criteria	≥ 80% normal development in surviving controls; < 25% Minimum Significant Difference (MSD)
Reference toxicant	Copper sulfate
Test protocol	EPA 600/R-95/136 (USEPA 1995)

3. RESULTS & DISCUSSION

Key sampling results summarizing organism recoveries, bioaccumulation and passive sampling data and comparisons are provided in this section.

3.1. 2014 DRY WEATHER – NBSD

3.1.1. *SEDIMENT CHEMISTRY*

Bulk and size fractioned sediment metal concentrations and Total Organic Carbon (TOC) were analyzed and are summarized in Table 3-1 and shown in Figure 3-1 through Figure 3-9. Total PAH concentrations in the sediments are summarized in Table 3-1 and shown in Figure 3-9.

As could be expected, for many of the metals analyzed, the smaller grain size accounted for the highest concentrations of each metal observed.

For the composited material, aluminum appears to have a trend of increasing concentration the further downstream collections were made. This is similar for copper and iron. Lead concentrations are the highest by far in the conveyance system sample for all size fractions analyzed. This is likely due to the nature of the inputs to the catch basin where the sample was collected. A large parking lot and road are the only land uses nearby and likely contributors to the observed measurements.

Table 3-1. 2014 Dry Weather Sediment Chemistry Results – NBSD.

Compartment ID	Grain Size Fraction (µm)	TOC (%)	Al (µg/g)	Cd (µg/g)	Cr (µg/g)	Cu (µg/g)	Fe (µg/g)	Pb (µg/g)	Ni (µg/g)	Zn (µg/g)	Total PAHs (µg/kg)
Upstream (US)	0-20	-	11751.6	ND	29.9	116.6	25576.9	84.6	12.7	930.7	-
	20-63	-	8123.1	ND	22.3	80.6	18616.6	48.5	8.2	521.7	-
	<63	10.8	4974.3 (1126.4)	ND	3.7 (3.5)	46.8 (46.8)	6040.0 (1305.7)	27.1 (8.0)	ND	346.7 (100.1)	-
	>63	1.0	3206.9	ND	ND	8.1	4631.9	ND	ND	100.0	-
	Composite	2.7	2252.9	ND	ND	7.8	2606.3	1.8	ND	75.6	1112.4 (329.9)
Tidal Creek (TC)	0-20	-	11244.4	ND	19.3	175.9	24157.8	130.3	7.4	781.6	-
	20-63	-	5425.8	ND	5.4	68.7	6516.3	47.6	ND	358.9	-
	<63µm	6.3	5094.8 (614.6)	ND	5.8 (3.7)	66.0 (12.6)	10017.2 (5543.2)	42.8 (6.9)	ND	293.2 (45.6)	-
	>63µm	0.8	3018.0	ND	ND	14.7	3252.9	7.2	ND	106.4	-
	Composite	1.5	2415.5	ND	0.3	18.1	3466.3	11.8	ND	122.9	693.1 (342.9)
Conveyance System (CS)	0-20	-	12570.4	0.55	89.3	644.6	34080.3	2999747.9	70.9	7796.5	-
	20-63	-	7812.5	ND	67.3	435.3	28182.6	1971085.7	40.1	3918.5	-
	<63µm	11.3	6911.5 (337.3)	ND	51.5 (4.3)	410.1 (17.8)	23164.8 (669.7)	1740791.6 (84547.5)	32.6 (2.1)	3920.0 (213.0)	-
	>63µm	1.1	2757.6	ND	14.0	86.9	19243.4	22346.9	6.8	550.1	-
	Composite	0.9	2400.0	ND	ND	38.3	3922.5	2400.3	ND	605.5	487.4 (300.4)
Inner Creek (IC)	0-20	-	19410.3	ND	72.0	312.5	40110.0	153.5	21.0	645.1	-
	20-63	-	11645.2	ND	25.9	209.9	24028.8	79.2	5.6	463.8	-
	<63µm	2.0	9612.4 (90.2)	ND	19.7 (0.9)	133.0 (5.0)	21203.6 (396.6)	59.7 (0.2)	0.2 (0.6)	267.8 (1.3)	-
	>63µm	0.2	6027.8	ND	11.0	48.7	6933.0	22.1	ND	173.0	-
	Composite	1.0	7556.5	ND	689.4	104.4	16219.3	381.4	ND	3908.1	2369.4 (644.7)
Outer Creek (OC)	0-20	-	20238.0	ND	57.0	261.0	40546.1	84.5	16.2	499.7	-
	20-63	-	14120.8	ND	26.7	227.4	28109.0	41.2	8.2	261.7	-
	<63µm	3.0	11737.3 (207.3)	ND	26.2 (0.7)	143.4 (5.4)	24971.4 (70.7)	40.3 (1.8)	2.0 (0.8)	243.2 (7.5)	-
	>63µm	0.5	3280.4	ND	3.5	21.7	5175.4	5.1	ND	42.2	-
	Composite	1.3	8758.3	ND	21.9	107.1	20067.0	31.0	0.1	179.8	1190.6 (564.0)

Values in ( ) are SD of duplicate samples tested. “-“– not tested. ND – non-detect.

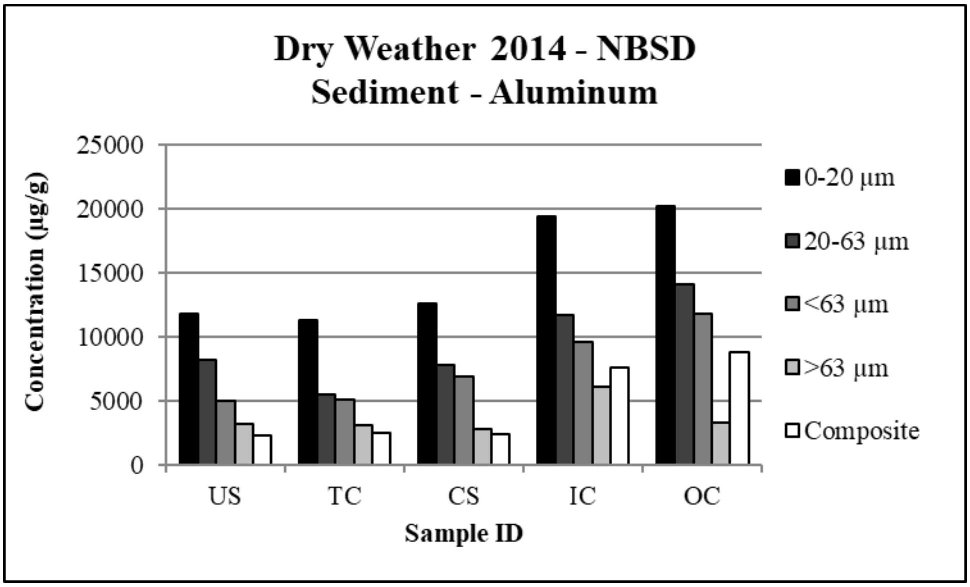


Figure 3-1. Comparison of size fractioned sediment aluminum concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

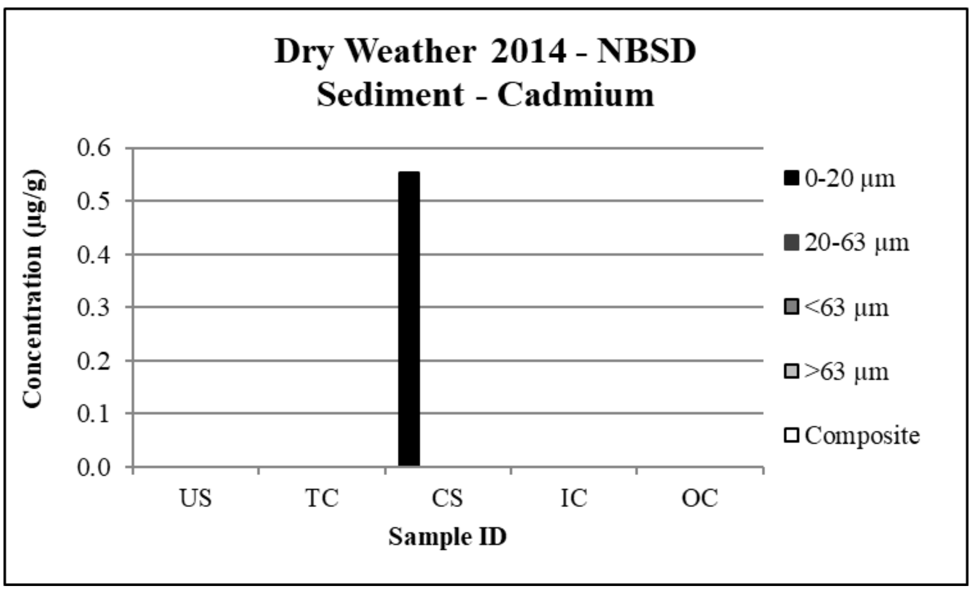


Figure 3-2. Comparison of size fractioned sediment cadmium concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

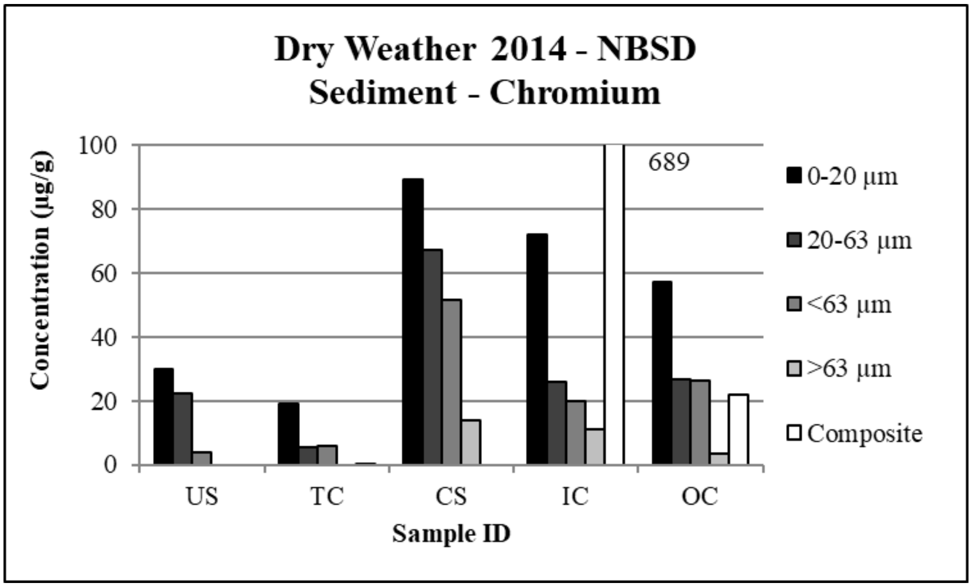


Figure 3-3. Comparison of size fractioned sediment chromium concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

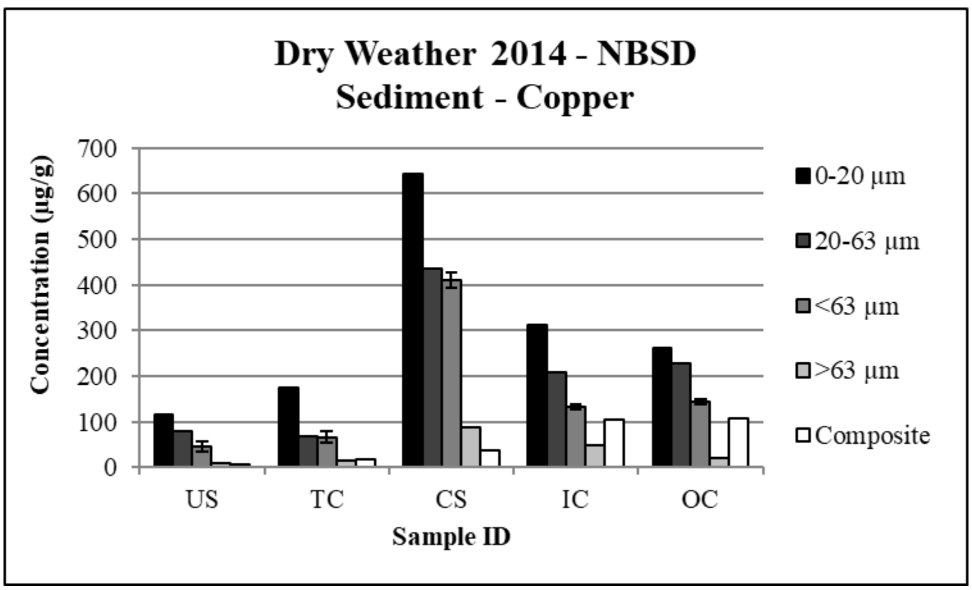


Figure 3-4. Comparison of size fractioned sediment copper concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

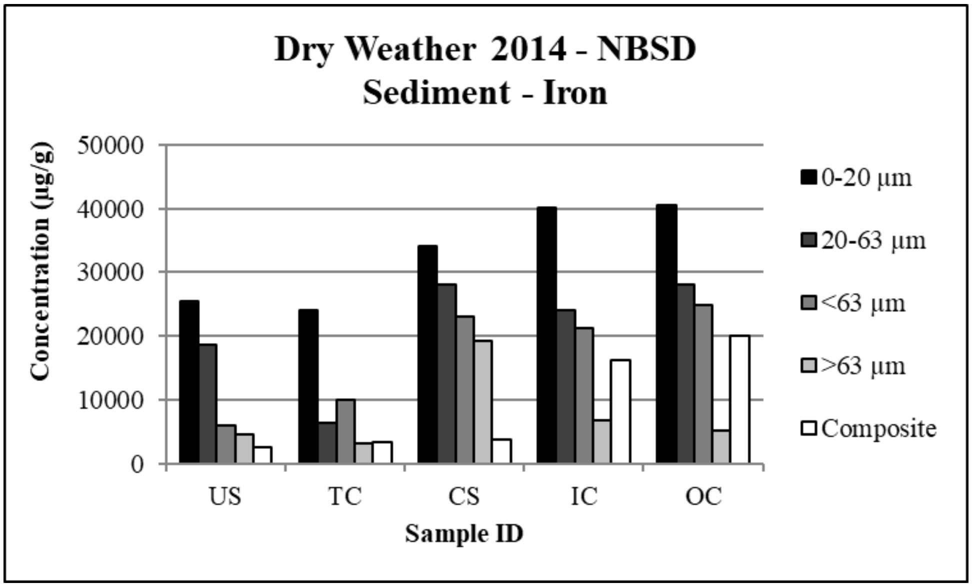


Figure 3-5. Comparison of size fractioned sediment iron concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

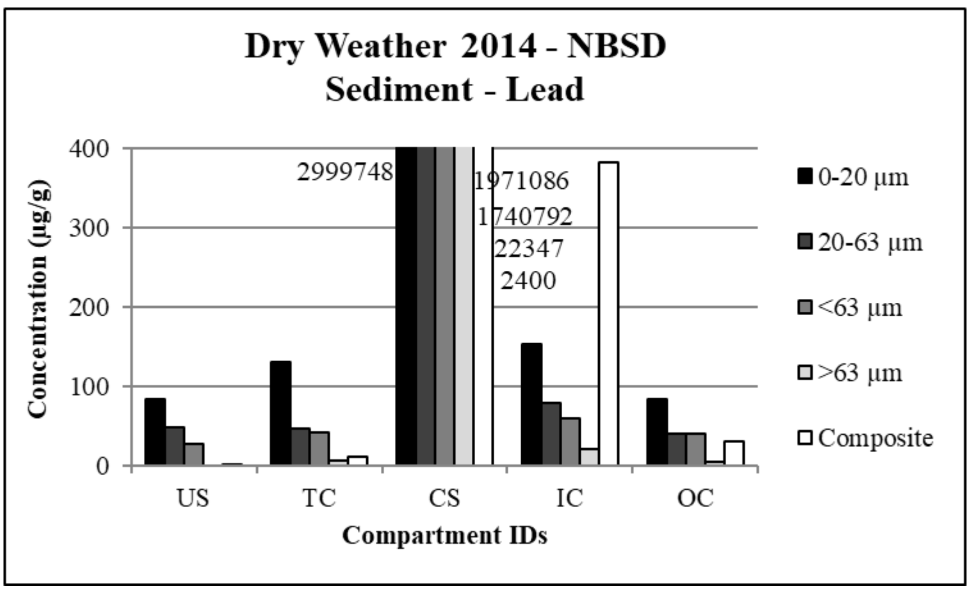


Figure 3-6. Comparison of size fractioned sediment lead concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

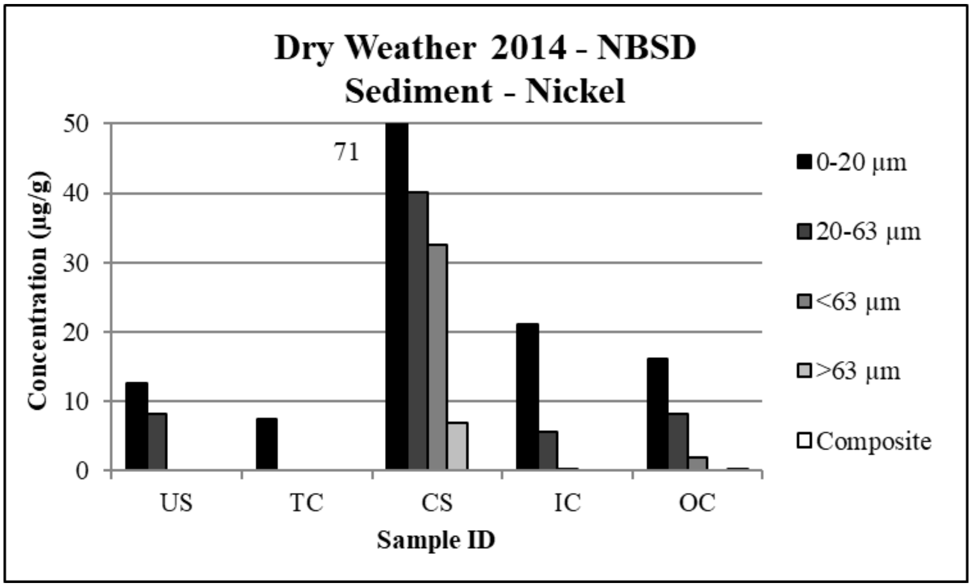


Figure 3-7. Comparison of size fractioned sediment nickel concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

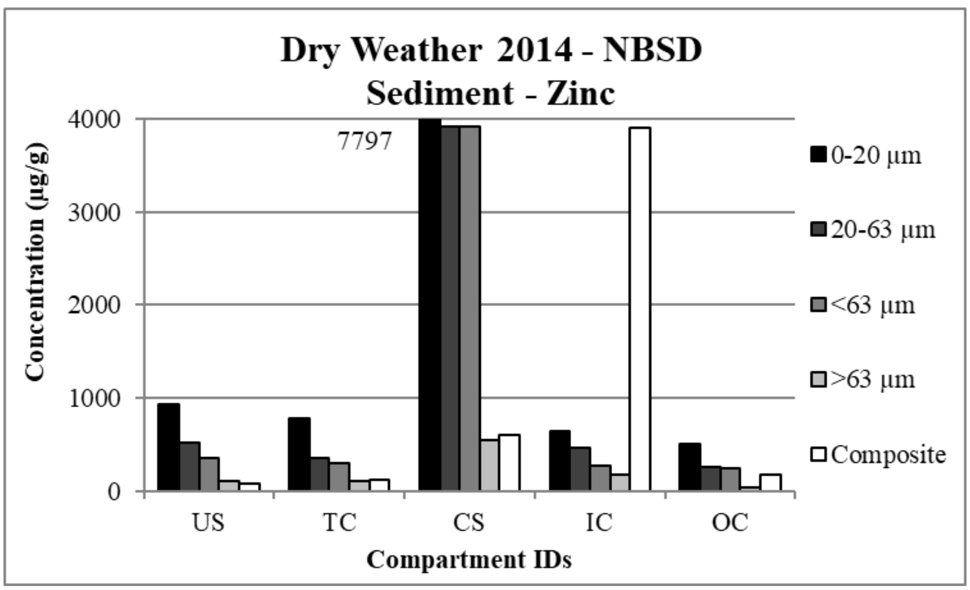


Figure 3-8. Comparison of size fractioned sediment zinc concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

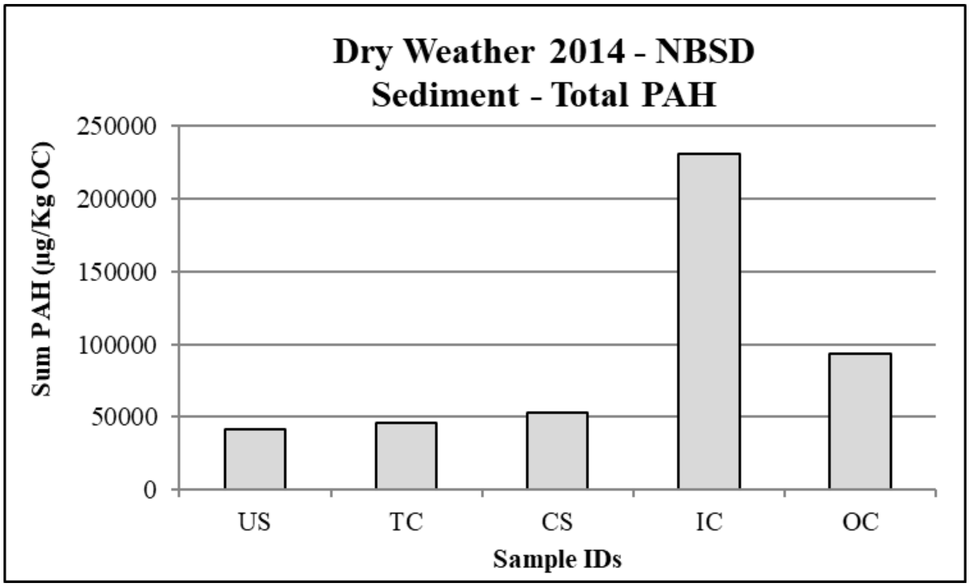


Figure 3-9. Comparison of sediment sum PAH concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD.

3.1.2. *SPME*

Sediment porewater total PAH concentrations measured with SPME are summarized in Table 3-2 and shown in Figure 3-10. SPME concentrations don't appear to vary significantly with grain size fractionation nor with sample collection location. Note that TTU provided these data to SSC Pac.

Table 3-2. 2014 Dry Weather NBSD SPME Results.

Compartment ID	Grain Size Fraction (µm)	Total PAHs (ng/L)
Upstream (US)	<63	NT
	>63	56.7
	Composite	35.5
Tidal Creek (TC)	<63	59.5
	>63	64.3
	Composite	85.5
Conveyance System (CS)	<63	NT
	>63	49.2
	Composite	42.2
Inner Creek (IC)	<63	58.7
	>63	60.8
	Composite	58.1
Outer Creek (OC)	<63	54.9
	>63	51.1
	Composite	50.4

NT – Not tested.

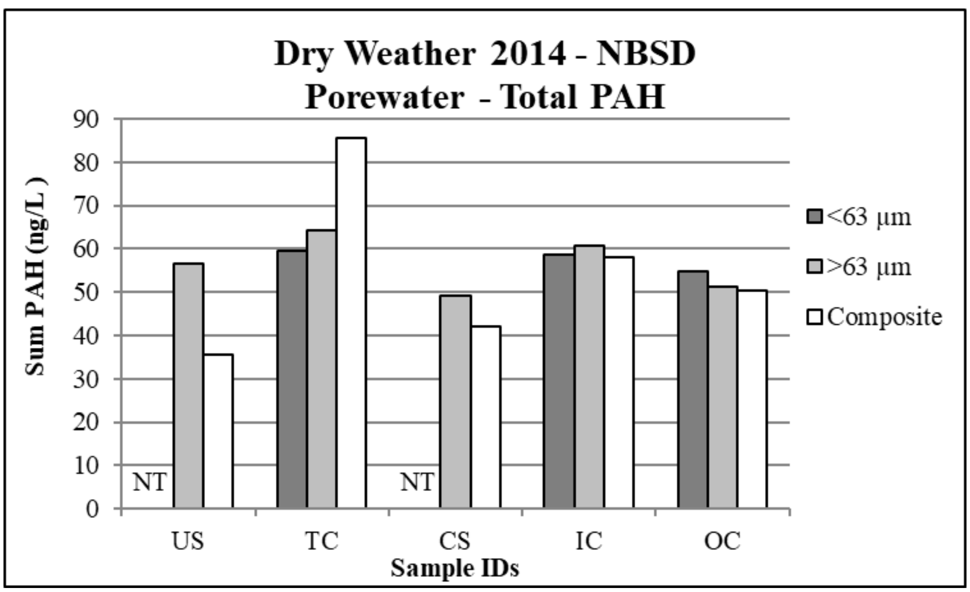


Figure 3-10. Comparison of size fractioned SPME PAH concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

3.1.3. *DGT*

Sediment porewater metal concentrations as measured with DGTs are summarized in Table 3-3 and shown in Figure 3-11 through Figure 3-19. Slight trends in metal DGT concentrations can be observed with copper and nickel with increasing concentrations from the Upstream to the Outer Creek sampling locations. As with the sediment samples, the DGT concentration of lead was by far the highest in the conveyance system (CS) sample.

Table 3-3. 2014 Dry Weather NBSD DGT Results.

Sample Compartment	Grain Size Fraction (µm)	Al (µg/L)	Cd (µg/L)	Cr (µg/L)	Cu (µg/L)	Fe (µg/L)	Ni (µg/L)	Pb (µg/L)	Zn (µg/L)	Hg (ng/L)
Upstream (US)	<63	NT	NT	NT	NT	NT	NT	NT	NT	NT
	>63	1.0	0.5	0.5	1.5	2536	3.8	0.0	66.4	13.5
	Composite	54.3	0.0	0.9	4.0	2666	3.9	0.2	234.8	21.8
Tidal Creek (TC)	<63µm	0.0	0.3	0.4	13.0	40975	8.2	1.2	857.5	44.9
	>63µm	43.0	0.0	0.2	3.0	62321	3.4	2.3	146.1	20.9
	Composite	1.6	0.0	0.9	1.9	7988	5.7	0.4	288.3	18.3
Conveyance System (CS)	<63µm	NT	NT	NT	NT	NT	NT	NT	NT	NT
	>63µm	NT	NT	NT	NT	NT	NT	NT	NT	23.4
	Composite	24.5	2.1	0.4	9.3	4144	4.2	100956	474.7	25.7
Inner Creek (IC)	<63µm	0.0	1.1	0.0	26.7	5281	7.7	0.7	582.2	133.6
	>63µm	135.6	0.0	1.8	3.8	11039	1.3	1.6	124.3	23.4
	Composite	NT	NT	NT	NT	NT	NT	NT	NT	NT
Outer Creek (OC)	<63µm	16.5	0.0	0.0	28.9	7341	6.0	0.0	294.9	87.4
	>63µm	714.3	0.0	1.5	47.8	266307	17.7	1.6	1048.6	28.3
	Composite	NT	NT	NT	NT	NT	NT	NT	NT	NT

NT – not tested.

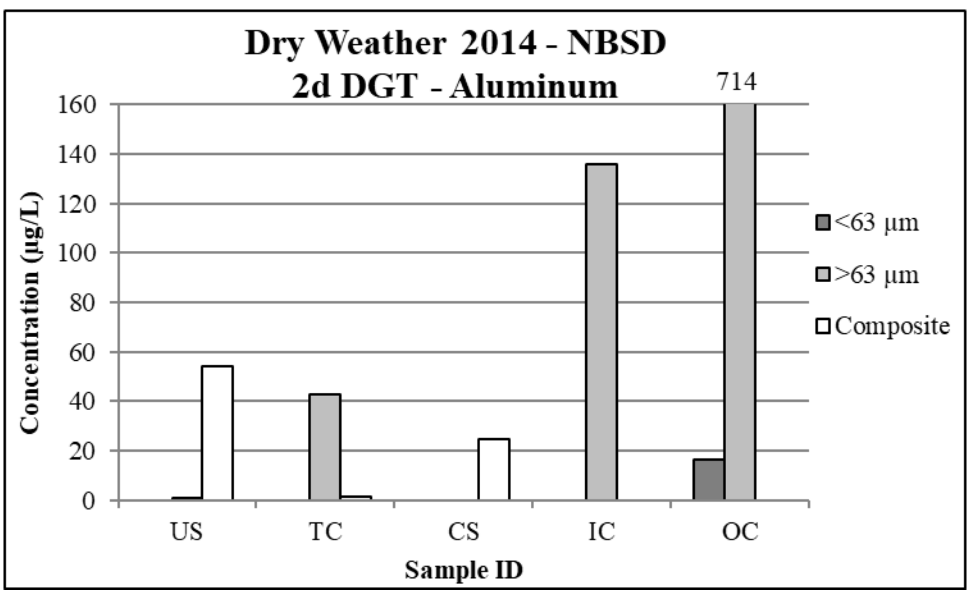


Figure 3-11. Comparison of size fractioned DGT aluminum concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

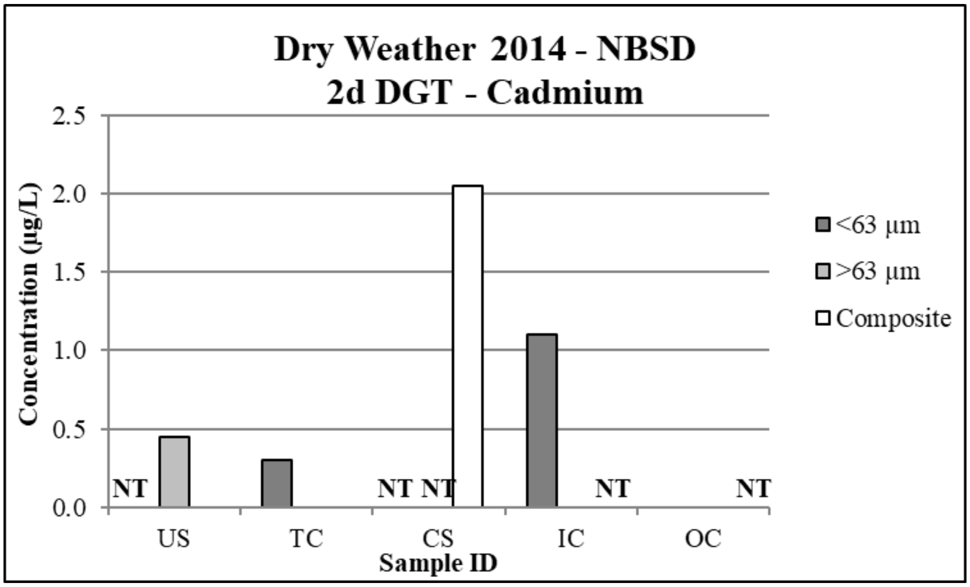


Figure 3-12. Comparison of size fractioned DGT cadmium concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

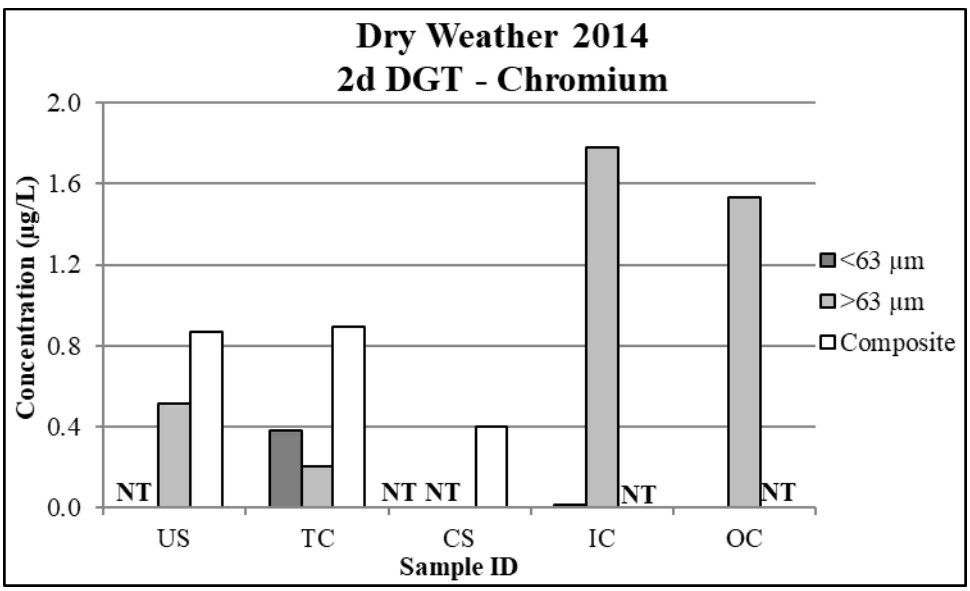


Figure 3-13. Comparison of size fractioned DGT chromium concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

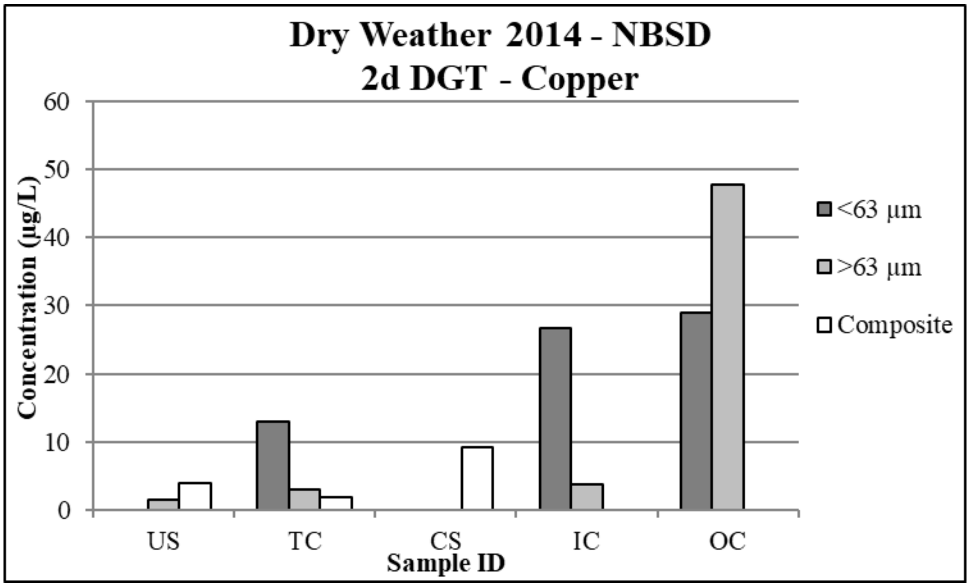


Figure 3-14. Comparison of size fractioned DGT copper concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

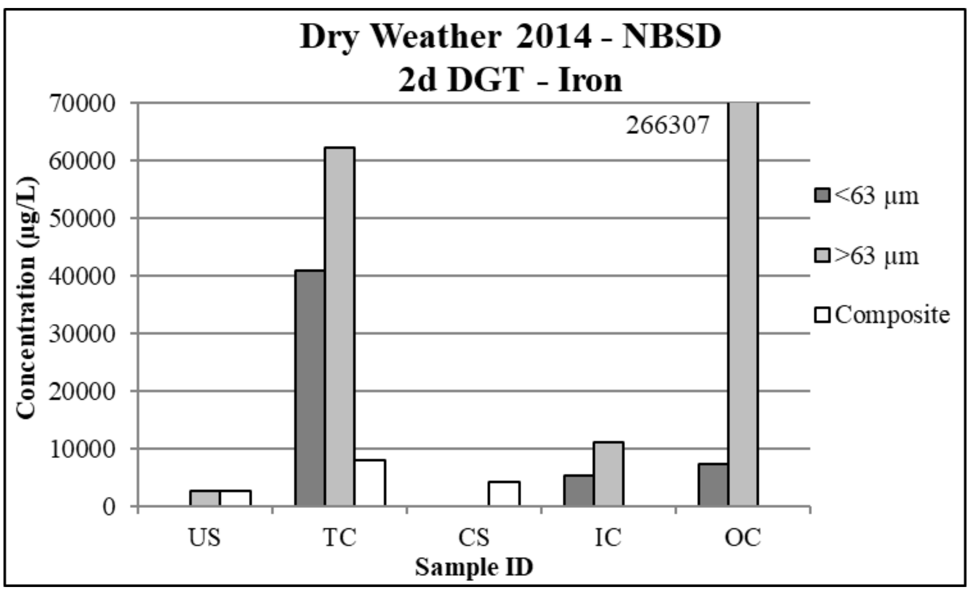


Figure 3-15. Comparison of size fractioned DGT iron concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

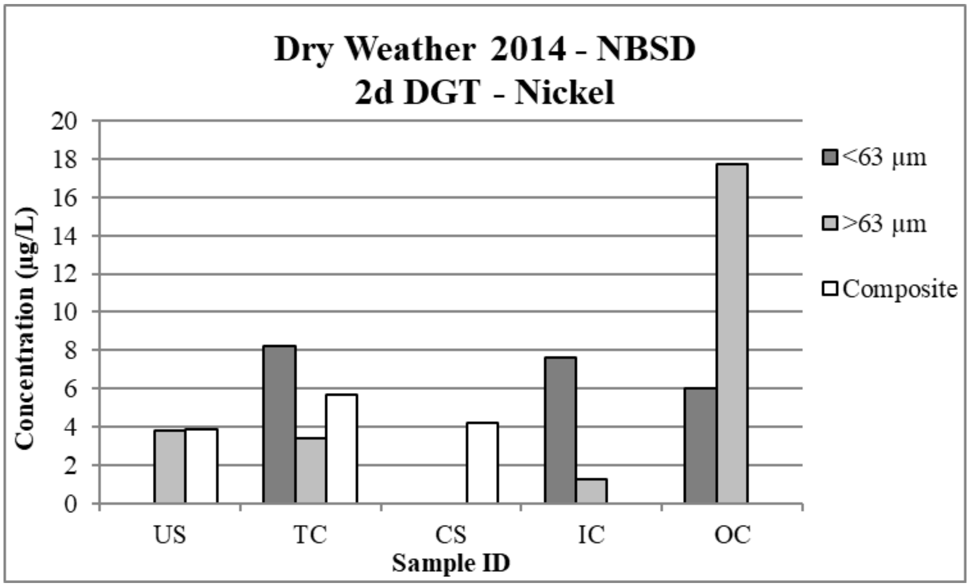


Figure 3-16. Comparison of size fractioned DGT nickel concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

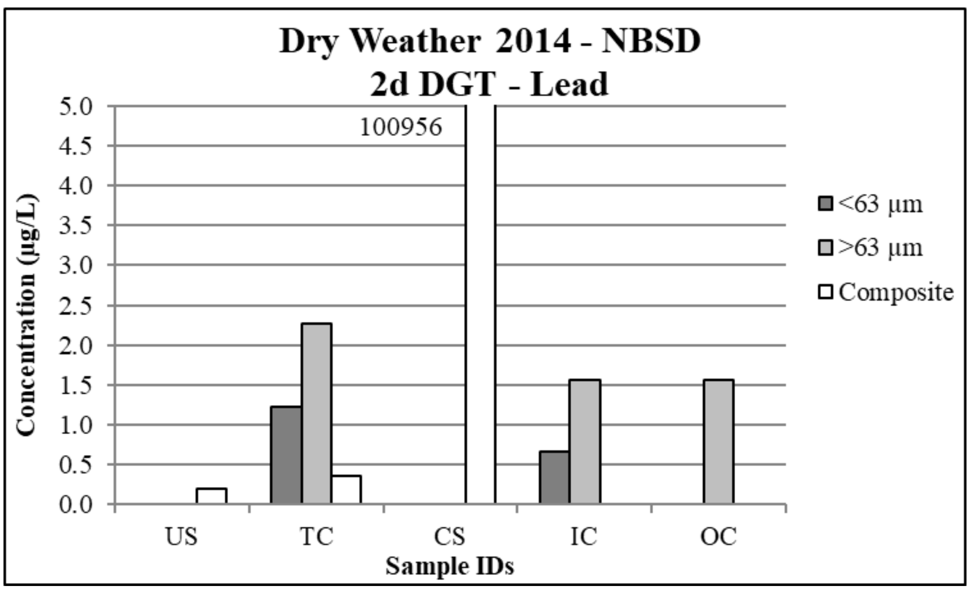


Figure 3-17. Comparison of size fractioned DGT lead concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

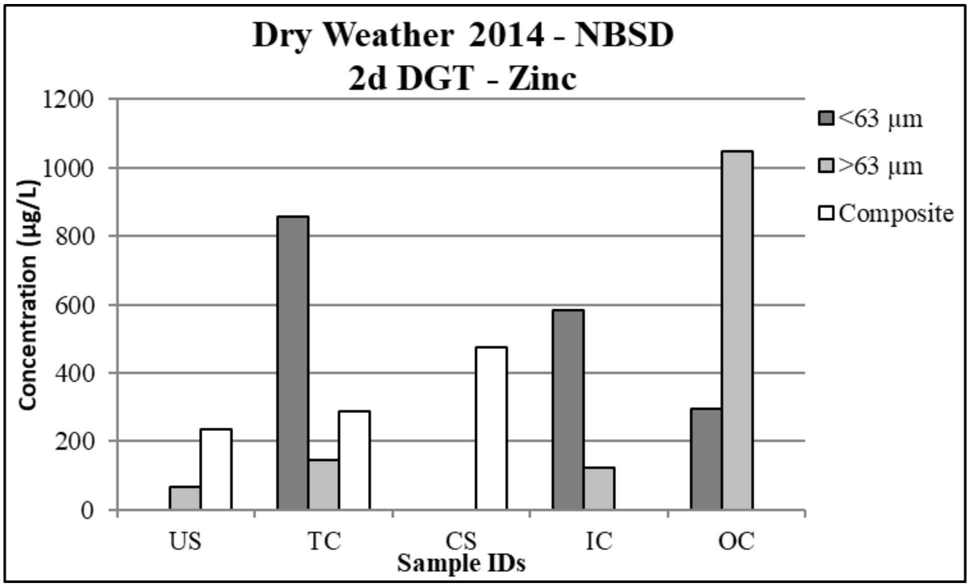


Figure 3-18. Comparison of size fractioned DGT zinc concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

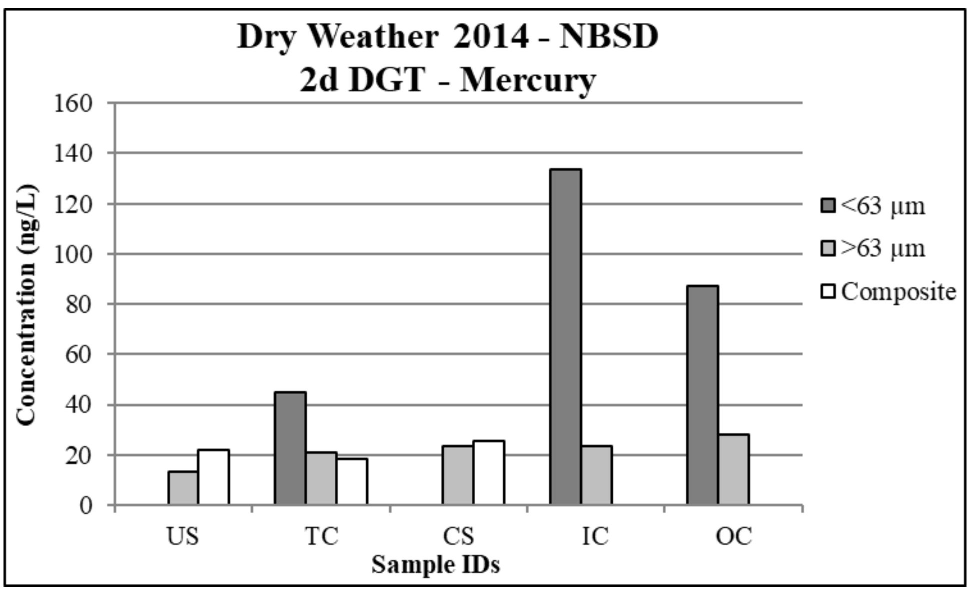


Figure 3-19. Comparison of size fractioned DGT mercury concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

3.1.4. *EX SITU BIOACCUMULATION*

Bioaccumulation tests performed for the evaluation of the Dry Weather sediment samples collected Oct & Nov-2014 met test acceptability criteria of 90% survival in the controls with 93.3% surviving organisms. All water quality parameters were within testing parameters throughout the duration of the exposure. Survival results of the clam *M. nasuta* is shown in Figure 3-20. No data is shown for the <63µm fraction for the Upstream or Conveyance System samples as there was insufficient volume of sample for bioaccumulation exposures. Metal accumulation in the tissues of the clams is shown in Figure 3-21 through Figure 3-28 and summarized in Table 3-4.

Samples collected from the receiving environment compartments (i.e. Inner Creek – IC and Outer Creek – OC) showed good survival of the organisms. The compartment designated Conveyance System (CS) showed decreased survival for the two size fractions tested. Concentrations of lead measured in both the sediment fractions and with the DGT could lend reason for the decreased survival of the clam. Of the surviving organisms in the CS sample, tissue concentrations of lead were extremely high, as could be expected.

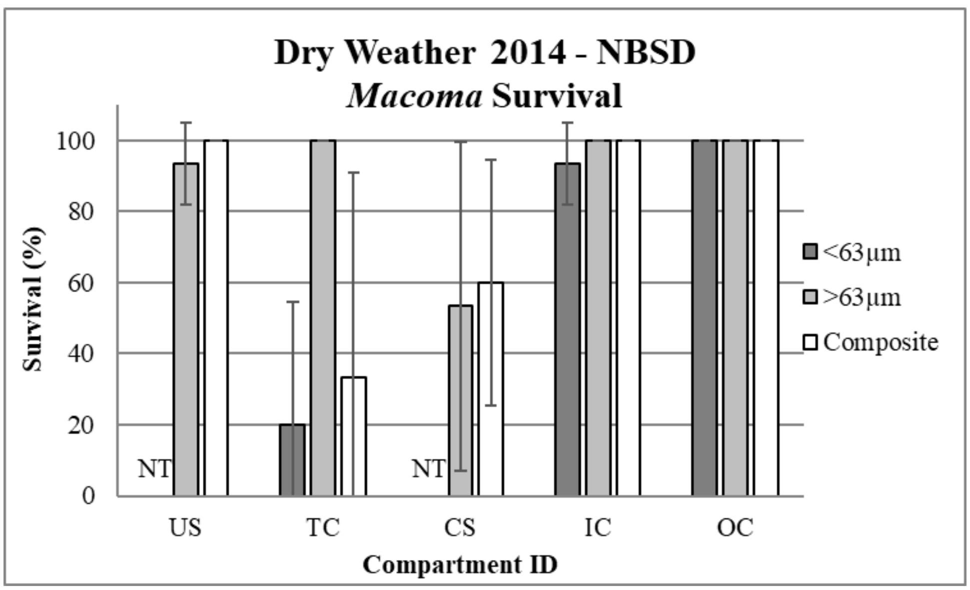


Figure 3-20. Comparison of survival of *Macoma nasuta* for the different size fractioned sediment treatments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

Table 3-4. 2014 Dry Weather NBSD Survival of *Macoma nasuta*.

Sample Compartment	Grain Size Fraction (µm)	Mean Survival (%)	SD
Control	NA	93.3	11.5
Upstream (US)	<63	NT	NA
	>63	93.3	11.5
	Composite	100	0
Tidal Creek (TC)	<63µm	20.0	34.6
	>63µm	100.0	0.0
	Composite	33.3	57.7
Conveyance System (CS)	<63µm	NT	NA
	>63µm	53.3	46.2
	Composite	60.0	34.6
Inner Creek (IC)	<63µm	93.3	11.5
	>63µm	100.0	0.0
	Composite	100.0	0.0
Outer Creek (OC)	<63µm	100.0	0.0
	>63µm	100.0	0.0
	Composite	100.0	0.0

NT – not tested. NA – not available.

Table 3-5. 2014 Dry Weather NBSD Bioaccumulation Results.

Sample Compartment	Grain Size Fraction (µm)	Al (µg/Kg)	Cd (µg/Kg)	Cr (µg/Kg)	Cu (µg/ Kg)	Fe (µg /Kg)	Ni (µg/ Kg)	Pb (µg/ Kg)	Zn (µg/ Kg)
Upstream (US)	<63	NT	NT	NT	NT	NT	NT	NT	NT
	>63	15.4	0.1	1.4	10.1	549.3	1.1	1.5	116.7
	Composite	234.6	0.1	1.7	12.0	1150.2	1.9	2.8	84.1
Tidal Creek (TC)	<63µm	31.8	0.2	2.8	18.3	899.7	1.3	0.7	108.1
	>63µm	160.8 (0.9)	0.1 (0.0)	1.9 (0.0)	18.0 (0.3)	1149.9 (20.8)	1.4 (0.0)	4.5 (0.1)	96.5 (1.1)
	Composite	16.0	0.1	1.5	12.4	531.5	1.0	0.3	101.7
Conveyance System (CS)	<63µm	NT	NT	NT	NT	NT	NT	NT	NT
	>63µm	13.3	0.5	1.0	7.0	520.3	0.9	87074.6	179.9
	Composite	22.5	0.8	1.5	7.6	404.3	1.1	50746.3	222.7
Inner Creek (IC)	<63µm	441.1	0.2	4.5	33.8	3060.7	2.4	8.7	167.6
	>63µm	56.4	0.1	0.8	6.5	719.1	0.8	2.8	66.6
	Composite	146.4	0.1	1.9	17.4	1120.5	1.2	3.5	74.3
Outer Creek (OC)	<63µm	134.0	0.0	1.2	5.5	1049.4	0.6	1.2	44.1
	>63µm	257.9	0.1	2.0	14.6	1638.1	1.4	2.1	96.3
	Composite	198.2	0.1	2.3	16.9	1729.3	1.2	2.6	105.4

Values in ( ) are SD of duplicate samples tested. NT – not tested.

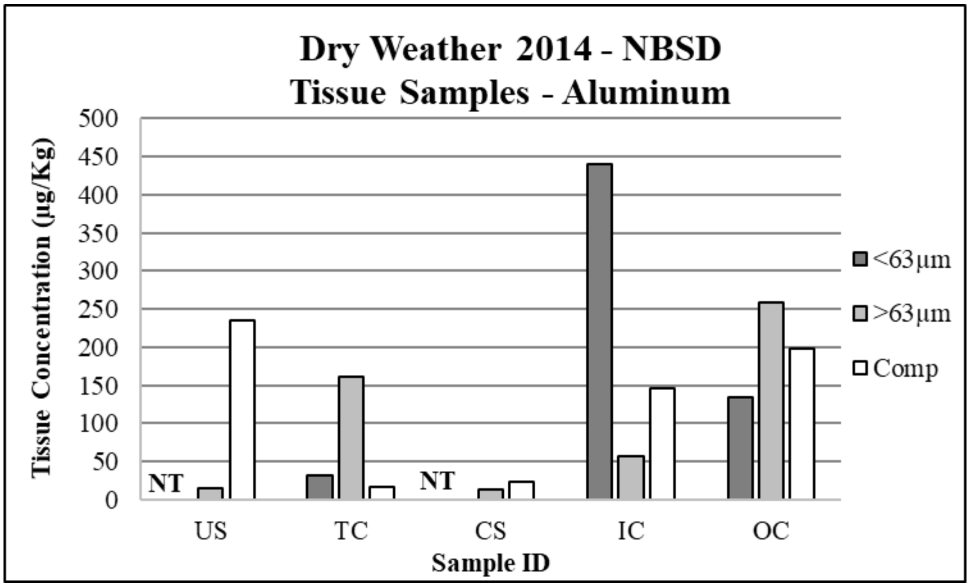


Figure 3-21. Comparison of size fractioned tissue aluminum concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

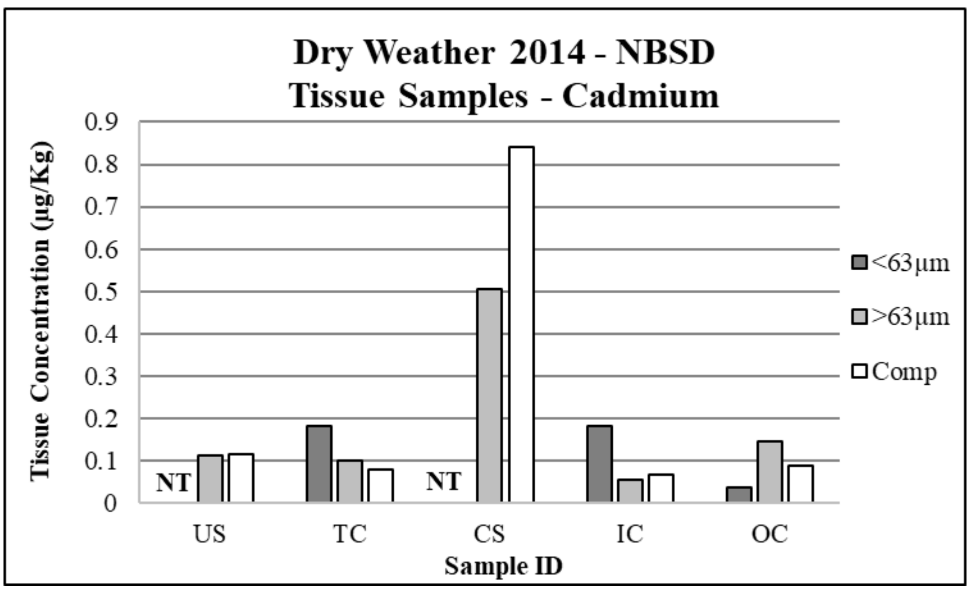


Figure 3-22. Comparison of size fractioned tissue cadmium concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

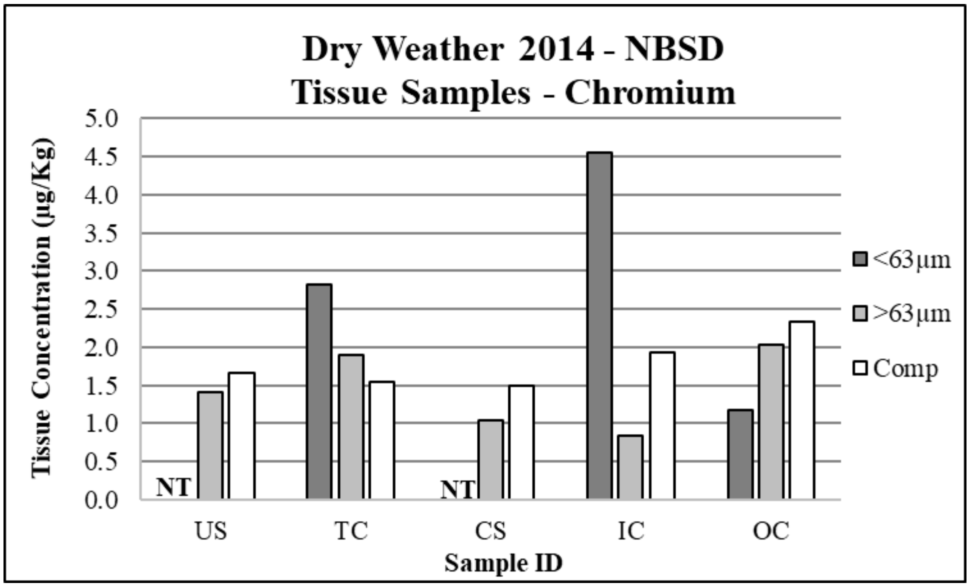


Figure 3-23. Comparison of size fractioned tissue chromium concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

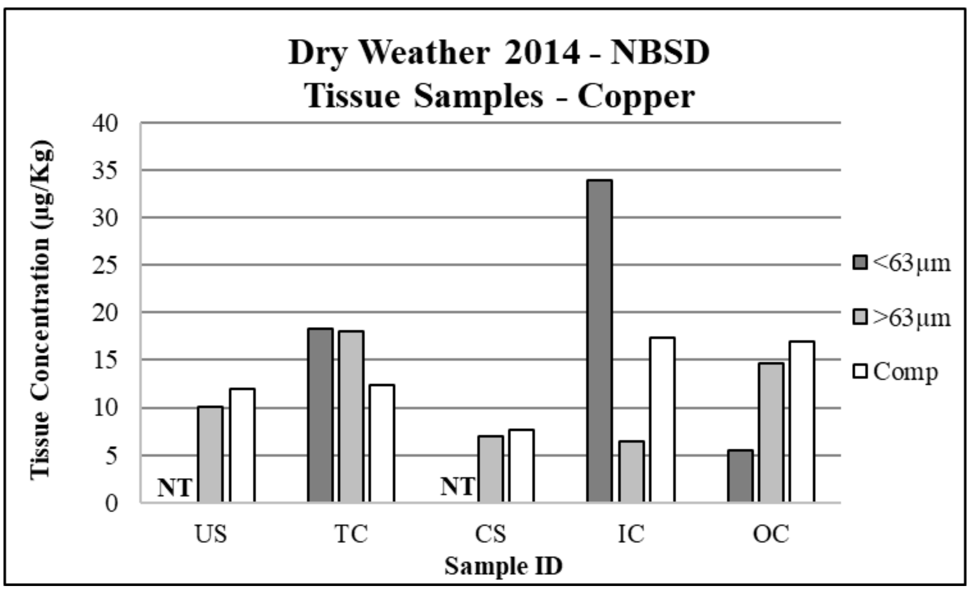


Figure 3-24. Comparison of size fractioned tissue copper concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

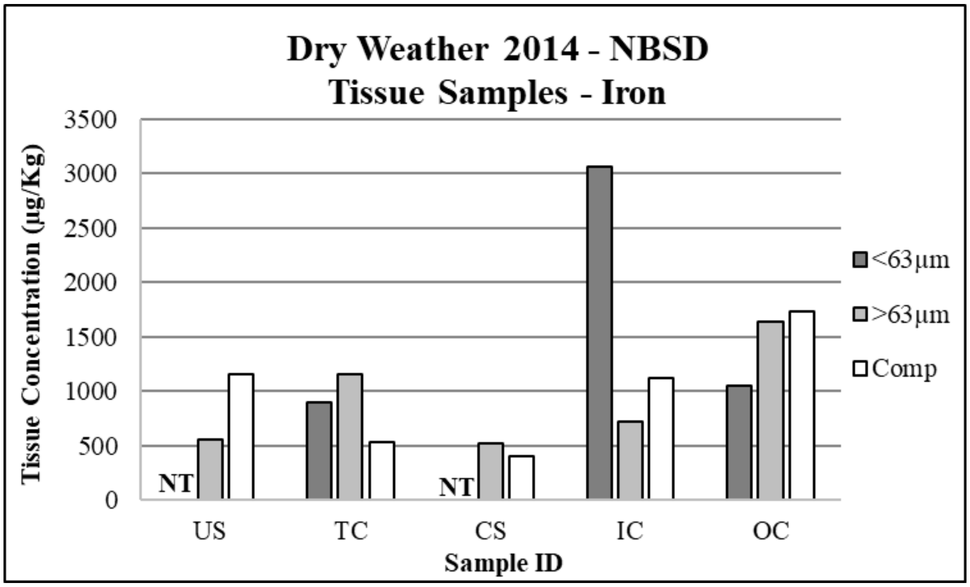


Figure 3-25. Comparison of size fractioned tissue iron concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

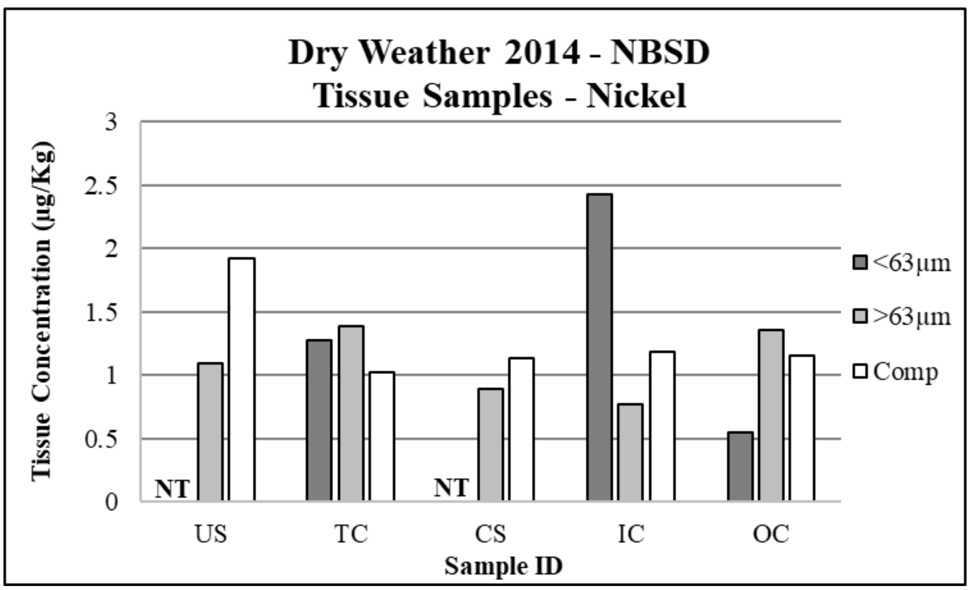


Figure 3-26. Comparison of size fractioned tissue nickel concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

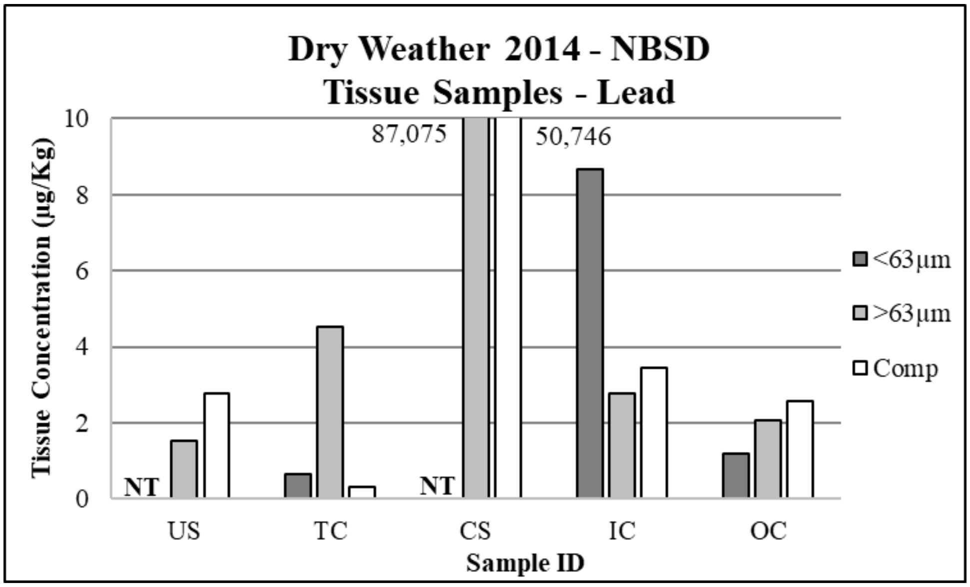


Figure 3-27. Comparison of size fractioned tissue lead concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

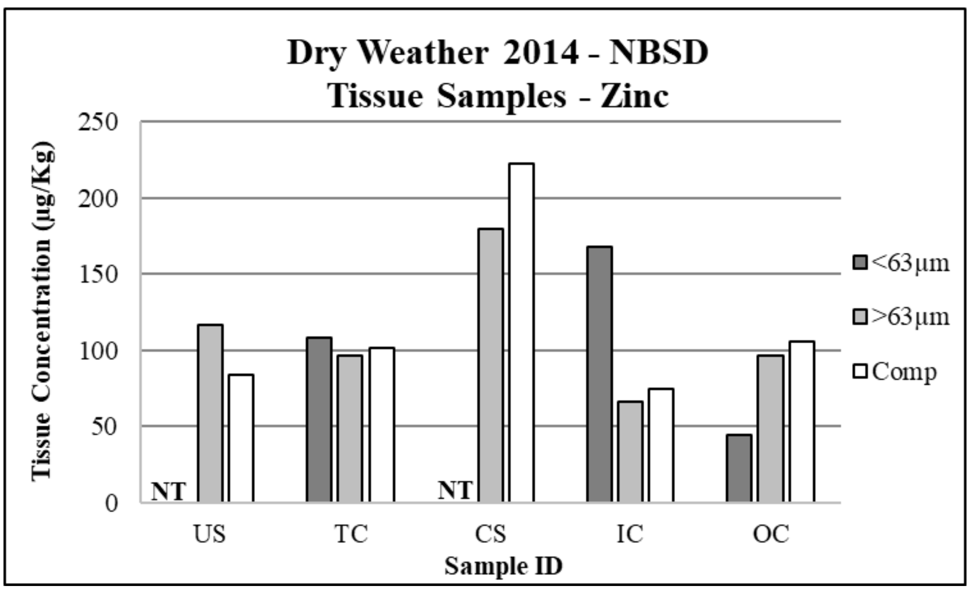


Figure 3-28. Comparison of size fractioned tissue zinc concentrations for the five compartments for the 2014 Dry Weather sampling effort at NBSD. NT – not tested.

3.1.5. *DISCUSSION*

Several correlation analyses were conducted on the following for all sample locations combined: 1) bulk sediment vs. tissue; 2) <63µm sediment fraction vs. tissue; >63µm fraction vs. tissue; 3) DGT vs. tissue (DGTs and clams deployed in same sediment types). Concentrations of lead were positively correlated with significant p-values between the bulk sediment vs. tissue and for the DGT vs. tissue ($p < 0.00$ for both). These results are likely being driven by the extremely high concentrations of lead that were detected in the conveyance system samples. Removal of the conveyance system samples from the correlation renders non-significance for both analyses.

Cadmium in the tissues of clams exposed to bulk sediments also showed a positive correlation with DGT concentrations. However, only 3 samples are contributing to the analysis (DGTs were only deployed in the Upstream, Tidal Creek and Conveyance System samples), thus reducing the robustness of this analysis.

3.2. 2015 DRY WEATHER – NBSD

3.2.1. *SEDIMENT CHEMISTRY*

Intact sediment cores were analyzed on a bulk fraction basis for total organic carbon (TOC) and black carbon (BC), trace metals, polycyclic aromatic hydrocarbons (PAHs), Polychlorinated biphenyls (PCBs) and pyrethroid pesticides. Results are summarized in Table 3-6 and shown in Figure 3-29 through Figure 3-41.

For all trace metals analyzed, except for lead, P17 showed higher concentrations relative to P11. The reference site showed concentrations lower than both P11 and P17 for all analytes.

For the organic analyses, once normalized to the organic carbon content, the same trend was observed where concentrations increased from the reference station to the highest concentrations observed at P17.

Table 3-6. 2015 Dry Weather Bulk Sediment Chemistry Results – NBSD.

Compartment ID	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/g DW)	Pb (µg/g DW)	Ni (µg/g DW)	Zn (µg/g DW)
Reference Station CP2243	3.6 (0.2)	0.1 (0.0)	61.1 (2.2)	0.3	22.7 (0.2)	7.7 (0.1)	113.1 (1.2)
P11	5.3 (0.1)	1.5 (0.1)	161.0	0.71	138.8 (30.0)	18.1 (2.3)	387.7 (18.8)
P17	9.1 (0.1)	1.8 (0.1)	334.8 (50.2)	0.8	141.6 (17.9)	23.5 (0.5)	674.6 (12.7)

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect.

Table 3-7. 2015 Dry Weather Bulk Sediment Chemistry Results – NBSD (cont'd).

Compartment ID	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/g OC)	Total PCBs (µg/kg)	Total PCBs (µg/g OC)	Pyrethroid Pesticides (µg/kg)	Pyrethroid Pesticides (µg/g OC)
Reference Station CP2243	1.75	0.17	225.5	14.3	8.1	0.5	0.8	0.05
P11	2.76	0.17	1717.4	66.4	221.9	8.6	6.1	0.2
P17	1.63	0.15	1290.8	87.2	233.5	15.8	46.0	3.1

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect.

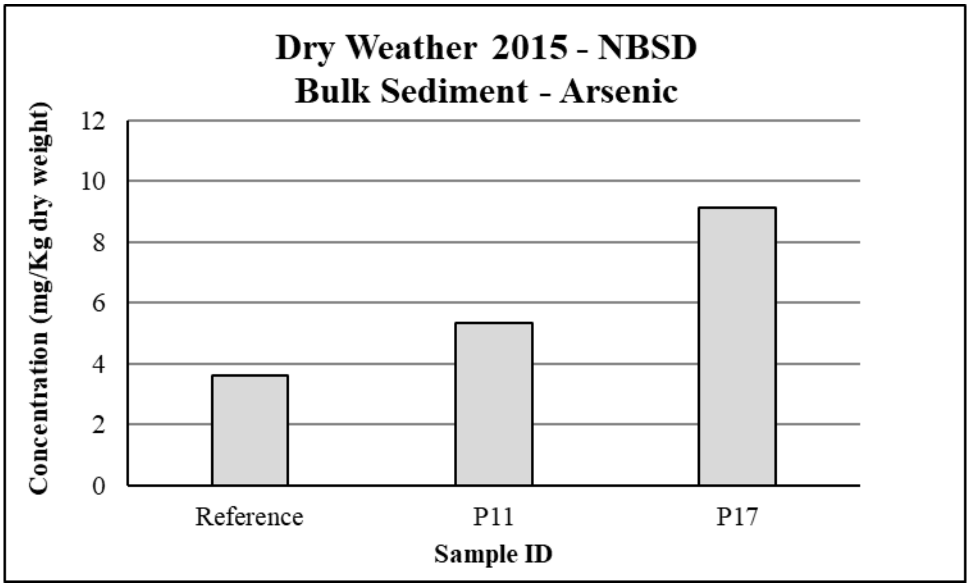


Figure 3-29. Bulk sediment arsenic concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

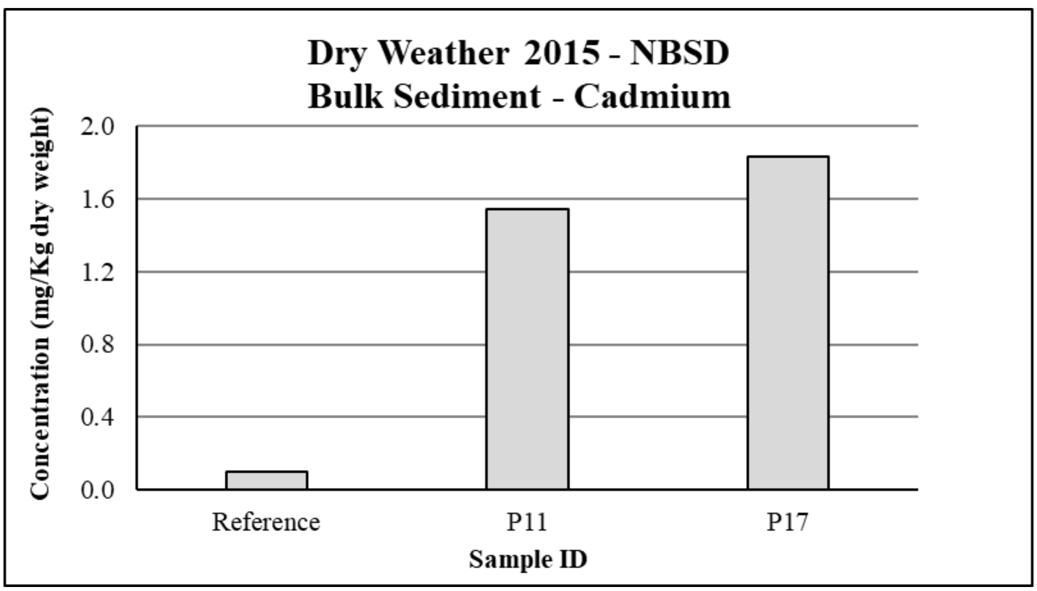


Figure 3-30. Bulk sediment cadmium concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

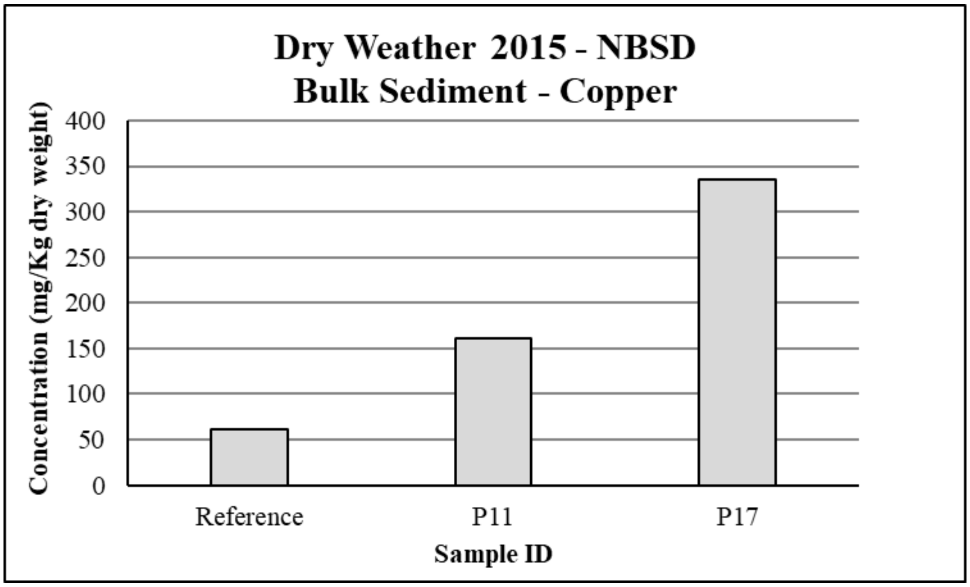


Figure 3-31. Bulk sediment copper concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

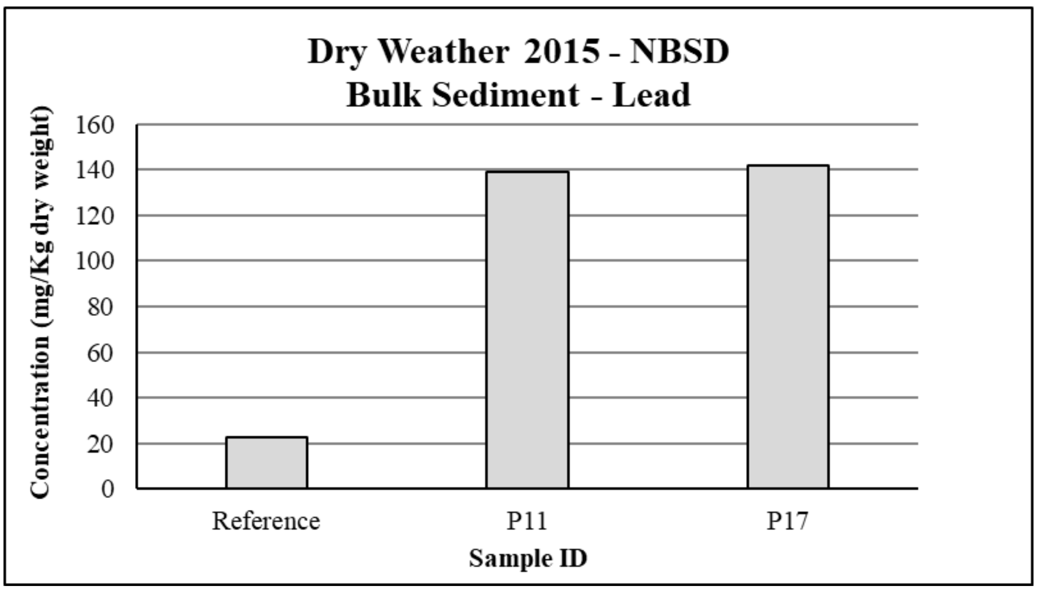


Figure 3-32. Bulk sediment lead concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

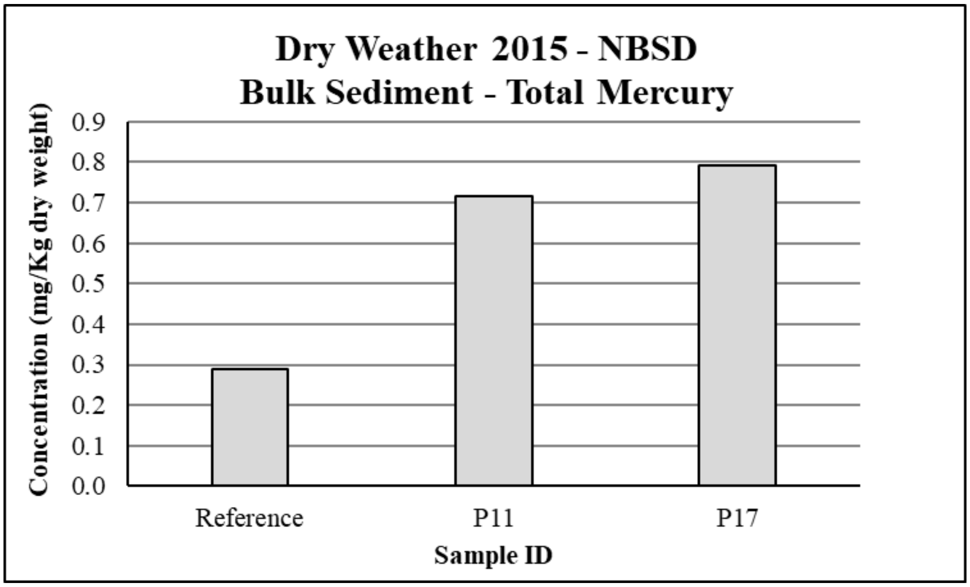


Figure 3-33. Bulk sediment mercury concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

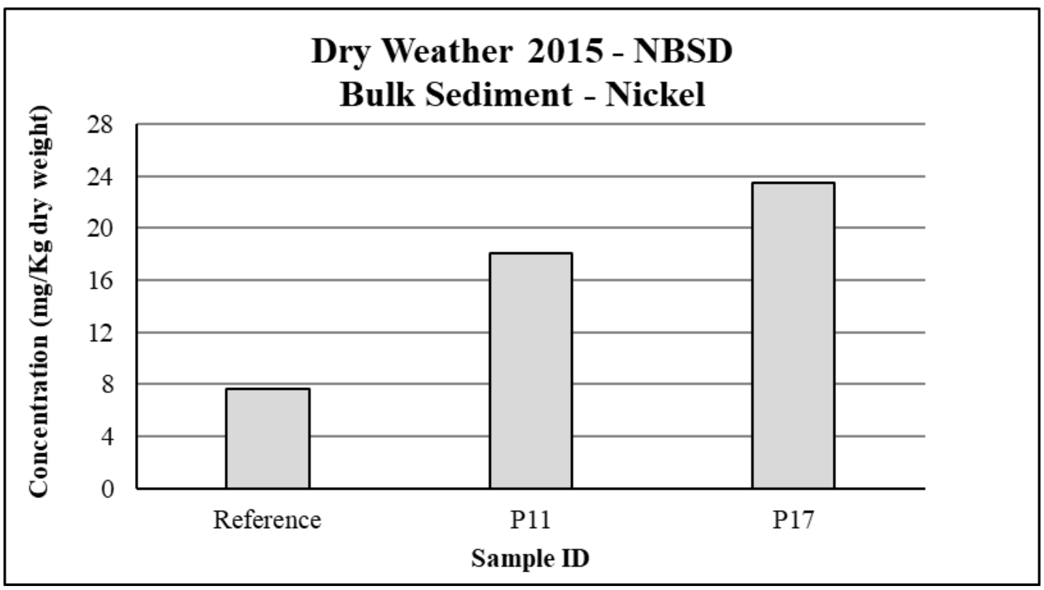


Figure 3-34. Bulk sediment nickel concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

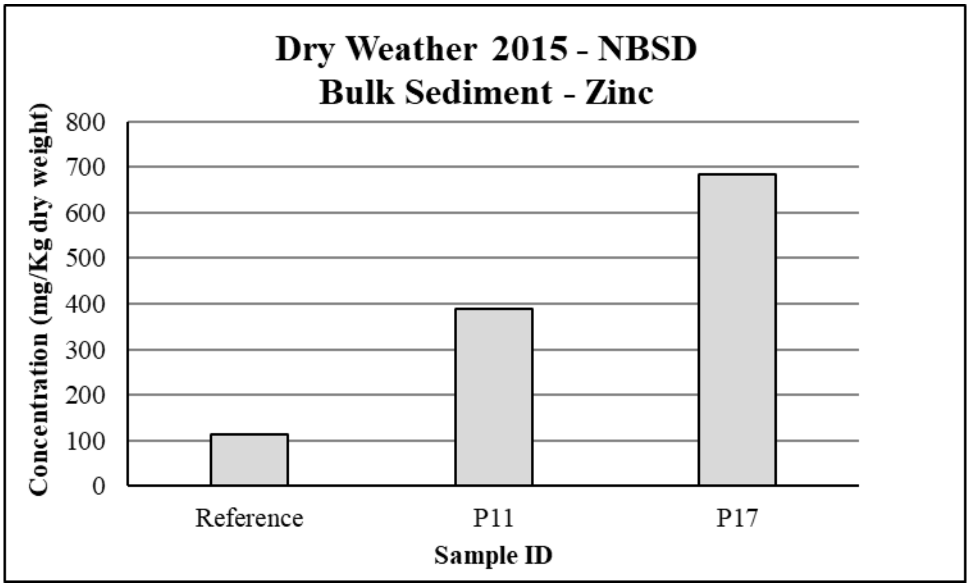


Figure 3-35. Bulk sediment zinc concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

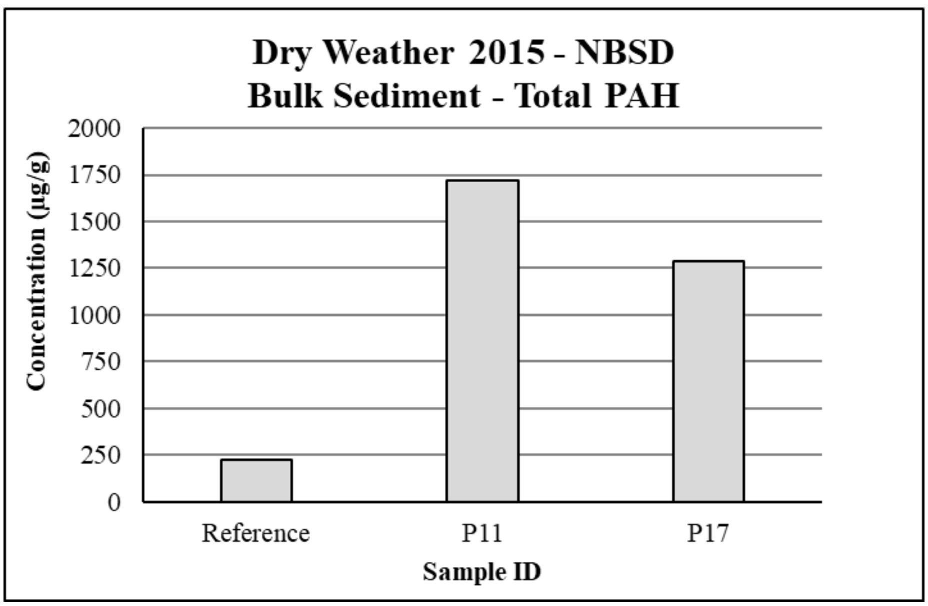


Figure 3-36. Bulk sediment Total PAH concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

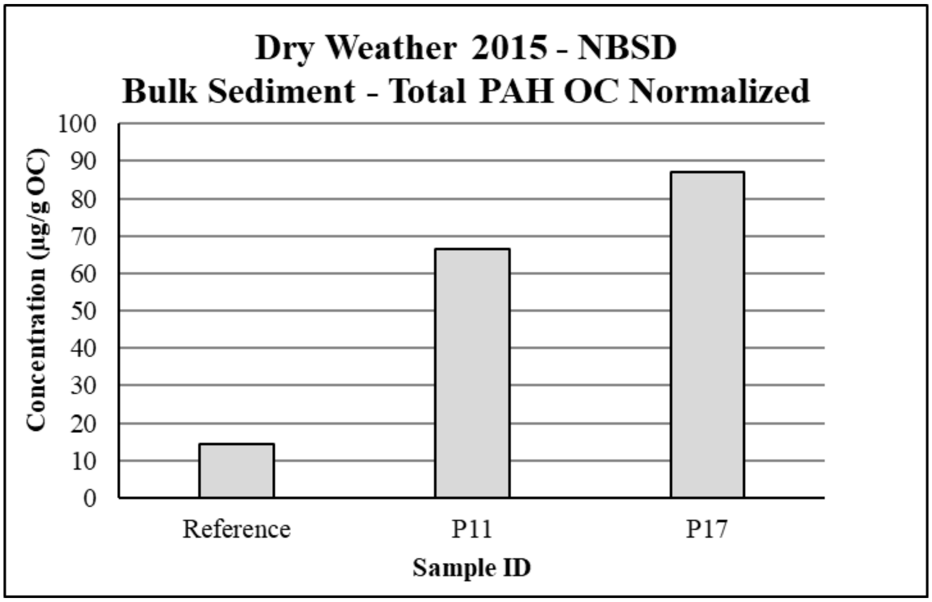


Figure 3-37. Bulk sediment Total PAH concentrations normalized to the organic carbon content for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

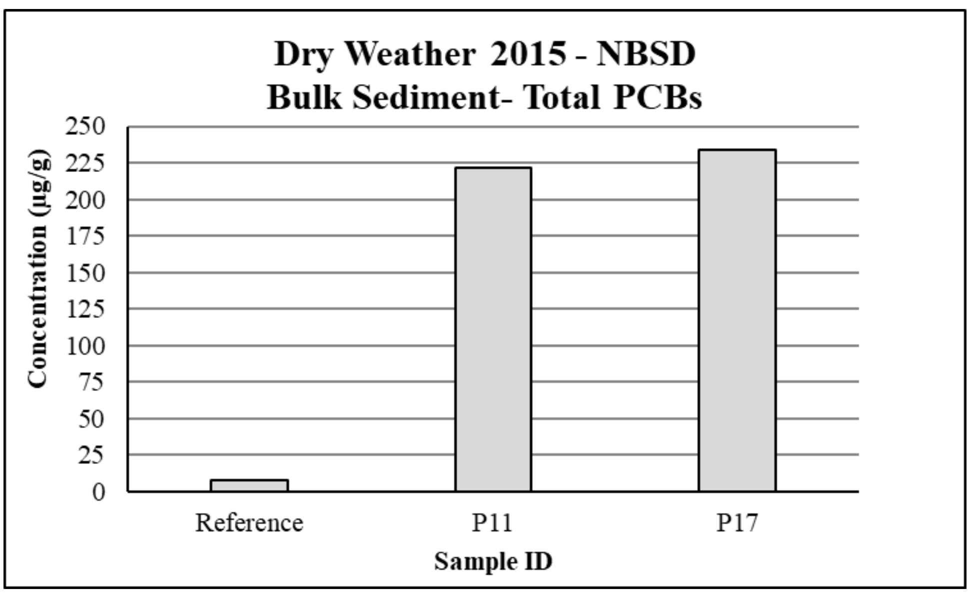


Figure 3-38. Bulk sediment Total PCB concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

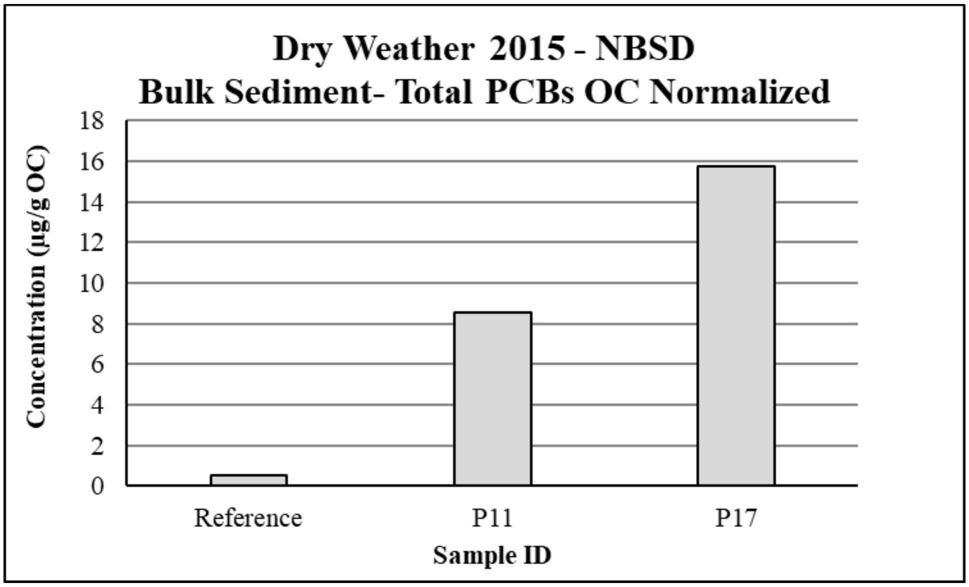


Figure 3-39. Bulk sediment Total PCB concentrations normalized to the organic carbon content for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

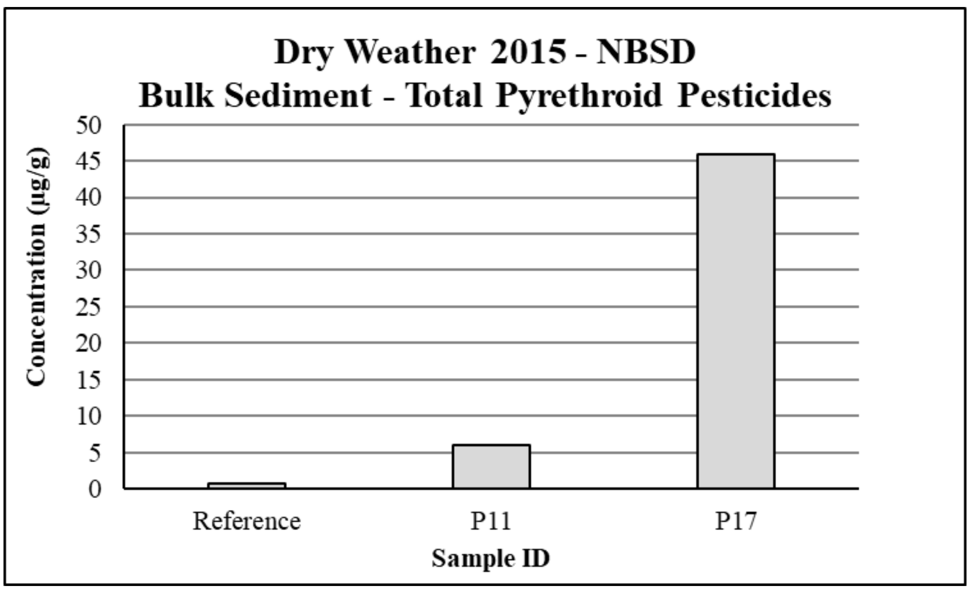


Figure 3-40. Bulk sediment pyrethroid pesticide concentrations for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

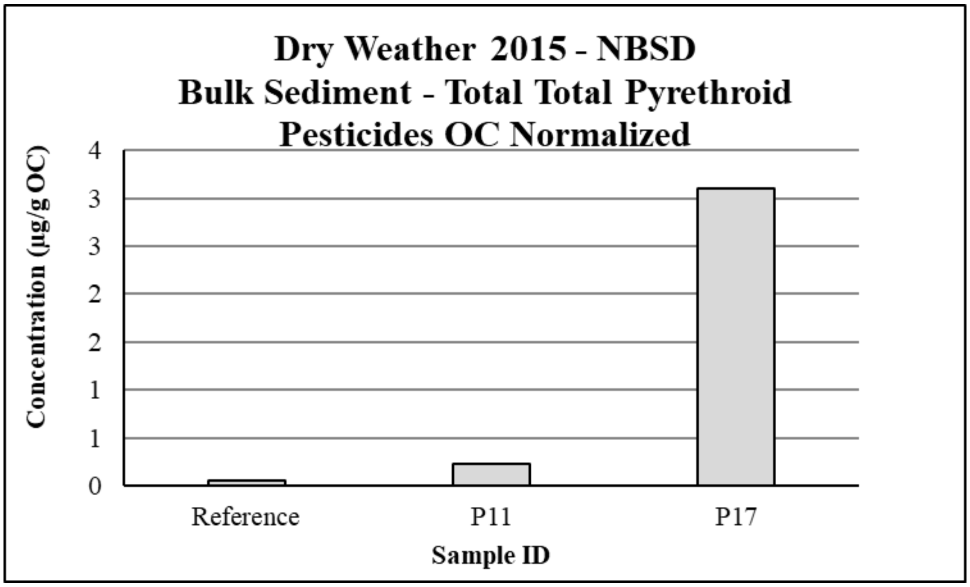


Figure 3-41. Bulk sediment pyrethroid pesticide concentrations normalized to the organic carbon content for the reference station and P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

3.2.2. *In Situ Studies*

Tidal conditions/elevations for the Dry weather deployment from 16-Jul-2015 to 12-Aug-2015 are shown in Figure 3-42. During the deployment, tidal elevations cycled through approximately 2 spring-neap tidal cycles.

Precipitation observed over the course of the deployment is shown in Figure 2-1. While the intent of the deployment was to characterize baseline/dry weather conditions, an unexpected summer rain event occurred on 18-Jul to 19-Jul-2015. Approximately 1.5” of precipitation was recorded at the San Diego International Airport – Lindbergh Field.

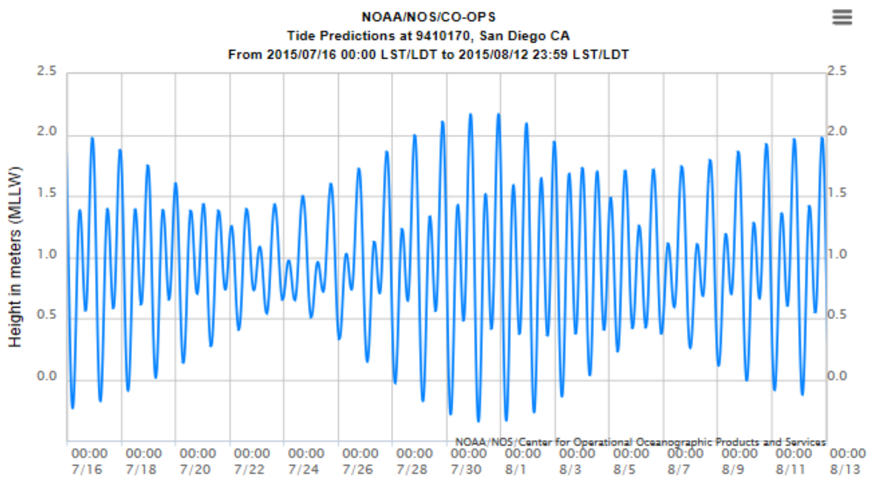


Figure 3-42. Dry Weather 2015 tidal conditions at Paleta Creek – NBSD.

3.2.2.1. SEDIMENT TRAPS

Sediment traps were recovered and initial processing was conducted by SSC Pac personnel. Size fractionation characterization of sediment trap material was conducted by TTU staff. Size fractions were classified as: Clay (<2µm); Fine silt (2-20µm); Coarse silt (20-63µm); and Sand (>63µm). Figure 3-43 below shows the % mass that each size fraction contributes to the total for each station sampled. Chemistry results for bulk sediment trap material is summarized in Table 3-8 and Table 3-9 and shown in Figure 3-44 through Figure 3-56.

As stated previously, the intent of the deployment was to characterize baseline/dry weather conditions. However, an unexpected summer rain event occurred on 18-Jul to 19-Jul-2015 with approximately 1.5” of precipitation.

Deposition rates at the deployment site were estimated based on the composite total mass collected in the three sediment traps deployed at each site, the combined surface area of the traps, and the time period of the deployment. The total sediment dry weight mass collected in the traps was 108.6 and 165.5g for P11 and P17, respectively. The combined surface area of the three traps at each station was 547 cm^2, and the deployment period was 27 days. This indicates a deposition rate of about 0.02 and 0.03 $g/cm^2/d$ for P11 and P17, respectively. Assuming a wet bulk density of 1.67 and 1.80g/cm^3 (estimated from moisture content and assumed solids density of 2.5 g/cm^3), this indicates a deposition rate of about 4.8 and 6.8 cm/y or a total deposition thickness for the deployment period of about 0.4 and 0.5cm for P11 and P17, respectively.

Interestingly, unlike the bulk sediment trace metal concentrations, several metals showed increased concentrations in sediment trap material recovered from P11 compared to P17 (i.e. arsenic, copper, nickel, mercury).

Additionally, organics (i.e. PAHs, PCBs and pyrethroid pesticides) also showed higher concentrations in sediment trap material recovered from P11 compared to P17. This is likely due to the relatively higher percentage of particle fractions less than 63µm recovered in the sediment traps from P11. P11 sediment traps had over 85% of the content in grain size fractions less than 63µm, whereas P17 had about 65% of the content in the less than 63µm fraction.

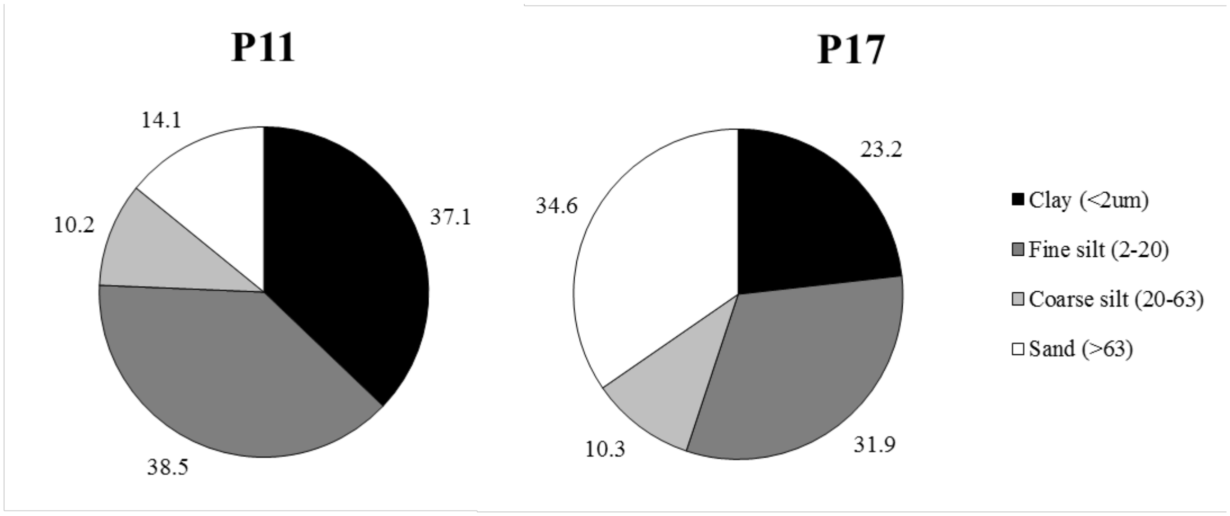


Figure 3-43. Proportion of each particle class size contributing to the total mass of sediment traps deployed at stations P11 and P17 during the Dry Weather monitoring 2016 – NBSD.

Table 3-8. 2015 Dry Weather Sediment Trap Chemistry Results – NBSD.

Sample ID	As (µg/g)	Cd (µg/g)	Cu (µg/g)	Hg (µg/g)	Pb (µg/g)	Ni (µg/g)	Zn (µg/g)
P11	12.9 (0.4)	0.5	310.1	0.73 (0.1)	127.6 (3.6)	31.6 (5.4)	412.8 (57.7)
P17	9.4 (0.4)	1.3 (0.3)	255.5	0.49 (0.0)	263.3 (8.7)	28.1 (1.3)	666.0 (91.3)

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect.

Table 3-9. 2015 Dry Weather Sediment Trap Chemistry Results – NBSD (cont'd).

Sample ID	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/kg OC)	Total PCBs (µg/kg)	Total PCBs (µg/kg OC)	Pyrethroid Pesticides (µg/g)	Pyrethroid Pesticides (µg/g OC)
P11	3.51 (0.06)	0.13 (0.02)	4576.6	135.4	384.9	11.4	363.2	10.7
P17	6.25 (0.24)	0.2 (0.05)	4239.6	69.7	178.1	2.9	29.2	0.48

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect

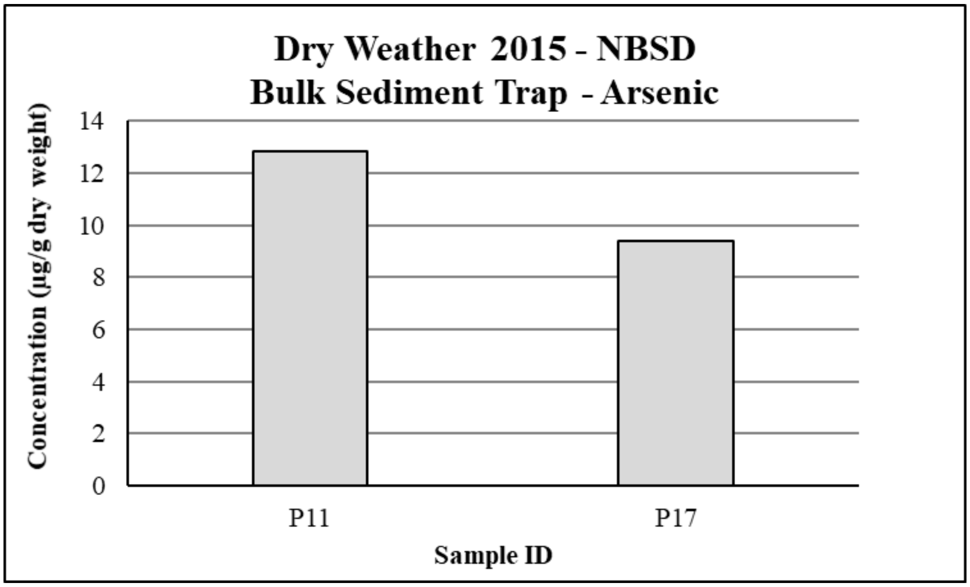


Figure 3-44. Bulk sediment trap arsenic concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

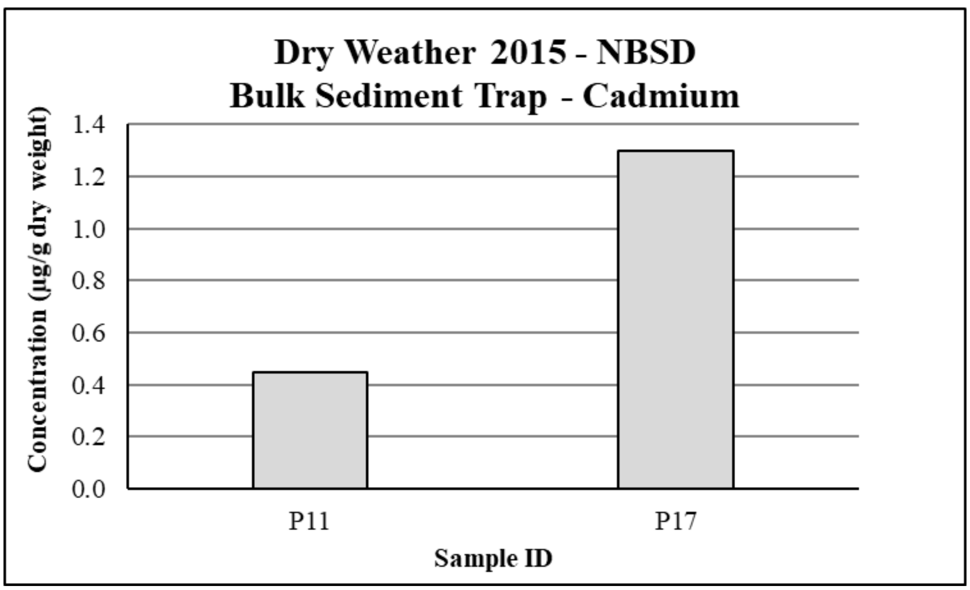


Figure 3-45. Bulk sediment trap cadmium concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

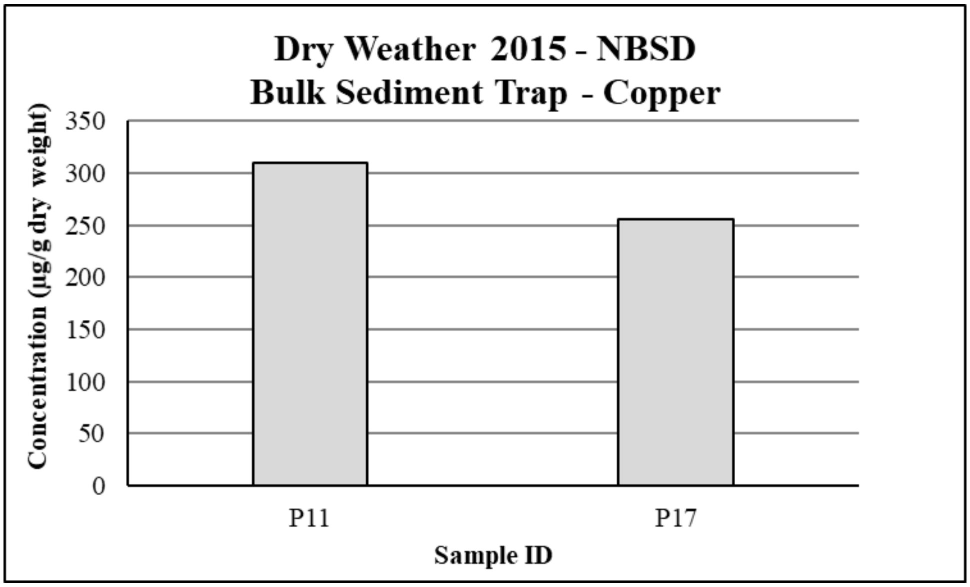


Figure 3-46. Bulk sediment trap copper concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

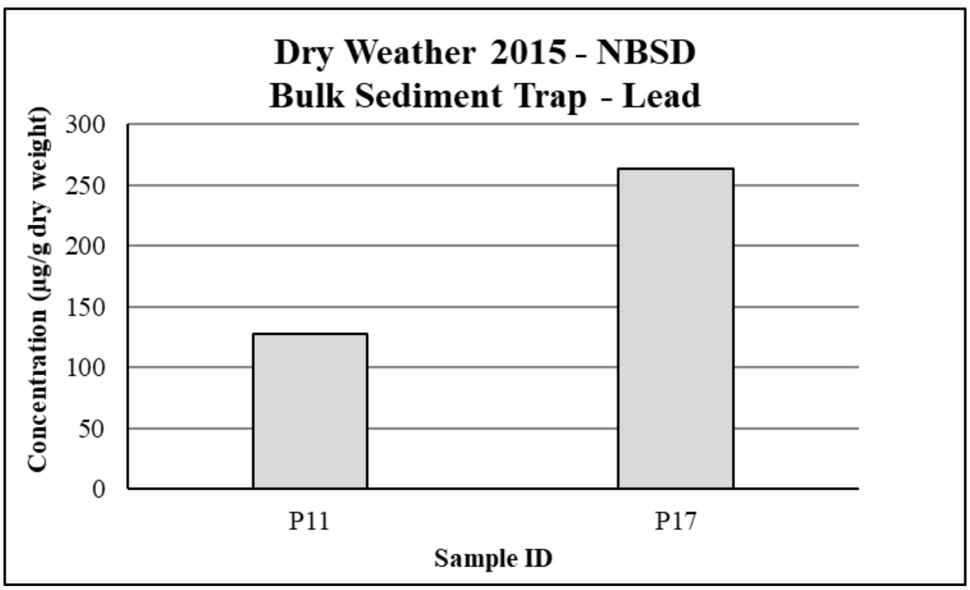


Figure 3-47. Bulk sediment trap lead concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

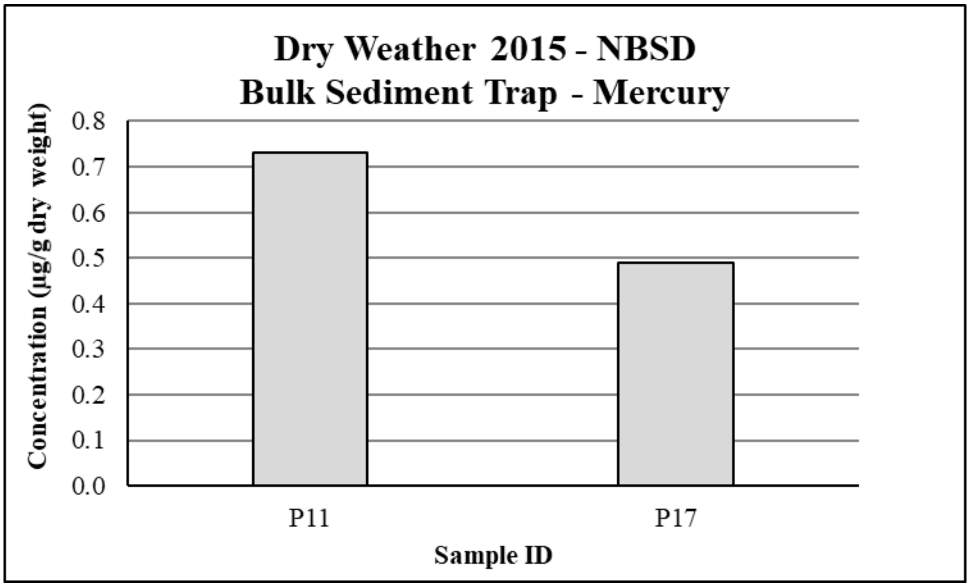


Figure 3-48. Bulk sediment trap mercury concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

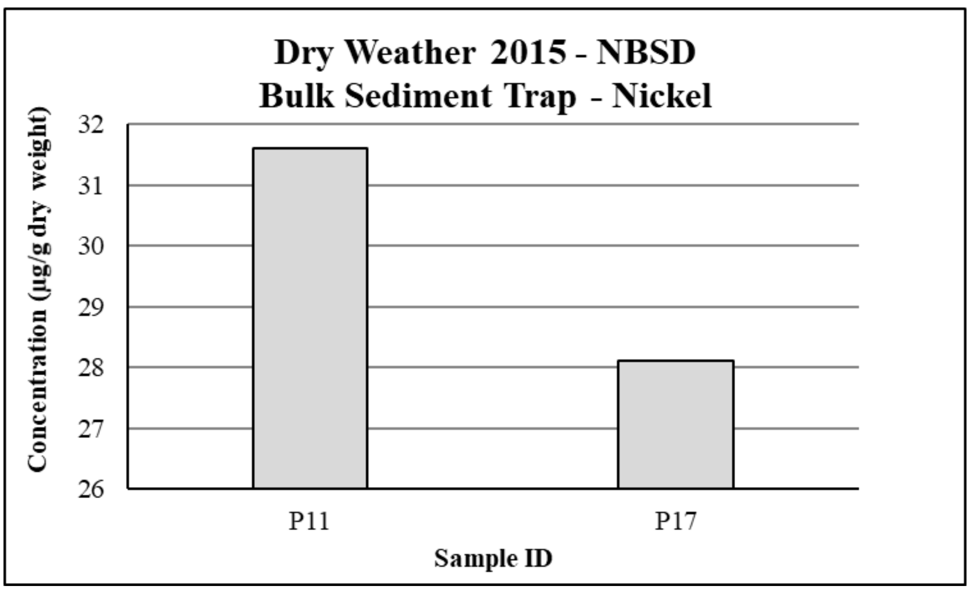


Figure 3-49. Bulk sediment trap nickel concentrations stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

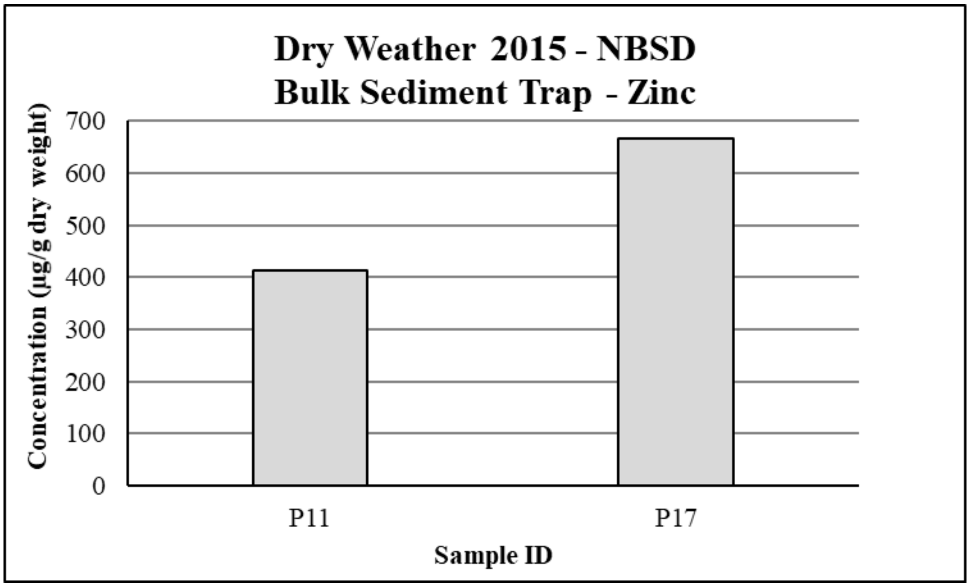


Figure 3-50. Bulk sediment trap zinc concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

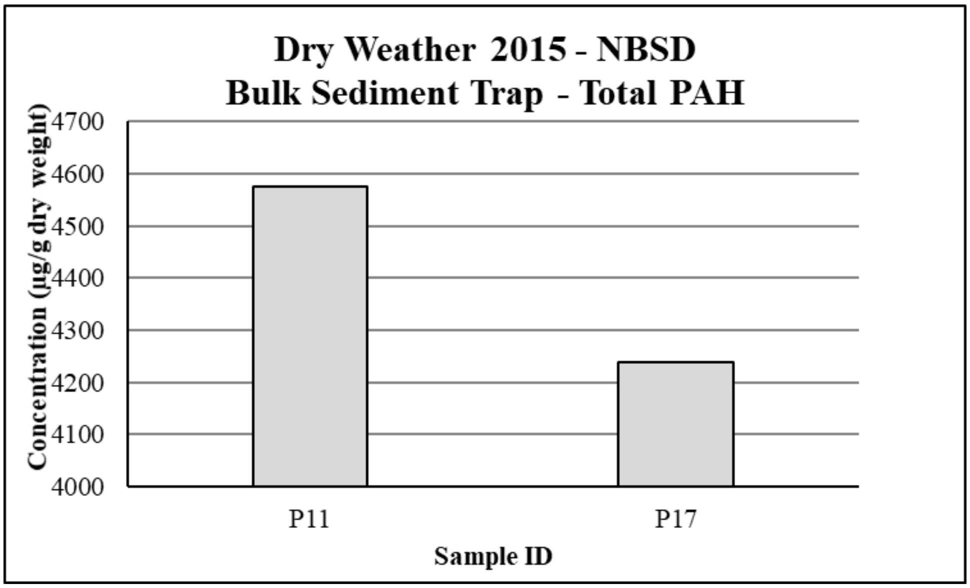


Figure 3-51. Bulk sediment trap Total PAH concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

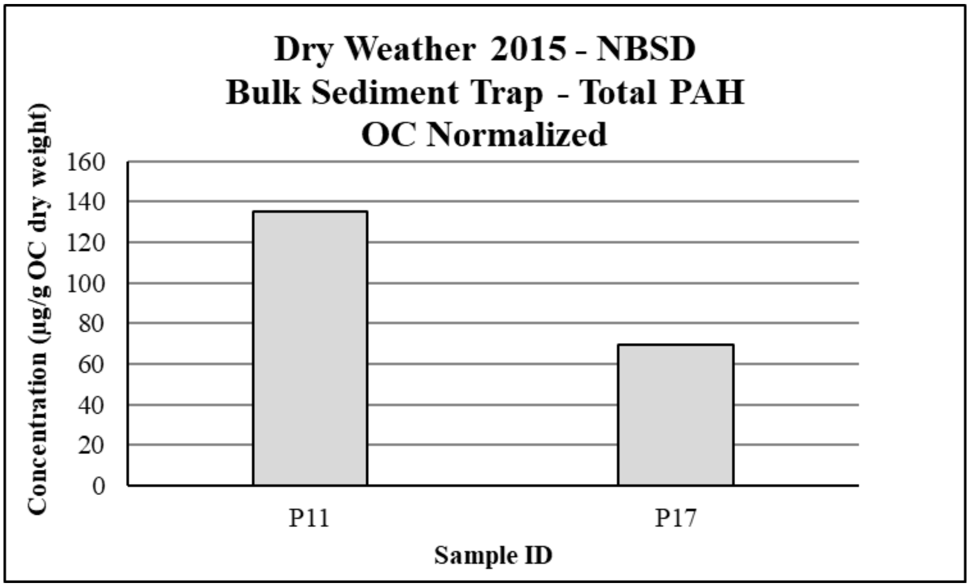


Figure 3-52. Bulk sediment trap Total PAH concentrations normalized to the organic carbon content for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

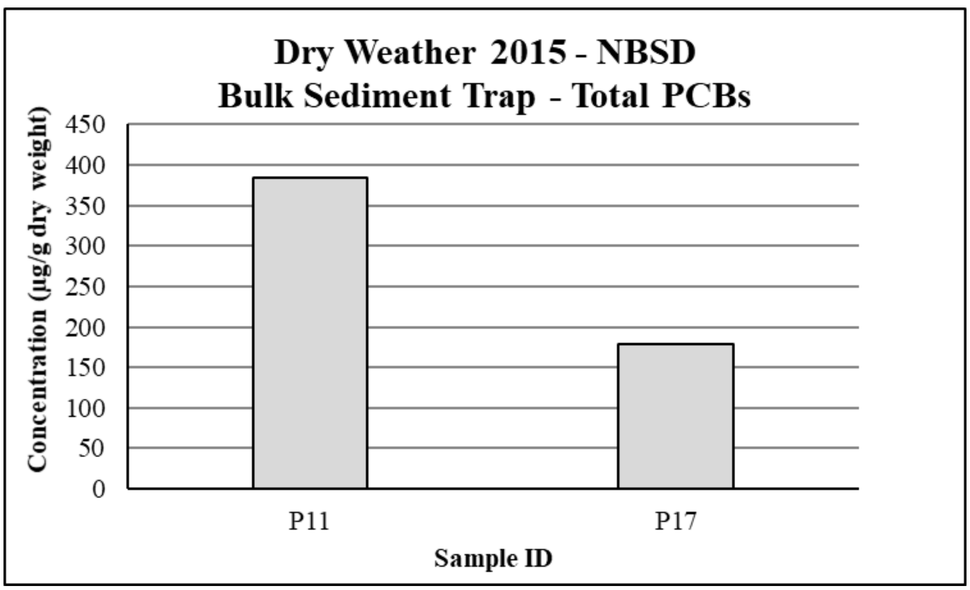


Figure 3-53. Bulk sediment trap Total PCB concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

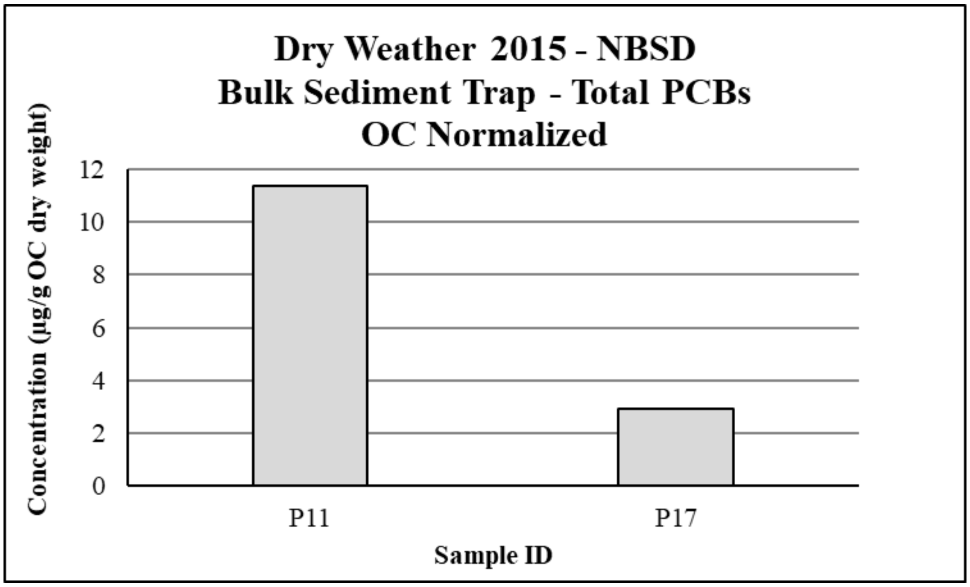


Figure 3-54. Bulk sediment trap Total PCB concentrations normalized to the organic carbon content for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

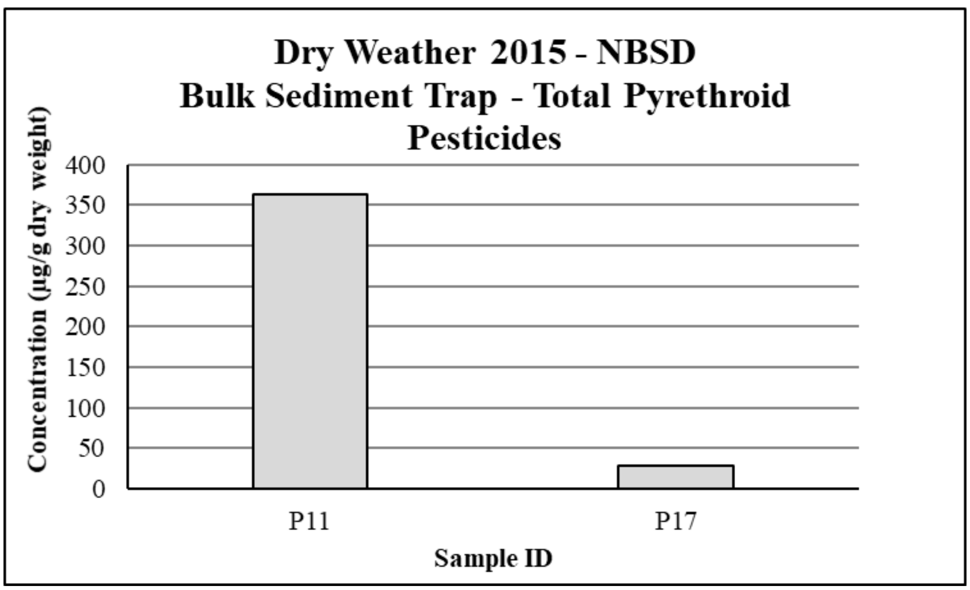


Figure 3-55. Bulk sediment trap pyrethroid pesticide concentrations for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

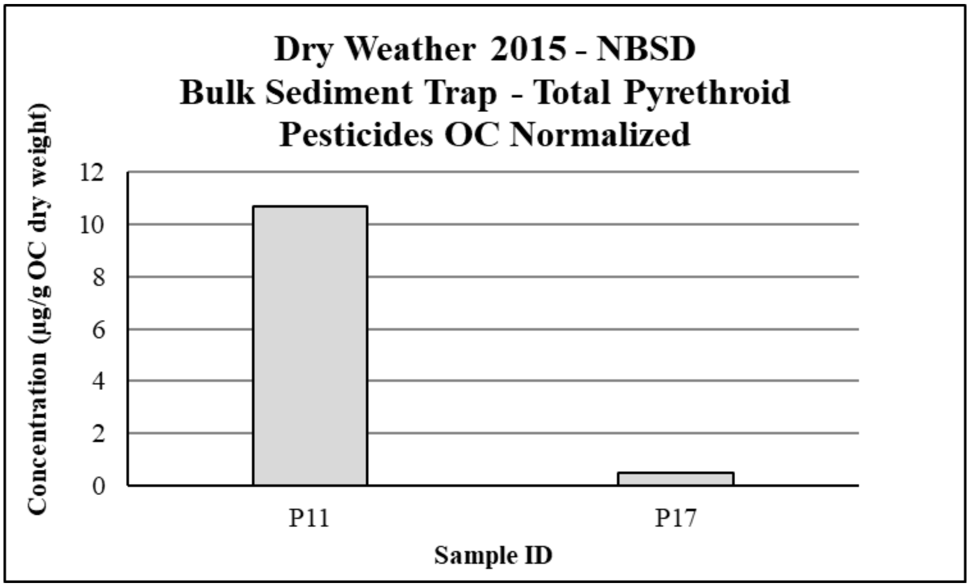


Figure 3-56. Bulk sediment trap pyrethroid pesticide concentrations normalized to the organic carbon content for stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

3.2.2.2. SPME PASSIVE SAMPLERS

As described in section 2.3.3, SPMEs deployed *in situ* were sectioned in 10cm sections for the portion of the SPME fiber that was exposed to the overlying water. For the sections of the SPMEs that were deployed in the sediment, the fiber was sectioned into 5cm sections. Total PAH concentrations in the overlying waters as derived from SPMEs for stations P11 and P17 are summarized in Table 3-10. Concentrations in the overlying waters ranged from 85 to 122 ng/L and are shown in Figure 3-57. Concentrations in the pore waters as derived from SPMEs ranged from 159 to 381 ng/L for stations P11 and P17 and are shown in Figure 3-58.

For SPMEs deployed at station P11, concentrations in the overlying water didn't appear to show trends with distance from the sediment surface. For station P17, concentrations seemed to increase in sections closer to the sediment surface.

For SPMEs deployed within the sediment at station P11, concentrations appeared to increase with depth while concentrations remained consistent across depths at station P17. As would be expected with a volatile substance, PAH concentrations could more easily dissipate in sediments that are more oxygen rich such as those closer to the sediment-water interface.

Table 3-10. 2015 Dry Weather NBSD *In Situ* SPME Total PAH Results.

Station ID	Placement	Depth Section (cm)	Total PAHs (ng/L)
P11	Overlying Water	30-40	99
		20-30	113
		10-20	98
		0-10	122
	Sediment	0-5	219
		5-10	215
		10-15	264
		15-20	185
		20-25	178
		25-30	235
		30-35	317
		35-40	330
		40-45	381
P17	Overlying Water	30-40	85
		20-30	127
		10-20	103
		0-10	114
	Sediment	0-5	181
		5-10	193
		10-15	179
		15-20	159
		20-25	173
		25-30	171
		30-35	186
		35-40	200
		40-45	179

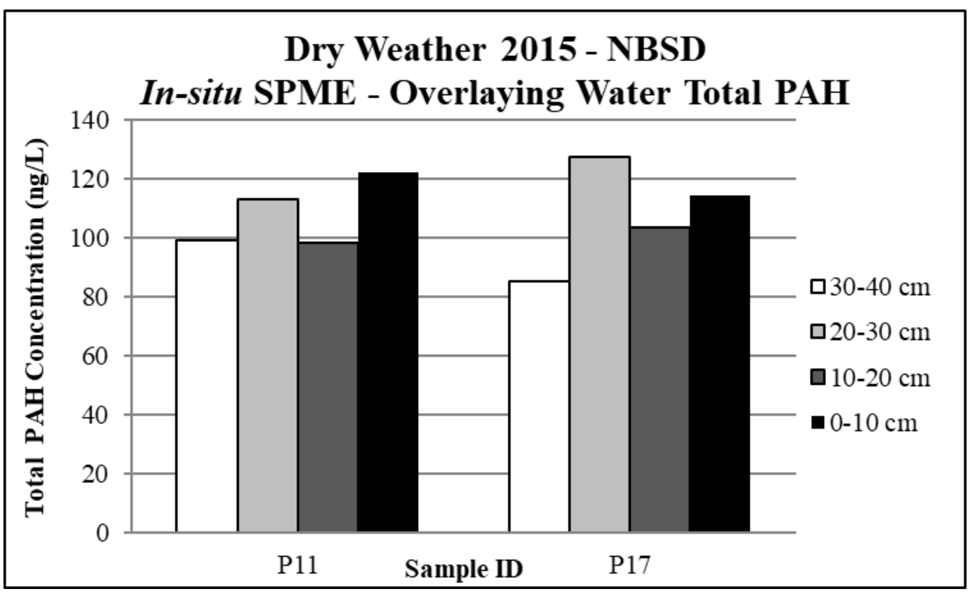


Figure 3-57. Total PAH concentrations in overlying waters derived from SPME fibers deployed for the 2015 Dry Weather sampling effort at NBSD.

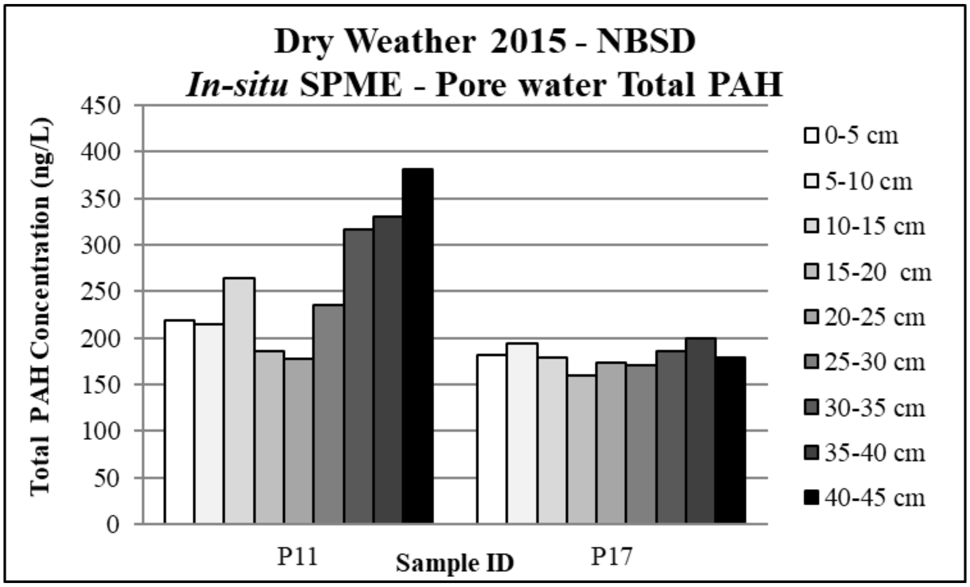


Figure 3-58. Total PAH concentrations in pore waters derived from SPME fibers deployed for the 2015 Dry Weather sampling effort at NBSD.

3.2.2.3. ADCP, OBS & SEDIMETER

Conditions for the ADCP measurements during the dry weather deployment are shown in Figure 3-59. Results show the scattering of material in the water column. Obvious variations at the water surface can be accounted by the tidal cycling in the bay (Figure 3-59, Figure 3-42). Higher measurements (160-200 dB) observed throughout the water column near Julian Day 200 are indicative of the significant rain event that occurred mid-July 2015. Measurements in the 140-180 dB range that are more apparent at depth and seem to occur in cycles of 5 may be explained by weekday ship movements in the vicinity of the ADCP.

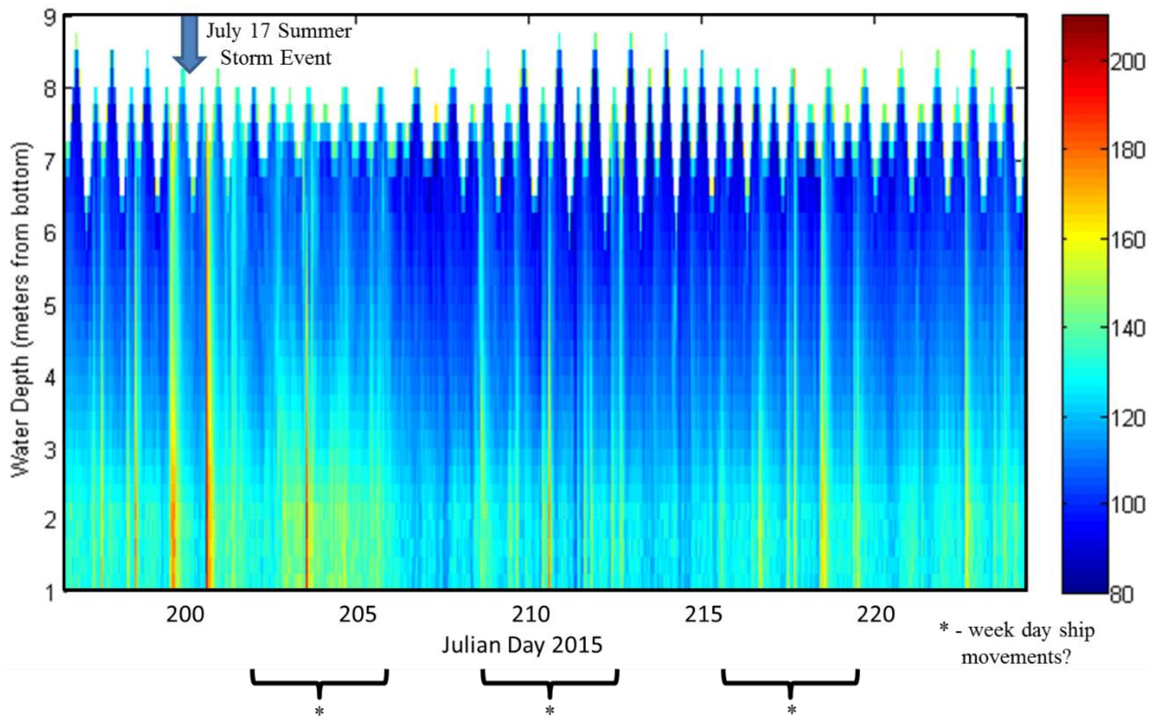


Figure 3-59. ADCP Backscatter Measurements at Station P17 – 2015 Dry Weather deployment effort at NBSD. * - indicates potential weekday ship movements.

Optical backscatter measurements were suspect due to the bio-fouling that occurred on the sensors. Data showed an increasing trend of backscatter leading data to be considered of questionable quality.

Results for the 19-Oct-2015 Sedimeter deployment are shown in Figure 3-60. The deployment successfully captured one fairly significant rain event, followed by a series of much smaller events. The results showed a clear deposition event in association with the larger storm event with a total cumulative deposition for that storm of about 2-3 cm. Estimates from the sediment traps at P17 ranged from about 2 cm/y (dry weather) to 4 cm/y (wet weather). The limited Sedimeter data for P17 would suggest that a substantial amount of this deposition arrived during these discrete stormwater discharge events. While limited data were obtained, and there were some equipment problems encountered, the Sedimeter technology did show promise for resolving deposition associated with coastal stormwater events.

cm

Figure 3-60. Cumulative precipitation (top) and Sedimeter measurements (bottom) at Station P17 – 2015 Dry Weather deployment effort at NBSD.

3.2.2.4. HOBO

Temperature and Dissolved Oxygen (DO) measurements taken by the HOBO loggers co-deployed with SEA Rings are shown in Figure 3-61 and Figure 3-62. Temperatures observed during deployment ranged from 22.3 to 25.2 and from 23.0 to 26.4°C for stations P11 and P17, respectively. Average temperatures over the course of the deployment were 24.0 and 24.4 for stations P11 and P17 respectively. DO levels averaged 5.6 and 3.1mg/L for stations P11 and P17, respectively. Minimum DO levels observed at each site were near or at 0mg/L and occurred following the precipitation event on 18 to 19-Jul, DO levels dropped significantly but recovered shortly thereafter for station P11. However, DO levels for P17 recovered slightly, but the variability in measurements was much greater than that observed at P11. Variability observed in the DO measurements are likely associated with higher oxygen production during daylight hours by phytoplankton followed with respiration during the night.

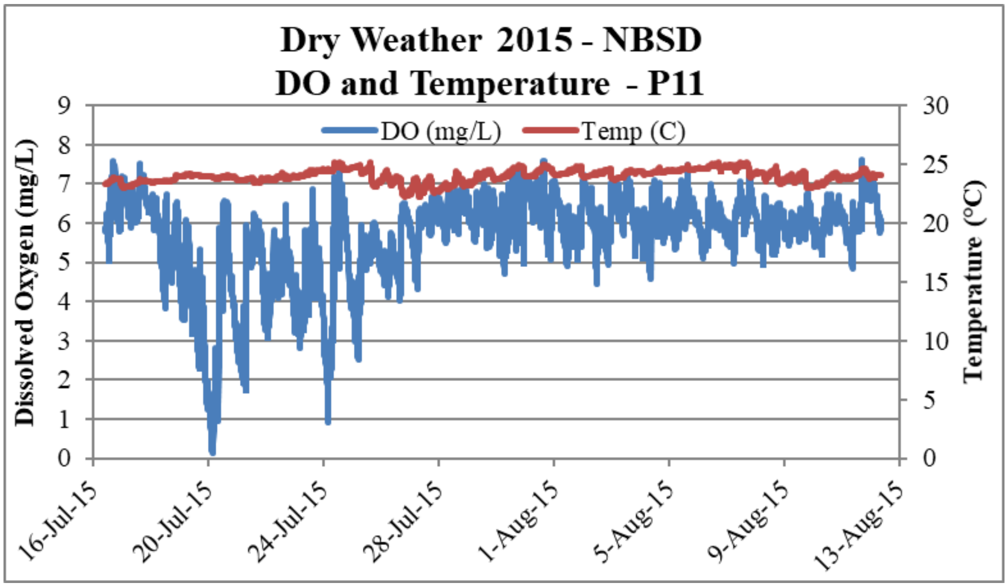


Figure 3-61. Dissolved oxygen and temperature readings taken at station P11 from within an exposure chamber mounted on a SEA Ring deployed for the 2015 Dry Weather sampling effort at NBSD.

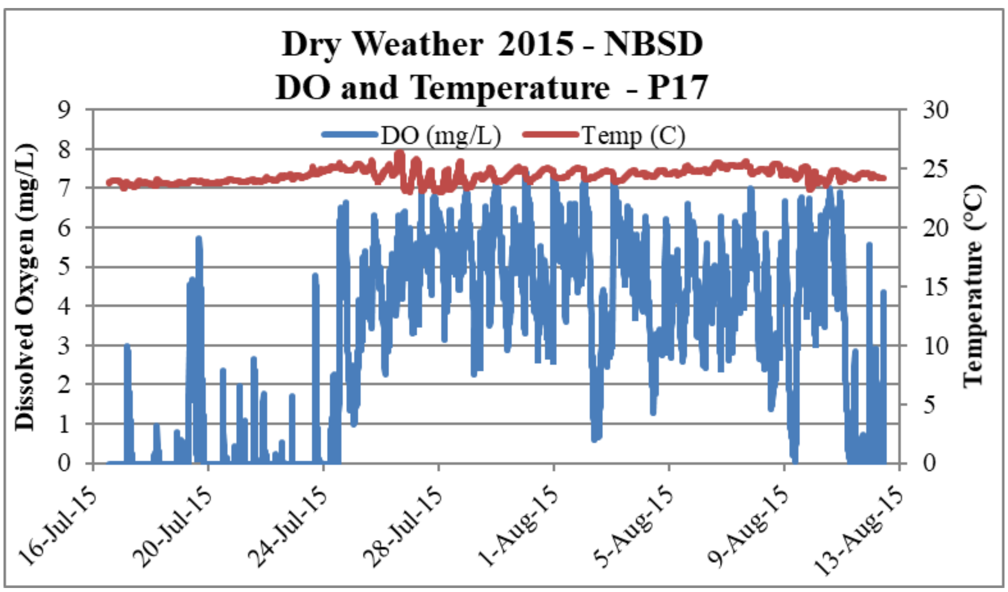


Figure 3-62. Dissolved oxygen and temperature readings taken at station P17 from within an exposure chamber mounted on a SEA Ring deployed for the 2015 Dry Weather sampling effort at NBSD.

3.2.2.5. BIOACCUMULATION

For both the 14-d and 28-d SEA Ring deployments, all organisms resulted in 0% survival. As was shown in Figure 3-61 and Figure 3-62, water quality observations were not conducive for organism survival. Particularly at station P17, DO levels were below a minimum threshold of 4mg/L for almost a week at the onset of deployment. At station P11, DO levels dropped to near 0mg/L following the unexpected precipitation event on 19-Jul-2017. The DO levels did recover at this station, but not to a sufficient level that would allow for clam and mussel survival.

3.2.3. *Ex Situ Studies*

Intact cores collected on 16-Jul-2015 were tested at the SSC Pac Bioassay Laboratory as described in section 2.4.

3.2.3.1. SPME

SPME exposures were conducted from 17-July-2015 to 14-Aug-2015. Concentrations of the pesticide chlordane, PAHs and PCBs are summarized in Table 3-11 and shown in Figure 3-63, Figure 3-64 and Figure 3-65, respectively. As could be expected if the upstream watershed is viewed as a source, concentrations of chlordane and PCBs decrease moving away from the mouth of Paleta Creek. PAHs don't seem to show this trend, as there is a slight increase in PAH concentration at station P11. This could be due to the proximity to several docks where fueling activities occur.

Table 3-11. 2015 Dry Weather NBSD SPME Results.

Sample ID	Total Chlordane (ng/L)	Total PAH (ng/L)	Total PCB (ng/L)
Reference	0.02	130.3	0.82
P11	0.02	159.9	1.19
P17	0.06	146.6	1.54

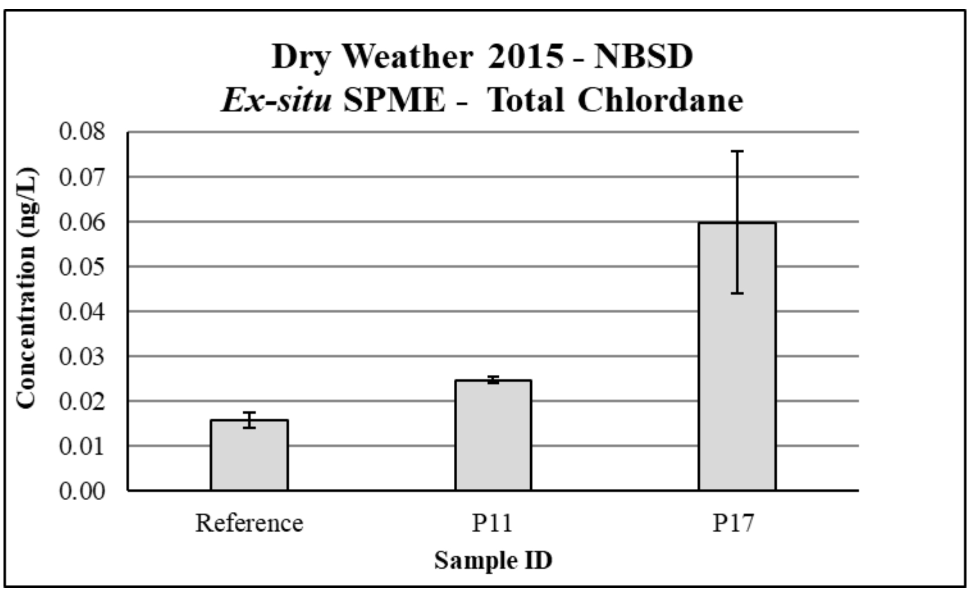


Figure 3-63. Total Chlordane concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2015 Dry Weather sampling effort at NBSD.

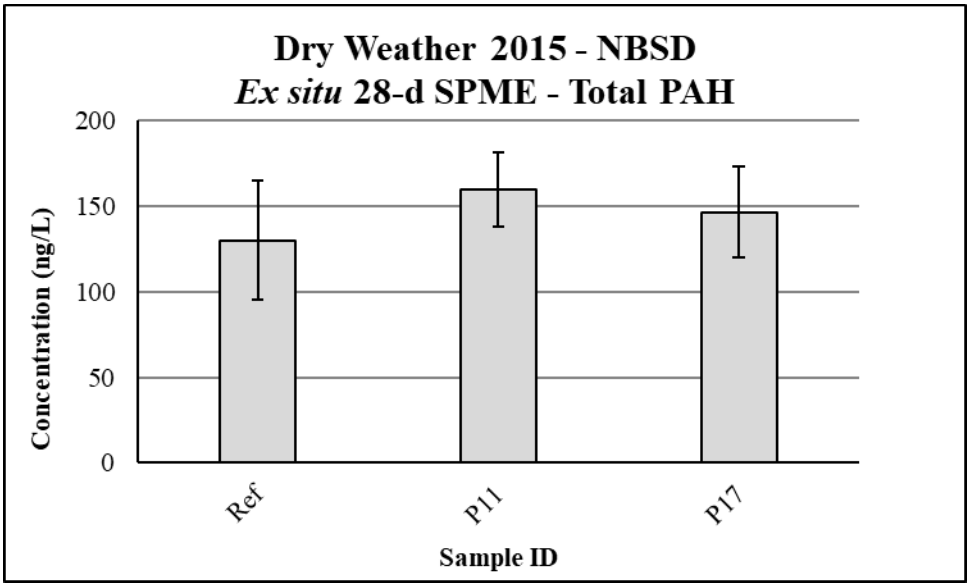


Figure 3-64. Total PAH concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2015 Dry Weather sampling effort at NBSD

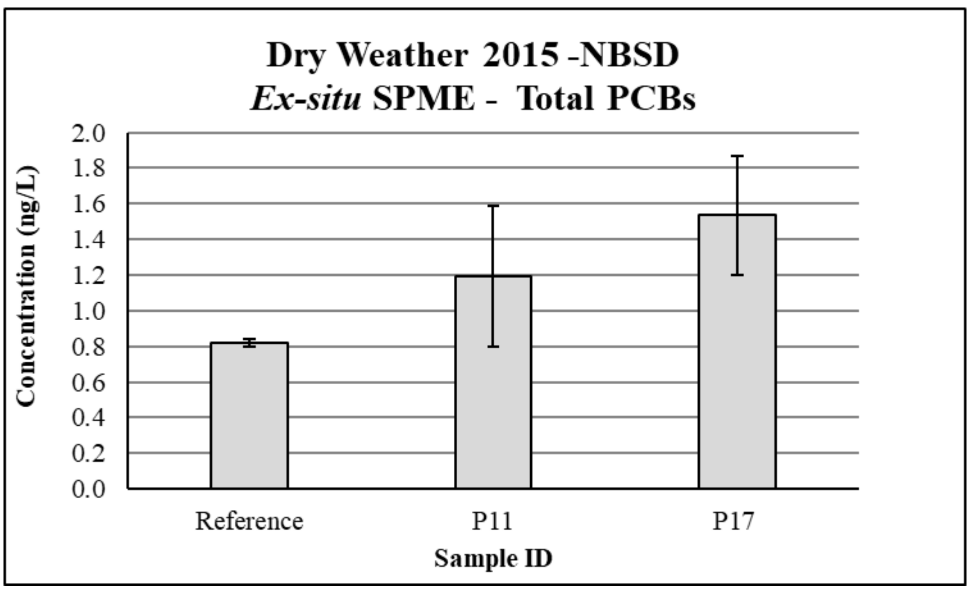


Figure 3-65. Total PCB concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2015 Dry Weather sampling effort at NBSD

3.2.3.2. DGT

Both trace metal and mercury DGTs were exposed in the intact cores collected on 16-Jul-2015. DGTs deployed in *ex situ* intact cores showed decreasing concentrations of Hg moving towards the mouth of Paleta Creek (i.e. P11 towards P17; Figure 3-66). DGT concentrations were 326.2, 140.5 and 80.8ng/L for the reference station, P11 and P17, respectively.

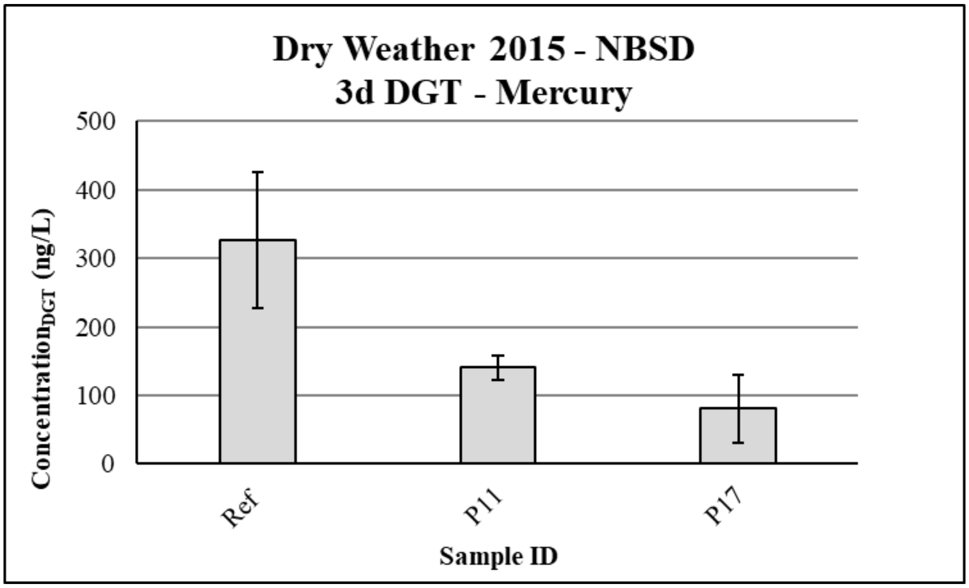


Figure 3-66. Hg concentrations in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015 Dry Weather sampling effort at NBSD.

3.2.3.3. BIOACCUMULATION & TOXICITY

Bioaccumulation and toxicity tests performed for the evaluation of the Dry Weather sediment samples collected Jul-2015 met test acceptability. Control survival for the clam, mussel and amphipod were 100, 92 and 90% respectively. All water quality parameters were within testing parameters throughout the duration of the exposures for all three tests. Survival results for the three organisms tested for the reference station and stations P11 and P17 is summarized in Table 3-12 and shown in Figure 3-67. For the clams, all replicates were analyzed for trace metals and PAHs individually, whereas the mussel replicates were combined and homogenized due to their small mass. Trace metal and PAH concentrations accumulated by the clams and mussels is summarized in Table 3-13 and Table 3-14 and are shown in Figure 3-68 through Figure 3-74. Lipid normalized PAH concentrations for both the clams and the mussels is shown in Figure 3-75.

The clams had tissue metal concentrations that increased from the reference site towards the mouth of Paleta Creek at station P17 for arsenic, copper and nickel. For the mussels, arsenic, cadmium, copper, nickel, lead and zinc all showed a similar trend of having the highest tissue concentrations at P17. For both species, mercury was highest in the reference station and lowest at P17.

Similar to the *in situ* and *ex situ* SPME results, the PAH concentrations associated with the tissues of the clams was higher at P11 compared to P17. For the mussels, PAH concentrations associated with the tissues was higher in P17 compared to P11.

Table 3-12. 2015 Dry Weather NBSD Survival of the Clam, Mussel and Amphipod *Ex Situ* Exposures.

Sample ID	Clam		Mussel		Amphipod	
	Mean Survival (%)	SD	Mean Survival (%)	SD	Mean Survival (%)	SD
Control	NT	NT	NT	NT	90	0
Reference	100	0	92	4.47	86	0.1
P11	88	11	88	13.04	92	0
P17	92	11	96	5.48	83	0.2

NT – not tested.

Table 3-13. 2015 Dry Weather NBSD Bioaccumulation Results for *M. nasuta Ex Situ* Exposures.

Sample ID	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/Kg DW)	Ni (µg/g DW)	Pb (µg/g DW)	Zn (µg/g DW)	% Lipids	Total PAH (µg/Kg lipid WW)
Reference	5.7 (0.4)	0.1 (0.0)	5.7 (1.2)	143.9 (18.0)	0.6 (0.1)	0.8 (0.2)	22.0 (4.8)	0.94 (0.1)	19199 (2313)
P11	6.0 (0.9)	0.1 (0.0)	5.6 (1.4)	127.4 (13.6)	0.7 (0.1)	2.2 (1.0)	26.2 (3.2)	1.0 (0.0)	61493 (34408)
P17	7.0 (1.0)	0.1 (0.0)	7.7 (2.1)	87.9 (15.1)	0.8 (0.2)	2.2 (1.2)	23.2 (3.4)	1.0 (0.1)	15158 (2344)

Values in ( ) are SD of duplicate samples tested.

Table 3-14. 2015 Dry Weather NBSD Bioaccumulation Results for *M. senhousia Ex Situ* Exposures.

Sample ID	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/Kg DW)	Ni (µg/g DW)	Pb (µg/g DW)	Zn (µg/g DW)	% Lipids	Total PAH (µg/Kg lipid WW)
Reference	1.65	0.13	2.62	287.5	0.70	0.57	12.09	1.1	13.53
P11	1.67	0.18	2.62	264.8	0.96	0.77	15.38	1.1	15.57
P17	1.94	0.21	3.21	237.2	1.17	1.43	15.59	1.0	29.71

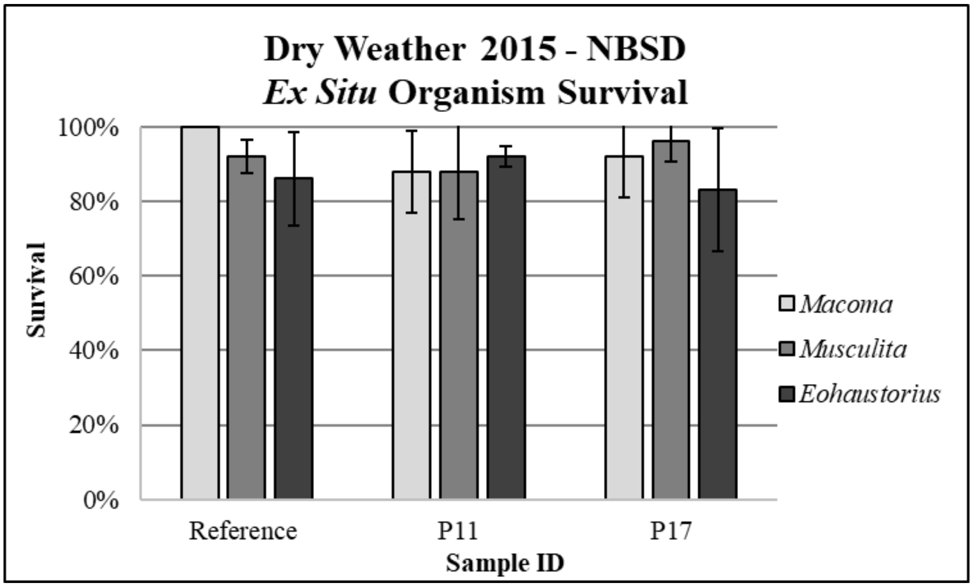


Figure 3-67. Organism survival for *ex situ* bioaccumulation and toxicity exposures to intact cores collected for the 2015 Dry Weather sampling effort at NBSD.

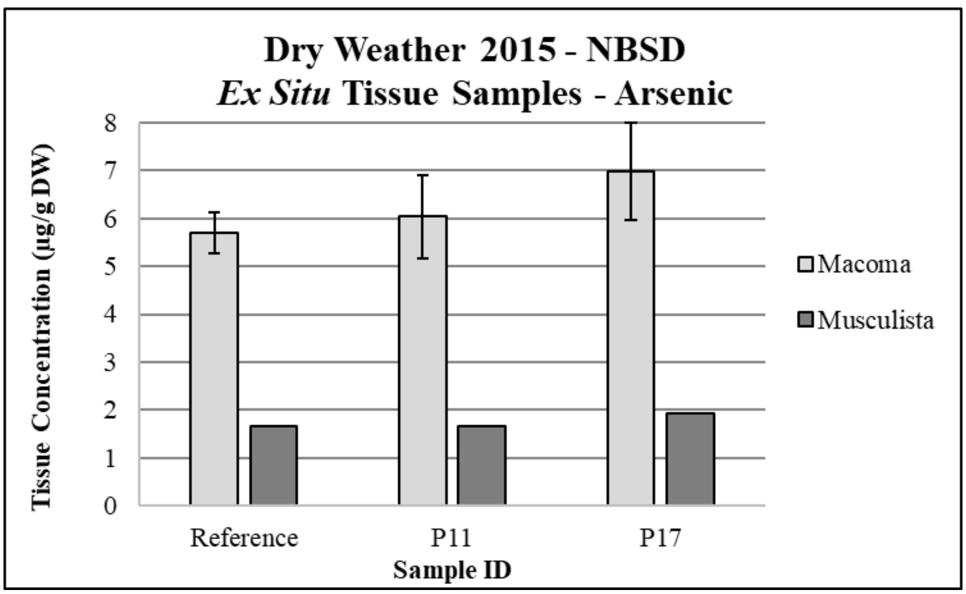


Figure 3-68. Clam and mussel tissue arsenic concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

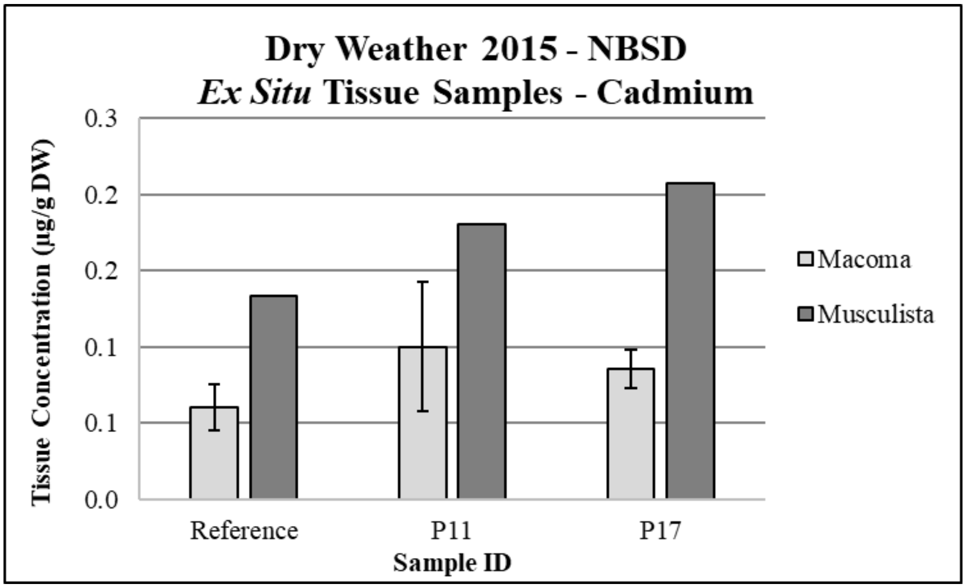


Figure 3-69. Clam and mussel tissue cadmium concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

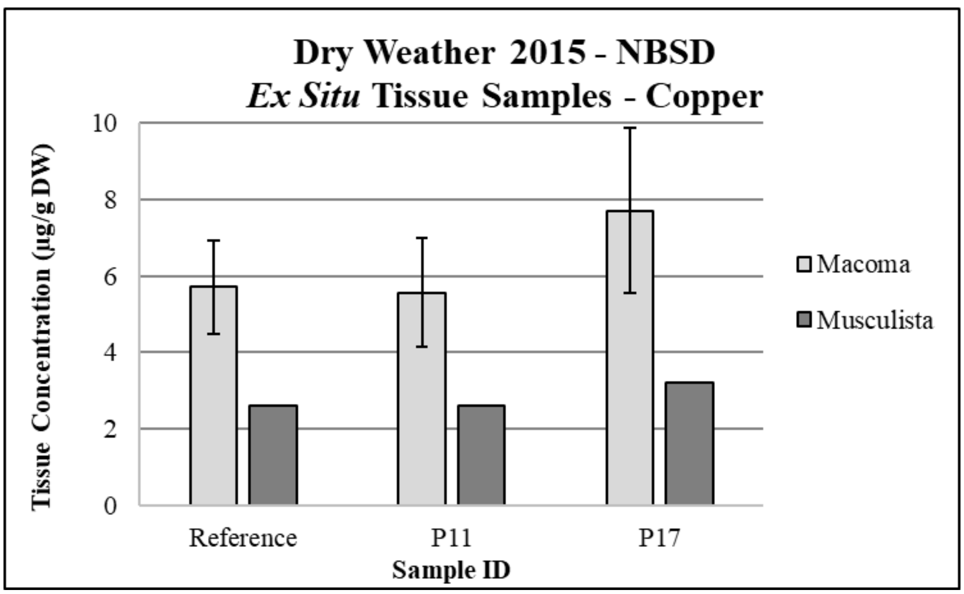


Figure 3-70. Clam and mussel tissue copper concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

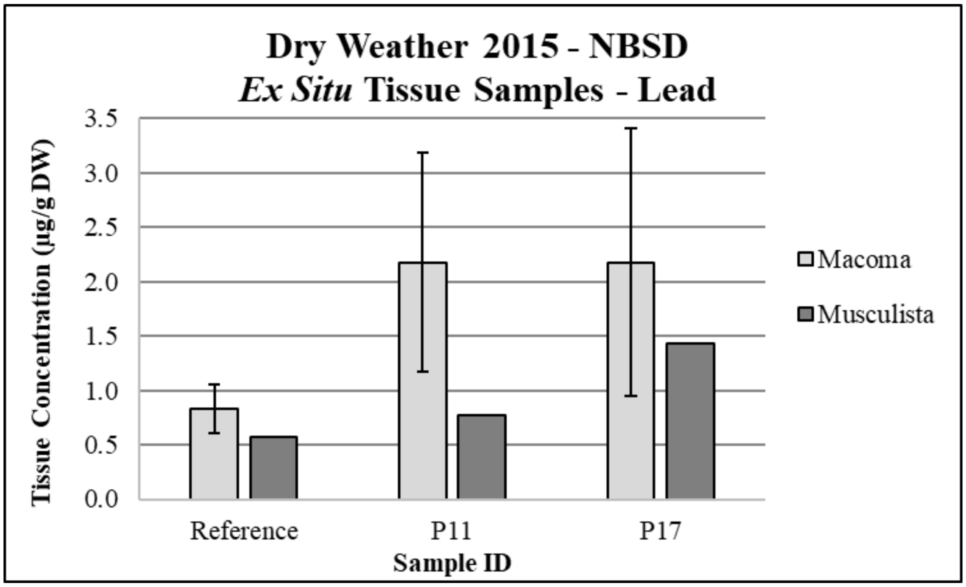


Figure 3-71. Clam and mussel tissue lead concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

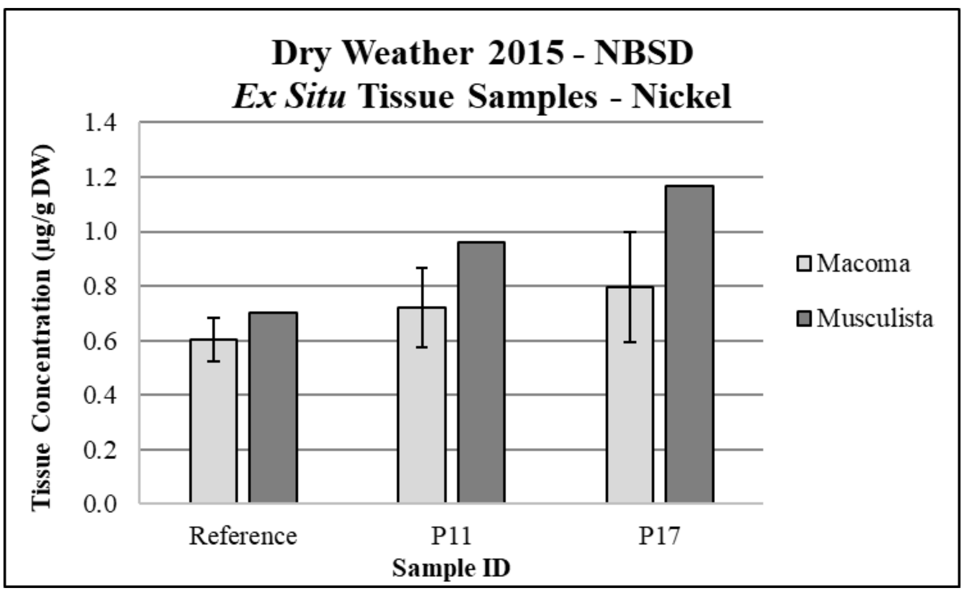


Figure 3-72. Clam and mussel tissue nickel concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

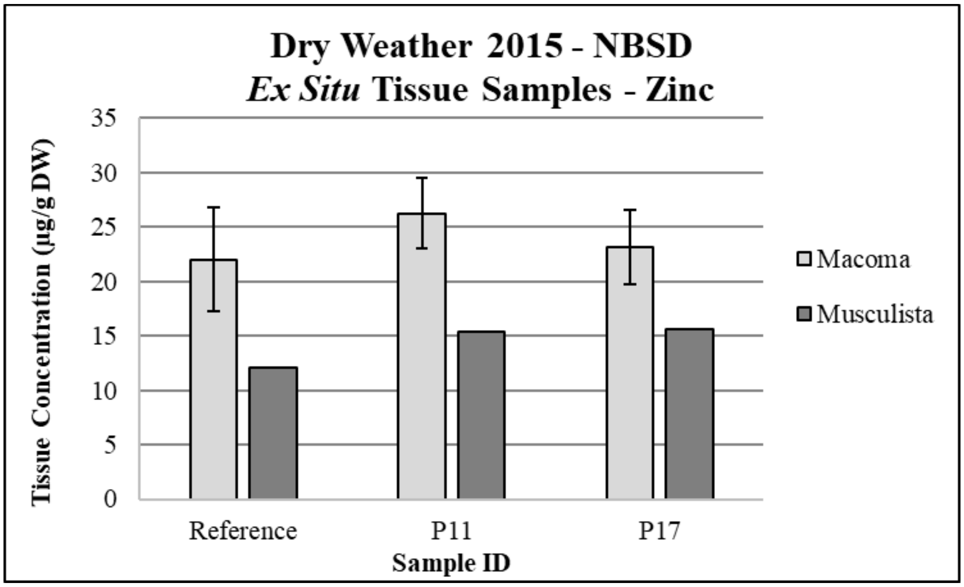


Figure 3-73. Clam and mussel tissue zinc concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

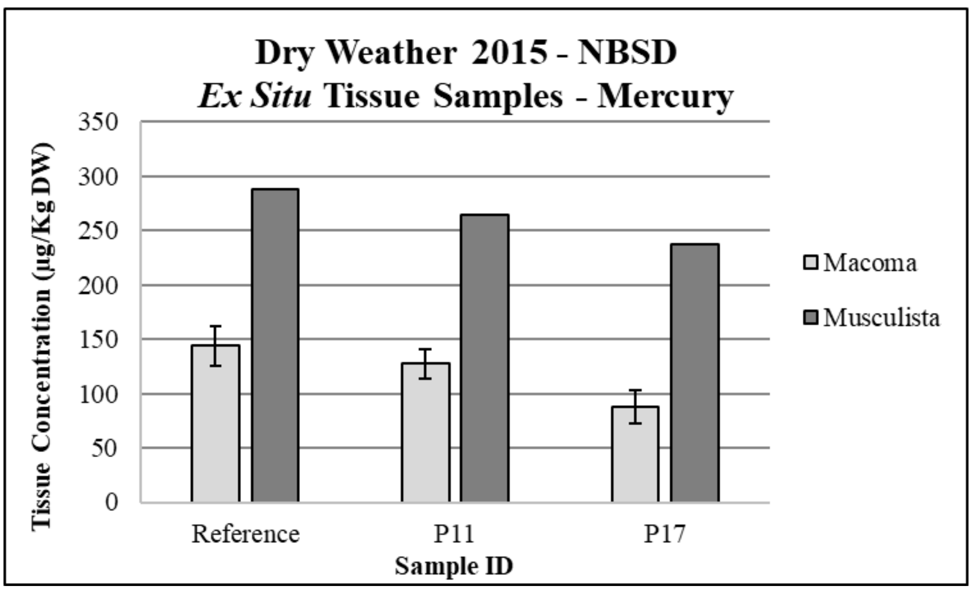


Figure 3-74. Clam and mussel tissue mercury concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

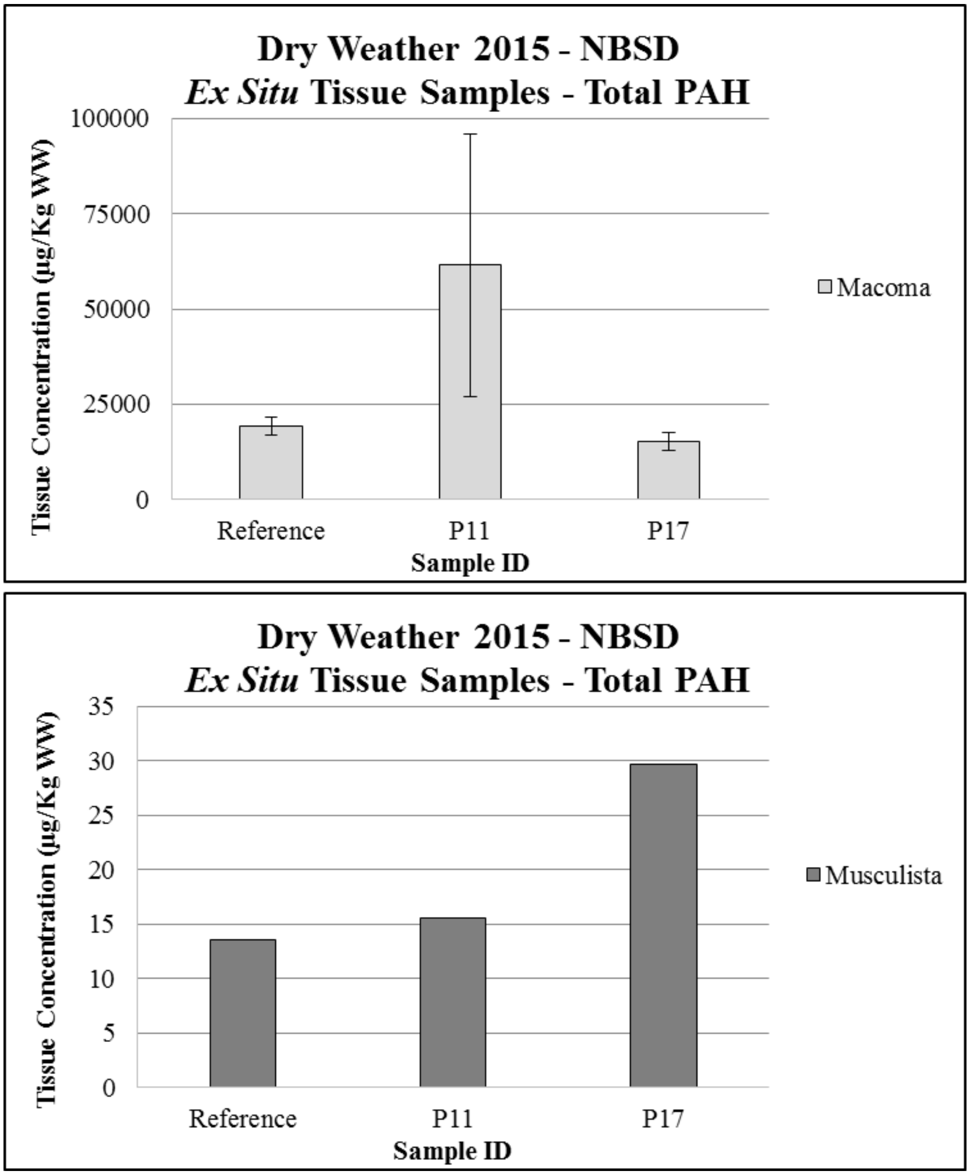


Figure 3-75. Clam (top) and mussel (bottom) tissue lipid normalized total PAH concentrations for the reference station and stations P11 and P17 for the 2015 Dry Weather sampling effort at NBSD.

3.3. <u>2015/2016 WET WEATHER – NBSD</u>

As mentioned previously in section 2.1.2, sediment cores were collected prior to and just after the typical rain season for Southern California. Samples collected in Oct-2015 and Feb-2016 were designated "Pre-storm" and "Post-storm" samples, respectively.

Also discussed previously, two rain events were captured in Jan-2016 for characterization of stormwater inputs to San Diego Bay.

3.3.1. *SEDIMENT CHEMISTRY*

Pre- and Post-storm intact sediment cores were analyzed on a bulk fraction basis for total organic carbon (TOC) and black carbon (BC), trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and pyrethroid pesticides. Results are summarized in Table 3-15 and Table 3-16 and shown in Figure 3-76 through Figure 3-88.

Concentrations of the trace metals Cd, Pb, Hg and Zn as well as PAH and PCB concentrations were elevated at station P11 in the post-storm sample compared to the pre-storm sample. The concentrations at P11 were also highest among the stations for the post-storm samples.

Pyrethroid concentrations increased for all stations at the end of the storm season relative to the beginning.

Table 3-15. 2015/2016 Wet Weather Bulk Sediment Chemistry Results – NBSD.

Compartment ID	Sampling Season	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/g DW)	Pb (µg/g DW)	Ni (µg/g DW)	Zn (µg/g DW)
P01	Pre-Storm	8.1 (0.3)	0.46 (0.0)	207.5 (10.0)	0.46 (0.0)	52.1 (1.5)	16.1 (0.6)	272 (14.3)
	Post-Storm	NT	NT	NT	NT	NT	NT	NT
P08	Pre-Storm	9.26 (0.4)	0.24 (0.0)	237.7 (5.7)	0.55 (0.1)	76.5 (2.2)	16.9 (0.2)	315.7 (13.8)
	Post-Storm	10.83 (0.2)	0.19 (0.0)	257.3 (9.8)	0.55 (0.0)	82 (3.3)	18.8 (0.2)	328 (11.1)
P11	Pre-Storm	8.26 (0.1)	1.55 (0.1)	244 (7.7)	0.97 (0.1)	158.8 (7.6)	18.4 (0.5)	491.9 (17.6)
	Post-Storm	9.61 (0.7)	4.63 (0.2)	253.8 (17.6)	1.61 (0.1)	431 (27.9)	27 (1.1)	939.7 (91.8)
P17	Pre-Storm	8.74 (0.4)	1.56 (0.1)	268.9 (29.8)	0.46 (0.1)	143.2 (20.9)	17.8 (0.9)	611.8 (70.9)
	Post-Storm	8.39 (0.0)	1.53 (0.03)	245.9 (14.7)	0.34 (0.0)	157.8 (19.4)	19.5 (0.8)	681.2 (19.8)

Values in ( ) are SD of duplicate samples tested. NT – not tested. ND – non-detect.

Table 3-16. 2015/2016 Wet Weather Bulk Sediment Chemistry Results – NBSD (cont'd).

Compartment ID	Sampling Season	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/kg OC)	Total PCBs (µg/kg)	Total PCBs (µg/kg OC)	Pyrethroid Pesticides (µg/g)	Pyrethroid Pesticides (µg/g OC)
P01	Pre-Storm	0.79 (0)	0.1 (0)	1961.3	284.2	113.4	16.4	5.9	0.86
	Post-Storm	NT	NT	NT	NT	NT	NT	NT	NT
P08	Pre-Storm	1.17 (0)	0.11 (0)	1459.0	137.6	86.2	8.1	17.8	1.68
	Post-Storm	1.51 (0)	0.13 (0)	1219.4	88.4	92.7	6.7	50.7	3.58
P11	Pre-Storm	1.75 (0.1)	0.17 (0)	3769.0	238.5	618.8	39.2	69.3	4.39
	Post-Storm	2.06 (0.1)	0.21 (0)	9508.3	514.0	1350.5	73.0	164.5	8.77
P17	Pre-Storm	3.63 (0.1)	0.23 (0)	2930.2	86.2	206.5	6.1	228.2	6.71
	Post-Storm	3.86 (0.2)	0.24 (0)	4640.3	128.2	212.5	5.9	359.5	9.82

Values in ( ) are SD of duplicate samples tested. NT – not tested. ND – non-detect.

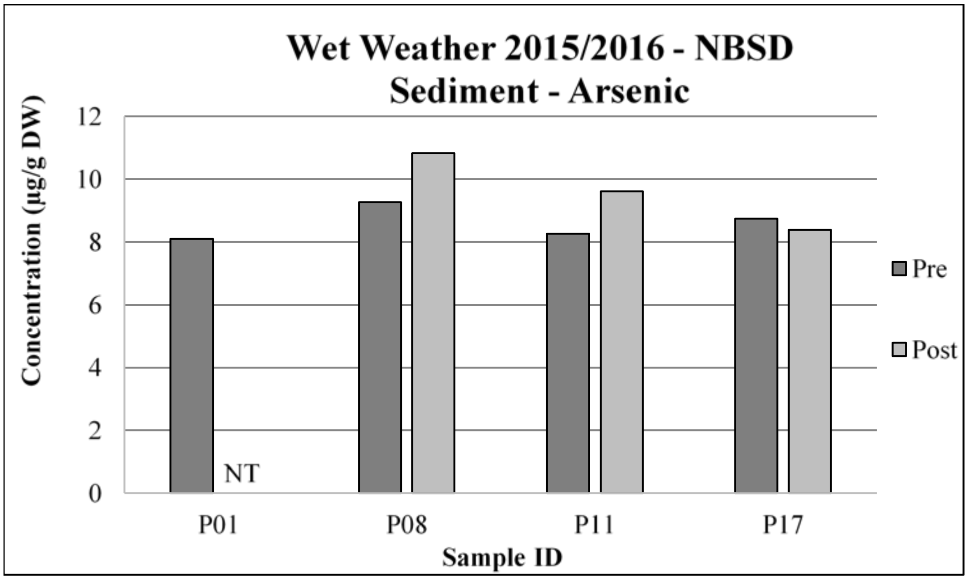


Figure 3-76. Bulk sediment arsenic concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

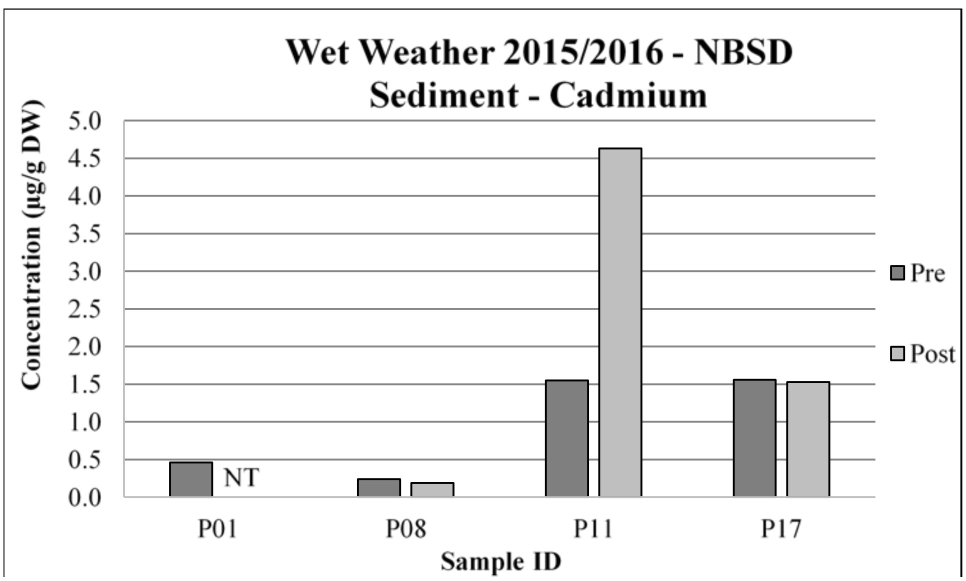


Figure 3-77. Bulk sediment cadmium concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

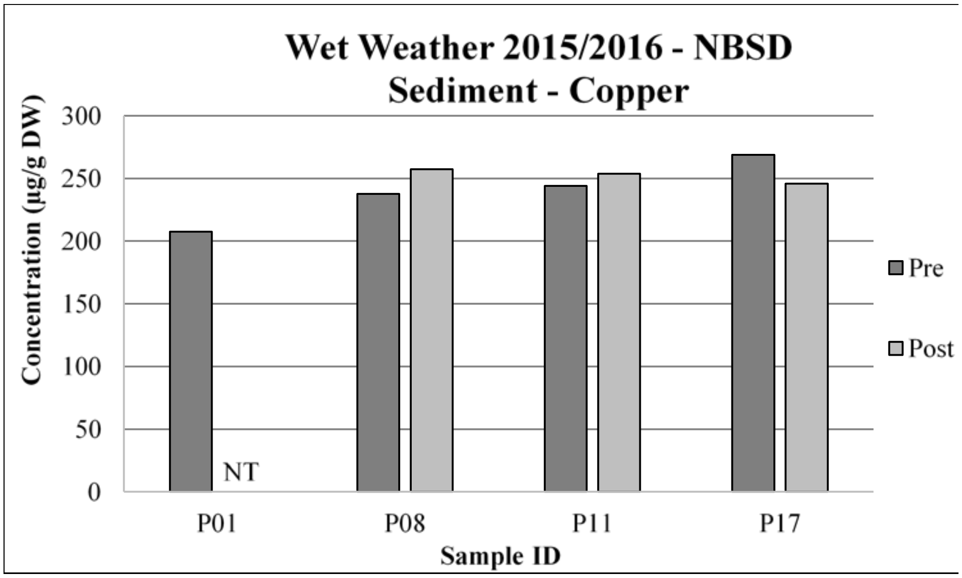


Figure 3-78. Bulk sediment copper concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

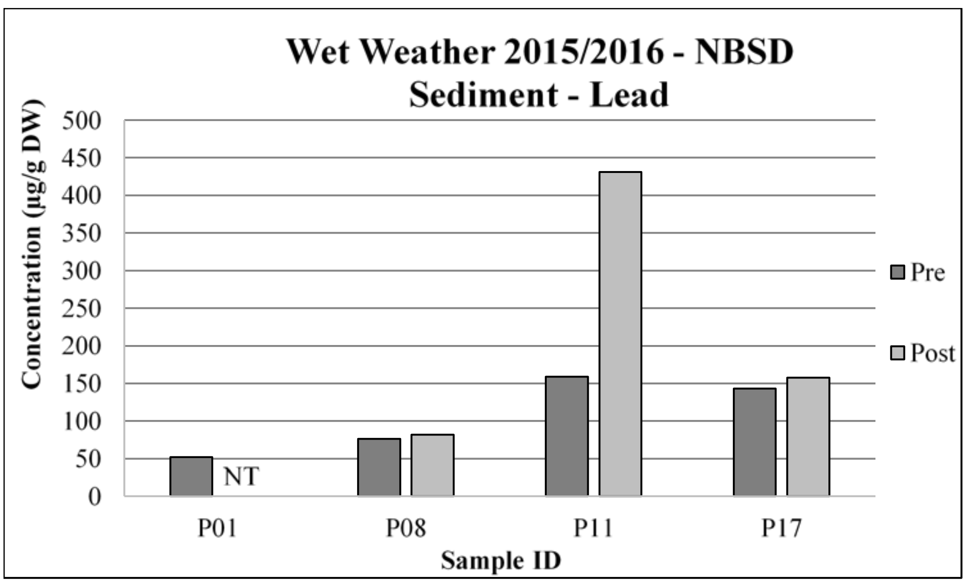


Figure 3-79. Bulk sediment lead concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

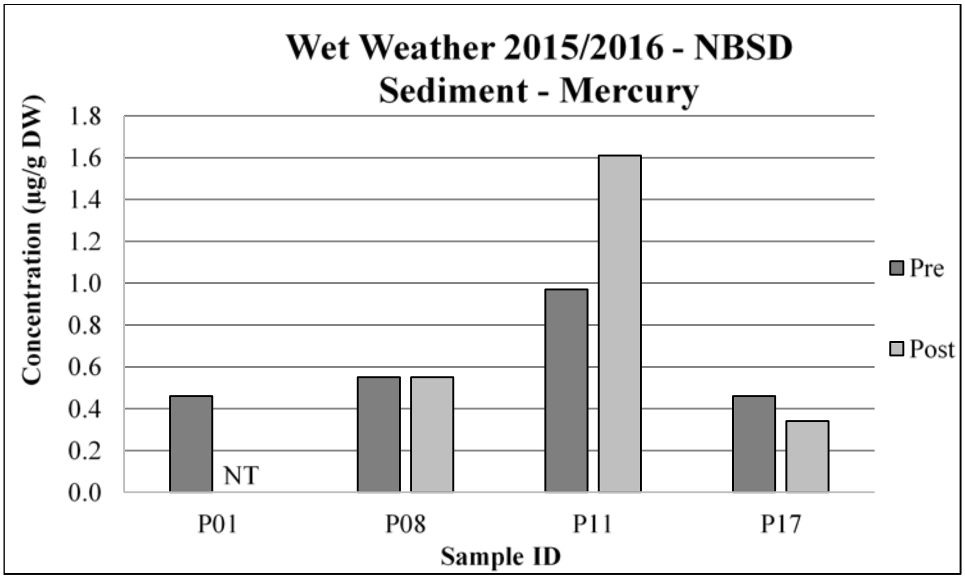


Figure 3-80. Bulk sediment mercury concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

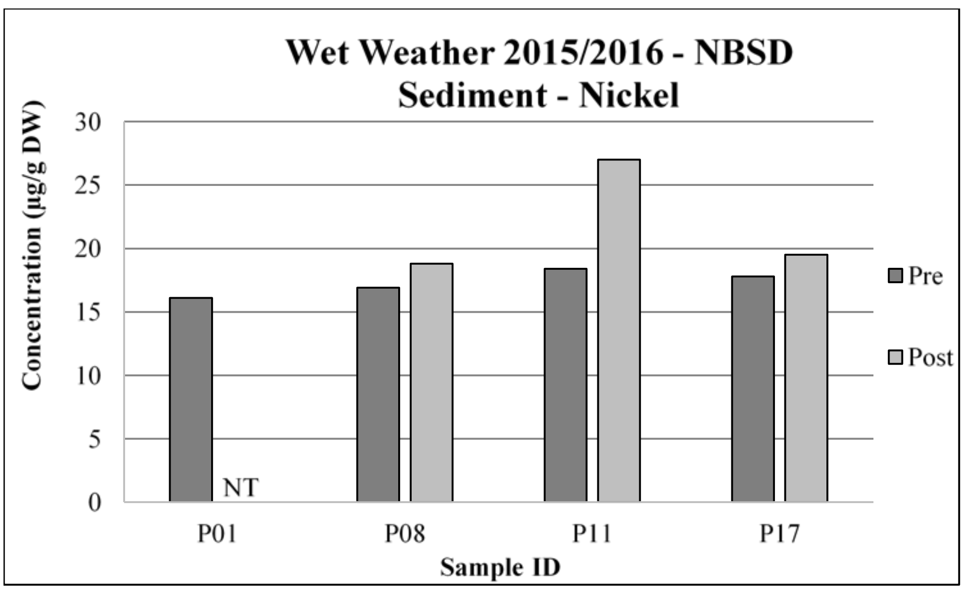


Figure 3-81. Bulk sediment nickel concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

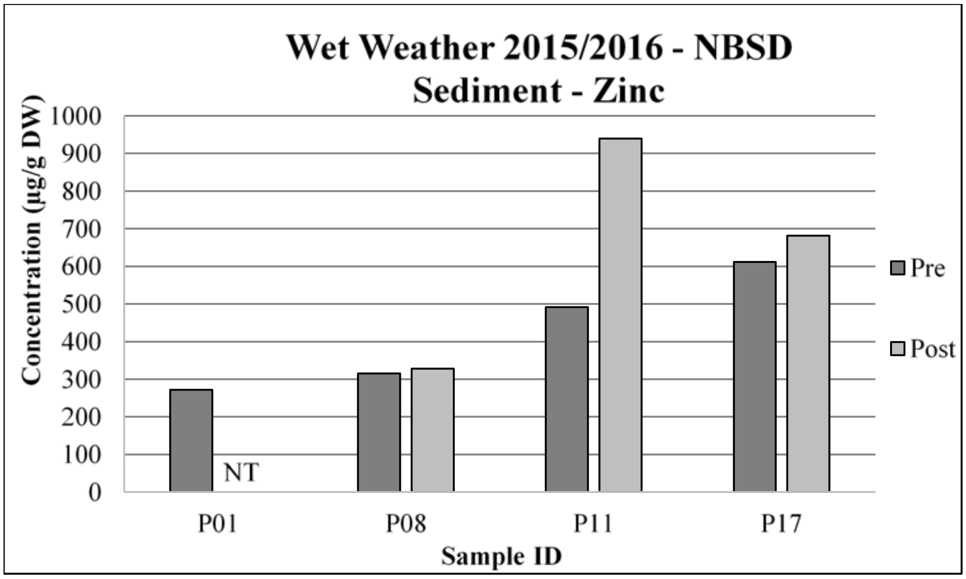


Figure 3-82. Bulk sediment zinc concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

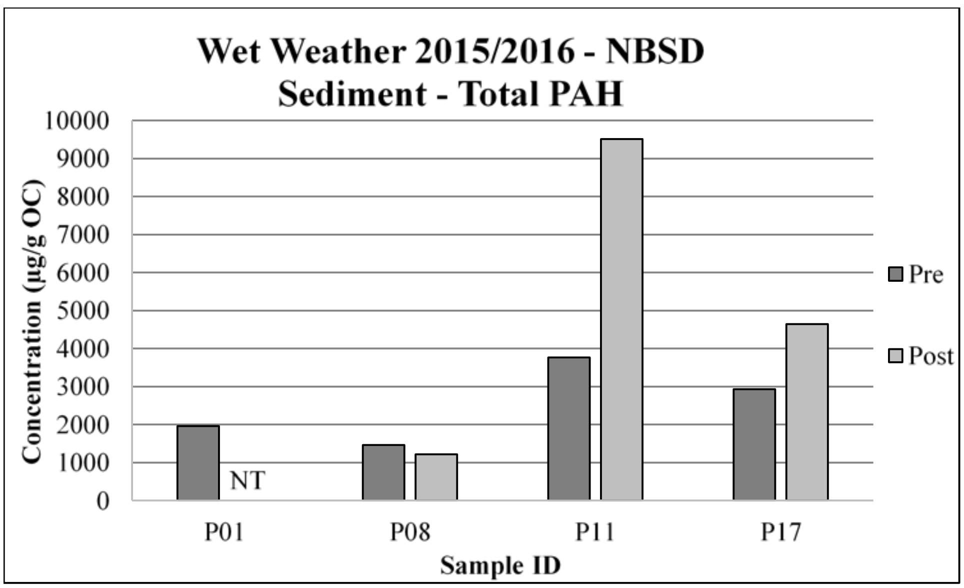


Figure 3-83. Bulk sediment Total PAH concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

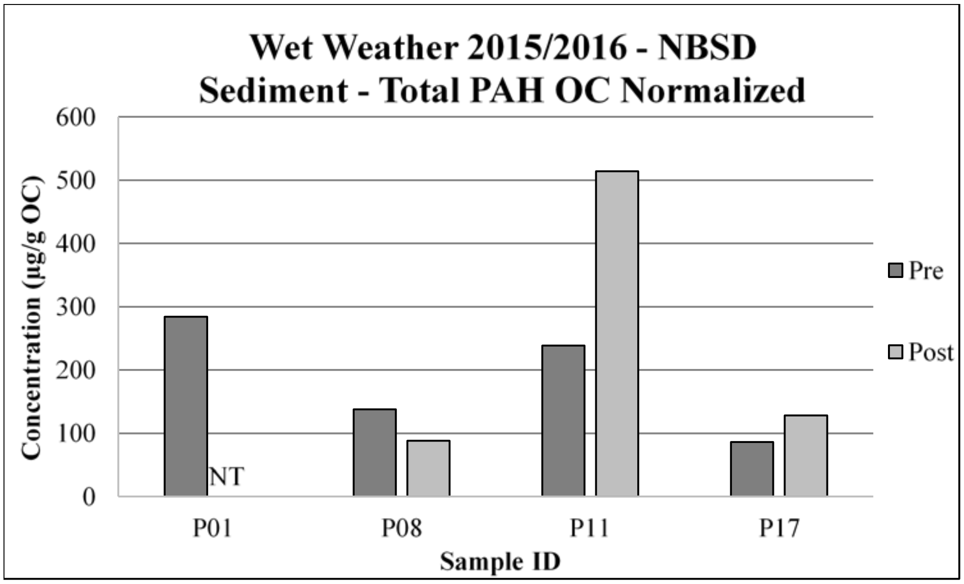


Figure 3-84. Bulk sediment Total PAH concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

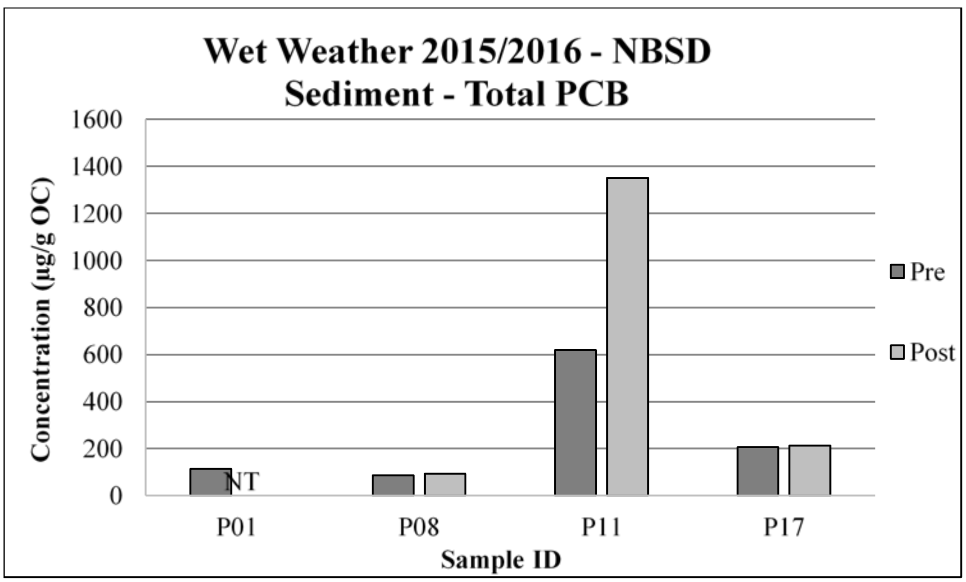


Figure 3-85. Bulk sediment Total PCB concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

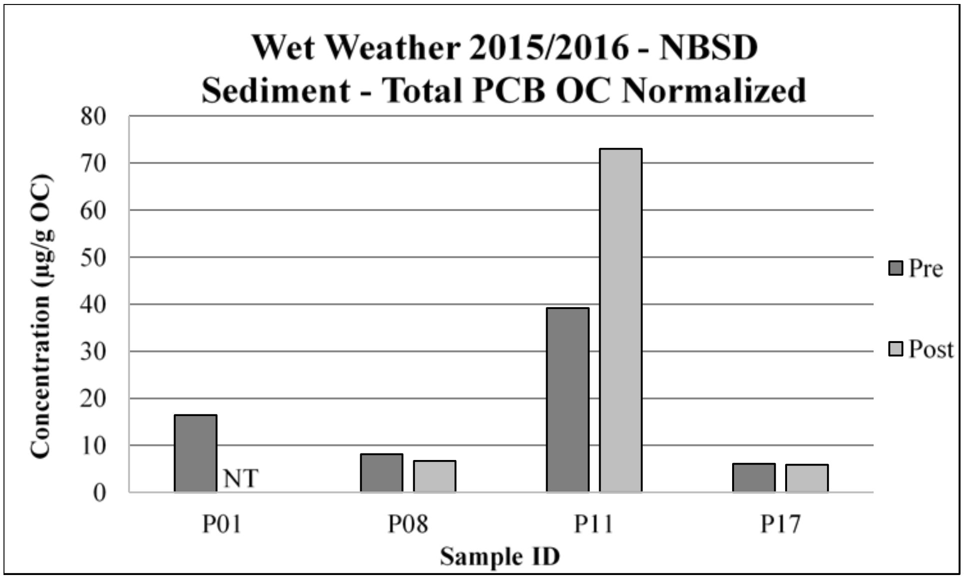


Figure 3-86. Bulk sediment Total PCB concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

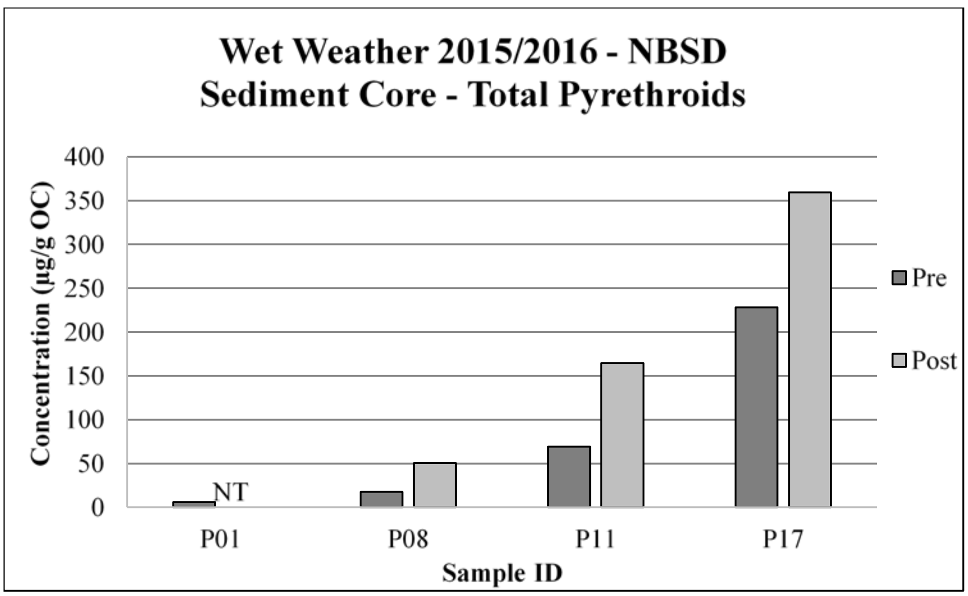


Figure 3-87. Bulk sediment pyrethroid pesticide concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

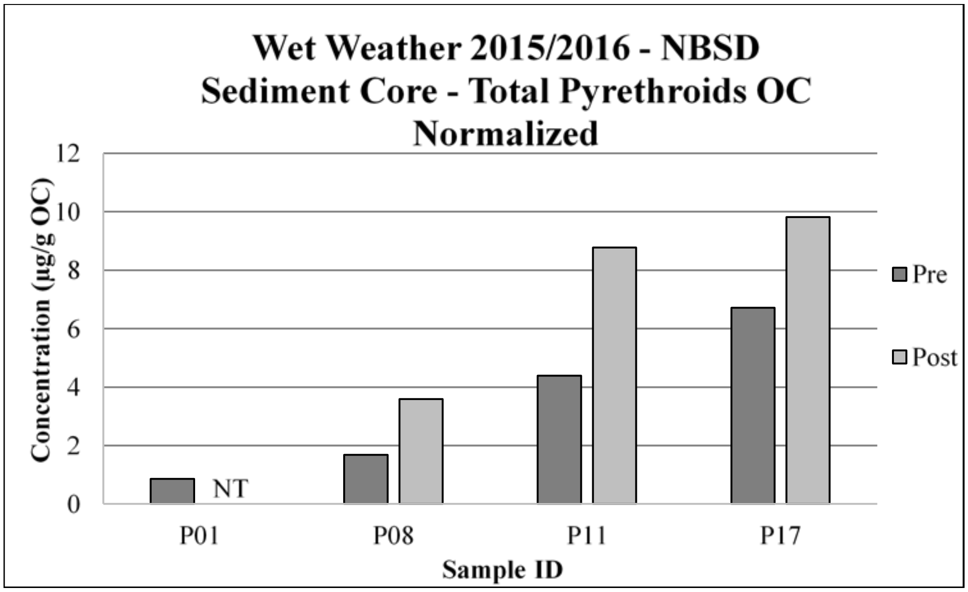


Figure 3-88. Bulk sediment pyrethroid pesticide concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

3.3.2. *STORMWATER CHEMISTRY*

Bulk and dissolved stormwater chemistry data for the two storm events sampled in Jan-2016 are summarized in Table 3-17 and Table 3-18 and shown in Figure 3-89 through Figure 3-96.

For the first storm on 5-Jan, ambient samples were collected in a time series fashion with the first sample collected at the onset of the storm (A1) and then subsequent samples were collected approximately 6 and 12hrs later, A2 and A3, respectively (Table 2-6, Figure 2-7). Except for the bulk and dissolved trace metal arsenic and dissolved PAHs, concentrations tend to decrease over the sampling times (i.e. A1>A2>A3). This trend of the first flush phenomenon has been demonstrated numerous times (Birch and Rochford 2010; Katz et al. 2006; Kayhanian et al. 2008; Sabin et al. 2005; Soller et al. 2005; Schiff and Tiefenthaler 2011).

For the 31-Jan storm, ambient sample A1 was also collected at the onset of the storm and A2 was collected approximately 6hrs later. Concentrations of bulk trace metals and PAHs were relatively low and when detected, and except for zinc, concentrations were higher in the "first-flush" sample compared to the one captured 6hrs into the storm event. Dissolved concentrations of zinc, mercury and PAHs increased in concentration from the first to second ambient sample, whereas the other metals (when detected) decreased in concentration from first to second sample.

For the creek samples C1 and C2, bulk trace metal concentrations were generally higher in the first storm compared to the second storm for all trace metals except for cadmium in sample C1. PAHs in the bulk water creek samples also showed this trend. For the dissolved fraction, this trend was only observed a few instances (i.e. C1-Ni, C2-Zn, C1-Hg and PAHs).

For the outfall samples (O1, O2, O3 & O4), bulk trace metals also tended to higher concentrations in the first storm of 5-Jan compared to 31-Jan. Exceptions to this were with the outfall sample O4 with copper and nickel in which concentrations were higher in the second storm. PAHs also were higher in concentrations in the 5-Jan storm compared to the 31-Jan storm. For the dissolved fraction of the outfall samples, the trend is not present for all samples collected.

Copper, lead and nickel exhibited a decrease in concentration from the 5-Jan to 31-Jan storm at O2, but not O4, which showed a significant increase in the dissolved concentration in the 31-Jan storm. Zinc showed an increase in concentrations for O2 and O4 from the 5-Jan to 31-Jan samples. Cadmium was pretty much non-detect during the second storm compared to the first storm. Mercury and PAHs exhibited decreases in concentrations at both O2 and O4 from one storm to the next.

Table 3-17. 2015/2016 Wet Weather Bulk Stormwater Chemistry Results – NBSD.

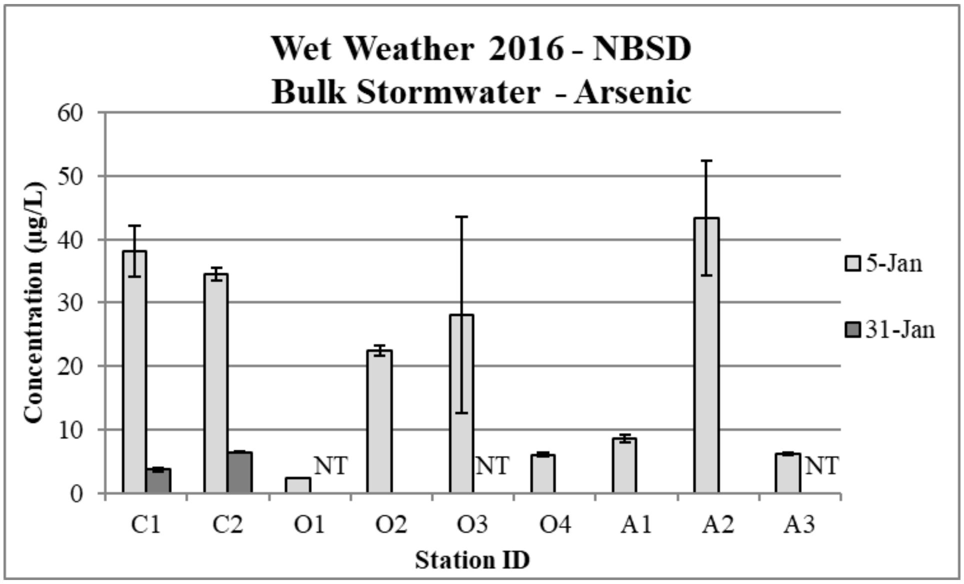
Compartment ID	Sampling Event	As (µg/L)	Cd (µg/L)	Cu (µg/L)	Hg (ng/L)	Pb (µg/L)	Ni (µg/L)	Zn (µg/L)	Total PAHs (ng/L)
C1	5-Jan	38.1 (4.1)	0.4 (0.0)	32.7 (0.6)	43.4 (5.3)	20.8 (2.5)	11.2 (0.2)	151.6 (9.2)	1213.0
	31-Jan	3.7 (0.3)	0.5 (0.2)	29.6 (1.8)	26.0 (2.2)	13.6 (1.7)	6.8 (0.1)	140.5 (11.2)	279.5
C2	5-Jan	34.4 (0.9)	0.9 (0.0)	75.3 (4.2)	77.9 (13.6)	45.5 (1.9)	19.1 (2.7)	419.0 (11.8)	1282.4
	31-Jan	6.4 (0.1)	0.4 (-)	60.4 (5.3)	46.1 (4.4)	30.0 (-)	13.9 (1.1)	334.7 (38.4)	1216.5
O1	5-Jan	2.3 (-)	0.5 (-)	16.8 (-)	8.6 (0.9)	18.8 (-)	7.3 (-)	207.5 (-)	835.2
	31-Jan	NT	NT	NT	NT	NT	NT	NT	NT
O2	5-Jan	22.4 (0.8)	2.7 (0.1)	144.5 (4.1)	776.3 (84.5)	67.9 (3.0)	25.4 (0.4)	308.6 (6.0)	77.2
	31-Jan	0 ()	0.0 (-)	64.6 (4.3)	21.7 (1.6)	11.2 (1.1)	14.9 (-)	78.4 (17.0)	184.4
O3	5-Jan	28.0 (15.4)	0.4 (0.0)	21.0 (2.1)	49.0 (3.6)	3.8 (0.0)	15.1 (0.3)	83.2 (8.5)	692.0
	31-Jan	NT	NT	NT	NT	NT	NT	NT	NT
O4	5-Jan	6.0 (0.4)	0.2 (0.0)	24.1 (0.4)	188.1 (60.2)	5.2 (0.1)	16.7 (0.4)	92.3 (1.7)	377.9
	31-Jan	0 (NA)	0.0 (-)	49.1 (0.3)	19.5 (0.4)	1.4 (0.1)	22.6 (-)	36.0 (10.4)	46.4
A1	5-Jan	8.5 (0.6)	0.6 (0.0)	50.9 (0.6)	95.2 (18.5)	32.3 (1.1)	11.0 (0.3)	233.7 (0.6)	3587.5
	31-Jan	0 (-)	0.0 (-)	71.4 (-)	19.5 (5.2)	5.3 (0.3)	22.8 (-)	71.4 (-)	203.0
A2	5-Jan	43.3 ()	0.3 (0.0)	23.0 (0.5)	28.1 (2.0)	11.7 (0.3)	7.5 (0.2)	85.8 (2.9)	581.0
	31-Jan	0 (-)	0.0 (-)	62.5 (1.1)	14.5 (1.4)	3.2 (1.6)	22.6 (-)	80.3 (-)	66.9
A3	5-Jan	6.1 (0.2)	0.0 (-)	12.5 (1.0)	8.0 (0.7)	2.4 (0.0)	7.8 (0.4)	28.0 (1.0)	147.8
	31-Jan	NT	NT	NT	NT	NT	NT	NT	NT

Values in ( ) are SD of duplicate samples tested. NT – not tested.

Table 3-18. 2015/2016 Wet Weather Filtered* Stormwater Chemistry Results – NBSD.

Compartment ID	Sampling Event	As (µg/L)	Cd (µg/L)	Cu (µg/L)	Hg (ng/L)	Pb (µg/L)	Ni (µg/L)	Zn (µg/L)	Total PAHs (ng/L)
C1	5-Jan	1.4 (0.0)	0.0 (-)	7.8 (0.9)	5.1 (-)	0.6 (0.2)	6.3 (0.3)	6.8 (0.1)	71.1
	31-Jan	NT	0.0 (-)	13.8 (4.3)	2.6 (0.7)	1.2 (0.2)	3.4 (0.3)	52.2 (12.3)	28.9
C2	5-Jan	1.1 (0.0)	0.0 (-)	5.5 (0.1)	3.3 (-)	1.1 (0.0)	2.0 (0.0)	21.7 (0.6)	99.1
	31-Jan	NT	0.0 (-)	11.6 (1.6)	2.6 (-)	1.2 (0.5)	2.2 (0.2)	47.2 (7.1)	26.8
O1	5-Jan	0.8 (0.0)	0.4 (0.0)	6.3 (0.2)	2.0 (-)	1.2 (0.1)	6.3 (0.2)	53.9 (1.0)	77.2
	31-Jan	NT	NT	NT	NT	NT	NT	NT	NT
O2	5-Jan	3.2 (0.1)	0.8 (0.0)	34.4 (1.6)	24.8 (-)	1.8 (0.1)	9.5 (0.5)	15.0 (1.8)	3027.5
	31-Jan	NT	0.0 (-)	50.1 (3.2)	4.5 (0.3)	1.6 (0.2)	14.9 (-)	44.5 (8.1)	27.1
O3	5-Jan	4.1 (0.0)	0.2 (0.0)	14.8 (0.1)	10.0 (1.2)	0.5 (0.0)	14.1 (0.3)	4.3 (0.2)	38.6
	31-Jan	NT	NT	NT	NT	NT	NT	NT	NT
O4	5-Jan	2.2 (0.0)	0.0 (-)	5.7 (0.1)	6.3 (-)	0.6 (0.0)	9.5 (0.1)	5.1 (0.3)	43.9
	31-Jan	NT	0.0 (-)	42.8 (-)	3.3 (-)	1.6 (0.5)	22.6 (-)	10.4 (-)	42.5
A1	5-Jan	1.9 (0.0)	0.2 (0.0)	12.9 (0.4)	2.7 (-)	0.7 (0.0)	7.6 (0.0)	34.6 (0.5)	21.4
	31-Jan	NT	0.0 (-)	71.4 (NA)	1.5 (0.4)	1.3 (0.0)	22.8 (-)	13.1 (5.0)	15.2
A2	5-Jan	2.6 (0.0)	0.0 (-)	7.5 (0.1)	2.3 (-)	0.6 (0.6)	5.5 (0.0)	11.6 (12.7)	102.9
	31-Jan	NT	0.0 (-)	52.0 (NA)	3.6 (1.3)	1.1 (-)	22.6 (-)	21.9 (6.6)	36.4
A3	5-Jan	3.1 (0.0)	0.0 (-)	12.7 (1.2)	2.7 (-)	0.5 (0.1)	7.8 (3.9)	9.7 (0.2)	112.5
	31-Jan	NT	NT	NT	NT	NT	NT	NT	NT

Values in ( ) are SD of duplicate samples tested. NT – not tested. * - water samples were filtered to 0.45µm for trace metal analysis and 0.70µm for PAH analysis.



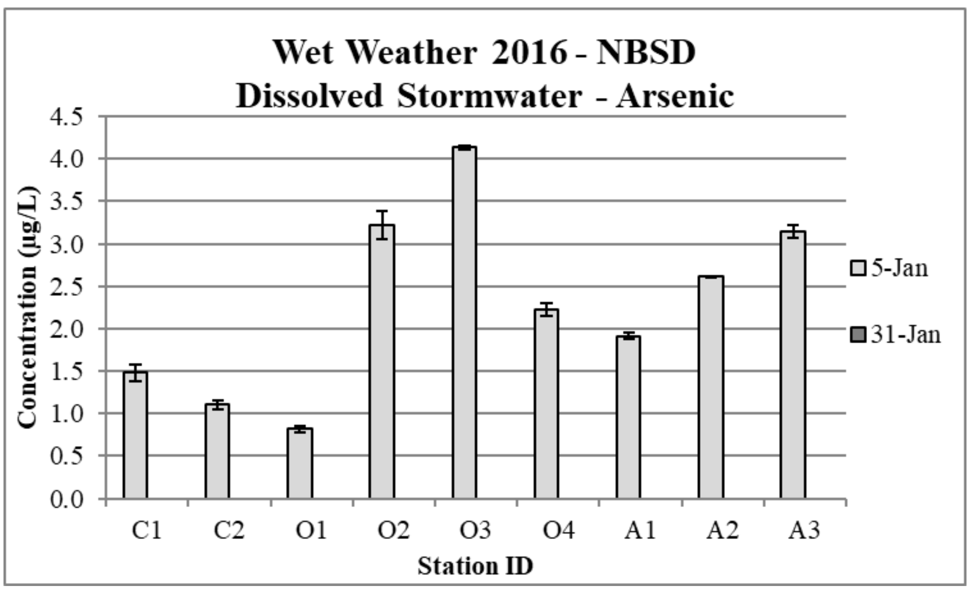
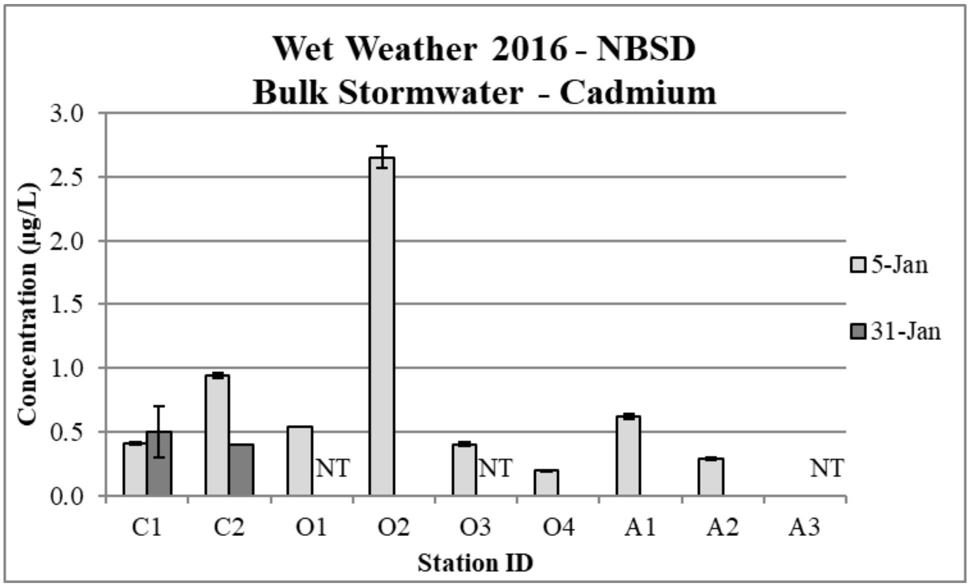


Figure 3-89. Bulk and dissolved stormwater arsenic concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD. No dissolved analyses for 31-Jan storm event.



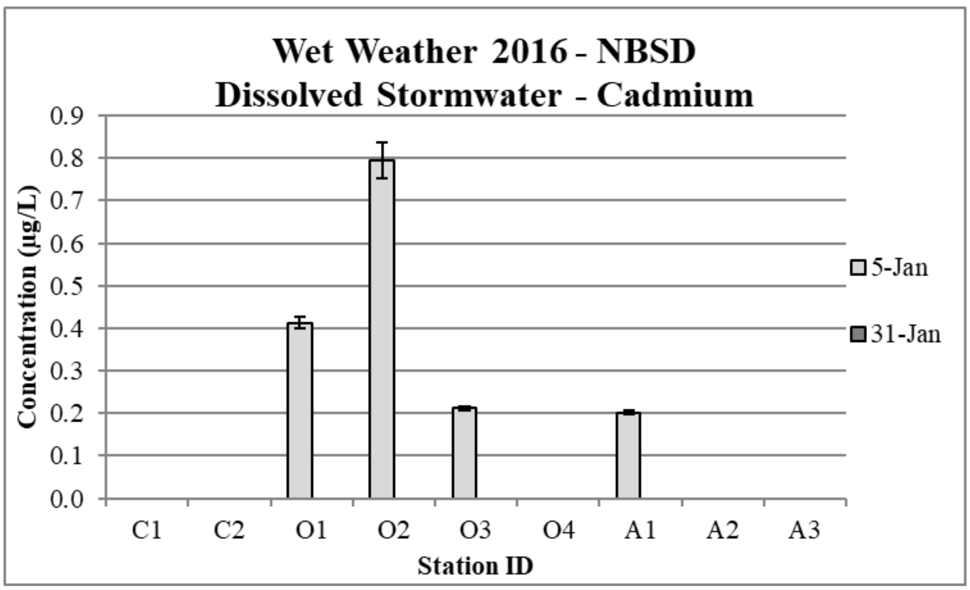


Figure 3-90. Bulk and dissolved stormwater cadmium concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.

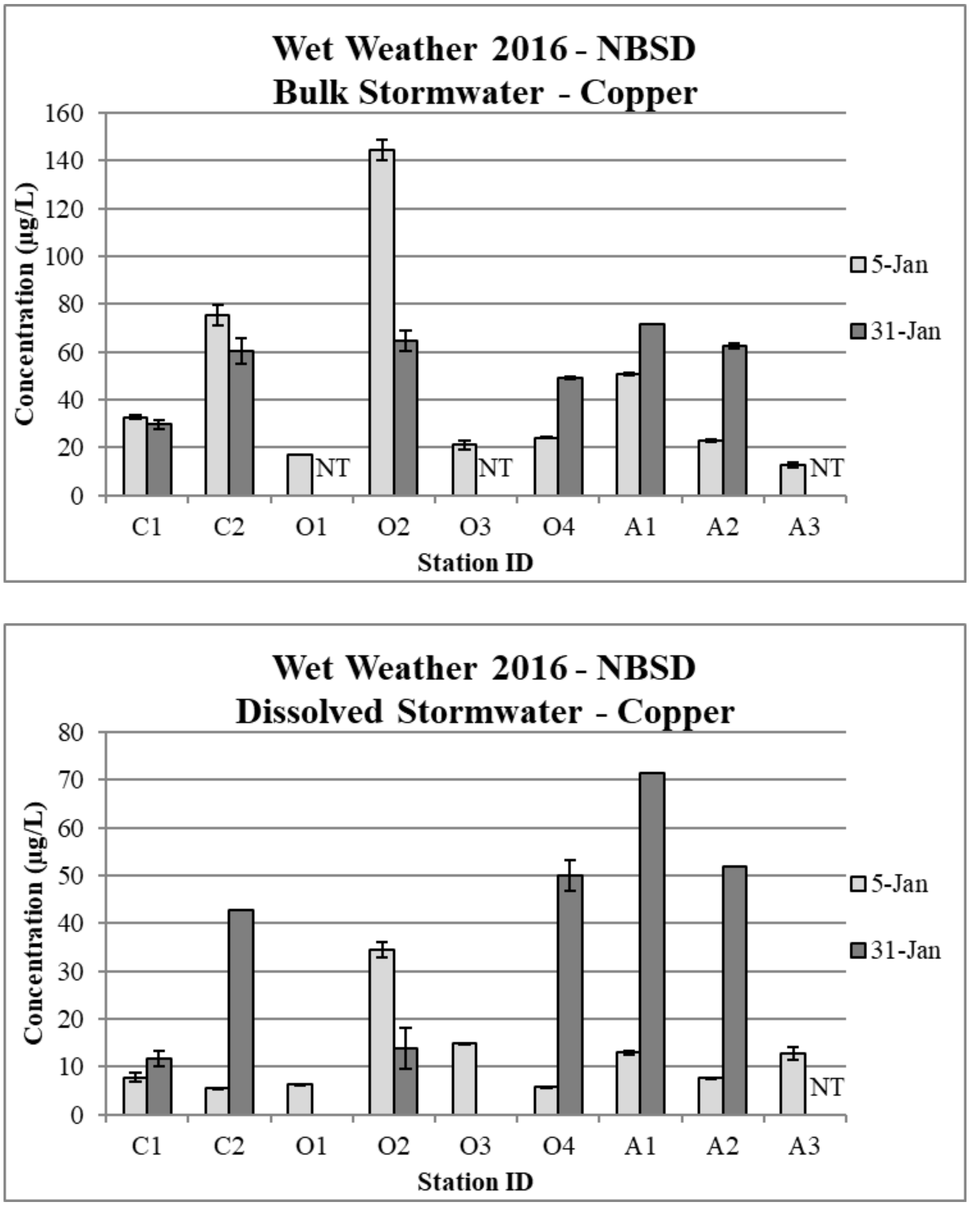
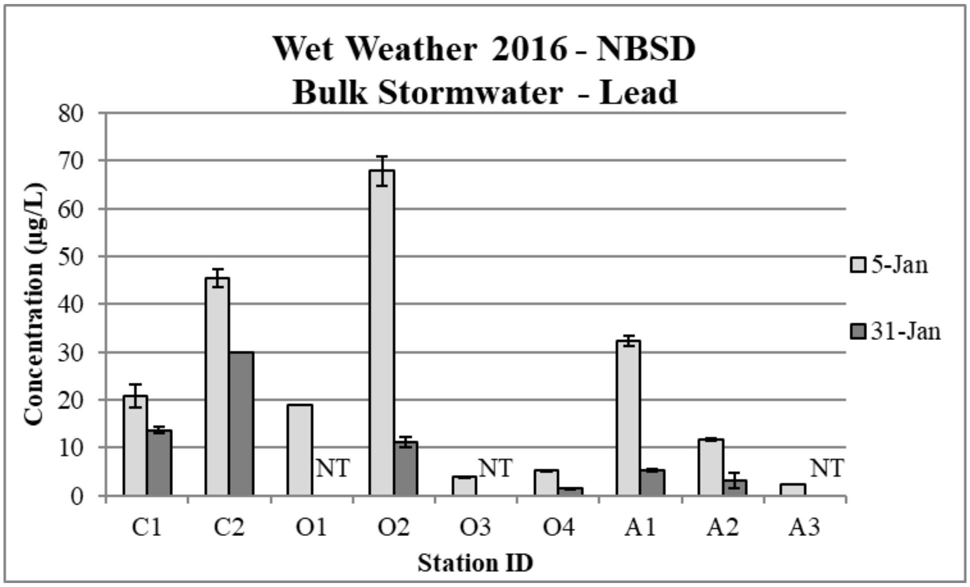


Figure 3-91. Bulk and dissolved stormwater copper concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.



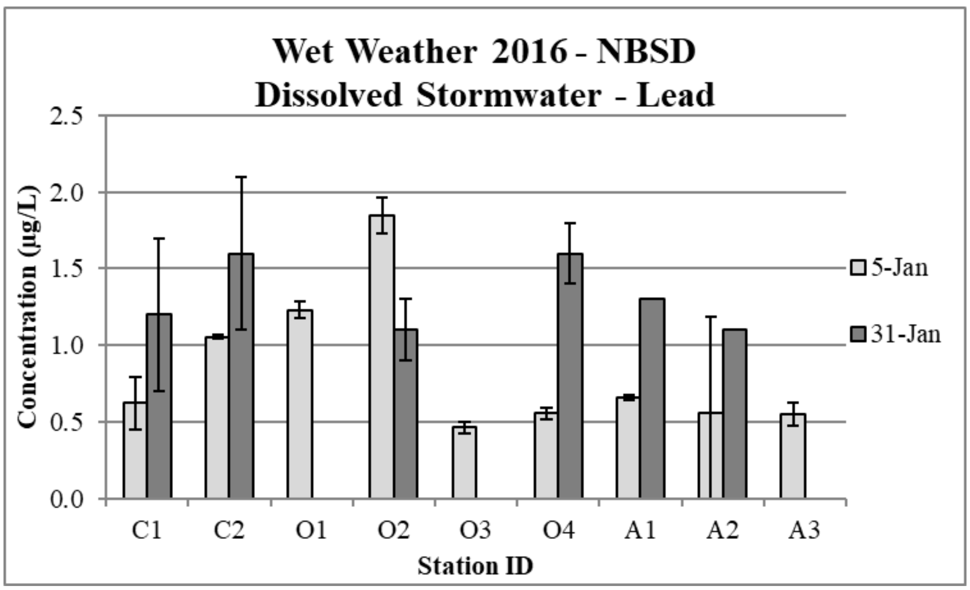
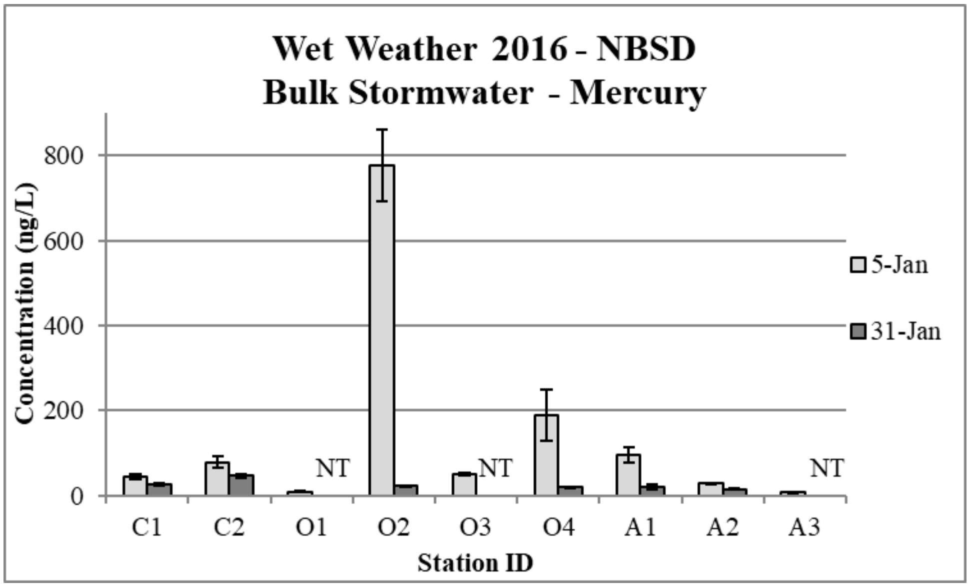


Figure 3-92. Bulk and dissolved stormwater lead concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.



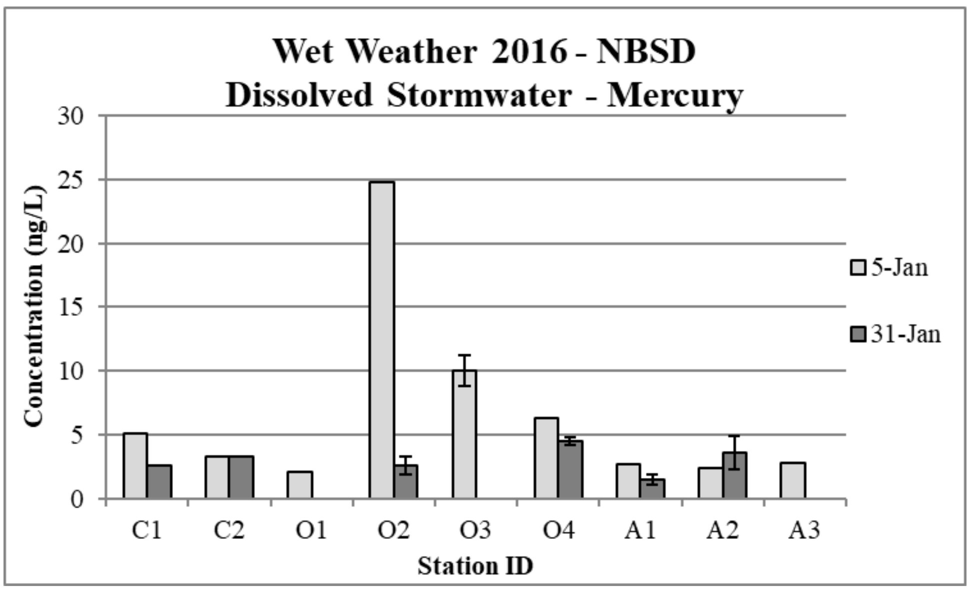
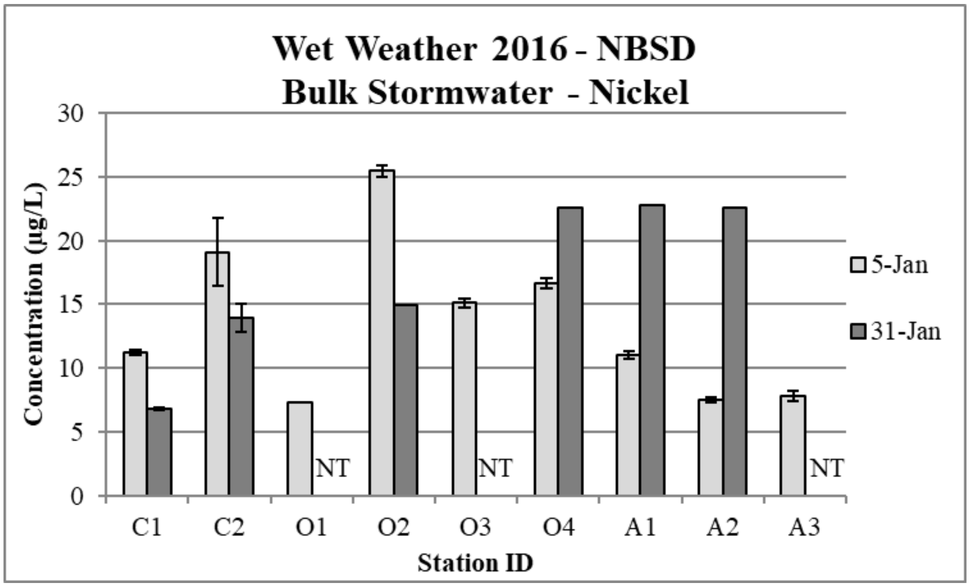


Figure 3-93. Bulk and dissolved stormwater mercury concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.



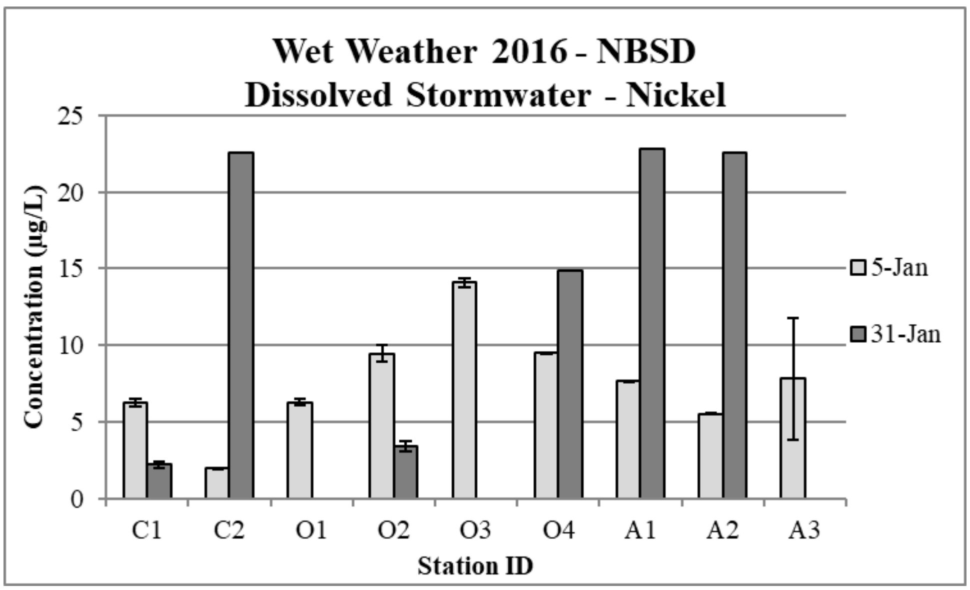
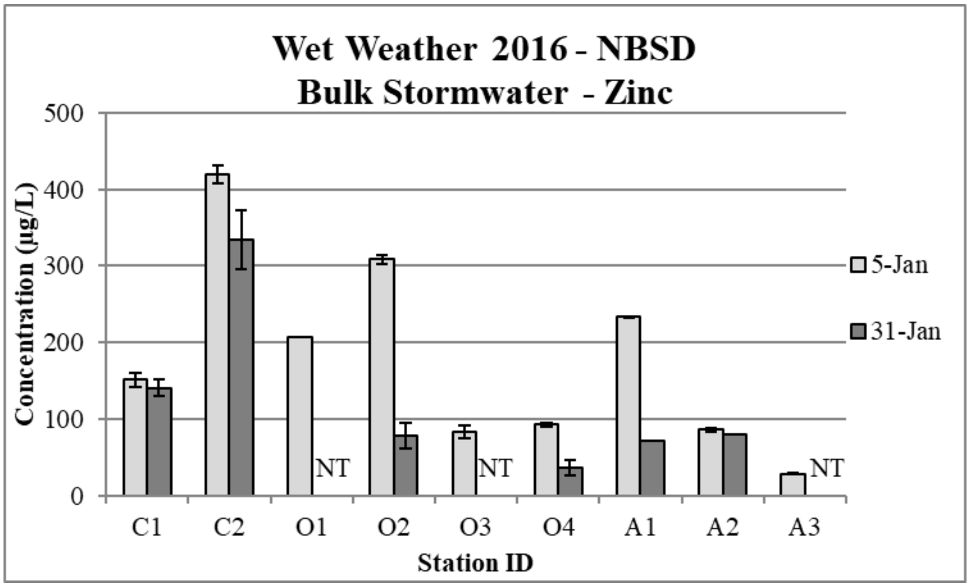


Figure 3-94. Bulk and dissolved stormwater nickel concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.



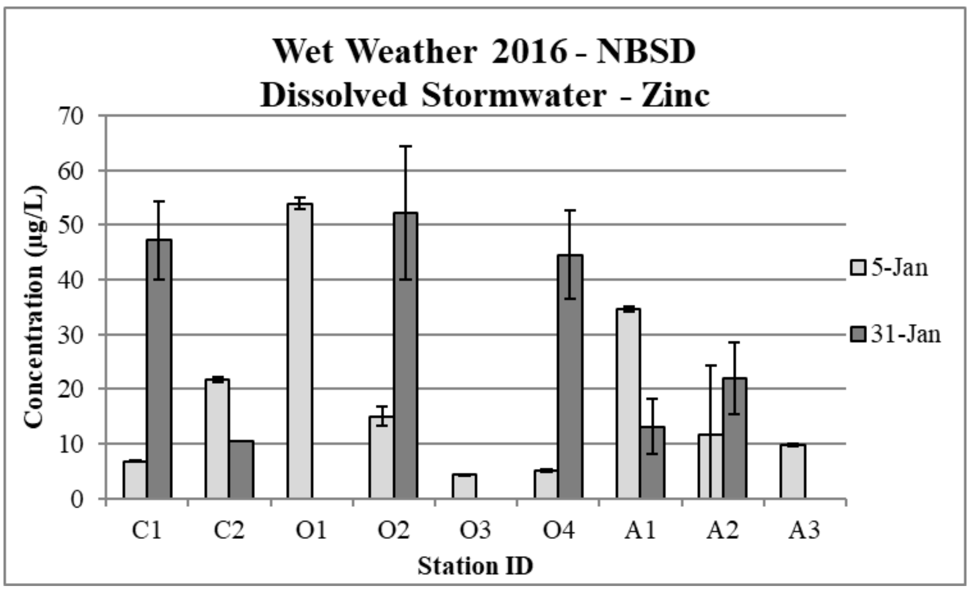
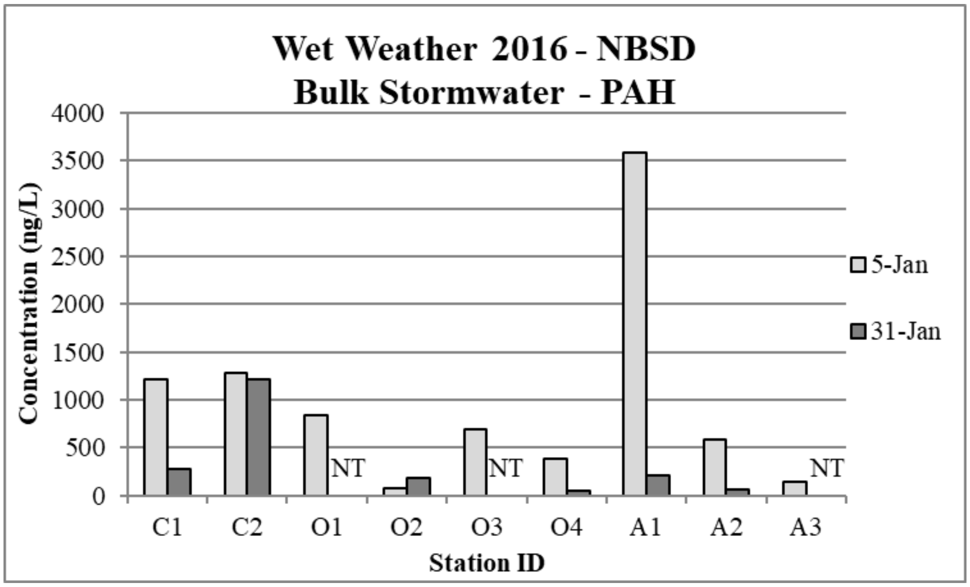


Figure 3-95. Bulk and dissolved stormwater zinc concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.



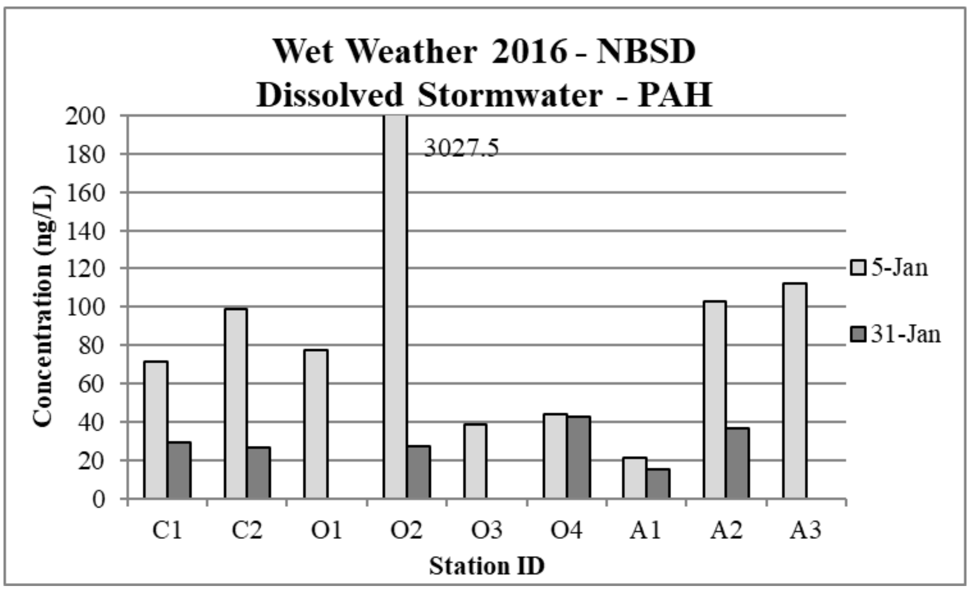


Figure 3-96. Bulk and dissolved stormwater Total PAH concentrations for the two storms sampled for the 2015/2016 Wet Weather sampling effort at NBSD.

3.3.3. *IN SITU STUDIES*

Tidal conditions/elevations for the Wet Weather season from 19-Oct-2015 to 23-Feb-2016 are shown in Figure 3-97. During the deployment, tidal elevations cycled through approximately 8 spring-neap tidal cycles.

Precipitation observed over the course of the deployment is shown in Figure 2-1. Approximately 5.7” of precipitation fell over the course of the monitoring period from about a dozen precipitation events.

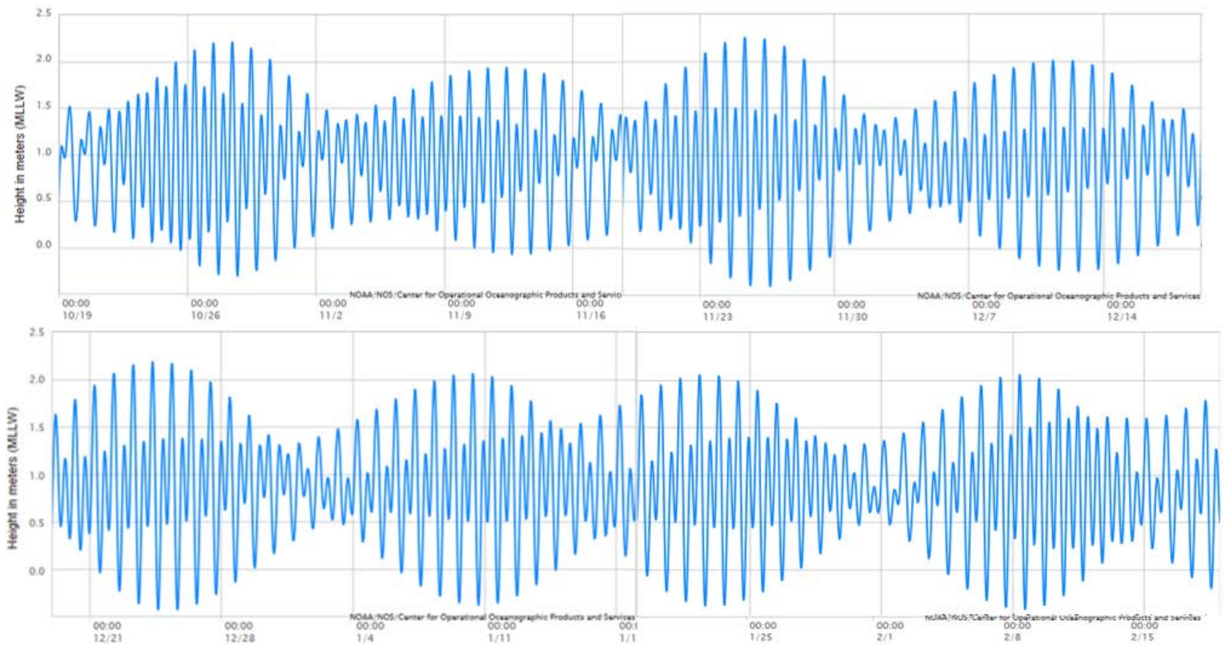


Figure 3-97. Wet Weather 2015/2016 tidal conditions at Paleta Creek – NBSD.

3.3.3.1. SEDIMENT TRAPS

Sediment traps were recovered and initial processing was conducted by SSC Pac personnel. Size fractionation characterization of sediment trap material was conducted by TTU staff. Size fractions were classified as: Clay (<2µm); Fine silt (2-20µm); Coarse silt (20-63µm); and Sand (>63µm). Figure 3-98 below shows the % mass that each size fraction contributes to the total for each station sampled. Chemistry results for bulk sediment trap material is summarized in Table 3-19 and Table 3-20 and shown in Figure 3-99 through Figure 3-111.

Deposition rates at the deployment site were estimated based on the composite total mass collected in the three sediment traps deployed at each site, the combined surface area of the traps, and the time period of the deployment. The total sediment dry weight mass collected in the traps for stations P01, P08, P11 and P17 were 971.7, 639.2, 528.3, and 1295.7g, respectively. The combined surface area of the three traps at each station was 547 cm^2, and the deployment period was 127 days. This indicates a deposition rate of about 0.04, 0.03, 0.02 and 0.06g/cm^2/d for stations P01, P08, P11 and P17, respectively. Assuming a wet bulk density of 1.52, 1.58, 1.56 and 1.80g/cm^3 (estimated from moisture content and assumed solids density of 2.5 g/cm^3), this indicates a deposition rate of about 10.1, 6.4, 5.3, and 11.3 cm/y or a total deposition thickness for the deployment period of about 3.5, 2.2, 1.9 and 3.9cm for P01, P08, P11 and P17, respectively.

Trace metal concentrations showed the trend of increasing concentrations towards the mouth of Paleta Creek for cadmium, lead and zinc. This trend was also similar in bulk sediment samples collected for both pre- and post-storm season samples. It appears to be an opposite trend with increasing concentrations away from the mouth of the Creek for copper, nickel, arsenic and mercury, which was not similar to what was observed in the bulk sediment samples.

Pesticides showed higher concentrations moving toward the mouth of Paleta Creek (i.e. P01<P08<P11<P17). Compared to dry weather deployments, this might indicate an upstream source of pesticides being introduced to San Diego Bay from precipitation events.

PAH concentrations were highest at site P11, which was consistent with the bulk sediment sample concentrations and similar to dry weather sampling results. Lower concentrations were observed in the two Outer Creek samples, P01 and P08, indicating that the source of PAHs is fairly specific and localized to the P11 site.

Dry weather PCBs showed PCB concentrations decreased at P17 relative to P11. Wet weather concentrations show a similar trend between these two sites. With the Outer Creek samples, organic carbon-normalized PCB concentrations trend in a decreasing fashion towards the mouth of Paleta Creek. Similarly to the dry weather sediment trap deployment, traps located at P17 had relatively less percentage of particle fractions in the <63µm fraction compared to the other sites. For P17, over 45% of the content in the >63µm fraction; whereas, approximately 10% or less of content was in the >63µm fraction for the other three sites (Figure 3-98).

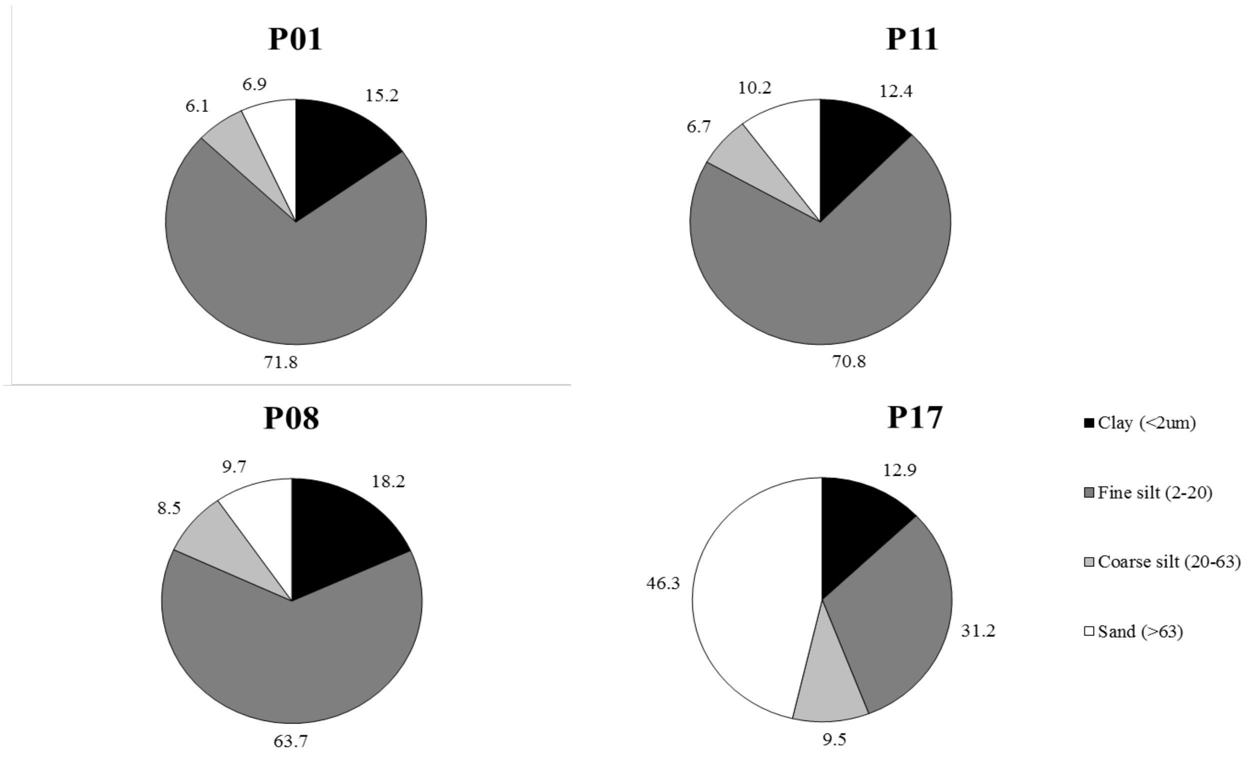


Figure 3-98. Proportion of each particle class size contributing to the total mass of sediment traps deployed at stations P01, P08, P11 and P17 during the Wet Weather monitoring 2015/2016 – NBSD.

Table 3-19. 2015/2016 Wet Weather Sediment Trap Chemistry Results – NBSD.

Sample ID	As (µg/g)	Cd (µg/g)	Cu (µg/g)	Hg (µg/g)	Pb (µg/g)	Ni (µg/g)	Zn (µg/g)
P01	13.1 (0.1)	ND	306.1 (30.5)	0.6 (0.0)	78.5 (5.2)	26.2 (1.3)	445.9 (91.2)
P08	12.5 (0.3)	0.3 (0.1)	299.8 (12.5)	0.63 (0.0)	85.7 (3.4)	28.2 (0.9)	406.9 (36.6)
P11	12.5 (0.2)	0.5 (0.1)	315.7 (34.1)	0.58 (0.0)	104.7 (2.8)	29.1 (0.6)	450.4 (46.7)
P17	7.1 (0.4)	1.2 (0.0)	212.4 (11.2)	0.35 (0.2)	126.1 (2.5)	23.2 (1.2)	561.9 (7.1)

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect.

Table 3-20. 2015/2016 Wet Weather Sediment Trap Chemistry Results – NBSD (cont'd).

Sample ID	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/kg OC)	Total PCBs (µg/kg)	Total PCBs (µg/kg OC)	Pyrethroid Pesticides (µg/g)	Pyrethroid Pesticides (µg/g OC)
P01	2.39 (0.0)	0.16 (0.0)	1056.9	47.3	75.9	3.40	24.1	0.90
P08	2.38 (0.2)	0.15 (0.0)	1058.7	47.4	92.1	4.12	34.2	1.52
P11	3.14 (0.2)	0.19 (0.0)	2252.0	76.3	119.5	3.81	77.8	2.63
P17	4.45 (0.3)	0.41 (0.0)	2127.7	52.7	110.9	2.74	140.8	3.48

Values in ( ) are SD of duplicate samples tested. "-"– not tested. ND – non-detect

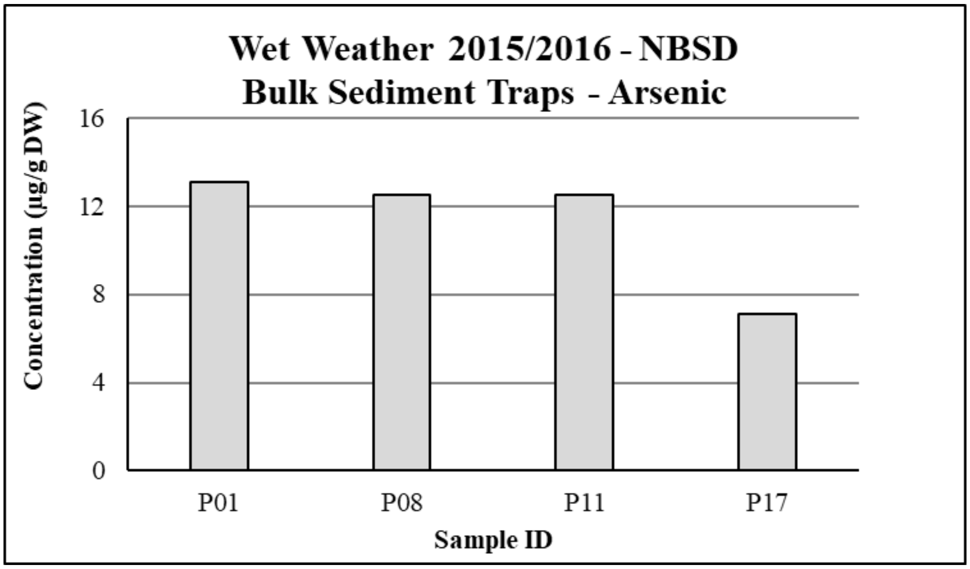


Figure 3-99. Bulk sediment trap arsenic concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

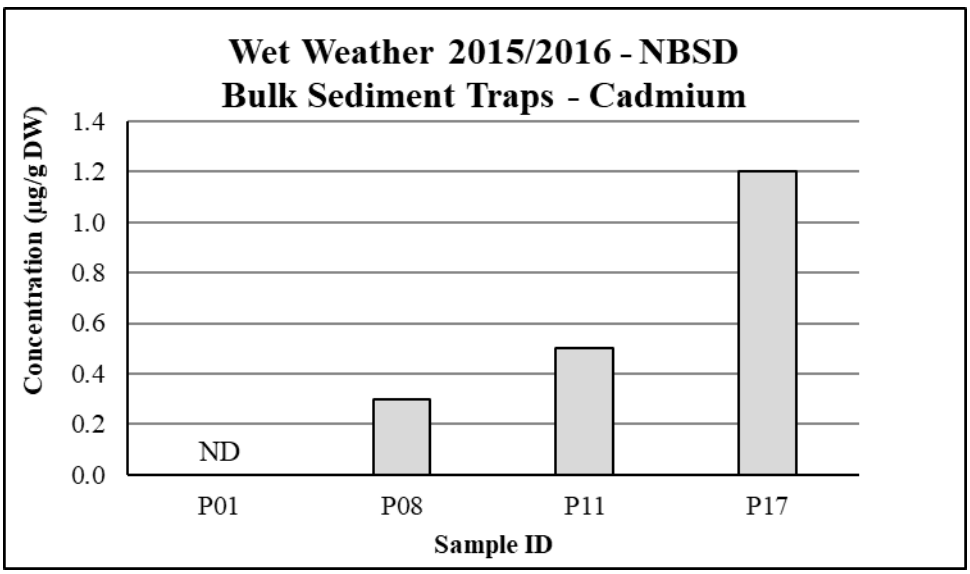


Figure 3-100. Bulk sediment trap cadmium concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

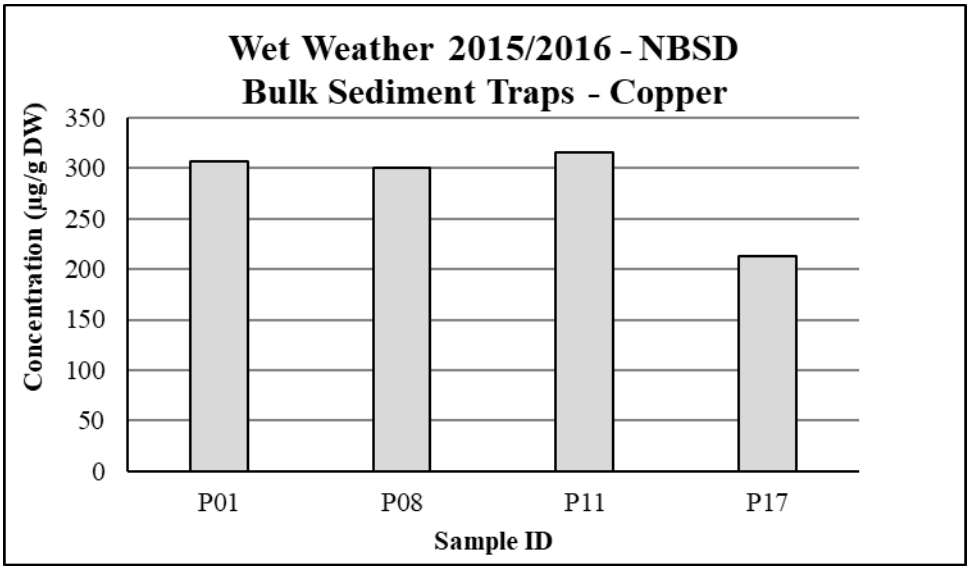


Figure 3-101. Bulk sediment trap copper concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

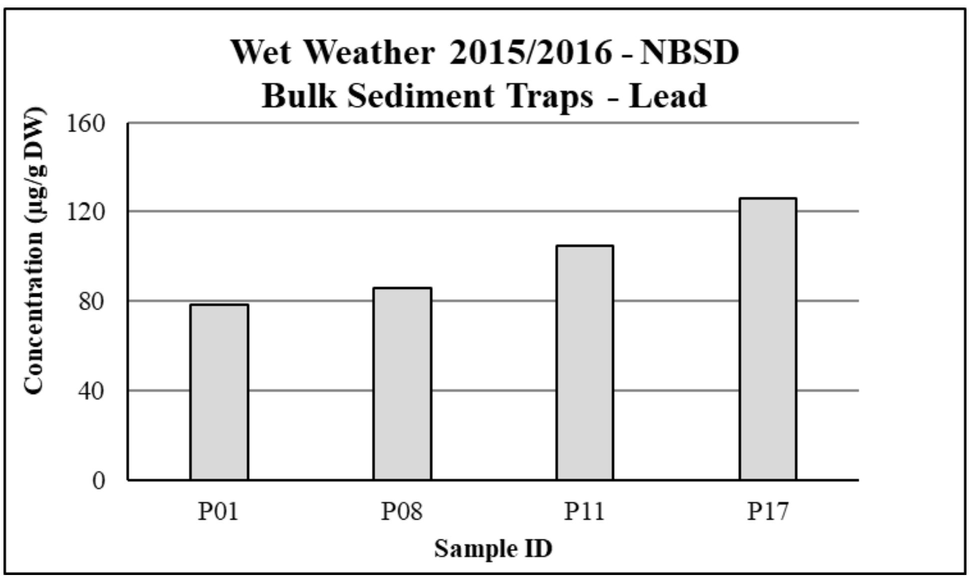


Figure 3-102. Bulk sediment trap lead concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

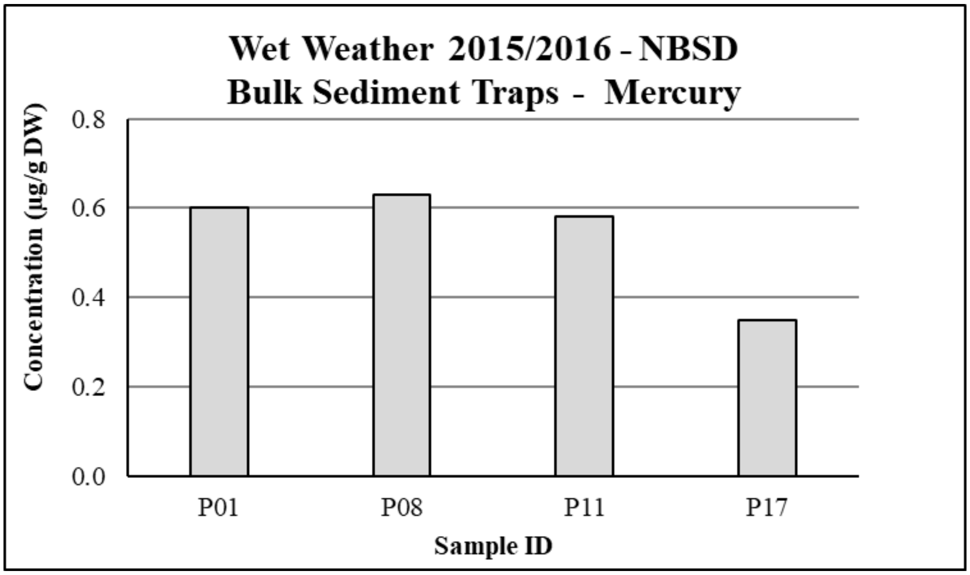


Figure 3-103. Bulk sediment trap mercury concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

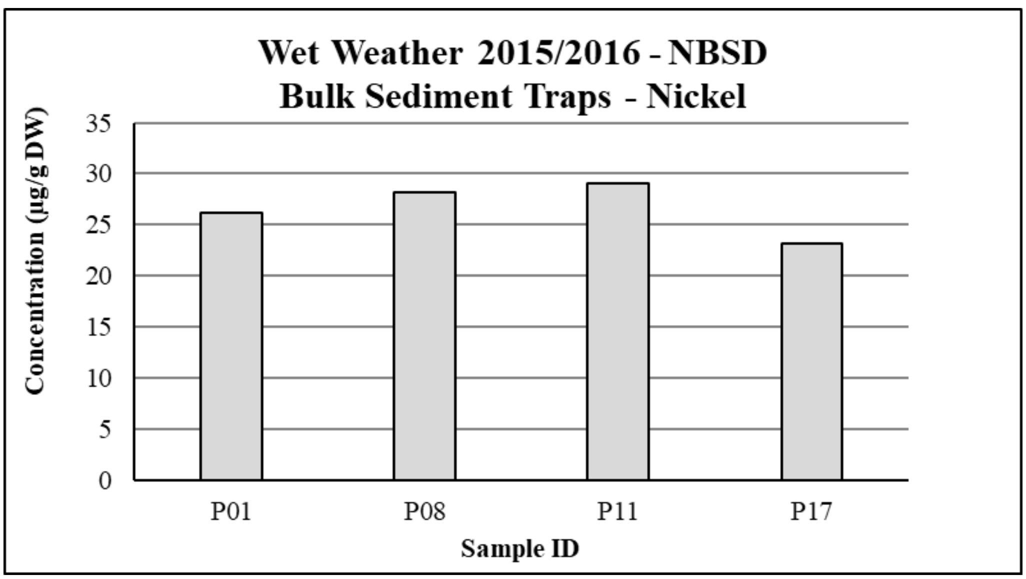


Figure 3-104. Bulk sediment trap nickel concentrations stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

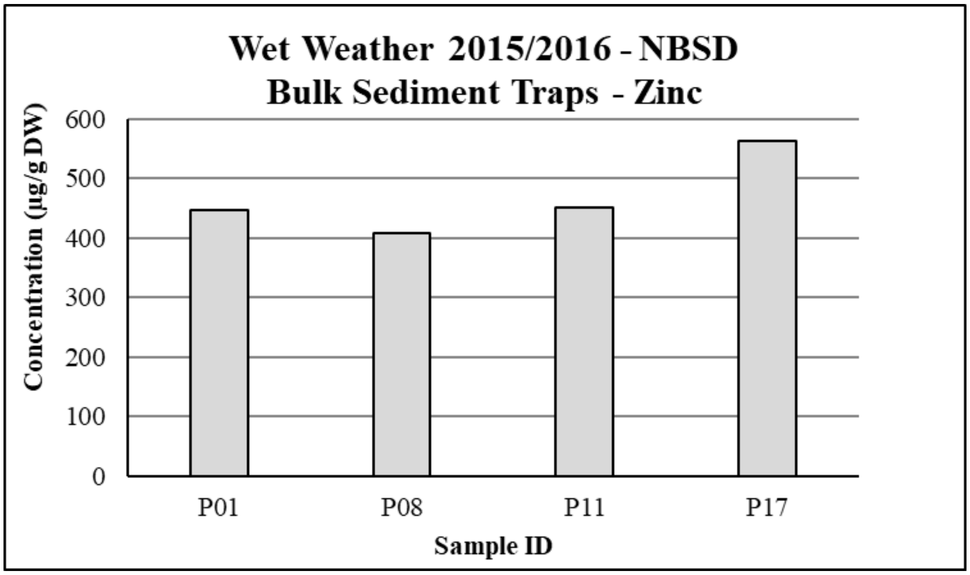


Figure 3-105. Bulk sediment trap zinc concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

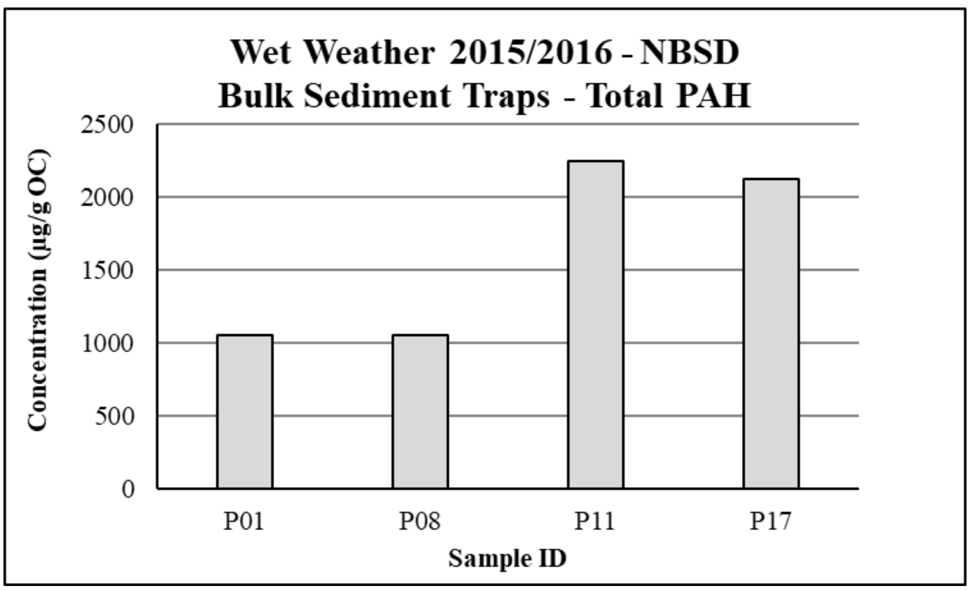


Figure 3-106. Bulk sediment trap Total PAH concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

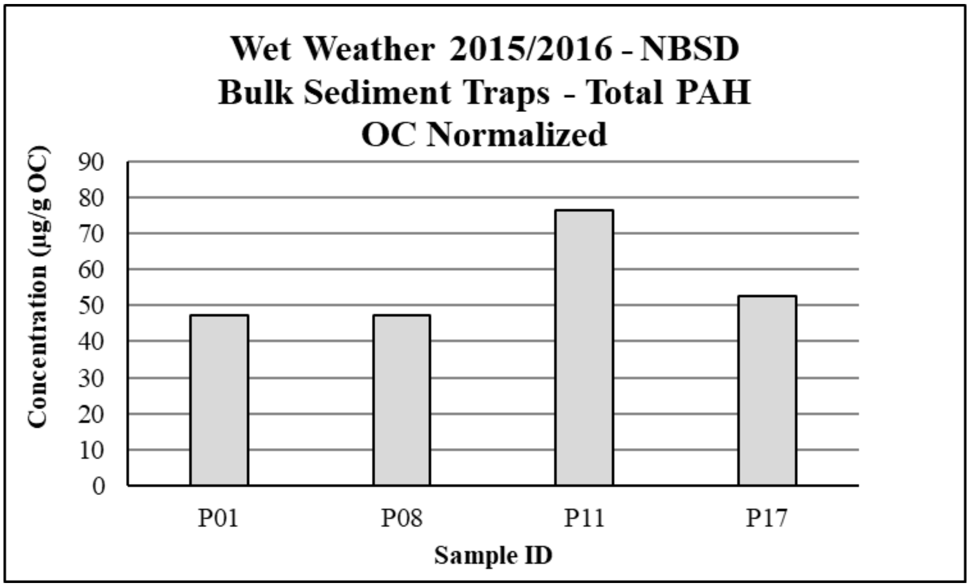


Figure 3-107. Bulk sediment trap Total PAH concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

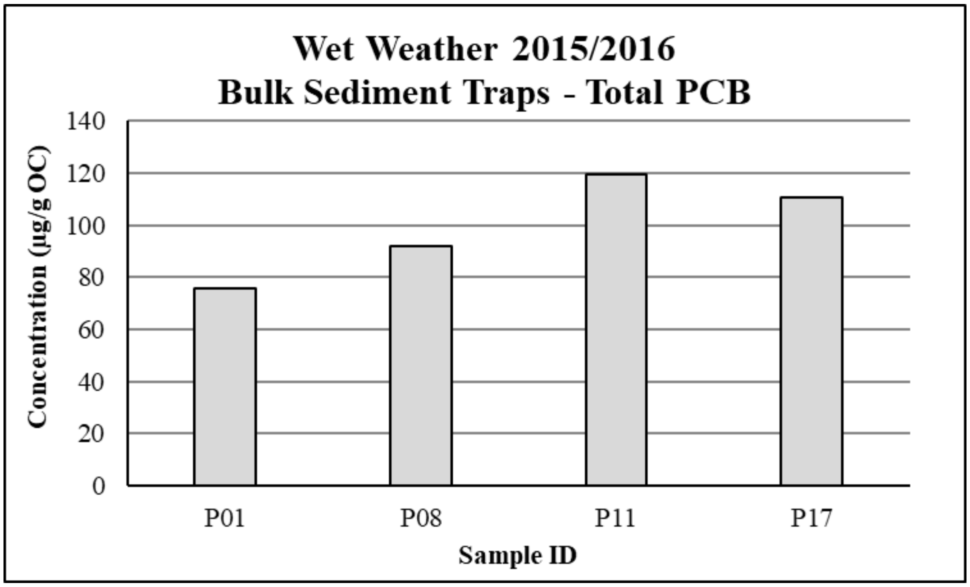


Figure 3-108. Bulk sediment trap Total PCB concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

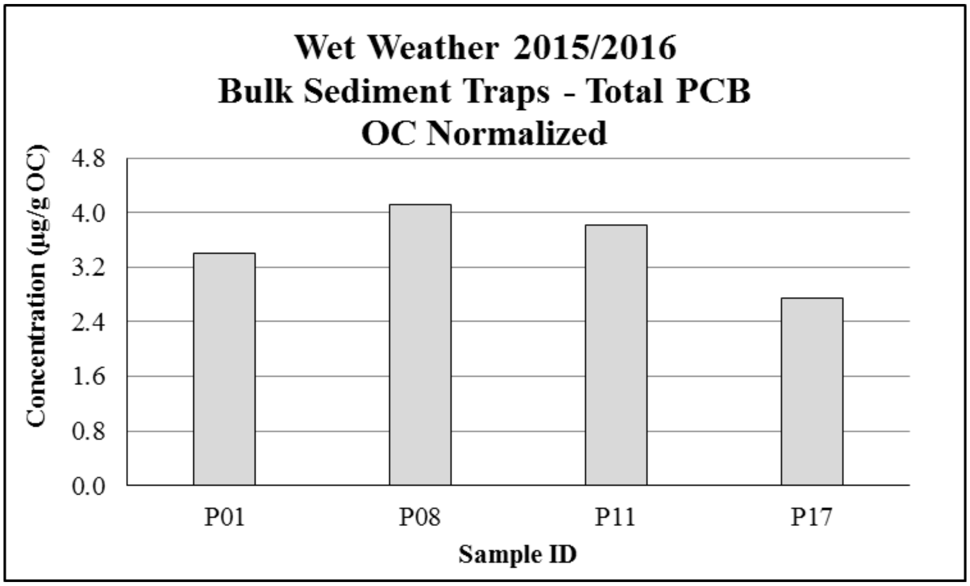


Figure 3-109. Bulk sediment trap Total PCB concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

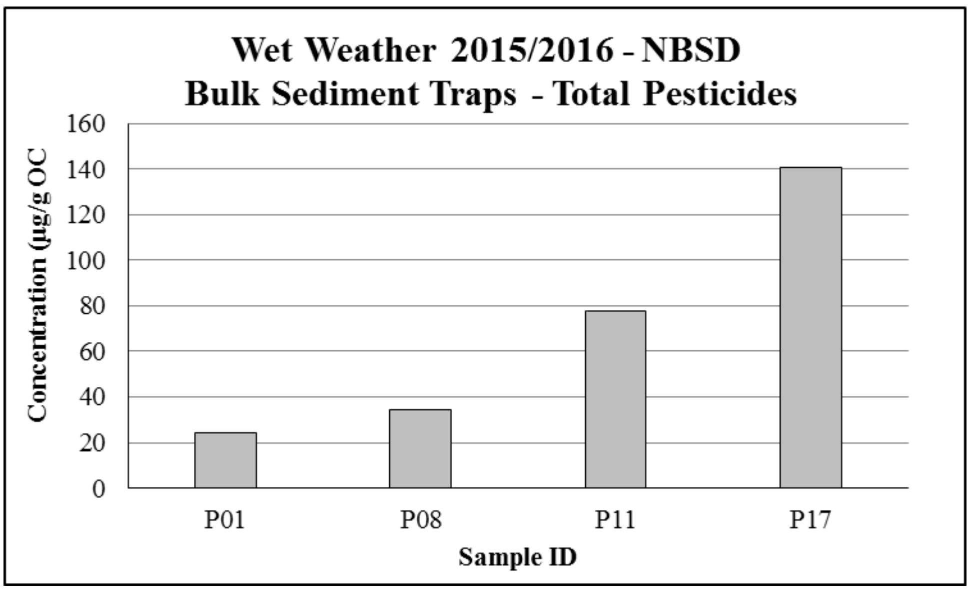


Figure 3-110. Bulk sediment trap pyrethroid pesticide concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

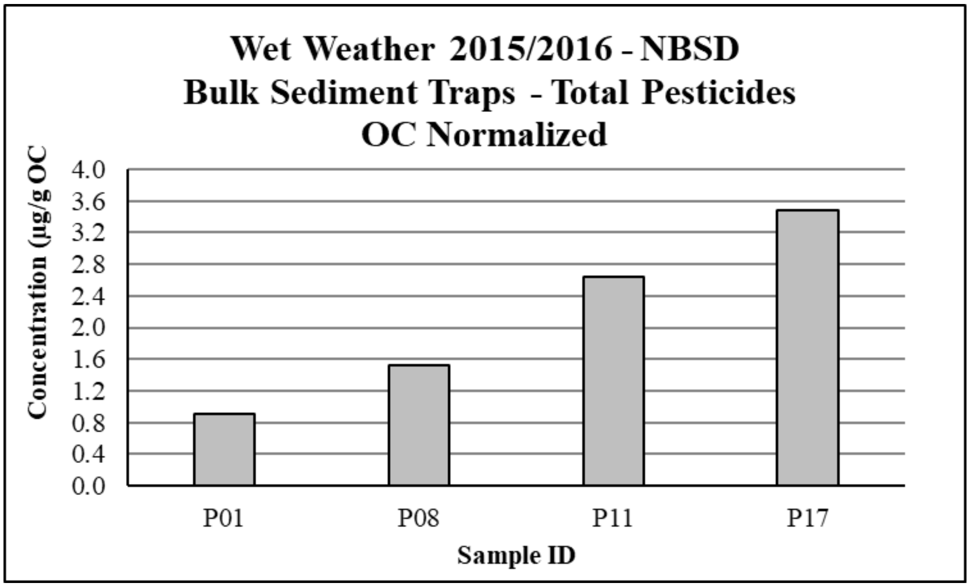


Figure 3-111. Bulk sediment trap pyrethroid pesticide concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

3.3.3.2. SPME PASSIVE SAMPLERS

As described in section 2.3.3, SPMEs were exposed to sediments and adjacent overlying waters for two deployments. The deployments in Oct-2015 and Jan-2016 were designated “Pre-storm” and “Post-storm” samples, respectively. SPMEs deployed *in situ* were sectioned in 10cm sections for the portion of the SPME fiber that was exposed to the overlying water. For the sections of the SPMEs that were deployed in the sediment, the fiber was sectioned into 5cm sections. Total PAH concentrations in the overlying and pore waters as derived from SPMEs for stations P01, P08, P11 and P17 are summarized in Table 3-21 and shown in Figure 3-112 through Figure 3-115.

For both deployments, concentrations of PAHs were typically higher in the sediments than in the overlying water. On average, the Post-storm concentrations of PAHs were higher than those observed for Pre-storm for both overlying water and sediment pore water concentrations as derived from SPME. Similarly to the Dry Weather 2015 SPME concentrations at P11, concentrations in the porewaters increased with depth, whereas at stations P01, P08 and P17, concentrations of PAHs tended to decrease with depth.

Table 3-21. 2015 Dry Weather NBSD *In Situ* SPME Total PAH Results for Stations P01 and P17.

Station ID	Placement	Oct-2015 to Jan-2016		Jan-2016 to Feb-2016	
		Depth Section (cm)	Total PAHs (ng/L)	Depth Section (cm)	Total PAHs (ng/L)
P01	Overlying Water	NA		33-41	407.5
				20-30	360.9
				10-20	363.0
				0-10	339.7
	Sediment	NA		0-5	545.2
				5-10	562.3
				10-15	477.4
				15-20	541.9
				20-26	439.9
P08	Overlying Water	33-42	186.8 (132.8)	33-41	-
		23-33	254.1 (166.9)	20-30	294.5
		13-23	370.7 (138.5)	10-20	240.1
		0-12	267.2 (95.7)	0-10	324.3
	Sediment	0-5	541.4 (212)	0-5	517.2
		5-10	344.2 (42.7)	5-10	464.7
		10-16	345.4 (190.5)	10-15	472.4
		-	-	15-20	406.4
		-	-	20-26	283.2
P11	Overlying Water	33-42	110.2	33-41	-
		23-33	101.8	20-30	348.1
		13-23	88.0	10-20	282.4
		0-12	166.1	0-10	381.6
	Sediment	0-5	428.8	0-5	479.9
		5-10	674.3	5-10	599.1
		10-16	599.0 (25.8)	10-15	682.1
		-	-	15-20	760.0
		-	-	20-26	885.9
P17	Overlying Water	33-42	302 (11.7)	33-41	-
		23-33	246.2 (43.8)	20-30	-
		13-23	298.7 (161.3)	10-20	439.7
		0-12	196.2 (55.7)	0-10	278.2
	Sediment	0-5	326.8 (200.7)	0-5	490.8
		5-10	334.4 (213.7)	5-10	451.2
		10-16	362.2 (161.9)	10-15	499.0
		-	-	15-20	442.5
		-	-	20-26	316.6

NA – Not available. Values in ( ) are SD of duplicate samples tested. "-"– not tested.

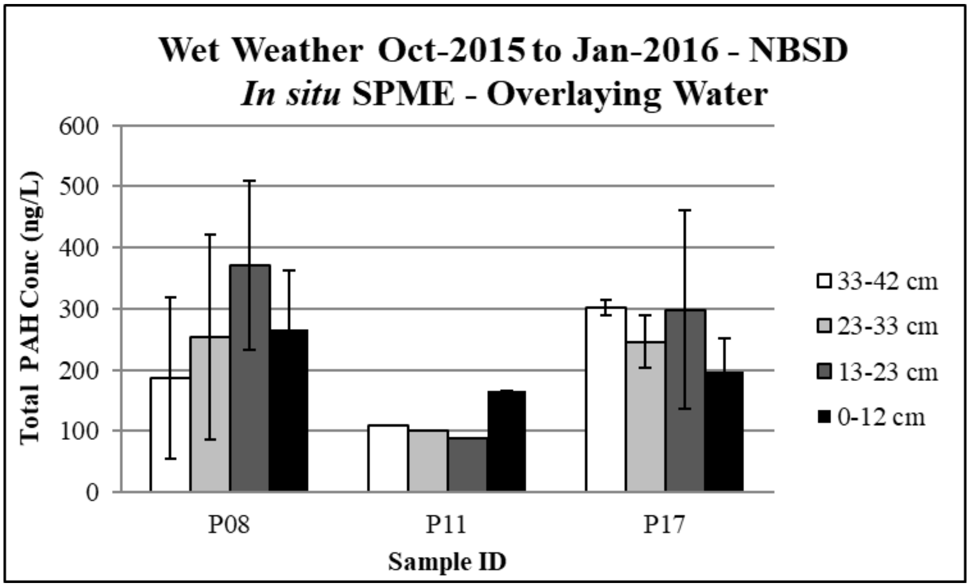


Figure 3-112. Total PAH concentrations in overlying waters derived from SPME fibers deployed at the onset of the 2015-2016 Wet Weather sampling effort at NBSD.

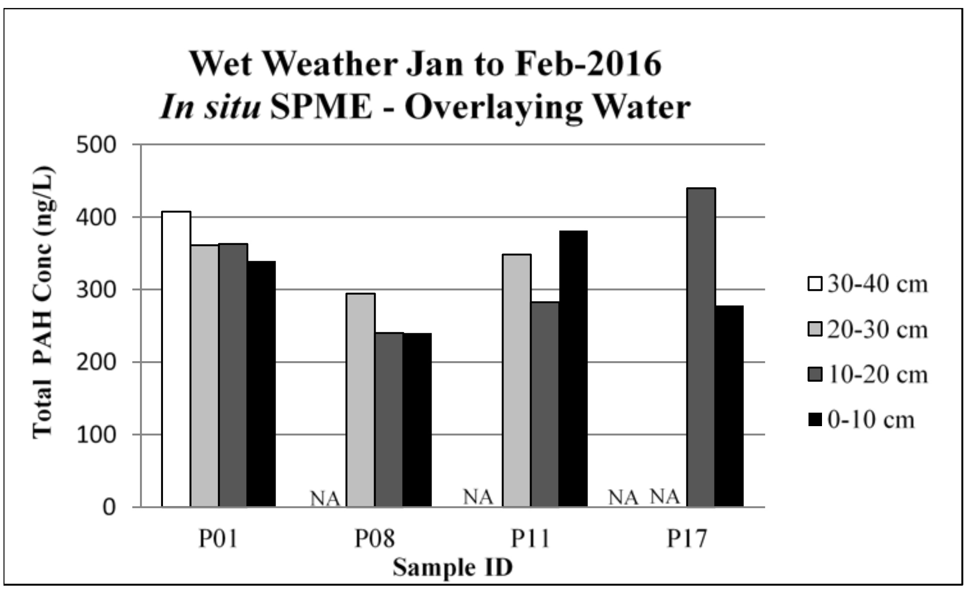


Figure 3-113. Total PAH concentrations in overlying waters derived from SPME fibers deployed following the 2015-2016 Wet Weather sampling effort at NBSD.

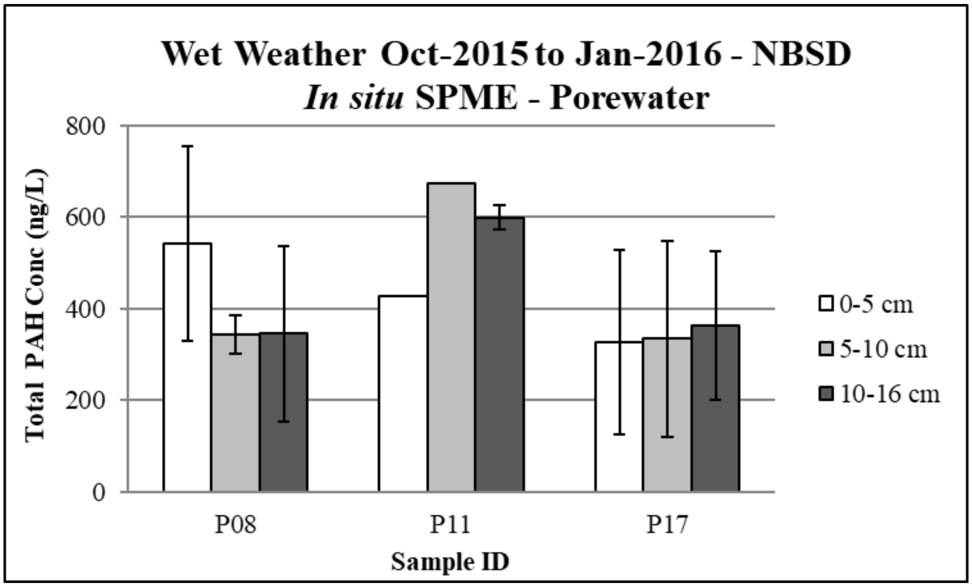


Figure 3-114. Total PAH concentrations in pore waters derived from SPME fibers deployed at the onset of the 2015-2016 Wet Weather sampling effort at NBSD.

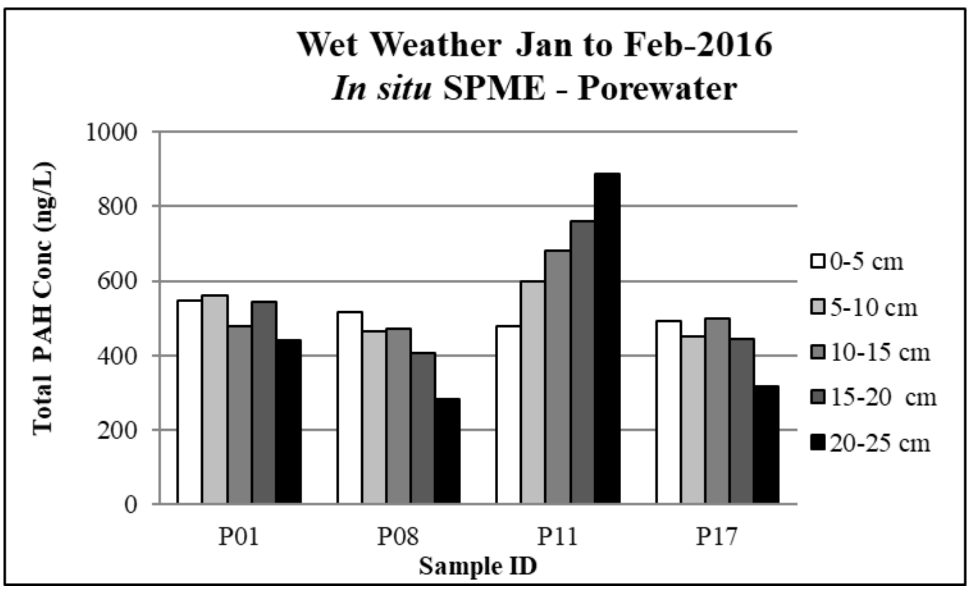


Figure 3-115. Total PAH concentrations in pore waters derived from SPME fibers deployed following the 2015-2016 Wet Weather sampling effort at NBSD.

3.3.3.3. ADCP, OBS & SEDIMETER

Conditions for the ADCP measurements during the wet weather deployment are shown in Figure 3-116. Again, results show the scattering of material in the water column with variations at the water surface due to the tidal cycling in the bay (Figure 3-116, Figure 3-97). Higher measurements (160-200 dB) observed throughout the water column near Julian Day 5 and 31 are indicative of the significant rain event that occurred 5 Jan and 31 Jan 2016. Some cyclical measurements prior to the storm event in early Jan 2016 may be due to week-day ship movements, but the resolution is not as apparent as noted in the dry weather deployment.

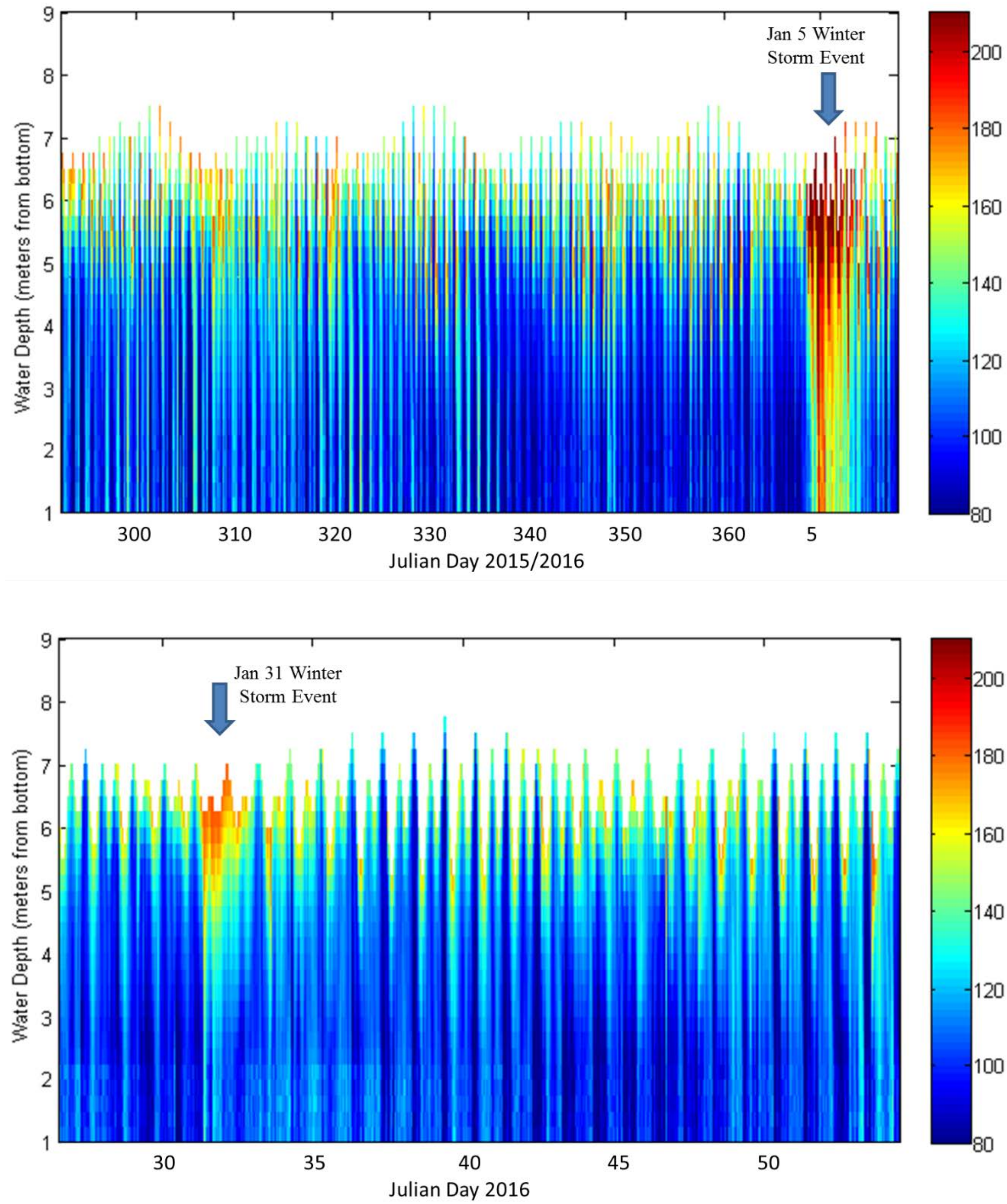


Figure 3-116. ADCP Backscatter Measurements at Station P17 – 2015/2016 Wet Weather deployment effort at NBSD.

Optical backscatter measurements were suspect due to the bio-fouling that occurred on the sensors. Data showed an increasing trend of backscatter leading data to be considered of questionable quality.

The Sedimeter that was deployed during this time frame experienced an equipment malfunction and data was not recoverable.

3.3.3.4. HOBO

Temperature and Dissolved Oxygen (DO) measurements recorded by the HOBO loggers co-deployed with SEA Rings are shown in Figure 3-117 and Figure 3-118. Temperatures observed during deployment ranged from 14.2 to 17.5 and from 14.0 to 17.8°C for stations P01 and P17, respectively. Average temperatures over the course of the deployment were 15.8 and 15.9 for stations P01 and P17 respectively. DO levels averaged 8.6 and 7.7mg/L for stations P01 and P17, respectively. DO levels at both stations never dropped below the recommended threshold of 4mg/L for bioaccumulation testing. Variability observed in the DO measurements are likely associated with higher oxygen production during daylight hours by phytoplankton followed with respiration during the night. Additionally, when stormwater enters the receiving environment at the mouth of Paleta Creek, DO levels were observed to decrease; hence the increased variability in DO observed at P17 compared to P01 due to their respective locations.

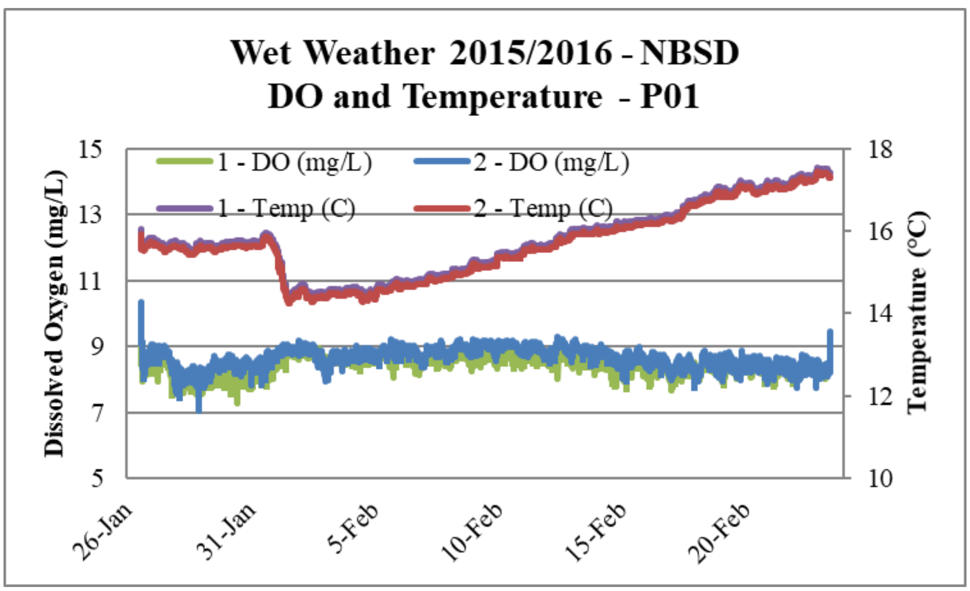


Figure 3-117. Dissolved oxygen and temperature readings taken at station P01 from within two exposure chambers mounted on a SEA Ring deployed for the 2015/2016 Wet Weather sampling effort at NBSD.

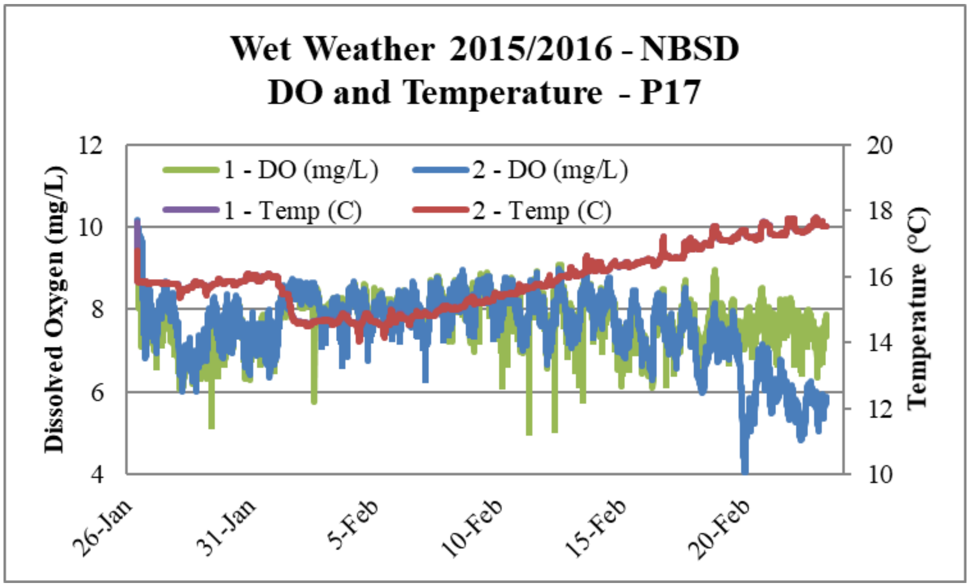


Figure 3-118. Dissolved oxygen and temperature readings taken at station P17 from within an exposure chamber mounted on a SEA Ring deployed for the 2015 Dry Weather sampling effort at NBSD.

3.3.3.5. BIOACCUMULATION

In situ bioaccumulation tests performed using Version 3.0 SEA Rings for the evaluation of Wet Weather conditions at Paleta Creek met test acceptability criteria for all four stations for all exposure treatments with survival of 95% or greater except for the open cage treatment at station P01. Recovery was decreased due to a loose fitting on the chamber that may have contributed to the loss of 5 clams. As shown in the previous section, water quality parameters for DO and temperature were within recommended parameters throughout the duration of the exposures. Performance of the all pumps on the SEA Rings were as expected with over 130 turnovers per day of the overlying water within exposure chambers. Survival results of the clam *M. nasuta* for each type of exposure chamber is shown in Figure 3-119. While the intent of the pre-filters was to isolate certain particle fractions from entering a subset of the exposure chamber, it was determined that there were no statistically significant differences (two factor ANOVAs) in the relative accumulation of any of the constituents of concern, except for the trace metal nickel, and therefore, all replicates were pooled together for summarization and analysis purposes.

Concentrations of contaminants associated with the clam tissues are summarized in Table 3-22 and Table 3-23 and shown in Figure 3-120 through Figure 3-129. Metal concentrations remained fairly consistent across sites for As, Cd, Cu and Ni. Concentrations of Pb seemed to decrease in concertation moving away from the mouth of Paleta Creek. Concentrations of Hg and Zn both appear to increase as distance increases from the mouth of Paleta Creek.

The pesticide chlordane appears to be relatively higher at stations P08, P11 and P17 compared to the outer most station of P01.

PCB concentrations are fairly consistent across stations P01, P08 and P11; whereas station P17 shows quite a decrease in PCB concentration relative to the other stations.

PAH concentrations again show the highest concentrations at station P11. This is consistent with measured values in bulk sediment samples which show increased concentrations at P11 for both the pre- and post-storm samples.

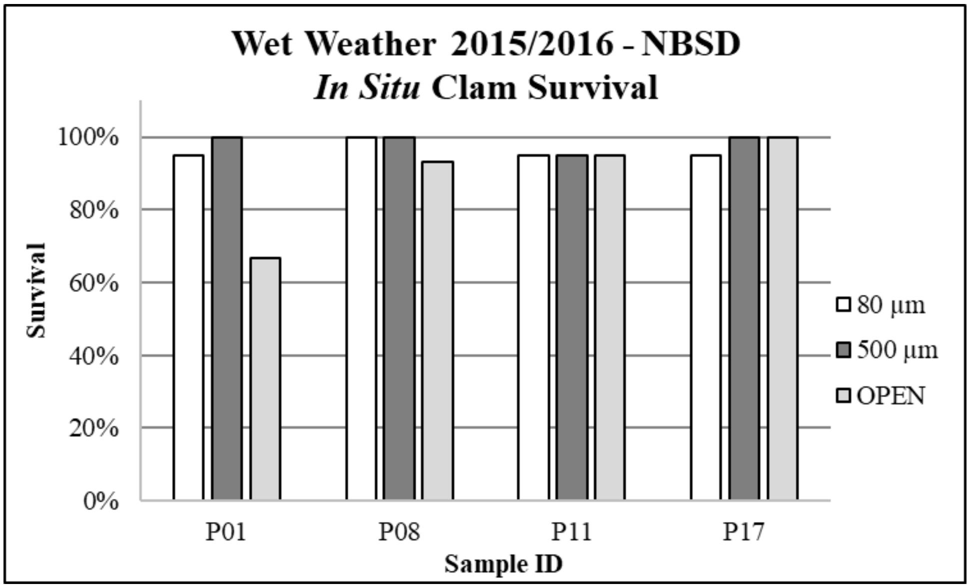


Figure 3-119. Organism survival for *in situ* bioaccumulation exposures for the 2015/2016 Wet Weather sampling effort at NBSD.

Table 3-22. 2015/2016 Wet Weather NBSD Bioaccumulation Results for *M. nasuta In Situ* Exposures.

Sample ID	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/Kg DW)	Ni (µg/g DW)			Pb (µg/g DW)	Zn (µg/g DW)
					Open	80µm	500µm		
P01	5.3 (1.5)	0.0 (0)	3.3 (1.6)	74.5 (13.3)	0.6	0.4	0.4	0.6 (0.1)	25. (3.7)
P08	5.2 (4.2)	0.0 (0)	3.6 (1.2)	70.9 (7.3)	0.7	0.2	0.4	0.7 (0.3)	21. (3.9)
P11	5.0 (2.5)	0.0 (0)	3.2 (0.4)	63.3 (9.4)	0.7	0.4	0.3	1.0 (0.3)	22. (2.9)
P17	4.5 (0.9)	0.0 (0)	3.1 (0.5)	47.8 (4.1)	0.6	0.3	0.4	0.8 (0.1)	18. (2.2)

Values in ( ) are SD of duplicate samples tested.

Table 3-23. 2015/2016 Wet Weather NBSD Bioaccumulation Results for *M. nasuta In Situ* Exposures (cont'd).

Sample ID	% Lipids	Total Chlordane (µg/Kg lipid WW)	Total PAH (µg/Kg lipid WW)	Total PCB (µg/Kg lipid WW)
P01	1.4 (0.4)	83.6 (62.5)	1285 (3)	3316 (409)
P08	0.7 (0.2)	233.4 (234.1)	18.5 (413)	3533 (2030)
P11	1.1 (0.3)	286 (32.2)	34.5 (13.8)	3340 (2196)
P17	1.3 (0.4)	206.8 (194.7)	9.2 (1)	639. (434)

Values in ( ) are SD of duplicate samples tested.

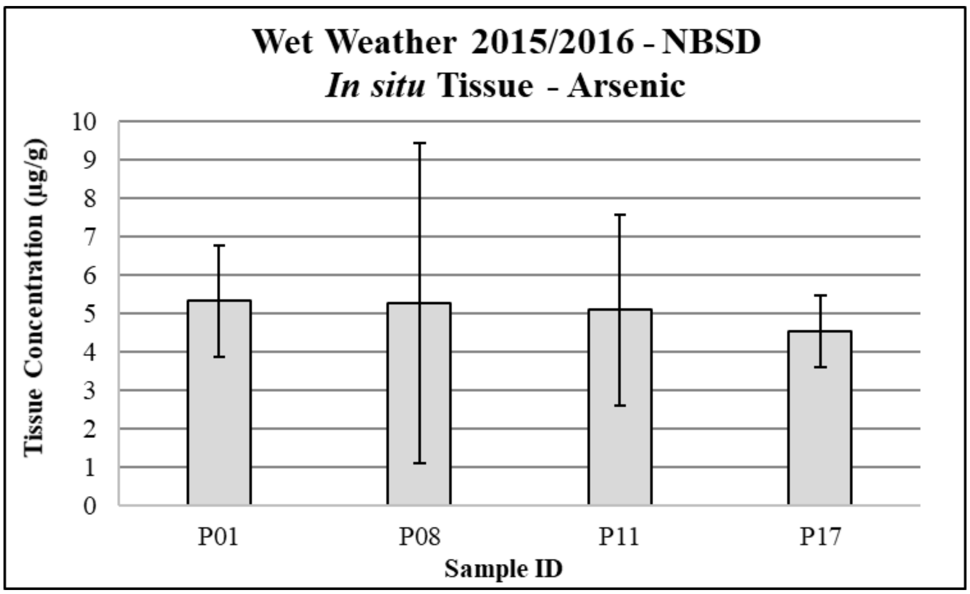


Figure 3-120. Clam tissue arsenic concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

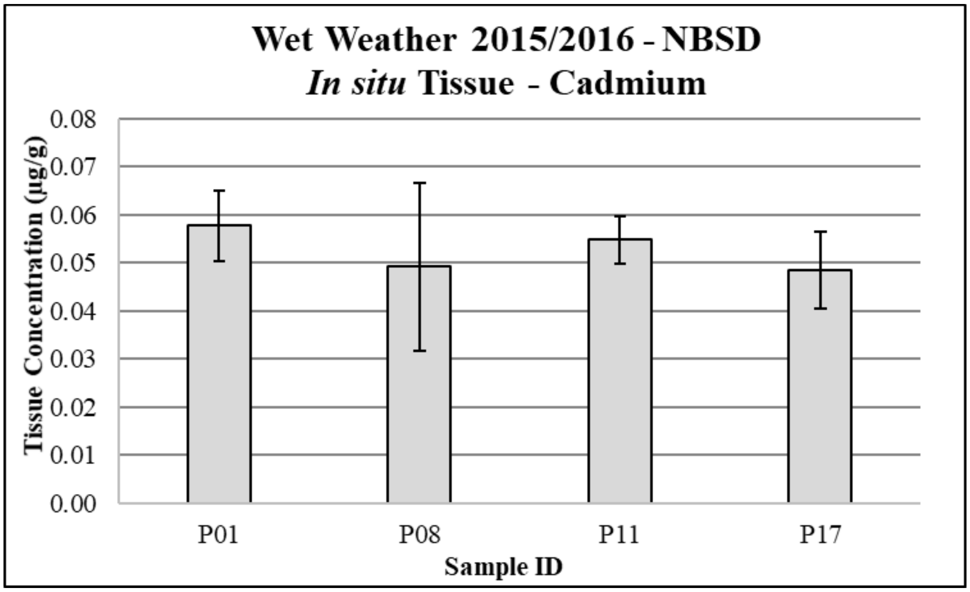


Figure 3-121. Clam tissue cadmium concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

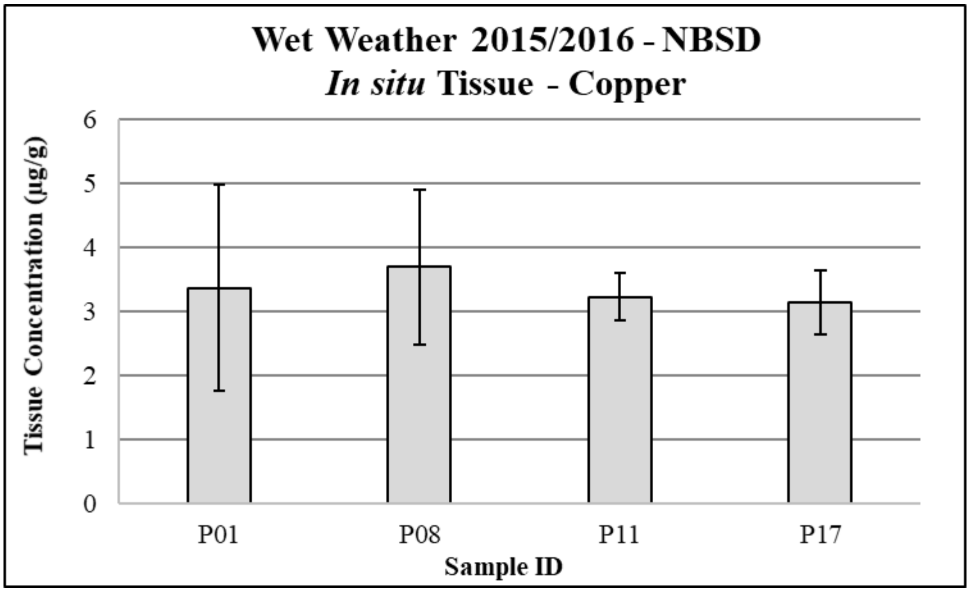


Figure 3-122. Clam tissue copper concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

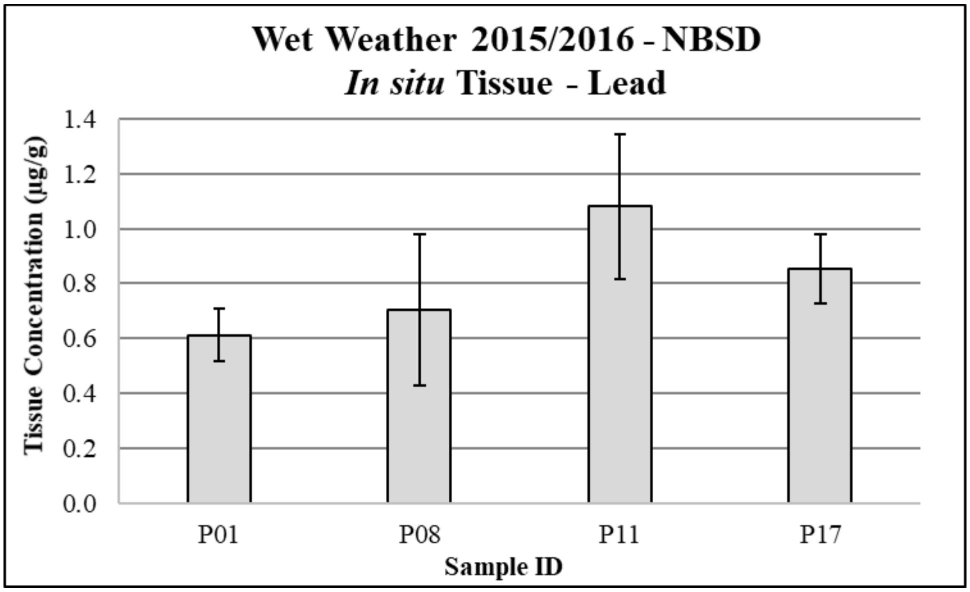


Figure 3-123. Clam tissue lead concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

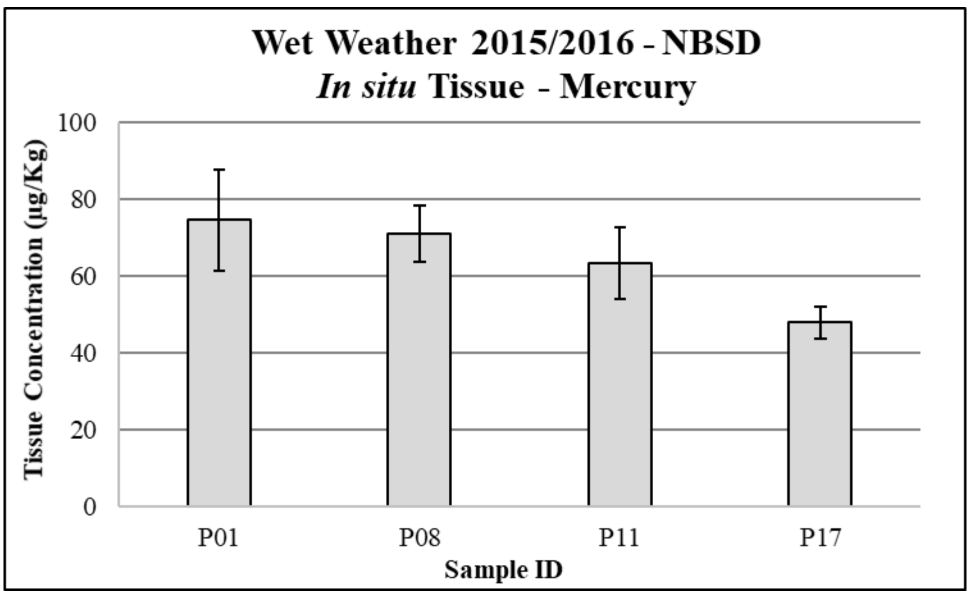


Figure 3-124. Clam tissue mercury concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

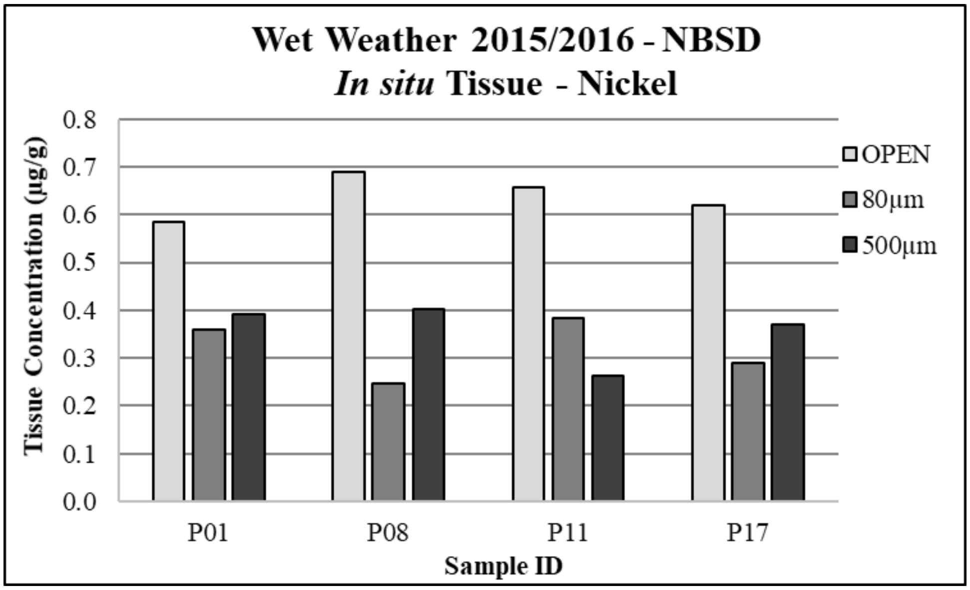


Figure 3-125. Clam tissue nickel concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD. Note: significant differences among the filtration treatments were observed and thus are shown separately in the figure.

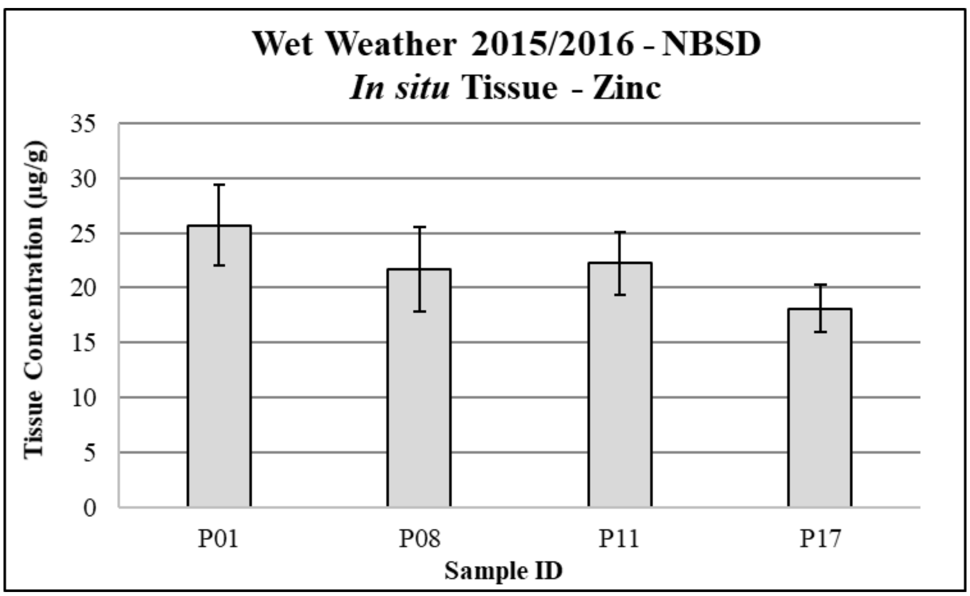


Figure 3-126. Clam tissue zinc concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

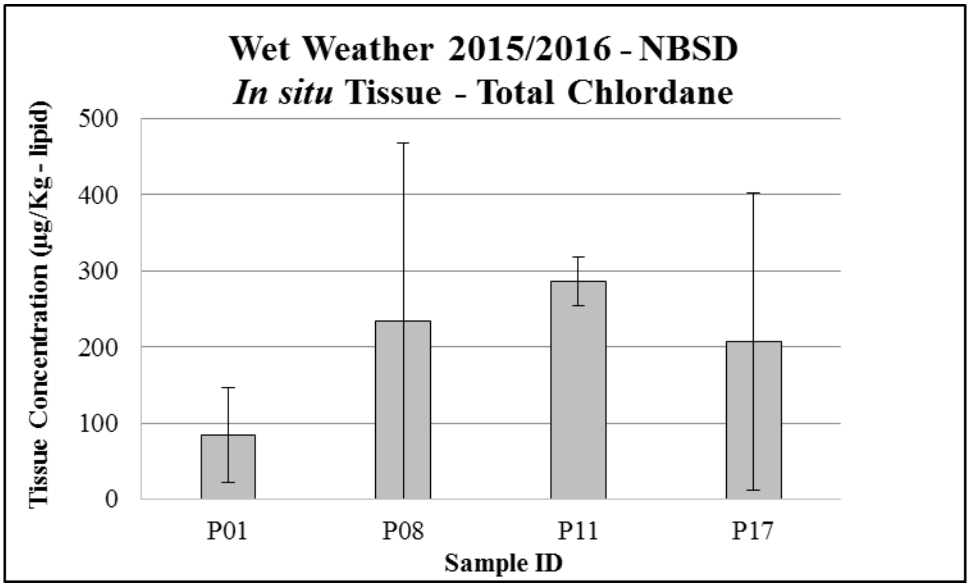


Figure 3-127. Clam tissue lipid normalized total chlordane concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

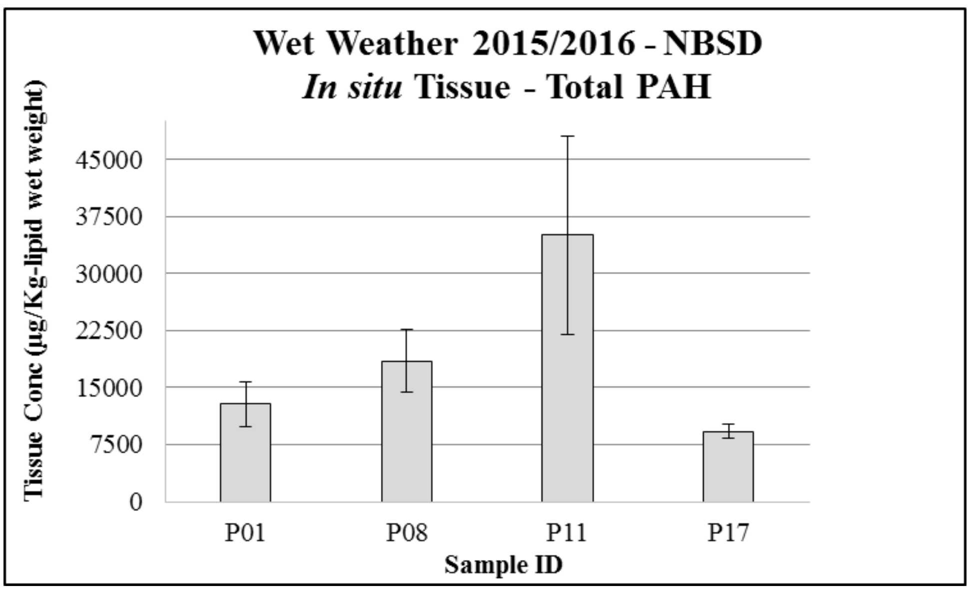


Figure 3-128. Clam tissue lipid normalized total PAH concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

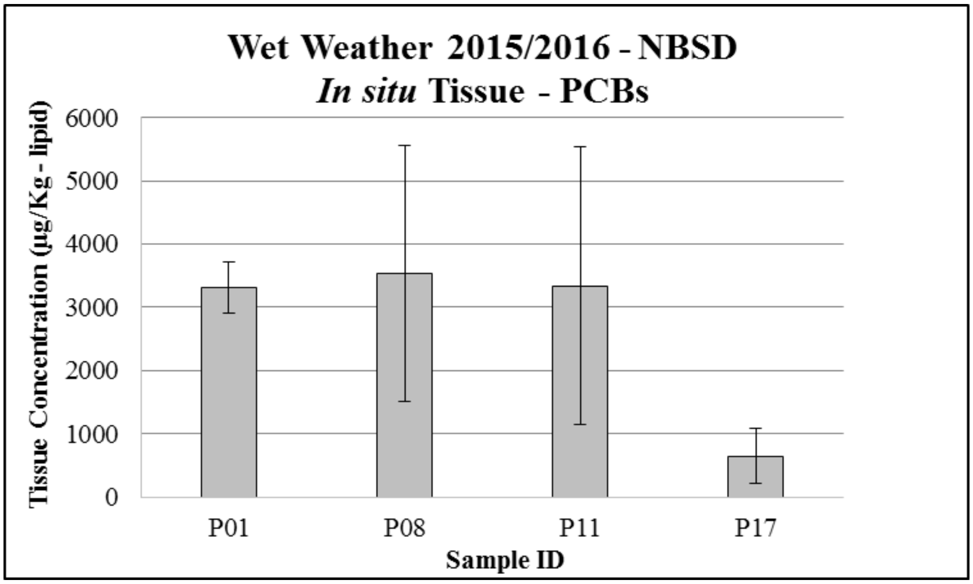


Figure 3-129. Clam tissue lipid normalized total PCB concentrations for stations P01, P08, P11 and P17 for the 2015/2016 Wet Weather sampling effort at NBSD.

3.3.4. *EX SITU STUDIES*

Intact cores collected on 19-Oct-2015 and 23-Feb-2016 were tested at the SSC Pac Bioassay Laboratory as described in section 2.4. Samples collected collect in Oct-2015 and Feb-2016 were designated “Pre-storm” and “Post-storm” samples, respectively. Additionally, as described in section 2.1.2, sediment trap material collected over the course of the wet season was used in *ex situ* exposures. Trap material was tested by itself as well as in additive treatment where sediment trap material was introduced to the corresponding intact core sample collected at the beginning of the wet season (i.e. “Pre +”).

3.3.4.1. SPME

SPME exposures were conducted from 1-Mar-2016 and 29-Mar-2016. Concentrations of the pesticide chlordane, PAHs and PCBs are summarized in Table 3-24 and are shown in Figure 3-130, Figure 3-131 and Figure 3-132, respectively. Total chlordane concentrations in the porewaters as derived from SPME tend to decrease as distance increases away from the mouth of Paleta Creek (i.e. P17-P11-P08-P01). Within the given stations P01 and P08, concentrations of total chlordane remain consistent across the wet weather season. For stations P11 and P17, concentrations of chlordane increase from the pre-season sample to post season sample as could be expected with the increased loading due to stormwater inputs.

Total PAH concentrations tend to increase over the course of the storm season for stations P01, P08 and P11, but not for P17, where they seem to decrease. For the post-season samples, P11 has the highest concentrations compared to the other stations. Total PCB concentrations are elevated at station P11 relative to the other stations throughout the sampling season. These trends are as expected considering the concentrations that were observed in the bulk sediments.

Total PCB concentrations are the highest at station P11 regardless of sampling season or treatment. For station P11, there is an increase in PCB concentrations over the course of the wet weather season and is consistent with the concentrations observed in the bulk sediments and sediment trap material.

Table 3-24. 2015/2016 Wet Weather NBSD SPME Results.

Sample ID	Sampling Season/Treatment	Total Chlordane (ng/L)	Total PAH (ng/L)	Total PCB (ng/L)
P01	Pre-Storm	0.03 (0.00)	135.4 (51)	0.72 (0.18)
	Pre-Storm Plus Sed. Trap	NT	NT	NT
	Post-Storm	0.03 (0.00)	170.5 (46.7)	1.03 (0.68)
P08	Pre-Storm	0.03 (0.00)	226.4 (159.1)	0.83 (0.26)
	Pre-Storm Plus Sed. Trap	0.03 (0.01)	125.9 (57.7)	0.76 (0.16)
	Post-Storm	0.03 (0.01)	307 (300.8)	0.69 (0.10)
P11	Pre-Storm	0.11 (0.01)	155.6 (116.1)	4.16 (1.96)
	Pre-Storm Plus Sed. Trap	0.07 (0.00)	197.6 (112.1)	5.73 (3.41)
	Post-Storm	0.08 (0.00)	355.5 (382.2)	8.67 (4.37)
P17	Pre-Storm	0.1 (0.00)	305.2 (270.0)	1.1 (0.38)
	Pre-Storm Plus Sed. Trap	NR	149.1 (32.4)	NR
	Post-Storm	0.07 (0.01)	213.2 (154.5)	1.01 (0.06)

NT – Not tested. NR – Not recorded.

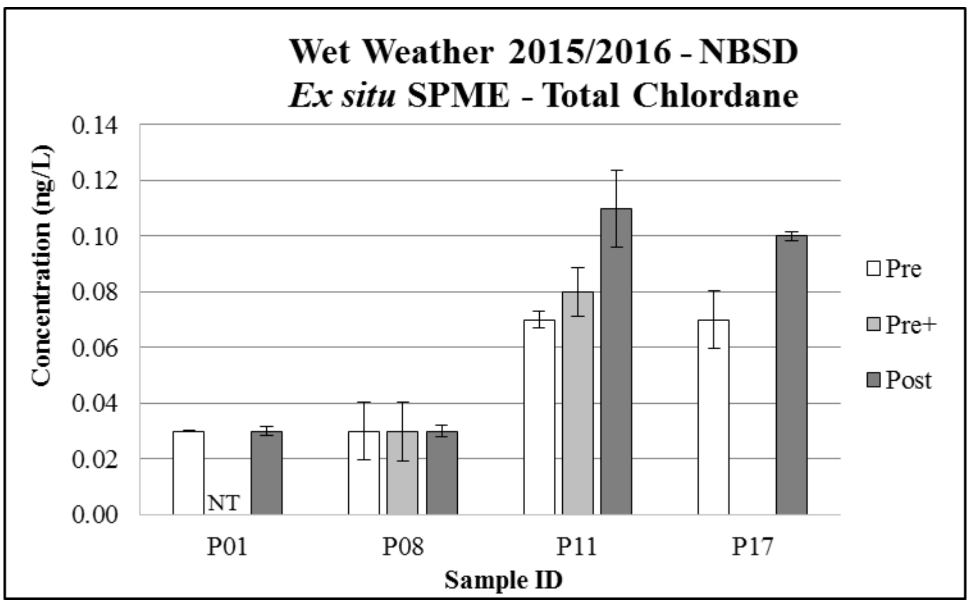


Figure 3-130. Total Chlordane concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD.

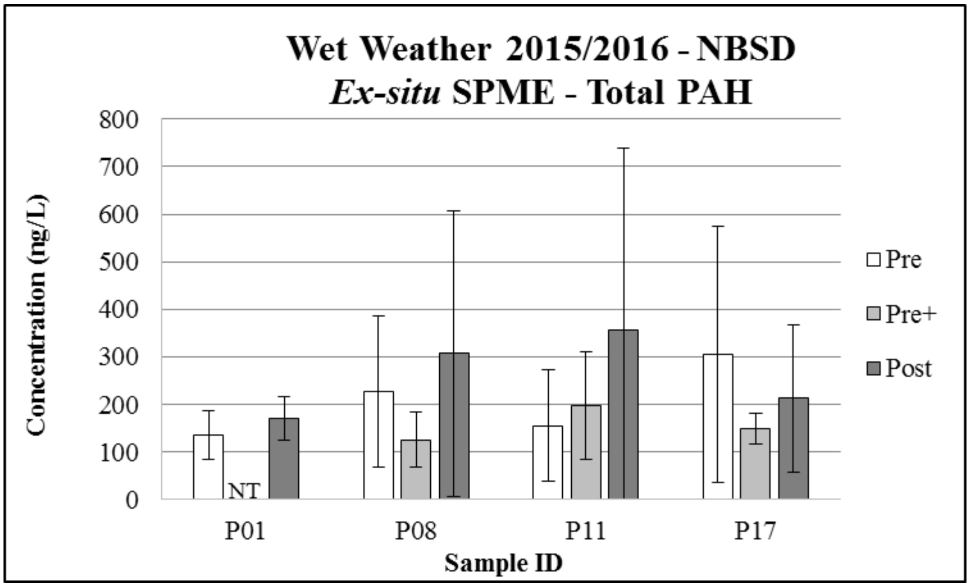


Figure 3-131. Total PAH concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD

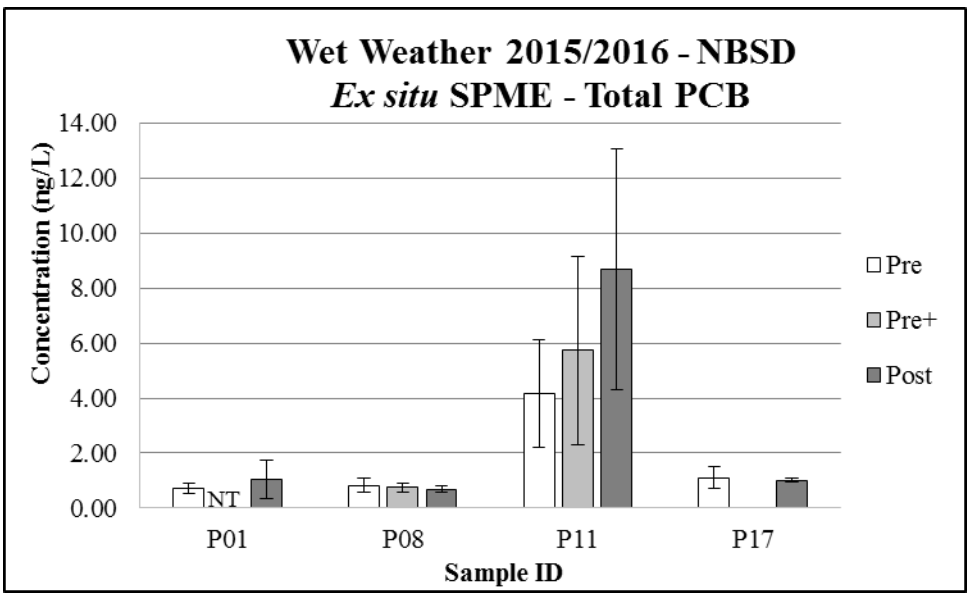


Figure 3-132. Total PCB concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD.

3.3.4.2. DGT

DGT exposures were exposed to the intact cores and sediment trap addition treatment from 3-Mar to 5-Mar-2016. Trace metal concentrations are summarized in Table 3-25 and shown in Figure 3-133 through Figure 3-139. Trace metal concentrations in the pore waters as derived from DGTs show the trend of higher measurements in the pre-storm samples relative to the post-storm samples as well as the pre-storm plus sediment trap material addition.

Table 3-25. 2015/2016 Wet Weather NBSD DGT Results.

Sample ID	Sampling Season/ Treatment	Ag (µg/L)	Cd (µg/L)	Cu (µg/L)	Ni (µg/L)	Pb (µg/L)	Zn (µg/L)	Hg (ng/L)
P01	Pre-Storm	0.01	0.11 (0.06)	6.2 (1.3)	1.5 (0.5)	0.1 (0.0)	31.2 (4.0)	190.6 (24.3)
	Pre-Storm Plus Sed. Trap	NT	NT	NT	NT	NT	NT	NT
	Post-Storm	ND	0.11	3.4 (1.9)	1.0 (0.2)	0.1 (0.1)	14.4 (7.3)	19.7 (6.7)
P08	Pre-Storm	0.01	0.13 (0.01)	9.1 (4.8)	1.8 (0.0)	0.4 (0.4)	38.1 (3.3)	183.7 (29.0)
	Pre-Storm Plus Sed. Trap	ND	ND	1.7 (0.8)	1.0 (0.2)	0.3 (0.1)	4.6 (1.6)	9.38 (0.7)
	Post-Storm	ND	ND	3.8 (1.0)	0.6 (0.0)	0.4 (0.0)	16.5 (4.0)	23.5 (8.3)
P11	Pre-Storm	0.02 (0)	0.55 (0.20)	14 (6.5)	5.2 (1.8)	1.2 (0.4)	247 (106)	279.6 (74.3)
	Pre-Storm Plus Sed. Trap	ND	0.07	4.0 (2.2)	1.6 (0.7)	0.7 (0.6)	25.3 (28.)	7.55 (6.3)
	Post-Storm	ND	0.04 (0.02)	5.6 (2.4)	0.6 (0.1)	0.3 (0.1)	19.9 (8.6)	23.2 (6.1)
P17	Pre-Storm	0.01	0.11 (0.01)	14.5 (1.0)	2.1 (0.0)	1.4 (0.3)	126.6 (0.2)	89.4 (29.5)
	Pre-Storm Plus Sed. Trap	ND	ND	1.0 (0.4)	0.9 (0.2)	0.1 (0.0)	3.0 (0.4)	0.54 (0.2)
	Post-Storm	ND	0.09	1.3 (0.5)	0.6 (0.1)	0.1 (0.0)	6.6 (3.4)	2.62 (0.6)

NT – not tested.

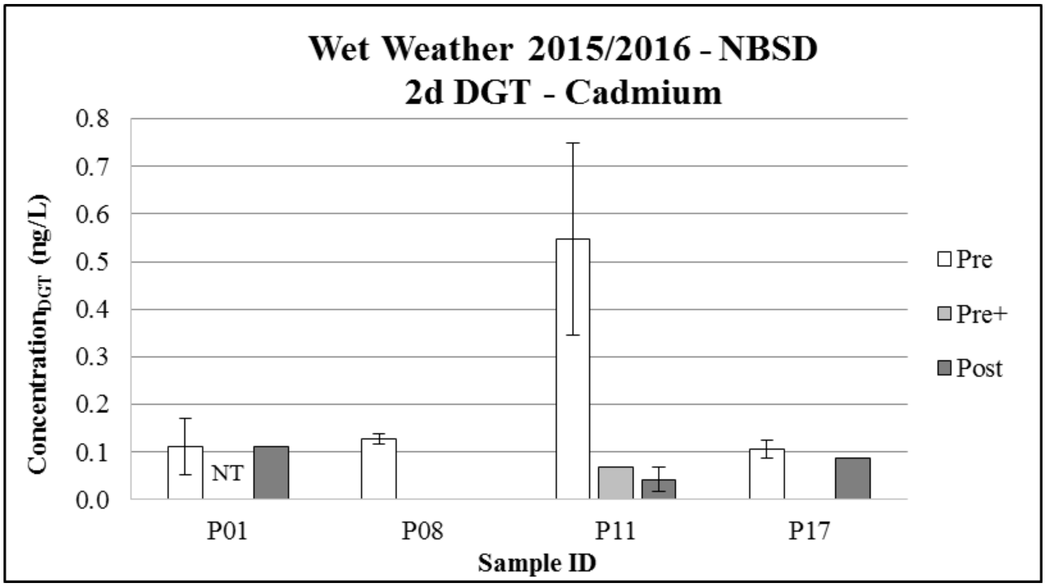


Figure 3-133. Concentrations of cadmium in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

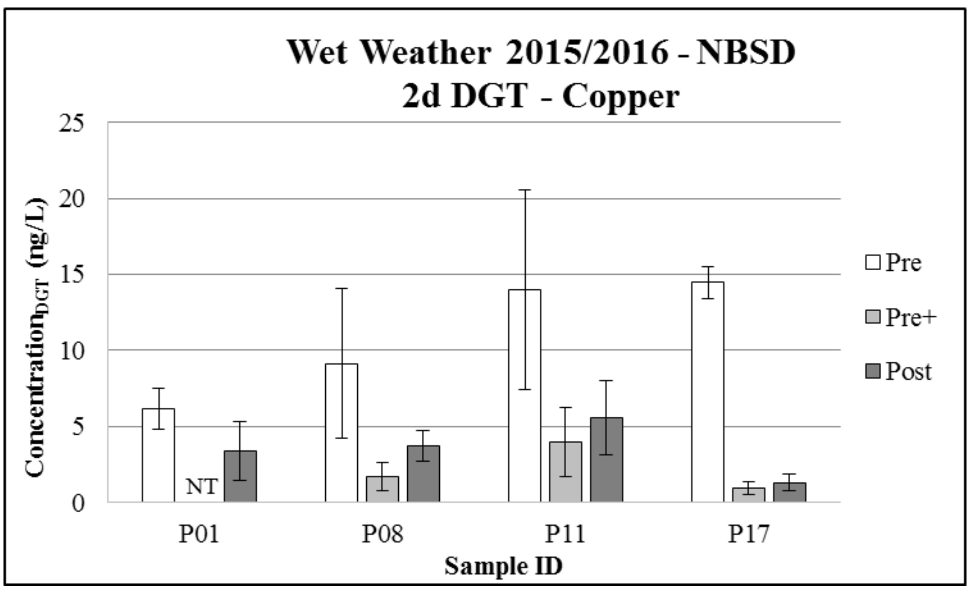


Figure 3-134. Concentrations of copper in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

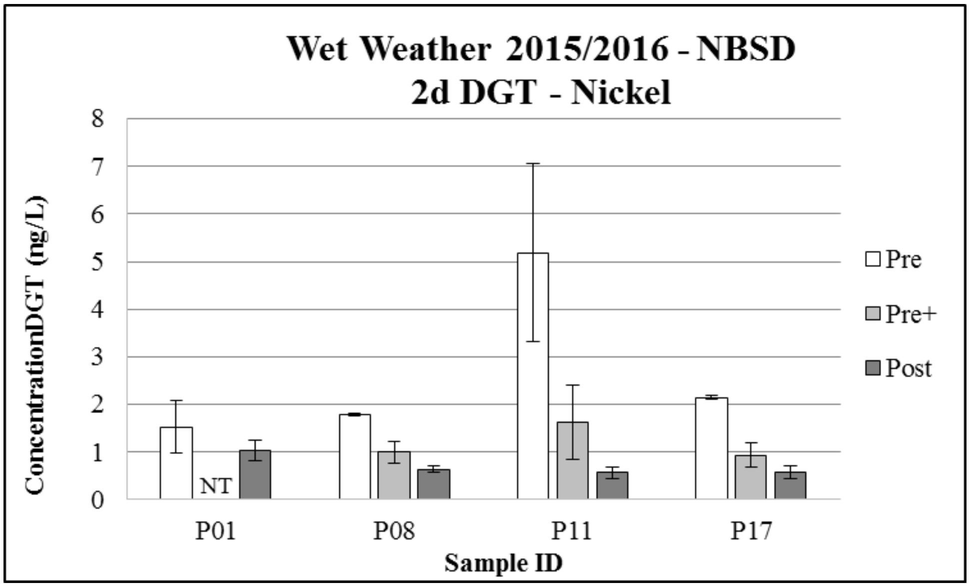


Figure 3-135. Concentrations of nickel in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

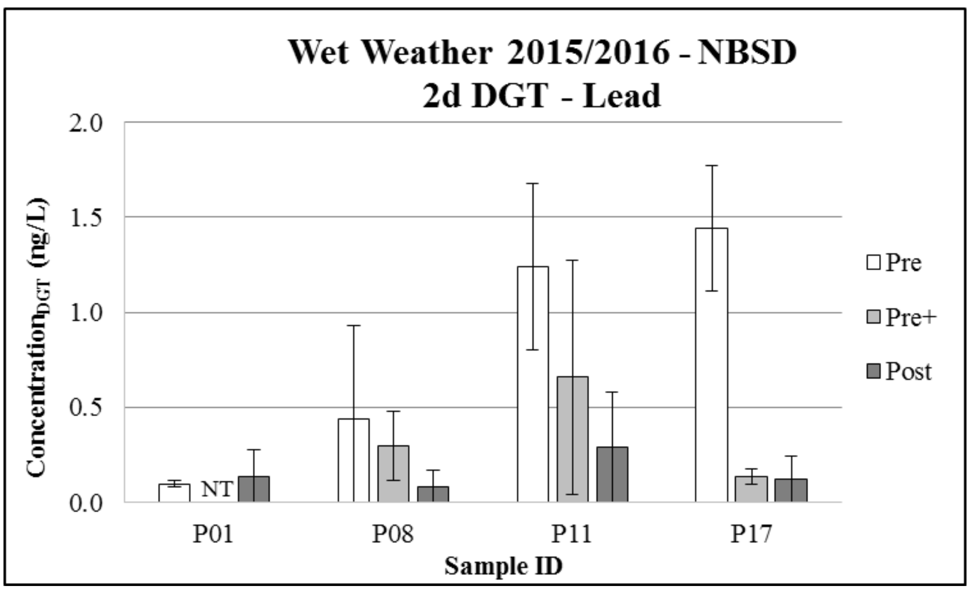


Figure 3-136. Concentrations of lead in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

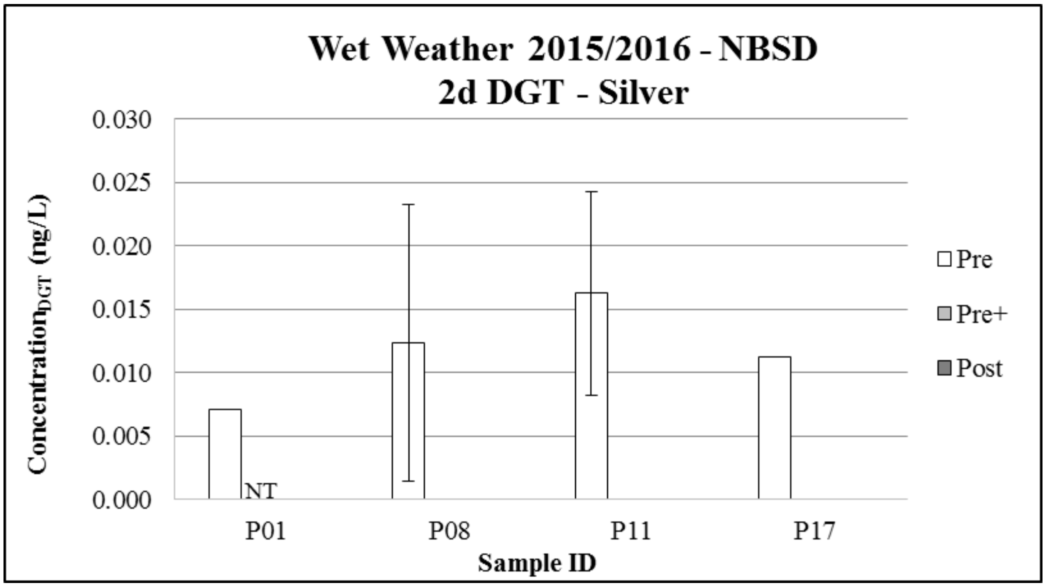


Figure 3-137. Concentrations of silver in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

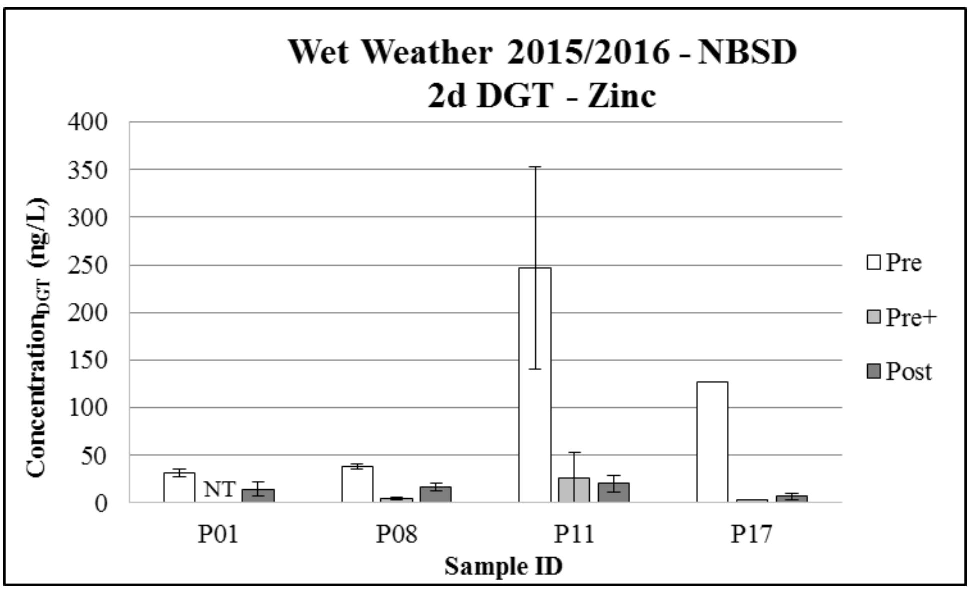


Figure 3-138. Concentrations of zinc in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

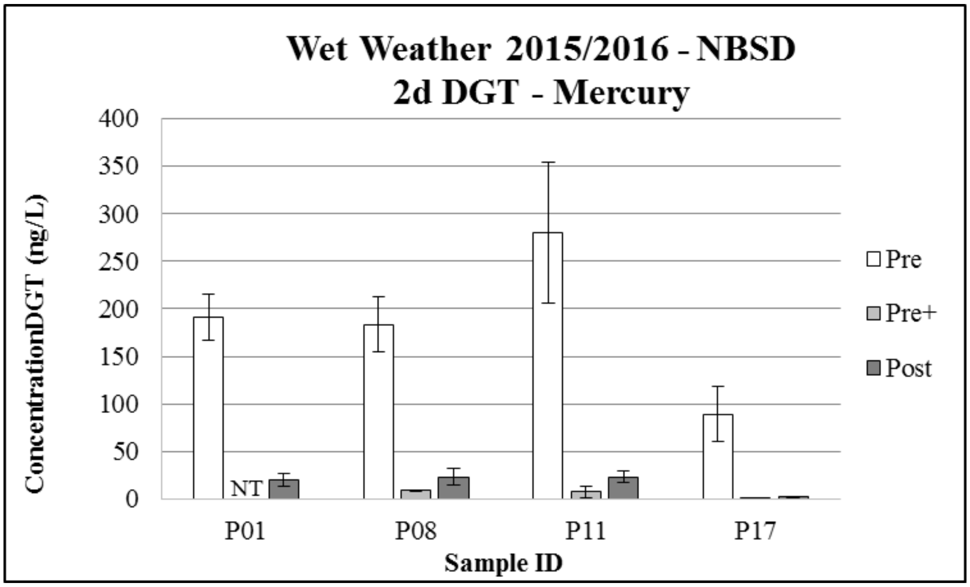


Figure 3-139. Concentrations of mercury in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

3.3.4.3. SEDIMENT BIOACCUMULATION & TOXICITY

Bioaccumulation and toxicity tests performed for the evaluation of the Wet Weather sediment samples collected Oct-2015 and Feb-2016 met test acceptability. Control survival for the clam and amphipod were 100 and 95%, respectively. All water quality parameters were within testing parameters throughout the duration of the exposures for both tests. Survival results for the two sediment organisms tested is summarized in Table 3-26 and shown in Figure 3-140 and Figure 3-141.

For the clams, all replicates were composited and analyzed for trace metals, pesticides, PAHs and PCBs. Trace metal and PAH concentrations accumulated by the clams is summarized in Table 3-27 and Table 3-28 and are shown in Figure 3-142 through Figure 3-151.

For pre-storm samples, concentrations of the trace metals arsenic, cadmium, copper, nickel, zinc, mercury seemed to increase from P17 to P01 (with the exception of a potentially erroneous value of mercury at P11). Concentrations of lead seemed to increase with increasing distance from the mouth of Paleta Creek, with the highest pre-storm concentration at P11. Concentrations of the pesticide, chlordane, exhibited the highest concentrations at P17. The other stations showed concentrations less than half of what was observed at P17. Concentrations of both PAHs and PCBs exhibited the highest concentrations at P11 for the pre-storm samples.

For the post-storm samples, concentrations of lead and cadmium were the highest at P11, which is consistent with the bulk sediment and DGT concentrations for those two metals. Mercury decreases in concentrations from the P01 station towards the mouth of the Creek to station P17. PAHs and PCBs were also the highest at P11 for post-storm samples which is also consistent with sediment concentrations as well as the *in situ* and *ex situ* SPMEs.

Table 3-26. 2015/2016 Wet Weather NBSD Survival of the Clam and Amphipod *Ex Situ* Exposures.

Sample ID	Sampling Season/ Treatment	Clam		Amphipod	
		Mean Survival (%)	SD	Mean Survival (%)	SD
Control	NA	100.0	0.0	95.0	7.1
P01	Pre-Storm	100.0	0.0	75.0	16.7
	Pre-Storm Plus Sed. Trap	NT	NT	NT	NT
	Post-Storm	95.0	10.0	77.5	7.6
	Sediment Trap Material	NT	NT	NT	NT
P08	Pre-Storm	100.0	0.0	74.2	9.2
	Pre-Storm Plus Sed. Trap	100.0	0.0	20.0	13.0
	Post-Storm	93.3	11.5	45.0	20.5
	Sediment Trap Material	NT	NT	17.5	10.4
P11	Pre-Storm	90.0	11.5	29.2	22.7
	Pre-Storm Plus Sed. Trap	90.0	20.0	4.2	3.8
	Post-Storm	100.0	0.0	17.5	6.9
	Sediment Trap Material	NT	NT	0.0	0.0
P17	Pre-Storm	100.0	0.0	34.2	13.9
	Pre-Storm Plus Sed. Trap	90.0	11.5	0.0	0.0
	Post-Storm	90.0	20.0	3.3	4.1
	Sediment Trap Material	NT	NT	0.0	0.0

NA – Not applicable. NT – not tested.

Table 3-27. 2015/2016 Wet Weather NBSD Bioaccumulation Results for *M. nasuta Ex Situ* Exposures.

Sample ID	Sampling Season/ Treatment	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/Kg DW)	Ni (µg/g DW)	Pb (µg/g DW)	Zn (µg/g DW)
P01	Pre-Storm	4.47	0.08	4.44	100.5	0.35	0.49	27.9
	Post-Storm	5.23	0.05	3.49	99.8	0.49	0.71	19.8
P08	Pre-Storm	4.25	0.05	3.57	70.2	0.44	0.83	18.4
	Pre-Storm Plus Sed. Trap	4.31	0.03	3.11	62.6	0.40	0.63	16.7
	Post-Storm	5.22	0.06	3.34	88.9	0.36	0.72	19.8
P11	Pre-Storm	3.81	0.05	2.29	1586.5	0.30	1.16	16.1
	Pre-Storm Plus Sed. Trap	4.63	0.05	3.04	73.4	0.44	1.17	19.8
	Post-Storm	0.48	0.09	2.29	55.1	0.31	1.17	23.2
P17	Pre-Storm	3.11	0.04	2.73	65.0	0.28	0.97	16.0
	Pre-Storm Plus Sed. Trap	3.58	0.06	2.80	46.2	0.46	1.00	15.6
	Post-Storm	3.68	0.04	2.50	58.4	0.37	0.95	17.3

Table 3-28. 2015/2016 Wet Weather NBSD Bioaccumulation Results for *M. nasuta Ex Situ* Exposures (cont'd).

Sample ID	Sampling Season/ Treatment	% Lipids	Total Chlordane (µg/Kg lipid WW)	Total PAH (µg/Kg lipid WW)	Total PCB (µg/Kg lipid WW)
P01	Pre-Storm	2.3	4.29	2173	1208
	Post-Storm	1.0	43.5	12393	7864
P08	Pre-Storm	1.7	18.7	7915	1229
	Pre-Storm Plus Sed. Trap	0.5	61.8	12277	7281
	Post-Storm	0.8	46.3	19167	5186
P11	Pre-Storm	1.5	12.3	15275	6078
	Pre-Storm Plus Sed. Trap	1.4	14.4	13936	4970
	Post-Storm	1.7	29.7	19537	24276
P17	Pre-Storm	0.7	73.8	7697	1854
	Pre-Storm Plus Sed. Trap	1.0	47.5	7269	930
	Post-Storm	0.8	48.5	9528	1475

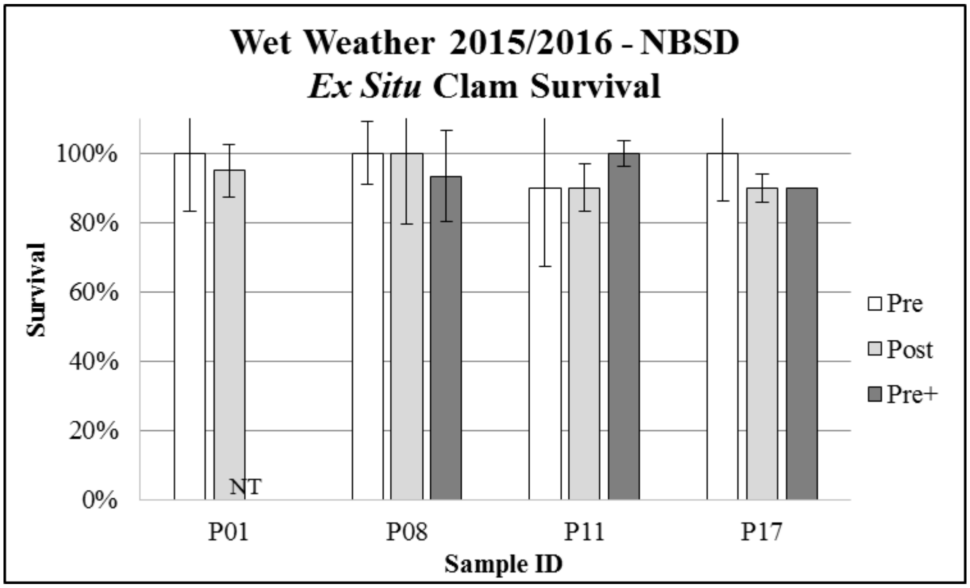


Figure 3-140. Organism survival for *ex situ* clam bioaccumulation exposures to intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

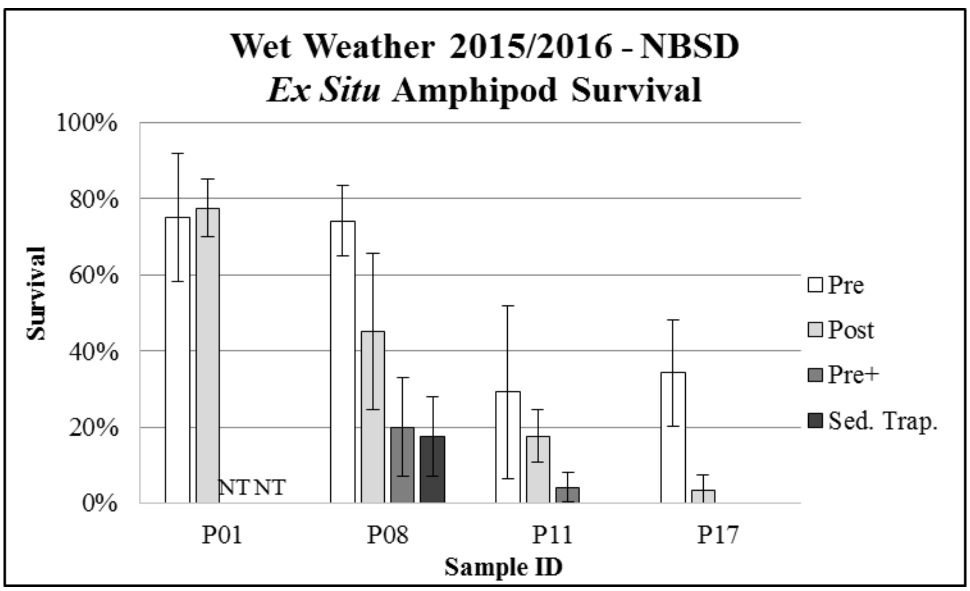


Figure 3-141. Organism survival for *ex situ* amphipod toxicity exposures to intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

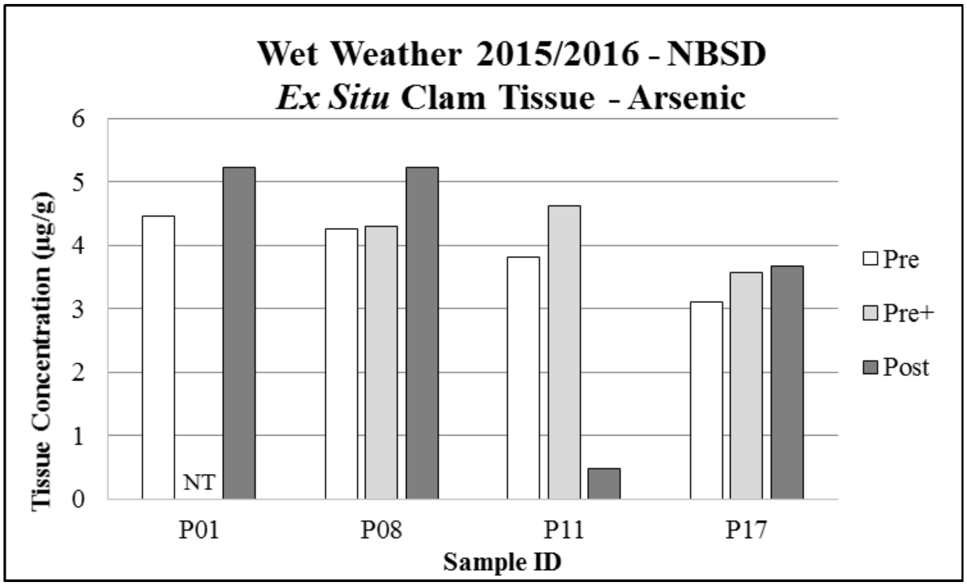


Figure 3-142. Clam tissue arsenic concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

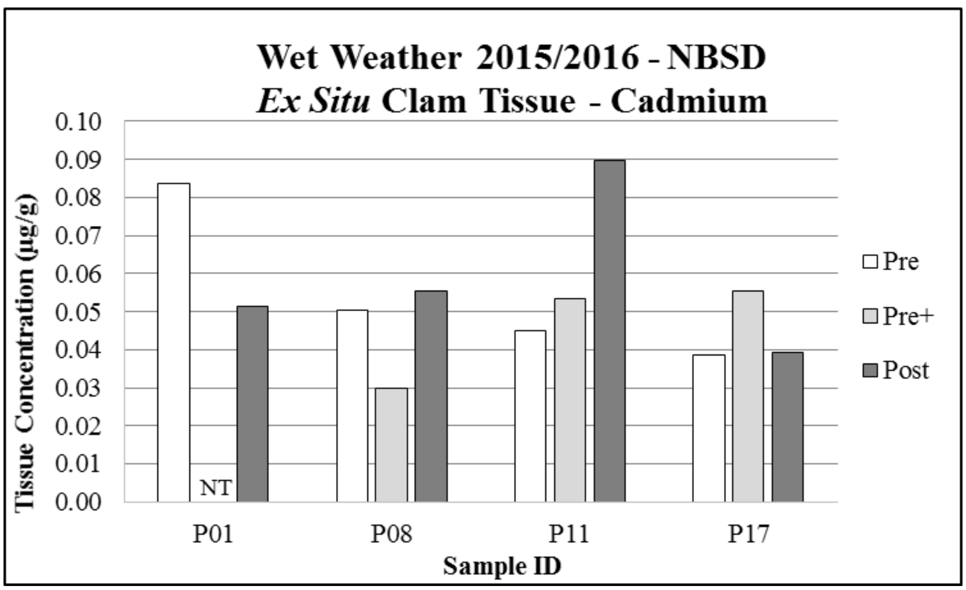


Figure 3-143. Clam tissue cadmium concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

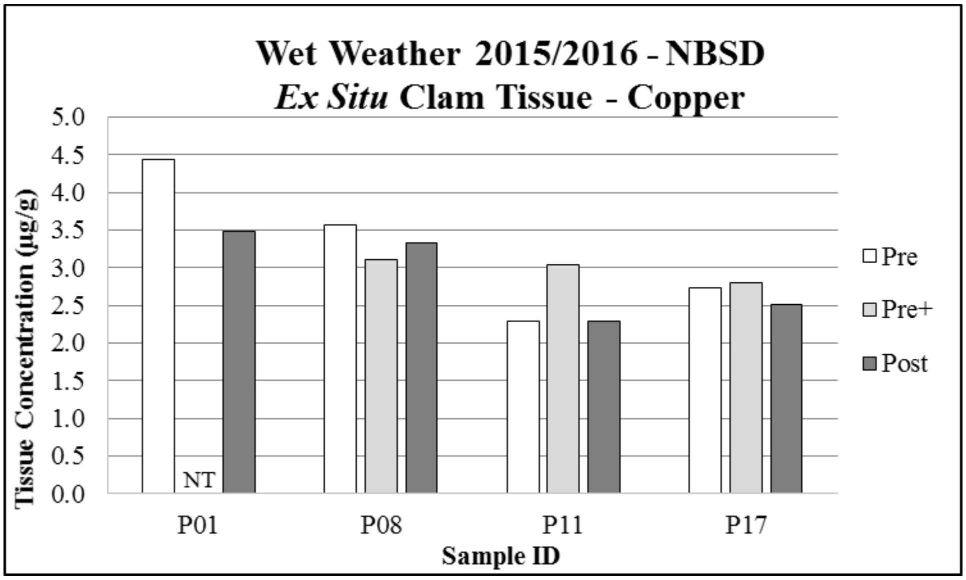


Figure 3-144. Clam tissue copper concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

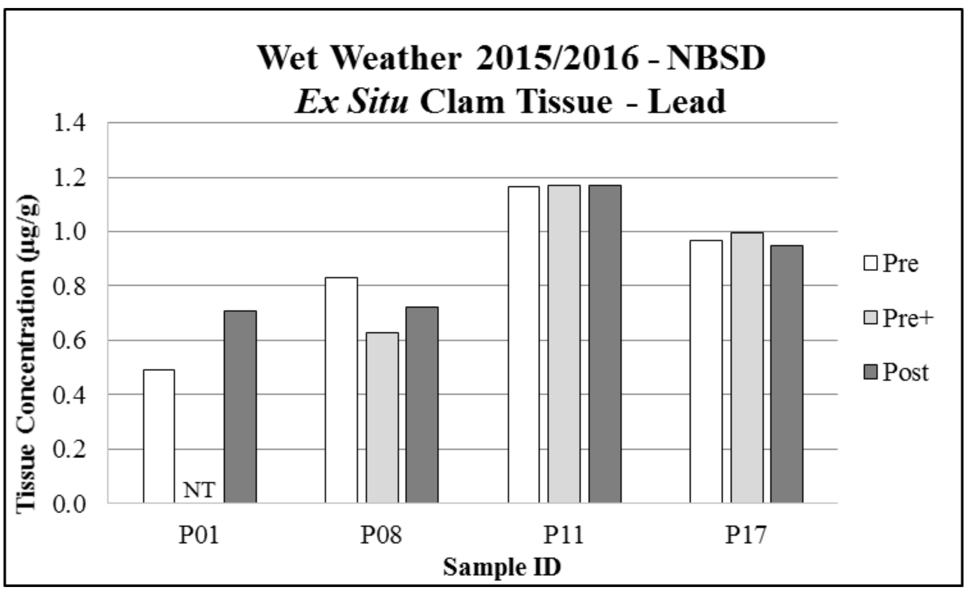


Figure 3-145. Clam tissue lead concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

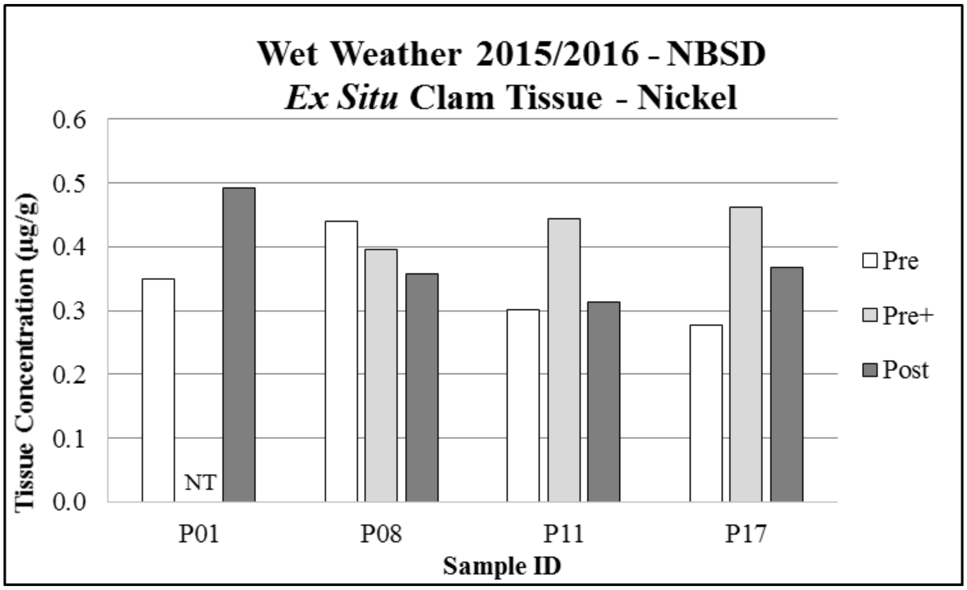


Figure 3-146. Clam tissue nickel concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

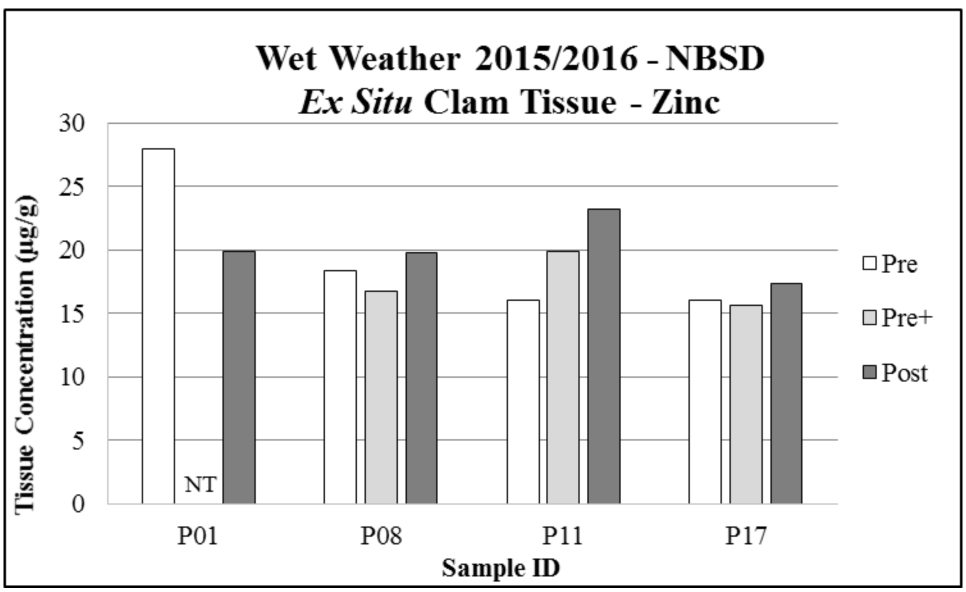


Figure 3-147. Clam tissue zinc concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

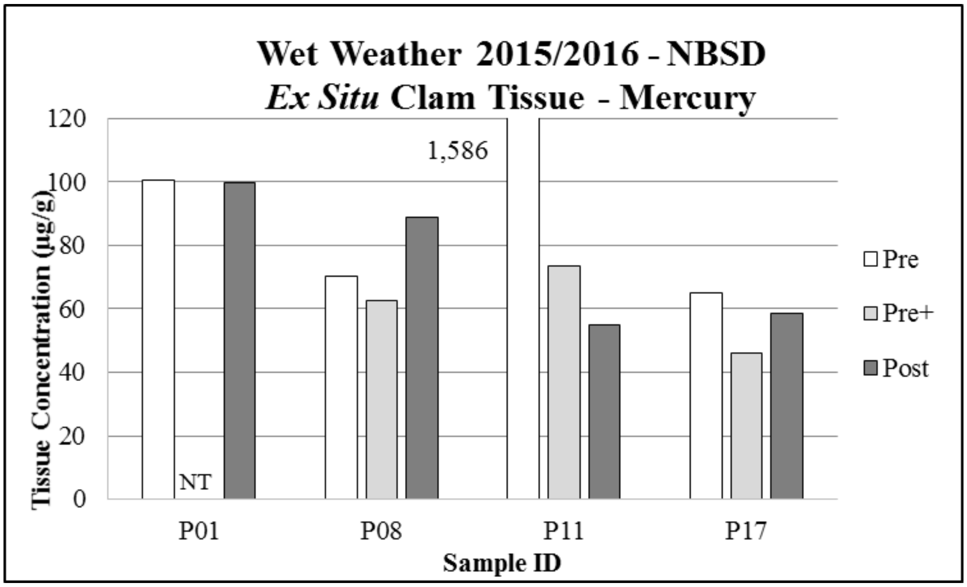


Figure 3-148. Clam tissue mercury concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

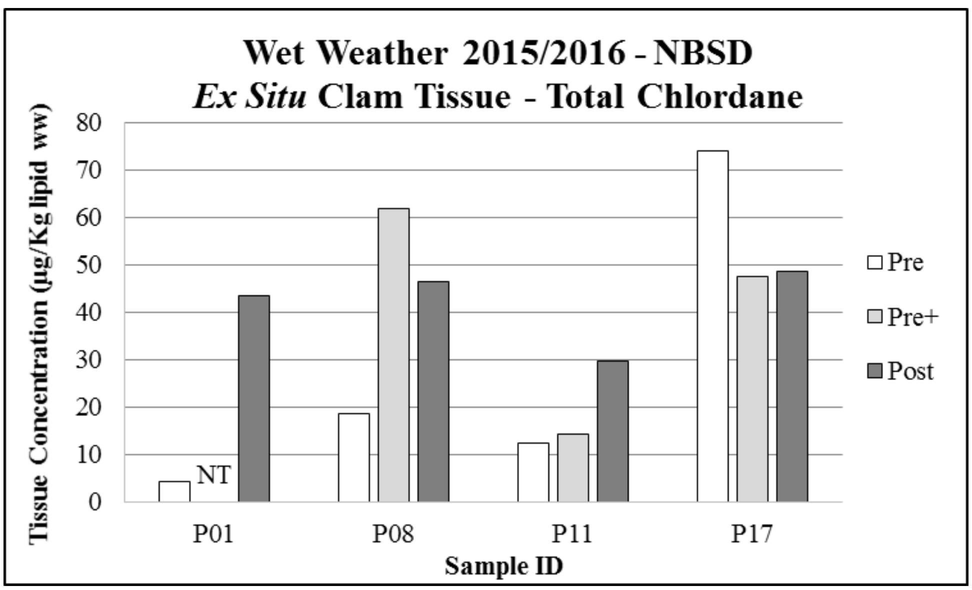


Figure 3-149. Clam tissue lipid normalized total chlordane concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

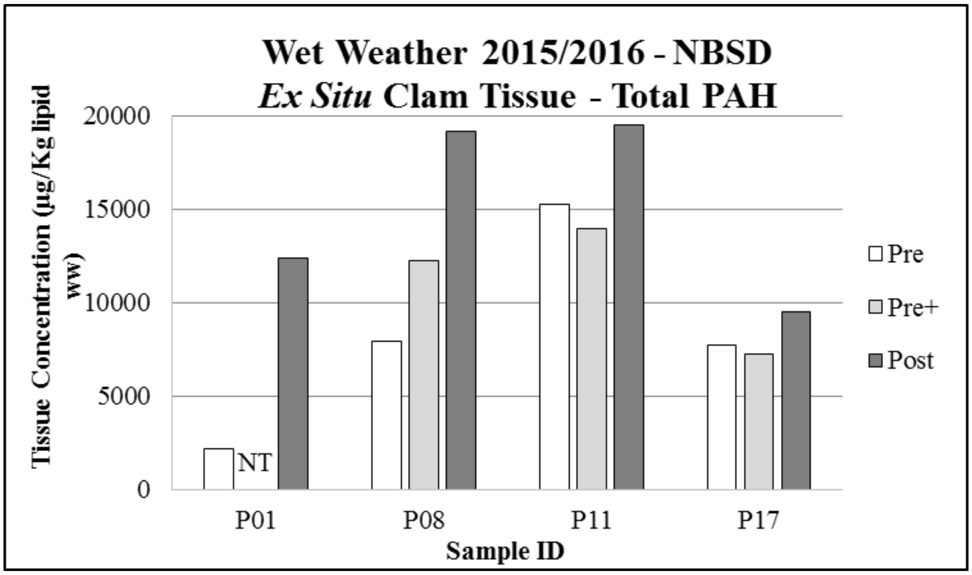


Figure 3-150. Clam tissue lipid normalized total PAH concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

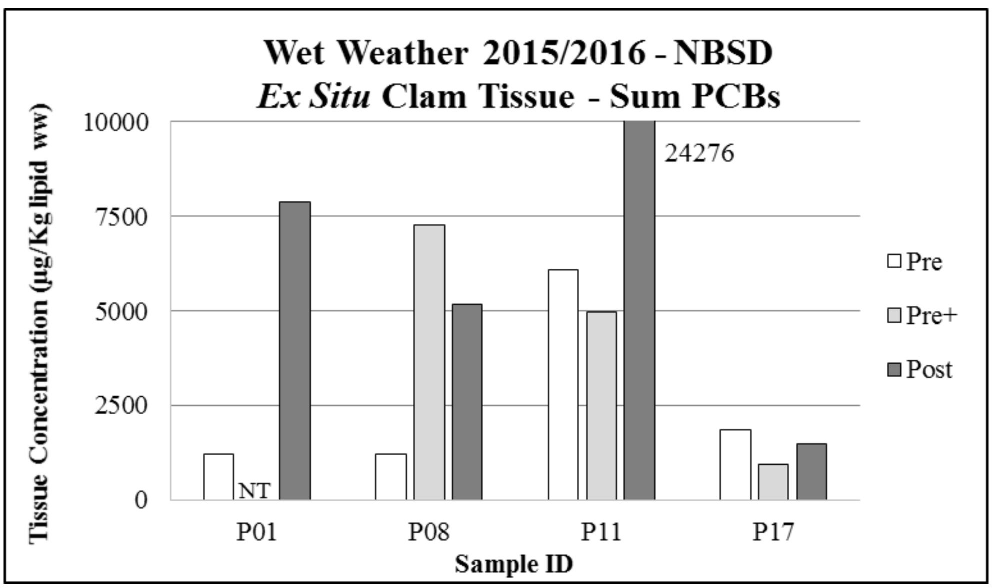


Figure 3-151. Clam tissue lipid normalized total PCB concentrations for intact cores and sediment trap material collected for the 2015/2016 Wet Weather sampling effort at NBSD. NT – not tested.

3.3.4.4. STORMWATER TOXICITY

Test results for met test acceptability criteria of ≥80% normal larval development for the sea urchin tests for both testing periods. All water quality parameters measured were within the recommended ranges for the duration of the tests.

All data presented were deemed acceptable for reporting purposes. A few QA/QC deviations from EPA and internal protocols occurred and were noted on raw data sheets. A thorough review of the data and test procedures for the sea urchin embryo-larval development tests did not identify any likely impacts on test results of these deviations. Explanations are provided below, and a glossary of the qualifier codes used on the test datasheets is provided in Appendix F.

All tests were conducted within the required 36-hour holding time from completion of sample collection. Samples were received from Geosyntec personnel and the temperatures of the samples were outside of the EPA recommended range of 0-6 °C upon receipt at the SSC Pac Laboratory; however, samples were in a state of cooling during transit, meeting ELAP requirements. Samples were stored at 4 °C in a refrigerator until test initiation.

The lab control tested concurrently with the 5-Jan ambient samples was slightly below the test acceptability criteria of 80% normal larval development (77.8%). However, the brine control tested with the ambient samples and all other lab controls tested met or exceeded the criteria of 80% and since statistical comparisons are made against the brine controls, this deviation was determined to be acceptable and did not impact test results.

Standard reference toxicant tests with copper that were conducted concurrently with the stormwater evaluations had median effective concentration (EC_{50}) values within two standard deviations of the internal historical mean, indicating sensitivity to copper was consistent with that historically observed for this organism (Table 3-29). Statistical analyses to calculate median effective concentrations and confidence intervals were conducted with the statistical software Comprehensive Environmental Toxicity Information System (CETIS) v1.8.7.16 (Tidepool 2012).

Table 3-29. 2015/2016 Wet Weather NBSD Results Summary for the Copper Reference Toxicant Tests Conducted Concurrently with the Purple Sea Urchin for *Ex Situ* Stormwater Exposures.

Stormwater Sampling Date	EC50 (µg/L copper)	Historical mean ± 2 SD (µg/L copper)
5-Jan-2016	22.9	20.1 ± 11.4
31-Jan-2016	19.6	20.0 ± 10.8

Water quality parameters of the stormwater samples upon receipt at the SSC Pacific Bioassay Laboratory are summarized in Table 3-30. Due to the low salinities of the samples upon collection, the addition of hypersaline brine was required to meet testing parameters for the purple sea urchin embryo-larval development test. This resulted in decreasing the overall concentration of each sample. The highest concentration tested for each sample is shown in Table 3-31.

Statistical analyses for the sea urchin embryo-larval development tests were performed against the brine control, as brine was added to increase the salinity of all the samples. Statistical analyses were conducted using two-sample t-tests or the USEPA (2010) Test for significant toxicity. The TST method examined whether the results of a given sample relative to its respective control differs by an a priori prescribed amount rather than whether they are the same, as in traditional hypothesis testing (USEPA 2010). For the sea urchin test, the a priori critical percent difference is set at 25%.

Table 3-31 summarizes and Figure 3-152 and Figure 3-153 show the mean percent normal embryo-larval development for each of the storm events sampled. Development values ranged from 4.5 to 99% and from 0 to 99% for the first and second sampling events, respectively.

For the 5-Jan storm samples, nearly all the Creek and Outfall samples resulted in significantly decreased normal development relative to the brine control (Table 3-31). Only the 10% concentration of the O4 sample was non-toxic relative to the brine control. Of the ambient samples, only the highest concentration tested for A1, or the “first-flush” sample resulted in a significant decrease in normal embryo-larval development compared to the brine control.

For the 31-Jan storm, all the Creek and Outfall samples exhibited significantly decreased normal development relative to the brine control for the highest concentration tested. Outfall samples O1 and O2 also showed decreased normal development in the 10% concentration tested. The 10% concentration for outfall sample O4 also showed significant decreases in normal development using the two-sample t-tests. Ambient sample A1 showed no significant decreases in normal development at the 10% or highest concentration tested. Ambient sample A2 did not show a significant decrease in normal development at the 10% concentration, whereas there was a significant decrease at the highest concentration tested using the two-sample t-test. For both the 10%-O4 sample and the high-A2 sample, the TST method was applied and these samples were designated non-toxic. The difference in the outcomes from these two statistical methods is due to the low variability that was observed in the results from both the 10%-O4 and the high-A2 samples. Statistically they are different from their respective brine controls; however, the result is biologically irrelevant, hence the use of the TST method to determine significant toxicity.

For analysis purposes, the calculated concentrations of trace metals and PAHs for their dissolved fractions are shown in Table 3-32 and Table 3-33. Correlation analyses were conducted for the mean percent normal development against each of the dissolved fractions of trace metals and PAHs to determine if a given analyte seemed to be driving toxicity. For the first storm event, no significant correlations were observed. For the second storm, a significant correlation was observed for zinc ($r = 0.7465$, $p = 0.021$), indicating that with increasing zinc concentrations, decreasing normal development in the urchins was observed. However, the highest concentration of zinc that the sea urchin larvae was exposed to was calculated to be 31.4 µg/L. In previous studies with urchin larval development, the concentration that would elicit a 50% effect was 146 µg/L

(Rosen et al. 2016). The correlation observed in the 31-Jan storm water samples for zinc is not necessarily pointing to a causal agent of toxicity, but more likely the mixture of numerous constituents in the effluent is causing the observed abnormal development.

Table 3-30. 2015/2016 Wet Weather NBSD Stormwater Water Quality Parameters Measured Upon Receipt at the SSC Pacific Bioassay Laboratory.

Sample ID	5-Jan Storm				31-Jan Storm			
	pH (units)	DO (mg/L)	Temp (°C)	Salinity (ppt)	pH (units)	DO (mg/L)	Temp (°C)	Salinity (ppt)
C1	7.72	7.6	14.4	4.7	7.25	7.1	18.7	0.8
C2	8.01	7.4	8.2	0.1	6.96	7.1	18.3	0.1
O1	7.59	7.9	16.3	2.6	7.63	7.8	18.5	0.1
O2	7.94	7.3	14.3	3.8	7.10	7.8	18.3	15.0
O3	7.73	6.4	10.3	6.0	-	-	-	-
O4	7.69	7.5	10.1	0.3	7.53	7.1	17.3	16.8
A1	7.52	7.0	10.4	3.3	7.67	7.3	7.3	24.7
A2	7.60	7.6	10.1	2.6	7.63	7.8	11.8	21.1
A3	7.68	7.1	10.0	4.5	-	-	-	-

Table 3-31. 2015/2016 Wet Weather NBSD Proportion Normal Development of the Purple Sea Urchin for *Ex Situ* Stormwater Exposures.

Sample ID	5-Jan Storm			31-Jan Storm		
	Concentration of Sample (%)	Mean Normal Development (%)	SD	Concentration of Sample (%)	Mean Normal Development (%)	SD
Lab Control	NA	99.7	0.5	NA	99.0	1.0
Brine Control	NA	84.0	1.7	NA	99.3	1.0
C1	10	**33.8**	18.9	10	98.8	1.3
	50.2	**4.5**	3.4	57.9	**65.8**	5.3
C2	10	**11.3**	10.7	10	98.5	2.4
	46.6	**15.5**	27.7	57.4	**64.4**	7.8
O1	10	**16.5**	11.0	10	**0.0**	0.0
	48.5	**5.0**	4.4	57.4	**0.0**	0.0
O2	10	**6.8**	5.7	10	**78.5**	0.0
	49.5	**11.8**	7.1	70.6	**0.5**	0.0
O3	10	**34.0**	9.1	-	-	-
	51.4	**9.8**	9.0	-	-	-
O4	10	89.3	5.7	10	**97.5***	0.0
	46.7	**47.3**	15.6	72.6	**85.0**	0.0
Lab Control	NA	77.8	20.0	NA	97.7	1.7
Brine Control	NA	81.5	17.3	NA	99.3	1.0
A1	10	83.5	5.4	10	99.3	1.0
	49.1	**57.0**	9.4	83.1	96.8	2.8
A2	10	95.5	3.1	10	99.0	0.8
	48.5	88.0	9.4	77.9	**93.3***	4.0
A3	10	93.3	7.1	-	-	-
	50.1	94.8	1.7	-	-	-

"-"– not tested. Values in **BOLD** indicate statistical significance compared to the brine control.
*Using USEPA (2010) Test for Significant Toxicity, samples were determined to be non-toxic.

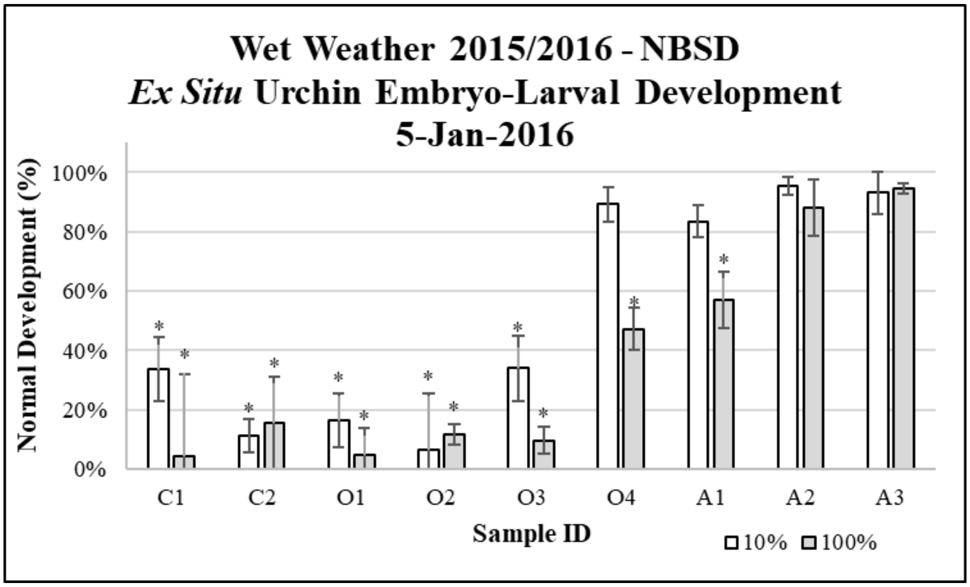


Figure 3-152. Mean percent normal development for the chronic Sea Urchin embryo-larval test on stormwater samples collected 5-Jan-2016 for the 2015/2016 Wet Weather sampling effort at NBSD. * - Indicates statistically significant decrease in normal development compared to the brine control.

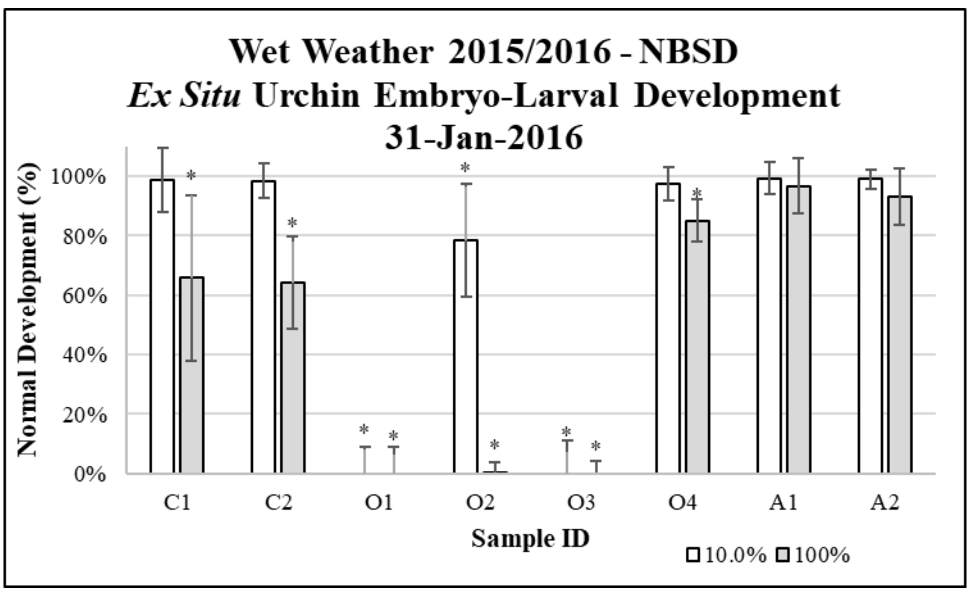


Figure 3-153. Mean percent normal development for the chronic Sea Urchin embryo-larval test on stormwater samples collected 31-Jan-2016 for the 2015/2016 Wet Weather sampling effort at NBSD. * - Indicates statistically significant decrease in normal development compared to the brine control.

Table 3-32. 2015/2016 Wet Weather Estimated Concentrations of Dissolved* 5-Jan-2016 Stormwater Chemistry Results – NBSD.

Compartment ID	Highest Concentration Tested (%)	As (µg/L)	Cd (µg/L)	Cu (µg/L)	Hg (ng/L)	Pb (µg/L)	Ni (µg/L)	Zn (µg/L)	Total PAHs (ng/L)
C1	49.5%	0.7	0.0	3.8	2.5	0.3	3.1	3.4	35.2
C2	50.3%	0.6	0.0	2.8	1.6	0.5	1.0	10.9	49.8
O1	51.4%	0.4	0.2	3.2	1.1	0.6	3.2	27.7	39.7
O2	46.7%	1.5	0.4	16.1	11.6	0.9	4.4	7.0	1414.4
O3	48.6%	2.0	0.1	7.2	4.9	0.2	6.8	2.1	18.8
O4	46.6%	1.0	0.0	2.7	2.9	0.3	4.4	2.4	20.5
A1	49.1%	0.9	0.1	6.3	1.3	0.3	3.8	17.0	10.5
A2	48.5%	1.3	0.0	3.7	1.1	0.3	2.7	5.6	49.9
A3	50.1%	1.6	0.0	6.4	1.4	0.3	3.9	4.9	56.4

*Calculated concentration based on highest concentration tested for sea urchin embryo-larval development tests due to the addition of hypersaline brine.

Table 3-33. 2015/2016 Wet Weather Estimated* 31-Jan-2016 Stormwater Chemistry Results – NBSD.

Compartment ID	Highest Concentration Tested (%)	As (µg/L)	Cd (µg/L)	Cu (µg/L)	Hg (ng/L)	Pb (µg/L)	Ni (µg/L)	Zn (µg/L)	Total PAHs (ng/L)
C1	57.9%	-	0.0	8.0	0.6	1.5	2.0	30.2	16.7
C2	57.4%	-	0.0	6.7	0.7	1.5	1.3	27.1	15.4
O1	57.4%	-	-	-	-	-	-	-	-
O2	70.6%	-	0.0	35.4	1.1	3.2	10.5	31.4	19.1
O3	-	-	-	-	-	-	-	-	-
O4	72.6%	-	0.0	31.1	1.2	2.4	16.4	7.6	30.9
A1	83.1%	-	0.0	59.3	1.1	1.2	18.9	10.9	12.6
A2	77.9%	-	0.0	40.5	0.9	2.8	17.6	17.1	28.4

“-“– not tested. *Calculated concentration based on highest concentration tested for sea urchin embryo-larval development tests due to the addition of hypersaline brine.

3.4. 2016/2017 WET WEATHER – NBSD

In a similar fashion to the 2015/2016 Wet Weather sampling efforts at NBSD, samples were collected prior to and after the 2016/2017 Wet Weather season on 8-Sep-2016 to represent a second "Dry Weather" or pre-storm sampling event. Additionally, sediment sampling was conducted on 9-Mar-2017 to represent a second "Wet Weather" or post-storm season.

3.4.1. *SEDIMENT CHEMISTRY*

Pre- and Post-storm season intact sediment cores were analyzed on a bulk fraction basis for total organic carbon (TOC) and black carbon (BC), trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and pyrethroid pesticides. Results are summarized in Table 3-34 and Table 3-35 and shown in Figure 3-154 through Figure 3-166. Size fractionation characterization of sediment cores were conducted by TTU staff. Size fractions were classified as: Clay (<2µm); Fine silt (2-20µm); Coarse silt (20-63µm); and Sand (>63µm). Figure 3-167 and Figure 3-168 show the % mass that each size fraction contributes to the total for each station sampled for the pre- and post-storm season samples, respectively.

Concentrations of the trace metals Cd were higher in the post-season compared to the pre-season samples for all station except P17, where Cd concentrations were almost the same. The concentrations of pyrethroids as well as PAHs were also elevated in the samples collected in Mar-2017 compared to Sep-2016.

For the trace metals Cd, Zn and Pb as well as for pyrethroids and PAHs, a spatial gradient is present with increasing concentrations with samples closer to the mouth of Paleta Creek (i.e. P01<P08<P11<P17) for both pre- and post-storm season samples. This spatial pattern is also present in PCB concentrations for the pre-storm season sample collected in Sep-2016 (PCBs were not evaluated in the Mar-2017 sediment samples).

Table 3-34. 2016/2017 Wet Weather Bulk Sediment Chemistry Results – NBSD.

Compartment ID	Sampling Season	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/g DW)	Pb (µg/g DW)	Ni (µg/g DW)	Zn (µg/g DW)
P01	Pre-Storm	8.4 (0.3)	ND	152.6 (8.5)	0.39 (0.01)	42.8 (1.9)	17.4 (0.8)	196.9 (13.1)
	Post-Storm	4.9 (0.6)	0.09 (0.01)	108 (8.8)	0.26 (0.04)	27.6 (1.3)	11.4 (0.8)	144.6 (11.5)
P08	Pre-Storm	8.9 (0.3)	ND	188.6 (9.1)	0.54 (0.03)	80.1 (27.2)	16.4 (1.1)	246.6 (12)
	Post-Storm	12.3 (1.5)	0.24 (0.02)	260.5 (5.1)	0.57 (0.02)	87.2 (2.1)	22.4 (0.5)	350.3 (10.2)
P11	Pre-Storm	11.5 (3.5)	ND	235.1 (13.6)	0.51 (0.04)	80.3 (2.1)	17.5 (1.4)	309.7 (16.6)
	Post-Storm	8.2 (0.1)	0.4 (0.03)	220.9 (12.5)	0.52 (0.08)	83.7 (0.4)	18.6 (0.5)	308.7 (11.2)
P17	Pre-Storm	7.5 (0.1)	1.4 (0.1)	177.6 (4.5)	0.44 (0.05)	107.1 (4.2)	14.4 (0.4)	425.3 (5.4)
	Post-Storm	8.1 (0.3)	1.36 (0.27)	184.7 (17)	0.37 (0.05)	110.4 (4.9)	18.6 (1.8)	496.7 (61.3)

Values in ( ) are SD of duplicate samples tested. "-" – not tested. ND – non-detect.

Table 3-35. 2016/2017 Wet Weather Bulk Sediment Chemistry Results – NBSD (cont'd).

Compartment ID	Sampling Season	TOC (%)	Black Carbon (%)	Total PAHs (µg/kg)	Total PAHs (µg/kg OC)	Total PCBs (µg/kg)	Total PCBs (µg/kg OC)	Pyrethroid Pesticides (µg/g)	Pyrethroid Pesticides (µg/g OC)
P01	Pre-Storm	0.98 (0.12)	0.10 (0.0)	464.7	52.7	27.0	3.07	8.6	0.99
	Post-Storm	0.72 (0.03)	0.07 (0.0)	635.4	97.8	-	-	4.0	0.62
P08	Pre-Storm	1.25 (0.03)	0.12 (0.01)	1007.9	88.8	59.6	5.25	20.2	1.78
	Post-Storm	1.96 (0.02)	0.17 (0.0)	1939.2	108.3	-	-	62.5	3.49
P11	Pre-Storm	1.93 (0.04)	0.15 (0.0)	1191.4	66.8	91.6	5.14	49.9	2.80
	Post-Storm	1.87 (0.04)	0.13 (0.0)	2187.9	125.8	-	-	96.8	5.56
P17	Pre-Storm	3.94 (0.17)	0.24 (0.01)	2182.2	58.9	118.7	6.66	ND	ND
	Post-Storm	5.16 (0.06)	0.27 (0.02)	3240.5	66.3	-	-	345.7	7.07

Values in ( ) are SD of duplicate samples tested. "-" – not tested. ND – non-detect.

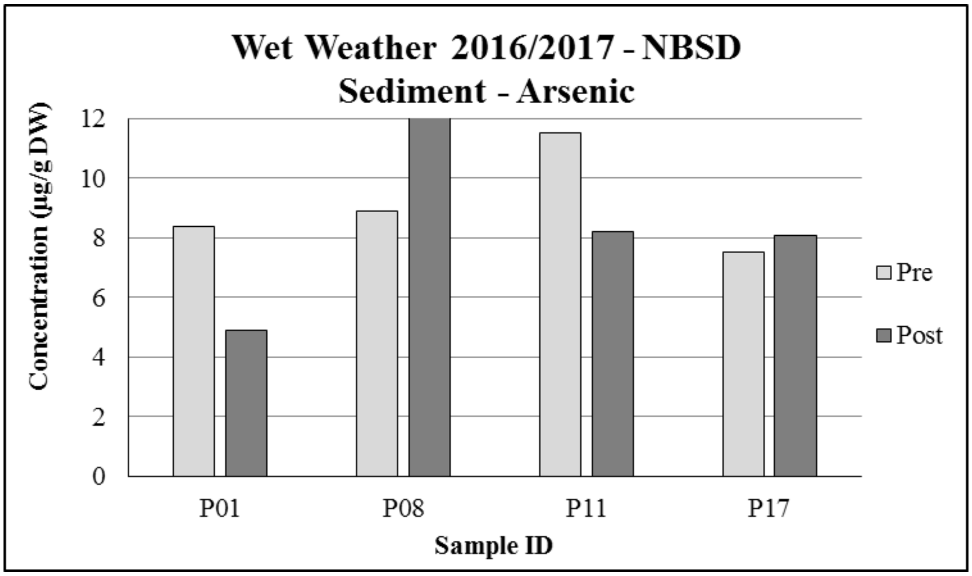


Figure 3-154. Bulk sediment arsenic concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

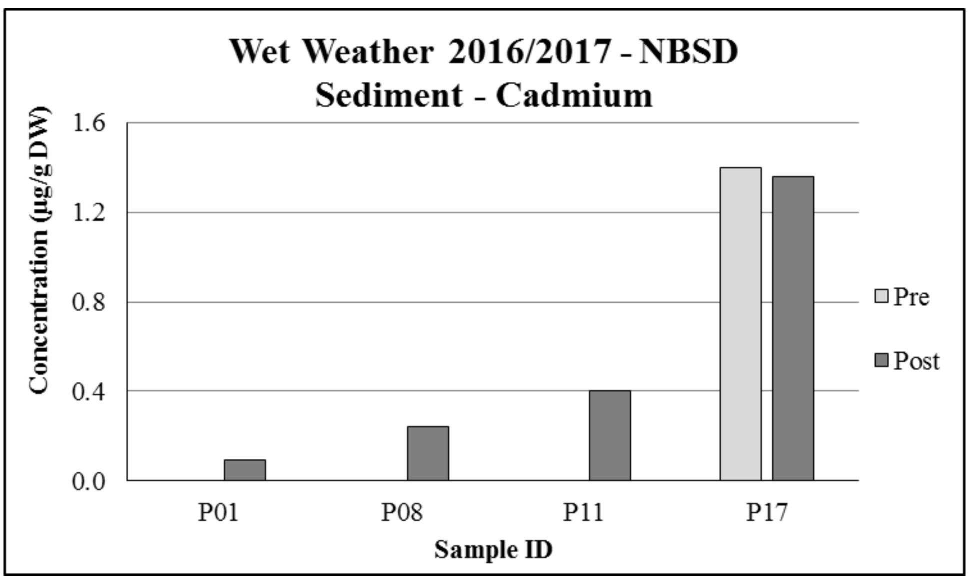


Figure 3-155. Bulk sediment cadmium concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

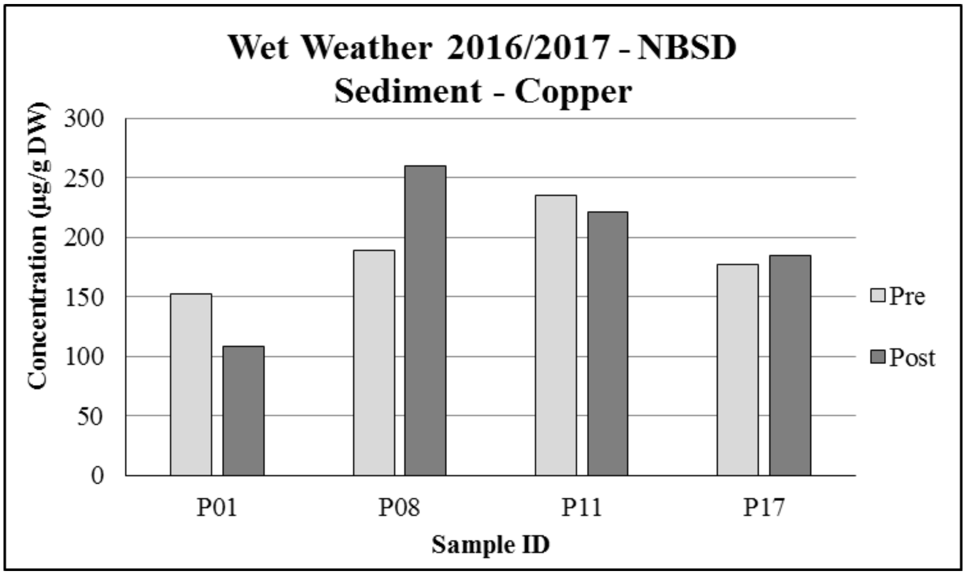


Figure 3-156. Bulk sediment copper concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

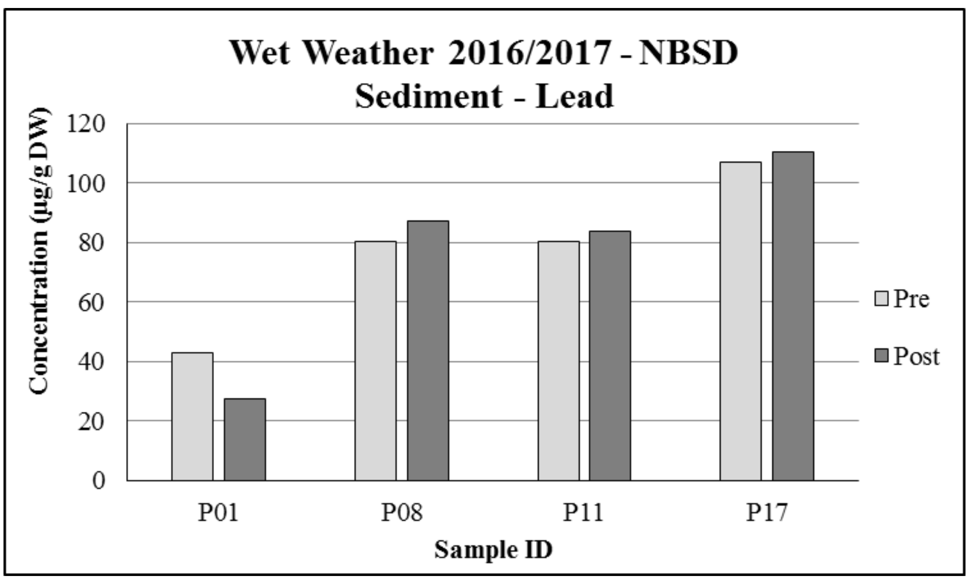


Figure 3-157. Bulk sediment lead concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

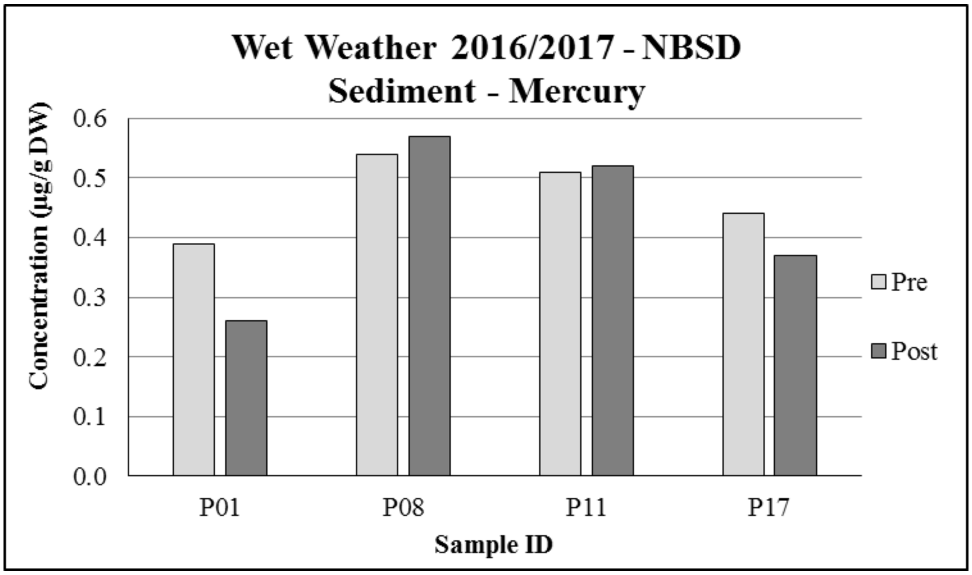


Figure 3-158. Bulk sediment mercury concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

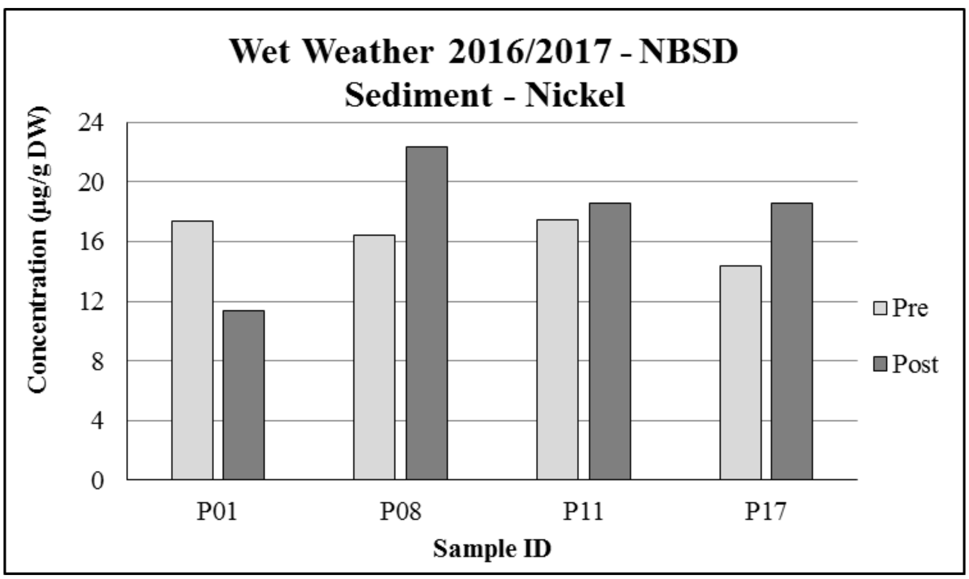


Figure 3-159. Bulk sediment nickel concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

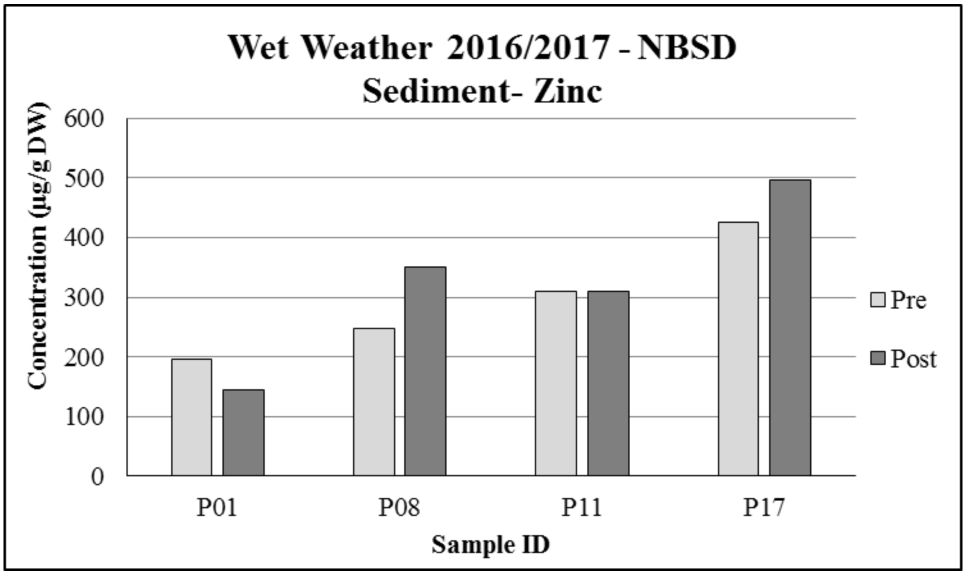


Figure 3-160. Bulk sediment zinc concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

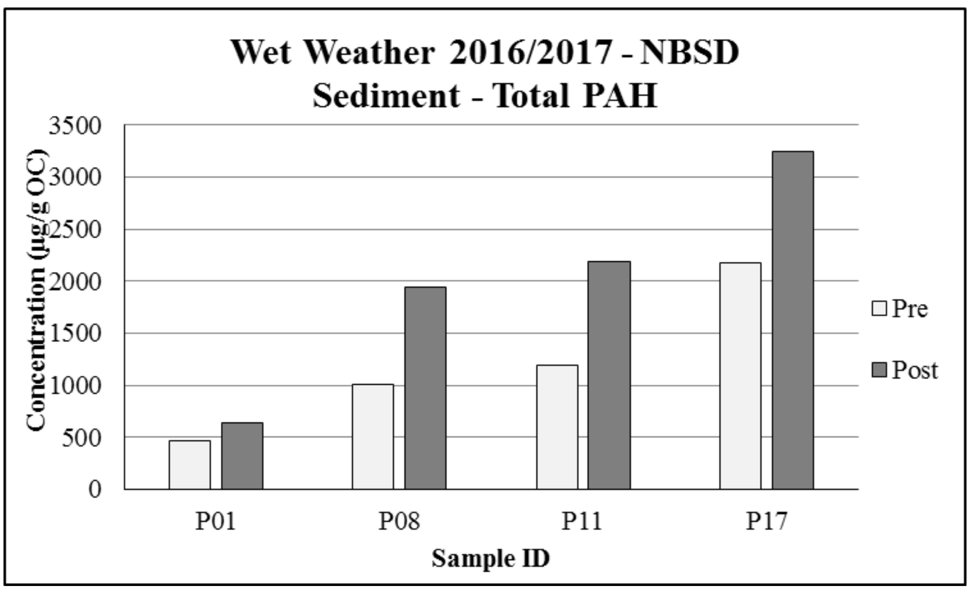


Figure 3-161. Bulk sediment Total PAH concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

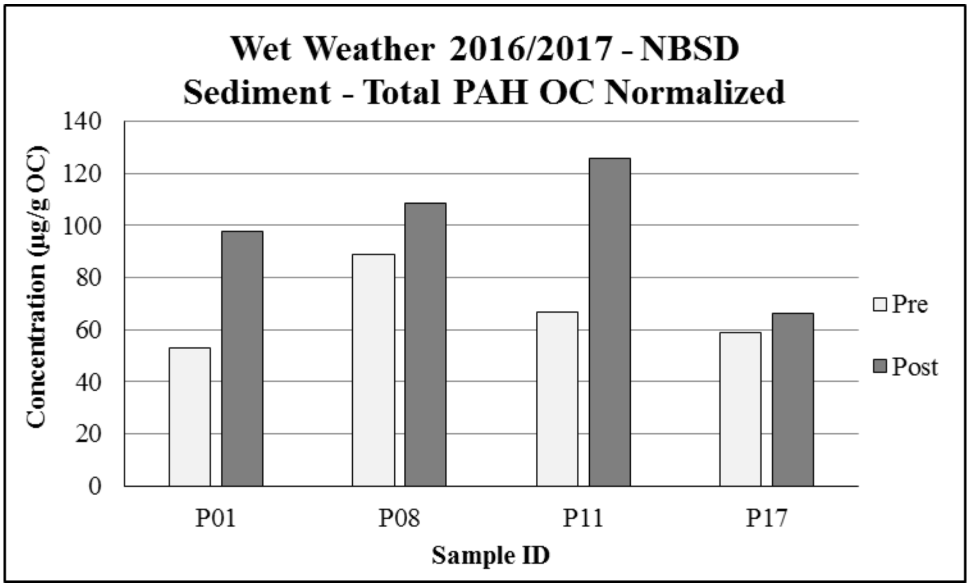


Figure 3-162. Bulk sediment Total PAH concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

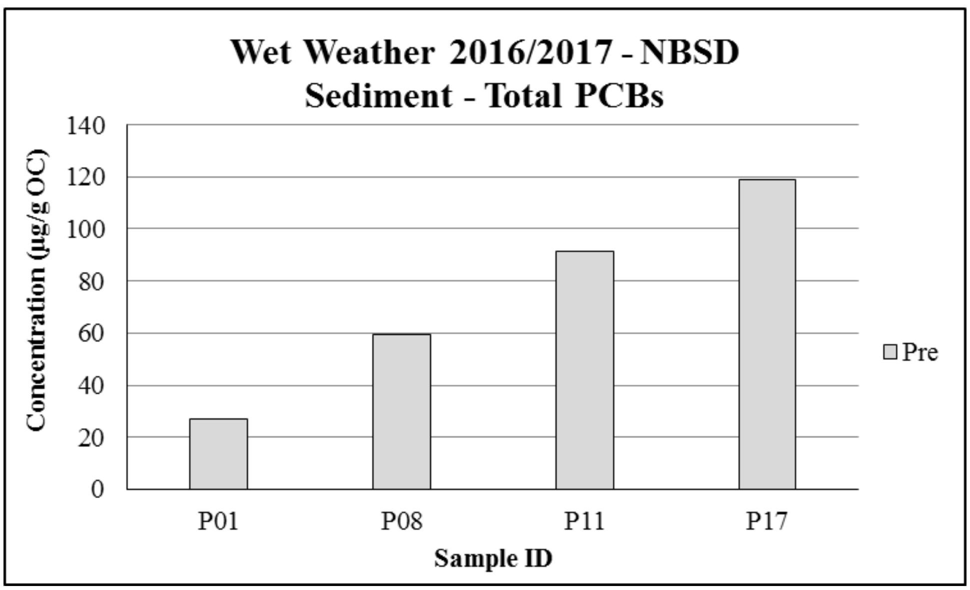


Figure 3-163. Bulk sediment Total PCB concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD. Note: no post-season samples were analyzed for PCBs.

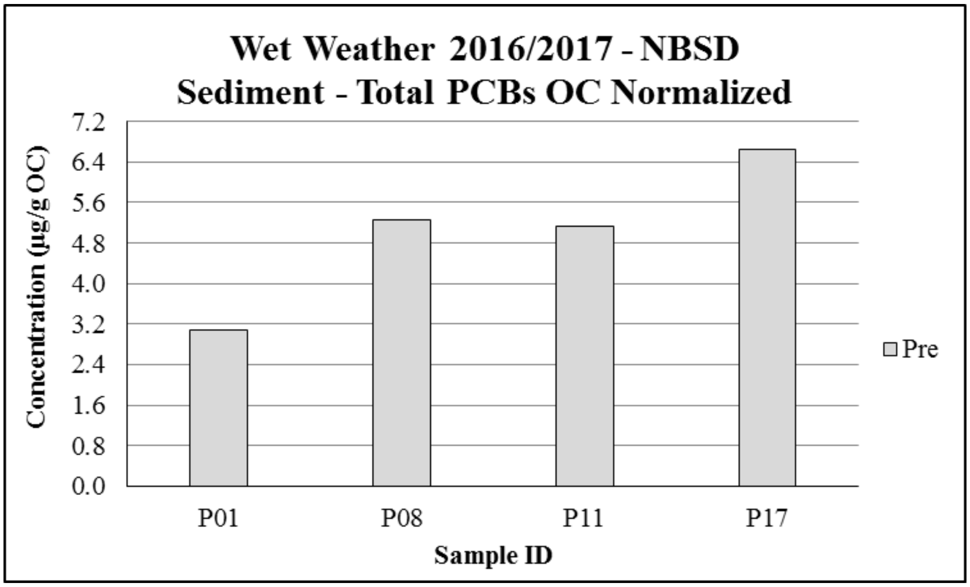


Figure 3-164. Bulk sediment Total PCB concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD. Note: no post-season samples were analyzed for PCBs.

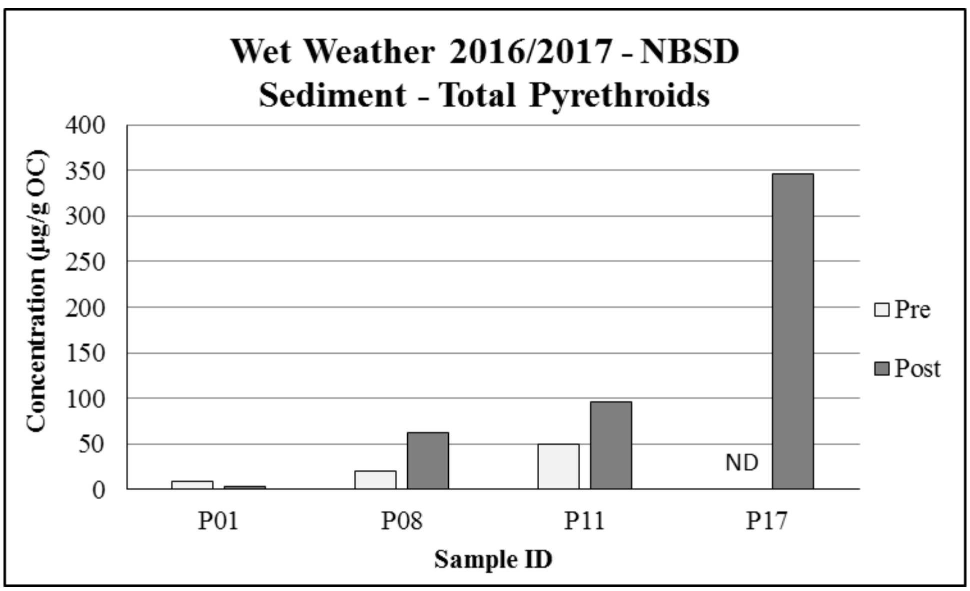


Figure 3-165. Bulk sediment pyrethroid pesticide concentrations for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

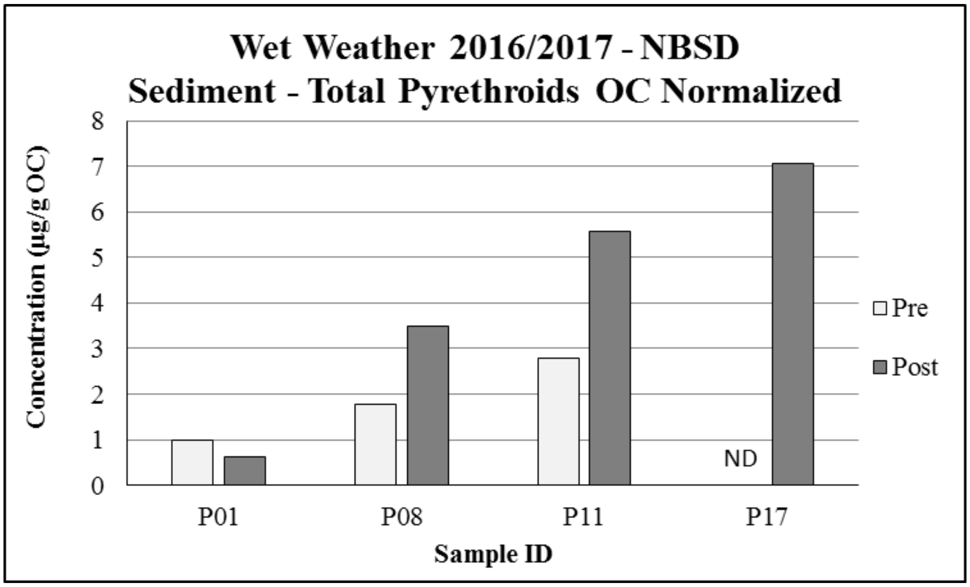


Figure 3-166. Bulk sediment pyrethroid pesticide concentrations normalized to the organic carbon content for stations P01, P08, P11 and P17 for the 2016/2017 Wet Weather sampling effort at NBSD.

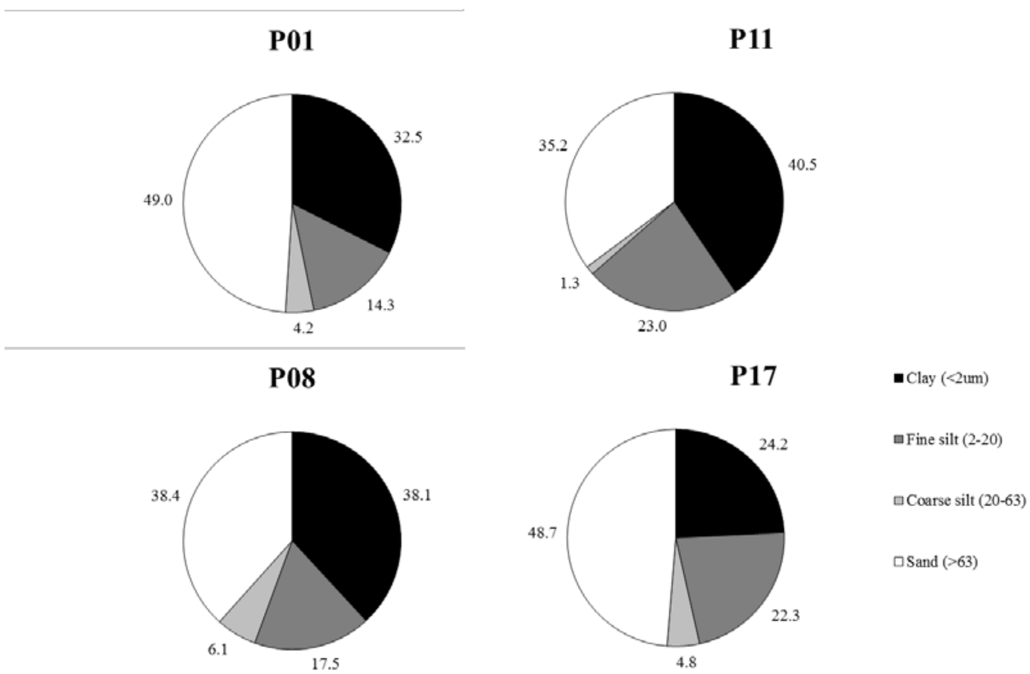


Figure 3-167. Proportion of each particle class size contributing to the total mass of sediment cores collected at stations P01, P08, P11 and P17 during Sept-2016 for the Wet Weather monitoring 2016/2017 – NBSD.

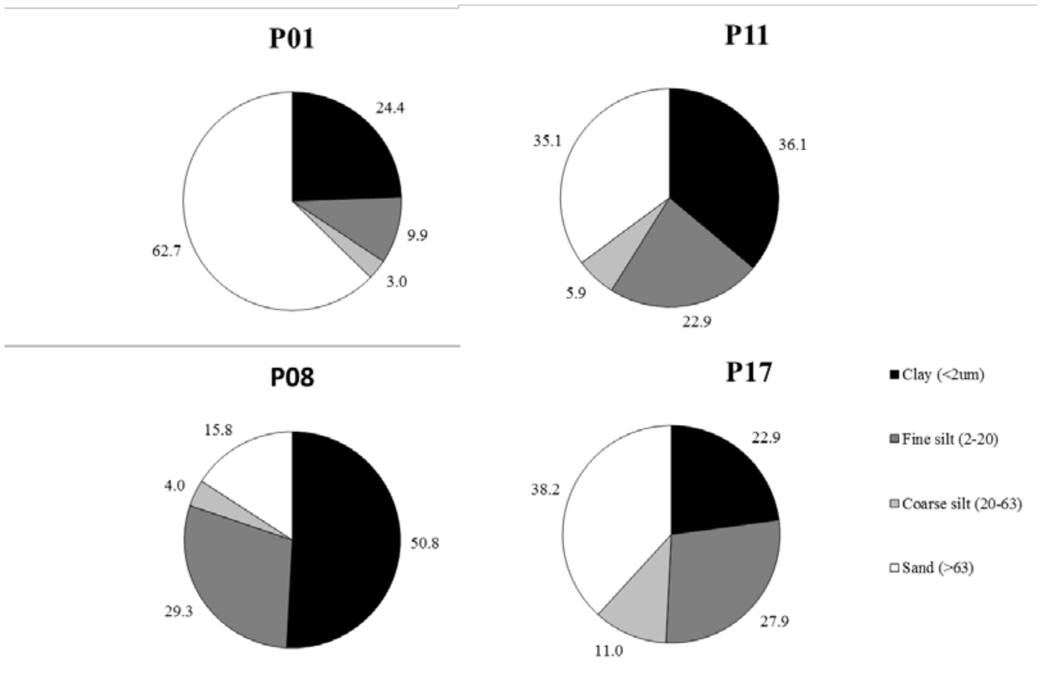


Figure 3-168. Proportion of each particle class size contributing to the total mass of sediment cores collected at stations P01, P08, P11 and P17 during Mar-2017 for the Wet Weather monitoring 2016/2017 – NBSD.

3.4.2. *EX SITU STUDIES*

Intact cores collected on 8-Sep-2016 and 9-Mar-2017 were tested at the SSC Pac Bioassay Laboratory as described in section 2.4. Samples collected collect in Sep-2016 and Mar-2017 were designated “Pre-storm” and “Post-storm” samples for the 2016/2017 storm season, respectively.

3.4.2.1. SPME

SPMEs were exposed to sediment cores *ex situ* for the Pre- and Post-season sediment cores on 12-Sep-2016 to 11-Oct-2016 and 14-Mar-2017 to 7-Apr-2017, respectively.

Concentrations of the pesticide chlordane, PAHs and PCBs are summarized in Table 3-36 and are shown in Figure 3-169, Figure 3-170 and Figure 3-171, respectively. Similar to the previous 2015/2016 wet weather season, total chlordane concentrations in the porewaters as derived from SPME tend to decrease as distance increases away from the mouth of Paleta Creek (i.e. P17-P11-P08-P01). For all stations, total chlordane concentrations increased from the pre- to the post-storm season samples as could be expected with the increased loading due to stormwater inputs.

Total PAH concentrations tend to increase towards the mouth of Paleta Creek for the pre-storm season samples, but this trend is not observed for the post-storm season sampling event. Post-storm season PAH concentrations are higher than pre-season concentrations for all stations except for P17.

Total PCD concentrations in the SPMEs are higher in the post-storm season for all stations compared to the pre-storm season SPME concentrations as could be expected considering stormwater loading to the receiving system over the course of the storm season. For post-storm season concentrations of PCBs, there seems to be a slight trend of increasing concentrations from the mouth of the Paleta Creek (i.e.P17<P11<P08<P01), but this trend was not observed in the pre-storm season samples.

Table 3-36. 2016/2017 Wet Weather NBSD SPME Results.

Sample ID	Sampling Season/Treatment	Total Chlordane (ng/L)	Total PAH (ng/L)	Total PCB (ng/L)
P01	Pre-Storm	0.03 (0.00)	29.1 (13.8)	0.41 (0.13)
	Post-Storm	0.06 (0.00)	66.4 (2.91)	1.28 (0.03)
P08	Pre-Storm	0.05 (0.01)	28.8 (0.19)	0.50 (0.02)
	Post-Storm	0.08 (0.01)	64.0 (2.55)	1.23 (0.11)
P11	Pre-Storm	0.06 (0.00)	30.8 (1.14)	0.47 (0.01)
	Post-Storm	0.14 (0.03)	40.4 (7.20)	1.20 (0.15)
P17	Pre-Storm	0.10 (0.02)	56.5 (3.41)	0.38 (0.05)
	Post-Storm	0.26 (0.01)	56.7 (11.5)	0.97 (0.04)

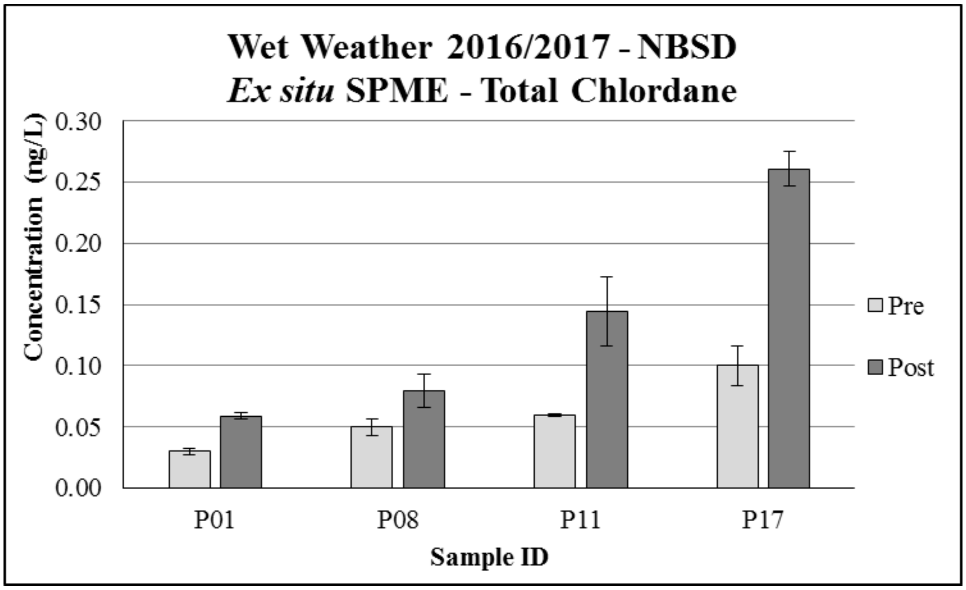


Figure 3-169. Total Chlordane concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2016/2017 Wet Weather sampling effort at NBSD.

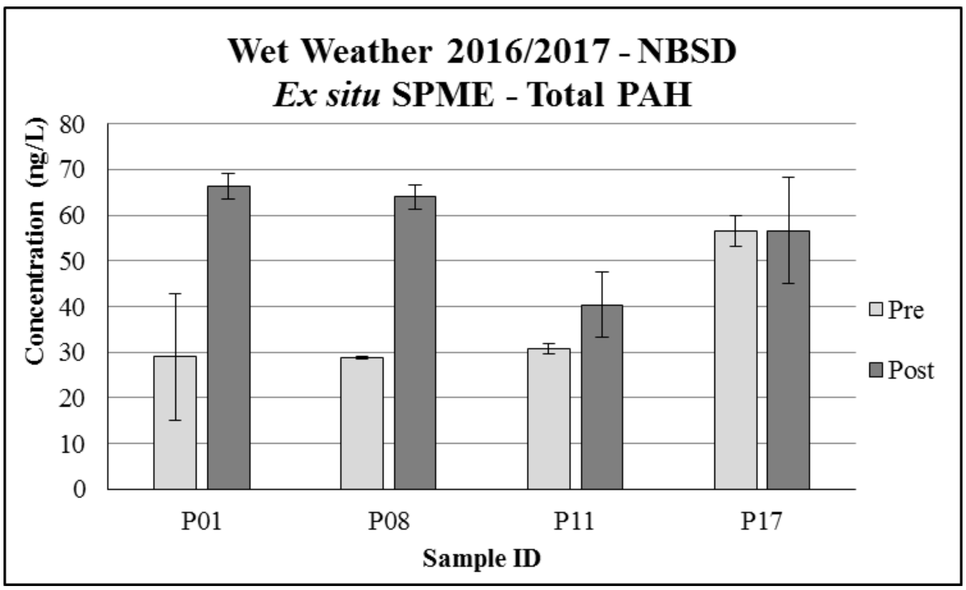


Figure 3-170. Total PAH concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2016/2017 Wet Weather sampling effort at NBSD

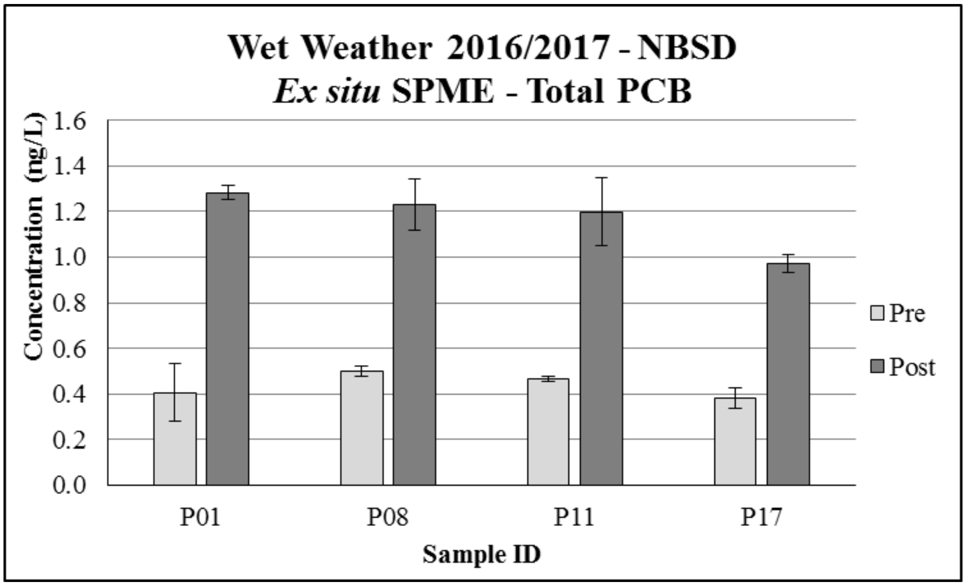


Figure 3-171. Total PCB concentrations in pore waters derived from SPME fibers deployed in *ex situ* sediment cores for the 2016/2017 Wet Weather sampling effort at NBSD.

3.4.2.2. DGT

DGTs were exposed to sediment cores *ex situ* for the Pre- and Post-season sediment cores on 13-Sep-2016 to 15-Sep-2016 and 11-Mar-2017 to 13-Mar-2017, respectively.

Trace metal concentrations are summarized in Table 3-37 and shown in Figure 3-172 through Figure 3-178. Trace metal concentrations in the pore waters as derived from DGTs show the trend of higher measurements in the pre-storm samples relative to the post-storm samples for nickel and mercury for all stations.

Table 3-37. 2015/2016 Wet Weather NBSD DGT Results.

Sample ID	Sampling Season/ Treatment	Ag (µg/L)	Cd (µg/L)	Cu (µg/L)	Ni (µg/L)	Pb (µg/L)	Zn (µg/L)	Hg (ng/L)
P01	Pre-Storm	0.01	0.11 (0.06)	6.2 (1.3)	1.5 (0.5)	0.1 (0.0)	31.2 (4.0)	130.5 (28.8)
	Post-Storm	ND	ND	2.35 (0.54)	0.50 (0.21)	0.13 (0.03)	29.8 (32.3)	28.7 (6.2)
P08	Pre-Storm	0.01	0.13 (0.01)	9.1 (4.8)	1.8 (0.0)	0.4 (0.4)	38.1 (3.3)	161.1 (31.0)
	Post-Storm	ND	ND	20.9 (0.93)	1.25 (0.35)	0.70 (0.47)	76.7 (48.5)	130.3 (19.5)
P11	Pre-Storm	0.02 (0)	0.55 (0.20)	14 (6.5)	5.2 (1.8)	1.2 (0.4)	247 (106)	88.3 (28.6)
	Post-Storm	0.01	0.04	10.7 (7.49)	0.76 (0.15)	0.67 (0.56)	22.7 (10.6)	23.6 (1.9)
P17	Pre-Storm	0.01	0.11 (0.01)	14.5 (1.0)	2.1 (0.0)	1.4 (0.3)	126.6 (0.2)	17.4 (7.28)
	Post-Storm	ND	0.02 (0.01)	3.23 (0.33)	0.63 (0.10)	0.38 (0.03)	10.2 (7.57)	3.4 (0.8)

ND – Non-detect.

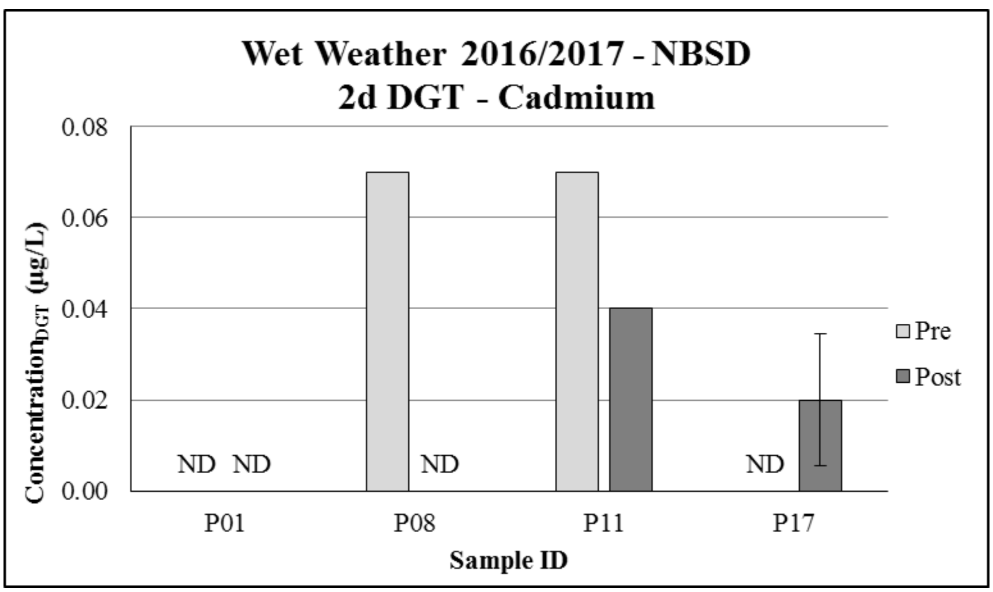


Figure 3-172. Concentrations of cadmium in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

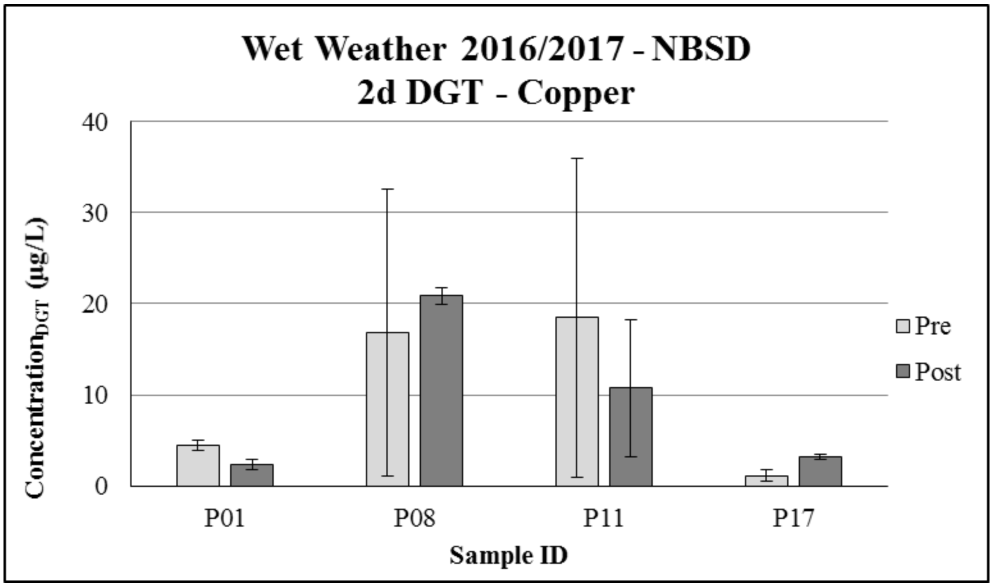


Figure 3-173. Concentrations of copper in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

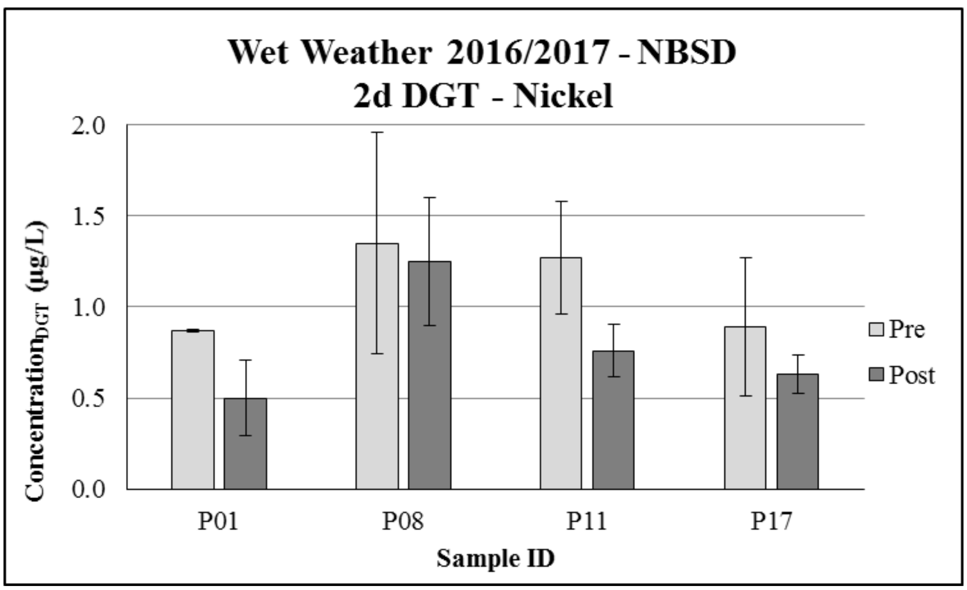


Figure 3-174. Concentrations of nickel in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

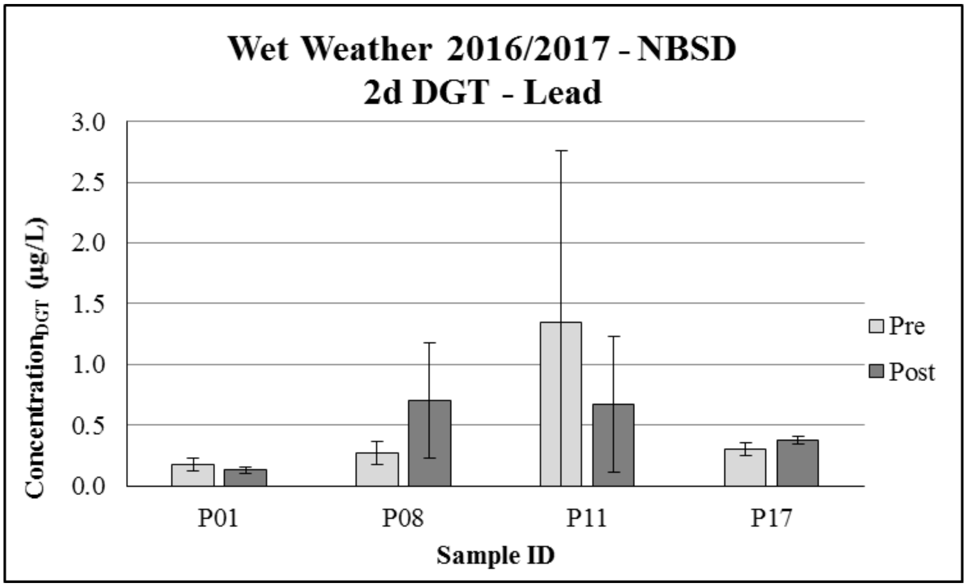


Figure 3-175. Concentrations of lead in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

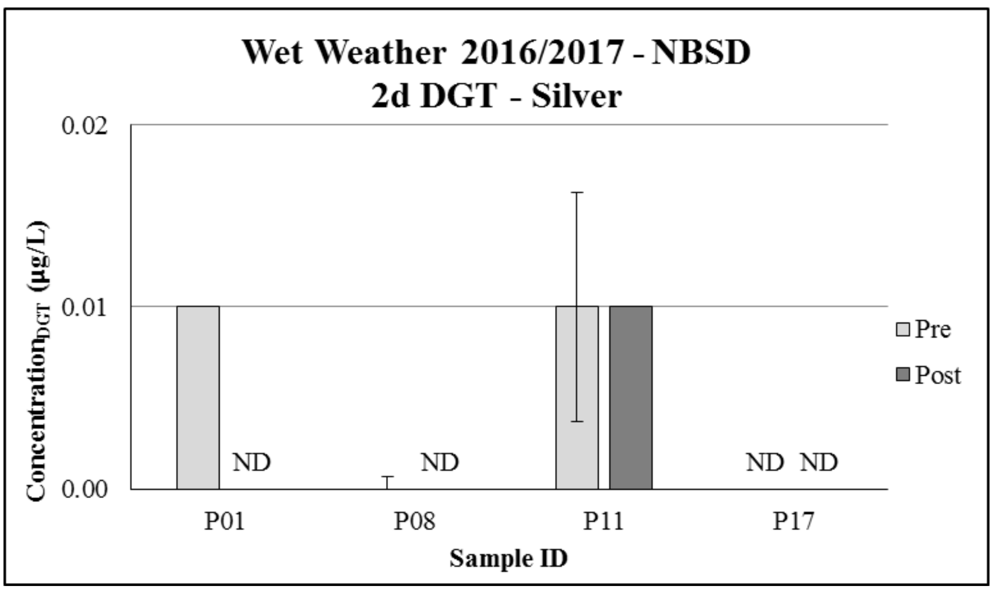


Figure 3-176. Concentrations of silver in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

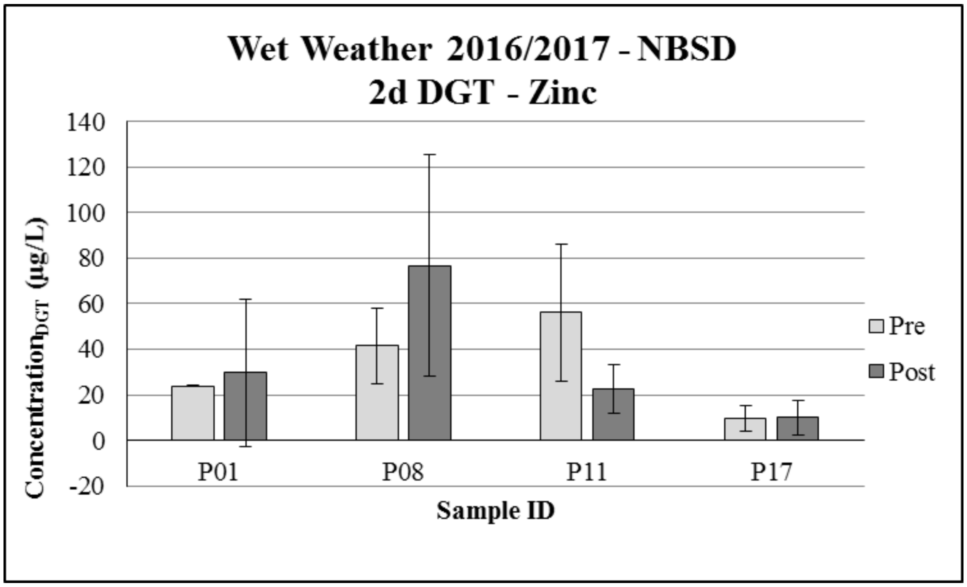


Figure 3-177. Concentrations of zinc in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

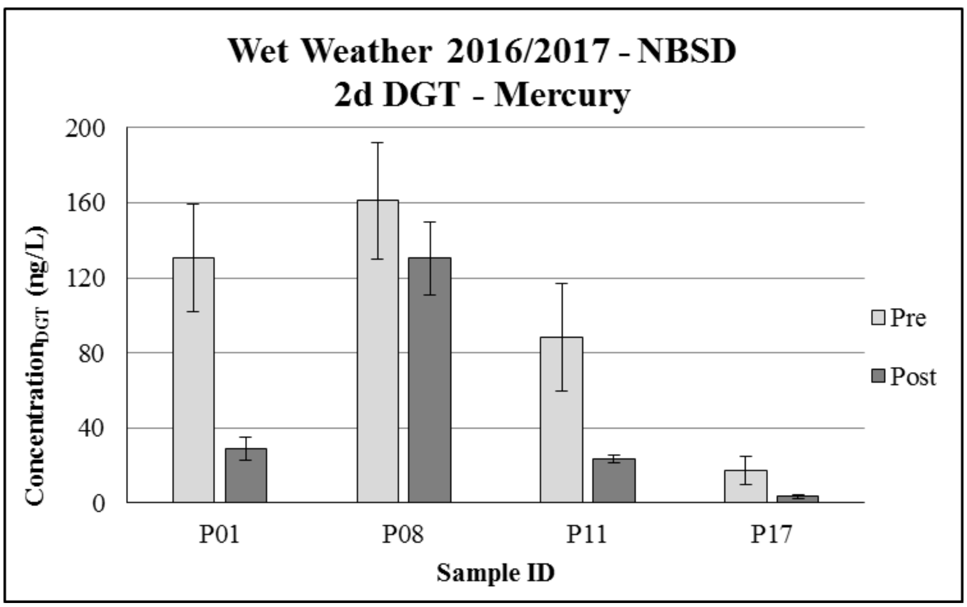


Figure 3-178. Concentrations of mercury in pore waters derived from DGTs deployed in *ex situ* sediment cores for the 2015/2016 Wet Weather sampling effort at NBSD. NT – Not tested.

3.4.2.3. BIOACCUMULATION & TOXICITY

Bioaccumulation and toxicity tests performed for the evaluation of the Wet Weather sediment samples collected Sep-2016 and Mar-2017 we conducted within a week sample collection on 10-Sep-2016 and 10-Mar-2017, respectively. For reporting purposes, the Sep-2016 and Mar-2017 sampling efforts were designated Pre- and Post-Storm Season, respectively. Control survival for the Sep-2016 samples for the clams and amphipods were 88 and 94%, respectively. Control survival for the Mar-2017 samples for the clams and amphipods were 100 and 96%, respectively. While the clam control survival for the Sep-2016 was just under the test acceptability criteria of 90% survival, the test as a whole was deemed acceptable all samples had mean percent survivals greater the 90%. All water quality measurements were within testing parameters throughout the duration of the exposures for all tests conducted. Survival results for the two sediment organisms tested is summarized in Table 3-38 and shown in Figure 3-179 and Figure 3-180.

For the Pre- and Post-Storm season clam exposures, all replicates were composited and analyzed for trace metals, pesticides, PAHs and PCBs. Trace metal and PAH concentrations accumulated by the clams is summarized in Table 3-39 and Table 3-40 and are shown in Figure 3-181 through Figure 3-190.

For all trace metals evaluated, concentrations were elevated in the Sep-2016 pre-storm season samples relative to the Mar-2017 post-storm season samples. There is also a spatial gradient of increasing concentrations towards the mouth of Paleta Creek (i.e. P01<P08<P11<P17) for the pre-storm season samples for Cd, Pb, and Ni. For the spatial gradients of Cd and Pb, this is consistent with concentrations observed in the sediments. Of interest is the opposite trend of increasing concentrations away from the mouth of the Creek for mercury in both pre- and post-storm season samples.

For the pesticide chlordane, the spatial gradient is also present for the Sep-2016 samples with increasing concentrations towards the mouth of Paleta Creek. Concentrations were also the highest at the mouth of the Creek for the Mar-2017 samples, but were also elevated at station P08.

Table 3-38. 2016/2017 Wet Weather NBSD Survival of the Clam and Amphipod *Ex Situ* Exposures.

Sample ID	Sampling Season/ Treatment	Clam		Amphipod	
		Mean Survival (%)	SD	Mean Survival (%)	SD
Control	NA	88.0 / 100.0*	11.0 / 0.0*	94.0 / 96.0*	2.2 / 4.2*
P01	Pre-Storm	96.0	8.9	92.0	8.4
	Post-Storm	100.0	0.0	90.0	5.8
P08	Pre-Storm	100.0	0.0	90.0	3.5
	Post-Storm	94.4	9.6	47.0	9.7
P11	Pre-Storm	92.0	11.0	90.0	12.7
	Post-Storm	100.0	0.0	11.0	12.4
P17	Pre-Storm	92.0	11.0	69.0	21.3
	Post-Storm	100.0	0.0	3.0	4.5

*First / second values are for pre-/post-storm season tests ran as separate efforts.

Table 3-39. 2016/2017 Wet Weather NBSD Bioaccumulation Results for *M. nasuta Ex Situ* Exposures.

Sample ID	Sampling Season/ Treatment	As (µg/g DW)	Cd (µg/g DW)	Cu (µg/g DW)	Hg (µg/Kg DW)	Ni (µg/g DW)	Pb (µg/g DW)	Zn (µg/g DW)
P01	Pre-Storm	5.40	0.07	4.98	141.8	0.63	0.60	24.0
	Post-Storm	2.13	0.03	3.26	85.1	0.30	0.34	18.3
P08	Pre-Storm	4.67	0.05	7.01	129.8	0.62	1.14	20.4
	Post-Storm	3.03	0.02	3.49	74.3	0.24	0.47	17.7
P11	Pre-Storm	7.44	0.07	9.51	117.3	0.74	1.19	25.0
	Post-Storm	3.42	0.03	3.53	73.3	0.28	0.58	18.9
P17	Pre-Storm	5.02	0.07	10.6	110.3	0.82	1.79	25.8
	Post-Storm	3.20	0.03	3.67	63.5	0.36	0.67	17.2

Table 3-40. 2016/2017 Wet Weather NBSD Bioaccumulation Results for *M. nasuta Ex Situ* Exposures (cont'd).

Sample ID	Sampling Season/ Treatment	% Lipids	Total Chlordane (µg/Kg lipid WW)	Total PAH (µg/Kg lipid WW)	Total PCB (µg/Kg lipid WW)
P01	Pre-Storm	0.93	55.5	14247	3414
	Post-Storm	0.70	60.2	15738	1820
P08	Pre-Storm	1.01	91.0	15021	2652
	Post-Storm	0.50	285.8	34815	4541
P11	Pre-Storm	0.62	338.7	24120	5210
	Post-Storm	1.00	218.0	15243	1705
P17	Pre-Storm	0.66	665.1	23213	3660
	Post-Storm	0.70	431.1	22033	1139

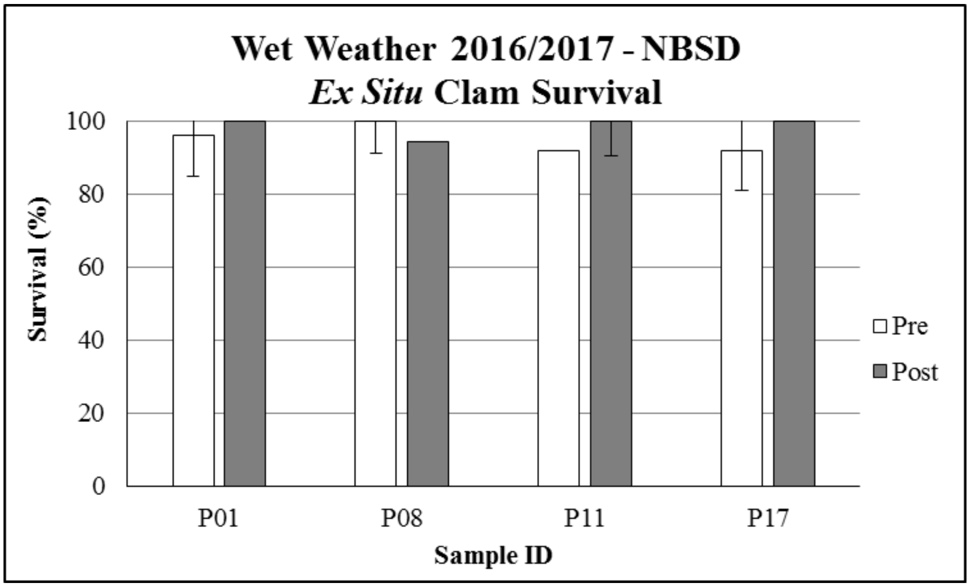


Figure 3-179. Organism survival for *ex situ* clam bioaccumulation exposures to intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

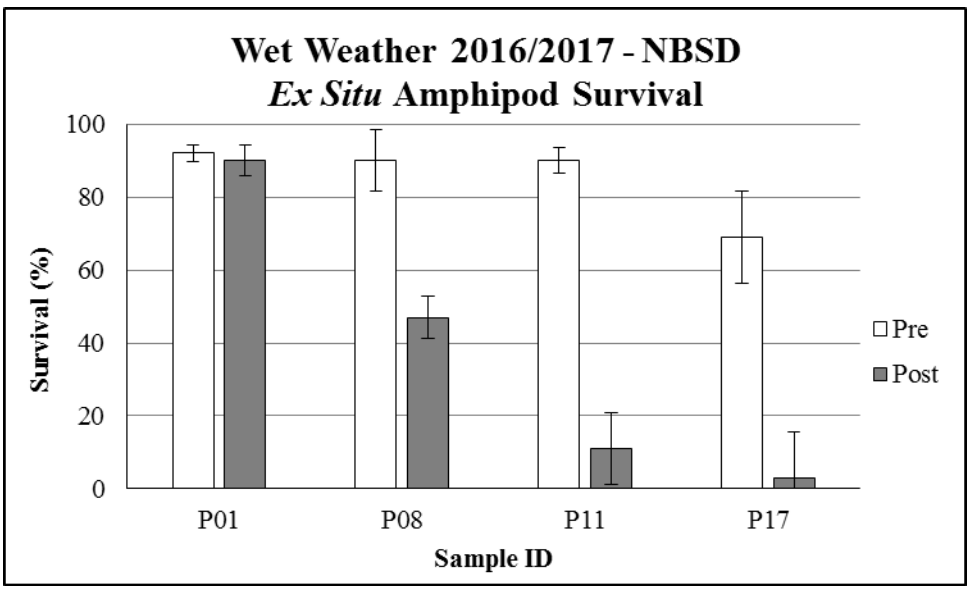


Figure 3-180. Organism survival for *ex situ* amphipod toxicity exposures to intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

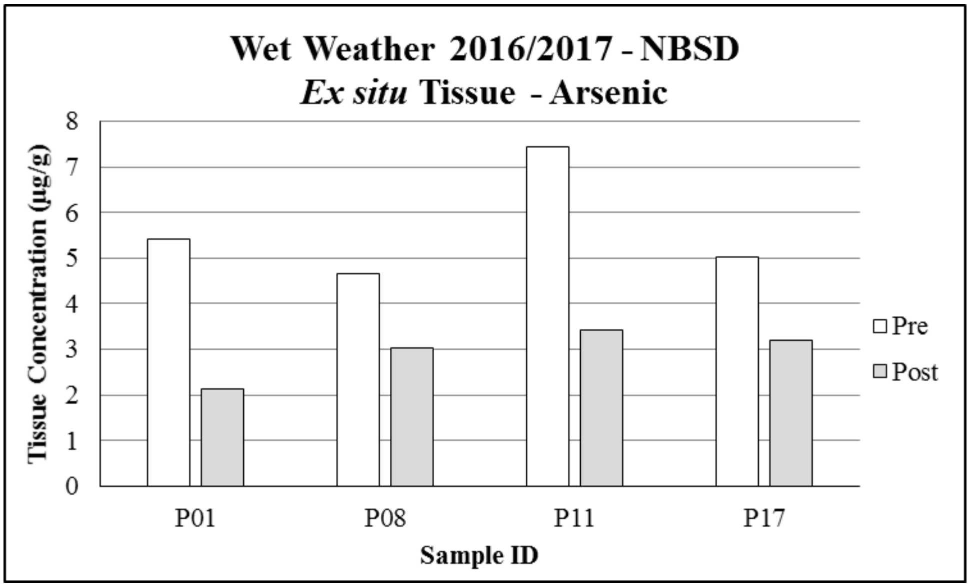


Figure 3-181. Clam tissue arsenic concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

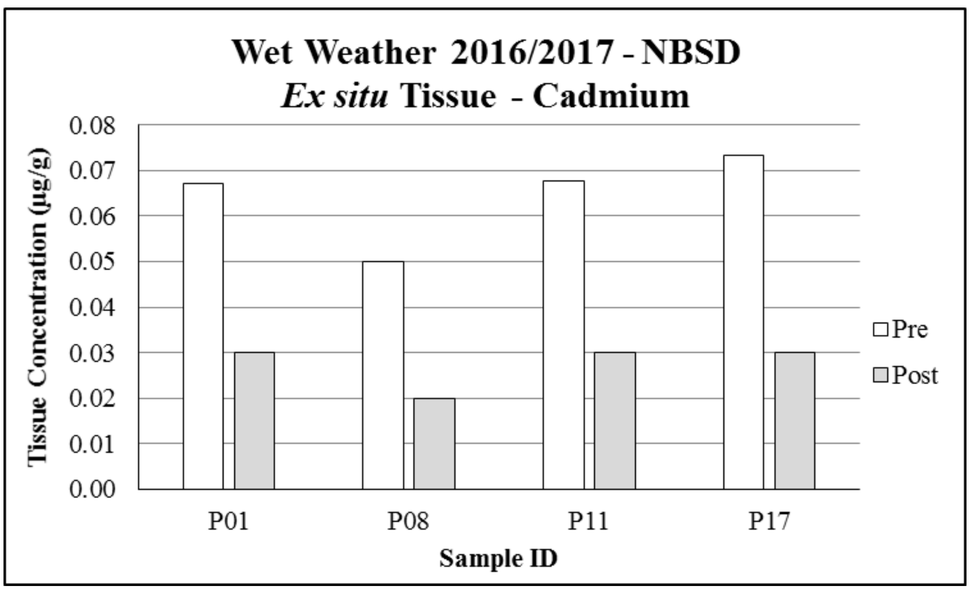


Figure 3-182. Clam tissue cadmium concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

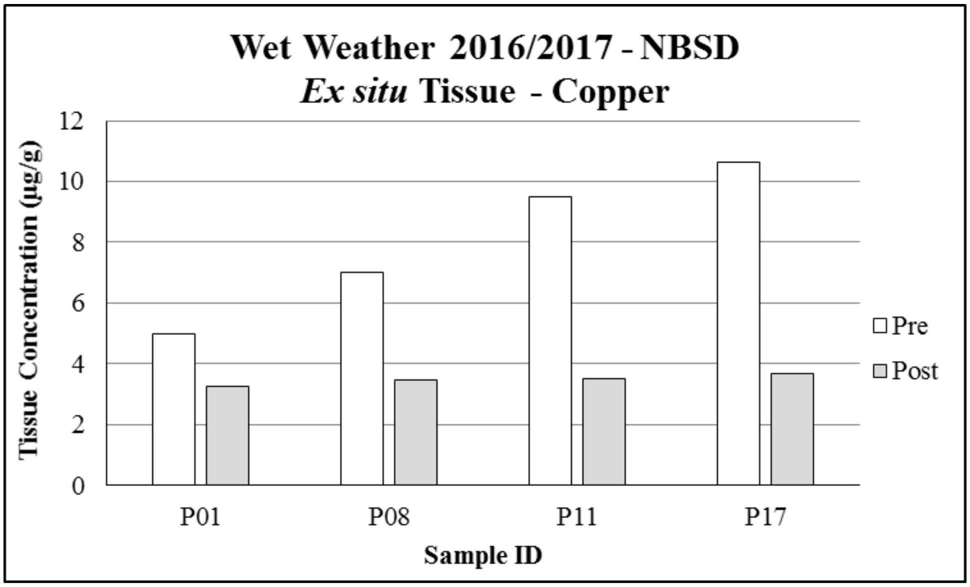


Figure 3-183. Clam tissue copper concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

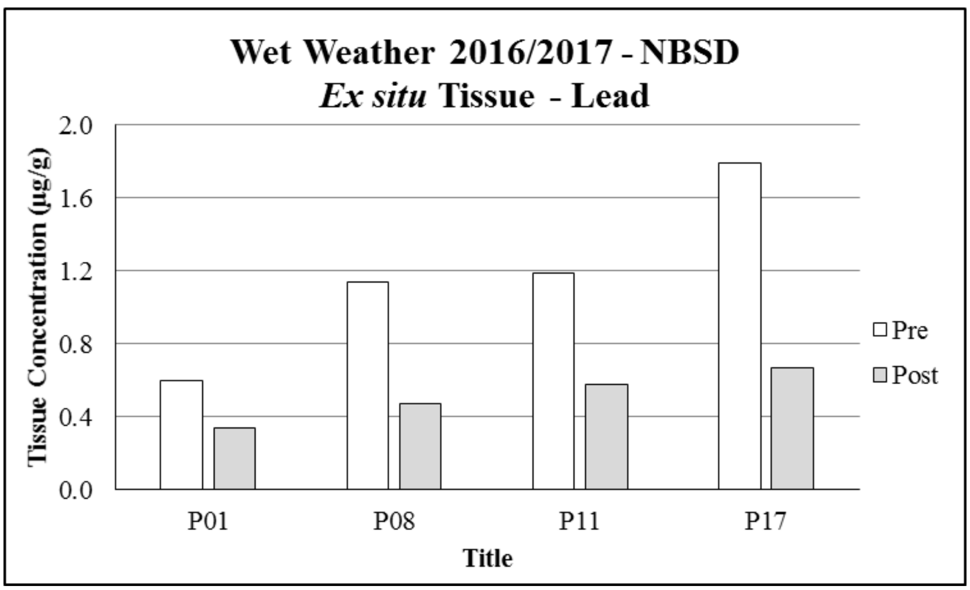


Figure 3-184. Clam tissue lead concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

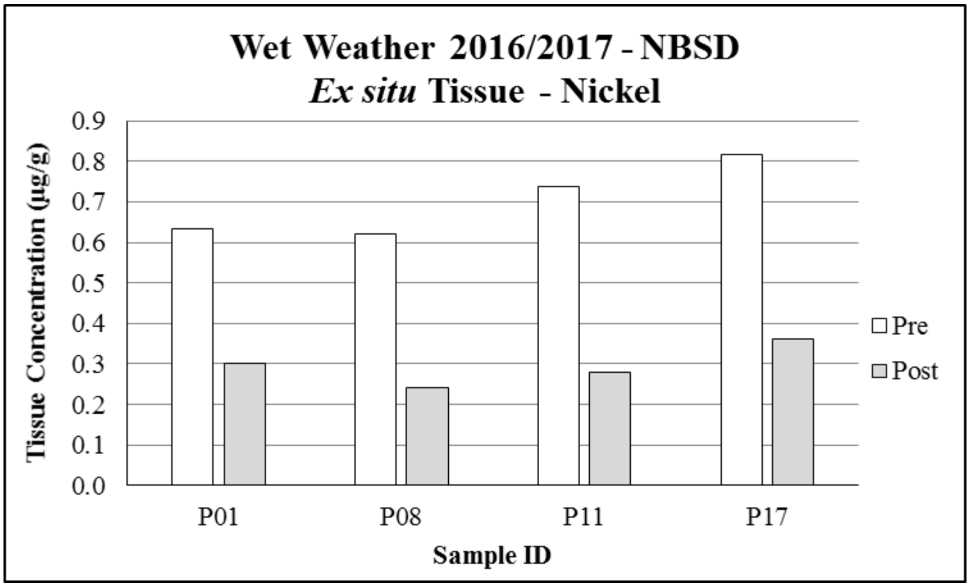


Figure 3-185. Clam tissue nickel concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

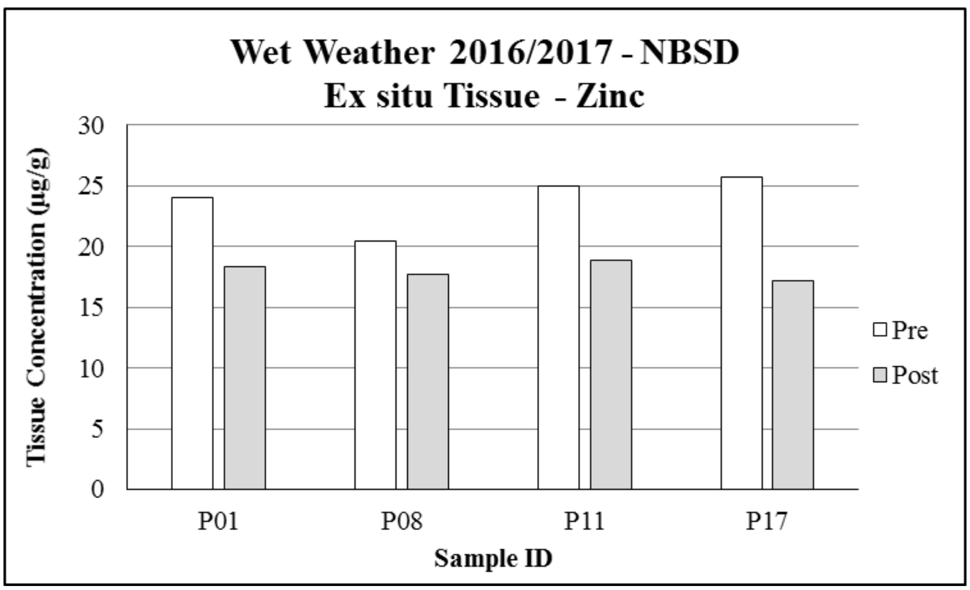


Figure 3-186. Clam tissue zinc concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

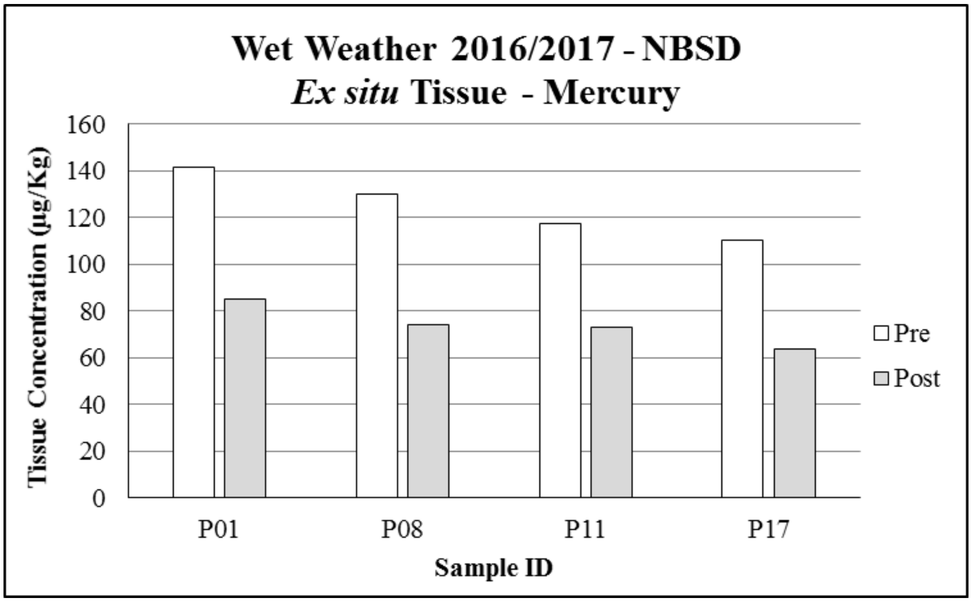


Figure 3-187. Clam tissue mercury concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

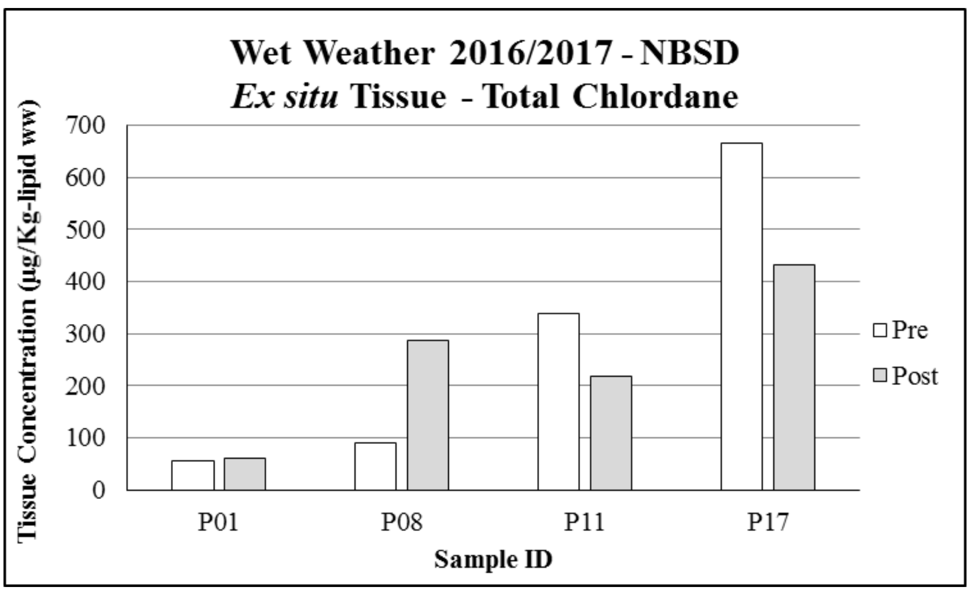


Figure 3-188. Clam tissue lipid normalized total chlordane concentrations for intact cores trap material collected for the 2016/2017 Wet Weather sampling effort at NBSD.

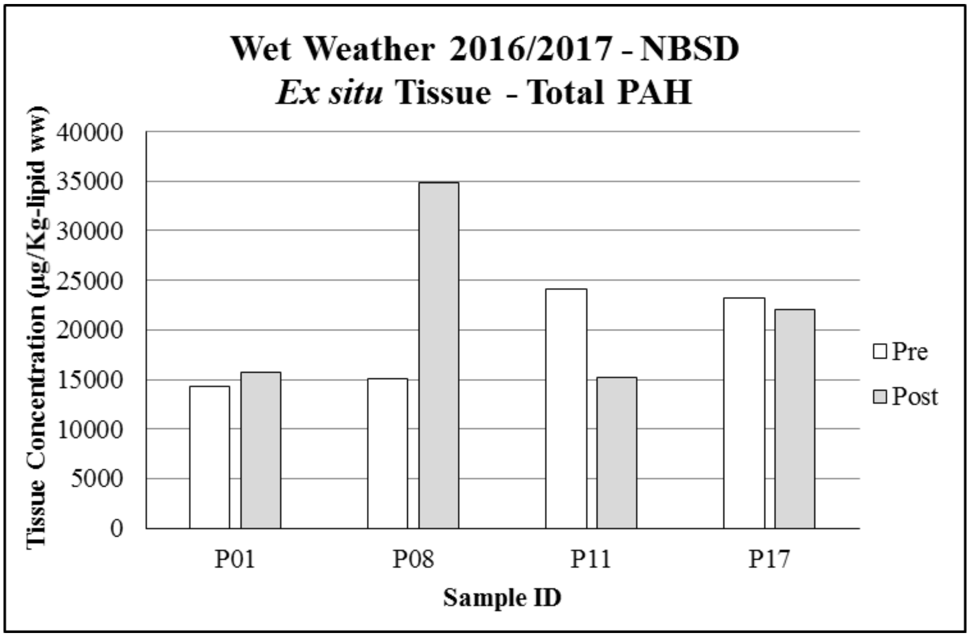


Figure 3-189. Clam tissue lipid normalized total PAH concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

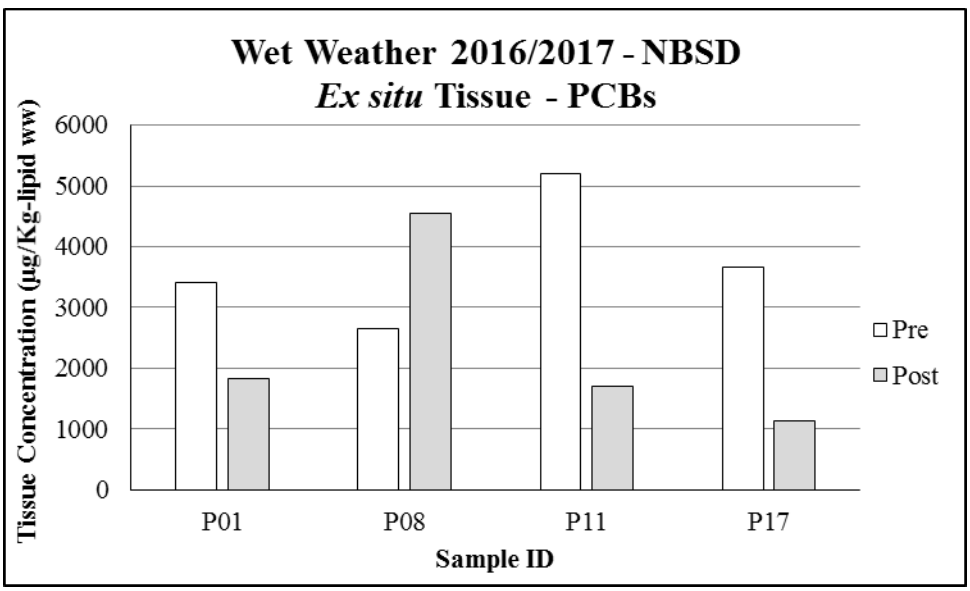


Figure 3-190. Clam tissue lipid normalized total PCB concentrations for intact cores collected for the 2016/2017 Wet Weather sampling effort at NBSD.

3.5. NBSD – SEASONAL ANALYSES

3.5.1. *SEDIMENT*

For metals, no overall trends were observed over the sampling seasons with regard to wet or dry sampling designations that were previously made. Some general trends over the course of the sampling years that are of potential interest are:

1) P17 & P11 – decrease in concentrations of cadmium (Figure 3-191).
2) P17 – possible decrease in concentrations of copper (Figure 3-192).
3) P01 & P08 – increase in concentrations of arsenic (Figure 3-193).

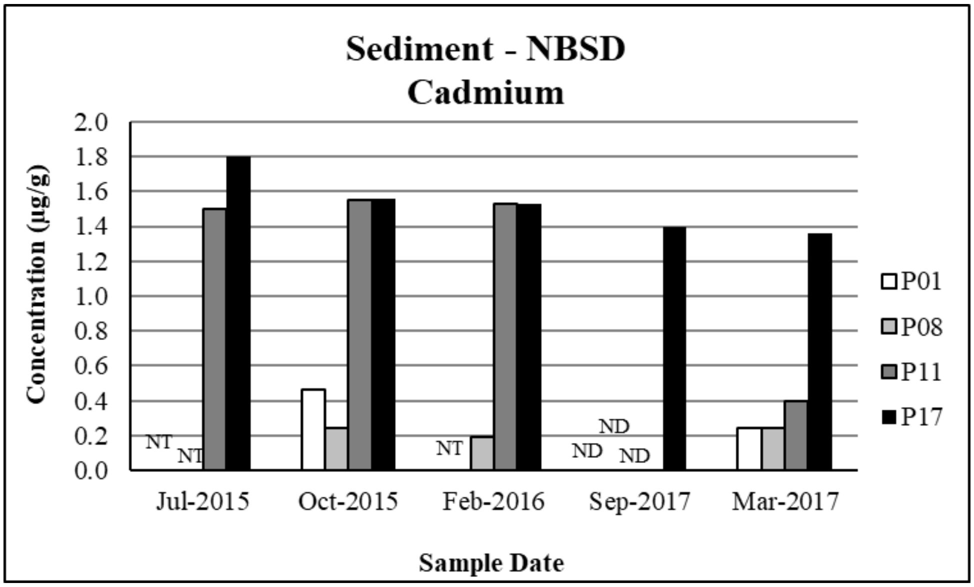


Figure 3-191. Concentrations of cadmium in bulk sediment over time at NBSD.

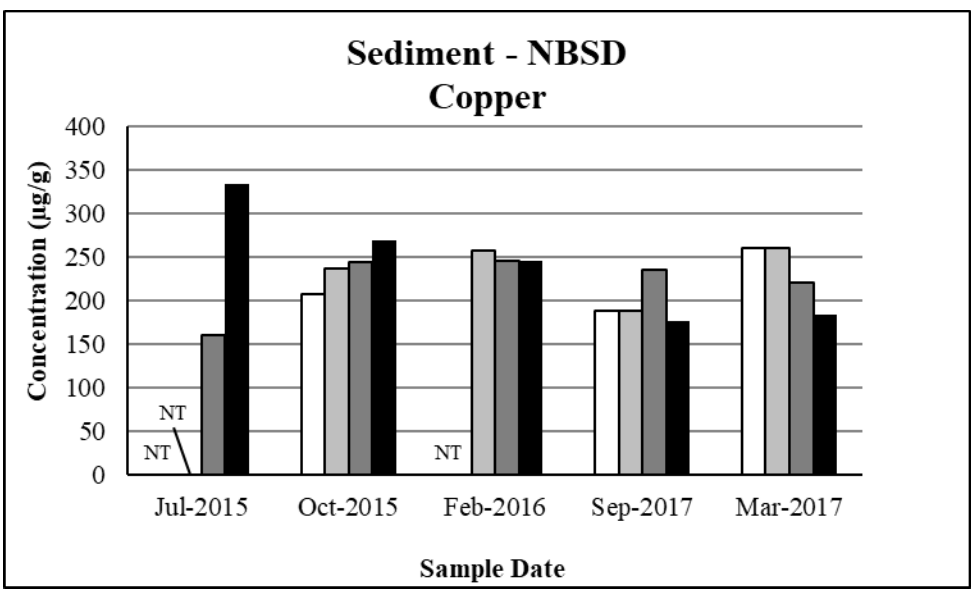


Figure 3-192. Concentrations of copper in bulk sediment over time at NBSD.

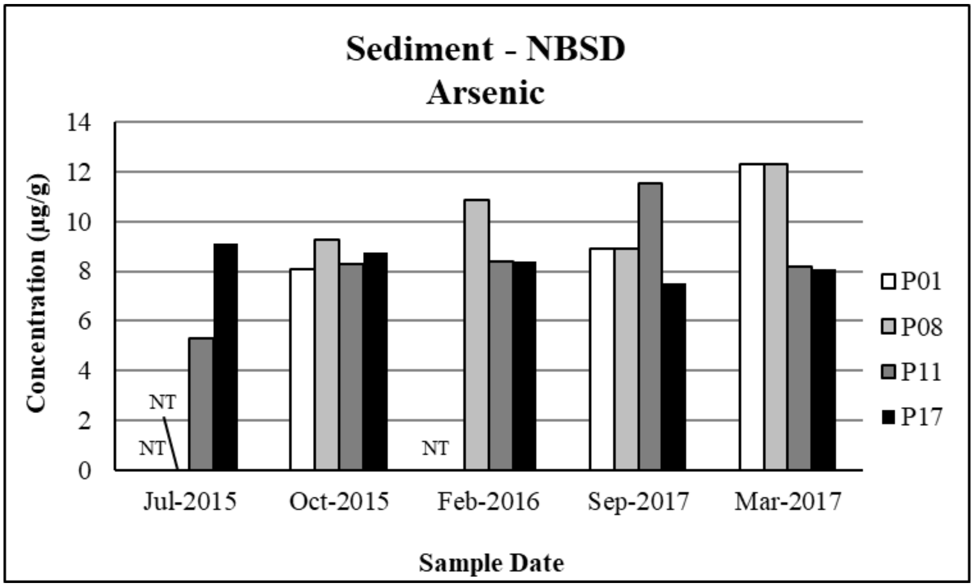


Figure 3-193. Concentrations of arsenic in bulk sediment over time at NBSD.

For PAHs, there is a slight seasonal effect with higher concentrations observed in the post-storm season samples (i.e. Feb-2016 and Mar-2017) relative to the respective pre-storm season samples (i.e. Oct-2015 and Sep-2016) for stations P11 and P17 (Figure 3-194). This trend is also observed in the 2016/2017 sample set for P01 and P08, as indicated in section 3.4.1.

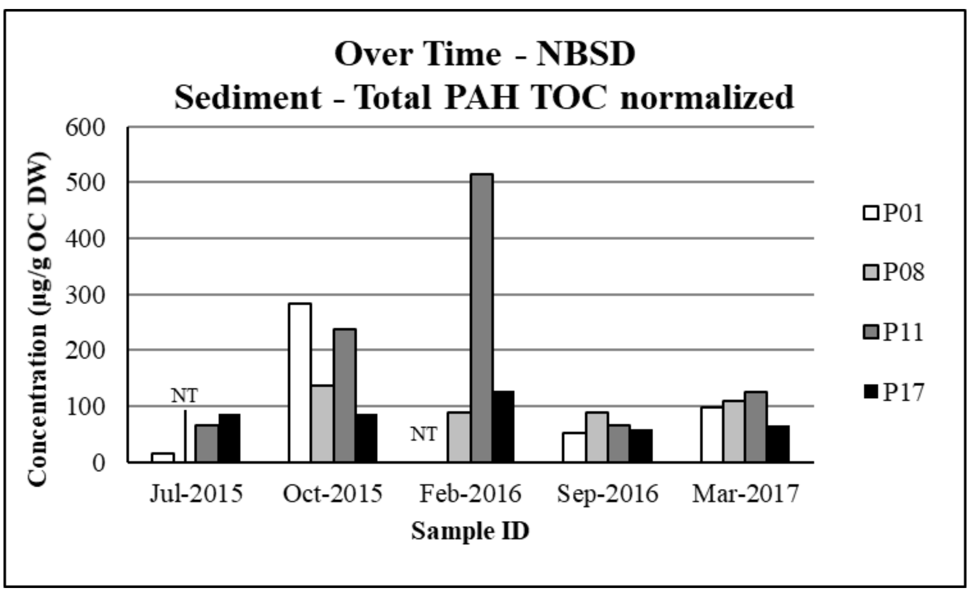


Figure 3-194. Concentrations of PAHs normalized to total organic carbon in bulk sediment over time at NBSD.

Total pyrethroid pesticides measured in the bulk sediment samples over the course of the sampling efforts showed seasonal increases for each sampling season for stations P08, P11 and P17 (Figure

3-195). Interestingly, station P01 showed the opposite trend with decreasing concentrations following the typical rain season for the San Diego area.

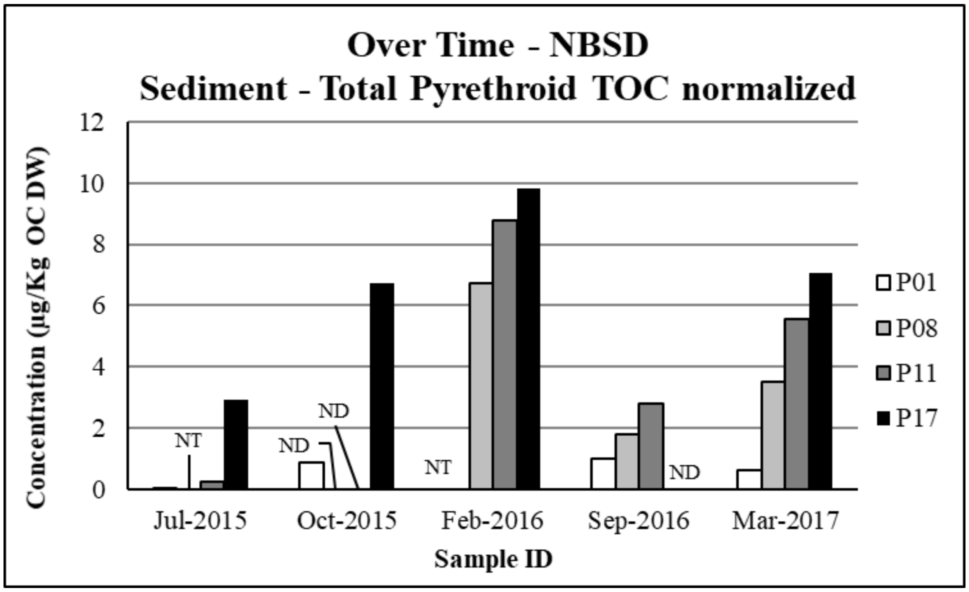


Figure 3-195. Concentrations of pyrethroid pesticides normalized to total organic carbon in bulk sediment over time at NBSD.

PCBs analyzed in bulk sediments showed significant increased concentrations at P11 for the first wet weather season of 2015-2016. However, concentrations dropped dramatically at the onset following season (Figure 3-196). Post wet-weather samples for 2016-2016 (i.e. Mar-2017) are not reported herein.

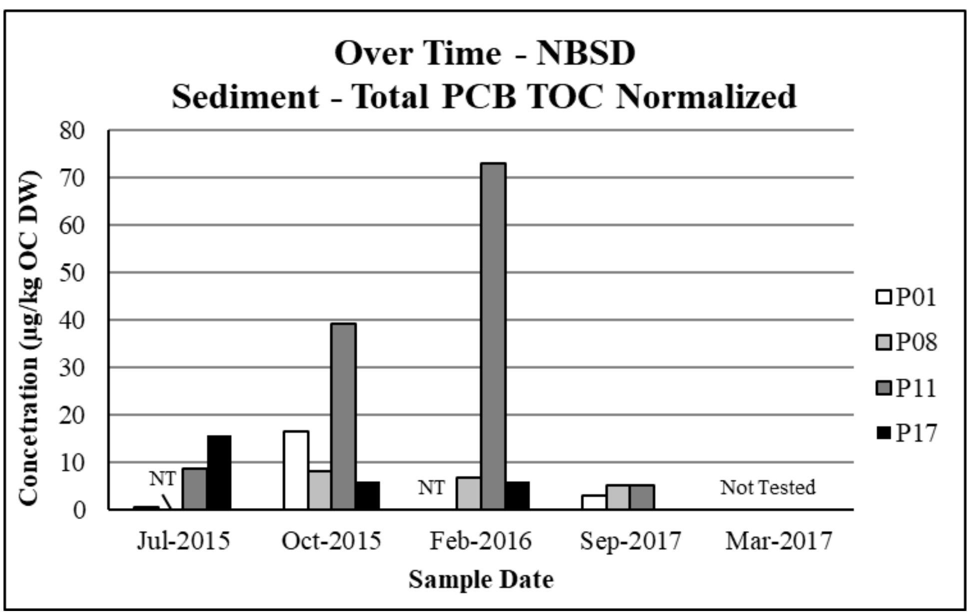
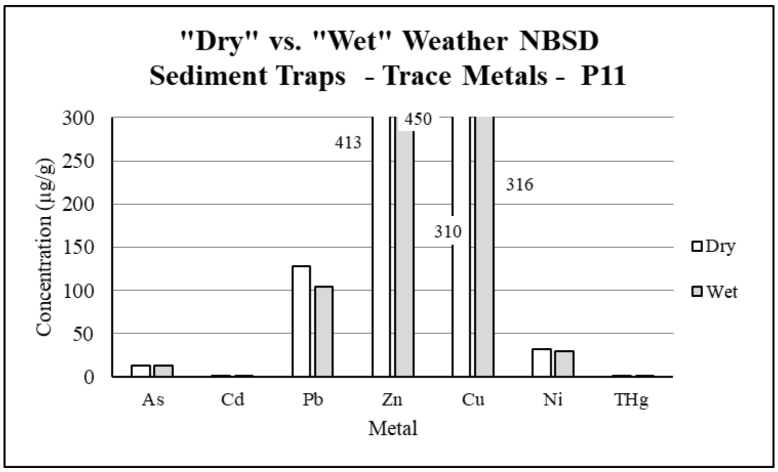


Figure 3-196. Concentrations of PCBs normalized to total organic carbon in bulk sediment over time at NBSD.

3.5.2. *SEDIMENT TRAPS*

Sediment trap material analyzed for trace metals on a bulk basis showed decreases in concentrations from the “Dry Weather” deployment relative to the “Wet Weather” deployment. While the intention of the deployment in Jul-2015 was to characterize dry weather conditions, the San Diego region experienced a rain event with approximately 1.5” of measurable precipitation. The “Wet Weather” deployment of sediment traps were exposed to a number of rain events that totaled approximately 5.7” of precipitation.

Interestingly, at station P17, a decrease in metals in the bulk material was observed for the “wet” deployment compared to the “dry” deployment (Figure 3-197). For the other station that was deployed during both events (P11), similar decreasing in metal concentrations was observed for lead, nickel and mercury.



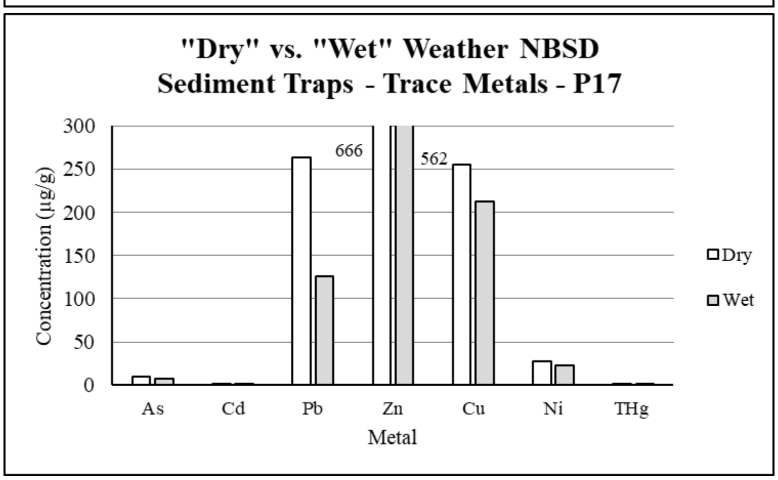


Figure 3-197. Concentrations of trace metals in bulk sediment trap material from “Dry” and “Wet” weather deployments at station P11 (top) and P17 (bottom).

PAH, PCB and pyrethroid concentrations at stations P11 decreased from the “Dry” to the “Wet” deployments (Figure 3-198). PAH concentrations also decreased over time at station P17. However, pyrethroid concentrations increased at station P17 from the “Dry” to the “Wet” deployments.

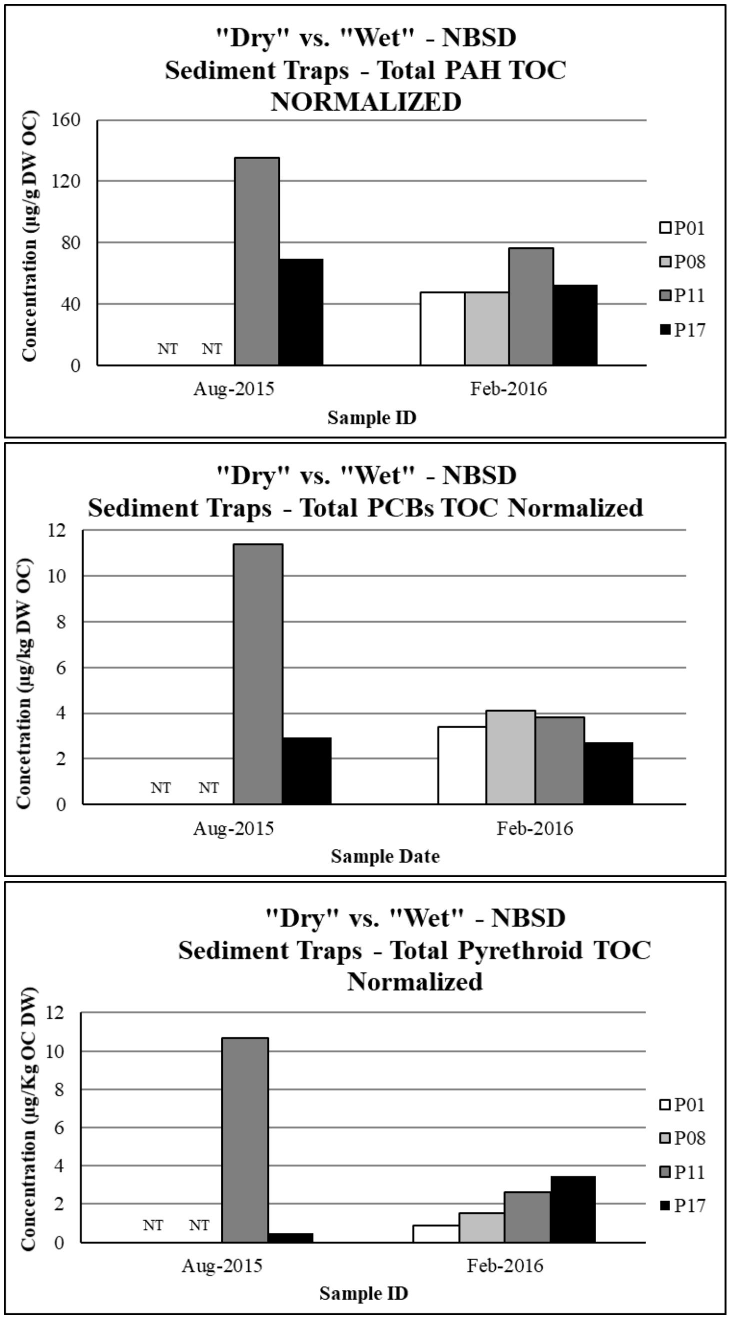


Figure 3-198. Concentrations of PAHs (top), PSBs (middle), and pyrethroids (bottom) normalized to total organic carbon in bulk sediment trap material from “Dry” and “Wet” weather deployments.

3.5.3. *POREWATER*

Sediment porewater concentrations of chlordane derived from SPME extractions show a trend of increasing concentrations over time for all stations. There appears to be a seasonal trend with slightly higher measurements in the "wet" season samples (i.e. Feb-2016 & Mar-2017) relative to the "dry" season samples (i.e. Oct-2015 & Sep-2016) for most of the stations (Figure 3-199).

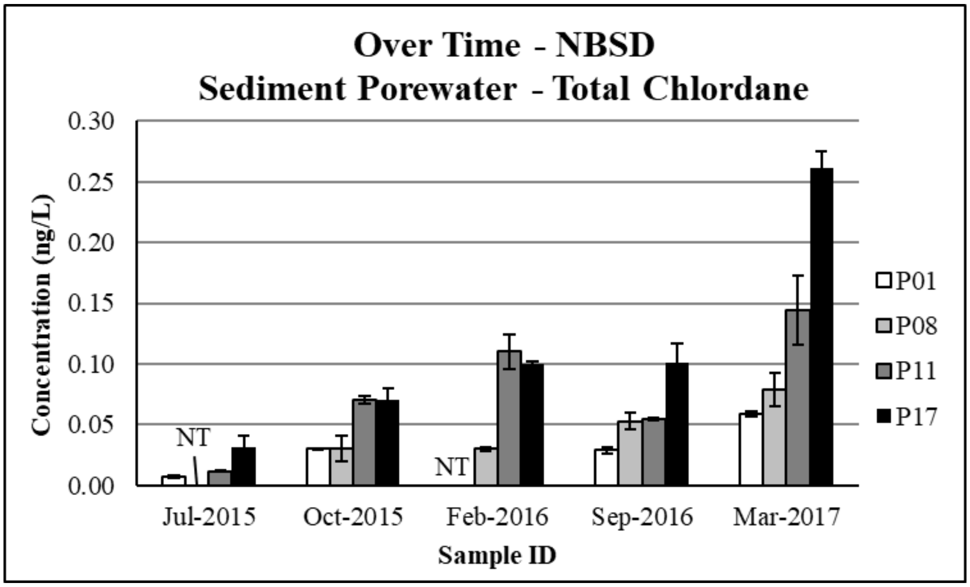


Figure 3-199. Concentrations of chlordane in sediment porewaters as derived from SPMEs sediment over time at NBSD.

3.5.4. *TISSUE CONCENTRATIONS*

Concentrations of constituents of concern associated with the tissues of the clam *Macoma nasuta* were evaluated over the course of the sampling efforts (Figure 3-200). Spatial patterns existed within a given sampling event for several for several metals. For example, for copper, nickel and lead, concentrations increased towards the mouth of Paleta Creek for the Sep-2016 sampling event, but this trend was not as strong or wasn't present for other sampling efforts. For total mercury, the spatial trend of decreasing concentrations towards the mouth of Paleta Creek was observed for almost all of the sampling efforts. At station P17, there might be a potential season trend of decreasing total mercury concentrations in sampling efforts following the rainy season (i.e. $[Hg_{Feb\text{-}2016}] < [Hg_{Oct\text{-}2015}]$ and similarly, $[Hg_{Mar\text{-}2017}] < [Hg_{Sep\text{-}2016}]$).

Total PAH concentrations associated with clam tissue generally increased over time for all stations except for P11, which had a very high concentration at in early sampling events (i.e. Jul-2015; Figure 3-201). Station P08 showed PAH concentrations that increase over time, with a slight decrease during the Sep-2016 sampling event and then an increase for the final sampling event in Mar-2017.

Total PCBs don't seem to show seasonal trends (Figure 3-202). The pesticide chlordane associated with tissues of the clam showed increasing concentrations over time as well as a spatial trend of increased concentrations towards the mouth of Paleta Creek (Figure 3-203).

Dec 1988 – Total Chlordane – 10.1ww

May 1993 – total chlordane 0.44

860, 1470, 1683, 3623 total PAH

113.2, 124.8, 222.3 total PCBs

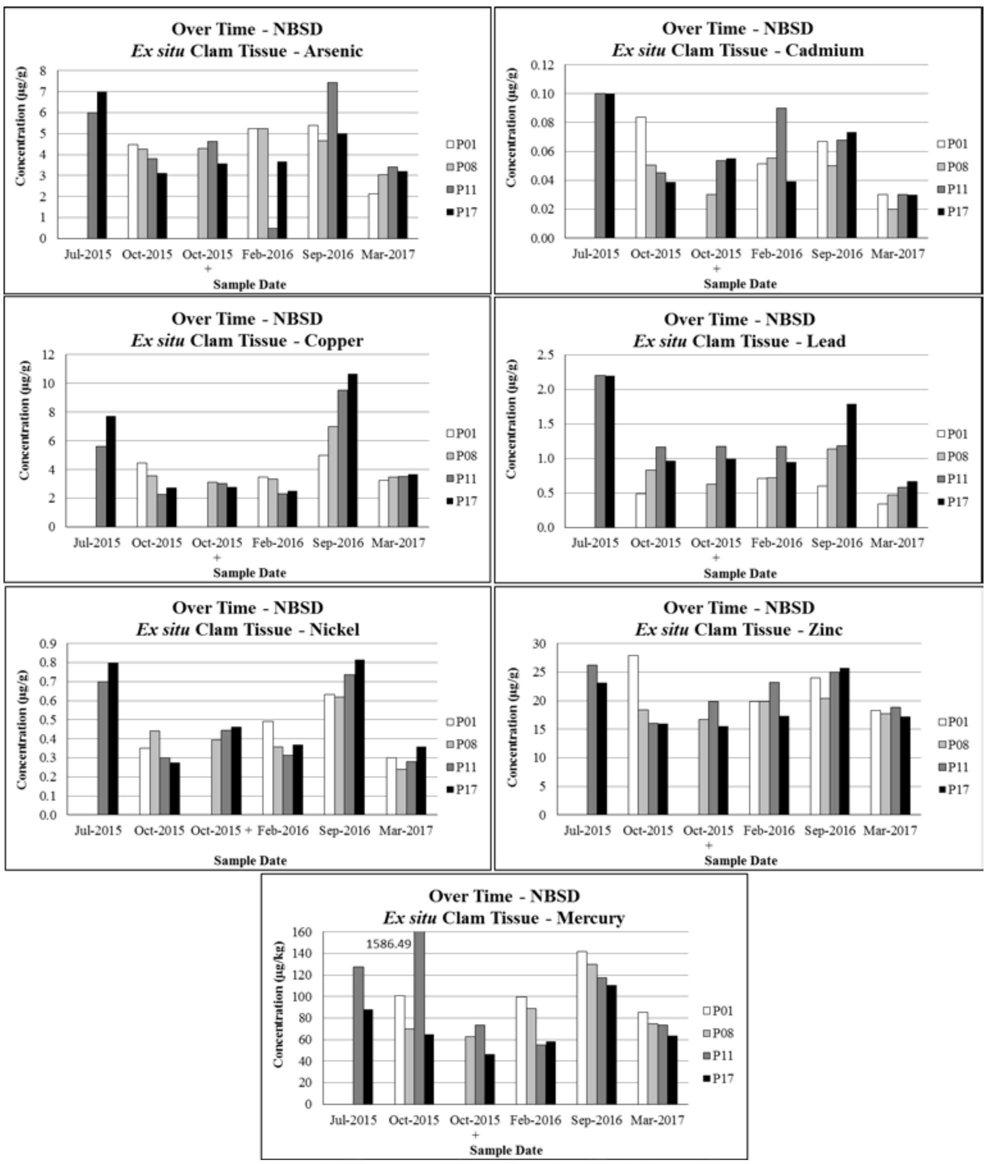


Figure 3-200. Concentrations of trace metals associated with the tissues of the bent-nosed clam *Macoma nasuta* over time at NBSD from *ex situ* exposures. Note: "+" below Oct-2015 date indicates the sediment trap material additive treatment.

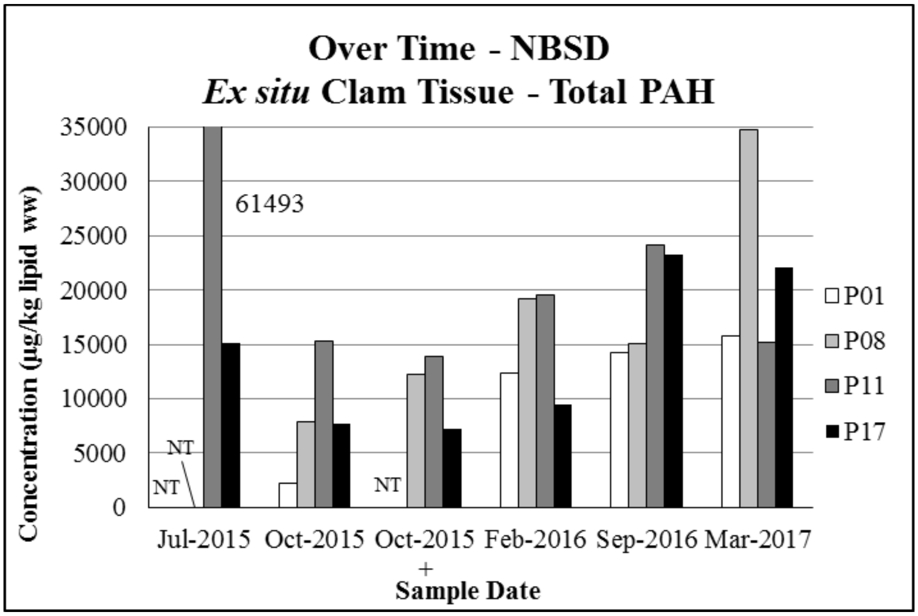


Figure 3-201. Concentrations of PAHs associated with the tissues of the bent-nosed clam *Macoma nasuta* over time at NBSD from *ex situ* exposures. Note: "+" below Oct-2015 date indicates the sediment trap material additive treatment.

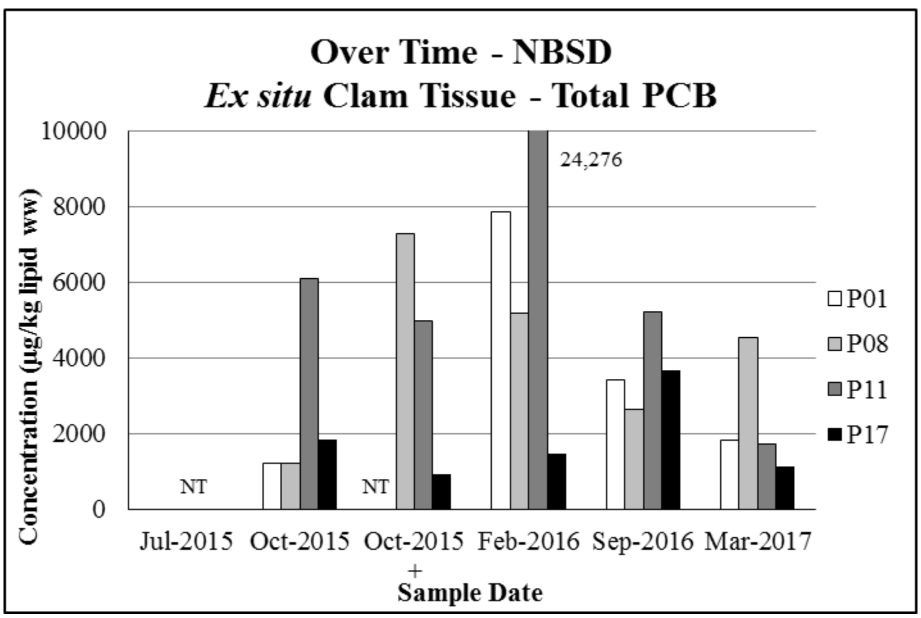


Figure 3-202. Concentrations of PCBs associated with the tissues of the bent-nosed clam *Macoma nasuta* over time at NBSD from *ex situ* exposures. Note: "+" below Oct-2015 date indicates the sediment trap material additive treatment.

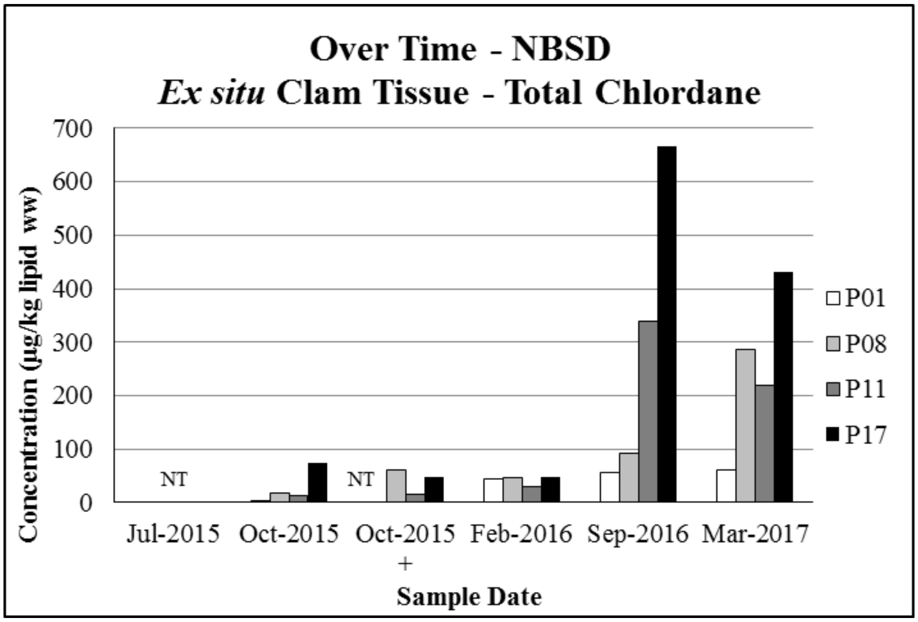


Figure 3-203. Concentrations of chlordane associated with the tissues of the bent-nosed clam *Macoma nasuta* over time at NBSD from *ex situ* exposures. Note: "+" below Oct-2015 date indicates the sediment trap material additive treatment.

3.5.5. *ORGANISM RESPONSE*

Evaluations of amphipod response over the course of the sampling events were conducted. The acute toxicity endpoint of survival relative to precipitation observed over the course of the sampling efforts is shown in Figure 3-204. Figure 3-205 shows a more focused view of the survival of the organisms for each sampling event without precipitation. As previously mentioned, there is a clear spatial pattern associated with toxicity increasing towards the mouth of Paleta Creek. It is also apparent that with increasing precipitation, toxicity to the amphipod increases as well over the course of the two storm seasons evaluated. One-way ANOVA analyses were performed for each station to determine if there was an effect of sampling date. All stations except for the reference station of P01 showed significant effects of sampling date on the survival of the amphipod (P01: $p = 0.057$; P08/P11/P17: $p < 0.001$; Figure 3-205).

To determine if a significant spatial effect was observed within a given effort, one-way ANOVAs were conducted (Figure 3-206). For the sampling effort of Jul-2015, no significant spatial effect was observed ($p = 0.836$). For the Oct-2015 event, a significant effect was observed ($p <0.001$) and post-hoc pairwise comparisons showed significant differences between the groupings of the outer creek samples (P01 & P08) and inner creek samples (P11 & P17). For the Feb-2016 sampling effort, a post-storm season sampling effort, all stations were shown to be significantly different from one another, with the most toxic response at P17 ($p < 0.001$). During the dry or pre-storm season sampling effort of Sp-2016, no significant differences were observed among the stations ($p = 0.063$). And similar to the post-storm event of Feb-2016, the post-storm event of Mar-2017 also showed a significant effect of sampling location ($p < 0.001$).

A closer examination of the 2015/2016 wet weather efforts was conducted looking at the sediment trap material additions to the *ex situ* bioassay performed. As already discussed an increase in toxicity was not only observed spatially, but a seasonal effect was also observed. In addition, mortality was greatest when the stormwater-associated particles from the sediment traps were added to the moderately toxic Oct-2015/ “pre-storm” cores. These results suggest that stormwater-associated particulates are contributing to the recontamination of these sediments, and that the observed toxicity is relatively ephemeral (Figure 3-207).

Correlation analyses were performed on the amphipod survival against the constituents of concern in the bulk sediments to assess possible drivers of toxicity. Measured pore water concentrations of metals (Cd, Cu, Ni. Pb, Zn, Hg), PAHs, PCBs, DDE, and chlordane are well below literature LC_{50} for *Eohaustorius estaurius.* Thus far, pyrethroid pesticides are the most highly correlated with amphipod toxicity. Using literature-based concentrations that elicit 50% mortality (LC_{50}), toxic units were calculated by summing the individual pyrethroid constituents. Pyrethroid summed TUs showed a significant correlation to amphipod toxicity (Figure 3-208; $r = -0.83$, $p = <0.001$). This result is similar to other recent finding with respect to amphipod sensitivity (e.g. Greenstein et al. 2014, Holmes et al. 2008). However, the TU analysis suggests that pyrethroids are not solely responsible for the observed toxicity and it is likely that a mixture of unmeasured contaminants are causing toxicity.

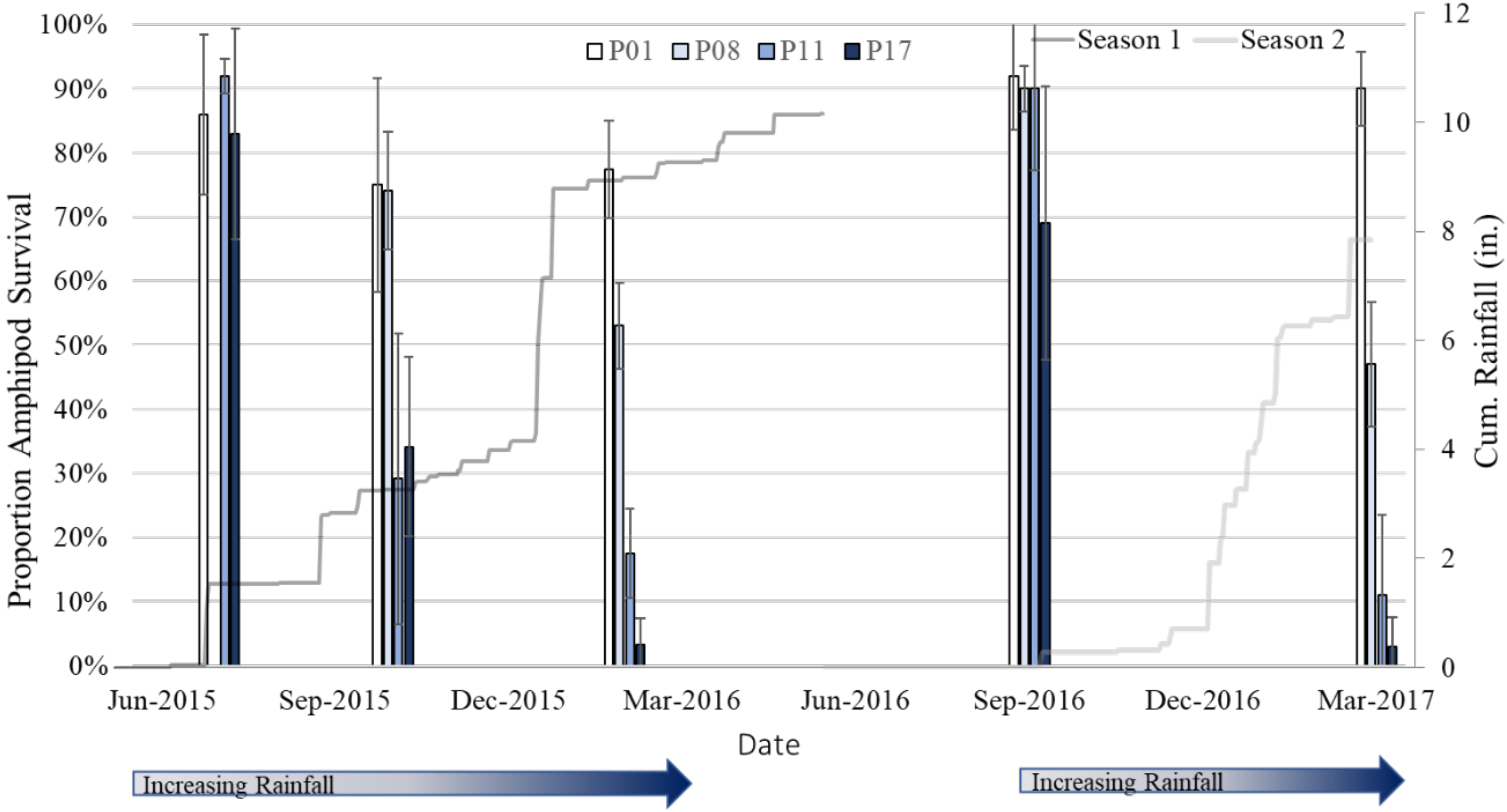


Figure 3-204. Survival of the marine amphipod, *E. estuarius,* over time along with cumulative precipitation for each storm season monitored for NBSD.

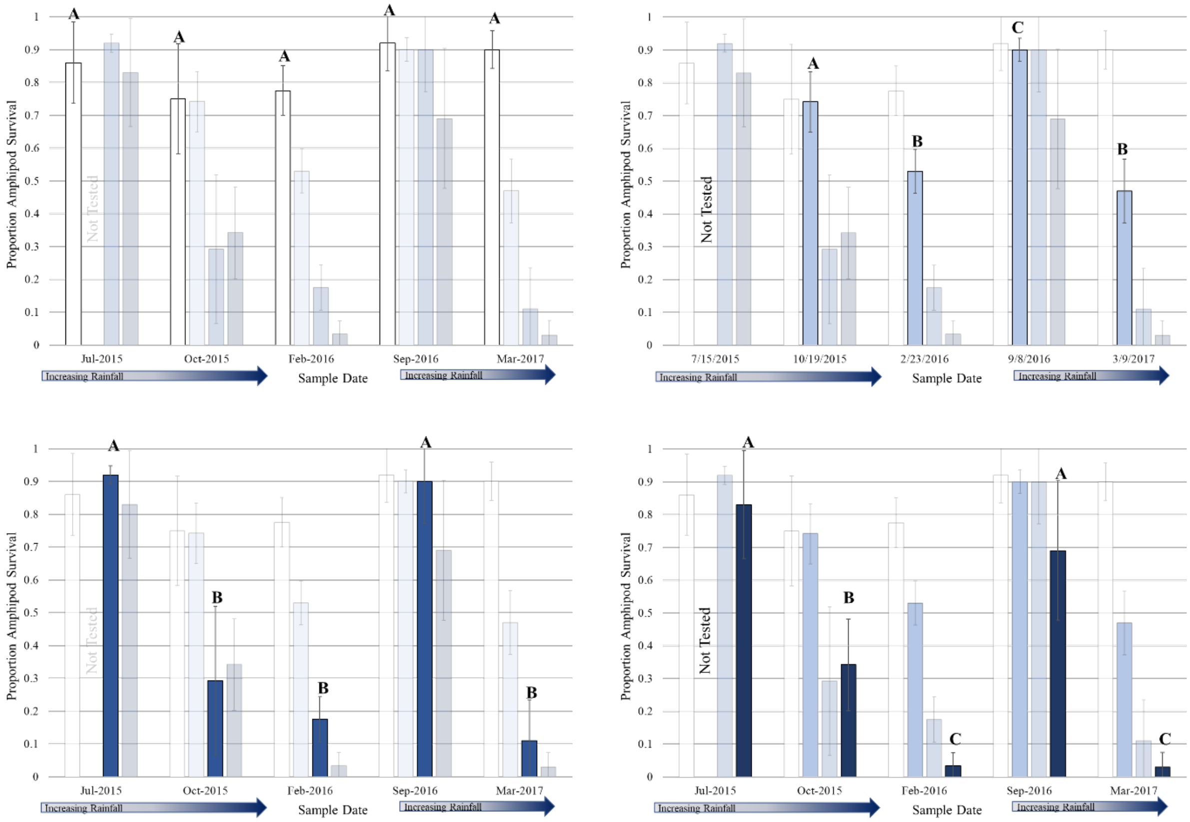


Figure 3-205. Survival of the marine amphipod, *E. estuarius*, for each sampling effort monitored at NBSD. Within each station, pairwise comparisons are shown with letters to indicate if a significant effect of sampling date was observed. P01 – upper left, P08 – upper right, P11 – lower left, P17 – lower right.

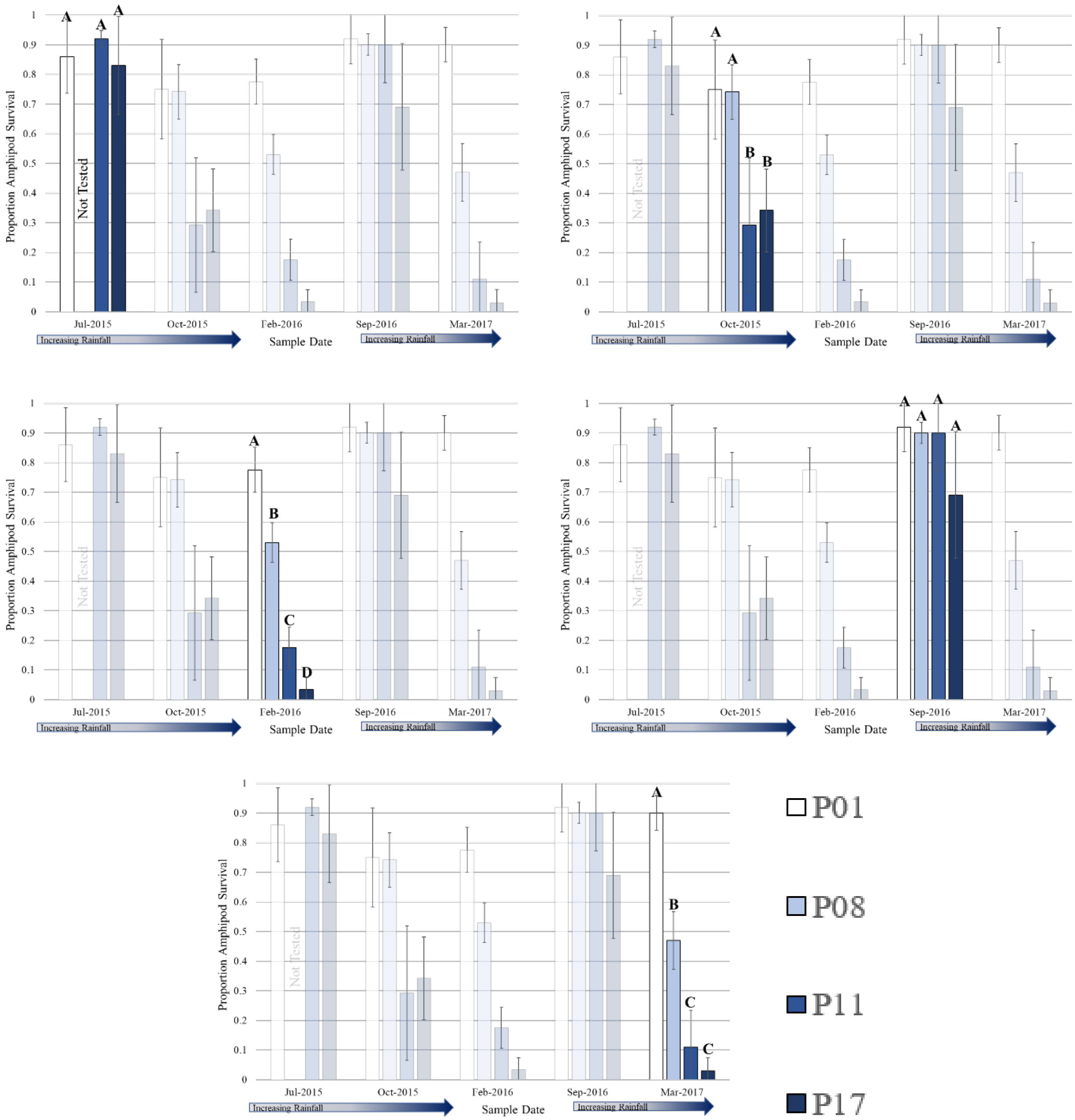


Figure 3-206. Survival of the marine amphipod, *E. estuarius*, for each sampling effort monitored at NBSD. Within each sampling event, pairwise comparisons are shown with letters to indicate if a significant effect of sampling location was observed. Jul-2015 – upper left, Oct-2015 – upper right, Feb-2016 – middle left, Sep-2016 – middle right, Mar-2017 – low center.

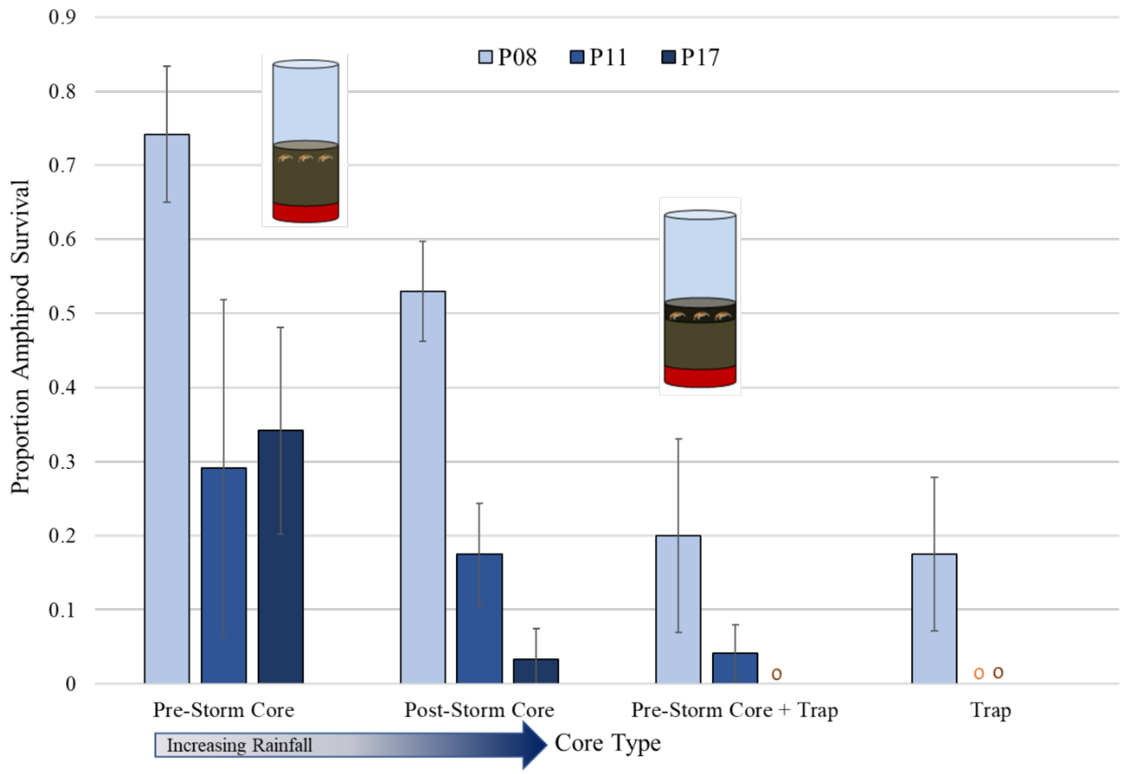


Figure 3-207. Survival of the marine amphipod, *E. estuarius*, for the 2015/2016 sampling season using intact sediment cores and sediment trap material treatments.

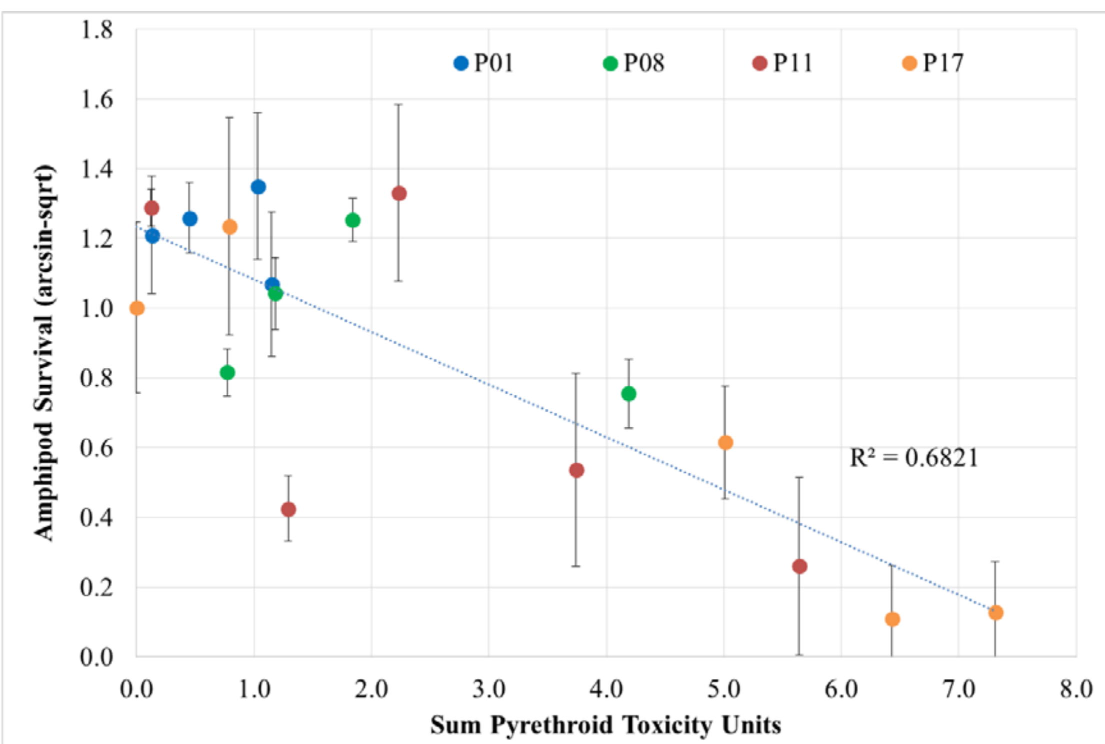


Figure 3-208. Amphipod survival versus summed toxic units (TUs) for pyrethroid pesticides.

3.6. 2016/2017 MONITORING – PSNS

3.6.1. *EFFLUENT & AMBIENT WATER TOXICITY*

Toxicity testing was conducted on 7-Dec-2016 and 29-Mar-2017 using the sea urchin embryo-larval development test as described in section 2.4.3. Test results for met test acceptability criteria of ≥80% normal larval development for the sea urchin tests for both testing periods. All water quality parameters measured were within the recommended ranges for the duration of the tests. Raw test data and bench water quality sheets are provided in Appendix E.

All data presented were deemed acceptable for reporting purposes. Some minor deviations from EPA and internal protocols occurred and were noted on raw data sheets. A thorough review of the data and test procedures for the sea urchin embryo-larval development tests did not identify any likely impacts on test results of these deviations. A glossary of the qualifier codes used on the test datasheets is provided in Appendix F.

All tests were conducted within the required 36-hour holding time from completion of sample collection. Samples were hand couriered by SSC Pacific personnel and the temperatures of the samples were within the EPA recommended range of 0-6°C upon receipt at the SSC Pac Laboratory. Samples immediately processed for same-day test initiation.

Standard reference toxicant tests with copper that were conducted concurrently with the stormwater evaluations had median effective concentration (EC_{50}) values within two standard deviations of the internal historical mean, indicating sensitivity to copper was consistent with that historically observed for this organism (Table 3-41). Statistical analyses to calculate median effective concentrations and confidence intervals were conducted with the statistical software Comprehensive Environmental Toxicity Information System (CETIS) v1.8.7.16 (Tidepool 2012).

Table 3-41. 2016/2017 Wet Weather PSNS Results Summary for the Copper Reference Toxicant Tests Conducted Concurrently with the Purple Sea Urchin for *Ex Situ* Water Exposures.

Toxicity Testing Date	EC50 (µg/L copper)	Historical mean ± 2 SD (µg/L copper)
7-Dec-2016	17.3	19.0 ± 9.2
29-Mar-2017	12.3	18.7 ± 9.3

Water quality parameters of the effluent and ambient samples upon receipt at the SSC Pacific Bioassay Laboratory are summarized in Table 3-42. Due to the low salinities of the samples upon collection, the addition of hypersaline brine was required to meet testing parameters for the purple sea urchin embryo-larval development test. This resulted in decreasing the overall concentration of each sample. The highest concentration tested for each sample is shown in Table 3-43.

Statistical analyses for the sea urchin embryo-larval development tests were performed against the brine control, as brine was added to increase the salinity of all the samples. Statistical analyses were conducted using two-sample t-tests or the USEPA (2010) Test for significant toxicity. The

TST method examined whether the results of a given sample relative to its respective control differs by an a priori prescribed amount rather than whether they are the same, as in traditional hypothesis testing (USEPA 2010). For the sea urchin test, the a priori critical percent difference is set at 25%.

Table 3-43 summarizes the mean percent normal embryo-larval development for each of the storm events sampled. Figure 3-209 shows the mean percent normal for the highest concentration tested for both sampling efforts. The effluent samples were tested in a 0.5 dilution series with separate laboratory and brine controls. The ambient samples were tested separately each with their own laboratory and a brine control.

Development values ranged from 92.8 to 99.4% and from 94.4 to 98.4% for the first and second sampling events, respectively. For both sampling events, the highest concentration tested for the effluent sample OF18 showed significant differences from their respective brine controls as well ambient sample PS06 for the first sampling event. Significant differences in the three cases observed is due to low variability in the mean percent development in both the controls and the effluent and ambient samples tests. However, using the USEPA TST method for analysis, no toxicity was observed in either the effluent or ambient samples compared to their respective brine controls, which is a more biologically relevant result.

Table 3-42. 2016/2017 Wet Weather PSNS Effluent and Ambient Water Quality Parameters Measured Upon Receipt at the SSC Pacific Bioassay Laboratory.

Sample ID	7-Dec-2016 Event				29-Mar-2017 Event			
	pH (units)	DO (mg/L)	Temp (°C)	Salinity (ppt)	pH (units)	DO (mg/L)	Temp (°C)	Salinity (ppt)
OF18AB	7.41	7.7	1.1	21.8	7.76	7.7	5.0	19.7
OF19	7.59	9.0	1.1	17.4	7.58	8.2	5.0	15.5
PS06	7.57	9.0	1.1	28.0	7.66	8.2	5.0	26.0
PS09	7.60	9.0	1.1	28.3	7.76	8.3	5.0	26.1

Table 3-43. 2016/2017 Wet Weather PSNS Proportion Normal Development of the Purple Sea Urchin for *Ex Situ* Stormwater Exposures.

Sample ID	7-Dec-2016 Event			29-Mar-2017 Event		
	Concentration of Sample (%)	Mean Normal Development (%)	SD	Concentration of Sample (%)	Mean Normal Development (%)	SD
Lab Control	NA	98.4	1.7	NA	97.4	1.1
Brine Control	NA	98.0	1.6	NA	98.4	2.5
OF18AB	6.25	98.8	1.1	6.25	97.6	1.1
	12.5	99.4	0.5	12.5	97.6	2.3
	25	99.0	1.0	25	96.4	1.9
	50	97.0	4.1	50	96.8	2.3
	79.7	**92.8***	5.0	76.9	**94.4***	3.6
Lab Control	NA	99.2	1.1	NA	96.2	2.2
Brine Control	NA	98.2	1.9	NA	95.4	1.1
OF19	6.25	98.4	1.5	6.25	97.6	0.9
	12.5	98.8	1.3	12.5	97.4	0.9
	25	99.4	0.9	25	98.1	1.2
	50	99.0	0.7	50	97.8	2.2
	74.3	98.0	1.9	72.1	98.6	1.7
Lab Control	NA	97.6	1.9	NA	97.0	2.0
Brine Control	NA	99.2	0.4	NA	97.4	1.3
PS06	88.9	**97.4***	1.5	85.6	97.6	1.5
Lab Control	NA	97.8	1.5	NA	97.0	2.0
Brine Control	NA	99.2	1.3	NA	97.4	1.3
PS09	89.4	97.4	1.7	85.8	98.2	1.1

"-" – not tested. Values in **BOLD** indicate statistical significance compared to the brine control.
*Using USEPA (2010) Test for Significant Toxicity, samples were determined to be non-toxic.

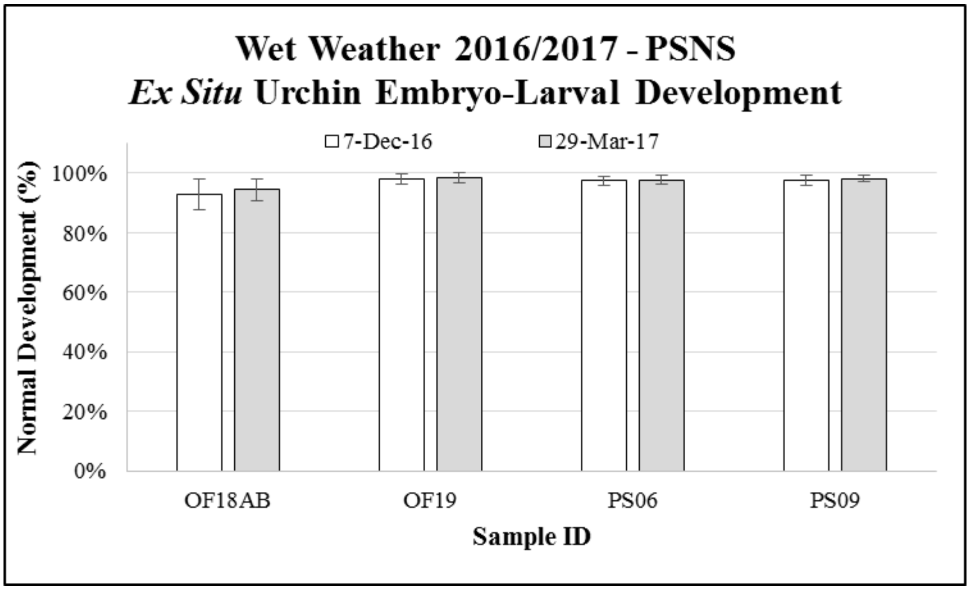


Figure 3-209. Mean percent normal development for the chronic Sea Urchin embryo-larval test on effluent and ambient samples collected 7-Dec-2016 and 29-Mar-2017 for the 2016/2017 Wet Weather sampling effort at PSNS.

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Appendix III
Paleta Creek, San Diego, Stormwater Monitoring and Data Analysis Report

Assessment and Management of Stormwater Impacts on Sediment Recontamination
ORSP Number 13-PAF05133

Strategic Environmental Research and Development Program (SERDP)

Prepared by

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September 2017

Contents

Summary Section: Summary and Conclusions

Abstract

In 2013, the team led by Texas Tech University, and consisting of researchers from the University of Michigan, the U.S. Navy's Space and Naval Warfare Systems Command (SPAWAR), and the University of Alabama, and Geosyntec were awarded grant funding through the Strategic Environmental Research and Development Program (SERDP) to study the role of urban stormwater in the recontamination of previously dredged sites. The primary study site for this project was Paleta Creek, San Diego, containing portions of Naval Base San Diego (NBSD) along with an extensive upper urbanized watershed in San Diego and National City, CA. The NBSD location was chosen to leverage past and ongoing studies as well as the research team's familiarity with the location. The monitoring data was used to refine existing stormwater models used to predict drainage area-specific loading rates, particulate strengths (concentration of pollutants per suspended sediment mass), and particle size associations (and therefore settling distances from points of discharge). Collectively, this information, along with the concurrent receiving water studies conducted by other study team members, describes the risk of bed sediment recontamination from stormwater discharges. Sediment recontamination risk is defined here as the likelihood of receiving water sediment cleanup efforts being impacted by ongoing long-term loading of suspended sediment from stormwater discharges, and it is primarily driven by the following site specific factors/variables, many of which were investigated within this project:

- suspended and bedload sediment mass loading and particle size distribution,
- pollutant-particle size association (fractionation) and particulate strength (particularly relative to local sediment assessment and/or cleanup criteria, and thresholds reflecting biota impact), and
- near-field settling distances (which are based in part on local receiving water hydrodynamics).

Wet weather stormwater composite sampling of NBSD stormdrain outlets and creek locations was conducted during the 2015/16 wet season. Equipment was deployed on October 13, 2015, but due to unusually dry weather, the onset of the wet season was delayed. Two qualifying monitoring events were sampled on January 4-8, 2016 and January 30-31, 2016. The monitoring program was able to successfully collect stormwater from most targeted locations, despite significant challenges associated with a highly tidally influenced water body, multi-leveled complex sampling triggers to target freshwater sample collection, and unusually flashy hydrologic patterns.

Stormwater loads were characterized physically, chemically and ecologically (by other team members) considering the spatial and temporal dynamics of the dominant stressors. The characterization of stormwater sources of contaminants were identified through WinSLAMM stormwater quality modeling, conducted in conjunction with a review and summary of existing data on stormwater source characterizations and loadings (the National Stormwater Quality Database). Targeted sampling of stormwater sources was conducted to complement the existing data bases and source characterization. These data were used in conjunction with a local version of the WinSLAMM stormwater quality model previously calibrated during prior Navy modeling efforts at NBSD.

The calibrated stormwater modeling enables calculations of stormwater discharge characteristics as determined by specific drainage area features and activities, and season. These stormwater loading calculations, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and associated settling rates) can be used to help quantify the

recontamination potential of the sediments by stormwater discharges and to compare to the receiving sediment recontamination measurements being obtained by other project researchers.

Many of the metals and PAHs analyzed were found to have significant correlations with the particulate solids concentrations, while no statistically significant differences were found in total, filtered, or particulate pollutant strength concentrations for the different sampling locations. The number of samples available would allow differences larger than about 50% to be identified as being significant. The sediment particle size distributions (PSD) were similar for both events for the NBSD locations, with less than 10% of the particulates being larger than 100 µm in size. The upper watershed stormwater PSD varied more between the two events, with 15 and 40% of the particulates greater than 100 µm. A few of the largest particle size (>63 µm) for the NBSD sites had much larger concentrations for many constituents than other particle size ranges, resulting in increased importance of the large particle sizes. This has been noted in other industrial area stormwater monitoring as some large oily and/or metallic debris are periodically present. The NBSD makes up about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and suspended sediment load. The NBSD contributions for the analyzed pollutants ranged from about 13% to as high as about 60%. The unit area pollutant loading rates (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area. The large particle size material from the upper watershed are likely from erosion sources in the watershed and from sediment scour in the upper, unchannelized natural bottom creek during runoff events. More than 75% of many metals and PAHs analyzed are associated with the largest particle size that would have near field effects on receiving water sediments. If deposited uniformly across the 9 acre area of impact at the creek mouth, and conservatively assuming zero export from the slip, this would equate to about one inch sediment accumulation over a 25 year period, as described later. These particles would require about an hour to settle 30 m in the receiving water. Far field effects (20 to 63 µm particles) would require about 50 hours to settle 30 m, while the smallest particles would require more than 500 hours to settle to this depth, and therefore both particle size categories might represent de minimus risk to local sediment cleanup efforts. Future investigations should evaluate near-field hydraulic retention time (travel time) at the mouth of Paleta Creek during storms to more accurately ascertain the relative risk of sediment recontamination at this specific location.

A number of stormwater controls could be used to reduce the discharges of the large particles of most interest, but would have to treat most of the very large volumes of runoff from the watershed for large reductions. Prior analysis as part of NBSD stormwater modeling efforts suggested that frequent street cleaning over most of the paved areas and catchbasins with sumps at inlets could target these large particles, but more effective reductions would be associated by using biofilters at paved locations. Future confirmation testing of these controls in the area would verify the performance of these potential stormwater controls. Erosion control and creek stability improvements would also reduce discharges of the large particulates from the upper watershed area, although these are much less contaminated compared to the lower watershed NBSD areas west of I5. Future research is needed to investigate alternative stormwater controls, considering likely criteria, cost-effectiveness, and unique aspects of naval facilities.

Sampling Locations

The Paleta Creek Watershed (approximately 2,000 acres) is located in National City and San Diego, CA. The Naval Base San Diego (NBSD) is located at the downstream portion of the watershed, while the upstream areas (east of I5) primarily consists of single-family residential land uses. Figure 1 is a map showing the land uses in the watershed.

Watershed and creek surveys were conducted to determine the detailed land use descriptions and land development characteristics needed for the watershed WinSLAMM water quality modeling and to determine pollutant sources and discharge variations, and stormwater control potential. Twenty subareas were used in the modeling for the different land use categories and locations in the watershed. WinSLAMM had previously been calibrated for San Diego area naval bases (along with Puget Sound, WA and Norfolk, VA facilities) during a previous project. These initial calibrations were based on facility monitoring data that had been collected over many years, but had only focused on a few critical constituents. The data collected during this SERDP project allowed the calibrations to be extended for the Paleta Creek watershed, especially focusing on the pollutant discharges by particle size category.

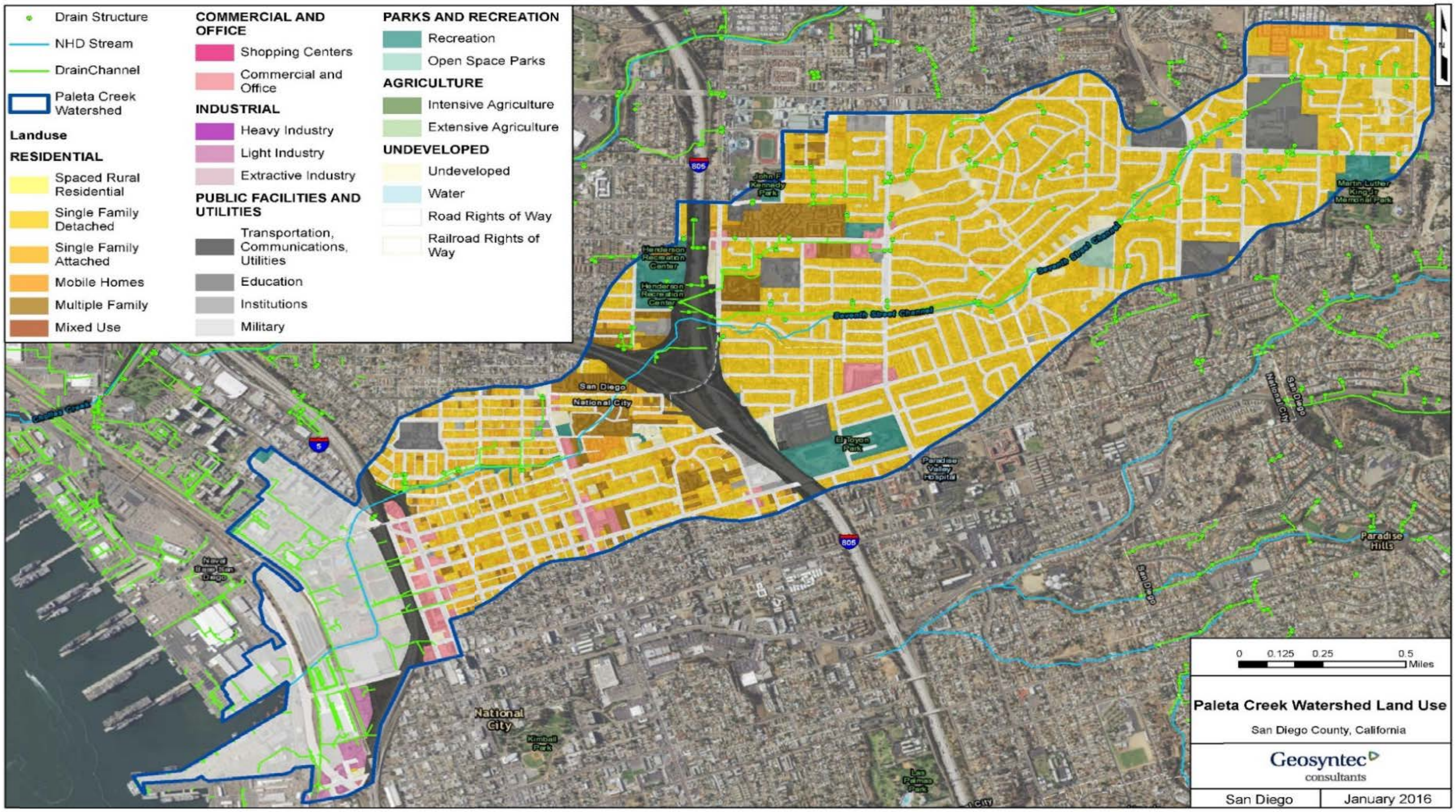


Figure 1. Paleta Creek Watershed Land Uses

Six monitoring locations were selected within the lower Paleta Creek watershed representing NBSD land uses, the upper urbanized watershed, and a downstream creek location affected by mixed flows from both NBSD and the upper watershed area. The outfall locations and associated drainage areas are shown Figure 2.

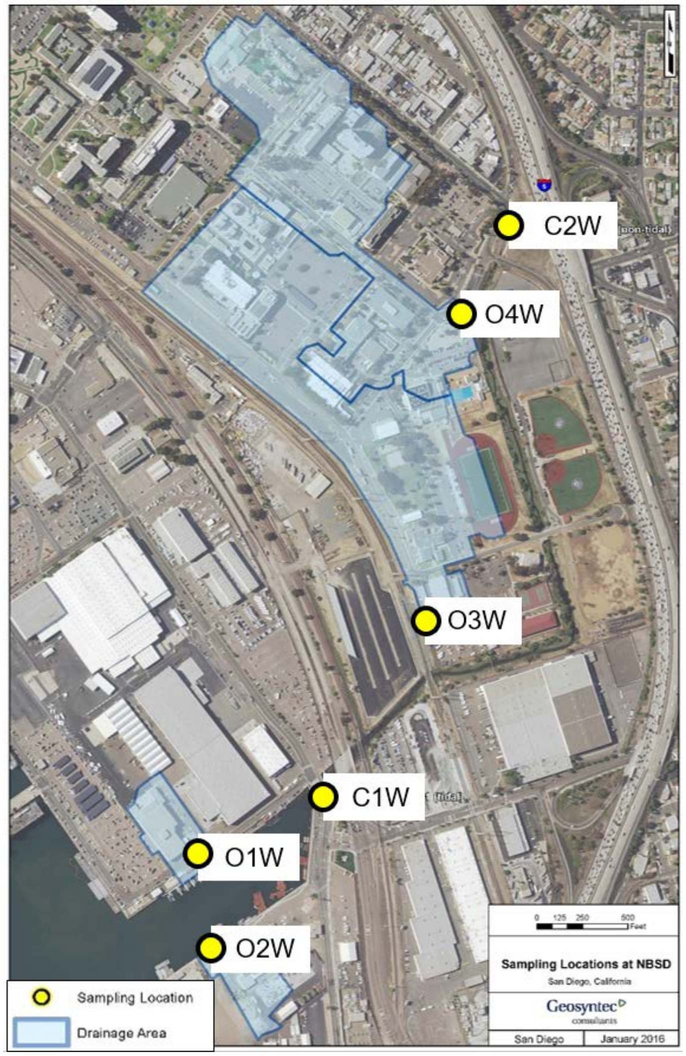
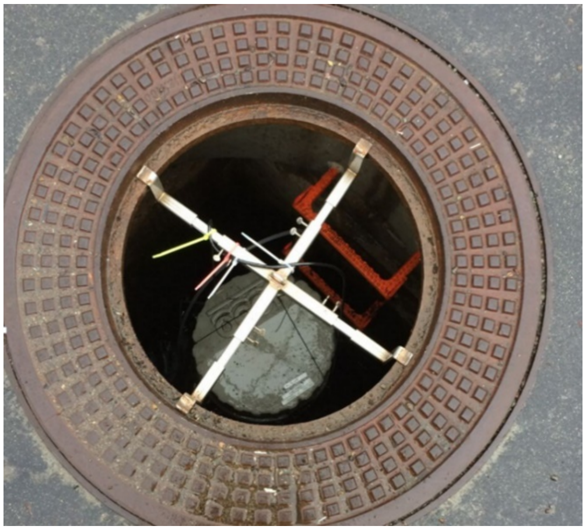


Figure 2. Drainage Area Characteristics for NBSD Outfalls

Stormwater Monitoring

ISCO 6712 automatic water samplers were deployed at all monitoring locations for the collection of time-spaced composite samples. ISCO AQ702 multi-parameter meters were also deployed at tidally influenced monitoring locations (C1W, O1W, O2W, and O3W) to measure salinity and target the collection of freshwater samples. ISCO 750 area-velocity (AV) meters were deployed at flow or depth-triggered monitoring locations (C2W, O1W, O2W, O3W, and

O4W). Figure 3 shows typical installations of automatic water samplers at manhole and surface locations.



Manhole sampling location example

Surface sampling example

Figure 3. Automatic water sampler installations.

Composite samples were split using a Teflon™ Dekaport sample splitter on-site by SPAWAR staff. The sample splitting and processing methodology is illustrated in Figure 4. The following parameters were analyzed:

- Metals (total and dissolved): Al, Cd, Cr, Cu, Fe, Pb, Zn, Hg
- PAHs
- PCBs and chlordane
- General: Total solids, TOC, BC, SSC, pH, carbonate, alkalinity, Cl, SO_4
- Particle Size Distribution

The analyses in this report focus on the particulate solids, metals, and PAHs. Sections 8 and 9 separately discuss PCBs and chlordane, as those data were evaluated after the metals and PAH data were available. The samples were analyzed for whole samples and also after being separated into four particle size ranges (0.45 to 5 µm; 5 to 20 µm, 20 to 63 µm, and >63 µm). These size ranges were selected to represent the expected majority of the particulate mass and those particles that could be most directly related to recontamination potential (near field for >63 µm, far field 20 to 63 µm, and distant effects for <20 µm). Larger particle size categories were not separately evaluated, even though they may have large particle masses, as they are captured in the >63 µm size range that would have near field affects. Larger particles would affect areas closest to the discharge locations.

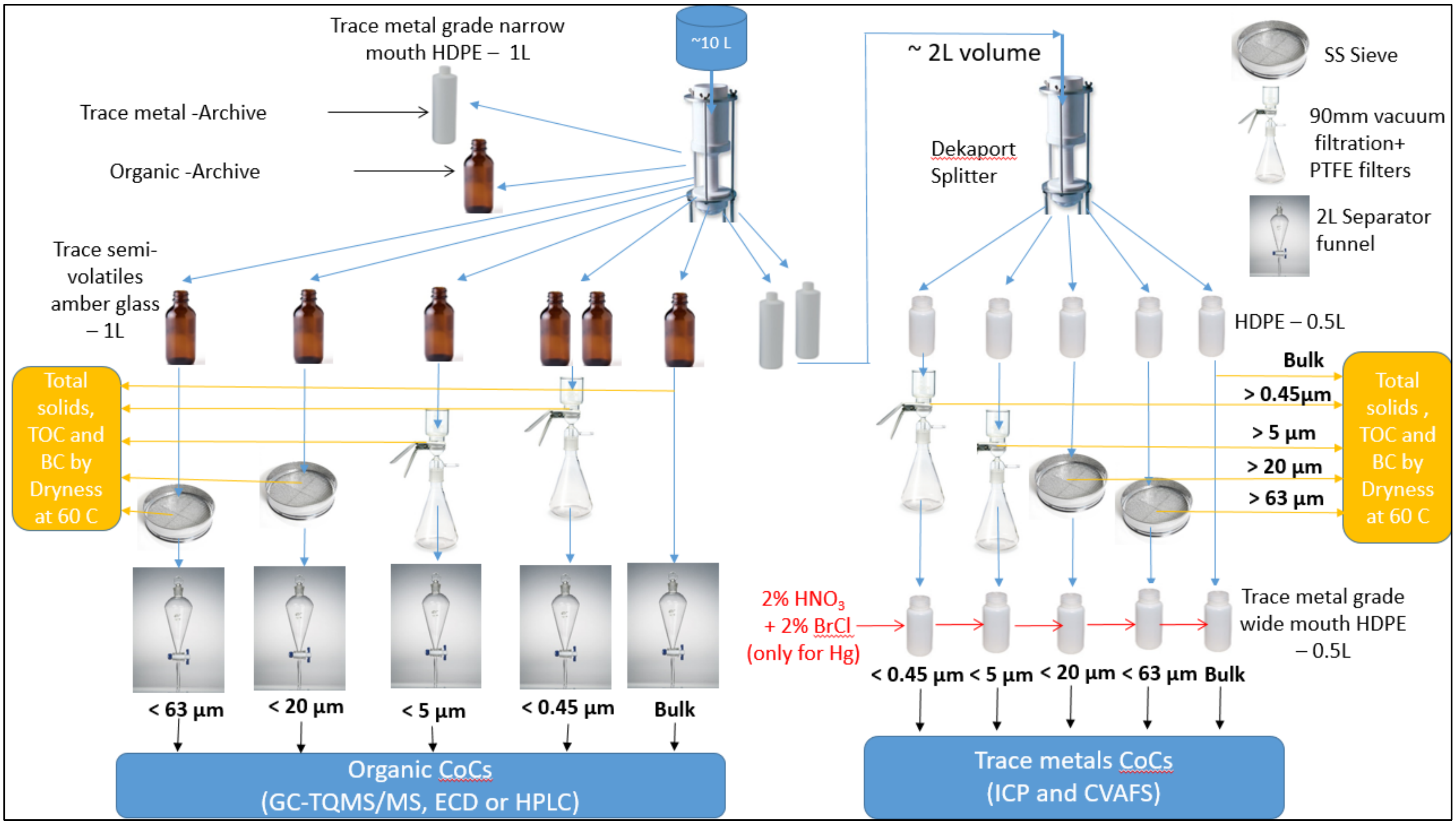


Figure 1. Composite sample splitting and analyses (Texas Tech diagram).

Two sample series were collected, per the project workplan, at the sampling locations. The first event was on January 4 to 8, 2016 and had 1.87 inches of rain. The second event was on January 30 to 31, 2016 and had 0.16 inches or rain. These two rains therefore represented both small and large rains for the area.

Data Evaluations

SERDP NBSD stormwater data collected for this project were compared for total, filtered, and pollutant strength concentrations. Pollutant strengths are calculated by dividing the difference between total and filtered concentrations by the particulate solids concentrations. It is a good measure of the important pollutant characteristics for a project concerned with sediment contamination. The stormwater samples were collected from four outfalls on the NBSD, in the main Paleta Creek channel before the NBSD and at several locations in the mouth of the creek representing mixed flows, as previously described in the sampling section. A total of 15 samples were collected during the two events. Each of the 15 samples were also separated into four particle size ranges for additional analyses.

Data Correlations

Pearson correlation analyses identify simple relationships between pairs of constituents. Significant correlations with the particulate solids were found with the total concentrations for:

- Metals: Cu, Zn, Cd, Pb, and Hg
- PAHs: fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, and benzo[k]fluoranthene

The following scatterplots (Figure 5) also show two sets of strong correlations between zinc and lead, and between chrysene and benzo[k]fluoranthene. Many other strong paired correlations were also identified as shown in the main report and appendices.

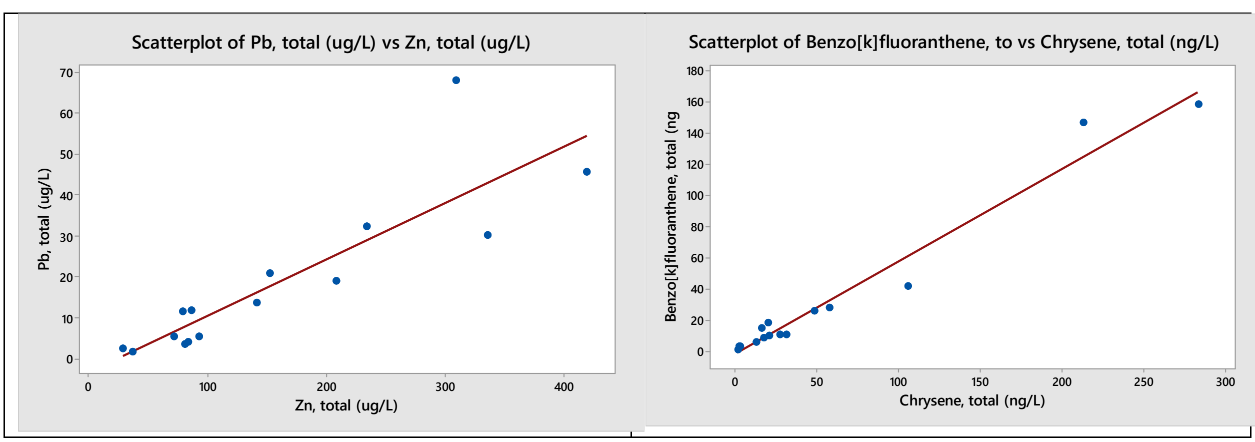


Figure 5. Example strong correlations between related constituents.

Multivariate analyses (Principal Components and Cluster tests) were also conducted using the concentration values. These identified more complex relationships between multiple sets of constituents. The following dendogram (Figure 6) from the Cluster analyses is for particulate strength concentrations, resulting in five main data groups:

Group one:
TOC, acenaphthene, and fluorene

Group two (weak):
Cu and Pb

Group three:
Zn, Cd, naphthalene, anthracene, and fluoranthene

Group four (strong):
Phenanthrene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, benzo[k]fluoranthene, pyrene, benzo[ghi]perylene+indeno, and dibenzo[a,h]anthracene

Group 5 (weak):
Ni and Hg

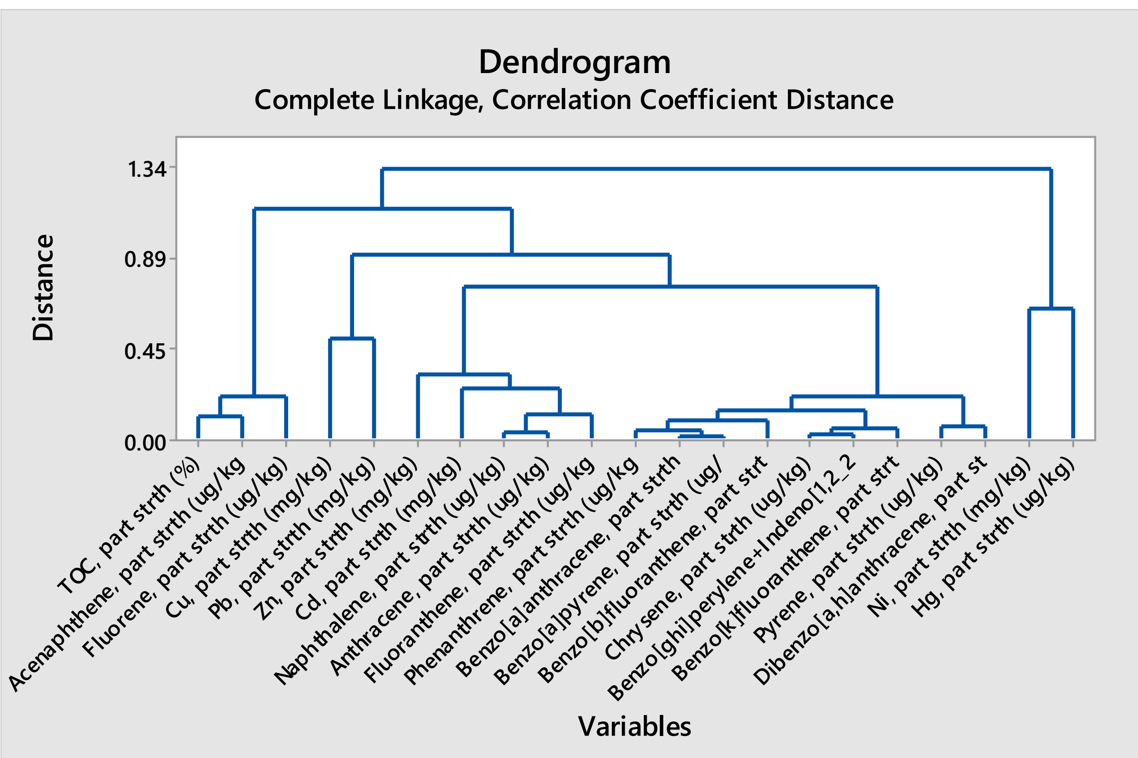


Figure 6. The PAH correlation groupings are more clearly defined than for the other constituents on this dendogram.

Sampling Location and Land Use Stormwater Concentrations

All total, filtered, and particulate strength data for each of the three sample categories were evaluated using several statistical analyses, including probability plots and Kruskal-Wallis (KW) tests to compare the data for each sample category. These tests were used to identify sampling location groups that were significantly different from the others (considering the sample variability and number of analyses available). Tables 1 and 2 shows selected median concentrations for these areas for total concentration and particulate strength data. The KW p values are all >0.05, indicating that there were no significant differences between the land use data sets, for the sample numbers available considering the concentration variability (refer to Figures 1 and 2 for sampling locations).

Table 1. Total Concentrations Compared from Different Sampling Locations

median concentrations (total)	mixed flow samples in Paleta Creek	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5)	upper watershed (mostly residential) (CW2 sampling location, east of I5)	Kruskal-Wallis p value (adjusted for ties)*	overall median
SSC, mg/L	203	91	511	0.15	184
Cu, ug/L	32.7	36.6	67.9	0.4	49.1
Pb, ug/L	11.7	8.2	37.8	0.23	11.7
Zn, ug/L	85.8	87.7	377	0.085	92.3
Anthracene, ng/L	1.95	7.05	nd	0.098	2
Benzo(a)anthracene, ng/L	10.9	16	46.1	0.67	18.6
Benzo(a)pyrene, ng/L	18.6	26.1	34.5	0.92	18.6
Chrysene, ng/L	16.5	21	44.7	0.58	21.2
Fluoranthene, ng/L	41	102	409	0.58	120
Naphthalene, ng/L	17	21.6	23.9	0.80	18
Phenanthrene, ng/L	28.9	40.6	164	0.40	37.3
Pyrene, ng/L	47.3	65	210	0.40	80

* no significant p values found for these comparisons. KW is a nonparametric test focusing on median values.

The SCCWRP report (Stein, *et. al*, 2007) report also summarizes stormwater monitoring data collected by SPWARS at other San Diego area bases, as summarized later in Section 6. These data are reported as total PAH concentrations (and total PCBs and chlordane). They are local concentrations and are of interest to this SERDP study, but are not available for the individual PAH compounds as shown in Table 1. Later phases of this SERDP research will acquire the basic data from the SCCWRP authors for comparison with the SERDP data and for other analyses, as was done with the Navy Base Point Loma (NBPL) data in Section 6 of this report.

Table 2. Particulate Strength Values* Compared from Different Sampling Locations

Particulate Strengths (median)	mixed flow samples in Paleta Creek	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5)	upper watershed (mostly residential areas) (CW2 sampling location, east of I5)	Kruskal-Wallis p value (adjusted for ties)**	overall median
Cu, mg/kg	103	138	164	0.51	121
Pb, mg/kg	55.4	79.5	103	0.92	61.9
Zn, mg/kg	754	599	938	1.00	628
Anthracene, ug/kg	3.11	1.62	nd	0.15	8.8
Benzo(a)anthracene,ug/kg	66	104	122	0.94	74.1
Benzo(a)pyrene, ug/kg	111	118	65.9	0.49	108
Chrysene, ug/kg	63	183	95	0.77	117
Fluoranthene, ug/kg	274	591	1,277	0.66	374
Naphthalene, ug/kg	23.5	54.5	43	0.36	25.1
Phenanthrene, ug/kg	104	125	224	0.94	104
Pyrene, ug/kg	371	389	571	0.92	386

* these are bulk sample values; particulate strength data by particle size ranges are shown in later sections of this report.

** no significant p values found for these comparisons. KW is a nonparametric test focusing on median values.

A literature review of stormwater particulate strengths described in the main body of this report was also conducted. These data are from many locations throughout the US. Source area sheetflow values (from selected research projects from CA, WI, AL, and other areas) are shown along with land use outfall data (from the National Stormwater Quality Database, which contains about 10,000 event observations from throughout the country). Estimated values from LA regional data are also shown (SCCWRP 2007). Filtered fractions were estimated based on observed values from this SERDP study, as no filtered concentrations were collected during the SCCWRP project. These are summarized in Table 3 and compared to the NBSD and upper watershed data collected during this SERDP study. The observed particulate strength values for the Cu SERDP Paleta Creek watershed are mostly less than reported previously. Some of the historical Pb particulate strength source area values reflect samples collected before non-leaded gasoline was commonly used, but the more recent outfall data are still greater than the SERDP observations. The zinc particulate strength values are closer to the historical residential and commercial area values, while the historical outfall Zn values are much greater than observed during this study. The recent heavy industrial site data also indicated much greater particulate strength values compared to the Paleta Creek watershed data.

Table 3. Particulate Strength Values as Reported during Past Studies (mg/kg)

	undeve. source areas (Pitt, et al. 1995)	resid. source areas (Pitt, et al. 1995)	comer. source areas (Pitt, et al. 1995)	indus. source areas (Pitt, et al. 1995)	resid. NSQD outfalls (Maestre 2005)	comer. NSQD outfalls (Maestre 2005)	indus. NSQD outfalls (Maestre 2005)	SE heavy indus. site (Eppakayala 2015)	LA County , all land uses combined, (SCCWRP 2007) (estimates)	this SERDP Paleta Creek study: NBSD lower watershed (O1W, O2W, O3W, and O4W west of I5)	this SERDP Paleta Creek study: mostly resid upper watershed (CW2 sampling location, east of I5)
Cu	14 to 90	35 to 250	100 to 180	74 to 1100	431	358	281	2360	300	138	164
Pb	19 to 250	230 to 1200	210 to 4000	100 to 2100	358	678	664	1300	200	80	103
Zn	50 to 270	120 to 1900	800 to 3500	540 to 1300	1260	1220	7150	2670	2000	600	940

PAH particulate strength data from urban areas are not commonly available. Table 4 compares PAH particulate strength observed values for several urban creek sediments during a recent study with the Paleta Creek watershed stormwater PAH particulate strength values. These locations and conditions are not directly comparable, but are both from urban areas. The comparisons are therefore only intended to be approximate. The anthracene in the Paleta Creek stormwater samples were much smaller than the urban creek sediments, while the other observed values from this study were near the low values observed for the urban creek sediments, except for fluoranthene from Paleta Creek which are near the upper values observed for the urban creek sediments.

Table 4. Selected PAH Particulate Strength Concentrations (µg/kg)

PAH particulate strength	Urban creek sediments, range of medians observed (Bathi 2008)	this SERDP Paleta Creek study: NBSD lower watershed area (O1W, O2W, O3W, and O4W west of I5)	this SERDP Paleta Creek study: mostly residential upper watershed area (CW2 sampling location, east of I5)
Anthracene	100 to 800	1.62	nd
Benzo(a)anthracene	50 to 1100	104	122
Benzo(a)pyrene	100 to 3000	118	65.9
Chrysene	75 to 1200	183	95
Fluoranthene	75 to 1500	591	1,277
Naphthalene	100 to 1200	54.5	43
Phenanthrene	100 to 600	125	224
Pyrene	100 to 1500	389	571

Few data are available for PAH particulate strengths for comparison with the SERDP observed values. For example, the estimated LA County (Stein, *et al.* 2007) total PAH particulate strengths were reported to be about 10 mg/kg (10,000 µg/kg). The SCCWRP report did not include information for individual PAH constituents, or for filtered concentrations.

Table 5 summarizes the percentage of the total concentrations that were filterable. Even though these sample portions are generally processed using 0.45 µm filters, they should not necessarily be considered "dissolved" (the conventional description), as significant portions are likely associated with colloids and only small portions of the filtered metals may be in ionic forms (the most toxic forms of many of the metals and the portion most amenable to ion-exchange stormwater treatment).

Table 5. Filtered Concentrations as a Percentage of Total Concentrations for Selected Constituents and Sampling Locations

% filterable compared to total, average % (COV*)	this SERDP Paleta Creek study: mixed flow samples in Paleta Creek	this SERDP Paleta Creek study: NBSD lower watershed (O1W, O2W, O3W, and O4W west of I5)	this SERDP Paleta Creek study: mostly residential upper watershed (CW2 sampling location, east of I5)	this SERDP Paleta Creek study; all data combined
Cu	40 (0.54)	53 (0.91)	68 (0.16)	50.6 (0.64)
Pb	14.0 (0.90)	26.9 (1.61)	3.1 (0.37)	17.7 (1.60)
Zn	21.5 (0.56)	22.2 (0.97)	34.5 (0.52)	19.8 (0.77)
Anthracene	17.9 (2.09)	51.3 (1.57)	n/a	34.6 (1.80)
Benzo(a)anthracene	4.9 (1.88)	3.7 (0.69)	1.4 (0.80)	3.9 (1.61)
Benzo(a)pyrene	3.0 (1.99)	2.9 (1.01)	2.3 (1.18)	2.8 (1.51)
Chrysene	5.6 (1.97)	4.0 (0.74)	2.4 (0.90)	4.6 (1.67)
Fluoranthene	23.0 (1.30)	11.5 (1.25)	1.3 (0.19)	15.5 (1.47)
Naphthalene	67.2 (0.48)	45.4 (0.52)	44.0 (0.16)	55.4 (0.50)
Phenanthrene	25.3 (1.23)	39.2 (1.04)	23.7 (1.41)	30.6 (1.10)
Pyrene	17.1 (1.27)	19.2 (1.04)	2.7 (0.37)	16.0 (1.21)

* The COV (coefficient of variation) values are shown in the parentheses. The COV is the ratio of the standard deviation to the mean, an indication of data variability.

The literature review of filtered stormwater concentrations are summarized in Table 6, for comparison to the SERDP Paleta Creek observations summarized in Table 5. The NBSD Cu filterable portions are higher than generally reported elsewhere, the Pb filterable portions are in the range reported elsewhere, while the Zn filterable portions are generally lower than reported elsewhere. The upper watershed Cu filterable portions are on the high side compared to other values, while the Cu filterable portions are similar to the other data, and the Zn filterable portions are on the low side of the other values. Morquecho (2005) also examined the characteristics of the filtered metals and found that most (<15%) of the zinc, cadmium and lead were not present in the free ionic form, but were bound to colloids or organic matter whose bonds could be broken by exposure to UV light. Only filtered copper occurred in mostly (70%) ionic forms. Other reported studies indicated somewhat different results, depending on the characteristics of the stormwater. After discharge to marine receiving waters, the binding of pollutants with particulates, or chemical transformations, are likely.

Table 6. Filtered Metal Concentrations as a Percentage of Total Concentration as Reported during Past Studies (%)

	sheetflow from many areas (Pitt, et al. 1995)	small stormwater impoundments (Pitt, et al. 1998)	Madison pond influent (House, et al. 1993)	Milw roof runoff (Bannerman, et al. 1983)	Long Island parking lot (STORET NURP)	Bham sheetflow (Pitt, et al. 1995)	Roof runoff (Morquecho 2005)	inlets (Morquecho 2005)	this SERDP Paleta Creek study: NBSD lower watershed	this SERDP Paleta Creek study: mostly residential upper watershed
Cu	<20%	33%	13%	n/a	n/a	1.4 to 86%	41%	60%	53%	68
Pb	<20	21	4	8%	16%	2.5 to 7.0	54	46	27	3
Zn	>50	70	34	n/a	n/a	1.3 to 100	70	58	22	35

Table 7 shows the average PAH filtered percentages of the total concentrations for a paved parking area compared to the SERDP Paleta Creek data, as an example. Again, this data is not readily available from other locations, making these comparisons difficult. Generally, this SERDP study found larger filterable fractions for anthracene and phenanthrene, but was reasonably consistent for the other PAHs shown.

Table 7. Filtered PAH Fractions as Reported during Past Studies (%)

	WI paved parking (Pitt, et al. 1999)	this SERDP Paleta Creek study: NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5)	this SERDP Paleta Creek study: upper watershed (mostly residential areas) (CW2 sampling location, east of I5)
Anthracene	8%	51.3%	n/a
Benzo(a)anthracene	3	3.7	1.4%
Benzo(a)pyrene	1	2.9	2.3
Chrysene	1	4.0	2.4
Fluoranthene	29	11.5	1.3
Naphthalene	22	45.4	44.0
Phenanthrene	2	39.2	23.7
Pyrene	19	19.2	2.7

The NBSD outfall data was represented by 6 samples, the upper watershed Paleta Creek station was represented by 2 samples, and the mixed waters at the creek mouth and receiving waters were represented by 7 samples. The Coefficient of Variation (COV) values, the ratio of the standard deviations to the means, range from a low of about 0.22 to a high of about 1.7, with most near 1. These are typical COV values for stormwater constituents. It is difficult to have small errors in the predicted average values unless the sample numbers are large in order to meet typical data quality objectives. As an example, for COV values of 1 (the standard deviations about the same as the average values), about 25 samples are needed to predict the average values with less than a 50% error (with 95 confidence and 80% power). Less than 10 samples (the approximate number for these analyses) would be needed if power was not considered as part of the data quality objectives for this same 50% uncertainty level (as reflected in post analyses of data).

Pollutant Associations by Particle Size Distributions of Stormwater Particulates

Particle Size Distributions and Specific Gravities

Each of the 15 samples were also divided into four particle size ranges and analyzed for the same constituents as the whole and filtered stormwater samples. Figure 7 is a plot of the particle size distributions (PSDs) for the first event, for the upper watershed (mostly residential land uses) stormwater samples and for the NBSD stormwater samples. The PSDs for the NBSD samples were similar for both events, and typical for most stormwater from paved areas (<10% greater than 100 µm). The upper watershed PSDs have a greater abundance of larger particles, likely associated with erosion from the steeper undeveloped areas in the watershed and channel scour (15 and 40% of the stormwater particulates were greater than 100 µm, for the first and second storms respectively). Tabular particle size distribution values are presented along with pollutant distributions in the following discussion and in the main report and appendices.

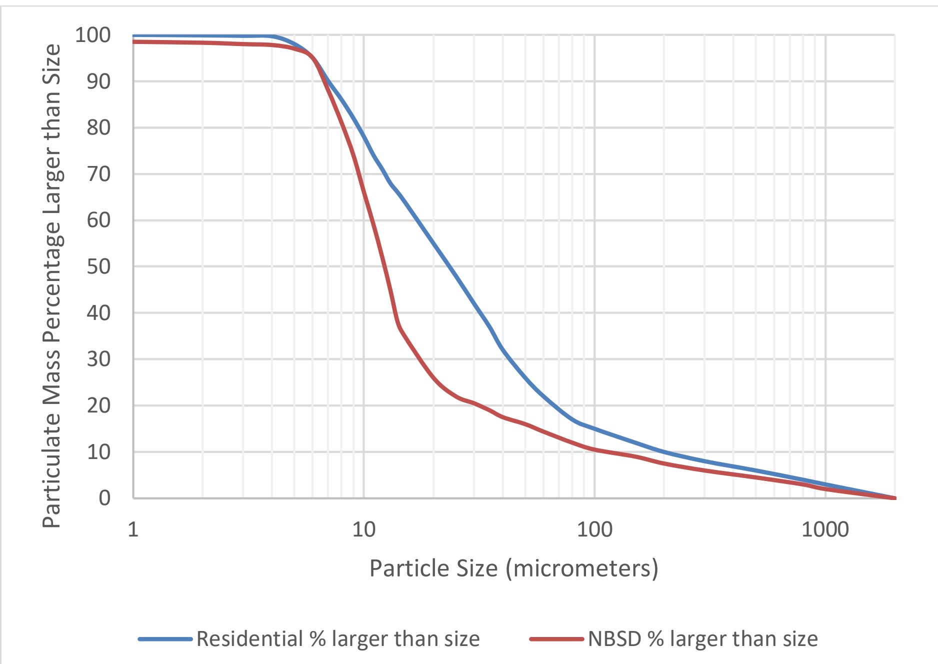


Figure 7. Paleta Creek upper watershed (mostly residential) and NBSD particle size distributions for event 1.

Specific gravity affects particle settling, but there is not much information for stormwater particle specific gravity values. Cai (2015) found that specific gravity decreases as the volatile solids content increases; larger particle sizes have lower specific gravity values (close to 1 or less) and greater volatile solids (>70% typical) as they contain larger amounts of light-weight organic debris. He found that small particles have much greater specific gravity values (3 or greater) with much smaller volatile solids content (about 25%), as they are more influenced by mineral content. These specific gravity changes moderate the differences in settling rates for the different sized particles. Bathi (2008) found that most of the volatile material found in urban creek sediments as associated with leaves and grass, plus some rubber. Generally, we have found that stormwater particulate specific gravity values range between 1.5 and 2.5.

Pollutant Distributions by Particle Size

Tables 8 and 9 show selected distributions by particle size for a few constituents (including particulates), grouped by sample category.

Table 8. Selected Particulate Metals Mass Distributions by Particle Size Range (average, with COV values in parentheses)

	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5) event 1 (avg, COV); n = 4	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5) event 2 (avg, COV); n = 2	Paleta Creek at Main Street representing upper watershed area ((mostly residential areas) (CW2 sampling location, east of I5), event 1; n = 1	Paleta Creek at Main Street representing upper watershed area ((mostly residential areas) (CW2 sampling location, east of I5), event 2; n = 1	Paleta Creek mixed flow event 1 (avg, COV); n = 4	Paleta Creek mixed flow event 2 (avg, COV); n = 3
Particulate Solids (% in size range)						
Particulate (0.45 -5 µm)	1.9 (1.82)	14.1 (0.90)	9.7	0.0	5.5 (1.73)	8.9 (1.35)
Particulate (5-20 µm)	67.3 (0.42)	67.9 (0.31)	19.2	19.8	73.1 (0.24)	65.5 (0.13)
Particulate (20-63 µm)	15.2 (1.15)	12.3 (0.41)	44.8	17.8	16.0 (1.08)	20.3 (0.80)
Particulate (> 63 µm)	15.6 (0.95)	5.7 (0.52)	26.3	62.4	5.4 (1.21)	5.3 (0.51)
Pb (% in size range)						
Particulate (0.45 -5 µm)	3.5 (2.00)	0.3 (1.41)	1.2	nd	1.7 (1.19)	2.1 (1.07)
Particulate (5-20 µm)	65.5 (0.46)	46.7 (0.44)	20.1	33.9	67.3 (0.47)	56.3 (0.40)
Particulate (20-63 µm)	0.7 (2.00)	19.7 (1.41)	9.8	6.9	4.3 (1.23)	30.9 (0.81)
Particulate (> 63 µm)	30.2 (0.85)	33.2 (0.24)	68.9	59.2	26.6 (0.98)	10.7 (0.61)
Zn (% in size range)						
Particulate (0.45 -5 µm)	1.5 (2.00)	19.5 (0.37)	0.6	nd	5.7 (1.33)	27.9 (1.49)
Particulate (5-20 µm)	27.5 (0.80)	nd (n/a)	15.6	29.4	39.6 (0.96)	44.5 (0.53)
Particulate (20-63 µm)	12.9 (1.15)	22.2 (1.41)	16.5	12.2	17.1 (1.32)	17.8 (0.85)
Particulate (> 63 µm)	58.1 (0.29)	58.3 (0.42)	67.3	58.4	37.6 (0.97)	9.8 (1.73)
Cu (% in size range)						
Particulate (0.45 -5 µm)	1.2 (1.95)	40.1 (0.49)	1.2	nd	4.7 (2.00)	nd (n/a)
Particulate (5-20 µm)	26.8 (1.01)	13.4 (0.75)	19.1	35.5	35.0 (1.25)	53.6 (0.55)
Particulate (20-63 µm)	22.1 (1.16)	29.2 (0.51)	19.4	8.0	15.9 (0.94)	34.0 (0.69)
Particulate (> 63 µm)	50.0 (0.68)	17.2 (1.41)	60.3	56.5	44.4 (1.03)	12.3 (0.50)

Past stormwater research projects have also separated stormwater particulates by size range and chemically analyzed each range separately for metals. Vignoles and Herremans (1995) examined heavy metal associations with different particles sizes in stormwater samples from Toulouse, France. They found that the majority of the heavy metal loadings in stormwater were associated with particles less than 10 µm in size (Cu: 63%; Pb: 73%; and Zn: 60%), with less than 10% of these metals associated with particles larger than 100 µm. Morquecho (2005) collected numerous Tuscaloosa, AL, urban area sheetflow and outfall samples for analyses of discrete particle size ranges. She found that only about 20% of these metals were found in particles larger than 45 µm, with more than 50% associated with particles smaller than 10 µm. During the Paleta Creek stormwater monitoring, Pb and Zn were found to be mostly in the 5 to 20 µm size range, with some also in the >63 µm size range, similar as reported during past studies, while many of the Cu data indicated a more even distribution in sizes >5 µm.

Table 9. Selected Particulate PAHs Mass Distributions by Particle Size Range

	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5) event 1 (avg, COV); n = 4	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5) event 2 (avg, COV); n = 2	Paleta Creek at Main Street (upper watershed (mostly residential areas, CW2 sampling location, east of I5) event 1; n = 1	Paleta Creek at Main Street (upper watershed (mostly residential areas, CW2 sampling location, east of I5) event 2; n = 1	Paleta Creek mixed flow event 1 (avg, COV); n = 4	Paleta Creek mixed flow event 2 (avg, COV); n = 3
Naphthalene (% in size range)						
0.7-2.7 µm	15.4 (1.73)	nd (n/a)	0.0	nd	nd (n/a)	3.0 (1.7)
2.7-20 µm	19.3 (1.51)	32.1 (0.61)	39.7	6.8	12.1 (0.73)	29.2 (0.94)
20-63 µm	9.6 (1.73)	nd (n/a)	0.0	93.2	19.3 (1.35)	48.5 (0.87)
> 63 µm	55.7 (0.75)	67.8 (0.29)	60.3	nd	68.6 (0.44)	19.3 (1.2)
Fluoranthene (% in size range)						
0.7-2.7 µm	nd (n/a)	nd (n/a)	3.1	nd	12.3 (1.48)	1.2 (0.91)
2.7-20 µm	16.7 (0.46)	45.1 (0.73)	9.5	10.1	33.0 (0.40)	49.8 (0.88)
20-63 µm	26.2 (1.13)	14.3 (1.41)	8.9	62.3	41.6 (0.31)	33.4 (1.02)
> 63 µm	57.1 (0.65)	40.6 (0.31)	78.5	27.6	13.1 (1.73)	15.6 (1.73)
Pyrene (% in size range)						
0.7-2.7 µm	2.1 (1.73)	nd (n/a)	2.4	nd	16.0 (1.30)	0.3 (1.73)
2.7-20 µm	35.3 (0.69)	22.3 (0.81)	31.2	18.0	38.1 (0.65)	42.2 (0.88)
20-63 µm	9.2 (1.03)	29.7 (0.94)	12.8	30.4	14.8 (0.59)	27.3 (0.42)
> 63 µm	53.5 (0.63)	48.0 (0.96)	53.6	51.5	31.1 (1.05)	30.2 (0.90)
Chrysene (% in size range)						
0.7-2.7 µm	0.9 (1.73)	nd (n/a)	4.8	nd	19.2 (1.37)	0.8 (1.49)
2.7-20 µm	22.6 (0.18)	4.1 (1.41)	49.6	20.1	32.4 (0.82)	41.3 (0.98)
20-63 µm	24.8 (1.19)	31.4 (1.14)	45.6	35.0	15.0 (0.53)	20.7 (0.36)
> 63 µm	51.7 (0.59)	64.6 (0.47)	0.0	44.9	33.3 (1.01)	37.1 (0.88)

Bathi (2008) studied PAH distributions by particle size in urban creek sediments in Tuscaloosa, AL. The high molecular weight PAHs had a greater portion associated with the particulates than did the low molecular weight PAHs. Overall, all PAHs studied showed similar trends, with the smaller and larger particles found to have relatively higher values compared to the intermediate sized particles. Cluster analyses of the PAH concentrations for the different particle sizes showed that for most cases examined, the large organic material fraction was found to have much higher concentrations than the other sizes. The Paleta Creek stormwater samples have very low PAH content in the smallest particle size category, and somewhat evenly spread over the larger sizes.

The overall range of particulate strengths shown here are within the range reported in the literature.

Concentrations by Particle Size

The following is an example of the particle size particulate strength data for fluoranthene for different sampling locations for event 2. Four outfalls were sampled at the NBSD during the first event and two were sampled during the second event. The second event had much less rain and the incoming tide affected the other sampling locations, so fewer samples were available during the second event. The Paleta Creek station at Main Street is the main channel and represents the upper watershed flows. This location was sampled during each event. The other Paleta Creek and ambient water samples represent mixed flows in the creek mouth, with four locations during the first event and three locations during the second event. These particulate strength data were plotted in 3D graphs for each event by particle size, showing the range of concentrations observed (Figure 8).

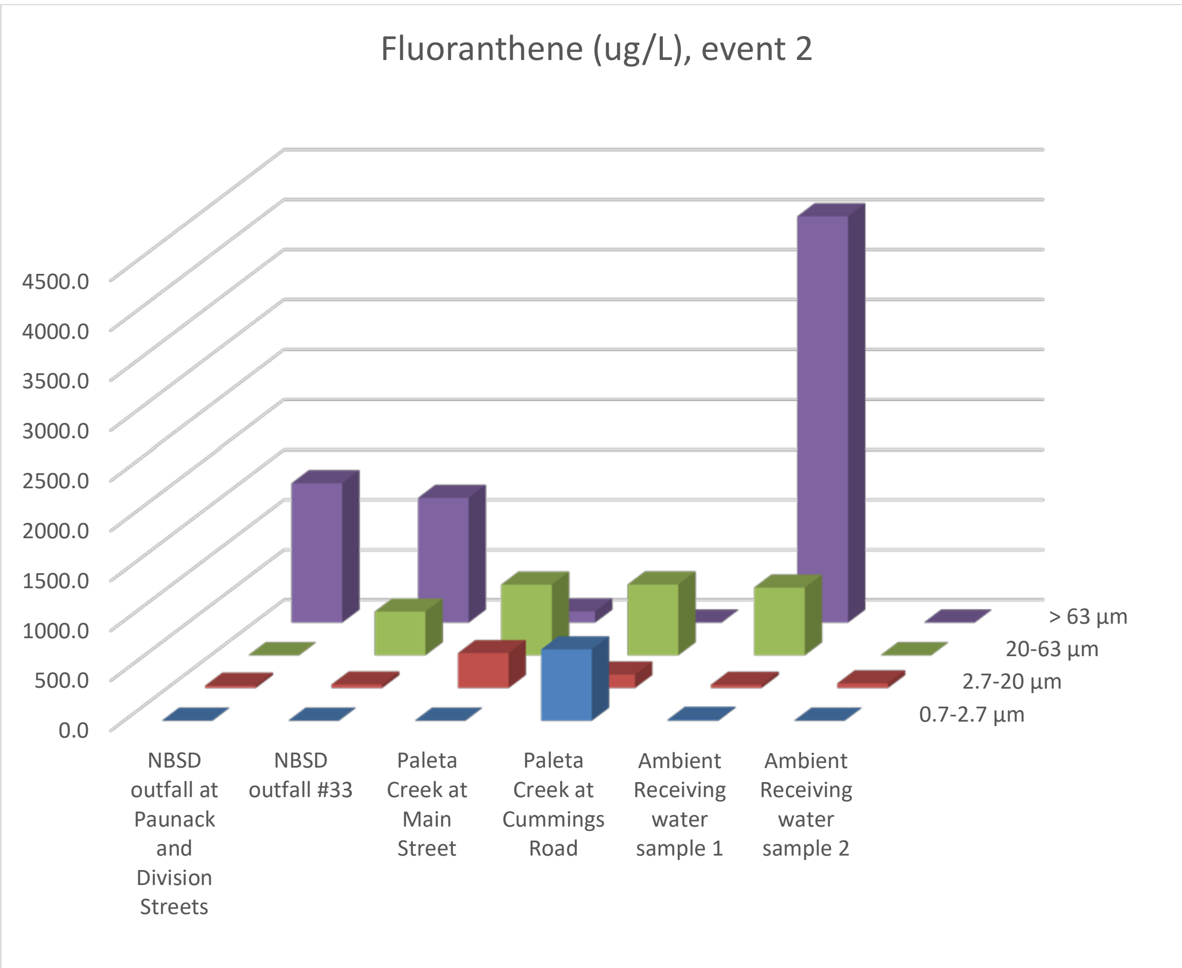


Figure 8. 3D plot of fluoranthene concentrations by particle size and location (µg/L) for event 2.

These plots illustrate the few very high values found in a few locations, especially for large particles. The data are also shown as a percentage of the total value for each size range to better normalize the information, as illustrated in Figure 9 for fluoranthene for event 2.

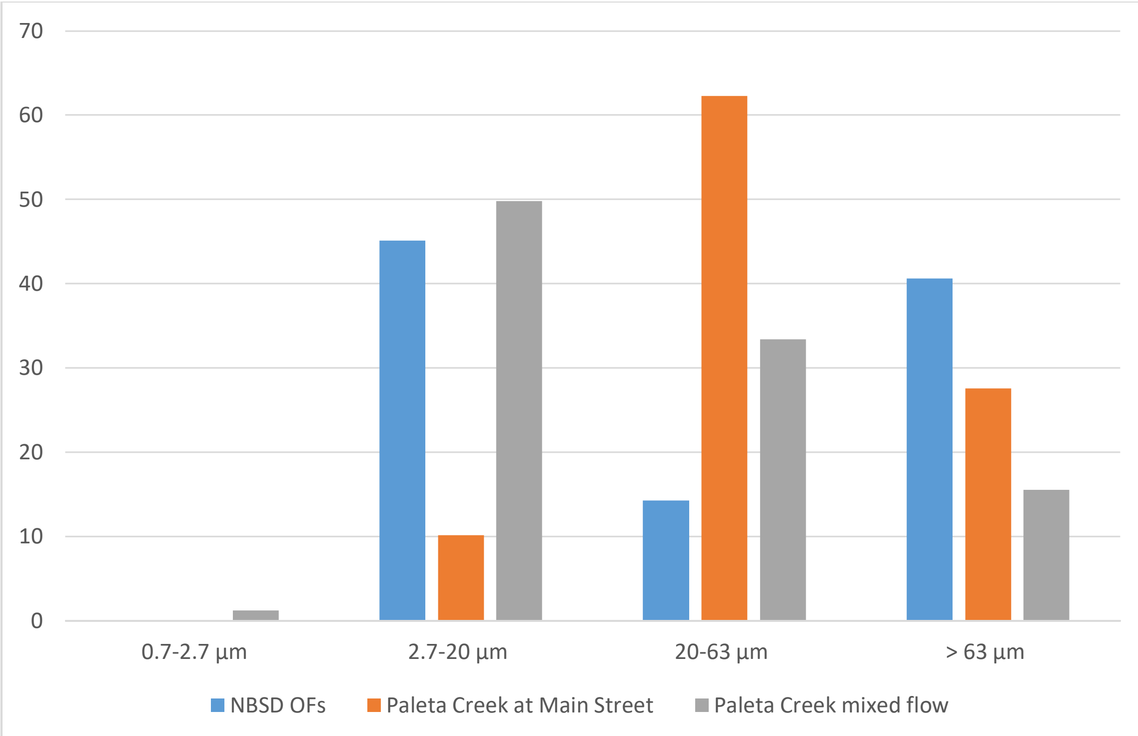


Figure 9. Percentage mass contributions for fluoranthene by land use and particle size (event 2).

Figure 9 indicates that about 30 to 40% of the fluoranthene from the NBSD and upper watershed areas were associated with the largest sizes analyzed (>63 µm). This large particle size is the most important when considering near-field deposition after discharge, with the remaining fluoranthene sedimentation occurring at greater depths and distances from the discharge location. This particle size can also be efficiently targeted for stormwater control to reduce the near-field recontamination potential. The main report and appendices contain similar data analyses for all of the constituents monitored.

Literature findings on metals in stormwater found that stormwater heavy metals are mostly associated with particulates, except for Zn which can have large portions associated with the filterable fraction. Residential and commercial areas may have greater filterable fractions of metals in the stormwater than industrial sites that may have greater fractions associated with particulates. The normal trend is for increases in pollutant strengths of metals with decreases in particle size. However, at industrial sites, large metallic/oily debris can be associated with larger particles sizes due to the nature of the source material. At a recently monitored heavy industrial area, the majority of the pollutant concentrations (and mass) were still associated with the 10 to 100 µm particle size range, even with periodic large debris. The PAH literature observations indicate that they are closely related to the organic content of the particulates, with typical bimodal distributions of concentrations (higher concentrations for small and large particle sizes).

The Paleta Creek watershed stormwater indicated that much of the metal and PAH mass discharges are associated with the >63 um size range. This upper limit was selected for this project as it correlated well with particles having near-field effects after discharge. Most literature included information for larger particles above this upper limit evaluated during this project; those larger sizes will affect near-field areas also.

Watershed Pollutant Discharges

Paleta Creek stormwater monitoring data was used with the WinSLAMM stormwater quality model that was previously calibrated for the area during previous NBSD projects. The model description and use are described later in this report and in the documents prepared during the prior NBSD projects.

This project used the flow calculations from the model (calibrated using on the detailed land use and development characteristics for the modeled areas in the Paleta Creek watershed, along with long-term regional rain data). The flow data was used in conjunction with the monitored metal and PAH data for several particle size ranges to allow better predictions of the fates of the discharged stormwater particulates after discharge to the receiving waters. The monitoring data and the modeled results will be coupled with measurements of receiving sediment impacts and ecological effects by other project team members. The stormwater modeling enabled calculations of stormwater discharge characteristics as determined by specific drainage area characteristics and activities in the Paleta Creek watershed. These stormwater loading predictions, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and related settling rates), were used to quantify the recontamination potential of the sediments by stormwater discharges and to compare the monitored data with the tentative TMDL allocations.

A full explanation of the model's capabilities, calibration, functions, and applications can be found at www.winslamm.com. For this project, the parameter files were calibrated using the local San Diego naval facility monitoring data (http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Site_Descriptions_Calibration_and_Sources_Feb_17_2014.pdf), supplemented by additional information from regional data from the National Stormwater Quality Database (NSQD), available at: http://bmpdatabase.org/nsqd.html as described in the following report describing regional calibrations of WinSLAMM using NSQD information: http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Standard_Land_Use_file_descriptions_final_April_18_2011.pdf.

Tables and graphs were prepared showing the mass discharges associated with the different land uses and particle sizes. Most of the NBSD area is comprised of industrial areas, where most of the upper watershed area is residential. The NBSD drainage areas are about 13.5% of the total watershed area. Long-term San Diego airport rainfall data were used for these calculations. The dramatic variation in stormwater discharges throughout the year is obvious, as very little rainfall occurs during the summer months. WinSLAMM was used to calculate the expected discharges per month throughout the year, as shown below on Figures 10 and 11. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. The following graph shows the modeled monthly average runoff and particulate discharges for the Paleta Creek watershed, showing the NBSD and upper watershed contributions by major land uses. These patterns reflect the monthly variations in rainfall for the area, with very little stormwater discharges during the dry summer months.

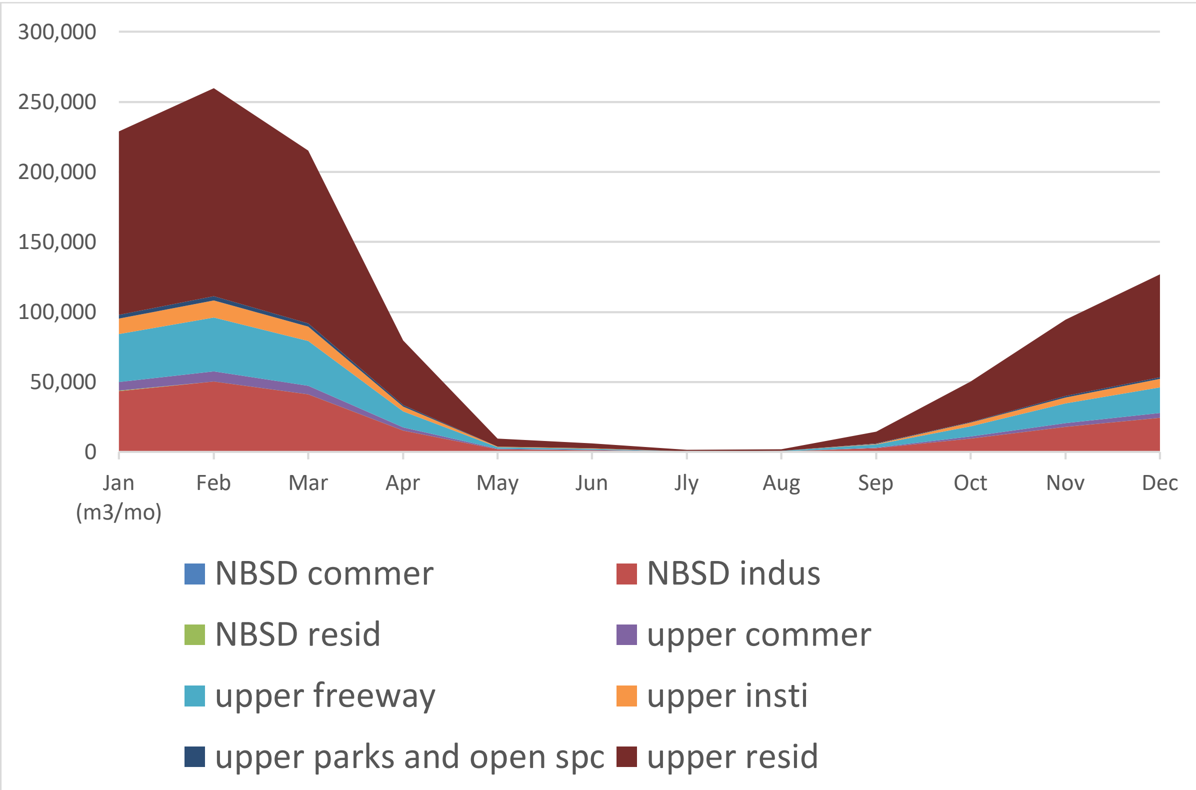


Figure 10. Modeled runoff volume discharges by month and land use (m^3/month).

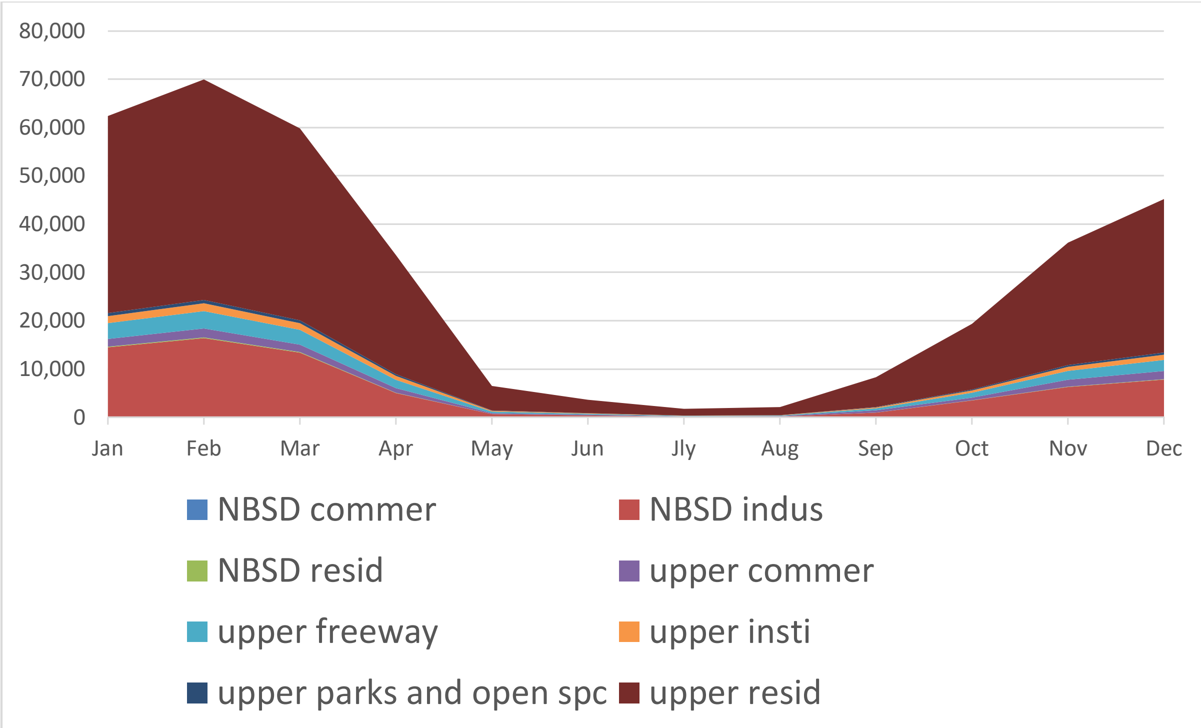


Figure 11. Modeled particulate solids mass discharges by month and land use (kg/month).

Figures 12 and 13 are example plots illustrating the particulate solids mass contributions by particle range for some of the monitored constituents. These are averaged for the six NBSD and two upper watershed samples obtained during the two monitored events. The constituents were weighted based on the amount of total particulates found in each size range times the constituent concentrations. The SSC mass has most of the material in the 5 to 20 µm size range, while the upper watershed SSC are more evenly distributed, with substantially more material in the largest particle size. The individual plots indicate that much of the constituents are in the large particle size range which would settle to the receiving water sediments near the discharge location. For the NBSD sites, periodic high concentrations were noted in this large size range, likely associated with some large oily debris from the active industrial sites. The upper watershed area was likely affected by watershed erosion and channel scour, with small concentrations. The weighting factors resulted in similarly high contributions for the large size range for both watershed areas for many of the constituents shown below.

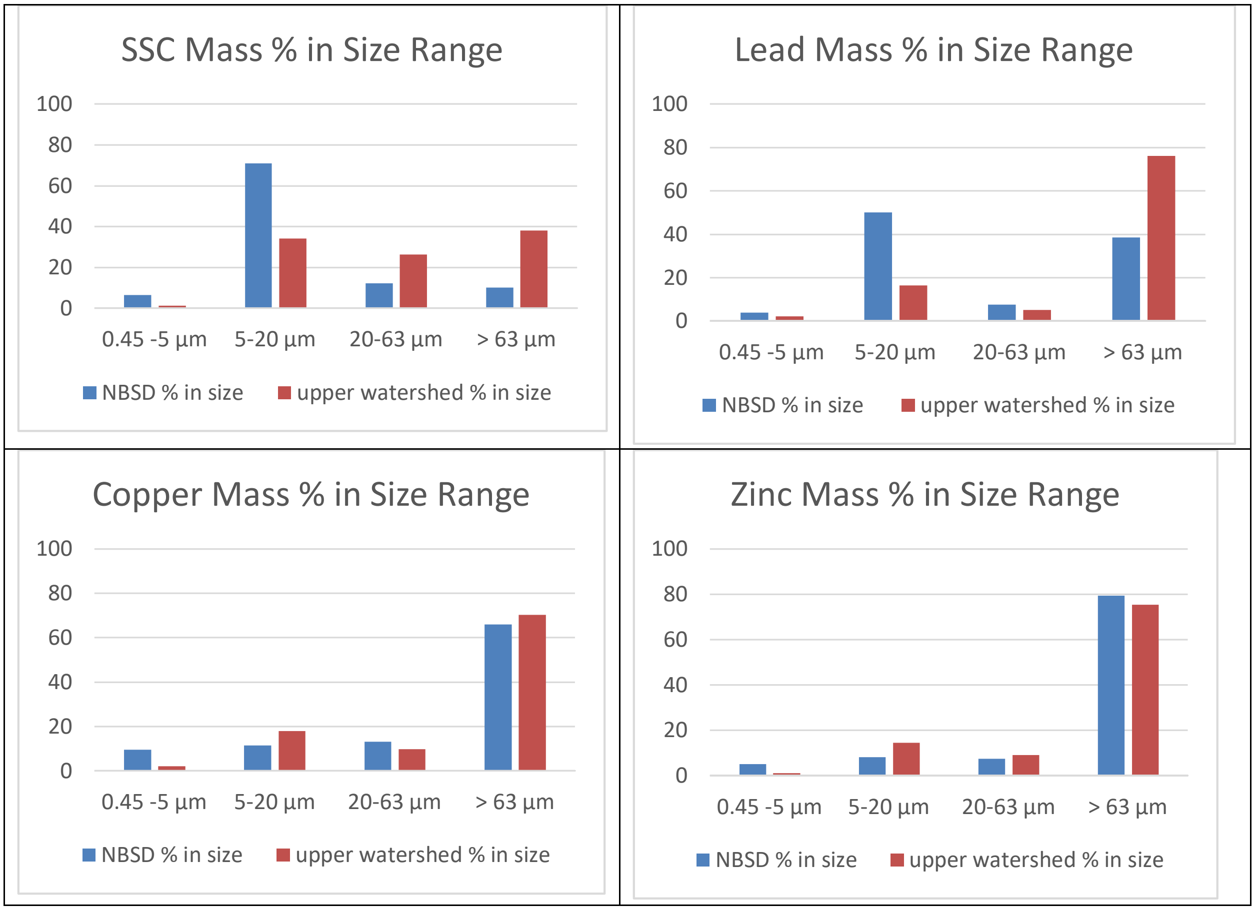


Figure 12. Particulate metal mass contributions by particle size and land use.

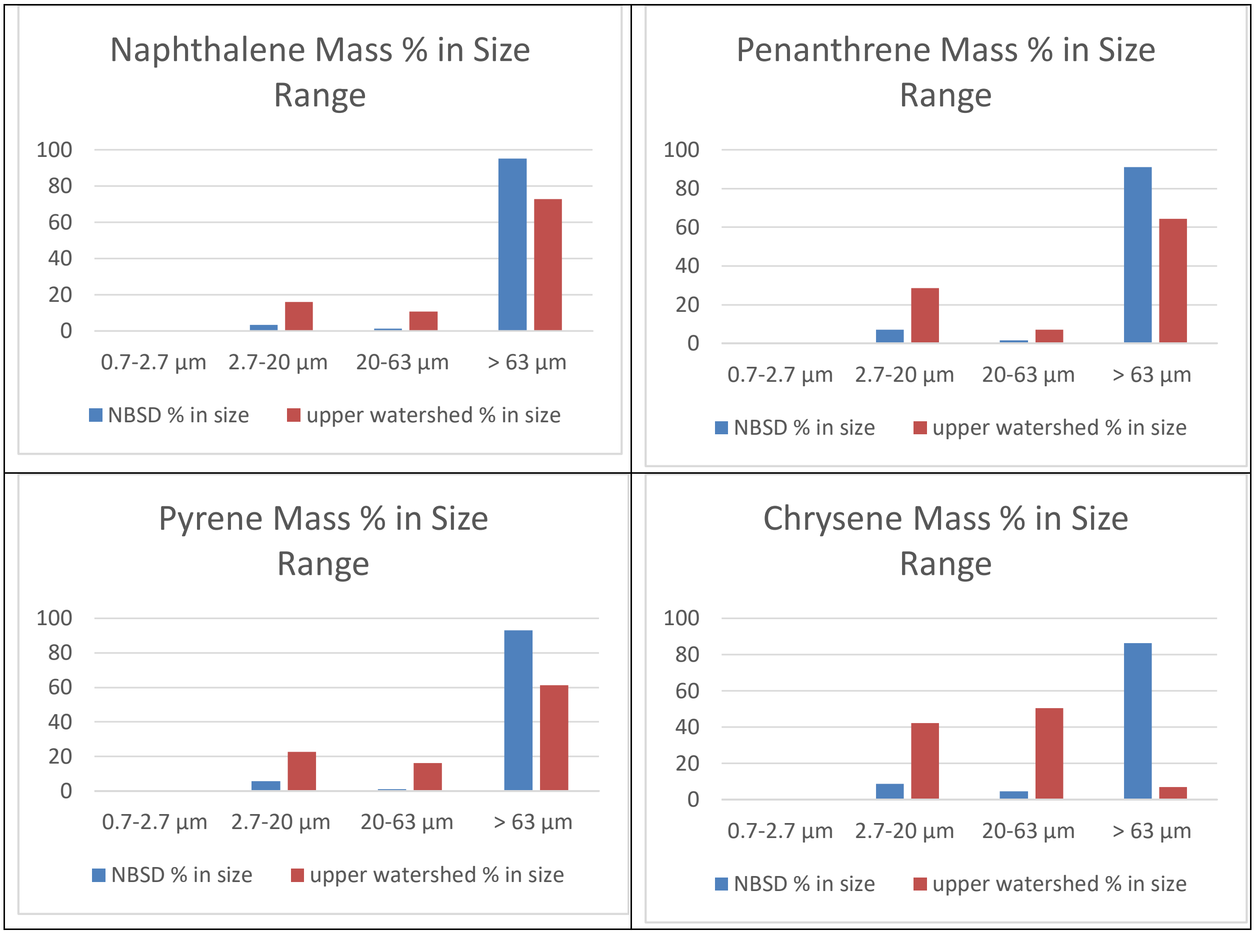


Figure 13. Particulate PAH mass contributions by land use and size range.

The NBSD makes up about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges. The NBSD contributions for the other constituents ranged from about 13% to as high as about 63%. The unit area discharges (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area (by up to about 5 times). These increased unit area discharges were mostly associated with a few very high pollutant strength values for some of the NBSD samples. In contrast, some of the upper watershed pollutant strengths had relatively small values associated with the large particle size. The high values for the large particles from the NBSD samples may be associated with periodic large debris having high metal and PAH values (as also found in industrial stormwater from other areas), while the large particles from the upper watershed area may be more associated with bank erosion and scour in the creek than from contaminated large particles. About 90% of these annual stormwater discharges are expected to occur during the six month October through March period, with very little stormwater discharges occurring during the typically dry summer months.

Fate of Discharged Stormwater Particulates from Paleta Creek Watershed

Settling rates were calculated using Newton's (turbulent) and Reynold's (laminar) settling equations for each of the particle size ranges investigated. Figure 14 plots the approximate settling times needed for the four particle size ranges examined, for 10 ft (3 m) to 100 ft (30 m) water depths.

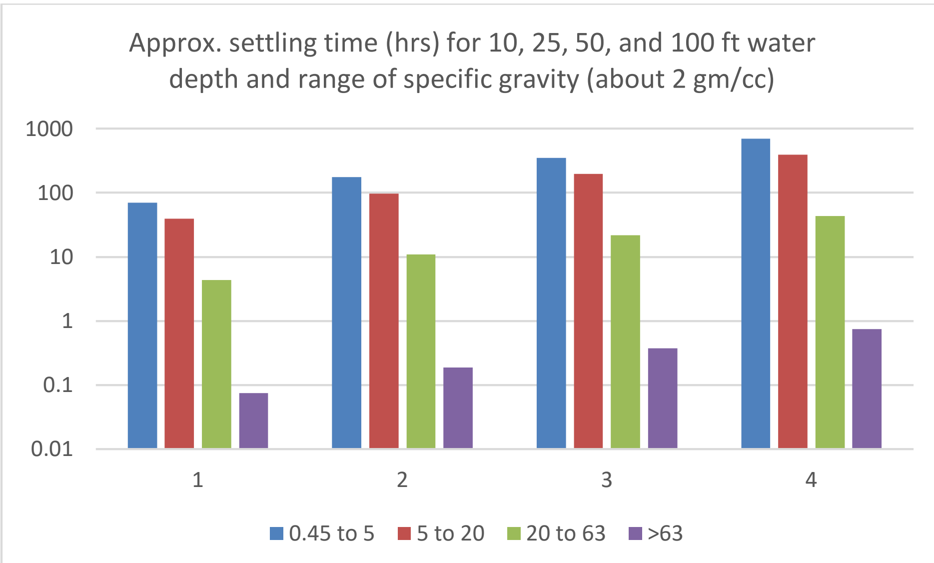


Figure 14. Settling times for different particle size ranges and water depths.

- Near field effects: The largest particles (>63 µm) would require about 1 hour to settle in 100 ft (30 m) of water, and only about 5 minutes to settle in 10 ft (3 m) of water. These particles have the greatest potential of affecting areas close to the discharge location and would not be widely dispersed.

- Far field effects: The intermediate particles (20 to 63 µm) would require about 50 hours to settle in 100 ft (30 m) of water and 5 hours to settle in 10 ft (3 m) of water. These particles would affect sediments located further from the discharge location.

- The smallest particles (<20 µm) would require even longer times to settle: about 500+ hours in 100 ft (30 m) of water and 50+ hours to settle in 10 ft (3 m) of water. Unless impounded, there particles would likely be transported a large distance beyond the discharge location.

The California Regional Water Quality Control Board, San Diego, prepared a tentative resolution in 2013 to establish TMDL limits for toxic pollutants in sediments at the mouths of several creeks draining into San Diego Bay. Although this resolution has not yet been adopted for Paleta Creek, the tentative TMDL report describes a 9 acre extent of impairment at the mouth of the creek. Benthic community effects and sediment toxicity are the listed pollutant stressors. Table 12 is a simple mass discharge calculation showing the expected particulate solids accumulation rate from stormwater discharges to this area of impairment. The overall average SSC concentration was used in this calculation, along with the long-term average rainfall for the area. The Rv (the ratio of the runoff depth to the rain depth) was calculated using WinSLAMM based on the land uses, development characteristics, and rainfall patterns for the area. Also, about 24% of the total stormwater particulates (average of the NBSD and upper watershed monitoring results) is larger than 63 µm, the size range that would affect these near-shore areas, as noted above. These calculations indicate that it would require about 25 years to produce one inch of sediment over this 9 acre area. Obviously, the deposition would be uneven in this area, depending on current velocities and depth of water. Generally, most of this material would likely settle near the creek mouth (except for a likely scour area as the narrow creek enters the wider creek mouth area). As noted above, it is expected that about 20% of this sediment (and corresponding accumulation depth) would be associated with NBSD discharges (which comprise about 13.5% of the total Paleta Creek watershed area) and about 80% would be associated with the upper watershed (non NBSD) area.

Table 12. Estimated Sediment Accumulation in 9 acre Paleta Creek Area of Impairment

rain:	10.81 inches/yr (27.46 cm/yr)
Rv:	0.49
area:	2000 acres (810 ha)
runoff:	38,000,000 ft^3/yr (1,100,000 m^3/yr)
SSC	305 mg/L
	770,000 lb/yr (330,000 kg/yr)
	380 lb/ac/yr (410 kg/ha/yr)
settleable solids fraction (>63µm)	0.24
settleable depth over 9 acre area of impairment at Paleta Creek mouth (assuming 2 gm/cm^3 stormwater particulate density)	0.043 in/yr (0.11 cm/yr)

Paleta Creek Tentative TMDL Allocations and Approximate Stormwater Treatment Needs

The California Regional Water Quality Control Board, San Diego, prepared a tentative resolution in 2013 to establish TMDL limits for toxic pollutants in sediments at the mouths of several creeks draining into San Diego Bay. Although this resolution has not yet been adopted for Paleta Creek, the tentative TMDL values are used in this SERDP monitoring report as a reference for potential limits to compare to the SERDP stormwater monitoring data and expected levels of stormwater control that may be needed. Table 13 shows the tentative limits for Paleta Creek.

Table 13. Tentative Criterion for Sediment and Water Column Concentrations for Paleta Creek

Contaminant of Concern	Numeric Limit
Sediment Concentration	
Total Chlordane	2.1 µg/kg
Priority Pollutant PAHs	2,965 µg/kg
Total PCBs	168 µg/kg
Water Column Concentration	
Total Chlordane	0.00059 µg/L (0.59 ng/L)
Benzo(a)pyrene	0.049 µg/L (49 ng/L
Total PCBs	0.00017 µg/L (0.17 ng/L)

As noted above, there are no tentative limits for heavy metals.

The total sediment PAH sums are compared to the criterion of 2,965 µg/kg in Table 14 for the NBSD samples, the upper Paleta Creek watershed samples, and the mixed Paleta Creek flows at the creek mouth. Table 15 indicates the percentages of several PAH compounds that are settleable (>63µm) that would have the greatest effects on the near-field bottom sediments near Paleta Creek.

Table 14. Sum of PAHs Compared to Tentative TMDL Criterion

	# sum PAHs >2,965 µg/kg	total # of observations	% >2,965 µg/kg	maximum observed total PAH concentration, µg/kg	ratio of maximum observed conc. to 2,965 µg/kg
mixed flows	2	7	28.6	14,480	4.9
NBSD	2	6	33.3	14,364	4.8
upper watershed area	1	2	50.0	3,807	1.3
overall	5	15	33.3	14,480	4.9

Table 15. Percentages of All Particles that are >63 µm (settleable in near-field near creek mouth), Average of Event 1 and 2 Events

	NBSD Outfalls in lower watershed (O1W, O2W, O3W, and O4W west of I5)	Paleta Creek at Main Street (upper watershed (mostly residential areas, CW2 sampling location, east of I5)	Paleta Creek mixed flow
Naphthalene	62%	30%	44%
Fluoranthene	49	54	15
Pyrene	51	53	31
Chrysene	58	22	35

The NBSD total PAH particulate strength values would have to be reduced by about 80% to meet the tentative criterion, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about 22%, if the all of the particle sizes were considered. If only the critical settleable portion (>63 um) in order to project the bottom sediments near the creek mouth were compared to this particle strength criterion, any reductions would be much less. Table 15 indicates that several PAH compounds have about 15 to 50% of their total particulate strengths associated with the large particles (>63 µm).

It is interesting to compare these total PAH strength values with the estimated values from the LA County report (SCCWRP 2007). The LA County total PAH particulate strengths were estimated to be about 10 mg/kg (10,000 µg/kg). The SCCWRP report did not include information for individual PAH constituents, or for filtered concentrations, so these are estimated using assumed filtered PAH values from this SERDP study. This approximate 10,000 µg/kg value is less than the maximum values found in the NBSD stormwater and for the mixed creek flow stormwater, but greater than the maximum stormwater value from the upper watershed (mostly residential) area.

The only water column PAH included on the tentative criterion list is benzo(a)pyrene, which was monitored during the SERDP stormwater monitoring efforts. The tentative criterion for benzo(a)pyrene is 49 ng/L, which is compared to the monitored data in Table 16.

Table 16. Comparison of Total Benzo(a)pyrene* Monitored Data to Tentative TMDL Criterion

flow source	# benzo(a)pyrene >49 ng/L	total # of obs	% >49 ng/L	maximum observed	max/49
mixed flows	2	7	29	275	5.6
NBSD	2	6	33	155	3.2
upper watershed area (mostly residential)	1	2	50	51	1.0
overall	5	15	33	275	5.6

One-third of the NBSD samples and one-half of the upper watershed area stormwater samples exceeded the tentative benzo(a)pyrene criterion of 49 ng/L. The maximum total concentration of benzo(a)pyrene observed at the NBSD was 155 ng/L and would require about 70% reductions, while the maximum concentration observed at the upper watershed area was 51 ng/L and would only require about 4% reductions. Overall, about one-third of the samples exceeded the criterion with a required reduction of about 80%. The following lists the settleable portions (>63 µm) of benzo(a)pyrene (the fraction that would most affect the critical area near the mouth of Paleta Creek for which this criterion was developed), and the approximate maximum concentrations:

Mixed flows (19% settleable), resulting in about 52 ng/L maximum concentration
NBSD flows (42%), resulting in about 65 ng/L maximum concentration
Upper watershed flows (17%), resulting in about 9 ng/L maximum concentration

Therefore, if the benzo(a)pyrene criterion of 49 ng/L was only applicable to the settleable portion of the compound to protect the bottom sediments near the creek mouth, only relatively small stormwater reductions would be needed to meet the tentative criterion.

Table 17 lists the mass-based tentative TMDL allocations for Paleta Creek, and Table 18 compares these to the monitored data.

Table 17. Mass Based Tentative TMDL Allocations for Paleta Creek

	San Diego WLA	National City WLA	Caltrans WLA	total upper watershed WLA	U.S. Navy WLA	total Paleta Creek WLA	Load Allocation	Margin of Safety	TMDL for Paleta Creek
Chlordane (g/d)	0.048	0.023	0.003	0.074	0.009	0.083	0.001	0.021	0.105
Total PAHs (g/d)	1.75	0.86	0.11	2.72	0.32	3.04	0	0.16	3.20
Total PCBs (mg/d)	0.24	0.118	0.014	0.372	0.044	0.416	0	0.022	0.438

Table 18a. Calculated Mass Loads of Total PAHs Compared to TMDL Allocations

flow source	average land use sum of PAHs µg/L	total annual stormwater flow discharge (m^3/yr)	total annual sum of PAH discharges (grams/day)	mass discharge load allocation (grams/day)	prorated margin of safety (grams/day)	TMDL (grams/day)	ratio of calculated total PAH discharges to TMDL
mixed flow	790	n/a	n/a	n/a	n/a	n/a	n/a
NBSD	785	208,743	0.45	0.32	0.017	0.337	1.33
upper watershed	1,093	880,336	2.64	2.72	0.143	2.863	0.92
overall/total	828	1,089,079	3.08	3.04	0.160	3.200	0.96

Table 18b. Calculated Mass Loads of Settleable Solid (>63µm)* PAHs Compared to TMDL Allocations

flow source	average land use sum of settleable PAHs µg/L*	total annual stormwater flow discharge (m^3/yr)	total annual sum of settleable PAH discharges (grams/day)*	mass discharge load allocation (grams/day)	prorated margin of safety (grams/day)	TMDL (grams/day)	approximate ratio of calculated settleable PAH discharges to TMDL
mixed flow	190	n/a	n/a	n/a	n/a	n/a	n/a
NBSD	188	208,743	0.11	0.32	0.017	0.337	0.33
upper watershed	262	880,336	0.63	2.72	0.143	2.863	0.22
overall/total	200	1,089,079	0.74	3.04	0.160	3.200	0.23

* assuming about 24% of total PAHs are >63um and are settleable in the near zone area near the creek mouth.

The WinSLAMM calculated watershed annual runoff amounts (about 5.3 inches of runoff/year for the entire watershed) were multiplied by the associated annual average sum of PAH concentrations to obtain the annual discharge estimates for the Paleta Creek watershed. The NBSD and upper watershed area mass discharge calculated total PAH amounts were then compared to the tentative TMDL allocations (including margin of safety). If the total PAH concentrations were subject to this criterion, the NBSD would need to reduce the total PAH stormwater mass discharges by about 25%, while the upper watershed area stormwater PAH mass discharges are below the tentative discharge limit. The total watershed calculated stormwater total PAH mass discharges are also barely below the TMDL tentative limit for the entire watershed. If only the settleable portion of the PAHs were compared to this criterion (in order to protect the critical bottom sediments near the Paleta Creek mouth area), then all of the discharge amounts from these areas would be below the tentative TMDL limit.

In summary, the following are the approximate reductions of the NBSD and upper watershed discharges to meet the tentative TMDL allocations:

- If all of the PAH sizes are compared to the tentative criterion, the NBSD total PAH particulate strength values would have to be reduced by about 80%, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about 22%. If only the settleable portion of the PAHs are applicable to this criterion (to protect the bottom sediments near the Paleta Creek mouth), then the discharges would need much smaller reductions to meet the tentative criterion.

- One-third of the NBSD samples and one-half of the upper watershed area stormwater samples exceeded the tentative benzo(a)pyrene criterion. The maximum concentration observed at the NBSD would require about 70% reductions, while the maximum concentration observed at the upper watershed area would only require about 4% reductions. Overall, about one-third of the samples exceeded the criterion with a required reduction of about 80%. Again, if only the critical settleable portion of the benzo(a)pyrene were applicable to this criterion, it is expected that only small to moderate reductions would be necessary.

- The NBSD would need to reduce the total PAH stormwater mass discharges by about 25%, while the upper watershed area stormwater PAH mass discharges are below the tentative discharge limit if all particle sizes are combined. The total watershed calculated stormwater total PAH mass discharges are also barely below the TMDL tentative limit for the entire watershed. If only the settleable portion of the PAHs are needed to protect the bottom sediments, then no reductions would likely be needed.

Chlordane and total PCB discharges are evaluated in Section 8 and 9 separately as those data became available later than the metals and PAH data.

The potential for several stormwater controls to reduce stormwater pollutant mass discharges from NBSD were calculated using WinSLAMM for local site conditions during past NBSD supported studies. These controls focusing on particulates and associated toxicants need to be verified during actual field demonstrations targeting these specific constituents of concern and particle size categories. The critical pollutants listed in the tentative TMDL allocation report are strongly associated with particulates, so the above estimated required reductions for the critical pollutants would be close to the necessary reductions of the stormwater particulates. Generally, NBSD particulates need about 80% reductions and upper watershed stormwater particulates would need about 20% reductions, if all particle sizes are compared to the tentative criterion, otherwise, only small to moderate reductions from the NBSD outfalls would be needed.

Because of their low volatility (low Henry's Law constant), high octanol-water partition coefficients (K_{OW}) and high soil organic coefficients (K_{OC}), many of the stormwater PAHs are preferentially adsorbed to particulate matter. Literature has shown that the smaller and larger particles can have relatively higher PAH particulate strength values compared to the intermediate sized particles, depending on the organic content of the material. PAHs can be controlled using the same controls that are effective for the particulates and most metals. Again, these controls need to be verified for site conditions for these compounds and for different particle size ranges.

Conclusions

The Paleta Creek Watershed (approximately 2,000 acres) is located in National City and San Diego, CA. The Naval Base San Diego (NBSD) is located at the downstream portion of the watershed, while the upstream areas (east of I5) primarily consists of single-family detached residential land uses. The NBSD areas comprise about 13.5% of the total watershed area (located west of I5). More than 96% of the total watershed is developed.

Two qualifying stormwater monitoring events were sampled during this project, on January 4-8, 2016 (2.48 inches) and on January 30-31, 2016 (0.18 inches), at up to six locations in the Paleta Creek watershed. The monitoring program was able to successfully collect stormwater from most targeted locations, despite significant challenges associated with a highly tidally influenced water body, multi-level complex sampling triggers to target freshwater sample collection, and unusually flashy hydrologic patterns. Detailed watershed and creek surveys were conducted to determine the land use descriptions and land development characteristics needed for the watershed WinSLAMM water quality modeling. Twenty subareas were used in the modeling for the different land use categories and locations in the watershed. The modeling was necessary to calculate the long-term stormwater characteristics and for further insight of the stormwater sources in the watershed. WinSLAMM had previously been calibrated for San Diego area naval bases (along with Puget Sound, WA and Norfolk, VA facilities) during a previous project for the Navy.

A total of 15 samples were collected during the two events. Four outfalls were sampled at the NBSD during the first event and two were sampled during the second event. The second event had much less rain and the incoming tide affected the other sampling locations, so fewer samples were available during the second event. The Paleta Creek station at Main Street is the main channel and represents the upper watershed flows. This location was sampled during each event. The other Paleta Creek and ambient water samples represent mixed flows in the creek mouth, with four locations during the first event and three locations during the second event.

Whole samples were analyzed for total and filterable forms of the contaminants. In addition, each of the 15 samples were also separated into four particle size ranges for analyses. A number of statistical tests were conducted on these data to identify significant associations between related constituents and significant differences associated with sampling locations. The constituents having significant correlations with SSC (suspended sediment concentration) were:

- Metals: Cu, Zn, Cd, Pb, and Hg
- PAHs: fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, and benzo[k]fluoranthene

Cluster analyses were used to identify strong relationships between different constituents. The sampling program included many different constituents (in total, filtered, and particulate strength forms). The cluster analyses for particulate strength concentrations indicated five data groups:

- Group one:
    - TOC, acenaphthene, and fluorene
- Group two (weak):
    - Cu and Pb
- Group three:
    - Zn, Cd, naphthalene, anthracene, and fluoranthene
- Group four (strong):
    - Phenanthrene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, benzo[k]fluoranthene, pyrene, benzo[ghi]perylene+indeno, and dibenzo[a,h]anthracene
- Group 5 (weak):
    - Ni and Hg

There were no statistically significant differences observed between total, filtered, or particulate strength concentrations for the different sampling location groups (upper watershed, mostly residential; NBSD, and Paleta Creek mouth mixed flows), most likely due to the relatively small number of samples available. It is estimated that differences as small as 50% would be found to be significant for the number of samples available, indicating smaller concentration differences actually occurring.

Each of the 15 samples were further divided into four particle size ranges (0.45 to 5, 5 to 20, 20 to 63, and >63 µm) and analyzed for the same suite of metals and PAHs as the whole samples. These particle size ranges were selected to correspond to settling zones and areas of potential impact as the particulate pollutants settle in the receiving waters, the primary objective for this project. The largest size group evaluated affects the near zone of impact and combines several groups that are commonly considered in the literature. The large size fraction was not further separated as that costly information was not necessary to calculate the recontamination rates in the near and far fields from the stormwater discharge locations.

The sediment PSDs for the NBSD samples were similar for both events, and typical for most stormwater from paved areas (<10% greater than 100 µm). The upper watershed PSDs have a greater abundance of larger particles, likely associated with erosion from the steeper undeveloped areas in the watershed and channel scour (15 and 40% greater than 100 µm, for the first and second storms respectively). However, a few of the NBSD large particle fractions had very large contributions, most likely associated with infrequent discharges of large oily or metallic debris material sometimes found in industrial area stormwater. These particles had a tendency to shift the importance of the pollutant contributions to the larger particle size range. As an example, about 60% of the zinc was associated with the largest size range analyzed (>63 µm). This large particle size is the most important when considering near-field deposition after discharge, with less zinc sedimentation occurring at greater depths and distances from the discharge location. This particle size can also be targeted for stormwater control to reduce the near-field contamination potential. The SSC mass from the NBSD areas in the lower watershed area has most of the material in the 5 to 20 µm size range, while the upper watershed SSC mass was more evenly distributed with particle size, but with more material in the largest particle size range.

The previously calibrated WinSLAMM stormwater quality model was used to calculate the expected discharges per month throughout the year for the Paleta Creek watershed subareas using long-term San Diego rainfall and watershed development characteristics, and for total annual conditions. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. The NBSD comprises about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges. The NBSD contributions for the other constituents ranged from about 13% to as high as about 63%. The unit area discharges (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area (by up to about five times). These increased unit area discharges were mostly associated with a few very high pollutant strength values for some of the NBSD samples (such as outfall #33 for the large sample size fraction). In contrast, some of the upper watershed pollutant strengths had relatively small values associated with the large particle size range. The high values for the large particles from the NBSD samples may be associated with periodic large debris having high metal and PAH values (as also found in industrial stormwater from other areas), while the large particles from the upper watershed area may be more associated with bank erosion and scour in the creek than from contaminated large particles.

Previous stormwater data from the NBSD were analyzed during prior studies that examined pollutant discharge distributions with time (event first-flush and seasonal first-flush, where concentrations are assumed to be larger at the beginning of a rain event and at the beginning of the seasonal rainy period). The 2013 stormwater quality data from the NBSD were reviewed, comparing TSS, total and dissolved copper, and total and dissolved zinc concentrations obtained during event first flushes to the same event sampled as a whole event composite. Only the dry side sites (mostly residential and commercial areas) had these concurrent data. No paired first flush and total storm composite data were available for the base industrial locations for this time period. The first flush TSS concentrations averaged about 3.6 times the total storm composite values, with a moderate significance ($p = 0.06$). The copper data also have marginal p values of 0.06 with first flush concentration increases over the total storm composite concentrations of about 3.1 and 2.6 for total and dissolved copper, respectively. The total and dissolved zinc paired concentration values had significant p values of 0.01, with all of the observed first flush concentrations greater than the composite concentrations. The concentration ratios for zinc were higher than for copper, being about 4.1 and 5.3 for total and dissolved zinc respectively. As found during many stormwater monitoring projects, event first-flush effects can be significant for small paved areas, while areas having mostly landscaped surfaces (or large complex areas) have fewer and/or less extreme first-flushes. These observations also vary for different constituents and are rarely seen for large watersheds.

Southern California stormwater managers frequently observe significant “seasonal first-flushes” when the initial rains of the year have larger concentrations compared to rains later in the rainy season, and may account for much of the total rain year stormwater discharges. Prior stormwater quality data from NBSD monitoring locations collected over many years for October and November were statistically compared to the other months. Based on these data, it is likely that the dry side (residential, commercial, and institutional land uses) have significant seasonal first flush conditions. However, there is no supporting information in the data from the naval industrial areas supporting seasonal first-flushes from this land use. It is thought that the highly varying industrial site activities during the different monitoring years caused a greater variability than the seasonal differences, effectively obscuring any seasonal first flush patterns.

Determining the recontamination potential of previously dredged areas with discharged stormwater particulates is a primary objective of this research. Settling rates were calculated using Newton’s (turbulent) and Reynold’s (laminar) settling equations to estimate the settling zones associated with each particle size category.

- Near field effects: The largest particles (>63 µm) would require about 1 hour to settle in 100 ft (30 m) of water, and only about 5 minutes to settle in 10 ft (3 m) of water. These particles have the greatest potential of affecting areas close to the discharge location and would not be widely dispersed.

- Far field effects: The intermediate particles (20 to 63 µm) would require about 50 hours to settle in 100 ft (30 m) of water and about 5 hours to settle in 10 ft (3 m) of water. These particles would affect distant locations in harbors or closer if slowly flowing water.

- The smallest particles (<20 µm) would require even longer times to settle: about 500+ hrs in 100 ft (30 m) of water and 50+ hours to settle in 10 ft (3 m) of water. Unless impounded, these particles would likely be transported a large distance beyond the discharge location, with minimal potential of affecting nearby areas.

About 24% of the stormwater particulates from the creek are in the >63um particle size range, affecting the near zone after discharge. The Tentative TMDL report indicates a 9 acre area of impairment for sediment toxicants. This most settleable portion of the stormwater discharges would result in about an inch of sedimentation over about a 25 year period, if evenly distributed. Obviously, sediment deposition would vary depending on water velocities and depth.

During prior NBSD projects, WinSLAMM was also used to make preliminary evaluations for a selection of stormwater controls that may be suitable for NBSD use, including: street cleaning, catchbasins, proprietary media filters, biofilters (NBSD currently is monitoring a biofilter pilot facility at a site parking area to obtain local performance measurements), porous pavement (NBSD is also currently monitoring a pilot porous pavement facility to obtain local performance information), and possibly grass filter and swales at selected locations. The Tentative TMDL allocation report includes several target numeric criteria (not yet officially set for Paleta Creek, but used here for comparison with the expected creek discharges). The NBSD total PAH particulate strength values would have to be reduced by about 80% to meet the tentative criterion, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about 22%, if all particle sizes are subject to this criterion. One-third of the NBSD samples and one-half of the upper watershed area stormwater samples exceeded the tentative benzo(a)pyrene criterion, when all particle sizes are considered. The maximum concentration observed at the NBSD would require about 70% reductions, while the maximum concentration observed at the upper watershed area would only require about 4% reductions. The NBSD would need to reduce the total PAH stormwater mass discharges by about 25%, while the upper watershed area stormwater PAH mass discharges are below the tentative discharge limit. The total watershed calculated stormwater total PAH mass discharges are also barely below the TMDL tentative limit for the entire watershed. If only the settleable portion of these compounds are compared to the tentative criteria to project the critical bottom sediments near the creek mouth, much smaller stormwater concentration reductions would be needed. Chlordane and total PCB discharges will be calculated and compared to the tentative limits when those data become available from the laboratory analyzing the stormwater samples.

Recommendations

Most naval facilities are located adjacent to the receiving waters with stormwater from adjacent mixed land use areas contributing to the total watershed discharges. The characteristics of these stormwaters are different due to the varying land uses and site activities, requiring a mixture of types of stormwater controls located in different locations. Numerous stormwater controls are available that can address particulate-associate toxicants, but the varying stormwater characteristics and source contribution complexities require a more complete decision analysis process to determine the best stormwater controls to be used than is typical. It is recommended that future work address stormwater controls that are suitable to meet likely treatment needs and that the cost of these controls be evaluate against their relative benefit, expressed in terms of reducing sediment recontamination risk, as defined in this study. Additional information should also be obtained concerning the unique characteristics of naval facility stormwater (especially particulate-bound organic compounds associated with different particle size ranges).

It is also recommended that any applicable criteria for the stormwater discharges focus on the pollutant forms of importance in protecting the receiving water sediments. For example, only the settleable portions of the pollutants (generally >63 µm) would affect the near zone bottom sediments of concern near the mouth of Paleta Creek, and any numeric criteria should therefore focus on these larger size particles. Also, any criteria should address the PAH compounds of concern that are affecting the receiving waters. The sum of the PAH compounds is very misleading as it is possible for less problematic PAHs in high concentrations to mask the significance of more important PAH compounds in smaller concentrations. Criteria focusing on total PAH concentrations is similar to a nonsensical criteria that would address total heavy metal concentrations. The results of the toxicological tests being conducted as part of this project would be an excellent tool to identify the critical PAH compounds for consideration for criteria development. The tentative criteria lists benzo(a)pyrene separately; therefore any other important PAH compound identified should also have a separate and meaningful criterion.

Section 1: Description of Sampling Locations and Watershed

The NBSD is located at the downstream end of the Paleta Creek Watershed (PCW). The PCW is approximately 2,000 acres and primarily consists of single-family residential land uses upstream of Interstate 5, while most of the portion of the watershed downstream of Interstate 5 is associated with NBSD. Figure 15 shows the land use breakdown within the PCW. The majority of the tributary area is categorized as single-family detached residential (42%), followed next by roads (20%), and third by military lands (11%). More than 96% of the watershed is developed (i.e., not characterized as recreation or open space parks). The distribution of land uses in the PCW is shown in Figure 16.

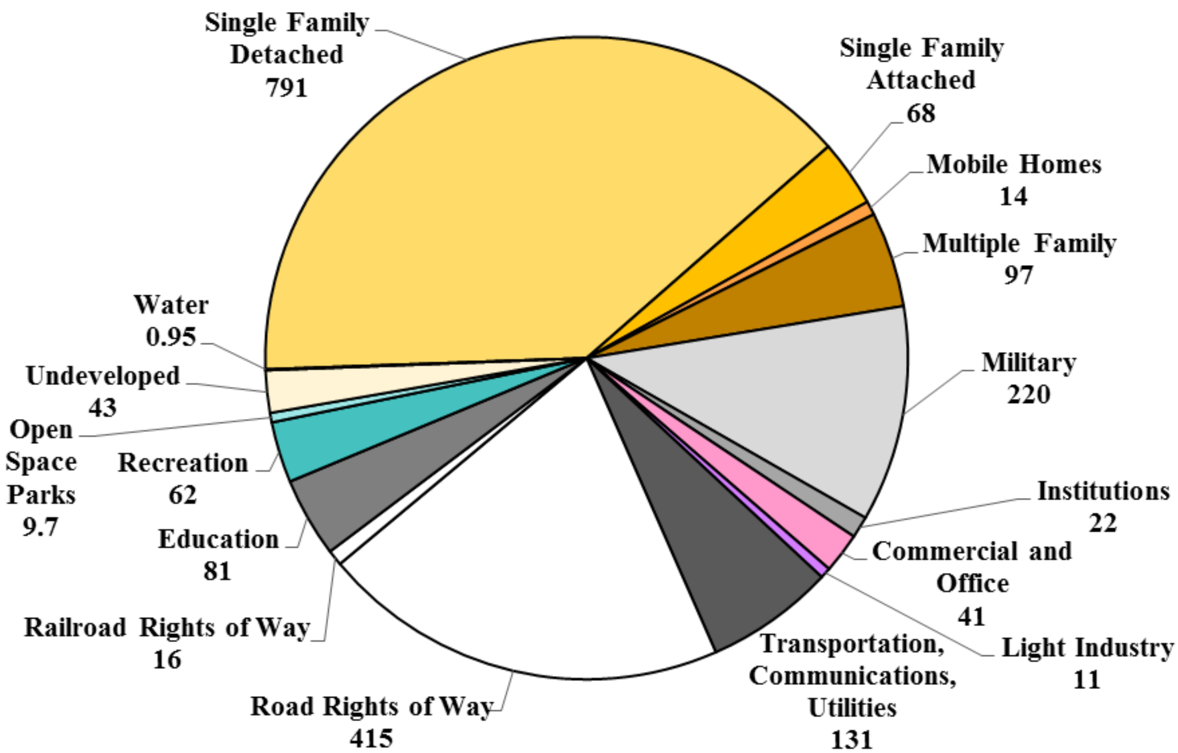


Figure 15. Paleta Creek Watershed Land Uses (in acres)

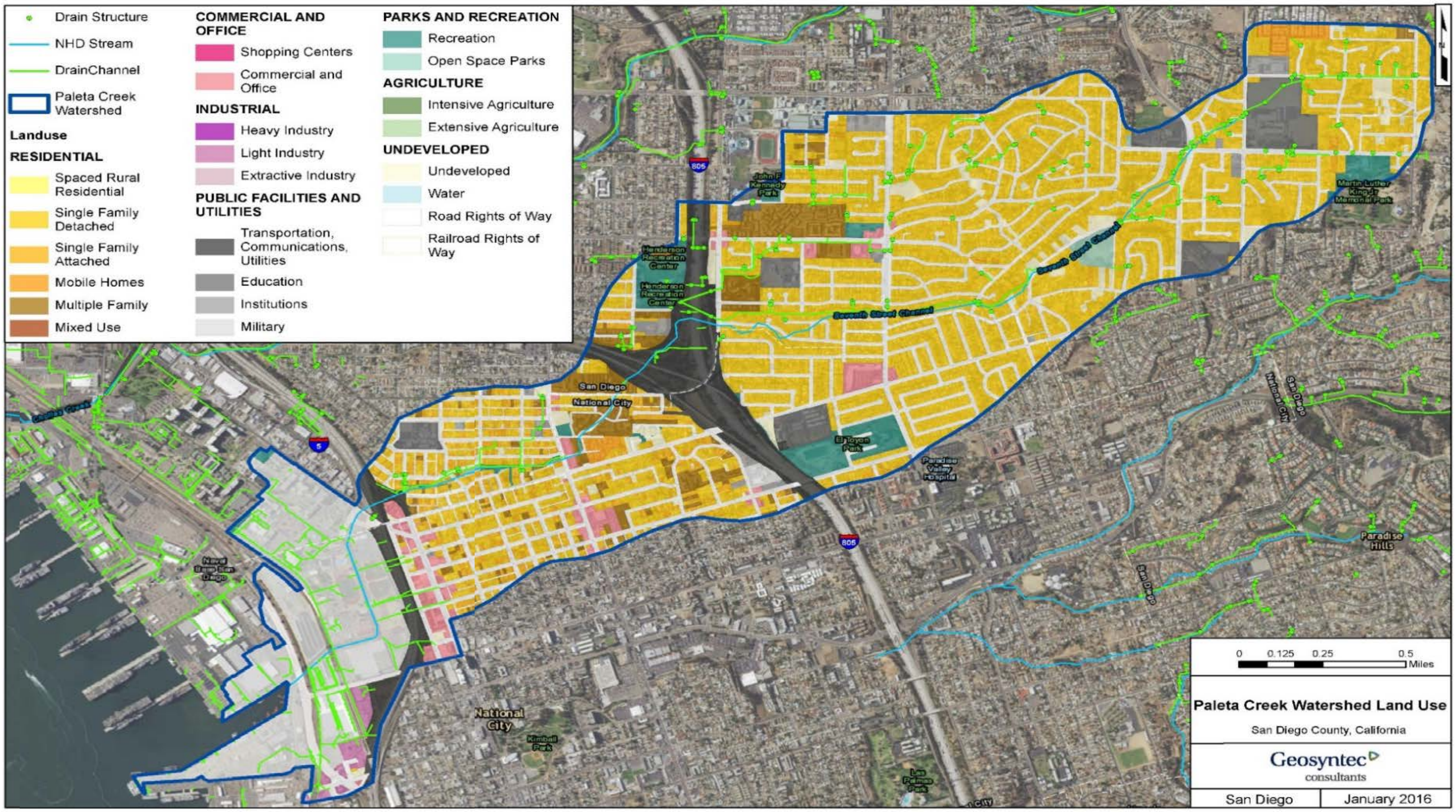


Figure 16. Paleta Creek Watershed Land Uses

Monitoring Site Selection
Six monitoring locations were selected within the lower Paleta Creek watershed (PCW) representing NBSD land uses, the upper urbanized watershed, and a downstream creek location affected by mixed flows from both NBSD and the upper watershed area.

Site selection was also based on sampling crew safety and equipment access. The sample locations are described below in Table 18 and their locations shown on Figure 23. C1W and C2W are receiving water sites within Paleta Creeks, while the remaining four locations are NBSD stormdrain outfalls just upstream of their confluence with Paleta Creek. Photographs and descriptions of each sampling location are included in Appendix A, as compiled during the initial site reconnaissance.

Table 18. Monitoring Locations

Site ID	Site ID Description	Location	Type	Approx. Drainage Area (acres)	Tidal	Drainage Area Description
C1W	Downstream Creek	Paleta Creek at Cummings Road	Receiving water	2,000	Yes	Downstream end of Paleta Creek
C2W	Upstream Creek	Paleta Creek at Main Street	Receiving water	1,660	No	Within Paleta Creek, upstream of tidal influence and upstream of NBSD outfalls
O1W	North of Harbor	NBSD outfall #23	Outfall	3.5	Yes	Industrial areas on the west side of NBSD
O2W	South of Harbor	NBSD outfall #33	Outfall	3.4	Yes	Industrial areas on the east side of NBSD which has been shown to have high copper and zinc concentrations during previous sampling activities
O3W	Auto Skills Center	NBSD outfall north of railroad crossing	Outfall	36	Yes	Large, central, mixed used portion of the NBSD facility, including residential areas, parking, and an auto shop
O4W	Guard Gate	NBSD outfall at Paunack and Division Streets	Outfall	29	Yes[1]	Large, central, mixed use portion of the NBSD facility, including apartment buildings, activity fields, and parking lots

1. O4W was not observed to be tidally influenced during the initial site reconnaissance, subsequent siting follow-up visits, or before Event #1. However, it can be surmised that based on the high salinity of the sample collected for Event #2, this location was in fact tidally influenced. This is discussed in more detail later in this report.

The outfall locations and associated drainage areas are shown Figure 17. Detailed GIS maps showing the land surface characteristics for the drainage areas for each of the monitored outfalls are presented in Appendix B.

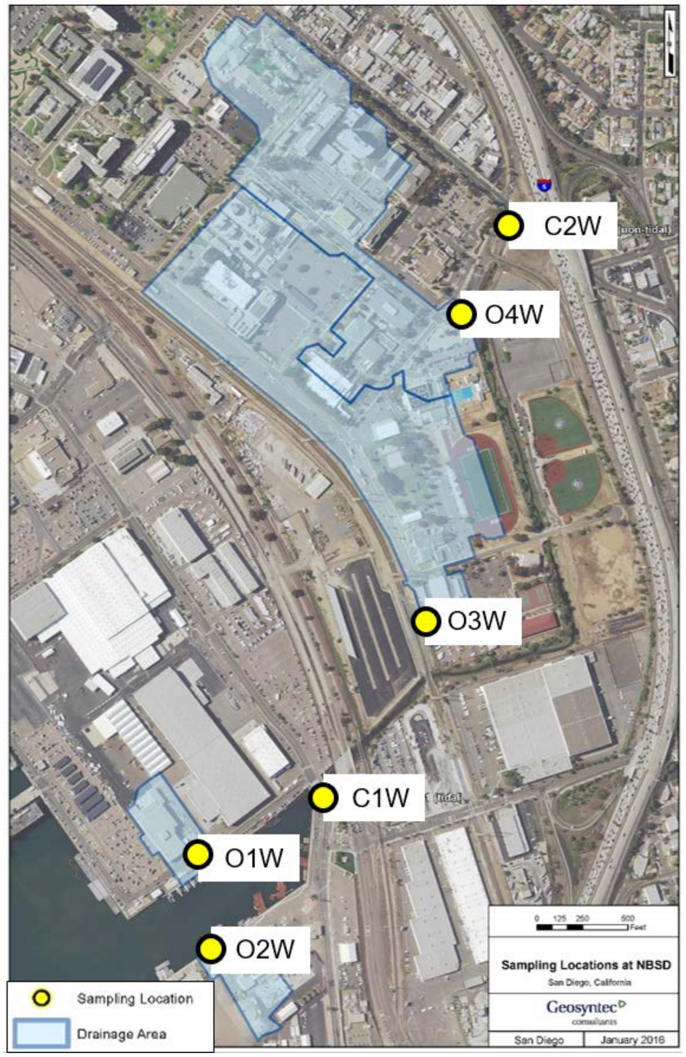


Figure 17. Drainage Area Characteristics for NBSD Outfalls

Creek Channel Survey

Appendix B contains field survey notes and surface area measurements for the Paleta Creek watershed conducted to support WinSLAMM analyses. The lower part of the watershed has a completely lined concrete channel. However, substantial vegetation is present in the channel, including moderate-sized palm trees. Stable sediment in the channel with vegetation, even with the large amounts of rain in the previous two weeks before the survey. Reasonably stable areas are adjacent to, and along, the channel. Figures 18 through 20 are photographs showing the character of the channel at different locations.

Figure 18. Lower Paleta Creek near 43rd St and Nordica Ave.

At other location in the channel, bare earth and poor vegetation can be erosion sources. There was some scoured silt/clay on bottom of channel evident with new erosion on bank side.

Figure 19. Paleta Creek near Solola Ave. and Euclid Ave. showing potential erosion sources.

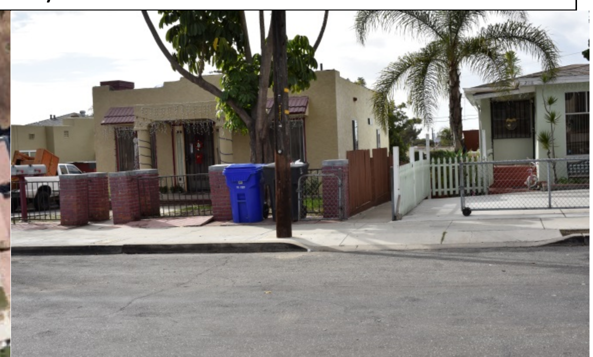
Near the top of the watershed, the creek splits with the main channel (unlined) extending further. The other branch is an unlined dry drainage. Much sediment erosion sources from adjacent poorly vegetated areas. Erosion in channel evident (grey silty material).

Figure 20. Upper Paleta Creek near Cervantes Ave. showing potential erosion sediment sources.

Upper Watershed Land Use Development Characteristics Survey

A land development survey of the area above the naval base (Interstate 5) was conducted on December 18, 2014. Ten neighborhoods were surveyed to determine building along with road and pavement characteristics. Parking conditions and street widths were also noted. Appendix B includes photographs and summaries of this survey, while Figure 21 show some example aerial and street views. Tables 19 and 20 summarize the major surface characteristics of the medium density residential and apartment land uses in the upper watershed area.

B and D Ave. and E3rd and E4th St., National City



Marine View/Division Ave. and S41st St., San Diego

Between Beta and Delta St. on S. 43rd St., San Diego

Figure 21. Example Residential Neighborhoods Surveyed in Upper Paleta Creek Watershed.
The following are the average land development characteristics for the medium density and apartment residential land uses surveyed in the upper Paleta Creek watershed.

Table 19. SD MDR (Paleta Creek Medium Density Residential) standard land use file (% of total area)

roof1	disconnected pitched roof	20.1
roof2	disconnected flat roof (outbuildings)	3.9
driveways 1	paved and connected	3.7
sidewalks 1	paved and connected	7.3
streets 1	smooth texture, light parking, 38 ft wide	13.7
streets 2	smooth texture, moderate parking, 58 ft wide	5.3
streets 3	smooth texture alley, no parking, 19 ft wide	2.5
small lands 1	mod compacted, silty	43.5
		100

Table 20. SD APTS (Paleta Creek Apartments Residential) standard land use file (% of total area)

roof1	disconnected pitched roof	24.4
roof2	connected flat roof	24.5
paved parking 1	connected	30.6
driveways 1	paved and connected	0
sidewalks 1	paved and connected	3.4
streets 1	smooth texture, moderate parking, 30 ft wide	2.8
streets 2	intermediate texture, moderate parking, 30 ft wide	4
small lands 1	mod compacted, silty	10.3
		100

WinSLAMM Modeling and Paleta Creek Watershed Subareas

Paleta Creek stormwater monitoring data was used with the WinSLAMM stormwater quality model that was previously calibrated for the area during previous NBSD projects. The model description and use are described later in this report and in the documents prepared during the prior NBSD projects.

This project used the flow calculations from the model (calibrated using on the detailed land use and development characteristics for the modeled areas in the Paleta Creek watershed, along with long-term regional rain data). The flow data was used in conjunction with the monitored metal and PAH data for several particle size ranges to allow better predictions of the fates of the discharged stormwater particulates after discharge to the receiving waters. The monitoring data and the modeled results will be coupled with measurements of receiving sediment impacts and ecological effects by other project team members. The stormwater modeling enabled calculations of stormwater discharge characteristics as determined by specific drainage area characteristics and activities in the Paleta Creek watershed. These stormwater loading predictions, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and related settling rates), were used to quantify the recontamination potential of the sediments by stormwater discharges and to compare the monitored data with the tentative TMDL allocations.

Brief Description of WinSLAMM

WinSLAMM was developed to evaluate stormwater runoff volumes and pollutant loadings in developed areas during a wide range of rain conditions, not just very large storms that are the focus of conventional drainage design models. WinSLAMM determines the runoff based on local rain records and calculates runoff volumes and pollutant loadings from each individual source area within each land use category for each rain. Examples of source areas include: roofs, streets, paved storage areas, loading docks, small landscaped areas, large landscaped areas, sidewalks, and parking lots.

WinSLAMM can use any length of rainfall record as determined by the user, from single rainfall events to several decades of rains. The rainfall file used in the initial calibration calculations for San Diego, CA, were developed from hourly data obtained from EarthInfo CDROMs that included NOAA 1948 through 2013 recorded hourly precipitation records obtained at the San Diego airport. The initial calculations focused on the five years from 1995 through 1999, while other calculations used varying lengths of the rain records.

Besides determining the main sources of the stormwater contaminants of concern, the model can calculate the benefits for a series of stormwater control practices, including rain barrels and water tanks for stormwater irrigation, pavement and roof disconnections, roof rain gardens, infiltration/biofiltration in parking lots and as curb-cut biofilters, street cleaning, wet detention ponds, grass swales, porous pavement, catchbasins, media filters, hydrodynamic devices, selected proprietary devices, and combinations of these practices located throughout the watersheds and at the outfalls. The model evaluates the practices through engineering calculations of the unit processes based on the actual designs and sizes of the controls specified and determines how effectively these practices remove runoff volume and pollutants.

WinSLAMM does not use a percent imperviousness or a curve number to generate runoff volume or pollutant loadings. The model applies volumetric runoff coefficients to each "source area" within a land use category depending on site and rainfall characteristics. Each source area has a different runoff coefficient equation based on factors such as: slope, type and condition of surface, soil properties, etc., and calculates the runoff expected for each rain. The runoff coefficients were developed using monitoring data from typical examples of each site type under a broad range of conditions.

Each source area also has a unique pollutant concentration (event mean concentrations - EMCs - and a probability distribution) assigned to it. The EMCs for a specific source area vary depending on the rain depth. The source area's EMCs are based on extensive monitoring conducted in North America by the USGS, Wisconsin DNR, University of Alabama, and other groups. These monitoring efforts isolated source areas (roofs, lawns, streets, etc.) for different land uses and examined long term data on the runoff quality. The pollutant concentrations are also continuously updated as new research data become available, including information collected from source areas at naval facilities. Nationwide regional calibrations based on the National Stormwater Quality Database are available as initial background that can be supported and modified by local monitoring data (as was done for the Navy).

For each rainfall event in a data set, WinSLAMM calculates the runoff volume and pollutant load (randomized EMC x runoff volume) for each source area. The model then sums the loads from the source areas to generate a land use or drainage basin subtotal load. The model continues this process for the entire rain series described in the rain file. It is important to note that WinSLAMM does not apply a "unit load" to a land use. Each rainfall produces a unique load from a modeled area based on the specific source areas in that modeled area.

The model replicates the physical processes occurring within each stormwater control practice. For example, for a wet detention pond, the model incorporates the following information for each rain event when calculating performance:

1. Runoff hydrograph, pollution load, and sediment particle size distribution from the watershed area to the pond,
2. Pond geometry (depth, area),
3. Hydraulics of the outlet structure,
4. Particle settling time and velocity within the pond based on retention time

Stokes Law and Newton's settling equations are used in conjunction with conventional surface overflow rate calculations and modified Puls-storage indication hydraulic routing methods to determine the sediment amounts and characteristics that are trapped in the pond. Again, it is important to note that the model does not apply "default" percent efficiency values to a control practice. Each rainfall is analyzed and the pollutant control effectiveness will vary based on each rainfall and the pond's antecedent condition.

The model's output is comprehensive and customizable, and typically includes:

1. Runoff volume, pollutant loadings and EMCs for a period of record and/or for each event.
2. The above data pre- and post- for each stormwater management practice.
3. Removal by particle size from stormwater management practices applying particle settling.
4. Other results can be selected related to flow-duration relationships for the study area, impervious cover model expected biological receiving water conditions, and life-cycle costs of the controls.

A full explanation of the model's capabilities, calibration, functions, and applications can be found at www.winslamm.com. For this project, the parameter files were calibrated using the local San Diego naval facility monitoring data (http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Site_Descriptions_Calibration_and_Sources_Feb_17_2014.pdf), supplemented by additional information from regional data from the National Stormwater Quality Database (NSQD), available at: http://bmpdatabase.org/nsqd.html as described in the following report describing regional calibrations of WinSLAMM using NSQD information: http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Standard_Land_Use_file_descriptions_final_April_18_2011.pdf.

Paleta Creek Subwatershed Areas Modeled in WinSLAMM

The Paleta Creek watershed survey was used with WinSLAMM for stormwater analyses of the watershed. The watershed drainage area was updated during the field survey and the land use breakdowns were also obtained from aerial photographs for each site. These neighborhood surveys were used to describe the land development conditions for the land uses in the area, and the creek survey was used to describe the channel modeling conditions. Aerial photographs were used to measure the areas for each surface type in each neighborhood. The resulting WinSLAMM model using this information along with current San Diego calibration information was then compared to more complete stormwater monitoring results for the area. Appendix B contains the land development characteristics for all of the subareas in the Paleta Creek watershed that were used in the WinSLAMM modeling analyses, while Appendix C contains the detailed model input information used for these analyses.

Table 21 summarizes the land surface characteristics for the drainage areas for the four NBSD outfalls monitored during this project.

Table 21. NBSD Monitored Drainage Area Land Use Characteristics (acres)

WinSLAMM IND area	SD Navy areas	Description (industrial areas)	O3W ac to creek	O4W ac to creek	O1W ac to estuary	O2W ac to estuary
1	roofs1	Roof, directly connected flat	6.384	6.306	1.349	1.336
13	PavedParking1	Paved Parking, directly connected	11.675	6.926	1.853	1.69
31	Sidewalks1	Sidewalk, directly connected	1.241	3.253		
37	streets1	Street, intermediate texture, no parking, 35 ft wide	3.788	3.369	0.275	
45	Large Landscaped Areas 2	Large Landscaped Area, normal silty	5.834			
51	Small Landscaped Areas 1	Small Landscaped Area, compacted silty	3.789	7.335		0.031
70	Water Body Areas	Water, wet	0.051	0.011		
89 (OIA6)	Light Laydown Area, asphalt paved, dir connected	Other Paved Area, directly connected	3.481	0.694		0.384
99 (ONPA1)	Light laydown unpaved, drains to soil	Other Pervious Area, compacted silty		1.011		
		Total acres	36.243	28.905	3.477	3.441

The NBSD industrial and the residential area land development characteristics were used to describe those land uses in the Paleta Creek watershed, while the other minor watershed areas (commercial, parks, etc.) used regional standard land use files (as described at: http://rpitt.eng.ua.edu/Publications/4_Stormwater_Characteristics_Pollutant_Sources_and_Land_Development_Characteristics/Land_development_characteristics/Standard%20Land%20Use%20file%20descriptions%20final%20April%2018%202011%20for%20EPA%20Cadmus.pdf).

Figure 22 is a map schematic (not to scale) that shows the connections of the 20 land use subareas in the Paleta Creek watershed used for the WinSLAMM analyses.

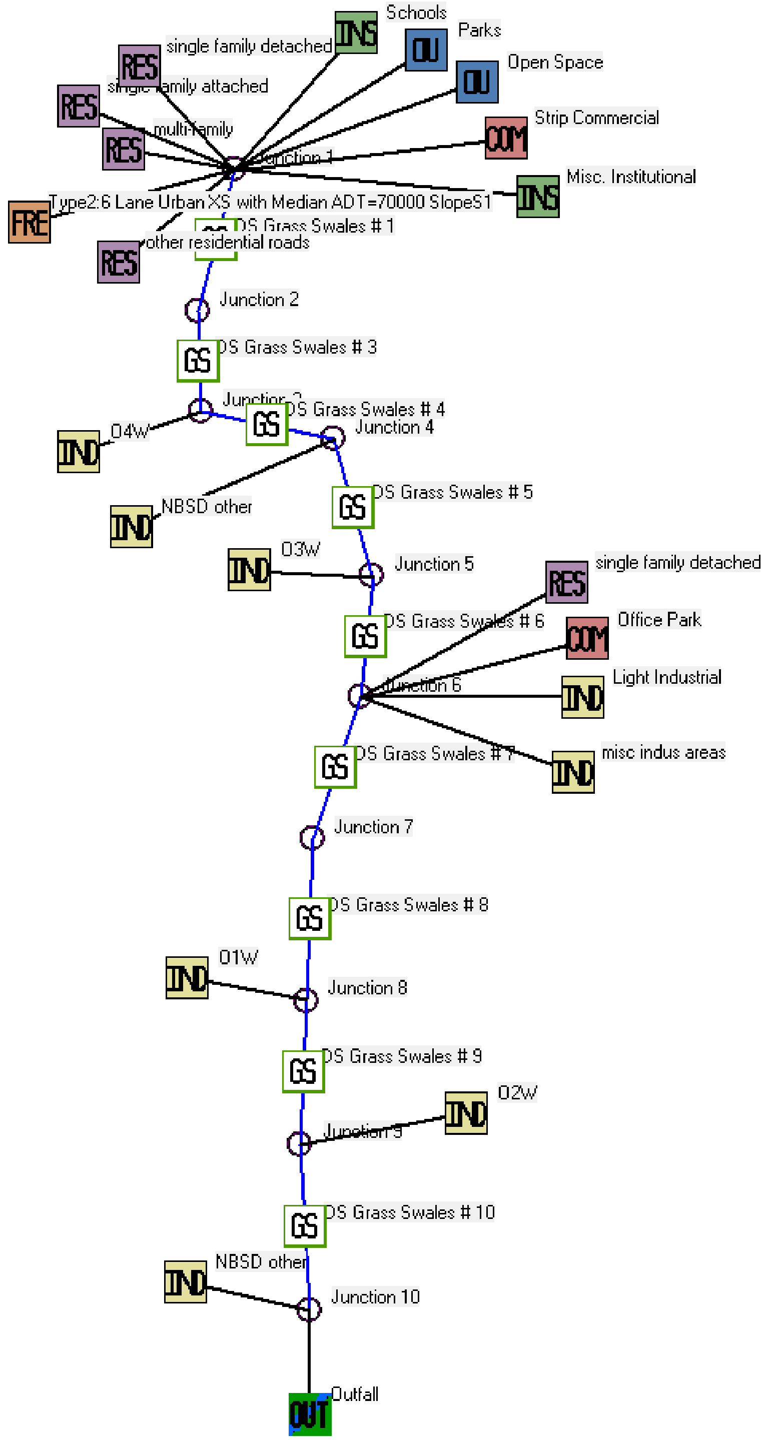


Figure 22. Paleta Creek WinSLAMM schematic.

Table 22 lists the 20 land use subareas used in the WinSLAMM analyses of Paleta Creek, as shown on the map schematic.

Table 22. Paleta Creek Watershed Land Use WinSLAMM Subareas (described in Appendix C)

Table 23 sorts the 20 WinSLAMM land use subareas by location; NBSD and intermediate (other land uses draining to Paleta Creek west of I5 with NBSD outfalls), and upper watershed (east of I5).

Table 23. Paleta Creek Watershed Land Use Subareas Sorted by NBSD and Upper Watershed Areas

land use description	upper watershed (mostly resid.), inter. or NBSD	Junction	land use	area (acres)	% of total area
LU# 18 - Commercial: Office Park	inter	J6	comme	1.3	0.1
LU# 19 - Industrial: Light Industrial	inter	J6	indus	11.1	0.6
LU# 20 - Industrial: misc indus areas	inter	J6	indus	41.2	2.1
LU# 5 - Residential: single family detached	inter	J6	resid	0.11	0.0
LU# 2 - Industrial: O4W	NBSD	J3	indus	28.91	1.4
LU# 7 - Industrial: O2W	NBSD	J3	indus	3.44	0.2
LU# 3 - Industrial: NBSD other	NBSD	J4	indus	87.18	4.4
LU# 8 - Industrial: NBSD other	NBSD	J4	indus	56.61	2.8
LU# 4 - Industrial: O3W	NBSD	J5	indus	36.24	1.8
LU# 6 - Industrial: O1W	NBSD	J8	indus	3.48	0.2
LU# 16 - Commercial: Strip Commercial	upper	J1	comme	40.04	2.0
LU# 11 - Freeway: Type2:6 Lane Urban XS with Median ADT=70000 SlopeS1	upper	J1	freew	397.64	19.9
LU# 13 - Institutional: Schools	upper	J1	insti	80.8	4.0
LU# 17 - Institutional: Misc. Institutional	upper	J1	insti	22.4	1.1
LU# 14 - Other Urban: Parks	upper	J1	other	62.13	3.1
LU# 15 - Other Urban: Open Space	upper	J1	other	42.63	2.1
LU# 1 - Residential: single family detached	upper	J1	resid	804.37	40.2
LU# 9 - Residential: single family attached	upper	J1	resid	68.21	3.4
LU# 10 - Residential: multi-family	upper	J1	resid	101.27	5.1
LU# 12 - Residential: other residential roads	upper	J1	resid	110.81	5.5
overall total				1999.87	100.0

Section 2: Methodology: Monitoring Approach

The following sections describe the equipment mobilization triggers, program triggers, sample collection procedures, sample processing, and quality assurance/quality control procedures.

Mobilization Triggers

The Monitoring Plan established that up to two rain events at the outfalls would be sampled before the end of February 2016. Triggers included:

1. **Pre-Mobilization**. Initiated when more than 0.2 inches of rainfall was predicted for a calendar day period at any likelihood, two days before the event. Pre-mobilization activities included scheduling staff, checking equipment status, contacting NBSD, charging batteries, etc.

2. **Mobilization**. Initially triggered based on forecasts of at least a 70 percent probability of greater than or equal to 0.2 inches of rainfall for a calendar day at least 24 hours prior to the start of the sampling event. The 70 percent probability was revised to 50 percent in early 2016 due to the limited number of qualifying events. Mobilization activities included programming and deploying the auto-samplers, batteries, collection bottles, sondes, etc. Auto-samplers were turned on four to six hours prior to the start of the sampling event, daylight permitting.

The National Weather Service (NWS) forecast for Lat/Lon: 32.6780/-117.1180 (Elevation 7 feet) in National City, CA was used to predict rainfall. The San Diego Lindbergh Field National Oceanic and Atmospheric Administration (NOAA) rain gauge (KSAN Station) was used to track accumulated rainfall in real-time. After the event, data from the NBSD HOBO gage and the on-site rain at C14 were reviewed. Both the NWS forecast area and the NOAA rain gage location are shown in Figure 23.

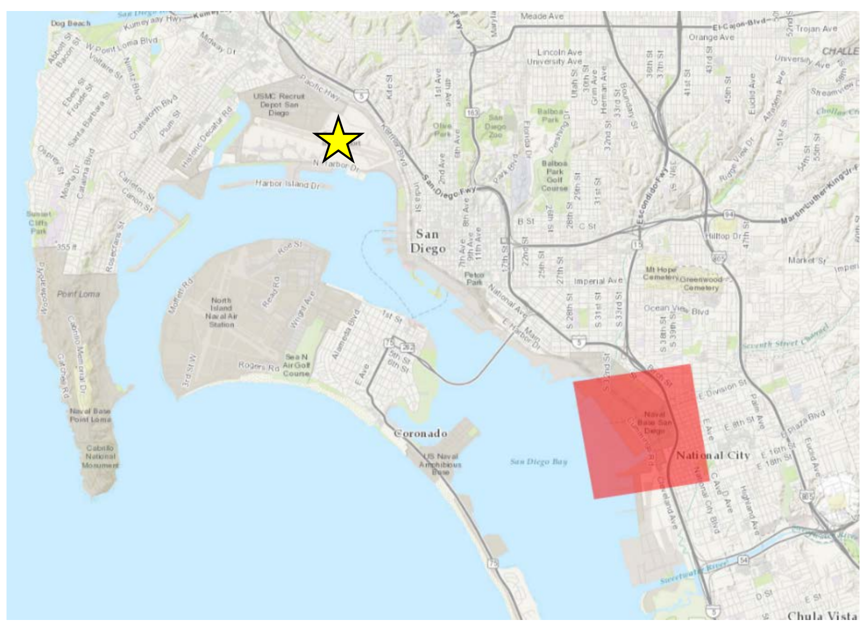


Figure 23. Location of National Weather Service Forecast Area (red box) and San Diego Lindbergh Field NOAA Rain Gauge (yellow star)

Sample Collection
ISCO 6712 automatic water samplers were deployed at all monitoring locations for the collection of time-spaced composite samples. ISCO AQ702 multi-parameter meters were deployed at tidally influenced monitoring locations (C1W, O1W, O2W, and O3W) to measure salinity and target the collection of freshwater samples. The intake tube and the salinity meter at C1W were floated on the freshwater lens for the second monitoring event. The meters were cleaned, calibrated, and deployed before each event. ISCO 750 area-velocity (AV) meters[1] were deployed at flow or depth-triggered monitoring locations (C2W, O1W, O2W, O3W, and O4W). These were deployed at the start of the monitoring season and checked/readjusted as necessary between events.

ISCO 6712 automatic water samplers collect a sample by drawing the sample through the suction line, pump tubing, and into the sample bottle. A purge/rinse cycle was initiated at each location prior to sample collection. All locations were programmed for time-spaced composite samples, adjusted to reflect the predicted storm intensity and duration, as forecasted by NWS. Strainers were added to the end of the suction lines at the outfall locations for the second event to minimize clogging of the sample lines.

Initially, one pre-washed 10L glass bottle was deployed at each monitoring location in either the manhole configuration (Figure 24, at O3W and O4W) or the surface configuration (Figure 25, at C1W, C2W, O1W, and O2W). Due to sample processing volume requirements, it was determined that more sample volume was needed for the second event. To address this, the surface configurations were modified to a dual-bottle configuration (Figure 26), now housing two 10L bottles, to allow the collection of up to 20L of volume per site. The bottles were wrapped in bubble wrap to prevent accidental collision/breakage and the bottle tops were covered in parafilm wax to reduce aerial contamination. It was not feasible to modify the manhole configurations to the dual-bottle configuration.

[1] The ISCO 750 AV meter utilized Doppler technology to directly measure average velocity, and an integral pressure transducer measures depth of liquid to determine flow area. Flow rate is then calculated using flow area and average velocity for each time increment.

Figure 24. 10L Manhole Configuration

Figure 25. 10L Surface Configuration

Figure 26. 20L Dual Bottle Surface Configuration

Program Triggers

The initiation of each automated ISCO sampling program was triggered by site-specific criteria, selected to target the collection of a stormwater sample, and avoid false triggers such as rising tides which would cause a backwater effect and contamination of stormwater at the sampling location by the sea water. Triggers included cumulative rainfall, flow, depth, and salinity for tidally influenced locations. Specific triggers are provided for each monitoring location in Table 24. For sampling locations with two triggers listed (C1W, O1W, O2W, and O3W), both triggers were required to be met for sampling to be initiated.

Table 24. Site-Specific Sample Collection Triggers

Site ID	Rainfall (in)	Flow (cfs)	Depth (ft)	Salinity (ppt)
C1W	> 0.03 cumulative depth	--	--	< 5
C2W	--	--	> 0.15/0.85[1]	--
O1W	--	> 0.05	--	< 5
O2W	--	> 0.05	--	< 5
O3W	--	> 0.05	--	< 5
O4W	--	--	> 0.85	--

1. Event #1 trigger > 0.15 ft. Event #2 trigger was modified to >0.85 ft to better capture the event peak.

Sample Processing

Composite samples were split using a Teflon™ Dekaport sample splitter on-site by SPAWAR staff. Since the complete samples were split, the particulate concentrations represent suspended sediment concentrations (SSC).The sample splitting and processing methodology is illustrated in Figure 27. One split was analyzed without being filtered, while the rest were processed using different sized filters in order to quantify pollutant concentrations (in water) that are associated with various suspended sediment particle size ranges. Each water concentration result (particulate only, so total concentration minus dissolved, based on a 0.45 µm-filtered split sample) was divided by its corresponding particle size SSC in order to produce the particulate strength, or the mass of pollutant per mass of solids in that particle size range. Sample analyses were performed by research partners at Texas Tech University. The following parameters were analyzed:

- Metals (total and dissolved): Al, Cd, Cr, Cu, Fe, Pb, Zn, Hg
- PAHs
- PCBs and chlordane
- General: Total solids, TOC, BC, SSC, pH, carbonate, alkalinity, Cl, SO_4
- Particle Size Distribution

The samples were analyzed for whole samples and also after being separated into four particle size ranges (0.45 to 5 µm; 5 to 20 µm, 20 to 63 µm, and >63 µm). These size ranges were selected to represent the expected majority of the particulate mass and those particles that could be most directly related to recontamination potential (near field for >63 µm, far field 20 to 63 µm, and distant effects for <20 µm). Larger particle size categories were not separately evaluated, even though they may large particle masses, as they are contained in the >63 µm size range that would have near field affects. Larger particles would affect areas closest to the discharge locations. This report includes information for the metals, PAHs, most of the general constituents, and the particle size distribution. Sections 8 and 9 discuss PCBs and chlordane separately.

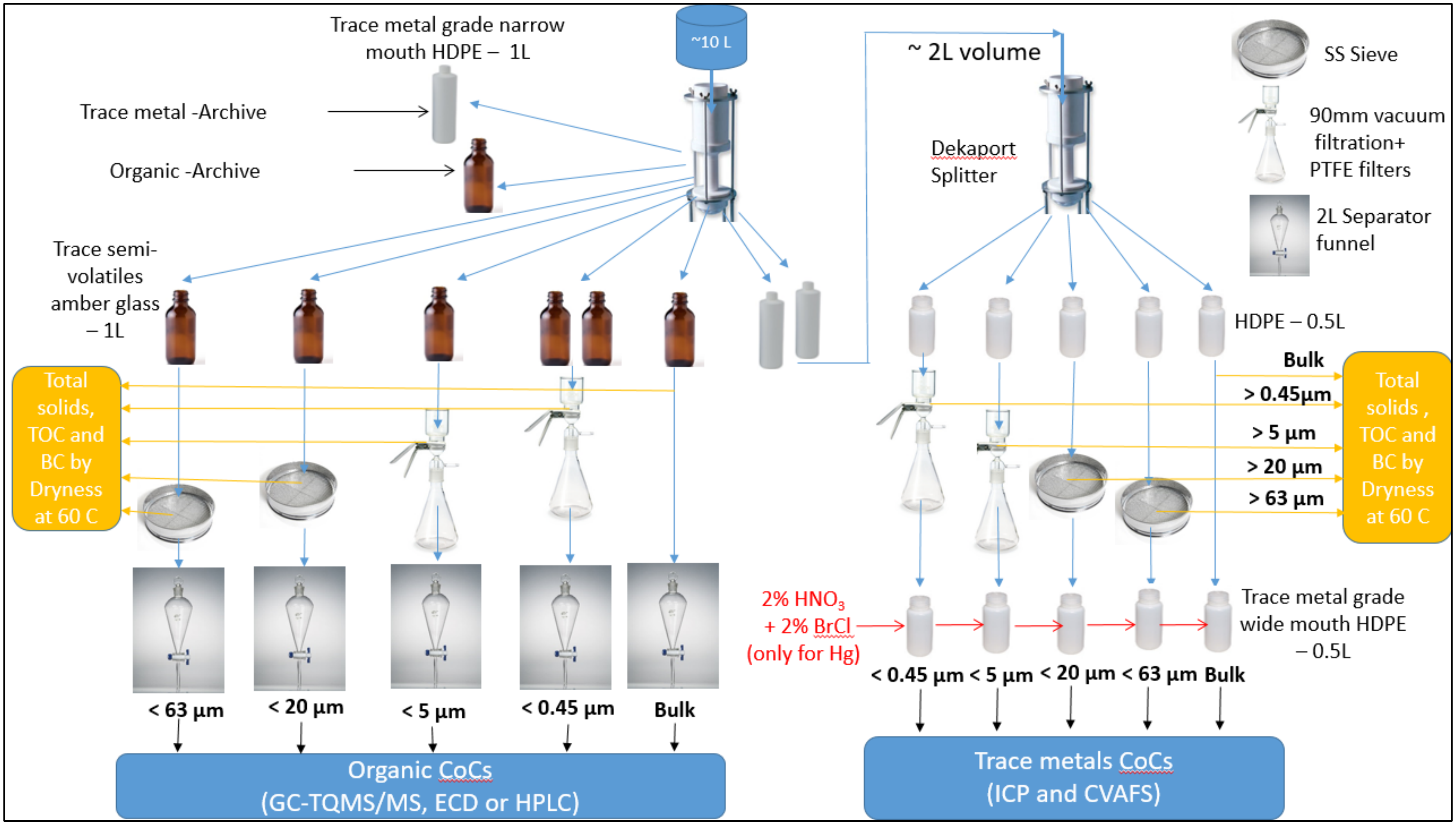


Figure 27. Composite sample splitting and analytical scheme.

Quality Assurance/Quality Control

Equipment was calibrated and maintained per manufacturer specifications. Equipment was also tested on site prior to program initiation to reduce the risk of field errors (e.g., ISCO grab samples were initiated manually into a beaker to be sure suction line was pulling the correct volume, etc.). Equipment was also locked to reduce the risk of vandalism and theft.

Prior to the start of the program, sampling instructions were prepared for the field team. The field team was also provided an overview of the purpose of the study and the sampling procedures. QAQC procedures included an established chain of command, standardized equipment list, clean hand/dirty hands procedures for sample collection/handling, requirement to wear clean nitrile gloves, samples packed in ice, use of chains of custody, etc.

Event Sample Summaries

The automatic water sampling monitoring equipment was initially deployed on October 13, 2015, however sampling was not initiated by the forecasts until January 4-8 and January 30-31, 2016. Despite a predicted El Nino for the 2015/2016 wet season[1], both events occurred late in the season due to an unusually extended dry period at the start of the expected rainy season, in combination with under-forecasting of the qualifying events that did occur. The two monitored events satisfied the sampling plan for the project. Figure 28 shows measured rainfall at the San Diego Lindbergh Field NOAA station from September 2015 through January 2016.

After the equipment was deployed in the field, there was one rain event that measured greater than 0.2 inches of rainfall (the mobilization trigger) and several other minor rain events. The large event from 11/3/2015 to 11/4/2015 measured 1.08 inches of rainfall. However, despite the actual event depth, the predicted 24-hr rainfall depths were not sufficient to trigger pre-mobilization or mobilization, as shown in Table 25.

Table 25. Predicted Rain Events

Date	Predicted Rainfall Depth (in)	Chance of Precipitation
11/2/2016	0.11	65%
11/3/2016	0.15	45%
11/4/2016	0.03	15%

[1] The wet season for a Mediterranean climate is typically from October through March.

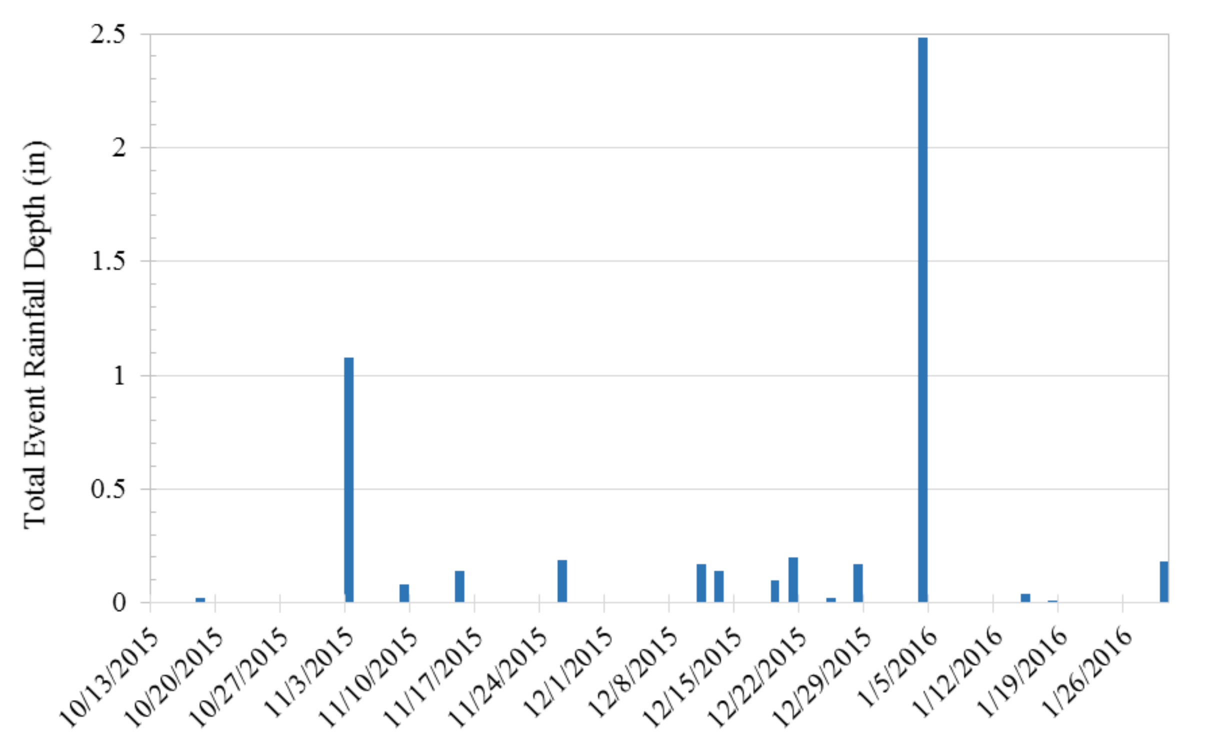


Figure 28. Rainfall time series for San Diego Lindbergh Field NOAA rain gauge.

Table 26 shows the event-specific data including duration, measured rainfall (at the San Diego Lindbergh Field NOAA gauge, the on-site NBSD HOBO gage, and the rain gage connected to the sampler at CW1), and the forecasted depth and probability per NWS for the two sampled events. The first event had a four day duration and measured more rainfall at all three gages than was predicted. The second event had a duration of less than one day and produced less than half of the predicted rainfall (despite 100% probability for a much larger rain) at all three gages. The second event was characterized by high peaks over short durations which, for monitoring locations with smaller drainage areas, did not provide sufficient time to trigger sample collection, rinse/purge the intake line, and collect the required sample volume before the water level fell below the required depth for sample collection. The time-spaced aliquots also provided a challenge for this flashy event and as such, target sample volumes were not fully met at some monitoring locations.

Table 26. Actual and Forecasted Event Data

Date	Duration (hr)	Total Rainfall Measured (in)			Forecasted Depth 24-hr in Advance (in) (% Probability)
		San Diego Lindbergh Field NOAA gauge	NBSD HOBO on-site gage	C1W Gage	
1/4-8/2016	97	2.48	1.87	1.42	1.32 (80%)
1/30-31/2016	17	0.18	0.16	0.20	0.42 (100%)

Despite the challenges associated with complex sampling triggers (e.g., combinations of tidally influenced outfalls, depth and flow-based triggers, and rainfall-triggered sample collection), the flashy nature of the monitored hydrologic events (e.g., small drainage areas combined with short duration storms), as well as the limited number of storms sampled, the program was successful in maximizing sample volumes collected, although the sample bottles were not filled at every location. Plots in Appendix D illustrate success in collecting freshwater samples during low tide and outflowing periods, in addition to collecting samples that were spaced evenly over the course of storm events (during periods in which the triggers were met, or “enabled”). This appendix also contains summaries of the monitored flows and rains and drainage area characteristics. Photos from each sampling event are included in Appendix E, along with the field observations.

Section 3: Literature Review of Stormwater Metal and PAH Associations by Particle Size

Knowing the distribution of pollutants associated with different sized stormwater particles allows more accurate determinations of their sources, transport, and control. Much of the information in this review is derived from several Ph.D. dissertations (as noted) by graduate students at the University of Alabama and from other research projects and publications prepared by Pitt, *et al*. (such as 2017a and b), along with data from other researchers.

Urban stormwater quality models can use this information when routing stormwater particulate-bound pollutants from their source areas and then through the drainage system and stormwater controls. The discharged particle size distributions and associated pollutants can then be used in receiving water models to calculate their fates and effects.

Pollutant strengths are the contaminant concentrations associated with the particulate matter in the stormwater. As such, these values can be used to help identify sources of these contaminants, based on their similar values to particulates found within the watershed ("fingerprinting"). Particulate strengths are determined by calculating the pollutant concentration only associated with the particulates (measured as TSS or SSC, depending on how the sample was collected and analyzed) in the stormwater. Particulate strengths are calculated by the following equation:

$$\frac{(total\ conc. - filterable\ conc.)}{particulate\ solids\ conc.}$$

As an example, if the total copper concentration was 50 µg/L, the filterable ("dissolved") copper concentration was 10 µg/L, and the particulate solids concentration was 150 mg/L, the particulate strength for this sample would be:

$$\frac{\left(50\ \mu\frac{gCu}{L} - 10\mu\frac{gCu}{L}\right)}{150\ mg/L} = 0.26\ \mu\frac{gCu}{mg\ solids}$$ = 260 µg Cu/g solids =

260 mg Cu/kg solids (also = 260 ppm, the usual units for soil analyses)

This value is therefore the pollutant concentration associated with the particulate matter in the runoff sample. These values are very useful when identifying erosion and other sources of the particulate-bound pollutants in the runoff, in contrast to the µg/L concentration values that are affected by site hydrology and subsequent dilution. As an example, the particulate strength data presented in this review for outfall samples can be compared to typical particulate strength data for watershed soils and source area dust and dirt, along with dry atmospheric deposition material.

Pollutant Strengths for all Sizes Combined

The first part of this review presents information concerning the particulate strength information for bulk samples mostly for heavy metals and polycyclic aromatic hydrocarbons (PAHs), while later sections present pollutant strength information for different particle size ranges. Pitt, *et al.* (2005a, b, and c) previously presented particulate strength information from a number of different stormwater research projects that also included the collection and analyses of source area particulates.

Heavy Metals

Metals in urban runoff can occur as dissolved, colloidal and particulate-bound species. Therefore, it is important to measure all forms of heavy metals, especially the particulate and filterable fractions, when determining their fate and effects, and especially their treatability. If possible, associations of the metals with different particle sizes should also be determined. Finally, to obtain the most meaningful data on either bioavailability or toxicity, it is important that chemical speciation/association techniques be applied (such as conducted by Florence and Bately 1980 and Morquecho 2005). Chemical speciation is the determination of the individual concentrations of the various chemical forms of an element that together makes up the total concentration of that element in a sample. Speciation of metals is dependent upon chemical and physical parameters such as pH, temperature and the presence of ligands and particulates. Depending on the chemical form of the metal, a water with a high total metal concentration may be less toxic than another water with a lower total metal concentration (Florence and Batley 1980). The speciation of the metals can also dramatically affect treatment efficiency and should guide the selection of the most appropriate unit treatment process.

Dissolved and Particulate Forms of Pollutants

Pollutants in stormwater runoff can to be separated into particulate-bound or filtered (filterable or "dissolved") forms to better understand their treatability (Pitt, *et al*. 1995, Maniquiz-Redillas, *et al*. 2014, Zgheib, *et al*. 2011). Vignoles and Herremans (1995) studied associations of heavy metal concentrations with different particle sizes in stormwater samples from France. The results showed that heavy metals were mostly associated with particle sizes less than 10 µm in size. However, in a study conducted on urban stormwater runoff in Cincinnati, Ohio, Sansalone, *et al*. (1997) observed that concentrations of heavy materials decreased with smaller particle sizes. Zgheib, *et al*. (2011) examined the partitioning of pollutants between dissolved and particulate phases from urban catchments. The results showed that heavy metals (Pb, Zn, Cu, and Cd) were mostly particulate bound with only Zn being observed in mostly filtered phases. Similar trends were observed in other studies conducted with metals being strongly associated with particulate matter (Harrison, *et al*., 1985, House, *et al*., 1993, EPA 1993, Gromaire-Mertz, *et al*. 1999, Glenn, *et al*. 2001, Hatje, *et al*. 2003, Maestre 2005, Karlsson, *et al*. 2008).

Table 27 summarizes the filterable fraction of heavy metals found in stormwater runoff sheet flows from many urban areas (Pitt, *et al.* 1995). Constituents that are mostly in filterable forms have a greater potential of affecting groundwater and are more difficult to control using conventional stormwater control practices that mostly rely on sedimentation and filtration principles. Luckily, most of the metals are associated with the non-filterable (suspended solids) fraction of stormwater. Likely exceptions include zinc which may be mostly found in the filtered sample portions. However, dry weather flows in storm drainage tend to have much more of the heavy metals associated with filtered sample fractions.

Table 27. Reported filterable fractions of stormwater heavy metals from source areas

Constituent	Filterable fraction (%)
Cadmium	20 to 50
Chromium	<10
Copper	<20
Iron	small amount
Lead	<20
Nickel	small amount
Zinc	>50

Pitt, *et al.* 1995

Pitt, *et al.* (1998) analyzed 550 samples for a broad list of metal and organic constituents, including the total and filtered observations shown in Table 28. The samples were collected from telecommunication manhole vaults that had collected stormwater. Most of the copper and lead were associated with the particulates (even with long periods of quiescent settling), while most of the zinc was found in the filterable fractions. These samples were obtained throughout the United States and represent all seasons.

Table 28. Average particulate fraction of selected constituents from 550 nationwide samples (mg/L, unless otherwise noted)

Constituents	Total concentration	Filtered concentration (< 0.45 µm)	Percent associated with filterable fraction (<0.45 µm)	Percent associated with non-filterable particulates (>0.45 µm)
Turbidity (NTU)	13	1.2	8%	91%
COD	25	22	86%	14%
Color (Hach)	34	20	59%	41%
Copper (µg/L)	29	9.5	33%	67%
Lead (µg/L)	14	3	21%	79%
Zinc (µg/L)	230	160	70%	30%

Pitt et al. (1998)

In an early study of stormwater pollutant partitioning, Harrison and Wilson (1985) examined the chemical associations of Cd, Cu, Pb, Mn and Fe in roadside drainage and receiving stream waters. Samples were taken during different stages of a storm event. They found that the water-soluble or dissolved metals were subject to a “first-flush” effect, while the metals which were substantially particle-associated were dependent upon flow needed to mobilize particles from the road surface and drainage system. Fe and Pb were particle-associated, while Cd and Cu were associated more with colloidal material.

A study by Sansalone and Buchberger (1997b) analyzed lateral pavement sheetflow for five events on a heavily traveled roadway in Cincinnati, Ohio. They found that the event-mean concentrations of Zn, Cd, and Cu were relatively high. Further, it was noted that Zn, Cd, and Cu were mainly in dissolved forms while other metals (Pb, Fe, and Al) were mainly bound to particles. Sansalone and Glenn (2000) analyzed stormwater for eight events during 1996 and 1997 from the same highway in Cincinnati, Ohio. Their results indicated that Zn, Cd and Cu masses were predominately dissolved in pavement sheetflow and that chemical treatment would be required to immobilize the dissolved metal mass.

Barry, *et al.* (1999) identified salinity effects on the partitioning of heavy metals in the stormwater canals entering Port Jackson (Sydney), Australia. Copper, lead, and zinc were found increasingly in dissolved phases as the salinity increased in the lower sections of the canals. During high flows, most of the metals seemed to be rapidly exported from the estuary as a discrete surface layer, while low flows contributed most of the metals to the estuary.

Shafer, *et al.* (1999) investigated the partitioning of trace metal levels (Al, Cd, Cu, Pb, and Zn) in Wisconsin rivers and found that the concentrations in the rivers were comparable to recent data collected in the Great Lakes and other river systems where clean methods were used for sampling and analysis. They also found that the variation in the partitioning coefficients of each metal between sampling locations could be explained by the amount of anthropogenic disturbance in the watershed and by the concentration of dissolved organic carbon (DOC) in the water.

Krein and Schorer (2000) investigated heavy metals and PAHs in road runoff and found that an inverse relationship existed between particle size and particle-bound heavy metals concentrations.

Significant amounts of non-point source runoff were shown to enter Santa Monica Bay (California) from the Ballona Creek Watershed during wet weather flow during monitoring by Buffleben, *et al.* (2001). The watershed is developed mostly with residential, commercial and light industrial land uses. They found that the suspended solids phase primarily transported the mass for five of the six metals studied: Cd, Cr, Cu, Pb, and Ni. Arsenic was found primarily in the aqueous phase.

Mosley and Peake (2001) characterized urban runoff from a catchment in Dunedin, New Zealand during base flows and storm flows from five rainfall events. Fe and Pb were found to be predominantly particle-associated (>0.4 µm) with concentrations increasing significantly at the beginning of storm runoff. In contrast, the majority of Cu and Zn was found in the <0.4 µm fraction prior to rain, but a significant proportion was present in the >0.4 µm fraction during the initial period of storm flows. The results indicate that Cu and Zn may be more bioavailable, and more difficult to remove by stormwater treatment than Pb. The pH level and the concentration of major ions (Ca^{+2}, Na^{+}, Mg^{+2}, K^{+}), dissolved PO_4^{-3}, and NO_3 generally decreased during storm flows due to rainwater dilution. Concentrations of total N and P often increased during the initial period of storm runoff, likely because of washoff of particulate plant material.

Fan, *et al.* (2001) reviewed the transport of toxic pollutants through multiple media and drainage systems in an urban watershed during wet-weather periods. Field studies have identified that a major portion of these pollutants including benzene, PAHs, polychlorinated biphenyls (PCBs), pesticides, and heavy metals (e.g., arsenic, cadmium, chromium, copper, lead, mercury, and zinc) contained in urban stormwater runoff are in particulate form, or sorbed onto particles.

Tobiason (2004) studied the removal of metals from roof runoff through media filtration. In particular, he looked at zinc runoff from a one-acre metal roofed building and tested different media for the ability to remove zinc from the roof runoff. He found that the concentration of zinc in the runoff ranged from 0.42 mg/L to 14.7 mg/L and averaged 86% dissolved.

DeCarlo, *et al.* (2004) studied the composition of water and suspended sediment in streams of urbanized watersheds in Hawaii. They found that suspended particulate matter controlled most of the trace element transport and that Pb, Zn, Cu, Ba and Co exhibited increased concentrations with urbanized portions of the watershed. Colich (2004) in his study of stormwater runoff from the Evergreen Point Floating Bridge in Seattle, Washington found elevated concentrations of metals, especially copper and zinc, when compared to the water body. During high volume traffic periods, the concentrations were up to three times higher than during low traffic volume periods.

Deletic and Orr (2005) collected sediment from an urban road in Aberdeen, Scotland using a wet sampling technique that involved washing the designated surfaces. They measured heavy metals (Zn, Cu, Pb and Cd) only in their particulate forms. They found the highest concentrations of heavy metals in the smallest particle size fraction analyzed (<63 µm).

Tables 29 through 31 summarize the particulate and filterable fraction of stormwater heavy metals from a number of studies. In almost all cases, the heavy metals are mostly associated with particulates, except for Zn which is mostly associated with the filterable fraction. Interesting exceptions are noted, however. Zinc stormwater concentrations from Birmingham industrial storage areas were found to be almost completely associated with the particulate fraction. These samples were apparently not affected by runoff from areas having galvanized metals, but were affected by heavy truck traffic, where the particulate forms of Zn would be mostly from tire wear.

Table 29. Filterable fraction of heavy metals observed at the inlet to the Monroe St. wet detention pond, Madison, Wisconsin (average and standard deviation)

	Copper	Lead	Zinc
Number of observations	60 to 64	59 to 64	57 to 64
Average total concentration (µg/L)	50 (14)	85 (52)	152 (136)
Average filtered concentration (µg/L)	6.4 (3.3)	3.5 (1.7)	51 (34)
Average percentage filterable	13%	4.1%	34%
Average percentage associated with particulates	87%	96%	66%

Source: House, Waschbusch, and Hughes 1993

Table 30. Milwaukee and Long Island NURP source area heavy metal associations (based on mean concentrations observed)

	Residential roof runoff		Commercial parking runoff	
	% filt.	% part.	% filt.	% part.
Arsenic[a]	….	….	25	75
Cadmium[a]	….	….	18	82
Chromium[a]	….	….	24	76
Lead[b]	8	92	3	97
Lead[a]	….	….	16	84

[a] STORET Site #596296-2954843 (Huntington-Long Island, N.Y.; NURP)

[b] *Source*: Bannerman et al. 1983 (Milwaukee; NURP)

Table 31. Birmingham, Alabama source area heavy metal particulate associations (based on mean concentrations observed)

	Roof areas (N=12)		Parking areas (N=16)		Storage areas (N=8)		Street runoff (N=6)		Loading docks (N=3)		Vehicle service areas (N=5)		Landscaped areas (N=6)		Urban creeks (N=19)		Detention ponds (N=12)	
	% filt.	% part.	% filt.	% part.	% filt.	% part.	% filt.	% part.	% filt.	% part.	% filt.	% part.	% filt.	% part.	% filt.	% part.	% filt.	% part.
Aluminum	3.4	97	13	87	7.8	92	29	71	na	na	25	75	52	48	31	69	47	53
Cadmium	12	88	9.5	90	36	64	1	99	29	71	3.2	97	na	na	2.4	98	25	75
Copper	2.6	97	9.5	90	86	14	1.4	99	40	60	6.2	94	5.1	95	2.8	97	47	53
Chromium	2.1	98	4.1	96	15	85	18	82	na	na	na	na	2.5	97	2.5	97	5.4	95
Lead	2.7	97	4.6	95	2.5	97	4.6	95	na	na	3.8	96	na	na	7.0	93	5.3	95
Nickel	na	na	11	89	na	na	na	na	na	na	na	na	na	na	7.9	92	13	87
Zinc	88	12	78	22	1.3	99	53	47	60	40	70	30	61	39	100	0	100	0

Source: Pitt, Lantrip, Harrison, Henry, and Hue. 1999

Notes: na=not available or too few detectable observations for calculation

Table 32 (Morquecho 2005) shows that most of the turbidity would be removed by the removal of particulates >0.45 μm. She found that about 60 to 80% of the stormwater COD was associated with the filterable fraction, except for two mixed samples (35% filterable). In previous work, COD was reduced almost 50% by removal of particulates to 0.45 µm (Johnson, *et al.* 2003). Total phosphorus showed a similar pattern to COD with about 35 to 55% associated with the filterable fractions. Heavy metals were in general found more in the filterable fraction. Only 30% of zinc in roof samples was associated with the particulate fraction, 42% for inlets and 8% for mixed samples. Almost all of the cadmium was in the filterable fraction with copper and lead more evenly divided between the two fractions. Previously, most of the heavy metals were found to be associated with particulates, except for zinc which was mostly in the filterable fraction.

Table 32. Average particulate and filterable fractions of pollutants analyzed

	Roofs		Inlets		Mixed	
Constituent	Ave % part.	Ave % filt.	Ave % part.	Ave % filt.	Ave % part.	Ave % filt.
Total solids	50	50	50	50	38	62
Turbidity	79	21	88	12	89	11
COD	21	79	39	61	63	37
Total phosphorus	44	56	59	41	64	36
Zinc	30	70	42	58	8	92
Copper	59	41	40	60	14	86
Cadmium	23	77	14	86	n/a	n/a
Lead	46	54	54	46	n/a	n/a

Morquecho 2005

Eppakayala (2015), during stormwater monitoring at a heavy industrial site in the southeastern US, found that SSC was highly correlated with all the metal constituents (Pearson correlation coefficients > 0.7) accounting to increases of total metal concentrations with increased SSC concentrations. This can be related to high affinity of association of metals with particulate matter. All the metals included in the analyses were strongly correlated with each other, while COD, total N and total P didn't show any positive correlations with other parameters included in the study. Nitrate showed significant correlations with bicarbonate and total alkalinity. Example scatterplots, with significant regressions (based on ANOVA) for some of these constituents are shown in Figures 29 to 32.

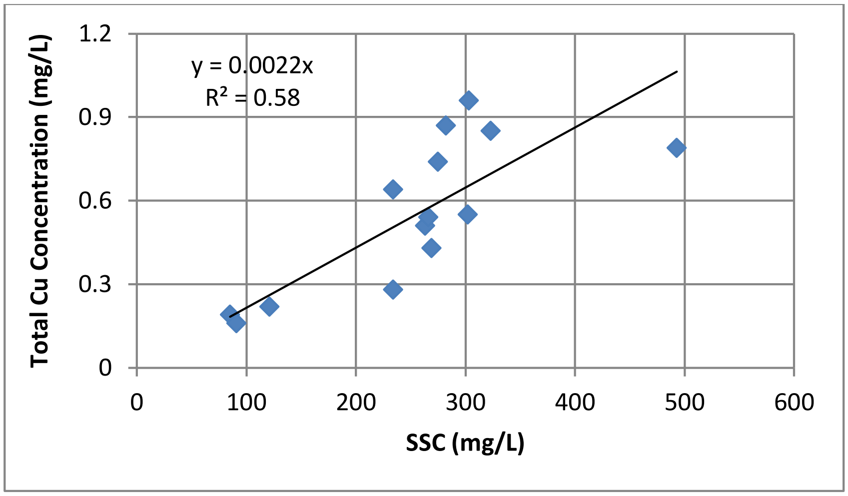


Figure 29. Scatterplot of SSC vs Total Cu Concentration (showing significant regression relationship) (Eppakayala 2015)

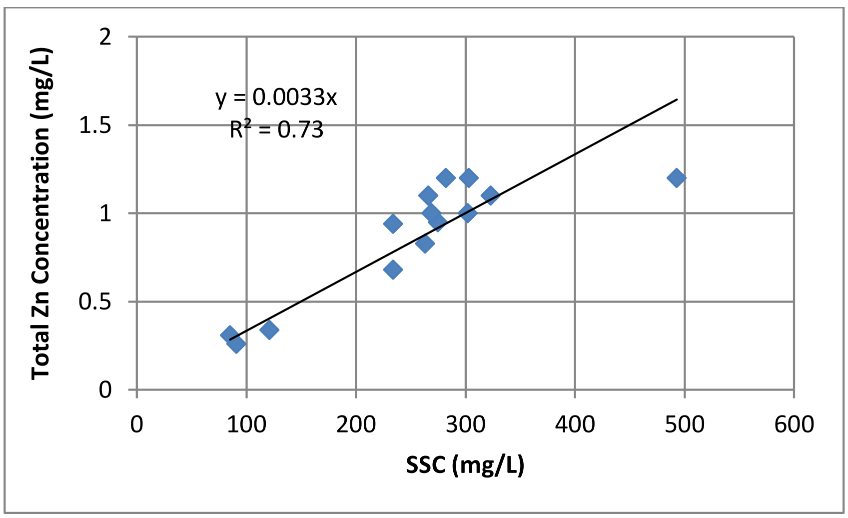


Figure 30. Scatterplot of SSC vs Total Zn Concentration (showing significant regression relationship) (Eppakayala 2015)

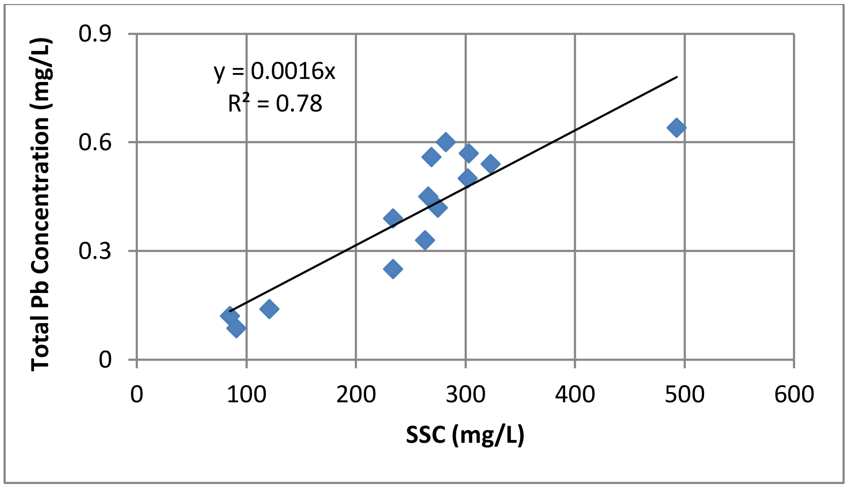


Figure 31. Scatterplot of SSC vs Total Pb Concentration (showing significant regression relationship) (Eppakayala 2015)

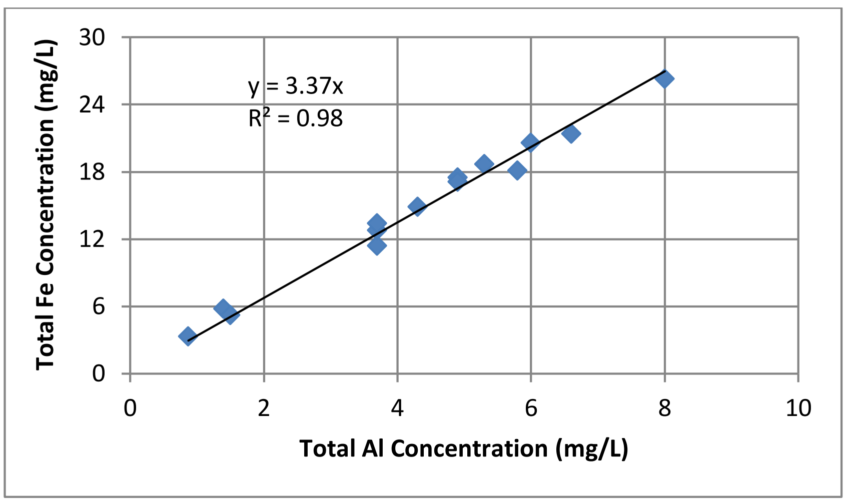


Figure 32. Scatterplot of Total Al Concentration vs Total Fe Concentration (showing significant regression relationship) (Eppakayala 2015)

Eppakayala (2015) also found that the median particle sizes were apparently negatively correlated (but not statistically significant) with hydrologic and water quality parameters, indicating smaller median particle sizes as the rain depth and intensities increased, an unexpected result, as increasing rain intensities and flow rates are associated with greater flow energy and should be more capable of eroding and transporting larger particles.

Speciation of Filterable Forms of Stormwater Metals

Measurements of the total metal concentration in a water sample provides little information about the bioavailability and/or toxicity of the metal. It has become more apparent that metal speciation is essential to understanding the fate of a metal and its availability to biota. In natural waters, only a small portion of the overall dissolved metal may be present as the free hydrated cations because metal ions form stable complexes with a large variety of inorganic and organic ligands, which influence the bioavailability, toxicity, and mobility of the metal (Mota and Correia Dos Santos 1995). In the case of metal toxicity, it is generally accepted that the free metal ion is the most toxic form to aquatic life. Strongly complexed metals, or metals associated with colloidal particles, are much less toxic (Florence and Batley 1980). To obtain meaningful data on either bioavailability or toxicity, it is essential that chemical speciation techniques be applied.

Morrison and Diaz-Diaz (1988) examined the association of copper with dissolved organic matter in urban runoff using gel filtration chromatography. Their results indicated that Cu preferentially associates with organic matter in stormwater. Spokes, *et al*. (1996) found that copper was largely bound to organic ligands in rainwater samples in Norwich, England.

Grout, *et al.* (1999) studied the colloidal phases in urban stormwater runoff entering Brays Bayou (Houston, Texas). Colloids in the filtrate (<0.45 µm) and further separation by ultracentrifuging, accounted for 79% of the Al, 85% of the Fe, 52% of the Cr, 43% of the Mn, and 29% of the Zn present in the filtrates. Changes in the colloidal composition were caused by changes in colloidal morphologies, varying from organic aggregates to diffuse gel-like structures rich in Si, Al, and Fe. Colloids were mostly composed of silica during periods of dry weather flow and at the maximum of the stormwater flow, while carbon dominated the colloidal fraction at the beginning and declining stages of the storm events. Garnaud, *et al.* (1999) examined the geochemical speciation of particulate metals using sequential extraction procedures for different runoff sources in Paris, France. They found that most metals were bound to acid soluble particulates in the runoff, but that Cu was almost entirely bound to oxidizable and residual fractions.

Water quality and particle size distributions were characterized from urban stormwater runoff from four sites in the Galveston Bay area of Texas (Characklis and Wiesner 1997). Results indicated a potential relationship between Zn and organic carbon and Fe and macrocolloids (0.45 – 20 µm size range). Results also indicated that concentrations of particle ion number, organic carbon, suspended solids, Fe and Zn increased during storm events, but showed no evidence of a “first flush” effect.

Dean, *et al.* (2005) examined the speciation of Pb, Cd, Cu and Zn in four samples from an elevated section of I-10 crossing City Park Lake in Baton Rouge, Louisiana. They found that Cd and Cu partitioned nearly equally between particulate and dissolved phases while Zn was generally particulate-bound and Pb was highly particulate-bound. Using water quality analyses, measured ion balances and speciation modeling, results for Cd and Zn indicated that divalent ionic forms of these metals dominated the dissolved species for all events, while Pb was predominately associated with dissolved organic matter, and Cu was predominately associated with carbonate species or dissolved organic matter.

The development of analytical techniques which can reliably measure the concentration of the various chemical forms of a trace metal in a water sample is a challenging problem. Florence

(1977) proposed a trace metal speciation scheme for determining the chemical forms of Cu, Pb, Cd and Zn in natural fresh waters. This scheme utilizes the chelating resin Chelex-100 to separate ionic and colloidal metal fractions and involves both ultraviolet irradiation and chelating resin separation steps, along with anodic stripping voltammetry (ASV) for measurements of labile metals in the separated fractions. For natural fresh waters using this analytical scheme, measurements showed that (1) filterable copper was associated mainly with organic matter, probably organic colloids, (2) filterable lead was divided between stable inorganic and organic forms, (3) filterable cadmium existed almost entirely as labile ionic forms, and (4) filterable zinc was divided between labile ionic species and a stable inorganic form. Very little zinc was associated with organic colloids.

Figura and McDuffie (1980) used a modified version of the Florence and Batley (1980) scheme to determine labilities of Cd, Cu, Pb and Zn in river, estuary and secondary sewage effluent water samples. The “ASV-inert” fraction was divided into three groups based on the rate of metal dissociation on Chelex columns: “moderately-labile”, “slowly-labile”, and “inert.” The ASV-labile fraction was described as “very labile.” They found that Cd and Zn were almost entirely in the “very” and “moderately” labile fractions, Cu existed primarily in the “moderately” and “slowly” labile fractions, and Pb existed in the “slowly labile” and “inert” fractions.

Morquecho (2005) developed a scheme for determining the associations of filterable metals in stormwater. The processing and analysis scheme for each stormwater sample she used is shown in Figure 33. Each water sample was first processed by splitting the sample into homogenous fractions using a Delrin® cone splitter. The Chelex-100 ion exchange resin was used to determine how much of the heavy metals occurred in the ionic form, considered more toxic to aquatic life, and those bound to colloids or other organic matter in solution. Table 33 lists the average percentage of the heavy metals analyzed that occurred as either ionic or bound forms. Most of the zinc, cadmium and lead were not present in the free ionic form, but were bound to colloids or organic matter whose bonds could be broken by exposure to UV light. Only copper occurred in mostly the ionic form. Results from these types of tests can be highly variable due to low metals concentrations in the filterable fractions.

Table 33: Average percentage of metals occurring as ionic or bound forms for last four samples (metals measured by ICP-MS).

	Average % Ionic	Average % bound to colloids or organic matter
Cadmium	10	90
Copper	70	30
Lead	12	88
Zinc	15	85

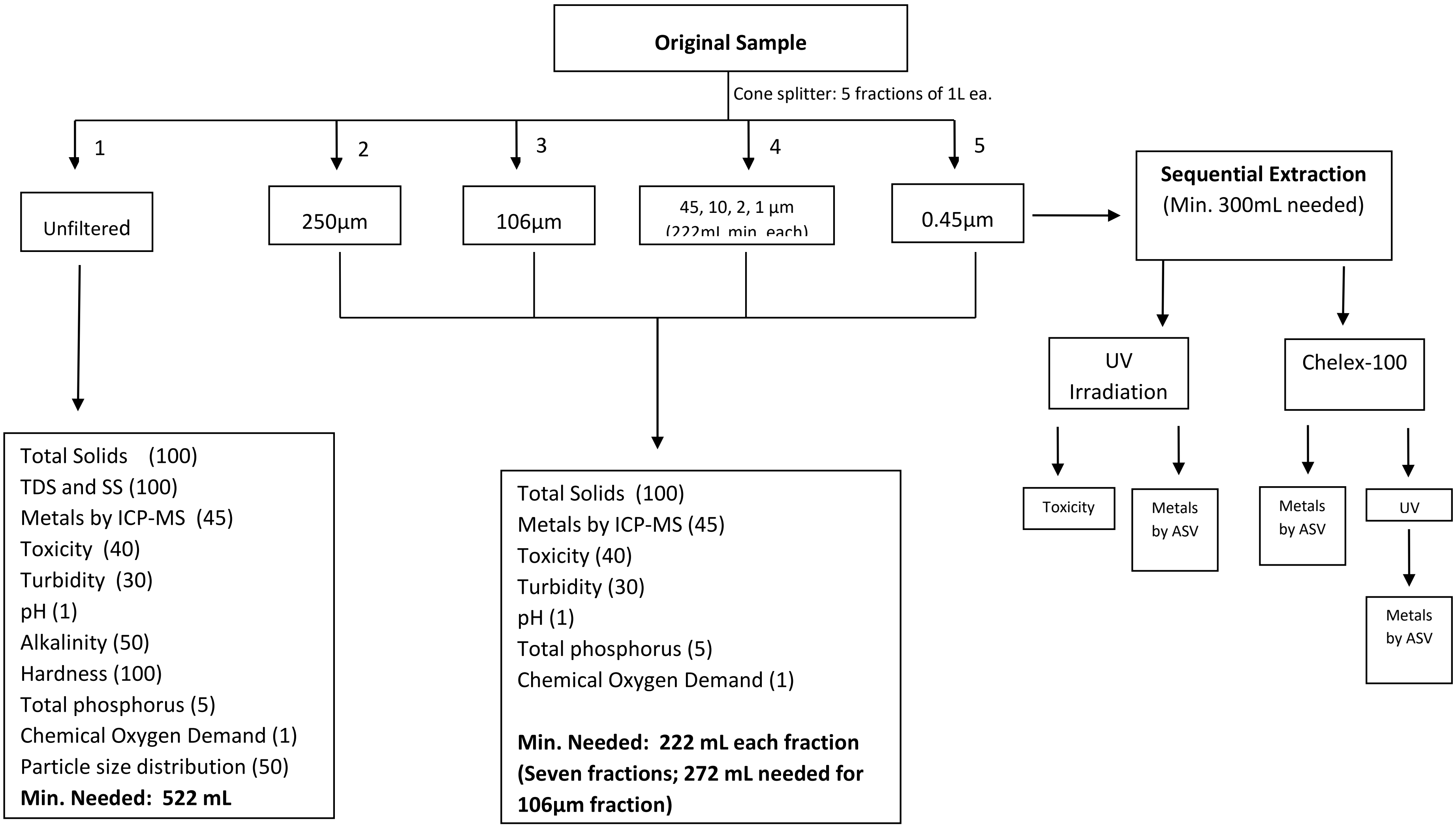


Figure 33. Sample analyses scheme by fraction (Morquecho 2005).

Heavy Metal Content of Stormwater Particulates

Most stormwater treatment efforts involve the physical removal of particulates. In order to better design sedimentation stormwater treatment devices, it is important to understand which pollutants are associated with different sized particulates and how they may be controlled during the removal of the particulates.

Tables 34 through 38 summarize pollutant strengths from various studies. These are divided by general land use categories and data are summarized for copper, lead, nickel, zinc, and chromium, the most commonly available data for particulate strength, although nickel is frequently missing. The rows are sorted based on the copper concentrations, from smallest to largest observed average concentrations, except that any n/a copper sources are listed last.

In some cases, such as the mass balance studies conducted in Toronto and Wisconsin, the particle strength data were an important aspect of the field monitoring activities and therefore are better represented. In other studies, such as the San Jose and Castro Valley, CA, and Bellevue, WA, projects, most of the field activities involved extensive street dirt measurements for the major land uses, and a large amount of these data are represented in the tables. In many cases, average and COV (coefficient of variation, or the standard deviation divided by the mean) values are given for the values where enough data is represented, or the data were available to calculate the values. In other cases, where only data summaries were available, only averages are presented. In most cases, obvious trends are seen with increasing particulate strengths for all of the metals as the site activities (such as vehicle usage) increase.

Table 34. Open Space, Undeveloped Land, Bare Soil Samples Particulate Strengths

	Copper (mg Cu/kg SS)	**Lead (mg Pb/kg SS)**	**Nickel (mg Ni/kg SS)**	**Zinc (mg Zn/kg SS)**	**Chromium (mg Cr/kg SS)**
Small landscaped areas (Pitt 2004 WI and MN sheetflow)	14 (0.4)	250 (1.1)	n/a	160 (1.3)	20
Resid./Commer. dirt path (Pitt and McLean 1986, Toronto, Ontario 125μm)	15	38	n/a	50	25
Soils (Hurley 2009)	25	19	19	60	54
California benchmark soils (Kearney 1996)	29 (9.1 to 96)	24 (12 to 97)	57 (9 to 510)	150 (88 to 240)	120 (23 to 1600)
Resid./Commer. garden soil (Pitt and McLean 1986, Toronto, Ontario 125μm)	30	50	n/a	120	35
Industrial bare ground (Pitt and McLean 1986, Toronto, Ontario 125μm)	91	135	n/a	270	38
Open Space NSQD outfalls	188 (1.2)	120 (0.9)	n/a	789 (1.2)	n/a
Dustfall Oceanic (Rubin 1976)	4500	n/a	n/a	230	38
Undeveloped (Pitt 2004 WI and MN sheetflow)	n/a	48	n/a	n/a	n/a

* Average and coefficient of variation values (where available). In some cases (XX to YY), the parenthetical values show the range.

Table 35. Residential Area Samples Particulate Strengths

	Copper (mg Cu/kg SS)	Lead (mg Pb/kg SS)	Nickel (mg Ni/kg SS)	Zinc (mg Zn/kg SS)	Chromium (mg Cr/kg SS)
Resid./Commer. road shoulder (Pitt and McLean 1986, Toronto, Ontario 125μm)	35	230	n/a	120	25
Residential streets (Pitt 2004 WI and MN sheetflow)	39 (0.6)*	87 (0.6)	n/a	350 (0.6)	11 (0.8)
Resid./Commer. pvd sidewalk (Pitt and McLean 1986, Toronto, Ontario 125μm)	44	1200	n/a	430	32
Resid./Commer. unpvd parking (Pitt and McLean 1986, Toronto, Ontario 125μm)	45	160	n/a	170	20
Paved driveways (Pitt 2004 WI and MN sheetflow)	89 (1.0)	240 (0.8)	n/a	650 (0.5)	11 (0.1)
Resid./Commer. roofs (Pitt and McLean 1986, Toronto, Ontario 125μm)	130	980	n/a	1900	77
Resid./Commer. pvd parking (Pitt and McLean 1986, Toronto, Ontario 125μm)	145	630	n/a	420	47
Residential roofs (Pitt 2004 WI and MN sheetflow)	160 (1.3)	870 (0.8)	n/a	2900 (0.6)	n/a
Resid./Comer. pvd driveways (Pitt and McLean 1986, Toronto, Ontario 125μm)	170	900	n/a	800	70
Street Dirt Residential (Pitt 1979, San Jose, CA <45 μm; Pitt 1985, Bellevue, WA) <63 μm; Pitt and McLean 1986, Toronto, Ontario <125 μm, Pitt and Sutherland 1982, Reno/Sparks, NV <63 μm)	230	1615	n/a	431	81
Residential NSQD outfalls	431 (2.6)	358 (2.1)	48 (1.4)	1262 (1.4)	n/a
Dustfall Urban (Rubin 1976)	1900	n/a	950	6700	190
Dustfall Suburban (Rubin 1976)	2700	n/a	1400	1400	270

* Average and coefficient of variation values (where available). In some cases (XX to YY), the parenthetical values show the range.

Table 36. Commercial Area Samples Particulate Strengths

	Copper (mg Cu/kg SS)	Lead (mg Pb/kg SS)	Nickel (mg Ni/kg SS)	Zinc (mg Zn/kg SS)	Chromium (mg Cr/kg SS)
Commercial parking (Pitt 2004 WI and MN sheetflow)	100 (0.7)*	320 (0.4)	n/a	802 (0.6)	47 (0.4)
Commercial streets (Pitt 2004 WI and MN sheetflow)	140 (1.3)	210 (0.5)	n/a	1150 (1.2)	38 (0.3)
Street Dirt Commercial (Bannerman, *et al*. 1983, Milwaukee, WI <31μm; Pitt 1979, San Jose, CA <45 μm; Pitt and Sutherland 1982, Reno/Sparks, NV <63 μm; Terstrip, *et al*. 1982, Champaign/Urbana, IL <63 μm)	175	4000	n/a	975	122
Commercial roofs (Pitt 2004 WI and MN sheetflow)	180 (1.0)	750 (0.5)	n/a	3500 (1.0)	n/a
Commercial NSQD outfalls	358 (1.8)	678 (1.1)	46 (1.4)	1218 (1.4)	n/a

* Average and coefficient of variation values (where available). In some cases (XX to YY), the parenthetical values show the range.

Table 37. Industrial Area Samples Particulate Strengths

	Copper (mg Cu/kg SS)	Lead (mg Pb/kg SS)	Nickel (mg Ni/kg SS)	Zinc (mg Zn/kg SS)	Chromium (mg Cr/kg SS)
Industrial streets (Pitt 2004 WI and MN sheetflow)	74 (0.4)*	100 (0.3)	n/a	540 (0.4)	24 (0.6)
Industrial parking (Pitt 2004 WI and MN sheetflow)	83 (0.5)	180 (0.5)	n/a	490 (0.5)	24 (0.4)
Industrial pvd path (Pitt and McLean 1986, Toronto, Ontario 125μm)	280	460	n/a	1300	63
Industrial NSQD outfalls	281 (0.6)	664 (0.9)	76 (0.6)	7147 (1.6)	n/a
Industrial street dirt (Pitt and McLean 1986, Toronto, Ontario <125 μm)	360	900	n/a	500	70
Industrial pvd parking (Pitt and McLean 1986, Toronto, Ontario 125μm)	1110	650	n/a	930	98
Industrial unpvd parking (Pitt and McLean 1986, Toronto, Ontario 125μm)	1120	2050	n/a	1120	62
Industrial roofs (Pitt 2004 WI and MN sheetflow)	n/a	220 (1.1)	n/a	n/a	n/a

* Average and coefficient of variation values (where available). In some cases (XX to YY), the parenthetical values show the range.

Table 38. Freeway Samples Particulate Strengths

	Copper (mg Cu/kg SS)	Lead (mg Pb/ kg SS)	Nickel (mg Ni/ kg SS)	Zinc (mg Zn/kg SS)	Chromium (mg Cr/kg SS)
Freeways NSQD outfalls	244 (0.7)*	375 (1.2)	51 (1.4)	1318 (0.6)	n/a
Freeways (Pitt 2004 WI and MN sheetflow)	300 (0.5)	230 (0.4)	n/a	1330 (0.4)	n/a
Dustfall (Spring 1978)	n/a	500 – 2800 (550 from and near LA freeway)	n/a	n/a	n/a

* Average and coefficient of variation values (where available). In some cases (XX to YY), the parenthetical values show the range.

The University of Alabama and the Center for Watershed Protection were awarded a U.S. Environmental Protection Agency, Office of Water 104(b)3 grant in 2001 to collect and evaluate stormwater data from a portion of the NPDES (National Pollutant Discharge Elimination System) MS4 (municipal separate storm sewer system) stormwater permit holders. Version 3 of this database was completed under continued 104(b)3 support from the EPA. The most recent version 4 of the NSQD is now available at: http://bmpdatabase.org/nsqd.html. These stormwater quality data and site descriptions were collected and reviewed to describe the characteristics of national stormwater quality, to provide guidance for future sampling needs, and to enhance local stormwater management activities in areas having limited data. The monitoring data collected over nearly a ten-year period from more than 200 municipalities. Version 3 contains data from more than 8,500 events from about 100 municipalities throughout the country, representing several land uses.

The NSQD Version 3 is a compilation of data collected from various stormwater sampling efforts including; the Nationwide Urban Runoff Program (NURP) (EPA 1983) [excluding lead data which has significantly reduced with time as a result of the elimination of lead in gasoline]; the International BMP Database (ASCE 2002) [only influent data to stormwater controls located at outfall locations]; the U.S. Geological Survey (USGS) Urban-Stormwater Database (Smullen and Case, 2002; Driver, *et al.* 1985) [associated with MS4 monitoring activities conducted by the USGS]; the data from the earlier National Stormwater Quality Database NSQD ver. 1.1, and additional data collected from other Phase 1 NPDES MS4 stormwater permit holders. Most of the data are from MS4 communities from their current permits.

About 30% of the storm events stored in the database represent residential land use areas, followed by mixed residential and commercial areas with 16% and 15% of the total events respectively. More than 5,800 events represent single land use areas. More than 100 events represent each EPA Rain Zone, except for the northern western mountain region. Most of the single land use sites represent residential, commercial, and industrial areas, with fewer institutional, freeway and open space areas represented.

Tables 39 through 42 were prepared using the NSQD Version 3 data set for TSS and for arsenic, cadmium, copper, chromium, nickel, lead, and zinc. These calculations were made to estimate the particulate strengths of the stormwater samples for different land uses and geographical areas. The other metals contained in the NSQD had relatively low detections (<40% were detected). For these calculations, non-detected total forms of the metals were eliminated from the calculations, and half of the detection limits were substituted for the non-detected filtered metal values. If the total metal concentration was close to the detection limit and the filtered metal was non-detected, that specific set of data were eliminated from these calculations. These calculations determined the particulate strength of the metals by subtracting available filterable metal concentrations from the total metal concentrations and then dividing the result by the suspended solids concentration for each sample. All three of these values were needed for any sample in order for the calculation to be made, resulting in many fewer data sets.

Unfortunately, only copper, lead, and zinc had any open space particulate strength observations in the NSQD Version 3 that could be summarized in the following tables showing metal particulate strengths by both land use and geographical area, the preferred approach. When the data were available, open space areas had the lowest particulate strengths compared to samples from other land uses. In most cases, industrial, commercial, and freeway samples had substantially higher particulate strengths, also as expected.

Figure 34 is a map showing the EPA Rain Zones in the U.S., along with the locations of the communities represented in the database. Of the 342 data sets available for copper particulate strength calculations, only 6 are available for all open space sites, while more than 90 are available for residential and freeway sites. This is similar for the lead and zinc data sets. When examining the complete data set containing several thousand data observations, repeatable apparent trends are observed: open space areas have the lowest stormwater concentrations for the total metals (and the lowest particulate strength values), while local and nearby activities further degrade these conditions as indicated by higher values for the other land use samples.

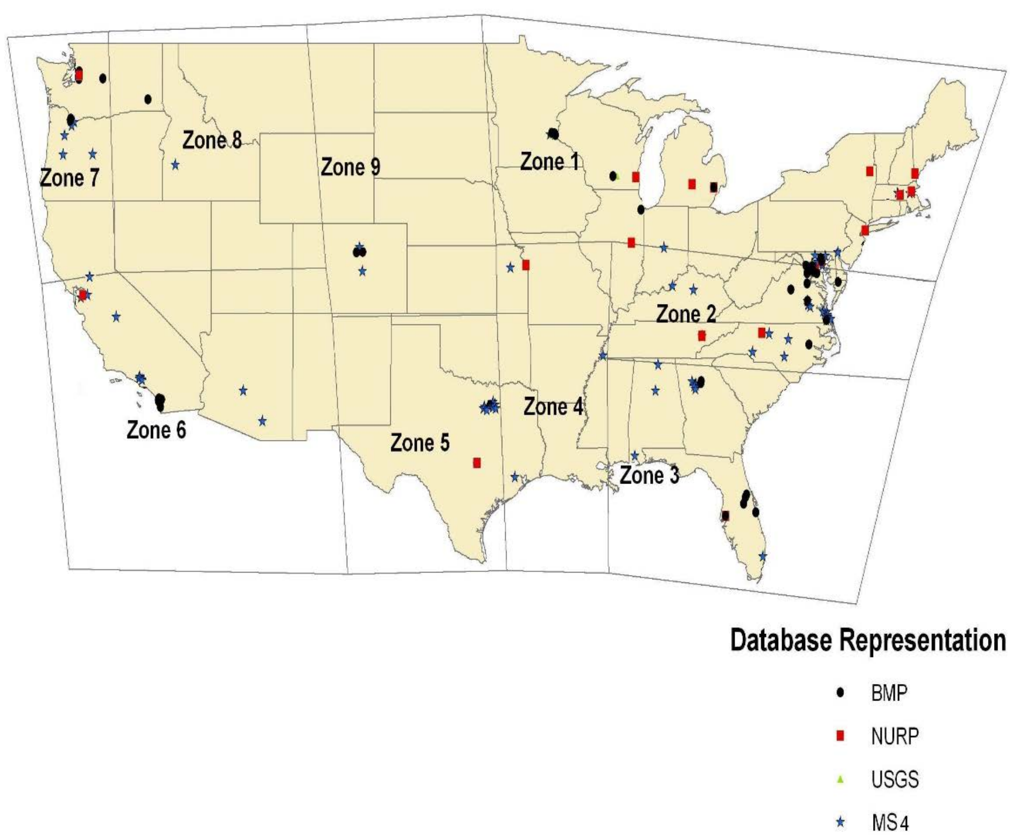


Figure 34. Sampling Locations for Data Contained in the National Stormwater Quality Database, version 3.

Table 39. NSQD Copper, particulate strength (µg Cu/g SS)

EPA Rain Zone	Open Space	Residential	Commercial	Industrial	Freeways	All combined
1	no samples	median = 37.5 average = 799 COV = 2.71 numb = 15	no samples	no samples	few samples	
2	median = 65.2 average = 90.0 COV = 0.98 numb = 3	median = 211 average = 649 COV = 1.79 numb = 39	median = 200 average = 344 COV = 1.02 numb = 19	no samples	no samples	
3	no samples	no samples	no samples	no samples	no samples	
4	no samples	no samples	no samples	no samples	no samples	
5	no samples	no samples	no samples	no samples	no samples	
6	few samples	median = 182 average = 283 COV = 0.70 numb = 9	median = 95.7 average = 730 COV = 1.16 numb = 7	median = 303 average = 310 COV = 0.60 numb = 40	median = 240 average = 270 COV = 0.73 numb = 66	
7	no samples	median = 65 average = 104 COV = 0.92 numb = 36	median = 200 average = 415 COV = 1.93 numb = 39	median = 216 average = 234 COV = 0.51 numb = 19	median = 160 average = 180 COV = 0.46 numb = 25	
8	no samples	median = 93.4 average = 243 COV = 1.43 numb = 5	median = 203 average = 236 COV = 0.84 numb = 5	few samples	no samples	
9	no samples	no samples	no samples	no samples	no samples	
Total	median = 107 average = 188 COV = 1.23 numb = 6	median = 108 average = 431 COV = 2.57 numb = 95	median = 180 average = 358 COV = 1.76 numb = 70	median = 251 average = 281 COV = 0.61 numb = 60	median = 191 average = 244 COV = 0.72 numb = 91	median = 185 average = 356 COV = 1.00 numb = 342

Table 40. NSQD Lead, particulate form (µg Pb/g SS)

EPA Rain Zone	Open Space	Residential	Commercial	Industrial	Freeways	All combined
1	no samples	median = 47.3 average = 73.8 COV = 0.99 numb = 5	no samples	no samples	few samples	
2	median = 125 average = 154 COV = 0.62 numb = 3	median = 168 average = 435 COV = 2.85 numb = 30	median = 388 average = 405 COV = 0.72 numb = 17	no samples	no samples	
3	no samples	no samples	no samples	no samples	no samples	
4	no samples	no samples	no samples	no samples	no samples	
5	no samples	no samples	no samples	no samples	no samples	
6	few samples	median = 372 average = 565 COV = 0.78 numb = 11	median = 213 average = 444 COV = 1.53 numb = 7	median = 850 average = 865 COV = 0.75 numb = 43	median = 230 average = 380 COV = 1.25 numb = 72	
7	no samples	median = 238 average = 307 COV = 1.00 numb = 38	median = 602 average = 845 COV = 1.00 numb = 40	median = 241 average = 239 COV = 0.42 numb = 19	median = 300 average = 360 COV = 0.80 numb = 26	
8	no samples	median = 161 average = 205 COV = 0.49 numb = 8	median = 552 average = 595 COV = 0.41 numb = 5	few samples	no samples	
9	no samples	no samples	no samples	no samples	no samples	
Total	median = 101 average = 120 COV = 0.87 numb = 4	median = 211 average = 358 COV = 2.10 numb = 87	median = 483 average = 678 COV = 1.06 numb = 69	median = 359 average = 664 COV = 0.93 numb = 63	median = 267 average = 375 COV = 1.15 numb = 98	median = 284 average = 500 COV = 1.00 numb = 338

Table 41. NSQD Nickel, particulate strength (µg Ni/g SS)

EPA Rain Zone	Open Space	Residential	Commercial	Industrial	Freeways	All combined
1	few samples	no samples	no samples	no samples	few samples	
2	few samples	no samples	no samples	no samples	no samples	
3	few samples	no samples	no samples	no samples	no samples	
4	few samples	no samples	no samples	no samples	no samples	
5	few samples	no samples	no samples	no samples	no samples	
6	few samples	no samples	median = 77.6 average = 124 COV = 0.95 numb = 6	median = 75.5 average = 88.3 COV = 0.55 numb = 33	median = 50 average = 80 COV = 1.36 numb = 66	
7	few samples	median = 17.5 average = 21.4 COV = 0.57 numb = 17	median = 23.1 average = 23.9 COV = 0.42 numb = 20	median = 42.0 average = 44.8 COV = 0.53 numb = 11	median = 30.0 average = 40.0 COV = 0.59 numb = 8	
8	no samples	median = 30.2 average = 32.0 COV = 0.44 numb = 5	median = 40.0 average = 34.2 COV = 0.46 numb = 3	few samples	no samples	
9	no samples	no samples	no samples	no samples	no samples	
Total	few samples (n = 1)	median = 30.2 average = 47.6 COV = 1.40 numb = 33	median = 29.4 average = 45.7 COV = 1.42 numb = 29	median = 66.6 average = 75.9 COV = 0.63 numb = 45	median = 51.2 average = 77.3 COV = 1.39 numb = 74	median = 47.8 average = 65.7 COV = 1.01 numb = 185

Table 42. NSQD Zn, particulate form (µg Zn/g SS)

EPA Rain Zone	Open Space	Residential	Commercial	Industrial	Freeways	All combined
1	no samples	median = 160 average = 478 COV = 1.51 numb = 14	no samples	no samples	few samples	
2	median = 1,000 average = 1,243 COV = 0.81 numb = 3	no samples	median = 3,149 average = 3,660 COV = 0.97 numb = 20	no samples	no samples	
3	no samples	no samples	no samples	no samples	no samples	
4	no samples	no samples	no samples	no samples	no samples	
5	no samples	no samples	no samples	no samples	no samples	
6	few samples	median = 1,846 average = 2,291 COV = 0.79 numb = 11	median = 1,237 average = 3,975 COV = 1.81 numb = 7	median = 3,242 average = 9,832 COV = 1.31 numb = 42	median = 1,190 average = 1,420 COV = 0.58 numb = 62	
7	no samples	median = 573 average = 862 COV = 0.86 numb = 38	median = 1,005 average = 1,450 COV = 1.11 numb = 38	median = 1,125 average = 1,214 COV = 0.65 numb = 19	median = 930 average = 1,070 COV = 0.61 numb = 25	
8	no samples	median = 828 average = 823 COV = 0.28 numb = 7	median = 2,470 average = 2,951 COV = 0.70 numb = 4	few samples	no samples	
9	no samples	no samples	no samples	no samples	no samples	
Total	median = 379 average = 789 COV = 1.20 numb = 5	median = 768 average = 1,262 COV = 1.39 numb = 102	median = 1,218 average = 2,435 COV = 1.36 numb = 69	median = 2,162 average = 7,147 COV = 1.59 numb = 61	median = 1,128 average = 1318 COV = 0.60 numb = 87	median = 1,090 average = 2,550 COV = 1.00 numb = 344

At a heavy industrial site in the southeastern US, Eppakayala (2015) compared the observed whole sample particulate strength data for Cu, Pb, Ni, and Zn to the data presented in the NSQD for industrial sites as shown in Table 43.

Table 43. Observed particulate strengths at an industrial site for Cu, Pb, Ni, and Zn in comparison to NSQD industrial outfall observations (Eppakayala 2015)

	Copper (mg Cu/kg SS)	Lead (mg Pb/kg SS)	Nickel (mg Ni/kg SS)	Zinc (mg Zn/kg SS)
SE heavy industrial site runoff	2,360 (0.21)*	1,300 (310)	83 (0)	3,666 (0)
NSQD Industrial outfalls	280 (0.6)	664 (0.9)	76 (0.6)	7,147 (1.6)

*Mean (COV)

Copper and lead particulate strengths for this heavy industrial study site are noticeably larger than those observed for NSQD industrial category (mostly light to medium industrial sites). Higher copper particulate strengths may be related to the exposure of material such as electrical wiring; roofing, automobile parts etc. on site, and higher lead particulate strengths may reflect exposure to lead materials on the site. Observed nickel particulate strengths were similar to reported values at NSQD industrial outfalls, while the observed zinc particulate strengths were smaller than those for industrial NSQD outfalls. This may be related to a larger fraction of zinc in dissolved forms at the industrial site.

PAH Associations with Stormwater Particulates and in Filterable Forms

Bathi (2008) examined polycyclic aromatic hydrocarbons (PAHs) in urban runoff in both insoluble and particulate-associated forms. Because of their low volatility (low Henry's Law constant), high octonal-water partition coefficients (K_{OW}) and high soil organic coefficients (K_{OC}), many of the PAHs are preferentially adsorbed to particulate matter. Bathi (2008) conducted fugacity partition calculations to identify the associations of selected PAHs with different phases in the aquatic environment under equilibrium conditions. When PAHs are released into the environment, they will partition into different phases (air, water, solids) which affect their treatability and how they should be analyzed. Sorption plays an important role in the fate of these organic contaminates. Due to their extremely low solubility and their hydrophobic nature, most PAHs are predominantly associated with particulate matter. Partitioning of PAHs between different phases in the environment also depends on the physical and chemical properties of the phases.

The solid-water sorption coefficient (K_d) of a contaminant describes the distribution between the aqueous and solid phases of the system at equilibrium. According to Boethling, *et al.* (2000), the organic carbon normalized sorption coefficient (K_{oc}) approach is the most appropriate procedure for estimating the sorption coefficients, where:

$$K_{oc} = \frac{K_d}{oc}$$

The K_d is the solid-water sorption coefficient and OC is the organic fraction of the solid. There are many regression models available to estimate the Log K_{oc} of PAHs from Log K_{ow}, where K_{ow} is the octonal water partition coefficient, for example:

Log K_{oc} = 0.904 log K_{ow} – 0.006 (Chiou, *et al.* 1983)

Log K_{oc} = 1.000 log K_{ow} – 0.210 (Karichhoff, *et al.* 1979)

Regression equations relating the Log K_{oc} and Log S are also available in the literature, where S is the solubility of PAH in water, for example:

Log K_{oc} = log S + 0.44 (Karichhoff, *et al.* 1979)

In general, the relationship between the dissolved and sorbed chemical concentrations of PAHs is non-linear in nature which can be represented by the Freundlich isotherm:

$C_{sorb} = K_f \cdot (C_w)^n$;

The C_{sorb} is the concentration of the sorbed chemical, K_f is the Freundlich constant, C_w is the concentration of the dissolved chemical, and n reflects the nonlinearity, with n equal to one representing a linear partition relationship.

Under equilibrium conditions, the partition coefficients discussed above may be effective in predicting the PAH partition concentrations in the liquid and solid phases, but these predictions may not be accurate for real time systems which are not usually at equilibrium. Differences between predicted sorption coefficients and actual measured observations were seen by Hwang, *et al.* (2006) in their study of PAHs in stormwater samples along the lower Anacostia River in Washington, D.C. Though the report did not provide the details about how different the predicted and observed values were, they reported that the concentrations of particulate-bond PAHs were higher than the predicted concentrations, as one could expect based on analyses of the solid-water partition coefficient (K_d).

Factors that affect the PAH associations with the particulate matter in the aquatic environment include the physical and chemical properties of the specific PAH contaminant, the physical and chemical properties of the aquatic medium, and the physical and chemical properties of the particulate matter. For the purpose of understanding such effects, Zhou, *et al*. (1998) studied the relationships between the concentrations of fluoranthene and pyrene on suspended solids with salinity, suspended solids concentration and particulate organic carbon, in the Humber estuary, UK. The concentrations of selected PAHs on suspended solids showed no correlation with the salinity of the samples, while concentrations of suspended solids and particulate organic carbon showed a clear relationship with concentrations of PAHs on the suspended solids. Concentrations of suspended solids in the samples showed negative correlations with the concentrations of selected PAHs on suspended solids, whereas particulate organic content showed positive correlations with the concentrations of particulate-associated PAHs. Zhou, *et al.* (1998) also showed that higher concentrations of PAHs are likely associated with the finer particles (generally classified as clay material which have large surface areas per unit weight), compared to the coarser particles (generally classified as sand particles which have comparatively less organic matter which are needed for greater sorption of PAHs).

A similar pattern was observed by Aryal, *et al.* (2005) who monitored suspended solids and PAHs associated with fractionated suspended solids in highway runoff for four rain events (samples were only collected during the initial 3 mm of runoff) at an inlet point of treatment facilities for a highway drainage system in Winterthur, Switzerland. The measured concentrations of PAHs in fine fractions (<45µm) were higher than their concentrations in coarse fractions (>45µm).

Mahler, *et al.* (2005), of the U.S. Geological Survey, examined PAHs in washoff water runoff and particulates collected from four parking lot test plots. Results indicated that the coal-tar-sealed parking lots had higher concentrations of PAHs than those from any other examined type of surface. The reported average total PAH concentrations in particulates in the runoff from the parking lots were 3,500,000 µg/kg from coal-tar-sealed, 620,000 µg/kg from asphalt-sealed, and 54,000 µg/kg from unsealed parking lots.

Rushton (2006) studied the association of selected PAHs on gross solids while analyzing the performance of a hydrodynamic separator retrofit unit installed to control stormwater discharging to the Hillsborough River, south Florida. The gross solids, consisting of litter, leaves, trash and sediment, collected by the CDS unit was found to have a wide range of concentrations for the selected PAHs. They found high concentrations of PAHs on the gross solids that had high organic content.

Fugacity level 1 (Mackay, *et al.* 1992) calculations were used by Bathi (2008) to predict the partitioning of PAHs among the environmental phases (only applicable for equilibrium conditions). Prediction fate model calculations for selected PAHs were performed based on typical environmental conditions and with the assumption of system equilibrium. Based on this model, the partition percentages of selected PAHs into different phases were calculated. The equations involved in the model calculations are:

$$C = Z * f \quad \text{(or)} \quad f = \frac{M}{\sum (V_i * Z_i)}$$

Where, C = Concentration of contaminant, mol/m^3; Z = fugacity capacity constant, mol/m^3; f = fugacity, Pa; V_i = Volume of the corresponding phases; and Z_i = fugacity capacities of phases for air, water, sediment, suspended sediment, and fish for i =1, 2, 3, 4, 5 respectively and are defined as follows.

$$Z_1 = \frac{1}{RT}$$

$$Z_2 = \frac{1}{H}$$

$$Z_3 = Z_2 * P_3 * \phi_3 * \frac{K_{OC}}{1000}$$

$$Z_4 = Z_2 * P_4 * \phi_4 * \frac{K_{OC}}{1000}$$

$$Z_5 = Z_2 * P_5 * L * \frac{K_{OW}}{1000}$$

Where R = gas constant (8.314 J/mol K), T = absolute temperature (K), H= Henry's law constant (Pa.m^3/mol), K_{OC} = Organic-water partition coefficient, K_{OW} = Octonal-water partition coefficient, P_3 = density of sediment (kg/m^3), P_4 = density of suspended sediment (kg/m^3), $Ø_3$= organic fraction of sediment, $Ø_4$= organic fraction of suspended sediment, P_5 = density of fish in the aquatic system (kg/m^3), L= Lipid content of fish.

Predicted partition values calculated using this model were employed by Bathi (2008) in studying the effect of selected environmental parameters on the associations of PAHs with different media compartments. Factorial analyses techniques are used for studying the effect of the parameters, namely, organic content of sediment particles, temperature of the system, concentration of selected PAH, and concentration of sediment particles in the system.

The Multi-Chambered Treatment Train (MCTT) study (Pitt, *et al.* 1999) contained PAH partitioning between water and particulate matter in stormwater as shown on Table 44. The fugacity equilibrium model under-predicted the percentage of the PAHs associated with the particulate matter compared to the observed conditions. This trend was found to be more obvious for the low molecular weight PAHs.

Table 44. MCTT Observed Percentage of Partitions (non-detects in filtered samples are replaced with half of DL)

PAH	% Association	
	Water	**Particulate Matter**
Naphthalene	22	78
Fluorene	3	97
Phenanthrene	2	99
Anthracene	8	92
Fluoranthene	29	71
Pyrene	19	81
Benzo(a)anthracene	3	99
Chrysene	1	99
Benzo(b)fluoranthene	1	99
Benzo(k)fluoranthene	2	98
Benzo(ghi)perylene	1	99
Benzo(a) pyrene	1	99

Pollutant Strengths by Particle Size

As for all constituents and characteristics, the overall particulate strength of stormwater particulates is determined by the amount of each component in the final mixture, along with the characteristics of each particle size range. This particle size range information is also very useful when predicting performance and design of stormwater controls. The following are brief summaries of project data that included stormwater particulate characteristics by particle size.

In a stormwater treatability study at an urban parking lot, Cai (2015) collected composite samples in high-density polyethylene bottles from the influent and effluent locations of the treatment controls. After each targeted storm event, the samples were brought to the laboratory as soon as possible and either cooled in a sample refrigerator or immediately processed. Composite samples were split evenly into ten one liter bottles using a USGS/Dekaport Teflon™ cone splitter. Nylon screening material with 1,180 µm openings was placed on top of the cone splitter to capture larger particles and debris to prevent clogging of the cone splitter and to capture and analyze this large material. The different steps involved in the sample processing and water quality analyses were as shown in Figure 35. Suspended solids concentrations (SSC) were analyzed in accordance with ASTM D 3977-97B. One of the influent sample splits for each event was screened through three different sieves and one filter for analyses of pollutant associations with different particle size ranges. The measured total volume of each subsample was used for the SSC and PSD analyses. Particle size distributions were determined in a multi-step procedure using screening (> 1,180 µm), sieving (250 to 1180 µm) and filtering (0.45-3 µm), followed with Coulter Counter analyses (3-250 µm). Metals were analyzed in accordance with EPA 200.7 method. After dividing the samples into particle size ranges, each sample fraction was analyzed for various constituents and properties.

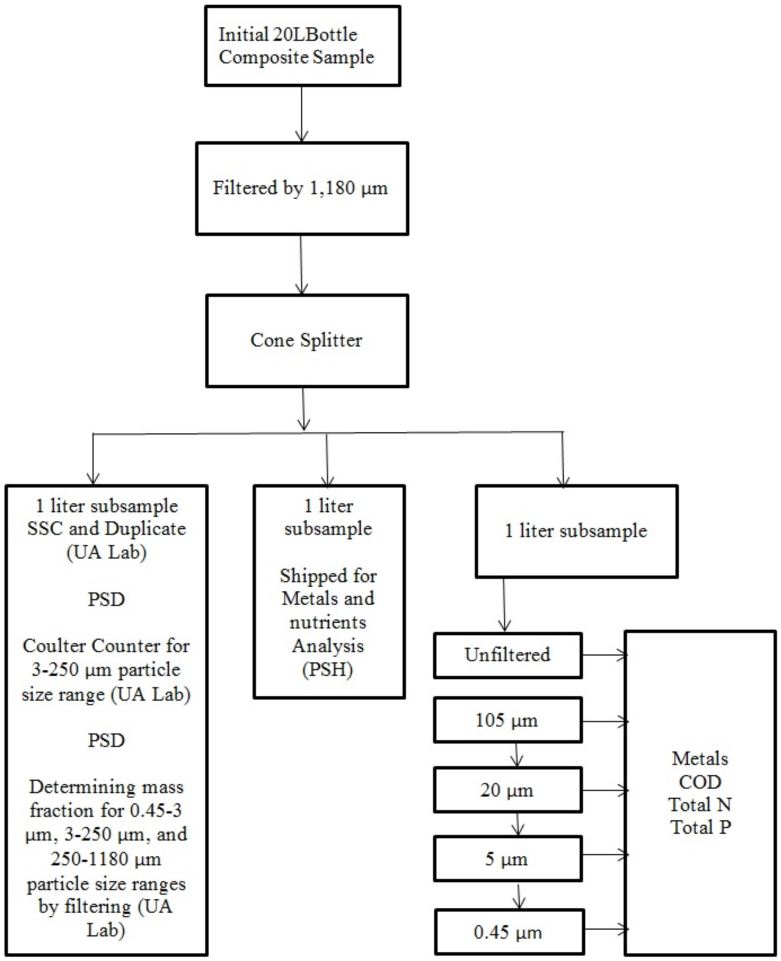


Figure 35. Flowchart showing steps of sample processing and water quality analyses (Cai 2015).

General Characteristics of Stormwater Particulates by Size

The following are summaries of general characteristics of stormwater characteristics by particle size range.

Specific Gravity and Settling Rates by Particle Size

After the eroded particulates start to move towards the drainage system (any natural or constructed conveyance), they will tend to settle as they flow towards the receiving water, altering the particle size distributions. If they settle slowly, such as occurs for small particles, they will remain suspended and not become part of the bed load or sediment. However, if they settle to the bottom before reaching the receiving water, they may become part of the bed load which will bounce along the conveyance bottom, or become trapped with other settled debris. When the flow stops, the sediments will tend to dry and become more consolidated. The next runoff event may cause some of this settled material to become re-suspended and may move towards the receiving water. Therefore, there are three phases to particulate transport in drainage systems: 1) settling of the particulates in the flowing water, 2) movement as bed load during the event, 3) accumulating as sediment and potentially subsequent scour. The following discussion summarizes these sediment transport phases.

Settling velocities of discrete particles are shown in Figure 36, based on Stoke's and Newton's settling relationships for laminar or turbulent settling conditions, respectively. This figure also illustrates the effects of different specific gravities on the settling rates. In most cases, stormwater particulates have specific gravities in the range of 1.5 to 2.5, depending on the mixture of organic and inert material in the particle. This corresponds to a relatively narrow range of settling rates for a specific particle size on this figure.

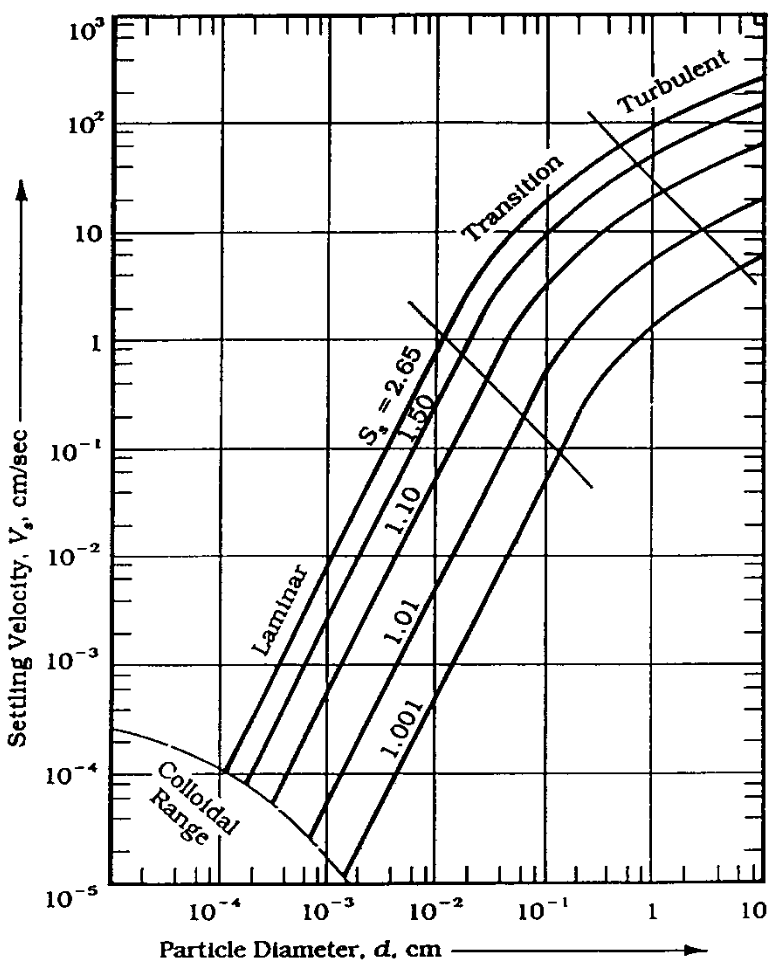


Figure 36. Type 1 (discrete) settling of spheres in water at 10° C (Reynolds and Richards 1996).

Scour of Previously Deposited Materials

Pitt, *et al.* (2007) summarized the erosion of previously deposited materials in drainage systems. Boundary shear stress (sometimes called tractive force) is commonly used as an appropriate criterion for predicting the stability of deposited materials in conveyances. The average boundary shear stress in uniform flow is calculated by:

$$\tau_0 = \gamma RS \quad (\text{lb/ft}^2)$$

Where:

γ = specific weight of water (62.4 lbs/ft^3)
R = hydraulic radius (ft)
S = hydraulic slope (ft/ft)

Flow characteristics predicting the initiation of motion of sediment in non-cohesive materials are usually presented in non-dimensional form in the Shield's diagram. The Corps of Engineers (COE 1994) in their assessment manual states that the use of the Shield's diagram is likely to over-predict the erodibility of the channel bottom material under most conditions. The problem occurs because the Shield's diagram assumes a flat bottom channel and the total roughness is determined by the size of the granular bottom material. The actual Manning's roughness value is likely much larger because it is largely determined by bed forms, channel irregularities, and vegetation, and not grain size. They recommend, as a more realistic assessment, that empirical data based on field observations be used. In the absence of local data, they present Figure 37 (from Chow 1959) for applications for channels in granular materials. This figure shows the permissible unit tractive force (shear stress) as a function of the average particle diameter, and the fine sediment content of the flowing water.

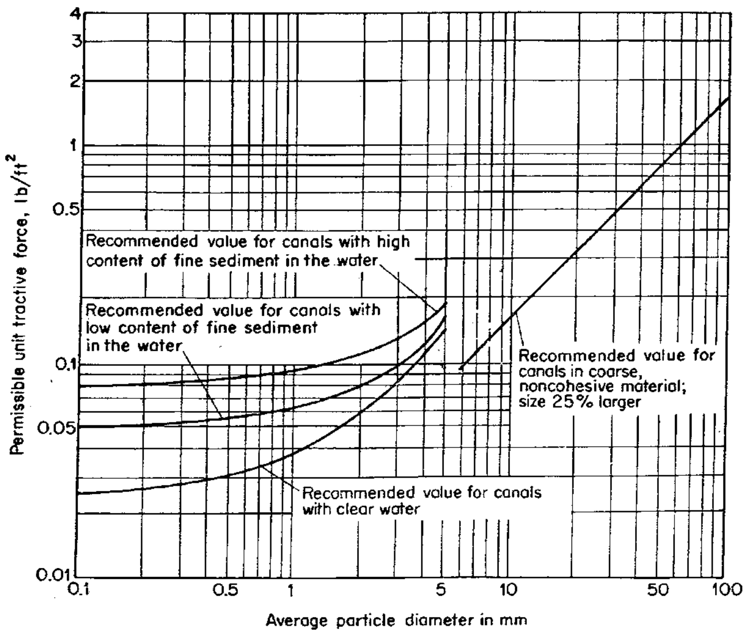


Figure 37. Allowable shear stresses (tractive forces) for canals in granular materials (U.S. Bureau of Reclamation, reprinted in Chow 1959).

<u>Erodibility of Previously Settled Material after Consolidation</u>

Figure 38 is an example of allowable shear stresses for a range of cohesive materials having a range of void ratios corresponding to varying amounts of consolidation. Again, the COE recommends that local field observation or laboratory testing results be given preference. If the void ratio was about 0.4, corresponding to a compact sediment, the shear stress would have to be greater than about 0.3 lb/ft^2 to affect particles larger than clays.

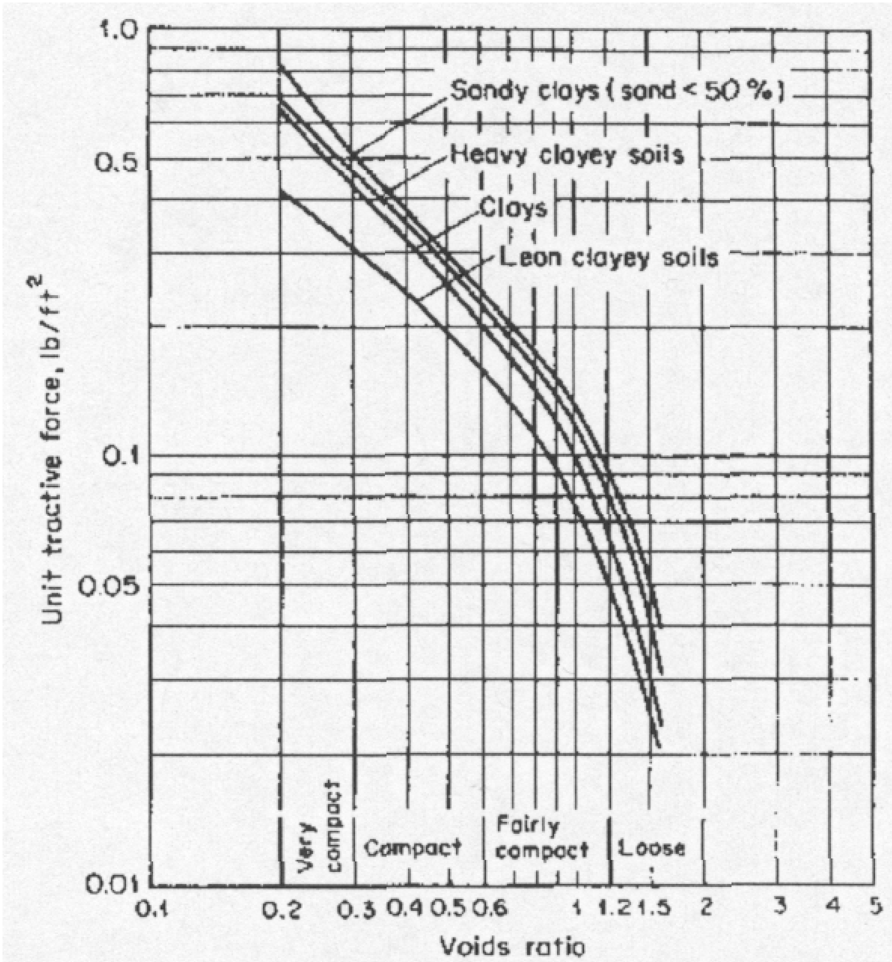


Figure 38. Example of allowable shear stresses (tractive forces) for cohesive materials (COE 1994) (A Leon clayey soil is hardpan. Hardpan is a condition of the soil or subsoil in which the soil grains become cemented together by such bonding agents as iron oxide and calcium carbonate, forming a hard, impervious mass).

Specific Gravity of Stormwater Particles

Bulk density of stormwater particulates can be determined by obtaining captured sediment from stormwater control devices. This material is air dried and then sieved into separate particle size ranges. Dried and separated sediment was then placed in a graduated cylinder to a known volume, with moderate compaction. The material was then weighed in the cylinder and after subtracting the tare weight of the cylinder, the bulk density can be calculated. The specific gravity can then be calculated after the void ratio is determined. The void ratio is determined by slowly pouring clean water (having a very small amount of detergent to act as a wetting agent) into the cylinder until the sediment sample is saturated. The amount of water added equals the void volume of the sample. This process allows bulk density and specific gravity to be determined for different size ranges. In order to determine the specific gravity of small size particles in the stormwater, the Coulter Counter volume values and particle counts are used for the particle sizes of interest. These are verified from the gravimetric solids analyses of the stormwater samples.

In a stormwater treatability study at an urban parking lot, Cai (2015) collected composite samples at the influent and effluent for an upflow treatment system at a paved parking lot in Tuscaloosa, AL. This was a complete mass balance analysis, so captured sediment was also evaluated. Table 45 shows the average specific gravity and volatile solids of the captured material for different size ranges.

Table 45. Specific Gravity and Volatile Solids for Different Size Fractions in the Sediment of a Stormwater Control Device (Cai 2015)

Sieve size range (um)	Average Specific Gravity (g/cc)	Average Volatile Solids (%)
Large Organic Material	0.84	81.2
>2800	0.66	70.9
1400 - 2800	1.15	57.8
710-1400	1.43	42.7
355-710	2.56	26.1
180-355	2.76	19.4
75-180	2.97	20.6
45-75	3.30	25.7
<45 (Pan)	3.46	26.0

Specific gravity decreases as the volatile solids content increases; larger particle sizes have lower specific gravity and greater volatile solids as they contain larger amounts of light-weight organic debris. Figure 39 is a plot of the specific gravity values for the influent and effluent stormwater for this site.

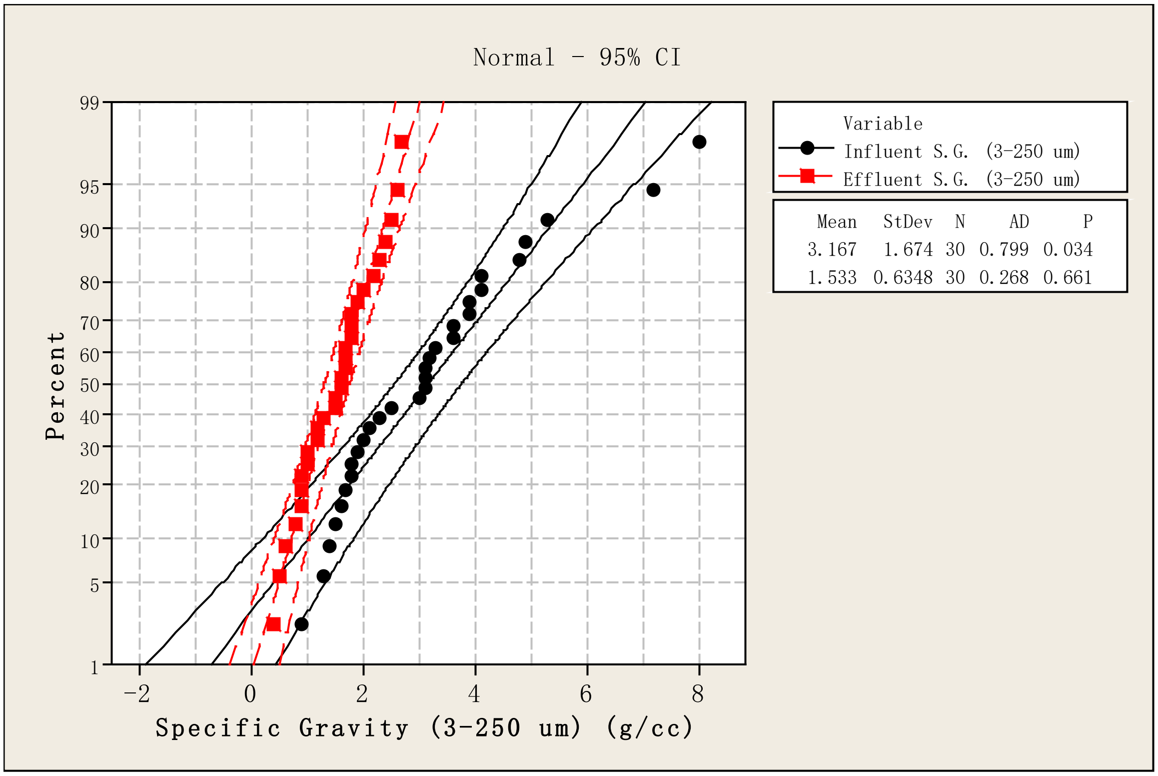


Figure 39. Changes in Specific Gravity with Sedimentation Treatment at a Paved Parking Area Site (Cai 2015).

This figure shows preferential removal of higher specific gravity materials that result in a shift to lower overall specific gravity of particulates in the effluent water (and greater migration distance in receiving water after discharge). The median specific gravity in the influent is 3.2 g/cc, while it dropped to 1.5 g/cc for the treated effluent. The probability plots show a wide range of specific gravities (about 1.3 to 6 g/cc for the 5th to the 95th percentiles).

<u>Identification of Source Material for Different Particle Sizes</u>

The chemical characteristics of the stormwater particulates are affected by the source and type of the material along with their exposure to contaminating processes. As an example, large organic material (such as leaves) usually contains large amounts of nutrients and basic organic material. The large amounts of organic matter are also very good at sorbing some organic pollutants (such as PAHs). Therefore, these particles can contribute large amounts of nutrients, plus PAHs, depending on their amount in the runoff. In most cases, area soils are the bulk of stormwater particulates. They can have various additional levels of contamination based on where they originated and what activities may contaminate them. In some cases, stormwater particulates may be of metallic origin due to site activities or because they are exhaust particulates. In addition, litter components that have physically broken down into finer sizes also contribute to stormwater particulates. Surface sorption of pollutants is a function of the material type (the organic leaf material probably the best) along with the available surface areas. Smaller particles have greater surface areas for the same mass compared to larger particles.

One way to determine the material of the stormwater particulates is thermal chromatography developed by Ray (1997) to identify the components of urban dirt samples collected from Madison, WI, streets. This method was used to identify the major components of the sediment samples. Identifying the amount of leaves and grass material associated with the sample indicates the amount of organic material in the sample. The procedure starts by placing a known amount of sediment sample in a crucible that is then heated progressively to higher temperatures, at set intervals, from 105 to 550°C. The heating process started with a temperature of 105°C to dry the samples. After 105°C, 240°C was the next temperature, then 365°C, then 470°C, and finally 550°C to complete the process. A heating time of 1 hour at each temperature was maintained to ensure stable weights. After each heating interval, the crucible (with sample) was cooled in a desiccator and weighed in order to determine the percent mass burned off since the last temperature. Table 46 shows the corresponding temperatures where different material will be combusted, based on Ray's (1997) work. Material lost between 240 and 365°C indicates the amount of leaves and grass associated with each particle size that may preferentially sorb PAHs, while material lost between 365 and 550°C indicates rubber and asphalt that likely has substantial PAH compounds as part of the component material.

Table 46. Ray (1997) Thermal Chromatography Method Parameters

Temperature (°C)	**Material Lost at These Temperatures**
up to 104	Moisture
104 – 240	Paper debris
240 – 365	Leaves and grass
365 – 470	Rubber
470 – 550	Asphalt
Above 550	Remaining material is inert

Bathi (2008) prepared a composite of five sediment samples collected for each creek sampling location and subjected the samples to thermal chromatography analysis. Table 47 shows the thermal chromatography results for the sediment composite samples from Hunter Creek. These results show that almost all of the material was inert, except for the large leaf fraction. Figure 46 compares the weight losses associated with the temperature range 240 – 365°C for the different creeks and sediments. Material lost in this temperature range was associated with organic material such as leaves and grass. Figures 41 and 42 show the results for the asphalt and rubber components.

Table 47. Percentage of Weight Losses over Temperature Ranges for Hunter Creek Sediment Samples (Bathi 2008)

Size Range (µm)	Percentage of Weight Loss (gm) Between Temperatures (°C)					Percentage of Inert Material
	105 – 240 (paper debris)	240 - 365 (leaves and grass)	365 – 470 (rubber)	470 – 550 (asphalt)	105 – 550 (total volatile content)	
<45	2.2	0.5	0.0	0.3	3.1	96.9
45 - 90	1.2	0.6	0.0	0.4	2.3	97.7
90 - 180	0.4	0.3	0.0	0.2	0.8	99.2
180 - 355	0.4	0.0	0.2	1.6	2.2	97.8
355 - 710	0.2	0.1	0.0	0.3	0.6	99.4
710 - 1400	1.8	2.0	0.7	1.0	5.5	94.5
1400 - 2800	2.7	6.0	2.3	0.7	11.6	88.4
>2800 (w/o LOM)	1.5	2.8	0.6	1.1	6.0	94.0
>2800 LOM	8.6	42.5	28.3	1.3	80.8	19.2

LOM: large organic matter (mostly leaves, with some other organic debris)
w/o LOM: with obvious large organic matter manually removed

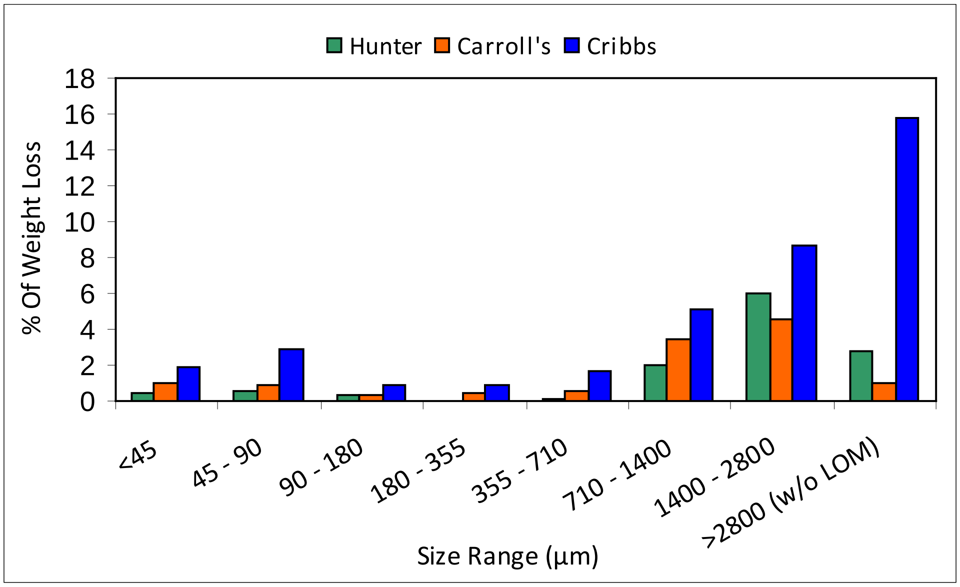


Figure 40. Comparison of weight loss over temperature range of 240 – 365°C (leaves and grass) (Bathi 2008).

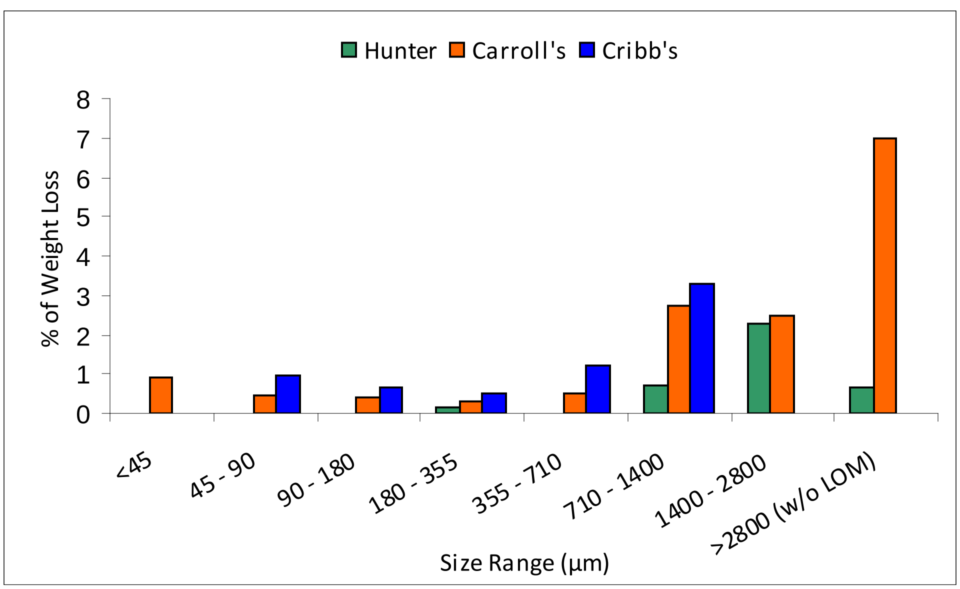


Figure 41. Comparison of weight loss over temperature range of 365 – 470°C (Rubber) (Bathi 2008).

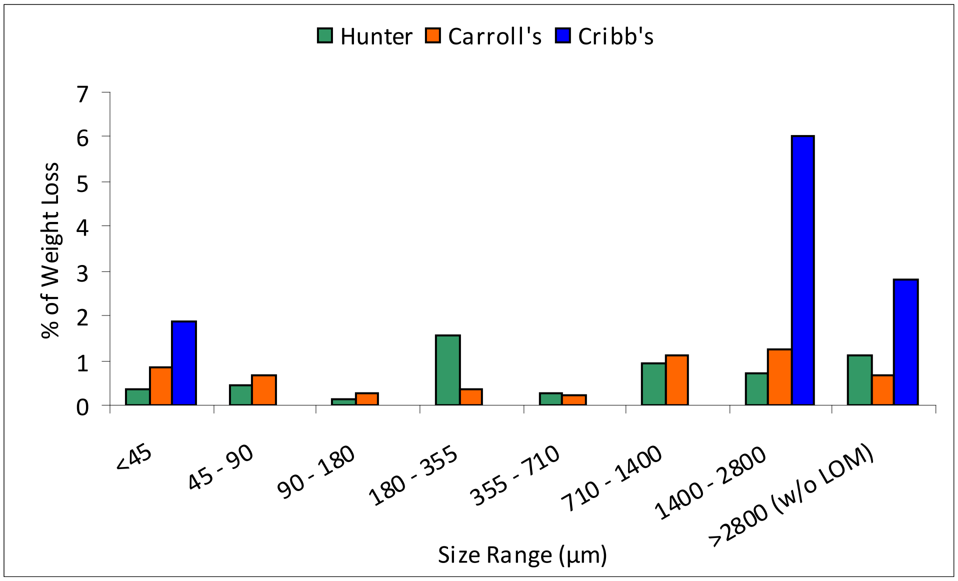


Figure 42. Comparison of weight loss over temperature range of 470 – 550°C (Asphalt) (Bathi 2008).

Heavy Metals

Several stormwater monitoring projects over the years have examined heavy metal pollutant strengths associated with different sized stormwater particulates.

Indirect indications of pollutant strengths by particle size are available from stormwater control monitoring projects. Examinations of sedimentation-based controls can directly relate to particle settling characteristics, for example. Randall, *et al.* (1982) recognized the strong correlation between pollutant removal effectiveness in wet detention ponds and pollutant associations with suspended solids. High lead removals were related to lead's affinity for suspended solids, while much smaller removals of BOD_5 and phosphorus were usually obtained because of their significant soluble fractions.

Wet detention ponds also are biological and chemical reactors. Dally, *et al.* (1983) monitored heavy metal forms in runoff entering and leaving a wet detention pond serving a bus maintenance area. They found that metals entering the monitored pond were generally in particulate (>0.2 µm) forms and underwent transformations into filterable (<0.2 µm) forms. The observed total metal removals by the pond were generally favorable, but the filterable metal outflows were much greater than the filterable metal inflows. This effect was most pronounced for Cd and Pb. Very little changes in Zn were found, probably because most of the Zn entering the pond was already in filterable forms. These metal transformations may be more pronounced in wet detention ponds that in natural waters because of potentially more favorable (for metal dissolution) pH and ORP conditions in wet pond sediments. Other studies have found similar transformations in the forms and availability of nutrients in wet detention ponds, usually depending on the extent of algal growth and algal removal operations.

The pollutant strengths of stormwater particulates were calculated for each pollutant with a particulate form and plotted on a probability versus strength chart for the Madison, Wisconsin, pond performance data from House, *et al.* (1993). An example is shown in Figure 43 for Zn. All pollutants had higher outlet than inlet strength values due to preferential removals of large particles in the detention pond, leaving relatively more small particles in the discharge water, further indicating that the small particles in stormwater have higher pollutant strengths than the large particles.

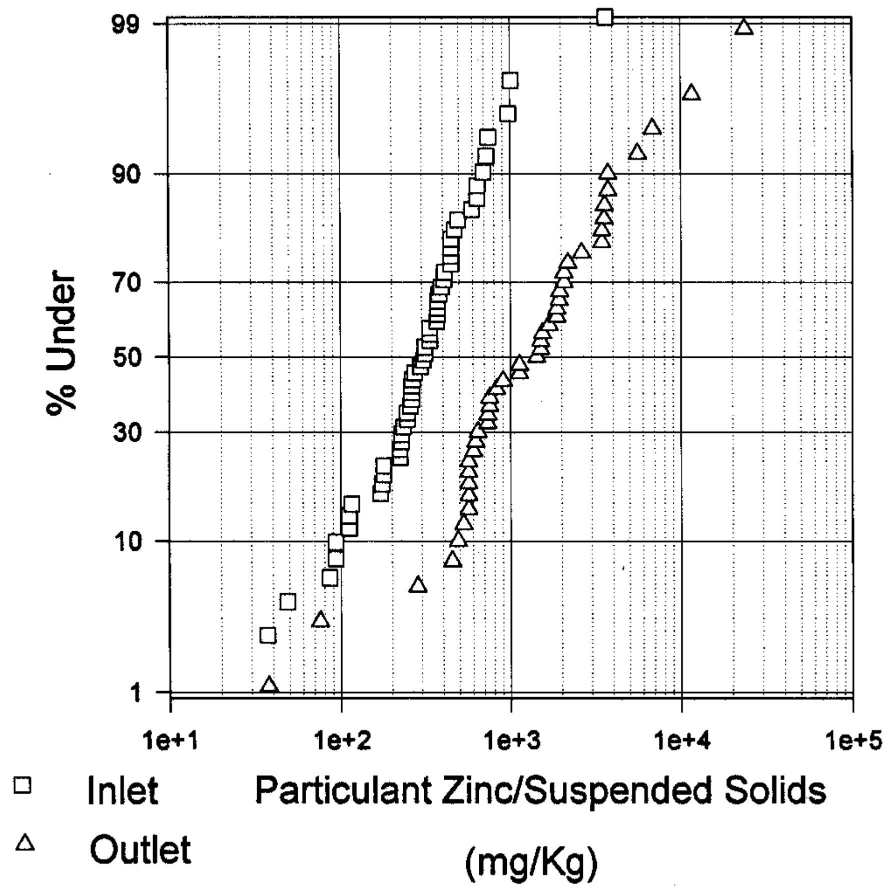


Figure 43. Particulate pollutant strengths for zinc (data from House, *et al.* 1993).

Projects have also separated stormwater particulates by size range and chemically analyzed each range separately. Vignoles and Herremans (1995) examined heavy metal associations with different particles sizes in stormwater samples from Toulouse, France. They found that the vast majority of the heavy metal loadings in stormwater were associated with particles less than 10 µm in size, as shown on Table 48.

Table 48. Percentages of suspended solids and distribution of heavy metal loadings associated with various stormwater particulate sizes in Toulouse, France (percentage associated with size class, concentration in mg/kg)

	>100 µm	50-100 µm	40-50 µm	32-40 µm	20-32 µm	10-20 µm	<10 µm
Suspended solids	15%	11%	6%	9%	10%	14%	35%
Cadmium	18 (13)	11 (11)	6 (11)	5 (6)	5 (5)	9 (6)	46 (14)
Cobalt	9 (18)	5 (16)	4 (25)	6 (20)	6 (18)	10 (22)	60 (53)
Chromium	5 (21)	4 (25)	2 (26)	6 (50)	3 (23)	9 (39)	71 (134)
Copper	7 (42)	8 (62)	3 (57)	4 (46)	4 (42)	11 (81)	63 (171)
Manganese	8 (86)	4 (59)	3 (70)	3 (53)	4 (54)	7 (85)	71 (320)
Nickel	8 (31)	5 (27)	4 (31)	5 (31)	5 (27)	10 (39)	63 (99)
Lead	4 (104)	4 (129)	2 (181)	4 (163)	5 (158)	8 (247)	73 (822)
Zinc	5 (272)	6 (419)	3 (469)	5 (398)	5 (331)	16 (801)	60 (1,232)

Source: Vignoles and Herremans (1995)

Morquecho (2005) collected numerous Tuscaloosa, AL, urban area sheetflow and outfall samples for analyses of discrete particle size ranges. Table 49 lists the percentage reduction in pollutants after removing larger particles than shown. These are for residential and commercial sheetflow and outfall samples and indicate a smaller particulate bound portion of these contaminants than for some of the other land use samples. Total solids and turbidity were reduced more than 50% by removal of all particulates >0.45 µm. The other pollutants, especially the heavy metals were reduced much less, even after filtration down to 0.45 µm. Previous studies in the same area indicated much more Zn, Pb and total phosphorus were reduced by reduction in particle size (Johnson, *et al.* 2003).

Table 49. Average percent reduction in pollutants after controlling for particle size indicated (Morquecho 2005)

	250µm	45µm	10µm	2µm	0.45µm
Total solids	6%	31%	43%	44%	42%
Suspended solids	23	64	88	93	100
Turbidity	30	42	65	69	83
COD	10	23	34	32	33
Total phosphorus	13	25	38	38	37
Zinc	5	14	20	26	22
Copper	6	14	25	27	38
Cadmium	5	10	9	14	15
Lead	6	16	22	35	30

These heavy metal filterable fractions results were much less compared to those seen at the inlet to the Monroe Street wet detention pond (House, *et al.* 1993) serving a residential and commercial area in Madison, WI. In the WI study, 87% of copper, 96% of lead and 66% of zinc were associated with the particulate fraction.

Tables 50 through 52 summarize the pollutant strengths for each size range for inlet, roof and storm drain outlet samples, respectively (Morquecho 2005). The normal trend is an increase in pollutant strengths with a decrease in particle size. For the inlets samples, most values tend to increase with a decrease in particle size. There is some variability, but the highest values are seen for the smaller (<10 µm) particle sizes. The same general trend is seen for the roof runoff and storm drain outlet samples.

Table 50. Summary table showing average pollutant associations for different particle sizes for combined (2001 and 2004/2005) inlet samples (N=13, rounded to two significant figures) (Morquecho 2005)

	Total phosphorus		COD		Zinc		Copper		Lead		Cadmium	
	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV
>250 µm	8,400	1.28	640,000	0.91	23,00,000	1.83	180,000	1.80	270,000	1.16	24,000	1.24
106-250 µm	2,400	0.95	140,000	0.99	680,000	1.30	180,000	1.47	38,000	1.03	22,000	1.29
45-106 µm	1,900	1.34	720,000	0.85	2,000,000	1.28	220,000	1.04	130,000	1.30	14,000	0.93
10-45 µm	4,400	0.69	1,100,000	1.73	2,600,000	1.01	270,000	0.51	400,000	1.60	140,000	na
2-10 µm	150,000	0.54	2,500,000	0.51	1,700,000	1.35	220,000	0.67	1,000,000	1.25	150,000	0.54
1-2 µm	98,000	2.19	1,300,000	na	31,000,000	1.87	5,900,000	2.03	3,100,000	1.52	210,000	1.09
0.45-1 µm	66,000	1.02	7,700,000	0.97	2,000,000	0.56	600,000	1.10	2,100,000	1.46	77,000	0.75

Note: na=too few detectable observations for calculation.

Table 51. Summary table showing average pollutant associations for different particle sizes for roof runoff samples (N=5, rounded to two significant figures) (Morquecho 2005)

	Total phosphorus		COD		Zinc		Copper		Lead		Cadmium	
	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV
>250 µm	4,400	0.77	300,000	0.91	2,800,000	1.15	150,000	0.28	630,000	0.35	13,000	1.24
106-250 µm	1,400	na	510,000	0.95	580,000	1.38	6,200	na	53,000	0.83	1,900	na
45-106 µm	1,400	1.30	520,000	0.43	na	na	1,900,000	na	200,000	1.22	na	na
10-45 µm	3,000	0.56	840	1.18	5,589,000	1.41	310,000	na	150,000	1.40	4,600	na
2-10 µm	na	na	370,000	na	2,000,000	0.40	na	na	120,000	na	5,400	1.03
1-2 µm	5,200	na	630,000	0.50	na	na	na	na	390,000	na	22,000	0.68
0.45-1 µm	6,800	1.69	1,212	0.85	45,000,000	1.12	4,900,000	na	5,100,000	0.70	87,000	1.13

Note: na=too few detectable observations for calculation

Table 52. Summary table showing average pollutant associations for different particle sizes for storm drain outlet samples (N=10, rounded to two significant figures) (Morquecho 2005)

	Total phosphorus		COD		Zinc		Copper		Lead		Cadmium	
	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV	mg/kg SS	COV
>250 µm	5,900	1.00	1,100,000	1.49	800,000	0.55	120,000	0.55	140,000	0.57	9,400	0.35
106-250 µm	1,900	1.45	780,000	1.33	52,000	0.68	20,000	0.52	30,000	0.54	8,300	1.29
45-106 µm	2,300	0.77	540,000	1.57	na	na	21,000	0.90	200,000	1.24	na	na
10-45 µm	3,400	0.73	720,000	0.49	990,000	na	130,000	1.06	150,000	1.22	9,100	0.67
2-10 µm	2,800	0.69	340,000	na	1,700,000	0.71	150,000	0.69	75,000	1.10	500,000	1.41
1-2 µm	8,000	0.78	670,000	na	540,000	1.17	32,0000	1.08	600,000	1.24	440,000	1.33
0.45-1 µm	8,200	0.88	1,400,000	na	1,600,000	1.05	430,000	0.91	430,000	0.71	110,000	0.80

Note: na=too few detectable observations for calculation.

Typical soil values for copper, lead and zinc are generally around 100 mg/kg (Lindsay 1979). The values reported by Morquecho (2005) are much higher, especially for the roof runoff. The roof runoff samples included at least two samples from a coated aluminum roof (Tuscaloosa courthouse). Heavy metals can also be picked up in the drainage gutters and/or downspouts. In comparison, these values are higher than those seen by Pitt and McLean (1986) in Toronto where they found copper values of about 30 to 200 mg/kg in most residential and commercial areas (particulates <125 µm), and from 100 to over 1000 mg/kg at industrial sites. Lead values for these samples were surprisingly high given the decreased use of leaded gasoline. Vignoles and Herremans (1995) found lead loadings of around 800 mg/kg for particulates <10 µm. Previous work in the late 1970s found values of lead of around 3,500 mg/kg (Pitt 1979). Storm drain outlet particulate levels of lead and cadmium were higher than inlet samples, but zinc and copper values were similar, indicating capture of large particulates in the drainage system before discharge. These results further emphasize the need for stormwater control practices to capture very small particles.

Figures 44 through 50 show the cumulative concentrations of pollutants for different particle size ranges, as reported by Cai (2015) for a paved parking area site in the southeastern US. The overall total concentrations would decrease with the preferential removal of large particulates, as occurs in sedimentation type devices. Small portions of the contaminants are found in the smallest particles sizes <5 µm. The majority of the pollutant concentrations (and mass) are associated with the 10 to 100 µm particle size range. Pre-treatment sedimentation controls removing only the largest particles (>100 µm for example) would only result in small reductions of the resulting effluent water concentrations (about 20% removals). More effective treatment controls that can remove smaller particles would result in much better effluent quality (down to about 5 µm, beyond which little additional benefit is likely by sedimentation processes for these data).

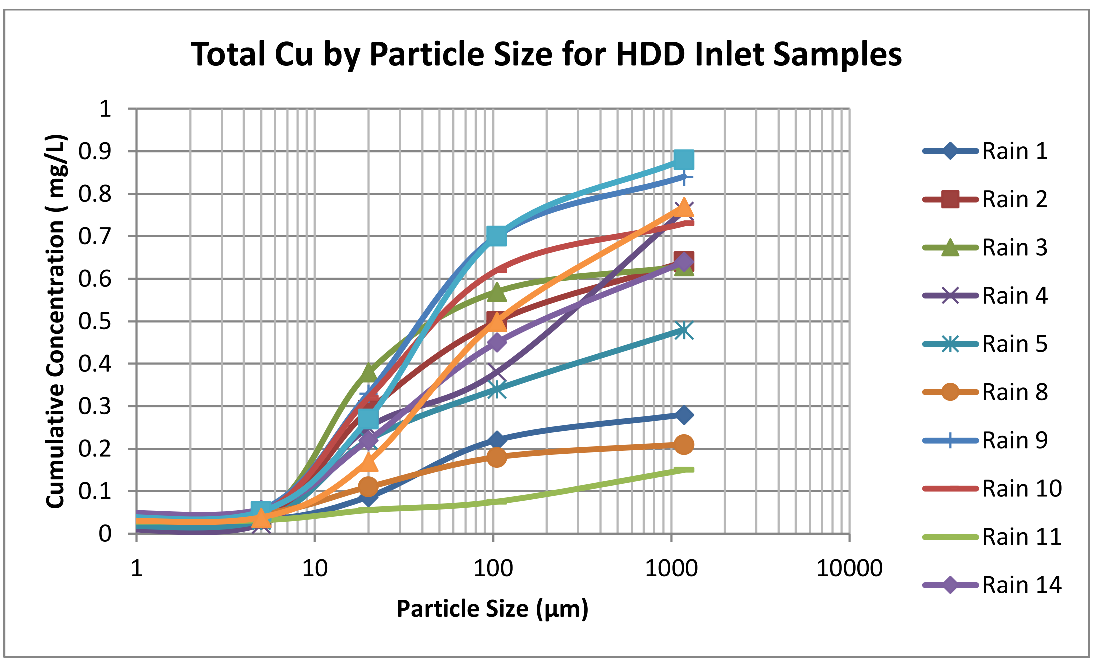


Figure 44. Cumulative concentration of Total Copper by Particle Size (Cai 2015).

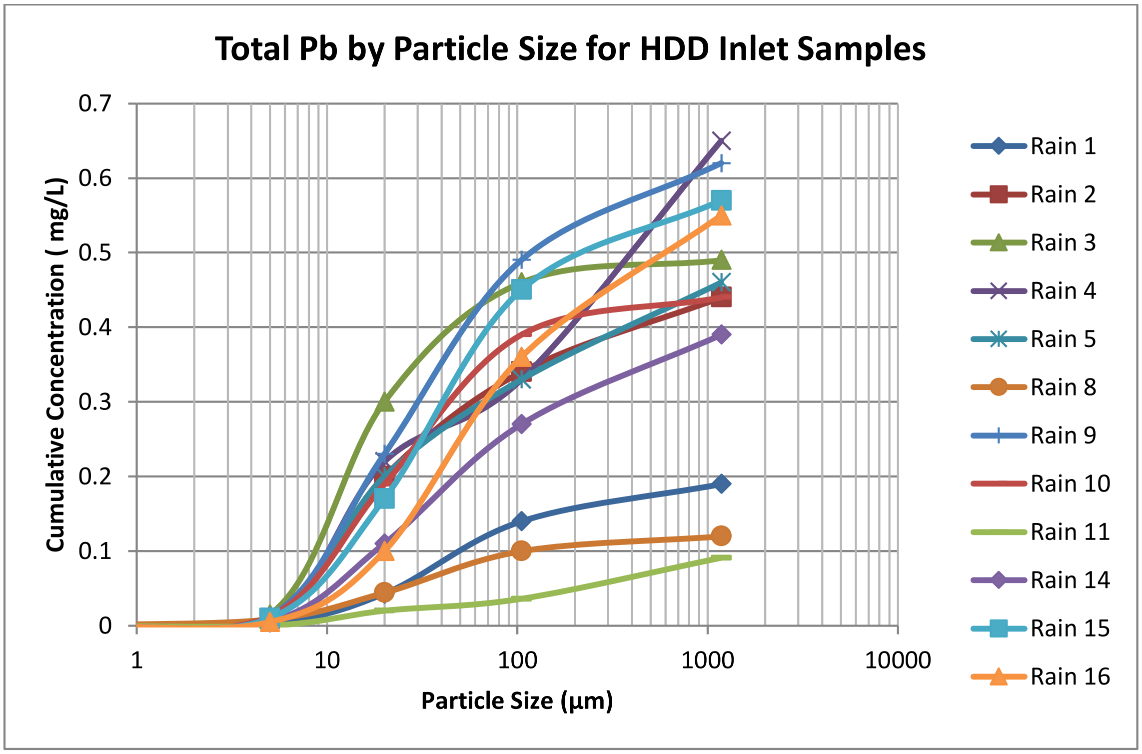


Figure 45. Cumulative concentration of Total Lead by Particle Size (Cai 2015).

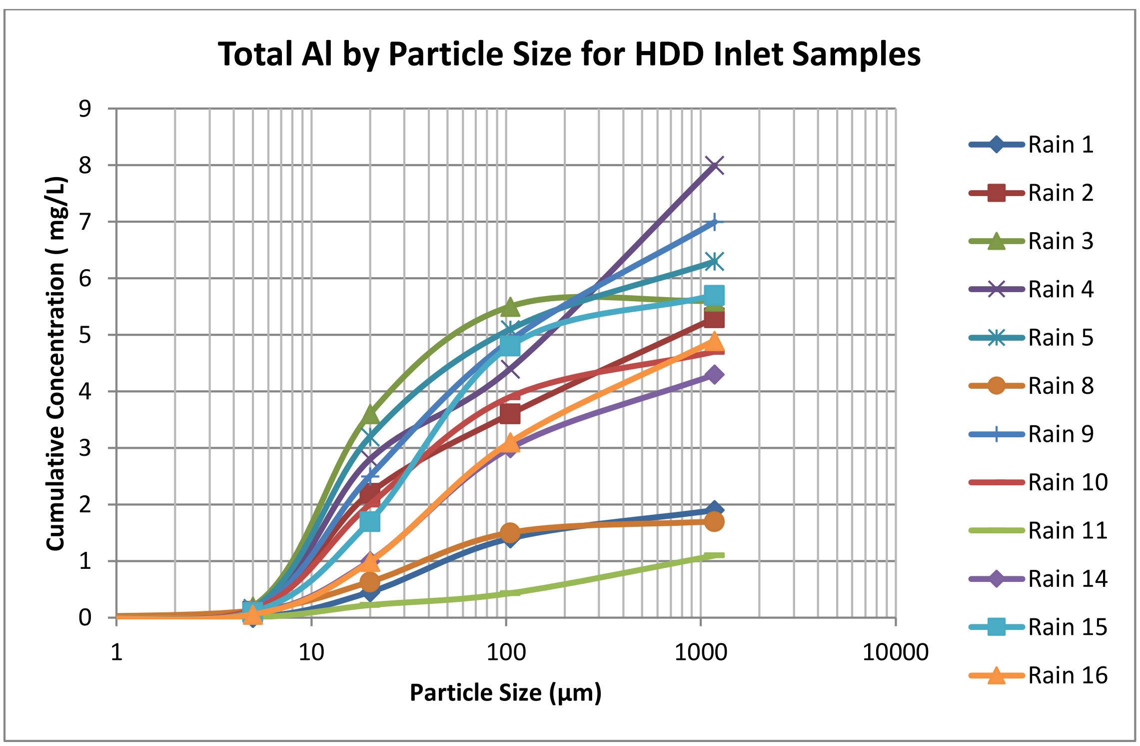


Figure 46. Cumulative concentration of Total Aluminum by Particle Size (Cai 2015).

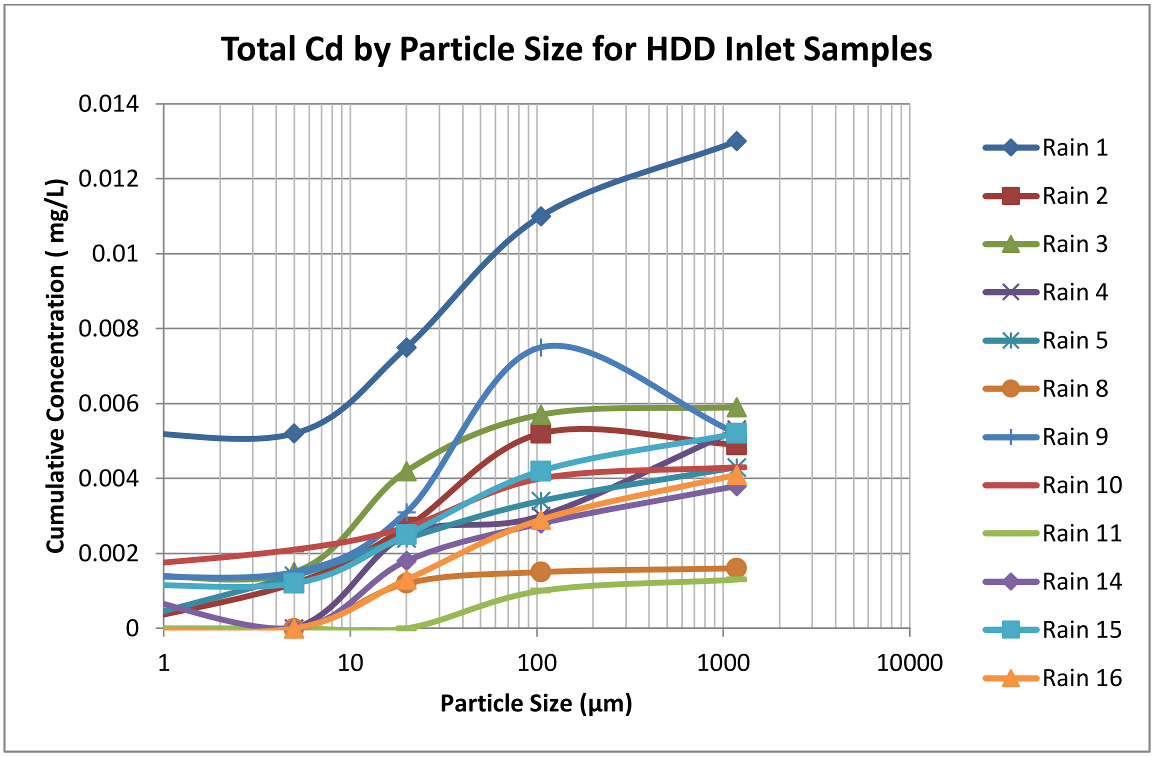


Figure 47. Cumulative concentration of Total Cadmium by Particle Size (Cai 2015).

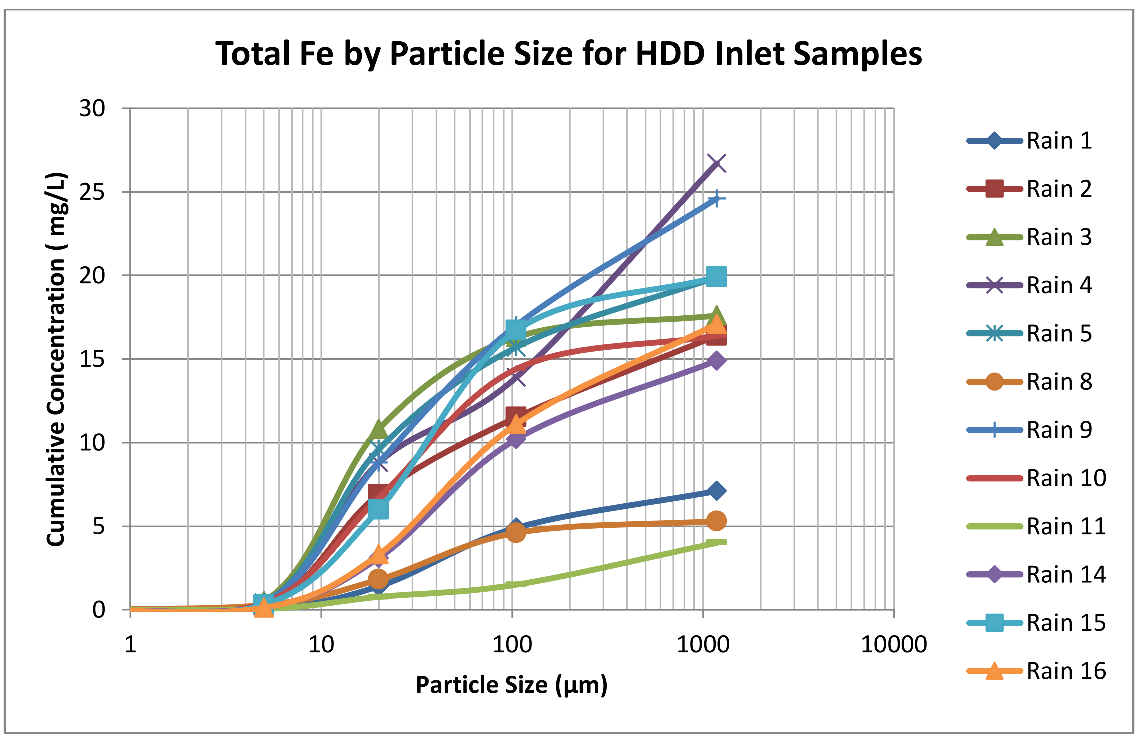


Figure 48. Cumulative concentration of Total Iron by Particle Size (Cai 2015).

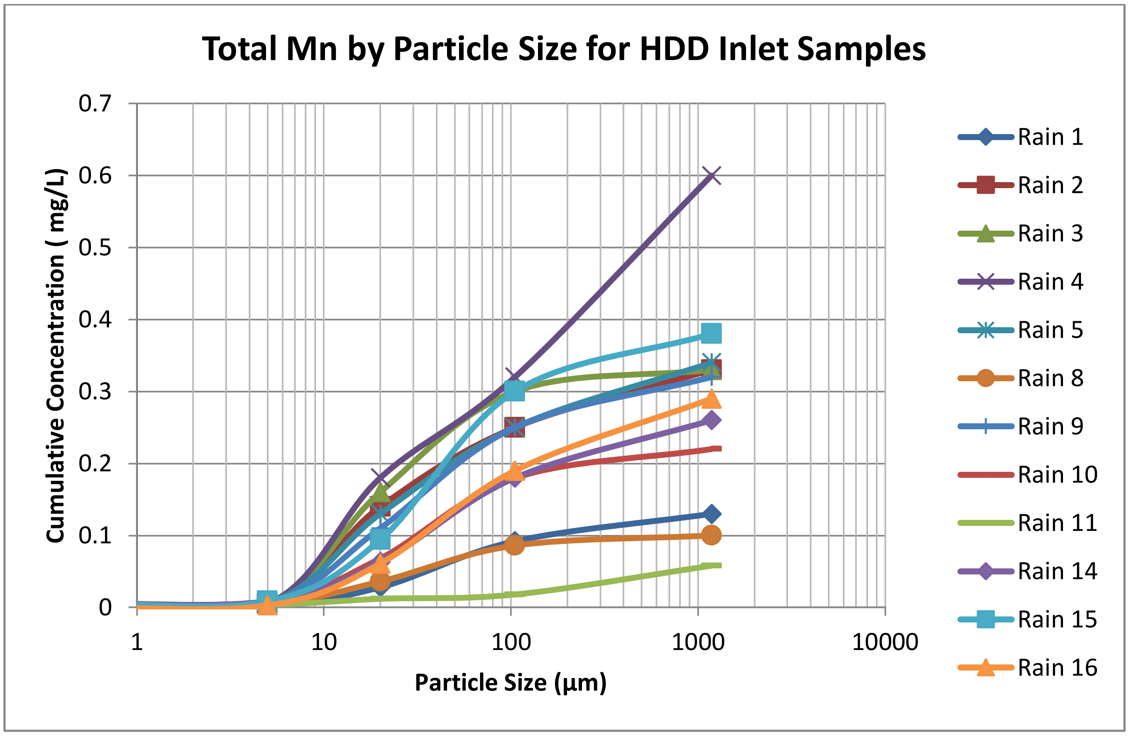


Figure 49. Cumulative concentration of Total Manganese by Particle Size (Cai 2015).

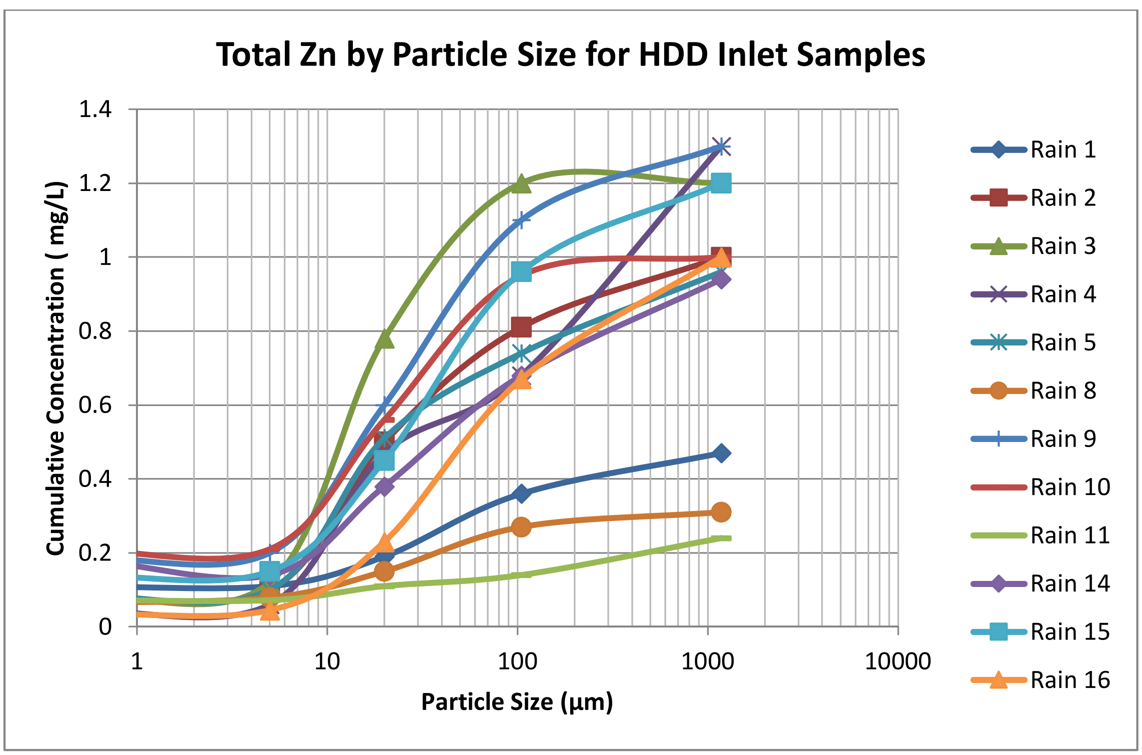


Figure 50. Cumulative concentration of Total Zinc by Particle Size (Cai 2015).

Cai (2015) also calculated the pollutant strengths for the different particle size ranges for metals, COD, TN and TP, as shown in Figures 51 through 59.

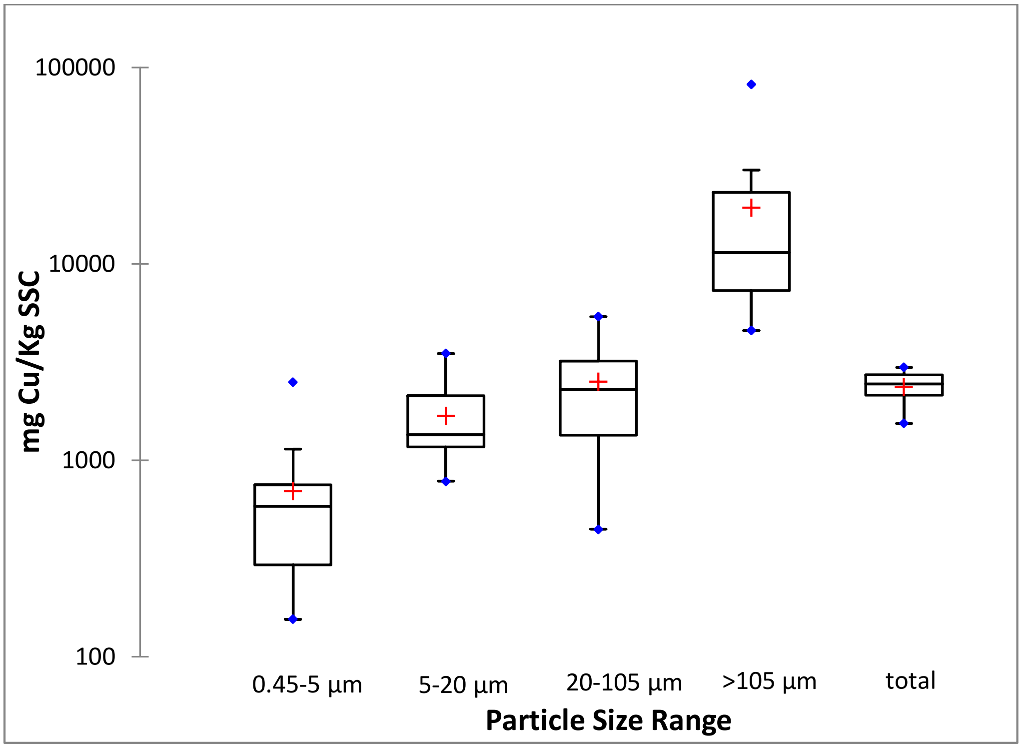


Figure 51. Copper Particulate Strengths by Particle Size (Cai 2015).

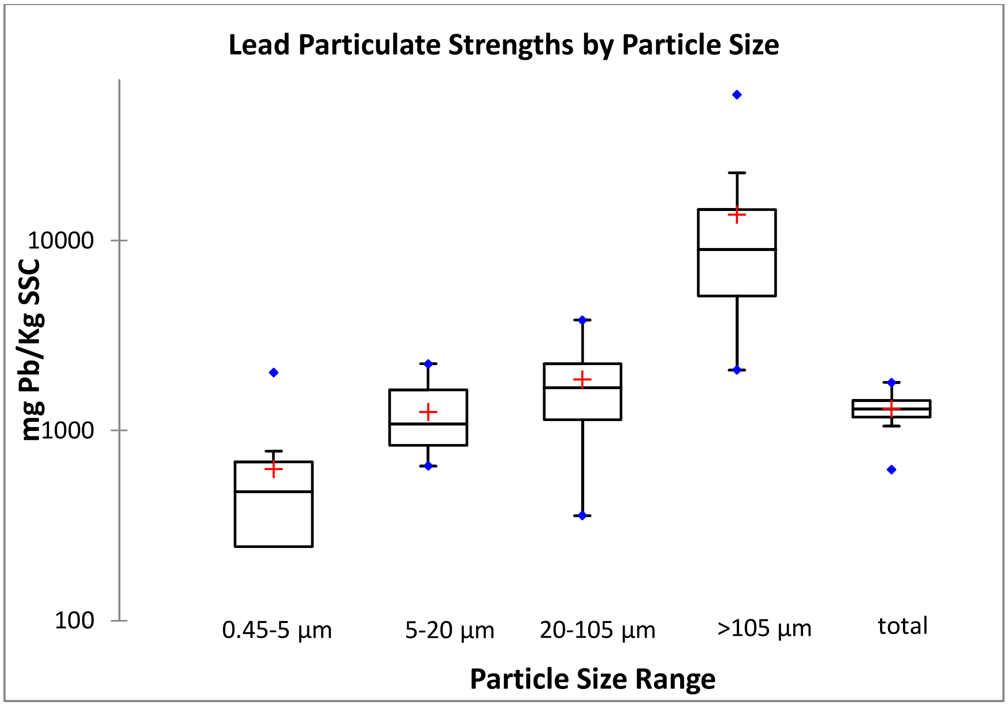


Figure 52. Lead Particulate Strengths by Particle Size (Cai 2015).

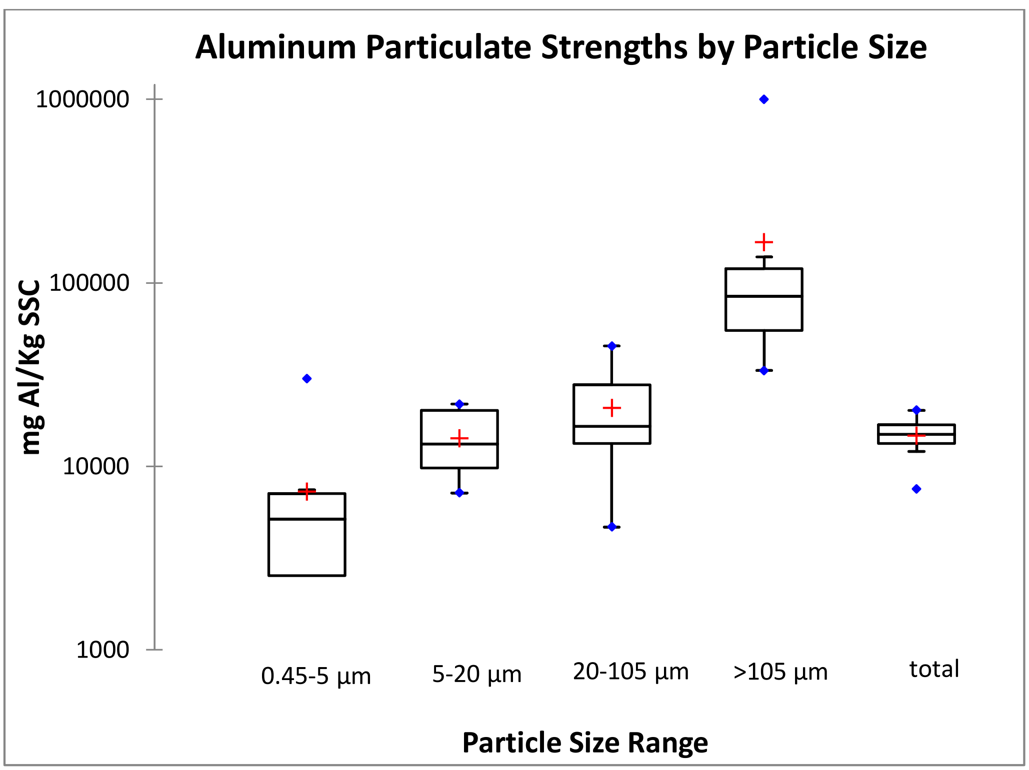


Figure 53. Aluminum Particulate Strengths by Particle Size (Cai 2015).

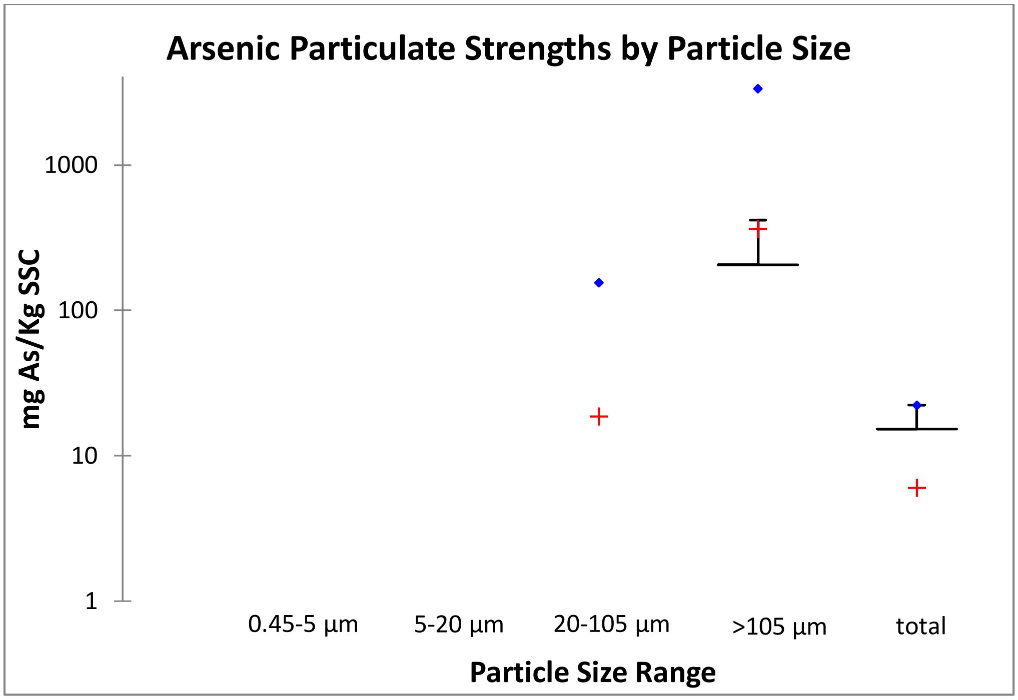


Figure 54. Arsenic Particulate Strengths by Particle Size (Cai 2015).

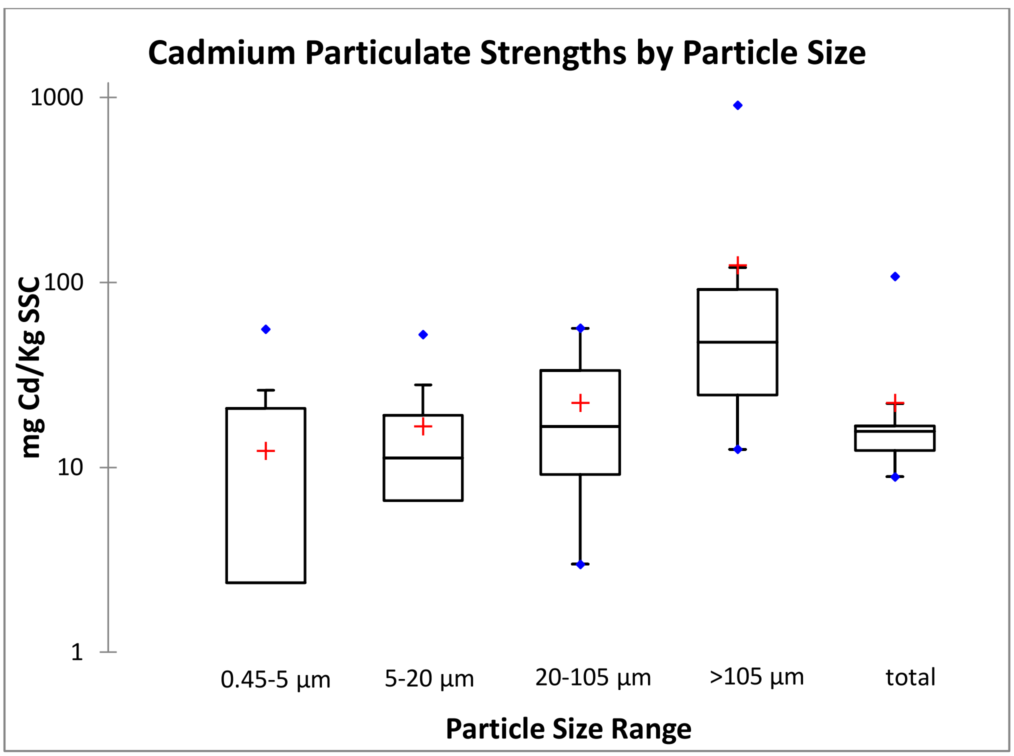


Figure 55. Cadmium Particulate Strengths by Particle Size (Cai 2015).

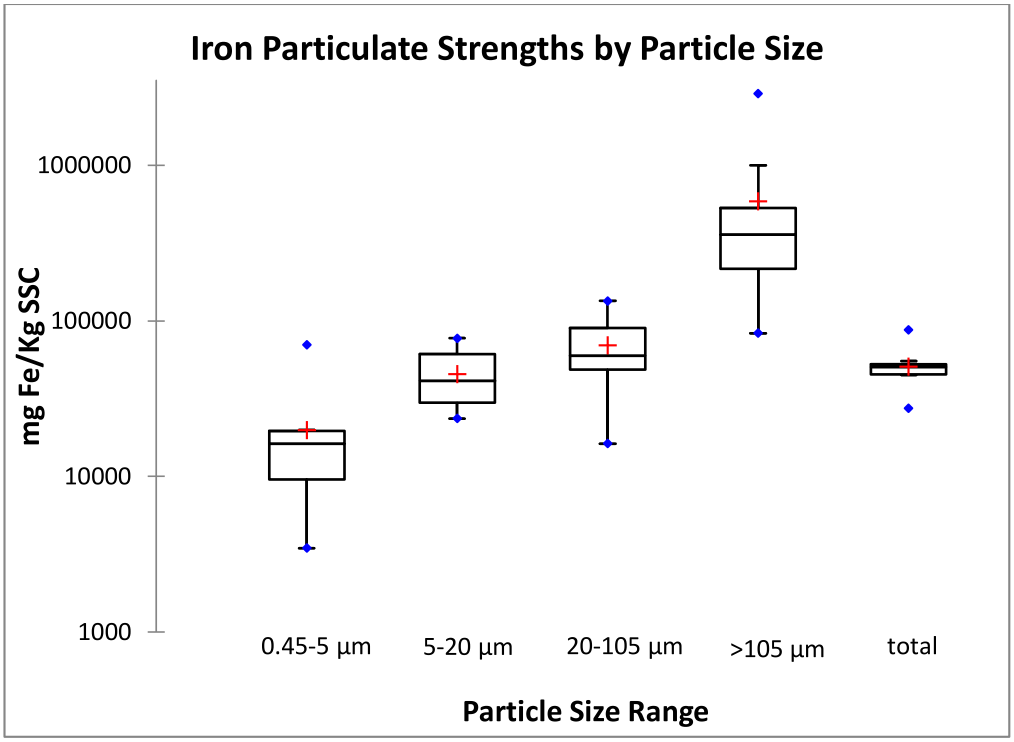


Figure 56. Iron Particulate Strengths by Particle Size (Cai 2015).

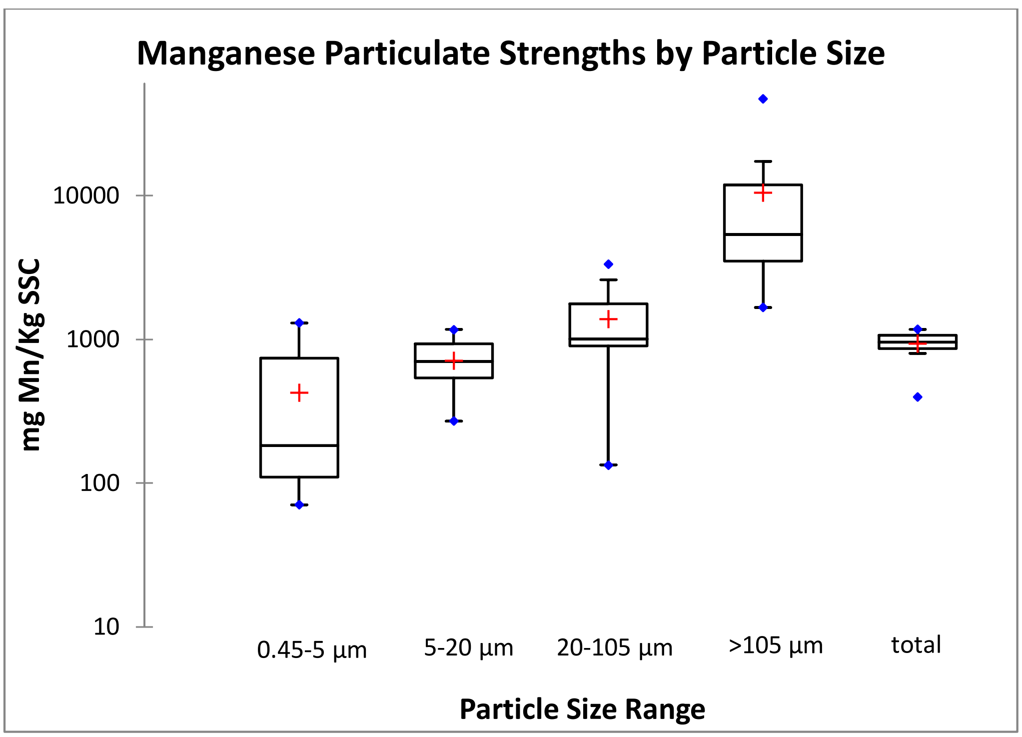


Figure 57. Manganese Particulate Strengths by Particle Size (Cai 2015).

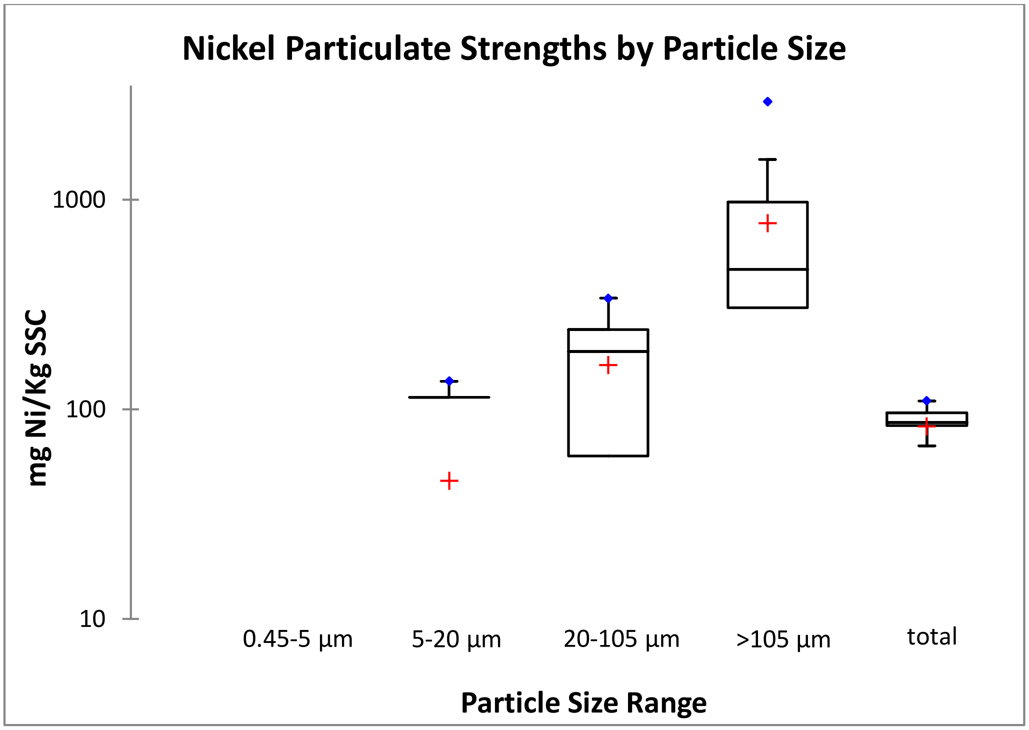


Figure 58. Nickel Particulate Strengths by Particle Size (Cai 2015).

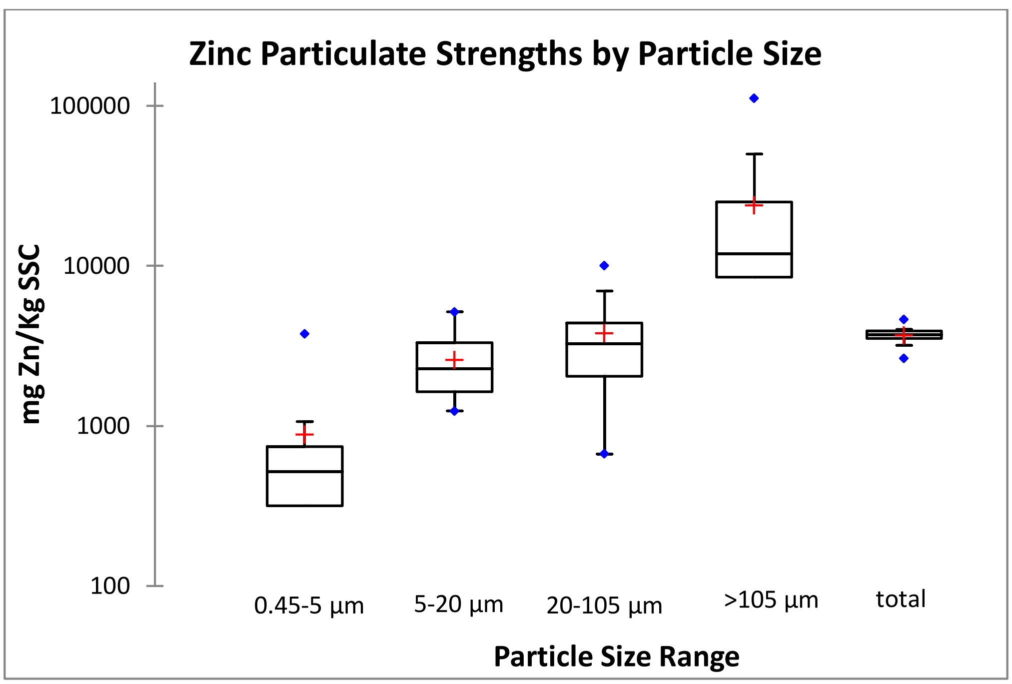


Figure 59. Zinc Particulate Strengths by Particle Size (Cai 2015).

At this parking area site, the particulate strengths tended to increase as the particle sizes increase. These results were similar to the results observed by Sansalone, *et al.* (1997). In general, metals tend to preferentially adsorb to smaller particle sizes due to larger surface areas.

<u>Colloidal Analysis to Characterize Filterable Metallic Forms</u>

Morquecho (2005) used Chelex-100 ion exchange resin to determine how much of the filterable heavy metals occurred in the ionic form (considered most toxic to aquatic life), and how much was bound to colloids or other organic matter in solution (difficult to remove by stormwater controls). Table 53 lists the average percentage of the heavy metals analyzed that occurred as either ionic or bound forms. Most of the zinc, cadmium and lead were not present in the free ionic form, but were bound to colloids or organic matter whose bonds could be broken by exposure to UV light. Only copper occurred in mostly ionic form. These results were similar to previous results reported by Johnson, *et al.* (2003) in which cadmium was mostly particulate/colloidal bound (70%) and about 50% of copper was in ionic forms. The other metals were mostly found in their ionic forms.

Table 53. Average percentage of metals occurring as ionic or bound forms for last four samples (metals measured by ICP-MS) (Morquecho 2005)

	Average % ionic	Average % bound in organic complexes
Zinc	15	85
Copper	70	30
Cadmium	10	90
Lead	12	88

PAHs

Bathi (2008) investigated Tuscaloosa, AL, urban area stream sediment PAH values for different size ranges. PAHs can occur in soluble and particulate-associated forms; however, previous studies have shown that particulate associated PAHs are most abundant in stormwater (Pitt, *et al.* 1999; Mahler, *et al.* 2005; Hwang and Foster 2005). Bathi also conducted fugacity based modeling to calculate the phase portioning of individual PAHs in an aquatic environment under equilibrium conditions for comparison to observed field values. The model results showed similar trends as observed with large associations of PAHs with sediments compared to the liquid or air portions, especially for high molecular weight PAHs.

Variations in organic content of the particulate matter in the water has been reported to affect the particulate PAH associations (Zhou, *et al.* 1998). Recent investigations have also found high PAH concentrations associated with large organic material trapped in stormwater floatable control devices (Rushton 2006). The composition of the sediment (organic matter and other litter, vs. inert material) affects the association of PAHs with the sediment.

Bathi (2008) collected sediment samples from three different creeks in and around Tuscaloosa and Northport, AL (Cribb's Mill Creek, Carroll's Creek, and Hunter Creek). All the samples were collected in pre-cleaned and autoclaved glass sample bottles using a manual dipper sampler made from polypropylene. The collected sediment samples were dried in aluminum trays at 104°C to remove moisture and were then sieved using a mechanical shaker and a set of sieves. All of the chemical analyses were conducted on the material retained by the sieves having openings of 45, 90, 180, 355, 710, 1,400 and 2,800 µm. In addition, the largest size fraction was separated into inert and organic fractions, with the large organic material (LOM) (mostly leaves) manually separated for separate analyses. All the size fractionated sediment particles were analyzed for PAH concentrations using thermal desorption GC/MS.

The observed PAH concentrations for the different sediment particle sizes and associated standard deviations are shown in Table 54. Figures 60 through 65 are box and whisker plots of the PAH concentrations associated with the different sediment fractions. As expected, there were large variations in the measured PAH concentrations. The PAH concentrations were therefore tested for their normality for each site and size range using probability plots and Anderson Darling statistical tests. Most of the PAH concentration groups were found to be normally distributed.

The PAH concentrations were found to be strongly associated with particulate matter. The variations in key characteristics of the sediment affect these associations. Fugacity level I partitioning calculations were performed for the PAHs in a hypothetical environmental system. This modeling approach indicated that except for the low molecular weight PAHs (naphthalene, fluorene, phenanthrene, and anthracene), all the other studied PAHs were predominantly portioned with the sediment phase. The model predictions also indicated that the PAHs with Log (K_{OW}) or Log (K_{OC}) values greater than about 4.5 were mostly partitioned with the sediment phase, compared to other phases. The high molecular weight PAHs had a greater portion associated with the particulates than did the low molecular weight PAHs.

Bathi (2008) found that overall, all characteristics studied showed similar trends, with the smaller and larger particles found to have relatively higher values compared to the intermediate sized particles. Cluster analyses of the PAH concentrations for the different particle sizes showed that for most cases examined, the LOM fraction was found to be a statistically separate sample category (having much higher concentrations) from all other size categories.

Table 54. Observed PAHs concentrations and associated standard deviations for urban creek sediment by size fractions (Bathi 2008)

PAH	Mean Concentration (µg/kg) (Standard Deviation)								
	< 45 µm	45 – 90 µm	90 – 180 µm	180 - 355 µm	355 - 710 µm	710 – 1,400 µm	1,400 – 2,800 µm	> 2,800 µm (w/o LOM)	> 2,800 µm LOM
Naphthalene	255 (275)	177(156)	163 (224)	94 (87)	124 (131)	790 (2,046)	891 (2,014)	124 (74)	2,637 (2,107)
Fluorene	257 (295)	189 (134)	225 (187)	125 (135)	139 (140)	196 (144)	293 (173)	216 (161)	1,771 (945)
Phenanthrene	264 (278)	205 (211)	140 (158)	92 (92)	110 (85)	130 (136)	197 (230)	188 (164)	2,007 (1,422)
Anthracene	354 (397)	288 (273)	261 (253)	152 (150)	182 (182)	366 (314)	491(614)	218 (152)	2,255 (1,089)
Fluoranthene	650 (868)	624 (753)	345 (372)	202 (242)	247 (336)	259 (237)	237 (197)	191(173)	1,520 (902)
Pyrene	653 (738)	519 (548)	412 (577)	175 (174)	240 (405)	207 (153)	192 (122)	172 (129)	2,054 (954)
Benzo(a) anthracene	501 (595)	408 (537)	258 (286)	169 (171)	224 (229)	167 (134)	271 (252)	278 (371)	2,164 (1,045)
Chrysene	591 (618)	602 (689)	363 (363)	202 (199)	273 (268)	190 (125)	296 (242)	171 (130)	1,810 (852)
Benzo(b) fluoranthene	597 (522)	517 (598)	358 (389)	402 (671)	227 (150)	316 (262)	375 (369)	329 (375)	2,179 (1,425)
Benzo(a)pyrene	1,474 (2,210)	1,524 (3,079)	662 (459)	434 (513)	351 (210)	502 (533)	1,119 (2,086)	392 (255)	2,330 (1,866)
Indeno(1,2,3-cd) pyrene	787 (544)	657 (538)	942 (794)	258 (187)	332 (189)	576 (774)	706 (917)	357 (424)	1,774 (933)
Dibenz(a,h) anthracene	1,267 (1,864)	787 (1,022)	675 (545)	276 (234)	355 (226)	687 (511)	835 (1,254)	286 (191)	1,492 (775)
Benzo(g,h,i) perylene	706 (686)	465 (451)	591 (691)	199 (226)	174 (116)	551 (567)	396 (299)	348 (229)	2,236 (1,728)

120

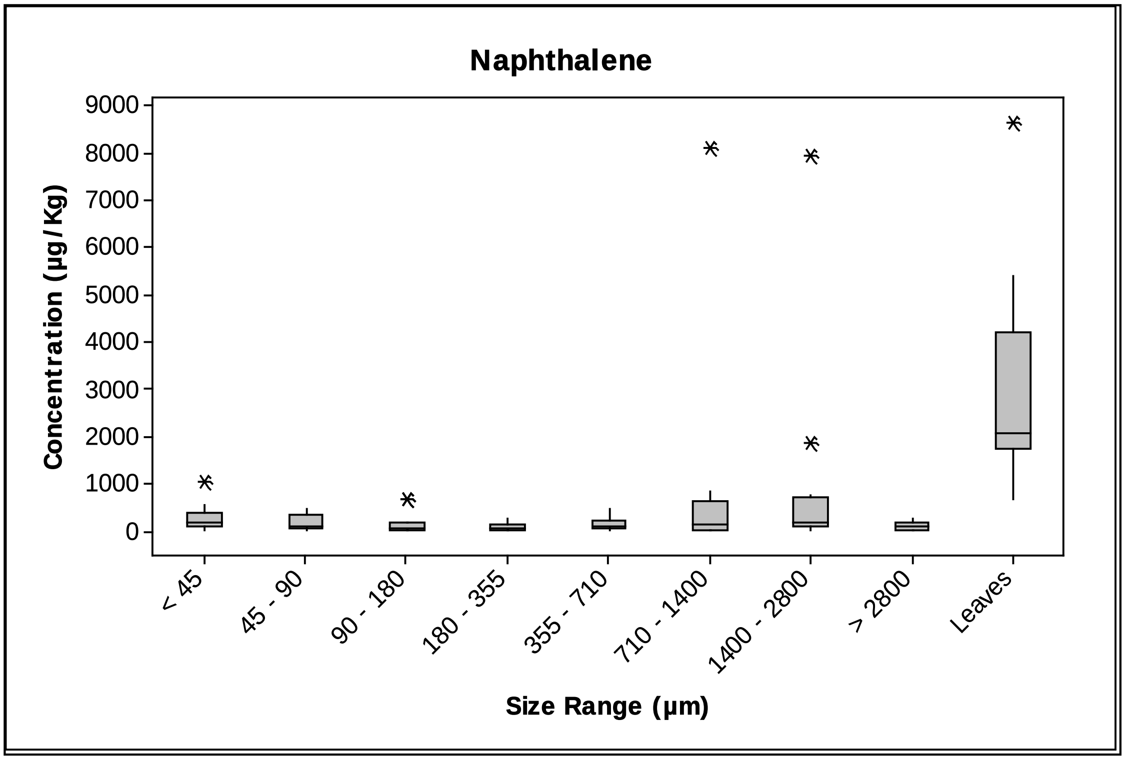


Figure 60. Size fractionation of naphthalene in urban creek sediments. (Bathi 2008)

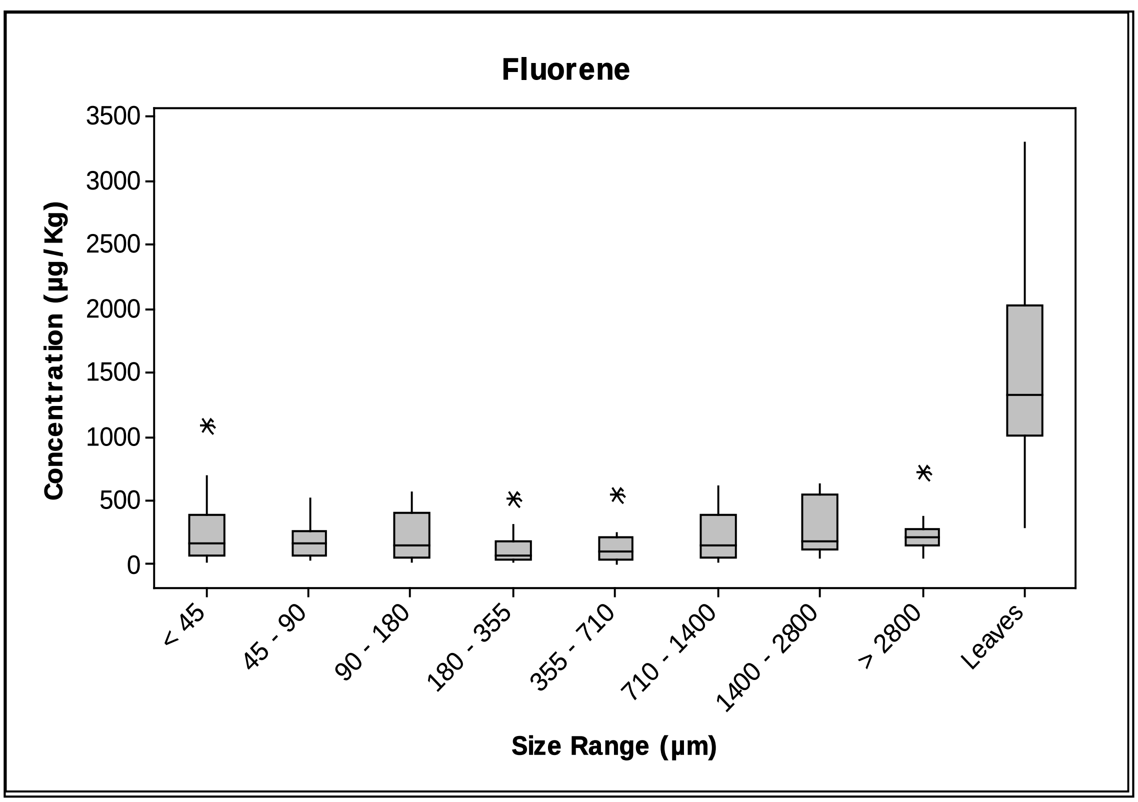


Figure 61. Size fractionation of fluorene in urban creek sediments. (Bathi 2008)

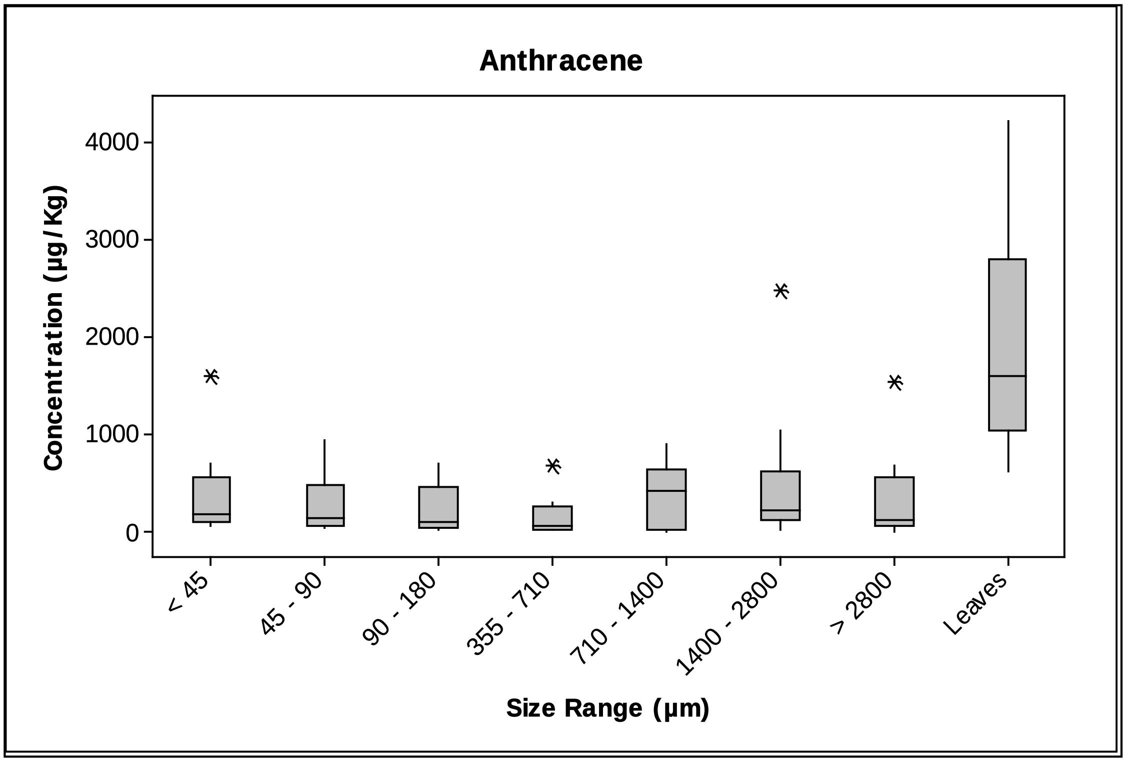


Figure 62. Size fractionation of anthracene in urban creek sediments. (Bathi 2008)

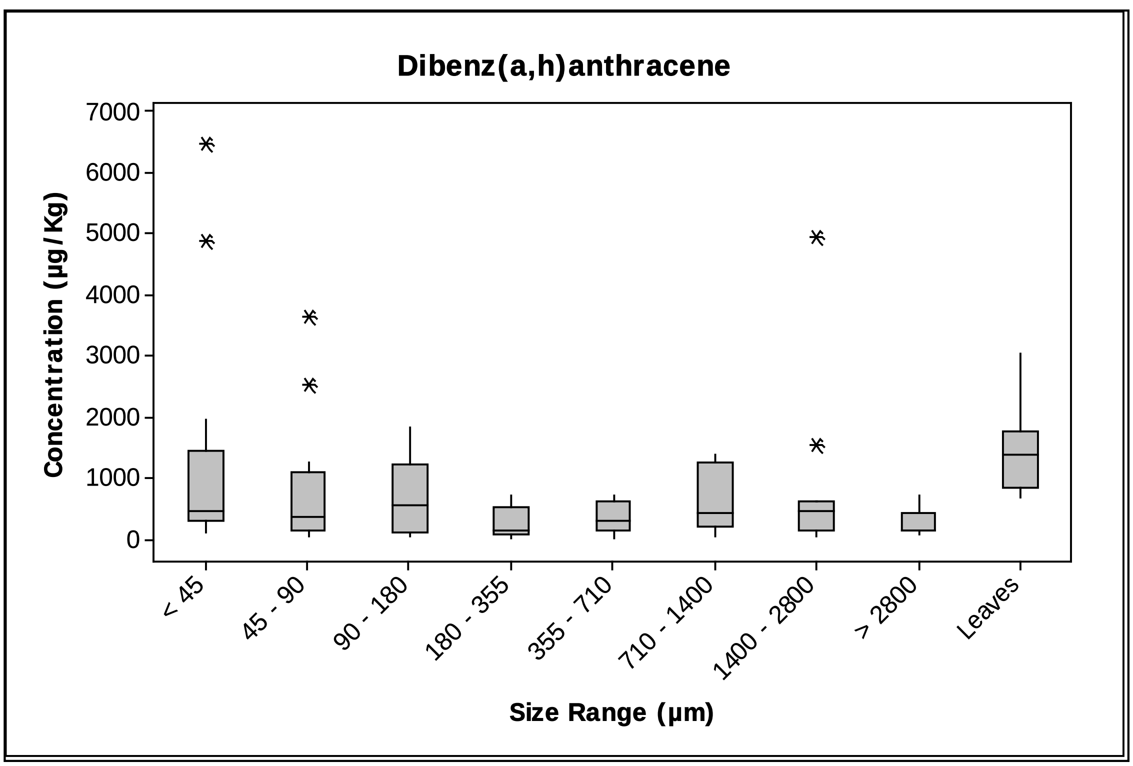


Figure 63. Size fractionation of dibenz(a,h)anthracene in urban creek sediments. (Bathi 2008)

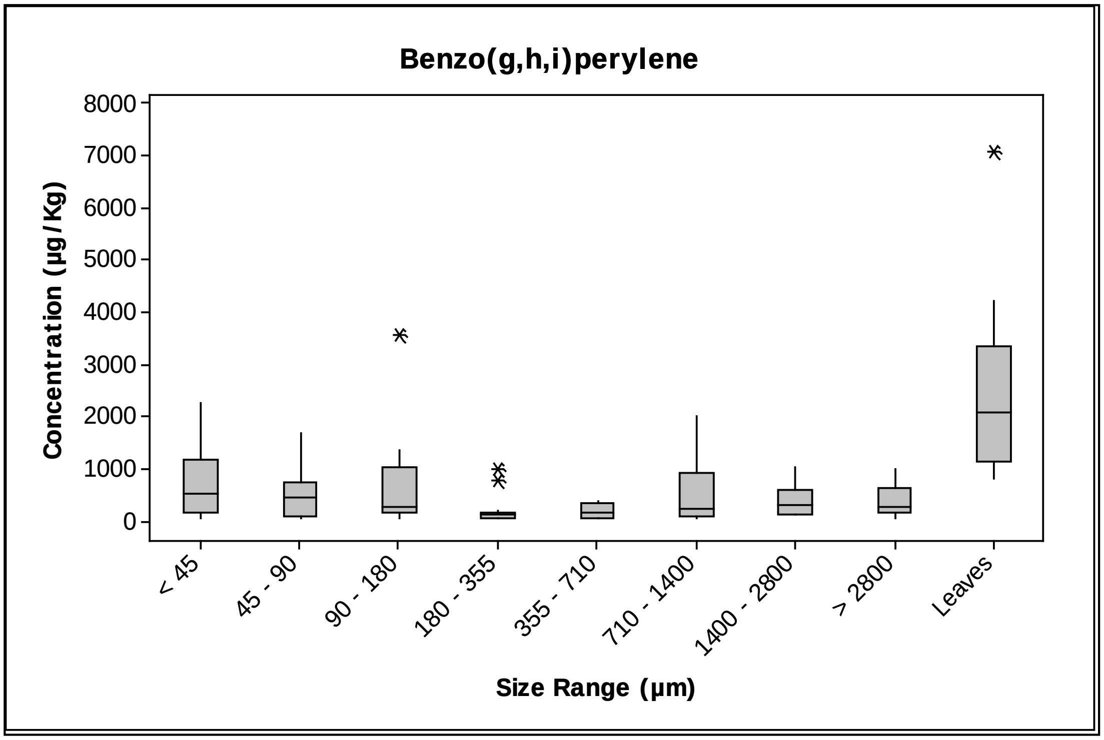


Figure 64. Size fractionation of benzo(g,h,i)perylene in urban creek sediments. (Bathi 2008)

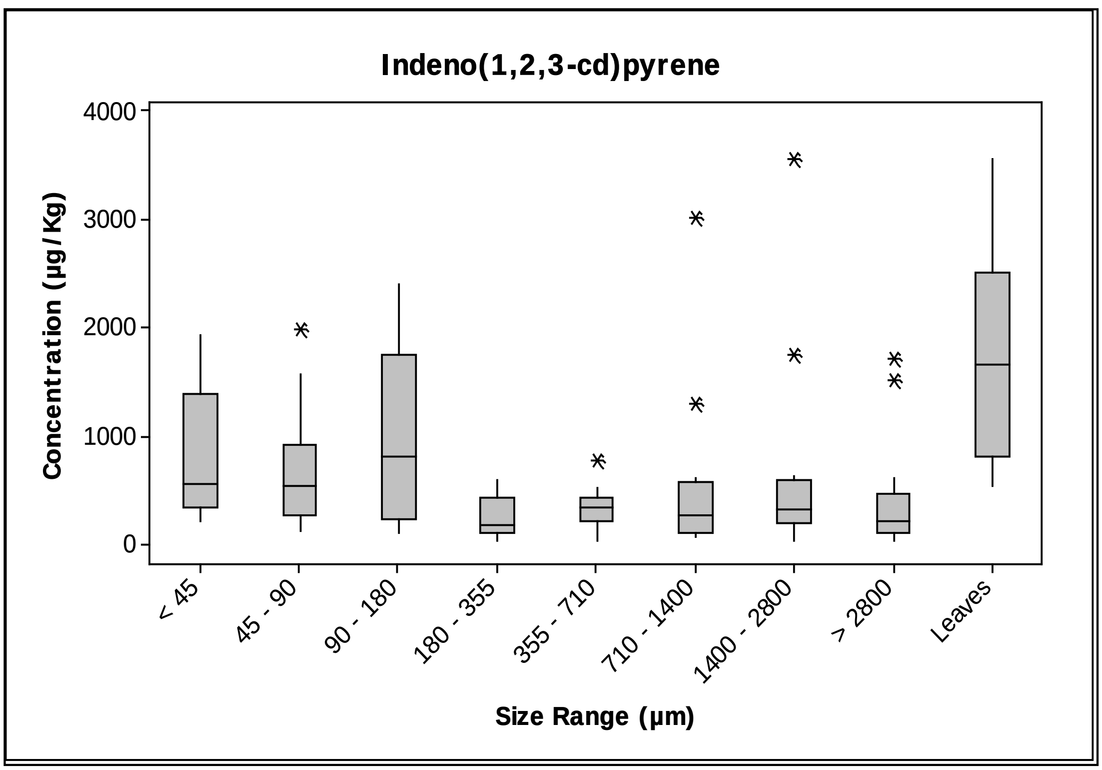


Figure 65. Size fractionation of indeno(1,2,3-cd)pyrene in urban creek sediments. (Bathi 2008)

Literature Review Conclusions

Many different research publications were reviewed and summarized concerning the particle associations of stormwater pollutants. Knowing the distribution of pollutants associated with different sized stormwater particles allows more accurate determinations of their sources, transport, and control. Pollutants in stormwater runoff can to be separated into particulate-bound or filtered (filterable or “dissolved”) forms. Pollutant strengths are the contaminant concentrations associated with the particulate matter in the stormwater. The following are brief comments concerning these characteristics of stormwater particulates.

Specific Gravity and Settling Rates:

In most cases, stormwater particulates have specific gravities in the range of 1.5 to 2.5, depending on the mixture of organic and inert material in the particle (or clump). This corresponds to a relatively narrow range of settling rates for a specific particle size. Newton (laminar) and Stoke (turbulent) settling equations can be used to calculate reasonable settling rates for these particulates, as long as suitable characteristics are known. Specific gravity decreases as the organic content increases; larger particle sizes have lower specific gravities and larger amounts of organic material. With sedimentation treatment, preferential removal of higher specific gravity materials results in a shift to lower overall specific gravity of particulates in the effluent water for similar size classes. Scour of deposited sediment is dependent on the particle characteristics, including compaction of the material, compared to the shear stress (tractive force) of the flowing water.

Heavy Metals:

In almost all cases, the heavy metals are mostly associated with particulates in stormwater, except for Zn which can have large portions associated with the filterable fraction. Residential and commercial areas may have greater filterable fractions of metals in the stormwater than industrial sites that may have greater fractions associated with particulates. The normal trend is increases in pollutant strengths of metals with decreases in particle size. However, at industrial sites, large metallic/oily debris may be associated with larger particles sizes due to the nature of the source material. At a monitored heavy industrial area, the majority of the pollutant concentrations (and mass) were associated with the 10 to 100 µm particle size range.

Residential and commercial stormwater filterable heavy metals (zinc, cadmium, and lead) are mostly bound to organic complexes or as colloids that are difficult to remove by ion exchange, but may be removed by sorption processes. Copper was mostly in ionic forms that can be readily removed by ion exchange (depending on the ionic strength).

Pre-treatment sedimentation controls removing only the largest particles (>100 µm for example) would only result in small reductions of the resulting effluent water concentrations. More effective treatment controls that can remove smaller particles would result in much better effluent quality (down to about 5 µm, beyond which little additional benefit is likely by sedimentation processes).

PAHs:

Because of their low volatility (low Henry's Law constant), high octanol-water partition coefficients (K_{OW}) and high soil organic coefficients (K_{OC}), many of the stormwater PAHs (especially high molecular weight PAHs) are preferentially adsorbed to particulate matter. The smaller and larger particle size ranges can have relatively higher PAH particulate strength values compared to the intermediate sized particles, depending on the organic content of the material. PAHs can be effectively controlled concurrent with high-levels of stormwater particulate control.

Section 4: SERDP Stormwater Concentration Data Analyses

Stormwater samples were collected from four outfalls on the NBSD, in the main Paleta Creek channel before the NBSD and at several locations at the mouth of the creek representing mixed flows, as previously described in the sampling section. A total of 15 samples were collected during two events. Whole samples were analyzed for total and filterable forms of the contaminants. In addition, each of the 15 samples were also separated into four particle size ranges for additional analyses. The following subsections of the report describe statistical analyses for these samples, including basic results comparing locations and particle sizes, relationships between different constituents, and mass calculations indicating discharge amounts for the constituents.

Whole Sample Total, Filtered, and Particulate Strength Concentrations and Relationships

Total and filtered analyses were conducted for 15 whole water samples from events 1 and 2 at these locations. These concentrations were used to calculate the particulate strengths for these samples. The average values for these 15 samples for total, filtered, and particulate strength are shown on Table 49, along with the Pearson correlations and associated p values indicating the significance of the total to filterable relationships, scatterplots, along with multivariate analyses (principal components and cluster analyses), are shown in Appendix F.

While Pearson correlations were conducted for all constituent combinations in Appendix F, Table 55 only shows those values comparing total vs. filtered values for each constituent separately. Comments are also listed describing the visual pattern between the two sets of data.

Table 55. Total Concentrations Compared to Filtered Concentrations

	total mean concentration	filterable mean concentration	mean particulate strength	Pearson correlation filtered vs. total conc.	p value of correlation between filtered and total conc.*	comment on scatterplot
SSC, mg/L	247	na	na			
TOC, mg/L; %	na	11.4	7.7			
As, ug/L; mg/kg	13.3	2.3	148	0.09	0.82	filterable concentrations mostly constant
Cd, ug/L; mg/kg	0.46	0.11	1.4	0.85	<0.001	marginal correlation
Cu, ug/L; mg/kg	49.2	23.3	126	0.48	0.07	poor correlation
Hg, ng/L; ug/kg	95	1	360	0.94	<0.001	good log-normal correlation
Ni, ug/L; mg/kg	16.6	10.7	16.6	0.61	0.02	marginal correlation
Pb, ug/L; mg/kg	18.2	1	1.4	0.39	0.15	poor correlation
Zn, ug/L; mg/kg	157	23.5	851	0.36	0.19	poor correlation
Acenaphthene, ng/L; ug/kg	17.8	4.7	56	0.16	0.58	filterable concentrations mostly constant
Anthracene, ng/L; ug/kg	9.9	1.2	80	0.19	0.51	filterable concentrations mostly constant
Benzo(a)anthracene, ng/L; ug/kg	43.5	1.2	202	0.61	0.02	filterable concentrations mostly constant
Benzo(a)pyrene, ng/L; ug/kg	52	1.2	265	0.39	0.15	filterable concentrations mostly constant
Benzo(b)fluoranthene; ng/L; ug/kg	106	2.9	487	0.51	0.05	filterable concentrations mostly constant
Benzo(k)fluoranthene, ng/L; ug/kg	32	1.1	138	0.63	0.01	filterable concentrations mostly constant
Benzo[ghi]perylene and Indeno, ng/L, ug/kg	76	1.4	371	0.07	0.08	filterable concentrations mostly constant
Chrysene, ng/L; ug/kg	57.7	1.9	244	0.57	0.03	filterable concentrations mostly constant
Dibenzo[a,h]anthracene, ng/L; ug/kg	13.8	0.65	68	0.48	0.07	filterable concentrations poorly correlated
Fluoranthene, ng/L; ug/kg	242	11.6	1,170	0.66	0.008	filterable concentrations mostly constant
Fluorene, ng/L; ug/kg	7.5	10.4	18	-0.11	0.69	filterable concentrations poorly correlated
Naphthalene, ng/L; ug/kg	18.9	10.7	77.4	0.71	0.003	good correlation (filt conc close to total conc)
Phenanthrene, ng/L; ug/kg	76.7	9.3	299	-0.27	0.33	filterable concentrations mostly constant
Pyrene, ng/L; ug/kg	162	9.5	631	0.69	0.005	filterable concentrations mostly constant

* significant p values indicated by yellow high-lighting for all paired total vs. filtered values

Figure 66 is an example for benzo[b]fluoranthene, a high-molecular weight PAH, indicating that the filterable concentrations are mostly constant (and very low), except for one large value which distorts the regression line inappropriately.

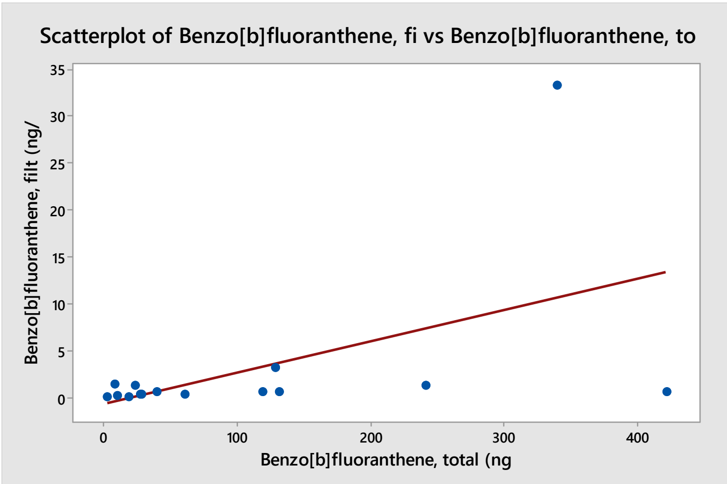


Figure 66. Total vs. filtered benzo[b]fluoranthene concentrations.

In contrast, Figure 67 plots naphthalene total vs. filtered concentrations and indicates that the filterable concentrations are about half of the total concentrations over the full range of values. Naphthalene is a low molecular weight PAH and has a greater portion associated with the water phase compared to high molecular weight PAHs.

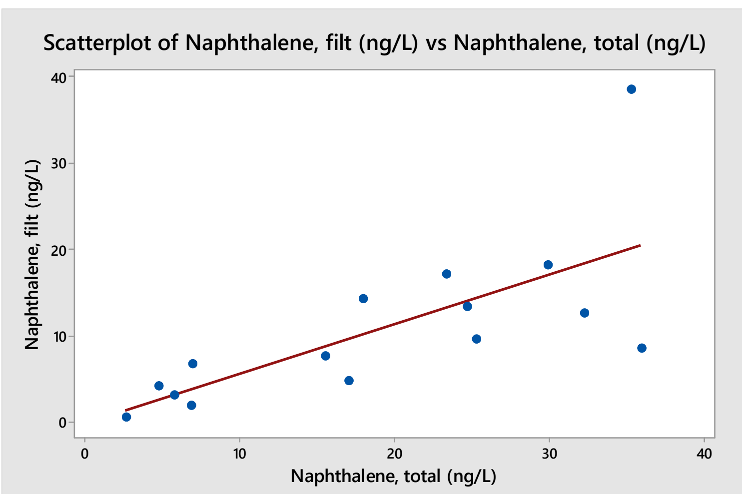


Figure 67. Total vs. filtered naphthalene concentrations.

Figure 68 is a scatterplot for lead shows that the filtered concentrations are quite small compared to the total concentrations, and do indicate any pattern.

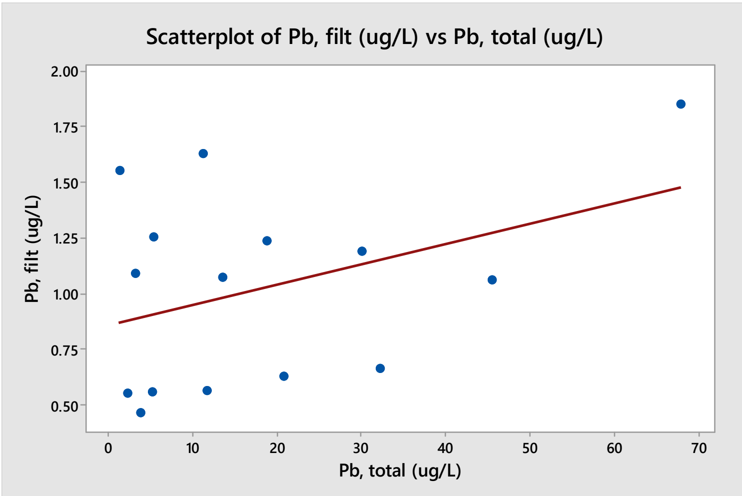


Figure 68. Total vs. filtered lead concentrations.

Pearson Correlation Analyses and Scatterplots of Correlated Constituents

Table 56 is a Pearson Correlation matrix for SSC, total metal and PAH concentrations, for all site data combined. This analysis indicates the strongest, simplest, relationships between different constituents. This matrix includes the correlation r values along with the p values for all possible relationships of these constituents. The significant correlations (p<0.05) are high-lighted. Usually, the constituents of greatest interest in stormwater management (and for particulate transport studies) are those strongly associated with the SSC particulates. The constituents having significant correlations with SSC, as shown on this matrix, include:

- Metals: Cu, Zn, Cd, Pb, and Hg
- PAHs: fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, and benzo[k]fluoranthene

Many other correlations are of interest, including many metals with copper (but the scatterplots in Appendix G are not very supportive of clear relationships), and many of the PAHs. Appendix G contains scatterplots for all of the significant Pearson correlations noted in this matrix, while Table 57 lists those scatterplots with reasonable correlations (along with the regression coefficients). Appendix H contains the scatterplots and regression statistics for those paired constituents that had significant Pearson correlation coefficients. Basic regression statistics along with ANOVA for the regression and coefficients are also shown, along with scatterplots and residual plots.

The correlations of the metals with PAHs (Cd vs. benzo[b]fluoranthene; Cd vs. anthracene; Cd vs. pyrene; Pb vs. benzo[b]fluoranthene; Pb vs. anthracene; and Pb vs. pyrene) do not seem reasonable, although the plots and statistical support significant correlations. It is expected that these are artificially high correlations due to indirect high correlations with SSC for these constituents (except for anthracene that is not as well correlated with SSC). Zn vs. Pb and Zn vs. Cd are likely true correlations (as shown below on the scatterplots), along with many of the PAH correlations. Figures 69 and 70 show scatterplots for some of these other strong relationships.

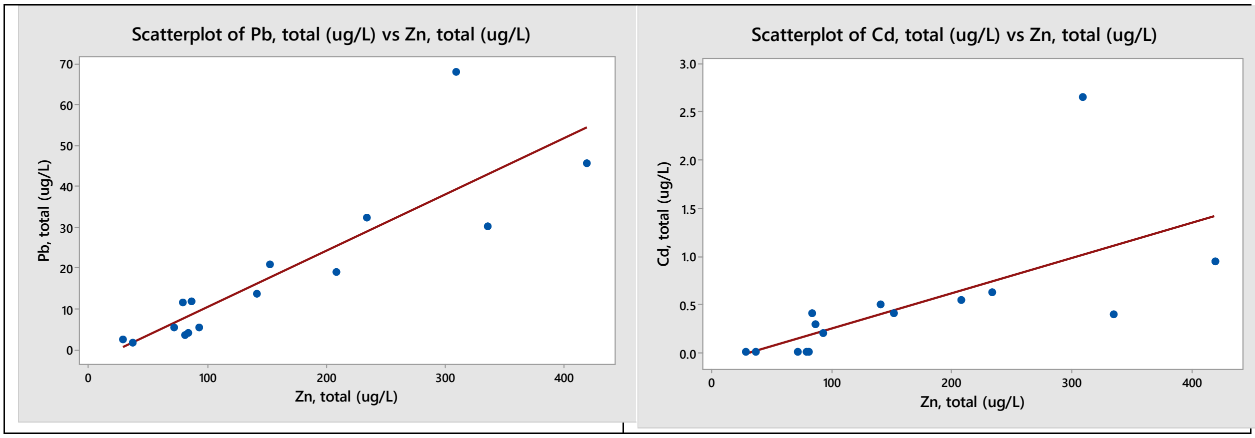


Figure 69. Scatterplots of strong metal correlations.

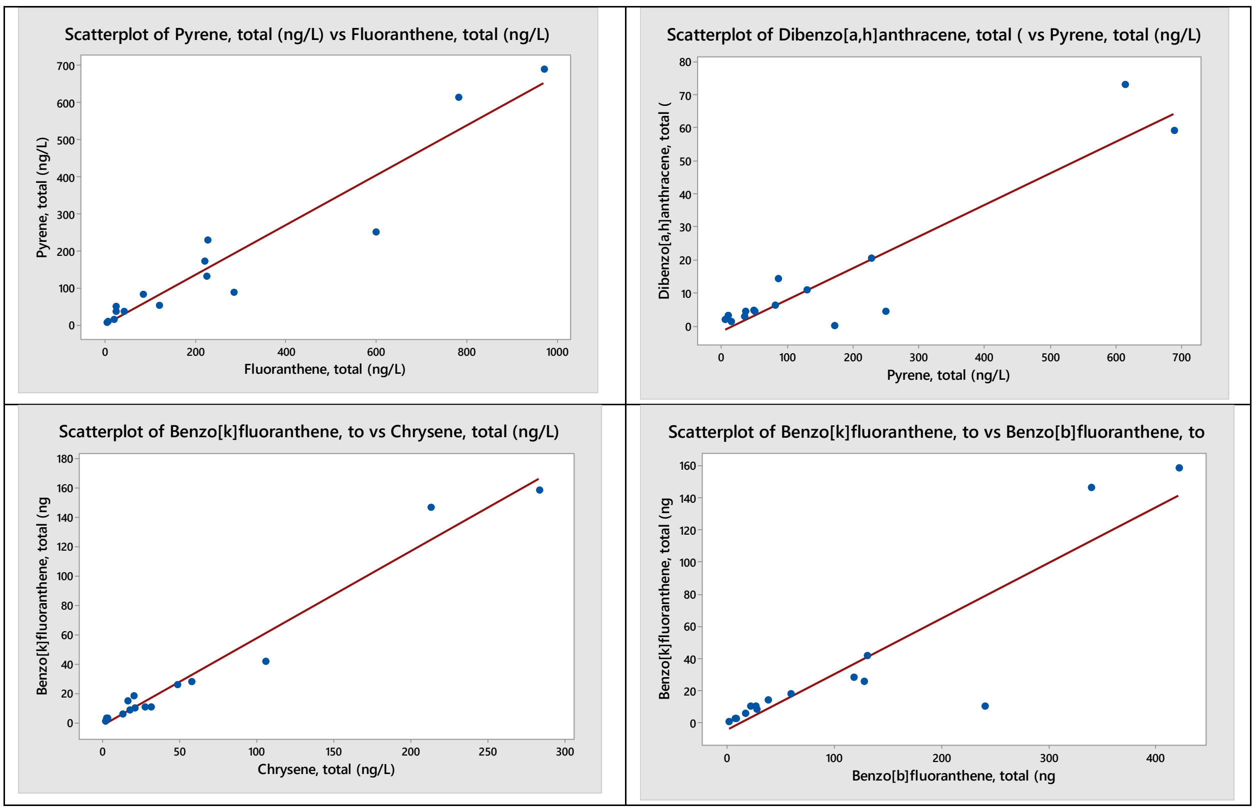


Figure 70. Scatterplots of strong PAH correlations.

Table 56. Pearson Correlation Matric for Total Concentrations (Pearson correlation r and associated p value*)

	SSC	TOC (% part strength)	As	Cu	Ni	Zn	Cd	Pb	Hg	Naphthalene	Fluorene	Acenaphthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Chrysene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Dibenzo[a,h]anthracene	Benzo[ghi]peryle
SSC	X																						
TOC (part strength, %)	-0.6	X																					
	0.83																						
As	0.2	-0.035	X																				
	0.48	0.9																					
Cu	0.76	-0.22	0.005	X																			
	0.001	0.43	0.99																				
Ni	0.37	-0.45	-0.15	0.74	X																		
	0.18	0.09	0.59	0.002																			
Zn	0.65	0.44	0.3	0.51	0.1	X																	
	0.009	0.1	0.27	0.05	0.72																		
Cd	0.79	0.07	0.35	0.71	0.29	0.65	X																
	<0.001	0.81	0.2	0.003	0.3	0.01																	
Pb	0.82	0.23	0.36	0.73	0.23	0.87	0.91	X															
	<0.001	0.41	0.19	0.002	0.42	<0.001	<0.001																
Hg	0.8	-0.2	0.19	0.75	0.46	0.4	0.91	0.75	X														
	<0.001	0.47	0.51	0.001	0.08	0.14	<0.001	0.001															
Naphthalene	-0.38	0.23	0.42	-0.64	-0.45	0.005	-0.2	-0.19	-0.33	X													
	0.16	0.41	0.12	0.01	0.09	0.99	0.47	0.49	0.23														
Fluorene	0.19	0.51	-0.26	-0.31	-0.45	0.23	-0.14	-0.15	-0.2	0.2	X												
	0.51	0.05	0.36	0.26	0.1	0.4	0.62	0.96	0.48	0.47													

Acenaphthene	0.75	0.42	0.06	0.39	-0.09	0.52	0.67	0.67	0.58	-0.17	0.51	X											
	0.51	0.12	0.84	0.15	0.75	0.05	0.006	0.007	0.02	0.54	0.05												
Phenanthrene	0.5	0.47	0.02	0.13	-0.21	0.58	0.26	0.48	0.13	-0.03	0.56	0.63	X										
	0.06	0.08	0.95	0.64	0.45	0.02	0.36	0.07	0.65	0.91	0.03	0.01											
Anthracene	0.18	0.05	0.38	0.08	-0.04	0.12	0.41	0.31	0.38	0.15	-0.24	0.24	0.43	X									
	0.51	0.86	0.17	0.78	0.9	0.68	0.13	0.26	0.16	0.58	0.39	0.39	0.12										
Fluoranthene	0.66	0.11	0.45	0.62	0.22	0.71	0.85	0.89	0.72	-0.04	-0.21	0.5	0.49	0.66	X								
	0.008	0.69	0.09	0.01	0.43	0.003	<0.001	<0.001	0.003	0.88	0.45	0.06	0.06	0.007									
Pyrene	0.69	0.11	0.33	0.61	0.18	0.62	0.81	0.85	0.73	-0.2	-0.16	0.58	0.58	0.69	0.96	X							
	0.004	0.7	0.22	0.02	0.52	0.01	<0.001	<0.001	0.002	0.48	0.56	0.02	0.02	0.005	<0.001								
Chrysene	0.53	0.26	0.16	0.45	0.03	0.49	0.64	0.7	0.56	-0.22	-0.07	0.59	0.69	0.74	0.83	0.94	X						
	0.04	0.35	0.58	0.1	0.93	0.07	0.01	0.004	0.03	0.43	0.81	0.02	0.004	0.002	<0.001	<0.001							
Benzo[a]anthrace	0.54	0.36	0.17	0.46	0.03	0.59	0.71	0.76	0.58	-0.14	-0.022	0.63	0.68	0.71	0.88	0.94	0.98	X					
	0.04	0.19	0.56	0.08	0.91	0.02	0.003	0.001	0.02	0.61	0.94	0.01	0.005	0.003	<0.001	<0.001	<0.001						
Benzo[b]fluorant	0.55	0.36	0.29	0.52	0.08	0.74	0.72	0.84	0.55	-0.048	-0.06	0.54	0.66	0.64	0.94	0.94	0.92	0.96	X				
	0.03	0.19	0.3	0.05	0.77	0.002	0.002	<0.001	0.03	0.87	0.83	0.04	0.008	0.01	<0.001	<0.001	<0.001	<0.001					
Benzo[k]fluorant	0.59	0.17	0.15	0.52	0.1	0.46	0.71	0.72	0.67	-0.25	-0.1	0.62	0.63	0.75	0.86	0.96	0.98	0.97	0.9	X			
	0.02	0.54	0.6	0.05	0.73	0.08	0.003	0.003	0.007	0.36	0.74	0.01	0.01	0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
Benzo[a]pyrene	0.4	0.37	0.1	0.29	-0.08	0.44	0.53	0.59	0.43	-0.12	0.03	0.56	0.73	0.76	0.77	0.87	0.97	0.97	0.9	0.95	X		
	0.14	0.17	0.72	0.29	0.77	0.1	0.04	0.02	0.11	0.67	0.92	0.03	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
Dibenzo[a,h]anth	0.46	0.08	0.22	0.44	0.09	0.34	0.64	0.62	0.61	-0.21	-0.25	0.46	0.52	0.83	0.84	0.93	0.96	0.93	0.87	0.98	0.94	X	
	0.09	0.77	0.44	0.1	0.75	0.22	0.01	0.01	0.02	0.46	0.37	0.08	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
Benzo[ghi]peryle	0.26	0.44	0.005	0.08	-0.24	0.38	0.24	0.4	0.14	0.08	0.2	0.45	0.86	0.66	0.56	0.7	0.87	0.83	0.76	0.8	0.92	0.78	X
	0.35	0.1	0.99	0.79	0.39	0.17	0.4	0.14	0.63	0.77	0.47	0.1	<0.001	0.008	0.03	0.004	<0.001	<0.001	0.001	<0.001	<0.001	0.001	

* p values indicating significant correlations ($p < 0.05$) high-lighted in yellow

Table 57. Significant Scatterplots with Reasonable Trends (most are irregular and driven by single very high value) (summarized from Appendix H):

	adjusted R^2	regression significance F	slope coefficient	lower 95% slope coefficient	upper 95% slope coefficient	P value of slope coefficient
Zn vs. Pb	0.8	<0.001	0.12	0.096	0.15	<0.001
Zn vs. Cd	0.54	<0.001	0.0032	0.0017	0.0047	<0.001
Cd vs. Benzo(b)fluoanthene (possibly due to both being strong with SSC?)	0.61	<0.001	170	103	238	<0.001
Cd vs. anthracene (ditto)	0.3	0.012	12.8	3.36	22.3	0.012
Cd vs. pyrene (ditto)	0.7	<0.001	290	199	381	<0.001
Pb vs. Benzo(b)fluoranthene (ditto)	0.76	<0.001	5.81	4.31	7.33	<0.001
Pb vs. anthracene (ditto)	0.29	0.015	0.39	0.09	0.68	0.014
Pb vs. pyrene (ditto)	0.76	<0.001	9.27	6.86	11.7	<0.001
Anthracene vs. Dibenzo[a,h]anthracene	0.71	<0.001	1.34	0.93	1.75	<0.001
Anthracene vs. Benzo[a]pyrene	0.65	<0.001	4.51	2.9	6.12	<0.001
fluoranthene vs. Dibenzo[a,h]anthracene	0.73	<0.001	0.06	0.042	0.077	<0.001
fluoranthene vs. Benzo[k]fluoranthene	0.75	<0.001	0.14	0.1	0.18	<0.001
fluoranthene vs. Benzo[b]fluoranthene	0.86	<0.001	0.42	0.35	0.48	<0.001
fluoranthene vs. Benzo[a]anthracene	0.79	<0.001	0.17	0.13	0.21	<0.001
fluoranthene vs. pyrene	0.88	<0.001	0.67	0.58	0.76	<0.001
pyrene vs. benzo[a]pyrene	0.77	<0.001	0.31	0.23	0.39	<0.001
pyrene vs. benzo[k]fluoranthene	0.86	<0.001	0.21	0.18	0.25	<0.001
pyrene vs. benzo[b]fluoranthene	0.86	<0.001	0.6	0.51	0.7	<0.001
pyrene vs. benzo[a]anthracene	0.86	<0.001	0.26	0.22	0.3	<0.001
pyrene vs. chrysene	0.85	<0.001	0.36	0.3	0.42	<0.001
chrysene vs. benzo[ghi]perlene + Indeno…..	0.76	<0.001	1.2	0.9	1.51	<0.001
chrysene vs. benzo[a]pyrene	0.89	<0.001	0.88	0.79	0.97	<0.001
chrysene vs. benzo[k]fluoranthene	0.91	<0.001	0.58	0.53	0.63	<0.001
chrysene vs. benzo[b]fluoranthene	0.82	<0.001	1.58	1.26	1.89	<0.001

chrysene vs. benzo[a]anthracene	0.9	<0.001	0.71	0.64	0.79	<0.001
benzo[a]anthracene vs. benzo[a]pyrene	0.89	<0.001	1.21	1.06	1.36	<0.001
benzo[a]anthracene vs. benzo[b]fluoranthene	0.88	<0.001	2.25	1.97	2.53	<0.001
benzo[a]anthracene vs. benzo[k]fluoranthene	0.89	<0.001	0.79	0.7	0.89	<0.001
benzo[b]fluoranthene vs. benzo[a]pyrene	0.8	<0.001	0.5	0.39	0.61	<0.001
benzo[b]fluoranthene vs. benzo[k]fluoranthene	0.79	<0.001	0.33	0.25	0.4	<0.001
benzo[k]fluoranthene vs. dibenzo[a,h]anthracene	0.9	<0.001	0.43	0.38	0.47	<0.001
benzo[k]fluoranthene vs. benzo[a]pyrene	9.86	<0.001	1.47	1.25	1.7	<0.001

Principal Component and Cluster Analyses of Total, Filtered, and Particulate Strength Concentrations
Appendix F also includes the results of the multivariate analyses comparing the different constituents. The Principal Component Analyses examined filtered values and particulate strength values separately due to the relatively small number of available data. For the filtered constituents, about 64% of the total variability is explained in the first component, which increases to about 78% for the first two components. The first component does not have any strong single loading constituent (the largest is about 0.25), but includes many filtered constituents with similar loadings (TOC, Cu, Pb, Hg, fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, and benzo[ghi]perylene+indeno). Therefore, most of the PAHs are in the first component, but none of them have strong individual loadings. The second component has fewer constituents with their highest loading (but with some from 0.27 to 0.51) and include: As, Ni, Zn, and Pb again. Therefore, this component is mostly represented by the metals.

The second analysis of total variability using Principal Components examined the particulate strengths. Again, the largest loadings in the first component (explaining about 55% of the total variability) were also about 0.25 and included mostly PAHs (Cd, phenanthrene, fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, and benzo[ghi]perylene+indeno). The main difference compared to the filtered concentrations was that the metals were spread over several of the principal components (PC2 through PC6) and not mostly in the second one, indicating a smaller effect of metals on the overall variability of the site's stormwater particulate strengths.

Cluster analyses were used to identify strong relationships between different constituents. The sampling program included many different constituents (in total, filtered, and particulate strength forms), but only 15 samples (with each also having four particle size ranges analyzed separately). In addition, a number of the filtered analyses were below the detection limits, further confusing the analyses.

Cluster analyses were conducted for different subgroups of constituents. Figures 71 and 72 are dendograms (diagrams that show simple and complex relationships between constituents) for filtered concentrations and for particulate strength concentrations. The closest relationships are associated with short branches. For the filtered concentrations, several different major groupings are seen:

Group one:

TOC and Hg
Fluoranthene and pyrene
The above four with Cu

Cd

Pb, and anthracene

Chrysene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[ghi]perylene+indeno, and dibenzo[a,h]anthracene

Group two:

As and Ni

Group three (weak):

Zn and fluorene

Group four:

Naphthalene, acenaphthene, and phenanthrene

The metals seen to be scattered in different groups that do not make much sense, but the PAH groupings are more closely related together.

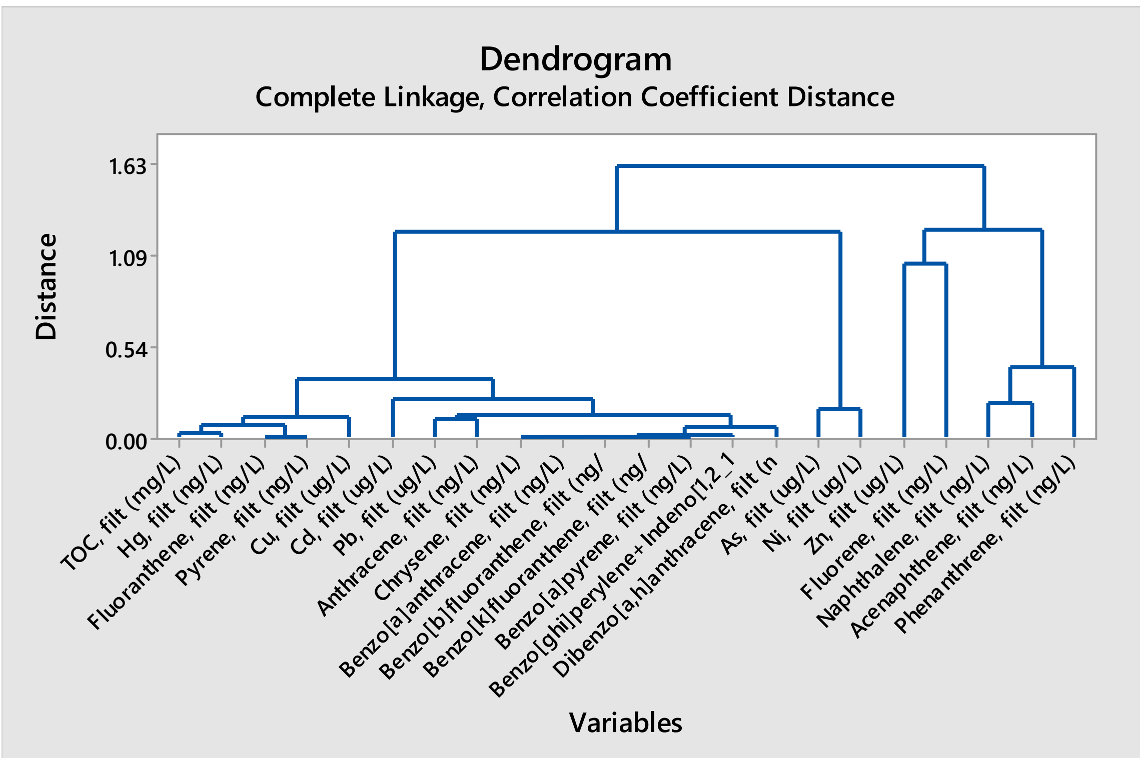


Figure 71. Cluster analysis dendogram for filtered concentrations.

The Figure 72 dendogram is for particulate strength concentrations, with five major data groups shown:

Group one:

TOC, acenaphthene, and fluorene

Group two (weak):

Cu and Pb

Group three:

Zn, Cd, naphthalene, anthracene, and fluoranthene

Group four (strong):

Phenanthrene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, benzo[k]fluoranthene, pyrene, benzo[ghi]perylene+indeno, and dibenzo[a,h]anthracene

Group 5 (weak):

Ni and Hg

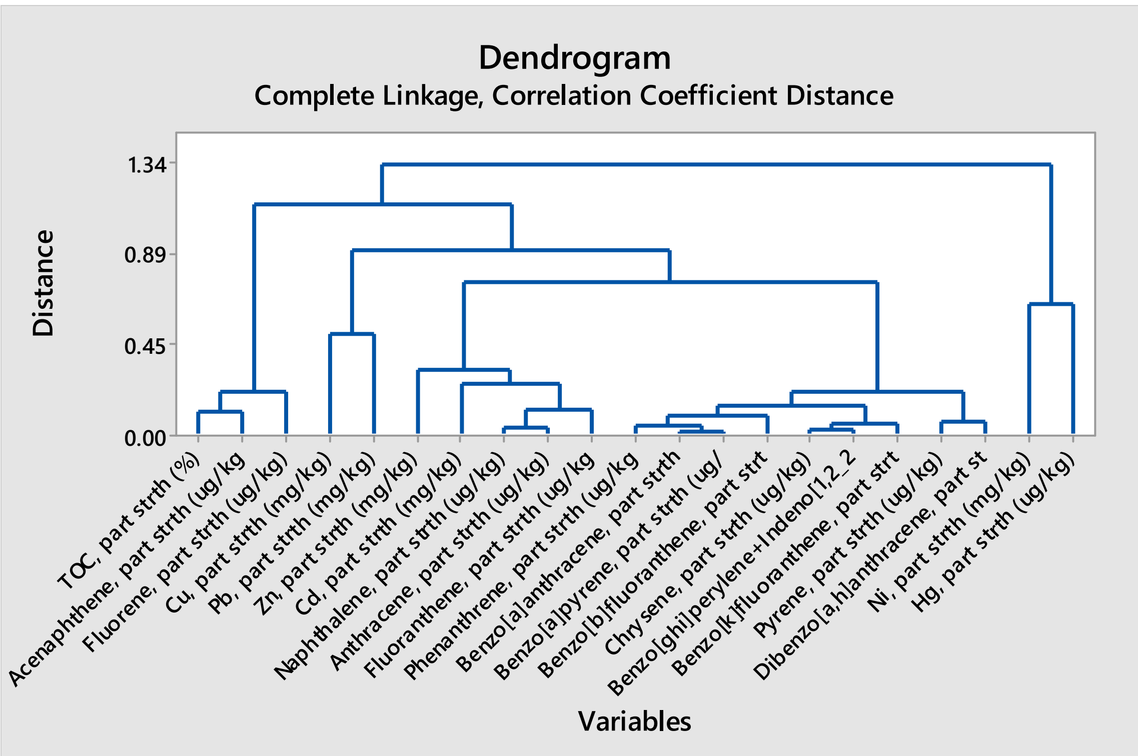


Figure 72. Cluster analysis dendogram for particulate strength values.

Again, the PAH groupings are more clearly defined together than the metals.

Total, Filtered, and Particulate Strength Concentrations for Different Sampling Locations/Land Uses

Tables 58 through 65 contain all of the monitored data for each of the 15 whole water samples. The total and filtered values are shown, along with the percentage filtered and the calculated particulate strength values. Summaries (average, standard deviation, and coefficient of variation) are also shown for the overall data set, the six NBSD samples, the two upper watershed samples, and the seven mixed creek mouth water samples. The NBSD and upper watershed values were used in conjunction with WinSLAMM to calculate the expected annual discharge loadings, described later in this report. The mixed water samples were not used for these calculations, but do typically show intermediate values between the NBSD and upper watershed concentrations. Also, samples from each of these locations were also divided into four particle size ranges and analyzed for the same constituents. Those data are presented and analyzed later.

Table 58. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	land use	Description	SSC (mg/L)	TOC, filt (mg/L)	TOC, part strth (%)	As, total (ug/L)	As, filt (ug/L)	% As filt	As, part strth (mg/kg)
O1W-1	NBSD	NBSD outfall #23	87	2.6	25.1	2.3	0.8	35.2	17
O2W-1	NBSD	NBSD outfall #33	1067	47.6	3.3	22.4	3.2	14.4	18
O2W-2	NBSD	NBSD outfall #33	84	5.9	5.6	0.0			
O3W-1	NBSD	NBSD outfall north of railroad crossing	34	11.7	4.8	28.1	4.1	14.7	700
O4W-1	NBSD	NBSD outfall at Paunack and Division Streets	184	7.9	4.7	6.0	2.2	36.9	21
O4W-2	NBSD	NBSD outfall at Paunack and Division Streets	95	26.9	1.9	0.0			
C2W-1	resid	Paleta Creek at Main Street	269	8.4	10.6	34.5	1.1	3.2	124
C2W-2	resid	Paleta Creek at Main Street	753	8.1	9.8	6.4		0.0	
A1W-1	mixed	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	227	5.6	12.9	8.6	1.9	22.3	29
A1W-2	mixed	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	203	19.2	7.2	0.0			
A2W-1	mixed	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	223	5.2	3.3	43.3	2.6	6.0	183
A2W-2	mixed	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	88	3.4	2.1	0.0			
A3W-1	mixed	Ambient Receiving water sample collected on 1/6/2016 at 0333 h	33	6.4	3.0	6.1	3.1	51.3	91
C1W-1	mixed	Paleta Creek at Cummings Road	242	5.5	12.1	38.1	1.5	3.9	152
C1W-2	mixed	Paleta Creek at Cummings Road	117	6.8	8.7	3.7		0.0	
			SSC (mg/L)	TOC, filt (mg/L)	TOC, part strth (%)	As, total (ug/L)	As, filt (ug/L)	% As filt	As, part strth (mg/kg)
overall average			247	11.4	7.7	13.3	2.3	17.1	148
stdev			286	11.9	6.0	15.5	1.1	17.3	216
COV			1.16	1.04	0.79	1.16	0.47	1.01	1.46
NBSD average			259	17.1	7.6	9.8	2.6	25.3	189
stdev			399	17.2	8.7	12.3	1.4	12.4	340
COV			1.54	1.00	1.15	1.25	0.55	0.49	1.80
upper average			511	8.3	10.2	20.4	1.1	1.6	124
stdev			343	0.2	0.5	19.9		2.3	
COV			0.67	0.03	0.05	0.97		1.41	
mixed average			162	7.4	7.0	14.3	2.3	16.7	114
stdev			82	5.3	4.4	18.4	0.7	21.1	68
COV			0.51	0.71	0.62	1.29	0.32	1.26	0.60

Table 59. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Cu, total (ug/L)	Cu, filt (ug/L)	% Cu filt	Cu, part strth (mg/kg)	Ni, total (ug/L)	Ni, filt (ug/L)	% Ni filtered	Ni, part strth (mg/kg)	Zn, total (ug/L)	Zn, filt (ug/L)	% Zn filtered	Zn, part strth (mg/kg)
O1W-1	17	6.3	37.4	121	7.3	6.3	86.4	11.4	208	53.9	26.0	1,764
O2W-1	144	34.4	23.8	103	25.4	9.5	37.2	15.0	309	15.0	4.9	275
O2W-2	65	50.1	77.5	244	14.9	14.9	100.0	0.0	78	44.5	56.8	571
O3W-1	21	14.8	70.4	181	15.1	14.1	93.1	30.4	83	4.3	5.1	2,303
O4W-1	24	5.7	23.8	100	16.7	9.5	56.8	39.0	92	5.1	5.5	473
O4W-2	49	42.8	87.0	156	22.6	22.6	100.0	0.0	36	10.4	28.9	628
C2W-1	75	5.5	7.4	260	19.1	2.0	10.5	63.5	419	21.7	5.2	1,477
C2W-2	60	11.6	19.2	68	13.9	2.2	16.1	16.1	335	47.2	14.1	398
A1W-1	51	12.9	25.4	167	11.0	7.6	69.5	14.8	234	34.6	14.8	877
A1W-2	71	71.3	100.0	0	22.8	22.8	100.0	0.0	71	13.1	18.3	754
A2W-1	23	7.5	32.7	70	7.5	5.5	73.4	9.0	86	11.6	13.5	333
A2W-2	62	52.0	83.3	179	22.6	22.6	100.0	0.0	80	21.8	27.2	1,003
A3W-1	13	12.7	101.4	0	7.8	11.1	143.7	0.0	28	9.7	34.7	561
C1W-1	33	7.8	23.7	103	11.2	6.3	55.8	20.5	152	6.8	4.5	599
C1W-2	30	13.8	46.5	135	6.8	3.4	49.5	29.4	141	52.2	37.2	754
	Cu, total (ug/L)	Cu, filt (ug/L)	% Cu filt	Cu, part strth (mg/kg)	Ni, total (ug/L)	Ni, filt (ug/L)	% Ni filtered	Ni, part strth (mg/kg)	Zn, total (ug/L)	Zn, filt (ug/L)	% Zn filtered	Zn, part strth (mg/kg)
overall average	49	23.3	50.6	126	15.0	10.7	72.8	16.6	157	23.5	19.8	851
stdev	34	21.2	32.4	76	6.4	7.3	35.9	18.0	119	18.0	15.2	573
COV	0.69	0.91	0.64	0.60	0.43	0.68	0.49	1.08	0.76	0.77	0.77	0.67
NBSD average	53	25.7	53.3	151	17.0	12.8	78.9	16.0	134	22.2	21.2	1,002
stdev	48	19.3	28.3	56	6.4	5.8	26.0	15.9	103	21.5	20.6	826
COV	0.91	0.75	0.53	0.37	0.38	0.45	0.33	1.00	0.77	0.97	0.97	0.82
upper average	68	8.6	13.3	164	16.5	2.1	13.3	39.8	377	34.5	9.6	938
stdev	11	4.3	8.3	136	3.7	0.2	4.0	33.5	60	18.1	6.3	763
COV	0.16	0.50	0.63	0.83	0.22	0.08	0.30	0.84	0.16	0.52	0.66	0.81
mixed average	40	25.4	59.0	93	12.8	11.3	84.6	10.5	113	21.4	21.5	697
stdev	22	25.5	34.9	74	7.0	8.1	32.6	11.6	68	16.5	12.0	221
COV	0.54	1.00	0.59	0.79	0.54	0.72	0.39	1.10	0.60	0.77	0.56	0.32

Table 60. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Cd, total (ug/L)	Cd, filt (ug/L)	% Cd filtered	Cd, part strth (mg/kg)	Pb, total (ug/L)	Pb, filt (ug/L)	% Pb filtered	Pb, part strth (mg/kg)	Hg, total (ng/L)	Hg, filt (ng/L)	% Hg filtered	Hg, part strth (ug/kg)
O1W-1	0.54	0.41	76.6	1.5	18.8	1.23	6.5	202.0	9	2.0	23.9	75
O2W-1	2.65	0.79	30.0	1.7	67.9	1.85	2.7	61.9	776	24.8	3.2	704
O2W-2	0.00	0.00		0.0	11.2	1.63	14.5	161.9	22	4.5	20.8	289
O3W-1	0.40	0.21	52.7	5.5	3.8	0.46	12.2	97.0	49	10.0	20.4	1140
O4W-1	0.19	0.00	0.0	1.1	5.2	0.55	10.6	25.3	188	6.3	3.3	986
O4W-2	0.00	0.00		0.0	1.4	1.55	114.6	0.0	20	3.3	16.7	398
C2W-1	0.94	0.00	0.0	3.5	45.5	1.05	2.3	165.3	78	3.3	4.2	277
C2W-2	0.39	0.00	0.0	0.4	30.0	1.19	4.0	39.9	46	2.6	5.7	60
A1W-1	0.62	0.20	32.6	1.8	32.3	0.66	2.1	139.2	95	2.7	2.8	407
A1W-2	0.00	0.00		0.0	5.3	1.25	23.5	52.9	19	1.5	7.9	233
A2W-1	0.29	0.00	0.0	1.3	11.7	0.56	4.8	49.9	28	2.3	8.3	116
A2W-2	0.00	0.00		0.0	3.2	1.09	33.9	36.4	15	3.6	24.8	187
A3W-1	0.00	0.00		0.0	2.4	0.55	23.2	55.4	8	2.7	34.4	161
C1W-1	0.41	0.00	0.0	1.7	20.8	0.62	3.0	83.3	43	5.1	11.6	159
C1W-2	0.50	0.00	0.0	2.5	13.6	1.07	7.9	106.8	26	2.6	10.2	199
	Cd, total (ug/L)	Cd, filt (ug/L)	% Cd filtered	Cd, part strth (mg/kg)	Pb, total (ug/L)	Pb, filt (ug/L)	% Pb filtered	Pb, part strth (mg/kg)	Hg, total (ng/L)	Hg, filt (ng/L)	% Hg filtered	Hg, part strth (ug/kg)
overall average	0.46	0.11	19.2	1.4	18.2	1.02	17.7	85.1	95	5.2	13.2	359
stdev	0.67	0.23	27.7	1.6	18.8	0.44	28.4	58.8	194	5.8	9.7	329
COV	1.44	2.09	1.45	1.11	1.04	0.43	1.60	0.69	2.05	1.13	0.74	0.92
NBSD average	0.63	0.24	39.8	1.6	18.0	1.21	26.9	91.3	177	8.5	14.7	599
stdev	1.01	0.32	32.6	2.1	25.2	0.58	43.2	78.5	301	8.5	9.2	416
COV	1.60	1.35	0.82	1.26	1.40	0.48	1.61	0.86	1.70	1.00	0.62	0.69
upper average	0.67	0.00	0.0	2.0	37.8	1.12	3.1	102.6	62	3.0	5.0	169
stdev	0.39	0.00	0.0	2.2	11.0	0.09	1.2	88.7	22	0.4	1.1	154
COV	0.58			1.11	0.29	0.08	0.37	0.86	0.36	0.15	0.22	0.91
mixed average	0.26	0.03	8.2	1.0	12.7	0.83	14.0	74.8	34	2.9	14.3	209
stdev	0.26	0.08	16.3	1.0	10.8	0.30	12.6	37.0	29	1.1	11.2	95
COV	1.01	2.65	2.00	1.00	0.85	0.36	0.90	0.49	0.88	0.38	0.78	0.45

Table 61. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Naphthalene, total (ng/L)	Naphthalene, filt (ng/L)	% Naphthalene filtered	Naphthalene, part strth (ug/kg)	Fluorene, total (ng/L)	Fluorene, filt (ng/L)	% fluorene filtered	Fluorene, part strth (ug/kg)	Acenaphthene, total (ng/L)	Acenaphthene, filt (ng/L)	% Acenaphthene filtered	Acenaphthene, part strth (ug/kg)
O1W-1	29.85	18.21	61.0	103	23.9	10.23	42.7	120.7	45.6	2.41	5.3	380.3
O2W-1	2.61	0.45	17.4	2	1.1	4.62	405.8	0.0	62.4	5.30	8.5	51.4
O2W-2	5.77	3.06	53.0	25	4.2	5.25	125.7	0.0	5.4	5.38	99.7	0.1
O3W-1	35.95	8.50	23.6	663	2.3	3.30	143.1	0.0	3.5	2.62	74.9	21.1
O4W-1	25.25	9.58	37.9	84	11.3	1.94	17.2	50.1	1.9	0.80	41.3	6.1
O4W-2	17.95	14.23	79.3	25	1.6	1.86	114.7	0.0	2.3	1.48	63.8	5.6
C2W-1	32.28	12.61	39.1	76	0.0	39.07		0.0	0.0	1.12		0.0
C2W-2	15.46	7.57	49.0	10	30.1	1.69	5.6	36.2	46.2	10.61	22.9	45.4
A1W-1	17.02	4.68	27.5	57	5.4	0.00	0.0	24.8	23.9	0.00	0.0	109.9
A1W-2	4.71	4.04	85.7	2	2.5	1.07	42.7	4.4	4.9	1.89	38.5	9.2
A2W-1	24.68	13.25	53.7	46	7.3	55.48	758.7	0.0	12.4	3.15	25.4	37.5
A2W-2	6.80	1.83	26.9	42	2.8	11.99	432.6	0.0	4.2	12.68	305.2	0.0
A3W-1	35.29	38.54	109.2	0	10.4	11.12	106.4	0.0	15.7	17.45	111.1	0.0
C1W-1	23.32	17.02	73.0	24	4.3	6.68	153.7	0.0	26.3	3.08	11.7	86.5
C1W-2	6.94	6.57	94.7	3	5.1	1.16	22.7	33.6	12.0	1.90	15.8	86.0
	Naphthalene, total (ng/L)	Naphthalene, filt (ng/L)	% Naphthalene filtered	Naphthalene, part strth (ug/kg)	Fluorene, total (ng/L)	Fluorene, filt (ng/L)	% fluorene filtered	Fluorene, part strth (ug/kg)	Acenaphthene, total (ng/L)	Acenaphthene, filt (ng/L)	% Acenaphthene filtered	Acenaphthene, part strth (ug/kg)
overall average	18.93	10.67	55.4	77	7.5	10.36	169.4	18.0	17.8	4.66	58.9	56.0
stdev	11.64	9.45	28.0	165	8.6	15.77	217.4	33.1	19.4	5.02	79.1	96.9
COV	0.61	0.89	0.50	2.13	1.15	1.52	1.28	1.84	1.09	1.08	1.34	1.73
NBSD average	19.56	9.00	45.4	150	7.4	4.53	141.5	28.5	20.2	3.00	48.9	77.4
stdev	13.32	6.65	23.5	254	8.9	3.11	138.6	49.4	26.8	1.93	37.6	149.5
COV	0.68	0.74	0.52	1.69	1.20	0.69	0.98	1.74	1.33	0.64	0.77	1.93
upper average	23.87	10.09	44.0	43	15.0	20.38	5.6	18.1	23.1	5.86	22.9	22.7
stdev	11.89	3.56	7.0	47	21.3	26.43		25.6	32.7	6.71		32.1
COV	0.50	0.35	0.16	1.08	1.41	1.30		1.41	1.41	1.14		1.41
mixed average	16.97	12.27	67.2	25	5.4	12.50	216.7	9.0	14.2	5.73	72.5	47.0
stdev	11.47	12.78	32.4	24	2.8	19.57	280.3	14.2	8.5	6.60	108.9	46.5
COV	0.68	1.04	0.48	0.96	0.51	1.57	1.29	1.58	0.60	1.15	1.50	0.99

Table 62. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Phenanthrene, total (ng/L)	Phenanthrene, filt (ng/L)	% Phenanthrene filtered	Phenanthrene, part strth (ug/kg)	Anthracene, total (ng/L)	Anthracene, filt (ng/L)	% Anthracene filtered	Anthracene, part strth (ug/kg)	Fluoranthene, total (ng/L)	Fluoranthene, filt (ng/L)	% fluoranthene filtered	Fluoranthene, part strth (ug/kg)
O1W-1	110	16.69	15.2	822	3.9	2.34	59.6	14	120	5.68	4.7	1,006
O2W-1	103	14.62	14.2	79	25.4	5.01	19.7	18	971	74.39	7.7	807
O2W-2	15	7.62	51.6	66	0.8	1.68	210.2	0	24	9.16	38.6	135
O3W-1	44	9.86	22.5	821	34.8	1.16	3.3	813	285	5.07	1.8	6,756
O4W-1	37	5.59	15.0	170	10.2	1.54	15.1	46	84	13.80	16.5	374
O4W-2	6	6.65	116.9	0	1.3	0.00	0.0	9	4	0.00	0.0	29
C2W-1	40	19.04	47.3	82	0.0	2.10		0	599	9.10	1.5	2,277
C2W-2	287	0.00	0.0	366	0.0	0.00		0	219	2.53	1.2	276
A1W-1	273	3.49	1.3	1242	41.6	0.00	0.0	191	780	4.97	0.6	3,570
A1W-2	29	3.77	13.1	77	1.0	0.00	0.0	3	41	1.73	4.2	120
A2W-1	36	10.03	28.1	104	9.9	0.83	8.4	37	226	11.41	5.1	869
A2W-2	8	0.23	2.9	68	0.3	0.00	0.0	3	7	5.65	79.1	13
A3W-1	22	19.90	91.8	47	1.9	1.83	94.1	3	20	10.24	50.0	274
C1W-1	112	13.82	12.3	368	18.3	0.95	5.2	65	227	16.10	7.1	788
C1W-2	29	7.95	27.5	178	0.0	0.00		0	25	3.74	14.9	182
	Phenanthrene, total (ng/L)	Phenanthrene, filt (ng/L)	% Phenanthrene filtered	Phenanthrene, part strth (ug/kg)	Anthracene, total (ng/L)	Anthracene, filt (ng/L)	% Anthracene filtered	Anthracene, part strth (ug/kg)	Fluoranthene, total (ng/L)	Fluoranthene, filt (ng/L)	% fluoranthene filtered	Fluoranthene, part strth (ug/kg)
overall average	77	9.28	30.6	299	10.0	1.16	34.6	80	242	11.57	15.5	1,165
stdev	90	6.38	33.8	370	13.8	1.37	62.5	209	303	17.96	22.8	1,825
COV	1.17	0.69	1.10	1.24	1.38	1.18	1.80	2.60	1.25	1.55	1.47	1.57
NBSD average	52	10.17	39.2	326	12.7	1.95	51.3	150	248	18.01	11.5	1,518
stdev	44	4.52	40.6	387	14.2	1.68	80.7	325	368	28.00	14.5	2,594
COV	0.84	0.44	1.04	1.19	1.11	0.86	1.57	2.17	1.48	1.55	1.25	1.71
upper average	164	9.52	23.7	224	0.0	1.05		0	409	5.81	1.3	1,277
stdev	175	13.46	33.5	201	0.0	1.48		0	269	4.65	0.3	1,415
COV	1.07	1.41	1.41	0.90		1.41			0.66	0.80	0.19	1.11
mixed average	73	8.46	25.3	298	10.4	0.52	17.9	43	190	7.69	23.0	831
stdev	95	6.79	31.2	431	15.3	0.72	37.4	70	278	5.06	29.9	1,252
COV	1.30	0.80	1.23	1.45	1.47	1.39	2.09	1.62	1.47	0.66	1.30	1.51

Table 63. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Pyrene, total (ng/L)	Pyrene, filt (ng/L)	% Pyrene filtered	Pyrene, part strth (ug/kg)	Chrysene, total (ng/L)	Chrysene, filt (ng/L)	% chrysene filtered	Chrysene, part strth (ug/kg)	Benzo[a]anthracene, total (ng/L)	Benzo[a]anthracene, filt (ng/L)	% Benzo[a]anthracene	Benzo[a]anthracene, part strth (ug/kg)
O1W-1	50	6.07	12.2	386	48.9	3.09	6.3	404	66.3	1.84	2.8	568
O2W-1	688	68.60	10.0	558	213.2	17.81	8.4	176	158.9	10.40	6.5	134
O2W-2	35	6.52	18.5	265	21.2	0.72	3.4	189	8.4	0.36	4.3	74
O3W-1	85	5.96	7.0	1,918	20.8	0.44	2.1	490	23.4	0.50	2.2	553
O4W-1	80	6.77	8.5	393	18.1	0.73	4.0	93	8.7	0.53	6.1	44
O4W-2	4	2.59	59.0	12	1.9	0.00	0.0	13	0.9	0.00	0.0	6
C2W-1	249	8.59	3.4	929	31.6	1.22	3.9	117	50.6	1.11	2.2	191
C2W-2	171	3.43	2.0	213	57.7	0.49	0.9	73	41.5	0.25	0.6	53
A1W-1	614	4.01	0.7	2,807	283.2	1.51	0.5	1,297	196.1	0.88	0.4	899
A1W-2	34	2.48	7.3	95	13.0	0.00	0.0	40	7.6	0.00	0.0	23
A2W-1	129	5.00	3.9	501	16.5	0.88	5.3	63	10.9	0.54	5.0	42
A2W-2	8	3.30	40.8	41	2.6	0.00	0.0	22	1.9	0.00	0.0	16
A3W-1	13	7.19	55.6	154	3.2	0.99	30.5	61	3.3	0.84	25.5	66
C1W-1	227	9.08	4.0	815	105.8	1.14	1.1	391	55.3	0.52	0.9	205
C1W-2	47	3.54	7.5	371	27.7	0.56	2.0	231	18.6	0.48	2.6	154
	Pyrene, total (ng/L)	Pyrene, filt (ng/L)	% Pyrene filtered	Pyrene, part strth (ug/kg)	Chrysene, total (ng/L)	Chrysene, filt (ng/L)	% chrysene filtered	Chrysene, part strth (ug/kg)	Benzo[a]anthracene, total (ng/L)	Benzo[a]anthracene, filt (ng/L)	% Benzo[a]anthracene	Benzo[a]anthracene, part strth (ug/kg)
overall average	162	9.54	16.0	631	57.7	1.97	4.6	244	43.5	1.22	3.9	202
stdev	213	16.47	19.4	769	82.8	4.45	7.6	328	58.7	2.58	6.4	262
COV	1.31	1.73	1.21	1.22	1.44	2.26	1.67	1.34	1.35	2.12	1.61	1.30
NBSD average	157	16.08	19.2	589	54.0	3.80	4.0	228	44.4	2.27	3.7	230
stdev	262	25.77	19.9	676	79.4	6.95	3.0	184	60.8	4.03	2.5	260
COV	1.67	1.60	1.04	1.15	1.47	1.83	0.74	0.81	1.37	1.77	0.69	1.13
upper average	210	6.01	2.7	571	44.7	0.86	2.4	95	46.0	0.68	1.4	122
stdev	55	3.65	1.0	506	18.5	0.52	2.1	31	6.4	0.60	1.1	98
COV	0.26	0.61	0.37	0.89	0.41	0.60	0.90	0.33	0.14	0.89	0.80	0.80
mixed average	153	4.94	17.1	683	64.6	0.73	5.6	301	42.0	0.47	4.9	201
stdev	218	2.37	21.8	974	102.8	0.57	11.1	459	70.4	0.35	9.2	316
COV	1.42	0.48	1.27	1.43	1.59	0.79	1.97	1.53	1.68	0.76	1.88	1.57

Table 64. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Benzo[b]fluoranthene, total (ng/L)	Benzo[b]fluoranthene, filt (ng/L)	% Benzo[b]fluoranthene filtered	Benzo[b]fluoranthene, part strth (ug/kg)	Benzo[k]fluoranthene, total (ng/L)	Benzo[k]fluoranthene, filt (ng/L)	% Benzo[k]fluoranthene filtered	Benzo[k]fluoranthene, part strth (ug/kg)	Benzo[a]pyrene, total (ng/L)	Benzo[a]pyrene, filt (ng/L)	% Benzo[a]pyrene filtered	Benzo[a]pyrene, part strth (ug/kg)
O1W-1	127.4	3.12	2.4	1,096	25.5	1.26	4.9	213	80.3	2.13	2.7	689
O2W-1	339.6	33.21	9.8	276	146.0	13.13	9.0	120	154.7	12.43	8.0	128
O2W-2	22.1	1.24	5.6	193	9.6	0.38	4.0	85	11.9	0.27	2.3	108
O3W-1	59.5	0.32	0.5	1,428	17.6	0.07	0.4	422	35.4	0.17	0.5	850
O4W-1	27.4	0.22	0.8	145	8.2	0.18	2.2	43	16.8	0.64	3.8	87
O4W-2	1.8	0.00	0.0	12	0.2	0.00	0.0	2	0.5	0.00	0.0	3
C2W-1	240.6	1.21	0.5	924	10.1	0.34	3.3	38	18.1	0.77	4.2	67
C2W-2	118.1	0.60	0.5	150	27.6	0.08	0.3	35	50.9	0.19	0.4	65
A1W-1	421.3	0.50	0.1	1,937	158.0	0.16	0.1	727	274.9	0.24	0.1	1,264
A1W-2	17.5	0.00	0.0	53	5.6	0.00	0.0	17	10.3	0.00	0.0	31
A2W-1	38.7	0.48	1.2	155	14.0	0.21	1.5	56	22.1	0.43	1.9	88
A2W-2	8.8	0.18	2.1	74	2.2	0.03	1.1	19	4.7	0.06	1.3	39
A3W-1	7.0	1.29	18.5	153	2.4	0.47	19.1	53	4.9	0.81	16.3	111
C1W-1	130.7	0.56	0.4	486	41.4	0.27	0.7	153	75.2	0.41	0.5	279
C1W-2	26.7	0.30	1.1	224	10.1	0.08	0.8	85	18.6	0.13	0.7	157
	Benzo[b]fluoranthene, total (ng/L)	Benzo[b]fluoranthene, filt (ng/L)	% Benzo[b]fluoranthene filtered	Benzo[b]fluoranthene, part strth (ug/kg)	Benzo[k]fluoranthene, total (ng/L)	Benzo[k]fluoranthene, filt (ng/L)	% Benzo[k]fluoranthene filtered	Benzo[k]fluoranthene, part strth (ug/kg)	Benzo[a]pyrene, total (ng/L)	Benzo[a]pyrene, filt (ng/L)	% Benzo[a]pyrene filtered	Benzo[a]pyrene, part strth (ug/kg)
overall average	105.8	2.88	2.9	487	31.9	1.11	3.2	138	52.0	1.24	2.8	265
stdev	130.2	8.43	5.0	585	50.0	3.34	5.0	195	74.0	3.14	4.3	370
COV	1.23	2.92	1.73	1.20	1.57	3.01	1.60	1.41	1.42	2.52	1.51	1.40
NBSD average	96.3	6.35	3.2	525	34.5	2.50	3.4	147	49.9	2.61	2.9	311
stdev	127.0	13.21	3.8	587	55.3	5.23	3.3	153	58.5	4.87	2.9	362
COV	1.32	2.08	1.19	1.12	1.60	2.09	0.98	1.04	1.17	1.87	1.01	1.16
upper average	179.3	0.90	0.5	537	18.9	0.21	1.8	36	34.5	0.48	2.3	66
stdev	86.6	0.43	0.0	547	12.4	0.18	2.2	2	23.2	0.41	2.7	2
COV	0.48	0.48	0.00	1.02	0.65	0.85	1.18	0.05	0.67	0.84	1.18	0.03
mixed average	92.9	0.47	3.4	440	33.4	0.17	3.3	159	58.7	0.29	3.0	282
stdev	151.0	0.41	6.7	676	56.6	0.16	7.0	255	98.4	0.28	5.9	441
COV	1.62	0.87	2.00	1.53	1.70	0.94	2.10	1.61	1.68	0.94	1.99	1.57

Table 65. Monitoring Data and Partitioning Calculations for Sampling Locations and Events

Station	Dibenzo[a,h]anthracene, total (ng/L)	Dibenzo[a,h]anthracene, filt (ng/L)	% Dibenzo[a,h]anthracene filtered	Dibenzo[a,h]anthracene, part strth (ug/kg)	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene, total (ng/L)	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene, filt (ng/L)	% Benzo[ghi]perylene+Indeno{1,2,3}pyrene filtered	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene, part strth (ug/kg)
O1W-1	4.2	1.54	37.0	23.1	99.8	2.62	2.6	856
O2W-1	58.8	3.33	5.7	49.9	103.3	9.15	8.9	85
O2W-2	4.1	0.49	12.0	33.0	17.3	0.42	2.4	156
O3W-1	14.0	0.25	1.8	331.2	30.5	0.43	1.4	726
O4W-1	5.9	0.85	14.4	27.1	43.2	0.79	1.8	227
O4W-2	1.7	0.00	0.0	11.7	1.8	0.00	0.0	12
C2W-1	4.2	0.51	12.0	14.3	6.2	2.28	36.9	15
C2W-2	0.0	0.52		0.0	151.7	0.92	0.6	192
A1W-1	72.7	0.36	0.5	333.0	426.1	0.57	0.1	1,959
A1W-2	2.8	0.00	0.0	8.4	29.5	0.22	0.8	89
A2W-1	10.8	0.23	2.1	42.7	24.0	0.93	3.9	94
A2W-2	2.8	0.28	9.9	21.7	6.5	0.12	1.9	54
A3W-1	0.9	0.52	55.0	11.4	7.4	1.34	18.1	164
C1W-1	20.3	0.58	2.9	73.4	145.2	0.88	0.6	539
C1W-2	4.5	0.34	7.7	35.0	47.9	0.37	0.8	404
	Dibenzo[a,h]anthracene, total (ng/L)	Dibenzo[a,h]anthracene, filt (ng/L)	% Dibenzo[a,h]anthracene filtered	Dibenzo[a,h]anthracene, part strth (ug/kg)	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene, total (ng/L)	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene, filt (ng/L)	% Benzo[ghi]perylene+Indeno{1,2,3}pyrene filtered	Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene, part strth (ug/kg)
overall average	13.8	0.65	11.5	67.7	76.0	1.40	5.4	371
stdev	21.9	0.83	15.8	108.9	109.1	2.27	9.9	510
COV	1.58	1.27	1.37	1.61	1.43	1.62	1.84	1.37
NBSD average	14.8	1.08	11.8	79.3	49.3	2.23	2.9	344
stdev	22.0	1.23	13.6	124.0	42.7	3.51	3.1	356
COV	1.49	1.14	1.15	1.56	0.87	1.57	1.08	1.04
upper average	2.1	0.51	12.0	7.2	78.9	1.60	18.8	104
stdev	3.0	0.01		10.1	102.9	0.96	25.7	125
COV	1.41	0.01		1.41	1.30	0.60	1.37	1.21
mixed average	16.4	0.33	11.1	75.1	98.1	0.63	3.7	472
stdev	25.7	0.19	19.7	115.9	152.3	0.44	6.4	681
COV	1.57	0.58	1.77	1.54	1.55	0.69	1.73	1.44

Appendix F contains probability plots of all total, filtered, and particulate strength data for each of the three sample categories shown above. Kruskal-Wallis (KW) tests were also conducted to identify if any of these locations were significantly different from the others, considering the sample sizes. Tables 66 through 68 summarize the median concentrations for these areas, along with the KW values and comments on the probability plot behaviors. The median values are always smaller than the average (mean) values as they are not numerically affected by the very large values that can have large effects on the average values. These summary tables show the median concentrations for the data presented earlier as the non-parametric tests focus on median (and not average) data set characteristics. The KW p values are all >0.05, indicating that there were no significant differences between the land use data sets, for the sample numbers available. However, the probability plots in Appendix F still provide useful information concerning the data spread and other characteristics.

Table 66. Total Concentrations Compared from Different Sampling Locations

median concentrations (total)	mixed	NBSD	residential	Kruskal-Wallis p value (adjusted for ties)*	overall median	comment on grouped probability plots
SSC, mg/L	203	91	511	0.15	184	mostly overlap
As, ug/L	6.1	4.2	20.4	0.48	6.1	mostly overlap
Cd, ug/L	0.29	0.3	0.67	0.55	0.39	mostly overlap
Cu, ug/L	32.7	36.6	67.9	0.4	49.1	mostly overlap
Hg, ng/L	26	35.4	62	0.37	28.1	mostly overlap
Ni, ug/L	11	15.9	16.5	0.51	14.9	mostly overlap
Pb, ug/L	11.7	8.2	37.8	0.23	11.7	resid higher than others
Zn, ug/L	85.8	87.7	377	0.085	92.3	resid narrow range and higher than others
Acenaphthene, ng/L	12.4	4.4	23.1	0.85	12	mostly overlap
Anthracene, ng/L	1.95	7.05	nd	0.098	2	mostly overlap
Benzo(a)anthracene, ng/L	10.9	16	46.1	0.67	18.6	mostly overlap
Benzo(a)pyrene, ng/L	18.6	26.1	34.5	0.92	18.6	mostly overlap
Benzo(b)fluoranthene; ng/L	26.7	43.3	179	0.48	38.7	mostly overlap
Benzo(k)fluoranthene, ng/L	10	13.6	18.9	0.79	10.1	mostly overlap
Benzo[ghi]perylene and Indeno, ng/L	29.5	36.9	78.9	0.97	30.5	mostly overlap
Chrysene, ng/L	16.5	21	44.7	0.58	21.2	mostly overlap
Dibenzo[a,h]anthracene, ng/L	4.5	5	2.1	0.49	4.2	one NBSD and resid higher than others
Fluoranthene, ng/L	41	102	409	0.58	120	mostly overlap
Fluorene, ng/L	5.1	3.2	15	0.82	4.4	mostly overlap
Naphthalene, ng/L	17	21.6	23.9	0.80	18	mostly overlap
Phenanthrene, ng/L	28.9	40.6	164	0.40	37.3	mostly overlap
Pyrene, ng/L	47.3	65	210	0.40	80	mostly overlap

* no significant p values found for these comparisons. KW is a nonparametric test focusing on median values.

Table 67. Filtered Concentrations Compared from Different Sampling Locations

median concentrations (filtered)	mixed	NBSD	residential	Kruskal-Wallis p value (adjusted for ties)*	overall median	comment on grouped probability plots
TOC, mg/L	5.6	9.8	8.3	0.26	6.8	NBSD greater than others
As, ug/L	2.3	2.7	1.1	0.47	2.2	mostly overlap
Cd, ug/L	nd	0.11	nd	0.18	nd	NBSD greater than others
Cu, ug/L	12.9	24.6	8.6	0.31	12.9	mostly overlap
Hg, ng/L	2.7	5.4	3	0.20	3.3	NBSD greater than others
Ni, ug/L	7.6	11.8	2.1	0.07	9.5	resid narrow range and lower than others
Pb, ug/L	0.66	1.39	1.12	0.49	1.1	mostly overlap
Zn, ug/L	13.1	12.7	34.5	0.57	15	mostly overlap
Acenaphthene, ng/L	3.1	2.5	5.9	0.88	2.6	mostly overlap
Anthracene, ng/L	nd	1.61	1.05	0.17	0.95	NBSD higher than others
Benzo(a)anthracene, ng/L	0.52	0.52	0.68	0.85	0.52	one NBSD very high
Benzo(a)pyrene, ng/L	0.24	0.46	0.48	0.62	0.27	one NBSD very high
Benzo(b)fluoranthene; ng/L	0.48	0.78	0.9	0.49	0.5	one NBSD very high
Benzo(k)fluoranthene, ng/L	0.16	0.28	0.21	0.68	0.18	one NBSD very high
Benzo[ghi]perylene and Indeno, ng/L	0.57	0.61	1.6	0.43	0.79	one NBSD very high
Chrysene, ng/L	0.88	0.72	0.86	0.94	0.73	one NBSD very high
Dibenzo[a,h]anthracene, ng/L	0.34	0.67	0.51	0.48	0.49	NBSD greater than others
Fluoranthene, ng/L	5.7	7.4	5.8	0.74	5.7	one NBSD very high
Fluorene, ng/L	6.7	4	20.4	0.94	4.6	mostly overlap
Naphthalene, ng/L	6.6	9	10.1	0.98	8.5	mostly overlap
Phenanthrene, ng/L	7.9	8.74	9.52	0.90	8	mostly overlap
Pyrene, ng/L	4	6.3	6	0.64	6	one NBSD very high

* no significant p values found for these comparisons. KW is a nonparametric test focusing on median values.

Table 68. Particulate Strength Values Compared from Different Sampling Locations

Particulate Strengths (median)	mixed	NBSD	residential	Kruskal-Wallis p value (adjusted for ties)*	overall median	comment on grouped probability plots
TOC, %	7.2	4.7	10.2	0.47	5.6	resid narrow conc range and higher than others
As, mg/kg	121	19.3	124	0.47	91.4	mostly overlap
Cd, mg/kg	1.3	1.3	2	0.77	1.3	mostly overlap
Cu, mg/kg	103	138	164	0.51	121	mostly overlap
Hg, ug/kg	187	551	169	0.12	233	mostly overlap
Ni, mg/kg	9	13.2	39.8	0.24	14.8	mostly overlap
Pb, mg/kg	55.4	79.5	103	0.92	61.9	mostly overlap
Zn, mg/kg	754	599	938	1.00	628	mostly overlap
Acenaphthene, ug/kg	37.5	13.6	22.7	0.79	21.1	one NBSD very high
Anthracene, ug/kg	3.11	1.62	nd	0.15	8.8	one NBSD very high
Benzo(a)anthracene,ug/kg	66	104	122	0.94	74.1	mostly overlap
Benzo(a)pyrene, ug/kg	111	118	65.9	0.49	108	mostly overlap
Benzo(b)fluoranthene; ug/kg	155	235	537	0.94	193	mostly overlap
Benzo(k)fluoranthene, ug/kg	55.8	102	36.5	0.44	55.8	mostly overlap
Benzo[ghi]perylene and Indeno, ug/kg	164	192	104	0.69	164	mostly overlap
Chrysene, ug/kg	63	183	95	0.77	117	mostly overlap
Dibenzo[a,h]anthracene, ug/kg	34.9	30.1	7.2	0.23	27.1	one mixed and NBSD very high
Fluoranthene, ug/kg	274	591	1,277	0.66	374	mostly overlap
Fluorene, ug/kg	nd	nd	0.18	0.90	nd	one NBSD very high
Naphthalene, ug/kg	23.5	54.5	43	0.36	25.1	one NBSD very high
Phenanthrene, ug/kg	104	125	224	0.94	104	mostly overlap
Pyrene, ug/kg	371	389	571	0.92	386	mostly overlap

* no significant p values found for these comparisons. KW is a nonparametric test focusing on median values.

Figure 73 is an example probability plot from Appendix F showing the SSC data for the three sampling areas, along with the associated Kruskal-Wallis analysis. The log-normal probability plot presents the data with log10 transformations. The plot shows that the three distributions generally overlap (the 95% confidence limits are not clearly separated), but the upper watershed (resid.) data (only 2 values available representing each of the two events) are larger than the corresponding data for the NBSD and upper watershed data. The Anderson-Darling (AD) test data on the plot indicates large p values for each category, indicating that these distributions are not significantly different from log-normal distributions. The KW analysis shows the number of observations available for each category, their median values and ranks, and the overall p value. The KW p value for these concentration sets is 0.15, indicating that none of the three data sets are significantly different from any of the others (confirmed by the CI overlap). The generally parallel plots also indicate that the data sets have similar variances (the similar variances and log-normal distributions allow many of the statistical tests to be applied with minimal losses of power).

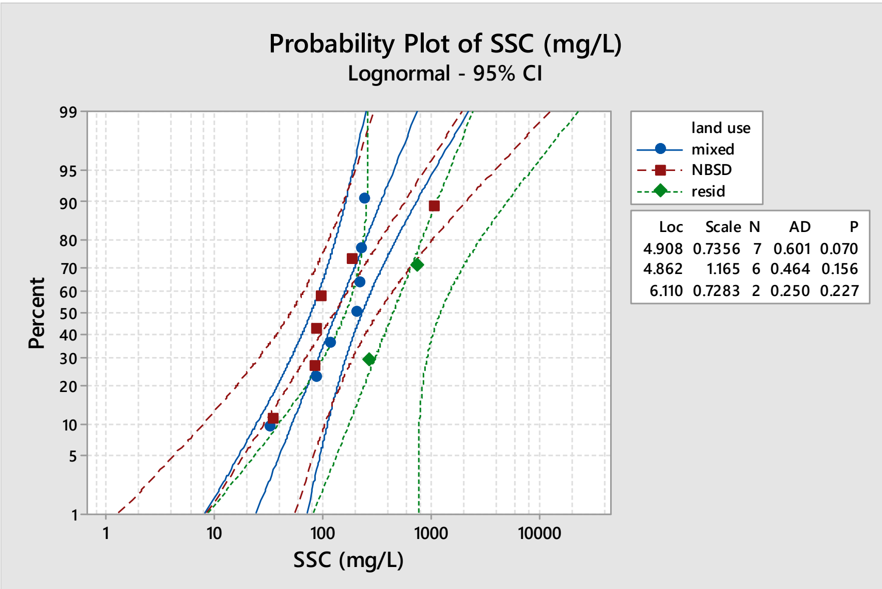


Figure 73. Log-normal probability plots for SSC data for three sampling categories.

Kruskal-Wallis Test on SSC (mg/L)

```
land use    N  Median  Ave Rank      Z
mixed       7  202.58       7.9  -0.12
NBSD        6   91.02       6.3  -1.18
resid       2  511.23      13.5   1.87
Overall    15               8.0

H = 3.87  DF = 2  P = 0.145

* NOTE * One or more small samples
```

Figure 74 contains probability plots for total copper, in contrast to the SSC plots, indicates that the upper watershed (resid.) data distribution that is steeper than for the other two data sets. The few data (only 2) result in much greater uncertainty for this sampling location.

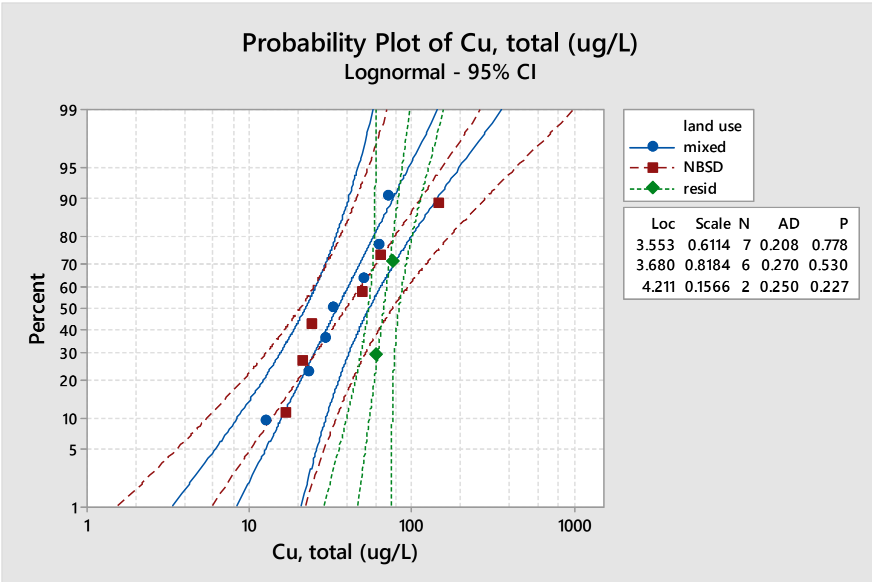


Figure 74. Log-normal probability plots for total copper data for three sampling categories.

Figure 75 contains log-normal probability plots for filtered fluoranthene that also indicates that the NBSD data set has an apparently different distribution then the others. The NBSD distribution is greatly distorted by a single large value, causing the AD test result to indicate a distribution significantly different from a log-normal distribution, and a much wider CI. The KW p value for these data are also large (p = 0.66).

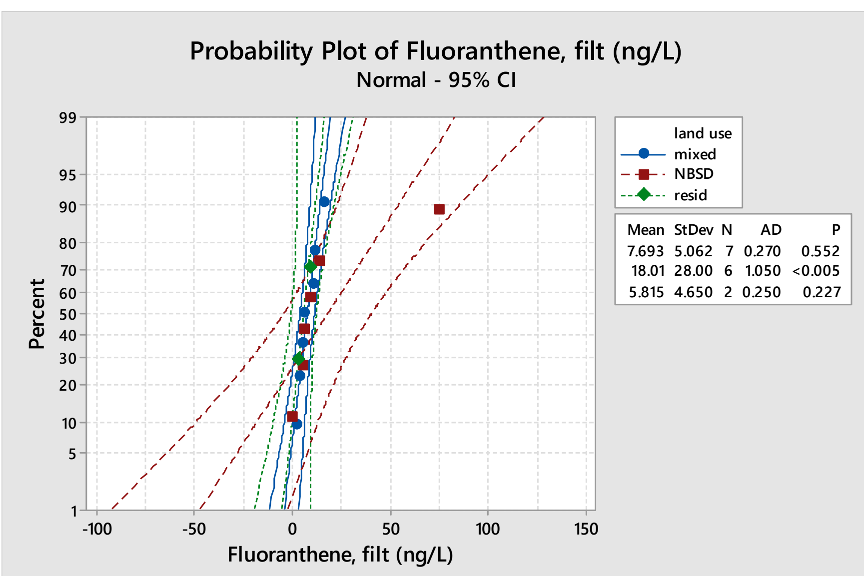


Figure 75. Log-normal probability plots for filtered fluoranthene data for three sampling categories.

Uncertainty due to Variability and Sample Numbers

The data presented above shows the average concentrations for total and filtered forms, along with the particulate strength values for the data collected during two rain events. These are organized for the overall data set (15 samples), the NBSD outfall data (6 samples), the upper watershed Paleta Creek station (2 samples), and mixed waters at the creek mouth and receiving waters (7 samples). Also shown are the standard deviations for the sample sets, along with the coefficient of variation values (the ratio of the standard deviation to average values). This information can be used to approximate the uncertainty of the average (or median) values when representing the data subsets.

The COV values range from a low of about 0.22 to a high of about 1.7, with most near 1. These are typical COV values for stormwater constituents. The following subsection presents data for four particle size ranges for each of the 15 samples. Again, the COV values are within this general range, with most about 1. Figure 76, from Burton and Pitt (2001), illustrates the likely errors in the overall sample mean for different sample numbers and variations. This figure is based on 95% confidence and 80% power and assumes normal distributions of the data. It is difficult to have small errors in the predicted average values unless the sample numbers are large in order to meet these data quality objectives. As an example, for COV values of 1 (the standard deviations about the same as the average values), about 25 samples are needed to predict the average values with less than a 50% error (with 95 confidence and 80% power). Less than 10 samples (the approximate number for these analyses) would be needed if power was not considered as part of the data quality objectives for this same 50% uncertainty level (as usually the case when statistical tests are used with previously collected data).

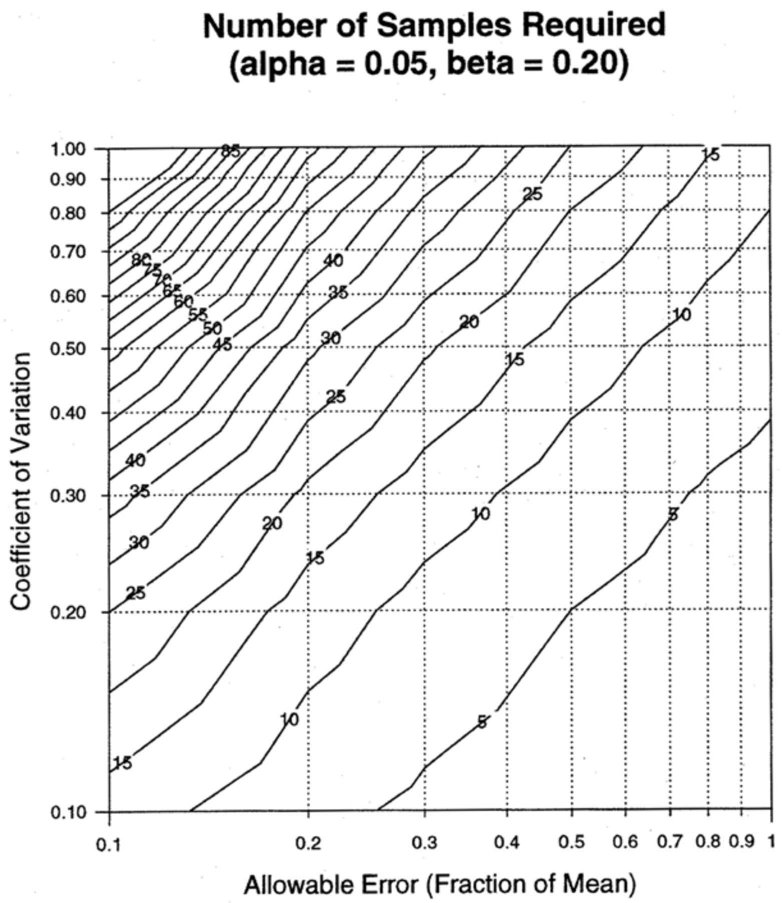


Figure 76. Sample requirements for different levels of allowable errors and data variations (Burton and Pitt 2001).

Size Distributions of Particulate Solids

Each of the 15 samples were further divided into four particle size ranges, as described in the methodology discussion. Appendices I and J show the particulate solids concentrations for these samples for the two events for metals and PAHs. Tables 69 through 71 show the percentage distributions for these particle size distributions (PSD).

Table 69. Particle Size Data for NBSD Samples

particulates (mg/L)	event 1 NBSD outfall at Paunack and Division Streets	event 1 Paleta Creek at Main Street	event 1 NBSD outfall north of railroad crossing	event 1 NBSD outfall #23	event 1 NBSD outfall #33	event 2 Paleta Creek at Main Street	event 2 NBSD outfall at Paunack and Division Streets	event 2 NBSD outfall #33	average NBSD outfalls	stdev NBSD	COV NBSD
Particulate (0.45 -5 µm)	1.1	0.4	0.0	0.0	8.2	0.0	5.1	23.1	4.7	8.0	1.69
Particulate (5-20 µm)	86.6	42.5	85.7	30.9	90.8	19.8	82.5	53.2	61.5	28.3	0.46
Particulate (20-63 µm)	7.5	36.9	0.0	31.2	0.5	17.8	8.7	15.9	14.8	13.5	0.91
Particulate (> 63 µm)	4.9	20.2	14.3	37.9	0.4	62.4	3.6	7.8	18.9	21.3	1.12
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		

Table 70. Particle Size Data for Upper Watershed Samples

particulates (mg/L)	event 1 Paleta Creek at Cummings Road	event 2 Paleta Creek at Cummings Road	average upper	stdev upper	COV upper
Particulate (0.45 -5 µm)	9.7	4.4	7.1	3.8	0.53
Particulate (5-20 µm)	19.2	56.5	37.9	26.4	0.70
Particulate (20-63 µm)	44.8	32.1	38.5	9.0	0.23
Particulate (> 63 µm)	26.3	7.0	16.6	13.7	0.82
	100	100	100		

Table 71. Particle Size Data for Mixed Flow Paleta Creek Samples

particulates (mg/L)	event 1 Time series at C1W 1/5/2016 at 1327 h	event 1 Time series at C1W 1/5/2016 at 1947 h	event 1 Time series at C1W 1/6/2016 at 0333 h	event 2 Ambient Receiving water sample collected on 1/5/2016 at 1327 h	event 2 Ambient Receiving water sample collected on 1/5/2016 at 1947 h	average mixed	stdev mixed	COV mixed
Particulate (0.45 -5 µm)	0.0	0.0	16.5	0.0	22.2	7.7	10.8	1.39
Particulate (5-20 µm)	53.0	86.3	80.0	66.4	73.7	71.9	12.9	0.18
Particulate (20-63 µm)	34.4	13.7	0.0	26.9	1.9	15.4	15.2	0.99

Particulate (> 63 µm)	12.6	0.0	3.5	6.7	2.2	5.0	4.9	0.98
	100	100	100	100	100	100		

Figures 77 through 80 are 3D plots showing the SSC concentrations and percentage distributions. It is clear that large values are associated with two samples (NBSD outfall 33 for event 1, and Paleta Creek at Main St for event 2). The percentage PSD SD plots indicate that the 5 to 20 um size range has the largest percentage component for many samples for both events.

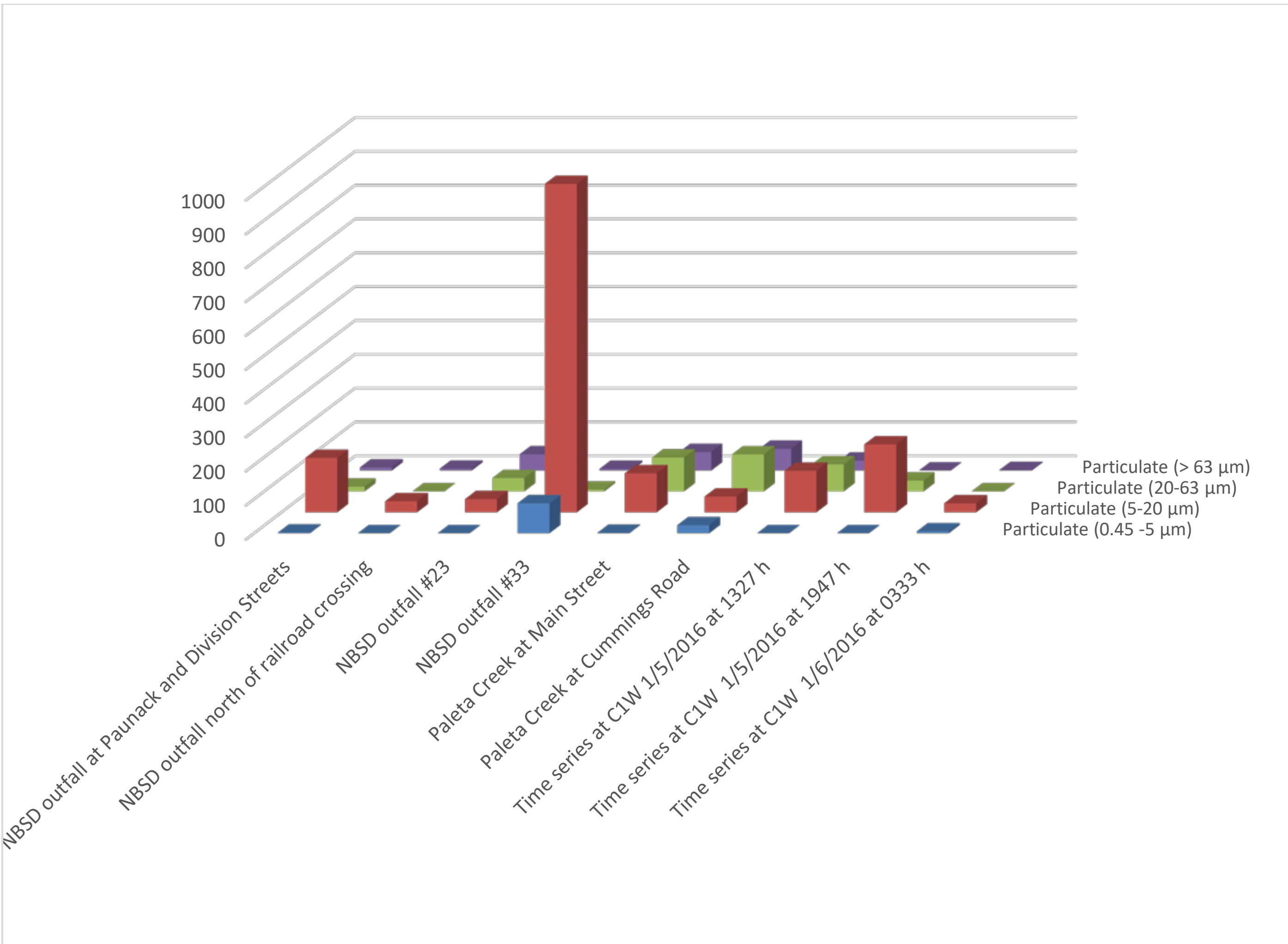


Figure 77. SSC concentrations (mg/L) by land use and particle size range, event 1.

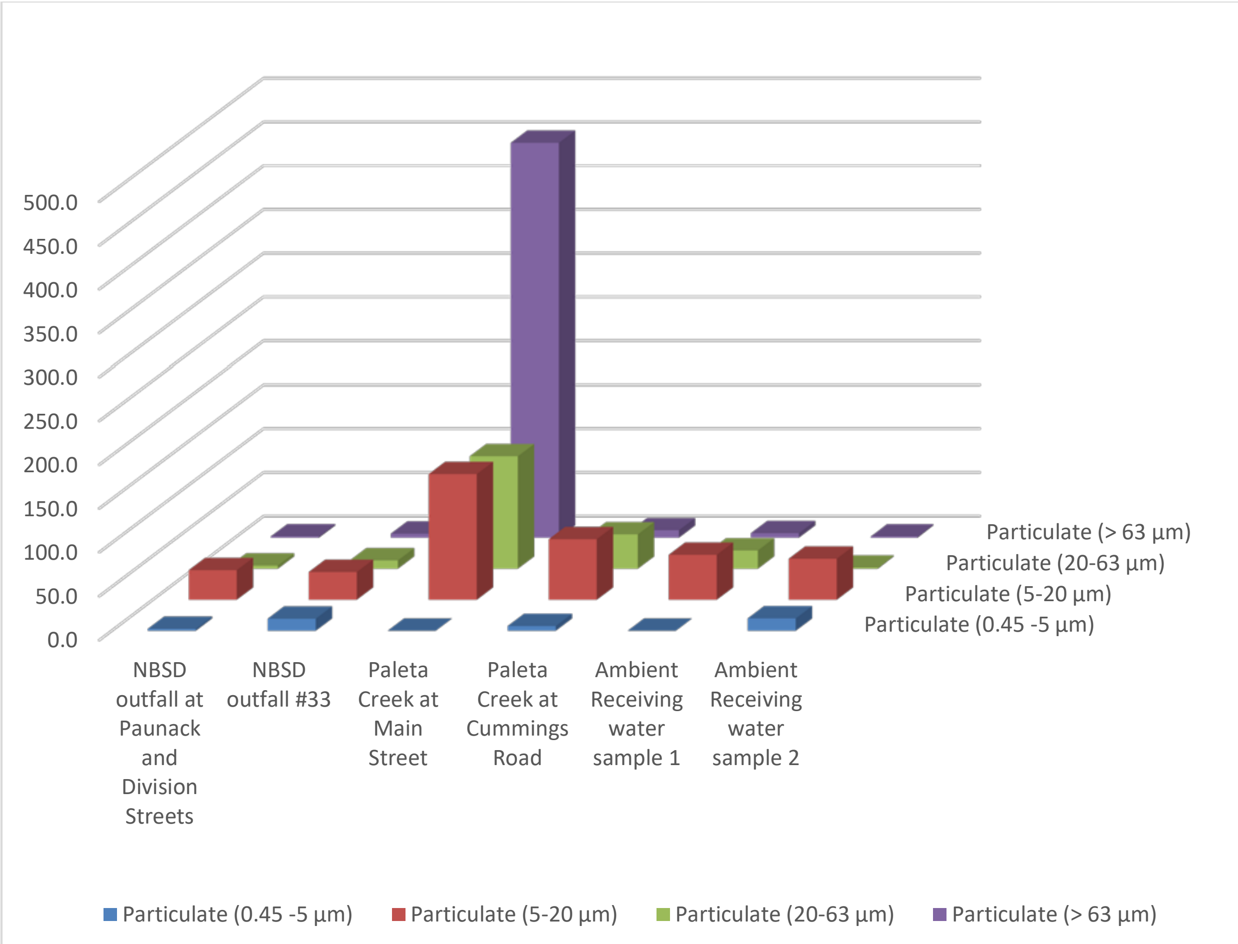


Figure 78. SSC concentrations (mg/L) by land use and particle size range, event 2.

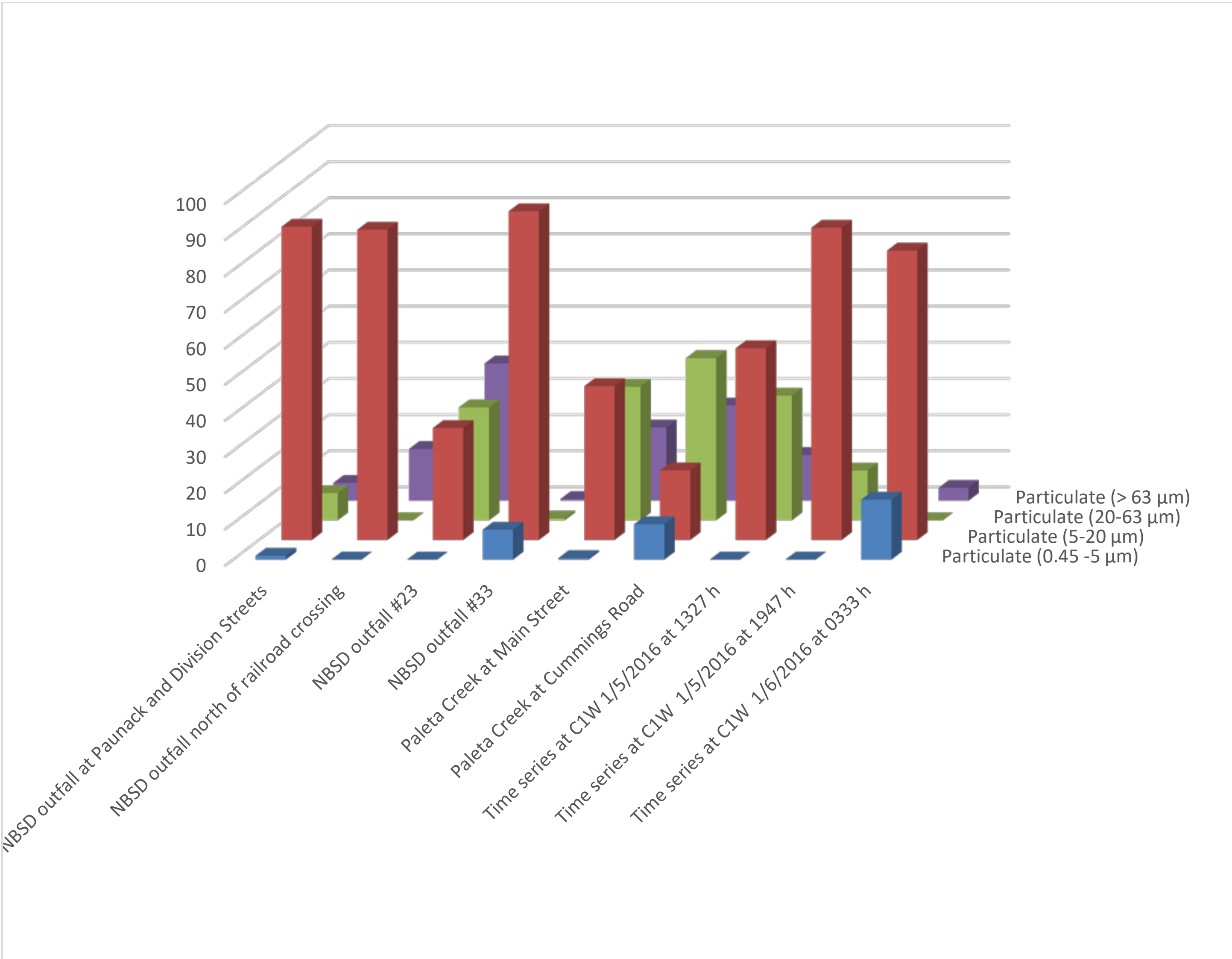


Figure 79. SSC percentage distributions by land use and particle size range, event 1.

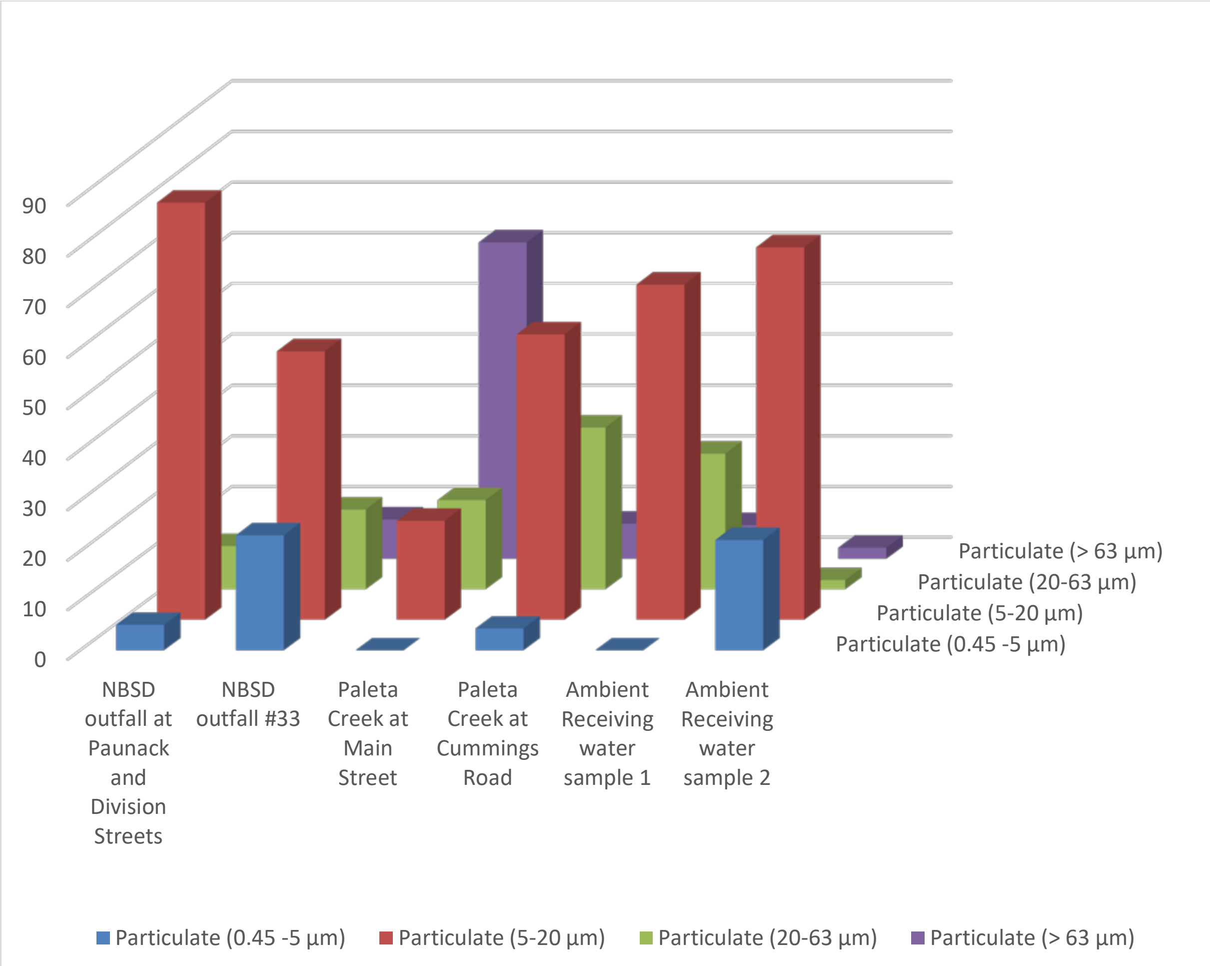


Figure 80. SSC percentage distributions by land use and particle size range, event 2.

Table 72 lists the median particle sizes, while Figures 81 and 82 are PSD plots for the averaged NBSD and upper watershed stormwater samples for event 1 and 2.

Table 72. Median Particle Sizes for NBSD and Upper Watershed Samples

median particle size (um)	NBSD	upper watershed
event 1	12	25
event 2	10	80

The PSDs for the NBSD samples were similar for both events, and typical for most stormwater from paved areas (<10% greater than 100 um). The upper watershed PSDs have a greater abundance of larger particles, likely associated with erosion from the steeper undeveloped areas in the watershed and channel scour (15 and 40% greater than 100 um, for the first and second storms respectively).

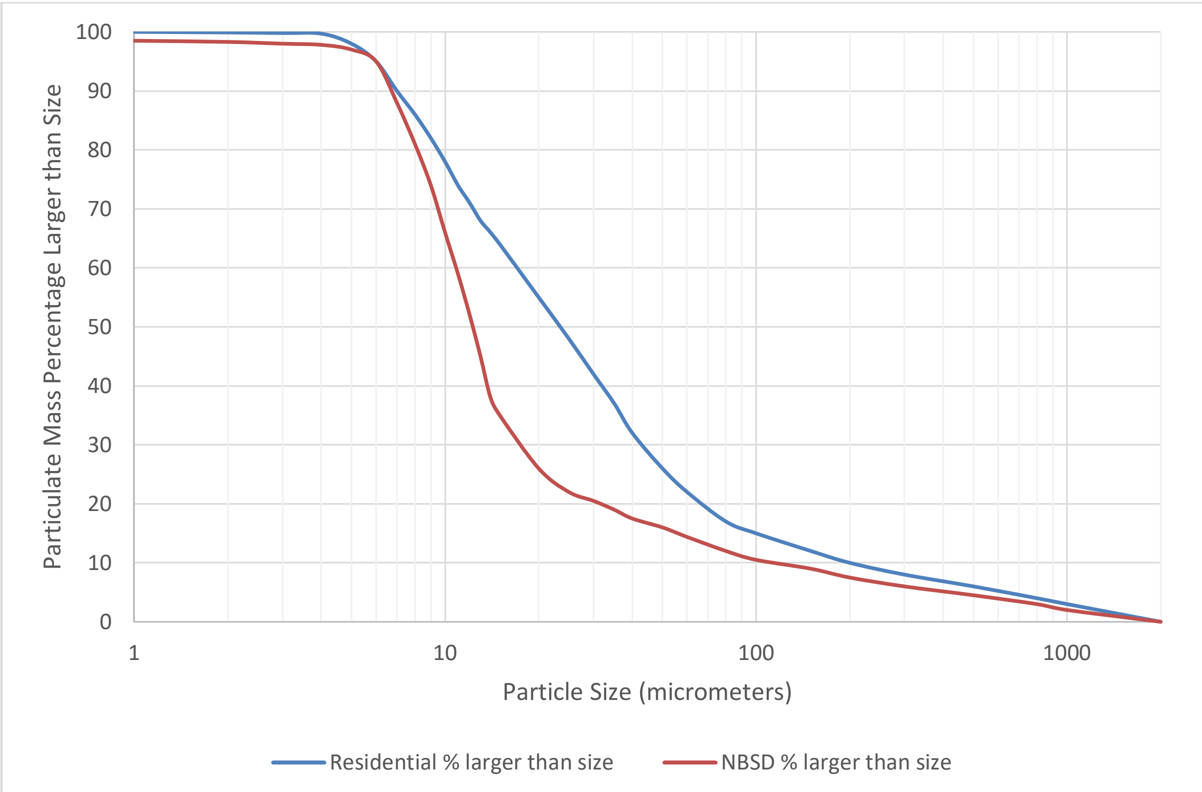


Figure 81. Upper Paleta Creek watershed and NBSD Particle Size Distributions for event 1.

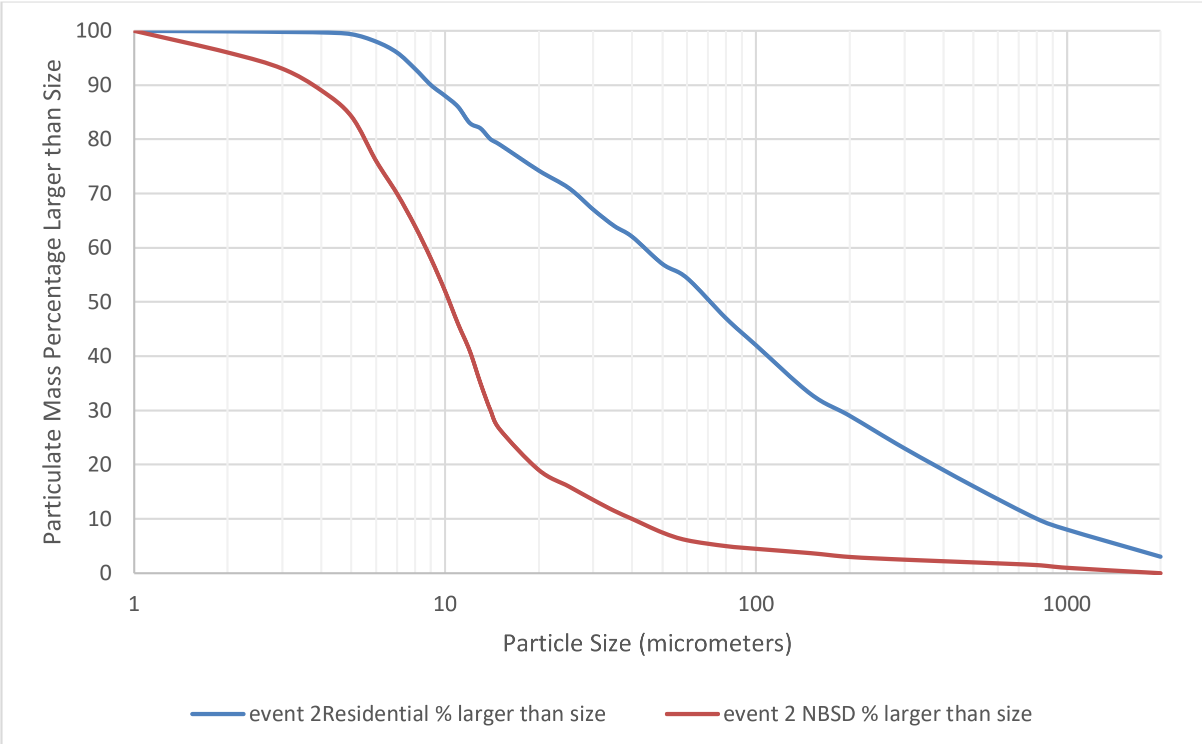


Figure 82. Upper Paleta Creek watershed and NBSD Particle Size Distributions for event 2.

Mass Distributions of Metals and PAHs by Particle Size Range

Appendices I and J contain the particle size range concentrations for the metals and PAHs, respectively. Tables 73 and 74 summarize the average concentrations and coefficients of variation for each constituent by particle size, grouped by sample category. As noted previously, these average concentrations are larger than median values shown previously for the whole samples, as summarized in Table 75. Blank cells represent missing data (no analyses), while non-detected values are indicated as nd, with na designations when the SSC was not detected.

Table 73. Particulate Metals Mass Distributions by Particle Size Range

	NBSD event 1 (avg, COV); n = 4	NBSD event 2 (avg, COV); n = 2	Paleta Creek at Main Street event 1; n = 1	Paleta Creek at Main Street event 2; n = 1	Paleta Creek mixed flow event 1 (avg, COV); n = 4	Paleta Creek mixed flow event 2 (avg, COV); n = 3
Hg (% in size range)						
Particulate (0.45 -5 µm)	0.4 (2.00)	5.0 (0.29)	0.0	nd	5.2 (2.00)	0.4 (1.73)
Particulate (5-20 µm)	37.7 (1.06)	41.4 (0.08)	17.6	33.5	49.6 (0.73)	52.0 (0.49)
Particulate (20-63 µm)	14.5 (1.23)	40.3 (0.01)	14.9	22.4	8.3 (1.21)	32.3 (1.22)
Particulate (> 63 µm)	47.3 (0.57)	13.3 (0.32)	67.5	44.1	36.8 (0.80)	15.4 (1.50)
Pb (% in size range)						
Particulate (0.45 -5 µm)	3.5 (2.00)	0.3 (1.41)	1.2	nd	1.7 (1.19)	2.1 (1.07)
Particulate (5-20 µm)	65.5 (0.46)	46.7 (0.44)	20.1	33.9	67.3 (0.47)	56.3 (0.40)
Particulate (20-63 µm)	0.7 (2.00)	19.7 (1.41)	9.8	6.9	4.3 (1.23)	30.9 (0.81)
Particulate (> 63 µm)	30.2 (0.85)	33.2 (0.24)	68.9	59.2	26.6 (0.98)	10.7 (0.61)
Cd (% in size range)						
Particulate (0.45 -5 µm)	nd (n/a)	nd (n/a)	0.0	nd	nd (n/a)	nd (n/a)
Particulate (5-20 µm)	17.7 (1.74)	nd (n/a)	22.4	nd	43.0 (1.12)	nd (n/a)
Particulate (20-63 µm)	8.6 (2.00)	nd (n/a)	15.4	12.2	9.6 (1.30)	46.9 (0.0)
Particulate (> 63 µm)	73.7 (0.41)	nd (n/a)	62.2	87.8	47.5 (1.06)	53.1 (0.0)
Zn (% in size range)						
Particulate (0.45 -5 µm)	1.5 (2.00)	19.5 (0.37)	0.6	nd	5.7 (1.33)	27.9 (1.49)
Particulate (5-20 µm)	27.5 (0.80)	nd (n/a)	15.6	29.4	39.6 (0.96)	44.5 (0.53)
Particulate (20-63 µm)	12.9 (1.15)	22.2 (1.41)	16.5	12.2	17.1 (1.32)	17.8 (0.85)
Particulate (> 63 µm)	58.1 (0.29)	58.3 (0.42)	67.3	58.4	37.6 (0.97)	9.8 (1.73)
Ni (% in size range)						
Particulate (0.45 -5 µm)	0.2 (2.00)	nd (n/a)	1.2	nd	7.8 (2.00)	nd (n/a)
Particulate (5-20 µm)	23.7 (1.43)	nd (n/a)	14.8	40.6	31.6 (1.16)	100 (n/a)
Particulate (20-63 µm)	27.0 (1.16)	nd (n/a)	21.9	4.3	18.4 (1.16)	nd (n/a)
Particulate (> 63 µm)	49.1 (0.73)	nd (n/a)	62.1	55.1	42.2 (1.19)	nd (n/a)
Cu (% in size range)						
Particulate (0.45 -5 µm)	1.2 (1.95)	40.1 (0.49)	1.2	nd	4.7 (2.00)	nd (n/a)
Particulate (5-20 µm)	26.8 (1.01)	13.4 (0.75)	19.1	35.5	35.0 (1.25)	53.6 (0.55)
Particulate (20-63 µm)	22.1 (1.16)	29.2 (0.51)	19.4	8.0	15.9 (0.94)	34.0 (0.69)
Particulate (> 63 µm)	50.0 (0.68)	17.2 (1.41)	60.3	56.5	44.4 (1.03)	12.3 (0.50)
Ag (% in size range)						
Particulate (0.45 -5 µm)		nd (n/a)		0.0		nd (n/a)
Particulate (5-20 µm)		nd (n/a)		52.9		100 (n/a)
Particulate (20-63 µm)		nd (n/a)		9.4		nd (n/a)
Particulate (> 63 µm)		nd (n/a)		37.7		nd (n/a)
As (% in size range)						
Particulate (0.45 -5 µm)	nd (n/a)		0.2		1.3 (1.29)	
Particulate (5-20 µm)	24.7 (1.43)		5.8		33.6 (1.27)	nd (n/a)
Particulate (20-63 µm)	36.8 (1.28)	nd (n/a)	5.3	29.2	9.1 (1.16)	nd (n/a)
Particulate (> 63 µm)	38.5 (1.11)	nd (n/a)	88.7	70.8	56.0 (0.86)	100 (n/a)
TOC (% in size range)						
Particulate (0.45 -5 µm)	8.9 (0.00)	nd (n/a)			20.6 (0.97)	2.5 (1.41)
Particulate (5-20 µm)	6.9 (0.78)	2.0 (n/a)	2.0	nd	4.7 (0.85)	4.1 (1.10)
Particulate (20-63 µm)	8.1 (1.05)	15.2 (n/a)	10.9	18.1	17.5 (0.77)	8.3 (0.61)
Particulate (> 63 µm)	27.0 (0.57)	21.6 (n/a)	19.8	2.2	20.8 (0.02)	17.7 (0.12)

Table 74. Particulate PAHs Mass Distributions by Particle Size Range

	NBSD event 1 (avg, COV); n = 4	NBSD event 2 (avg, COV); n = 2	Paleta Creek at Main Street event 1; n = 1	Paleta Creek at Main Street event 2; n = 1	Paleta Creek mixed flow event 1 (avg, COV); n = 4	Paleta Creek mixed flow event 2 (avg, COV); n = 3
Naphthalene (% in size range)						
0.7-2.7 µm	15.4 (1.73)	nd (n/a)	0.0	nd	nd (n/a)	3.0 (1.7)
2.7-20 µm	19.3 (1.51)	32.1 (0.61)	39.7	6.8	12.1 (0.73)	29.2 (0.94)
20-63 µm	9.6 (1.73)	nd (n/a)	0.0	93.2	19.3 (1.35)	48.6 (0.87)
> 63 µm	55.7 (0.75)	67.8 (0.29)	60.3	nd	68.6 (0.44)	19.3 (1.2)
Fluorene (% in size range)						
0.7-2.7 µm	25.0 (1.73)	nd (n/a)	0.0	nd	6.8 (1.41)	nd (n/a)
2.7-20 µm	25.0 (1.73)	100 (n/a)	100.0	15.8	16.1 (1.41)	49.8 (1.41)
20-63 µm	9.2 (1.32)	nd (n/a)	0.0	84.2	nd (n/a)	0.1 (1.41)
> 63 µm	40.8 (1.02)	nd (n/a)	0.0	nd	77.2 (0.26)	50.1 (1.40)
Acenaphthene (% in size range)						
0.7-2.7 µm	2.4 (1.73)	nd (n/a)	0.0	nd	33.7 (0.90)	0.7 (1.73)
2.7-20 µm	0.7 (1.73)	66.6 (0.07)	100.0	nd	3.0 (1.00)	56.3 (0.91)
20-63 µm	34.2 (1.04)	18.3 (1.41)	0.0	4.0	10.1 (1.73)	nd (n/a)
> 63 µm	62.7 (0.62)	15.1 (1.41)	0.0	96.0	53.2 (0.73)	43.0 (1.20)
Phenanthrene (% in size range)						
0.7-2.7 µm	10.0 (1.73)	nd (n/a)	0.0	nd	nd (n/a)	1.3 (1.73)
2.7-20 µm	6.6 (1.03)	29.9 (1.41)	90.8	nd	33.1 (1.18)	47.3 (1.06)
20-63 µm	19.8 (1.23)	nd (n/a)	9.2	nd	11.0 (1.16)	15.5 (1.73)
> 63 µm	63.6 (0.60)	70.1 (0.60)	0.0	100.0	55.9 (0.65)	35.9 (0.87)
Anthracene (% in size range)						
0.7-2.7 µm	25.0 (1.73)	nd (n/a)	0.0		0.5 (1.73)	33.3 (1.73)
2.7-20 µm	12.2 (1.00)	nd (n/a)	0.0		44.7 (0.77)	48.3 (1.04)
20-63 µm	29.8 (1.02)	nd (n/a)	100.0		29.5 (0.71)	18.4 (1.73)
> 63 µm	33.1 (1.19)	100 (n/a)	0.0		25.3 (1.10)	nd (n/a)
Fluoranthene (% in size range)						
0.7-2.7 µm	nd (n/a)	nd (n/a)	3.1	nd	12.3 (1.48)	1.2 (0.91)
2.7-20 µm	16.7 (0.46)	45.1 (0.73)	9.5	10.1	33.0 (0.40)	49.8 (0.88)
20-63 µm	26.2 (1.13)	14.3 (1.41)	8.9	62.3	41.6 (0.31)	33.4 (1.02)
> 63 µm	57.1 (0.65)	40.6 (0.31)	78.5	27.6	13.1 (1.73)	15.6 (1.73)
Pyrene (% in size range)						
0.7-2.7 µm	2.1 (1.73)	nd (n/a)	2.4	nd	16.0 (1.30)	0.3 (1.73)
2.7-20 µm	35.3 (0.69)	22.3 (0.81)	31.2	18.0	38.1 (0.65)	42.2 (0.88)
20-63 µm	9.2 (1.03)	29.7 (0.94)	12.8	30.4	14.8 (0.59)	27.3 (0.42)
> 63 µm	53.5 (0.63)	48.0 (0.96)	53.6	51.5	31.1 (1.05)	30.2 (0.90)
Chrysene (% in size range)						
0.7-2.7 µm	0.9 (1.73)	nd (n/a)	4.8	nd	19.2 (1.37)	0.8 (1.49)
2.7-20 µm	22.6 (0.18)	4.1 (1.41)	49.6	20.1	32.4 (0.82)	41.3 (0.98)
20-63 µm	24.8 (1.19)	31.4 (1.14)	45.6	35.0	15.0 (0.53)	20.7 (0.36)
> 63 µm	51.7 (0.59)	64.6 (0.47)	0.0	44.9	33.3 (1.01)	37.1 (0.88)
Benzo[a]anthracene (% in size range)						
0.7-2.7 µm	0.2 (1.73)	nd (n/a)	2.1	nd	14.9 (1.20)	0.7 (1.73)
2.7-20 µm	19.2 (0.25)	5.9 (1.41)	28.3	14.2	43.9 (0.54)	38.3 (0.88)
20-63 µm	23.2 (1.31)	34.5 (0.89)	36.5	18.9	11.8 (1.37)	25.4 (0.09)
> 63 µm	57.4 (0.58)	59.6 (0.38)	33.2	66.9	29.5 (0.91)	35.5 (0.89)

Benzo[b]fluoranthene (% in size range)						
0.7-2.7 µm	2.1 (1.73)	nd (n/a)	1.4	nd	18.9 (1.20)	0.6 (0.89)
2.7-20 µm	28.2 (0.59)	12.8 (1.41)	11.2	15.0	46.8 (0.45)	42.2 (0.59)
20-63 µm	16.0 (0.91)	39.6 (0.44)	18.8	29.5	14.7 (1.34)	42.6 (0.46)
> 63 µm	53.6 (0.58)	47.7 (0.01)	68.6	55.5	19.5 (1.50)	14.6 (1.51)
Benzo[k]fluoranthene (% in size range)						
0.7-2.7 µm	1.3 (1.73)	nd (n/a)	3.6	nd	19.1 (1.73)	0.6 (1.19)
2.7-20 µm	35.9 (0.57)	23.6 (0.19)	37.8	17.3	48.6 (0.57)	39.7 (0.65)
20-63 µm	12.5 (0.85)	33.4 (0.71)	58.6	37.3	23.6 (0.85)	41.7 (0.37)
> 63 µm	50.4 (0.59)	42.9 (0.66)	0.0	45.4	8.7 (0.59)	18.0 (1.13)
Benzo[a]pyrene (% in size range)						
0.7-2.7 µm	0.1 (1.73)	nd (n/a)	3.7	nd	16.9 (1.18)	0.9 (0.99)
2.7-20 µm	34.8 (0.64)	7.9 (1.41)	37.7	20.4	44.3 (0.52)	38.5 (0.74)
20-63 µm	13.2 (0.86)	59.2 (0.97)	58.5	45.2	19.9 (0.93)	41.3 (0.39)
> 63 µm	52.0 (0.59)	32.8 (1.41)	0.0	34.4	18.9 (0.64)	19.3 (1.12)
Dibenzo[a,h]anthracene (% in size range)						
0.7-2.7 µm	nd (n/a)	nd (n/a)	2.7	nd	15.4 (1.19)	2.7 (1.44)
2.7-20 µm	36.1 (0.71)	9.8 (1.41)	54.0	9.5	47.7 (0.38)	48.4 (0.93)
20-63 µm	15.5 (1.69)	2.6 (1.41)	43.3	90.5	12.1 (0.46)	42.4 (0.93)
> 63 µm	48.3 (0.78)	87.6 (0.20)	0.0	0.0	24.8 (1.05)	6.5 (1.73)
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene (% in size range)						
0.7-2.7 µm	2.1 (1.70)	nd (n/a)	4.2	nd	18.6 (1.15)	0.2 (1.73)
2.7-20 µm	37.9 (0.44)	17.0 (0.10)	38.3	25.4	42.7 (0.54)	38.6 (0.86)
20-63 µm	15.6 (0.79)	35.9 (0.49)	57.5	60.2	14.2 (1.01)	45.0 (0.45)
> 63 µm	44.4 (0.65)	47.1 (0.34)	0.0	14.4	24.5 (0.61)	16.2 (1.24)

Table 75. Comparison of Particulate Strengths from Whole Samples (medians) Compared to Sieved Samples (average)

	NBSD part strength (mg/kg or ug/kg), median values	upper part. strength (mg/kg or ug/kg), median values	NBSD from size values, average values	upper from size values, average values
As, mg/kg	16	38	333	253
Cu, mg/kg	132	116	1,244	331
Hg, ug/kg	330	115	4,104	392
Ni, mg/kg	45	28	293	83
Pb, mg/kg	75	72	211	248
Zn, mg/kg	824	670	8,235	2,130
Acenaphthene, ug/kg	21	34	1,737	77
Benzo(a)anthracene, ug/kg	170	89	4,050	174
Benzo(a)pyrene, ug/kg	282	67	3,968	270
Benzo(b)fluoranthene; ug/kg	467	349	8,425	1,225
Benzo(k)fluoranthene, ug/kg	146	37	3,046	150
Benzo[ghi]perylene and Indeno, ug/kg	399	151	2,229	809
Chrysene, ug/kg	223	86	4,558	195
Fluoranthene, ug/kg	1,040	789	38,832	3,550
Naphthalene, ug/kg	138	27	3,680	161
Phenanthrene, ug/kg	350	302	5,308	271
Pyrene, ug/kg	645	399	16,570	946

The particle strength values from the whole samples are much smaller than those derived from the mass-weighted values from the sieved samples (especially for the NBSD values). This is because the sieved samples contained very high particulate strength values for some of the large particle sizes, and the values shown are numeric averages of a few samples which would be affected by a few unusual values. These are associated with a few large debris caught on the large sieve that represented oily or metallic components from the industrial areas. The whole water sample values are median concentrations and would not be numerically affected by these unusual values. However, the overall range of particulate strengths shown here are within the range reported in the literature. For these reasons, the watershed mass discharge calculations rely on the particle size distribution weighted values, as the periodic high values need to be considered.

Appendices I (metals) and J (PAHs) show the individual particulate strength data by particle size for each of the sampled events and locations. These data are presented in both tabular (Tables 76 and 77) and graphic form (Figures 89 and 90), for some of the data for zinc.

Table 76. Zinc Particulate Strength Data for Event 1 for Different Sampling Locations and Particle Size Range

Zn (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	2667	5.3	nd	nd	2169	414	6.0	nd	533
Particulate (5-20 µm)	146	546	42.6	173	543	265	590	211	131
Particulate (20-63 µm)	1610	8.3	1098	nd	659	161	1226	86.1	nd
Particulate (> 63 µm)	4046	8797	2505	29021	4917	1657	842	31.7	10254

Table 77. Zinc Particulate Strength Data for Event 2 for Different Sampling Locations and Particle Size Range

Zn (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	2995	454	nd	1343	5.6	3138
Particulate (5-20 µm)	nd	nd	595	502	726	298
Particulate (20-63 µm)	nd	2039	274	523	749	394
Particulate (> 63 µm)	13086	3875	375	3054	nd	nd

Four outfalls were sampled at the NBSD during the first event and two were sampled during the second event. The second event had much less rain and the incoming tide affected the other sampling locations, so fewer samples were available during the second event. The Paleta Creek station at Main Street is the main channel and represents the upper watershed flows. This location was sampled during each event. The other Paleta Creek and ambient water samples represent mixed flows in the creek mouth, with four locations during the first event and three locations during the second event. These particulate strength data were plotted in 3D graphs for each event by particle size, as shown on Figures 83 and 84, showing the range of concentrations observed.

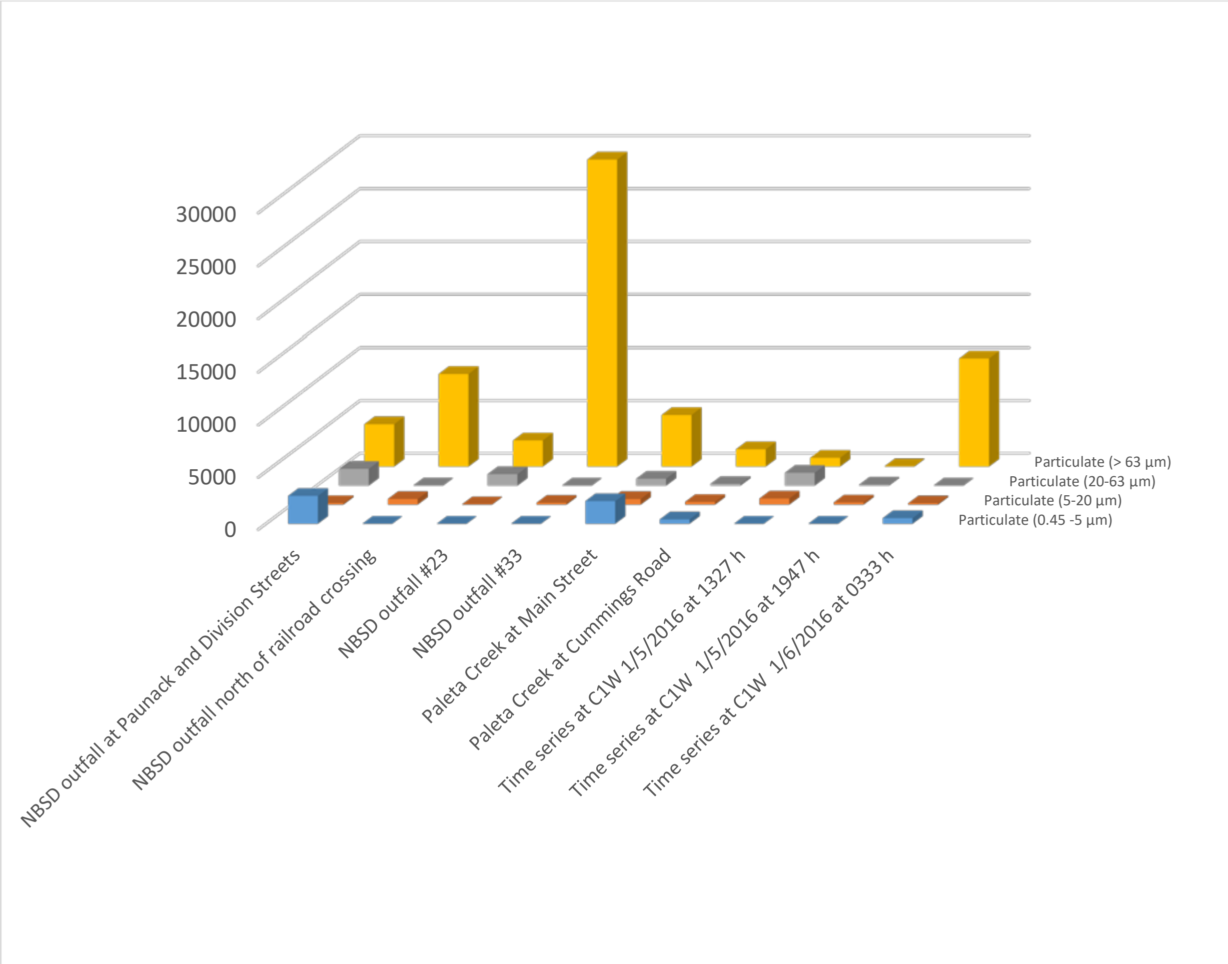


Figure 83. Zinc particulate strength values (mg/kg) for sampling locations and particle size ranges, event 1.

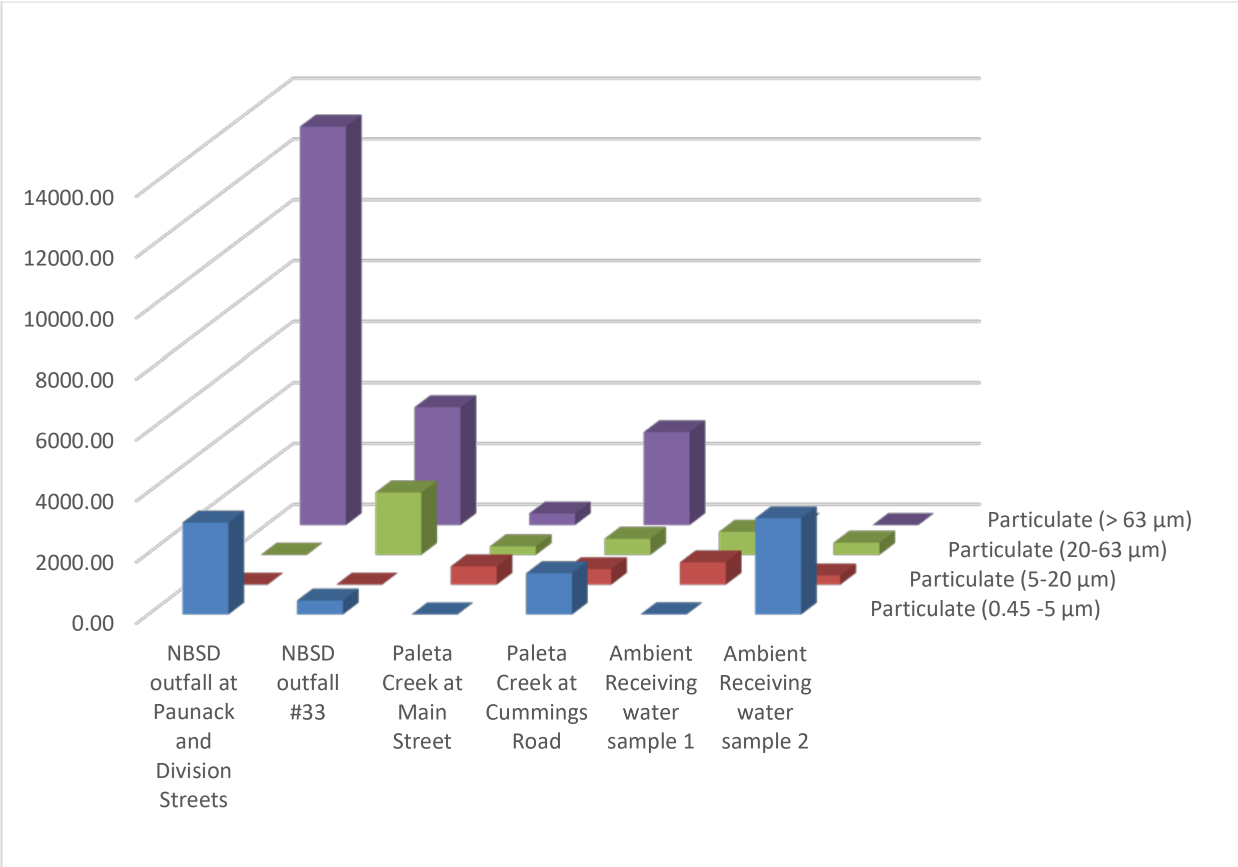


Figure 84. Zinc particulate strength values (mg/kg) for sampling locations and particle size ranges, event 2.

These plots illustrate the few very high values found in a few locations, especially for some of the large particles. Figure 85 shows these data as a percentage of the total value for each size range to better normalize the information.

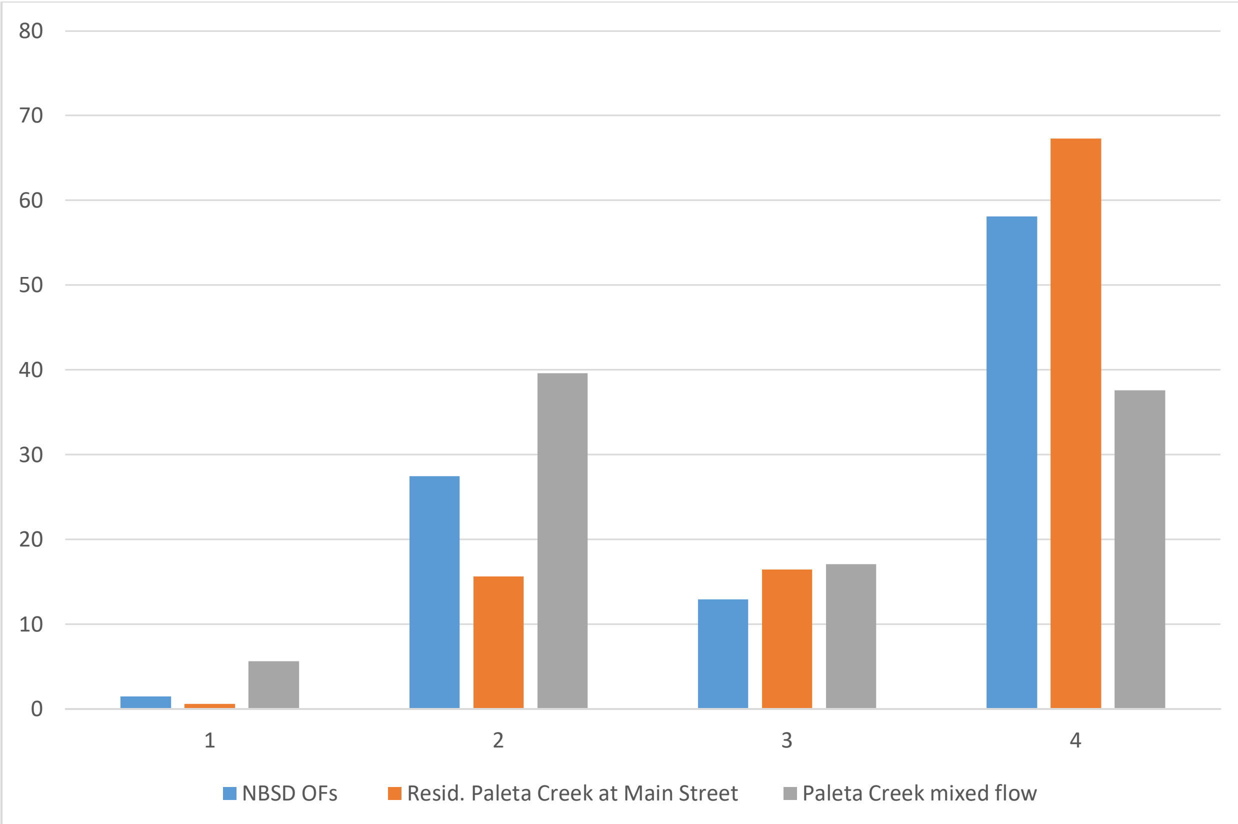


Figure 85. Zinc relative mass (% of total) by land use and particle size ranges, event 1.

This plot indicates that about 60% of the zinc from both the NBSD and upper watershed areas were associated with the largest sizes analyzed (>63um). This large particle size is the most important when considering near-field deposition after discharge, with less zinc sedimentation occurring at greater depths and distances from the discharge location. This particle size can also be targeted for stormwater control to reduce the near-field contamination potential.

Section 5: Paleta Creek Watershed Mass Discharge Calculations by Land Use and Particle Size

Appendix K presents tables and graphs illustrating the mass discharges associated with the different land uses. Table 8 and Figure 86 show the major land use breakdowns for the NBSD drainage areas and the upper watershed area. Most of the NBSD area is comprised of industrial areas, where most of the upper watershed area is residential. The NBSD drainage areas comprise about 13.5% of the total watershed area. More land use and development information is presented in the site description section of this report.

Table 78. Land Use Components in Paleta Creek Watershed

land use	area (ac)	% of total area
NBSD commercial	1.3	0.1
NBSD industrial	268.16	13.4
NBSD residential	0.11	<0.1
upper commercial	40.04	2.0
upper freeway	397.64	19.9
upper institutional	103.2	5.2
upper parks and open space	104.76	5.2
upper residential	1084.66	54.2
sum:	1999.87	100

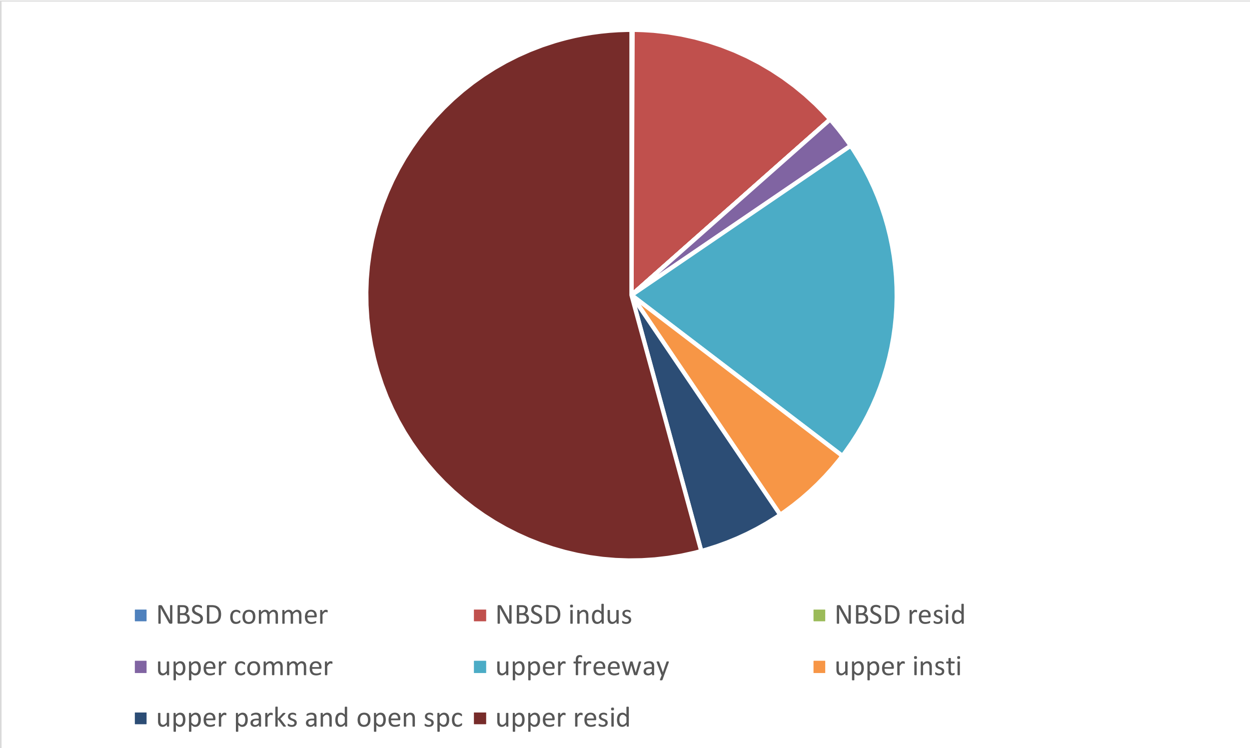


Figure 86. Paleta Creek land use components.

Sources of Flows and Particulates in Watershed

Tables 79 and 80, and Figure 87, show the annual and monthly runoff and particulate discharges from the Paleta Creek watershed, along with the local rains.

Table 79. Calculate Runoff and Particulate Solids Yields for Paleta Creek Watershed

		NBSD part yield	NBSD unit area yield per ha	NBSD % of total	upper part yield	upper unit area yield per ha	upper % of total	total part yield	NBSD/upper unit area yield ratio
rainfall	in/yr	10.81			10.81				
rainfall	mm/yr	275			275				
area	acres	270		13.5	1,730		86.5	2,000	
area	ha	109		13.5	700		86.5	809	
runoff vol	ft^3/yr	7,371,767	67,573	19.2	31,089,050	44,398	80.8	38,460,817	1.52
runoff vol	m^3/yr	208,743	1,913	19.2	880,336	1,257	80.8	1,089,079	1.52
part solids	kg/yr	69,859	640	20.0	278,816	398	80.0	348,675	1.61

The following are based on calculated discharges from WinSLAMM, calibrated during the recent NBSD navy project (http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Site_Descriptions_Calibration_and_Sources_Feb_17_2014.pdf). Long-term San Diego airport rainfall data were used for these calculations. The dramatic variation throughout the year is obvious, as very little rainfall occurs during the summer months. WinSLAMM was used to calculate the expected discharges per month throughout the year, as summarized below. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March.

Table 80. Rainfall and Discharge Variations Occurring Each Month

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec
Rainfall (in)	1.99	1.88	1.67	0.76	0.18	0.06	0.02	0.06	0.16	0.45	1.09	1.42
Flow (% of annual total)	21.0	23.8	19.8	7.3	0.9	0.6	0.1	0.2	1.3	4.6	8.7	11.7
Sediment (% of annual total)	17.7	19.9	16.9	9.4	1.8	1.1	0.5	0.6	2.6	5.5	10.7	13.3

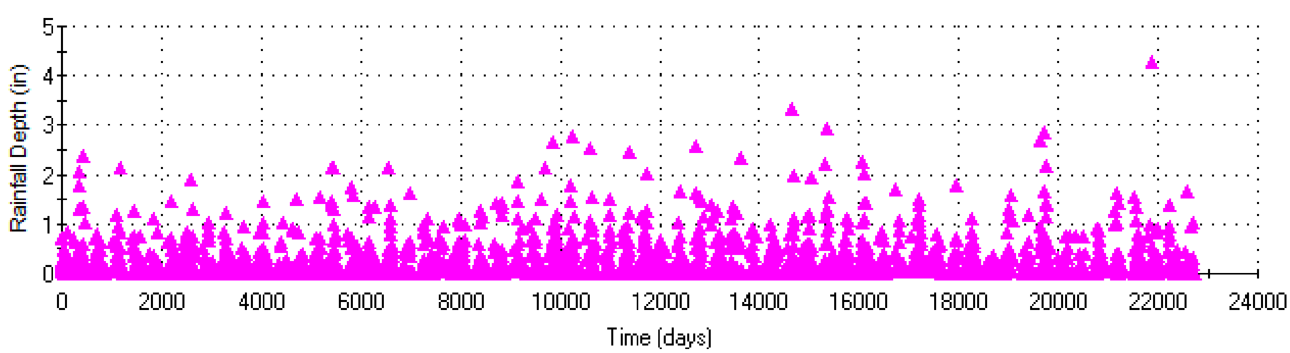


Figure 87. Long-term rainfall at San Diego's Lindberg Field (1951 through 2013).

These variations change from year-to-year due to the highly variable nature of the local rainfall, but very little of the annual discharges are expected to occur during the summer months. During this 62 year period, the average rainfall was 0.26 inches, with a maximum of 4.28 inches and the annual average rainfall was about 10 inches. Tables 81 and 82 show the monthly total amounts of rain and the number of rain events per month for this period.

Table 81. Monthly Rain Depths during 1951 through 2013, Lindberg Field, San Diego

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec	Annual total
Average	1.99	1.88	1.67	0.76	0.18	0.06	0.02	0.06	0.16	0.45	1.09	1.42	9.73
Std Dev	2.00	1.67	1.64	0.80	0.31	0.15	0.05	0.29	0.34	0.78	1.17	1.36	4.08
COV	1.01	0.89	0.99	1.06	1.77	2.34	2.44	4.63	2.07	1.74	1.07	0.96	0.42
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	3.41
Maximum	9.09	7.47	6.57	3.71	1.79	0.87	0.24	2.13	1.90	4.98	5.82	6.60	19.41

Table 82. Monthly Number of Rain Events per Month during 1951 through 2013, Lindberg Field, San Diego

	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec	Annual total
Average	5.9	5.8	5.8	4.0	1.9	0.9	0.5	0.4	1.1	2.4	4.0	5.0	37.7
Std Dev	3.9	3.5	4.1	2.7	1.8	1.1	0.8	0.8	1.6	2.5	2.1	2.8	10.1
COV	0.7	0.6	0.7	0.7	1.0	1.3	1.7	2.0	1.5	1.0	0.5	0.6	0.3
Minimum	0	0	0	0	0	0	0	0	0	0	0	1	21
Maximum	16	15	18	11	8	6	3	5	7	11	10	13	75

Figures 88 through 93 summarize the modeled monthly average runoff and particulate discharges for the Paleta Creek watershed, showing the NBSD and upper watershed contributions. These patterns reflect the monthly variations in rainfall for the area, with very little stormwater discharges during the dry summer months.

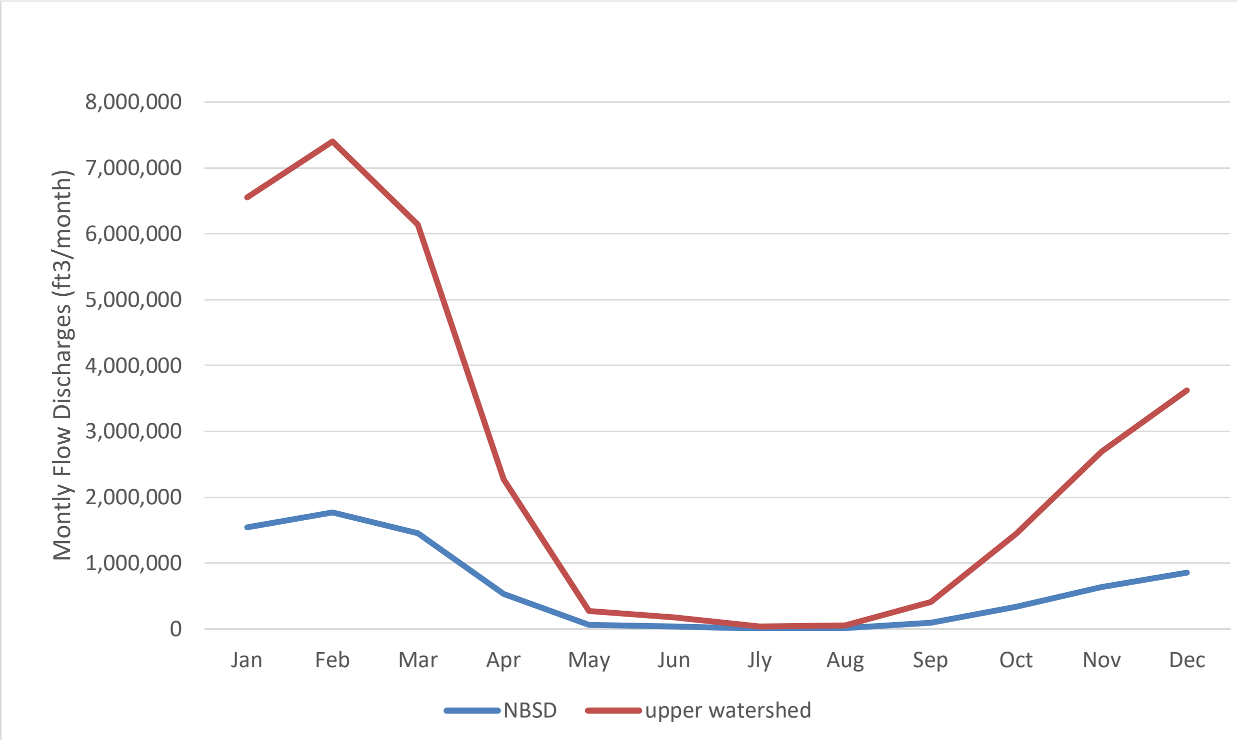


Figure 88. Monthly stormwater discharges for the Paleta Creek watershed.

Figures 89 and 90 show the calculated runoff contributions from each land use in the Paleta Creek watershed for each month of the year. The residential areas from the upper watershed area are the most important runoff source, with the NBSD industrial areas next in importance.

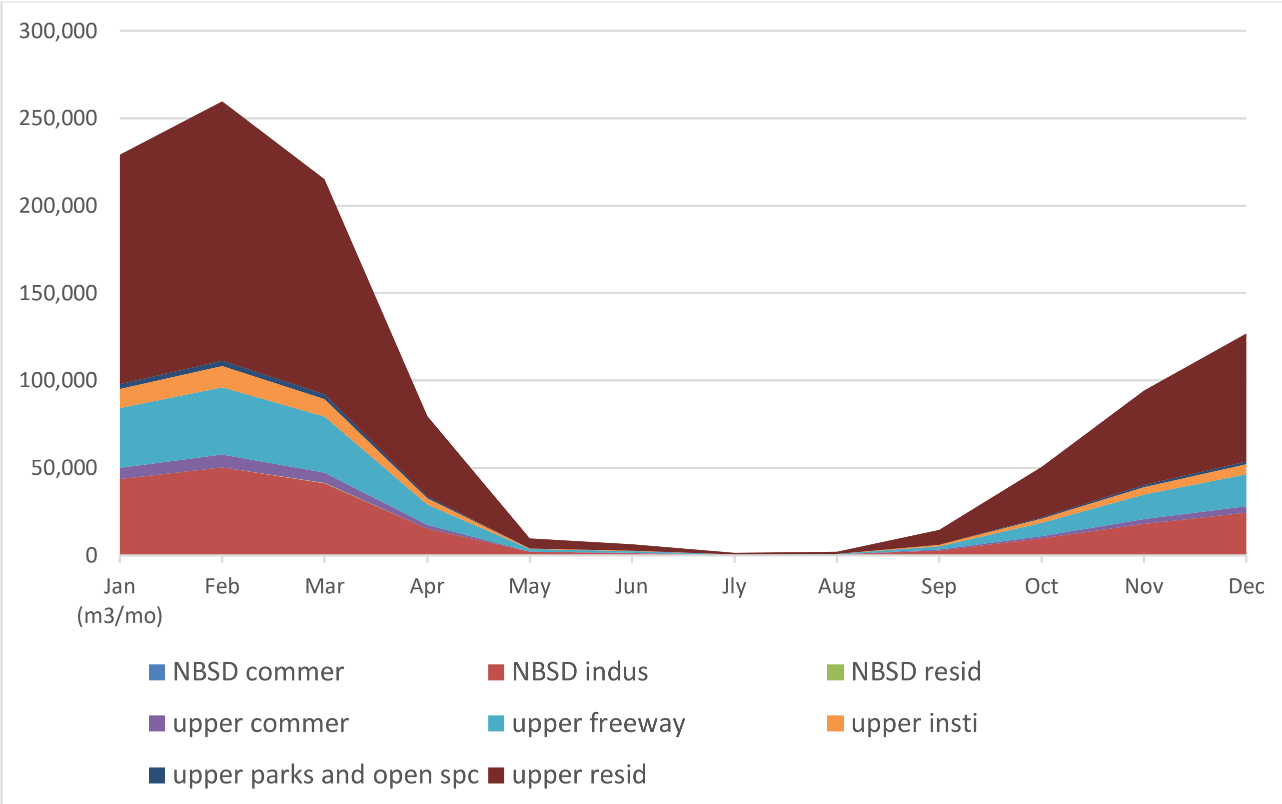


Figure 89. Runoff volume monthly discharges (m^3/month) by land use in the Paleta Creek watershed.

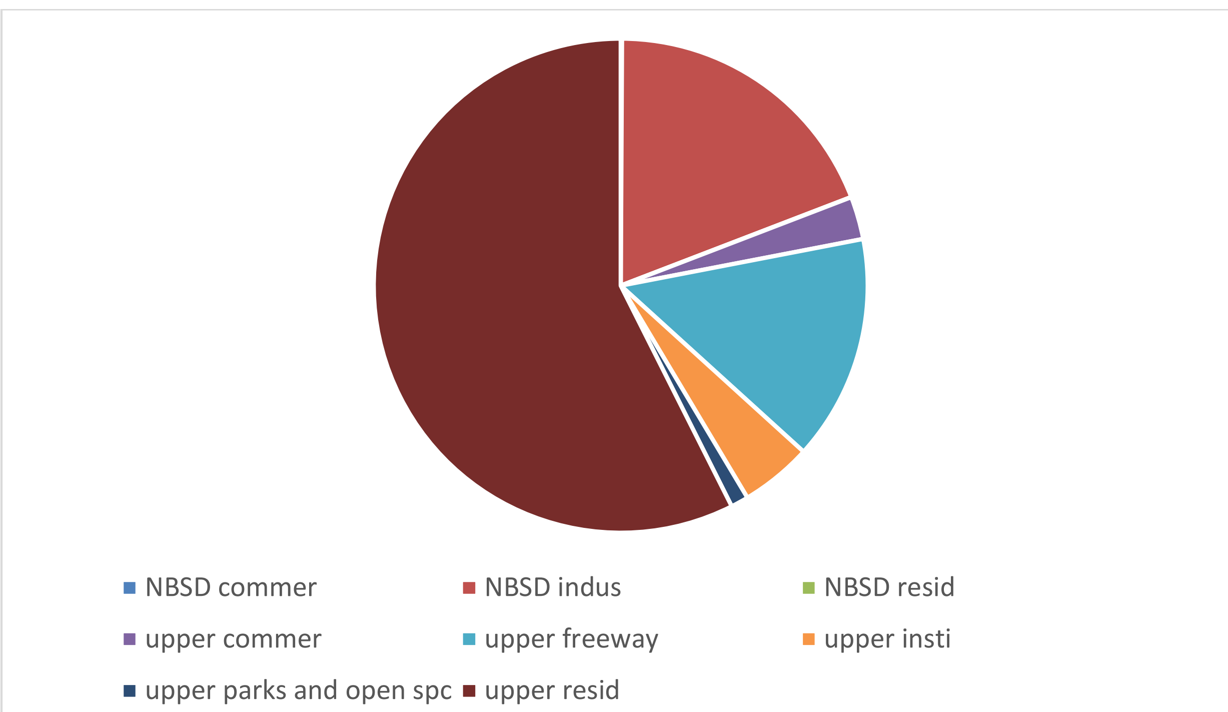


Figure 90. Annual stormwater flow discharge contributions by land use in Paleta Creek watershed.

Figures 91 through 93 plot the particulate solids discharges. Again, the upper watershed residential areas and the NBSD industrial areas are the most important stormwater particulate solids sources.

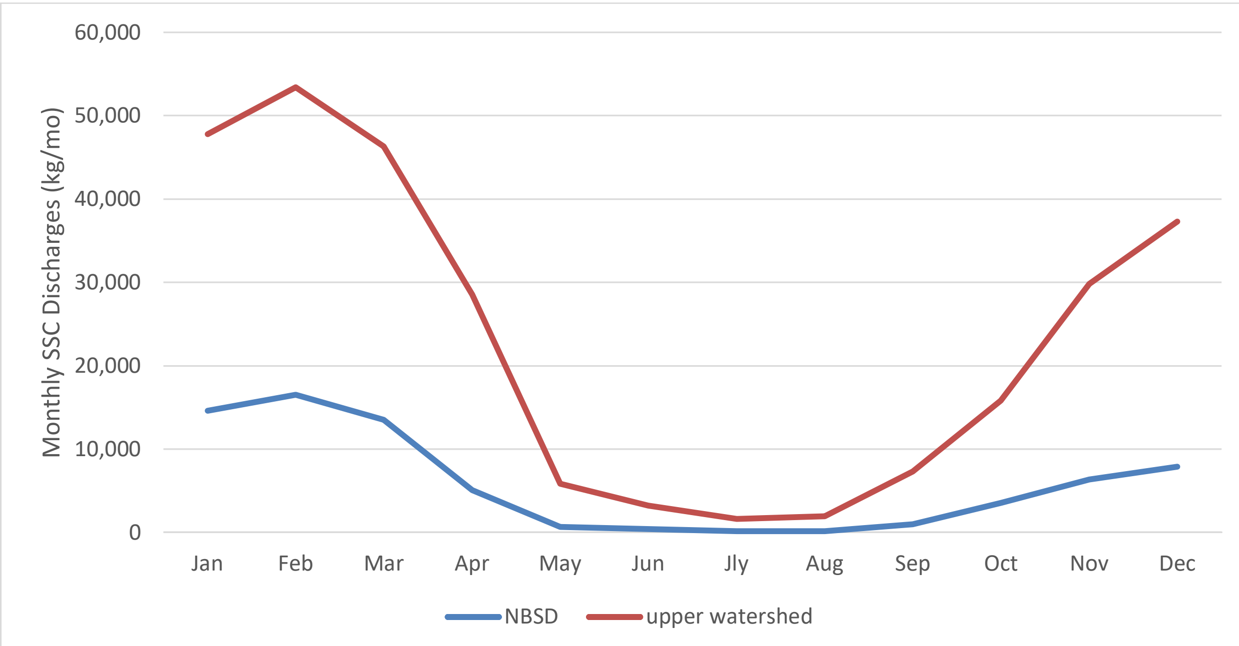


Figure 91. Monthly SSC discharge contributions for the Paleta Creek watershed.

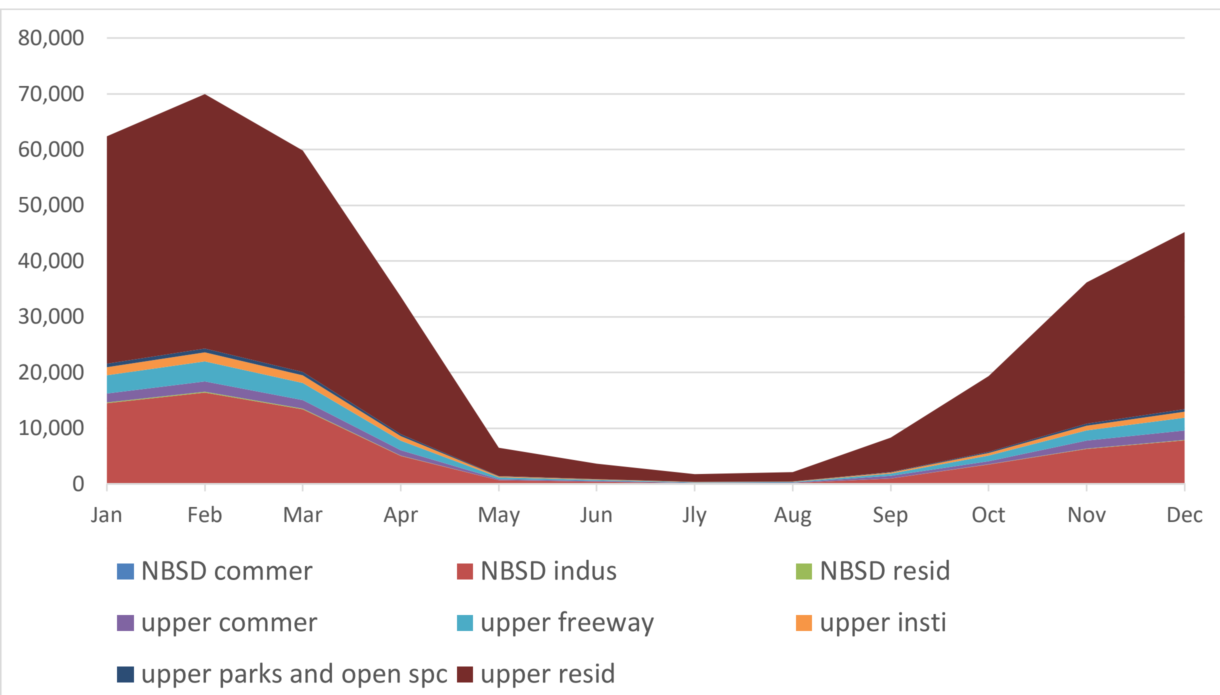


Figure 92. Particulate discharges (kg/month) by month and land use.

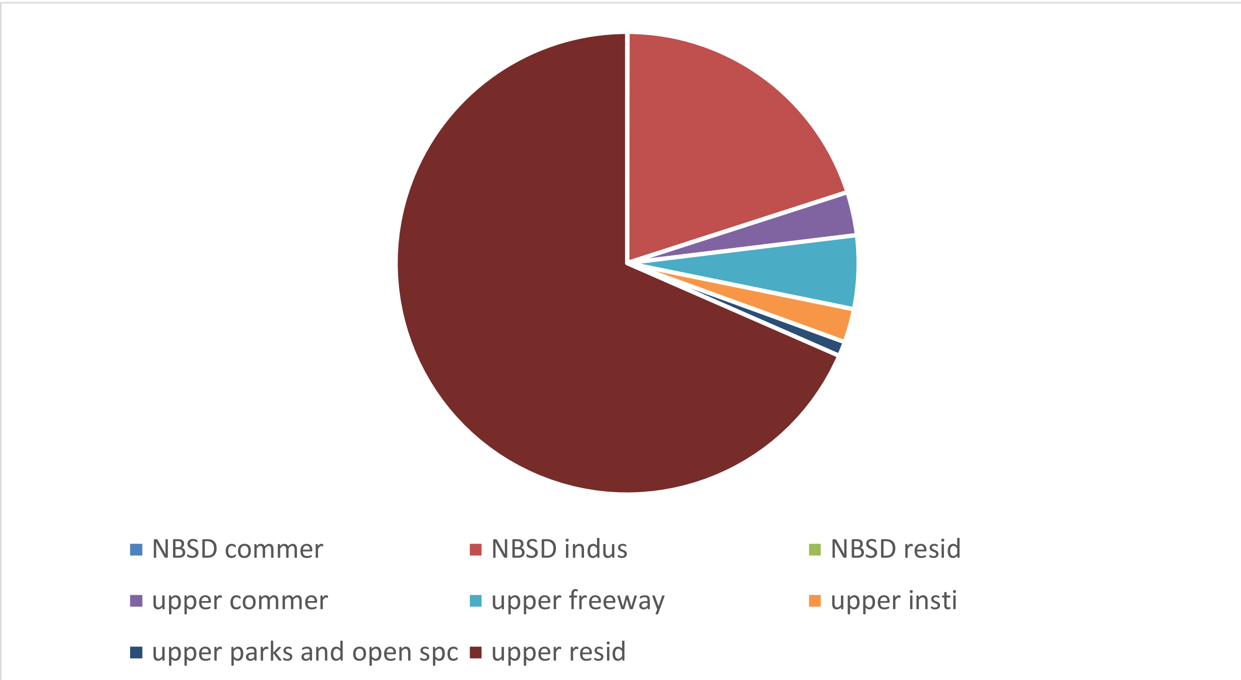


Figure 93. Annual stormwater particulate watershed discharge contributions by land use in the Paleta Creek watershed.

Particle Size Distributions of Constituents and Watershed Area

Figures 94 through 96, also from Appendix K, illustrate the mass contributions by particle range for the monitored constituents. These are from the six NBSD and two upper watershed samples obtained during the two monitored events. The constituents were weighted based on the amount of total particulates found in each size range times the constituent concentrations. The SSC mass has most of the material in the 5 to 20 µm size range, as previously noted, while the upper watershed SSC are more evenly distributed, with substantially more material in the largest particle size. The individual plots indicate that much of the constituents are in the large particle size range. For the NBSD sites, periodic high concentrations were noted in this large size range, likely associated with some large oily debris from the active industrial sites. The upper watershed area was likely affected by watershed erosion and channel scour, with small concentrations. The weighting factors resulted in similarly high contributions for the large size range for both watershed areas for many of the constituents shown below.

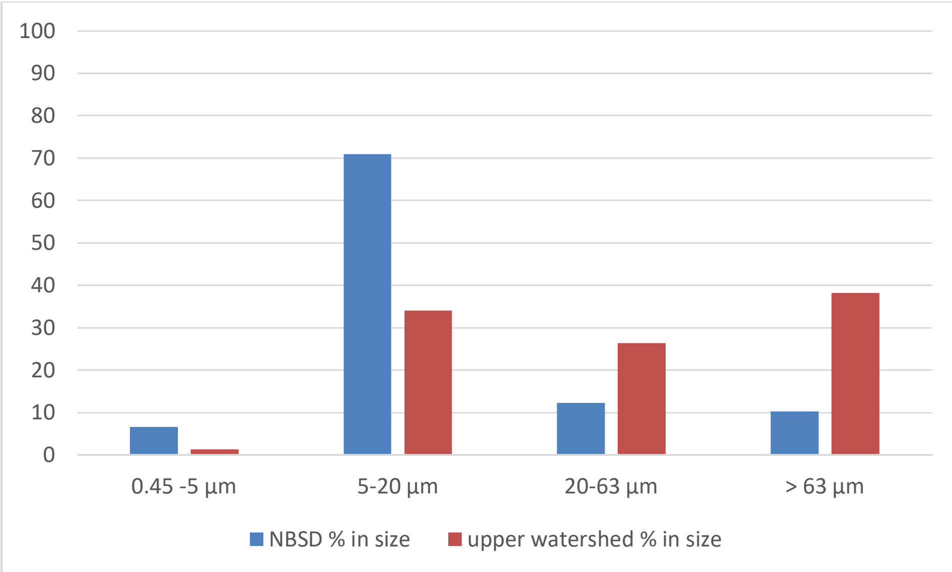
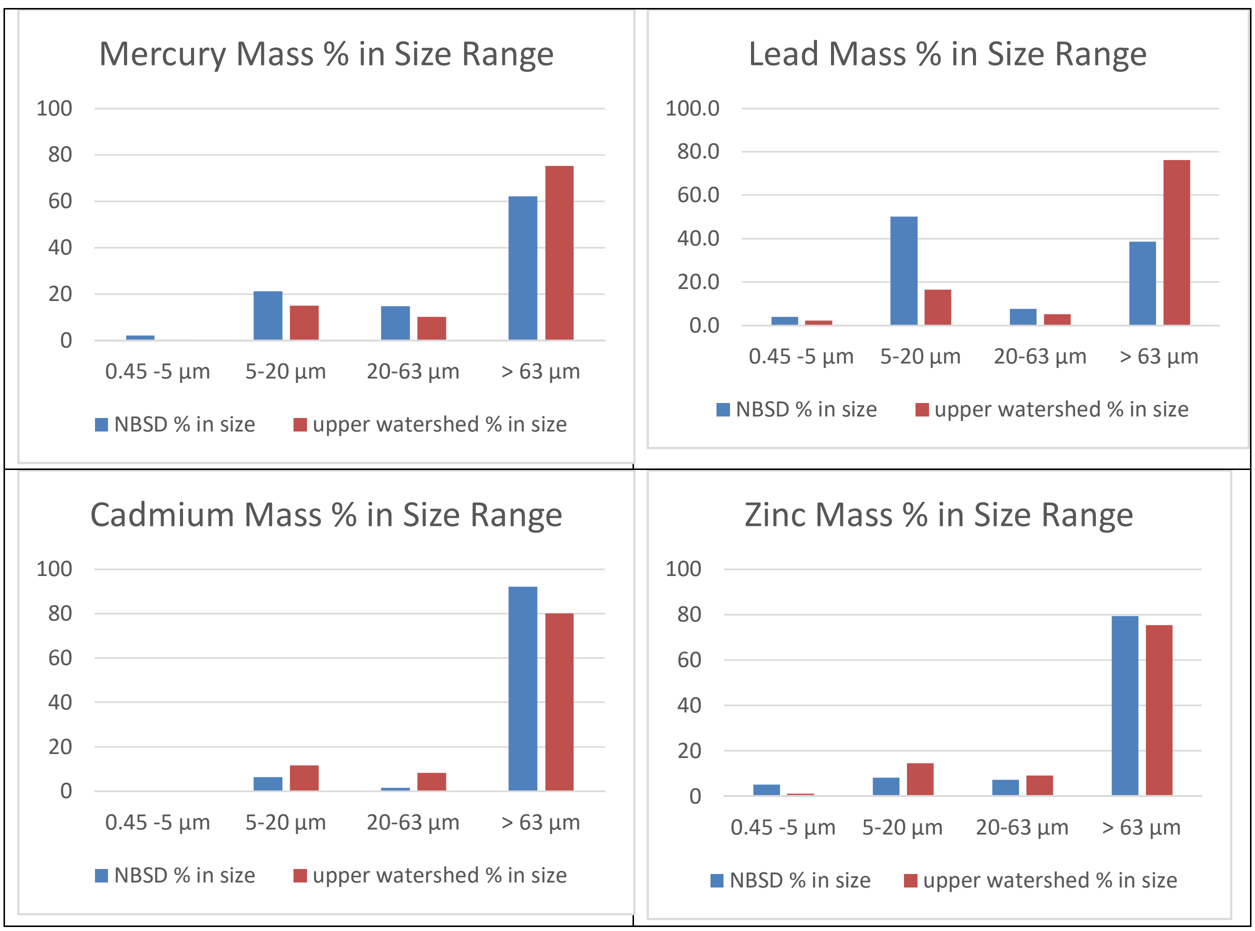


Figure 94. SSC mass (%) in size range by land use in Paleta Creek watershed.



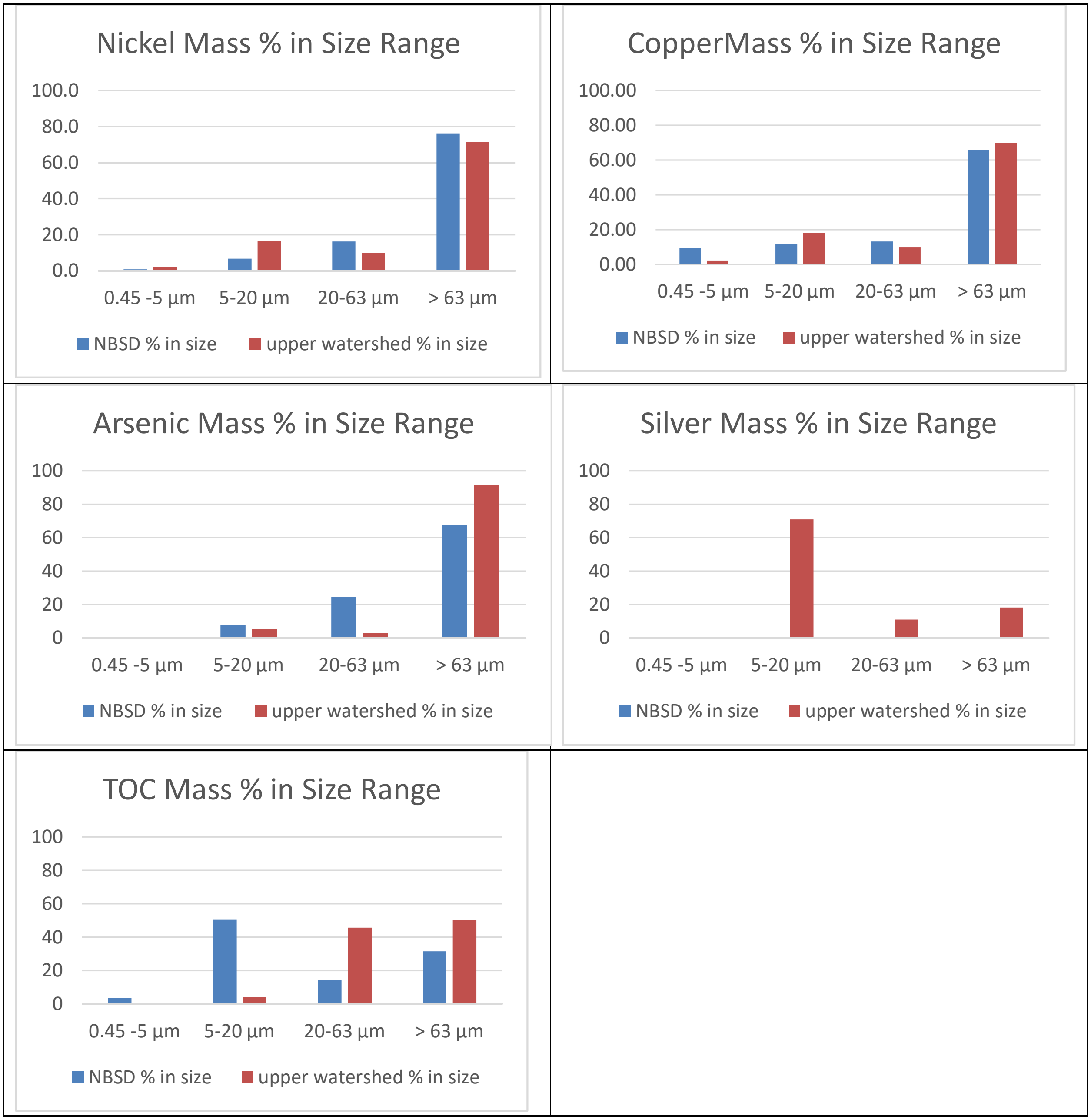
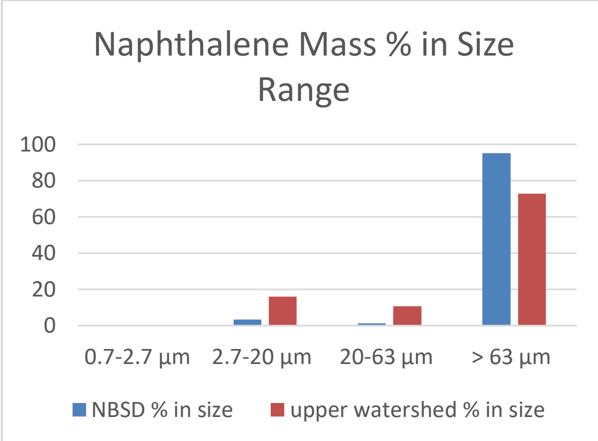
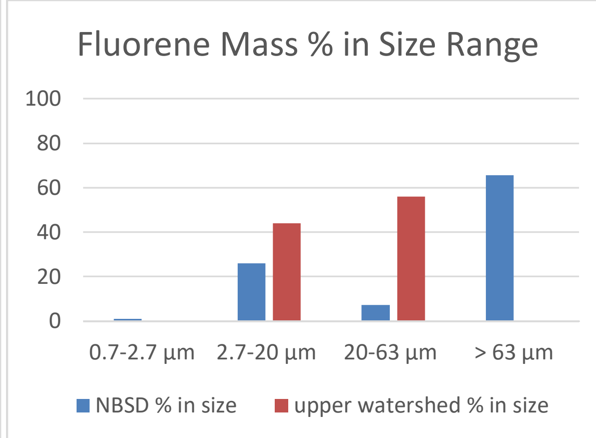
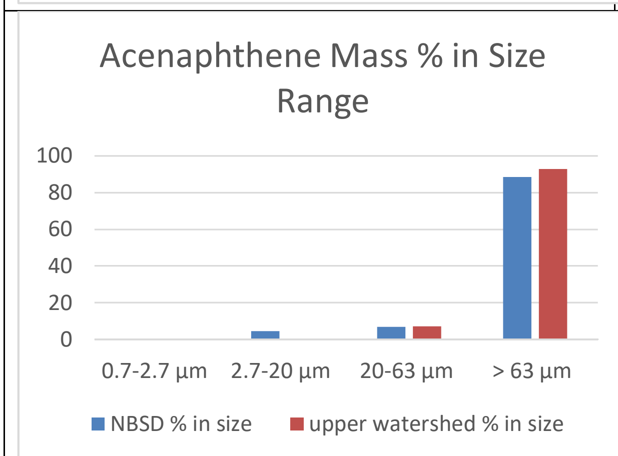
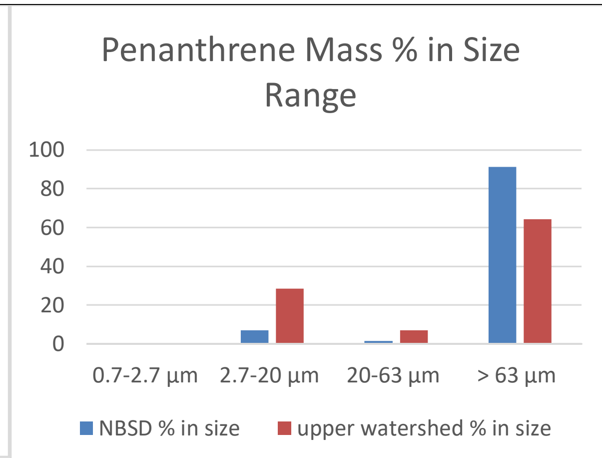


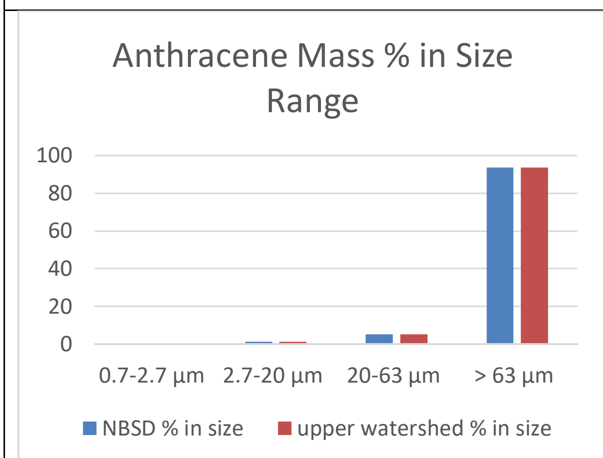
Figure 95. Metal mass (%) discharges by size range and land use in Paleta Creek watershed.

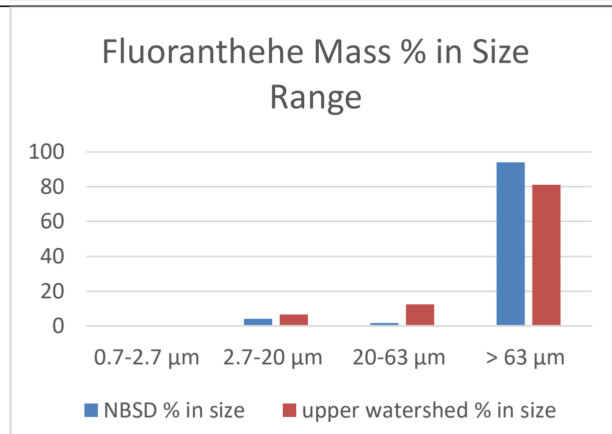

Naphthalene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

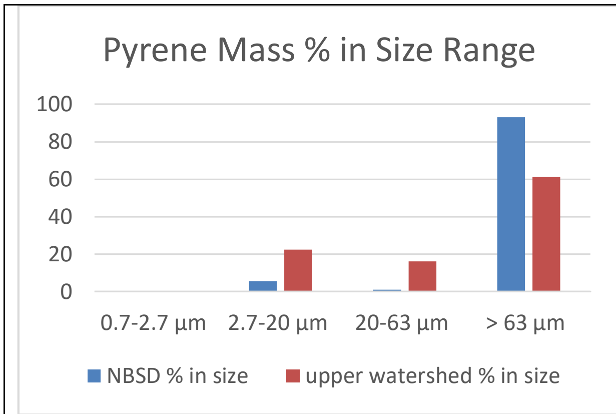

Fluorene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

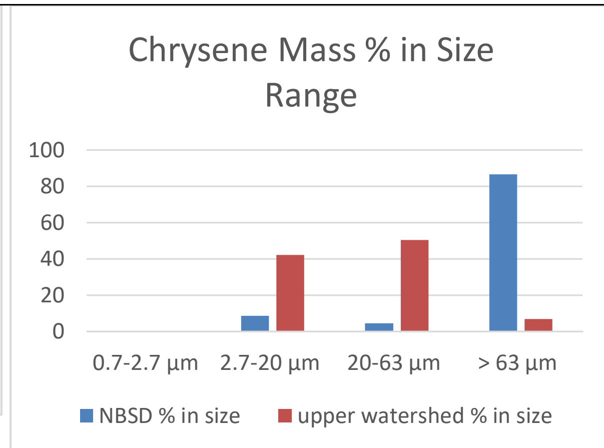

Acenaphthene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

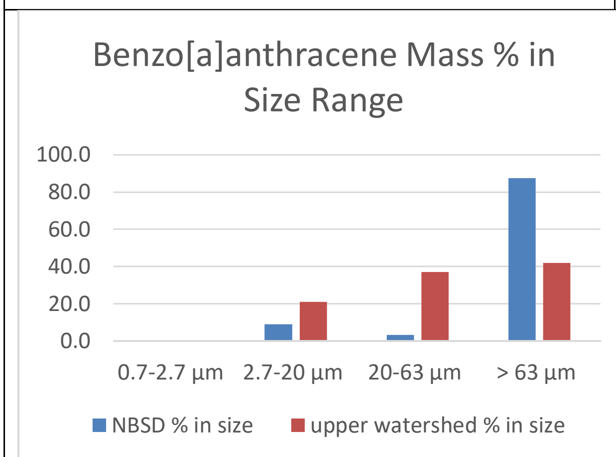

Penanthrene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

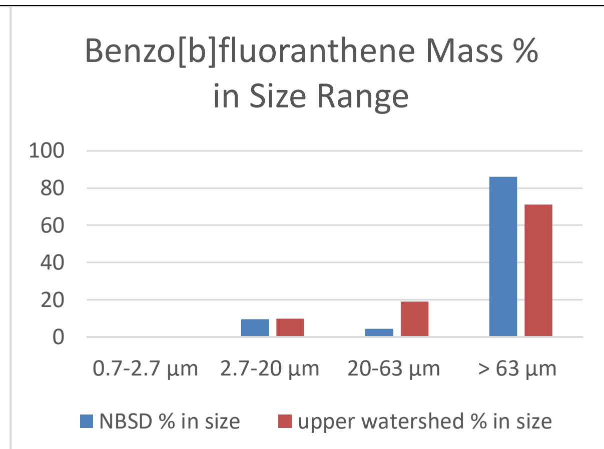

Anthracene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

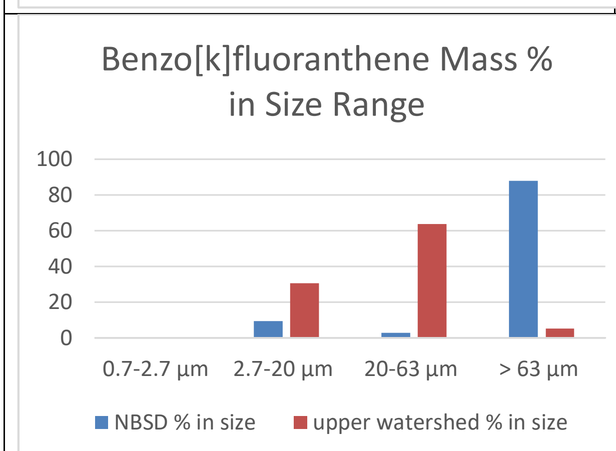

Fluoranthehe Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

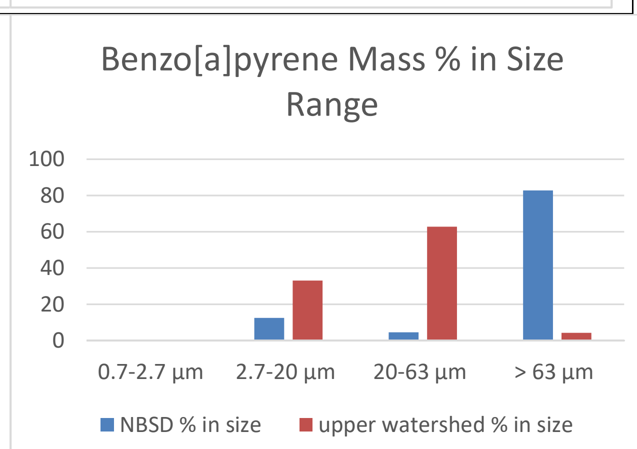

Pyrene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size


Chrysene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size


Benzo[a]anthracene Mass % in Size Range
100.0
80.0
60.0
40.0
20.0
0.0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size


Benzo[b]fluoranthene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size


Benzo[k]fluoranthene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size


Benzo[a]pyrene Mass % in Size Range
100
80
60
40
20
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

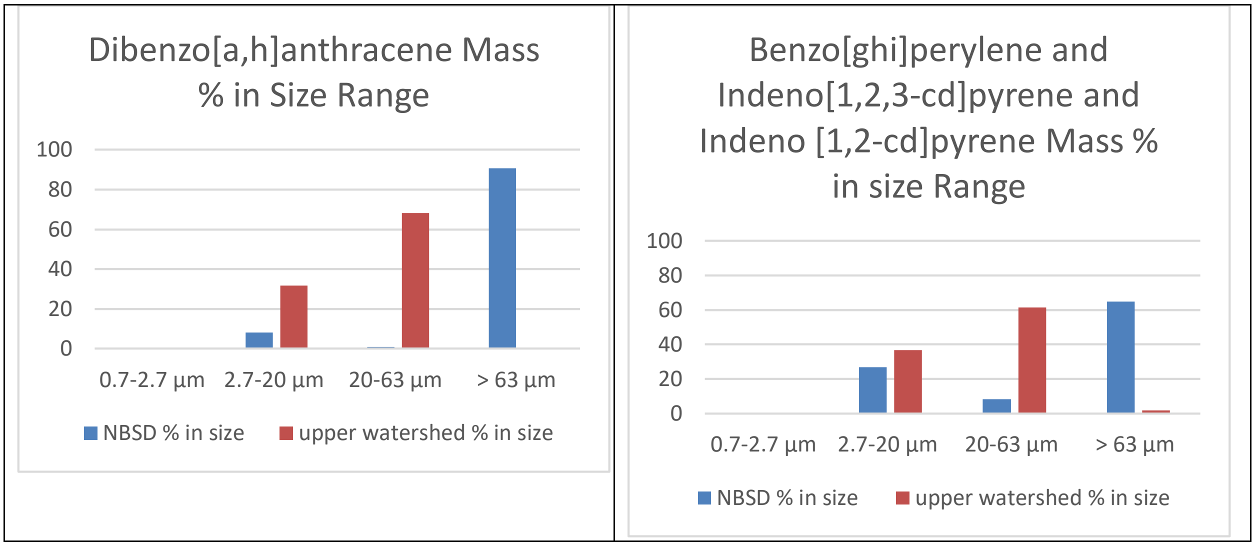


Figure 96. PAH mass (%) discharges by size range and land use in Paleta Creek watershed.

Annual Mass Discharges in Paleta Creek Watershed from NBSD and Upper Watershed Areas

The mass discharges for Paleta Creek subareas for particle size ranges were calculated based on:

1) Particulate strength values were calculated for each of the four particle size ranges for each constituent and sample. These values for the two rain events were separated into three sample groups (NBSD outfalls, upper watershed main channel location, and several samples obtained from the mixed receiving waters) which were averaged for each group. Only the NBSD and upper watershed area data are used for these calculations.

2) The version of WinSLAMM previously calibrated for San Diego naval bases was used to calculate long-term runoff volume and particulate discharges. Twenty-six years of San Diego rains were evaluated for the detailed watershed land uses and development characteristics. The Paleta Creek watershed was extensively surveyed (described earlier) to provide surface source areas (street areas, roof areas, sidewalks, driveways, landscaped areas, parking and storage areas, etc.) and drainage characteristics. The locally calibrated model was then used to calculate the expected annual runoff volume and particulate discharges for specific Paleta Creek and NBSD characteristics.

3) Modeled long-term runoff and particulate discharges were then used with the monitored metal and PAH data for the different sampling locations to calculate the expected long-term particulate pollutant discharges for the upper watershed and NBSD areas. These data were also separated by particle size range, resulting in annual unit area discharges by size range, and for total watershed contributions from these two main land use areas. These data area summarized on Table 83.

There are data uncertainties associated with the values shown on this table. The two rains monitored were for a large and for a small event. These do not completely represent the complete range of rains represented during the long-term modeling simulations, but do cover typical large and small events. The number of samples representing each sample category was small (6 for the NBSD and 2 for the upper watershed), resulting to a lack of representativeness for the complete range of conditions. Therefore, a number of additional statistical analyses were conducted with the data to examine consistent relationships and patterns. In additional, historical data sets for the area were also examined for comparison. Overall, even though the numbers of discrete samples were small, the collective information, supported by other data, indicated the reasonableness of the information. However, small differences between data groups should not be considered important in absence of consideration of likely uncertainties.

Table 83. Calculated Paleta Creek Watershed Discharges for NBSD and Upper Areas and Particle Size Ranges

	NBSD % contr	NBSD yield grams/ha/yr	NBSD yield <20 um, gm/ha/yr	NBSD yield 20 - 63 um, gm/ha/yr	NBSD yield >63 um, gm/ha/yr	upper % contr	upper yield grams/ha/yr	upper yield <20 um, gm/ha/yr	upper yield 20 - 63 um, gm/ha/yr	upper yield >63 um, gm/ha/yr	total watershed part yield	NBSD/upper unit area yield ratio
flow	19.2					80.8					1,089,079	1.52
SSC	20.0	640,906	496,702	78,831	65,372	80.0	398,309	141,001	105,154	152,154	348,675	1.61
Ag	na	na	na	na	na	na	0.081	0.057	0.009	0.014	na	na
As	12.8	43	3.4	11	29	87.2	46	2.6	1.3	42	37	0.94
Cd	27.5	2.6	0.16	0.042	2.4	72.5	1.1	0.12	0.089	0.85	1.0	2.44
Cu	23.2	175	37	23	116	76.8	91	18	8.8	64	83	1.94
Hg	50.9	0.7	0.15	0.097	0.41	49.1	0.10	0.015	0.0099	0.074	0.14	6.65
Ni	18.1	32	2.4	5.1	24.21	81.9	22	4.2	2.2	16	19	1.42
Pb	15.8	72	39	5.4	28	84.2	60	11	3.1	46	50	1.20
Zn	19.7	845	112	63	671	80.3	535	83	49	403	466	1.58
TOC	20.0	53,511	28,896	7,813	16,802	80.0	33,402	1,369	15,231	16,801	29,214	1.60
Acenaphthene	62.5	0.14	0.0067	0.0100	0.13	37.5	0.014	nd	0.00099	0.013	0.025	10.68
Anthracene	50.0	0.24	0.0029	0.013	0.23	50.0	0.038	0.00045	0.0020	0.035	0.053	6.42
Benzo(a)anthracene	46.2	0.35	0.031	0.012	0.30	53.8	0.063	0.013	0.023	0.026	0.082	5.51
Benzo(a)pyrene	49.6	0.38	0.047	0.017	0.31	50.4	0.060	0.020	0.037	0.0025	0.083	6.31
Benzo(b)fluoranthene	26.1	0.74	0.071	0.033	0.64	73.9	0.33	0.032	0.062	0.23	0.31	2.27
Benzo(k)fluoranthene	55.1	0.26	0.024	0.0072	0.23	44.9	0.033	0.010	0.021	0.0018	0.051	7.87
Benzo[ghi]perylene and Indeno	22.6	0.33	0.090	0.027	0.22	77.4	0.18	0.066	0.11	0.0030	0.16	1.88
Chrysene	54.2	0.40	0.035	0.019	0.34	45.8	0.052	0.022	0.026	0.0037	0.080	7.61
Dibenzo[a,h]anthracene	56.3	0.17	0.014	0.0017	0.16	43.7	0.021	0.0067	0.014	nd	0.033	8.26
Fluoranthene	36.2	2.9	0.12	0.052	2.7	63.8	0.79	0.052	0.099	0.64	0.87	3.64
Fluorene	na	na	na	na	na	na	0.15	0.065	0.083	nd	na	na
Naphthalene	49.5	0.27	0.0094	0.0040	0.25	50.5	0.042	0.0070	0.0045	0.031	0.059	6.31
Phenanthrene	50.5	0.42	0.031	0.0071	0.38	49.5	0.064	0.018	0.0045	0.041	0.090	6.55
Pyrene	38.7	1.3	0.071	0.014	1.2	61.3	0.31	0.070	0.050	0.19	0.35	4.06

The NBSD comprises about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges. The NBSD contributions for the other constituents ranged from about 13% to as high as about 63%. The unit area discharges (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area (by up to about 5 times). These increased unit area discharges were mostly associated with a few very high pollutant strength values for some of the NBSD samples (such as outfall #33 for the large sample size fraction). In contrast, some of the upper watershed pollutant strengths had relatively small values associated with the large particle size range. The high values for the large particles from the NBSD samples may be associated with periodic large debris having high metal and PAH values (as also found in industrial stormwater from other areas), while the large particles from the upper watershed area may be more associated with bank erosion and scour in the creek than from contaminated large particles.

About 90% of these annual stormwater discharges are expected to occur during the six month October through March period, with very little discharges occurring during the typically dry summer months.

Fate of Discharged Paleta Creek Stormwater Sediment

Settling rates were calculated using Newton's (turbulent) and Reynold's (laminar) settling equations. For the specific gravities associated with typical stormwater particulates (1.5 to 2.5), turbulent flow would only be associated with particles larger than about 0.5 cm (highly unlikely in stormwater), while laminar flow would be associated with particles smaller than about 100 um (most common). Transitional settling would affect intermediate sized particles, resulting in slightly reduced settling rates compared to laminar settling (but still quite fast). Table 84 summarizes example settling rates (50^{o}F, or 10^{o} C, and freshwater) for stormwater particulates.

Table 84. Calculated Settling Rates and Settling Times for Stormwater Particulates

	settling rates (cm/sec) for		time (min) to settle 10 ft (305 cm)		time (min) to settle 25 ft (762 cm)		time (min) to settle 50 ft (1,520 cm)		time (min) to settle 100 ft (3,050 cm)	
size (um)	1.5 sp gr	2.5 sp gr	1.5 sp gr	2.5 sp gr	1.5 sp gr	2.5 sp gr	1.5 sp gr	2.5 sp gr	1.5 sp gr	2.5 sp gr
0.45	colloidal	colloidal	never	never	never	never	never	never	never	never
5	0.0008	0.0025	6,350	2,032	15,875	5,080	31,750	10,160	63,500	20,320
20	0.006	0.03	847	169	2,117	423	4,233	847	8,467	1,693
63	0.2	0.5	25	10	64	25	127	51	254	102
106	0.3	1	17	5.1	42	13	85	25	169	51
256	2	3	2.5	1.7	6.4	4.2	13	8.5	25	17
1000	10	23	0.51	0.22	1.3	0.55	2.5	1.1	5.1	2.2

Figure 97 plots the approximate settling times needed for the four particle size ranges examined, for 10 ft (3 m) to 100 ft (30 m) water depths.

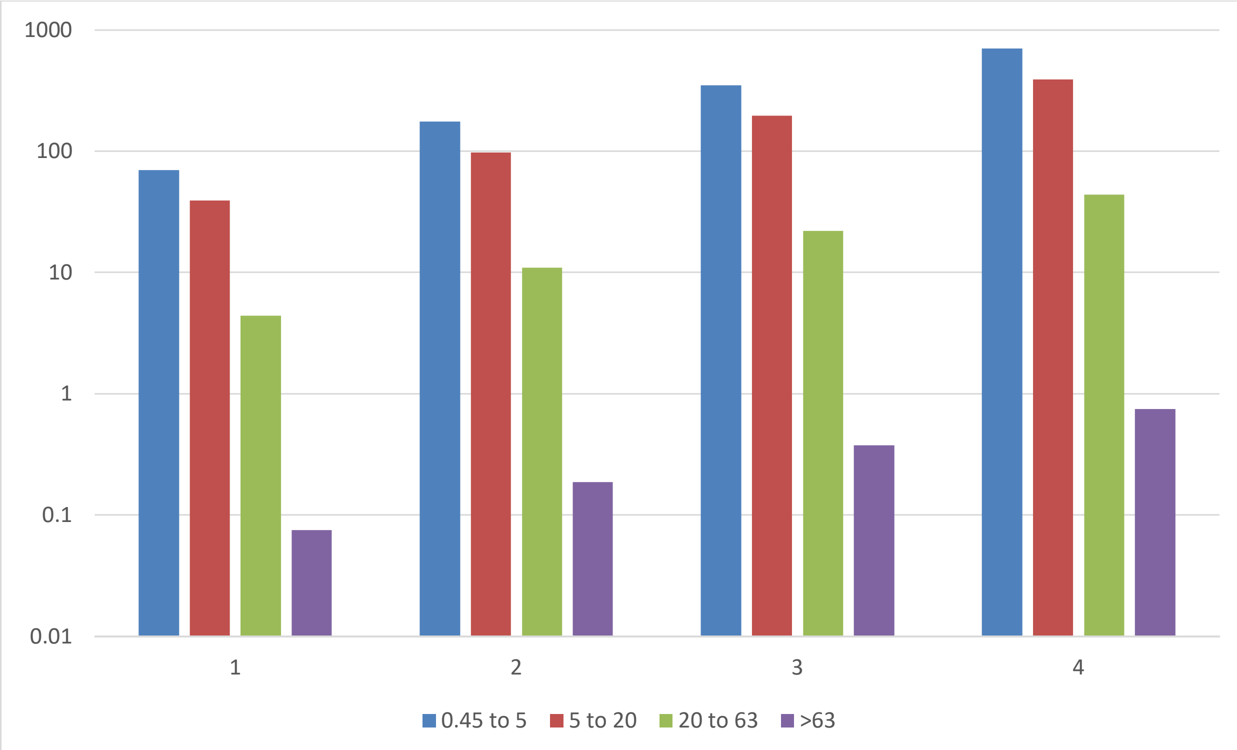


Figure 97. Approximate settling times (hours) for 10, 25, 50, and 100 ft water depths for different particle size ranges.

- Near field effects: The largest particles (>63 µm) would require about 1 hour to settle in 100 ft (30 m) of water, and only about 5 minutes to settle in 10 ft (3 m) of water. These particles have the greatest potential of affecting areas close to the discharge location and would not be widely dispersed.

- Far field effects: The intermediate particles (20 to 63 µm) would require about 50 hours to settle in 100 ft (30m) of water and 5 hours to settle in 10 ft (3 m) of water. These would affect sediments further from the discharge location, or closer, if slow moving and/or shallow water.

- The smallest particles (<20 µm) would require even longer times to settle: about 500+ hrs in 100 ft (30 m) of water and 50+ hours to settle in 10 ft (3 m) of water. Unless impounded, these particles would likely be transported a large distance beyond the discharge location.

Table 85 lists the particulate constituents from the NBSD outfalls that would have more than 75% of their expected mass discharges associated with the large particle size category (>63um) that would affect nearby locations.

Table 85. NBSD Particulate Constituents having more than 75% of Expected Annual Mass Discharges in >63 µm Particle Size Category

Cd
Ni
Zn
Acenaphthene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Chrysene
Dibenzo[a,h]anthracene
Fluoranthene
Naphthalene
Phenanthrene

Similarly, Table 86 lists the particulate constituents from the upper watershed that are expected to have more than 75% of their annual mass discharges associated with the large particle size category (>63um) that would affect the nearby locations.

Table 86. Upper Watershed Particulate Constituents having more than 75% of Expected Annual Mass Discharges in >63 µm Particle Size Category

As
Hg
Pb
Zn
Acenaphthene
Anthracene
Fluoranthene

Section 6: Observations from other Regional and NBSD Stormwater Monitoring Activities

The following subsection reviews some of the stormwater information collected and analyzed during prior NBSD facility projects, along with a review of a large Southern California stormwater monitoring and evaluation project.

Southern California Coastal Water Resources Project Report Summary

Appendix L contains a summary of the Southern California Coastal Water Resources report: Stein, E.D., L.L. Tiefenthaler, and K.C. Schiff. *Sources, Patterns and Mechanisms of Storm Water Pollutant Loading from Watersheds and Land Uses of the Greater Los Angeles Area, California, USA*. Southern California Coastal Water Resources Project. Costa Mesa, CA. Technical Report 510, March 2007. This project conducted a stormwater sampling program from 2000 through 2005.Samples were measured over the entire storm durations from eight different land use types during 11 storm events in five watersheds in the greater Los Angeles, CA region. They also collected samples from mass emission sites (streams draining multiple land uses and large drainage areas).

The regional data contained in this SCCWRP report (Stein, *et. al*, 2007) is a very important data set for southern California stormwater quality characteristics. The findings associated with these data are also interesting and of interest for comparison with other regional data and the NBSD SERDP data. Some of the SCCWRP conclusions of most interest to the SERDP report are as follows:

- All constituents were strongly correlated with total suspended solids. Land use had a strong influence on constituent concentrations. Total suspended solids (TSS) was strongly correlated with constituent EMCs at most land use sites, although not all correlations were statistically significant.

- Land use based sources of pollutant concentrations and fluxes varied by constituent. No single land use type was responsible for contributing the highest loading for all constituents measured.

- The Los Angeles region contributed a similar range of storm water runoff pollutant loads as that of other regions of the United States.

- Peak concentrations for all constituents were observed during the early part of the storm. For all storms sampled, the highest constituent concentrations occurred during the early phases of storm water runoff with peak concentrations usually preceding peak flow.

- The magnitude of a mass first flush effect at land use sites was a function of watershed size. Management strategies aimed at capturing constituent loads should focus on more than just the initial portion of the storm at moderate to large catchments.

- Highest constituent loading was observed early in the storm season with intra-annual variability driven more by antecedent dry period than amount of rainfall.

They also had a series of recommendations, including: further research is needed to directly assess the relationship between constituent concentrations and particle-size distributions in storm water runoff, which is supported by the NBSD SERDP results.

Data from this report was analyzed and compared to the monitoring results from this SERDP project. Figure 98 shows the correlations between TSS and Total PAHs.

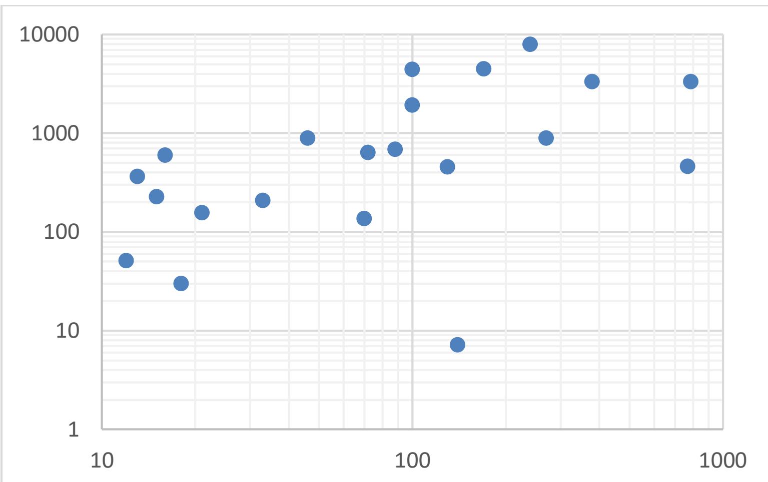


Figure 98. Correlation between TSS (x axis) and Total PAHs (y axis) (adjusted R^2 = 0.88; P-value: <0.001, slope coefficient: 1.37 (1.19 to 1.55)).

Multivariate analyses identified a number of close correlations between the measured constituents as shown in the Cluster analysis dendogram (Figure 99).

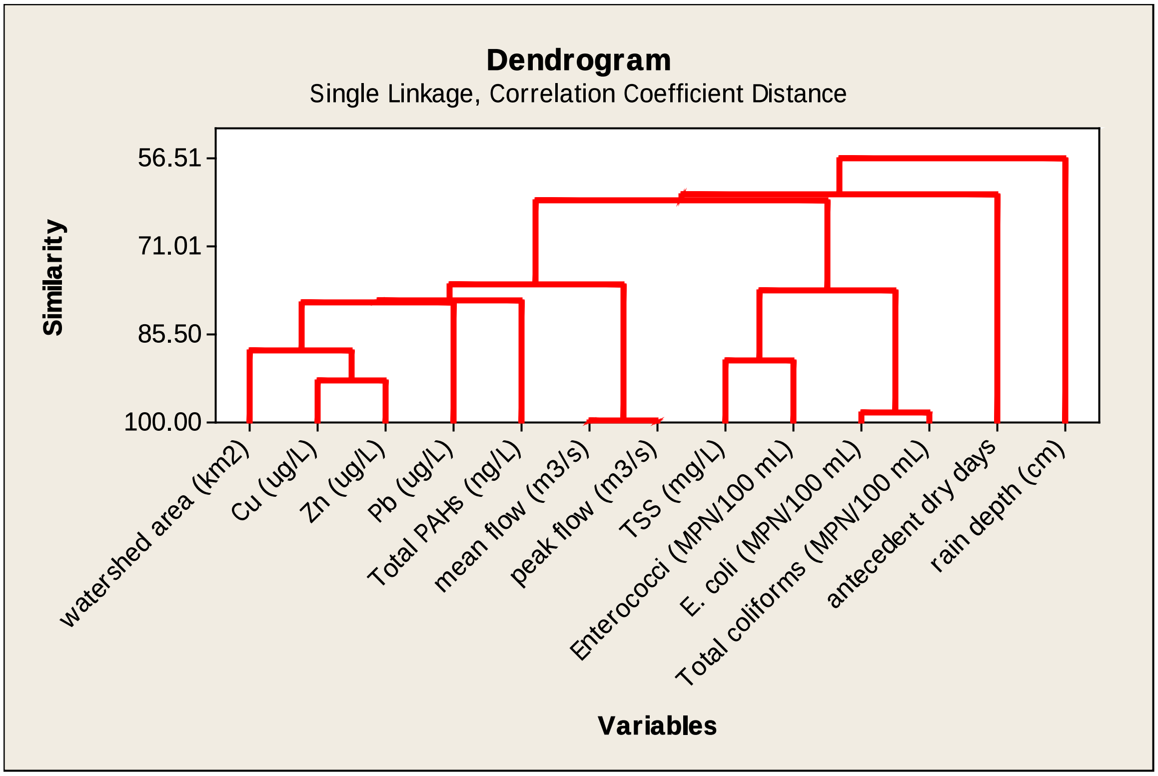


Figure 99. Simple and complex relations for monitored stormwater constituents from the SCCWRP report (Stein, *et. al*, 2007).

Stormwater concentrations from the different land uses were evaluated using Kruskal-Wallis One Way Analysis of Variance on Ranks tests. Figure 100 is a grouped box and whisker plot for TSS showing the overlapping observed concentrations from most land use categories.

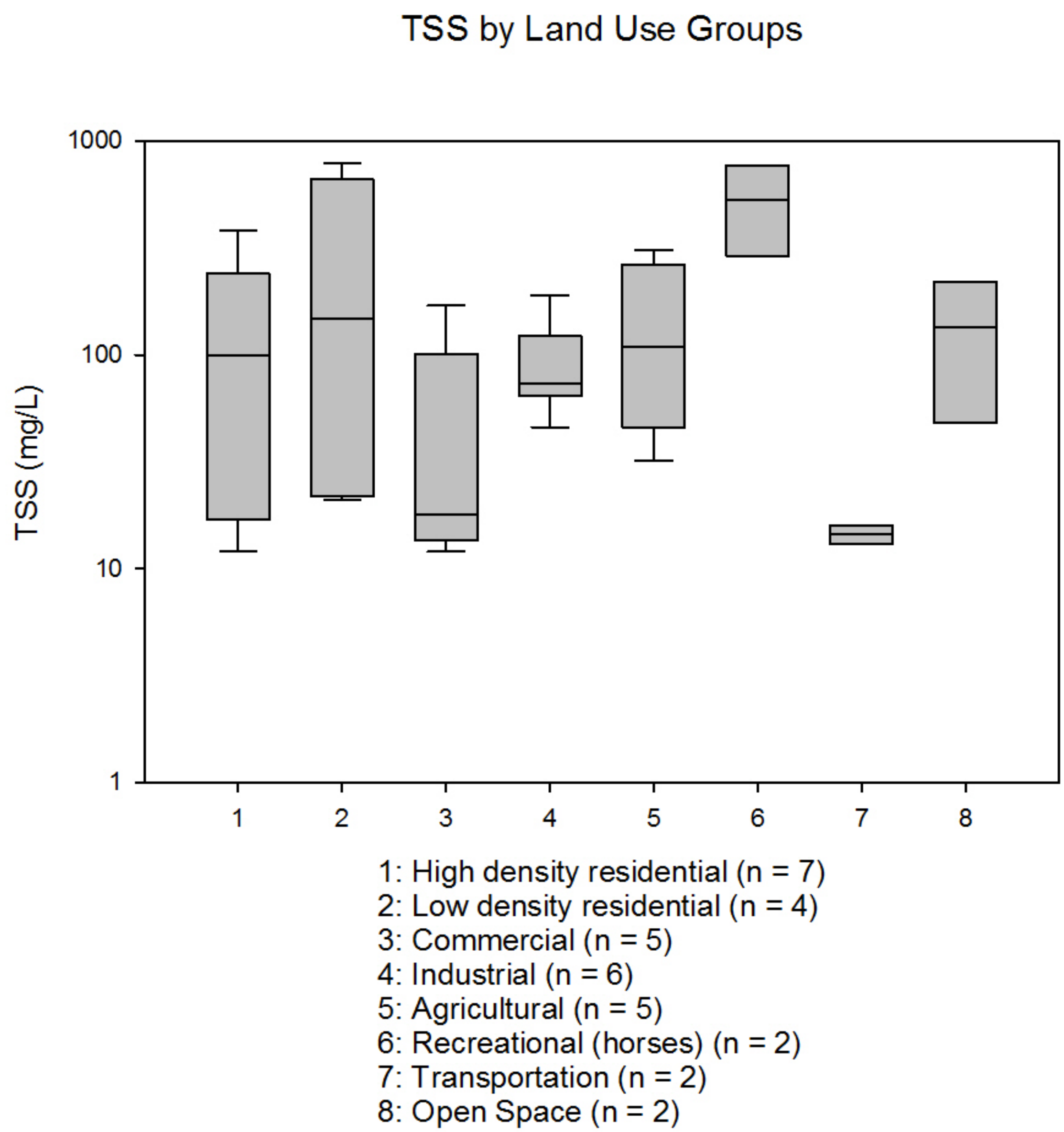


Figure 100. TSS concentrations for different land use categories.

There were no significant differences observed for these TSS data, due to the overlapping data ranges and the relatively small number of observations. In contrast, lead concentrations were found to be significantly different from the different land uses (P = 0.02), as illustrated in Figure 101. However, the all pairwise multiple comparison procedure (Dunn's Method did not identify and land use pairing that was significantly different for the number of samples available.

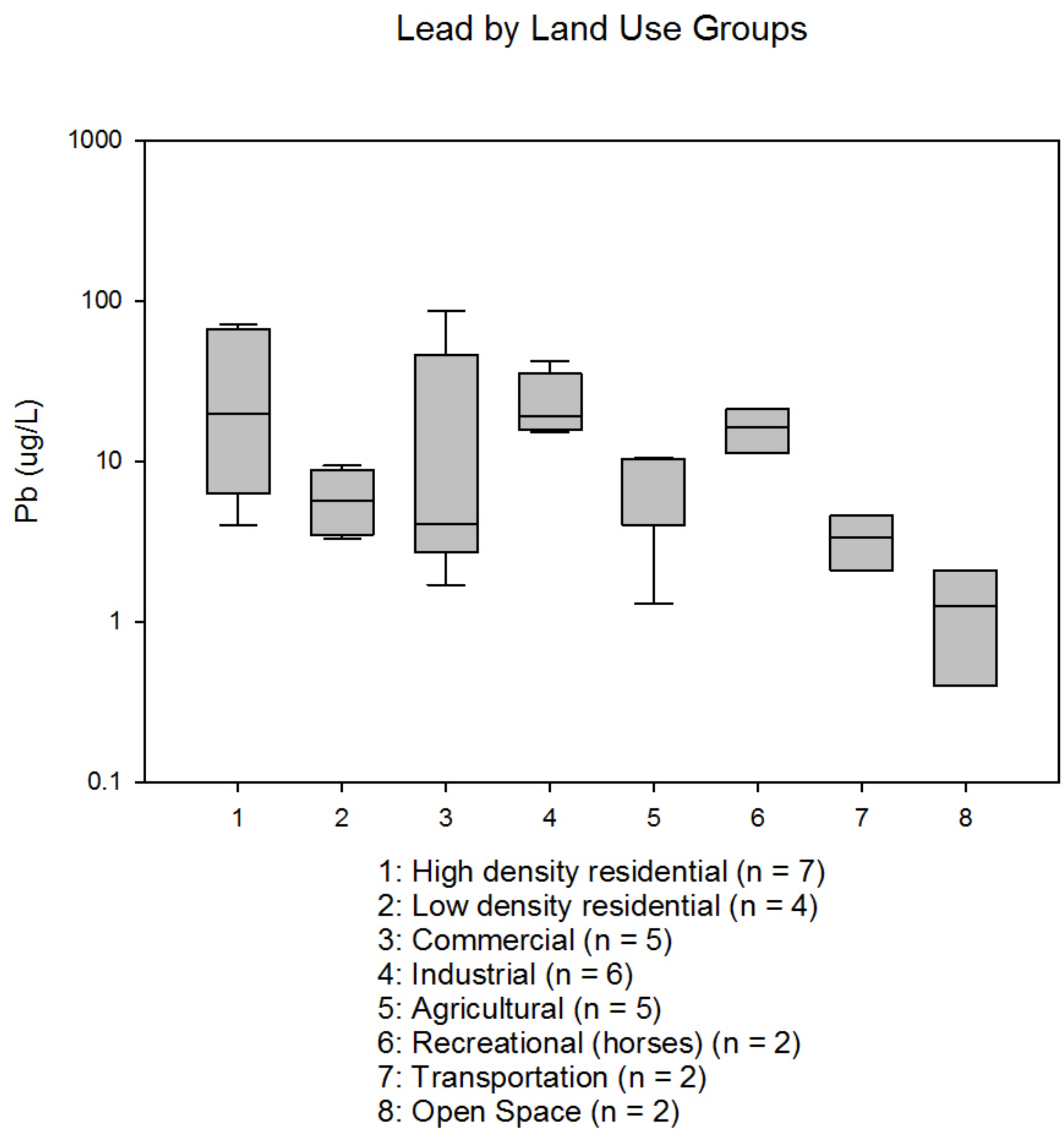


Figure 101. Likely significant differences in lead stormwater concentrations from different land use categories.

Zinc had significant differences between industrial and open space areas (P = 0.02) and between industrial and low density residential areas (P = 0.05), as shown on Figure 102.

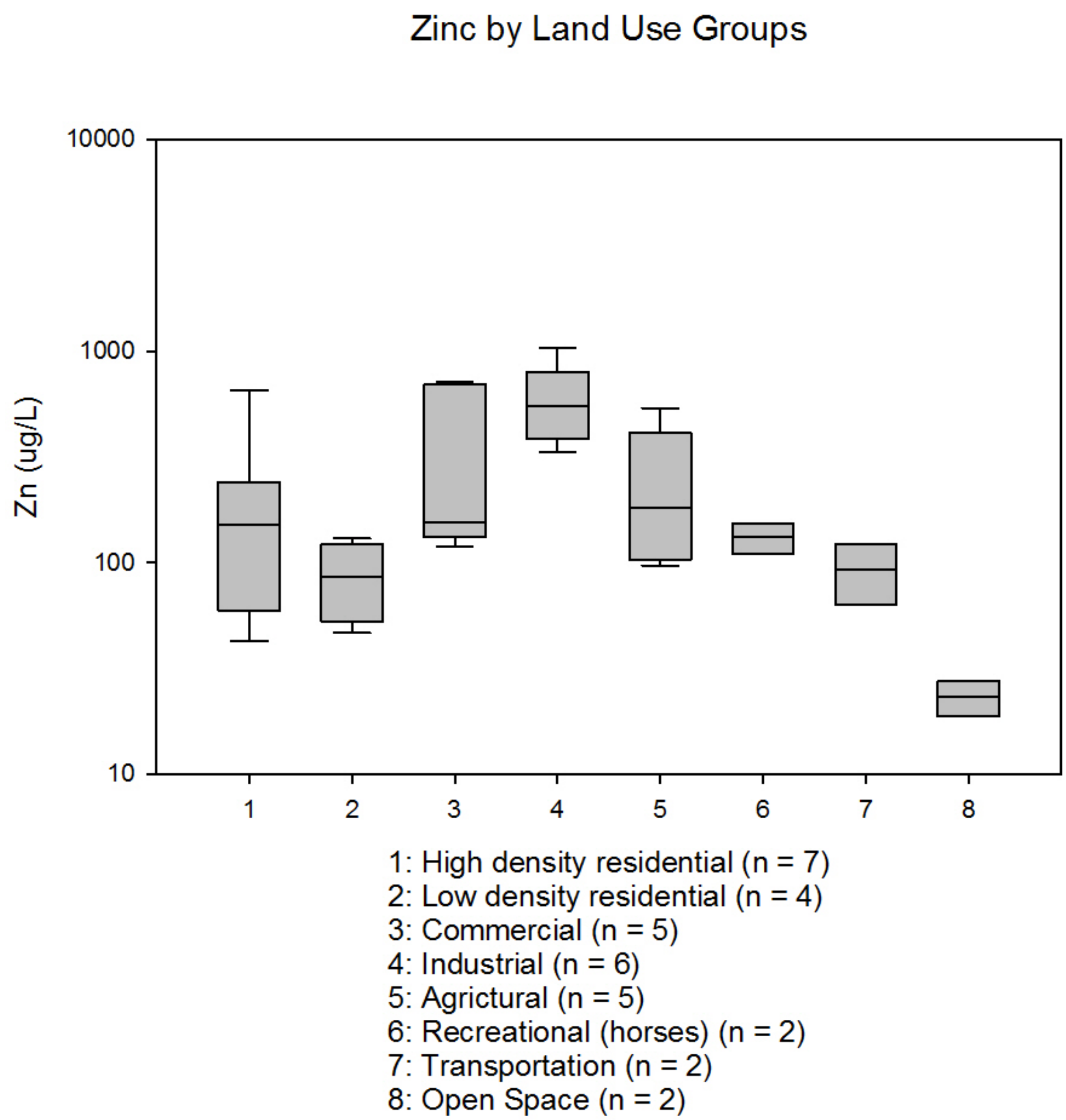


Figure 102. Zinc differences between land use categories.

Total PAHs were not found to have any significant differences between the land uses, as shown on Figure 103 (P = 0.98).

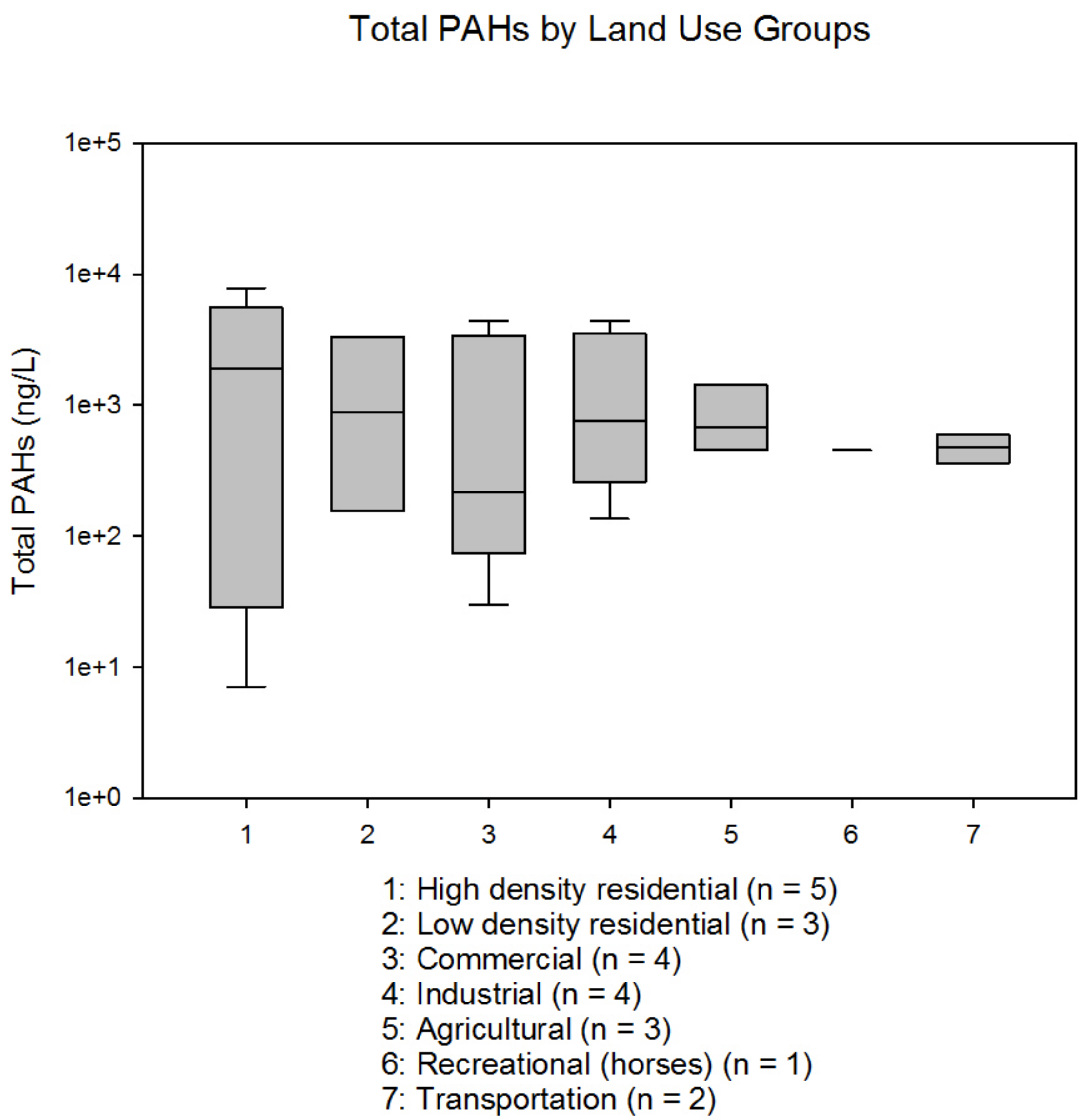


Figure 103. Total PAHs by land use (no significant differences found).

First-Flush vs. Composite Stormwater Quality at NBSD

The stormwater quality data from the San Diego Naval Base monitoring locations for 2013 were reviewed, comparing TSS, total and dissolved copper, and total and dissolved zinc concentrations obtained during event first flushes to the same event sampled as a whole event composite. Only the dry side sites, shown in Table 87, had these concurrent data; the subase pier monitoring locations did not have any paired data. Only one to three paired sample sets were available for each site, so the data from the seven events were combined as there was insufficient data to compare these relationships for the individual locations. The rain totals ranged from 0.01 to 1.02 inches (based on the nearby San Diego International Airport rainfall monitoring location). The non-parametric sign test for paired data was used to determine the significance of the observed differences in the concentrations of these paired data groups.

Table 87. Dry Side 2013 Monitoring Locations at San Diego Naval Base having First Flush and Composite Data

OF51:	High density residential and big box commercial
OF70:	High density residential and big box commercial
OF72:	High density residential (small portion) and big box commercial (mostly)
OF73:	Big box commercial (mostly parking)

The first flush TSS concentrations averaged about 3.6 times the composite values, with a moderate significance (p = 0.06), considering the number of sample pairs available. The copper data (also with p values of 0.06) had concentrations ratios of about 3.1 and 2.6 for total and dissolved copper, respectively. The total and dissolved zinc paired concentration values (significant p = 0.01), with all 7 first flush concentrations greater than the composite concentrations. The concentration ratios were higher than for the copper values, being about 4.1 and 5.3 for total and dissolved zinc respectively.

Stormwater Quality Variations by Seasons at San Diego Naval Monitoring Locations

Southern California stormwater managers frequently observe significant "seasonal first-flushes" when the initial rains of the year have larger concentrations compared to other rains later in the rainy season, and may account for much of the total rain year stormwater discharges. The rain year normally starts in the late fall and extends into the spring. Pollutant concentrations at the San Diego Naval Base monitoring locations for October and November were compared to the other months, with non-paired Wilcoxon rank-sum p tests comparing the two concentration groups. Data from the earlier Navy WinSLAMM analyses that focused on naval industrial monitoring locations (outfalls 26, 14, 1, 13, and 9) examined TSS. The more recent monitoring period at the Navy dry side monitoring locations (residential, commercial, and institutional) examined TSS, dissolved and total Cu, and dissolved and total Zn. Pier outfall data for TSS, dissolved and total Cu, and total Zn were also compared by season.

The results for the earlier monitored naval industrial sites do not indicate any significant differences for the available TSS data. The concentration ratios are also not indicative of higher concentrations for the early monitored events (the largest ratio was only 1.18 for TSS at OF1, for example). Outfall 9 had a p value of 0.07, therefore being marginally significant, but the October and November TSS concentrations were much smaller than the later event TSS concentrations. The data for the dry side locations found that only dissolved zinc had a statistically significant difference between the two data groups, while total copper and total zinc had p values of 0.06 and 0.07 respectively, indicating a marginal level of significance. Much larger concentrations were seen during the early monitoring period compared to later rains for the dry side locations. The pier monitoring locations showed similar results as the earlier naval industrial site data; only one condition (TSS) had marginally significantly different concentrations, but the early season data appears to have much lower concentrations than the later season observations.

It is likely that the dry side (residential, commercial, and institutional land uses) have significant seasonal first flush conditions. However, there is no supporting information in the data from the naval industrial data sets supporting seasonal first-flushes from these land uses. It is thought that the highly varying site activities during the different industrial monitoring years caused a greater variability than the seasonal differences, effectively obscuring any seasonal first flush patterns.

WinSLAMM Calibration Results

WinSLAMM is an urban stormwater watershed model that has been demonstrated for use at Navy facilities to characterize sources of copper and zinc in storm runoff at Navy facilities in 2014 (Katz, *et al.* 2014). During this earlier Navy project, WinSLAMM was optimized and calibrated specifically for Navy facilities using Navy-specific drainage characteristics and stormwater datasets. The model calibration was based on a comparison of over 300 stormwater datasets and detailed site characterizations from 19 drainages on 11 Navy Bases in the Southwest, Northwest, and Mid-Atlantic regions of the US ranging in size from 1 to 1400 acres. The model generated reasonable results though with a relatively high degree of variability that was primarily a result of first-flush (first hour of runoff) stormwater data, the most common data collected across the country as well as unknown changes in operations and land uses over time.

The calibration process started with the San Diego “dry side” locations and data, and the files were then used with the industrial area data for the “wet side” locations having mostly industrial land uses. After this calibration effort, the Virginia locations were calibrated (all naval industrial land uses) based on the regional WinSLAMM land use calibration data (based on the National Stormwater Quality Database), but adjusted using the locally naval base collected information and data. The Puget Sound calibration effort started with mixed land use areas for the residential and commercial/institutional land uses, and then used the prior industrial area calibration files from the first navy project phase with the other locations.

The first calibration activities focused on the TSS data at each location and land use. Calibration started with the regional calibration files for the southwest for all land uses besides the industrial areas (which used the initial navy calibrated files). Model runs were conducted using truncated rain files that had the best rain data available corresponding to the events actually monitored at the site. The TSS concentrations and mass loadings were examined for patterns and other relationships to indicate where adjustments were needed. As an example, if the loads for the small events were low, the directly connected impervious areas (locations that generated flows during the small events) were adjusted to closely match the observed loads. Then the complete rain series available was examined and adjustments were then made to the non-paved areas to closely match the observed loads. When multiple sites of the same land use occurred at one area, all of the land use areas were examined and adjusted together to obtain the least sum of squares of the residuals. Basically, the sum of all the event loads for all sites were compared and the ratio of the observed to the calculated load sum was then used as a factor to modify the calibration file data.

Besides the particle concentration file data, changes were also simultaneously made to the street TSS washoff delivery file (as the street runoff TSS load is calculated by the model and does not use a calibration file directly). Therefore, matching the sum of loads for the observed and calculated data sets was the primary calibration objective. When a satisfactory overall match was obtained, further analyses were conducted examining individual event loads and concentration values. Further adjustments were made in an attempt to best represent the overall range and variation in loads and concentrations.

After the TSS calibrations were completed, copper and zinc calibrations were next conducted for both particulate and filtered conditions, starting with mass discharges and then concentrations. After these calibrations were made for the residential, commercial, and institutional land uses, the initial industrial calibration files were used for newer industrial areas for the California and Washington sites. The Virginia industrial calibrations only reflected the most recent data as prior naval facility data were not available for that area.

Figure 104 describes the performance for the TSS mass calibrations. Inconsistent data collection efforts over the years of site monitoring, relatively few data at each location, and lack of historical site activity information likely added to less desirable calibration results for some conditions. However, most of these results are very good and the calibrated model was used to calculate the expected sources of the flows and pollutants.

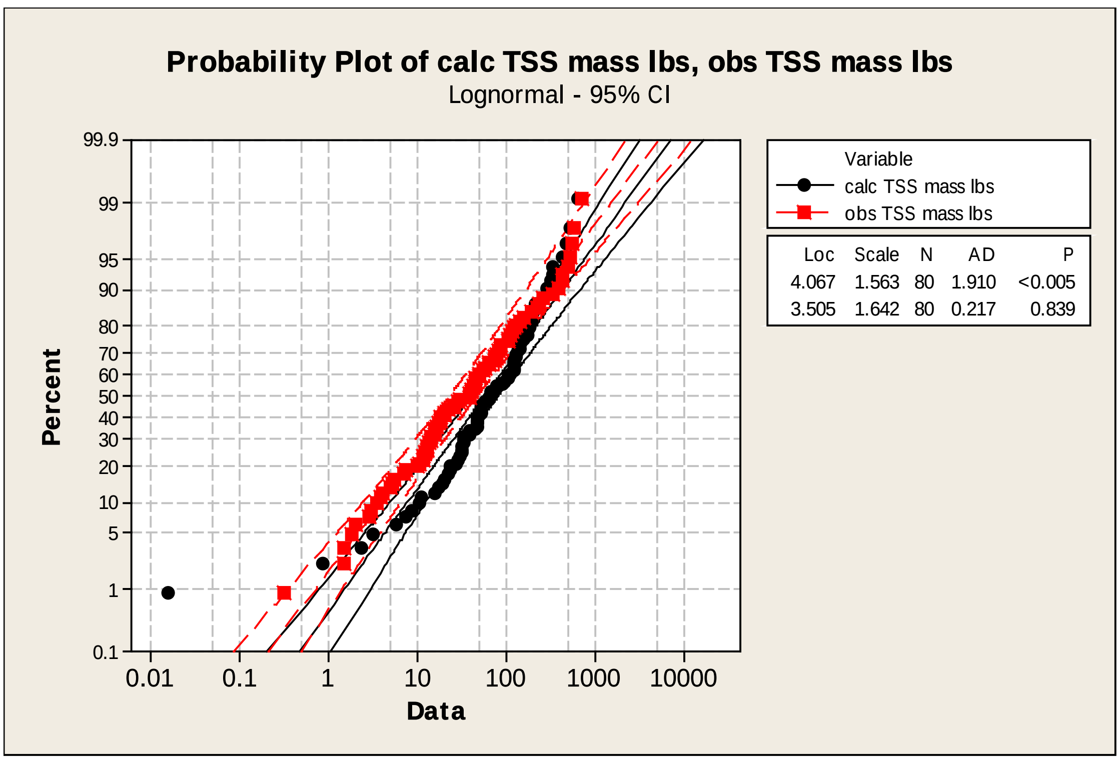


Figure 104. Log-normal probability plot of observed and modeled TSS mass discharges.

This figure shows probability plots for the observed and calculated TSS masses for all sites combined, showing similar and overlapping distributions. The 95% confidence intervals (CI) for each set of data are also shown. Generally, these two data sets overlap (they cross at both the top and bottom of the range and the CI bands are close). These are log-normal probability plots and also indicate how closely the data distributions reflect normal conditions (after being log-transformed). These data sets are not perfectly super-imposed and indicate some bias, especially some over-predictions in calculated TSS mass for some intermediate observed values.

Figures 105 through 107 are scatterplots showing the observed vs. modeled TSS, copper, and zinc loads per event. The scatter in these plots indicate the typical pattern of variation for the data, but overall indicate good data fits.

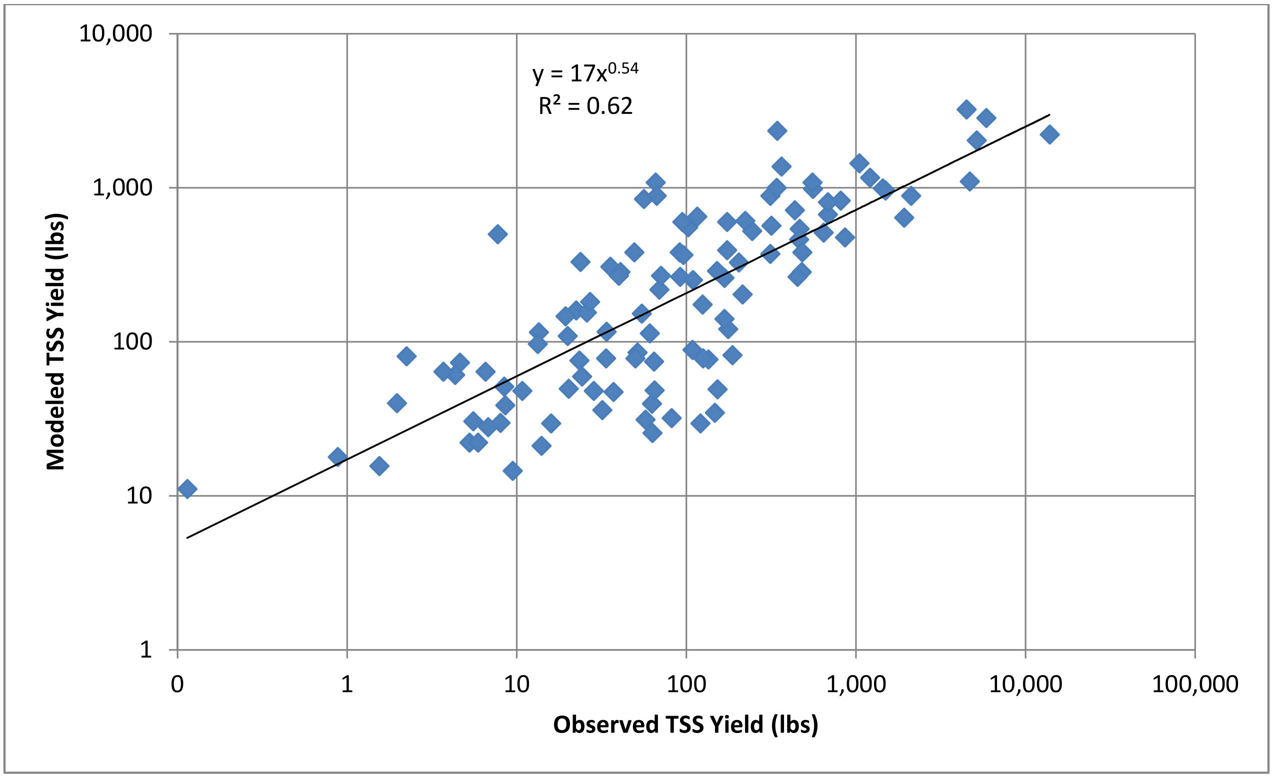


Figure 105. Scatterplot of simultaneous observed and modeled TSS mass discharges.

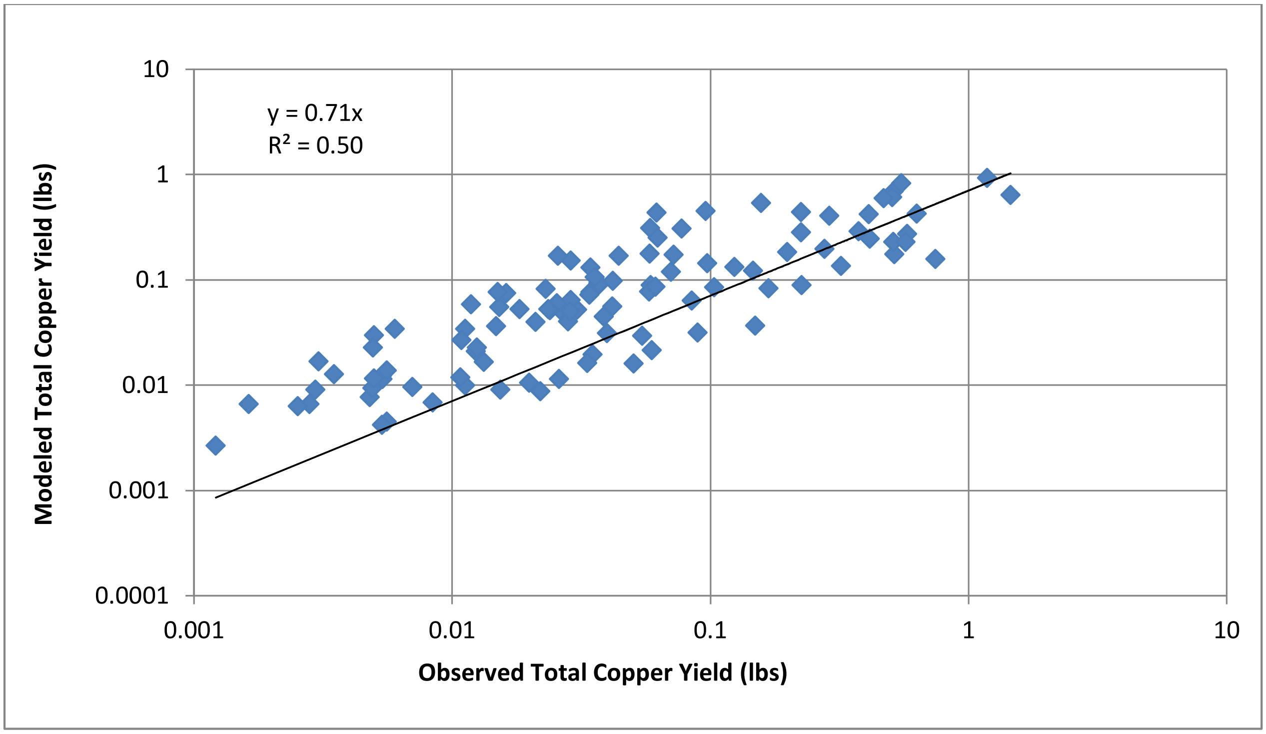


Figure 106. Scatterplot of simultaneous observed and modeled total copper mass discharges.

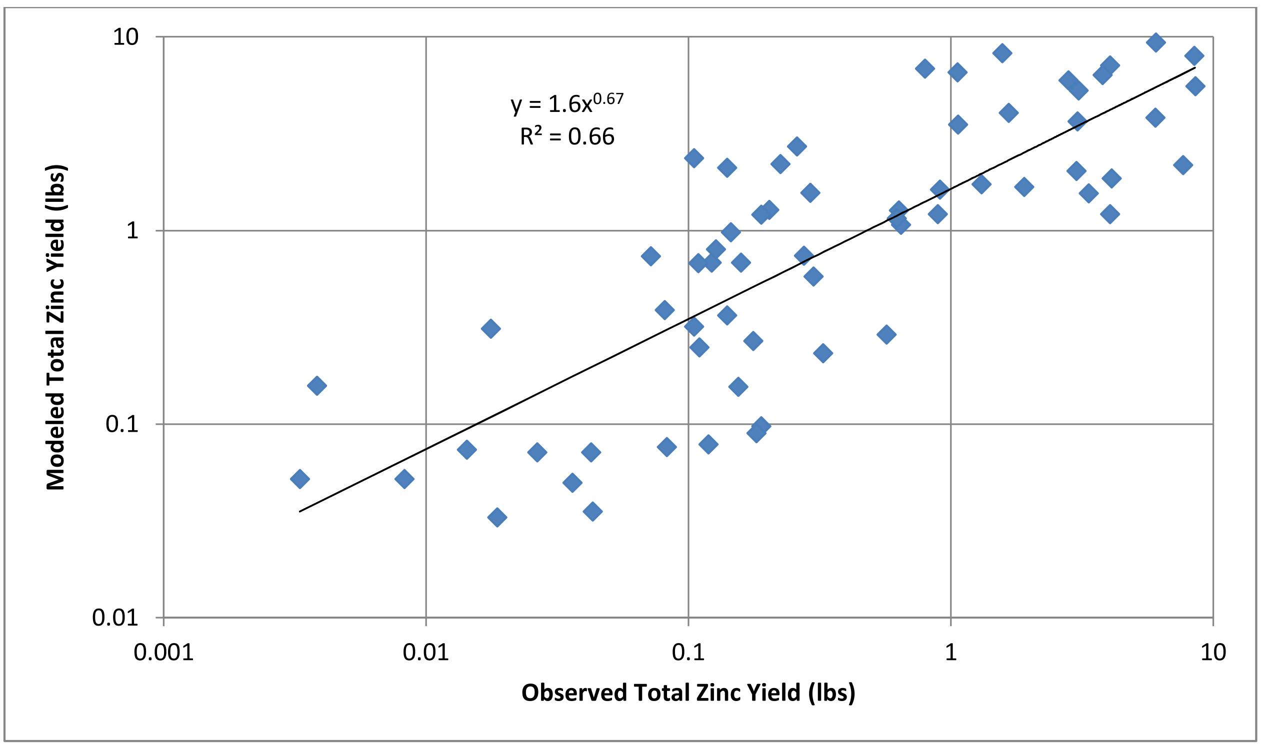


Figure 107. Scatterplot of simultaneous observed and modeled total zinc mass discharges.

Sources of NBSD Stormwater Metals

SPAWARSYSCEN-PACIFIC Navy personnel conducted a series of material washoff tests as part of the earlier stormwater research project. The 79 materials were sorted into the following 16 categories for statistical analyses: aluminum ramp, artificial turf, brick wall, concrete, galvanized metal (bare), galvanized metal (painted), galvanized metal (coated), barge hull, metal (bare), metal (painted), plaster, roof, rubber, wood (bare), wood (painted), and wood (treated). Some of these categories have only a single sample, while others have many.

The data are presented by metal. These data were evaluated in SigmaPlot (version 15) using the non-parametric Kruskal-Wallis one way analysis of variance on ranks to determine if at least one group is significantly different from any of the others. Simultaneously, grouped box and whisker plots were prepared in SigmaPlot for these groups. These results were then used to group the groups into a fewer number of combined groups indicating materials that had low washoff concentrations, high concentrations, and the other categories. Box and whisker plots and Kruskal-Wallis analyses were used to evaluate these categories. Figures 108 through 110 and Tables 88 through 90 are summaries for concentrations from the washoff tests.

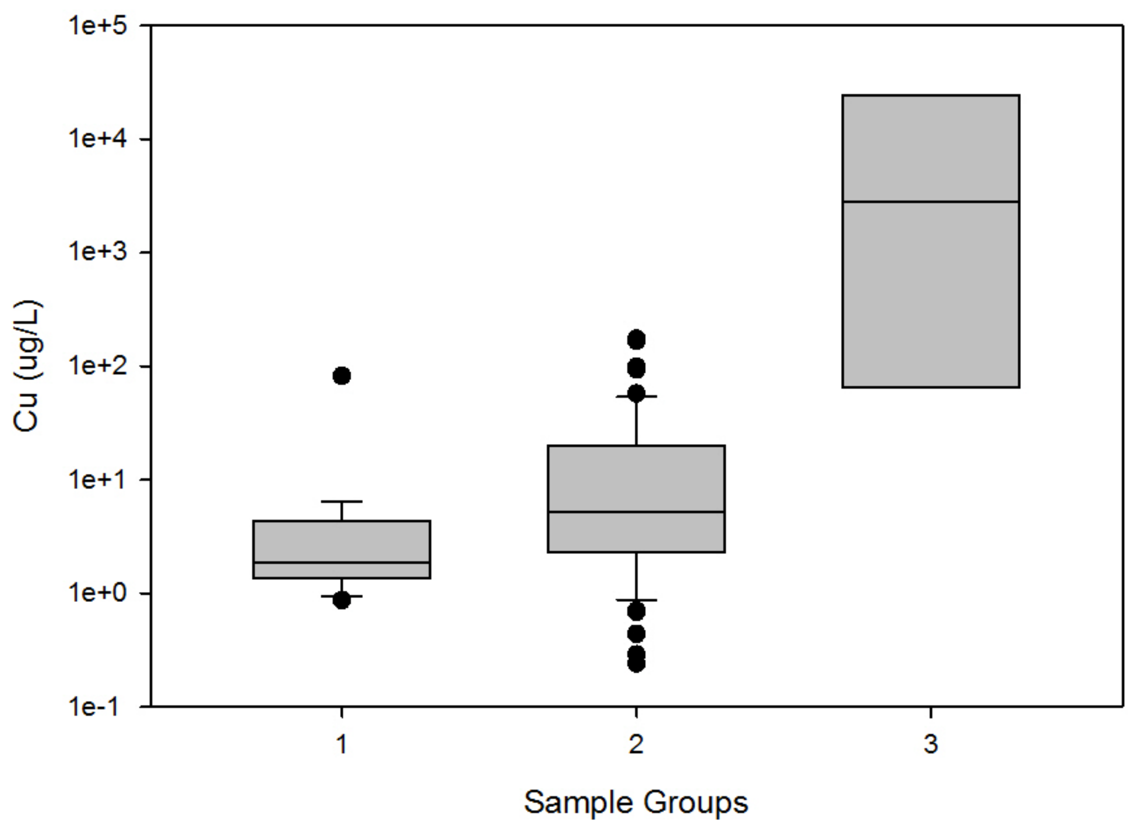


Figure 108. Box and whisker plots showing copper washoff concentrations for three principle groups of materials.

Table 88. Summary Statistics for Copper Concentration Grouped Categories (µg/L)

Grouped category:	low	all others	high
Sample Category in Groups:	Al ramp brick wall concrete plaster roof	artificial turf galv bare galv painted galv coated metal bare metal painted rubber wood bare wood painted	barge hull wood treated
number	19	47	4
min	1	0	27
max	81	174	30334
average	7	21	8989
median	2	4	2798
st dev	18	39	14449
COV	2.7	1.8	1.6

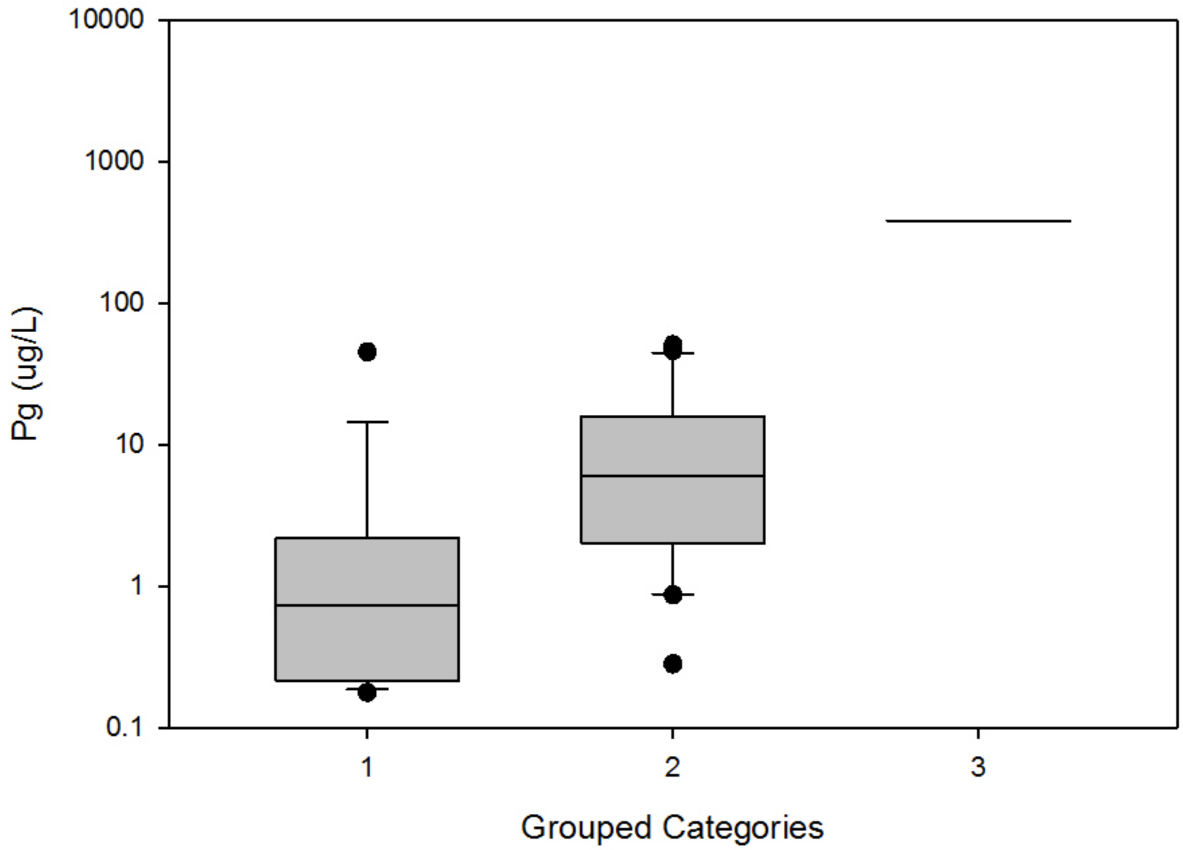


Figure 109. Box and whisker plots showing lead washoff concentrations for three principle groups of materials.

Table 89. Summary Statistics for Lead Concentration Grouped Categories (µg/L)

Grouped category:	low	others	high
Sample Category in Groups:	brick wall metal painted roof wood treated	Al ramp artificial turf concrete galv bare barge hull metal bare rubber wood bare	galv painted
number	17	21	2
min	0.2	0.3	1.5
max	45.3	50.7	764.0
average	3.9	12.4	382.8
median	0.7	6.0	382.8
st dev	10.8	15.7	539.2
COV	2.7	1.3	1.4

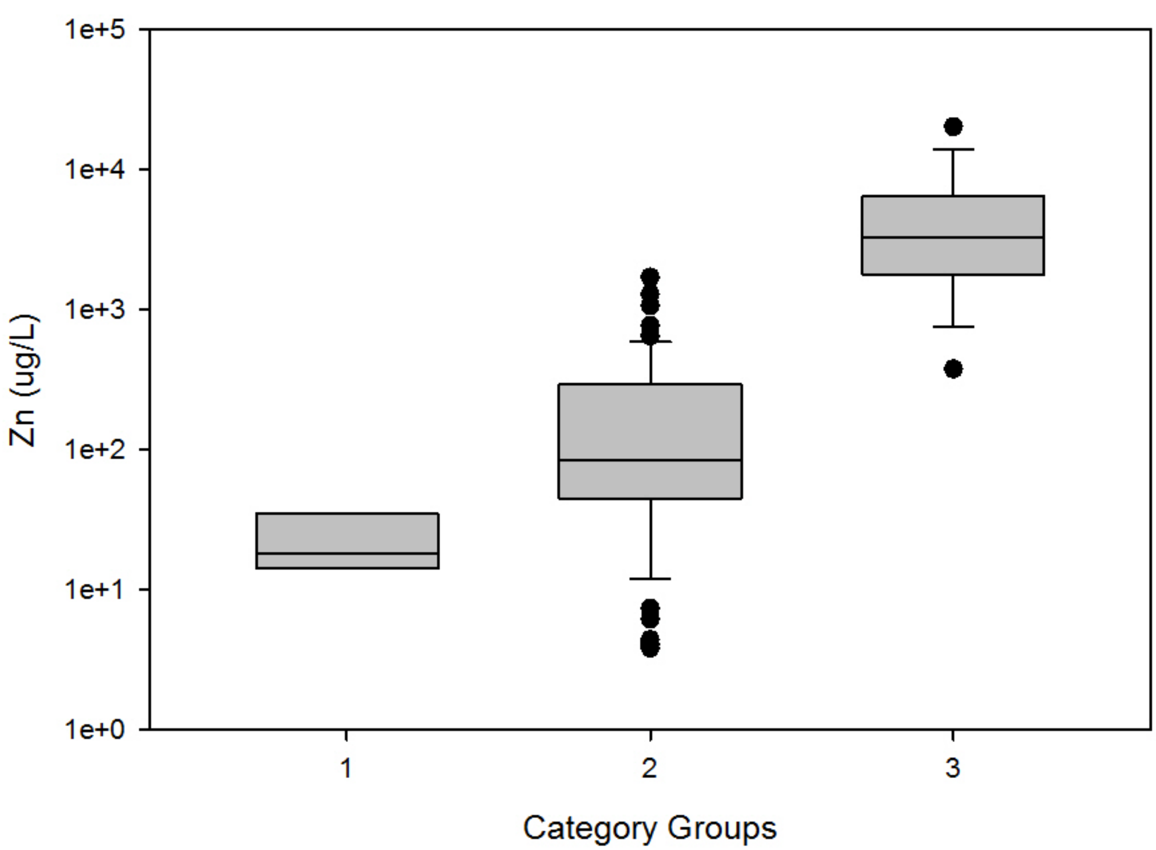


Figure 110. Box and whisker plots showing zinc washoff concentrations for three principle groups of materials.

Table 90. Summary Statistics for Zinc Concentration Grouped Categories (µg/L)

Grouped category:	low	all others	high
Sample Category in Groups:	Al ramp brick wall galv coated plaster wood painted	concrete metal bare metal painted roof rubber wood bare wood treated	artificial turf galv bare galv painted barge hull
number	7	51	17
min	10	4	377
max	38	1,705	20,269
average	23	225	4,988
median	18	85	3,287
st dev	11	343	5,008
COV	0.5	1.5	1.0

Due to the varying number of observations for the different material categories, some of the test statistics are incomplete, but they do enable the identification of the types of materials of greatest interest. Most of these groupings are obvious and as expected, such as the bare galvanized metal being the highest category for zinc, and the aluminum ramp being the highest for aluminum. Other findings are interesting and potentially important, such as:

- Aluminum ramp high for aluminum (as expected)
- Artificial turf high for zinc and possibly high for iron, possibly due to recycled rubber tire crumbles used to support artificial grass leaves
- Bare galvanized metal high for zinc (as expected)
- Painted galvanized metal high for zinc, and high for aluminum and lead (the aluminum and lead are higher than for bare galvanized materials, likely due to the metal primers or paints; coated galvanized metals were much lower for all metals)
- Barge hull high for zinc, copper, and iron, possibly associated with anti-fouling paints
- Bare wood high for aluminum and iron
- Treated wood high for copper (as expected)

The high metals associated the artificial turf and the high metals associated with the barge hull are important findings, but are only represented by single samples.

Other WinSLAMM Analyses of NBSD Stormwater Conditions

The Navy conducted a site specific source identification effort to identify the primary sources of contaminants exceeding NAL thresholds. The effort began with an evaluation of where and how many of the exceedances were observed in stormwater samples collected between 2013 and 2015. The approach was to identify where, how often, and how many exceedances were occurring so that additional efforts could focus on areas and constituents that showed consistency. The storm data were sorted by drainage, by number of storms where a single NAL was exceeded, and by number of constituents exceeded. The outcome of this evaluation identified six drainages that had the most consistent NAL exceedances for multiple constituents. These drainages included Pier 2, Pier 4, Pier 13, Outfall 34, Outfall 39, and Outfall 80B. The six NBSD outfalls were then evaluated by conducting a site characterization survey and then running a contaminant source modeling assessment on the observations.

Though the original Navy modeling efforts focused on TSS, copper and zinc, WinSLAMM was updated with these recent stormwater data to extend the calibration to the other NAL constituents: iron, aluminum, magnesium, nitrate plus nitrite, and chemical oxygen demand. This was done by using current storm data to conduct additional calibration as well as to assess relationships amongst the constituents that can be used to infer sources. Because the recent data sets were limited to only four storms, the modeling calibration results have a larger degree of uncertainty compared to the original calibrations. The most useful information for the additional constituents is thus likely to be related to the relative co-occurrence of the contaminants to one another and their relationship to particulate or aqueous phases.

Site characterizations were performed by NBSD environmental staff accompanied by SSC Pacific scientists that demonstrated the WinSLAMM modeling technique. Staff visited each of the six drainages to identify the nature and extent of site operations, land uses and materials present, and how each are connected to the storm conveyance system. These data were put into a site characterization spreadsheet modeling tool developed as part of the Navy's demonstration efforts.

Nineteen outfalls in San Diego each had two samples collected in December 2014 and May 2015 for a broad range of contaminants, including TSS, COD, NO3+NO2, aluminum, copper, iron, magnesium, and zinc (NAL listed contaminants). These additional data were used to extend the prior calibrations which were for TSS, copper and zinc. These data were examined by outfall and all combined. Eight of the drainage areas for these outfalls were also examined in detail to obtain necessary site characteristics needed for model use (areas of different source areas such as roofs, laydown areas, material storage areas, etc.). Table 91 summarizes the average concentrations (from the two observations) for each site, plus the overall averages and variabilities.

Table 91. NBSD Outfall Stormwater Quality Data (2013 - 2015)

Site:	Total Suspended Solids (TSS), mg/L	Chemical Oxygen Demand (COD), mg/L	Nitrate plus Nitrite-N, mg/L	Aluminum, Total, µg/L	Copper, Total, µg/L	Iron, Total, µg/L	Magnesium, Total, µg/L	Zinc, Total, µg/L
5	26				84			565
9	852			4,840	225	6,290		1,236
11	67				94			925
11B	43				55			255
14	26				23			150
34	131	102	0.86	5,750	66	6,800	3,850	300
39	69	111	0.44	2,220	144	2,650	2,850	360
46	10				39			365
48	46				72			765
72					56			110
73					150			260
80A	39	64	2.43	417	122	410	5,550	103
80B	190			3,440	145	4,050		325
Pier 2: 107&172-195	49	59	1.23	470	50	775	2,100	310
124					42			180
126					61			910
Pier 4: 218-247	86	160	0.92	960	186	1,810	4,050	1,025
343	9	98	0.71	133	43	225	12,350	180
Pier 13: 415-438	139	415	1.20	1,500	270	4,250	9,150	1,350

	Total Suspended Solids (TSS)	Chemical Oxygen Demand (COD)	Nitrate plus Nitrite-N	Aluminum, Total	Copper, Total	Iron, Total	Magnesium, Total	Zinc, Total
average	118.7	144.0	1.11	2,192	101	3,029	5,700	509
median	48.5	102.0	0.92	1,500	72	2,650	4,050	325
min	9.3	59.0	0.44	133	23	225	2,100	103
max	852.0	415.0	2.43	5,750	270	6,800	12,350	1,350
stdev	209.2	124.1	0.64	2,049	69	2,470	3,728	399
COV	1.76	0.86	0.58	0.93	0.68	0.82	0.65	0.78

Figure 111 is a Cluster Analysis dendogram (MiniTab) that illustrates associations between the different constituents based on explaining variability. Aluminum and iron are closely associated with each other and with TSS, while nitrates plus nitrites are not associated with any other constituent for example. Copper and zinc (plus COD) are also closely related, while magnesium is more distantly related to COD, Cu, and Zn.

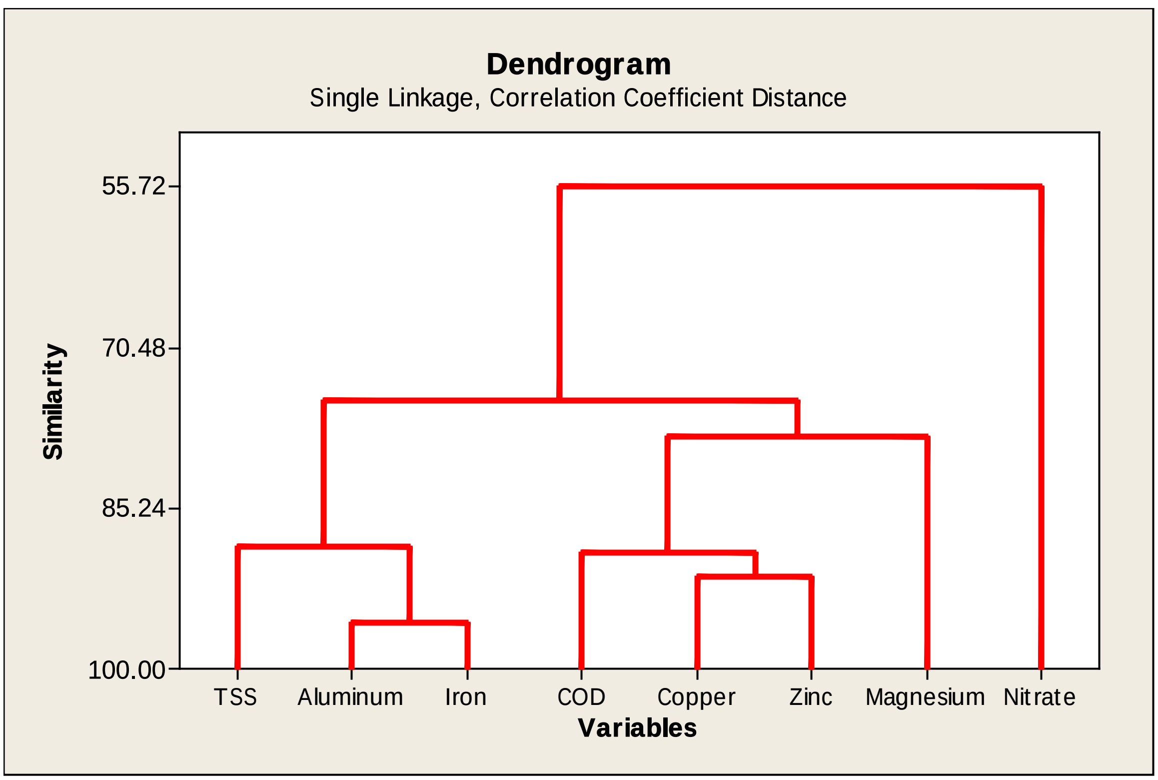


Figure 111. Cluster Analysis dendogram of NBSD outfall stormwater quality data (2013 - 2015).

Naval Base Point Loma (NBPL) Stormwater Relationships

The Naval Base Point Loma WinSLAMM analyses focused on three drainage areas: North Pier (outfall 24), South Pier (outfalls 26, 27, and 28) and Outfall 52. Overall, there were 112 samples for TSS, copper, and zinc, while only the south pier had data for phosphorus and magnesium (12 samples), in addition to selected PAH data. As typical for stormwater quality, the observed concentrations were widely variable, as reflected in the relatively large standard deviations and coefficients of variability.

Pearson Correlation (calculated using Minitab 17) calculations were conducted for the observed stormwater quality data from NBPL. All of the data from the three locations were combined for these statistical analyses in order to obtain sufficient data. These analyses identified simple relationships between any two constituents. Reasonable and strong correlations were found between TSS and Cu and Zn, between Cu and Zn, and between the four PAHs included in the analysis (chrysene, fluoranthene, phenanthrene, and pyrene).

Figure 112 is a dendogram calculated using Minitab 17 that indicates simple to complex relationships between the different constituents. As indicated with the Pearson Correlation, the two metals are closely related as are the four PAHs (phenanthrene not as closely related to the others). The toxicity, TSS, oil and grease, and pH are noted as not closely related to any of the other constituents.

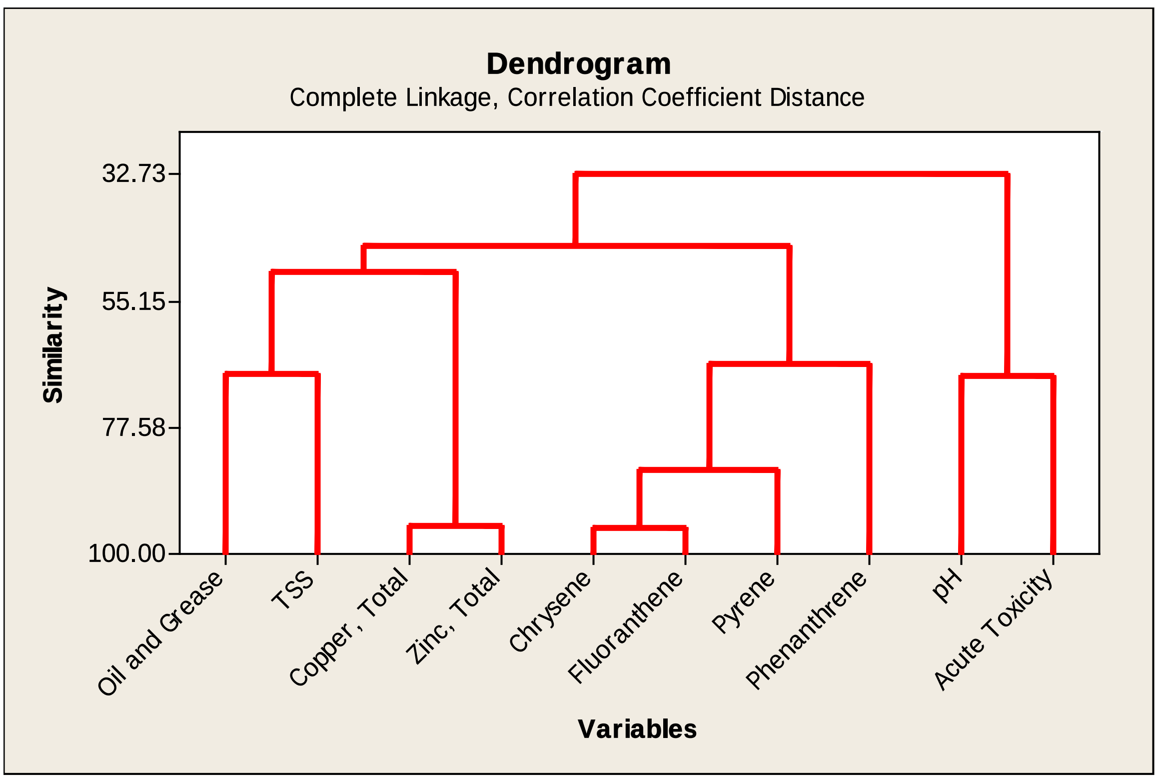


Figure 112. Cluster Analysis dendogram of NBPL outfall stormwater quality data.

The SCCWRP report (Stein, *et. al*, 2007) report also summarizes stormwater monitoring data collected by SPWARS at other San Diego area bases, besides the Point Loma example above. The following is from the SCCWRP report:

“The U.S. Navy conducts stormwater monitoring for PAHs at Naval Base San Diego as required by their NPDES permit. The PAH monitoring results for the area at the Paleta Creek mouth are presented in Table F-41 and show that contaminants are found in the Navy’s storm water discharge. Benzo(a)pyrene exceeds the California Toxics Rule (CTR) water quality objective of 0.00017 µg/L for Human Health Water & Organism.

Three storm events in the Paleta Creek watershed sampled for total PAHs produced event mean concentrations (EMCs) of 7,302 ng/L, 4,052 ng/L, and 592 ng/L (Chadwick, *et al*. 1999). One storm that was sampled for total chlordane produced an EMC of 6.3 ng/L and when sampled for total PCBs produced an EMC of 59.0 ng/L (Chadwick, *et al.* 1999).

Tale F-41. New stormwater monitoring data for Paleta Creek storm drain outfalls (1994 – 2000)

Pollutant	Arithmetic Mean Concentration (µg/L)	Number of Records	Standard Deviation	Range (µg/L)	Sample Dates	Number of Non-Detects
Acenapthene	5.7	7	4	1.7 – 10	1994-2000	5
Benzo(a)pyrene	1.6	2	-	1.6	2000	2
Chrysene	5.1	5	5	1.4 – 11	1996-2000	3
Fluoranthene	32.3	20	58	1.8 – 28	1995-2000	6
Fluorene	10.6	9	9	1.8 – 28	1995-2000	6
Phenanthrene	77.1	4	149	1.4 – 400	1994-2000	3
Pyrene	21.6	19	40	1.6 - 160	1994-2000	5

Source: US Navy (2000)

As part of the Phase II portion of this TMDL study, *Monitoring and Modeling of Chollas, Paleta, and Switzer Creeks* (Appendix C-1: Schiff and Carter 2007) provided monitoring results of stormwater sampling during the winter of 2005-2006 (wet season). Samples were collected at locations above tidal influence. PAHs and some pesticides were found in measurable amounts. Paleta and Chollas creeks had the greatest flow-weighted average for PAHs and Switzer Creek had the greatest flow-weighted average for chlordane. No detectable measurements of PCBs or lindane were made in any sample from any of the watersheds. The flow weighted mean stormwater data are presented in Table F-43. No single storm generated the greatest concentrations and no correlations between rainfall volumes, intensity, or durations were observed.

When TSS normalized stormwater concentrations and sediment concentrations are compared for PAHs, concentrations from the watershed are, in many cases, higher than those found in the estuary sediments (Figures F-15 and F-16). These results indicate that the watershed is a source of loading to the Paleta Creek mouth. Note that this same analysis was not performed for Switzer Creek. Also note that PCBs and chlordane cannot be compared in this manner. Chlordane concentrations in the stormwater samples were compared to the California Toxics Rule (CTR) values for freshwater with chlordane concentrations exceeding this value.

Table F-43. Seasonal flow weighted mean stormwater data for organics for Chollas, Paleta, and Switzer Creeks

Pollutant (ng/L)	Switzer Creek[a,b]	Chollas Creek (south)[a,b]	Chollas Creek (north)[a,b]	Paleta Creek[a,b]
Total PCBs	0.50 ± 0.00	0.50 ± 0.00	0.50 ± 0.00	0.50 ± 0.00
Total PAHs	535.7 ± 539.1	387.2 ± 159.7	1,264.6 ± 337.2	851.8 ± 337.2
Total chlordane[c]	47.27 ± 42.05	11.56 ± 6.93	39.69 ± 0.00	40.49 ± 0.00
Lindane	0.50 ± 0.00	0.50 ± 0.00	0.50 ± 0.00	0.50 ± 0.00

[a]Data presented with +-95% confidence intervals
[b]Data collected during 3 storm events during the wet season in 2005-2006.
[c]CTR value for criterion continuous concentration is 4.3 ng/L (US EPA 2000b)
Source: Schiff and Carter (2007)

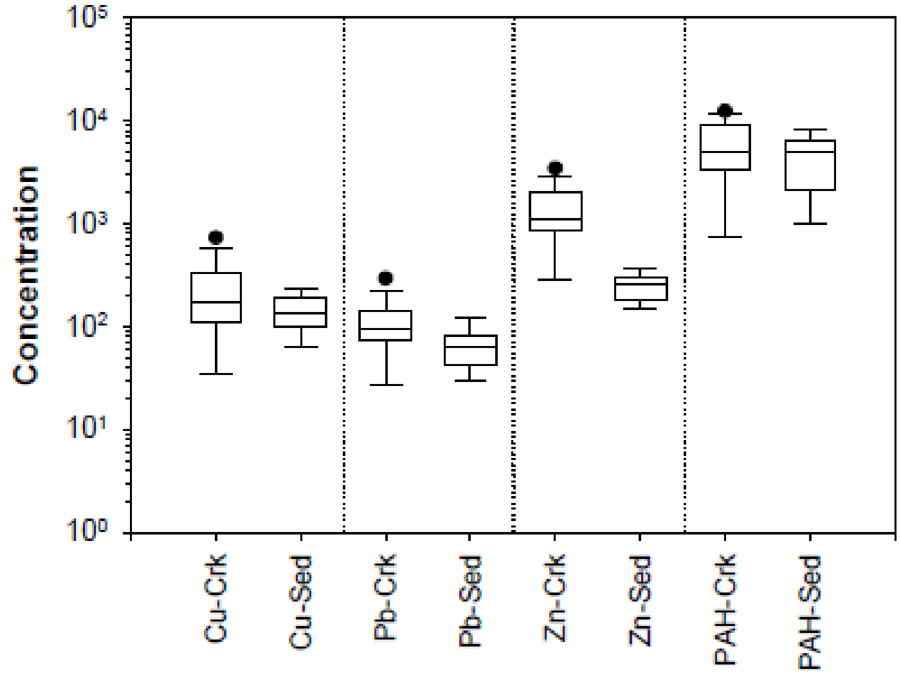


Figure F-15. Comparisons of TSS normalized stormwater concentrations (crk) and sediment concentrations (sed) at the mouth of Paleta Creek
Source: Schiff and Carter (2007)"

Section 7: Tentative TMDL Allocations and Stormwater Controls at NBSD Sites Evaluated using WinSLAMM

Review of Paleta Creek Stormwater Criteria

The California Regional Water Quality Control Board, San Diego, prepared a tentative resolution in 2013 to establish TMDL limits for toxic pollutants in sediments at the mouths of several creeks draining into San Diego Bay. This tentative resolution is referenced as:

California Regional Water Quality Control Board, San Diego Region. *A Resolution Amending the Water Quality Control Plan for the San Diego Basin (9) to Incorporate Total Maximum Daily Loads for Toxic Pollutants in Sediment at the Mouths of Paleta, Chollas, and Switzer Creeks in San Diego Bay*. Tentative Resolution No. R9-2013-0003. February 19, 2013.

Although this resolution has not yet been adopted for Paleta Creek, the tentative TMDL values are used in this SERDP monitoring report as a reference for potential limits to compare to the SERDP stormwater monitoring data. The following text and tables are excerpts from this document focusing on Paleta Creek:

Toxic Hot Spots Listed as Impaired Waters

"These three specific segments of San Diego Bay Shoreline in the San Diego Region were placed on the List of Water Quality Limited Segments because of toxic conditions to aquatic life and degraded benthic community structure. Levels of chlordane, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) in sediment at these locations exceed the narrative sediment quality objective and have been shown to cause these toxic conditions. The shoreline segments of San Diego Bay for which water quality is impaired by toxic pollutants in sediment, and for which TMDLs have been calculated, are shown below.

Table 92. Summary of San Diego Impaired Waters

The beneficial uses in these shoreline segments that are sensitive to toxic pollutants in sediment are estuarine habitat (EST), marine habitat (MAR), wildlife habitat (WILD), commercial and sport fishing (COMM), and shellfish harvesting (SHELL). Concentrations of pollutants in sediment have been shown to have toxic effects on mortality and development of indicator organisms and effects on abundance and diversity of benthic communities. Concentrations of pollutants have been shown to be bioaccumulating in aquatic life that are harmful to human health."

Numeric Targets

"One or more quantitative numeric targets are required to calculate a TMDL. Numeric targets are selected based on the water quality standards (i.e., beneficial uses and the water quality objectives) that are applicable to the water body. The selected numeric target(s) must be able to interpret and implement the water quality standards. When the numeric targets are met in the impaired water body, the water quality objectives will be met and the water quality standards should be restored.

The numeric targets for sediment, water, and fish tissue are selected to interpret and implement the narrative sediment quality objectives cited in finding 8 to protect aquatic life and human health. Sediment numeric targets for chlordane, priority pollutant PAHs, and total PCBs are set at the 95 percent upper confidence limit of the mean of available San Diego Bay monitoring data of locations assessed as unimpacted using the Aquatic Life-Benthic Community Protection SQO MLOE approach. Water column numeric targets for chlordane, benzo(a)pyrene, and total PCBs are set at the California Toxics Rule human health criteria for ingestion of organisms. Additionally, a fish tissue numeric target is set at OEHHA Fish Contaminant Goal for total PCBs to protect human health."

Sources of Toxic Pollutants in Sediment

"The pollutants can be deposited either directly to a waterbody (the impaired waterbody or a contributing waterbody) or onto land surfaces where the pollutants wash off during storm events. Chlordane, total PAHs, and total PCBs have a tendency to bind to soil and organic particles, and are linked to the transport and deposition of suspended sediment. Storm water runoff from urbanized areas flows off a number of land uses including residential areas, commercial and industrial areas, roads, highways and bridges. Essentially all sources (point and nonpoint) in the watershed enter Paleta, Chollas, and Switzer creeks through the storm water conveyance systems and discharge pollutant loads into the mouths of Paleta, Chollas, and Switzer creeks, particularly during storm events.

Other likely point and nonpoint source pollutant loads in all three creeks include storm water runoff from adjacent industrial discharges (individual WDRs), sediment re-suspension and flux, leaching from creosote pier pilings, and direct atmospheric deposition of pollutants to the surface of the waterbody. Sources specific to particular creeks include the National Steel and Shipbuilding Company (NASSCO) shipyard located just north of the Chollas Creek mouth, the Naval Station San Diego (NAVSTA) located near Paleta and Chollas creek mouths, sediment re-suspension and migration caused by boat and ship traffic near Paleta, Chollas, and Switzer creek mouths, and the Tenth Avenue Marine Terminal located near Switzer Creek mouth.

Numeric targets are established to restore aquatic life and human health beneficial uses by attaining the narrative Sediment Quality Objectives for Aquatic Life – Benthic Community Protection (Aquatic Life) and Human Health. Numeric targets for these sediment TMDLs are derived using the MLOE Approach to interpret the Aquatic Life Sediment Quality Objective. The numeric target values were set at the 95 percent upper confidence limit of available San Diego Bay data of stations that were assessed to be "Unimpacted" or "Likely Unimpacted" in accordance with the MLOE Approach. Water column targets are set equal to the California Toxics Rule (CTR) human health criteria for consumption of organisms. Fish tissue concentrations are set equal to the Fish Contaminant Goal for PCBs developed by the Office of Environmental Health Hazard Assessment."

Table 93. Numeric Targets for Toxic Pollutants at the Creek Mounts of Paleta, Chollas, and Switzer Creeks

Contaminant of Concern	Numeric Target
Sediment Concentration	
Total Chlordane	2.1 μg/kg
Priority Pollutant PAHs[1]	2,965 μg/kg
Total PCBs[2]	168 μg/kg
Water Column Concentration	
Total Chlordane	0.00059 μg/L
Benzo(a)pyrene	0.049 μg/L
Total PCBs	0.00017 μg/L
Fish Tissue Concentration	
Total PCBs	3.6 μg/kg wet weight

[1] Priority Pollutant PAHs = Σ [Acenapthene] [Acenapthylene] [Anthracene] [Benz(a)anthracene] [Benzo(a)pyrene] [Benzo(b)fluoranthene] [Benzo(k)fluoranthene] [Benzo(g,h,i)perylene] [Chrysene] [Dibenz(a,h)anthracene] [Fluoranthene] [Fluorene] [Indeno(1,2,3-c,d)pyrene] [Naphthalene] [Phenanthrene] [Pyrene]

[2] Total PCBs is sum of 41 congeners

Table 94 presents the mass-based TMDLs, allocations, and margins of safety for these waterbodies:

Table 94. Mass-Based Toxic Pollutants in Sediment TMDLs for Paleta Creek

Paleta Creek TMDL WLAs, LAs, MOS, and TMDLs													
		San Diego WLA	La Mesa WLA	Lemon Grove WLA	SD County WLA	National City WLA	Caltrans WLA	U.S Navy WLA	SD Port District WLA	WLA Total	LA	MOS	TMDL
Chlordane	g/d	0.048	NA	NA	NA	0.023	0.003	0.009	NA	0.083	0.001	0.021	0.105
Total PAHs	g/d	1.75	NA	NA	NA	0.86	0.11	0.32	NA	3.04	0	0.16	3.20
Total PCBs	mg/d	0.240	NA	NA	NA	0.118	0.014	0.044	NA	0.416	0	0.022	0.438

Required Monitoring

"Storm Water Effluent Monitoring

Watershed monitoring of stormwater effluent concentrations and flow at a subset of MS4 outfalls within each jurisdiction of each watershed. The subset of outfalls must be representative of stormwater flows from areas consisting primarily of residential, commercial, and industrial land uses. The data will be used to calculate or estimate the annual loads. Samples should be collected during at least two wet weather events occurring in the rainy season, October 1st through April 30th.

Stormwater samples will be analyzed and reported for total chlordane, PCB congeners and total PCBs, total PAHs and PPPAHs, and total suspended solids. Sampling shall be designed in a way to collect sufficient volumes of suspended solids to allow for analysis of the listed pollutants in the bulk sediment. In addition to TMDL constituents, general water chemistry (temperature, dissolved oxygen, pH, and electrical conductivity) and a flow measurement will be required at each sampling event. General chemistry measurements may be taken in the laboratory immediately following sample collection, if auto samplers are used for sample collection or if weather conditions are unsuitable for field measurements. The sample must not be influenced by sea water.

If exceedances of the concentration-based TMDLs are observed in the monitoring data, additional monitoring locations and/or other source identification methods must be implemented to identify the sources causing the exceedances. The additional monitoring locations and/or other source identification methods must also be used to demonstrate that organic pollutant loads from the identified sources have been addressed and are no longer causing exceedances in the receiving waters."

Tentative TMDL Limits for Paleta Creek Compared to SERDP Monitoring Results

The following discussion compares these tentative TMDL limits for Paleta Creek with the current SERDP stormwater monitoring data. Table 95 shows the tentative limits for Paleta Creek.

Table 95. Tentative Criterion for Sediment and Water Column Concentrations for Paleta Creek

Contaminant of Concern	Numeric Limit
Sediment Concentration	
Total Chlordane	2.1 µg/kg
Priority Pollutant PAHs	2,965 µg/kg
Total PCBs	168 µg/kg
Water Column Concentration	
Total Chlordane	0.00059 µg/L (0.59 ng/L)
Benzo(a)pyrene	0.049 µg/L (49 ng/L
Total PCBs	0.00017 µg/L (0.17 ng/L)

Priority Pollutant PAHs Sediment Concentration

The following tables compare the monitored SERDP project PAH concentrations to the tentative numeric sediment quality limits.

Table 96. The total priority pollutant PAHs are the sum of the following individual PAH compounds:

NBSD	µg/kg	%	accumulative %
Fluoranthene	1,518	36.9	37
Pyrene	589	14.3	51
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	344	8.3	60

Phenanthrene	326	7.9	67
Benzo[a]pyrene	311	7.6	75
Benzo[a]anthracene	230	5.6	81
Chrysene	228	5.5	86
Naphthalene	150	3.6	90
Anthracene	150	3.6	93
Benzo[k]fluoranthene	147	3.6	97
Dibenzo[a,h]anthracene	79	1.9	99
Fluorene	28	0.7	100
Acenaphthene	17	0.4	100

Figures 113 to 115 and Tables 97 and 98 show the sum of PAH conditions associated with this SERDP monitoring project. Benzo[b]fluoranthene was also monitored during the SERDP project, but was not included in the tentative total PAH list. Also, acenapthene was listed in the tentative sum list, but was not analyzed during the SERDP project. Therefore, these two PAH compounds are not included in the SERDP calculated sum of PAH concentrations for the sediment objective. These differences are not expected to result in any important changes in the total PAH criterion calculations.

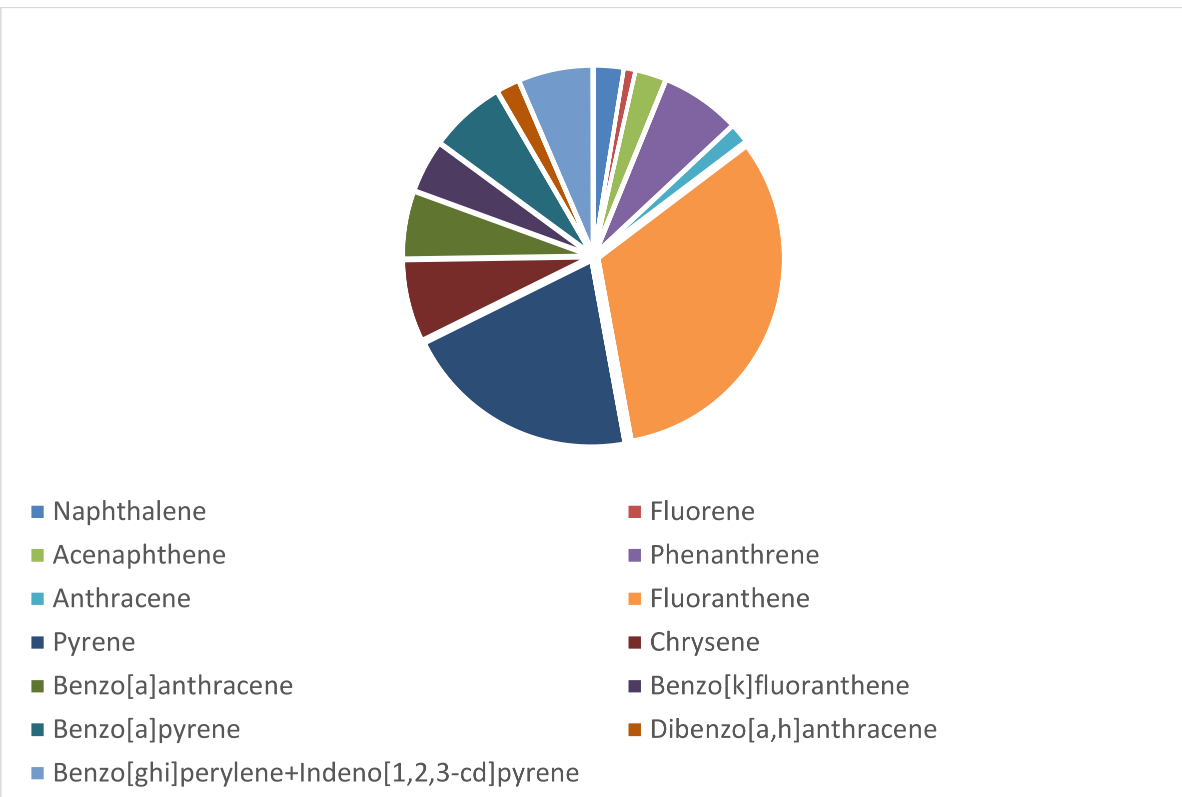


Figure 113. NBSD individual PAH particulate strength contributions to sum of PAH particle strengths.

Table 97. PAH Components for Upper Paleta Creek Watershed

upper Paleta Creek watershed (mostly residential)	µg/kg	%	accumulative %
Fluoranthene	1,277	49.4	49
Pyrene	571	22.1	71
Phenanthrene	224	8.7	80
Benzo[a]anthracene	122	4.7	85
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	104	4.0	89
Chrysene	95	3.7	93
Benzo[a]pyrene	66	2.5	95
Naphthalene	43	1.7	97
Benzo[k]fluoranthene	36	1.4	98
Acenaphthene	23	0.9	99
Fluorene	18	0.7	100
Dibenzo[a,h]anthracene	7	0.3	100
Anthracene	0	0.0	100

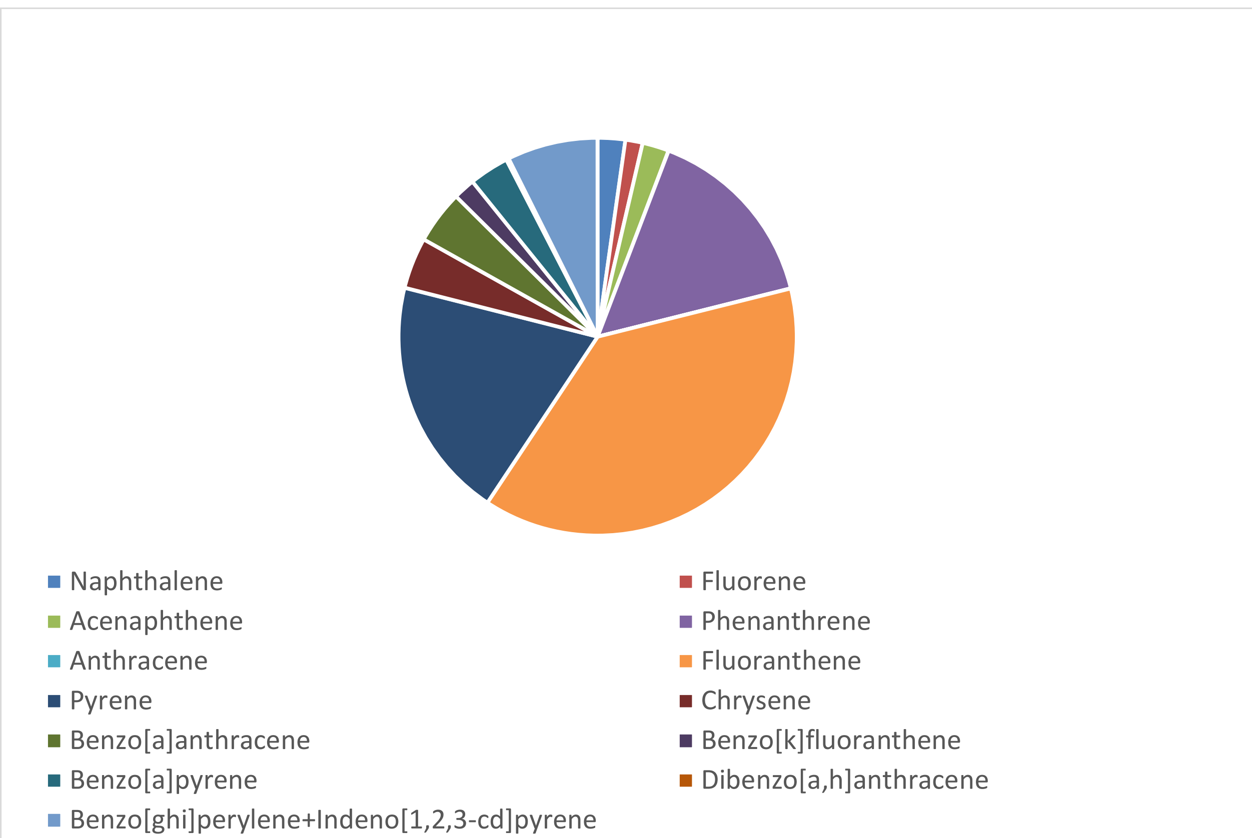


Figure 114. Upper watershed individual PAH particulate strength contributions to sum of PAH particle strengths.

Table 98. PAH Components for Mixed Flows in Paleta Creek Watershed

mixed flows	µg/kg	%	accumulative %
Fluoranthene	831	24.3	24
Pyrene	683	20.0	44
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	472	13.8	58
Chrysene	301	8.8	67
Phenanthrene	298	8.7	75
Benzo[a]pyrene	282	8.2	84
Benzo[a]anthracene	201	5.9	90
Benzo[k]fluoranthene	159	4.6	94
Dibenzo[a,h]anthracene	75	2.2	96
Acenaphthene	47	1.4	98
Anthracene	43	1.3	99
Naphthalene	25	0.7	100
Fluorene	9	0.3	100

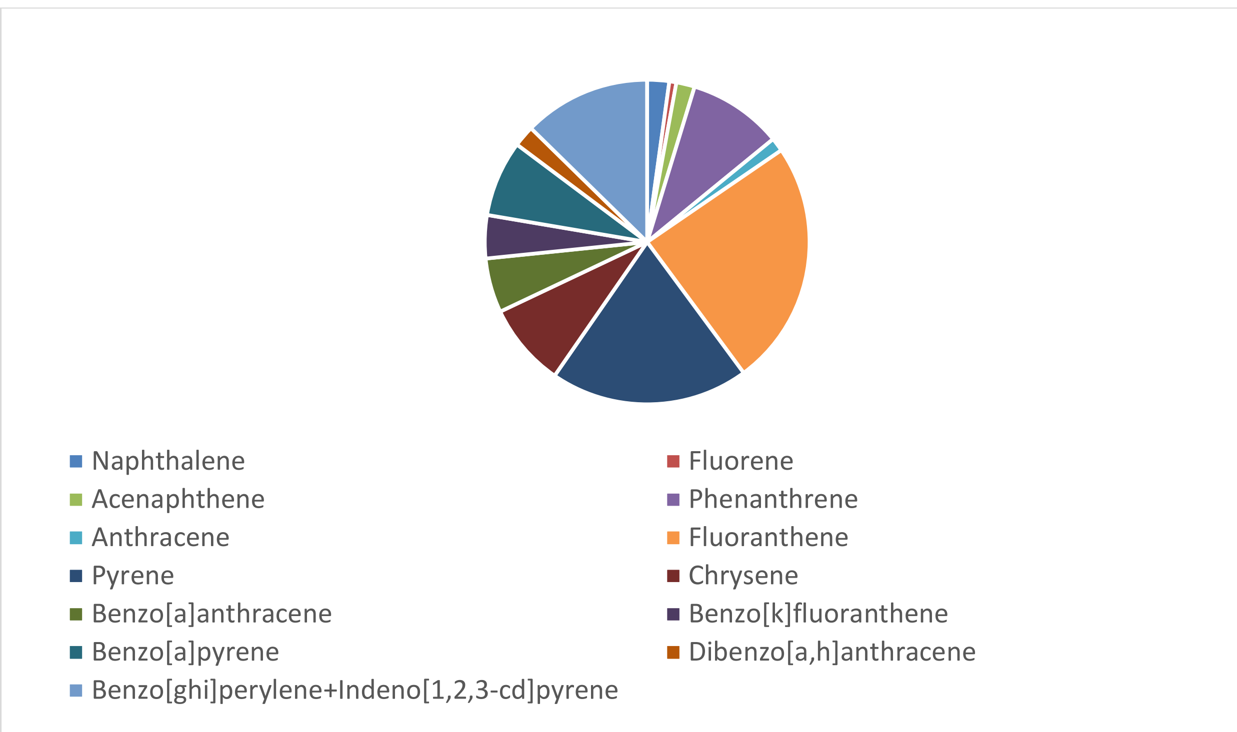


Figure 115. Mixed flow Paleta Creek Watershed individual PAH particulate strength contributions to sum of PAH particle strengths.

The total sediment PAH sums are compared to the criterion of 2,965 µg/kg in the following table for the NBSD samples, the upper Paleta Creek watershed samples, and the mixed Paleta Creek flows at the creek mouth. The overall sum of particulate strength values is also shown in Table 99.

Table 99. Observed Total PAH Particulate Strength Values Compared to Tentative Criterion

	# sum PAHs >2,965 µg/kg	total # of observations	% >2,965 µg/kg	maximum observed total PAH concentration, µg/kg	ratio of maximum observed conc. to 2,965 µg/kg
mixed flows	2	7	28.6	14,480	4.9
NBSD	2	6	33.3	14,364	4.8
upper watershed area	1	2	50.0	3,807	1.3
overall	5	15	33.3	14,480	4.9

The NBSD total PAH particulate strength values would have to be reduced by about 80% to meet the tentative criterion, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about 22%, if the all of the particle sizes were considered. If only the critical settleable portion (>63 um) in order to project the bottom sediments near the creek mouth were compared to this particle strength criterion, any reductions would be much less.

Tables 100 and 101 list the primary PAH constituents that comprise the majority of the total PAH particulate strength values, by watershed area.

Table 100. Observed NBSD Particulate Strength Values

NBSD	µg/kg	% of total PAHs	accumulative %
Fluoranthene	1,518	36.9	37
Pyrene	589	14.3	51
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	344	8.3	60
Phenanthrene	326	7.9	67
Benzo[a]pyrene	311	7.6	75
Benzo[a]anthracene	230	5.6	81

Table 101. Observed Upper Watershed Particulate Strength Values

upper watershed	µg/kg	% of total PAHs	accumulative %
Fluoranthene	1,277	49.4	49
Pyrene	571	22.1	71

Phenanthrene	224	8.7	80
Benzo[a]anthracene	122	4.7	85
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene	104	4.0	89
Chrysene	95	3.7	93

Fluoranthene (37 and 49%) and pyrene (14 and 22%) are the only PAHs that comprise more than 10% of the total sum of PAH particulate strengths for the NBSD and upper watershed areas. The particulate-bound PAHs would be effectively reduced with concurrent reductions in the stormwater particulate solids.

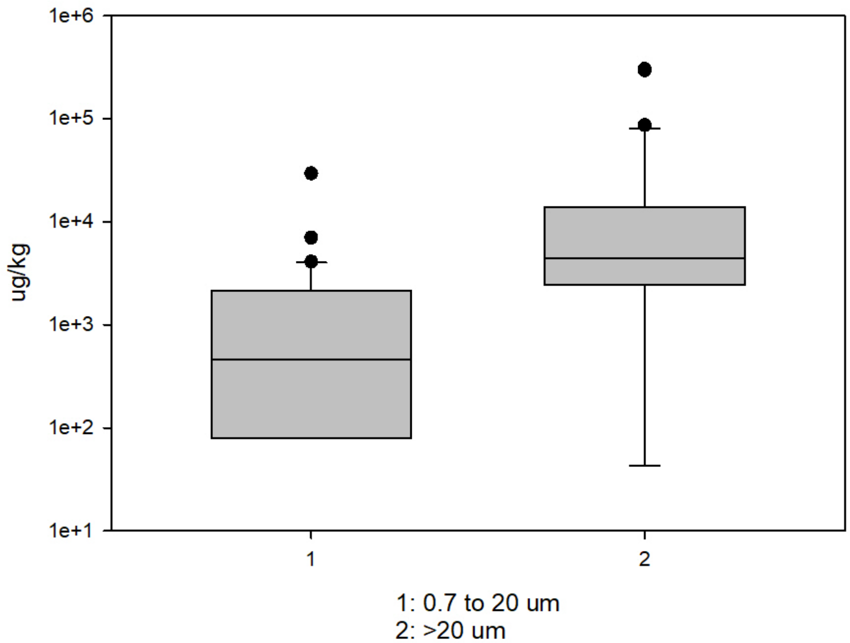
Because of the lack of significance between sampling location categories, all of the site data were combined to examine differences between the particle size categories, as shown below. The particulate strengths associated with each size range category were found to be different with a high degree of significance (p = <0.001). The number of samples exceeding the tentative limit ranged from about 13% for the smallest size range, to 73% for the largest size range.

Observed Particulate Strength Concentrations of Sum of PAHs by Size Range, All Locations Combined (µg/kg)

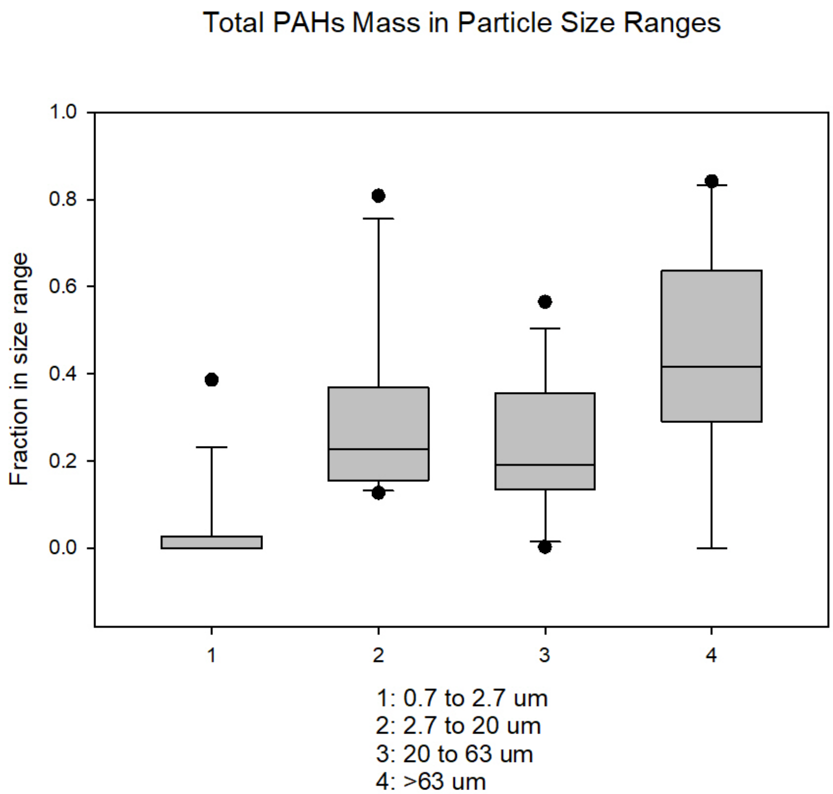
All Sites Combined	**0.7-2.7 µm**	**2.7-20 µm**	**20-63 µm**	**> 63 µm**
Kruskal-Wallis p value comparing all size ranges	<0.001 (highly significant)			
average	2,490	1,650	3,858	52,677
minimum	nd	116	426	nd
maximum	29,321	7,007	9,294	302,461
standard deviation	7,486	1,916	2,307	102,014
COV	3.01	1.16	0.60	1.94
number of observations	15	15	15	15
#>2,965	2	3	7	11
%>2,965	13.3	20.0	46.7	73.3

High-lighted values are >2,965 µg/kg

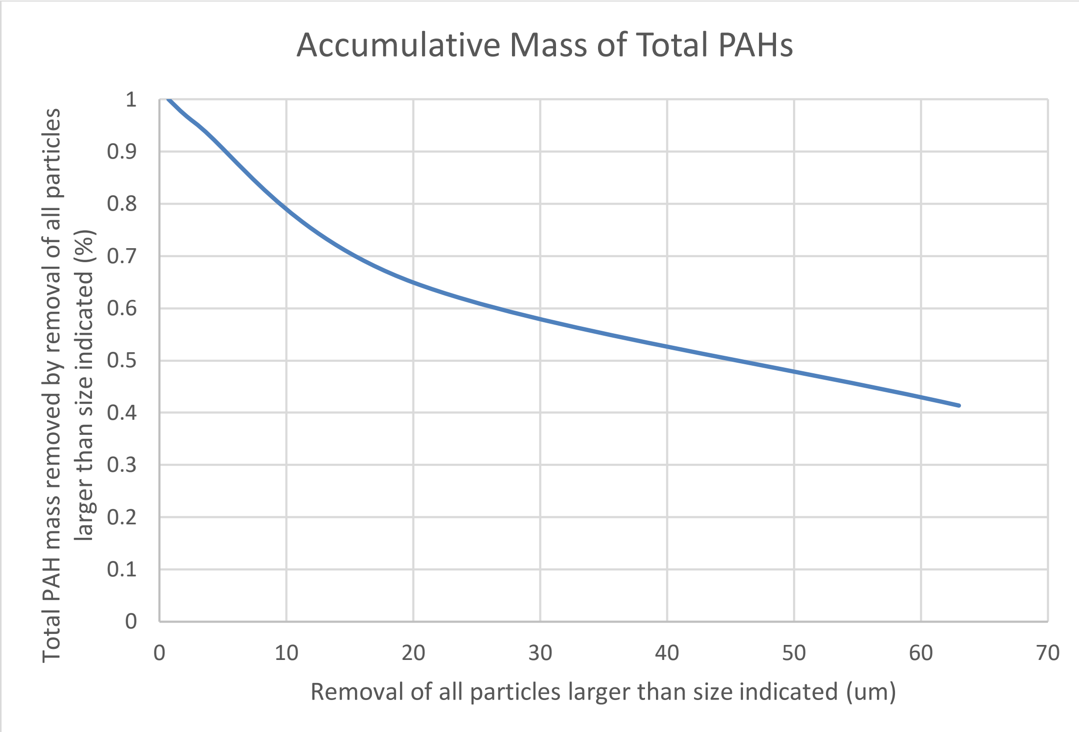
A multiple comparison test on ranks test was used (SigmaPlot, version 13) to identify which size groups could be combined and which should remain separate. These tests resulted in combining 0.7 to 2.7 µm with 2.7 to 20 µm and 20 to 63 µm with >63 µm. The following group box and whisker plot (SigmaPlot, version 13) shows the data ranges for the sum of PAH particulate strengths for each of the particle size ranges, for all location data combined. This plot clearly indicates increasing particulate strengths with increasing particle sizes for the sum of PAHs, similar to what was found for the separate PAH analyses.



Mass fractions by particle size were also calculated for the sum of PAH values by weighting the particulate strength concentrations by the fraction of particulate solids in each size range. All Kruskal-Wallis One Way Analysis of Variance on Ranks p results indicated no significant differences between the sites for each particle size, for the number of samples available, so the site data were combined. The following plot indicates that the >63 µm size category (near-field deposition) comprises about 40% of the sum of PAH discharges. The intermediate size range (2.7 to 63 µm) comprises about 45% of the sum of PAH discharges, while the smallest size range (<2.7 µm) only contributes a very small fraction of the sum of PAHs.



The following accumulative chart indicates that the median size associated with sum of PAH mass discharges is about 45 µm, while about 30% of the sum of PAH discharges is associated with sizes smaller than about 15 µm. This plot can only be used to reduce mass discharges of total PAHs; it is not relevant to changing the particulate strengths. Removing the large particles, either through stormwater management practices or by deposition in the channel, would not likely allow the particulate strengths to be smaller than the tentative limit for all events. The small particles, even though having smaller particulate strength values than the large particles), still can exceed the tentative particulate strength limit of 2,965 µg/kg about 13% of the time.



Priority Pollutant PAHs Water Column Concentration

The only water column PAH included on the tentative criterion list is benzo(a)pyrene, which was monitored during the SERDP stormwater monitoring efforts. The tentative criterion for benzo(a)pyrene is 49 ng/L.

Table 102. Benzo(a)Pyrene Tentative Criterion Compared to Observed Paleta Creek Stormwater

	# benzo(a)pyrene >49 ng/L	total # of obs	% >49 ng/L	max observed	max/49
mixed flows	2	7	29	275	5.6
NBSD	2	6	33	155	3.2
upper watershed area (mostly residential)	1	2	50	51	1.0
overall	5	15	33	275	5.6

One-third of the NBSD samples and one-half of the upper watershed area stormwater samples exceeded the tentative benzo(a)pyrene criterion of 49 ng/L. The maximum total concentration of benzo(a)pyrene observed at the NBSD was 155 ng/L and would require about 70% reductions, while the maximum concentration observed at the upper watershed area was 51 ng/L and would only require about 4% reductions. Overall, about one-third of the samples exceeded the criterion with a required reduction of about 80%. The following lists the settleable portions (>63 µm) of benzo(a)pyrene (the fraction that would most affect the critical area near the mouth of Paleta Creek for which this criterion was developed), and the approximate maximum concentrations:

Mixed flows (19% settleable), resulting in about 52 ng/L maximum concentration
NBSD flows (42%), resulting in about 65 ng/L maximum concentration
Upper watershed flows (17%), resulting in about 9 ng/L maximum concentration

Therefore, if the benzo(a)pyrene criterion of 49 ng/L was only applicable to the settleable portion of the compound to protect the bottom sediments near the creek mouth, only relatively small stormwater reductions would be needed to meet the tentative criterion.

Mass-Based TMDL Allocations for Paleta Creek

Tables 103 and 104 show the mass-based tentative TMDL allocations for Paleta Creek and necessary reductions.

Table 103. Mass Based Tentative TMDL Allocations for Paleta Creek

	San Diego WLA	National City WLA	Caltrans WLA	total upper watershed WLA	U.S. Navy WLA	total Paleta Creek WLA	Load Allocation	Margin of Safety	TMDL for Paleta Creek
Chlordane (g/d)	0.048	0.023	0.003	0.074	0.009	0.083	0.001	0.021	0.105
Total PAHs (g/d)	1.75	0.86	0.11	2.72	0.32	3.04	0	0.16	3.20
Total PCBs (mg/d)	0.24	0.118	0.014	0.372	0.044	0.416	0	0.022	0.438

Table 104a. Calculated Mass Loads of Total PAHs Compared to TMDL Allocations

	average land use sum of PAHs µg/L	total annual stormwater flow discharge (m^3/yr)	total annual sum of PAH discharges (grams/day)	mass discharge load allocation (grams/day)	prorated margin of safety (grams/day)	TMDL (grams/day)	ratio of calculated total PAH discharges to TMDL
mixed flow	790	n/a	n/a	n/a	n/a	n/a	n/a
NBSD	785	208,743	0.45	0.32	0.017	0.337	1.33
upper watershed	1,093	880,336	2.64	2.72	0.143	2.863	0.92
overall/total	828	1,089,079	3.08	3.04	0.160	3.200	0.96

Table 104b. Calculated Mass Loads of Settleable Solid (>63µm)* PAHs Compared to TMDL Allocations

flow source	average land use sum of settleable PAHs µg/L*	total annual stormwater flow discharge (m^3/yr)	total annual sum of settleable PAH	mass discharge load allocation (grams/day)	prorated margin of safety (grams/day)	TMDL (grams/day)	approximate ratio of calculated settleable PAH

			discharges (grams/day)*				discharges to TMDL
mixed flow	190	n/a	n/a	n/a	n/a	n/a	n/a
NBSD	188	208,743	0.11	0.32	0.017	0.337	0.33
upper watershed	262	880,336	0.63	2.72	0.143	2.863	0.22
overall/total	200	1,089,079	0.74	3.04	0.160	3.200	0.23

* assuming about 24% of total PAHs are >63um and are settleable in the near zone area near the creek mouth.

The WinSLAMM calculated watershed annual runoff amounts (about 5.3 inches of runoff/year for the entire watershed) were multiplied by the associated annual average sum of PAH concentrations to obtain the annual discharge estimates for the Paleta Creek watershed. The NBSD and upper watershed area mass discharge calculated total PAH amounts were then compared to the tentative TMDL allocations (including margin of safety). If the total PAH concentrations were subject to this criterion, the NBSD would need to reduce the total PAH stormwater mass discharges by about 25%, while the upper watershed area stormwater PAH mass discharges are below the tentative discharge limit. The total watershed calculated stormwater total PAH mass discharges are also barely below the TMDL tentative limit for the entire watershed. If only the settleable portion of the PAHs were compared to this criterion (in order to protect the critical bottom sediments near the Paleta Creek mouth area), then all of the discharge amounts from these areas would be below the tentative TMDL limit.

Chlordane and total PCB discharges will be calculated and compared to the tentative limits when those data become available from the laboratory analyzing the stormwater samples.

Stormwater Controls at NBSD

During prior NBSD projects, WinSLAMM was also used to make preliminary evaluations for a selection of stormwater controls that may be suitable for NBSD use, including: street cleaning, catchbasins, proprietary media filters, biofilters (NBSD currently is monitoring a biofilter pilot facility at a site parking area to obtain local performance measurements), porous pavement (NBSD is also currently monitoring a pilot porous pavement facility to obtain local performance information), and possibly grass filter and swales at selected locations.

Piers are challenging from a stormwater management perspective. They have no distinguishable drainage system to install controls, expect for placement at many separate inlets. Alternatively, street cleaning may be a suitable control practice for areas not covered by materials or structures. Previous reports conducted with NBSD have discussed pollution prevention by minimizing the use of various exposed materials (such as galvanized metals).

In some cases, filtered forms of the constituents of concern may also need to be reduced if the criteria cannot be met through the control of particulate forms of the pollutants alone. The literature review indicated that residential and commercial stormwater filterable heavy metals (zinc, cadmium, and lead) are mostly bound to organic complexes or as colloids that are difficult to remove by ion exchange, but may be removed by sorption processes. The filtered forms of copper are likely mostly in ionic forms that can be readily removed by ion exchange (depending on the ionic strength). Pre-treatment sedimentation controls removing the largest particles (>50 µm for example) followed by sorption and/or ion exchange processes could be very effective in meeting stringent water quality criteria. The Paleta Creek stormwater data indicates that most of the metals and PAHs are associated with the largest particles examined (>63 µm), which can be controlled with less advanced and lower unit cost stormwater treatment controls.

Because of their low volatility (low Henry's Law constant), high octanol-water partition coefficients (K_{OW}) and high soil organic coefficients (K_{OC}), many of the stormwater PAHs are preferentially adsorbed to particulate matter. Literature has shown that the smaller and larger particles can have relatively higher PAH particulate strength values compared to the intermediate sized particles, depending on the organic content of the material. PAHs can be controlled using the same controls that are effective for the particulates and most metals. Again, these controls need to be verified for site conditions for these compounds and for different particle size ranges.

Section 8: Chlordane Stormwater Characteristics at Paleta Creek

Transchlordane and cischlordane were measured in 14 samples collected in the Paleta Creek watershed. These were analyzed in filtered and unfiltered samples, and in four particle size ranges (0.7 to 2.7 µm, 2.7 to 20 µm, 20 to 63 µm, and >63 µm). The following table shows the fraction of the total chlordane associated with each of these two components, separated by sample category. These sample categories had about 51 to 70% of the total chlordane associated with transchlordane, and 30 to 49% associated with cischlordane. The smallest particle size range (0.7 to 2.7 µm) had the largest fraction as transchlordane.

average fractions for	fraction transchlordane	fraction cischlordane
Bulk water	0.52	0.48
filtered water (< 0.7 µm)	0.56	0.44
Total Particulate POPs (>0.7µm)	0.62	0.38
0.7-2.7 µm	0.70	0.30
2.7-20 µm	0.53	0.47
20-63 µm	0.51	0.49
> 63 µm	0.53	0.47

These two chlordane components were added together for the total chlordane concentrations that are discussed in the following section. Shown below are the unfiltered and filtered chlordane concentrations by sample group. The yellow high-lighted values exceed the tentative limit for chlordane for the Paleta Creek discharges (0.00059 µg/L). The chlordane concentrations exceeded this tentative limit in about 71% of the unfiltered samples and in about 33% of the filtered samples. Therefore, even though most of the chlordane is associated with particulate solids (average about 83% particulate), removal of all particulates would still result in about 33% exceedance of the tentative limit.

Unfiltered and Filtered Chlordane Concentrations (µg/L) by Sampling Location Category

	mixed flows			NBSD			Upper watershed		
	unfiltered Chlordane	filtered Chlordane	fraction filtered	unfiltered Chlordane	filtered Chlordane	fraction filtered	unfiltered Chlordane	filtered Chlordane	fraction filtered
	nd	2.49E-04		4.16E-03	3.86E-04	0.09	2.00E-03	7.61E-04	0.38
	6.25E-03	4.60E-04	0.07	nd	6.69E-04				
		4.71E-04			3.29E-04				
	1.46E-02	6.79E-04	0.05	3.91E-03	2.59E-04	0.07			
average	6.96E-03	4.65E-04	0.06	2.69E-03	4.11E-04	0.08	2.00E-03	7.61E-04	0.38
median	6.25E-03	4.66E-04	0.06	3.91E-03	3.58E-04	0.08			
standard deviation	7.35E-03	1.76E-04	0.02	2.33E-03	1.80E-04	0.02			
COV	1.05	0.38	0.32	0.87	0.44	0.24			
minimum	nd	2.49E-04	0.05	nd	2.59E-04	0.07			
maximum	1.46E-02	6.79E-04	0.07	4.16E-03	6.69E-04	0.09			
count	3	4	2	3	4	2	1	1	1
#>0.00059 µg/L	2	1		2	1		1	1	
%>0.00059 µg/L	66.7	25.0		66.7	25.0		100.0	100.0	

Yellow high-lighted cells are chlordane concentrations >0.00059 µg/L, the tentative limit for Paleta Creek

Paired two sample T-Test for means (Excel) indicated no significant differences for either the unfiltered or filtered observed chlordane concentrations between the sample locations. The upper watershed samples were not evaluated due to lack of data. The chlordane data were therefore grouped for all sampling locations, as shown below:

Unfiltered and Filtered Chlordane Concentrations (µg/L) All Locations Combined

	all unfiltered	all filtered	fraction filtered
	nd	2.49E-04	
	6.25E-03	4.60E-04	0.07
		4.71E-04	
	1.46E-02	6.79E-04	0.05
	4.16E-03	3.86E-04	0.09
	nd	6.69E-04	
		3.29E-04	
	3.91E-03	2.59E-04	0.07
	2.00E-03	7.61E-04	0.38
average	4.42E-03	4.74E-04	0.13
median	3.91E-03	4.60E-04	0.07
standard deviation	5.05E-03	1.90E-04	0.14
COV	1.14	0.40	1.06
minimum	nd	2.49E-04	0.05
maximum	1.46E-02	7.61E-04	0.38
count	7	9	5
#>0.00059 µg/L	5	3	
%>0.00059 µg/L	71.4	33.3	

The mass discharges of chlordane associated with the mixed creek flows, the upper watershed (mostly residential), and the Naval Base San Diego are shown below. These were calculated using the average unfiltered and filtered chlordane concentrations for each of these three sample groups, multiplied by the calculated annual runoff amounts (using WinSLAMM continuous simulations and long-term rainfall records). Most of the chlordane is associated with particulates, with about 7 to 38% filterable through 0.7 µm filters. Due to the variability in the concentrations between the samples and the few samples available (especially for the upper watershed), these annual discharges should only be considered approximate. Only about eight grams of chlordane per year are likely to be discharged from the 810 ha total watershed (about 0.01 g/ha/yr). The NBSD may discharge about three times the chlordane as the upper watershed area, on a unit area basis.

Unfiltered and Filtered Chlordane Mass Discharges by Land Use

	mixed flows (complete watershed, 810 ha)		upper watershed flows, 722 ha)		NBSD flows (87 ha)	
	annual discharges (m^3/yr)	m^3/ha/yr	annual discharges (m^3/yr)	m^3/ha/yr	annual discharges (m^3/yr)	m^3/ha/yr
	1,089,079	1,345	880,336	1,219	208,743	2,399
avg. unfiltered chlordane, µg/L	6.96E-03		2.00E-03		2.69E-03	
avg. filtered chlordane, µg/L	4.65E-04		7.61E-04		4.11E-04	
unfiltered chlordane mass discharge, g/yr and g/ha/yr	7.58	0.0094	1.76	0.0024	0.56	0.0065
filtered chlordane mass discharges, g/yr and g/ha/yr	0.51	0.0006	0.67	0.0009	0.09	0.0010

The following table summarizes the fraction of the chlordane in each size range for the sample groups. Only 9 of the 14 samples had these size-associated chlordane values available. The Kruskal-Wallis test did not indicate any significant differences in the size fraction associations for the different sample groups, so these data were combined, as shown in the following composite table and plot. Only about 9% of the total chlordane mass is associated with the largest particles (>63 µm) that would affect near-field sediment deposition areas, while about 75% of the total chlordane mass is associated with the intermediate 2.7 to 63 µm size range that would affect areas further from the discharge location. About 15% of the total chlordane mass is associated with the smallest particle sizes (0.7 to 2.7 µm) that would stay suspended in the water column for long times/distances.

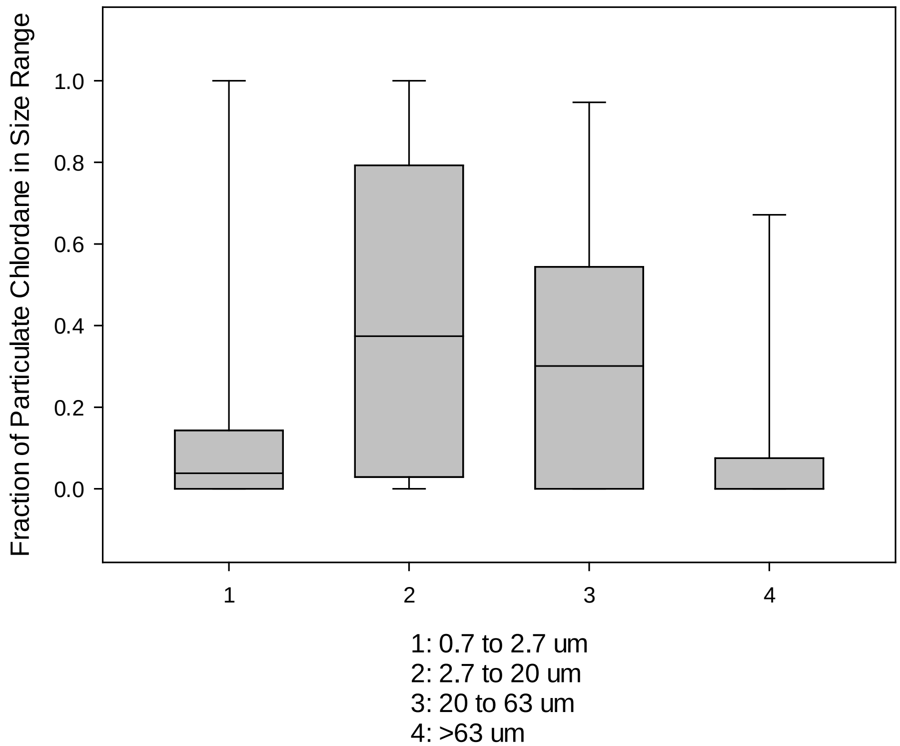
Mass Fractions of Chlordane from Different Sample Group Locations and Particle Size Ranges

	Fraction of Chlordane mass in 0.7 to 2.7 um size range			Fraction of Chlordane mass in 2.7 to 20 um size range			Fraction of Chlordane mass in 20 to 63 um size range			Fraction of Chlordane mass in >63 um size range		
	mixed	upper	NBSD	mixed	upper	NBSD	mixed	upper	NBSD	mixed	upper	NBSD
	0.00	0.02	0.00	0.37	0.03	0.03	0.63	0.95	0.30	0.00	0.00	0.67
	0.05		0.05	0.53		0.95	0.43		0.00	0.00		0.00
	1.00		0.00	0.00		1.00	0.00		0.00	0.00		0.00
	0.04		0.24	0.35		0.64	0.46		0.13	0.15		0.00
K-W p	0.91			0.41			0.10			0.97		
average	0.27	0.02	0.07	0.31	0.03	0.65	0.38	0.95	0.11	0.04	0.00	0.17
median	0.04		0.03	0.36		0.79	0.44		0.06	0.00		0.00
st dev	0.49		0.11	0.22		0.45	0.27		0.14	0.08		0.34
COV	1.79		1.56	0.71		0.68	0.70		1.33	2.00		2.00
min	0.00		0.00	0.00		0.03	0.00		0.00	0.00		0.00
max	1.00		0.24	0.53		1.00	0.63		0.30	0.15		0.67
count	4	1	4	4	1	4	4	1	4	4	1	4

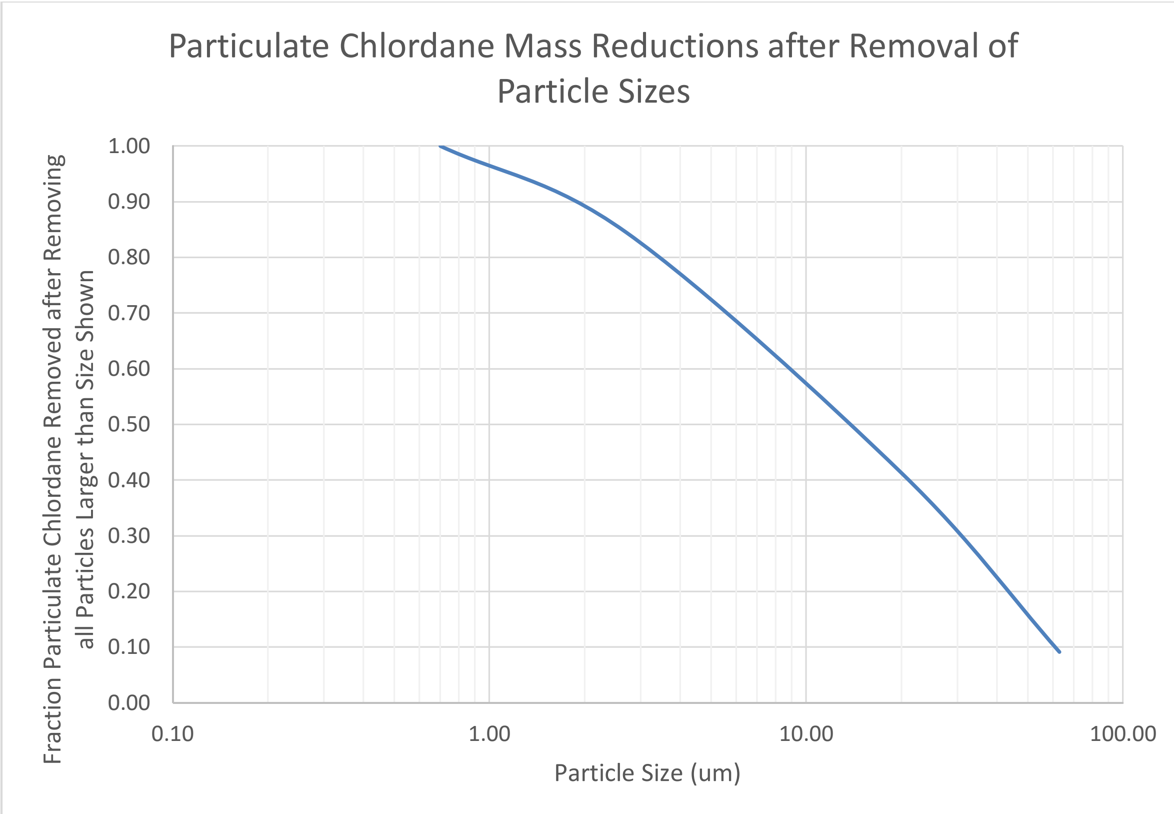
Fraction of Chlordane mass by particle size range

	all 0.7 to 2.7	all 2.7 to 20	all 20 to 63	all >63
	0.00	0.37	0.63	0.00
	0.05	0.53	0.43	0.00
	1.00	0.00	0.00	0.00
	0.04	0.35	0.46	0.15
	0.02	0.03	0.95	0.00
	0.00	0.03	0.30	0.67
	0.05	0.95	0.00	0.00
	0.00	1.00	0.00	0.00
	0.24	0.64	0.13	0.00
average	0.15	0.43	0.32	0.09
median	0.04	0.37	0.30	0.00
st dev	0.33	0.38	0.33	0.22
COV	2.10	0.88	1.02	2.44
min	0.00	0.00	0.00	0.00
max	1.00	1.00	0.95	0.67
count	9	9	9	9

Chlordane Mass Fractions by Particle Size Ranges



The following plot shows the accumulative chlordane mass distribution by particle size. About 55% of the chlordane mass would be removed from the stormwater if all particles larger than about 10 µm (a difficult treatment goal) were removed. It would require capture of particles as small as 2 µm to reduce the chlordane mass by about 90%.



The following tables present the chlordane particulate strength values for the particle size ranges and sampling location groups. Yellow high-lighted values exceed the tentative goal of 2.1 µg/kg for Paleta Creek discharges. The detected chlordane particulate strength values all exceeded this tentative limit. Depending on the frequency of non-detected occurrences, the exceedances range from about 50 to 100% for each category shown. The Kruskal-Wallis test did not identify any significant differences between the sample location groups, so these data were combined to examine differences by particle size.

Chlordane Particulate Strengths (µg/kg) for Different Sample Groups and Particle Sizes

	total	total	total	0.7 to 2.7	0.7 to 2.7	0.7 to 2.7	2.7 to 20	2.7 to 20	2.7 to 20
	upper	NBSD	mixed	upper	NBSD	mixed	upper	NBSD	mixed
	4.77	31.39		26.81	nd	452.66	2.82	3.58	nd
			23.49		nd	12.98		20.98	27.47
		9.56	52.12		9.07	42.85		15.05	30.80
		nd	nd		5.08	nd		2.60	37.63
average	4.77	13.65	25.20	26.81	3.54	127.12	2.82	10.55	23.97
median		9.56	23.49		2.54	27.91		9.32	29.13
st dev		16.09	26.10		4.40	217.76		8.96	16.53
COV		1.18	1.04		1.24	1.71		0.85	0.69
min		nd	nd		nd	nd		2.60	nd
max		31.39	52.12		9.07	452.66		20.98	37.63
count	1	3	3	1	4	4	1	4	4
#>2.1 ug/kg	1	2	2	1	2	3	1	4	3
%>2.1 ug/kg	100.0	66.7	66.7	100.0	50.0	75.0	100.0	100.0	75.0

Chlordane Particulate Strengths (µg/kg) for Different Sample Groups and Particle Sizes (continued)

	20 to 63	20 to 63	20 to 63	>63	>63	>63
	upper	NBSD	mixed	upper	NBSD	mixed
	286.20	19.74	nd	nd	80.97	nd
		nd	549.71			nd
		8.71	138.64		nd	41.47
		nd	71.80		nd	nd
average	286.20	7.11	190.04	nd	26.99	10.37
median		4.35	105.22		nd	nd
st dev		9.37	246.37		46.75	20.73
COV		1.32	1.30		1.73	2.00
min		nd	nd		nd	nd
max		19.74	549.71		80.97	41.47
count	1	4	4	1	3	4
#>2.1 ug/kg	1	2	3	0	1	1
%>2.1 ug/kg	100.0	50.0	75.0	0.0	33.3	25.0

The following table and graph presents the chlordane particle strength data by particle size range. Again, the high-lighted values exceed the tentative limit of 2.1 µg/kg chlordane in the sediments, which all detected values exceed. The largest particle size range (>63 µm) had the lowest particulate strength, while the intermediate size ranges (especially 20 to 63 µm) have the highest chlordane particulate strength values.

Chlordane Particulate Strengths (µg/kg) for Different Particle Sizes

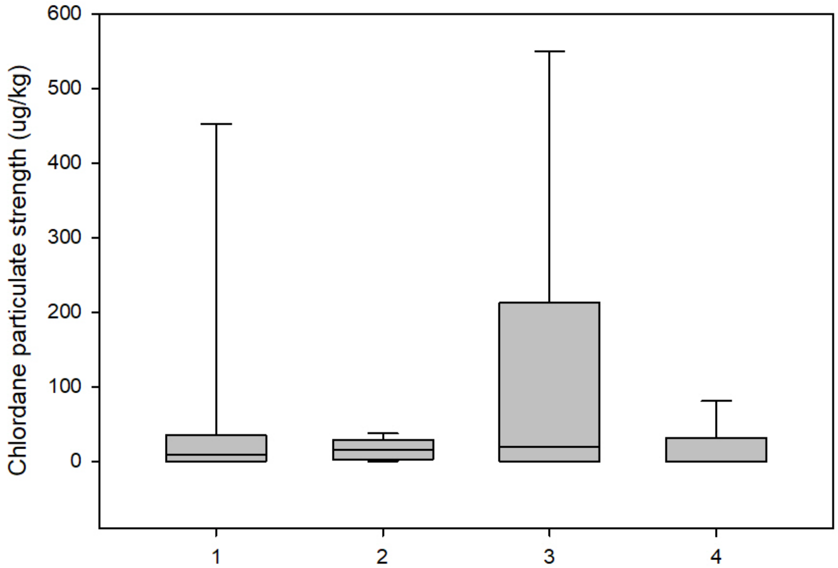
	All Flows Combined				
	total particulates (>0.7 um)	0.7-2.7 µm	2.7-20 µm	20-63 µm	> 63 µm
	NA	452.66	nd	nd	nd
	23.49	12.98	27.47	549.71	nd
	52.12	42.85	30.80	138.64	41.47
	nd	nd	37.63	71.80	nd
	31.39	nd	3.58	19.74	80.97
	NA	nd	20.98	nd	NA
	9.56	9.07	15.05	8.71	nd
	nd	5.08	2.60	0.00	nd
	4.77	26.81	2.82	286.20	nd
average	17.33	61.05	15.66	119.42	15.31
median	9.56	9.07	15.05	19.74	nd
st dev	19.43	147.56	14.17	187.28	30.24
COV	1.12	2.42	0.90	1.57	1.98
min	nd	nd	nd	nd	nd
max	52.12	452.66	37.63	549.71	80.97
count	7	9	9	9	8
#>2.1 ug/kg	5	6	8	6	2
%>2.1 ug/kg	71.4	66.7	88.9	66.7	25.0

Kruskal-Wallis One Way Analysis of Variance on Ranks p = 0.33

NA sample not available

nd chlordane not detected in sample

Chlordane Particulate Strength by Particle Size (ug/kg)



1: 0.7 to 2.7 um
2: 2.7 to 20 um
3: 20 to 63 um
4: >63 um

Section 9: PCB Observations at Paleta Creek

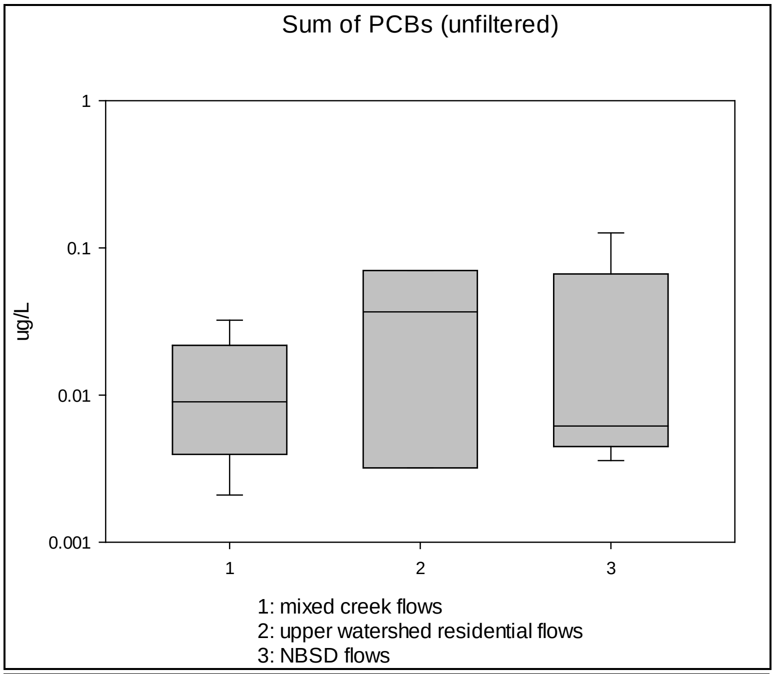
PCB congeners were analyzed in 13 unfiltered and in 15 filtered stormwater samples collected at various locations in the Paleta Creek watershed. The following table shows the observed total PCB concentrations observed (obtained by summing the results from the individual 111 congener values).

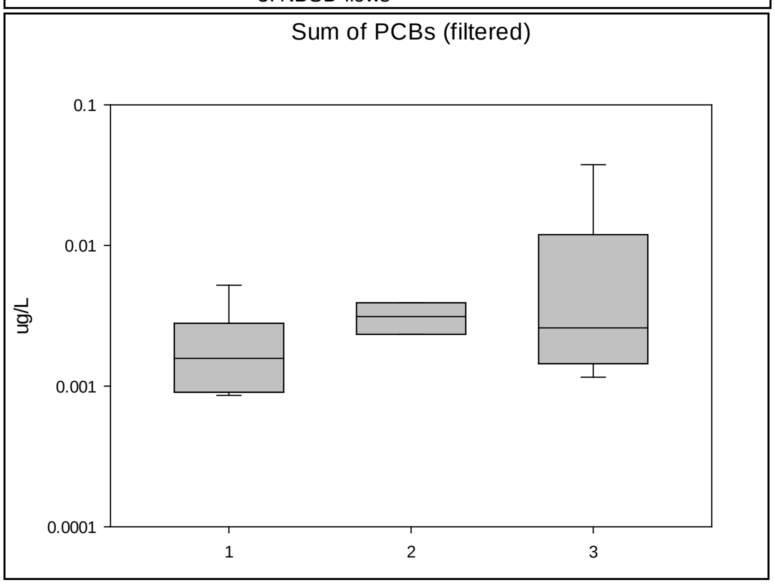
Observed Total PCB Concentrations (111 Congeners) (µg/L)

	all PCBs mixed bulk flows	all PCBs upper watershed bulk flows	all PCBs NBSD bulk flows	all PCBs mixed filtered flows	all PCBs upper watershed filtered flows	all PCBs NBSD filtered flows
	1.83E-02	3.20E-03	5.36E-03	2.61E-03	2.33E-03	3.43E-03
	4.59E-03	7.03E-02	1.27E-01	9.05E-04	3.91E-03	3.75E-02
	6.91E-03		6.73E-03	1.57E-03		1.16E-03
	2.10E-03		6.17E-03	8.58E-04		1.88E-03
	3.23E-02		3.59E-03	1.57E-03		1.54E-03
	1.11E-02			5.22E-03		3.30E-03
				2.79E-03		
Kruskal-Wallis One Way Analysis of Variance on Ranks, p value	0.99 (not significant)			0.51 (not significant)		
average	1.25E-02	3.67E-02	2.97E-02	2.22E-03	3.12E-03	8.14E-03
median	9.01E-03	3.67E-02	6.17E-03	1.57E-03	3.12E-03	2.59E-03
standard deviation	1.12E-02	4.74E-02	5.41E-02	1.52E-03	1.12E-03	1.44E-02
COV	0.89	1.29	1.82	0.69	0.36	1.77
minimum	2.10E-03	3.20E-03	3.59E-03	8.58E-04	2.33E-03	1.16E-03
maximum	3.23E-02	7.03E-02	1.27E-01	5.22E-03	3.91E-03	3.75E-02
count	6	2	5	7	2	6
#>1.7E-4 µg/L	6	2	5	7	2	6
%>1.7E-04 µg/L	100.00	100.00	100.00	100.00	100.00	100.00

All detected total PCB concentrations exceeded the tentative numeric target for Paleta Creek discharges. The tentative numeric target is for 41 congeners (not specified), while 111 congeners were measured during this project.

The following box and whisker plots (SigmaPlot version 13) illustrate the median and ranges of these observed total PCB concentrations, separated by sampling location category.





Kruskal-Wallis One Way Analysis of Variance on Ranks test results did not indicate any significant difference between the sample total PCB concentrations for the different location groups, for the number of samples available. However, there is an apparent increase in total PCB concentrations for the NBSD samples compared to the mixed creek flow values. The following table summarizes the observed total PCB concentrations for unfiltered (bulk) and filtered samples. Most of the total PCBs are associated with particulate-bound material (overall average of about 80%).

Total PCB Concentrations for All Sampling Locations Combined (μg/L)

	Count	Average	Median	Min	Max	Std Dev	COV
all samples bulk	13	2.29E-02	6.73E-03	2.10E-03	1.27E-01	3.64E-02	1.59
all samples filtered	15	4.71E-03	2.33E-03	8.58E-04	3.75E-02	9.16E-03	1.94

The following table shows the calculated mass discharges of total PCBs from the NBSD, upper watershed, and total watershed areas. As the upper watershed is only represented by two samples, those results are not as reliable as for the NBSD and total watershed (represented by the mixed flows from the receiving waters). These mass discharges were calculated based on the average total PCB concentrations observed at each sampling location group multiplied by the modeled total area average annual stormwater discharges (using WinSLAMM and long-term recorded rains). Unit area discharges are also shown, calculated by dividing the total area average annual discharges by the subwatershed areas.

Loading Calculations for Total PCB Discharges by Sampling Location Category

	Upper Watershed (722 ha, 1,784 ac) [2 unfiltered and filtered samples]	NBSD (87 ha, 216 ac) [5 unfiltered and 6 filtered samples]	Mixed Flows (complete watershed) (810 ha, 2,000 ac) [6 unfiltered and 7 filtered samples]
Annual runoff (m^3/yr):	880,336	208,743	1,089,079
Annual unit area runoff (m^3/ha/yr):	1,219	2,399	1,345
Bulk (unfiltered) mass discharges (g/yr)	32.30	6.19	13.70
Bulk (unfiltered) unit area mass discharges (g/ha/yr)	0.045	0.071	0.017
Filtered mass discharges (g/yr)	2.75	1.70	2.42
Filtered mass discharges (g/ha/yr)	0.004	0.020	0.003
% bulk (unfiltered mass discharge as filtered forms	8.5	27.4	17.7

particulate bound mass discharges (g/yr)	29.60	4.50	11.30
particulate bound mass unit area discharges (g/ha/yr)	0.041	0.052	0.014

As noted previously, the particulate-bound total PCB concentrations comprise most of the total PCB values. It is estimated that the NBSD discharges are responsible for about 40% of the total watershed total PCB discharges, while only comprising about 11% of the total watershed area.

The following tables lists all of the observed particulate strength values for total PCBs (all congeners summed) by particle size and sampling location group.

Particulate Strength Total PCB (sum of all congeners) for Mixed Creek Flows: A1W, A2W, A3W, and C1W (7 samples)

µg/kg	0.7-2.7 µm	2.7-20 µm	20-63 µm	> 63 µm
Ambient Receiving water sample collected on 1/5/2016 at 1327 h (A1W), event 1	nd	258	267	nd
Ambient Receiving water sample 1 (A1W), event 2	3.17	4.33	174	nd
Ambient Receiving water sample collected on 1/5/2016 at 1947 h (A2W), event 1	49.0	22.2	518	nd
Ambient Receiving water sample 2 (A2W), event 2	nd	30.2	nd	nd
Ambient Receiving water sample collected on 1/6/2016 at 0333 h (A3W), event 1	1,269	33.7	5.78	
Paleta Creek at Cummings Road (C1W), event 1	nd	101	286	nd
Paleta Creek at Cummings Road (C1W), event 2	417	19.5	nd	nd
average	347	67.1	178	nd

Particulate Strength Total PCB (sum of all congeners) for Upper watershed flows (mostly residential): C2W (2 samples)

ug/kg	0.7-2.7 µm	2.7-20 µm	20-63 µm	> 63 µm
Paleta Creek at Main Street (C2W), event 1	na	3.25	240	na
Paleta Creek at Main Street (C2W), event 2	na	46.1	21.2	112
average	na	24.7	130	56.4

Particulate Strength Total PCB (sum of all congeners) for NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)

ug/kg	0.7-2.7 µm	2.7-20 µm	20-63 µm	> 63 µm
NBSD outfall #23 (O1W), event 1	nd	nd	43.8	22.3
NBSD outfall #33 (O2W), event 1	492	272	nd	nd
NBSD outfall #33 (O2W), event 2	nd	30.9	210	128
NBSD outfall north of railroad crossing (O3W), event 1	nd	72.4	nd	na
NBSD outfall at Paunack and Division Streets (O4W), event 1	23.0	19.9	39.0	nd
NBSD outfall at Paunack and Division Streets (O4W), event 2	nd	2.72	125	nd
average	257	66.5	69.9	37.6

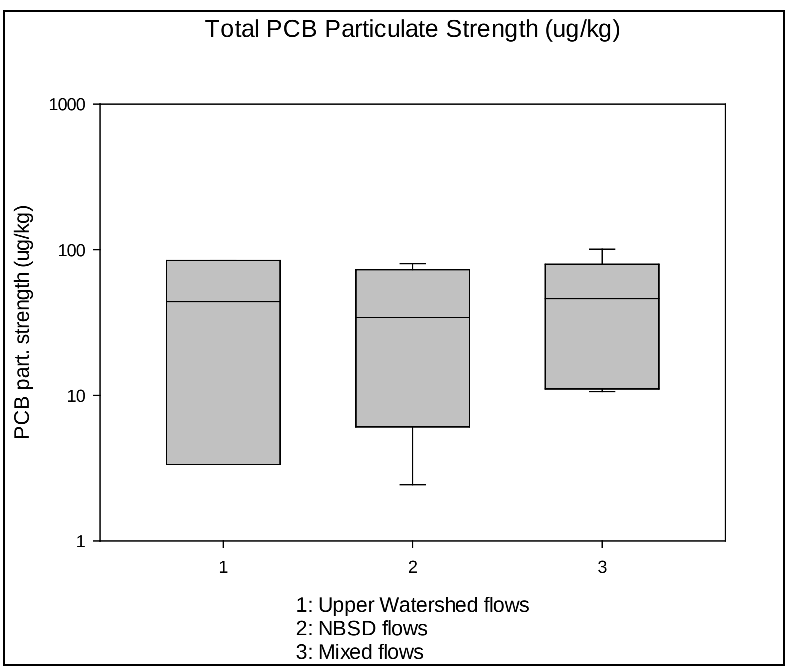
The following table shows the total sample PCB particulate strength values for all of the samples, compared to the 168 µg/kg tentative numeric limit for Paleta Creek. All of the samples are less than this tentative limit, with the largest value observed being 101 µg/kg (about 0.6 of the tentative limit).

Total Sample Particulate Strength Total PCB Values Compared to Tentative Numeric Limit

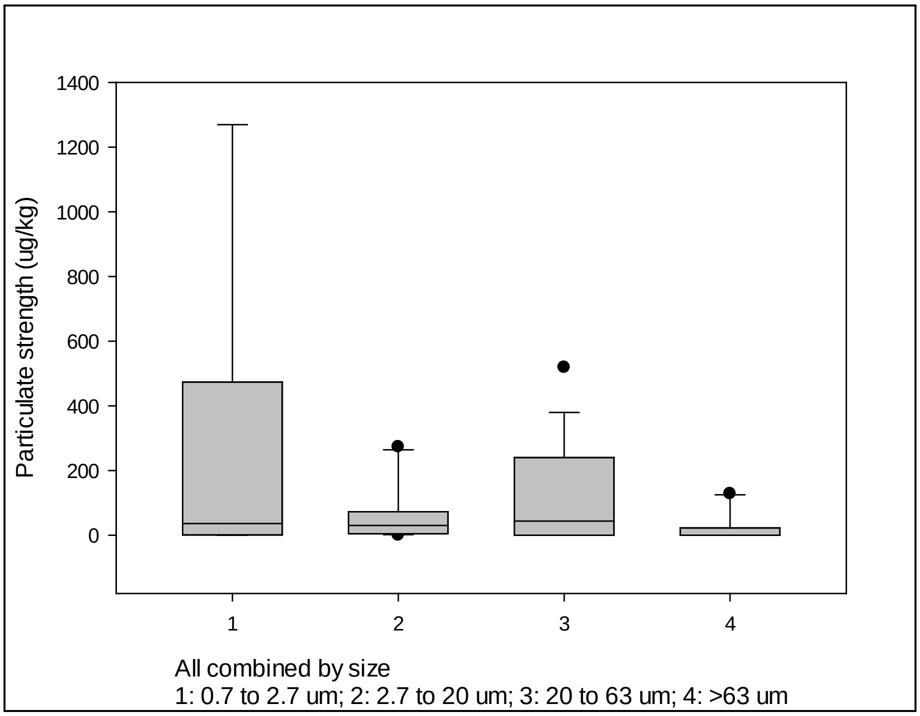
Solid Fraction (>0.7 µm)	Total particulate PCBs sum of all 111 congeners (µg/kg)	ratio observed/168 µg/kg
MF C1W event 1	101	0.60
MF C1W event 2	70.6	0.42
Creek C2W event 1	3.35	0.02
Creek C2W event 2	84.6	0.50
MF A1W event 1	72.3	0.43

MF A1W event 2	11.2	0.07
MF A2W event 1	21.6	0.13
MF A2W event 2	10.5	0.06
MF A3W event 1	NA	na
NBSD O1W event 1	16.9	0.10
NBSD O2W event 1	80.1	0.48
NBSD O2W event 2	51.5	0.31
NBSD O3W event 1	NA	na
NBSD O4W event 1	ND	na
NBSD O4W event 2	2.43	0.01
average	43.8	0.26
standard deviation	36.4	0.22
COV	0.83	0.83
median	36.6	0.22
number of observations	12	12
minimum	2.43	0.01
maximum	101	0.60

The following box and whisker plot compares the observed concentration range for particulate strengths for total PCB values by sample location group. The Kruskal-Wallis One Way Analysis of Variance on Ranks calculated p value was 0.88, indicating no significant differences between the sampling locations, as visually apparent.



The following plot shows the total PCB particulate strength values for all of the samples combined, by particle size range. It is apparent that the smallest particle sizes (0.7 to 2.7 µm) have a wider range with larger observed values than the larger particle sizes.



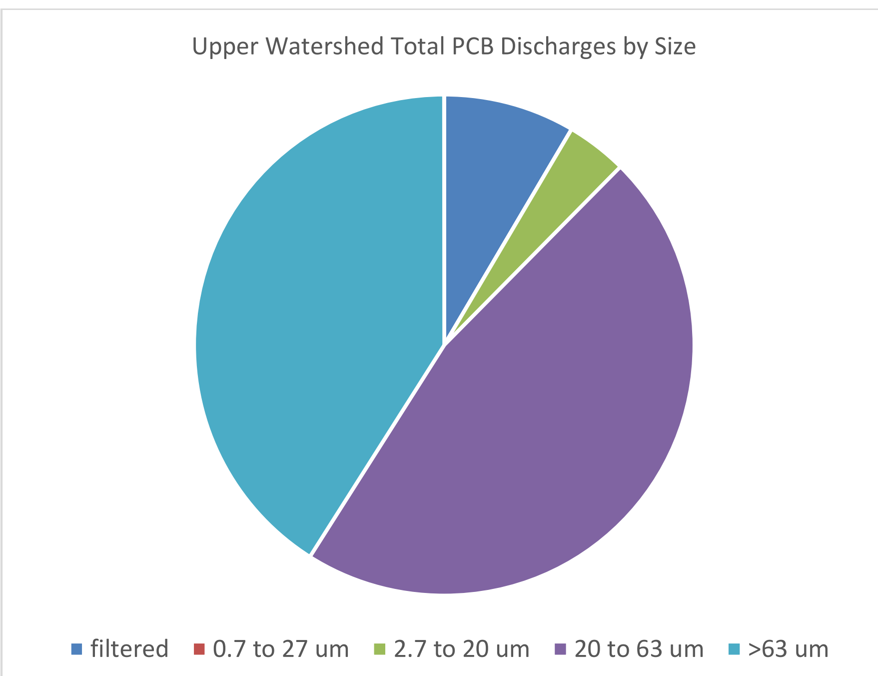
However, the particulate solids distribution compensates for this distribution pattern somewhat, as shown on the following table of mass discharge calculations by particle size range and sample location groups. The upper watershed particulate PCB discharges are mostly in the >20 µm size range (but these values are only supported by two samples). The NBSD and mixed flow creek samples have most of their particulate PCB discharges in the 2.7 to 63 µm size range.

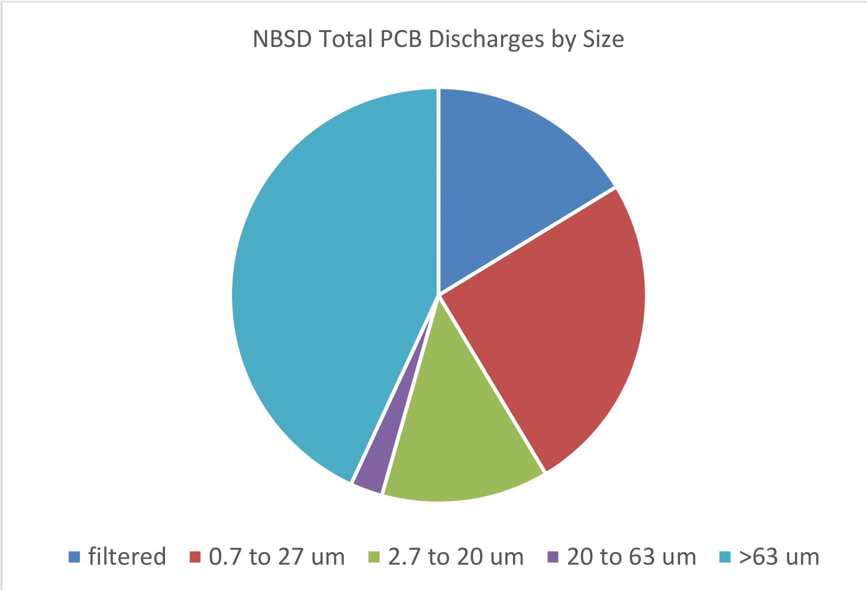
Calculated Particulate PCB Mass Discharges by Size Range and Sampling Location Group

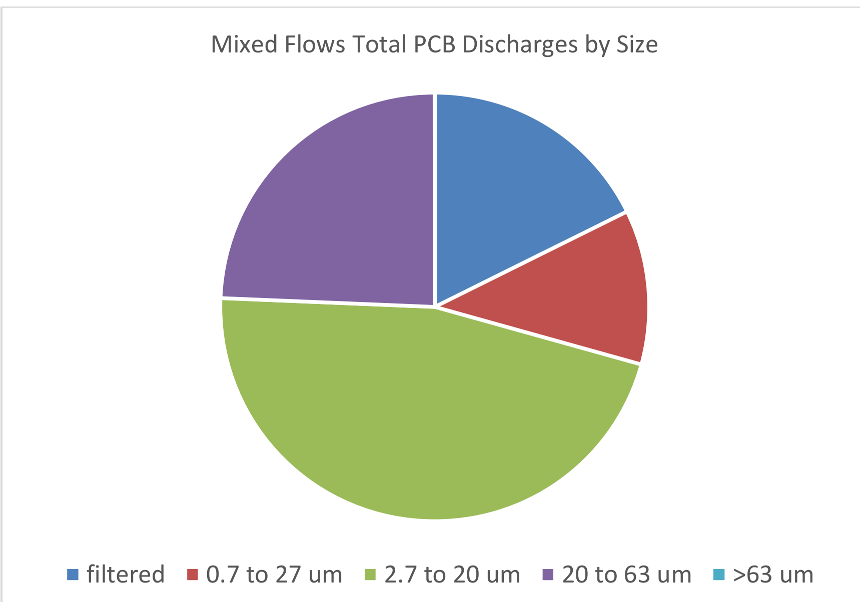
Sample Component	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)
average mass fraction in size 0.7 to 27 um	0.00	0.06	0.14

average mass fraction in size 2.7 to 20 um	0.04	0.58	0.56
average mass fraction in size 20 to 63 um	0.51	0.30	0.30
average mass fraction in size >63 um	0.45	0.06	0.00
particulate discharge in size 0.7 to 27 um (g/yr)	0.00	2.62	1.59
particulate discharge in size 2.7 to 20 um (g/yr)	1.27	1.36	6.33
particulate discharge in size 20 to 63 um (g/yr)	15.07	0.26	3.33
particulate discharge in size >63 um (g/yr)	13.26	4.50	0.00

The following figures show plots of these mass particulate total PCB discharges.







Selected congener concentration and loading data are included in Appendices M and N. Details are provided for the following 12 congeners: those listed on relative risk reports: 105, 114, 118, 123, 126, 156, 157, and 189; and those found to be most abundant at most sampling areas: 092, 101, 110, and 153. Other congeners are listed on the relative risk reports that were not detected in any of the samples (congeners 167 and 169), or not analyzed (congeners 77 and 81). Some of the congeners shown in the appendix had mostly non-detected values, which hindered the data analyses.

List of Congeners having Relative Ricks and Paleta Creek Observed Contributions and Ranks

PCB congeners	Van den Berg, et al. Environmental Health Perspectives, V 106, No 12, Dec 1998. pgs 775 - 792.	WHO TEF (1998 paper) human risk and mammals	WHO TEF (1998 paper) fish	WHO TEF (1998 paper) birds	Mixed bulk flows, PCB congeners (% of total and rank of all 111; 101 detected)	upper watershed bulk flows, PCB congeners (% of total and rank of all 111; 81 detected)	NBSD bulk flows, PCB congeners (% of total and rank of all 111; 100 detected)
77	non-ortho PCBs	0.0001	0.0001	0.05	na	na	na
81	non-ortho PCBs	0.0001	0.0005	0.1	na	na	na
105	mono-ortho PCBs	0.0001	<0.000005	0.0001	2.24 (12)	2.32 (12)	2.19 (13)
114	mono-ortho PCBs	0.0005	<0.000005	0.0001	1.16 (28)	0 (nd)	0.35 (71)
118	mono-ortho PCBs	0.0001	<0.000005	0.00001	2.89 (9)	2.02 (15)	3.05 (7)
123	mono-ortho PCBs	0.0001	<0.000005	0.00001	0.07 (91)	0 (nd)	0.1 (86)
126	non-ortho PCBs	0.1	0.005	0.1	0.13 (78)	0 (nd)	0.07 (90)
156	mono-ortho PCBs	0.0005	<0.000005	0.0001	1.05 (31)	0.85 (38)	0.69 (49)
157	mono-ortho PCBs	0.0005	<0.000005	0.0001	0.08 (89)	0 (nd)	0.06 (96)
167	mono-ortho PCBs	0.00001	<0.000005	0.00001	0 (nd)	0 (nd)	0 (nd)
169	non-ortho PCBs	0.01	0.00005	0.001	0 (nd)	0 (nd)	0 (nd)
189	mono-ortho PCBs	0.0001	<0.000005	0.00001	0.01 (101)	0 (nd)	0.003 (100)

The most common observed congeners in the Paleta Creek watershed listed on the relative risk reports were: 118 (ranked 7 to 15), 105 (ranked 12 and 13), 114 (ranked 28 to 71), and 156 (ranked 31 to 49). The other congeners listed in the relative risk reports were less abundant. Congeners 092, 110, 153, and 101 were generally the most abundant in the samples.

The following tables list the rankings of the 111 PCB congeners analyzed in the samples during this project, separated by sample location category. These are ranked by abundance, with the congeners comprising the largest fractions of the total PCB values at the top of the lists. Also shown are the accumulative percentages of the congeners. If the concentration or loading for any individual congener is desired, it is possible to multiply the associated congener percentage value by the total PCB concentrations or loading value.

Following the tables, are graphs that plot the filtered vs. total concentrations for each congener. This relationship is more consistent for the NBSD congeners than for the other sample groups. The filtered congeners for the NBSD samples comprised about 25% of the total PCB concentration. In contrast, the mixed flow samples from the creek indicated about 12% filtered PCB content, and the upper watershed samples indicated only about 4% filtered PCB content. As noted, there was much more data scatter for the upper watershed and mixed flow samples, likely due to the lower filtered PCB congener concentrations.

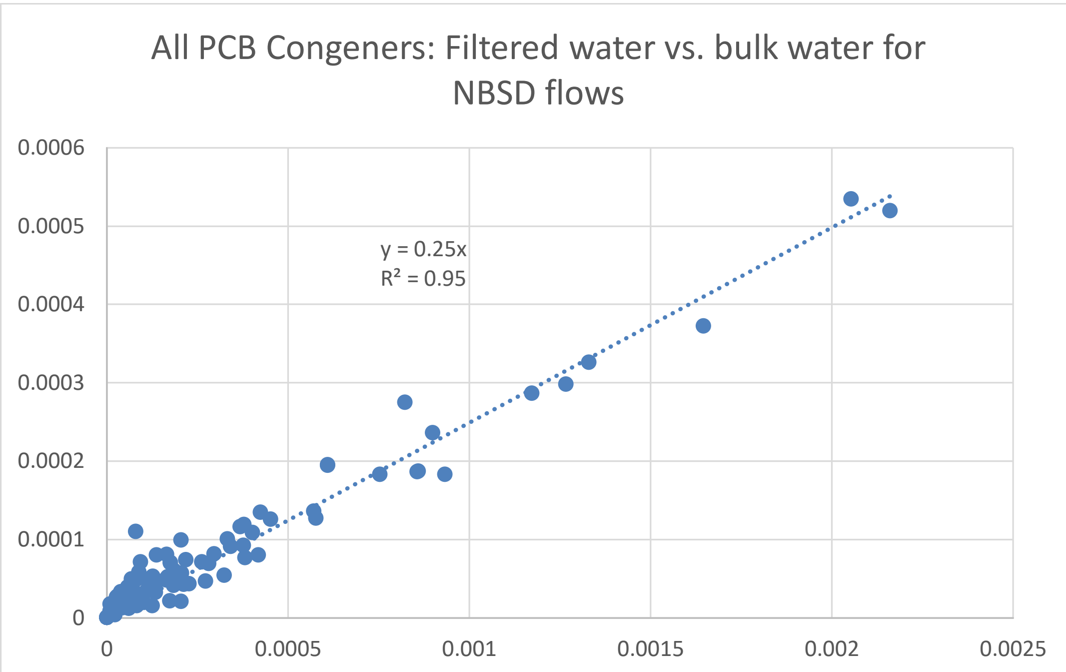
Ranked PCB Congeners by Abundance for NBSD Samples for Unfiltered and Filtered Samples

Unfiltered Samples			Filtered Samples		
NBSD Samples Congeners	This bulk congener as % of sum of all congeners	% accumulative	NBSD Samples Congeners	This filtered congener as % of sum of all filtered congeners	% accumulative
110 Results	5.4	5.4	101 Results	6.3	6.3
101 Results	4.8	10.2	110 Results	4.9	11.2
153 Results	4.6	14.8	114 Results	4.5	15.7
149 Results	3.4	18.1	052 Results	3.4	19.1
180 Results	3.2	21.3	099 Results	3.0	22.2
099 Results	3.1	24.4	153 Results	2.9	25.1
118 Results	3.1	27.5	087 Results	2.8	27.9
174 Results	2.9	30.3	149 Results	2.8	30.7
138 Results	2.7	33.0	070 Results	2.7	33.4
163 Results	2.6	35.6	093 Results	2.7	36.1
087 Results	2.5	38.0	095 Results	2.6	38.7
031 Results	2.4	40.4	031 Results	2.5	41.2
105 Results	2.2	42.6	118 Results	2.0	43.3
052 Results	2.2	44.8	015 Results	1.9	45.2
066 Results	1.9	46.7	018 Results	1.9	47.1
170 Results	1.9	48.6	107 Results	1.8	48.9
028 Results	1.8	50.4	092 Results	1.8	50.7
020 Results	1.8	52.2	103 Results	1.7	52.4
093 Results	1.7	53.9	044 Results	1.7	54.0
095 Results	1.7	55.6	105 Results	1.6	55.6
187 Results	1.7	57.3	77 Results	1.6	57.2
041 Results	1.4	58.7	066 Results	1.5	58.7
092 Results	1.4	60.1	177 Results	1.5	60.3
132 Results	1.3	61.4	084 Results	1.5	61.8
044 Results	1.3	62.7	180 Results	1.4	63.2
017 Results	1.3	64.0	020 Results	1.4	64.6
070 Results	1.3	65.3	115 Results	1.4	66.0
77 Results	1.1	66.4	151 Results	1.3	67.3
056 Results	1.1	67.5	017 Results	1.3	68.7
194 Results	1.1	68.6	172 Results	1.3	70.0

060 Results	1.1	69.6	082 Results	1.2	71.2
141 Results	1.1	70.7	025 Results	1.2	72.4
198 Results	1.1	71.7	008 Results	1.2	73.6
177 Results	1.0	72.8	138 Results	1.2	74.7
158 Results	1.0	73.8	163 Results	1.1	75.9
146 Results	1.0	74.8	132 Results	1.1	77.0
151 Results	1.0	75.8	141 Results	1.1	78.1
084 Results	1.0	76.8	028 Results	1.1	79.2
015 Results	1.0	77.8	041 Results	1.1	80.2
018 Results	1.0	78.7	174 Results	1.0	81.3
115 Results	1.0	79.7	024 Results	1.0	82.3
082 Results	0.9	80.6	037 Results	1.0	83.3
103 Results	0.9	81.5	056 Results	1.0	84.2
022 Results	0.9	82.4	074 Results	0.9	85.2
037 Results	0.8	83.3	060 Results	0.9	86.1
025 Results	0.8	84.1	047 Results	0.9	86.9
206 Results	0.7	84.8	022 Results	0.9	87.8
024 Results	0.7	85.5	146 Results	0.8	88.6
156 Results	0.7	86.2	004 Results	0.8	89.5
183 Results	0.7	86.9	005 Results	0.8	90.2
203 Results	0.6	87.5	027 Results	0.8	91.0
196 Results	0.6	88.1	136 Results	0.8	91.8
074 Results	0.6	88.7	003 Results	0.7	92.5
008 Results	0.6	89.3	170 Results	0.7	93.1
047 Results	0.6	89.8	016 Results	0.6	93.7
027 Results	0.5	90.3	083 Results	0.6	94.3
136 Results	0.5	90.8	026 Results	0.6	94.9
107 Results	0.5	91.3	040 Results	0.6	95.5
048 Results	0.5	91.8	071 Results	0.6	96.0
190 Results	0.4	92.2	187 Results	0.6	96.6
071 Results	0.4	92.7	158 Results	0.6	97.2
016 Results	0.4	93.1	032 Results	0.6	97.7
042 Results	0.4	93.5	156 Results	0.5	98.2
004 Results	0.4	93.9	045 Results	0.5	98.7
172 Results	0.4	94.3	198 Results	0.5	99.2
005 Results	0.4	94.7	002 Results	0.5	99.6
045 Results	0.4	95.0	135 Results	0.5	100.1
135 Results	0.4	95.4	042 Results	0.5	100.5
003 Results	0.4	95.8	001 Results	0.4	100.9
032 Results	0.4	96.1	194 Results	0.4	101.3

114 Results	0.4	96.5	010 Results	0.4	101.7
179 Results	0.3	96.8	206 Results	0.3	102.0
040 Results	0.3	97.1	006 Results	0.3	102.4
026 Results	0.3	97.4	203 Results	0.3	102.7
205 Results	0.3	97.7	196 Results	0.3	103.0
144 Results	0.3	98.0	144 Results	0.3	103.2
209 Results	0.3	98.2	183 Results	0.3	103.5
002 Results	0.3	98.5	009 Results	0.2	103.7
006 Results	0.2	98.7	048 Results	0.2	104.0
178 Results	0.2	98.9	007 Results	0.2	104.2
001 Results	0.2	99.0	179 Results	0.2	104.4
208 Results	0.1	99.2	190 Results	0.2	104.6
119 Results	0.1	99.3	205 Results	0.2	104.7
134 Results	0.1	99.4	209 Results	0.2	104.9
083 Results	0.1	99.5	019 Results	0.2	105.1
123 Results	0.1	99.6	123 Results	0.1	105.2
010 Results	0.1	99.7	119 Results	0.1	105.3
147 Results	0.1	99.8	126 Results	0.1	105.4
81 Results	0.1	99.9	193 Results	0.1	105.5
126 Results	0.1	100.0	81 Results	0.1	105.5
193 Results	0.1	100.0	134 Results	0.1	105.6
009 Results	0.1	100.1	147 Results	0.1	105.7
019 Results	0.1	100.2	178 Results	0.1	105.8
171 Results	0.1	100.2	195 Results	0.1	105.8
007 Results	0.1	100.3	157 Results	0.1	105.9
157 Results	0.1	100.4	171 Results	0.1	106.0
195 Results	0.1	100.4	197 Results	0.0	106.0
207 Results	0.0	100.4	208 Results	0.0	106.0
197 Results	0.0	100.4	207 Results	0.0	106.1
189 Results	0.0	100.4	189 Results	0.0	106.1
034 Results	0.0	100.4	034 Results	0.0	106.1
029 Results	0.0	100.4	029 Results	0.0	106.1
046 Results	0.0	100.4	046 Results	0.0	106.1
069 Results	0.0	100.4	069 Results	0.0	106.1
067 Results	0.0	100.4	067 Results	0.0	106.1
131 Results	0.0	100.4	131 Results	0.0	106.1
128 Results	0.0	100.4	128 Results	0.0	106.1
167 Results	0.0	100.4	167 Results	0.0	106.1
173 Results	0.0	100.4	173 Results	0.0	106.1
191 Results	0.0	100.4	191 Results	0.0	106.1

169 Results	0.0	100.4	169 Results	0.0	106.1



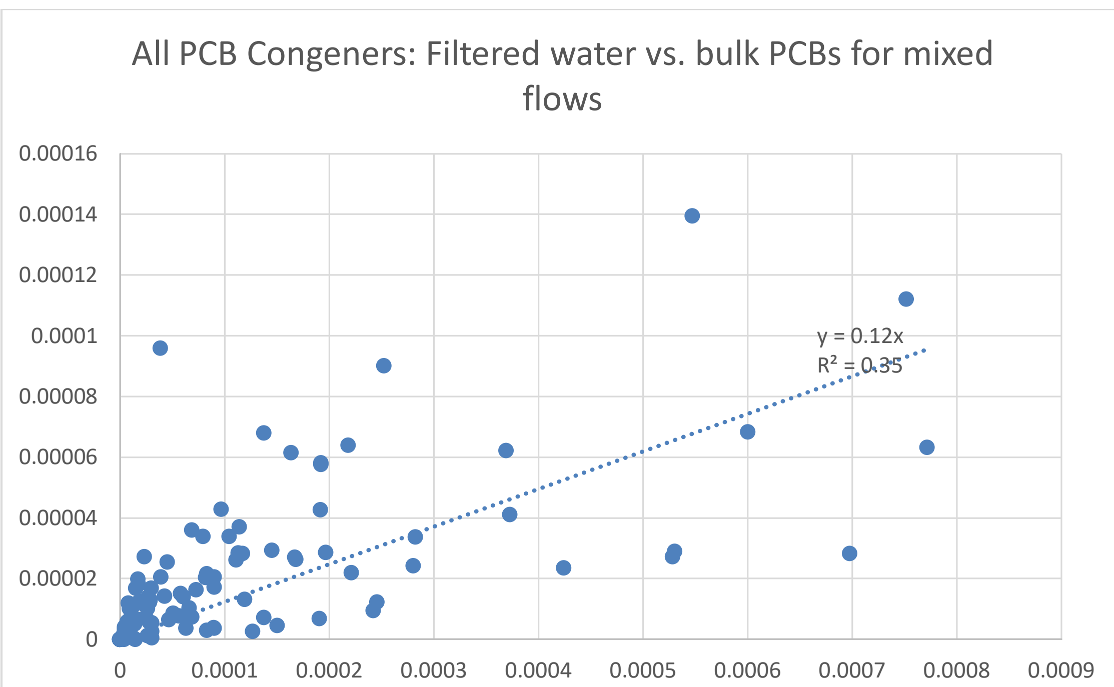
Ranked PCB Congeners by Abundance for Mixed Flow Creek Samples for Unfiltered and Filtered Samples

Unfiltered Samples			Filter Samples		
Mixed Flows Congeners	This bulk congener as % of sum of all congeners	accumulative %	Mixed Flows Congeners	This filtered congener as % of sum of all filtered congeners	accumulative %
110 Results	6.3	6.3	101 Results	6.4	6.4
153 Results	5.8	12.1	110 Results	5.2	11.5
180 Results	4.8	16.9	052 Results	4.1	15.7
101 Results	4.8	21.7	107 Results	3.1	18.8
149 Results	4.8	26.5	149 Results	3.1	21.9
138 Results	4.0	30.4	031 Results	3.0	24.9
163 Results	3.9	34.3	099 Results	2.8	27.6
087 Results	2.9	37.3	114 Results	2.8	30.4
118 Results	2.9	40.2	087 Results	2.7	33.2
170 Results	2.7	42.9	153 Results	2.7	35.8
070 Results	2.6	45.5	093 Results	2.5	38.3

105 Results	2.2	47.7	095 Results	2.5	40.8
052 Results	2.2	50.0	082 Results	2.4	43.2
132 Results	2.1	52.1	015 Results	2.2	45.4
099 Results	2.0	54.1	103 Results	2.1	47.5
187 Results	1.9	55.9	070 Results	2.0	49.5
093 Results	1.7	57.6	092 Results	1.9	51.4
095 Results	1.7	59.3	044 Results	1.9	53.4
174 Results	1.7	61.0	020 Results	1.8	55.2
041 Results	1.6	62.6	118 Results	1.6	56.8
044 Results	1.6	64.3	018 Results	1.6	58.4
141 Results	1.6	65.9	105 Results	1.5	59.9
066 Results	1.5	67.4	074 Results	1.4	61.3
194 Results	1.4	68.8	77 Results	1.4	62.7
092 Results	1.3	70.1	066 Results	1.4	64.1
151 Results	1.3	71.5	028 Results	1.3	65.4
031 Results	1.2	72.7	008 Results	1.3	66.7
114 Results	1.2	73.8	138 Results	1.3	68.0
198 Results	1.2	75.0	041 Results	1.3	69.3
77 Results	1.1	76.1	151 Results	1.3	70.5
156 Results	1.1	77.1	180 Results	1.2	71.8
084 Results	1.0	78.1	084 Results	1.2	73.0
074 Results	1.0	79.0	163 Results	1.1	74.1
028 Results	1.0	80.0	132 Results	1.1	75.1
082 Results	0.9	81.0	115 Results	1.0	76.2
183 Results	0.9	81.8	141 Results	1.0	77.2
146 Results	0.9	82.7	017 Results	1.0	78.2
177 Results	0.9	83.6	004 Results	1.0	79.2
015 Results	0.9	84.4	056 Results	0.9	80.1
103 Results	0.8	85.3	025 Results	0.9	81.0
020 Results	0.8	86.1	060 Results	0.9	81.8
206 Results	0.8	86.9	037 Results	0.8	82.7
115 Results	0.8	87.6	024 Results	0.8	83.5
056 Results	0.7	88.4	022 Results	0.8	84.3
060 Results	0.7	89.1	170 Results	0.8	85.1
172 Results	0.7	89.8	005 Results	0.7	85.8
136 Results	0.7	90.5	172 Results	0.7	86.6
196 Results	0.6	91.2	040 Results	0.7	87.3
203 Results	0.6	91.8	136 Results	0.7	88.0
018 Results	0.6	92.4	003 Results	0.7	88.7
037 Results	0.5	92.9	123 Results	0.7	89.4

047 Results	0.5	93.4	047 Results	0.6	90.0
135 Results	0.5	93.9	083 Results	0.6	90.7
190 Results	0.5	94.4	045 Results	0.6	91.2
071 Results	0.5	94.9	146 Results	0.6	91.8
008 Results	0.5	95.3	194 Results	0.5	92.3
040 Results	0.4	95.8	016 Results	0.5	92.9
042 Results	0.4	96.2	032 Results	0.5	93.4
179 Results	0.3	96.5	174 Results	0.5	93.9
022 Results	0.3	96.9	156 Results	0.5	94.4
004 Results	0.3	97.1	026 Results	0.5	94.9
003 Results	0.3	97.4	002 Results	0.5	95.4
209 Results	0.3	97.6	147 Results	0.5	95.9
048 Results	0.2	97.9	027 Results	0.4	96.4
158 Results	0.2	98.1	187 Results	0.4	96.8
005 Results	0.2	98.4	071 Results	0.4	97.2
144 Results	0.2	98.6	135 Results	0.4	97.6
024 Results	0.2	98.8	177 Results	0.4	98.0
016 Results	0.2	99.1	042 Results	0.4	98.3
032 Results	0.2	99.3	126 Results	0.4	98.7
147 Results	0.2	99.5	001 Results	0.3	99.0
107 Results	0.2	99.7	006 Results	0.3	99.3
045 Results	0.2	99.9	81 Results	0.3	99.6
002 Results	0.2	100.0	010 Results	0.3	99.9
017 Results	0.2	100.2	157 Results	0.3	100.1
025 Results	0.2	100.4	193 Results	0.3	100.4
026 Results	0.2	100.5	144 Results	0.2	100.6
126 Results	0.1	100.6	206 Results	0.2	100.8
083 Results	0.1	100.8	119 Results	0.2	101.0
001 Results	0.1	100.9	048 Results	0.2	101.3
171 Results	0.1	101.0	009 Results	0.2	101.4
81 Results	0.1	101.1	198 Results	0.2	101.6
208 Results	0.1	101.2	196 Results	0.2	101.8
006 Results	0.1	101.4	007 Results	0.2	101.9
134 Results	0.1	101.5	203 Results	0.1	102.1
195 Results	0.1	101.6	183 Results	0.1	102.2
193 Results	0.1	101.6	178 Results	0.1	102.4
178 Results	0.1	101.7	179 Results	0.1	102.5
157 Results	0.1	101.8	209 Results	0.1	102.6
010 Results	0.1	101.9	019 Results	0.1	102.7
123 Results	0.1	101.9	205 Results	0.1	102.8

009 Results	0.1	102.0	158 Results	0.1	102.8
027 Results	0.1	102.1	195 Results	0.0	102.9
007 Results	0.1	102.1	197 Results	0.0	102.9
119 Results	0.0	102.1	190 Results	0.0	103.0
131 Results	0.0	102.2	134 Results	0.0	103.0
205 Results	0.0	102.2	207 Results	0.0	103.0
019 Results	0.0	102.2	189 Results	0.0	103.0
207 Results	0.0	102.2	208 Results	0.0	103.0
197 Results	0.0	102.3	034 Results	0.0	103.0
189 Results	0.0	102.3	029 Results	0.0	103.0
034 Results	0.0	102.3	046 Results	0.0	103.0
029 Results	0.0	102.3	069 Results	0.0	103.0
046 Results	0.0	102.3	067 Results	0.0	103.0
069 Results	0.0	102.3	131 Results	0.0	103.0
067 Results	0.0	102.3	128 Results	0.0	103.0
128 Results	0.0	102.3	167 Results	0.0	103.0
167 Results	0.0	102.3	171 Results	0.0	103.0
173 Results	0.0	102.3	173 Results	0.0	103.0
191 Results	0.0	102.3	191 Results	0.0	103.0
169 Results	0.0	102.3	169 Results	0.0	103.0

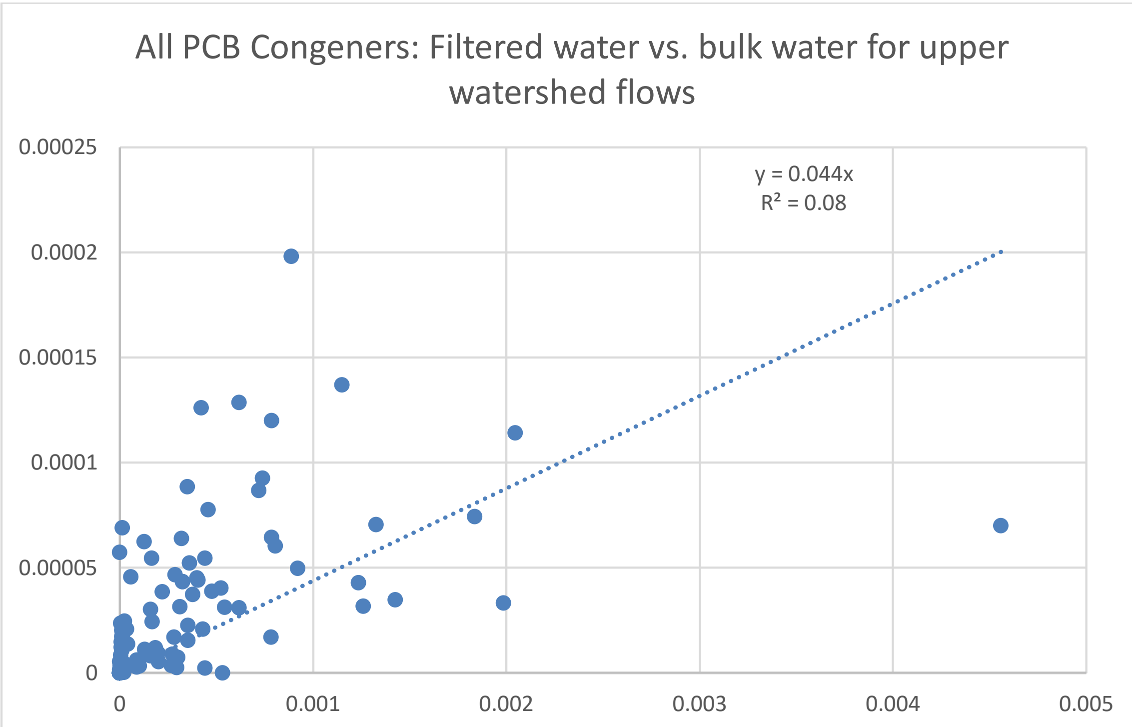


Ranked PCB Congeners by Abundance for Upper Watershed Samples for Unfiltered and Filtered Samples

Unfiltered Samples			Filtered Samples		
Upper Watershed Congeners	This bulk congener as % of sum of all congeners	accumulative %	Upper Watershed Congeners	This filtered congener as % of sum of all filtered congeners	accumulative %
092 Results	7.1	7.1	031 Results	5.5	5.5
110 Results	6.0	13.1	101 Results	4.7	10.2
101 Results	4.7	17.8	110 Results	3.9	14.1
153 Results	4.6	22.4	099 Results	3.5	17.6
149 Results	4.0	26.4	020 Results	3.5	21.1
082 Results	3.6	30.0	017 Results	3.3	24.4
138 Results	3.4	33.3	052 Results	3.0	27.5
163 Results	3.2	36.5	107 Results	3.0	30.4
180 Results	2.9	39.4	158 Results	2.9	33.4
172 Results	2.6	42.0	105 Results	2.7	36.1
087 Results	2.4	44.4	172 Results	2.5	38.6
105 Results	2.3	46.8	015 Results	2.5	41.1
099 Results	2.3	49.0	149 Results	2.5	43.6
187 Results	2.1	51.1	153 Results	2.5	46.1
118 Results	2.0	53.1	092 Results	2.1	48.2
031 Results	1.9	55.0	087 Results	2.1	50.2
103 Results	1.8	56.9	024 Results	2.0	52.3
170 Results	1.8	58.7	070 Results	2.0	54.3
052 Results	1.8	60.5	103 Results	1.9	56.2
77 Results	1.8	62.3	018 Results	1.9	58.1
132 Results	1.7	64.0	77 Results	1.9	60.0
093 Results	1.6	65.6	025 Results	1.8	61.8
095 Results	1.6	67.2	041 Results	1.7	63.4
015 Results	1.6	68.8	027 Results	1.6	65.1
066 Results	1.5	70.3	093 Results	1.5	66.6
141 Results	1.5	71.8	095 Results	1.5	68.1
070 Results	1.4	73.2	022 Results	1.5	69.7
151 Results	1.4	74.5	028 Results	1.5	71.1
025 Results	1.3	75.8	180 Results	1.5	72.6
020 Results	1.2	77.0	066 Results	1.4	74.0
115 Results	1.2	78.2	044 Results	1.4	75.4

044 Results	1.1	79.3	056 Results	1.4	76.7
041 Results	1.1	80.4	060 Results	1.3	78.0
056 Results	1.0	81.4	151 Results	1.3	79.3
060 Results	1.0	82.4	084 Results	1.1	80.4
194 Results	1.0	83.3	082 Results	1.1	81.5
146 Results	0.9	84.3	132 Results	1.1	82.6
156 Results	0.9	85.1	141 Results	1.1	83.6
028 Results	0.8	86.0	037 Results	1.1	84.7
018 Results	0.8	86.8	163 Results	1.0	85.7
084 Results	0.8	87.6	138 Results	1.0	86.8
037 Results	0.8	88.4	071 Results	0.9	87.7
024 Results	0.8	89.1	115 Results	0.9	88.6
003 Results	0.8	89.9	118 Results	0.9	89.5
174 Results	0.7	90.6	008 Results	0.9	90.3
017 Results	0.7	91.3	004 Results	0.7	91.1
071 Results	0.7	92.0	047 Results	0.7	91.8
198 Results	0.6	92.5	045 Results	0.7	92.5
135 Results	0.6	93.1	003 Results	0.7	93.2
002 Results	0.5	93.6	040 Results	0.6	93.9
136 Results	0.5	94.1	136 Results	0.6	94.4
183 Results	0.5	94.6	032 Results	0.6	95.0
022 Results	0.5	95.1	187 Results	0.6	95.6
001 Results	0.5	95.5	074 Results	0.6	96.1
177 Results	0.5	96.0	016 Results	0.5	96.7
107 Results	0.4	96.4	146 Results	0.5	97.2
008 Results	0.4	96.8	005 Results	0.5	97.7
026 Results	0.4	97.2	002 Results	0.5	98.2
074 Results	0.4	97.5	026 Results	0.4	98.6
203 Results	0.3	97.9	156 Results	0.4	99.0
047 Results	0.3	98.2	042 Results	0.4	99.4
196 Results	0.3	98.5	001 Results	0.4	99.7
005 Results	0.3	98.8	135 Results	0.3	100.1
206 Results	0.3	99.1	174 Results	0.3	100.4
004 Results	0.3	99.3	206 Results	0.3	100.6
179 Results	0.3	99.6	019 Results	0.2	100.9
027 Results	0.3	99.9	177 Results	0.2	101.1
144 Results	0.3	100.1	144 Results	0.2	101.3
040 Results	0.3	100.4	007 Results	0.2	101.4
016 Results	0.2	100.6	006 Results	0.2	101.6
042 Results	0.2	100.8	048 Results	0.2	101.8

032 Results	0.2	101.0	198 Results	0.1	101.9
045 Results	0.2	101.2	009 Results	0.1	102.1
006 Results	0.1	101.3	203 Results	0.1	102.2
209 Results	0.1	101.4	209 Results	0.1	102.3
048 Results	0.1	101.6	010 Results	0.1	102.5
007 Results	0.1	101.7	196 Results	0.1	102.6
009 Results	0.1	101.8	183 Results	0.1	102.6
010 Results	0.1	101.8	197 Results	0.1	102.7
208 Results	0.0	101.9	170 Results	0.1	102.7
019 Results	0.0	101.9	179 Results	0.0	102.8
034 Results	0.0	101.9	208 Results	0.0	102.8
029 Results	0.0	101.9	034 Results	0.0	102.8
046 Results	0.0	101.9	029 Results	0.0	102.8
069 Results	0.0	101.9	046 Results	0.0	102.8
067 Results	0.0	101.9	069 Results	0.0	102.8
119 Results	0.0	101.9	067 Results	0.0	102.8
083 Results	0.0	101.9	119 Results	0.0	102.8
81 Results	0.0	101.9	083 Results	0.0	102.8
147 Results	0.0	101.9	81 Results	0.0	102.8
123 Results	0.0	101.9	147 Results	0.0	102.8
134 Results	0.0	101.9	123 Results	0.0	102.8
114 Results	0.0	101.9	134 Results	0.0	102.8
131 Results	0.0	101.9	114 Results	0.0	102.8
158 Results	0.0	101.9	131 Results	0.0	102.8
178 Results	0.0	101.9	178 Results	0.0	102.8
126 Results	0.0	101.9	126 Results	0.0	102.8
128 Results	0.0	101.9	128 Results	0.0	102.8
167 Results	0.0	101.9	167 Results	0.0	102.8
171 Results	0.0	101.9	171 Results	0.0	102.8
157 Results	0.0	101.9	157 Results	0.0	102.8
173 Results	0.0	101.9	173 Results	0.0	102.8
197 Results	0.0	101.9	193 Results	0.0	102.8
193 Results	0.0	101.9	191 Results	0.0	102.8
191 Results	0.0	101.9	169 Results	0.0	102.8
169 Results	0.0	101.9	190 Results	0.0	102.8
190 Results	0.0	101.9	189 Results	0.0	102.8
189 Results	0.0	101.9	195 Results	0.0	102.8
195 Results	0.0	101.9	207 Results	0.0	102.8
207 Results	0.0	101.9	194 Results	0.0	102.8
205 Results	0.0	101.9	205 Results	0.0	102.8


All PCB Congeners: Filtered water vs. bulk water for upper watershed flows
y = 0.044x
R² = 0.08
0.00025
0.0002
0.00015
0.0001
0.00005
0
0
0.001
0.002
0.003
0.004
0.005

Section 10: Conclusions and Recommendations

The Paleta Creek Watershed (approximately 2,000 acres) is located in National City and San Diego, CA. The Naval Base San Diego (NBSD) is located at the downstream portion of the watershed, while the upstream areas (east of I5) primarily consists of single-family detached residential land uses. The NBSD areas comprise about 13.5% of the total watershed area (located west of I5). More than 96% of the total watershed is developed.

Two qualifying stormwater monitoring events were sampled during this project, on January 4-8, 2016 (2.48 inches) and on January 30-31, 2016 (0.18 inches), at up to six locations in the Paleta Creek watershed. The monitoring program was able to successfully collect stormwater from most targeted locations, despite significant challenges associated with a highly tidally influenced water body, multi-level complex sampling triggers to target freshwater sample collection, and unusually flashy hydrologic patterns. Detailed watershed and creek surveys were conducted to determine the land use descriptions and land development characteristics needed for the watershed WinSLAMM water quality modeling. Twenty subareas were used in the modeling for the different land use categories and locations in the watershed. The modeling was necessary to calculate the long-term stormwater characteristics and for further insight of the stormwater sources in the watershed. WinSLAMM had previously been calibrated for San Diego area naval bases (along with Puget Sound, WA and Norfolk, VA facilities) during a previous project for the Navy.

A total of 15 samples were collected during the two events. Four outfalls were sampled at the NBSD during the first event and two were sampled during the second event. The second event had much less rain and the incoming tide affected the other sampling locations, so fewer samples were available during the second event. The Paleta Creek station at Main Street is the main channel and represents the upper watershed flows. This location was sampled during each event. The other Paleta Creek and ambient water samples represent mixed flows in the creek mouth, with four locations during the first event and three locations during the second event.

Whole samples were analyzed for total and filterable forms of the contaminants. In addition, each of the 15 samples were also separated into four particle size ranges for analyses. A number of statistical tests were conducted on these data to identify significant associations between related constituents and significant differences associated with sampling locations. The constituents having significant correlations with SSC (suspended sediment concentration) were:

- Metals: Cu, Zn, Cd, Pb, and Hg
- PAHs: fluoranthene, pyrene, chrysene, benzo[a]anthracene, benzo[b]fluoranthene, and benzo[k]fluoranthene

Cluster analyses were used to identify strong relationships between different constituents. The sampling program included many different constituents (in total, filtered, and particulate strength forms). The cluster analyses for particulate strength concentrations indicated five data groups:

- Group one:
    - TOC, acenaphthene, and fluorene

- Group two (weak):
    - Cu and Pb

- Group three:
    - Zn, Cd, naphthalene, anthracene, and fluoranthene

- Group four (strong):
    - Phenanthrene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, benzo[k]fluoranthene, pyrene, benzo[ghi]perylene+indeno, and dibenzo[a,h]anthracene

- Group 5 (weak):
    - Ni and Hg

There were no statistically significant differences observed between total, filtered, or particulate strength concentrations for the different sampling location groups (upper watershed, mostly residential; NBSD, and Paleta Creek mouth mixed flows), most likely due to the relatively small number of samples available. It is estimated that differences as small as 50% would be found to be significant for the number of samples available, indicating smaller concentration differences actually occurring.

Each of the 15 samples were further divided into four particle size ranges (0.45 to 5, 5 to 20, 20 to 63, and >63 µm) and analyzed for the same suite of metals and PAHs as the whole samples. These particle size ranges were selected to correspond to settling zones and areas of potential impact as the particulate pollutants settle in the receiving waters, the primary objective for this project. The largest size group evaluated affects the near zone of impact and combines several groups that are commonly considered in the literature. The large size fraction was not further separated as that costly information was not necessary to calculate the recontamination rates in the near and far fields from the stormwater discharge locations.

The sediment PSDs for the NBSD samples were similar for both events, and typical for most stormwater from paved areas (<10% greater than 100 µm). The upper watershed PSDs have a greater abundance of larger particles, likely associated with erosion from the steeper undeveloped areas in the watershed and channel scour (15 and 40% greater than 100 µm, for the first and second storms respectively). However, a few of the NBSD large particle fractions had very large contributions, most likely associated with infrequent discharges of large oily or metallic debris material sometimes found in industrial area stormwater. These particles had a tendency to shift the importance of the pollutant contributions to the larger particle size range. As an example, about 60% of the zinc was associated with the largest size range analyzed (>63 µm). This large particle size is the most important when considering near-field deposition after discharge, with less zinc sedimentation occurring at greater depths and distances from the discharge location. This particle size can also be targeted for stormwater control to reduce the near-field contamination potential. The SSC mass from the NBSD areas in the lower watershed area has most of the material in the 5 to 20 µm size range, while the upper watershed SSC mass was more evenly distributed with particle size, but with more material in the largest particle size range.

The previously calibrated WinSLAMM stormwater quality model was used to calculate the expected discharges per month throughout the year for the Paleta Creek watershed subareas using long-term San Diego rainfall and watershed development characteristics, and for total annual conditions. Only about ten percent of the total annual flows and particulate discharges occur during the six months of April through September, with most of the discharges occurring in the three months of January through March. The NBSD comprises about 13.5% of the total Paleta Creek watershed area and produces about 20% of the annual flows and particulate discharges. The NBSD contributions for the other constituents ranged from about 13% to as high as about 63%. The unit area discharges (annual discharges divided by the areas) for the NBSD area were usually much larger than for the upper watershed area (by up to about five times). These increased unit area discharges were mostly associated with a few very high pollutant strength values for some of the NBSD samples (such as outfall #33 for the large sample size fraction). In contrast, some of the upper watershed pollutant strengths had relatively small values associated with the large particle size range. The high values for the large particles from the NBSD samples may be associated with periodic large debris having high metal and PAH values (as also found in industrial stormwater from other areas), while the large particles from the upper watershed area may be more associated with bank erosion and scour in the creek than from contaminated large particles.

Previous stormwater data from the NBSD were analyzed during prior studies that examined pollutant discharge distributions with time (event first-flush and seasonal first-flush, where concentrations are assumed to be larger at the beginning of a rain event and at the beginning of the seasonal rainy period). The 2013 stormwater quality data from the NBSD were reviewed, comparing TSS, total and dissolved copper, and total and dissolved zinc concentrations obtained during event first flushes to the same event sampled as a whole event composite. Only the dry side sites (mostly residential and commercial areas) had these concurrent data. No paired first flush and total storm composite data were available for the base industrial locations for this time period. The first flush TSS concentrations averaged about 3.6 times the total storm composite values, with a moderate significance ($p = 0.06$). The copper data also have marginal p values of 0.06 with first flush concentration increases over the total storm composite concentrations of about 3.1 and 2.6 for total and dissolved copper, respectively. The total and dissolved zinc paired concentration values had significant p values of 0.01, with all of the observed first flush concentrations greater than the composite concentrations. The concentration ratios for zinc were higher than for copper, being about 4.1 and 5.3 for total and dissolved zinc respectively. As found during many stormwater monitoring projects, event first-flush effects can be significant for small paved areas, while areas having mostly landscaped surfaces (or large complex areas) have fewer and/or less extreme first-flushes. These observations also vary for different constituents and are rarely seen for large watersheds.

Southern California stormwater managers frequently observe significant “seasonal first-flushes” when the initial rains of the year have larger concentrations compared to rains later in the rainy season, and may account for much of the total rain year stormwater discharges. Prior stormwater quality data from NBSD monitoring locations collected over many years for October and November were statistically compared to the other months. Based on these data, it is likely that the dry side (residential, commercial, and institutional land uses) have significant seasonal first flush conditions. However, there is no supporting information in the data from the naval industrial areas supporting seasonal first-flushes from this land use. It is thought that the highly varying industrial site activities during the different monitoring years caused a greater variability than the seasonal differences, effectively obscuring any seasonal first flush patterns.

Determining the recontamination potential of previously dredged areas with discharged stormwater particulates is a primary objective of this research. Settling rates were calculated using Newton’s (turbulent) and Reynold’s (laminar) settling equations to estimate the settling zones associated with each particle size category.

- Near field effects: The largest particles (>63 µm) would require about 1 hour to settle in 100 ft (30 m) of water, and only about 5 minutes to settle in 10 ft (3 m) of water. These particles have the greatest potential of affecting areas close to the discharge location and would not be widely dispersed.

- Far field effects: The intermediate particles (20 to 63 µm) would require about 50 hours to settle in 100 ft (30 m) of water and about 5 hours to settle in 10 ft (3 m) of water. These particles would affect distant locations in harbors or closer if slowly flowing water.

- The smallest particles (<20 µm) would require even longer times to settle: about 500+ hrs in 100 ft (30 m) of water and 50+ hours to settle in 10 ft (3 m) of water. Unless impounded, these particles would likely be transported a large distance beyond the discharge location, with minimal potential of affecting nearby areas.

About 24% of the stormwater particulates from the creek are in the >63um particle size range, affecting the near zone after discharge. The Tentative TMDL report indicates a 9 acre area of impairment for sediment toxicants. This most settleable portion of the stormwater discharges would result in about an inch of sedimentation over about a 25 year period, if evenly distributed. Obviously, sediment deposition would vary depending on water velocities and depth.

During prior NBSD projects, WinSLAMM was also used to make preliminary evaluations for a selection of stormwater controls that may be suitable for NBSD use, including: street cleaning, catchbasins, proprietary media filters, biofilters (NBSD currently is monitoring a biofilter pilot facility at a site parking area to obtain local performance measurements), porous pavement (NBSD is also currently monitoring a pilot porous pavement facility to obtain local performance information), and possibly grass filter and swales at selected locations. The Tentative TMDL allocation report includes several target numeric criteria (not yet officially set for Paleta Creek, but used here for comparison with the expected creek discharges). The NBSD total PAH particulate strength values would have to be reduced by about 80% to meet the tentative criterion, while the upper Paleta Creek watershed area (mostly residential land use) would need to be reduced by about 22%, if all particle sizes are subject to this criterion. One-third of the NBSD samples and one-half of the upper watershed area stormwater samples exceeded the tentative benzo(a)pyrene criterion, when all particle sizes are considered. The maximum concentration observed at the NBSD would require about 70% reductions, while the maximum concentration observed at the upper watershed area would only require about 4% reductions. The NBSD would need to reduce the total PAH stormwater mass discharges by about 25%, while the upper watershed area stormwater PAH mass discharges are below the tentative discharge limit. The total watershed calculated stormwater total PAH mass discharges are also barely below the TMDL tentative limit for the entire watershed. If only the settleable portion of these compounds are compared to the tentative criteria to project the critical bottom sediments near the creek mouth, much smaller stormwater concentration reductions would be needed. Chlordane and total PCB discharges were calculated and compared to the tentative limits separately in sections 9 and 10 as, those data become available from the laboratory after the other data was available.

Most naval facilities are located adjacent to the receiving waters with stormwater from adjacent mixed land use areas contributing to the total watershed discharges. The characteristics of these stormwaters are different due to the varying land uses and site activities, requiring a mixture of types of stormwater controls located in different locations. Numerous stormwater controls are available that can address particulate-associate toxicants, but the varying stormwater characteristics and source contribution complexities require a more complete decision analysis process to determine the best stormwater controls to be used than is typical. It is recommended that future work address stormwater controls that are suitable to meet likely treatment needs and that the cost of these controls be evaluate against their relative benefit, expressed in terms of reducing sediment recontamination risk, as defined in this study. Additional information should also be obtained concerning the unique characteristics of naval facility stormwater (especially particulate-bound organic compounds associated with different particle size ranges).

It is also recommended that any applicable criteria for the stormwater discharges focus on the pollutant forms of importance in protecting the receiving water sediments. For example, only the settleable portions of the pollutants (generally >63 µm) would affect the near zone bottom sediments of concern near the mouth of Paleta Creek, and any numeric criteria should therefore focus on these larger size particles. Also, any criteria should address the PAH compounds of concern that are affecting the receiving waters. The sum of the PAH compounds is very misleading as it is possible for less problematic PAHs in high concentrations to mask the significance of more important PAH compounds in smaller concentrations. Criteria focusing on total PAH concentrations is similar to a nonsensical criteria that would address total heavy metal concentrations. The results of the toxicological tests being conducted as part of this project would be an excellent tool to identify the critical PAH compounds for consideration for criteria development. The tentative criteria lists benzo(a)pyrene separately; therefore any other important PAH compound identified should also have a separate and meaningful criterion.

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Appendix A: Photolog of NBSD Site Surveys

Appendix B: Site Survey at Paleta Creek Watershed, San Diego and National City, California

Appendix C: Paleta Creek Watershed WinSLAMM Analyses

Appendix D: Field Observations and Recorded Measurements during Monitoring Events

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Appendix G: Scatterplots of Correlated Constituents

Appendix H: Regressions for Scatterplots Identified with Significant Pearson Correlations

Appendix I: Metal Concentrations and Mass Yields by Land Use and Particle Size

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Appendix K: Paleta Creek Watershed Stormwater Metal and PAH Discharges by Land Use and Particle Size

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Appendix A: Photolog of NBSD Initial Site Surveys

Outfall #1 (O1W) – NBSD Outfall #23

32.673556°, -117.117605°

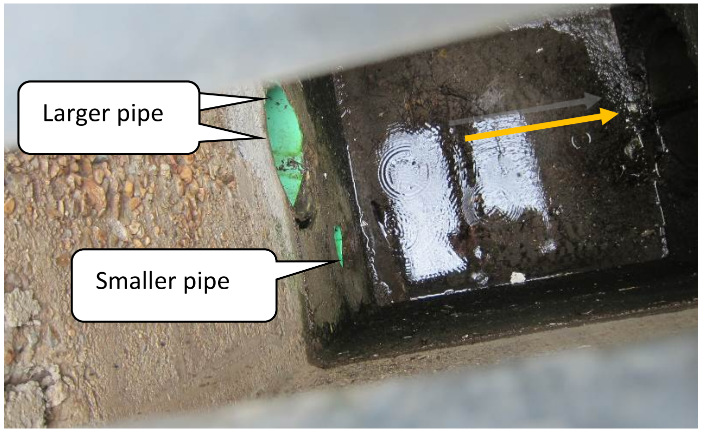
Photo looking east. Arrow indicates location of Outfall #23, on Southall St. on NBSD. Locate sampling equipment on south side of fence, protected from traffic with K-rail or similar traffic barrier.

Tidally influenced catch basin. Orange arrow indicates direction of stormwater flow. Upstream pipe is slip lined PVC/HDPE. Downstream pipe is corrugated metal (CMP). Rocks (approximately 1" diameter), sediment and sand in catch basin.

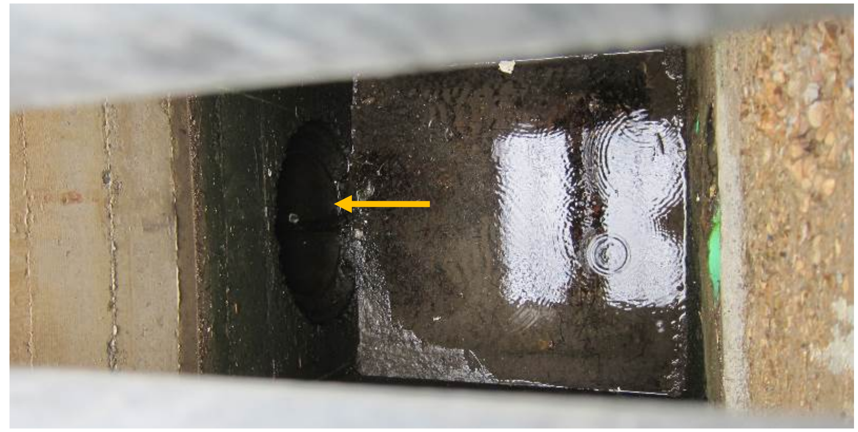
Outfall from Stormdrain #23 into Paleta Creek. Ground surface to bottom of CMP – approximately 7'. Rust evident in pipe. High tide water mark on concrete wall approximately 18" above top of discharge pipe. Access to discharge by boat only.

- Pipe Size in catch basin: Upstream– 18"
  Downstream to Paleta Creek – 26"
- Catch Basin Access:
  - Equipment needed to remove catch basin surface grate.
  - Tripod rental and confined space entry safety requirements.
  - 5'8" to bottom of catch basin.
  - Does not appear to be a sump/invert into or out of catch basin, but depth of sediment in catch basin is unknown.
- No site access (ex. after hours) limitations.
- Sampling heavily dependent upon tides and storm size/duration. Fresh water sample collection may be difficult during high tide.
- Use salinity/conductivity sensor to determine whether sampling should occur.
- Install flow meter in catch basin.
- Flow-weighted sampling possible.

Outfall #2 (O2W) – NBSD Outfall #33
32.672020°, -117.117382°



Larger Pipe: Size 14”, Depth from ground surface 5’3”
Smaller Pipe: Size 6”, Depth from ground surface 6’2”



Outfall Pipe Size: 18”

Tidally influenced catch basin. Orange arrow indicates direction of flow. Two PVC slip lined pipes enter catch basin from the south. Downstream pipe is slip lined PVC. Minimal amount of sediment and sand in catch basin. Locate sampling equipment in a designated parking space protected with K-rails. No issues of tampering reported during previous sampler deployments on the Base.

Outfall from Stormdrain #33 into Paleta Creek. Ground surface to bottom of CMP – 8’3”. Rust evident in pipe. High tide water mark on concrete wall approximately 3’ above top of discharge pipe. Access to discharge by boat only.

- Catch Basin Access:
  - Equipment needed to remove catch basin surface grate.
  - Tripod rental and confined space entry safety requirements
  - 7” to bottom of catch basin.
  - Does not appear to be a sump/invert into or out of catch basin, but depth of sediment in catch basin is unknown.
- No site access (ex. after hours) limitations.
- Sampling heavily dependent upon tides and storm size/duration. Fresh water sample collection may be difficult during high tide.
- Use salinity/conductivity sensor to determine whether sampling should occur.
- Install flow meter in catch basin.
- Flow-weighted sampling possible.

Outfall #3 (O3W) – NBSD North of Railroad within Navy Auto Skills Center

32.676986°, -117.113659°

Photo looking south into Paleta Creek from the Navy Long Term Vehicle Storage Lot. Orange arrow indicates direction of flow from Outfall Sampling Location #3. Red arrow indicates approximate location where previous photo was taken.

Recommended sampling location at the manhole located northwest of Outfall Location #3. Orange arrow indicates direction of flow. MS4 map review and site reconnaissance indicates this is the last storm drain access point prior to entering Paleta Creek.

Outfall #3 (O3W) – NBSD North of Railroad within Navy Auto Skills Center (Continued)

Orange arrow indicates direction of flow.

Orange arrow indicates direction of flow. Pipe submerged approximately halfway in standing water. Standing water in pipe indicates potential tidal influence. Pipes appeared to be concrete and did not appear to be slip lined.

- Both upstream and downstream pipes are 36".
- Catch Basin Access:
  - Ladder access and confined space entry safety requirements.
  - 9'6" to bottom of catch basin.
  - Does not appear to be a sump/invert into or out of catch basin, but depth of sediment in catch basin is unknown.
  - Suspend sampling equipment within catch basin.
  - Use salinity/conductivity sensor to determine whether sampling should occur.
  - Install flow meter in catch basin.
  - Flow-weighted sampling possible

- Auto Skills Center after-hours access is limited. If sampling outside of these hours, access is not permitted.
  - Auto Skills Center Hours:
    - Tues-Fri – 11:30 AM – 7 PM
    - Sat-Sun – 9 AM 4:30 PM
    - Mon and Holidays – Closed
  - Contact (619) 556-7009, navylifesw.com

Outfall #4 (O4W) – NBSD at Paunack/Division St.

32.681684°, -117.112970°

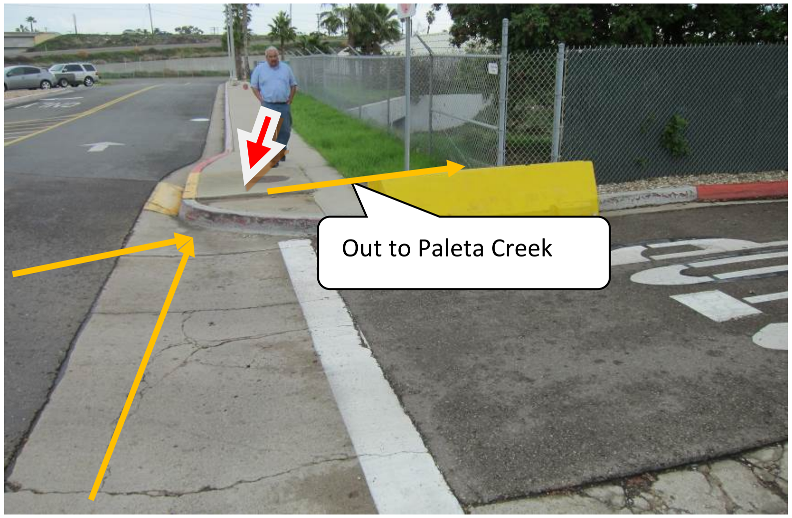


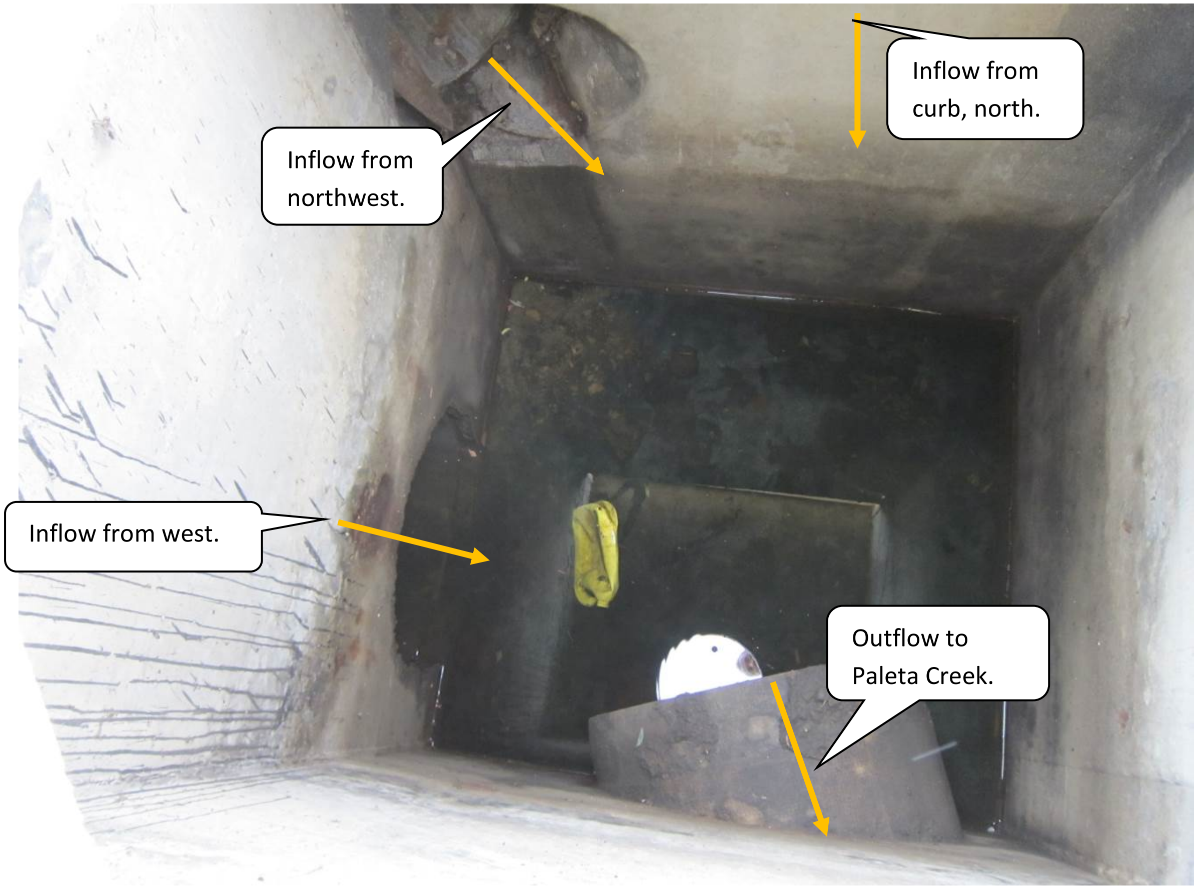
Photo of Outfall Sampling Location #4 looking east. Two storm drain pipes and curb runoff converge at the catch basin indicated by the red arrow. Orange arrows indicate direction of flow.


Photo of Paleta Creek looking south, downstream. Orange arrow indicates direction of flow from Sampling Location #4 into Paleta Creek.


Outfall from Sampling Location #4 into Paleta Creek indicated by red arrow. Orange arrow indicates direction of flow. Blue arrow indicates approximate location of catch basin.

Photo of Outfall Sampling Location #4 looking east.

Outfall #4 (O4W) – NBSD at Paunack/Division St. (continued)



Outflow to Paleta Creek:

- Size: 30”

Catch Basin Access:

- Tripod rental and confined space entry safety requirements.
- 9’ to bottom of catch basin.
- Does not appear to be a sump/invert out of catch basin, but depth of sediment in catch basin is unknown.
- No site access (ex. after hours) limitations.
- Suspend sampling equipment within catch basin.
- Install flow meter in catch basin.
- Flow-weighted sampling possible.

Receiving Water #2 (C2W) (non-tidal) – Main Street
32.682824°, -117.112252°

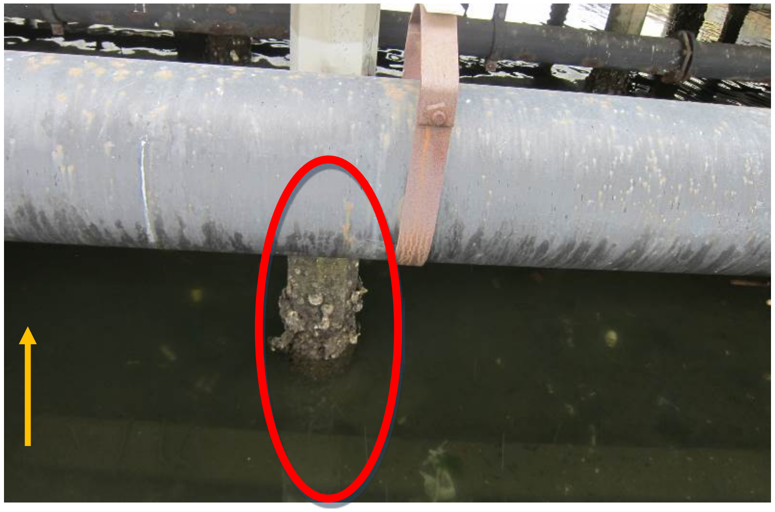
Photos of site access facing south. Signage indicates that it is Naval Property and there is one gate with a padlock. Access could be obtained via the 5 on-ramp by foot but equipment mobilization would require gate access.

Photo looking northeast. Orange arrow indicates direction of flow. Blue arrow indicates approximate location of sampling equipment. Equipment should be secured to prevent theft.

- Channel not accessible during site visit so measurements are approximate.
- Creek Access:
    - Ladder and gate access.
    - ~6' to bottom of trapezoidal channel.
    - Channel bottom is ~ 8' wide.
- No site access (ex. after hours) limitations.
- Area secured by gate and lock but the presence of graffiti indicates people are accessing the area through the storm drain.
- Recommend securing the sampler within a container to prevent tampering and removing sample intake hose and flow meter equipment from channel between sampling events.
- Flow-weighted sampling possible.

Receiving Water #1 (C1W) (tidal) – Cummings Road Pedestrian Bridge

32.674429°, -117.115446°



Photos looking west, downstream. Tidally influenced receiving water location. Orange arrow indicates direction of flow for Paleta Creek. Railroad tie or other large piece of debris on the bottom of the creek seems to be the deepest location (~2 ft. deep during at 11 AM on 1/30/15). Bridge piling indicated by red oval would be best location for sample tubing. Equipment would be placed to the south, off of the bridge.

Photo looking north from potential sample equipment staging location.

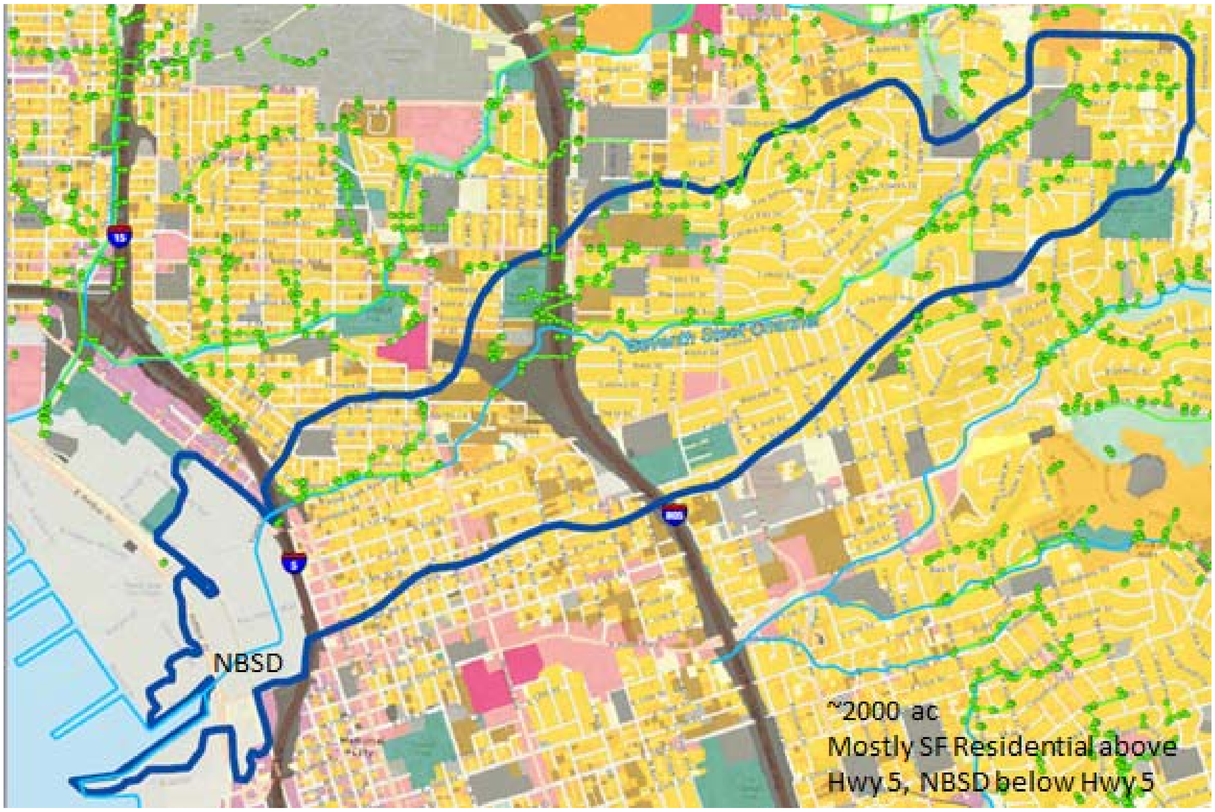
- Creek Access:
  - Ladder or tripod required
  - 12' from bridge to creek bottom.
  - 12' from equipment staging location to bridge piling.
- Stage sampling equipment on the south side of the pedestrian bridge next to the yellow traffic bollard shown in the picture to the left. Secure equipment to bollard or bridge railing.
- No site access (ex. after hours) limitations.
- Up to 8 feet of tidal influence, at 0 ft MSL during site visit (per Bart)
- Sampling heavily dependent upon tides and storm size/duration.
- Sample tubing height and salinity/conductivity sensor should be adjustable to account for storm size and tides in order to capture fresh water outflow from creek.
- Use salinity/conductivity sensor to determine whether sampling should occur.
- Use ultrasonic type flow meter to measure creek flow available from ISCO (may not be able to work with sampler).
- Time-weighted sampling may be only option.

Appendix B: Site Survey at Paleta Creek Watershed, San Diego and National City, California

Contents

Channel Survey

The following map shows the approximate Paleta watershed that contributes stormwater to the SERDP study area at the creek mouth on the Naval Base, San Diego. A survey of the area examining the nature of the main channel and other main watershed features was conducted on December 17, 2014.



Map of Paleta Watershed (Brandon Steets, Geosyntec, Dec 18, 2014)

A moderate rain occurred the previous day and runoff was still present in the creek. Minor flooding on streets adjacent to creek along with deposited sediment on streets near creek and eroding adjacent areas were also evident. Moderate to heavy rains occurred previously in December, but very dry season otherwise. The December 2014 recorded rain depths for San Diego were as follows:

December 2, 3 and 4: 0.42, 0.27, 1.84 (2.53 total) inches
December 12: 1.05 inches
December 16 and 17: 0.43 and 0.41 (0.84 total) inches
Total December 2014 rain for San Diego prior to creek survey: 4.32 inches (normal December rain total for San Diego is 1.54 inches).

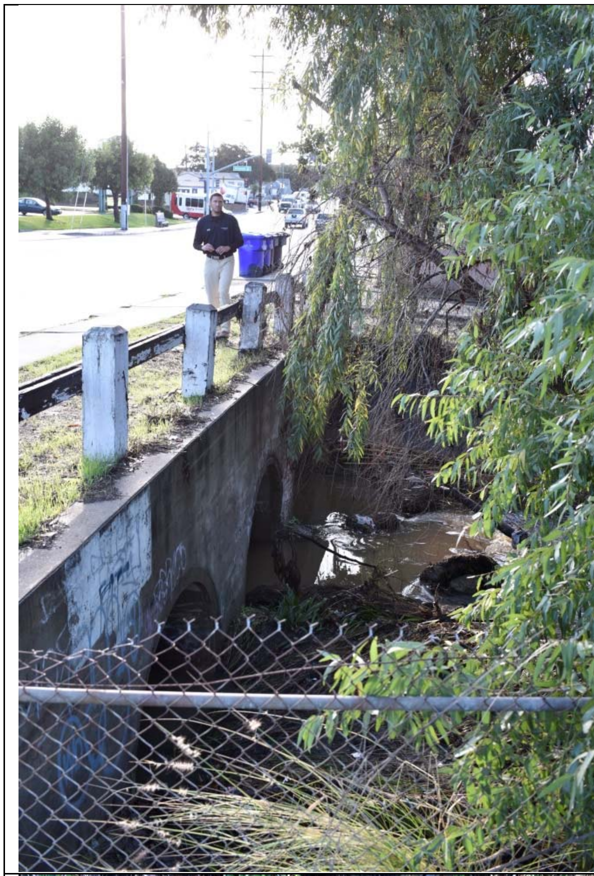
The following are photographs of various locations along the creek channel.

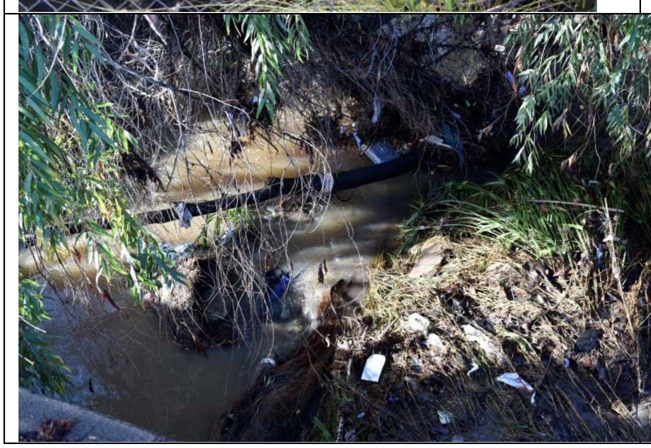
Near 43rd St and Nordica Ave.




This lower part of the watershed has a completely lined concrete channel. However, substantial vegetation is present in the channel, including moderate-sized palm trees. Stable sediment in the channel with vegetation, even with the large amounts of rain in the previous two weeks. Reasonably stable areas adjacent to channel and along channel.

Near 42nd St and Nordica Ave.

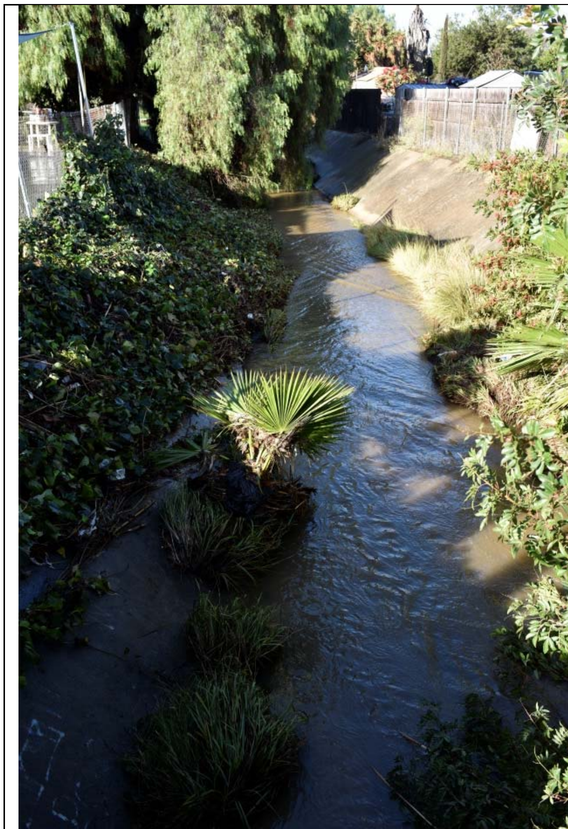




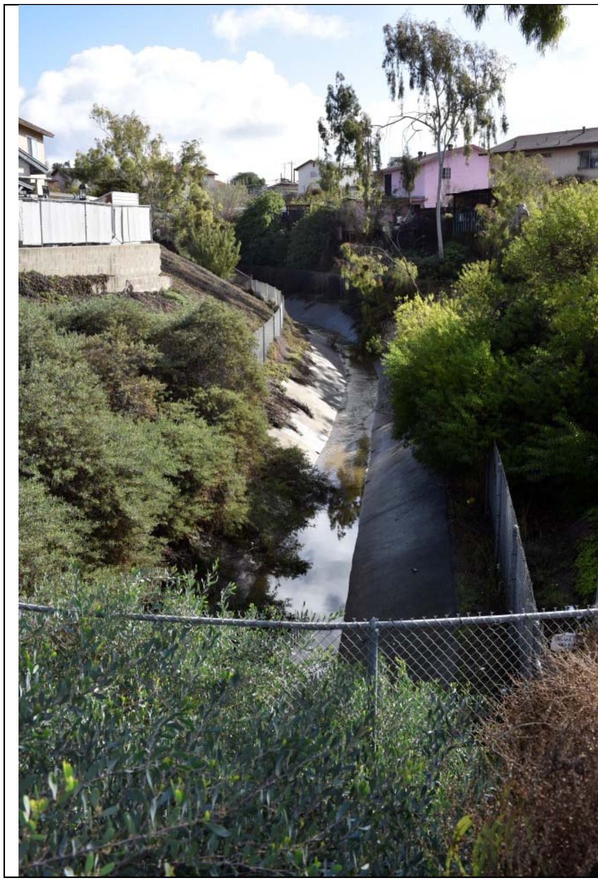
Also channelized with lots of stable sediment and vegetation. Upstream side of culvert crossing caught large debris (mattress, fan, etc.)

Near Solola Ave. and Euclid Ave.



Concrete-lined channel, but bare dirt and poor vegetation above concrete that are erosion sources. Some scoured silt/clay on bottom of channel evident. Some new erosion on bank side.

Near Solola Ave and Bonita Ave



Fully-lined concrete channel little sediment and vegetation in channel, and hillsides/slopes to channel are heavily vegetated with no evidence of erosion.

Near Cervantes Ave.

Near top of watershed; creek splits with main channel (unlined) extending further. Other branch (unlined) dry drainage. Much sediment erosion sources from adjacent poorly vegetated areas. Erosion in channel evident (grey silty material).

Upper Watershed Survey

A land development survey of the area above the naval base (Interstate 5) was conducted on December 18, 2014. Ten neighborhoods were surveyed to determine building along with road and pavement characteristics. Parking conditions and street widths were also noted. These characteristics are summarized in the following table for these ten areas. Subsections also include photographs for these areas.

Site Characteristics of Watershed Neighborhoods

Site #	1	2	3	4	5
Location	B and D Ave. and E3rd and E4th St., National City	Marine View/Division Ave. and S41st St., San Diego	Cottonwood (Creekside), Nordica, and S 40th St., San Diego	Gamma and Delta St and S41st and S42nd St., San Diego	Between Beta and Delta St. on S. 443rd St., San Diego
Land use	High den single family (small lots) with alley	Medium-high den single family with alley	High density single family residential, with alley	Medium density residential, with alley	Multi-family
Income level	medium	Medium	Low-medium	Medium	medium
Age of development	<1960	<1960	<1960	<1960	1960-1990
Maintenance of buildings	Moderate	Excellent	Moderate-poor	Moderate	Excellent-moderate
Heights of buildings	1	1	1 and some 2	1 with some 2	3
Roof drains	Few gutters; to surrounding area	Few gutters; to surrounding area	No gutters; to surrounding area	No gutters; to surrounding area	No gutters; to surrounding area
Roof types	Pitched comp. shingle	Pitched comp. shingle	Pitched comp. shingle	Pitched comp. shingle	Pitched comp. shingle
Sediment sources nearby	No	No	Poor landscaping erosion and creek sediment flooding debris	Flooding silt and some local erosion	Some erosion from eroding hillside on Delta
Treated wood near connected pavement	Telephone poles	No	Telephone poles	Telephone poles	Telephone poles
Landscaping near road and connected pavement	Some grass	Some grass	Some grass	None-some grass	Some grass and evergreens
Landscaping maintenance	Adequate-poor	Adequate-poor	poor	Adequate-poor	adequate
Leaves on street	None-some	None-some	none	None	None
Street slope	<2%	2-5%	<2%	<2%	2-5%

Land slope	<2%	2-5%	<2%	2-5%	2-5%
Traffic speed	25-40 mph	<25; >40 mph	<25 mph	<25 mph	25-40 mph
Traffic density	Moderate	Light; heavy	light	Light	Moderate
Parking density	50-80%	50-80%	>80%	50-80%	>80%
Number of parking lanes	2	2	2	2	2
Number of driving lanes	2	2	2	2	2
Condition of street	Good	Good	Good	Good	fair
Texture of street	Smooth	Smooth	Smooth	Smooth	intermediate
Pavement material	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
Driveway material	Paved	Paved	Paved	Paved	Paved
Driveway condition	Fair	Fair	Good	Good	Good
Driveway Texture	Smooth-intermediate	Smooth-intermediate	Smooth	Smooth	Smooth
Gutter material and condition	Fair asphalt	Good asphalt	Good concrete	Good concrete	Good concrete
Street/gutter interface	smooth	smooth	Smooth	Smooth	Smooth
Litter loadings near street	Clean-fair	clean	Clean (flooding sediment debris)	clean	clean
Parking/pavement area condition	Good concrete alley	Good concrete alley	Good concrete alley	Good concrete alley	Good apt parking area
Parking/pavement area texture	smooth	smooth	smooth	smooth	smooth
Parking/pavement area directly connected?	Directly connected	Directly connected	Directly connected	Directly connected	Directly connected

Site Characteristics of Watershed Neighborhoods (continued)

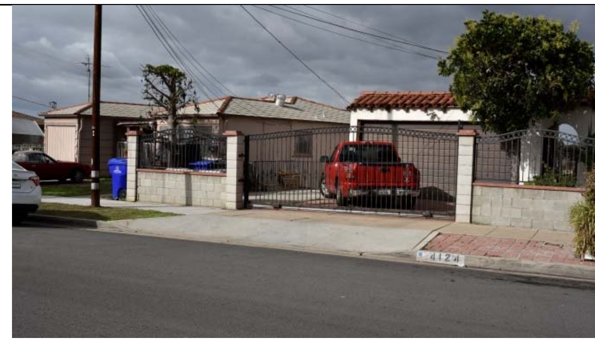
Site #	6	7	8	9	10
Location	Laurel Ave. between E2nd and E3rd St, National City	M and Palm Ave. and E5th and E6th St., National City	S. Harbison and Rachael Ave. and E. 6th St., National City	Encina and Santa Isabel Dr. and Bonita Dr., San Diego	Olvera, S. Rodeo and Skyline and Duluth, San Diego
Land use	Multi-family	Medium density single family, partial alley	Medium-high density single family residential	Medium density residential	Medium density residential
Income level	medium	Medium	medium	Medium	Medium
Age of development	1960-1990	<1960	<1960	<1960	1960-1990
Maintenance of buildings	Moderate	Excellent-moderate	Excellent-moderate	Excellent-moderate	Excellent-moderate
Heights of buildings	3	1	1	1 with some 2	1
Roof drains	Underground with no gutter connections	Few gutters; to surrounding area	No gutters; to surrounding area	Some gutters; to surrounding area	No gutters; to surrounding area
Roof types	flat	Pitched comp. shingle, some tile	Pitched comp. shingle, some tile	Pitched comp. shingle	Pitched comp. shingle
Sediment sources nearby	Lots of sediment on street (from prior heavy rains)	Some terrace strip erosion	no	Some terrace strip erosion	Some terrace strip erosion
Treated wood near connected pavement	Telephone poles	Telephone poles	Telephone poles	Telephone poles	Telephone poles
Landscaping near road and connected pavement	none	Some grass	Some grass; some have gravel front yards	None-some grass	some grass
Landscaping maintenance	n/a	Adequate-poor	adequate	Adequate	poor
Leaves on street	None	None	much	None	much
Street slope	2-5%	<2%	2-5%	>5%	>5%

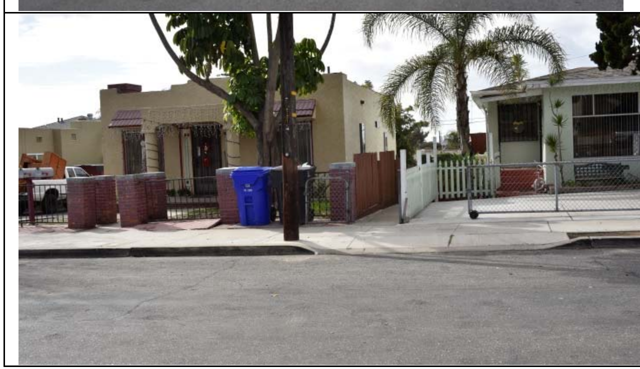
Land slope	2-5%	<2%	2-5%	2-5%	>5%
Traffic speed	25-40 mph	25-40 mph	<25 mph	<25 mph	<25 mph
Traffic density	Moderate	Light	light	Light	Light
Parking density	>80%	20-50%	50-80%	20-50%	20-50%
Number of parking lanes	2	2	2	2	2
Number of driving lanes	2	2	2	2	2
Condition of street	Good	Good	Good	Fair	Good
Texture of street	Smooth	Smooth	Smooth	Smooth	Smooth
Pavement material	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
Driveway material	Paved	Paved	Paved	Paved	Paved
Driveway condition	good	good	Good	Good	Good
Driveway Texture	Smooth	Smooth	Smooth	Smooth	Smooth
Gutter material and condition	good asphalt	Good asphalt	Fair concrete	Good concrete	Good concrete
Street/gutter interface	smooth	smooth	Smooth	Smooth	Smooth
Litter loadings near street	Fair (dirt)	clean	Clean-fair	clean	clean
Parking/pavement area condition	Can't observe off street parking	Concrete and asphalt partial alley	n/a	n/a	n/a
Parking/pavement area texture	n/a	smooth	n/a	n/a	n/a
Parking/pavement area directly connected?	n/a	Directly connected	n/a	n/a	n/a
Other:			Some galvanized metal garages near side street		

1) B and D Ave. and E3rd and E4th St., National City

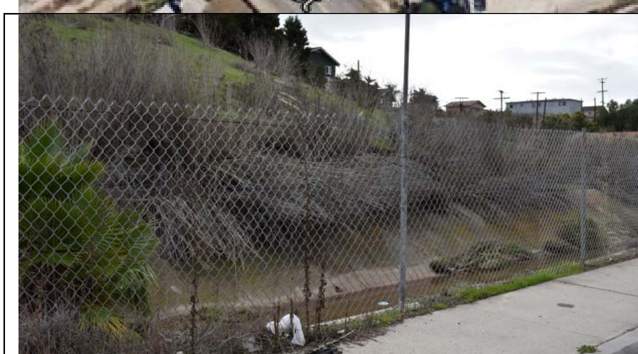
Google Maps

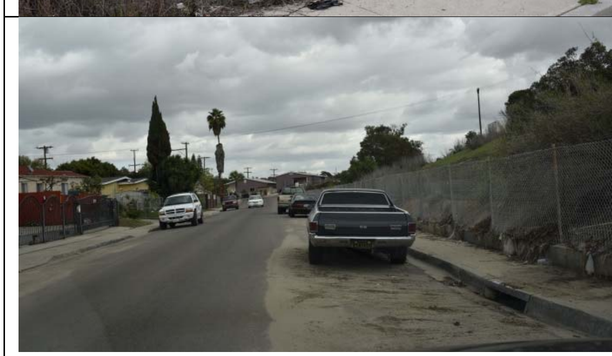
2) Marine View/Division Ave. and S41st St., San Diego

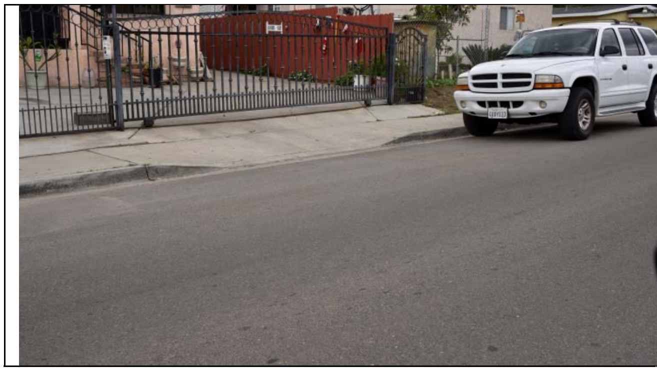



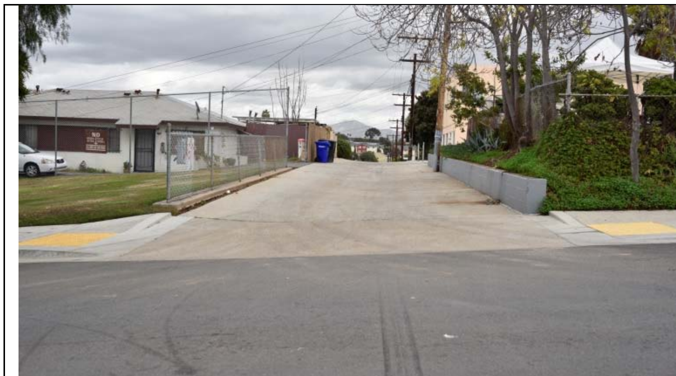
3) Cottonwood (Creekside), Nordica, and S 40th St., San Diego

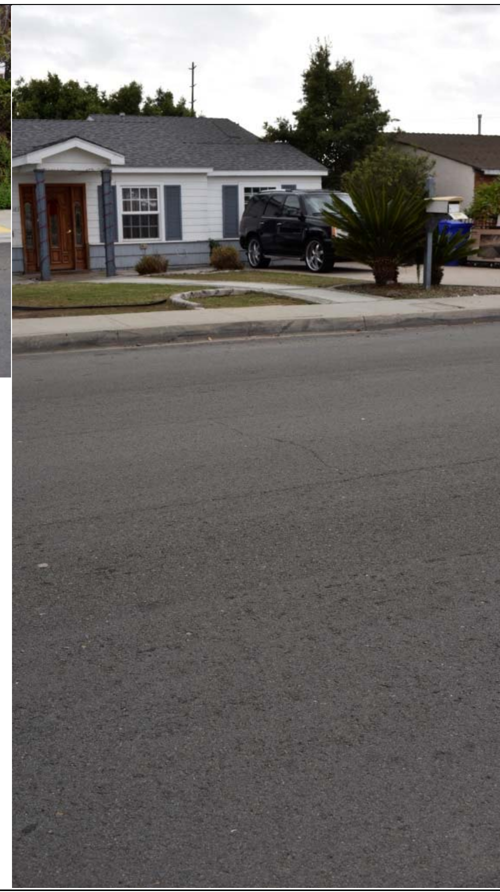




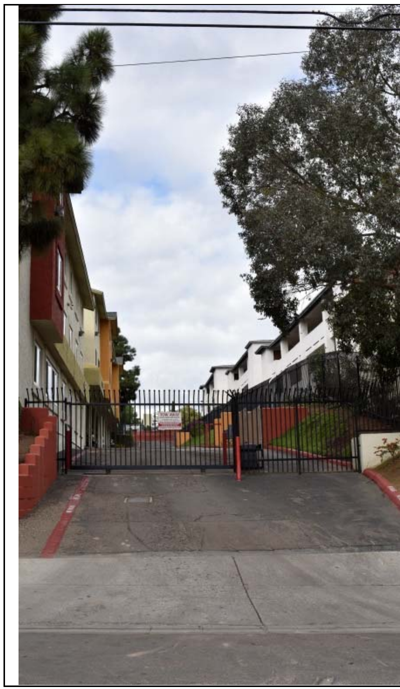


4) Gamma and Delta St and S41st and S42nd St., San Diego





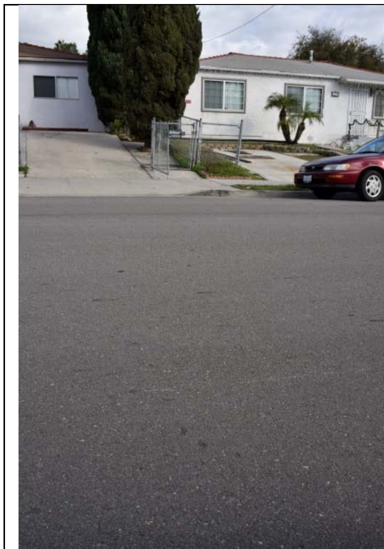
5) Between Beta and Delta St. on S. 43rd St., San Diego



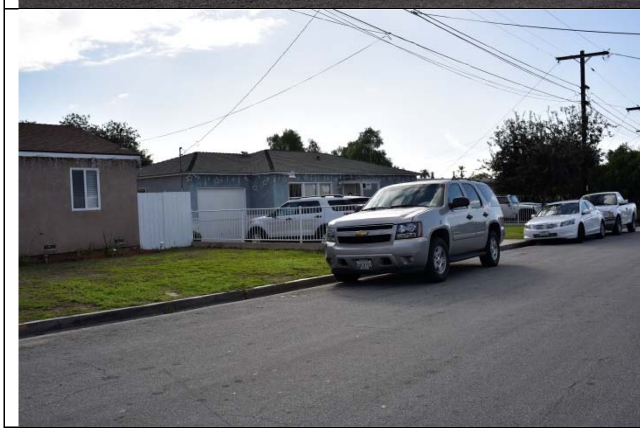
6) Laurel Ave. between E2nd and E3rd St, National City

203 Laurel Lane	

7) M and Palm Ave. and E5th and E6th St., National City







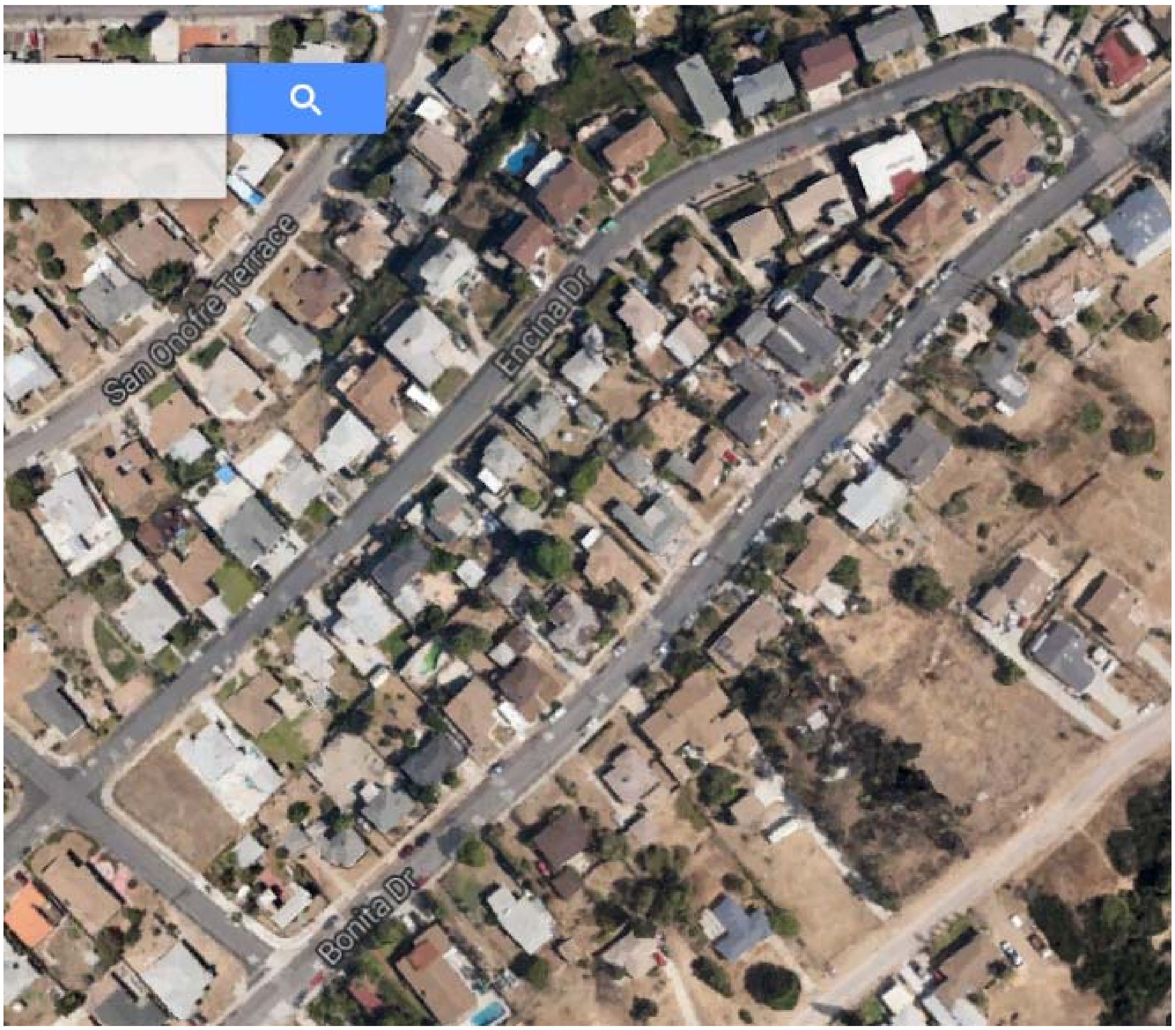

8) S. Harbison and Rachael Ave. and E. 6th and E. 4th St., National City

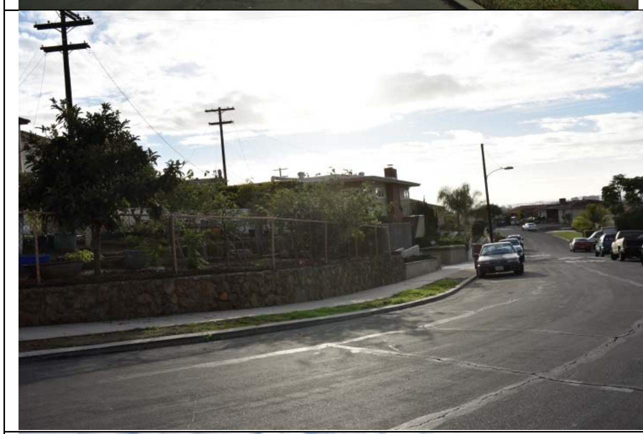



514




9) Encina and Santa Isabel Dr. and Bonita Dr., San Diego






STOP


BUMP

10) Olvera , S. Rodeo and Skyline and Duluth Ave., San Diego

This upper watershed survey was used in WinSLAMM for model analyses. The watershed drainage area was updated during the field survey and the land use breakdowns were also obtained from aerial photographs for each site. These neighborhood surveys were used to describe the land development conditions for the land uses in the area, and the creek survey was used to describe the channel modeling conditions. Aerial photographs were used to measure the areas for each surface type in each neighborhood. The resulting WinSLAMM model using this information along with current San Diego calibration information was then compared to more complete stormwater monitoring results for the area.

Drainage Area Characteristics for NBSD Monitoring Outfalls

The following GIS maps show the detailed land surface components for the drainage area for each of the four NBSD monitored outfalls.

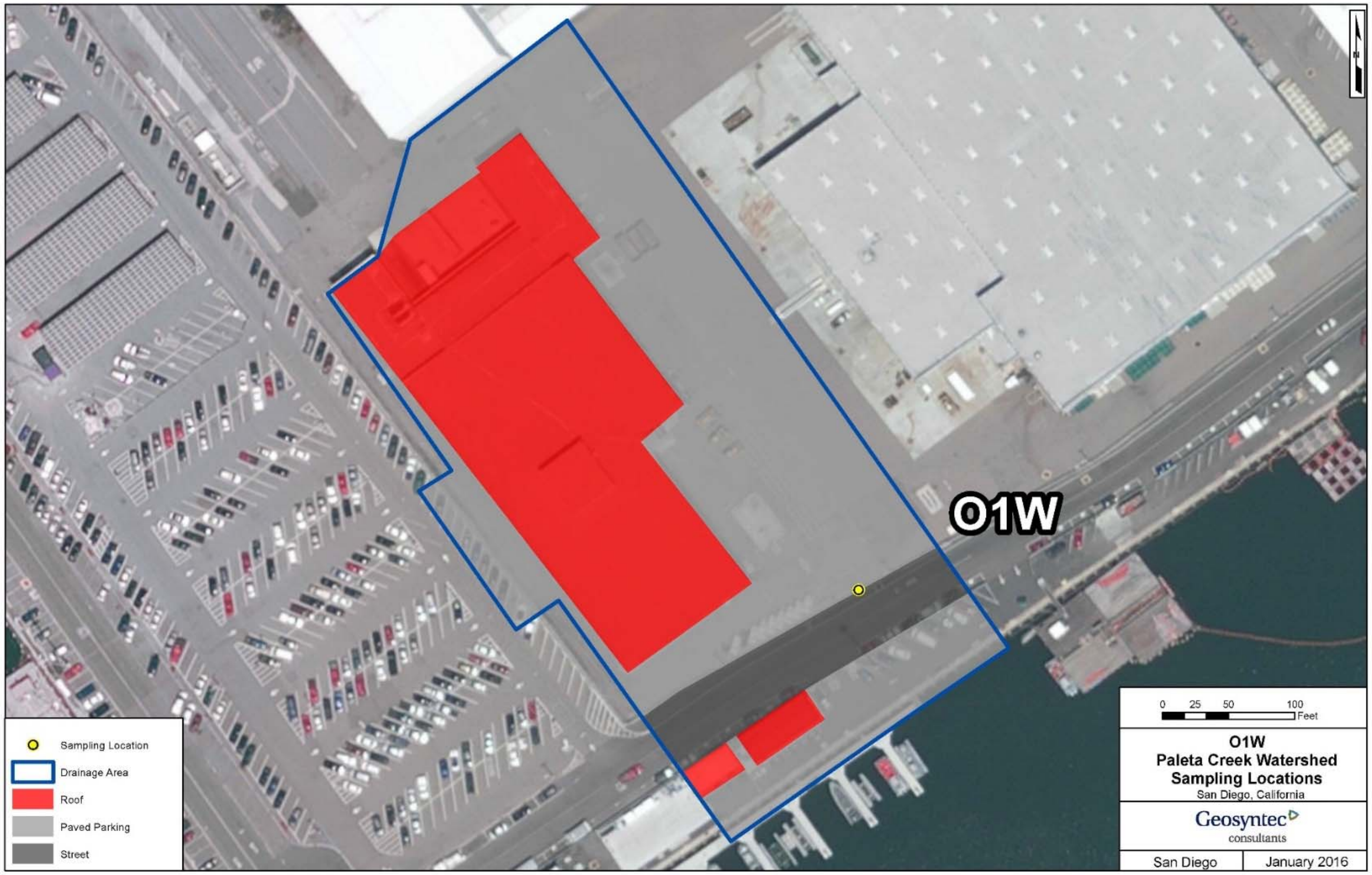


Figure B-1. Land Use Characteristics for O1W

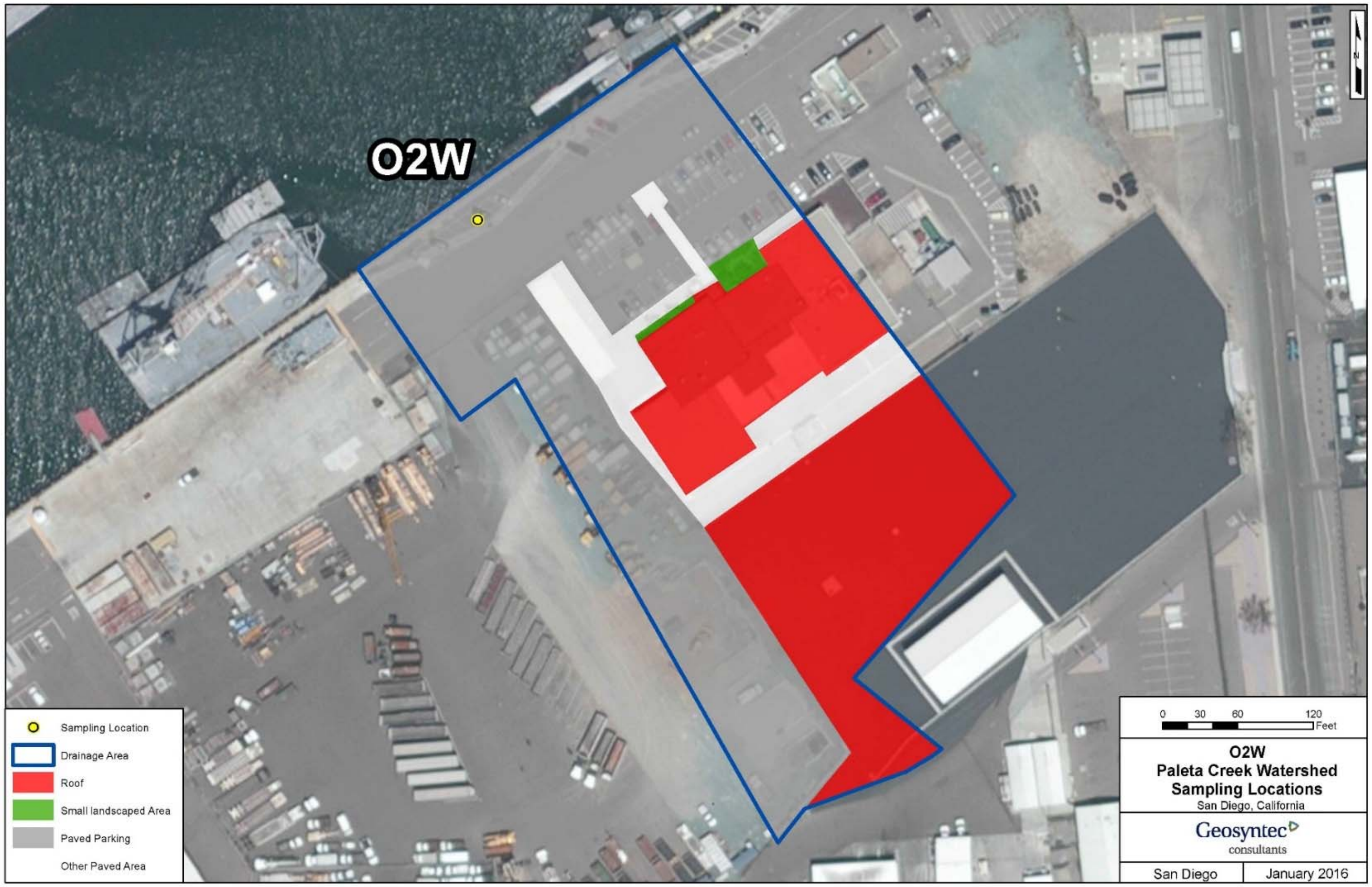


Figure B-2. Land Use Characteristics for O2W

Figure B-3. Land Use Characteristics for O3W

Figure B-4. Land Use Characteristics for O4W

Paleta Creek Site Surveys and Land Components

Paleta Creek Watershed Medium Density Residential Land Development Characteristics

site		land use	area (ac)	# lots	house density (#/acre)	roofs (%)	roof connections	roof slope	outbuildings (%)	roof connections and slope	main road (%)	street texture	parking density	street width (ft)
1	B&D/E 3rd and E4th St., Nationa City	MDR	5.15	25	4.85	23.4	disconnected	pitched	2.0	disconnected/flat	25.1	smooth	moderate	58.0
2	Marine View/Division Ave & S41st, San Diego	MDR	2.06	10	4.85	14.1	disconnected	pitched	5.2	disconnected/flat	17.2	smooth	light to heavy	34.0
3	Cottonwood (Creekside), Nordica & S40st, San Diego	MDR	2.4	15	6.25	18.3	disconnected	pitched	5.2	disconnected/flat	24.0	smooth	light	33.0
4	Gamma & Delta/S41st & S 42nd St., San Diego	MDR	6.09	22	3.61	20.0	disconnected	pitched	10.0	disconnected/flat	14.5	smooth	light	36.0
7	M & Palm Ave/E5th & E6th, National City	MDR	7.73	32	4.14	22.8	disconnected	pitched	2.0	disconnected/flat	18.3	smooth	light	46.0
8	S. Harbison & Rachael Ave/E6th & E4th St., National City	MDR	5.15	20	3.88	23.0	disconnected	pitched	3.2	disconnected/flat	17.6	smooth	light	40.0
9	Encina & Santa Isabell Dr./Bonita Dr., San Diego	MDR	7.26	29	3.99	18.9	disconnected	pitched	2.9	disconnected/flat	15.6	smooth	light	33.0
10	Olivera & S. Radio & Skyline/Duluth Ave., San Diego	MDR	4.56	20	4.39	19.9	disconnected	pitched	1.6	disconnected/flat	19.5	smooth	light	39.0
		min	2.06	10	3.61	14.1			1.6		14.5			33.0
		max	7.73	32	6.25	23.4			10.0		25.1			58.0
		average	5.05	21.625	4.50	20.1			4.0		19.0			39.9
		stdev	2.048372	7.150175	0.83	3.1			2.8		3.8			8.5
		COV	0.41	0.33	0.19	0.15			0.70		0.20			0.21

Paleta Creek Watershed Medium Density Residential Land Development Characteristics (cont.)

site		land use	alley (%)	alley width (ft)	paved parking (%)	connection	driveways (%)	connected	sidewalks (%)	connected	landscaping (%)	compaction/texture	total (%)
1	B&D/E 3rd and E4th St., Nationa City	MDR	8.3	29.0	0.0	n/a	2.1	paved/connected	4.2	paved/connected	34.9	mod/silty	100
2	Marine View/Division Ave & S41st, San Diego	MDR	2.5	15.0	0.0	n/a	1.8	paved/connected	10.3	paved/connected	48.9	mod/silty	100
3	Cottonwood (Creekside), Nordica & S40st, San Diego	MDR	2.6	14.0	0.0	n/a	1.2	paved/connected	6.0	paved/connected	42.7	mod/silty	100
4	Gamma & Delta/S41st & S 42nd St., San Diego	MDR	5.3	21.0	0.0	n/a	5.3	paved/connected	4.2	paved/connected	40.7	mod/silty	100
7	M & Palm Ave/E5th & E6th, National City	MDR	1.4	15.0	0.0	n/a	3.3	paved/connected	6.1	paved/connected	46.1	mod/silty	100
8	S. Harbison & Rachael Ave/E6th & E4th St., National City	MDR	0.0	n/a	0.0	n/a	4.5	paved/connected	6.6	paved/connected	45.1	mod/silty	100
9	Encina & Santa Isabell Dr./Bonita Dr., San Diego	MDR	0.0	n/a	0.0	n/a	7.5	paved/connected	7.8	paved/connected	47.3	mod/silty	100
10	Olivera & S. Radio & Skyline/Duluth Ave., San Diego	MDR	0.0	n/a	0.0	n/a	3.7	paved/connected	13.0	paved/connected	42.3	mod/silty	100
		min	0.0	14.0	0.0		1.2		4.2		34.9		100
		max	8.3	29.0	0.0		7.5		13.0		48.9		100
		average	2.5	18.8	0.0		3.7		7.3		43.5		100.0
		stdev	3.0	6.3			2.1		3.0		4.4		
		COV	1.18	0.34			0.57		0.42		0.10		

Paleta Creek Watershed Apartment Land Development Characteristics

Site		land use	area (ac)	# lots	building density (#/acre)	roofs (%)	roof connections	roof slope	outbuildings (%)	roof connections and slope	main road (%)	street texture	parking density	street width (ft)	alley (%)
5	Beta & Delta/S.43rd St, San Diego	apartments	11.34	38	3.35	48.8	disconnected	pitched	0.0	n/a	7.9	intermediate	moderate	30.0	0.0
6	Laurel Ave./E2nd & E3rd St, National City	apartments	4.87	15	3.08	49.0	connected	flat	0.0	n/a	5.6	smooth	moderate	30.0	0.0
		min	4.87	15	3.08	48.8			0.0		5.6			30.0	0.0
		max	11.34	38	3.35	49.0			0.0		7.9			30.0	0.0
		average	8.105	26.5	3.22	48.9			0.0		6.8			30.0	0.0
		stdev	4.574981	16.26346	0.19	0.1					1.6			0.0	
		COV	0.56	0.61	0.06	0.00					0.24			0.00	

Paleta Creek Watershed Apartment Land Development Characteristics (cont.)

Site		land use	alley texture	alley width (ft)	paved parking (%)	connection	driveways (%)	connected	sidewalks (%)	connected	landscaping (%)	compaction/texture	total (%)
5	Beta & Delta/S.43rd St, San Diego	apartments	n/a	n/a	32.9	direct	0.0	n/a	4.0	direct	6.4	mod/silty	100
6	Laurel Ave./E2nd & E3rd St, National City	apartments	n/a	n/a	28.4	direct	0.0	n/a	2.8	direct	14.2	mod/silty	100
		min		n/a	28.4		0.0		2.8		6.4		92
		max		n/a	32.9		0.0		4.0		14.2		108
		average		n/a	30.7		0.0		3.4		10.3		100.0
		stdev		n/a	3.2				0.8		5.5		
		COV		n/a	0.10				0.25		0.54		

NBSD Monitored Outfall Drainage Areas (acres)

NBSD outfall	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O1W	1.349	0.275	1.853							3.477
O2W	1.336		1.69		0.031		0.384			3.441
O3W	6.384	3.788	11.675	1.241	3.789	5.834	3.481		0.051	36.243
O4W	6.306	3.369	6.926	3.253	7.335		0.694	1.011	0.011	28.905
	15.375	7.432	22.144	4.494	11.155	5.834	4.559	1.011	0.062	72.066

NBSD Monitored Outfall Drainage Areas (%)

NBSD outfall	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O1W	38.8	7.9	53.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0
O2W	38.8	0.0	49.1	0.0	0.9	0.0	11.2	0.0	0.0	100.0
O3W	17.6	10.5	32.2	3.4	10.5	16.1	9.6	0.0	0.1	100.0
O4W	21.8	11.7	24.0	11.3	25.4	0.0	2.4	3.5	0.0	100.0
min	17.6	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	
max	38.8	11.7	53.3	11.3	25.4	16.1	11.2	3.5	0.1	
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	
average	29.3	7.5	39.6	3.7	9.2	4.0	5.8	0.9	0.0	100.0
stdev	11.2	5.2	13.9	5.3	11.8	8.0	5.4	1.7	0.1	
COV	0.38	0.70	0.35	1.45	1.28	2.00	0.94	2.00	1.49	

NBSD Naval Facility Areas (acres)

WinSLAMM IND area	SD Navy areas	Description	O3W ac to creek	O4W ac to creek	other NBSD to creek	other NBSD to estuary	O1W ac to estuary	O2W ac to estuary
1	roofs1	Roof, directly connected flat	6.384	6.306	25.51495	16.56321	1.349	1.336
13	PavedParking1	Paved Parking, directly connected	11.675	6.926	34.56671	22.43922	1.853	1.69
31	Sidewalks1	Sidewalk, directly connected	1.241	3.253	3.199485	2.076968		
37	streets1	Street, intermediate texture, no parking, 35 ft wide	3.788	3.369	6.542784	4.247294	0.275	
45	Large Landscaped Areas 2	Large Landscaped Area, normal silty	5.834		3.508722	2.277712		
51	Small Landscaped Areas 1	Small Landscaped Area, compacted silty	3.789	7.335	8.006563	5.197517		0.031
70	Water Body Areas	Water, wet	0.051	0.011	0.038968	0.025296		
89 (OIA6)	Light Laydown Area, asphalt paved, dir connected	Other Paved Area, directly connected	3.481	0.694	5.049419	3.277866		0.384
99 (ONPA1)	Light laydown unpaved, drains to soil	Other Pervious Area, compacted silty		1.011	0.762403	0.49492		
		Total	36.243	28.905	87.19	56.6	3.477	3.441

Standard Land Use Categories to Use:	Landuse Category, west of I5 (besides NBSD), all to creek	other land uses to creek
SD MDR, direct entry	Single Family Detached	0.112
office park SLU	Commercial and Office	1.301
light industrial SLU	Light Industry	11.099
37 streets1, directly connected, inter texture, 50 ft wide, IND	Transportation, Communications, Utilities	25.079
Type1:4land urban XS with median ADT=3500 SLU FRE	Road Rights of Way (add to other land uses)	24.527
77 other direct con imp areas in IND, direct entry	Railroad Rights of Way	14.634
57 undeveloped areas 1, IND direct entry	Undeveloped	0.534
70 water body areas, IND direct entry	Water	0.951
	Total	78.237

Paleta Creek Watershed Areas east of I5 (upper watershed area)

Standard Land Use Categories to Use:	Landuse Category	East of I5 Area (ac)	% of total
SD MDR, direct entry	Single Family Detached	804.36	46.49
Type2: 6lane urban XS with median ADT = 70,000 slopeS1, FRE SLU	Road Rights of Way	397.64	22.98
37 streets1, directly connected, inter texture, 35 ft wide RES	Transportation, Communications, Utilities	110.81	6.40
SD APTS, direct entry	Multiple Family	101.26	5.85
Schools; INT SLU	Education	80.8	4.67
SD APTS, direct entry	Single Family Attached	68.21	3.94
Parks; Other Urban SLU	Recreation	62.13	3.59
Open Space; Other Urban SLU	Undeveloped	42.63	2.46
STRIPCON COM SLU	Commercial and Office	40.04	2.31
Misc. Institutional, INST SLU	Institutions	22.4	1.29
	Total	1730.28	100.00

Paleta Creek Medium Density Residential Areas Standard Land Use File Description

		area (%)	single family attached East of I5 (ac)	single family detached East of I5 (ac)	single family detached west of I5 to creek(ac)
roof1	disconnected pitched roof	20.1	13.71	161.68	0.02
roof2	disconnected flat roof (outbuildings)	3.9	2.66	31.37	0.00
driveways 1	paved and connected	3.7	2.52	29.76	0.00
sidewalks 1	paved and connected	7.3	4.98	58.72	0.01
streets 1	smooth texture, light parking, 38 ft wide	13.7	9.34	110.20	0.02
streets 2	smooth texture, moderate parking, 58 ft wide	5.3	3.62	42.63	0.01
streets 3	smooth texture alley, no parking, 19 ft wide	2.5	1.71	20.11	0.00
small lands 1	mod compacted, silty	43.5	29.67	349.90	0.05
total		100	68.21	804.36	0.11

Paleta Creek Apartment Residential Areas Standard Land Use File Description

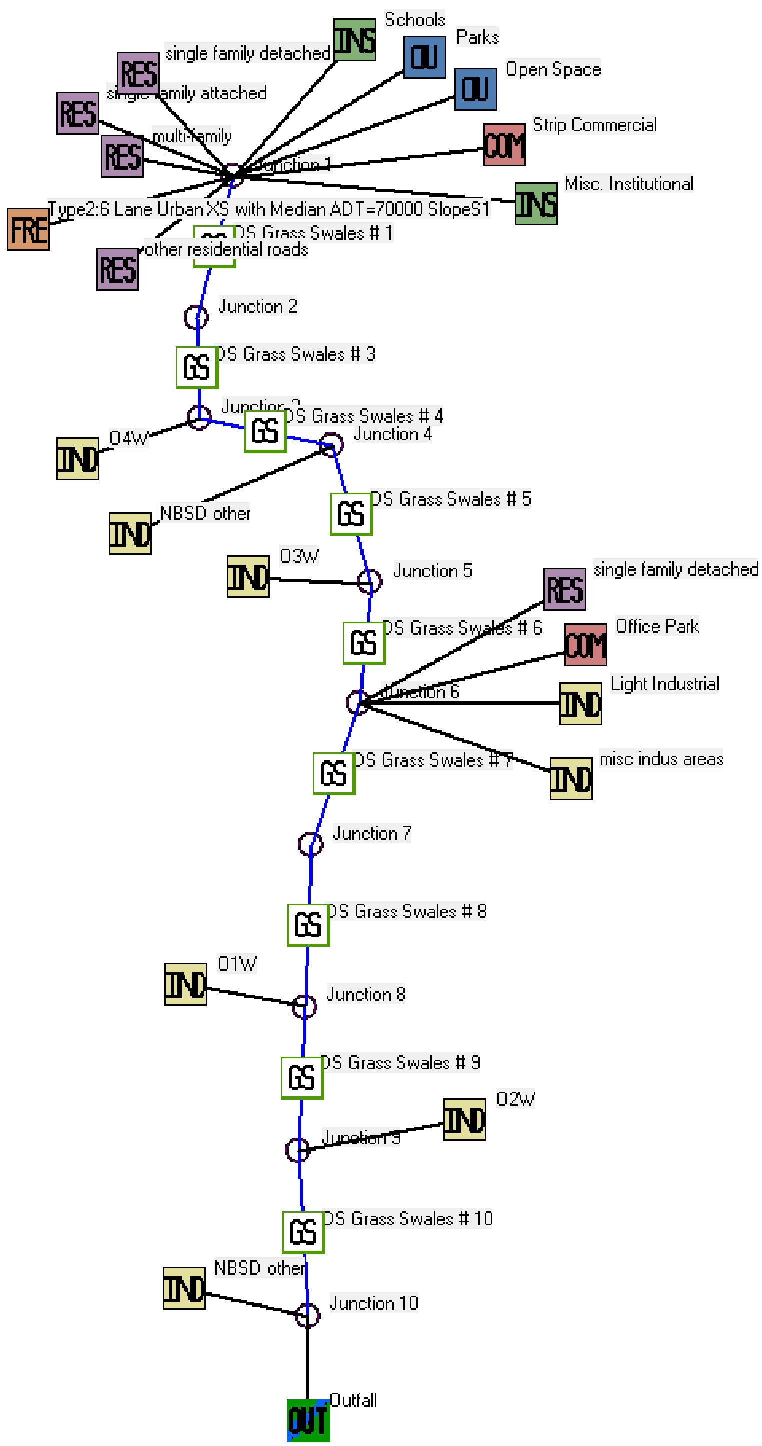
		area (%)	multi-family East of I5 (ac)
roof1	disconnected pitched roof	24.4	24.71
roof2	connected flat roof	24.5	24.81
paved parking 1	connected	30.6	30.99
sidewalks 1	paved and connected	3.4	3.44
streets 1	smooth texture, moderate parking, 30 ft wide	2.8	2.84
streets 2	intermediate texture, moderate parking, 30 ft wide	4	4.05
small lands 1	mod compacted, silty	10.3	10.43
total		100	101.26

Appendix C: Paleta Creek Watershed WinSLAMM Analyses

Contents

The NBSD industrial and the residential area land development characteristics were used to describe those land uses in the Paleta Creek watershed, while the other minor watershed areas (commercial, parks, etc.) used regional standard land use files (as described at: http://rpitt.eng.ua.edu/Publications/4_Stormwater_Characteristics_Pollutant_Sources_and_Land_Development_Characteristics/Land_development_characteristics/Standard%20Land%20Use%20file%20descriptions%20final%20April%2018%202011%20for%20EPA%20Cadmus.pdf).

Paleta Creek WinSLAMM Schematic



Paleta Creek Watershed Land Use WinSLAMM Subareas

Land Use #	Land Use Type	Land Use Label	Land Use Area (acres)
1	Residential	single family detached	804.370
2	**Industrial**	**04W**	**28.905**
3	Industrial	NBSD other	87.179
4	Industrial	03W	36.243
5	Residential	single family detached	0.110
6	Industrial	01W	3.477
7	Industrial	02W	3.441
8	Industrial	NBSD other	56.605
9	Residential	single family attached	68.210
10	Residential	multi-family	101.270
11	Freeway	Type2:6 Lane Urban XS with Median Al	397.640
12	Residential	other residential roads	110.810
13	Institutional	Schools	80.800
14	Other Urban	Parks	62.130
15	Other Urban	Open Space	42.630
16	Commercial	Strip Commercial	40.040
17	Institutional	Misc. Institutional	22.400
18	Commercial	Office Park	1.301
19	Industrial	Light Industrial	11.099
20	Industrial	misc indus areas	41.198

Paleta Creek WinSLAMM Parameter Files

Data file name: C:\WinSLAMM Files\Example Files\SERDP\PoletaCrNBSD.mdb
WinSLAMM Version 10.2.203
Rain file name: C:\WinSLAMM Files\Rain Files\CA SanDiego AP 4805.ran
Particulate Solids Concentration file name: C:\WinSLAMM Files\NavySD2015\Navy SD Sept 28 2015.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\NavySD2015\Southwest Navy Sept 28 2015.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\Southwest street Res and Other Urban Nov 7 2013.std
Institutional Street Delivery file name: C:\WinSLAMM Files\NavySouthwest street Com Inst Indust Nov 7 2013.std
Commercial Street Delivery file name: C:\WinSLAMM Files\NavySouthwest street Com Inst Indust Nov 7 2013.std
Industrial Street Delivery file name: C:\WinSLAMM Files\NavySouthwest street Com Inst Indust Nov 7 2013.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\Southwest street Res and Other Urban Nov 7 2013.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Southwest Freeway.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\NavySD2015\NavySouthwest Sept 10 2016.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\PSD source area SSC.csv
Cost Data file name:
Seed for random number generator: -42
Study period starting date: 01/01/80   Study period ending date: 12/03/05

Paleta Creek Land Use Development Characteristics
LU# 1 - Residential: single family detached Total area (ac): 804.370
1 - Roofs 1: 161.680 ac. Pitched Disconnected Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
2 - Roofs 2: 31.370 ac. Flat Disconnected Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
25 - Driveways 1: 29.760 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 58.720 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 110.200 ac. Smooth Street Length = 47.85 curb-mi Street Width (assuming two curb-mi per street mile) = 38 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 42.630 ac. Smooth Street Length = 12.128 curb-mi Street Width (assuming two curb-mi per street mile) = 57.99761 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
39 - Streets 3: 20.110 ac. Smooth Street Length = 17.464 curb-mi Street Width (assuming two curb-mi per street mile) = 18.99994 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 349.900 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 2 - Industrial: O4W Total area (ac): 28.905
1 - Roofs 1: 6.306 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 6.926 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 3.253 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 3.369 ac. Intermediate Street Length = 1.588 curb-mi Street Width (assuming two curb-mi per street mile) = 35.00535 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 7.335 ac. Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
70 - Water Body Areas: 0.011 ac. Source Area PSD File:
89 - Other Impervious Areas 6: 0.694 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
99 - Other Non-Paved Areas 1: 1.011 ac. Disconnected Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 3 - Industrial: NBSD other Total area (ac): 87.179
1 - Roofs 1: 25.510 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz

13 - Paved Parking 1: 34.570 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 3.199 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 6.530 ac.   Intermediate   Street Length = 3.078 curb-mi   Street Width (assuming two curb-mi per street mile) = 35.00488 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
45 - Large Landscaped Areas 1: 3.510 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
51 - Small Landscaped Areas 1: 8.010 ac.   Moderately Compacted Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
70 - Water Body Areas: 0.040 ac.   Source Area PSD File:
89 - Other Impervious Areas 6: 5.050 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
99 - Other Non-Paved Areas 1: 0.760 ac.   Disconnected   Moderately Compacted Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 4 - Industrial: O3W   Total area (ac): 36.243
1 - Roofs 1: 6.384 ac.   Flat   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 11.675 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 1.241 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 3.788 ac.   Intermediate   Street Length = 1.786 curb-mi   Street Width (assuming two curb-mi per street mile) = 34.99552 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
45 - Large Landscaped Areas 1: 5.834 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
51 - Small Landscaped Areas 1: 3.789 ac.   Moderately Compacted Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
70 - Water Body Areas: 0.051 ac.   Source Area PSD File:
89 - Other Impervious Areas 6: 3.481 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 5 - Residential: single family detached   Total area (ac): 0.110
1 - Roofs 1: 0.020 ac.   Pitched   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
31 - Sidewalks 1: 0.010 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 0.020 ac.   Smooth   Street Length = 0.009 curb-mi   Street Width (assuming two curb-mi per street mile) = 36.66667 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 0.010 ac.   Smooth   Street Length = 0.003 curb-mi   Street Width (assuming two curb-mi per street mile) = 55 ft

Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 0.050 ac.   Moderately Compacted Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 6 - Industrial: O1W   Total area (ac): 3.477
1 - Roofs 1: 1.349 ac.   Flat   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 1.853 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 0.275 ac.   Intermediate   Street Length = 0.13 curb-mi   Street Width (assuming two curb-mi per street mile) = 34.90385 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 7 - Industrial: O2W   Total area (ac): 3.441
1 - Roofs 1: 1.336 ac.   Flat   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 1.690 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 0.031 ac.   Moderately Compacted Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
89 - Other Impervious Areas 6: 0.384 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 8 - Industrial: NBSD other   Total area (ac): 56.605
1 - Roofs 1: 16.560 ac.   Flat   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 22.440 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 2.080 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 4.250 ac.   Intermediate   Street Length = 2.004 curb-mi   Street Width (assuming two curb-mi per street mile) = 34.99252 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
45 - Large Landscaped Areas 1: 2.280 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
51 - Small Landscaped Areas 1: 5.200 ac.   Moderately Compacted Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
70 - Water Body Areas: 0.025 ac.   Source Area PSD File:
89 - Other Impervious Areas 6: 3.280 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
99 - Other Non-Paved Areas 1: 0.490 ac.   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 9 - Residential: single family attached   Total area (ac): 68.210

1 - Roofs 1: 13.710 ac. Pitched Disconnected Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
2 - Roofs 2: 2.660 ac. Flat Disconnected Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
25 - Driveways 1: 2.520 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 4.980 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 9.340 ac. Smooth Street Length = 5.949 curb-mi Street Width (assuming two curb-mi per street mile) = 25.9052 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 3.620 ac. Smooth Street Length = 1.508 curb-mi Street Width (assuming two curb-mi per street mile) = 39.60875 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
39 - Streets 3: 1.710 ac. Smooth Street Length = 2.171 curb-mi Street Width (assuming two curb-mi per street mile) = 12.99632 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 29.670 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 10 - Residential: multi-family Total area (ac): 101.270
1 - Roofs 1: 24.710 ac. Pitched Disconnected Moderately Compacted Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
2 - Roofs 2: 24.810 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 30.990 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 3.440 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets 1: 2.840 ac. Smooth Street Length = 1.562 curb-mi Street Width (assuming two curb-mi per street mile) = 30 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 4.050 ac. Intermediate Street Length = 2.228 curb-mi Street Width (assuming two curb-mi per street mile) = 29.99327 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
51 - Small Landscaped Areas 1: 10.430 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 11 - Freeway: Type2:6 Lane Urban XS with Median ADT=70000 SlopeS1 Total area (ac): 397.640
1 - Paved Lane/Shlder Area 1: 188.283 ac. Poor/Flat C&G Freeway Length = 16.06466 mi Freeway Width (assuming two curb-mi per freeway mile) = 193.4 ft
ADT = 70000 veh/day Default Initial St. Dirt Loading Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz

20 - Large Turf Areas 2: 209.358 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 12 - Residential: other residential roads Total area (ac): 110.810
37 - Streets 1: 110.810 ac. Intermediate Street Length = 52.239 curb-mi Street Width (assuming two curb-mi per street mile) = 35 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 13 - Institutional: Schools Total area (ac): 80.800
1 - Roofs 1: 12.120 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 8.605 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
25 - Driveways 1: 1.600 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 2.351 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 2.165 ac. Smooth Street Length = 1.00192 curb-mi Street Width (assuming two curb-mi per street mile) = 35.66129 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 3.499 ac. Intermediate Street Length = 1.616 curb-mi Street Width (assuming two curb-mi per street mile) = 35.7225 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
39 - Streets 3: 1.325 ac. Rough Street Length = 0.61408 curb-mi Street Width (assuming two curb-mi per street mile) = 35.60527 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
46 - Large Landscaped Areas 2: 17.849 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
52 - Small Landscaped Areas 2: 14.083 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
58 - Undeveloped Areas 2: 0.339 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
63 - Paved Playgrounds 1: 14.003 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
72 - Other Pervious Areas 2: 1.770 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
79 - Other Part Con Imp Areas 2: 1.091 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 14 - Other Urban: Parks Total area (ac): 62.130
1 - Roofs 1: 0.062 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
3 - Roofs 3: 0.068 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz

6 - Roofs 6: 0.155 ac. Pitched Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 2.603 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
21 - Unpaved Parking 3: 0.137 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
25 - Driveways 1: 0.752 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 0.304 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 0.621 ac. Smooth Street Length = 0.385206 curb-mi Street Width (assuming two curb-mi per street mile) = 26.6129 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 1.410 ac. Intermediate Street Length = 0.857394 curb-mi Street Width (assuming two curb-mi per street mile) = 27.1413 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
46 - Large Landscaped Areas 2: 48.430 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
52 - Small Landscaped Areas 2: 0.528 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
63 - Paved Playgrounds 1: 0.559 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
65 - Paved Playgrounds 3: 0.559 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
69 - Isolated Areas: 4.399 ac. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
79 - Other Part Con Imp Areas 2: 1.541 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 15 - Other Urban: Open Space Total area (ac): 42.630
1 - Roofs 1: 0.234 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
31 - Sidewalks 1: 0.247 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 0.733 ac. Smooth Street Length = 0.439089 curb-mi Street Width (assuming two curb-mi per street mile) = 27.5534 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 0.861 ac. Intermediate Street Length = 0.5158231 curb-mi Street Width (assuming two curb-mi per street mile) = 27.54545 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
46 - Large Landscaped Areas 2: 0.252 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
58 - Undeveloped Areas 2: 40.302 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz

LU# 16 - Commercial: Strip Commercial Total area (ac): 40.040
1 - Roofs 1: 7.888 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
3 - Roofs 3: 1.481 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 16.376 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
21 - Unpaved Parking 3: 0.561 ac. Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
25 - Driveways 1: 0.801 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 1.722 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 4.605 ac. Smooth Street Length = 1.76176 curb-mi Street Width (assuming two curb-mi per street mile) = 43.125 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 3.443 ac. Intermediate Street Length = 1.36136 curb-mi Street Width (assuming two curb-mi per street mile) = 41.73529 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
52 - Small Landscaped Areas 2: 2.322 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
58 - Undeveloped Areas 2: 0.080 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
72 - Other Pervious Areas 2: 0.761 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
LU# 17 - Institutional: Misc. Institutional Total area (ac): 22.400
1 - Roofs 1: 1.207 ac. Flat Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
3 - Roofs 3: 1.891 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
6 - Roofs 6: 0.130 ac. Pitched Disconnected Normal Silty Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 6.095 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
25 - Driveways 1: 0.672 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 0.493 ac. Connected Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 0.896 ac. Smooth Street Length = 0.4256 curb-mi Street Width (assuming two curb-mi per street mile) = 34.73684 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 1.514 ac. Intermediate Street Length = 0.72352 curb-mi Street Width (assuming two curb-mi per street mile) = 34.53251 ft
Default St. Dirt Accum. Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz

39 - Streets 3: 0.296 ac.   Rough   Street Length = 0.14112 curb-mi   Street Width (assuming two curb-mi per street mile) = 34.57143 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
46 - Large Landscaped Areas 2: 1.196 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
52 - Small Landscaped Areas 2: 5.947 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
58 - Undeveloped Areas 2: 0.410 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
63 - Paved Playgrounds 1: 0.381 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
65 - Paved Playgrounds 3: 0.381 ac.   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
72 - Other Pervious Areas 2: 0.594 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
79 - Other Part Con Imp Areas 2: 0.298 ac.   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 18 - Commercial: Office Park   Total area (ac): 1.301
1 - Roofs 1: 0.171 ac.   Flat   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 0.558 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
25 - Driveways 1: 0.060 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 0.018 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 0.040 ac.   Smooth   Street Length = 0.0127498 curb-mi   Street Width (assuming two curb-mi per street mile) = 52.36224 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 0.104 ac.   Intermediate   Street Length = 0.0329153 curb-mi   Street Width (assuming two curb-mi per street mile) = 52.17392 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
46 - Large Landscaped Areas 2: 0.076 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
52 - Small Landscaped Areas 2: 0.237 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
72 - Other Pervious Areas 2: 0.030 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
79 - Other Part Con Imp Areas 2: 0.007 ac.   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 19 - Industrial: Light Industrial   Total area (ac): 11.099
1 - Roofs 1: 2.276 ac.   Flat   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz

3 - Roofs 3: 0.285 ac.   Pitched   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
5 - Roofs 5: 0.252 ac.   Flat   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC roof average.cpz
13 - Paved Parking 1: 3.656 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
21 - Unpaved Parking 3: 0.704 ac.   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
25 - Driveways 1: 0.284 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
31 - Sidewalks 1: 0.142 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
37 - Streets1: 0.204 ac.   Smooth   Street Length = 0.0943415 curb-mi   Street Width (assuming two curb-mi per street mile) = 35.71765 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
38 - Streets 2: 0.963 ac.   Intermediate   Street Length = 0.455059 curb-mi   Street Width (assuming two curb-mi per street mile) = 34.93171 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
39 - Streets 3: 0.036 ac.   Rough   Street Length = 0.0166485 curb-mi   Street Width (assuming two curb-mi per street mile) = 35.2 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
46 - Large Landscaped Areas 2: 0.390 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
52 - Small Landscaped Areas 2: 1.094 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
58 - Undeveloped Areas 2: 0.482 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
72 - Other Pervious Areas 2: 0.307 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
79 - Other Part Con Imp Areas 2: 0.023 ac.   Disconnected   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
LU# 20 - Industrial: misc indus areas   Total area (ac): 41.198
37 - Streets 1: 25.079 ac.   Intermediate   Street Length = 8.276 curb-mi   Street Width (assuming two curb-mi per street mile) = 50.00042 ft
Default St. Dirt Accum.   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz
57 - Undeveloped Areas 1: 0.534 ac.   Normal Silty   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC landscaped average.cpz
70 - Water Body Areas: 0.951 ac.   Source Area PSD File:
77 - Other Direct Con Imp Areas: 14.634 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\psd files\SSC pavement average.cpz

Paleta Creek Channel Characteristics

Control Practice 1: Grass Swale CP# 1 (DS) - DS Grass Swales # 1
Total drainage area (acres)= 1730.300
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 3000.00
Total swale length (ft) = 3000
Average swale length to outlet (ft)= 3000
Typical bottom width (ft) = 20.0
Typical swale side slope (_H:1V) = 1.0
Typical longitudinal slope (ft.H/ft.V) = 0.030
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 2: Grass Swale CP# 2 (DS) - DS Grass Swales # 3
Total drainage area (acres)= 1730.300
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 500.00
Total swale length (ft) = 500
Average swale length to outlet (ft)= 500
Typical bottom width (ft) = 20.0
Typical swale side slope (_H:1V) = 2.0
Typical longitudinal slope (ft.H/ft.V) = 0.020
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 3: Grass Swale CP# 3 (DS) - DS Grass Swales # 4
Total drainage area (acres)= 1759.205
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 250.00
Total swale length (ft) = 500
Average swale length to outlet (ft)= 500
Typical bottom width (ft) = 20.0
Typical swale side slope (_H:1V) = 2.0

Typical longitudinal slope (ft.H/ft.V) = 0.020
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 4: Grass Swale CP# 4 (DS) - DS Grass Swales # 5
Total drainage area (acres)= 1846.384
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 66.67
Total swale length (ft) = 200
Average swale length to outlet (ft)= 200
Typical bottom width (ft) = 20.0
Typical swale side slope (_H:1V) = 2.0
Typical longitudinal slope (ft.H/ft.V) = 0.020
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 5: Grass Swale CP# 5 (DS) - DS Grass Swales # 6
Total drainage area (acres)= 1882.627
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 50.00
Total swale length (ft) = 200
Average swale length to outlet (ft)= 200
Typical bottom width (ft) = 20.0
Typical swale side slope (_H:1V) = 2.0
Typical longitudinal slope (ft.H/ft.V) = 0.010
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 6: Grass Swale CP# 6 (DS) - DS Grass Swales # 7

Total drainage area (acres)= 1936.335
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 40.00
Total swale length (ft) = 200
Average swale length to outlet (ft)= 200
Typical bottom width (ft) = 50.0
Typical swale side slope (_H:1V) = 1.0
Typical longitudinal slope (ft.H/ft.V) = 0.010
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 7: Grass Swale CP# 7 (DS) - DS Grass Swales # 8
Total drainage area (acres)= 1936.335
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 20.00
Total swale length (ft) = 100
Average swale length to outlet (ft)= 100
Typical bottom width (ft) = 50.0
Typical swale side slope (_H:1V) = 1.0
Typical longitudinal slope (ft.H/ft.V) = 0.010
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 8: Grass Swale CP# 8 (DS) - DS Grass Swales # 9
Total drainage area (acres)= 1939.812
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 16.67
Total swale length (ft) = 100
Average swale length to outlet (ft)= 100
Typical bottom width (ft) = 50.0
Typical swale side slope (_H:1V) = 1.0
Typical longitudinal slope (ft.H/ft.V) = 0.010
Swale retardance factor: E

Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True
Control Practice 9: Grass Swale CP# 9 (DS) - DS Grass Swales # 10
Total drainage area (acres)= 1943.253
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 14.29
Total swale length (ft) = 100
Average swale length to outlet (ft)= 100
Typical bottom width (ft) = 50.0
Typical swale side slope (_H:1V) = 1.0
Typical longitudinal slope (ft.H/ft.V) = 0.010
Swale retardance factor: E
Typical grass height (in) = 1.0
Swale dynamic infiltration rate (in/hr)= 0.010
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True

Appendix D: Field Observations and Recorded Measurements during Monitoring Events

Contents

Summary of Sample Volumes Collected

Sampling Event	Monitoring Location	Volume per Aliquot (mL)	Number of Sample Pulls Completed	Total Volume Collected (L)
1/4/2016 – 1/8/2016	C1W	500	10	5
	C2W	500	8	4
	O1W	500	10	5
	O2W	500	20	10
	O3W	500	20	10
	O4W	500	16	8
1/30/2016 – 1/31/2016	C1W	1000	18	18
	C2W	1000	5	5
	O1W	1000	0	0[1]
	O2W	1000	20	20[2]
	O3W	500	0	0[3]
	O4W	500	14	7

1. Sample collection had been attempted, but no liquid was detected. Problem potentially that the strainer slightly elevates the inlet tube from the culvert invert, and this site has such a small drainage area that it takes a decent amount of flow to get the depth high enough to sample (this was observed in person during one short rain burst). Not able to safely enter catch basin to examine strainer.
2. Timing of sample appears it had sampled during dry conditions with mid-level tide, suggesting either backwater tidal flow or a source other than stormwater runoff.
3. Auto-sampler battery died.

The following tables summarize key observations at each monitoring location, including progress throughout the event, problems that required troubleshooting in the field, abnormalities in the sampling procedure, etc., for the first and second monitoring events.

Key Observations – Event 1 (1/4/2016-1/8/2016)

Date/Time	Comments
C2W – Paleta Creek Upstream	
1/4/2016	• Bracket to be used for installation at center of channel could not be located due to high flow, sediment, and potentially theft. Improvised by attaching flowmeter and inlet tube to rebar on bank.
1/5/2016 10:00 AM	• Sample bottle ~20-30% full • Much more trash in creek than day prior, indicating the overnight rain had resulted in substantial flows.
1/6/2016 10:00 AM	• Sample bottle ~40% full • Flow meter and strainer buried in several inches of sediment/mud (recorded depths may not be correct as a result). Sediment cleared from both units and strainer moved higher on the edge of the bank, above the sediment layer. • Reprogrammed to collect sample every 10 minutes when enabled • Bottle packed in ice
1/7/2015 10:45 AM	• Sample bottle full/collected • Water depth 3-4 inches; velocity approximately 0.38 ft/s (visual estimate) • 3-4 inches of sediment covering the intake tube and flow meter • All equipment removed for safety, data download, and calibration
C1W –Paleta Creek Downstream	
1/5/2016 11:20 AM	• Sample bottle ~20% full • Rain gage undisturbed • Data readout said first three samples show no liquid[1] and no sample collected • Tested the system via running a manual grab sample through the auto-sampler and back to the channel, functioned fine, unclear why error was shown
1/6/2016 1:00 PM	• Sample bottle ~20% full • Rain gage undisturbed • Several samples still said no liquid detected, so inlet tube was removed from PVC pipe, inlet screen was attached, and tubing lowered into channel. Tube may have been kinked in PVC pipe?

[1] The auto-sampler includes a liquid detector that detects liquid in the pump tubing (Teledyne ISCO, 2015). The sampler will retry to detect liquid until a successful sample has been received or a maximum number of three retires has been attempted.

Date/Time	Comments
1/7/2016 8:00 AM	• Sample bottle ~50% full • No visible sediment in bottle • Manual grab sample collected, expelled to channel, test was successful. • Reading 33 ppt with flow direction toward the bay at approximately 0.5 ft/s (visual estimate).
O4W – Guard Gate	
1/5/2016 10:50 AM	• Sample bottle ~20-30% full • ISCO battery died at 10:30 AM (replaced on site) • Inlet tube had come loose and surfaced - zip-tied it to a stainless steel hammer and lowered it into the culvert. • Restarted program
1/6/2016 10:50 AM	• Sample bottle ~85% full (appears to be maximum volume since tube extends into the bottle at that depth) • Collected bottle
O3W – Auto Skills Center	
1/5/2016 1:00 PM	• Installed ISCO, battery, bottle, and meter • ISCO programmed • ISCO housing was full of ~two inches of water (source was unclear); emptied • No liquid was detected upon test grab sample collected; manhole entry was not permitted nor safe, so original inlet tube was abandoned and new tube attached to ISCO • End of new tube zip-tied to a heavy metal object and dropped into manhole as a weight (will most likely affect metals results)
1/6/2016 11:30 AM	• No sample collected • Plastic bag observed on inlet tube; removed • Battery had died; replaced on site • Reprogrammed to take more frequent samples
1/7/2016 11:30 AM	• Sample bottle full • Collected bottle
O2W – South of Harbor	
1/5/2016 11:10 AM	• Sample bottle ~20-30% full • Salinity recording 0, low tide, and sea level below culvert inlet (minor outflow observed at outfall, kitchen faucet flow)
1/6/2016 12:50 PM	• Sample bottle ~60-70% full • Program had completed, it was restarted and adjusted for forecasted event

Date/Time	Comments
1/7/2016 8:45 AM	• Sample bottle full • Red hue to sample and ~0.5 inches of sediment settled on bottom
O1W – North of Harbor	
1/5/2016 12:00 PM	• Sample bottle empty • Inlet tube had been previously attached to side of pipe, approximately 4 inches above the invert. Inlet tube appears to be getting floated up above water level inhibiting sample collection. • No access to stormdrain due to confined space and danger of inflows, so inlet tube pulled out of bracket, weighted down with a filled water bottle (available supplies were limited), and lowered into cleanout.
1/6/2016 12:00 PM	• Sample bottle ~5% full • Inlet tube weighted down with stainless steel hammer • Program restarted for forecasted event • Re-secured salinity probe
1/7/2016 9:45 AM	• Sample bottle 50% full • Collected bottle • Suspected cracked tubing for fail to fill, but manual grab sample worked fine.

Sampling Observations – Event 2 (1/30/2016-1/31/2016)

Date	Comments
C2W – Paleta Creek Upstream	
1/28/2016 11:30 AM	• 10 inches of sediment on channel bottom • Installed auto-sampler, battery, and flowmeter • Flowmeter was secured to a cinder block, which was chained to rebar scraps on the side for the channel. Intent is to keep the intake and flowmeter out of the sediment, but still allow them to be submerged under flow.
1/29/2016 2:30 PM	• Dug cinder block slightly deeper into sediment to allow for quicker triggering • Programmed pacing at time-spaced 36-minute intervals (12-hour duration, 20 samples of 1000 mL each) • Setup and tested dual bottle configuration • No water in creek for manual measurements or tests of any kind

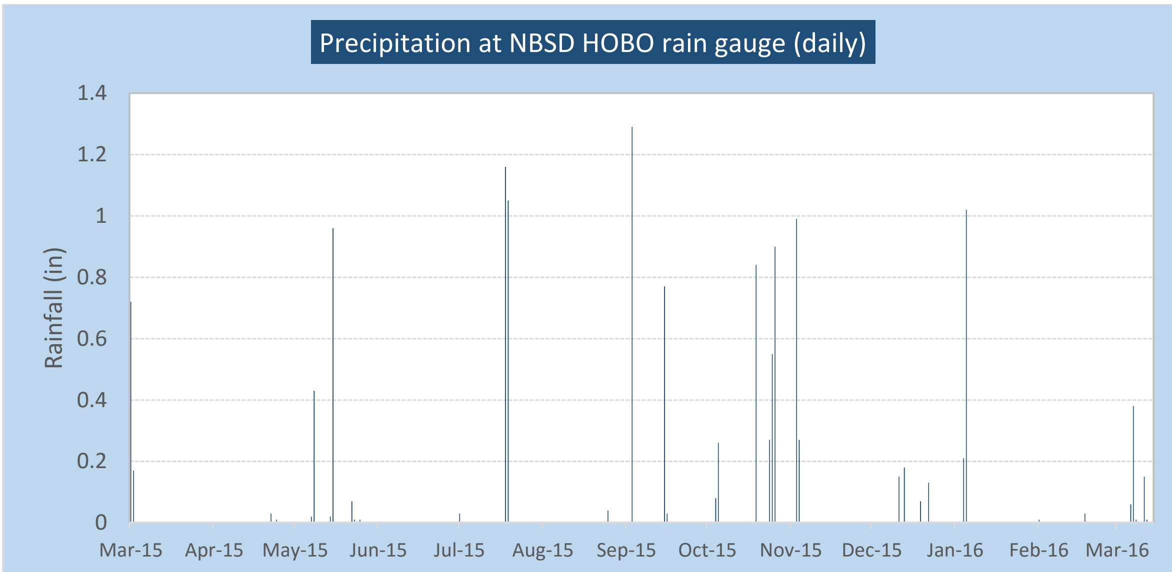
Date	Comments
1/31/2016 9:00 AM	• Samples partially collected • Flowmeter and inlet strainer still in place with flow passing over them. Slight jump in flow at cord connection (u/s end of flowmeter). • Velocity reading -3.3 fps; measured visually 2 fps • Level reading 0.16-ft; no measurement possible due to safety constraint, but approx. 2-in looks correct based on visual estimate • Auto-sampler time is 1 hour fast
2/1/2016 7:30 AM	• ~4L collected between two 10L bottles • Creek dry • Flowmeter and strainer are still exposed (not buried), with some minor debris having been caught on tube and cord
C1W –Paleta Creek Downstream	
1/28/2016	• Installed auto-sampler, battery, and rain gage • Deployed floating housing for the salinity meter – the inlet strainer is attached to this apparatus. Secured to the bridge piers by coated cable wire and rope. • Tested 500mL grab sample volume, test successful
1/29/2016 8:30 AM	• Connected salinity meter and attached battery • Re-leveled rain gage • Programmed pacing at time-spaced 18-minute intervals (12-hour duration, safety factor of 2 for tidal impacts, 20 samples of 1000 mL each) • Set up dual 10L bottle configuration • Tested 2-bottle configuration. 1000mL grab produced 1000mL split - very difficult to get this exactly correct (500mL in each bottle) as it depends on the angle of the tubing, which is inserted with the container lid on. • Covered 10L bottle openings in paraffin to reduce aerial contaminants • Wrapped bottles in bubble wrap to avoid accidental breakage • Did not add ice because event was not predicted for 48-hours, in which case the ice could melt, lift the bottles, and disturb the tubing configuration. • Level reading 3.482-ft; measured 4.83-ft at black PVC tube • Salinity reading 33.4 ppt • Velocity reading -0.08 fps; stagnant flow, no visual velocity estimates possible
1/31/2016 9:30 AM	• Floating apparatus in place, intake and salinity probe submerged, but at water surface (correct placement) • ISCO sample enabled and collected while onsite • Velocity reading 0.11 fps; flow very slow, no visual estimate possible. • Salinity reading 0.3ppt; confirmed by low tide • Level reading 2.48-ft; measured 3.75-ft

Date	Comments
2/1/2016 9:00 AM	• ~14 L collected between two 10L bottles • Program had stopped due to full bottle • No measurable flow
O4W – Guard Gate	
1/15/2016	• Deployed ISCO inside manhole. • Rinsed inlet tube via grab function with 3.78L distilled water. Rinse water collected for offsite disposal. • Attached strainer to inlet tube downstream of area-velocity meter. Area-velocity meter was dangling from cord attached to side of pipe – not sure if bracket at pipe invert came loose or scissor ring was rotated? Attempted to rotate the scissor ring, but could not. • Since there was no attachment bracket present, the AV meter cord was zip-tied to the scissor ring at the pipe invert. Current depth reading 7.7-in (measured 8 inches), no flow present for flow test. • Tested grab sample pull volume in installed condition to collect 500mL. Test successful. • Attached flowmeter cable to ISCO.
1/29/2016	• Attached battery • Programmed pacing at time-spaced 36-minute intervals (12-hour duration, 20 samples of 500 mL each) • Tested grab sample volume, successfully produced 500mL • Added 3 bags of ice • Level reading 0.404-ft; measured 5-6-in (0.42-0.5-in) • No velocity to measure
2/1/2016 8:20 AM	• ~7L collected in one bottle • Battery had died
O3W – Auto Skills Center	
1/15/2016	• Deployed ISCO • Rinsed inlet tube via grab function with 3.78L distilled water. Rinse water collected for offsite disposal. • Attached strainer to inlet tube downstream of area-velocity meter. • Deep standing water in pipe (high tide), so inlet tube was attached to ladder rungs with zip ties and strainer inserted into pipe downstream of area-velocity meter. • Tested grab sample pull volume in installed condition to collect 500mL. Test successful. • Attached flowmeter cable to ISCO.

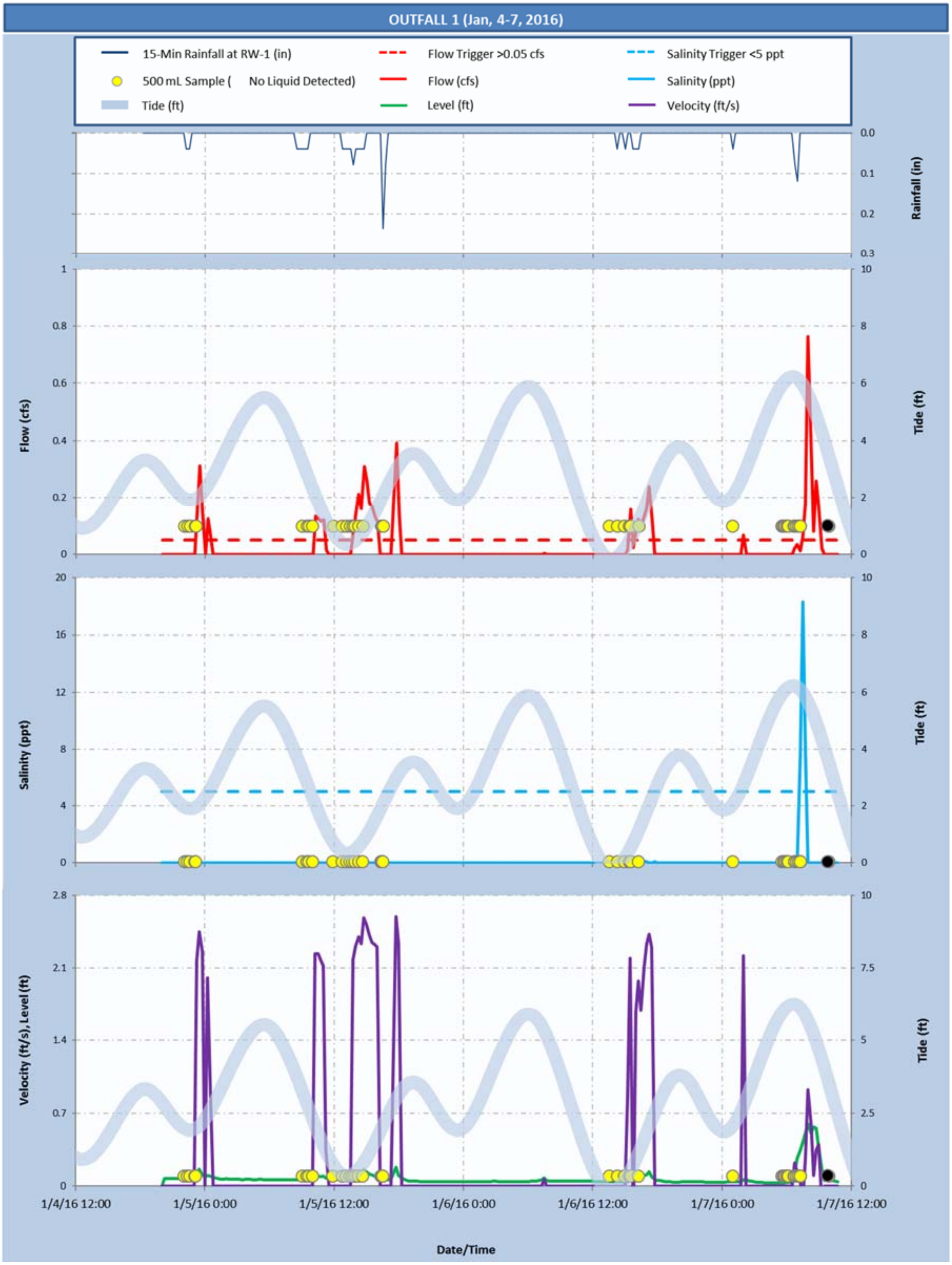
Date	Comments
1/29/2016	• Connected salinity meter and attached battery • Programmed pacing at time-spaced 18-minute intervals (12-hour duration, safety factor of 2 for tidal impacts, 20 samples of 1000 mL each) • Salinity reading 27.4 ppt • Level reading 1.864-ft; measured 23-in (1.92-ft) • No measureable velocity • Observed sample being collected at high salinity upon setup (volume was not being discharged to the sample bottle). Stopped program, checked and restarted program. Sample was not immediately enabled/collected, so sampler was left in place.
2/2/2016 11:30 AM	• Sample bottle empty • Battery dead
O2W – South of Harbor	
1/15/2016	• Deployed ISCO • Attached strainer to inlet tube and secured in pipe, downstream of flowmeter. • Tested grab sample pull volume in installed condition – needed to more securely attach tubing and slightly adjust suction length to collect 500mL. Test successful. • Attached flowmeter cable to ISCO.
1/29/2016 11:50 AM	• Connected salinity meter and attached battery • Programmed pacing at time-speed 18-minute intervals (12-hour duration, safety factor of 2 for tidal impacts, 20 samples of 1000 mL each) • Set up dual bottle configuration • Tested dual bottle configuration. 1000mL grab produced 400mL/600mL split. Very difficult to get this exactly correct as it depends on the angle of the tubing, which is inserted with the container lid on. • Level reading 0.881-ft. Measured 9-in (0.75-ft). • Salinity reading 33.9 ppt
1/31/2016 10:00 AM	• Both 10L sample bottles were full • Preliminary timing appears it had sampled during dry conditions with mid-level tide • Likely either sampling backwater tidal flow or something others than stormwater (i.e., hydrant testing) • Emptied both bottles, checked and restarted the program for another 20 samples • Added 3 retries to this program as well since it also has a decently small drainage area.
2/1/2016 9:25 AM	• Both 10L sample bottles full • Level reading -.05-ft; visually dry • Requested SPAWAR to take salinity readings (~15ppt reported)
O1W – North of Harbor	

Date	Comments
1/15/2016	• Deployed ISCO inside DLA fence. • Rinsed inlet tube via manual grab function with 3.78L distilled water. Rinse water collected for offsite disposal. • Attached strainer to inlet tube downstream of area-velocity meter. AV meter was installed facing upstream (cord attached on downstream end), unable to remove/readjust, so left in place. • Tested grab sample pull volume in installed condition to collect 500mL. Test successful. • Attached flowmeter cable to ISCO.
1/29/2016 12:00 PM	• Connected salinity meter and attached battery • Programmed pacing at time-spaced 18-minute intervals (12-hour duration, safety factor of 2 for tidal impacts, 20 samples of 1000 mL each) • Set up dual bottle configuration • Tested dual bottle configuration. 1000mL grab produced 400mL/600mL split. Very difficult to get this exactly correct as it depends on the angle of the tubing, which is inserted with the container lid on. • Did not add ice because event was not predicted for 48-hours, in which case the ice could melt, lift the bottles, and disturb the tubing configuration. • No flow in catch basin for manual measurements
1/31/2016 10:45 AM	• Both sample bottles empty (even though it had rained earlier) • Seven samples had been attempted to be collected but detected no liquid • Inlet tubing was tested on 1/29, but could not safely enter catch basin to examine strainer • Problem could be that the strainer slightly elevates the inlet tube from the culvert invert, and this site has such a small drainage area that it takes a decent amount of flow to get the depth high enough to sample (i.e., it is very flashy). This was observed in person during one short rain burst. Restarted the program to collect another 20 samples and set 3 retries for no liquid detection
2/1/2016 10:00 AM	• Bottle essentially empty upon collection

Rainfall data at NBSD (HOBO gauge)



January 4 – 7, 2016 Outfall 1 Recorded Data

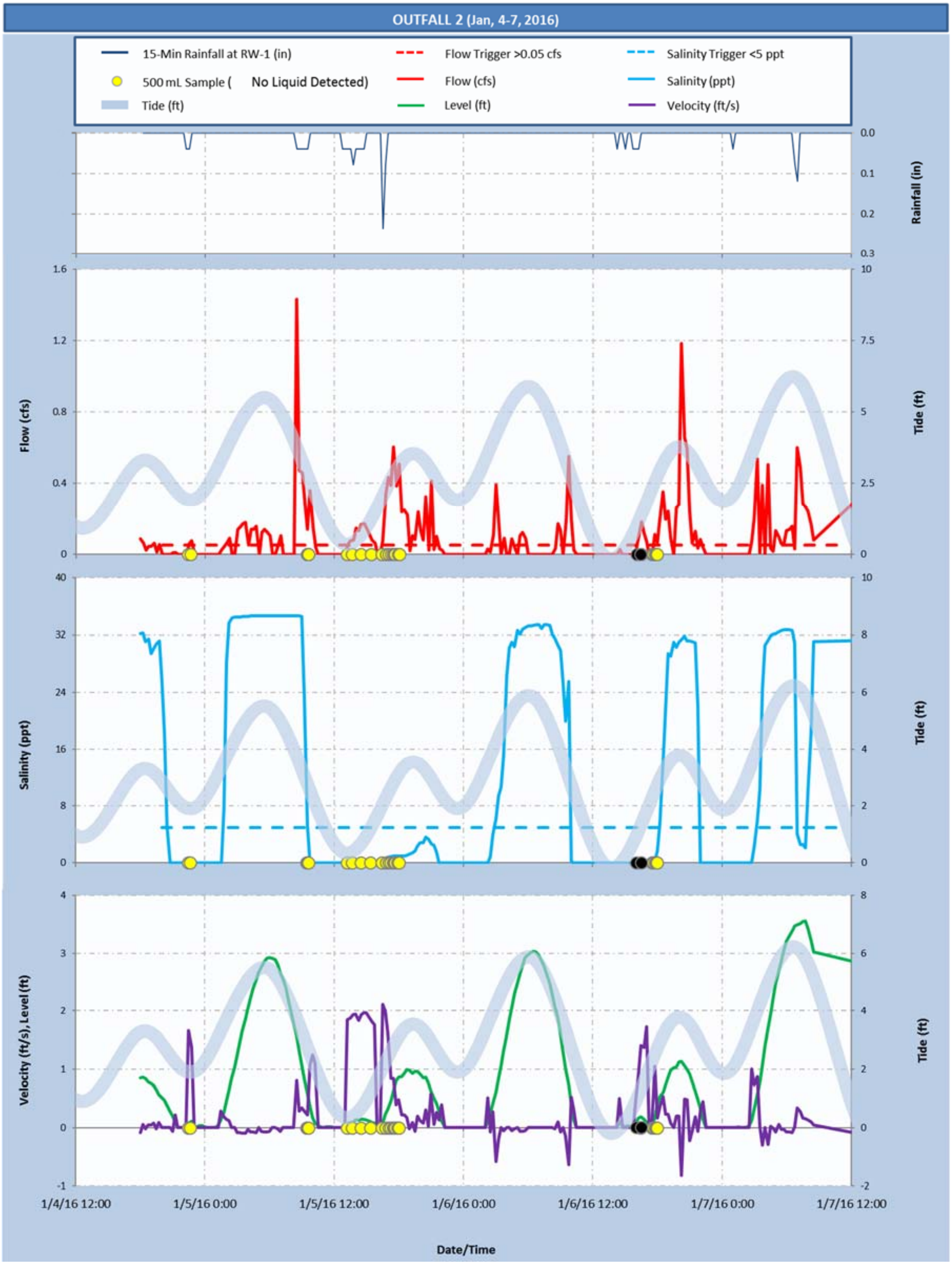


January 4 – 7, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/4/2016 22:15
Rain Event End Date/Time:	1/7/2016 07:00
Rain Duration, actual precipitation period with <6 hrs between recorded rain (hours):	26
Total Precipitation (inches):	4.65
Average Rain Intensity, actual precipitation time (in/hr):	0.18
Peak 15-min Rain Intensity (in/hr):	0.78

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O1W	1.349	0.275	1.853							3.477

January 4 – 7, 2016 Event Runoff Characteristics	
	Outfall 1
Flow Start Date/Time:	1/4/2016 23:15
Flow End Date/Time:	1/7/2016 09:15
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	19.25
Total Runoff Depth (inch):	0.49
Total Outflow (cf):	6,151
Average Runoff Rate (cfs):	0.089
Peak 15-min Runoff Rate (cfs):	0.76
Peak to Average Runoff Ratio:	8.6
Calculated Runoff Curve Number (CN):	49
Calculated Rational Equation C Coefficient:	0.28
Calculated Volumetric Runoff Coefficient (Rv)	0.10

January 4 – 7, 2016 Outfall 2 Recorded Data

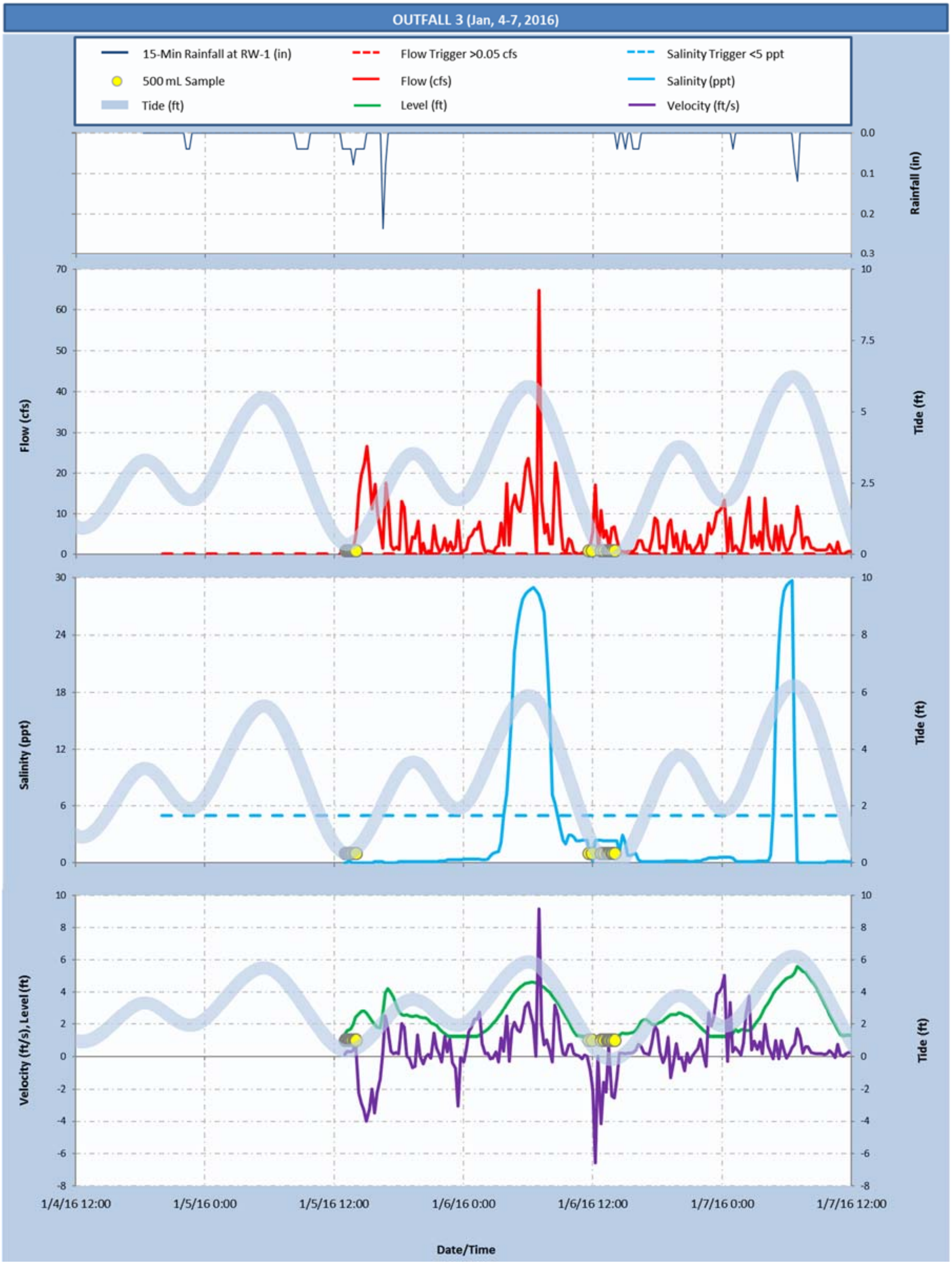


January 4 – 7, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/4/2016 22:15
Rain Event End Date/Time:	1/7/2016 07:00
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	26
Total Precipitation (inches):	4.65
Average Rain Intensity, actual precipitation time (in/hr):	0.18
Peak 15-min Rain Intensity (in/hr):	0.78

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O2W	1.336		1.690		0.031		0.384			3.441

January 4 – 7, 2016 Event Runoff Characteristics	
	Outfall 2
Flow Start Date/Time:	1/4/2016 17:45
Flow End Date/Time:	1/7/2016 08:30
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	62.5
Total Runoff Depth (inch):	1.79
Total Outflow (cf):	22,325
Average Runoff Rate (cfs):	0.10
Peak 15-min Runoff Rate (cfs):	1.4
Peak to Average Runoff Ratio:	14
Calculated Runoff Curve Number (CN):	70
Calculated Rational Equation C Coefficient:	0.53
Calculated Volumetric Runoff Coefficient (Rv)	0.53

January 4 – 7, 2016 Outfall 3 Recorded Data



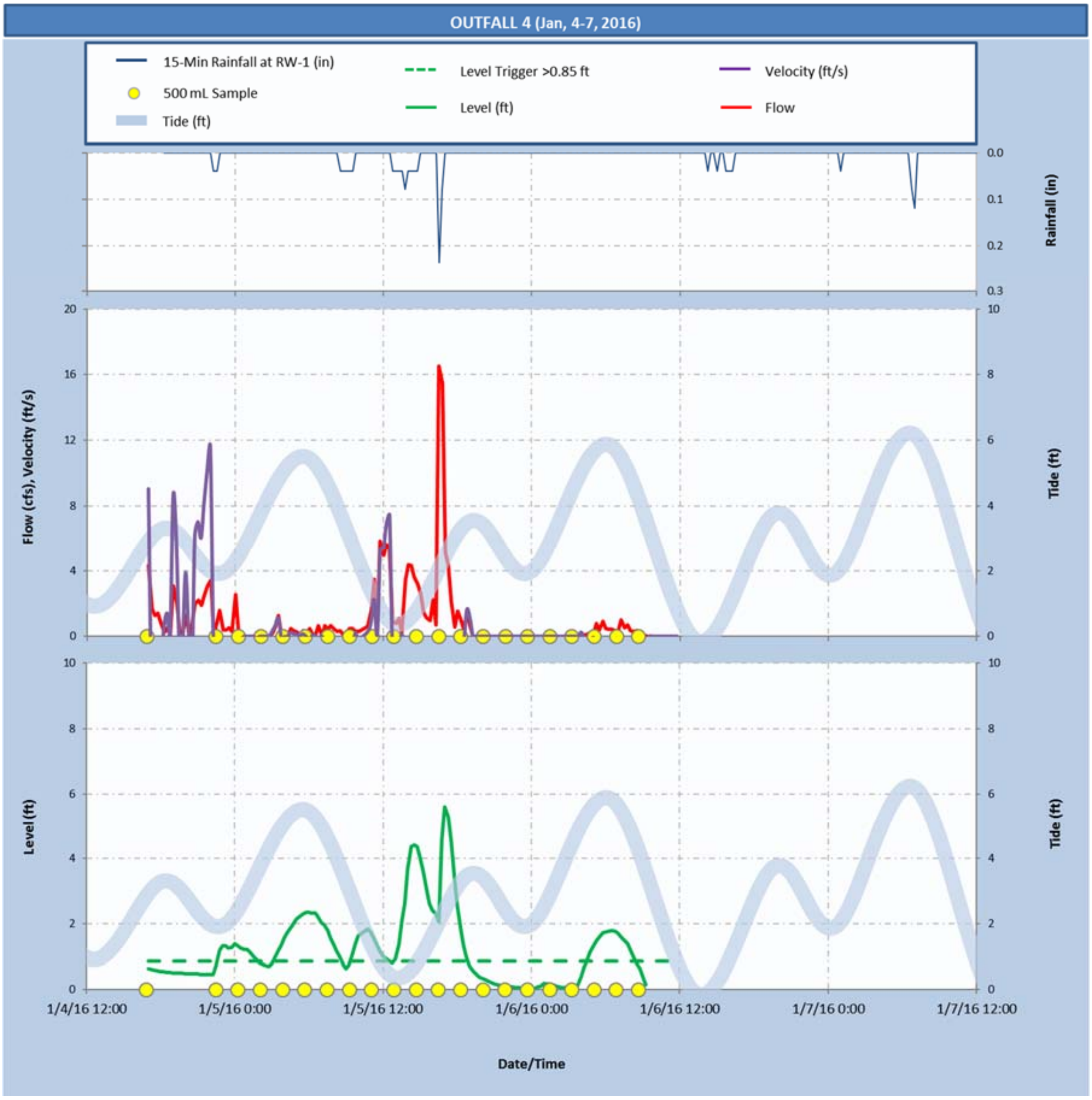
January 4 – 7, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/4/2016 22:15
Rain Event End Date/Time:	1/7/2016 07:00
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	26
Total Precipitation (inches):	4.65
Average Rain Intensity, actual precipitation time (in/hr):	0.18
Peak 15-min Rain Intensity (in/hr):	0.78

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O3W	6.384	3.788	11.675	1.241	3.789	5.834	3.481		0.051	36.24 3

January 4 – 7, 2016 Event Runoff Characteristics	
	Outfall 3
Flow Start Date/Time:	1/5/2016 11:45
Flow End Date/Time:	1/7/2016 10:45
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	47
Total Runoff Depth (inch):	6.85
Total Outflow (cf):	901,445
Average Runoff Rate (cfs):	5.33
Peak 15-min Runoff Rate (cfs):	65
Peak to Average Runoff Ratio:	12
Calculated Runoff Curve Number (CN):	116*
Calculated Rational Equation C Coefficient:	2.3*
Calculated Volumetric Runoff Coefficient (Rv)	1.5*

*the monitored runoff volume is greater than the rain volume, due to either flow rate monitoring error or baseflow

January 4 – 7, 2016 Outfall 4 Recorded Data

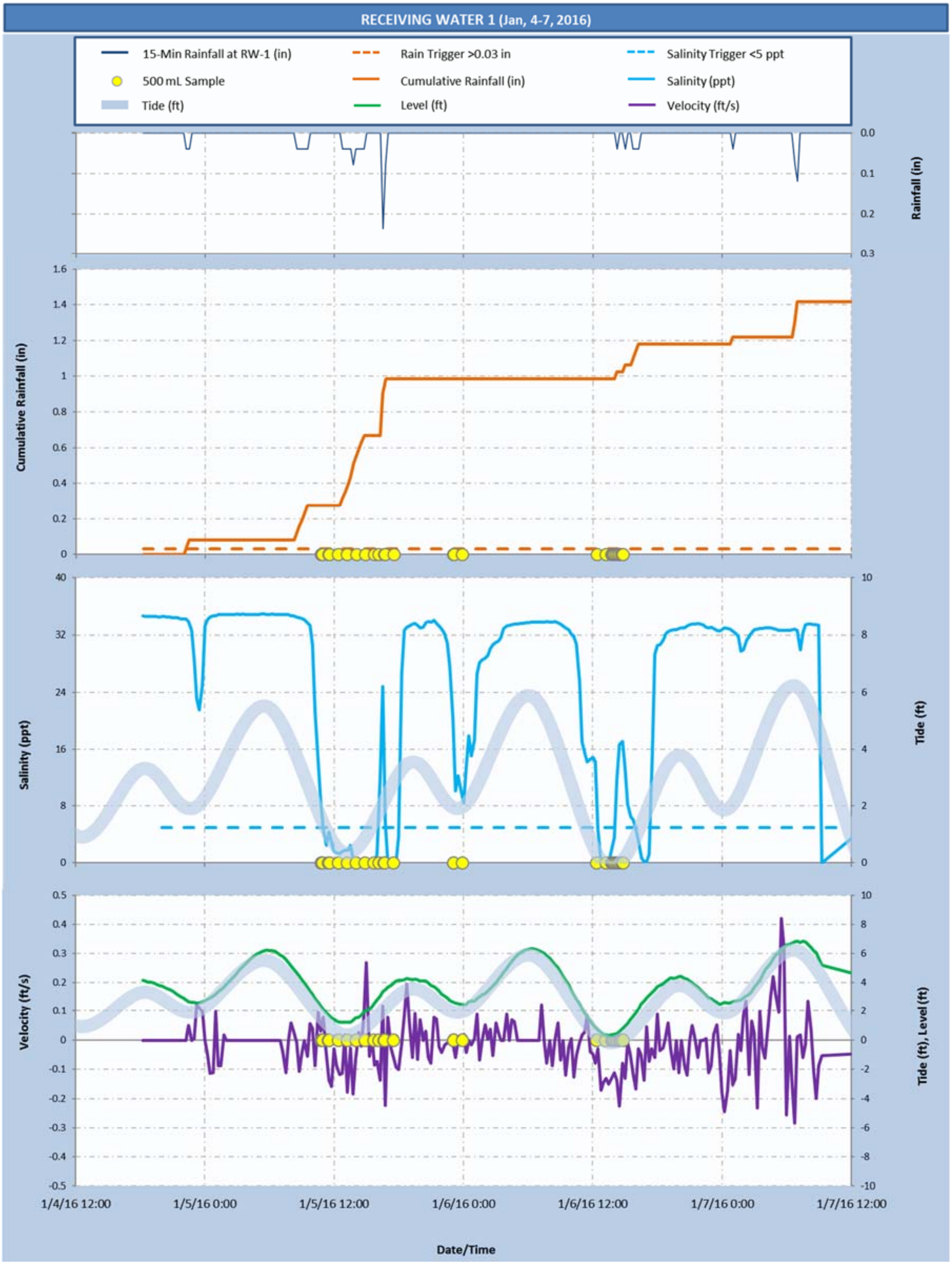


January 4 – 7, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/4/2016 22:15
Rain Event End Date/Time:	1/7/2016 07:00
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	26
Total Precipitation (inches):	4.65
Average Rain Intensity, actual precipitation time (in/hr):	0.18
Peak 15-min Rain Intensity (in/hr):	0.78

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O4W	6.306	3.369	6.926	3.253	7.335		0.694	1.011	0.011	28.90 5

January 4 – 7, 2016 Event Runoff Characteristics	
	Outfall 4
Flow Start Date/Time:	1/4/2016 17:00
Flow End Date/Time:	1/6/2016 09:15
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	31
Total Runoff Depth (inch):	1.37
Total Outflow (cf):	148,927
Average Runoff Rate (cfs):	1.33
Peak 15-min Runoff Rate (cfs):	17
Peak to Average Runoff Ratio:	12
Calculated Runoff Curve Number (CN):	64
Calculated Rational Equation C Coefficient:	0.71
Calculated Volumetric Runoff Coefficient (Rv)	0.30

January 4 – 7, 2016 Receiving Water 1 Recorded Data



January 4 – 7, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/4/2016 22:15
Rain Event End Date/Time:	1/7/2016 07:00
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	26
Total Precipitation (inches):	4.65
Average Rain Intensity, actual precipitation time (in/hr):	0.18
Peak 15-min Rain Intensity (in/hr):	0.78

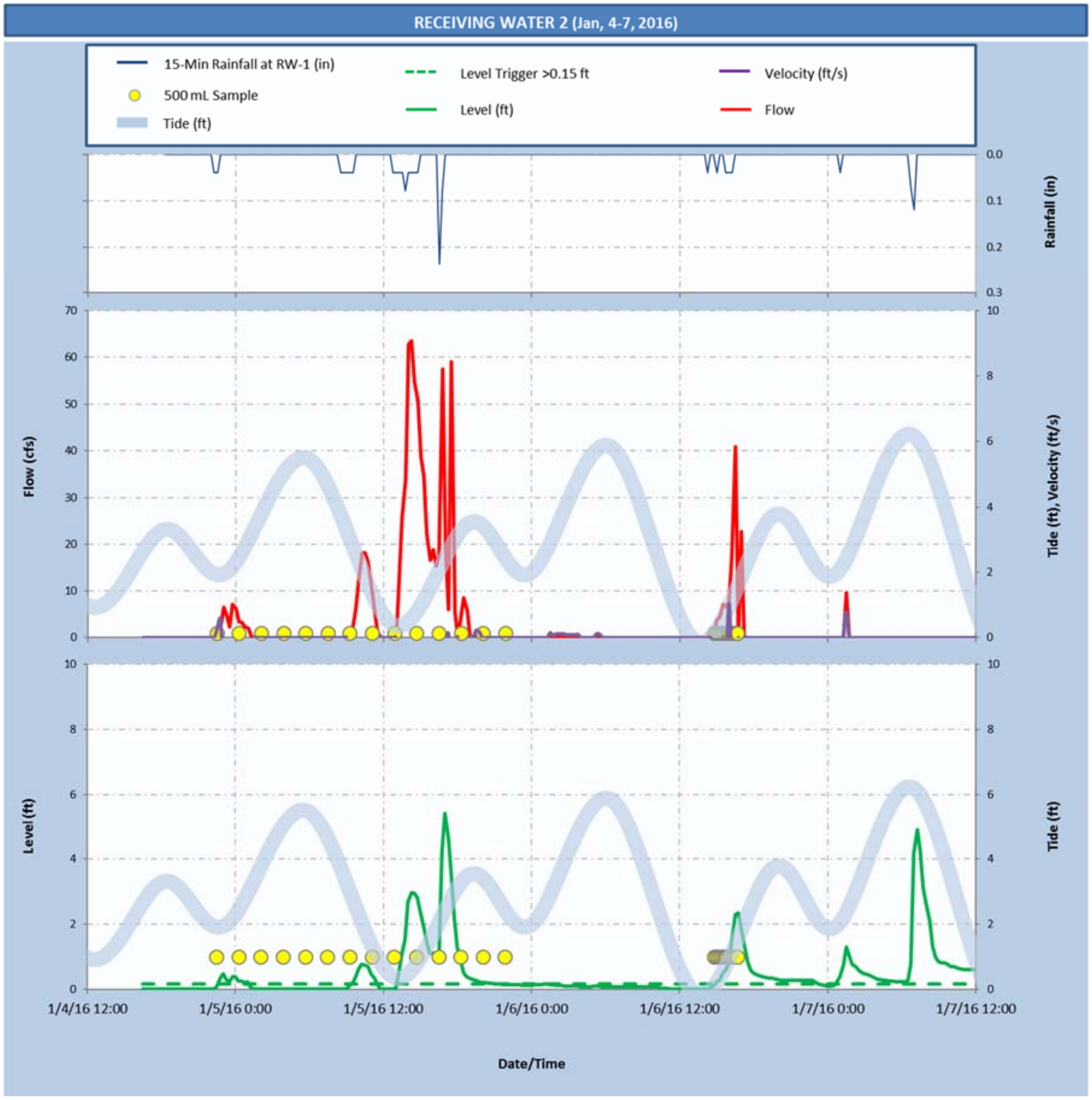
Landuse Category: Receiving water 1	Area (ac)
Single Family Detached	791.420
Single Family Attached	68.213
Mobile Homes	14.119
Multiple Family	97.258
Military	219.645
Institutions	22.386
Commercial and Office	41.310
Light Industry	11.099
Transportation, Communications, Utilities	130.888
Road Rights of Way	415.402
Railroad Rights of Way	15.846
Education	80.803
Recreation	62.134
Open Space Parks	9.749
Undeveloped	43.162
Water	0.951
Total	2024.384

January 4 – 7, 2016 Event Runoff Characteristics	
	Receiving Water 1
Flow Start Date/Time:	1/4/2016 22:15
Flow End Date/Time:	1/7/2016 09:15
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	59
Total Runoff Depth (inch):	0.47
Total Outflow (cf):	3,477,772
Average Runoff Rate (cfs):	16.37

Peak 15-min Runoff Rate (cfs):	193
Peak to Average Runoff Ratio:	12
Calculated Runoff Curve Number (CN):	48
Calculated Rational Equation C Coefficient:	0.12
Calculated Volumetric Runoff Coefficient (Rv)	0.10

* Flow calculated based on width estimation (using LiDAR data)

January 4 – 7, 2016 Receiving Water 2 Recorded Data



January 4 – 7, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/4/2016 22:15
Rain Event End Date/Time:	1/7/2016 07:00
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	26
Total Precipitation (inches):	4.65
Average Rain Intensity, actual precipitation time (in/hr):	0.18
Peak 15-min Rain Intensity (in/hr):	0.78

Landuse Category Receiving water 2	Area (ac)
Single Family Detached	791.308
Single Family Attached	68.213
Mobile Homes	14.119
Multiple Family	97.258
Military	3.778
Institutions	22.386
Commercial and Office	40.009
Light Industry	0.000
Transportation, Communications, Utilities	105.809
Road Rights of Way	390.875
Railroad Rights of Way	1.212
Education	80.803
Recreation	62.134
Open Space Parks	9.749
Undeveloped	42.628
Water	0.000
Total	1730.283

January 4 – 7, 2016 Event Runoff Characteristics	
	Receiving Water 2
Flow Start Date/Time:	1/4/2016 22:15
Flow End Date/Time:	1/7/2016 01:30
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	26
Total Runoff Depth (inch):	0.13
Total Outflow (cf):	794,524
Average Runoff Rate (cfs):	8.49
Peak 15-min Runoff Rate (cfs):	64
Peak to Average Runoff Ratio:	7.5
Calculated Runoff Curve Number (CN):	39
Calculated Rational Equation C Coefficient:	0.05
Calculated Volumetric Runoff Coefficient (Rv)	0.03*

* runoff volume much lower than expected

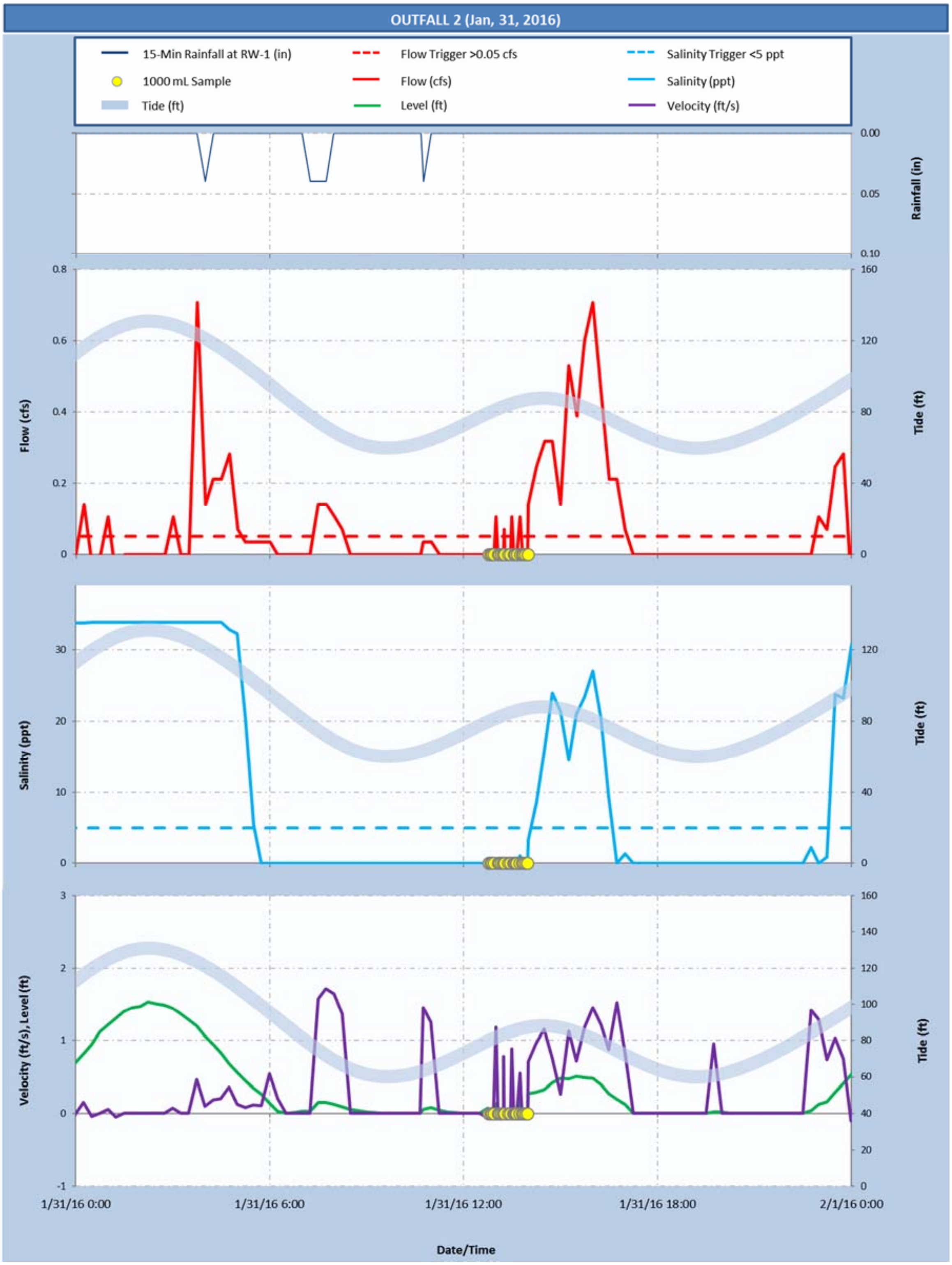
January 31, 2016 Outfall 1 (no water quality samples collected due to low flows at outfall)
Recorded Data

January 31, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/31/16 3:45
Rain Event End Date/Time:	1/31/16 10:45
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	7
Total Precipitation (inches):	0.20
Average Rain Intensity, actual precipitation time (in/hr):	0.028
Peak 15-min Rain Intensity (in/hr):	0.039

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O1W	1.349	0.275	1.853							3.477

January 31, 2016 Event Runoff Characteristics	
	Outfall 1
Flow Start Date/Time:	1/31/2016 04:00
Flow End Date/Time:	1/31/2016 11:15
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	7.25
Total Runoff Depth (inch):	0.093
Total Outflow (cf):	1,176
Average Runoff Rate (cfs):	0.045
Peak 15-min Runoff Rate (cfs):	0.25
Peak to Average Runoff Ratio:	5.5
Calculated Runoff Curve Number (CN):	99
Calculated Rational Equation C Coefficient:	1.8
Calculated Volumetric Runoff Coefficient (Rv)	0.46

January 31, 2016 Outfall 2 Recorded Data



January 31, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/31/16 3:45
Rain Event End Date/Time:	1/31/16 10:45
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	7
Total Precipitation (inches):	0.20
Average Rain Intensity, actual precipitation time (in/hr):	0.028
Peak 15-min Rain Intensity (in/hr):	0.039

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O2W	1.336		1.690		0.031		0.384			3.441

January 31, 2016 Event Runoff Characteristics	
	Outfall 2
Flow Start Date/Time:	1/30/2016 03:15
Flow End Date/Time:	2/1/2016 06:45
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	35.5
Total Runoff Depth (inch):	1.3
Total Outflow (cf):	16,209
Average Runoff Rate (cfs):	0.13
Peak 15-min Runoff Rate (cfs):	1.2
Peak to Average Runoff Ratio:	9.5
Calculated Runoff Curve Number (CN):	102
Calculated Rational Equation C Coefficient:	8.9
Calculated Volumetric Runoff Coefficient (Rv)	6.5

* more runoff than rainfall; due to measurement errors or baseflows

January 31, 2016 Outfall 3 (no water quality samples due to low flow) Recorded Data

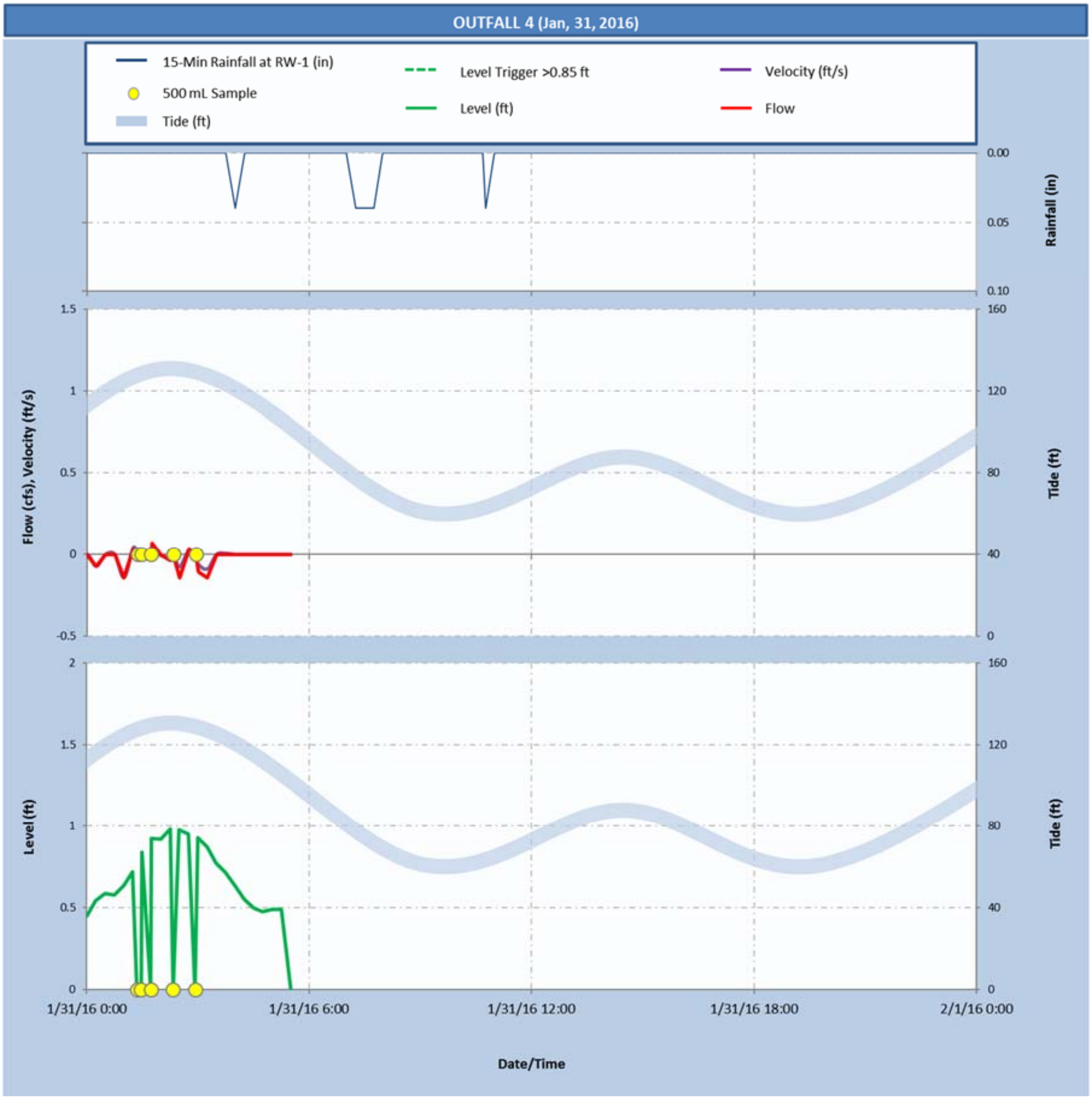
January 31, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/31/16 3:45
Rain Event End Date/Time:	1/31/16 10:45
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	7
Total Precipitation (inches):	0.20
Average Rain Intensity, actual precipitation time (in/hr):	0.028
Peak 15-min Rain Intensity (in/hr):	0.039

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O3W	6.384	3.788	11.675	1.241	3.789	5.834	3.481		0.051	36.24 3

January 4 – 7, 2016 Event Runoff Characteristics	
	Outfall 3
Flow Start Date/Time:	1/30/2016 00:45
Flow End Date/Time:	1/30/2016 15:30
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	14.75
Total Runoff Depth (inch):	1.14
Total Outflow (cf):	149,921
Average Runoff Rate (cfs):	2.82
Peak 15-min Runoff Rate (cfs):	13
Peak to Average Runoff Ratio:	4.5
Calculated Runoff Curve Number (CN):	102
Calculated Rational Equation C Coefficient:	8.9
Calculated Volumetric Runoff Coefficient (Rv)	5.7

* more runoff than rainfall recorded, due to measurement errors or baseflow

January 31, 2016 Outfall 4 Recorded Data

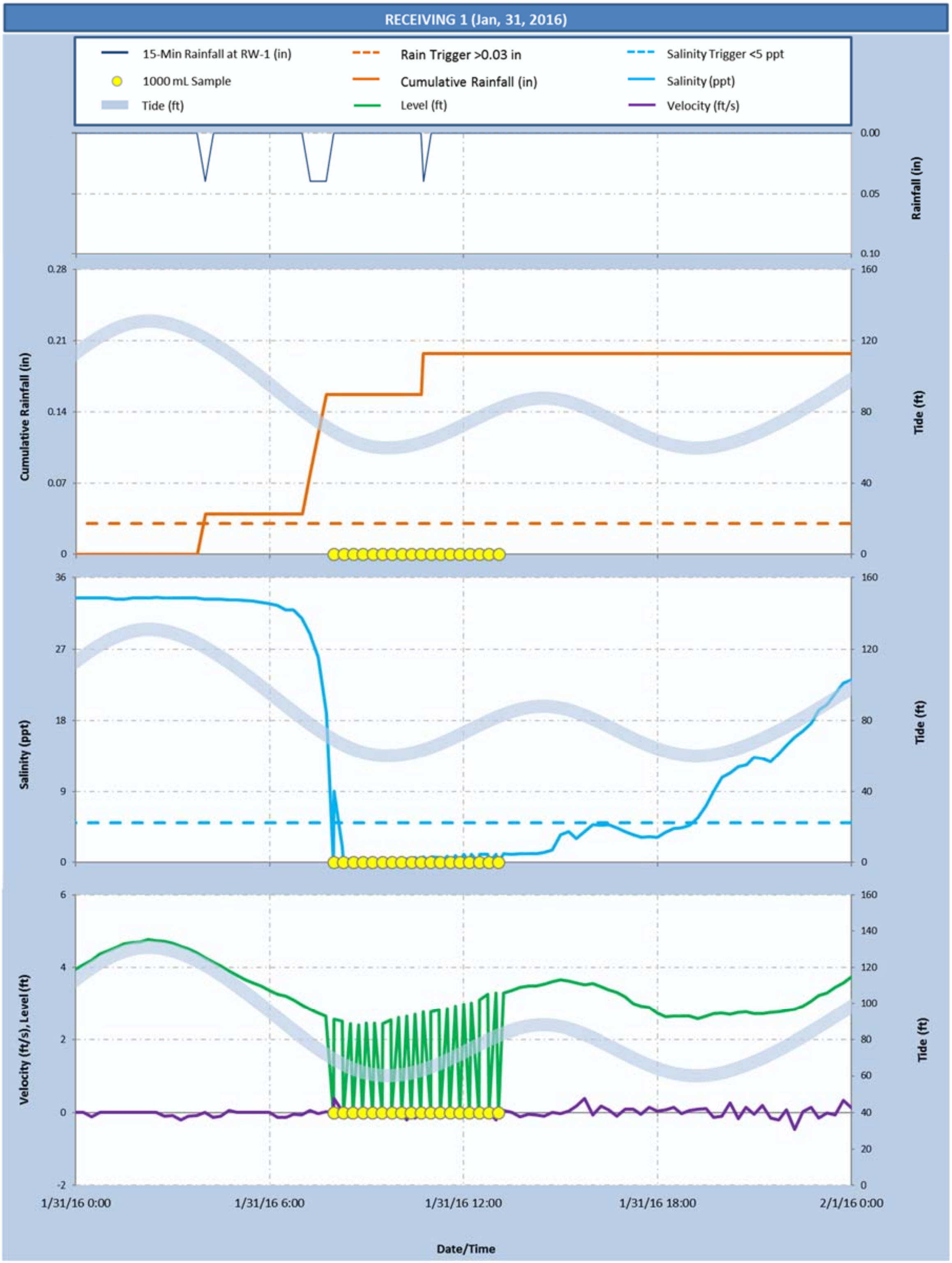


January 31, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/31/16 3:45
Rain Event End Date/Time:	1/31/16 10:45
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	7
Total Precipitation (inches):	0.20
Average Rain Intensity, actual precipitation time (in/hr):	0.028
Peak 15-min Rain Intensity (in/hr):	0.039

Outfall	Area (ac)									
	Roof	Street	Paved Parking	Sidewalk	Small Landscaped Area	Large Landscaped Area	Other Paved Area	Other Pervious Area	Water	Total
O4W	6.306	3.369	6.926	3.253	7.335		0.694	1.011	0.011	28.905

January 31, 2016 Event Runoff Characteristics	
	Outfall 4
Flow Start Date/Time:	1/30/2016 00:15
Flow End Date/Time:	1/31/2016 02:45
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	16.25
Total Runoff Depth (inch):	0.054
Total Outflow (cf):	5,880
Average Runoff Rate (cfs):	0.10
Peak 15-min Runoff Rate (cfs):	1.7
Peak to Average Runoff Ratio:	17
Calculated Runoff Curve Number (CN):	97
Calculated Rational Equation C Coefficient:	1.5
Calculated Volumetric Runoff Coefficient (Rv)	0.27

January 31, 2016 Receiving Water 1 Recorded Data



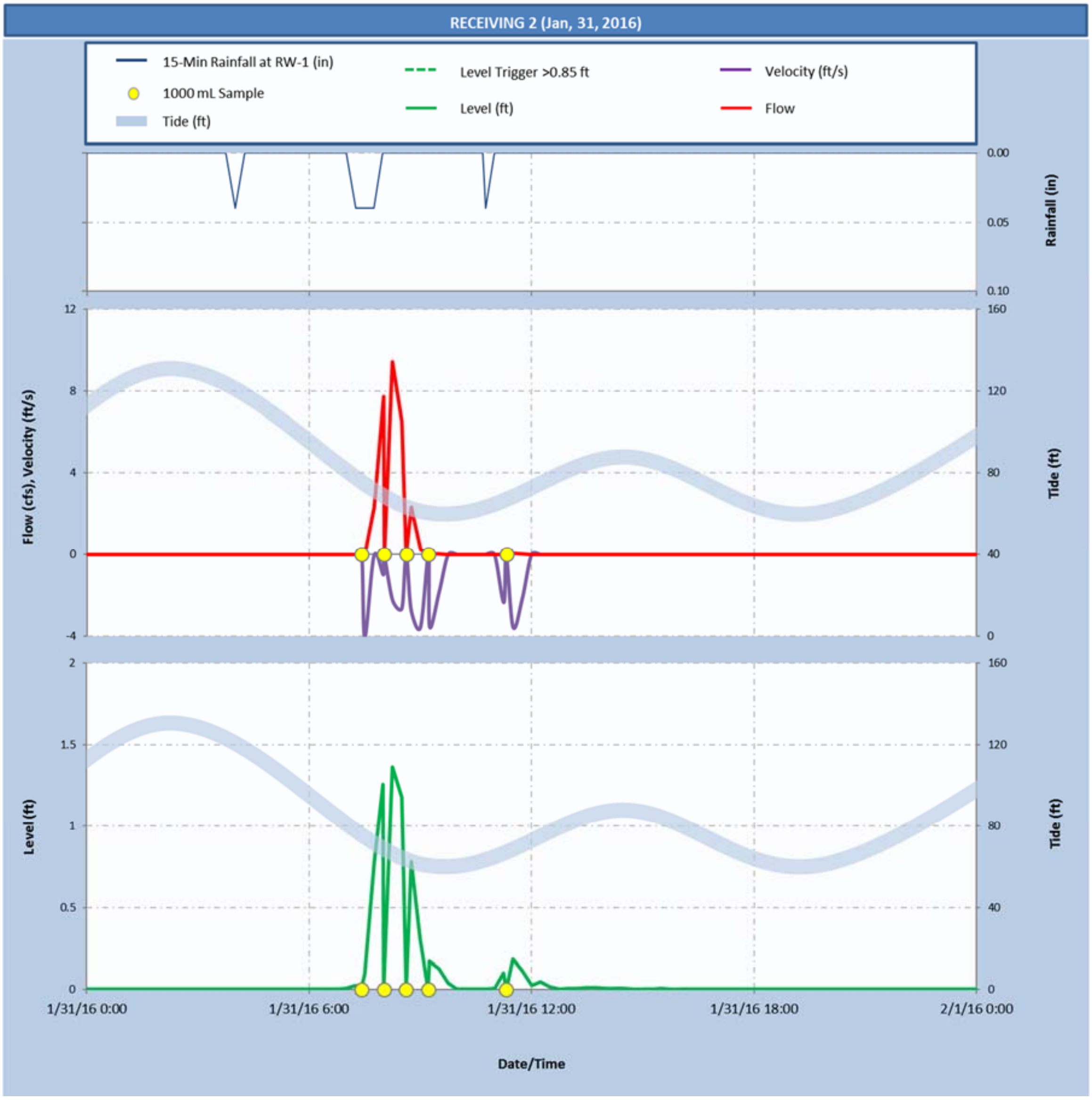
January 31, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/31/16 3:45
Rain Event End Date/Time:	1/31/16 10:45
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	7
Total Precipitation (inches):	0.20
Average Rain Intensity, actual precipitation time (in/hr):	0.028
Peak 15-min Rain Intensity (in/hr):	0.039

Landuse Category: Receiving water 1	Area (ac)
Single Family Detached	791.420
Single Family Attached	68.213
Mobile Homes	14.119
Multiple Family	97.258
Military	219.645
Institutions	22.386
Commercial and Office	41.310
Light Industry	11.099
Transportation, Communications, Utilities	130.888
Road Rights of Way	415.402
Railroad Rights of Way	15.846
Education	80.803
Recreation	62.134
Open Space Parks	9.749
Undeveloped	43.162
Water	0.951
Total	2024.384

January 31, 2016 Event Runoff Characteristics	
	Receiving Water 1
Flow Start Date/Time:	1/30/2016 08:00
Flow End Date/Time:	2/1/2016 08:45
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	48.75
Total Runoff Depth (inch):	0.58
Total Outflow (cf):	4,279,674
Average Runoff Rate (cfs):	24.4
Peak 15-min Runoff Rate (cfs):	151
Peak to Average Runoff Ratio:	6.2
Calculated Runoff Curve Number (CN):	101
Calculated Rational Equation C Coefficient:	1.9
Calculated Volumetric Runoff Coefficient (Rv)	2.9

* Flow calculated based on width estimation (using LiDAR data); much of the event was tidally influenced

January 31, 2016 Receiving Water 2 Recorded Data



January 31, 2016 Event Rain Characteristics	
Rain Event Start Date/Time:	1/31/16 3:45
Rain Event End Date/Time:	1/31/16 10:45
Rain Duration, actual precipitation time, with <6 hrs between recorded rain (hours):	7
Total Precipitation (inches):	0.20
Average Rain Intensity, actual precipitation time (in/hr):	0.028
Peak 15-min Rain Intensity (in/hr):	0.039

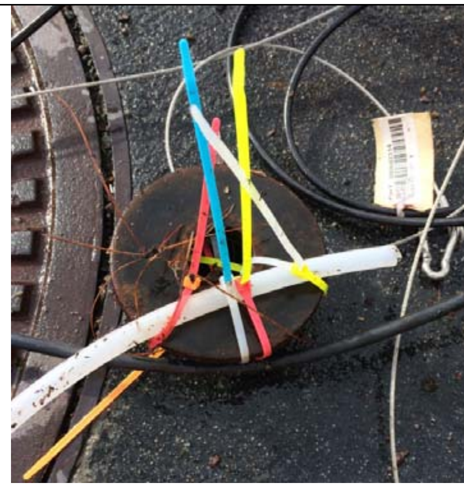
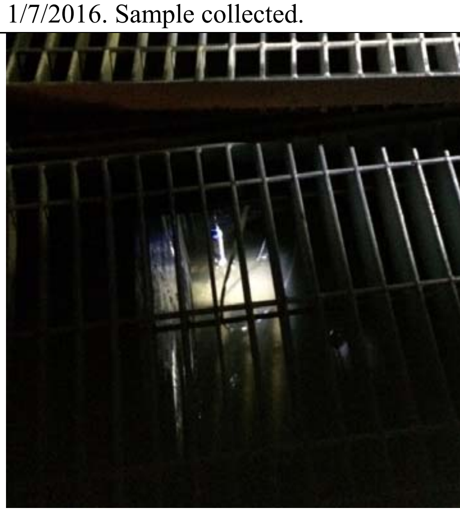
Landuse Category Receiving water 2	Area (ac)
Single Family Detached	791.308
Single Family Attached	68.213
Mobile Homes	14.119
Multiple Family	97.258
Military	3.778
Institutions	22.386
Commercial and Office	40.009
Light Industry	0.000
Transportation, Communications, Utilities	105.809
Road Rights of Way	390.875
Railroad Rights of Way	1.212
Education	80.803
Recreation	62.134
Open Space Parks	9.749
Undeveloped	42.628
Water	0.000
Total	1730.283

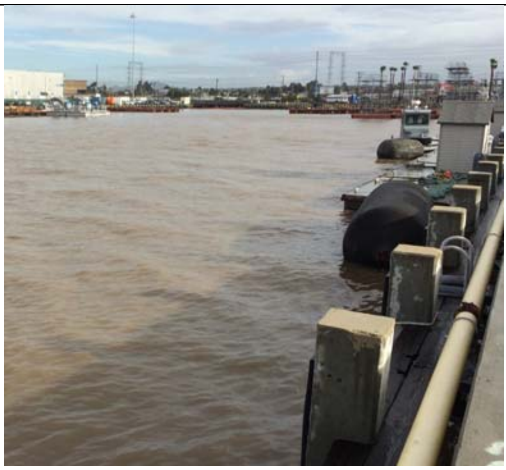
January 31, 2016 Event Runoff Characteristics	
	Receiving Water 2
Flow Start Date/Time:	1/30/2016 12:00
Flow End Date/Time:	1/31/2016 11:45
Flow Duration, actual runoff period with <6 hrs of no flow between recorded runoff (hours):	5
Total Runoff Depth (inch):	0.004
Total Outflow (cf):	8,486
Average Runoff Rate (cfs):	1.4
Peak 15-min Runoff Rate (cfs):	9.4
Peak to Average Runoff Ratio:	6.5
Calculated Runoff Curve Number (CN):	93
Calculated Rational Equation C Coefficient:	0.14
Calculated Volumetric Runoff Coefficient (Rv)	0.04

Appendix E: Photos from Sampling Events

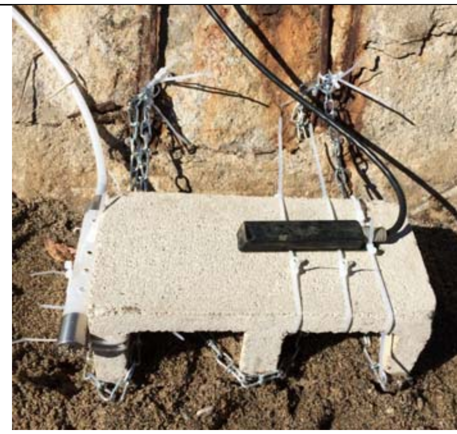
Event #1

C2W	 1/5/2016. Installed configuration – bracket missing.	 1/6/2016. Locations of inlet strainer and flow meter after first rain.
C2W	 1/7/2016. Flow level/equipment location.	 1/7/2016. Sample collected.
C1W	 1/5/2016. Rain gauge and ISCO locations.	 1/5/2016. Rain gauge.

O4W	 1/6/2016. Sample collected.	
O3W	 1/7/2016. Sample collected.	 1/7/2016. Weight used for sample intake.
O2W	 1/4/2016. Salinity probe secured to grate.	 1/5/2016. Equipment setup facing north.

O2W	 1/7/2016. Bay adjacent to outfall.	 1/7/2016. Monitoring location facing south.
O1W	 1/5/2016. Equipment Setup.	 1/5/2016. Water bottle weight for inlet tube.
O1W	 1/7/2016. Sample collected.	

Event #2

C2W	 1/28/2016. Revised installation location.	 1/28/2016. Revised installation, close up.
C2W	 1/28/2016. Significant sediment accumulation.	 1/29/2016. ISCO location/dual bottle configuration.
C2W	 2/1/2016. Accumulated debris/litter.	

C1W	 1/29/2016. Floating inlet configuration.	 1/29/2016. Inlet deployed.
C1W	 2/1/2016. Sample collected.	
C1W	 1/29/2016. ISCO dual bottle configuration.	 1/29/2016. Inside the dual bottle configuration (in blue HDPE container).

O4W	 2/1/2016. Sample collected.	
O2W	 2/1/2016. Sample collected.	

Appendix F: Total, Filtered, and Particulate Strength Concentration Relationships

Contents

Pearson Correlations for Constituents

Correlation: Cu, total (u, Cu, filt (ug, Ni, total (u, Ni, filt (ug, ...

	Cu, total (ug/L)	Cu, filt (ug/L)	Ni, total (ug/L)
Cu, filt (ug/L)	0.478		
	0.072		
Ni, filt (ug/L)	0.134	0.847	0.605
	0.633	0.000	0.017

	Ni, filt (ug/L)	Zn, total (ug/L)	Zn, filt (ug/L)
Zn, filt (ug/L)	-0.370	0.355	
	0.174	0.194	

	Cd, total (ug/L)	Cd, filt (ug/L)	Pb, total (ug/L)
Cd, filt (ug/L)	0.849		
	0.000		
Pb, filt (ug/L)	0.388	0.397	0.390
	0.153	0.143	0.151

	Pb, filt (ug/L)	Hg, total (ng/L)
Hg, filt (ng/L)	0.356	0.937
	0.193	0.000

Cell Contents: Pearson correlation
P-Value

Correlation: As, total (ug/L), As, filt (ug/L)

Pearson correlation of As, total (ug/L) and As, filt (ug/L) = 0.089
P-Value = 0.819

Correlation: Naphthalene,, Naphthalene,, Fluorene, to, Fluorene, fi, ...

	Naphthalene, tot	Naphthalene, fil	Fluorene, total
Naphthalene, fil	0.714		
	0.003		
Fluorene, filt (	0.352	0.208	-0.114
	0.198	0.456	0.685

	Fluorene, filt (	Acenaphthene, to	Acenaphthene, fi

Acenaphthene, fi	-0.024	0.155	
	0.933	0.581	

	Phenanthrene, to	Phenanthrene, fi	Anthracene, tota
Phenanthrene, fi	-0.269		
	0.333		
Anthracene, filt	-0.101	0.664	0.186
	0.721	0.007	0.507

	Anthracene, filt	Fluoranthene, to	Fluoranthene, fi
Fluoranthene, fi	0.841	0.659	
	0.000	0.008	

	Pyrene, total (n	Pyrene, filt (ng	Chrysene, total
Pyrene, filt (ng	0.689		
	0.005		
Chrysene, filt (	0.713	0.987	0.567
	0.003	0.000	0.027

	Chrysene, filt (	Benzo[a]anthrace	Benzo[a]anthrace
Benzo[a]anthrace	0.998	0.605	
	0.000	0.017	

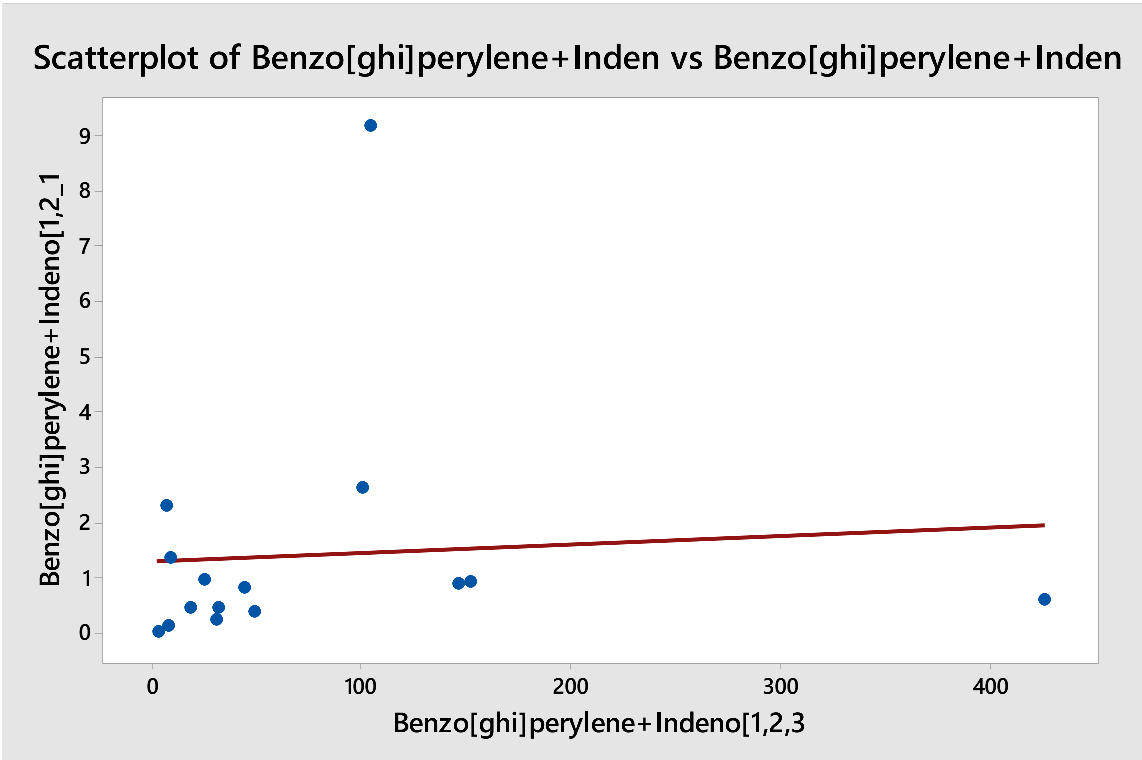
	Benzo[b]fluorant	Benzo[b]fluorant	Benzo[k]fluorant
Benzo[b]fluorant	0.510		
	0.052		
Benzo[k]fluorant	0.506	1.000	0.629
	0.054	0.000	0.012

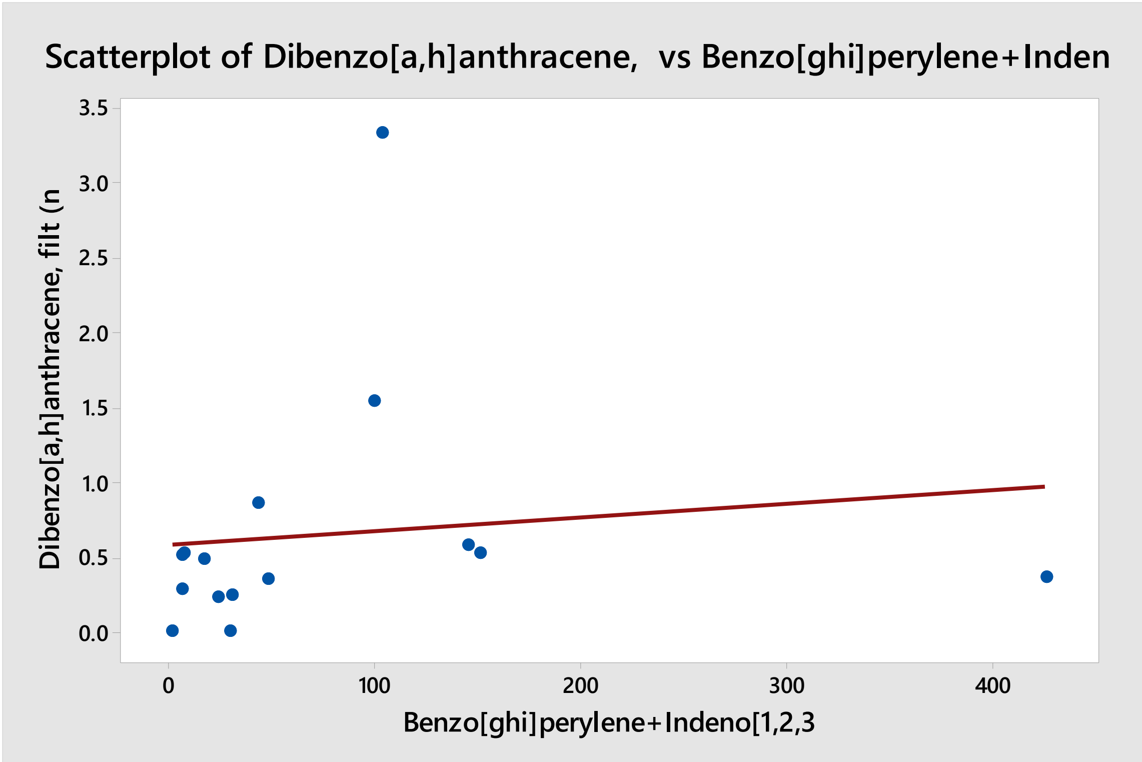
	Benzo[k]fluorant	Benzo[a]pyrene,	Benzo[a]pyrene,
Benzo[a]pyrene,	0.996	0.393	
	0.000	0.147	

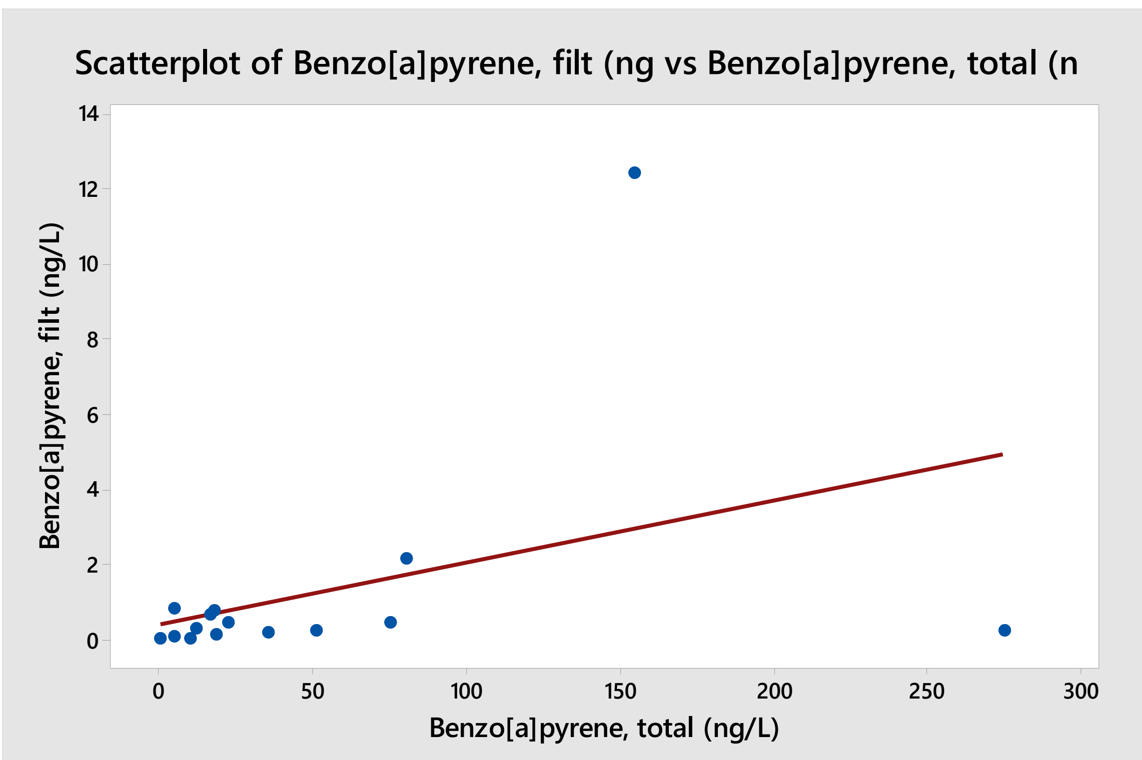
	Dibenzo[a,h]anth	Dibenzo[a,h]anth	Benzo[ghi]peryle
Dibenzo[a,h]anth	0.482		
	0.069		
Benzo[ghi]peryle	0.507	0.957	0.070
	0.053	0.000	0.803

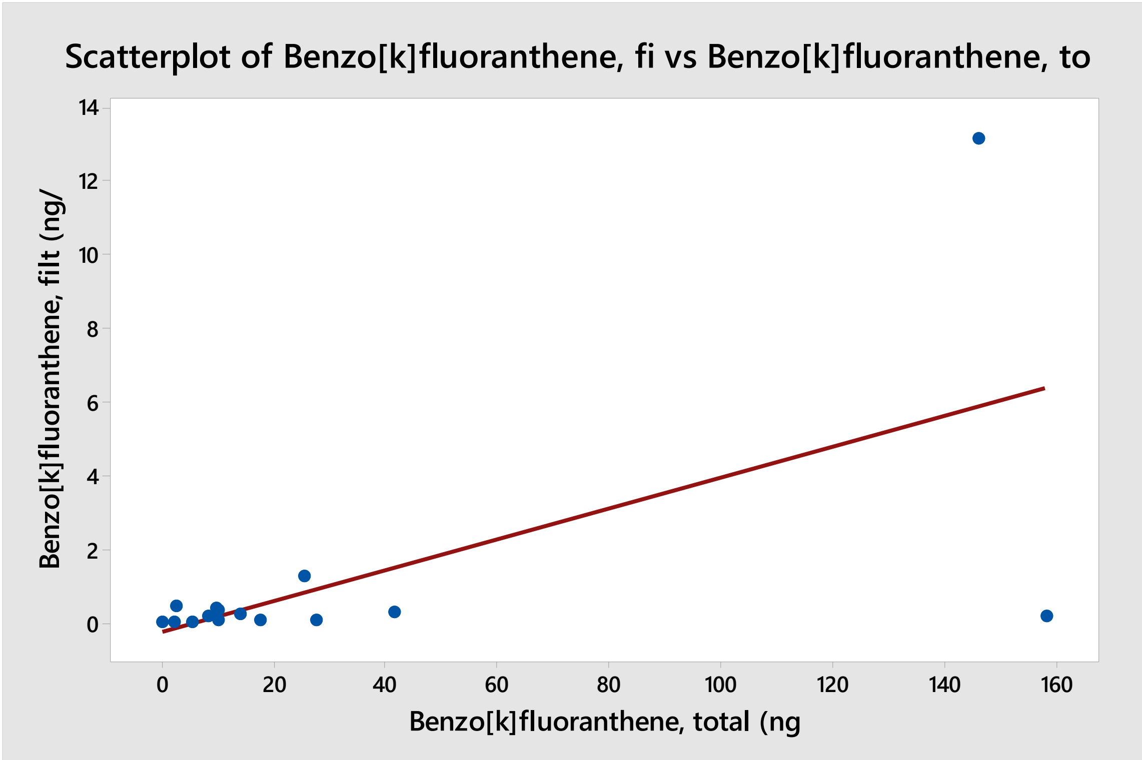
Cell Contents: Pearson correlation
P-Value

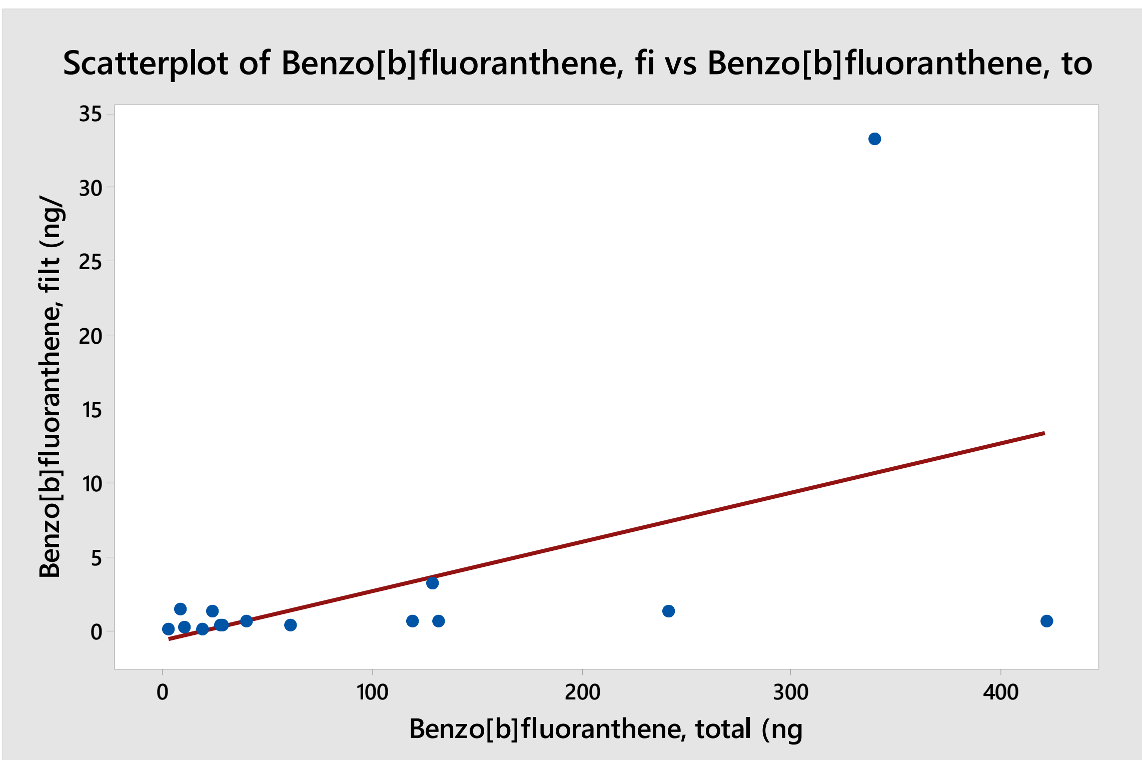
Scatterplots of Total vs. Filtered Constituents

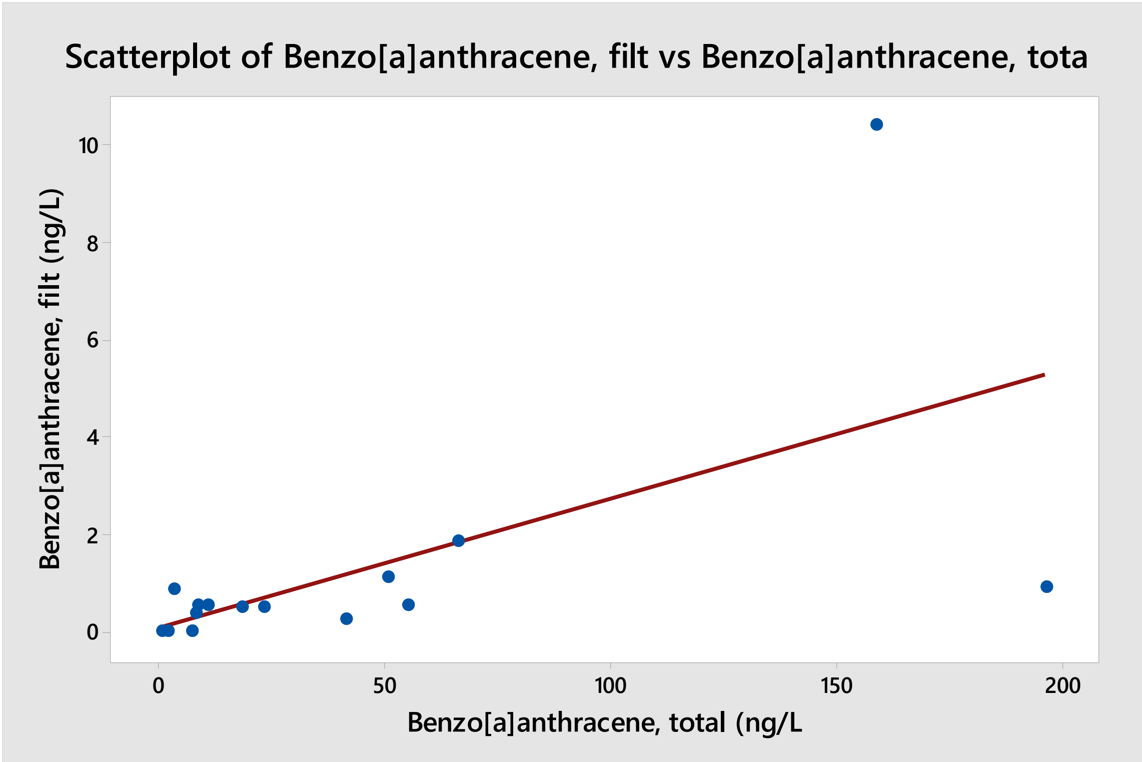


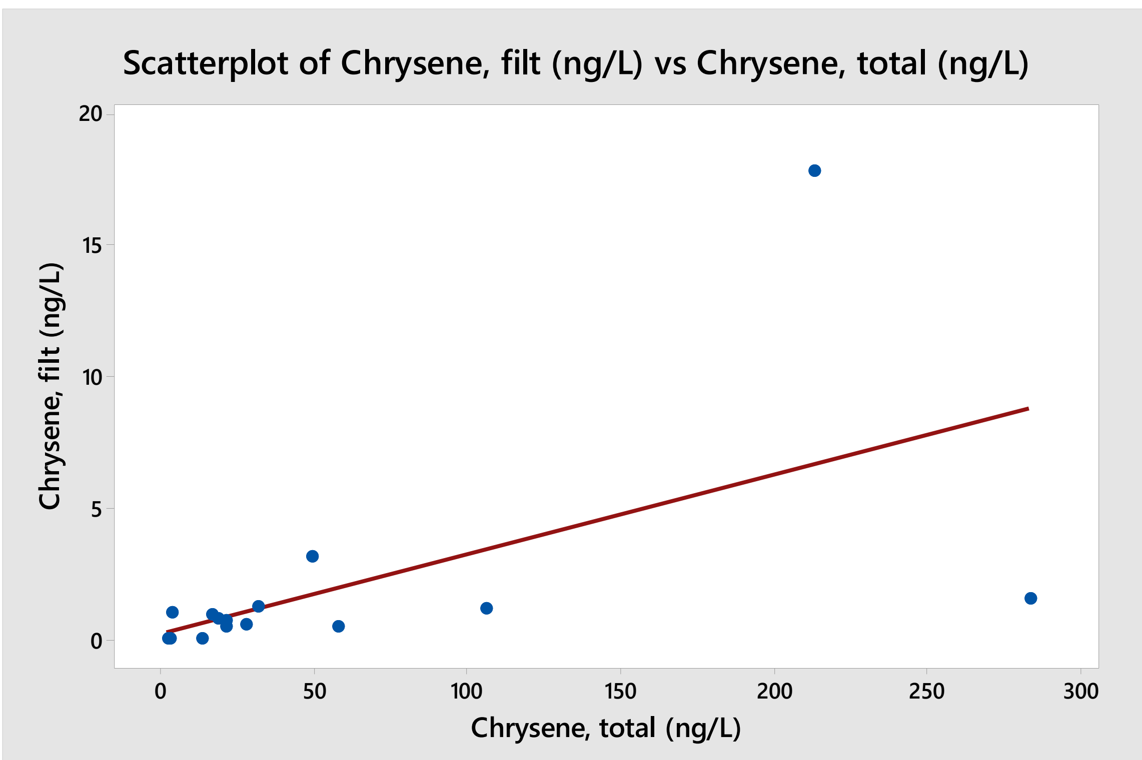

Scatterplot of Dibenzo[a,h]anthracene, vs Benzo[ghi]perylene+Inden
Dibenzo[a,h]anthracene, filt (n
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
100
200
300
400
Benzo[ghi]perylene+Indeno[1,2,3

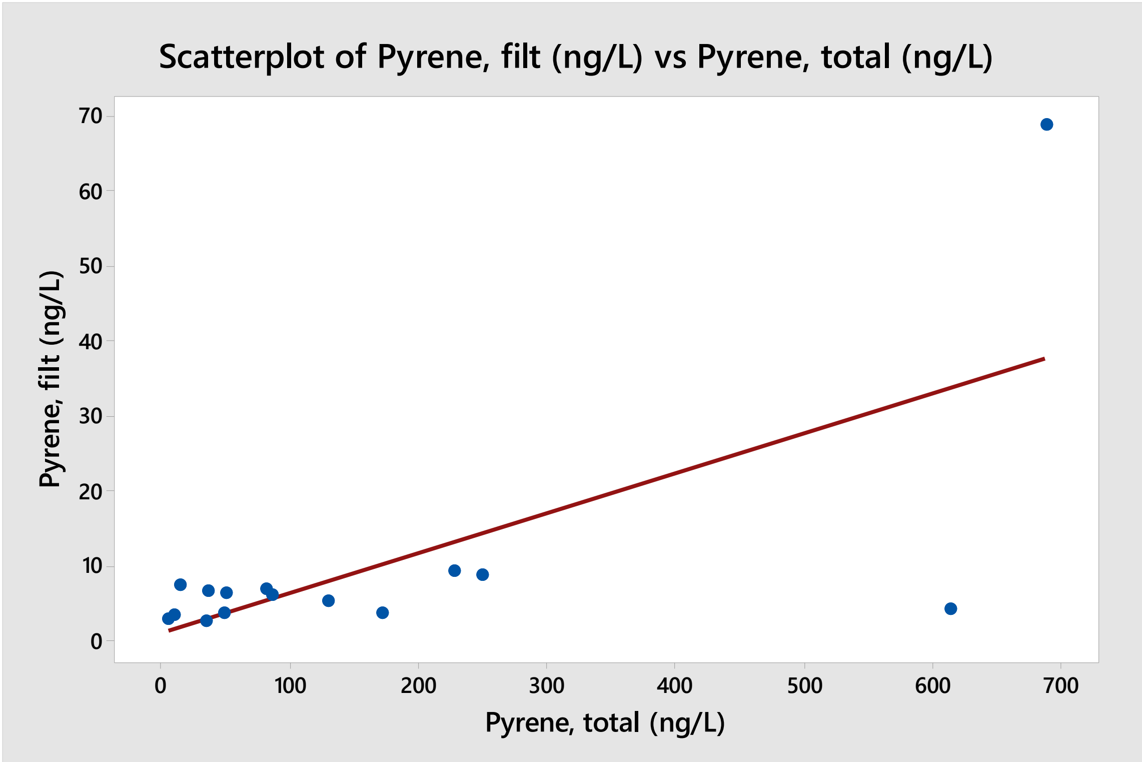

Scatterplot of Benzo[a]pyrene, filt (ng vs Benzo[a]pyrene, total (n
Benzo[a]pyrene, filt (ng/L)
14
12
10
8
6
4
2
0
0
50
100
150
200
250
300
Benzo[a]pyrene, total (ng/L)


Scatterplot of Benzo[k]fluoranthene, fi vs Benzo[k]fluoranthene, to
Benzo[k]fluoranthene, filt (ng/
Benzo[k]fluoranthene, total (ng
0
2
4
6
8
10
12
14
20
40
60
80
100
120
140
160

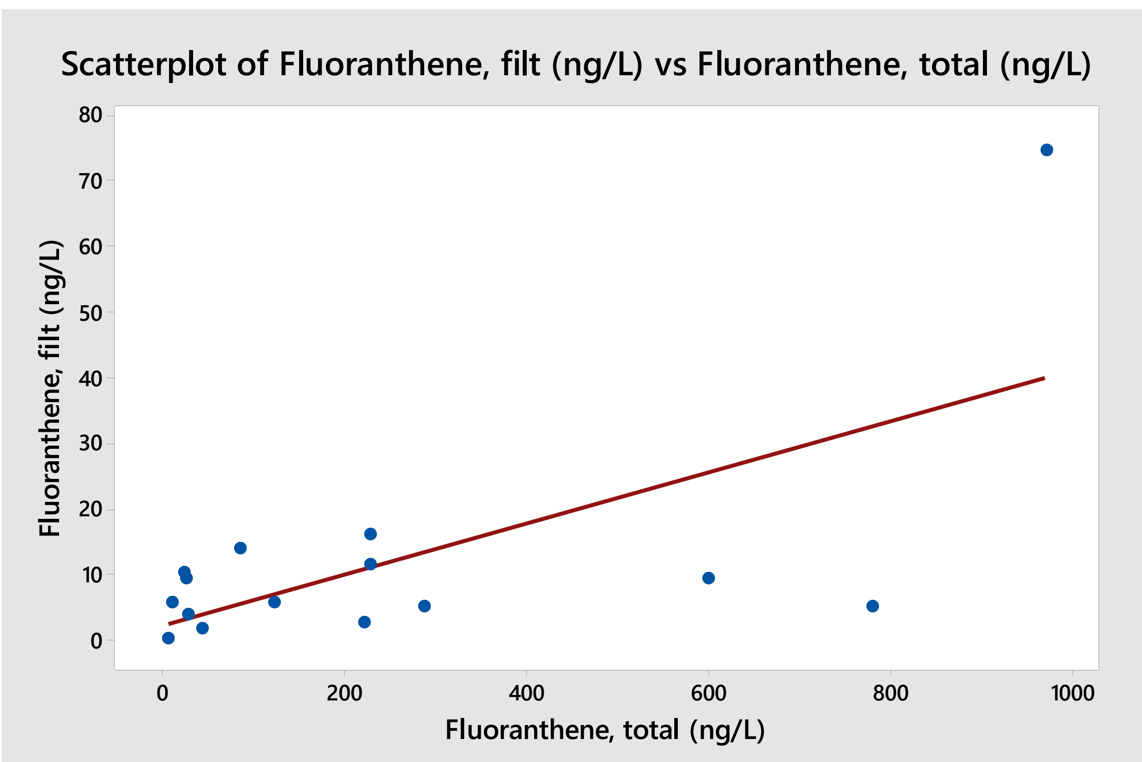

Scatterplot of Benzo[b]fluoranthene, fi vs Benzo[b]fluoranthene, to
Benzo[b]fluoranthene, filt (ng/
Benzo[b]fluoranthene, total (ng
0
5
10
15
20
25
30
35
100
200
300
400


Scatterplot of Benzo[a]anthracene, filt vs Benzo[a]anthracene, tota
Benzo[a]anthracene, filt (ng/L)
Benzo[a]anthracene, total (ng/L
0
2
4
6
8
10
0
50
100
150
200

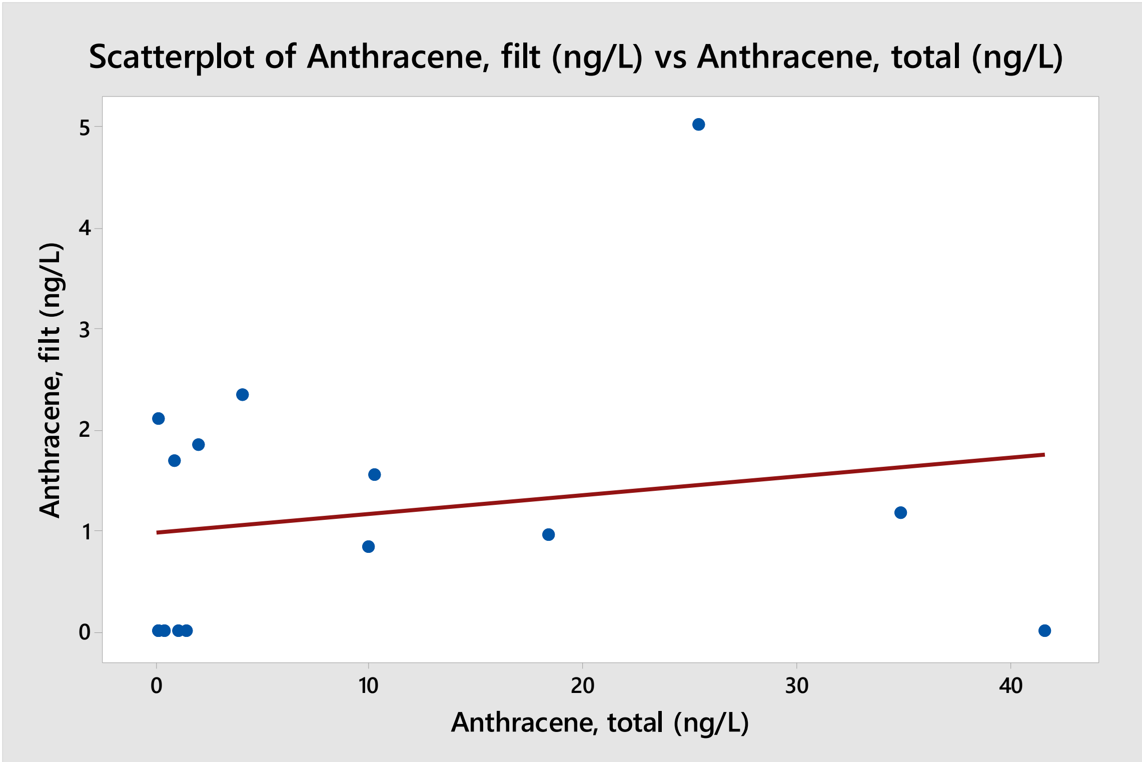

Scatterplot of Chrysene, filt (ng/L) vs Chrysene, total (ng/L)
Chrysene, filt (ng/L)
Chrysene, total (ng/L)
0
5
10
15
20
0
50
100
150
200
250
300

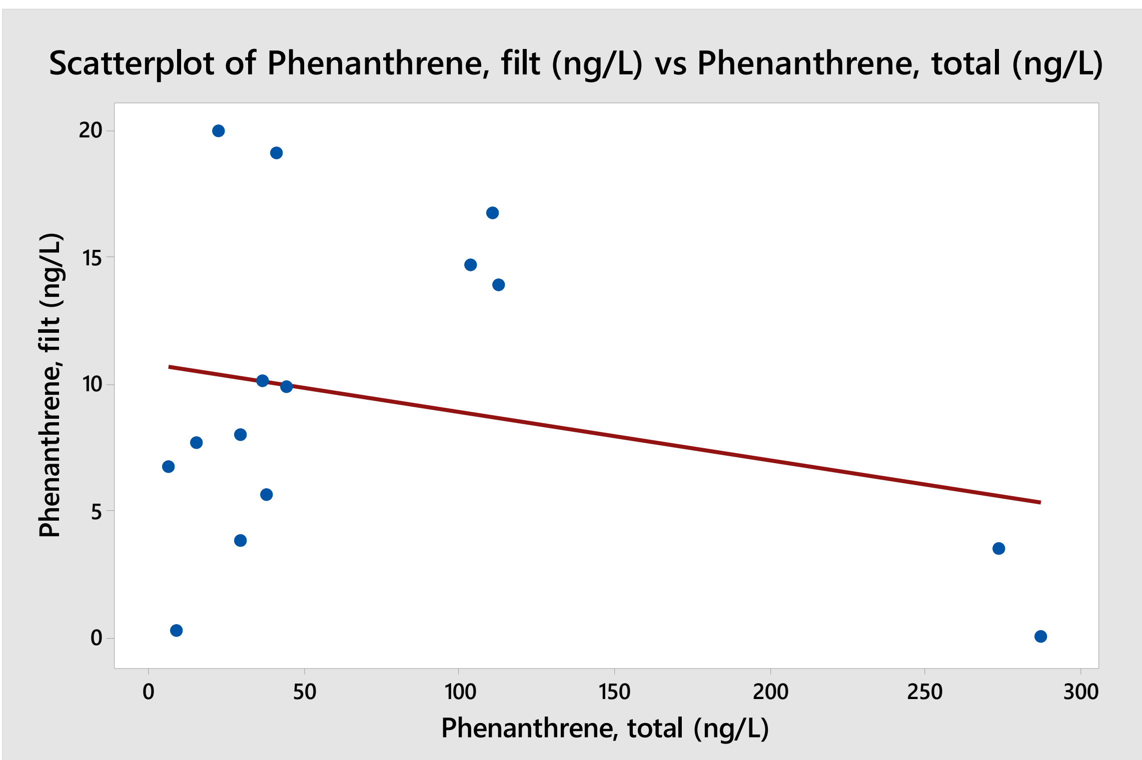


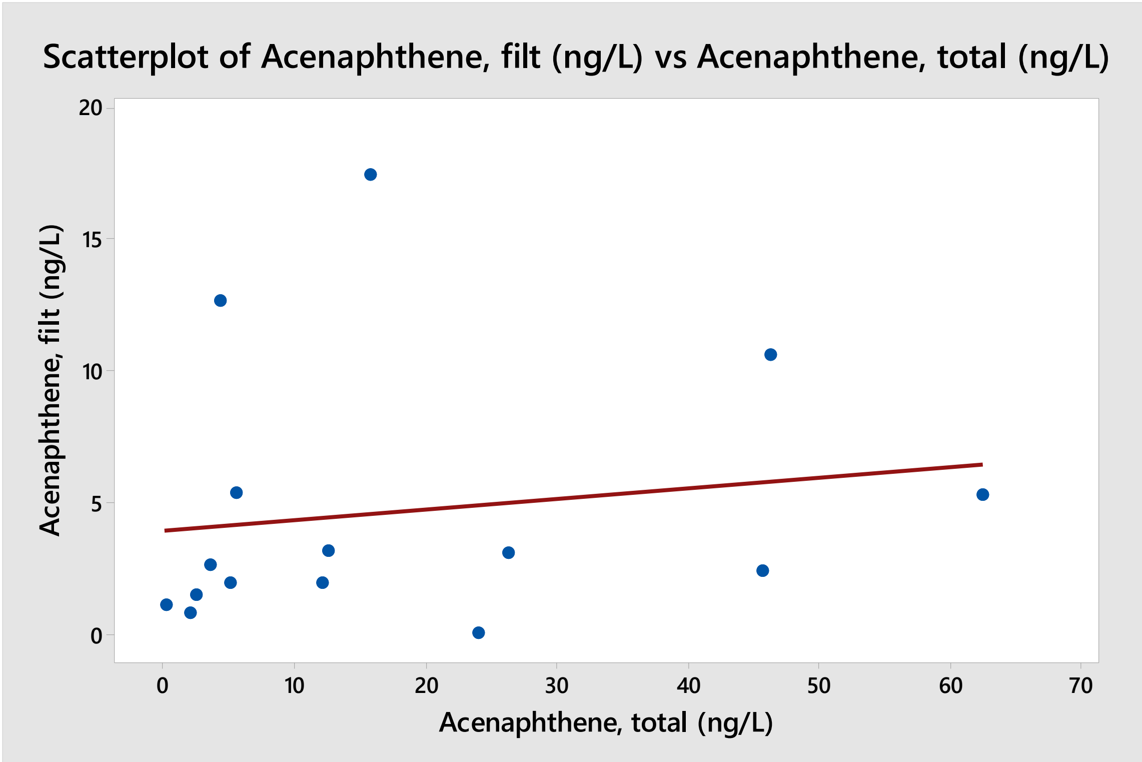
Scatterplot of Pyrene, filt (ng/L) vs Pyrene, total (ng/L)
Pyrene, filt (ng/L)
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)



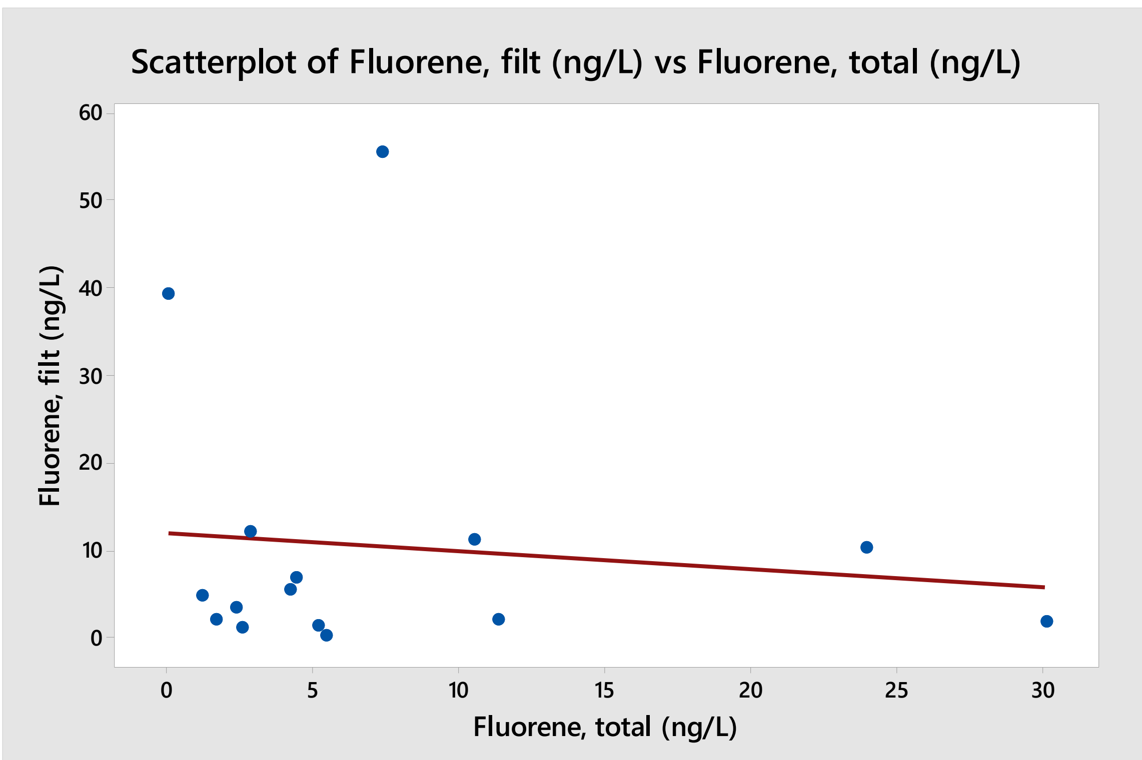
Scatterplot of Fluoranthene, filt (ng/L) vs Fluoranthene, total (ng/L)
Fluoranthene, filt (ng/L)
80
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)


Scatterplot of Anthracene, filt (ng/L) vs Anthracene, total (ng/L)
Anthracene, filt (ng/L)
0
1
2
3
4
5
0
10
20
30
40
Anthracene, total (ng/L)

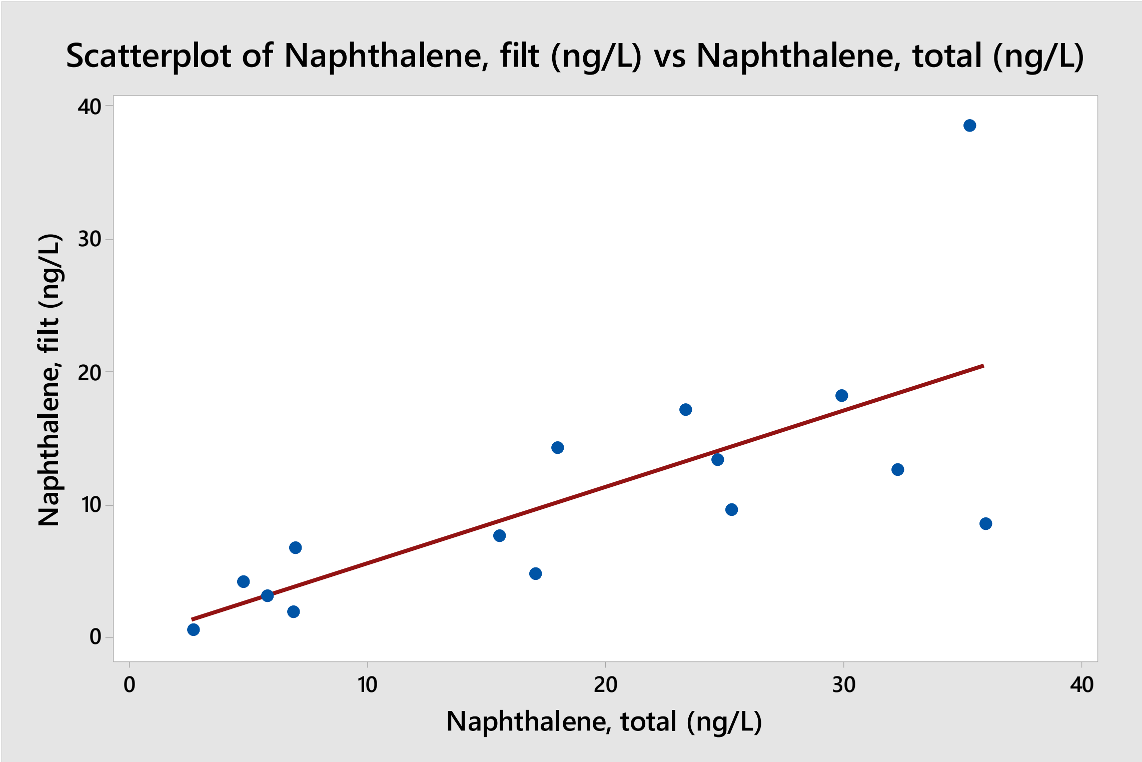

Scatterplot of Phenanthrene, filt (ng/L) vs Phenanthrene, total (ng/L)
Phenanthrene, filt (ng/L)
0
5
10
15
20
0
50
100
150
200
250
300
Phenanthrene, total (ng/L)

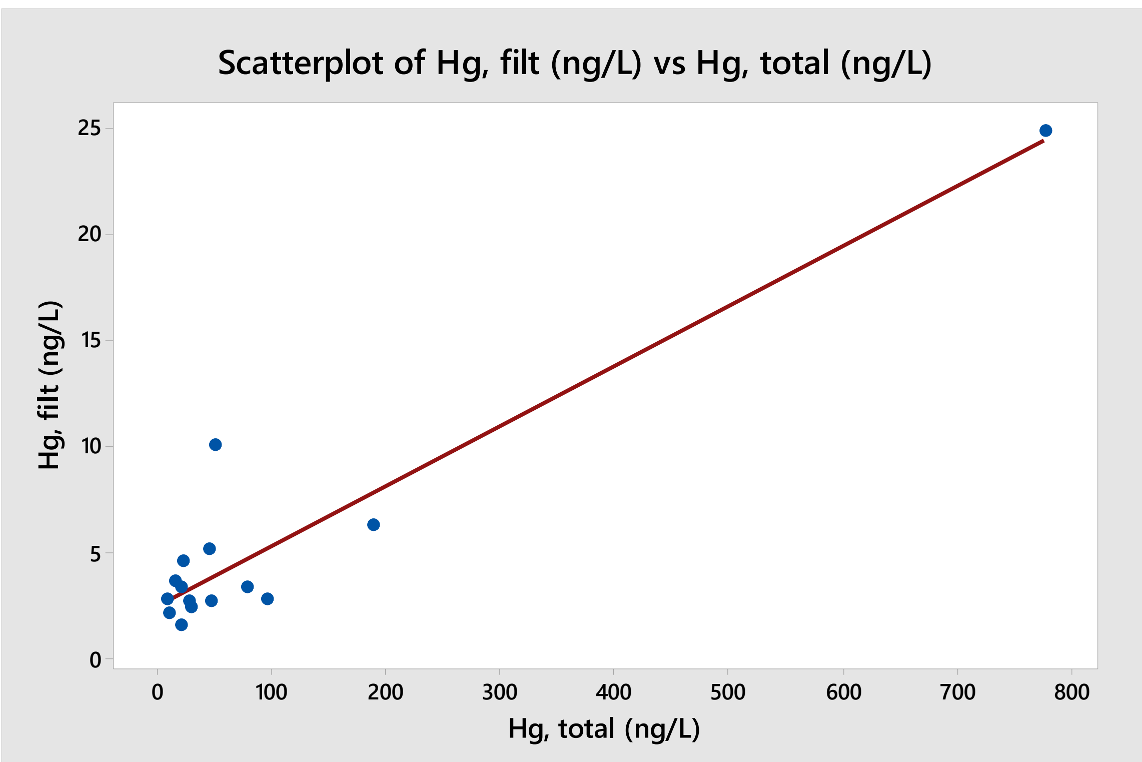


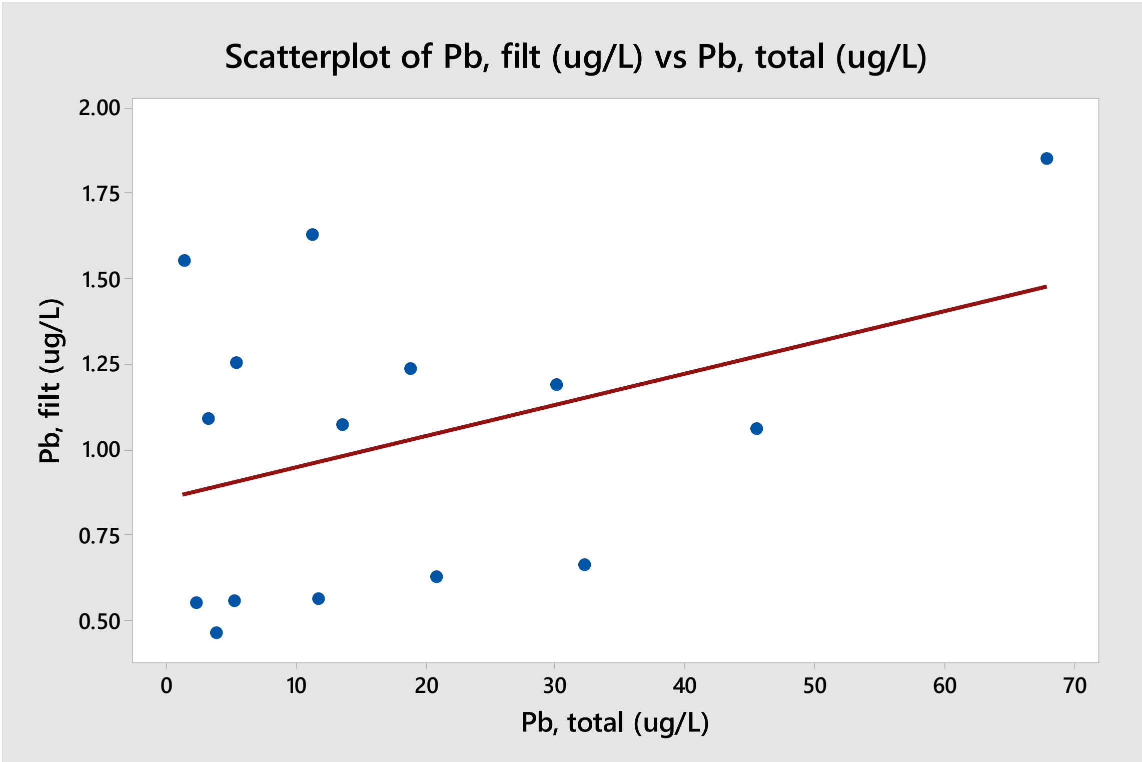
Scatterplot of Acenaphthene, filt (ng/L) vs Acenaphthene, total (ng/L)
Acenaphthene, filt (ng/L)
0
5
10
15
20
0
10
20
30
40
50
60
70
Acenaphthene, total (ng/L)

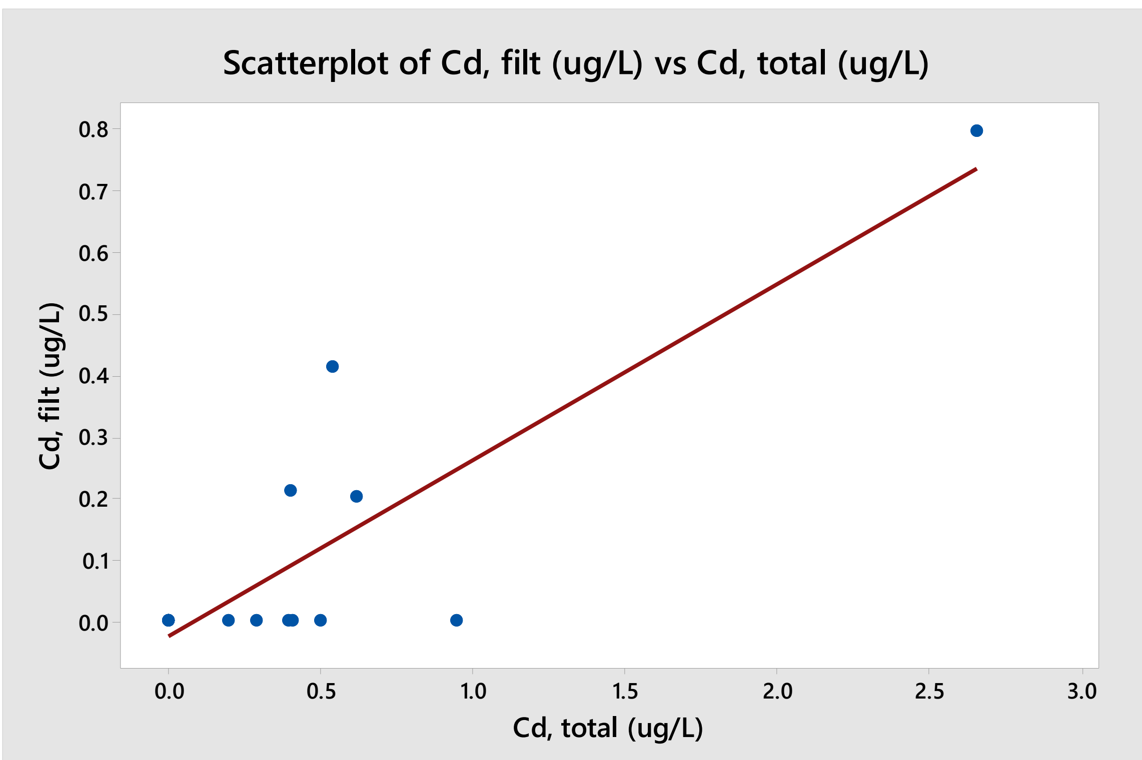


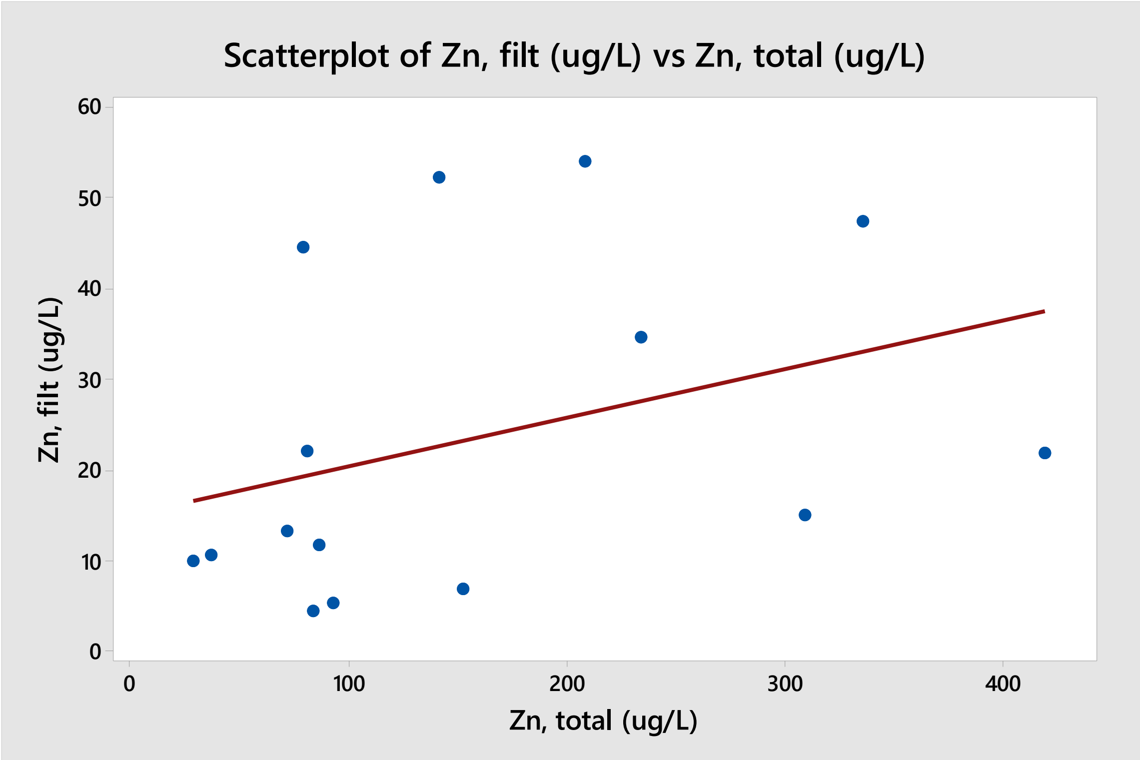
Scatterplot of Fluorene, filt (ng/L) vs Fluorene, total (ng/L)
Fluorene, filt (ng/L)
0
10
20
30
40
50
60
0
5
10
15
20
25
30
Fluorene, total (ng/L)

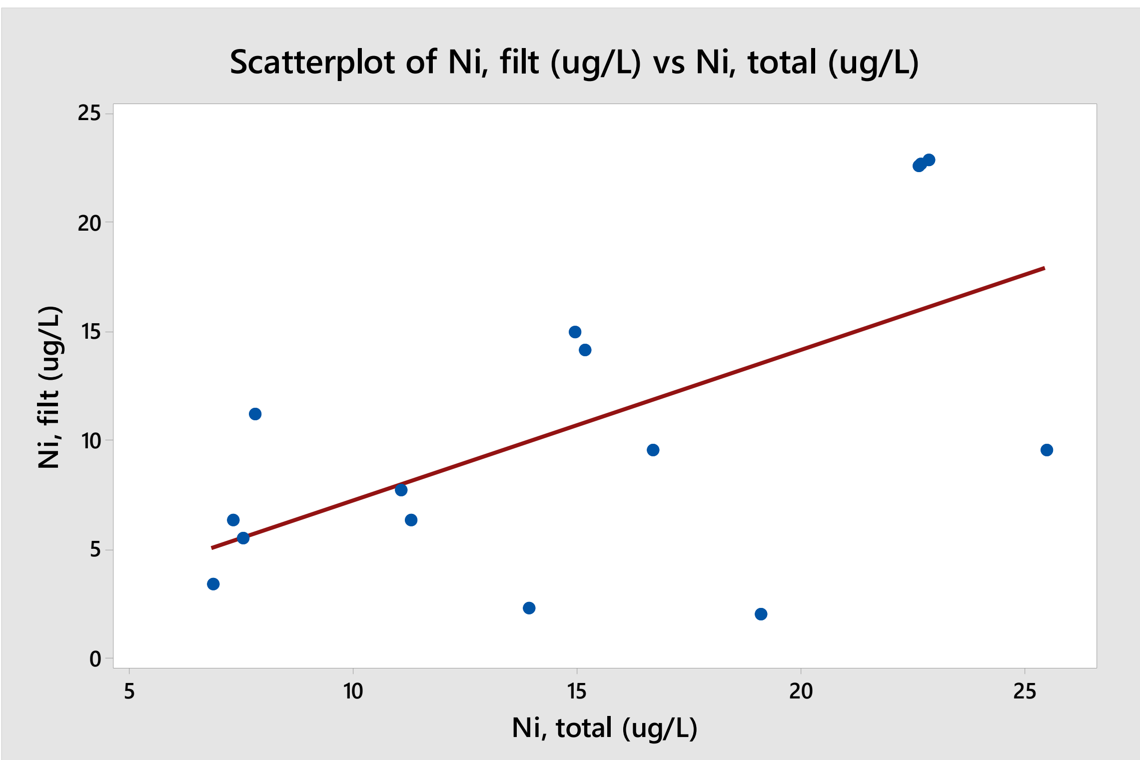

Scatterplot of Naphthalene, filt (ng/L) vs Naphthalene, total (ng/L)
Naphthalene, filt (ng/L)
0
10
20
30
40
0
10
20
30
40
Naphthalene, total (ng/L)

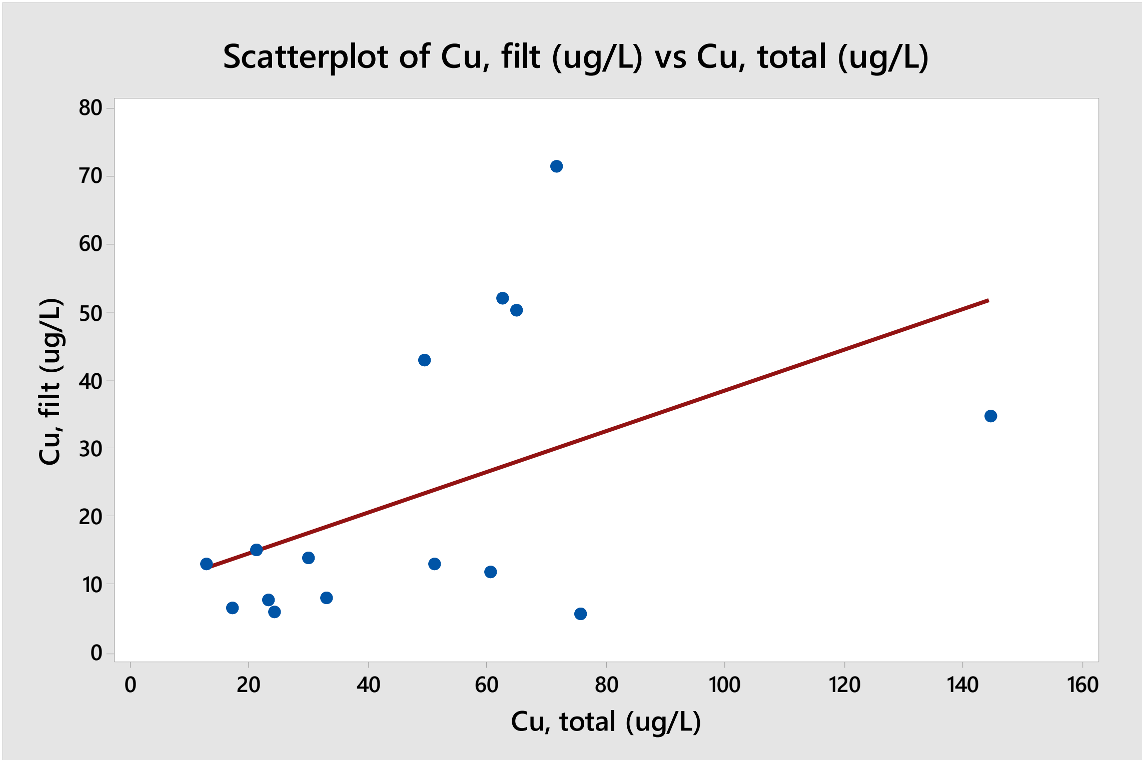

Scatterplot of Hg, filt (ng/L) vs Hg, total (ng/L)
Hg, filt (ng/L)
0
5
10
15
20
25
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)

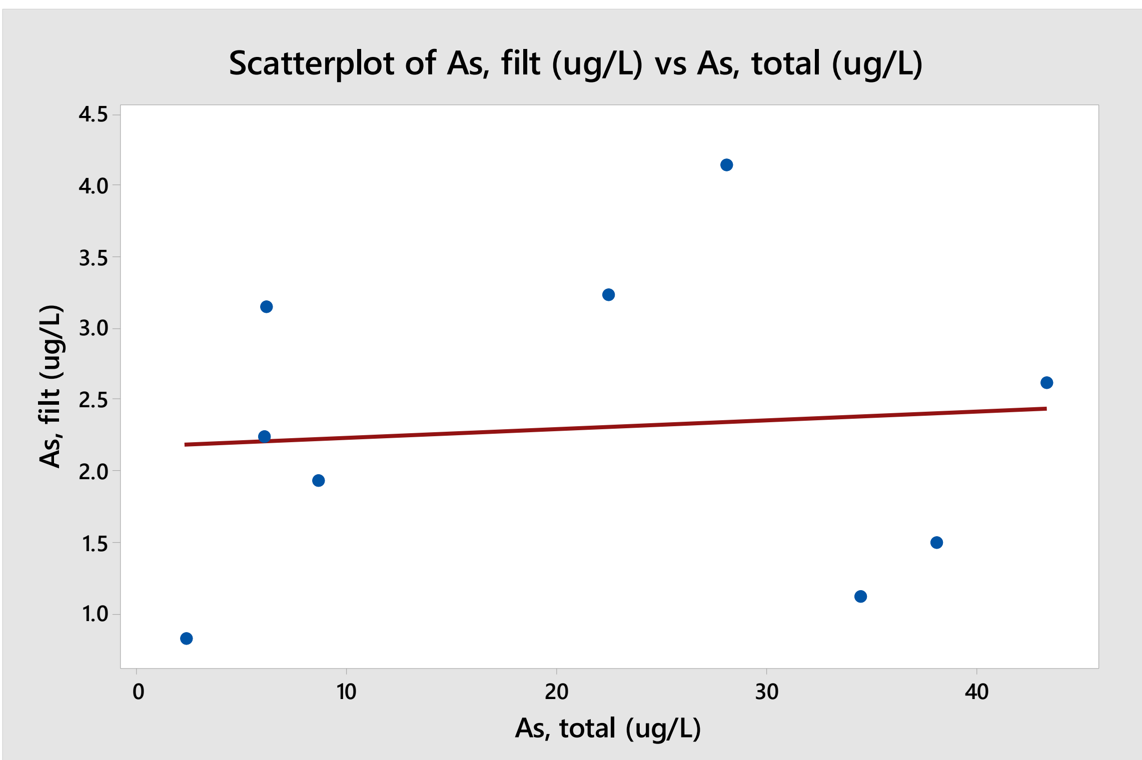

Scatterplot of Pb, filt (ug/L) vs Pb, total (ug/L)
Pb, filt (ug/L)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0
10
20
30
40
50
60
70
Pb, total (ug/L)


Scatterplot of Cd, filt (ug/L) vs Cd, total (ug/L)
Cd, filt (ug/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)


Scatterplot of Zn, filt (ug/L) vs Zn, total (ug/L)
Zn, filt (ug/L)
0
10
20
30
40
50
60
0
100
200
300
400
Zn, total (ug/L)


Scatterplot of Ni, filt (ug/L) vs Ni, total (ug/L)
Ni, filt (ug/L)
0
5
10
15
20
25
5
10
15
20
25
Ni, total (ug/L)


Scatterplot of Cu, filt (ug/L) vs Cu, total (ug/L)
Cu, filt (ug/L)
0
10
20
30
40
50
60
70
80
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)


Scatterplot of As, filt (ug/L) vs As, total (ug/L)
As, filt (ug/L)
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
0
10
20
30
40
As, total (ug/L)

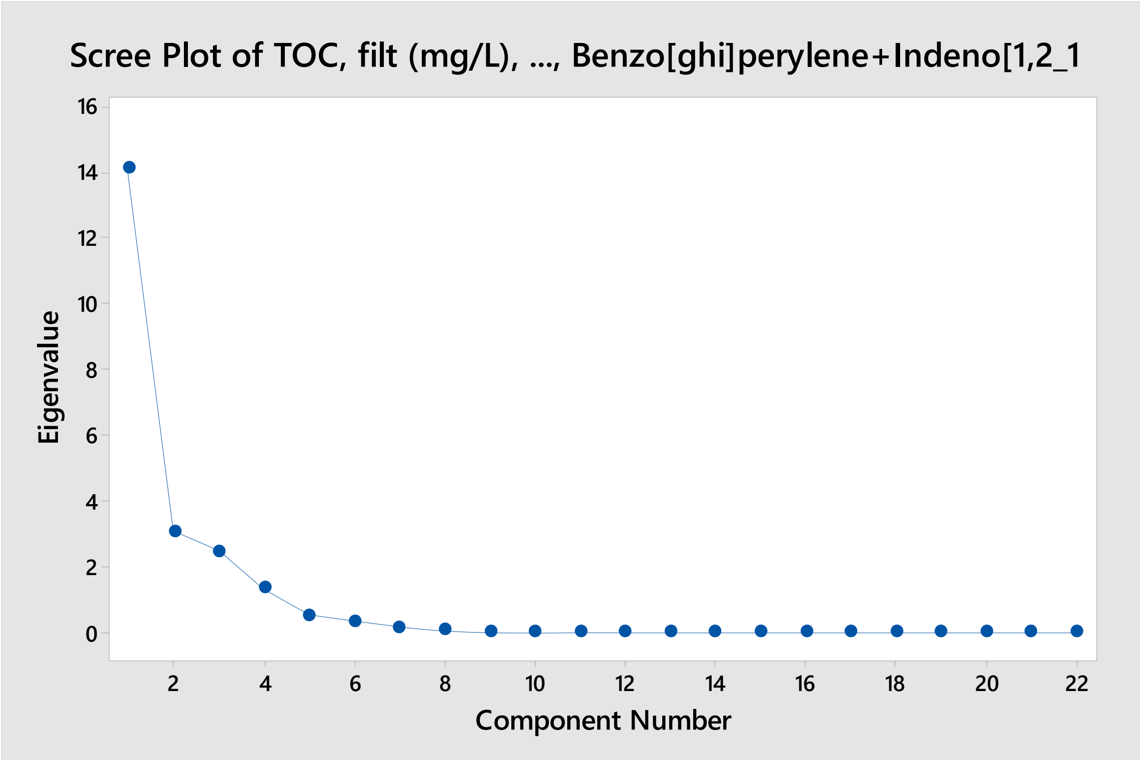
Principal Component Analyses for Significant Constituents Groupings

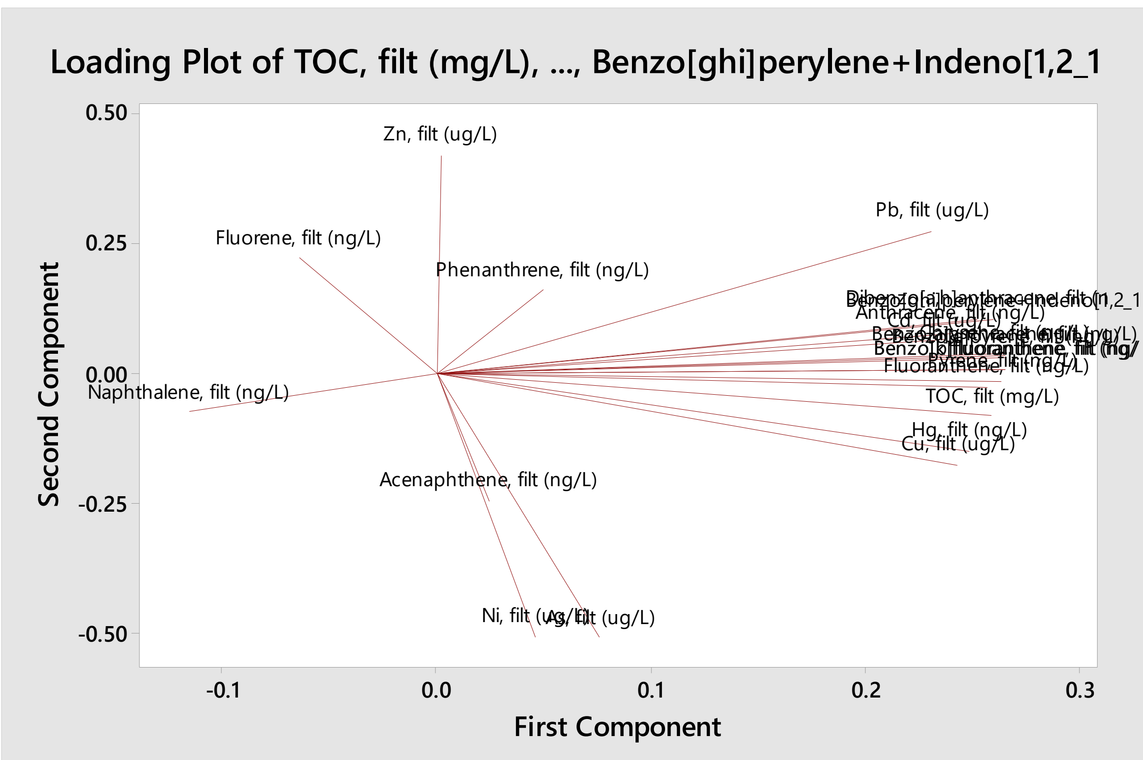
Principal Component Analysis: TOC, filt (m, As, filt (ug, Cu, filt (ug, Ni, fil

Eigenanalysis of the Correlation Matrix
9 cases used, 6 cases contain missing values

Eigenvalue	14.126	3.058	2.466	1.334	0.505	0.314
Proportion	0.642	0.139	0.112	0.061	0.023	0.014
Cumulative	0.642	0.781	0.893	0.954	0.977	0.991

Variable	PC1	PC2	PC3	PC4	PC5	PC6
TOC, filt (mg/L)	0.259	-0.084	-0.037	0.125	-0.027	0.031
As, filt (ug/L)	0.076	-0.508	0.005	0.126	0.433	0.186
Cu, filt (ug/L)	0.243	-0.177	-0.021	-0.030	0.204	-0.193
Ni, filt (ug/L)	0.046	-0.508	-0.032	-0.317	0.145	0.262
Zn, filt (ug/L)	0.002	0.417	-0.038	-0.508	0.478	-0.092
Cd, filt (ug/L)	0.237	0.063	-0.097	-0.281	0.316	0.146
Pb, filt (ug/L)	0.231	0.271	0.047	-0.074	0.031	0.152
Hg, filt (ng/L)	0.248	-0.151	-0.097	0.085	-0.116	0.235
Naphthalene, filt (ng/L)	-0.116	-0.076	0.546	-0.171	-0.065	-0.194
Fluorene, filt (ng/L)	-0.065	0.220	0.164	0.646	0.561	0.008
Acenaphthene, filt (ng/L)	0.024	-0.246	0.544	-0.118	0.092	-0.400
Phenanthrene, filt (ng/L)	0.049	0.158	0.559	0.012	-0.070	0.516
Anthracene, filt (ng/L)	0.240	0.076	0.186	0.005	-0.113	0.385
Fluoranthene, filt (ng/L)	0.256	-0.028	0.008	0.152	-0.185	-0.229
Pyrene, filt (ng/L)	0.263	-0.015	0.009	0.094	-0.089	-0.105
Chrysene, filt (ng/L)	0.264	0.037	-0.005	0.007	0.021	-0.154
Benzo[a]anthracene, filt (ng/L)	0.265	0.034	0.008	0.014	0.035	-0.108
Benzo[b]fluoranthene, filt (ng/	0.265	0.008	0.010	0.040	0.015	-0.119
Benzo[k]fluoranthene, filt (ng/	0.265	0.007	0.007	0.038	0.007	-0.128
Benzo[a]pyrene, filt (ng/L)	0.265	0.030	0.022	0.013	0.006	-0.091
Dibenzo[a,h]anthracene, filt (n	0.252	0.103	0.024	-0.141	-0.130	0.002
Benzo[ghi]perylene+Indeno[1,2_1	0.260	0.101	0.073	0.032	0.008	-0.001


Scree Plot of TOC, filt (mg/L), ..., Benzo[ghi]perylene+Indeno[1,2_1
Eigenvalue
Component Number
0
2
4
6
8
10
12
14
16
2
4
6
8
10
12
14
16
18
20
22

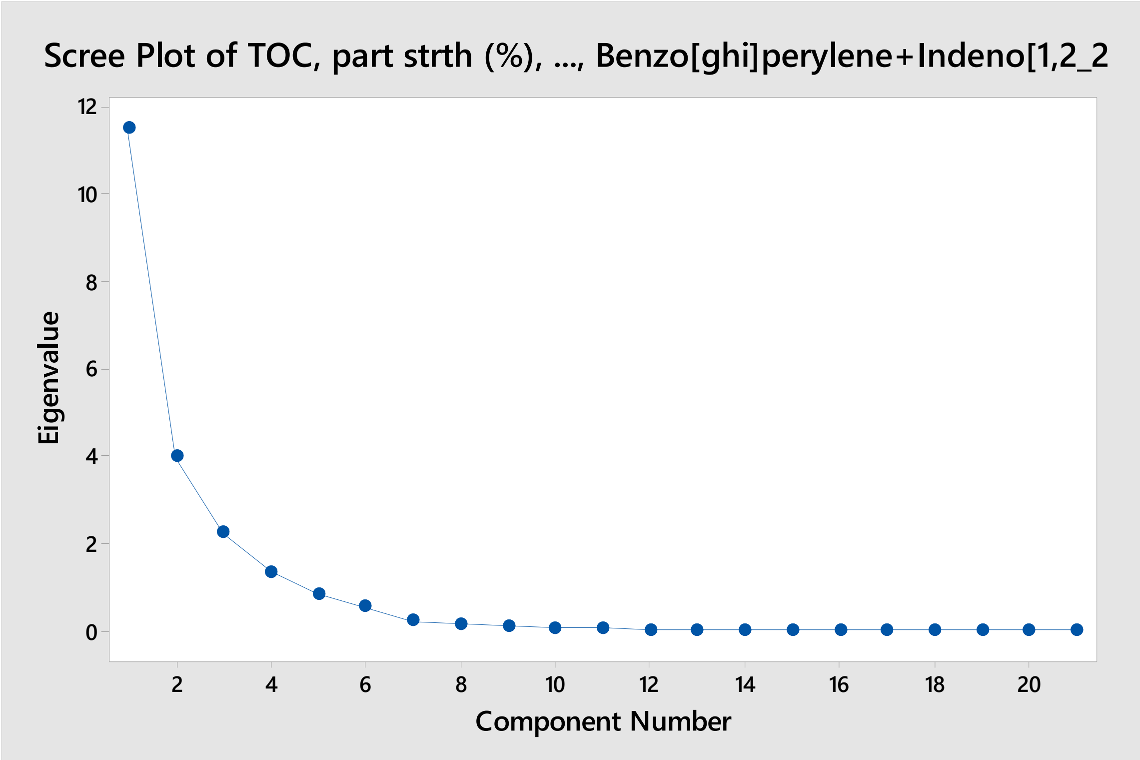

Loading Plot of TOC, filt (mg/L), ..., Benzo[ghi]perylene+Indeno[1,2_1
Second Component
First Component
0.50
0.25
0.00
-0.25
-0.50
-0.1
0.0
0.1
0.2
0.3
Zn, filt (ug/L)
Pb, filt (ug/L)
Fluorene, filt (ng/L)
Phenanthrene, filt (ng/L)
Anthracene, filt (ng/L)
Cd, filt (ug/L)
Pyrene, filt (ng/L)
Fluoranthene, filt (ng/L)
Naphthalene, filt (ng/L)
TOC, filt (mg/L)
Hg, filt (ng/L)
Cu, filt (ug/L)
Acenaphthene, filt (ng/L)
Ni, filt (ug/L)
As, filt (ug/L)

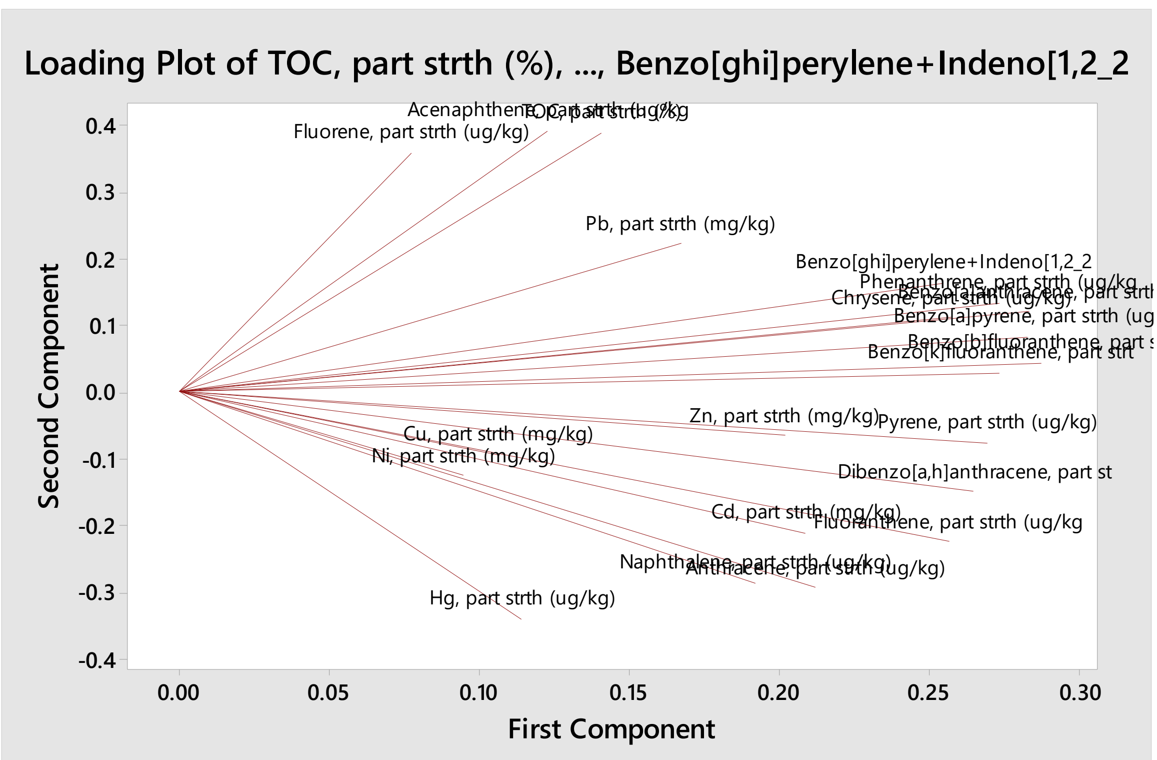
Principal Component Analysis: TOC, part st, Cu, part str, Ni, part str, Zn, par

Eigenanalysis of the Correlation Matrix

Eigenvalue	11.475	3.972	2.224	1.334	0.832	0.545
Proportion	0.546	0.189	0.106	0.064	0.040	0.026
Cumulative	0.546	0.736	0.841	0.905	0.945	0.971

Variable	PC1	PC2	PC3	PC4	PC5	PC6
TOC, part strth (%)	0.141	0.388	-0.231	0.045	-0.061	-0.151
Cu, part strth (mg/kg)	0.107	-0.094	-0.271	-0.532	0.337	0.548
Ni, part strth (mg/kg)	0.094	-0.126	-0.412	-0.289	-0.619	-0.153
Zn, part strth (mg/kg)	0.202	-0.065	-0.363	0.187	0.353	-0.079
Cd, part strth (mg/kg)	0.209	-0.211	-0.293	-0.026	-0.184	-0.289
Pb, part strth (mg/kg)	0.167	0.222	-0.294	-0.290	0.255	-0.039
Hg, part strth (ug/kg)	0.114	-0.340	-0.028	0.185	-0.345	0.600
Naphthalene, part strth (ug/kg)	0.192	-0.287	-0.173	0.327	0.186	0.013
Fluorene, part strth (ug/kg)	0.077	0.359	-0.230	0.335	-0.247	0.366
Acenaphthene, part strth (ug/kg	0.123	0.391	-0.169	0.259	0.013	0.066
Phenanthrene, part strth (ug/kg	0.273	0.134	0.110	0.114	-0.038	0.014
Anthracene, part strth (ug/kg)	0.212	-0.293	-0.021	0.280	0.144	-0.056
Fluoranthene, part strth (ug/kg	0.257	-0.225	-0.055	0.061	0.059	-0.175
Pyrene, part strth (ug/kg)	0.269	-0.076	0.167	-0.204	-0.140	-0.113
Chrysene, part strth (ug/kg)	0.257	0.111	0.247	-0.179	-0.074	0.047
Benzo[a]anthracene, part strth	0.284	0.120	0.069	-0.017	0.008	0.016
Benzo[b]fluoranthene, part strt	0.287	0.044	-0.011	-0.111	0.001	-0.081
Benzo[k]fluoranthene, part strt	0.274	0.030	0.240	-0.068	-0.012	0.047
Benzo[a]pyrene, part strth (ug/	0.283	0.083	0.145	0.054	0.037	0.051
Dibenzo[a,h]anthracene, part st	0.265	-0.150	0.212	-0.001	0.040	0.006
Benzo[ghi]perylene+Indeno[1,2_2	0.254	0.165	0.234	-0.050	-0.088	0.055


Scree Plot of TOC, part strth (%), ..., Benzo[ghi]perylene+Indeno[1,2_2
Eigenvalue
Component Number
12
10
8
6
4
2
0
2
4
6
8
10
12
14
16
18
20


Loading Plot of TOC, part strth (%), ..., Benzo[ghi]perylene+Indeno[1,2_2
Second Component
First Component
Acenaphthene, part strth (ug/kg
TOC, part strth (%)
Fluorene, part strth (ug/kg)
Pb, part strth (mg/kg)
Benzo[ghi]perylene+Indeno[1,2_2
Phenanthrene, part strth (ug/kg
Chrysene, part strth (ug/kg)
Benzo[a]pyrene, part strth (ug
Benzo[k]fluoranthene, part strt
Zn, part strth (mg/kg)
Pyrene, part strth (ug/kg)
Cu, part strth (mg/kg)
Ni, part strth (mg/kg)
Dibenzo[a,h]anthracene, part st
Cd, part strth (mg/kg)
Fluoranthene, part strth (ug/kg
Naphthalene, part strth (ug/kg)
Anthracene, part strth (ug/kg)
Hg, part strth (ug/kg)
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
0.00
0.05
0.10
0.15
0.20
0.25
0.30

Cluster Analyses Showing Groupings of Constituents

Cluster Analysis of Observations: TOC, part st, Cu, part str, Ni, part str, ...

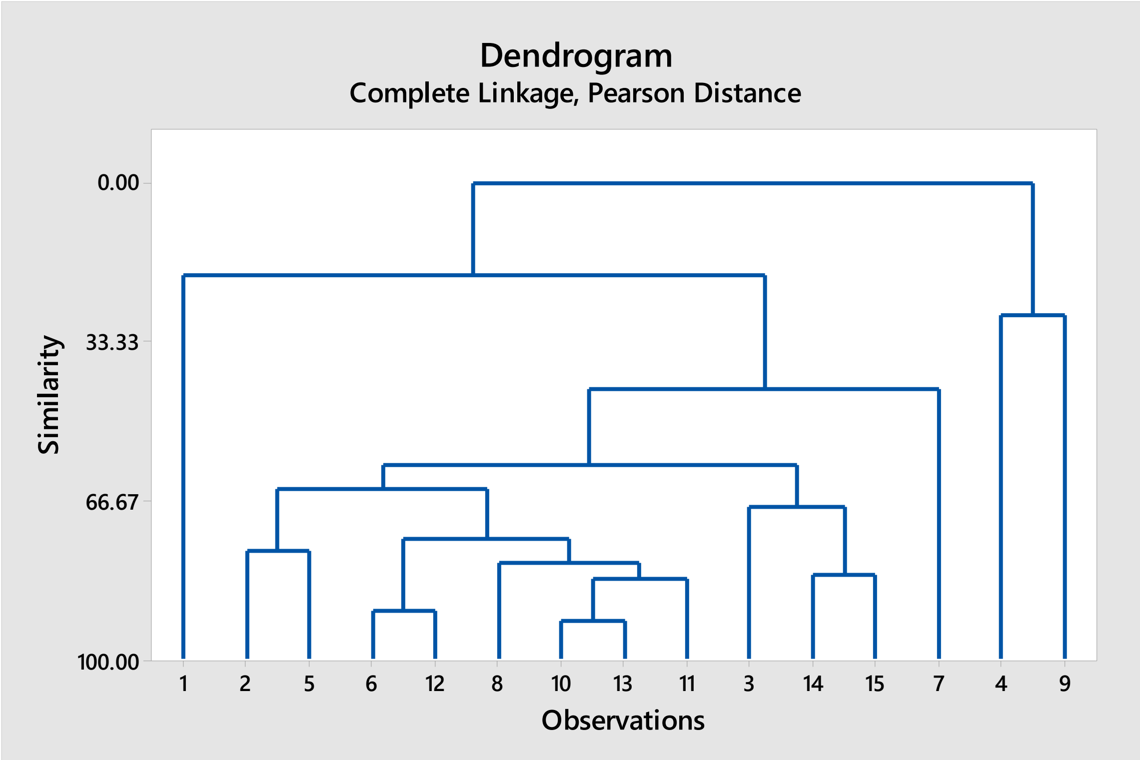
Standardized Variables, Pearson Distance, Complete Linkage
Amalgamation Steps

Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	14	91.8501	0.9236	10	13	10	2
2	13	89.5220	1.1875	6	12	6	2
3	12	82.9564	1.9316	10	11	10	3
4	11	82.3172	2.0040	14	15	14	2
5	10	79.5117	2.3220	8	10	8	4
6	9	77.1119	2.5939	2	5	2	2
7	8	74.4535	2.8952	6	8	6	6
8	7	68.0546	3.6204	3	14	3	3
9	6	64.2768	4.0486	2	6	2	8
10	5	59.0931	4.6360	2	3	2	11
11	4	43.1746	6.4401	2	7	2	12
12	3	27.5587	8.2099	4	9	4	2
13	2	19.2842	9.1476	1	2	1	13
14	1	0.0000	11.3331	1	4	1	15

Final Partition
Number of clusters: 1

	Number of observations	Within cluster sum of squares	Average distance from centroid	Maximum distance from centroid
Cluster1	15	294	3.82318	8.71227

Dendrogram

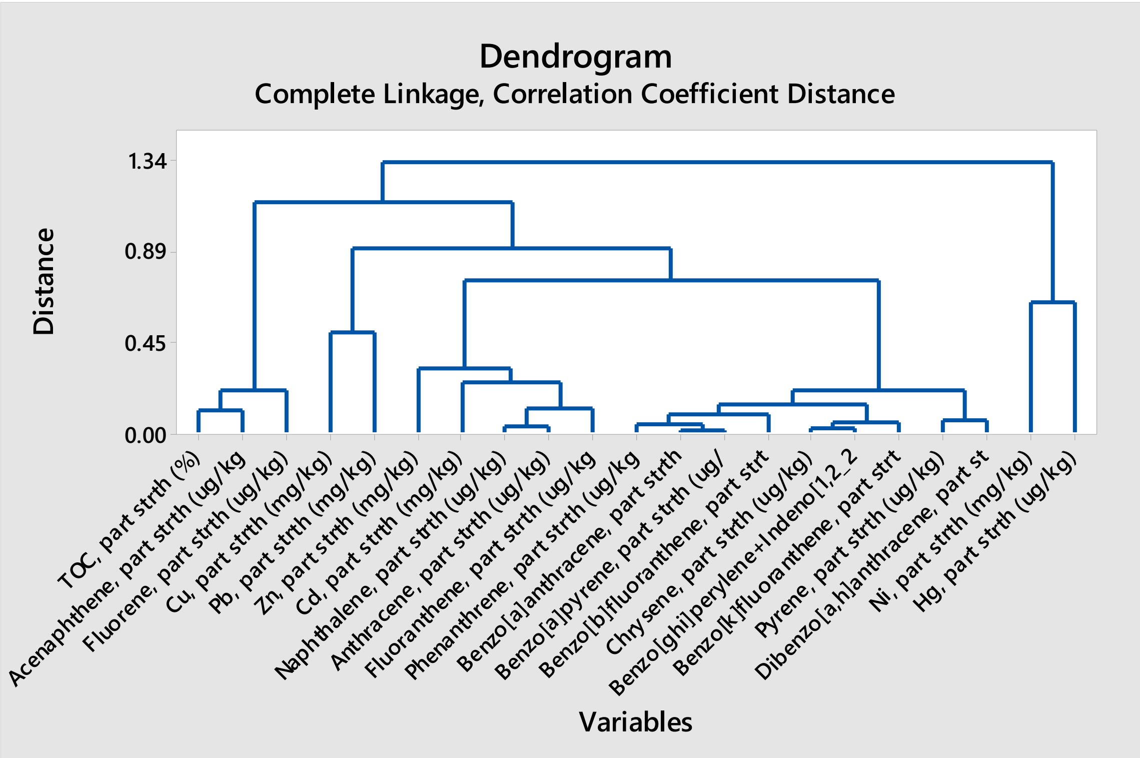


Cluster Analysis of Variables: TOC, part st, Cu, part str, Ni, part str, ...

Correlation Coefficient Distance, Complete Linkage
Amalgamation Steps

Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	20	99.1904	0.01619	16	19	16	2
2	19	98.8713	0.02257	15	21	15	2
3	18	98.2495	0.03501	8	12	8	2
4	17	97.8990	0.04202	11	16	11	3
5	16	97.3972	0.05206	15	18	15	3
6	15	96.7739	0.06452	14	20	14	2
7	14	95.0894	0.09821	11	17	11	4
8	13	94.3454	0.11309	1	10	1	2
9	12	93.8968	0.12206	8	13	8	3
10	11	92.8998	0.14200	11	15	11	7
11	10	89.3406	0.21319	11	14	11	9
12	9	89.2345	0.21531	1	9	1	3
13	8	87.6200	0.24760	5	8	5	4
14	7	83.7957	0.32409	4	5	4	5
15	6	75.3325	0.49335	2	6	2	2
16	5	67.9156	0.64169	3	7	3	2
17	4	62.5371	0.74926	4	11	4	14
18	3	54.6496	0.90701	2	4	2	16
19	2	43.3464	1.13307	1	2	1	19
20	1	33.1187	1.33763	1	3	1	21

Dendrogram



Cluster Analysis of Observations: TOC, filt (m, Cu, filt (ug, Ni, filt (ug, ...

Standardized Variables, Pearson Distance, Complete Linkage
Amalgamation Steps

Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	14	86.6284	1.8846	4	5	4	2
2	13	85.4299	2.0535	6	10	6	2
3	12	84.1269	2.2371	8	15	8	2
4	11	83.4402	2.3339	4	14	4	3
5	10	81.7199	2.5764	7	11	7	2
6	9	77.9102	3.1133	3	12	3	2
7	8	73.4727	3.7387	3	6	3	4

8	7	72.3727	3.8937	8	9	8	3
9	6	70.7907	4.1167	4	7	4	5
10	5	64.9353	4.9419	1	8	1	4
11	4	63.0772	5.2038	4	13	4	6
12	3	54.5013	6.4125	1	3	1	8
13	2	51.4377	6.8443	1	4	1	14
14	1	0.0000	14.0938	1	2	1	15

Final Partition
Number of clusters: 1

	Number of observations	Within cluster sum of squares	Average distance from centroid	Maximum distance from centroid
Cluster1	15	294	3.76768	12.1345

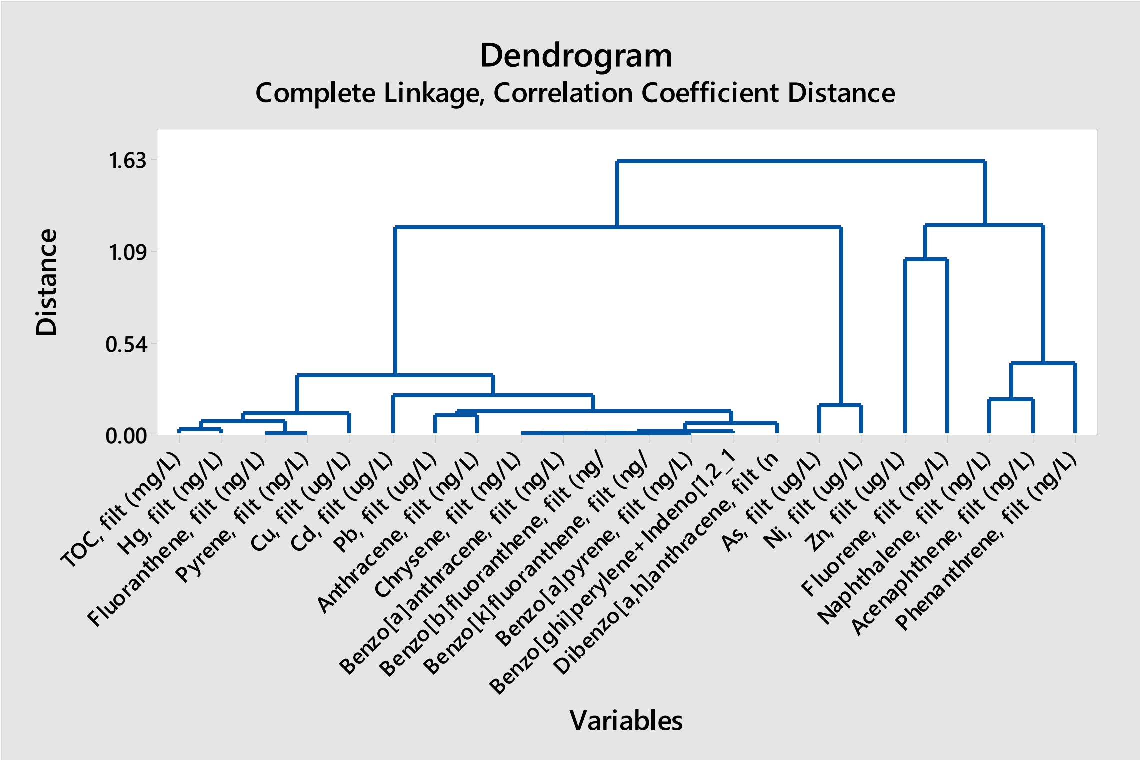
Dendrogram

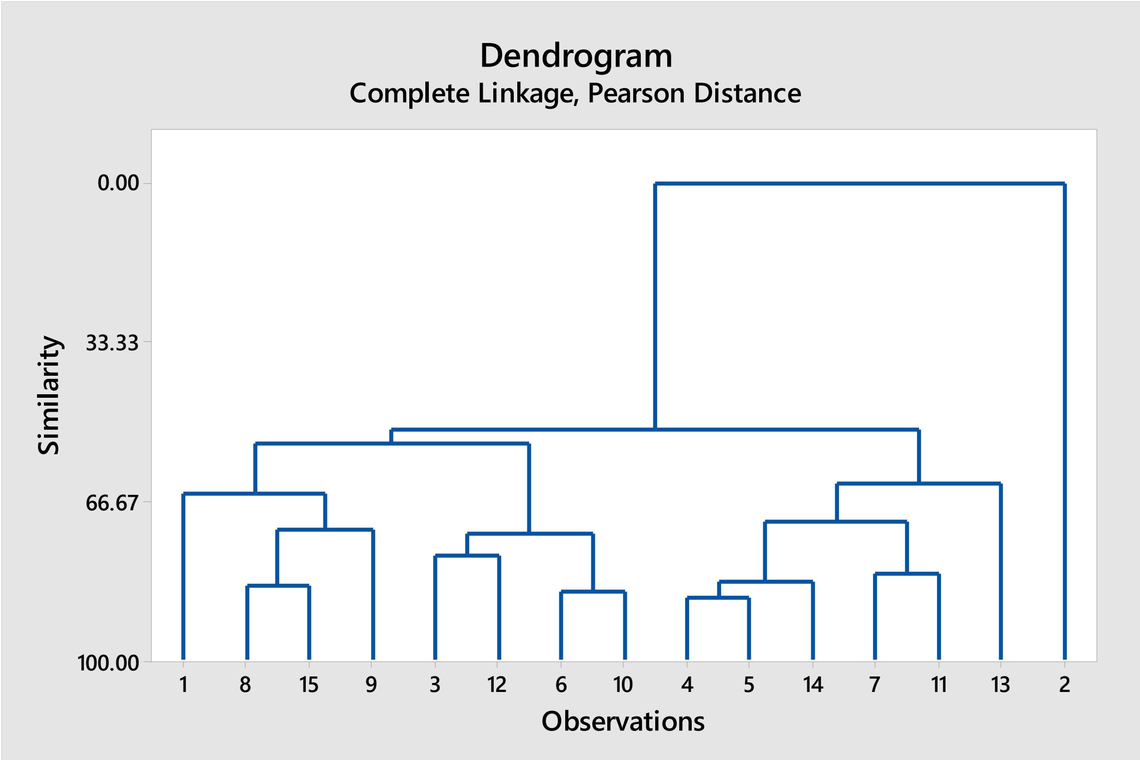
Cluster Analysis of Variables: TOC, filt (m, As, filt (ug, Cu, filt (ug, ...

Correlation Coefficient Distance, Complete Linkage
Amalgamation Steps

Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	21	99.9938	0.00012	18	19	18	2
2	20	99.9359	0.00128	16	17	16	2
3	19	99.8719	0.00256	16	18	16	4
4	18	99.8653	0.00269	16	20	16	5
5	17	99.4784	0.01043	14	15	14	2
6	16	98.8606	0.02279	16	22	16	6
7	15	98.6978	0.02604	1	8	1	2
8	14	96.9512	0.06098	16	21	16	7
9	13	96.0995	0.07801	1	14	1	4
10	12	94.1958	0.11608	7	13	7	2
11	11	93.8379	0.12324	1	3	1	5
12	10	93.0045	0.13991	7	16	7	9
13	9	91.6258	0.16748	2	4	2	2
14	8	89.7928	0.20414	9	11	9	2
15	7	88.0779	0.23844	6	7	6	10
16	6	82.2041	0.35592	1	6	1	15
17	5	78.7939	0.42412	9	12	9	3
18	4	47.9540	1.04092	5	10	5	2
19	3	38.4335	1.23133	1	2	1	17
20	2	37.5686	1.24863	5	9	5	5
21	1	18.3764	1.63247	1	5	1	22

Dendrogram

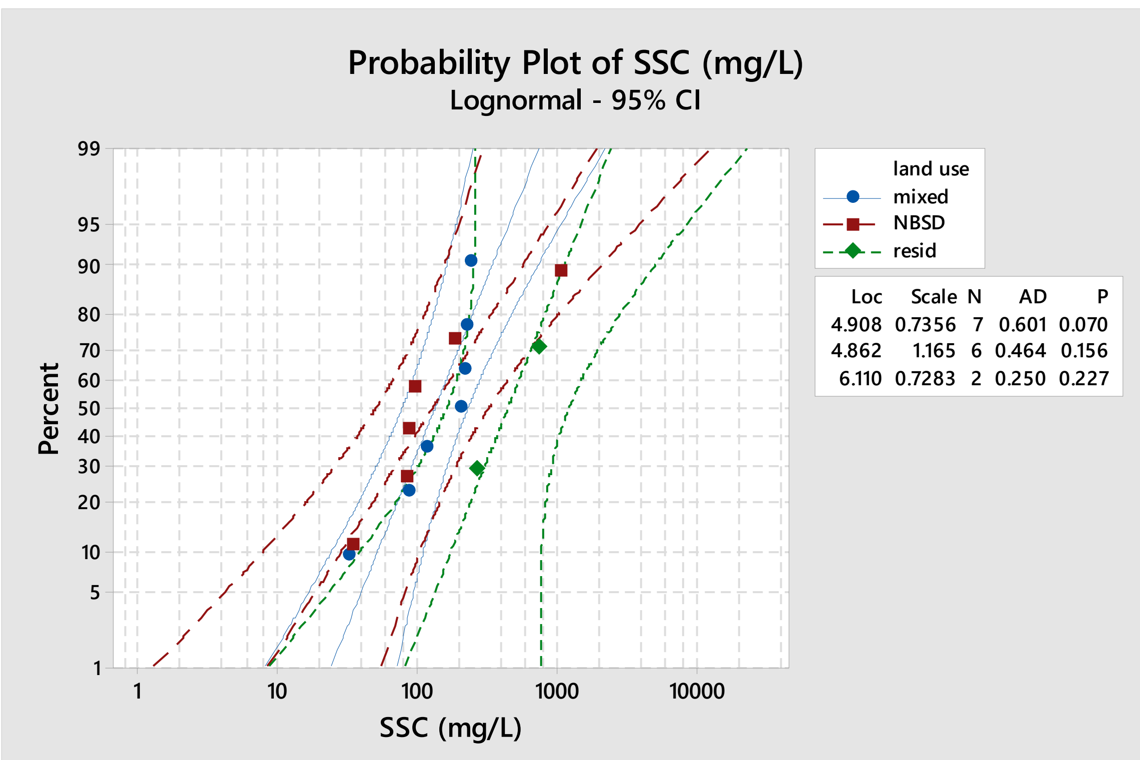

Dendrogram
Complete Linkage, Correlation Coefficient Distance
Distance
1.63
1.09
0.54
0.00
TOC, filt (mg/L)
Hg, filt (ng/L)
Fluoranthene, filt (ng/L)
Pyrene, filt (ng/L)
Cu, filt (ug/L)
Cd, filt (ug/L)
Pb, filt (ug/L)
Anthracene, filt (ng/L)
Chrysene, filt (ng/L)
Benzo[a]anthracene, filt (ng/L)
Benzo[b]fluoranthene, filt (ng/
Benzo[k]fluoranthene, filt (ng/
Benzo[a]pyrene, filt (ng/L)
Benzo[ghi]perylene+Indeno[1,2_1
Dibenzo[a,h]anthracene, filt (n
As, filt (ug/L)
Ni, filt (ug/L)
Zn, filt (ug/L)
Fluorene, filt (ng/L)
Naphthalene, filt (ng/L)
Acenaphthene, filt (ng/L)
Phenanthrene, filt (ng/L)
Variables


Dendrogram
Complete Linkage, Pearson Distance
Similarity
0.00
33.33
66.67
100.00
1
8
15
9
3
12
6
10
4
5
14
7
11
13
2
Observations

Probability Plots and Kruskal-Wallis Analyses of Concentrations for Different Land Use Sampling Locations

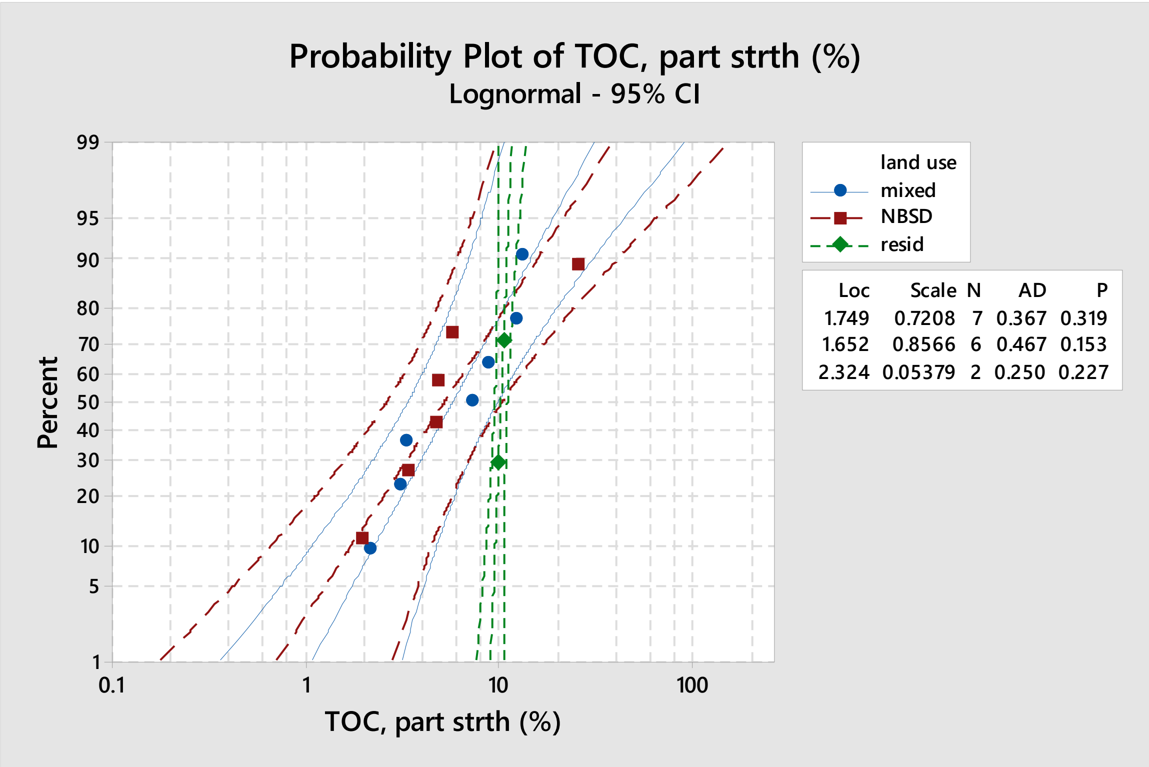
Kruskal-Wallis Test on SSC (mg/L)

```
land use    N  Median  Ave Rank      Z
mixed       7  202.58       7.9  -0.12
NBSD        6   91.02       6.3  -1.18
resid       2  511.23      13.5   1.87
Overall    15               8.0

H = 3.87  DF = 2  P = 0.145

* NOTE * One or more small samples
```



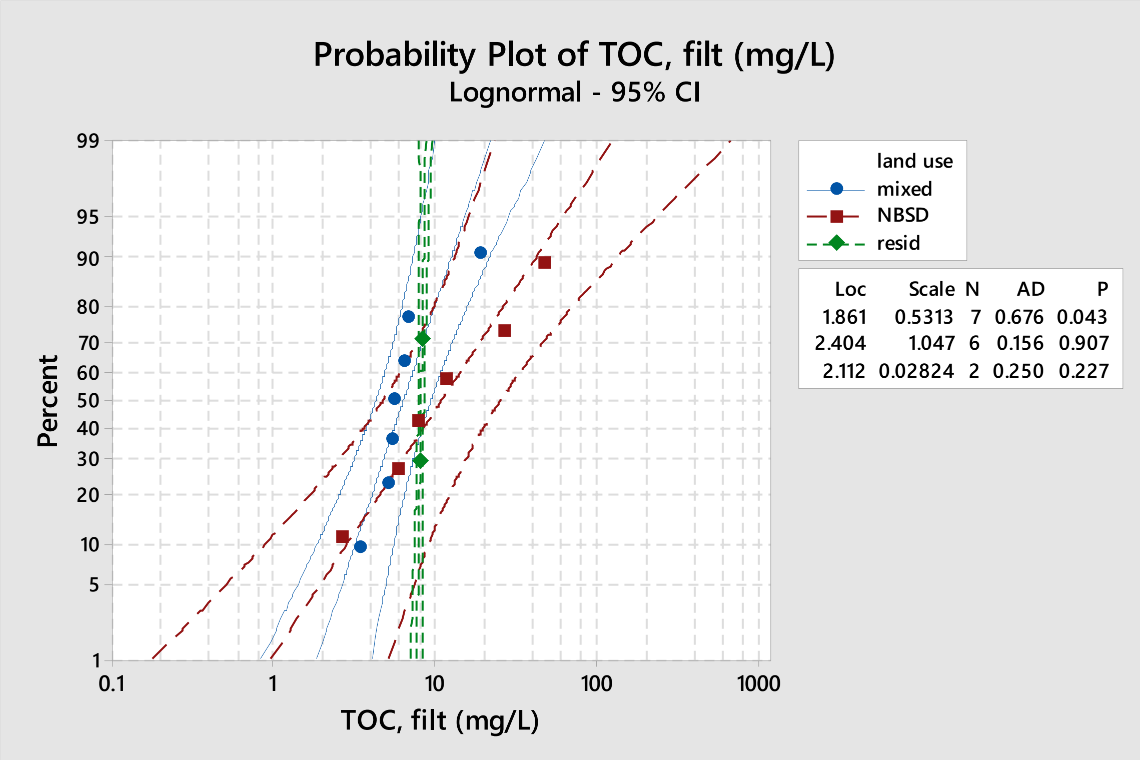
Kruskal-Wallis Test: TOC, part strth (%) versus land use

```
Kruskal-Wallis Test on TOC, part strth (%)

land use    N  Median  Ave Rank      Z
mixed       7   7.229       7.9  -0.12
NBSD        6   4.706       7.0  -0.71
resid       2  10.225      11.5   1.19
Overall    15               8.0

H = 1.53  DF = 2  P = 0.465
```



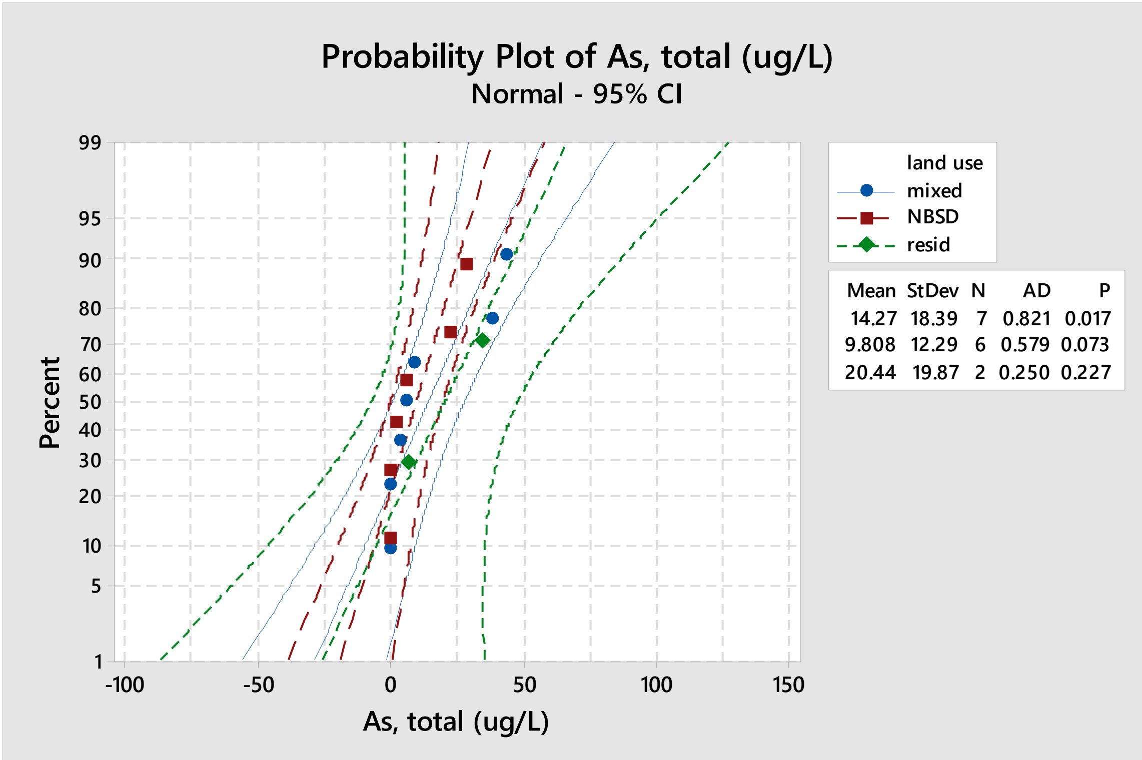
Kruskal-Wallis Test: TOC, filt (mg/L) versus land use

```
Kruskal-Wallis Test on TOC, filt (mg/L)

land use    N  Median  Ave Rank      Z
mixed       7   5.640       6.0  -1.62
NBSD        6   9.795       9.5   1.06
resid       2   8.265      10.5   0.85
Overall    15               8.0

H = 2.70  DF = 2  P = 0.259

* NOTE * One or more small samples
```



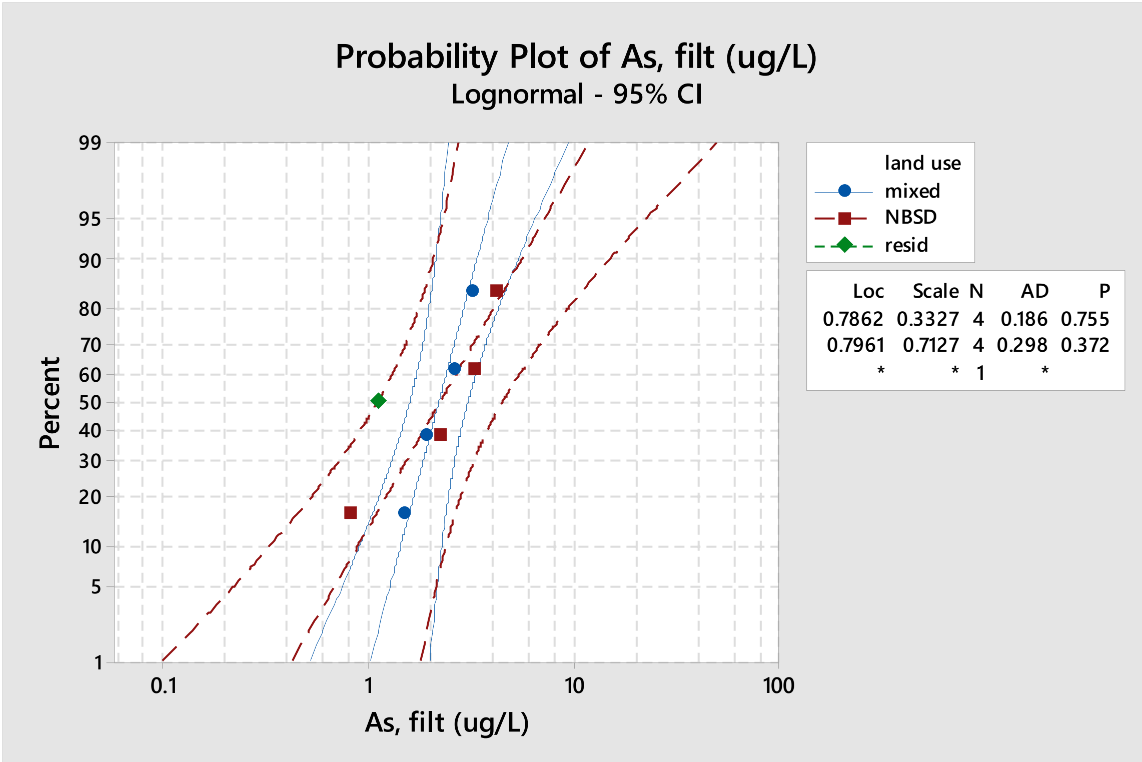
Kruskal-Wallis Test: As, total (ug/L) versus land use

```
Kruskal-Wallis Test on As, total (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7   6.122       8.3   0.23
NBSD        6   4.176       6.7  -0.94
resid       2  20.435      11.0   1.02
Overall    15               8.0

H = 1.46  DF = 2  P = 0.481
H = 1.49  DF = 2  P = 0.475  (adjusted for ties)

* NOTE * One or more small samples
```



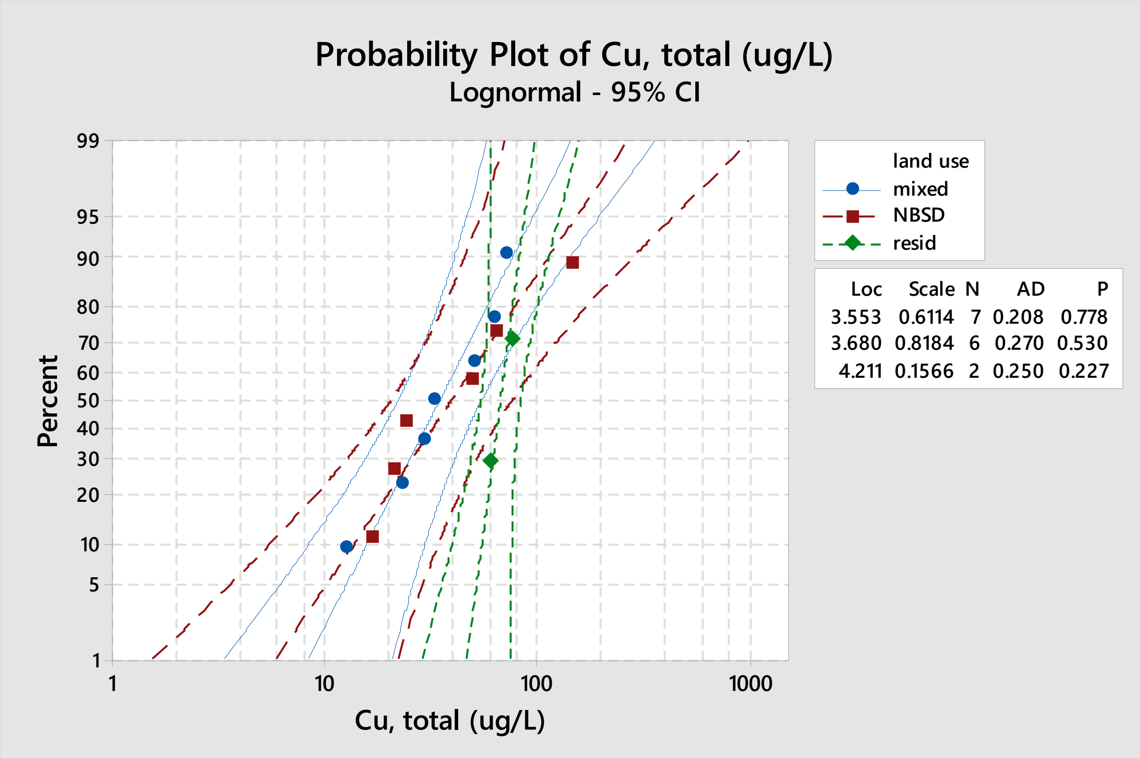
Kruskal-Wallis Test: As, filt (ug/L) versus land use

```
9 cases were used
6 cases contained missing values


Kruskal-Wallis Test on As, filt (ug/L)

                      Ave
land use  N  Median  Rank      Z
mixed     4   2.262   5.0   0.00
NBSD      4   2.721   5.8   0.73
resid     1   1.105   2.0  -1.16
Overall   9           5.0

H = 1.50  DF = 2  P = 0.472

* NOTE * One or more small samples
```



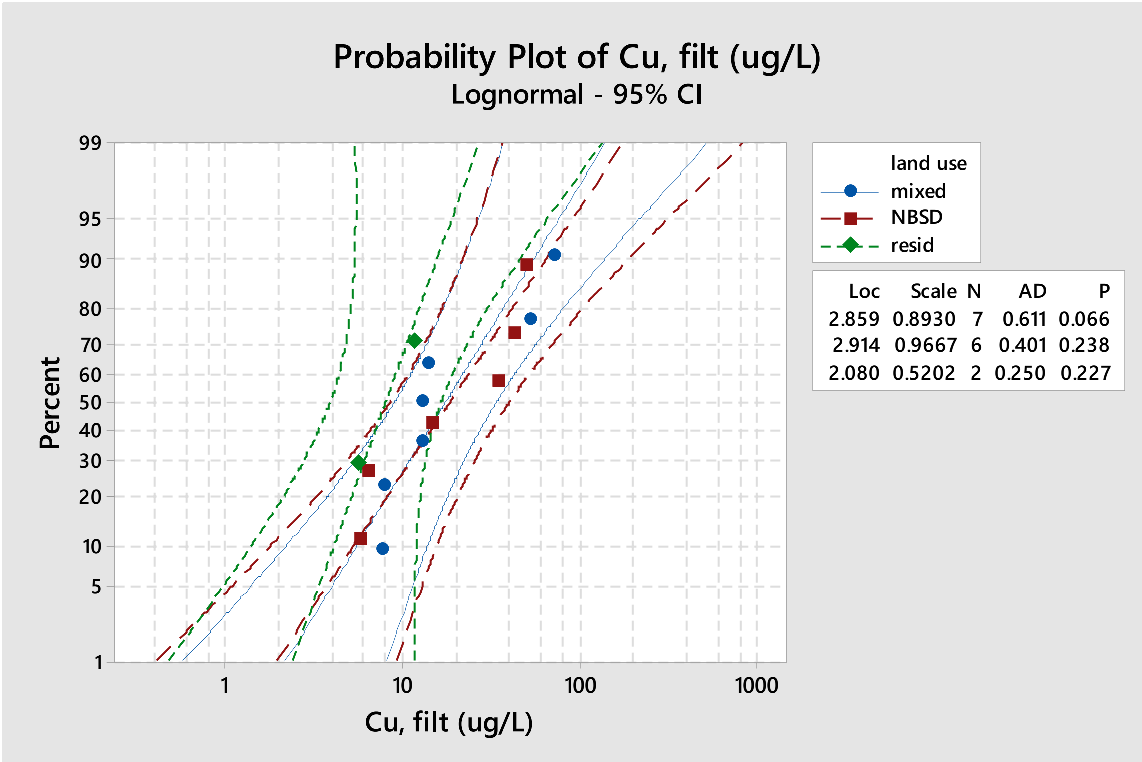
Kruskal-Wallis Test: Cu, total (ug/L) versus land use

```
Kruskal-Wallis Test on Cu, total (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7   32.73       7.3  -0.58
NBSD        6   36.61       7.5  -0.35
resid       2   67.86      12.0   1.36
Overall    15               8.0

H = 1.85  DF = 2  P = 0.396

* NOTE * One or more small samples
```



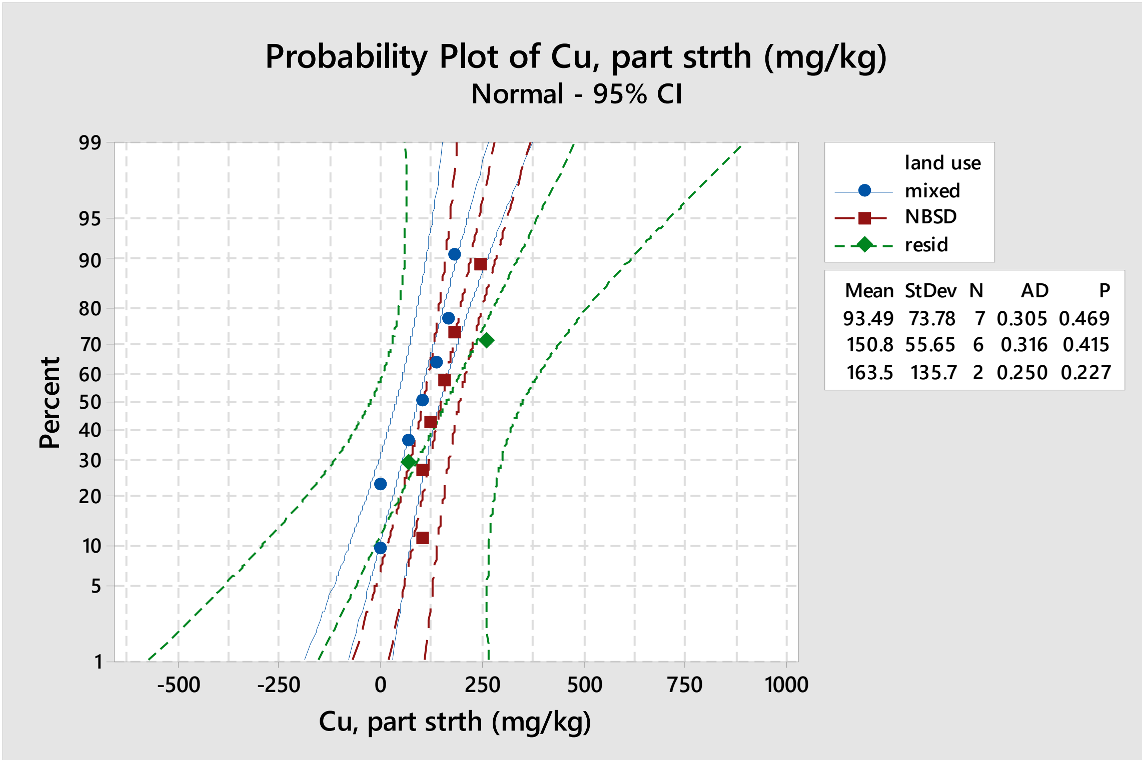
Kruskal-Wallis Test: Cu, filt (ug/L) versus land use

```
Kruskal-Wallis Test on Cu, filt (ug/L)

                            Ave
land use     N   Median    Rank       Z
mixed        7   12.904     8.9    0.69
NBSD         6   24.608     8.5    0.35
resid        2    8.553     3.5   -1.53
Overall     15              8.0

H = 2.36   DF = 2   P = 0.308

* NOTE * One or more small samples
```



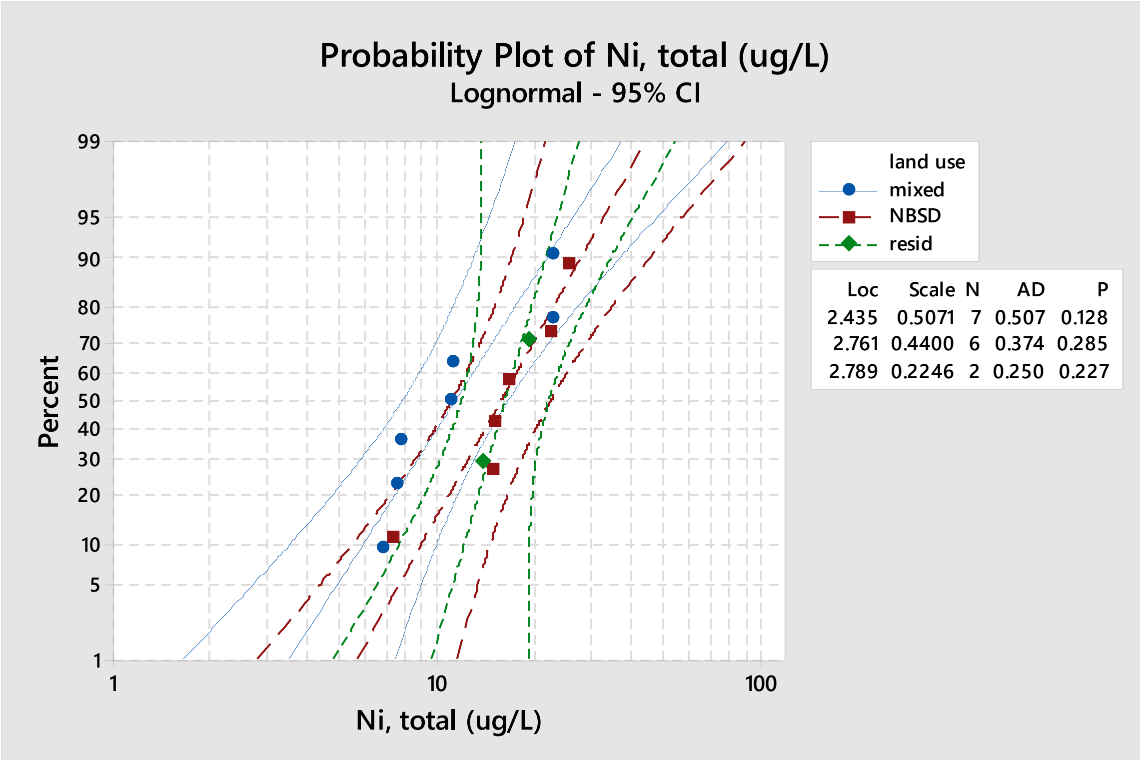
Kruskal-Wallis Test: Cu, part strth (mg/kg) versus land use

```
Kruskal-Wallis Test on Cu, part strth (mg/kg)

                           Ave
land use    N  Median  Rank       Z
mixed       7   103.3   6.6   -1.16
NBSD        6   138.4   9.3    0.94
resid       2   163.5   9.0    0.34
Overall    15           8.0

H = 1.35  DF = 2  P = 0.510
H = 1.35  DF = 2  P = 0.509  (adjusted for ties)

* NOTE * One or more small samples
```



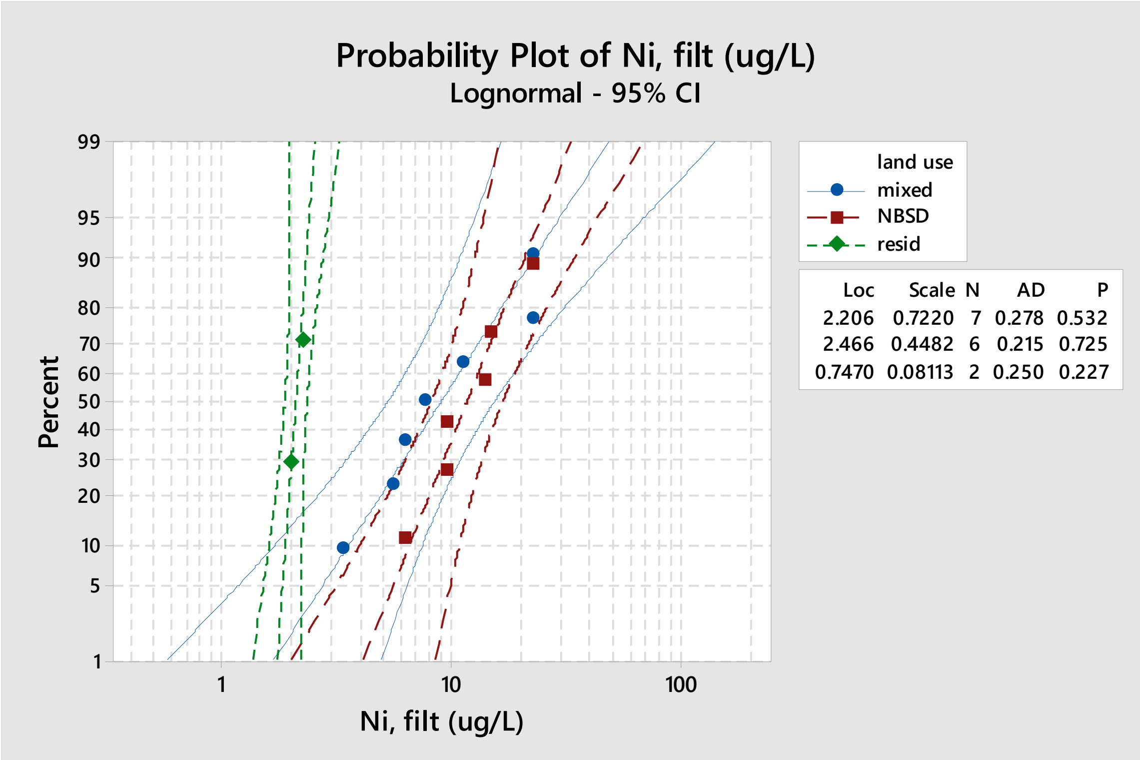
Kruskal-Wallis Test: Ni, total (ug/L) versus land use

```
Kruskal-Wallis Test on Ni, total (ug/L)

                         Ave
land use    N  Median   Rank       Z
mixed       7   11.00    6.6   -1.16
NBSD        6   15.90    9.3    0.94
resid       2   16.48    9.0    0.34
Overall    15            8.0

H = 1.35  DF = 2  P = 0.510

* NOTE * One or more small samples
```



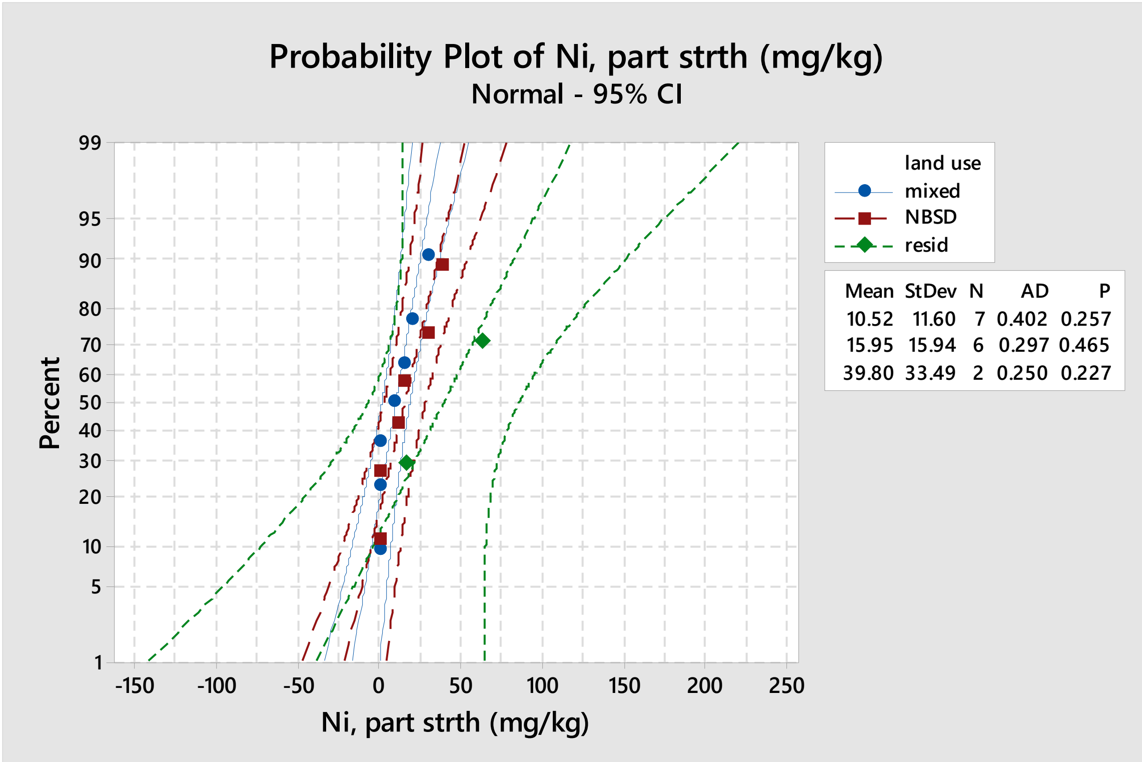
Kruskal-Wallis Test: Ni, filt (ug/L) versus land use

```
Kruskal-Wallis Test on Ni, filt (ug/L)

                          Ave
land use     N  Median   Rank       Z
mixed        7   7.646    8.3    0.23
NBSD         6  11.780    9.8    1.30
resid        2   2.114    1.5   -2.21
Overall     15            8.0

H = 5.26  DF = 2  P = 0.072

* NOTE * One or more small samples
```



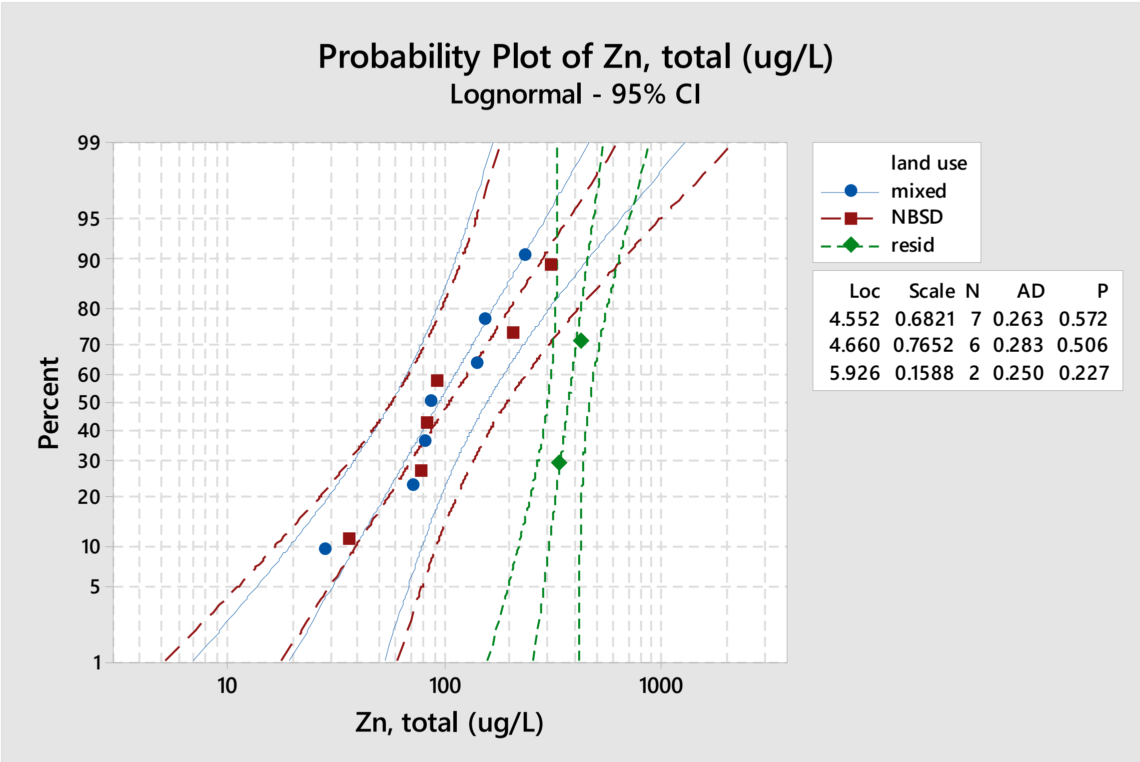
Kruskal-Wallis Test: Ni, part strth (mg/kg) versus land use

```
Kruskal-Wallis Test on Ni, part strth (mg/kg)

land use    N  Median  Ave Rank      Z
mixed       7   8.959       6.6  -1.16
NBSD        6  13.171       8.2   0.12
resid       2  39.801      12.5   1.53
Overall    15               8.0

H = 2.75  DF = 2  P = 0.253
H = 2.85  DF = 2  P = 0.241  (adjusted for ties)

* NOTE * One or more small samples
```



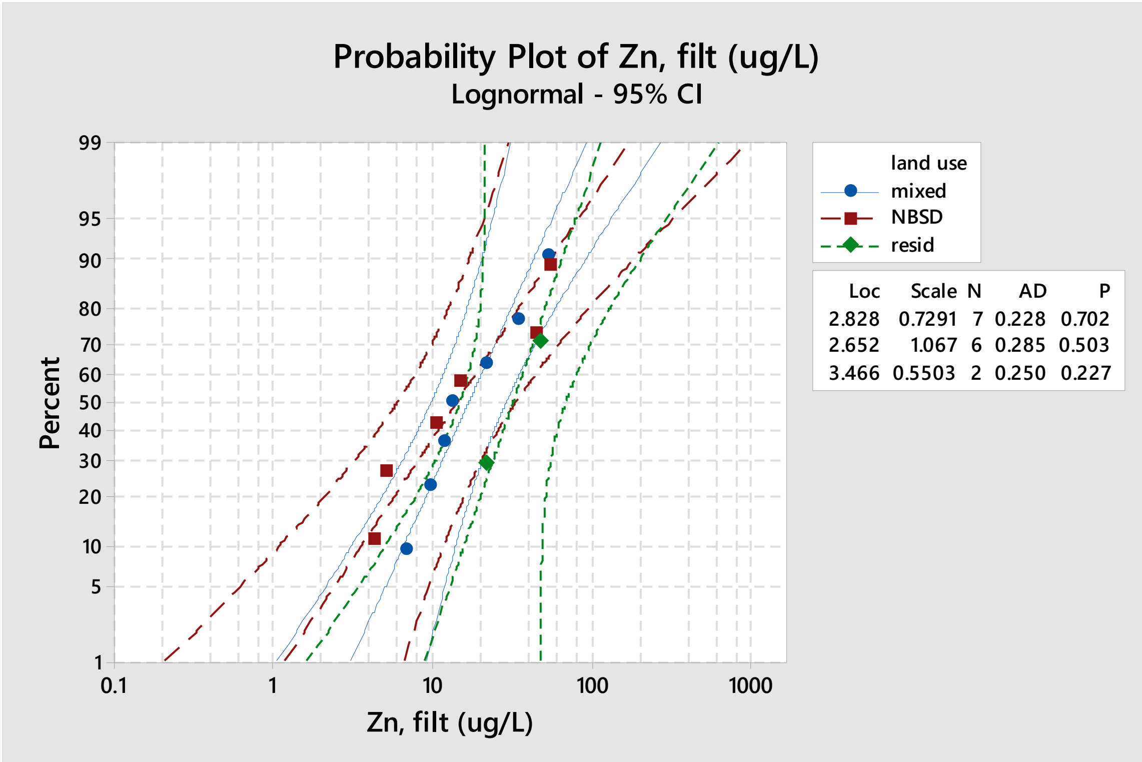
Kruskal-Wallis Test: Zn, total (ug/L) versus land use

```
Kruskal-Wallis Test on Zn, total (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7   85.79       6.7  -1.04
NBSD        6   87.71       7.3  -0.47
resid       2  376.89      14.5   2.21
Overall    15               8.0

H = 4.94  DF = 2  P = 0.085

* NOTE * One or more small samples
```



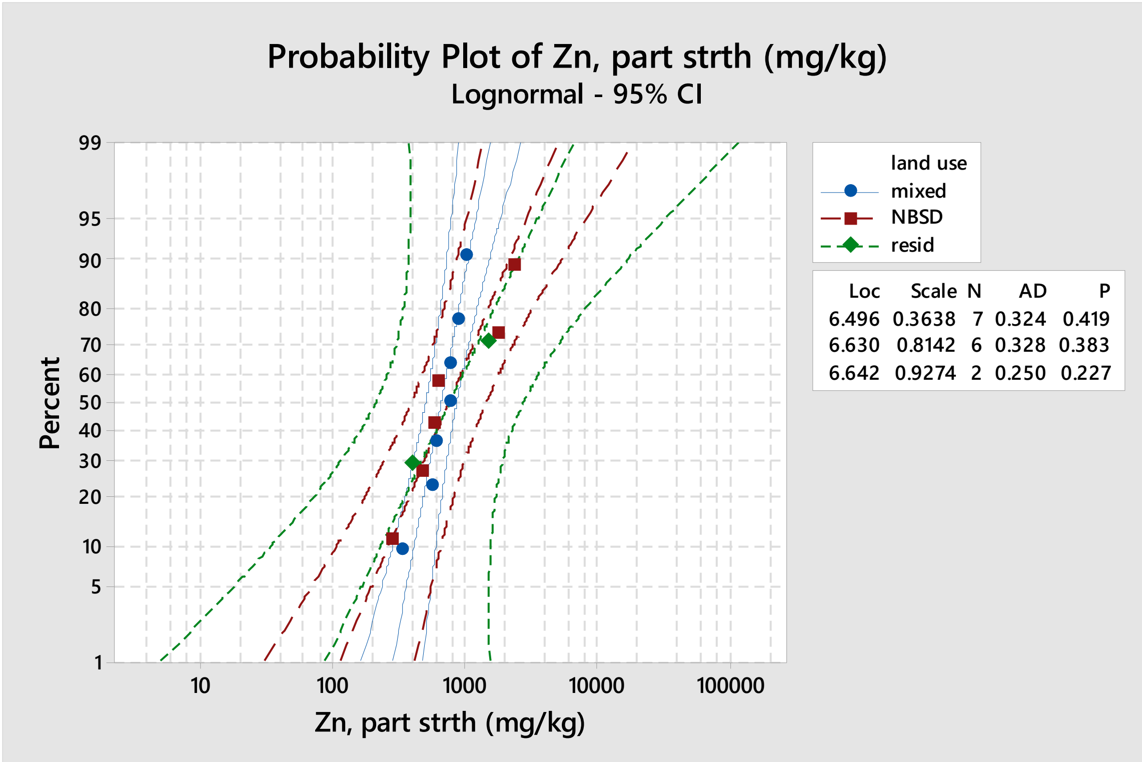
Kruskal-Wallis Test: Zn, filt (ug/L) versus land use

```
Kruskal-Wallis Test on Zn, filt (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7   13.08       7.9  -0.12
NBSD        6   12.70       7.2  -0.59
resid       2   34.45      11.0   1.02
Overall    15               8.0

H = 1.12  DF = 2  P = 0.573

* NOTE * One or more small samples
```



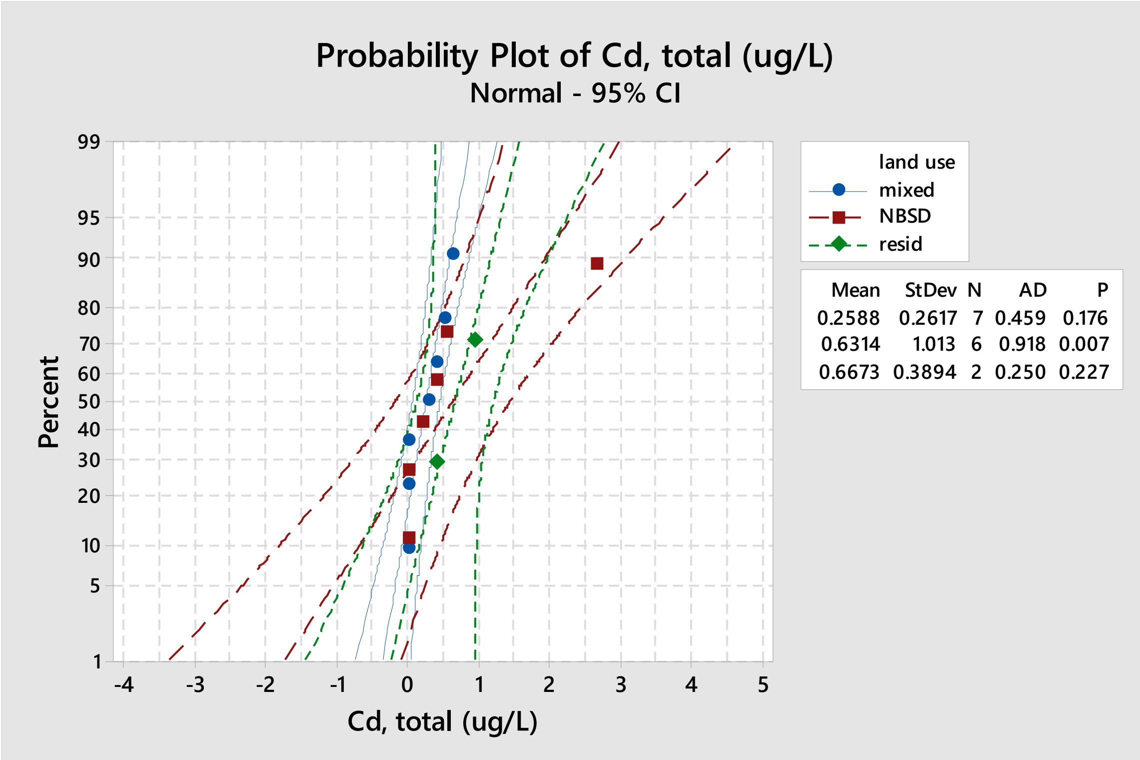
Kruskal-Wallis Test: Zn, part strth (mg/kg) versus land use

```
Kruskal-Wallis Test on Zn, part strth (mg/kg)

                       Ave
land use    N  Median  Rank      Z
mixed       7   754.1   8.0   0.00
NBSD        6   599.2   8.0   0.00
resid       2   937.6   8.0   0.00
Overall    15           8.0

H = 0.00  DF = 2  P = 1.000

* NOTE * One or more small samples
```



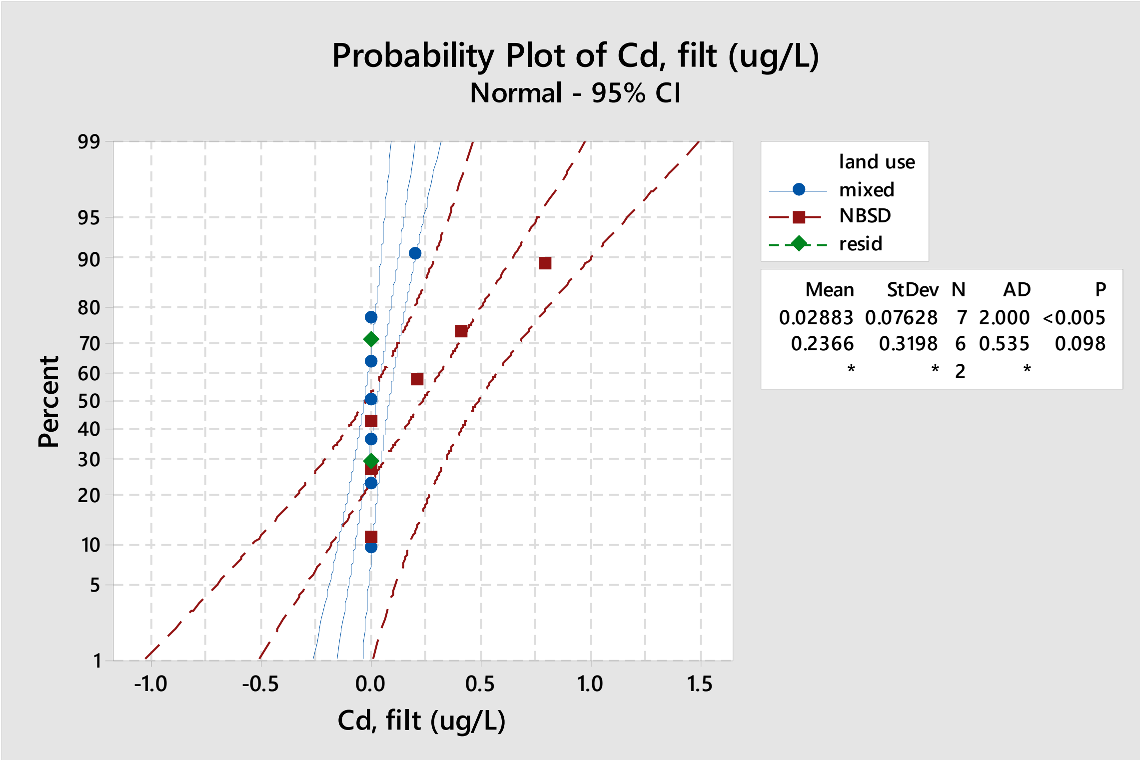
Kruskal-Wallis Test: Cd, total (ug/L) versus land use

```
Kruskal-Wallis Test on Cd, total (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7  0.2871       7.1  -0.69
NBSD        6  0.2981       8.0   0.00
resid       2  0.6673      11.0   1.02
Overall    15               8.0

H = 1.16  DF = 2  P = 0.561
H = 1.20  DF = 2  P = 0.549  (adjusted for ties)

* NOTE * One or more small samples
```



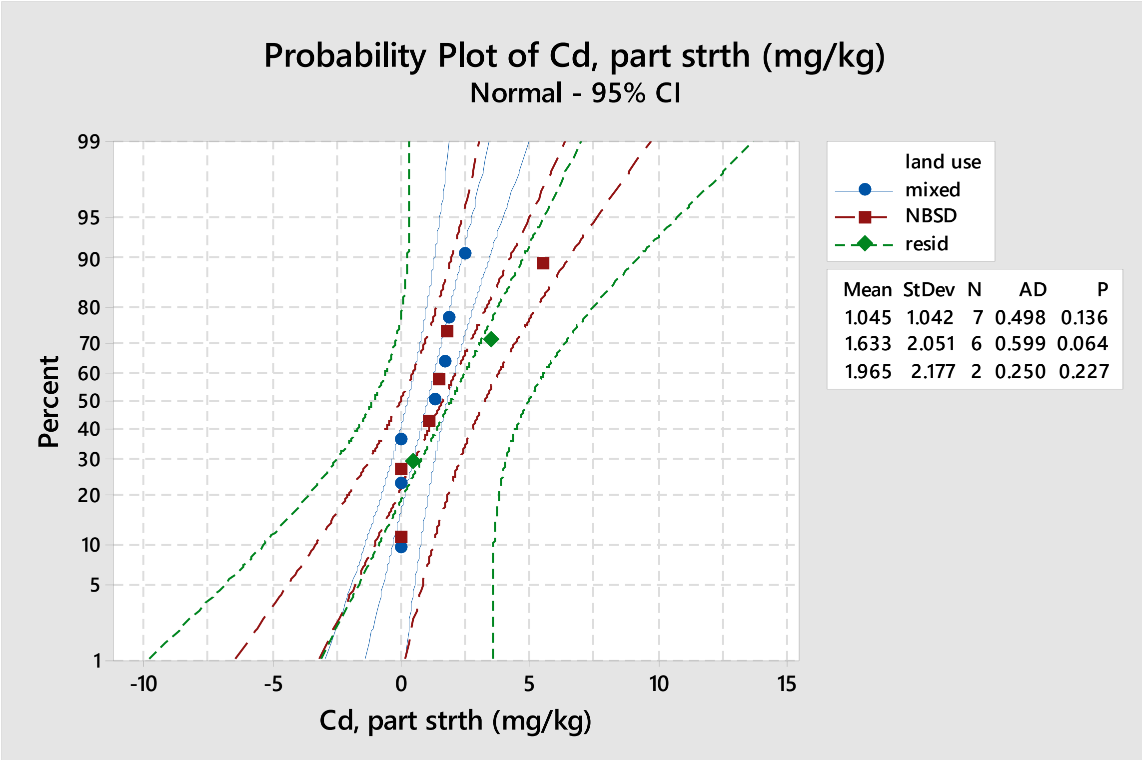
Kruskal-Wallis Test: Cd, filt (ug/L) versus land use

```
Kruskal-Wallis Test on Cd, filt (ug/L)

land use    N       Median  Ave Rank      Z
mixed       7  0.000000000       6.9  -0.93
NBSD        6  0.105742750      10.0   1.41
resid       2  0.000000000       6.0  -0.68
Overall    15                    8.0

H = 2.06  DF = 2  P = 0.358
H = 3.39  DF = 2  P = 0.184  (adjusted for ties)

* NOTE * One or more small samples
```



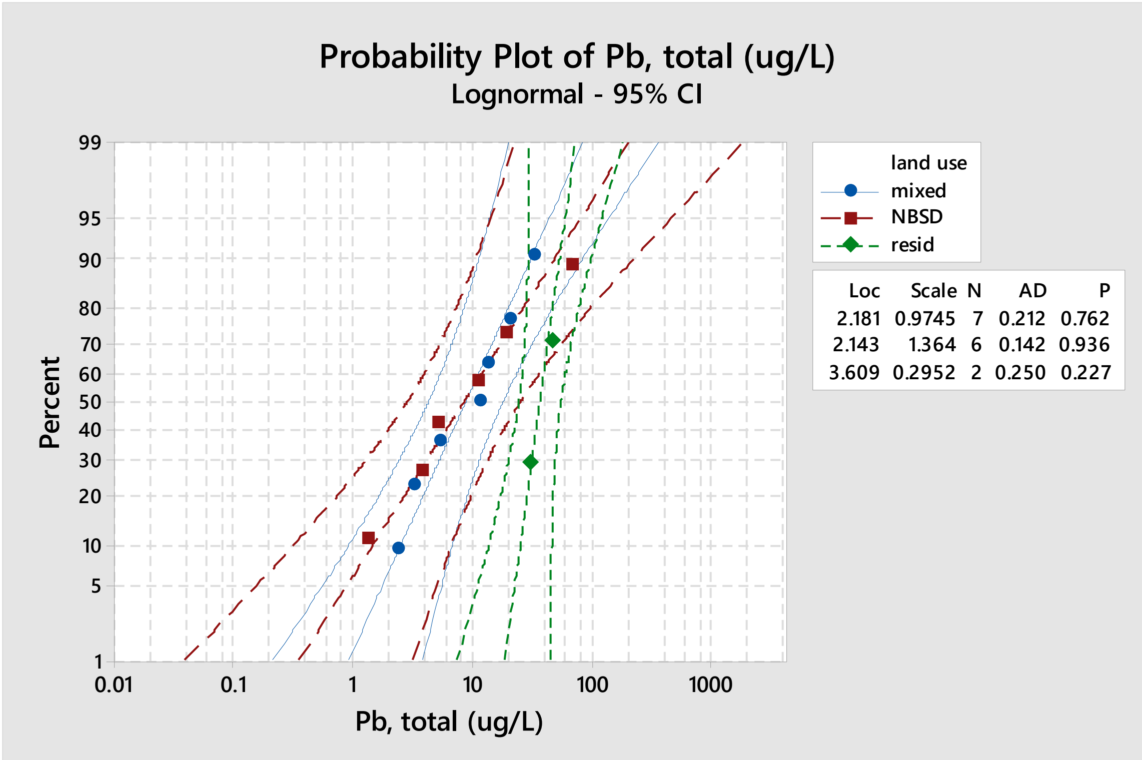
Kruskal-Wallis Test: Cd, part strth (mg/kg) versus land use

```
Kruskal-Wallis Test on Cd, part strth (mg/kg)

land use    N  Median  Ave Rank      Z
mixed       7   1.290       7.4  -0.46
NBSD        6   1.254       8.0   0.00
resid       2   1.965      10.0   0.68
Overall    15               8.0

H = 0.51  DF = 2  P = 0.773
H = 0.53  DF = 2  P = 0.766  (adjusted for ties)

* NOTE * One or more small samples
```



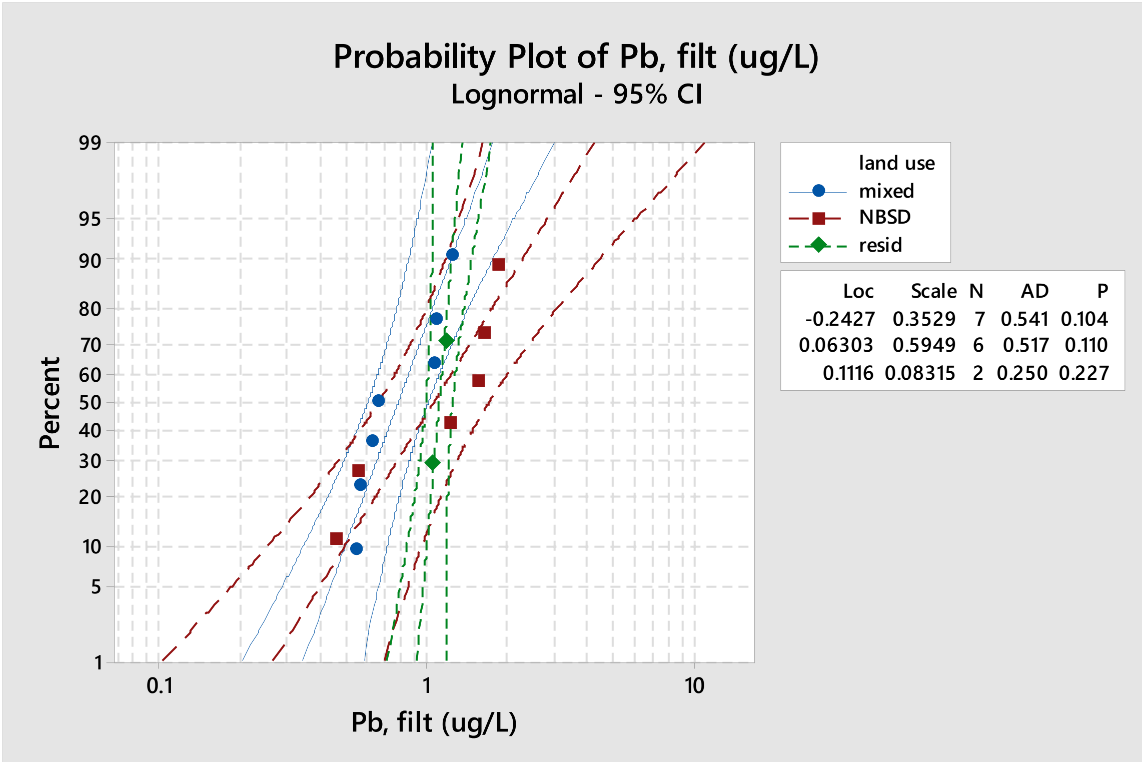
Kruskal-Wallis Test: Pb, total (ug/L) versus land use

```
Kruskal-Wallis Test on Pb, total (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7  11.670       7.4  -0.46
NBSD        6   8.226       7.0  -0.71
resid       2  37.755      13.0   1.70
Overall    15               8.0

H = 2.91  DF = 2  P = 0.233

* NOTE * One or more small samples
```



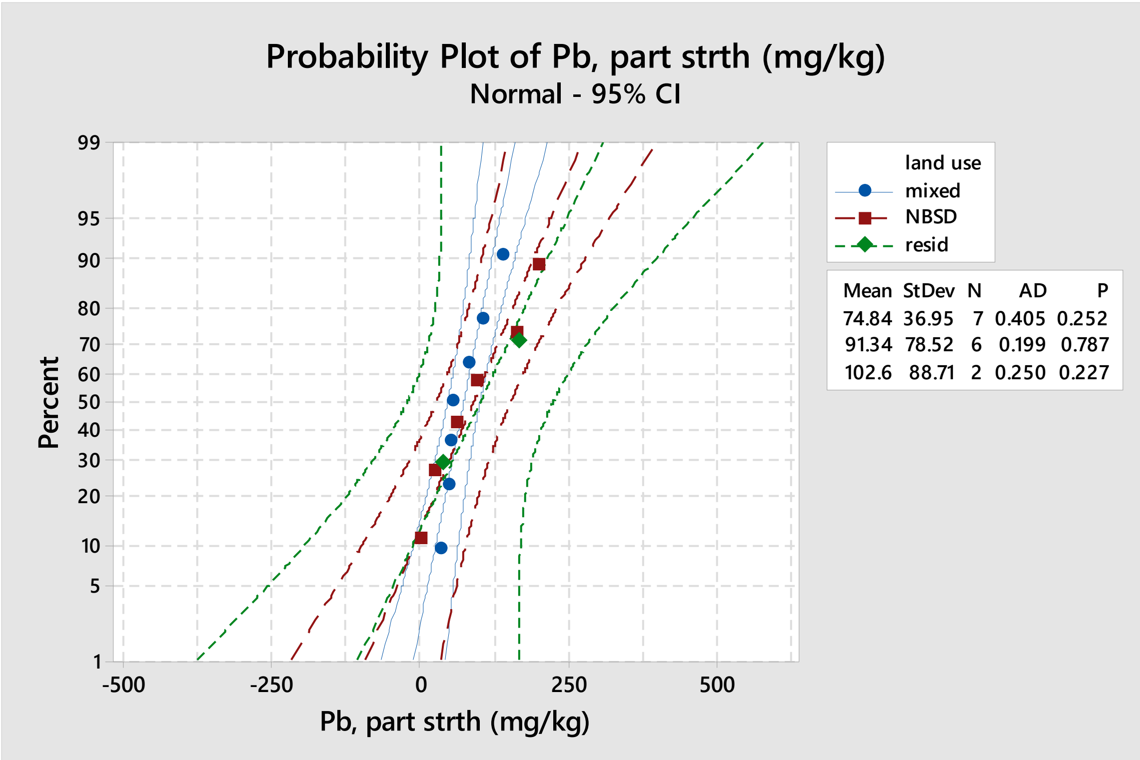
Kruskal-Wallis Test: Pb, filt (ug/L) versus land use

```
Kruskal-Wallis Test on Pb, filt (ug/L)

                          Ave
land use    N  Median    Rank       Z
mixed       7  0.6613    6.6   -1.16
NBSD        6  1.3890    9.5    1.06
resid       2  1.1200    8.5    0.17
Overall    15            8.0

H = 1.41  DF = 2  P = 0.493

* NOTE * One or more small samples
```



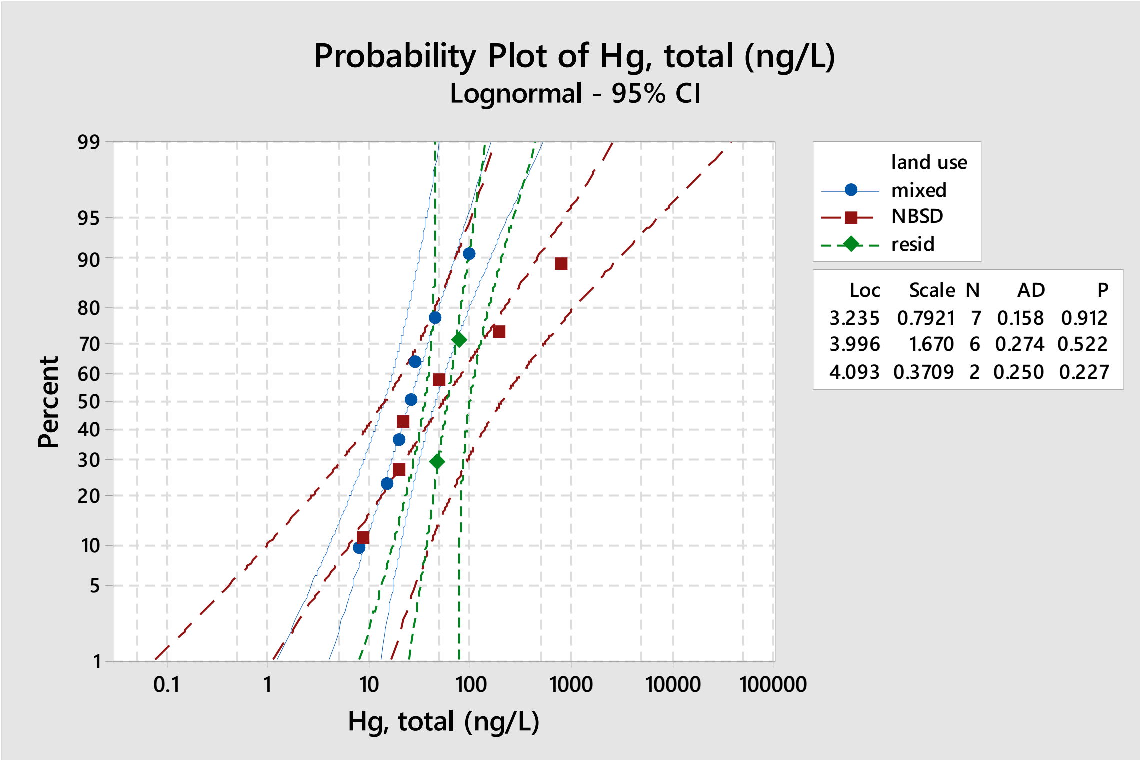
Kruskal-Wallis Test: Pb, part strth (mg/kg) versus land use

```
Kruskal-Wallis Test on Pb, part strth (mg/kg)

                          Ave
land use    N  Median    Rank       Z
mixed       7   55.42     7.6   -0.35
NBSD        6   79.46     8.2    0.12
resid       2  102.59     9.0    0.34
Overall    15             8.0

H = 0.17  DF = 2  P = 0.917

* NOTE * One or more small samples
```



Kruskal-Wallis Test: Hg, total (ng/L) versus land use

```
Kruskal-Wallis Test on Hg, total (ng/L)

land use    N  Median  Ave Rank      Z
mixed       7   25.96       6.4  -1.27
NBSD        6   35.36       8.8   0.59
resid       2   61.99      11.0   1.02
Overall    15               8.0

H = 1.97  DF = 2  P = 0.373

* NOTE * One or more small samples
```



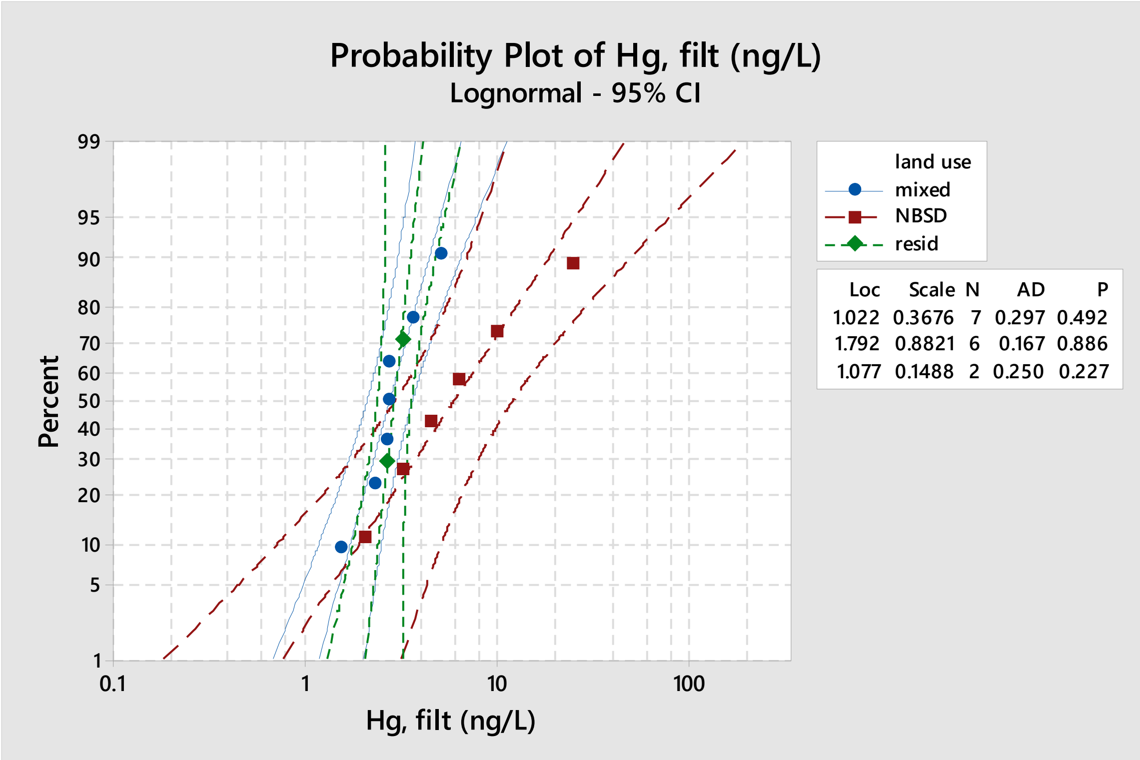
Kruskal-Wallis Test: Hg, filt (ng/L) versus land use

Kruskal-Wallis Test on Hg, filt (ng/L)

land use	N	Median	Ave Rank	Z
mixed	7	2.706	6.1	-1.50
NBSD	6	5.379	10.5	1.77
resid	2	2.951	7.0	-0.34
Overall	15		8.0	

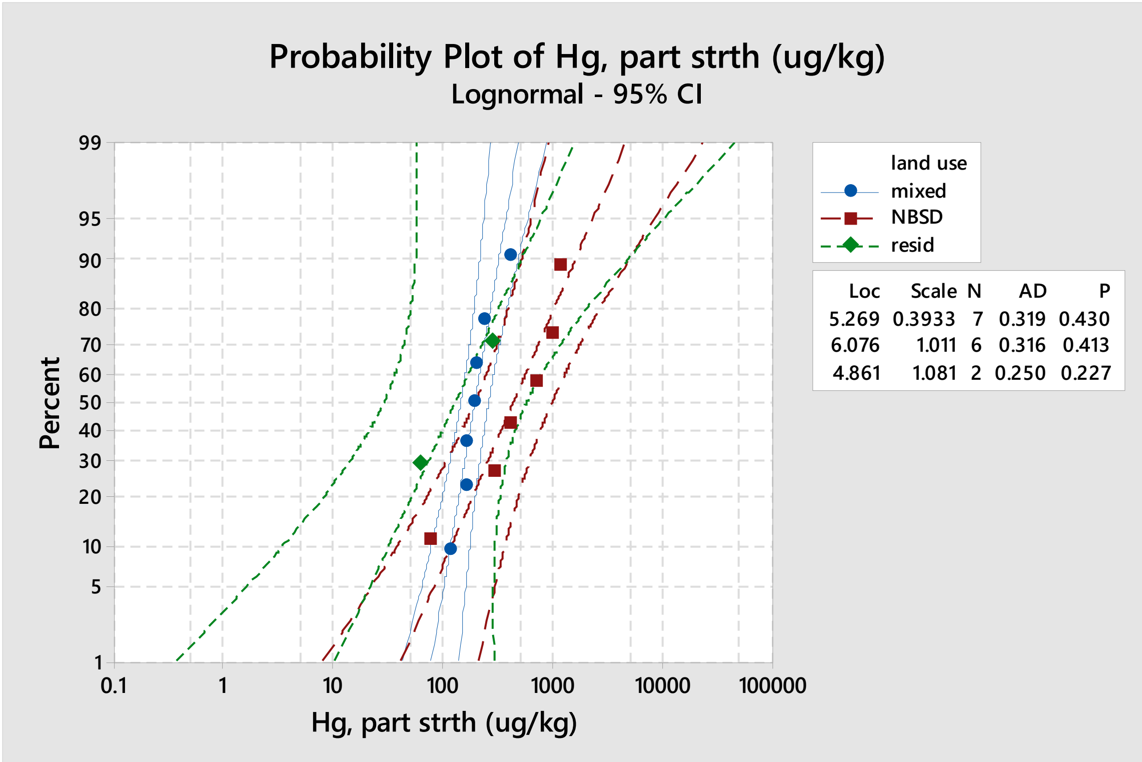
H = 3.18 DF = 2 P = 0.204

* NOTE * One or more small samples



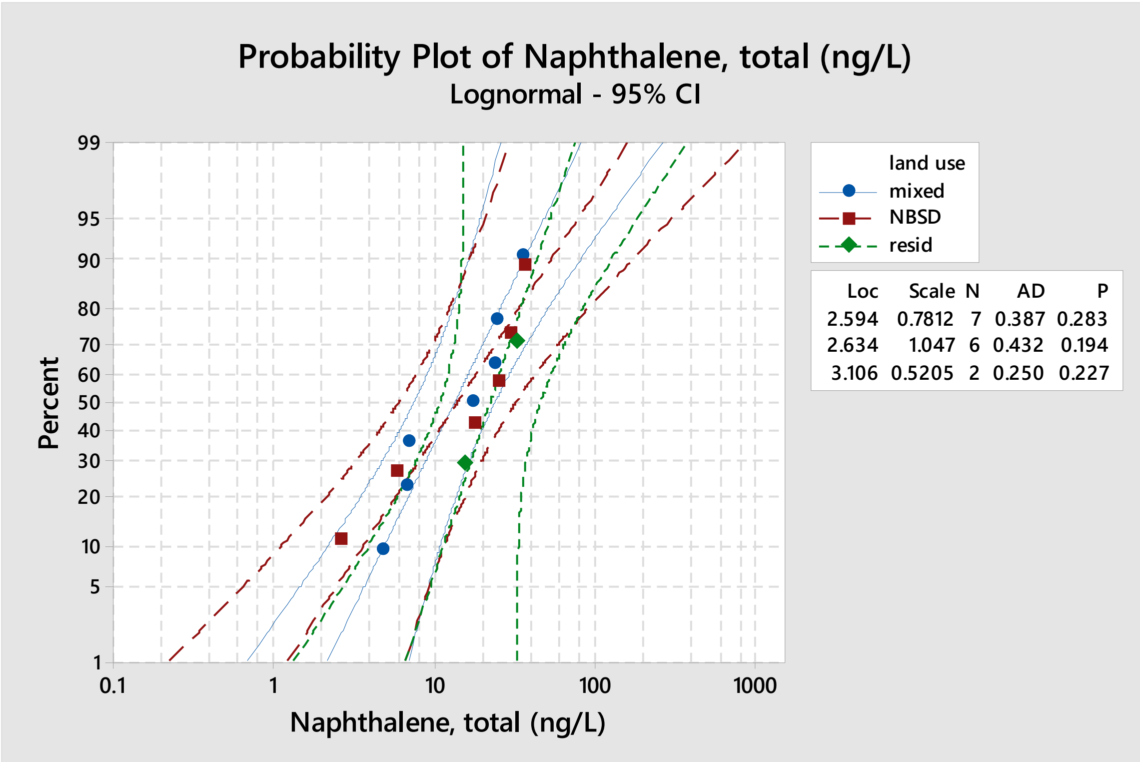
Kruskal-Wallis Test: Hg, part strth (ug/kg) versus land use

```
Kruskal-Wallis Test on Hg, part strth (ug/kg)

land use    N  Median  Ave Rank      Z
mixed       7   187.2       6.4  -1.27
NBSD        6   551.3      10.8   2.00
resid       2   168.8       5.0  -1.02
Overall    15               8.0

H = 4.17  DF = 2  P = 0.124

* NOTE * One or more small samples
```



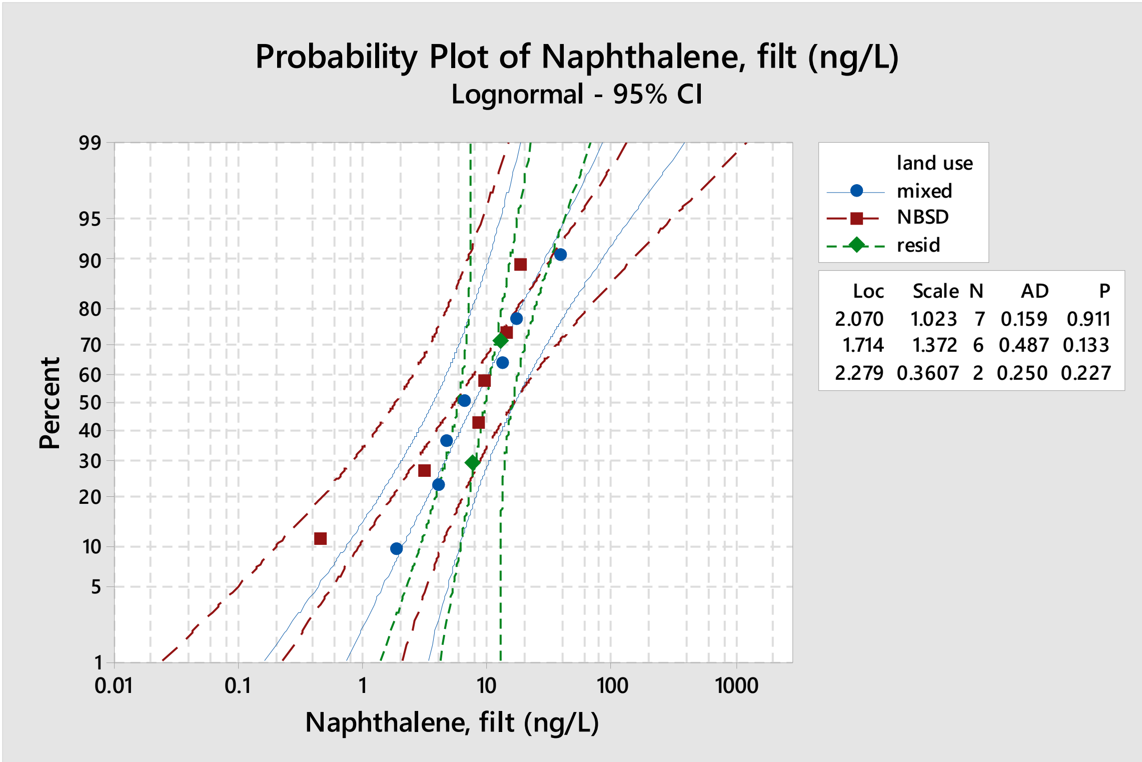
Kruskal-Wallis Test: Naphthalene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Naphthalene, total (ng/L)

                          Ave
land use    N  Median    Rank      Z
mixed       7   17.02     7.3  -0.58
NBSD        6   21.60     8.3   0.24
resid       2   23.87     9.5   0.51
Overall    15             8.0

H = 0.44  DF = 2  P = 0.804

* NOTE * One or more small samples
```



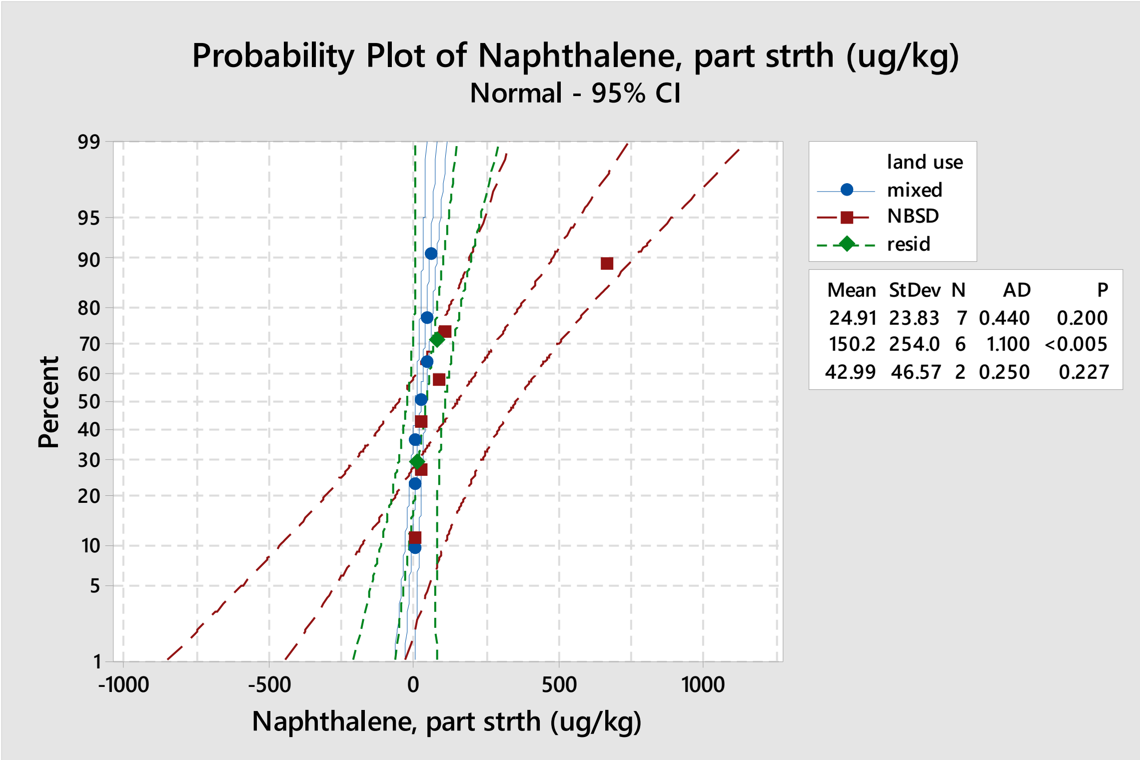
Kruskal-Wallis Test: Naphthalene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Naphthalene, filt (ng/L)

                        Ave
land use    N  Median  Rank      Z
mixed       7   6.573   8.0   0.00
NBSD        6   9.038   7.8  -0.12
resid       2  10.089   8.5   0.17
Overall    15           8.0

H = 0.03  DF = 2  P = 0.983

* NOTE * One or more small samples
```



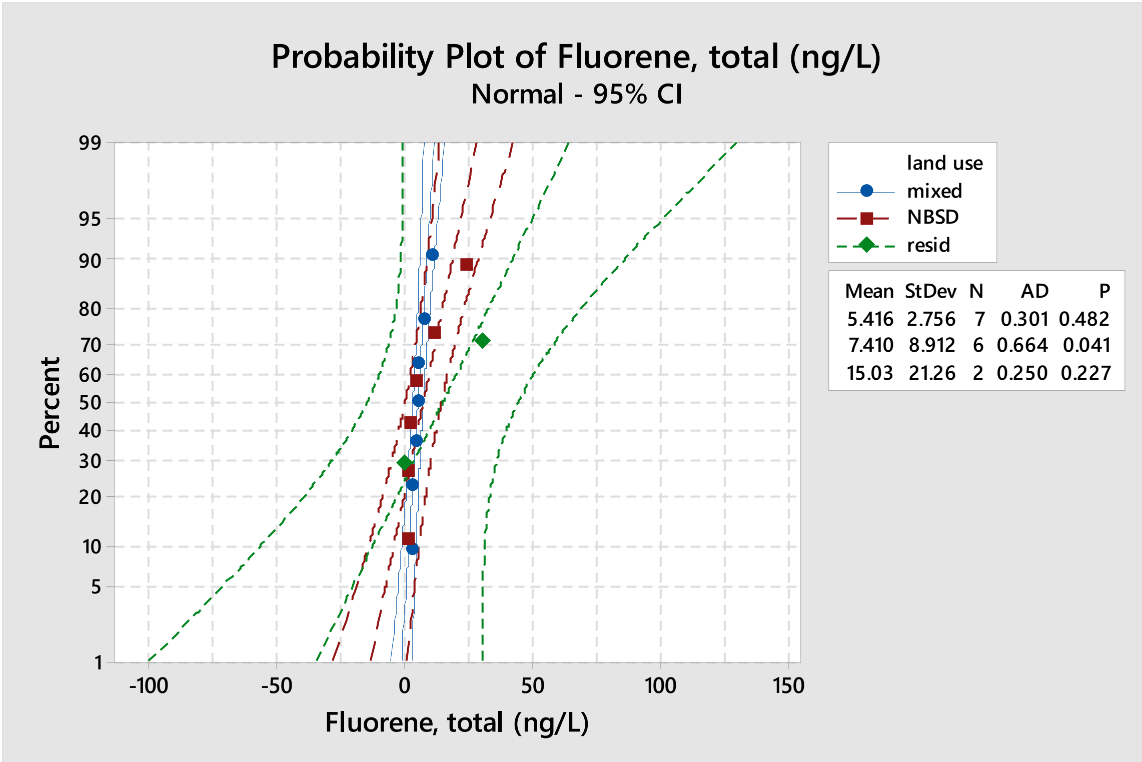
Kruskal-Wallis Test: Naphthalene, part strth (ug/kg) versus land use

```
Kruskal-Wallis Test on Naphthalene, part strth (ug/kg)

                          Ave
land use    N  Median   Rank       Z
mixed       7   23.52    6.3   -1.39
NBSD        6   54.54    9.8    1.30
resid       2   42.99    8.5    0.17
Overall    15            8.0

H = 2.06  DF = 2  P = 0.357

* NOTE * One or more small samples
```



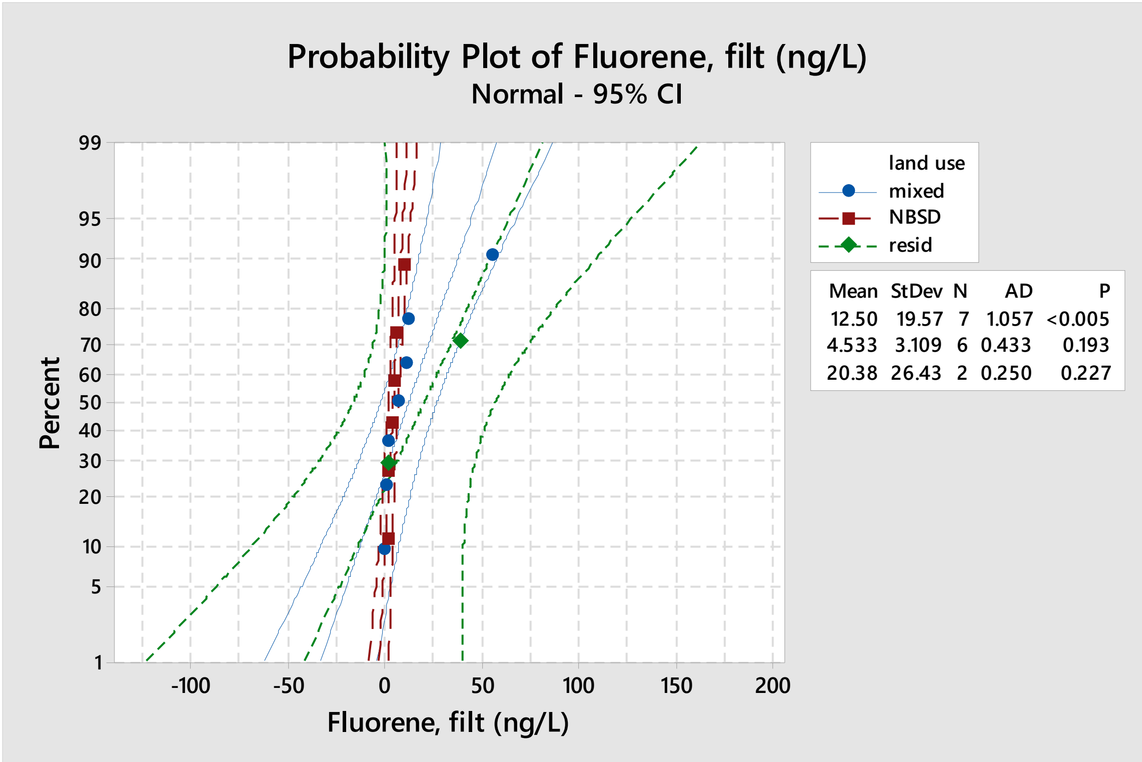
Kruskal-Wallis Test: Fluorene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Fluorene, total (ng/L)

                          Ave
land use    N  Median    Rank      Z
mixed       7   5.122     8.7   0.58
NBSD        6   3.240     7.2  -0.59
resid       2  15.030     8.0   0.00
Overall    15             8.0

H = 0.39  DF = 2  P = 0.824

* NOTE * One or more small samples
```



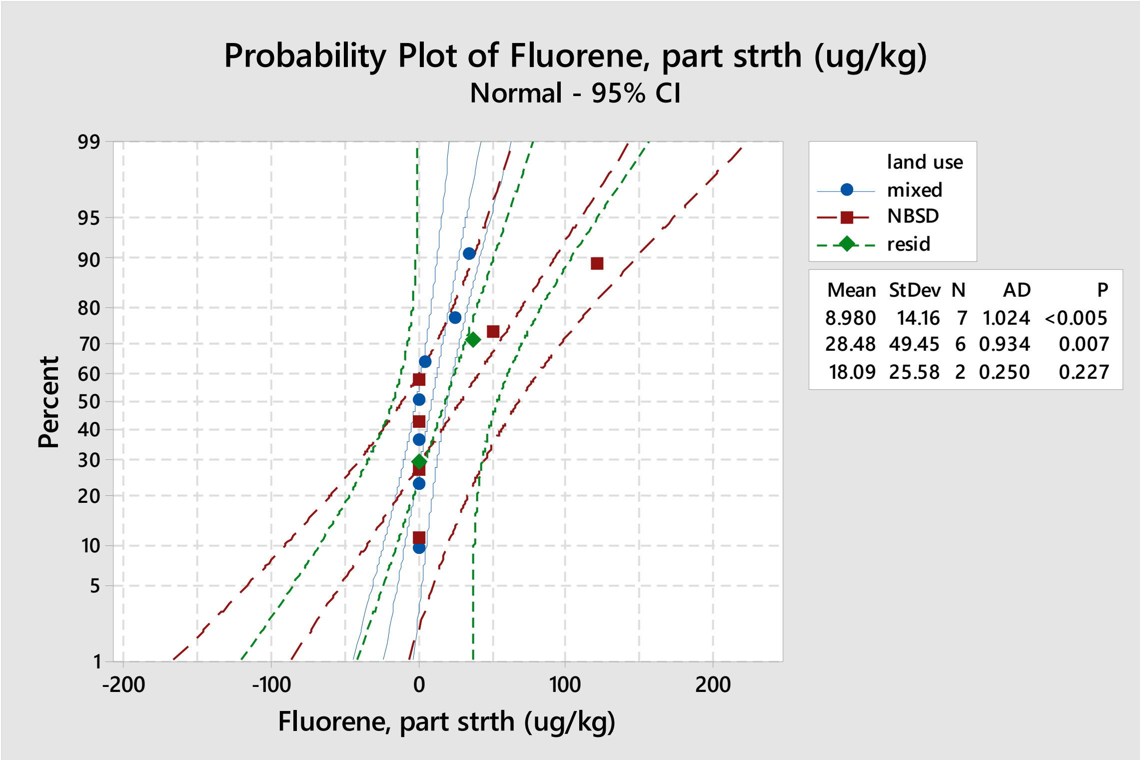
Kruskal-Wallis Test: Fluorene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Fluorene, filt (ng/L)

                         Ave
land use    N   Median  Rank       Z
mixed       7    6.679   8.0    0.00
NBSD        6    3.961   7.7   -0.24
resid       2   20.378   9.0    0.34
Overall    15            8.0

H = 0.13  DF = 2  P = 0.936

* NOTE * One or more small samples
```



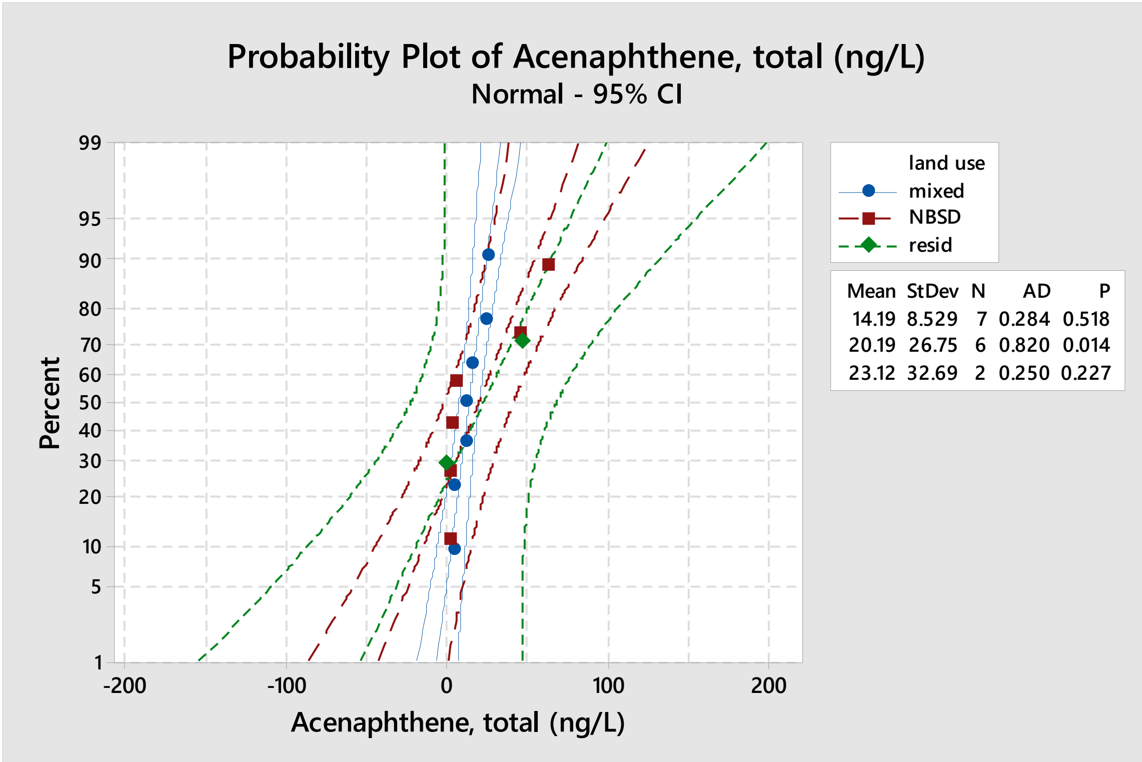
Kruskal-Wallis Test: Fluorene, part strth (ug/kg) versus land use

```
Kruskal-Wallis Test on Fluorene, part strth (ug/kg)

                               Ave
land use    N        Median   Rank       Z
mixed       7   0.000000000    7.6   -0.35
NBSD        6   0.000000000    8.2    0.12
resid       2   1.80852E+01    9.0    0.34
Overall    15                  8.0

H = 0.17  DF = 2  P = 0.917
H = 0.22  DF = 2  P = 0.896  (adjusted for ties)

* NOTE * One or more small samples
```



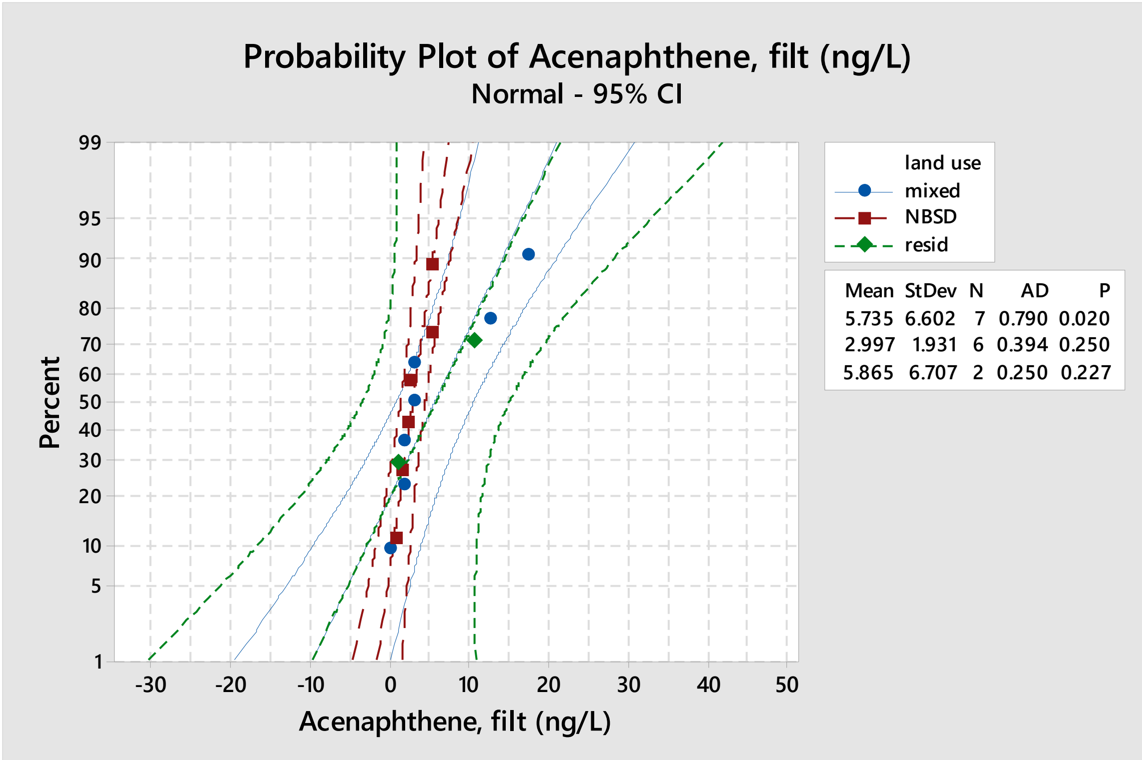
Kruskal-Wallis Test: Acenaphthene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Acenaphthene, total (ng/L)

                          Ave
land use    N  Median   Rank      Z
mixed       7  12.397    8.7   0.58
NBSD        6   4.444    7.3  -0.47
resid       2  23.118    7.5  -0.17
Overall    15            8.0

H = 0.34  DF = 2  P = 0.845

* NOTE * One or more small samples
```



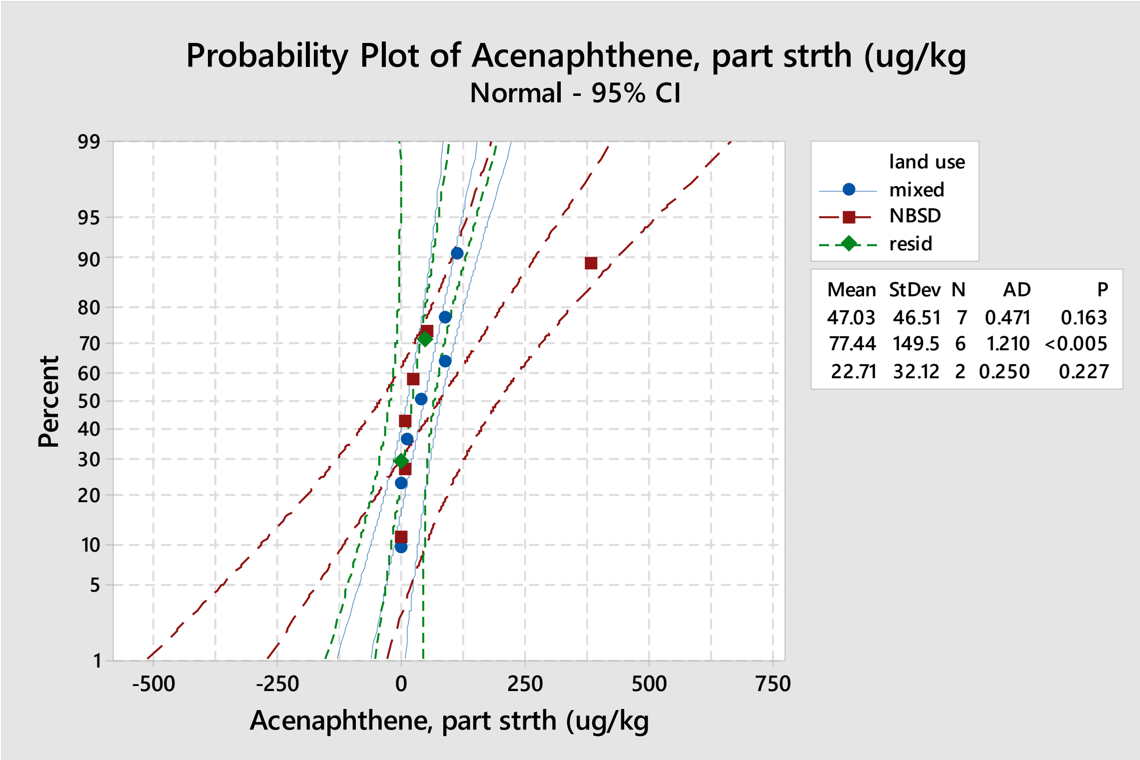
Kruskal-Wallis Test: Acenaphthene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Acenaphthene, filt (ng/L)

                         Ave
land use    N  Median   Rank       Z
mixed       7   3.077    8.6    0.46
NBSD        6   2.513    7.3   -0.47
resid       2   5.865    8.0    0.00
Overall    15            8.0

H = 0.25  DF = 2  P = 0.884

* NOTE * One or more small samples
```



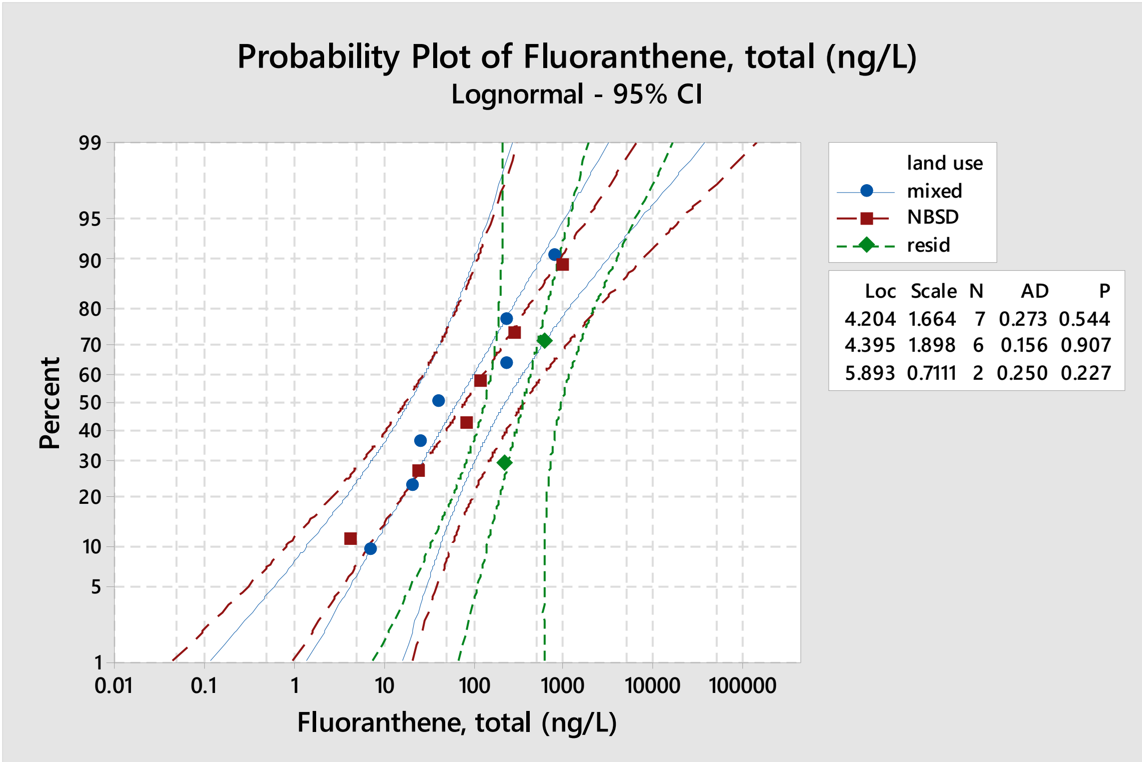
Kruskal-Wallis Test: Acenaphthene, part strth (ug/kg versus land use

```
Kruskal-Wallis Test on Acenaphthene, part strth (ug/kg

                           Ave
land use    N  Median   Rank       Z
mixed       7   37.53    8.4    0.35
NBSD        6   13.59    8.2    0.12
resid       2   22.71    6.0   -0.68
Overall    15            8.0

H = 0.47  DF = 2  P = 0.790
H = 0.48  DF = 2  P = 0.788  (adjusted for ties)

* NOTE * One or more small samples
```



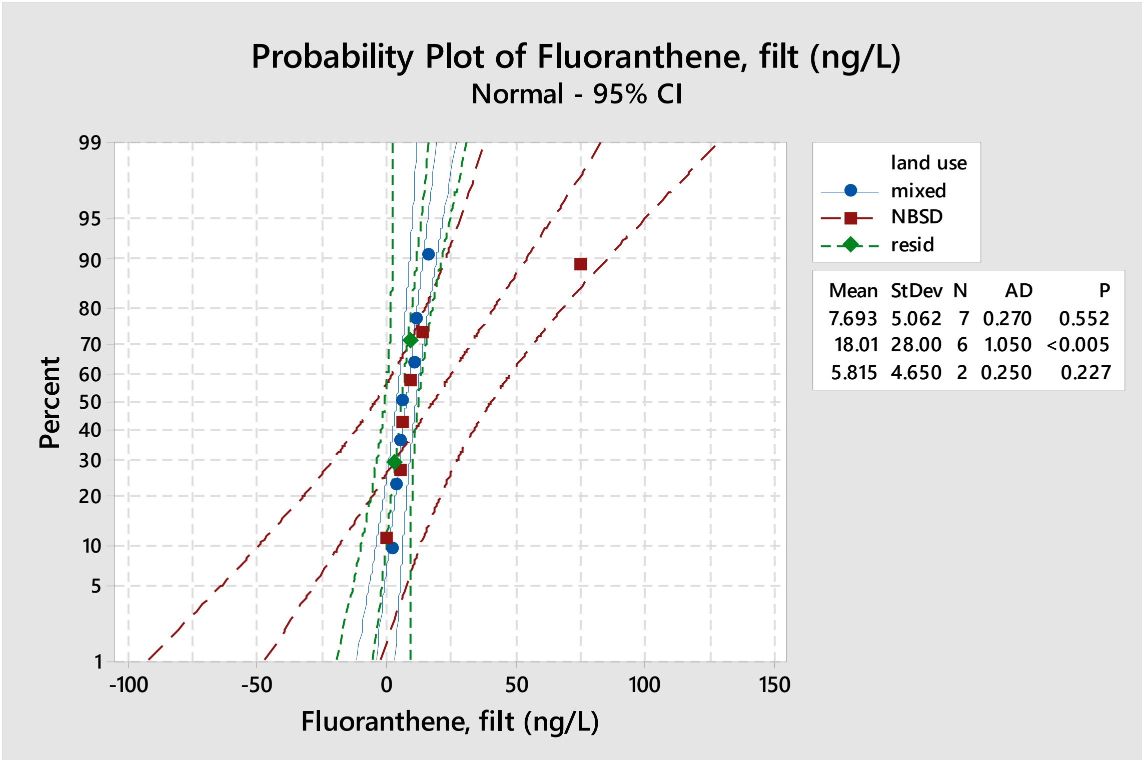
Kruskal-Wallis Test: Fluoranthene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Fluoranthene, total (ng/L)

land use    N   Median  Ave Rank      Z
mixed       7    41.03       7.3  -0.58
NBSD        6   101.72       7.8  -0.12
resid       2   409.18      11.0   1.02
Overall    15                8.0

H = 1.09  DF = 2  P = 0.581

* NOTE * One or more small samples
```



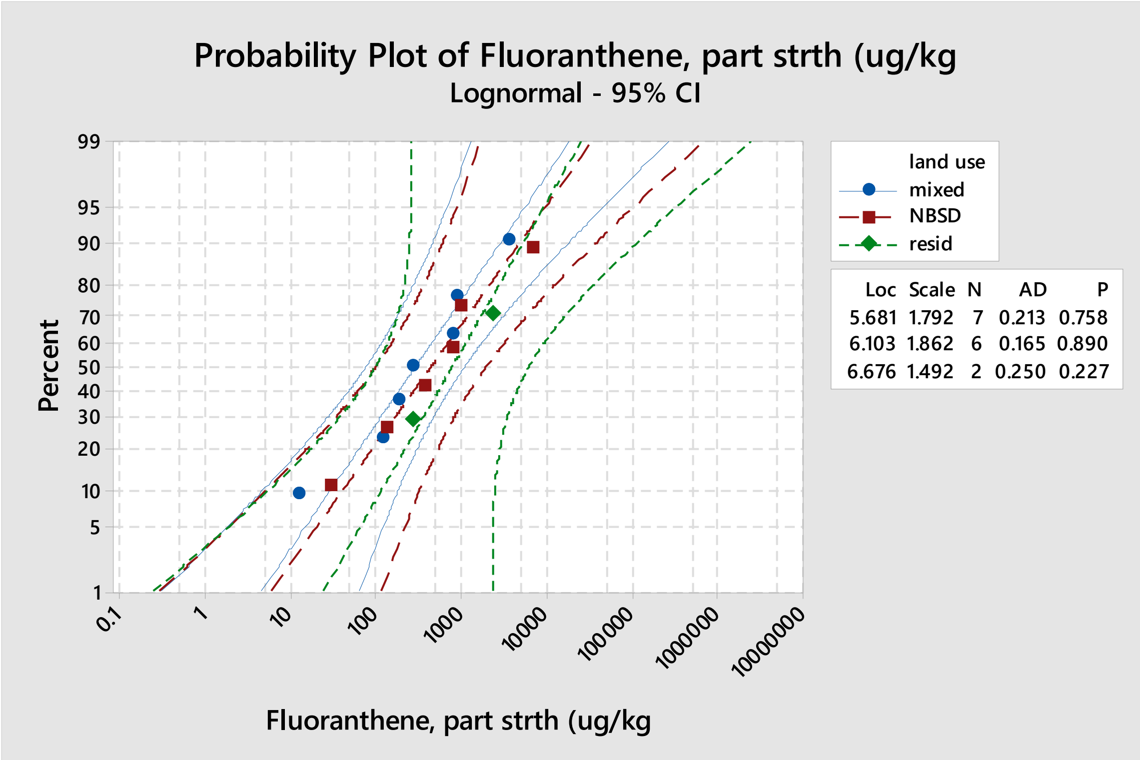
Kruskal-Wallis Test: Fluoranthene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Fluoranthene, filt (ng/L)

                         Ave
land use    N  Median   Rank       Z
mixed       7   5.652    7.9   -0.12
NBSD        6   7.416    8.8    0.59
resid       2   5.815    6.0   -0.68
Overall    15            8.0

H = 0.62  DF = 2  P = 0.735

* NOTE * One or more small samples
```



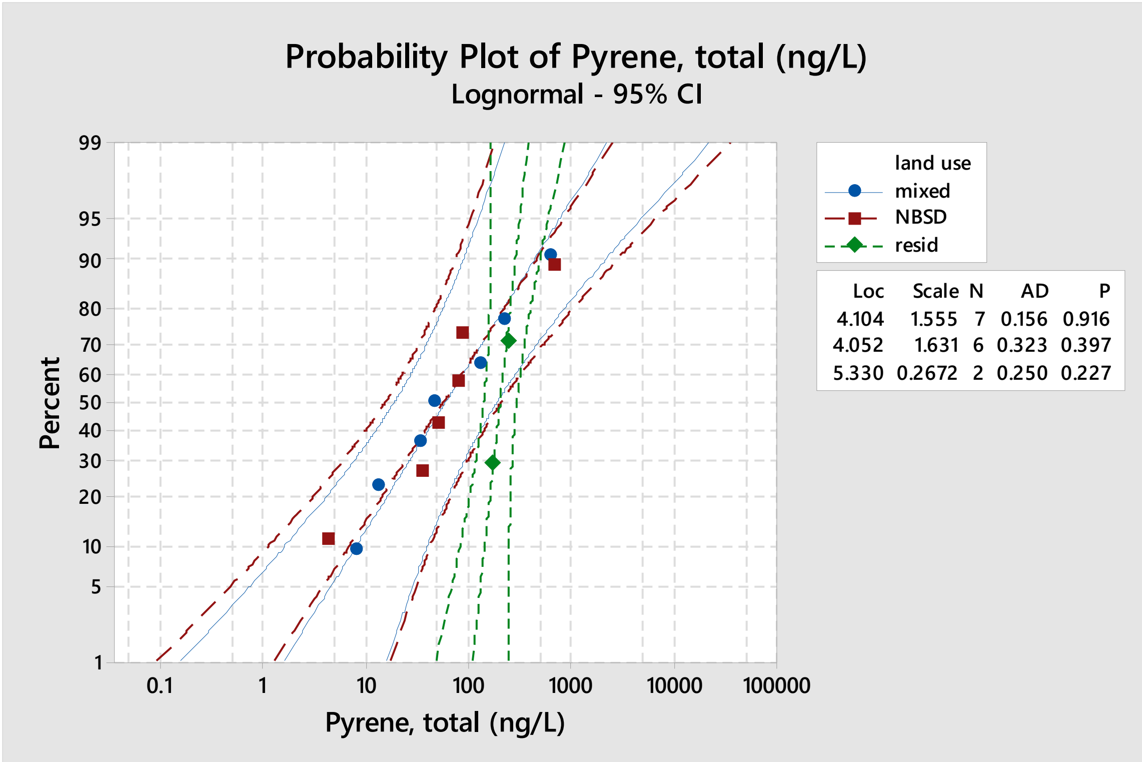
Kruskal-Wallis Test: Fluoranthene, part strth (ug/kg versus land use

```
Kruskal-Wallis Test on Fluoranthene, part strth (ug/kg

land use    N  Median  Ave Rank      Z
mixed       7   274.3       7.0  -0.81
NBSD        6   590.6       8.5   0.35
resid       2  1276.8      10.0   0.68
Overall    15               8.0

H = 0.82  DF = 2  P = 0.662

* NOTE * One or more small samples
```



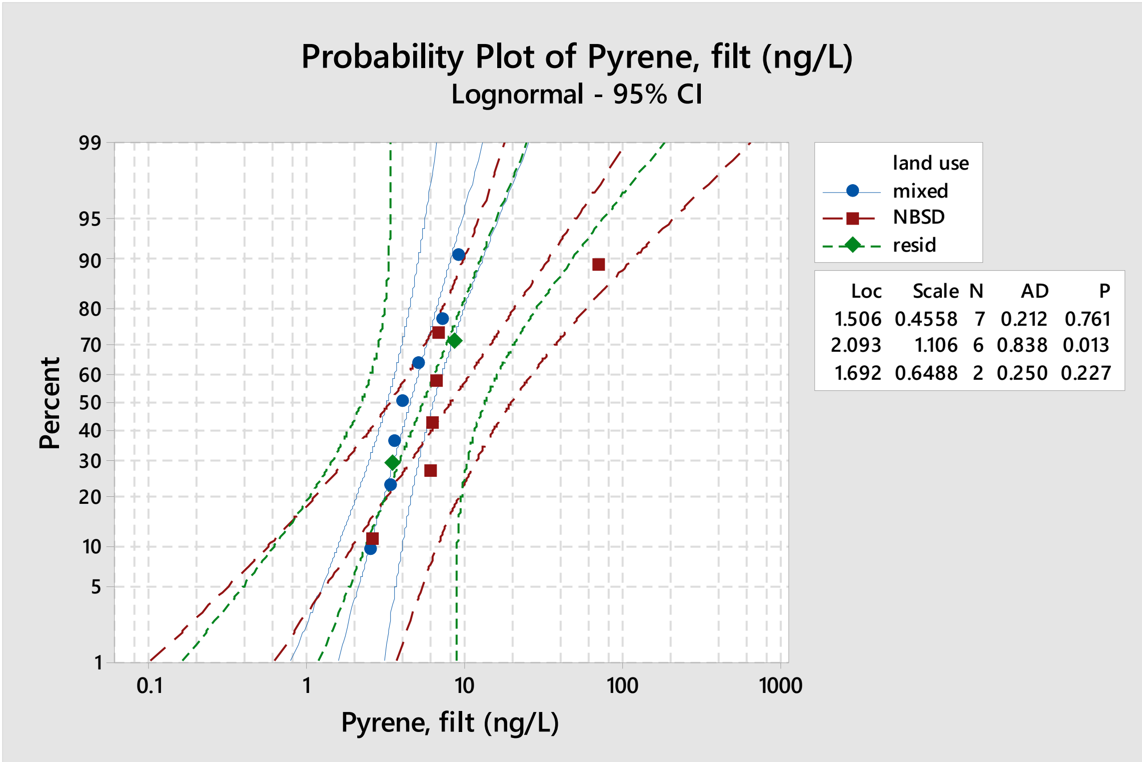
Kruskal-Wallis Test: Pyrene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Pyrene, total (ng/L)

land use    N  Median  Ave Rank      Z
mixed       7   47.25       7.3  -0.58
NBSD        6   64.96       7.5  -0.35
resid       2  210.12      12.0   1.36
Overall    15               8.0

H = 1.85  DF = 2  P = 0.396

* NOTE * One or more small samples
```



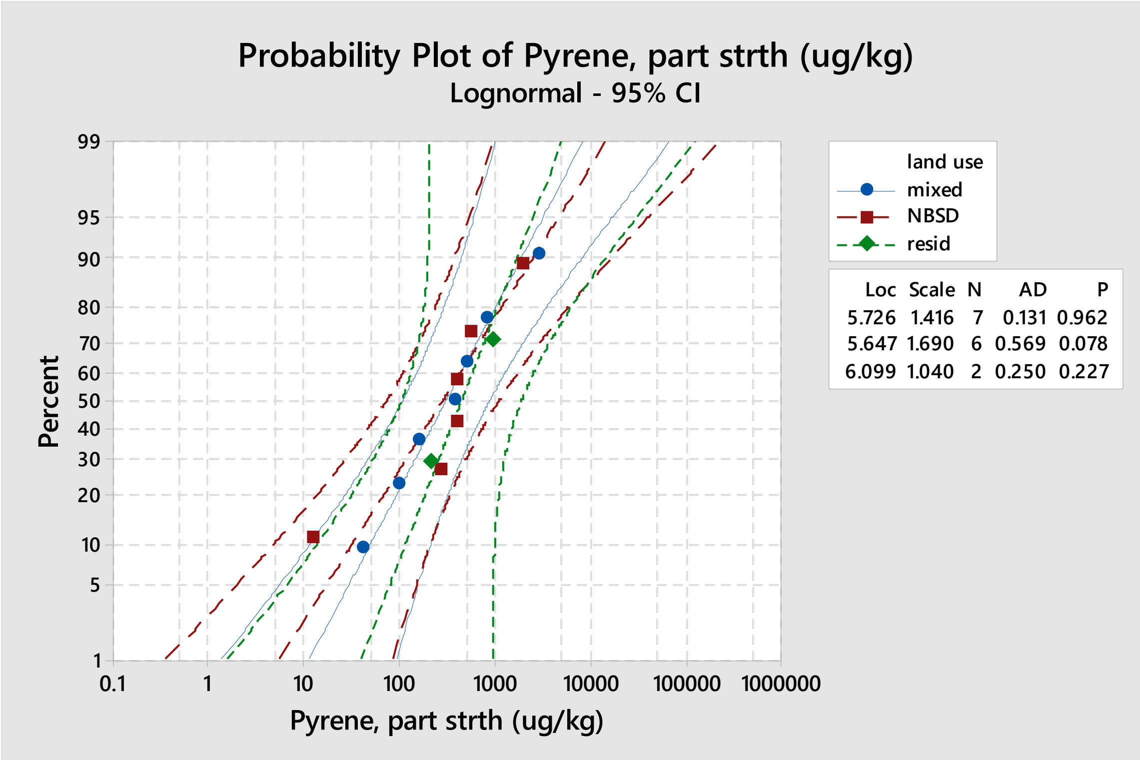
Kruskal-Wallis Test: Pyrene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Pyrene, filt (ng/L)

                        Ave
land use    N  Median  Rank       Z
mixed       7   4.011   6.9   -0.93
NBSD        6   6.293   9.2    0.82
resid       2   6.012   8.5    0.17
Overall    15           8.0

H = 0.89  DF = 2  P = 0.641

* NOTE * One or more small samples
```



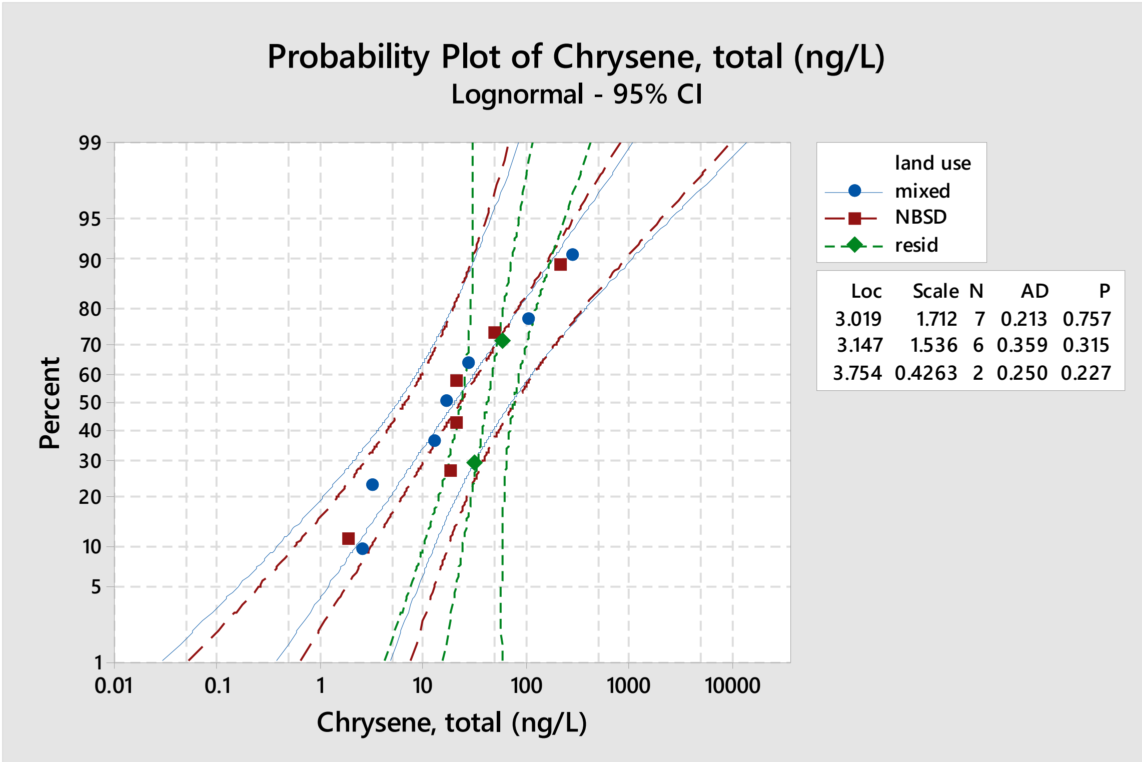
Kruskal-Wallis Test: Pyrene, part strth (ug/kg) versus land use

```
Kruskal-Wallis Test on Pyrene, part strth (ug/kg)

                          Ave
land use    N  Median   Rank       Z
mixed       7   371.4    7.6   -0.35
NBSD        6   389.4    8.2    0.12
resid       2   571.4    9.0    0.34
Overall    15            8.0

H = 0.17  DF = 2  P = 0.917

* NOTE * One or more small samples
```



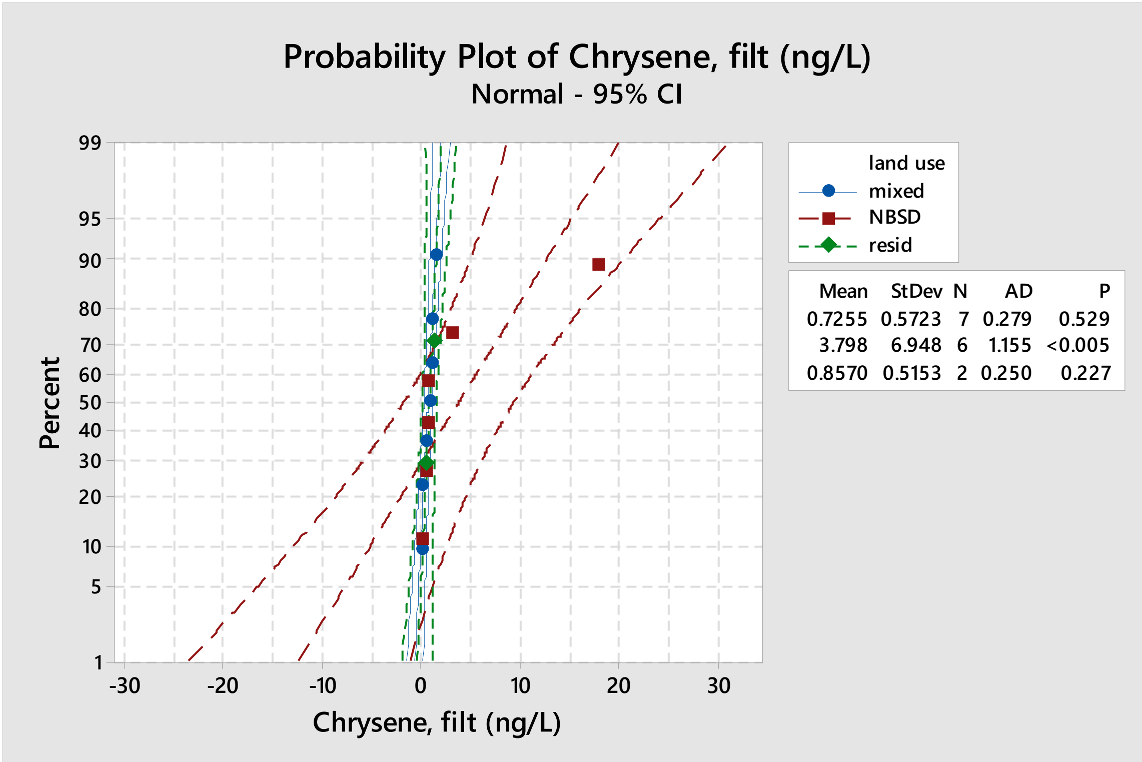
Kruskal-Wallis Test: Chrysene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Chrysene, total (ng/L)

land use    N  Median  Ave Rank      Z
mixed       7   16.53       7.3  -0.58
NBSD        6   20.97       7.8  -0.12
resid       2   44.66      11.0   1.02
Overall    15               8.0

H = 1.09  DF = 2  P = 0.581

* NOTE * One or more small samples
```



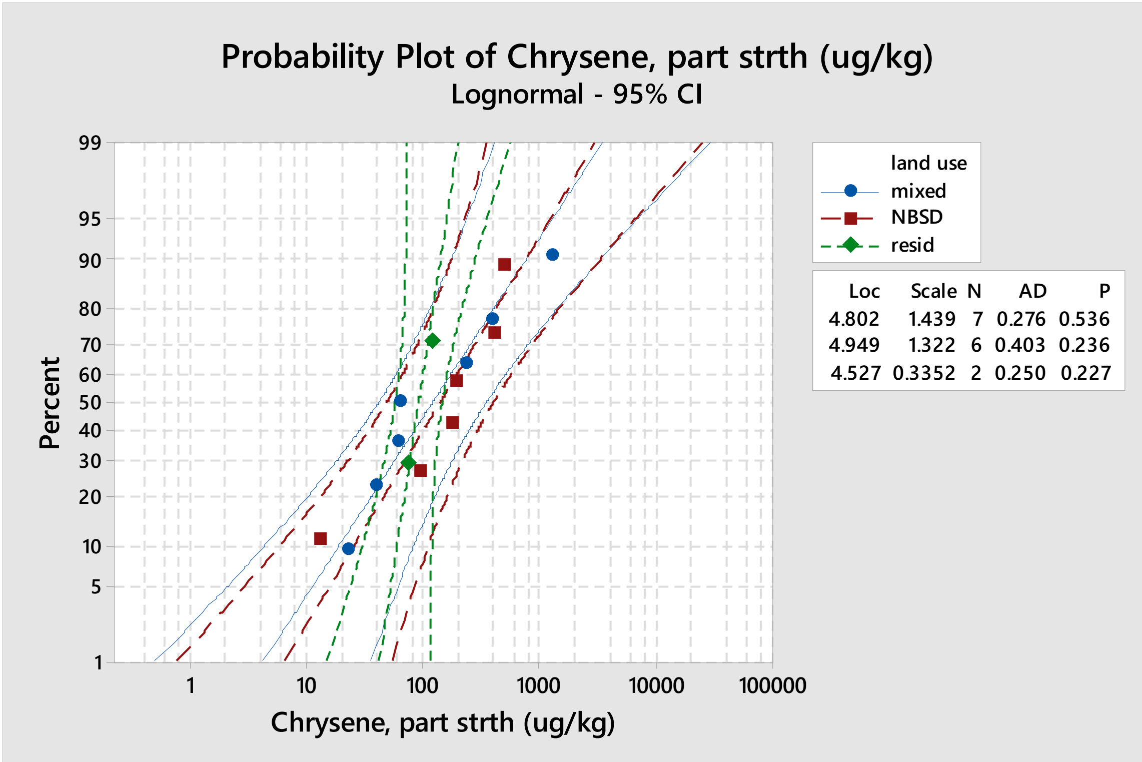
Kruskal-Wallis Test: Chrysene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Chrysene, filt (ng/L)

                          Ave
land use     N  Median   Rank       Z
mixed        7  0.8799    7.6   -0.35
NBSD         6  0.7236    8.3    0.24
resid        2  0.8570    8.5    0.17
Overall     15            8.0

H = 0.12  DF = 2  P = 0.941
H = 0.12  DF = 2  P = 0.940  (adjusted for ties)

* NOTE * One or more small samples
```



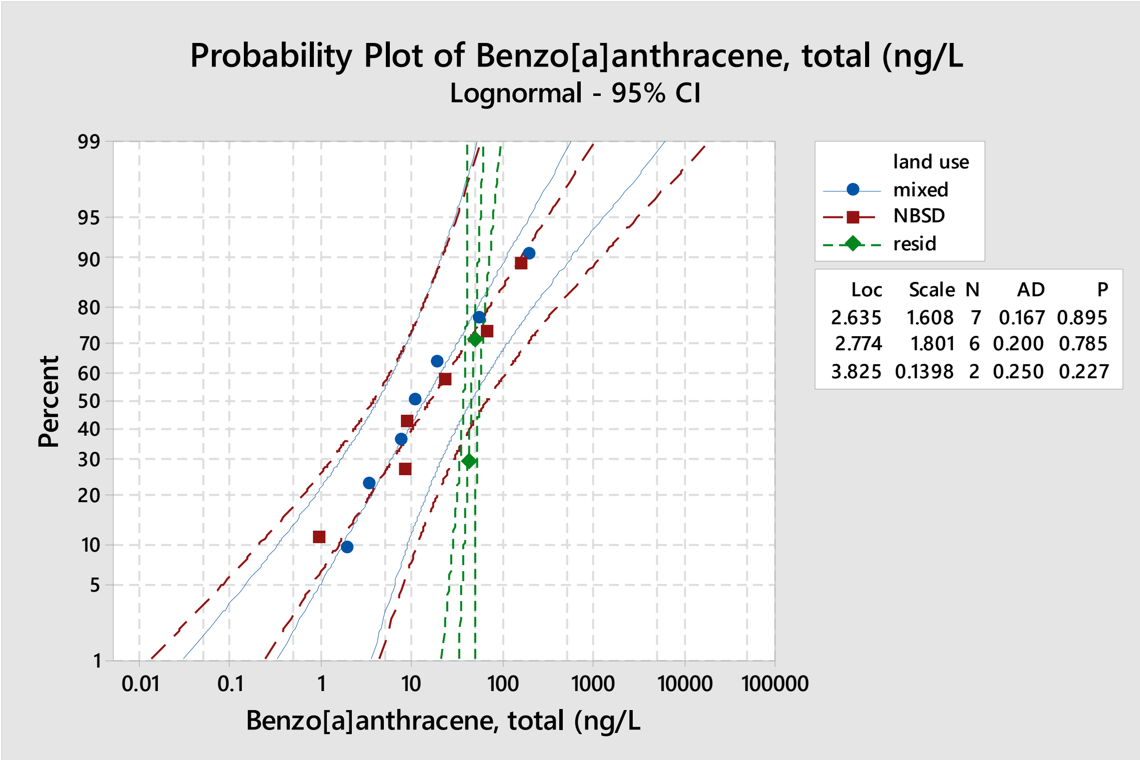
Kruskal-Wallis Test: Chrysene, part strth (ug/kg) versus land use

```
Kruskal-Wallis Test on Chrysene, part strth (ug/kg)

                              Ave
land use     N  Median   Rank       Z
mixed        7   63.49    7.4   -0.46
NBSD         6  182.56    9.0    0.71
resid        2   95.09    7.0   -0.34
Overall     15            8.0

H = 0.51  DF = 2  P = 0.773

* NOTE * One or more small samples
```



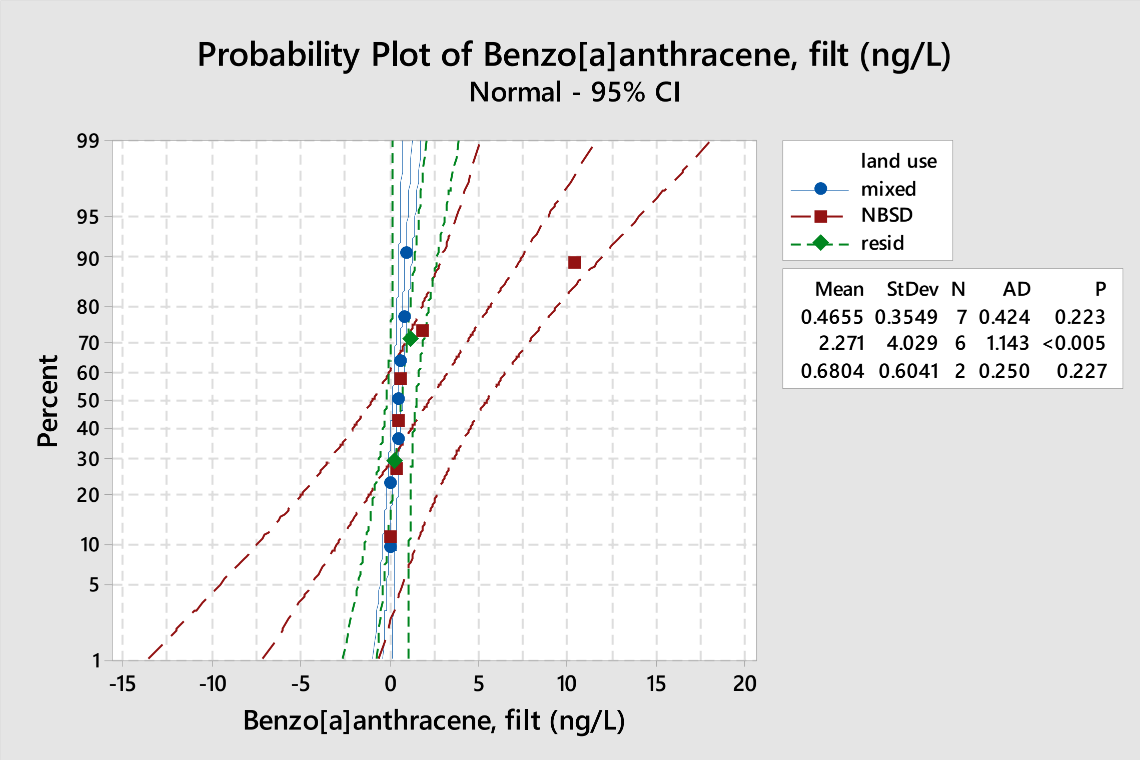
Kruskal-Wallis Test: Benzo[a]anthracene, total (ng/L versus land use

```
Kruskal-Wallis Test on Benzo[a]anthracene, total (ng/L

land use    N  Median  Ave Rank      Z
mixed       7   10.88       7.3  -0.58
NBSD        6   16.03       8.0   0.00
resid       2   46.05      10.5   0.85
Overall    15               8.0

H = 0.80  DF = 2  P = 0.669

* NOTE * One or more small samples
```



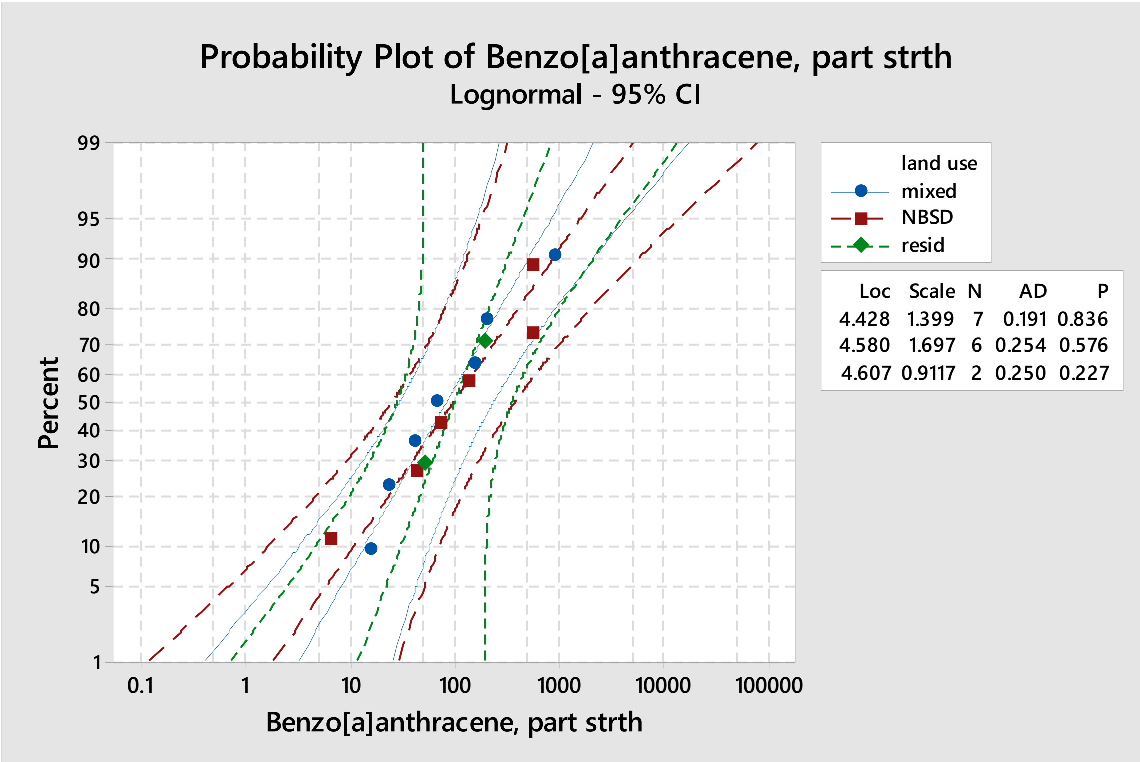
Kruskal-Wallis Test: Benzo[a]anthracene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Benzo[a]anthracene, filt (ng/L)

                          Ave
land use    N  Median   Rank       Z
mixed       7  0.5205    7.3   -0.58
NBSD        6  0.5175    8.7    0.47
resid       2  0.6804    8.5    0.17
Overall    15            8.0

H = 0.34  DF = 2  P = 0.845
H = 0.34  DF = 2  P = 0.844  (adjusted for ties)

* NOTE * One or more small samples
```



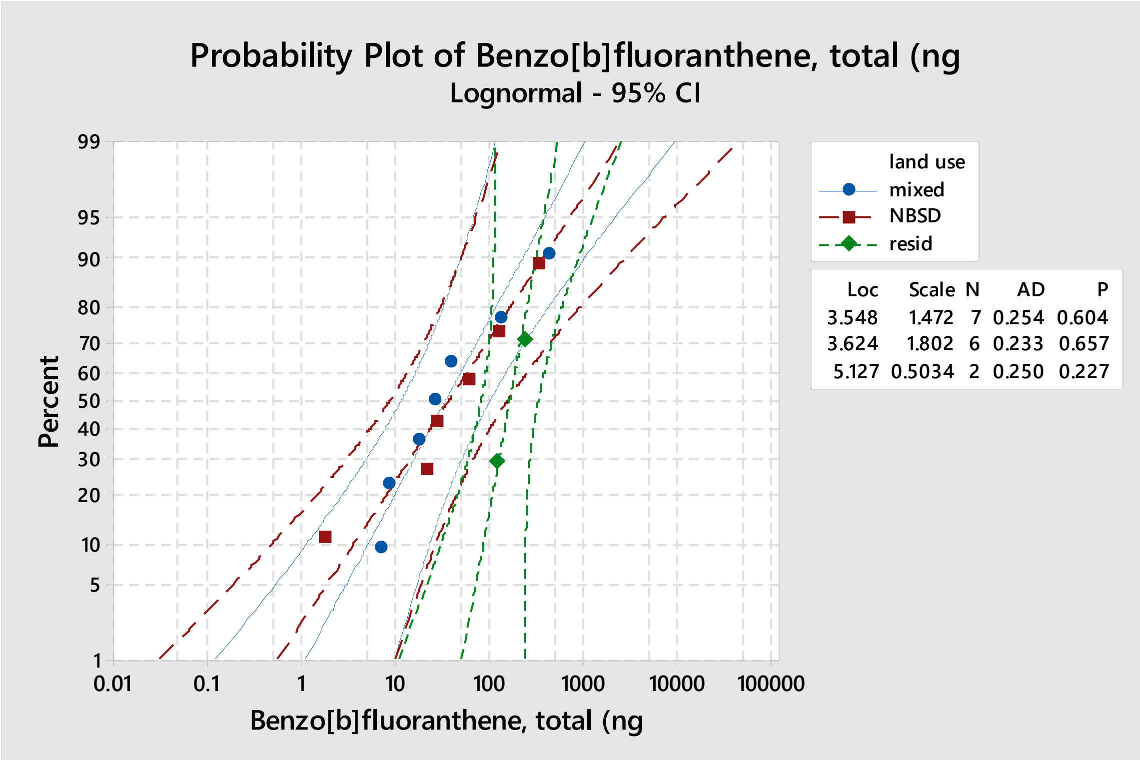
Kruskal-Wallis Test: Benzo[a]anthracene, part strth versus land use

```
Kruskal-Wallis Test on Benzo[a]anthracene, part strth

                        Ave
land use    N  Median  Rank       Z
mixed       7   66.10   7.6   -0.35
NBSD        6  103.90   8.3    0.24
resid       2  121.77   8.5    0.17
Overall    15           8.0

H = 0.12  DF = 2  P = 0.941

* NOTE * One or more small samples
```



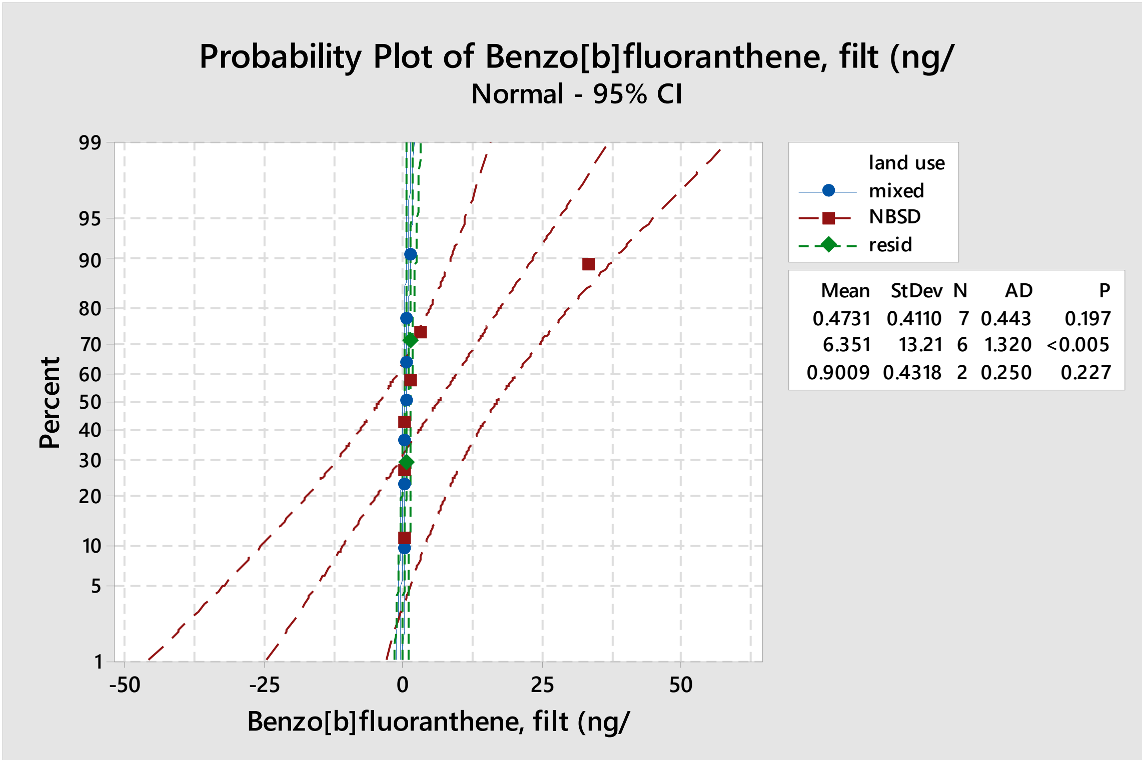
Kruskal-Wallis Test: Benzo[b]fluoranthene, total (ng versus land use

```
Kruskal-Wallis Test on Benzo[b]fluoranthene, total (ng

land use    N  Median  Ave Rank      Z
mixed       7   26.68       7.1  -0.69
NBSD        6   43.43       7.8  -0.12
resid       2  179.30      11.5   1.19
Overall    15               8.0

H = 1.49  DF = 2  P = 0.475

* NOTE * One or more small samples
```



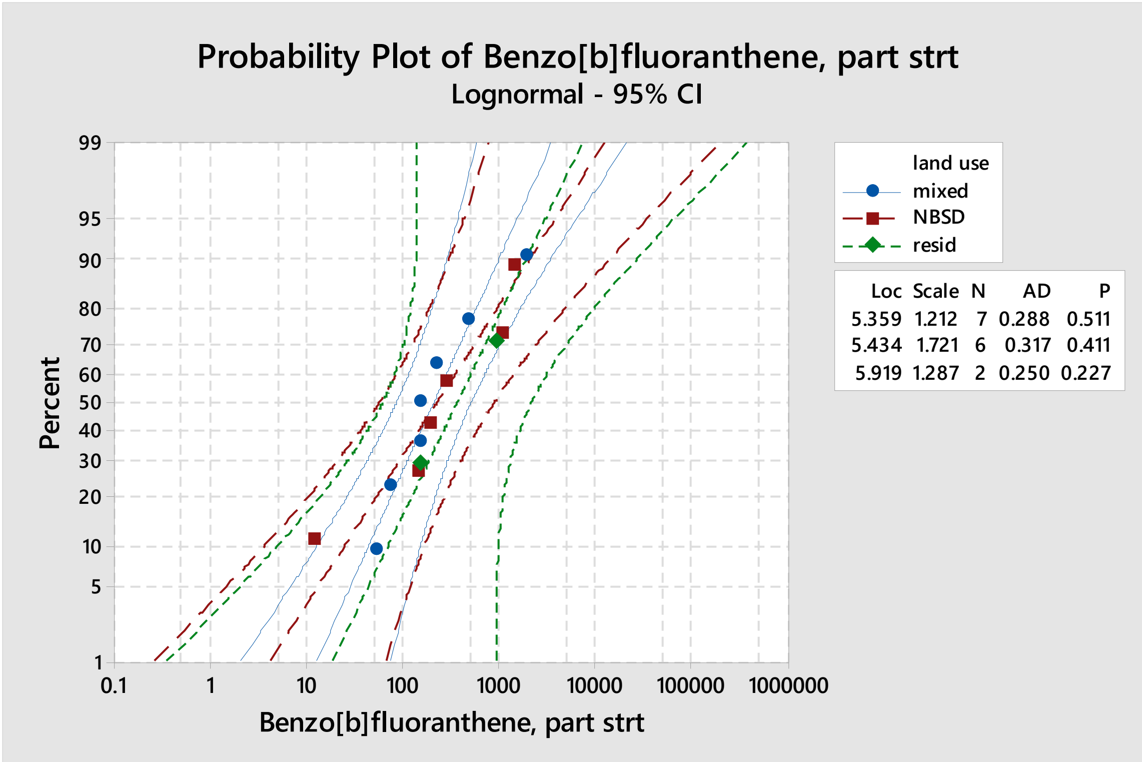
Kruskal-Wallis Test: Benzo[b]fluoranthene, filt (ng/ versus land use

```
Kruskal-Wallis Test on Benzo[b]fluoranthene, filt (ng/

land use    N  Median  Ave Rank      Z
mixed       7  0.4766       6.6  -1.10
NBSD        6  0.7781       8.8   0.53
resid       2  0.9009      10.5   0.85
Overall    15               8.0

H = 1.44  DF = 2  P = 0.487
H = 1.44  DF = 2  P = 0.487  (adjusted for ties)

* NOTE * One or more small samples
```



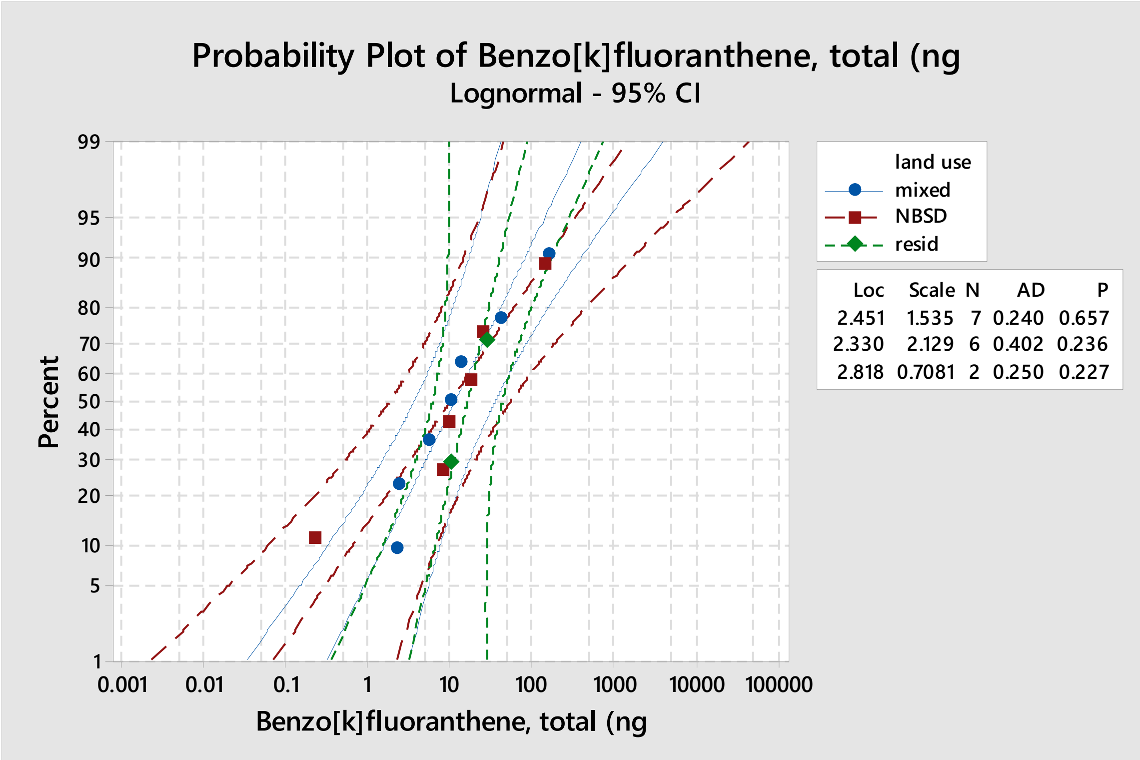
Kruskal-Wallis Test: Benzo[b]fluoranthene, part strt versus land use

```
Kruskal-Wallis Test on Benzo[b]fluoranthene, part strt

                          Ave
land use    N  Median   Rank      Z
mixed       7   154.9    7.6  -0.35
NBSD        6   234.6    8.3   0.24
resid       2   536.8    8.5   0.17
Overall    15            8.0

H = 0.12  DF = 2  P = 0.941

* NOTE * One or more small samples
```



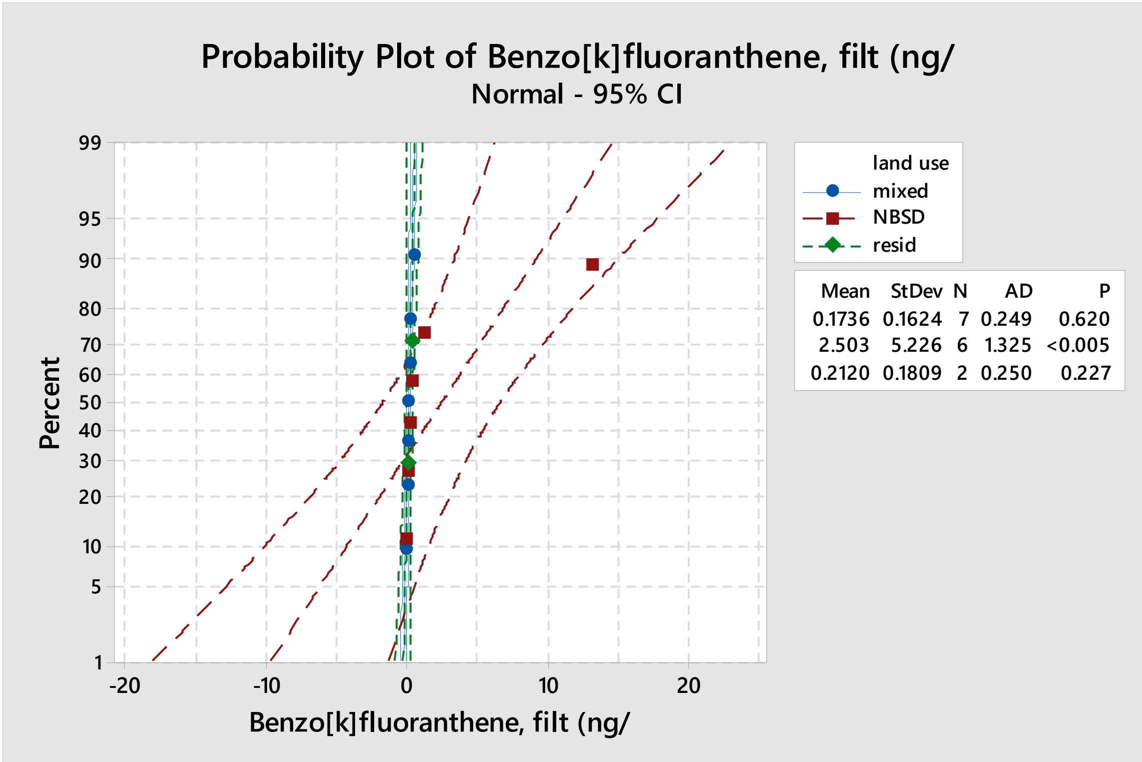
Kruskal-Wallis Test: Benzo[k]fluoranthene, total (ng versus land use

```
Kruskal-Wallis Test on Benzo[k]fluoranthene, total (ng

land use    N  Median  Ave Rank      Z
mixed       7   10.06       7.6  -0.35
NBSD        6   13.59       7.8  -0.12
resid       2   18.89      10.0   0.68
Overall    15               8.0

H = 0.47  DF = 2  P = 0.790

* NOTE * One or more small samples
```



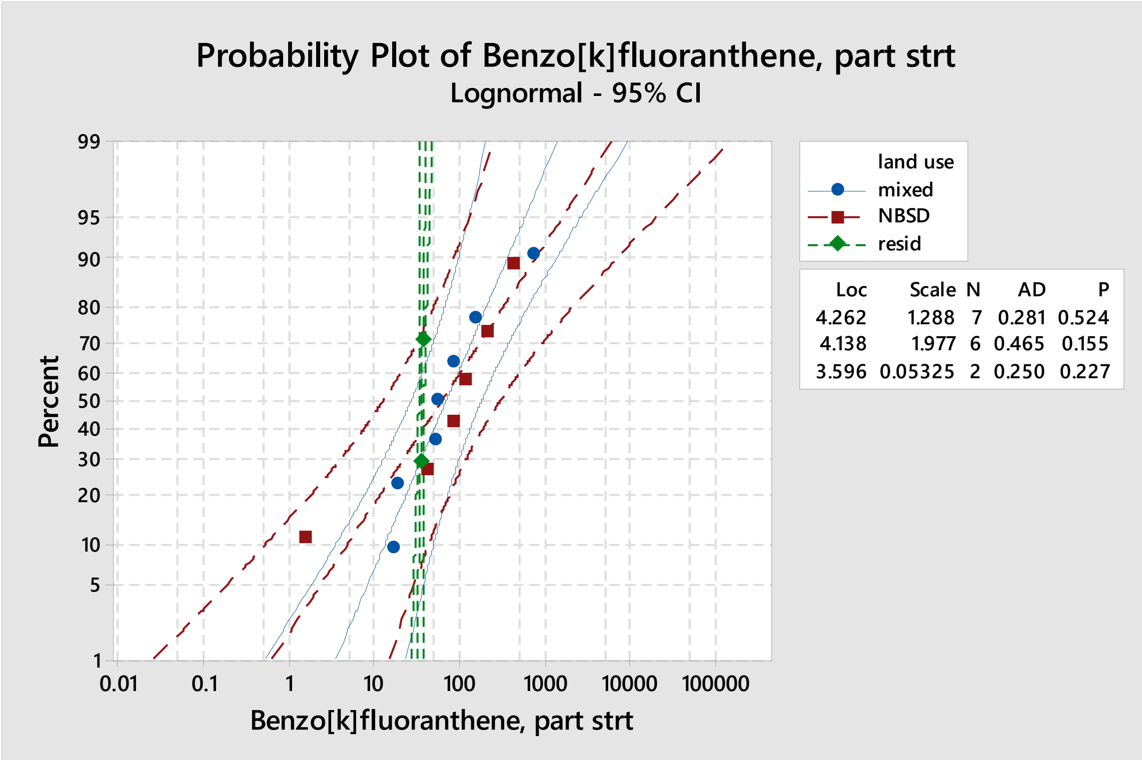
Kruskal-Wallis Test: Benzo[k]fluoranthene, filt (ng/ versus land use

```
Kruskal-Wallis Test on Benzo[k]fluoranthene, filt (ng/

                            Ave
land use    N  Median    Rank       Z
mixed       7  0.1639     6.9   -0.87
NBSD        6  0.2805     9.1    0.77
resid       2  0.2120     8.5    0.17
Overall    15             8.0

H = 0.78  DF = 2  P = 0.677
H = 0.78  DF = 2  P = 0.677  (adjusted for ties)

* NOTE * One or more small samples
```



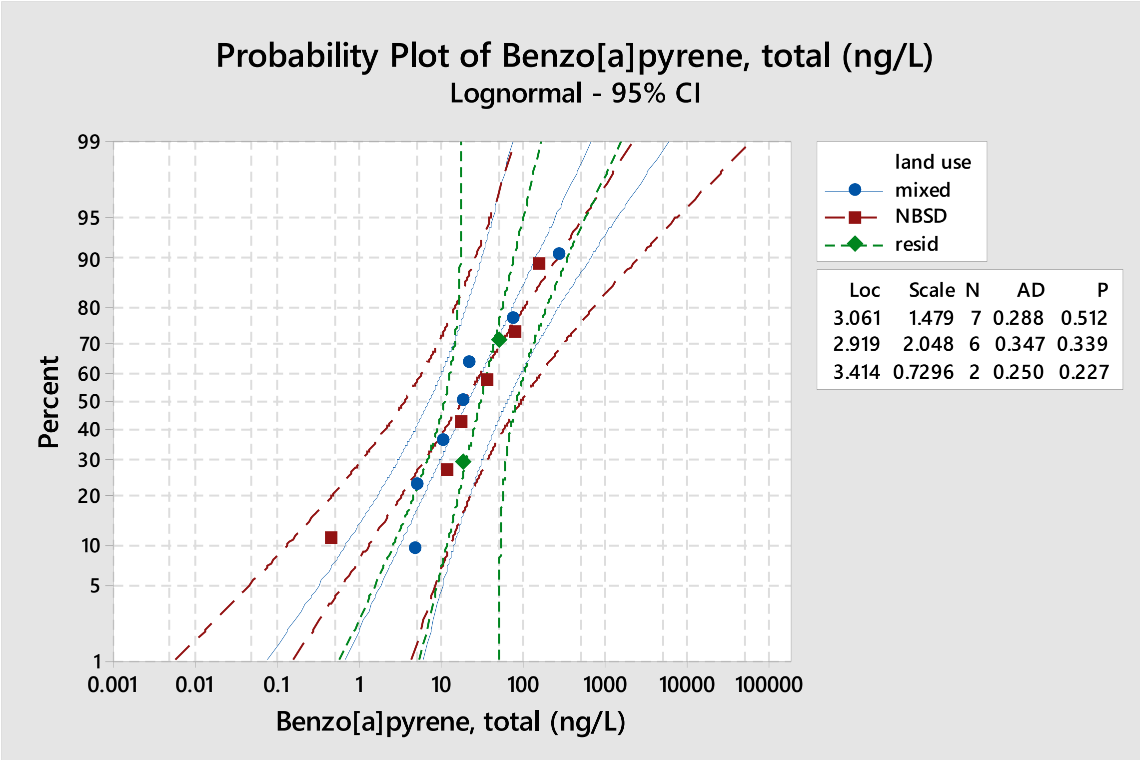
Kruskal-Wallis Test: Benzo[k]fluoranthene, part strt versus land use

```
Kruskal-Wallis Test on Benzo[k]fluoranthene, part strt

                             Ave
land use     N  Median    Rank       Z
mixed        7   55.80     8.0    0.00
NBSD         6  102.48     9.2    0.82
resid        2   36.48     4.5   -1.19
Overall     15             8.0

H = 1.63  DF = 2  P = 0.442

* NOTE * One or more small samples
```



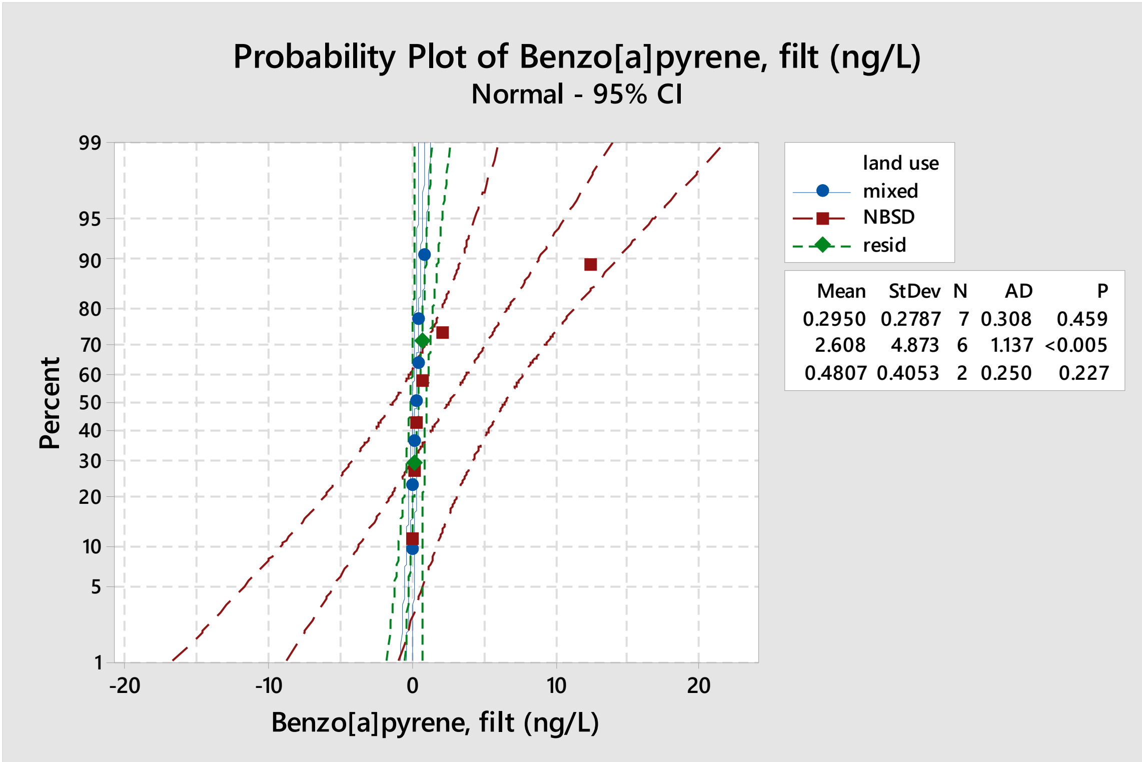
Kruskal-Wallis Test: Benzo[a]pyrene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Benzo[a]pyrene, total (ng/L)

                           Ave
land use    N  Median    Rank       Z
mixed       7   18.64     7.6   -0.35
NBSD        6   26.12     8.2    0.12
resid       2   34.53     9.0    0.34
Overall    15             8.0

H = 0.17  DF = 2  P = 0.917

* NOTE * One or more small samples
```



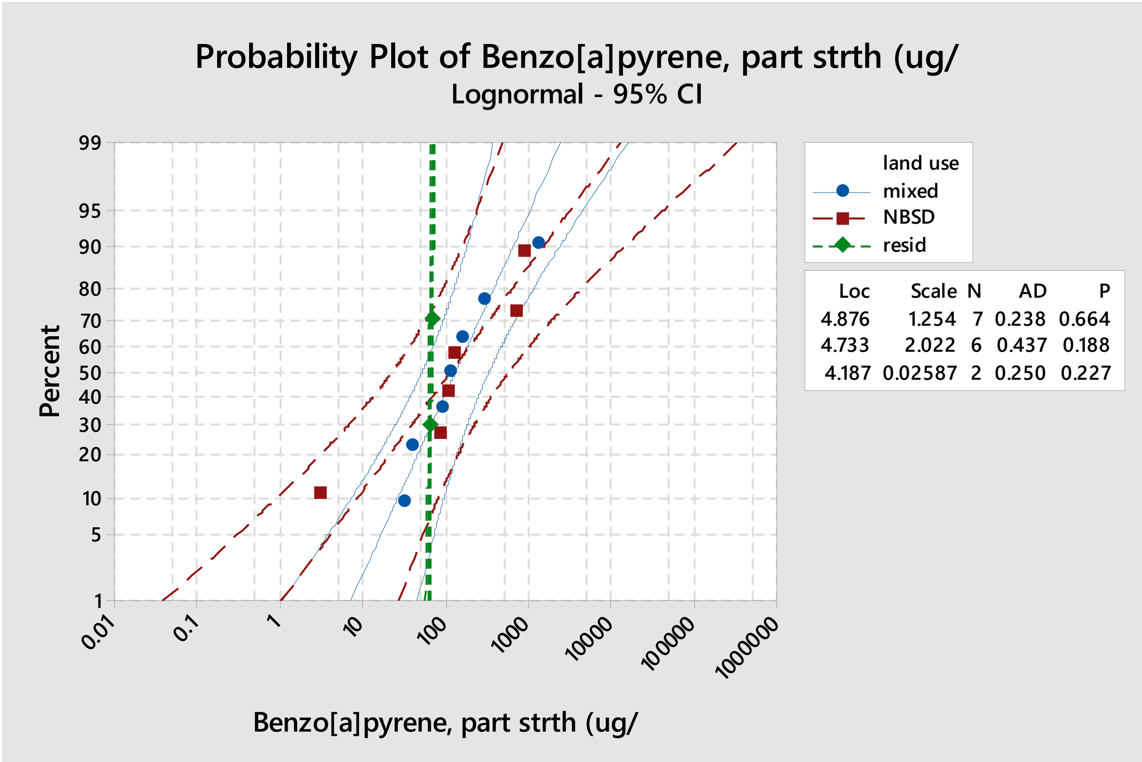
Kruskal-Wallis Test: Benzo[a]pyrene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Benzo[a]pyrene, filt (ng/L)

                           Ave
land use    N  Median    Rank       Z
mixed       7  0.2350     6.8   -0.98
NBSD        6  0.4559     9.1    0.77
resid       2  0.4807     9.0    0.34
Overall    15             8.0

H = 0.97  DF = 2  P = 0.616
H = 0.97  DF = 2  P = 0.616  (adjusted for ties)

* NOTE * One or more small samples
```



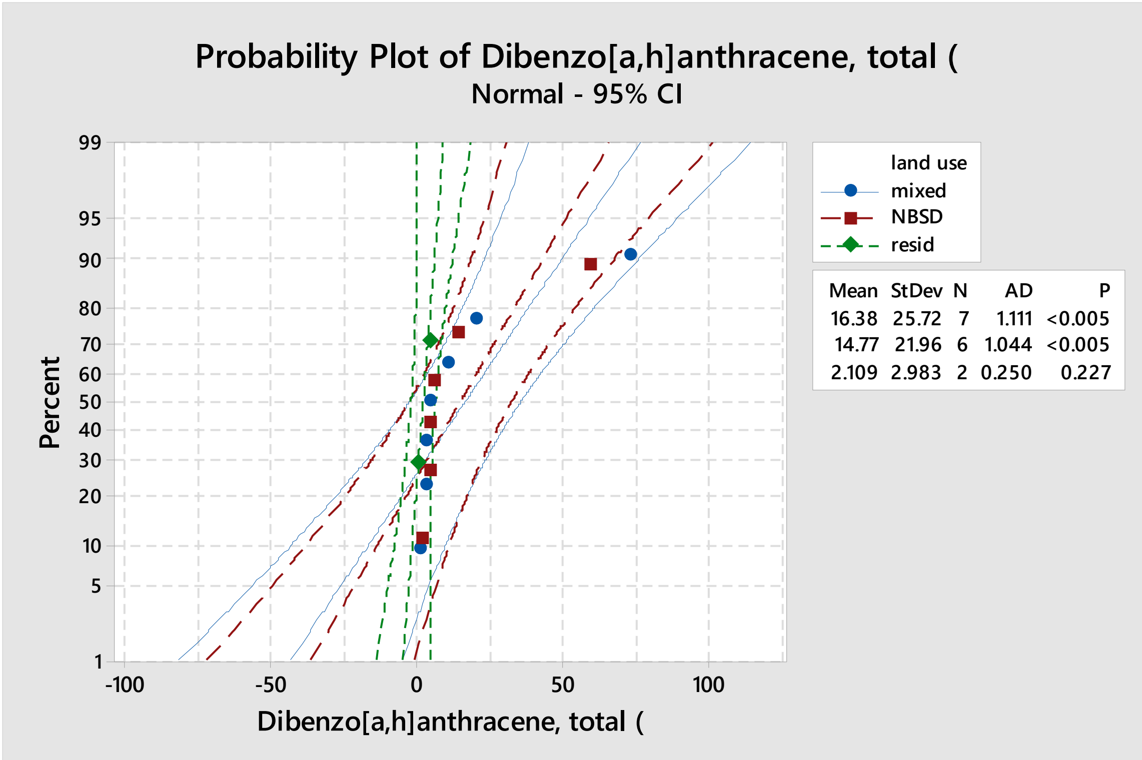
Kruskal-Wallis Test: Benzo[a]pyrene, part strth (ug/ versus land use

```
Kruskal-Wallis Test on Benzo[a]pyrene, part strth (ug/

                        Ave
land use    N  Median  Rank       Z
mixed       7  110.91   8.4    0.35
NBSD        6  117.98   8.7    0.47
resid       2   65.86   4.5   -1.19
Overall    15           8.0

H = 1.42  DF = 2  P = 0.491

* NOTE * One or more small samples
```



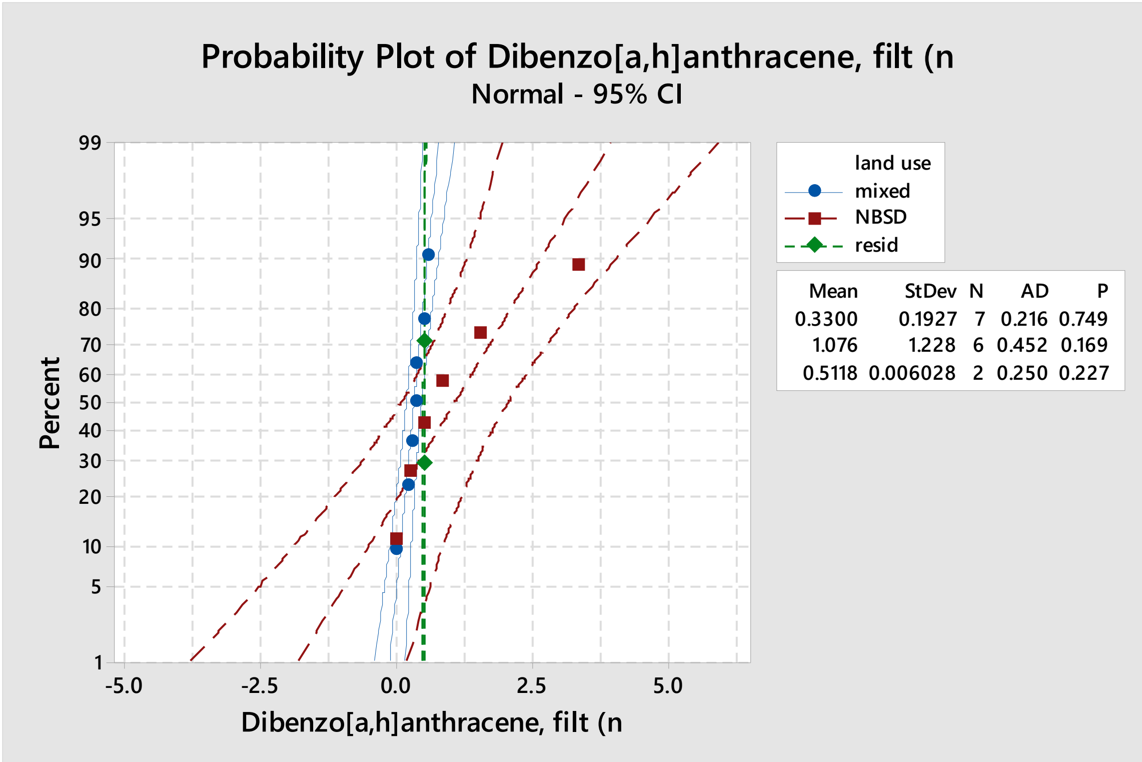
Kruskal-Wallis Test: Dibenzo[a,h]anthracene, total (versus land use

```
Kruskal-Wallis Test on Dibenzo[a,h]anthracene, total (

                             Ave
land use     N  Median   Rank       Z
mixed        7   4.457    8.4    0.35
NBSD         6   5.034    8.7    0.47
resid        2   2.109    4.5   -1.19
Overall     15            8.0

H = 1.42  DF = 2  P = 0.491

* NOTE * One or more small samples
```



Kruskal-Wallis Test: Dibenzo[a,h]anthracene, filt (n versus land use

```
Kruskal-Wallis Test on Dibenzo[a,h]anthracene, filt (n

                         Ave
land use     N  Median  Rank       Z
mixed        7  0.3415   6.5   -1.22
NBSD         6  0.6680   9.3    0.88
resid        2  0.5118   9.5    0.51
Overall     15           8.0

H = 1.48  DF = 2  P = 0.477
H = 1.48  DF = 2  P = 0.476  (adjusted for ties)

* NOTE * One or more small samples
```



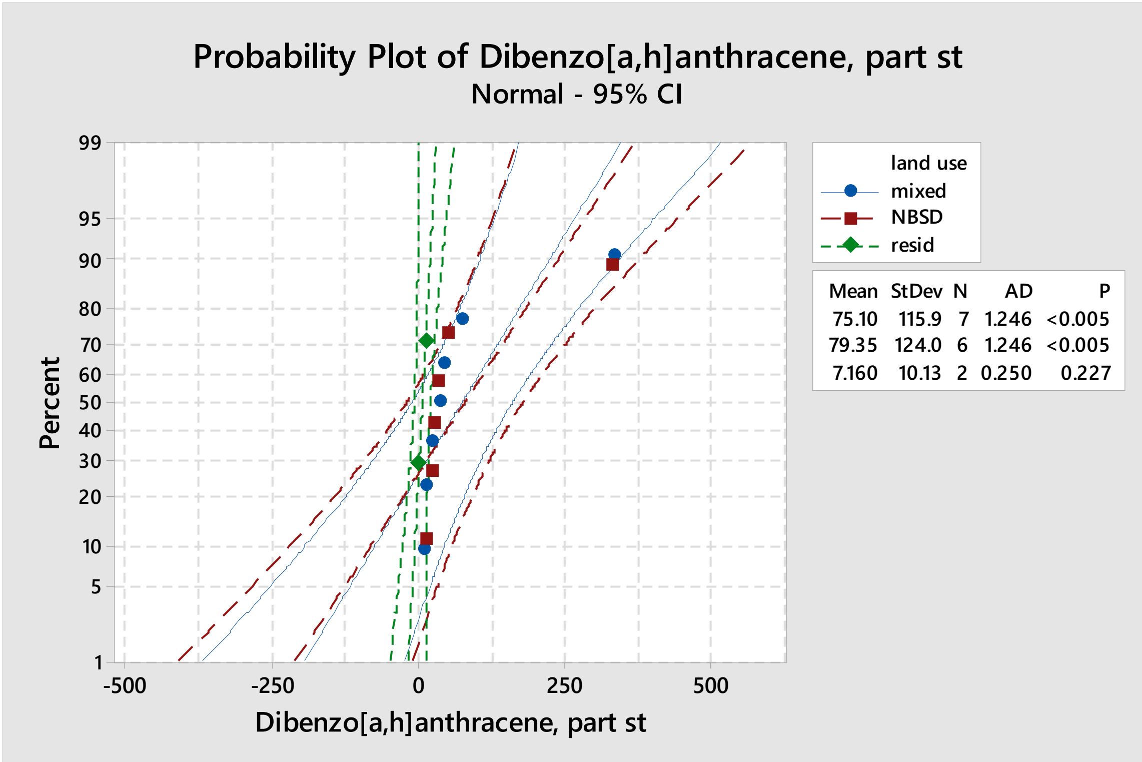
Kruskal-Wallis Test: Dibenzo[a,h]anthracene, part st versus land use

Kruskal-Wallis Test on Dibenzo[a,h]anthracene, part st

land use	N	Median	Ave Rank	Z
mixed	7	34.964	8.6	0.46
NBSD	6	30.050	9.0	0.71
resid	2	7.160	3.0	-1.70
Overall	15		8.0	

H = 2.91 DF = 2 P = 0.233

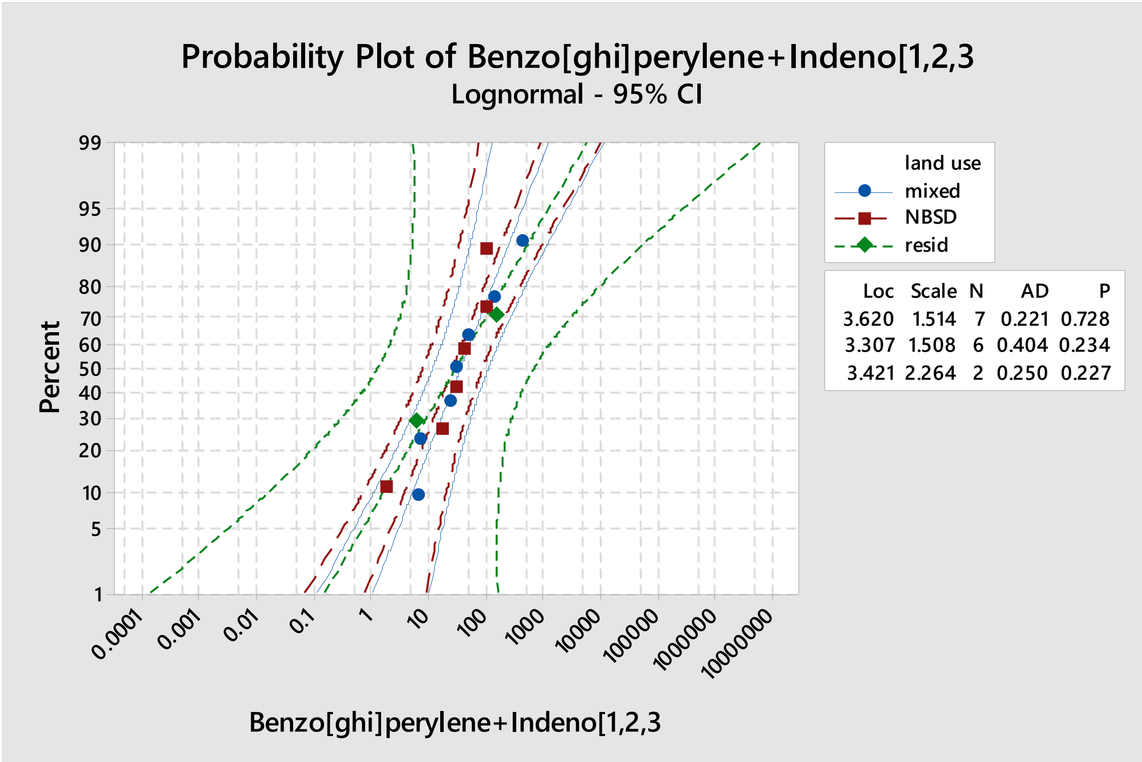
* NOTE * One or more small samples



Kruskal-Wallis Test: Benzo[ghi]perylene+Indeno[1,2,3 versus land use

TOTAL

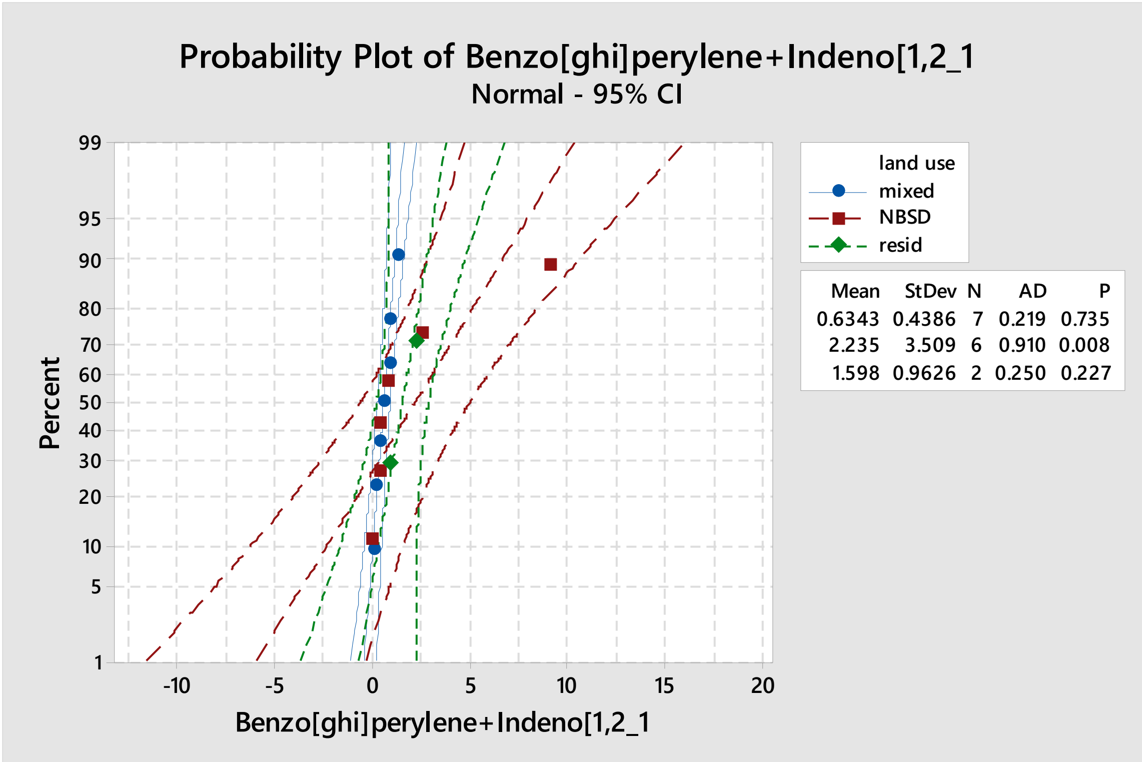
```
Kruskal-Wallis Test on Benzo[ghi]perylene+Indeno[1,2,3

                          Ave
land use    N   Median   Rank       Z
mixed       7    29.49    8.3    0.23
NBSD        6    36.85    7.7   -0.24
resid       2    78.93    8.0    0.00
Overall    15             8.0

H = 0.06  DF = 2  P = 0.970

* NOTE * One or more small samples
```



Kruskal-Wallis Test: Benzo[ghi]perylene+Indeno[1,2_1 versus land use

FILT

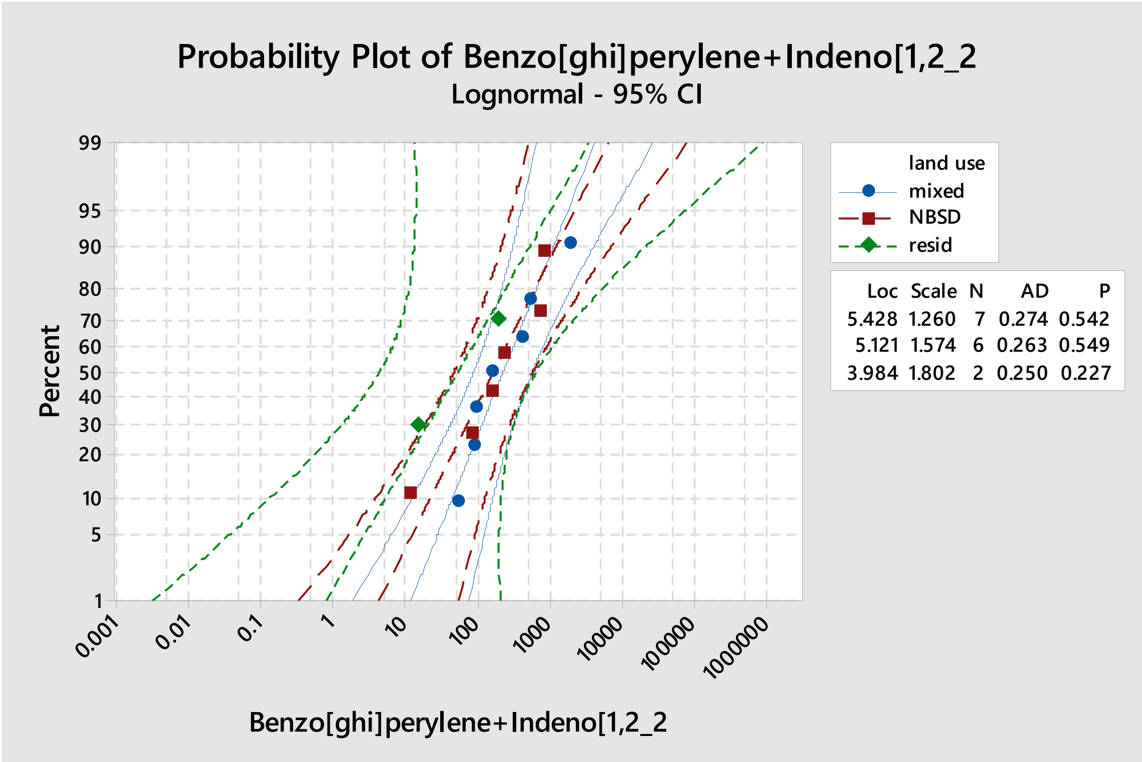
```
Kruskal-Wallis Test on Benzo[ghi]perylene+Indeno[1,2_1

land use    N  Median  Ave Rank      Z
mixed       7  0.5747       6.9  -0.93
NBSD        6  0.6104       8.2   0.12
resid       2  1.5977      11.5   1.19
Overall    15               8.0

H = 1.69  DF = 2  P = 0.429

* NOTE * One or more small samples
```



Kruskal-Wallis Test: Benzo[ghi]perylene+Indeno[1,2_2 versus land use

PART

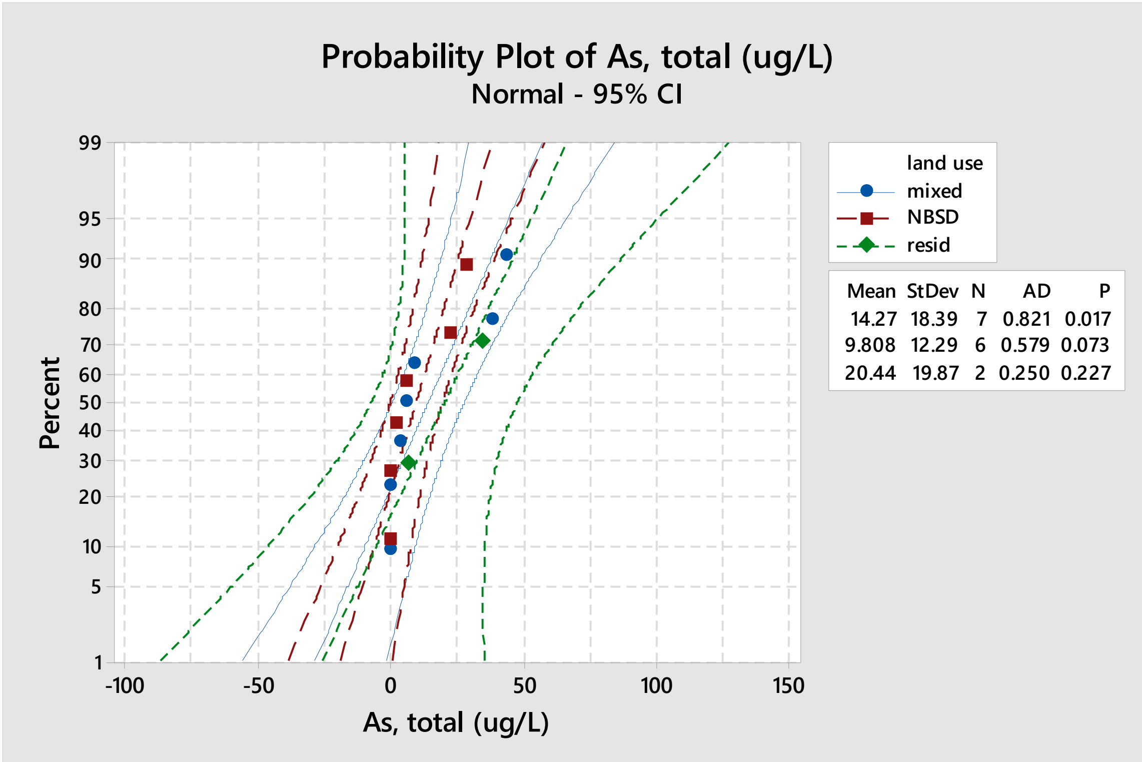
```
Kruskal-Wallis Test on Benzo[ghi]perylene+Indeno[1,2_2

                         Ave
land use    N  Median   Rank      Z
mixed       7   163.6    8.6   0.46
NBSD        6   191.6    8.2   0.12
resid       2   103.6    5.5  -0.85
Overall    15            8.0

H = 0.75  DF = 2  P = 0.688

* NOTE * One or more small samples
```



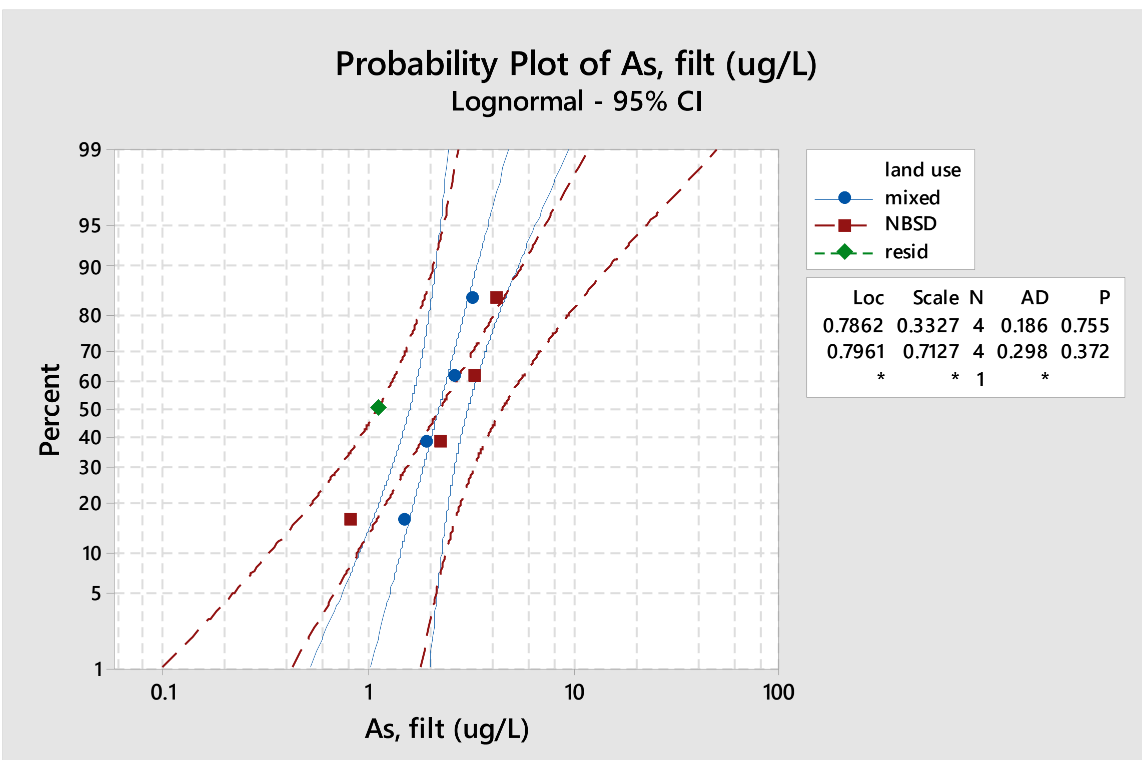

```
Arsenic
```

Kruskal-Wallis Test: As, total (ug/L) versus land use

```
Kruskal-Wallis Test on As, total (ug/L)

land use    N  Median  Ave Rank      Z
mixed       7   6.122       8.3   0.23
NBSD        6   4.176       6.7  -0.94
resid       2  20.435      11.0   1.02
Overall    15               8.0

H = 1.46  DF = 2  P = 0.481
H = 1.49  DF = 2  P = 0.475  (adjusted for ties)

* NOTE * One or more small samples

Too few items for filt As
```



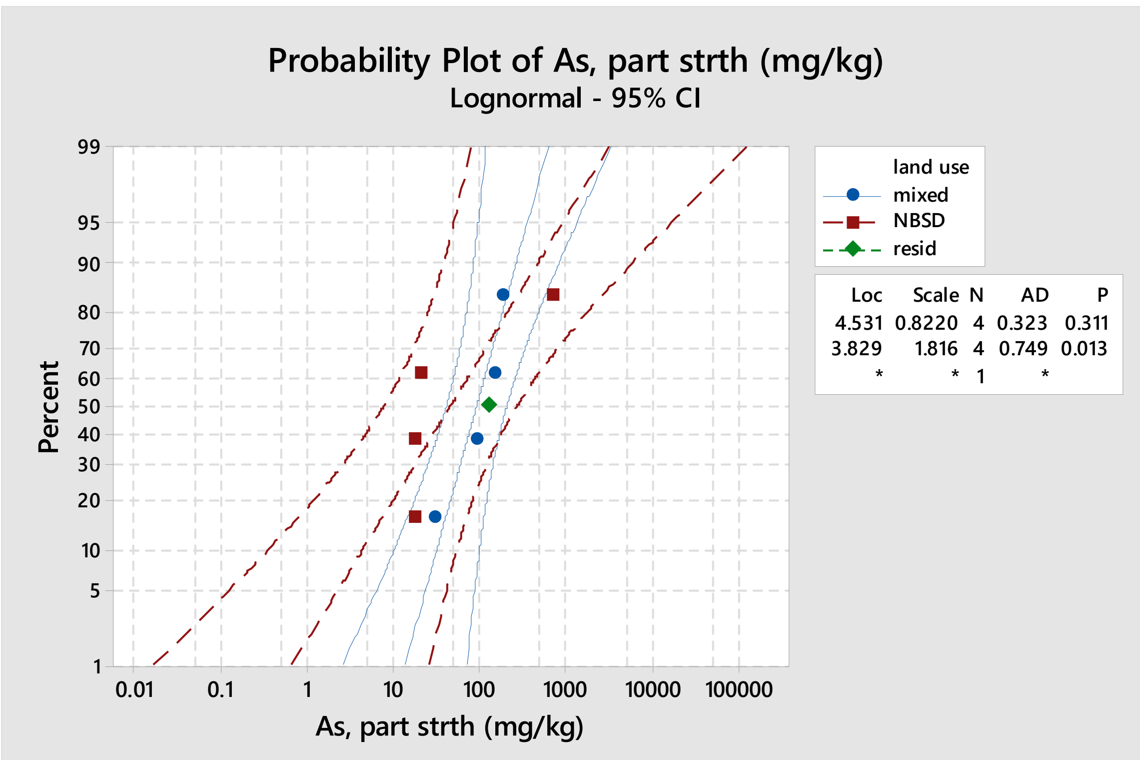
Probability Plot of As, total (ug/L)
Normal - 95% CI
99
95
90
80
70
60
50
40
30
20
10
5
1
Percent
-100
-50
0
50
100
150
As, total (ug/L)
land use
mixed
NBSD
resid
Mean StDev N AD P
14.27 18.39 7 0.821 0.017
9.808 12.29 6 0.579 0.073
20.44 19.87 2 0.250 0.227



Probability Plot of As, filt (ug/L)
Lognormal - 95% CI
99
95
90
80
70
60
50
40
30
20
10
5
1
Percent
0.1
1
10
100
As, filt (ug/L)
land use
mixed
NBSD
resid
Loc Scale N AD P
0.7862 0.3327 4 0.186 0.755
0.7961 0.7127 4 0.298 0.372
* * 1 *

Kruskal-Wallis Test: As, part strth (mg/kg) versus land use

```
9 cases were used
6 cases contained missing values


Kruskal-Wallis Test on As, part strth (mg/kg)

                         Ave
land use   N  Median  Rank       Z
mixed      4  121.48   6.0    0.98
NBSD       4   19.31   3.8   -1.22
resid      1  124.09   6.0    0.39
Overall    9           5.0

H = 1.50  DF = 2  P = 0.472

* NOTE * One or more small samples
```

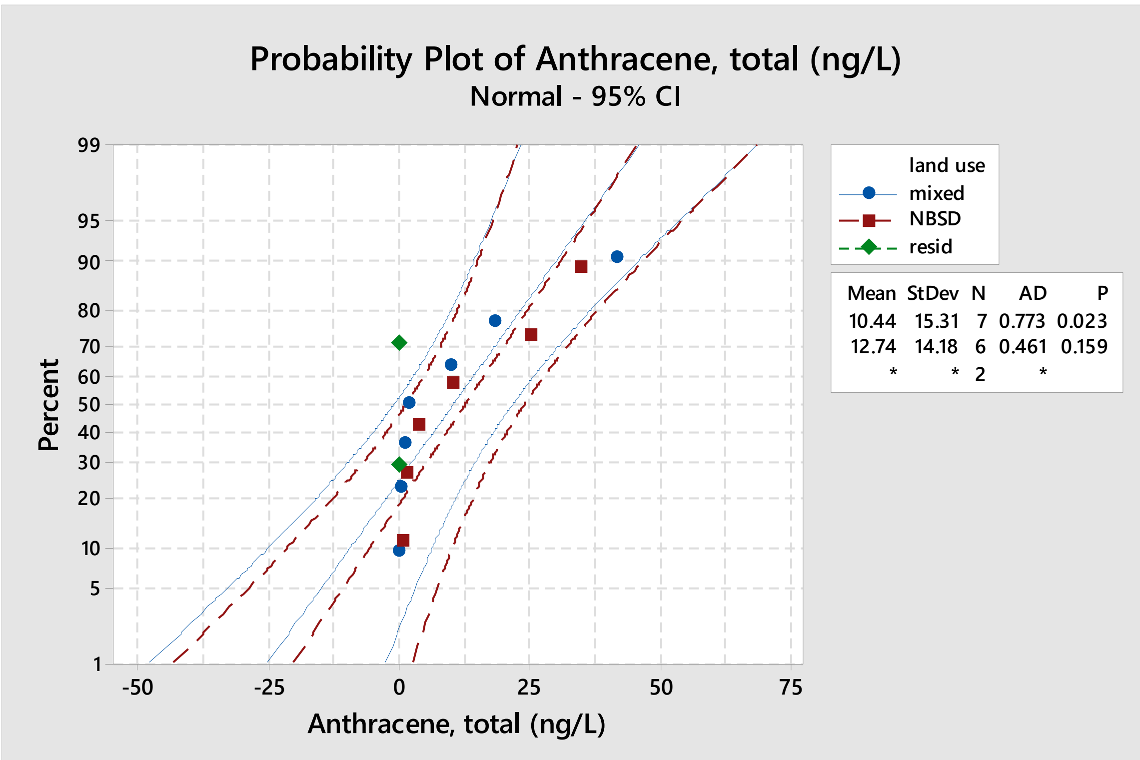



```
Anthracene
```

Kruskal-Wallis Test: Anthracene, total (ng/L) versus land use

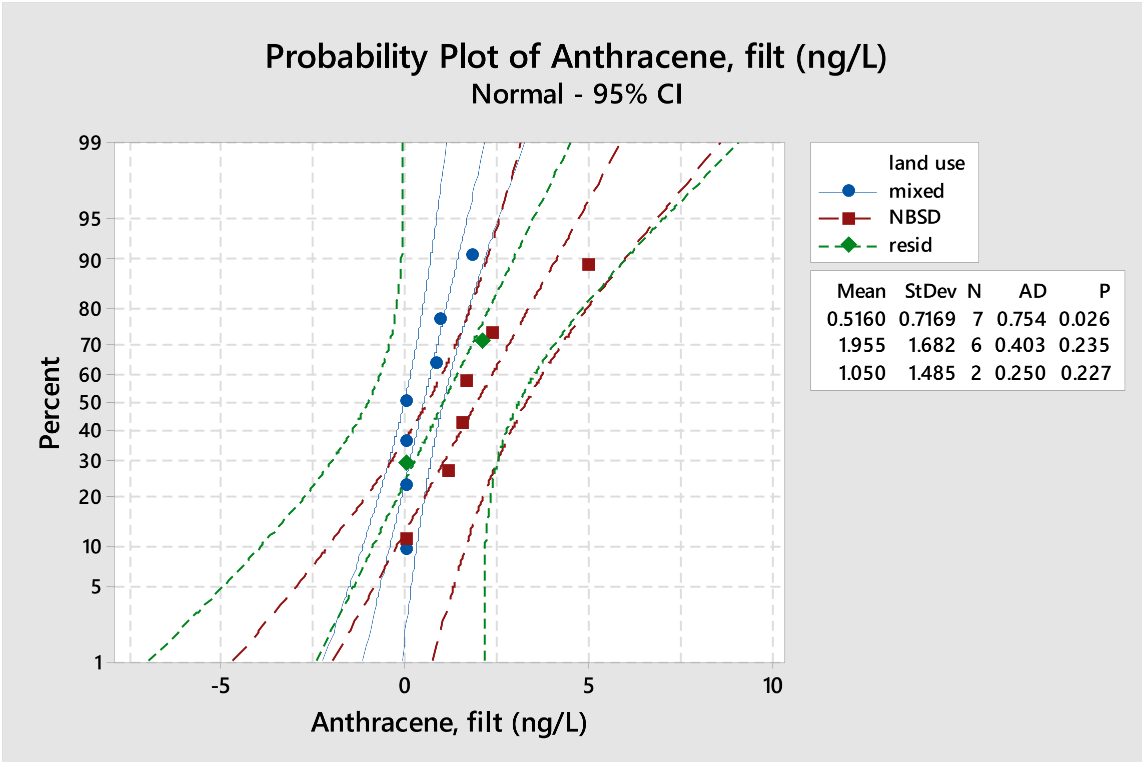
```
Kruskal-Wallis Test on Anthracene, total (ng/L)
```

```
                             Ave
land use    N        Median  Rank       Z
mixed       7   1.948228779   8.1    0.12
NBSD        6   7.053571429   9.8    1.30
resid       2   0.000000000   2.0   -2.04
Overall    15                 8.0

H = 4.62  DF = 2  P = 0.099
H = 4.65  DF = 2  P = 0.098  (adjusted for ties)

* NOTE * One or more small samples
```



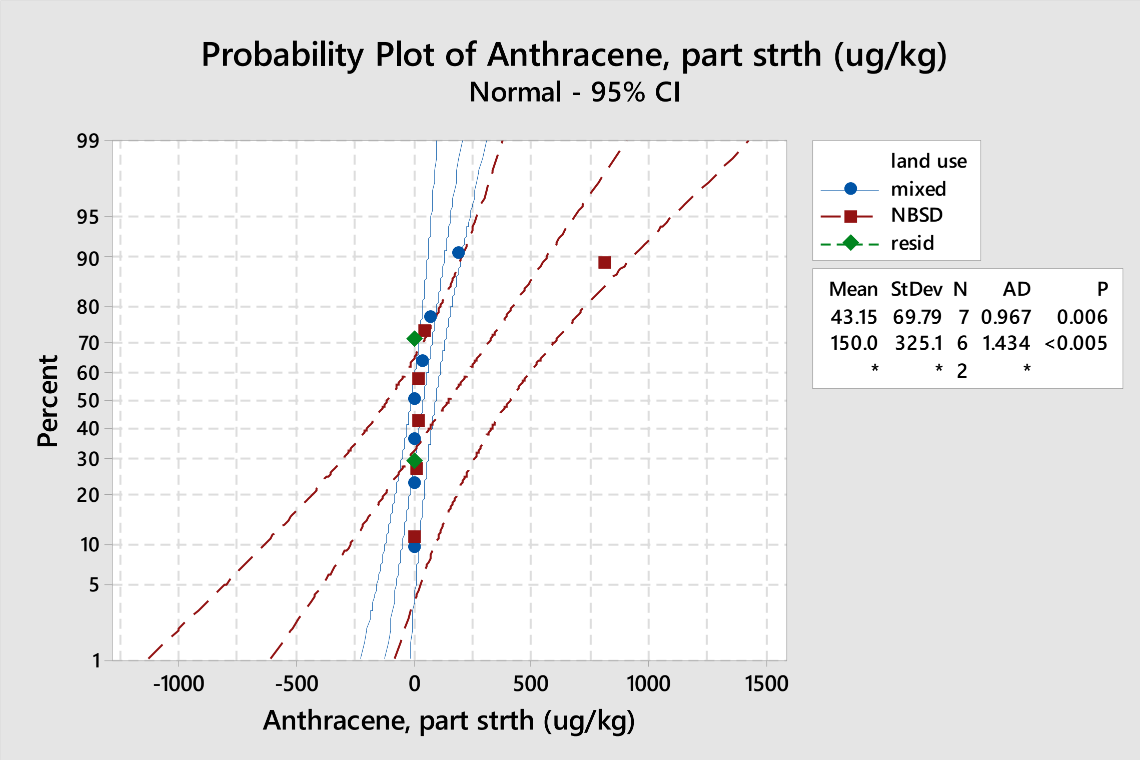
Kruskal-Wallis Test: Anthracene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Anthracene, filt (ng/L)

land use    N        Median  Ave Rank       Z
mixed       7   0.000000000       5.9   -1.74
NBSD        6   1.610114496      10.4    1.71
resid       2   1.049950468       8.3    0.08
Overall    15                     8.0

H = 3.37  DF = 2  P = 0.186
H = 3.59  DF = 2  P = 0.166  (adjusted for ties)

* NOTE * One or more small samples
```



Kruskal-Wallis Test: Anthracene, part strth (ug/kg) versus land use

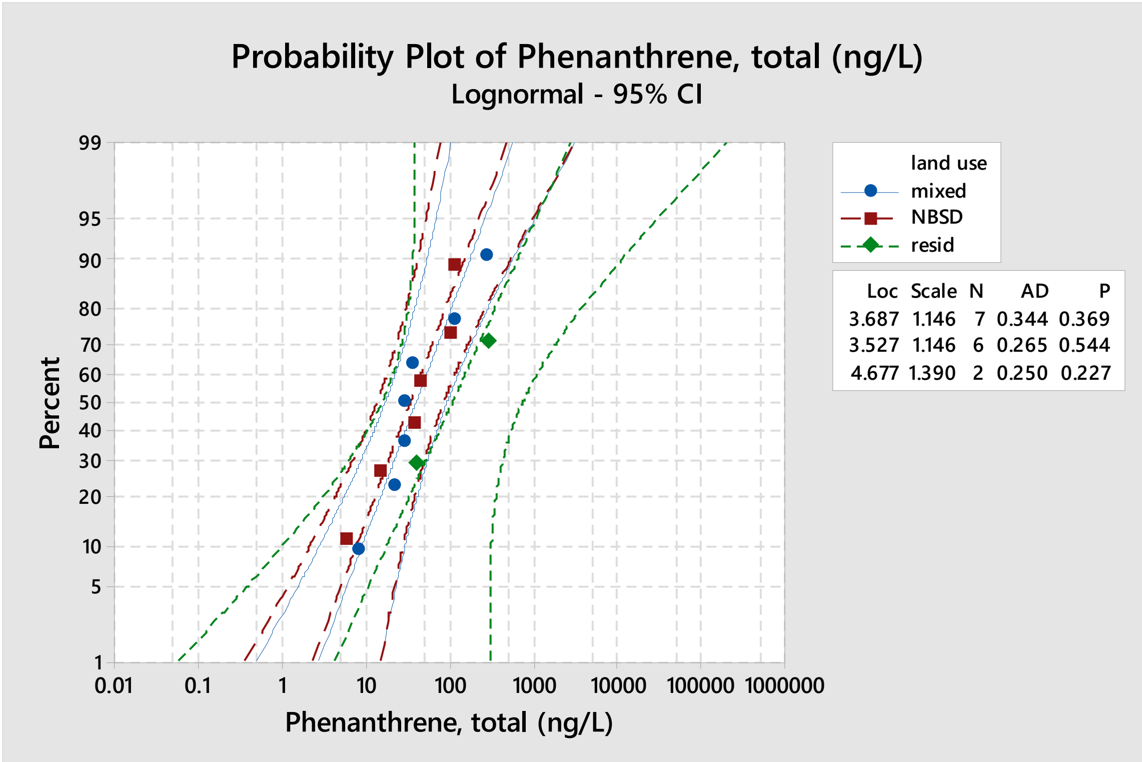
```
Kruskal-Wallis Test on Anthracene, part strth (ug/kg)

                                 Ave
land use    N       Median   Rank       Z
mixed       7  3.109396027    8.4    0.29
NBSD        6  1.61768E+01    9.4    1.00
resid       2  0.000000000    2.5   -1.87
Overall    15                 8.0

H = 3.67  DF = 2  P = 0.159
H = 3.74  DF = 2  P = 0.154  (adjusted for ties)

* NOTE * One or more small samples
```



phenanthrene

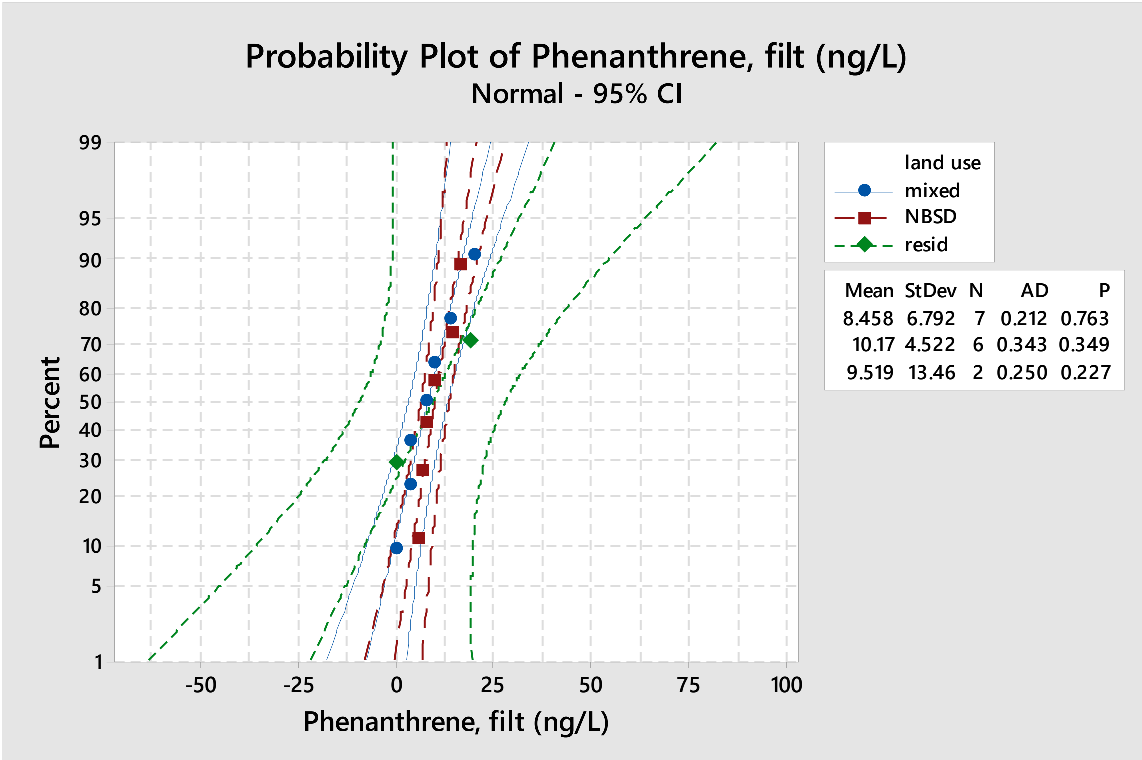
Kruskal-Wallis Test: Phenanthrene, total (ng/L) versus land use

```
Kruskal-Wallis Test on Phenanthrene, total (ng/L)

land use    N  Median  Ave Rank      Z
mixed       7   28.89       7.3  -0.58
NBSD        6   40.59       7.5  -0.35
resid       2  163.70      12.0   1.36
Overall    15               8.0

H = 1.85  DF = 2  P = 0.396

* NOTE * One or more small samples
```



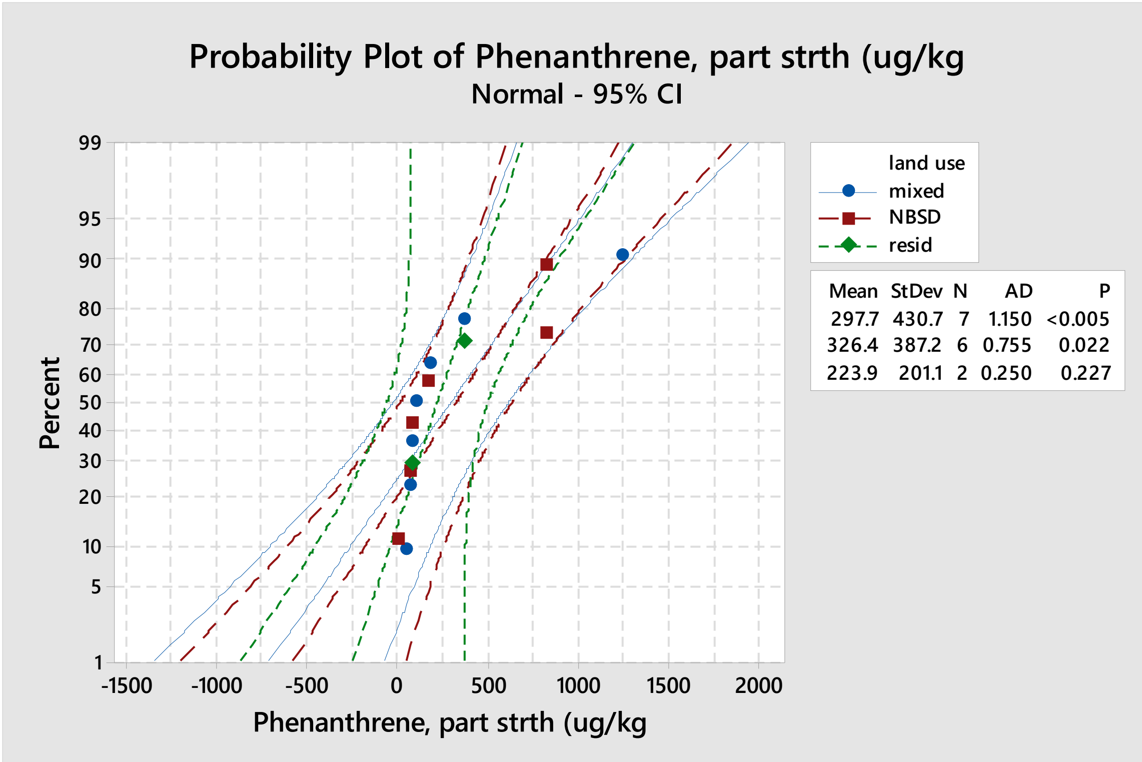
Kruskal-Wallis Test: Phenanthrene, filt (ng/L) versus land use

```
Kruskal-Wallis Test on Phenanthrene, filt (ng/L)

                          Ave
land use    N  Median    Rank       Z
mixed       7   7.945     7.6   -0.35
NBSD        6   8.738     8.7    0.47
resid       2   9.519     7.5   -0.17
Overall    15             8.0

H = 0.22   DF = 2   P = 0.895

* NOTE * One or more small samples
```



Kruskal-Wallis Test: Phenanthrene, part strth (ug/kg versus land use

```
Kruskal-Wallis Test on Phenanthrene, part strth (ug/kg

                           Ave
land use    N  Median   Rank       Z
mixed       7   104.1    8.0    0.00
NBSD        6   124.6    7.7   -0.24
resid       2   223.9    9.0    0.34
Overall    15            8.0

H = 0.13  DF = 2  P = 0.936

* NOTE * One or more small samples
```



Descriptive Statistics: SSC (mg/L), TOC, filt (m, TOC, part st, ...

Variable	land use	Total Count	Mean	SE Mean	StDev
SSC (mg/L)	mixed	7	161.7	30.9	81.8
	NBSD	6	259	163	399
	resid	2	511	242	343
TOC, filt (mg/L)	mixed	7	7.44	2.00	5.29
	NBSD	6	17.10	7.01	17.17
	resid	2	8.265	0.165	0.233
TOC, part strth (%)	mixed	7	7.05	1.66	4.40
	NBSD	6	7.56	3.55	8.69
	resid	2	10.225	0.389	0.550
As, total (ug/L)	mixed	7	14.27	6.95	18.39
	NBSD	6	9.81	5.02	12.29
	resid	2	20.4	14.0	19.9
As, filt (ug/L)	mixed	7	2.286	0.368	0.735
	NBSD	6	2.598	0.710	1.421
	resid	2	1.1047	*	*
As, part strth (mg/kg)	mixed	7	113.8	34.0	67.9
	NBSD	6	189	170	340
	resid	2	124.09	*	*
Cu, total (ug/L)	mixed	7	40.37	8.18	21.63

	NBSD	6	53.3	19.7	48.3
	resid	2	67.86	7.48	10.58
Cu, filt (ug/L)	mixed	7	25.44	9.64	25.50
	NBSD	6	25.67	7.87	19.27
	resid	2	8.55	3.01	4.26
Cu, part strth (mg/kg)	mixed	7	93.5	27.9	73.8
	NBSD	6	150.8	22.7	55.6
	resid	2	163.5	96.0	135.7
Ni, total (ug/L)	mixed	7	12.82	2.64	6.98
	NBSD	6	17.00	2.62	6.41
	resid	2	16.48	2.59	3.67
Ni, filt (ug/L)	mixed	7	11.34	3.07	8.13
	NBSD	6	12.80	2.36	5.77
	resid	2	2.114	0.121	0.171
Ni, part strth (mg/kg)	mixed	7	10.52	4.38	11.60
	NBSD	6	15.95	6.51	15.94
	resid	2	39.8	23.7	33.5
Zn, total (ug/L)	mixed	7	113.1	25.6	67.8
	NBSD	6	134.3	42.0	102.9
	resid	2	376.9	42.1	59.6
Zn, filt (ug/L)	mixed	7	21.41	6.25	16.52
	NBSD	6	22.20	8.78	21.50
	resid	2	34.5	12.8	18.1
Zn, part strth (mg/kg)	mixed	7	697.4	83.5	220.9
	NBSD	6	1002	337	826
	resid	2	938	540	763
Cd, total (ug/L)	mixed	7	0.2588	0.0989	0.2617
	NBSD	6	0.631	0.414	1.013
	resid	2	0.667	0.275	0.389
Cd, filt (ug/L)	mixed	7	0.0288	0.0288	0.0763
	NBSD	6	0.237	0.131	0.320
	resid	2	0.000000	0.000000	0.000000
Cd, part strth (mg/kg)	mixed	7	1.045	0.394	1.042
	NBSD	6	1.633	0.837	2.051
	resid	2	1.97	1.54	2.18
Pb, total (ug/L)	mixed	7	12.74	4.08	10.81
	NBSD	6	18.0	10.3	25.2
	resid	2	37.75	7.77	10.99
Pb, filt (ug/L)	mixed	7	0.828	0.112	0.296
	NBSD	6	1.211	0.237	0.580
	resid	2	1.1200	0.0658	0.0930
Pb, part strth (mg/kg)	mixed	7	74.8	14.0	37.0
	NBSD	6	91.3	32.1	78.5
	resid	2	102.6	62.7	88.7
Hg, total (ng/L)	mixed	7	33.5	11.1	29.4
	NBSD	6	177	123	301
	resid	2	62.0	15.9	22.5

Hg, filt (ng/L)	mixed	7	2.945	0.421	1.114
	NBSD	6	8.48	3.46	8.47
	resid	2	2.951	0.309	0.438
Hg, part strth (ug/kg)	mixed	7	208.8	35.9	94.9
	NBSD	6	599	170	416
	resid	2	169	109	154
Naphthalene, total (ng/L	mixed	7	16.97	4.34	11.47
	NBSD	6	19.56	5.44	13.32
	resid	2	23.87	8.41	11.89
Naphthalene, filt (ng/L)	mixed	7	12.27	4.83	12.78
	NBSD	6	9.00	2.71	6.65
	resid	2	10.09	2.52	3.56
Naphthalene, part strth	mixed	7	24.91	9.01	23.83
	NBSD	6	150	104	254
	resid	2	43.0	32.9	46.6
Fluorene, total (ng/L)	mixed	7	5.42	1.04	2.76
	NBSD	6	7.41	3.64	8.91
	resid	2	15.0	15.0	21.3
Fluorene, filt (ng/L)	mixed	7	12.50	7.40	19.57
	NBSD	6	4.53	1.27	3.11
	resid	2	20.4	18.7	26.4
Fluorene, part strth (ug	mixed	7	8.98	5.35	14.16
	NBSD	6	28.5	20.2	49.4
	resid	2	18.1	18.1	25.6
Acenaphthene, total (ng/	mixed	7	14.19	3.22	8.53
	NBSD	6	20.2	10.9	26.8
	resid	2	23.1	23.1	32.7
Acenaphthene, filt (ng/L	mixed	7	5.73	2.50	6.60
	NBSD	6	2.997	0.788	1.931
	resid	2	5.86	4.74	6.71
Acenaphthene, part strth	mixed	7	47.0	17.6	46.5
	NBSD	6	77.4	61.0	149.5
	resid	2	22.7	22.7	32.1
Phenanthrene, total (ng/	mixed	7	72.7	35.8	94.7
	NBSD	6	52.4	18.0	44.1
	resid	2	164	123	175
Phenanthrene, filt (ng/L	mixed	7	8.46	2.57	6.79
	NBSD	6	10.17	1.85	4.52
	resid	2	9.52	9.52	13.46
Phenanthrene, part strth	mixed	7	298	163	431
	NBSD	6	326	158	387
	resid	2	224	142	201
Anthracene, total (ng/L)	mixed	7	10.44	5.79	15.31
	NBSD	6	12.74	5.79	14.18
	resid	2	0.000000	0.000000	0.000000
Anthracene, filt (ng/L)	mixed	7	0.516	0.271	0.717
	NBSD	6	1.955	0.687	1.682
	resid	2	1.05	1.05	1.48

Anthracene, part strth (	mixed	7	43.2	26.4	69.8
	NBSD	6	150	133	325
	resid	2	0.000000	0.000000	0.000000
Fluoranthene, total (ng/	mixed	7	190	105	278
	NBSD	6	248	150	368
	resid	2	409	190	269
Fluoranthene, filt (ng/L	mixed	7	7.69	1.91	5.06
	NBSD	6	18.0	11.4	28.0
	resid	2	5.81	3.29	4.65
Fluoranthene, part strth	mixed	7	831	473	1252
	NBSD	6	1518	1059	2594
	resid	2	1277	1001	1415
Pyrene, total (ng/L)	mixed	7	153.1	82.3	217.7
	NBSD	6	157	107	262
	resid	2	210.1	39.2	55.5
Pyrene, filt (ng/L)	mixed	7	4.944	0.897	2.374
	NBSD	6	16.1	10.5	25.8
	resid	2	6.01	2.58	3.65
Pyrene, part strth (ug/k	mixed	7	683	368	974
	NBSD	6	589	276	676
	resid	2	571	358	506
Chrysene, total (ng/L)	mixed	7	64.6	38.9	102.8
	NBSD	6	54.0	32.4	79.4
	resid	2	44.7	13.1	18.5
Chrysene, filt (ng/L)	mixed	7	0.725	0.216	0.572
	NBSD	6	3.80	2.84	6.95
	resid	2	0.857	0.364	0.515
Chrysene, part strth (ug	mixed	7	301	174	459
	NBSD	6	227.6	74.9	183.6
	resid	2	95.1	22.1	31.3
Benzo[a]anthracene, tota	mixed	7	42.0	26.6	70.4
	NBSD	6	44.4	24.8	60.8
	resid	2	46.05	4.54	6.41
Benzo[a]anthracene, filt	mixed	7	0.465	0.134	0.355
	NBSD	6	2.27	1.64	4.03
	resid	2	0.680	0.427	0.604
Benzo[a]anthracene, part	mixed	7	201	119	316
	NBSD	6	230	106	260
	resid	2	121.8	69.2	97.8
Benzo[b]fluoranthene, to	mixed	7	92.9	57.1	151.0
	NBSD	6	96.3	51.9	127.0
	resid	2	179.3	61.3	86.6
Benzo[b]fluoranthene, fi	mixed	7	0.473	0.155	0.411
	NBSD	6	6.35	5.39	13.21
	resid	2	0.901	0.305	0.432
Benzo[b]fluoranthene, pa	mixed	7	440	255	676
	NBSD	6	525	240	587

	resid	2	537	387	547
Benzo[k]fluoranthene, to	mixed	7	33.4	21.4	56.6
	NBSD	6	34.5	22.6	55.3
	resid	2	18.89	8.74	12.36
Benzo[k]fluoranthene, fi	mixed	7	0.1736	0.0614	0.1624
	NBSD	6	2.50	2.13	5.23
	resid	2	0.212	0.128	0.181
Benzo[k]fluoranthene, pa	mixed	7	158.5	96.3	254.8
	NBSD	6	147.5	62.4	152.8
	resid	2	36.48	1.37	1.94
Benzo[a]pyrene, total (n	mixed	7	58.7	37.2	98.4
	NBSD	6	49.9	23.9	58.5
	resid	2	34.5	16.4	23.2
Benzo[a]pyrene, filt (ng	mixed	7	0.295	0.105	0.279
	NBSD	6	2.61	1.99	4.87
	resid	2	0.481	0.287	0.405
Benzo[a]pyrene, part str	mixed	7	282	167	441
	NBSD	6	311	148	362
	resid	2	65.86	1.20	1.70
Dibenzo[a,h]anthracene,	mixed	7	16.38	9.72	25.72
	NBSD	6	14.77	8.97	21.96
	resid	2	2.11	2.11	2.98
Dibenzo[a,h]anthracene,	mixed	7	0.3300	0.0728	0.1927
	NBSD	6	1.076	0.501	1.228
	resid	2	0.51178	0.00426	0.00603
Dibenzo[a,h]anthracene,	mixed	7	75.1	43.8	115.9
	NBSD	6	79.3	50.6	124.0
	resid	2	7.16	7.16	10.13
Benzo[ghi]perylene+Inden	mixed	7	98.1	57.6	152.3
	NBSD	6	49.3	17.5	42.7
	resid	2	78.9	72.8	102.9
Benzo[ghi]perylene+Inden	mixed	7	0.634	0.166	0.439
	NBSD	6	2.23	1.43	3.51
	resid	2	1.598	0.681	0.963
Benzo[ghi]perylene+Inden	mixed	7	472	257	681
	NBSD	6	344	145	356
	resid	2	103.6	88.6	125.3

Variable	land use	Median
SSC (mg/L)	mixed	202.6
	NBSD	91
	resid	511
TOC, filt (mg/L)	mixed	5.64
	NBSD	9.79
	resid	8.265
TOC, part strth (%)	mixed	7.23
	NBSD	4.71
	resid	10.225

As, total (ug/L)	mixed	6.12
	NBSD	4.18
	resid	20.4
As, filt (ug/L)	mixed	2.262
	NBSD	2.721
	resid	1.1047
As, part strth (mg/kg)	mixed	121.5
	NBSD	19
	resid	124.09
Cu, total (ug/L)	mixed	32.73
	NBSD	36.6
	resid	67.86
Cu, filt (ug/L)	mixed	12.90
	NBSD	24.61
	resid	8.55
Cu, part strth (mg/kg)	mixed	103.3
	NBSD	138.4
	resid	163.5
Ni, total (ug/L)	mixed	11.00
	NBSD	15.90
	resid	16.48
Ni, filt (ug/L)	mixed	7.65
	NBSD	11.78
	resid	2.114
Ni, part strth (mg/kg)	mixed	8.96
	NBSD	13.17
	resid	39.8
Zn, total (ug/L)	mixed	85.8
	NBSD	87.7
	resid	376.9
Zn, filt (ug/L)	mixed	13.08
	NBSD	12.70
	resid	34.5
Zn, part strth (mg/kg)	mixed	754.1
	NBSD	599
	resid	938
Cd, total (ug/L)	mixed	0.2871
	NBSD	0.298
	resid	0.667
Cd, filt (ug/L)	mixed	0.0000
	NBSD	0.106
	resid	0.000000
Cd, part strth (mg/kg)	mixed	1.290
	NBSD	1.254
	resid	1.97
Pb, total (ug/L)	mixed	11.67
	NBSD	8.2

	resid	37.75
Pb, filt (ug/L)	mixed	0.661
	NBSD	1.389
	resid	1.1200
Pb, part strth (mg/kg)	mixed	55.4
	NBSD	79.5
	resid	102.6
Hg, total (ng/L)	mixed	26.0
	NBSD	35
	resid	62.0
Hg, filt (ng/L)	mixed	2.706
	NBSD	5.38
	resid	2.951
Hg, part strth (ug/kg)	mixed	187.2
	NBSD	551
	resid	169
Naphthalene, total (ng/L	mixed	17.02
	NBSD	21.60
	resid	23.87
Naphthalene, filt (ng/L)	mixed	6.57
	NBSD	9.04
	resid	10.09
Naphthalene, part strth	mixed	23.52
	NBSD	55
	resid	43.0
Fluorene, total (ng/L)	mixed	5.12
	NBSD	3.24
	resid	15.0
Fluorene, filt (ng/L)	mixed	6.68
	NBSD	3.96
	resid	20.4
Fluorene, part strth (ug	mixed	0.00
	NBSD	0.0
	resid	18.1
Acenaphthene, total (ng/	mixed	12.40
	NBSD	4.4
	resid	23.1
Acenaphthene, filt (ng/L	mixed	3.08
	NBSD	2.513
	resid	5.86
Acenaphthene, part strth	mixed	37.5
	NBSD	13.6
	resid	22.7
Phenanthrene, total (ng/	mixed	28.9
	NBSD	40.6
	resid	164
Phenanthrene, filt (ng/L	mixed	7.95

	NBSD	8.74
	resid	9.52
Phenanthrene, part strth	mixed	104
	NBSD	125
	resid	224
Anthracene, total (ng/L)	mixed	1.95
	NBSD	7.05
	resid	0.000000
Anthracene, filt (ng/L)	mixed	0.000
	NBSD	1.610
	resid	1.05
Anthracene, part strth (	mixed	3.1
	NBSD	16
	resid	0.000000
Fluoranthene, total (ng/	mixed	41
	NBSD	102
	resid	409
Fluoranthene, filt (ng/L	mixed	5.65
	NBSD	7.4
	resid	5.81
Fluoranthene, part strth	mixed	274
	NBSD	591
	resid	1277
Pyrene, total (ng/L)	mixed	47.2
	NBSD	65
	resid	210.1
Pyrene, filt (ng/L)	mixed	4.011
	NBSD	6.3
	resid	6.01
Pyrene, part strth (ug/k	mixed	371
	NBSD	389
	resid	571
Chrysene, total (ng/L)	mixed	16.5
	NBSD	21.0
	resid	44.7
Chrysene, filt (ng/L)	mixed	0.880
	NBSD	0.72
	resid	0.857
Chrysene, part strth (ug	mixed	63
	NBSD	182.6
	resid	95.1
Benzo[a]anthracene, tota	mixed	10.9
	NBSD	16.0
	resid	46.05
Benzo[a]anthracene, filt	mixed	0.521
	NBSD	0.52
	resid	0.680

Benzo[a]anthracene, part	mixed	66
	NBSD	104
	resid	121.8
Benzo[b]fluoranthene, to	mixed	26.7
	NBSD	43.4
	resid	179.3
Benzo[b]fluoranthene, fi	mixed	0.477
	NBSD	0.78
	resid	0.901
Benzo[b]fluoranthene, pa	mixed	155
	NBSD	235
	resid	537
Benzo[k]fluoranthene, to	mixed	10.1
	NBSD	13.6
	resid	18.89
Benzo[k]fluoranthene, fi	mixed	0.1639
	NBSD	0.28
	resid	0.212
Benzo[k]fluoranthene, pa	mixed	55.8
	NBSD	102.5
	resid	36.48
Benzo[a]pyrene, total (n	mixed	18.6
	NBSD	26.1
	resid	34.5
Benzo[a]pyrene, filt (ng	mixed	0.235
	NBSD	0.46
	resid	0.481
Benzo[a]pyrene, part str	mixed	111
	NBSD	118
	resid	65.86
Dibenzo[a,h]anthracene,	mixed	4.46
	NBSD	5.03
	resid	2.11
Dibenzo[a,h]anthracene,	mixed	0.3415
	NBSD	0.668
	resid	0.51178
Dibenzo[a,h]anthracene,	mixed	35.0
	NBSD	30.1
	resid	7.16
Benzo[ghi]perylene+Inden	mixed	29.5
	NBSD	36.8
	resid	78.9
Benzo[ghi]perylene+Inden	mixed	0.575
	NBSD	0.61
	resid	1.598
Benzo[ghi]perylene+Inden	mixed	164
	NBSD	192
	resid	103.6

Descriptive Statistics: SSC (mg/L), TOC, filt (m, TOC, part st, ...

Variable	Total Count	Mean	SE Mean	StDev	Median
SSC (mg/L)	15	247.0	73.8	286.0	184.4
TOC, filt (mg/L)	15	11.42	3.06	11.85	6.80
TOC, part strth (%)	15	7.68	1.56	6.03	5.60
As, total (ug/L)	15	13.31	4.00	15.50	6.12
As, filt (ug/L)	15	2.293	0.362	1.087	2.222
As, part strth (mg/kg)	15	148.3	72.0	216.1	91.4
Cu, total (ug/L)	15	49.22	8.72	33.75	49.14
Cu, filt (ug/L)	15	23.28	5.47	21.18	12.90
Cu, part strth (mg/kg)	15	125.8	19.6	75.8	120.6
Ni, total (ug/L)	15	14.98	1.65	6.40	14.92
Ni, filt (ug/L)	15	10.69	1.88	7.27	9.47
Ni, part strth (mg/kg)	15	16.60	4.65	18.00	14.78
Zn, total (ug/L)	15	156.7	30.7	118.7	92.3
Zn, filt (ug/L)	15	23.47	4.66	18.04	14.98
Zn, part strth (mg/kg)	15	851	148	573	628
Cd, total (ug/L)	15	0.462	0.172	0.668	0.392
Cd, filt (ug/L)	15	0.1081	0.0583	0.2256	0.0000
Cd, part strth (mg/kg)	15	1.403	0.403	1.561	1.290
Pb, total (ug/L)	15	18.19	4.86	18.84	11.67
Pb, filt (ug/L)	15	1.020	0.114	0.440	1.069
Pb, part strth (mg/kg)	15	85.1	15.2	58.8	61.9
Hg, total (ng/L)	15	94.8	50.1	194.2	28.1
Hg, filt (ng/L)	15	5.16	1.51	5.84	3.26
Hg, part strth (ug/kg)	15	359.5	85.0	329.2	232.8
Naphthalene, total (ng/L	15	18.93	3.01	11.64	17.95
Naphthalene, filt (ng/L)	15	10.67	2.44	9.45	8.50
Naphthalene, part strth	15	77.4	42.6	165.1	25.1
Fluorene, total (ng/L)	15	7.50	2.22	8.61	4.35
Fluorene, filt (ng/L)	15	10.36	4.07	15.77	4.62
Fluorene, part strth (ug	15	17.99	8.54	33.07	0.00
Acenaphthene, total (ng/	15	17.78	5.01	19.39	12.03
Acenaphthene, filt (ng/L	15	4.66	1.30	5.02	2.62
Acenaphthene, part strth	15	56.0	25.0	96.9	21.1
Phenanthrene, total (ng/	15	76.7	23.2	89.8	37.3
Phenanthrene, filt (ng/L	15	9.28	1.65	6.38	7.95
Phenanthrene, part strth	15	299.3	95.6	370.3	104.1
Anthracene, total (ng/L)	15	9.97	3.56	13.78	1.95
Anthracene, filt (ng/L)	15	1.163	0.353	1.367	0.946
Anthracene, part strth (	15	80.2	53.9	208.6	8.8
Fluoranthene, total (ng/	15	242.2	78.3	303.2	119.8
Fluoranthene, filt (ng/L	15	11.57	4.64	17.96	5.68
Fluoranthene, part strth	15	1165	471	1825	374
Pyrene, total (ng/L)	15	162.3	55.0	213.1	80.1
Pyrene, filt (ng/L)	15	9.54	4.25	16.47	5.96
Pyrene, part strth (ug/k	15	631	198	769	386
Chrysene, total (ng/L)	15	57.7	21.4	82.8	21.2
Chrysene, filt (ng/L)	15	1.97	1.15	4.45	0.73
Chrysene, part strth (ug	15	244.0	84.6	327.6	117.2
Benzo[a]anthracene, tota	15	43.5	15.2	58.7	18.6
Benzo[a]anthracene, filt	15	1.216	0.667	2.584	0.521
Benzo[a]anthracene, part	15	201.8	67.7	262.2	74.1
Benzo[b]fluoranthene, to	15	105.8	33.6	130.2	38.7
Benzo[b]fluoranthene, fi	15	2.88	2.18	8.43	0.50
Benzo[b]fluoranthene, pa	15	487	151	585	193
Benzo[k]fluoranthene, to	15	31.9	12.9	50.0	10.1
Benzo[k]fluoranthene, fi	15	1.110	0.862	3.340	0.178

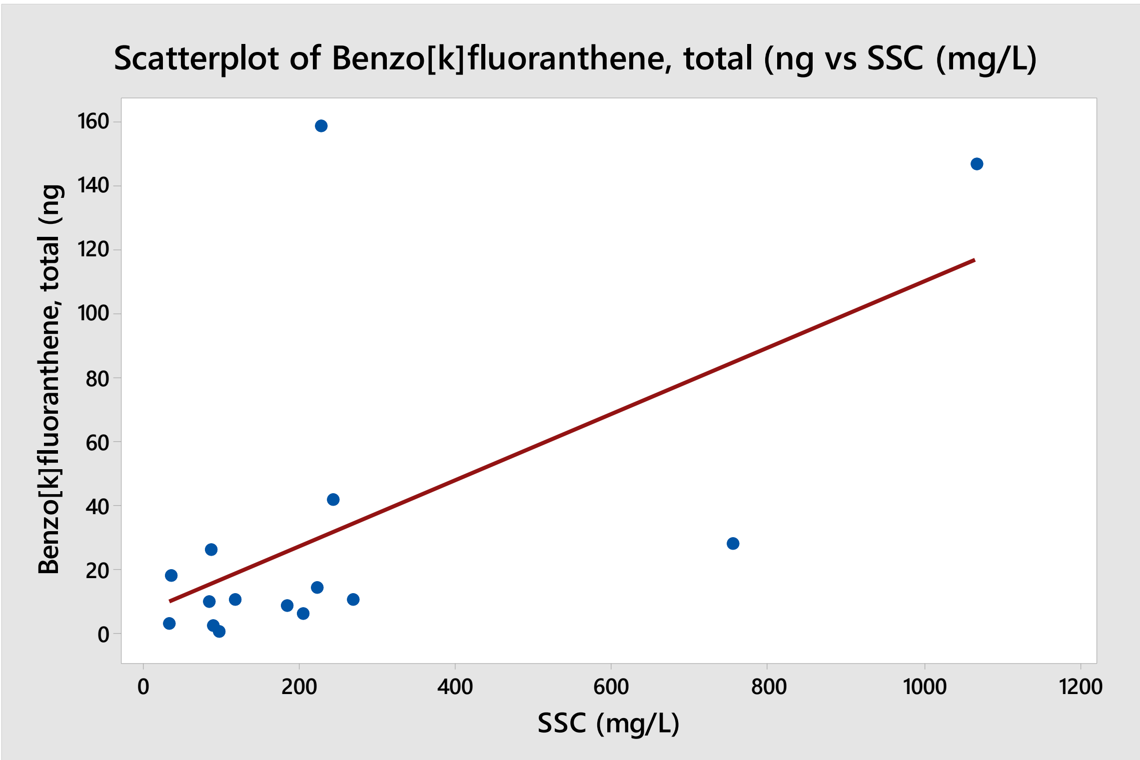
Benzo[k]fluoranthene, pa	15	137.8	50.3	194.6	55.8
Benzo[a]pyrene, total (n	15	52.0	19.1	74.0	18.6
Benzo[a]pyrene, filt (ng	15	1.245	0.811	3.139	0.272
Benzo[a]pyrene, part str	15	264.5	95.5	370.0	107.9
Dibenzo[a,h]anthracene,	15	13.83	5.65	21.90	4.22
Dibenzo[a,h]anthracene,	15	0.653	0.214	0.829	0.487
Dibenzo[a,h]anthracene,	15	67.7	28.1	108.9	27.1
Benzo[ghi]perylene+Inden	15	76.0	28.2	109.1	30.5
Benzo[ghi]perylene+Inden	15	1.403	0.586	2.268	0.791
Benzo[ghi]perylene+Inden	15	371	132	510	164

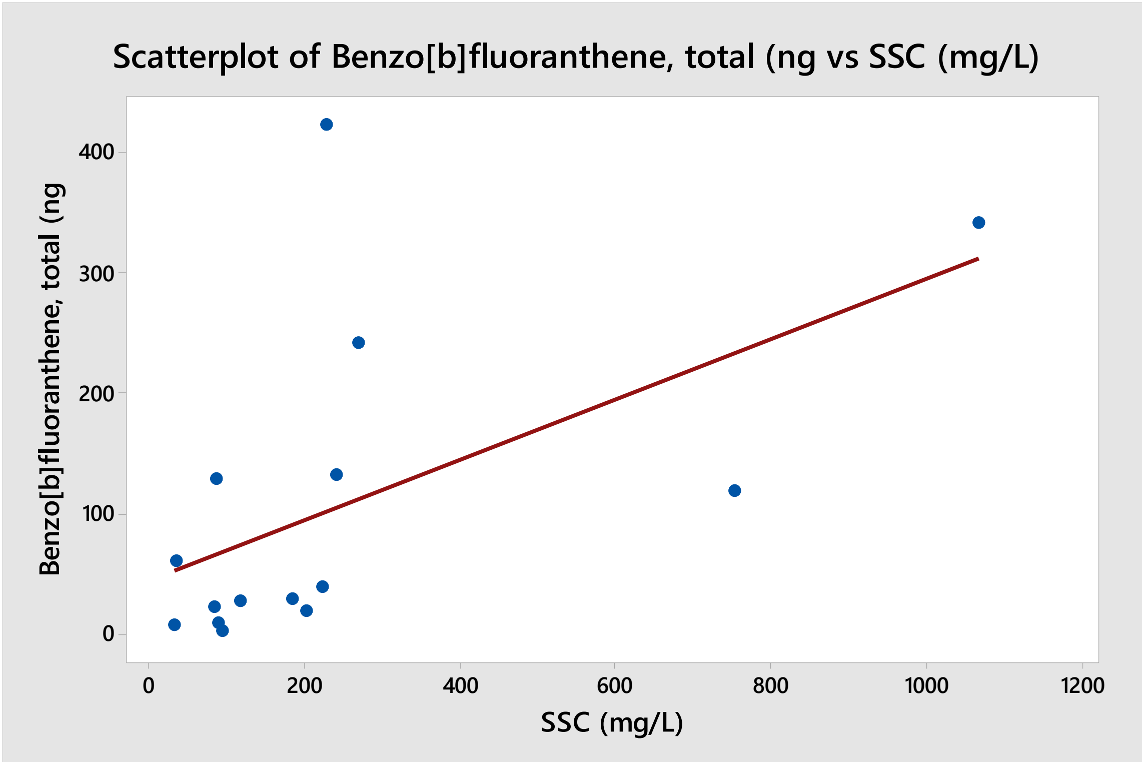
Appendix G: Scatterplots of Correlated Constituents

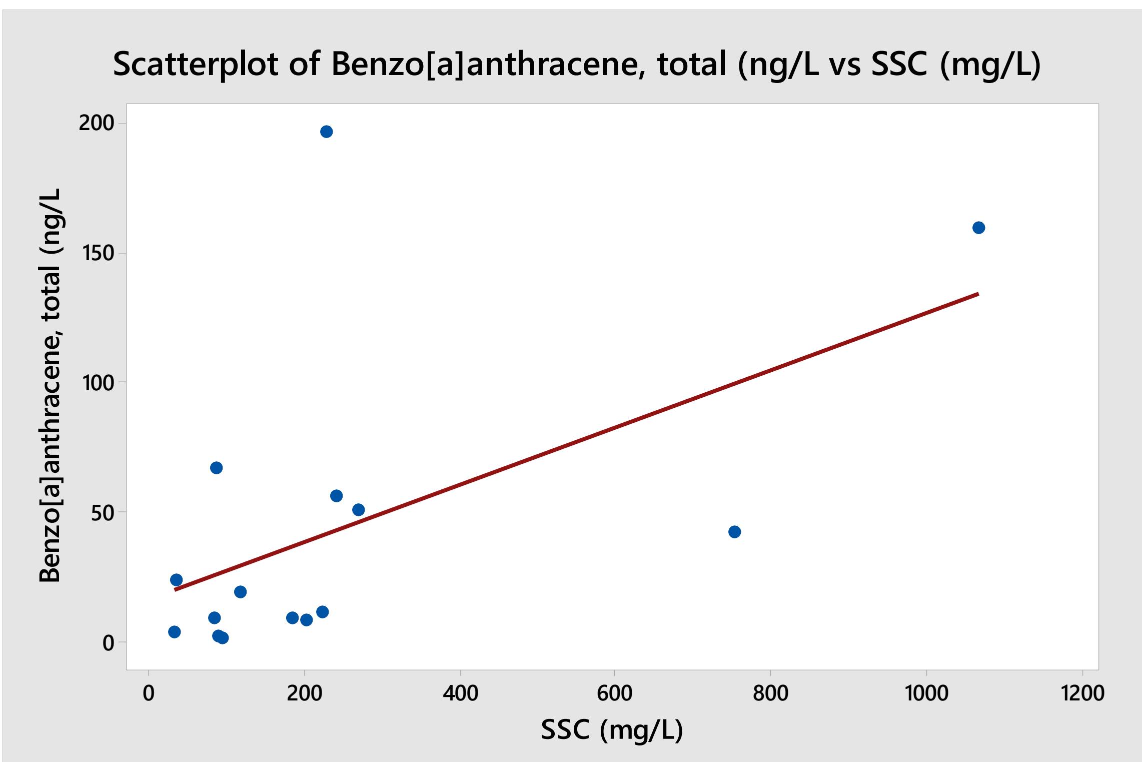
Contents

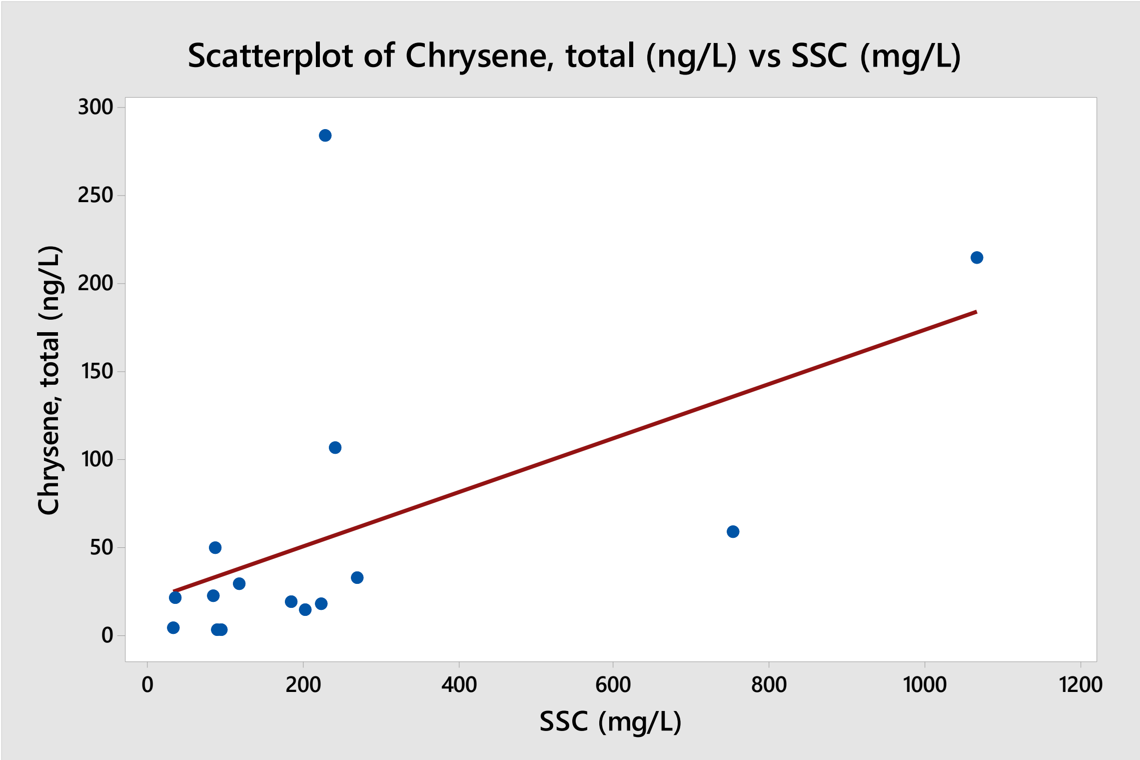
Scatterplots of Significant Pearson Correlations

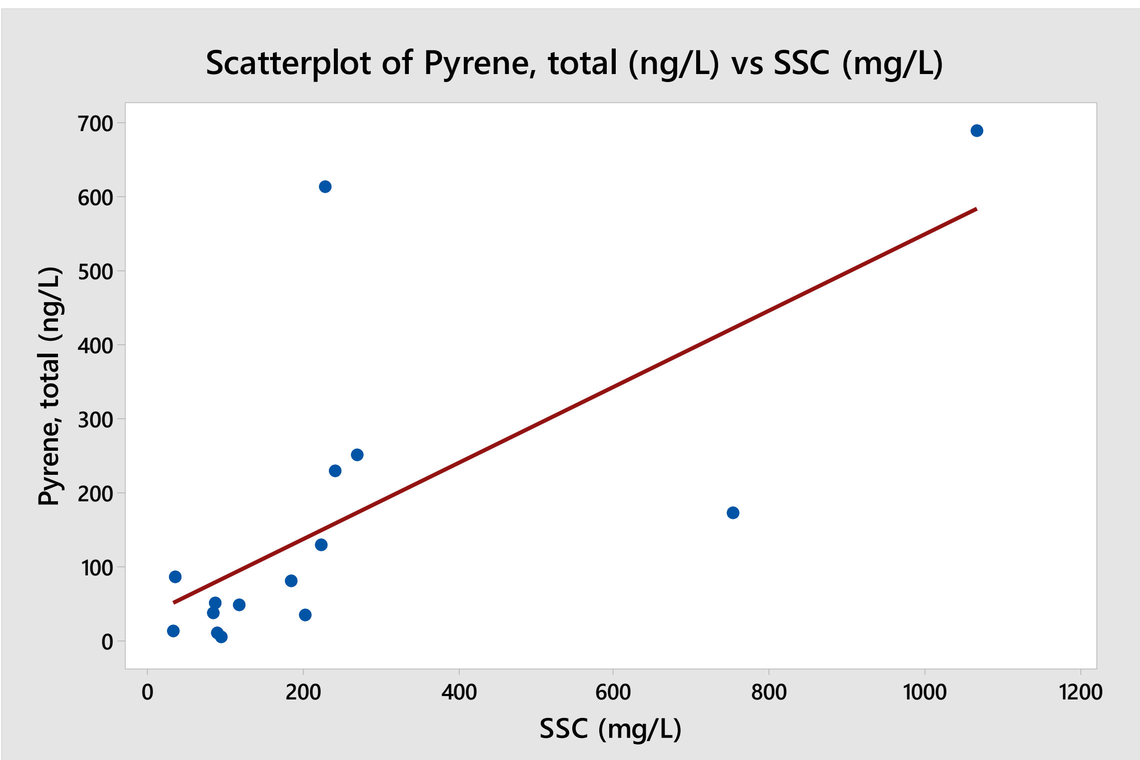
SSC Correlations

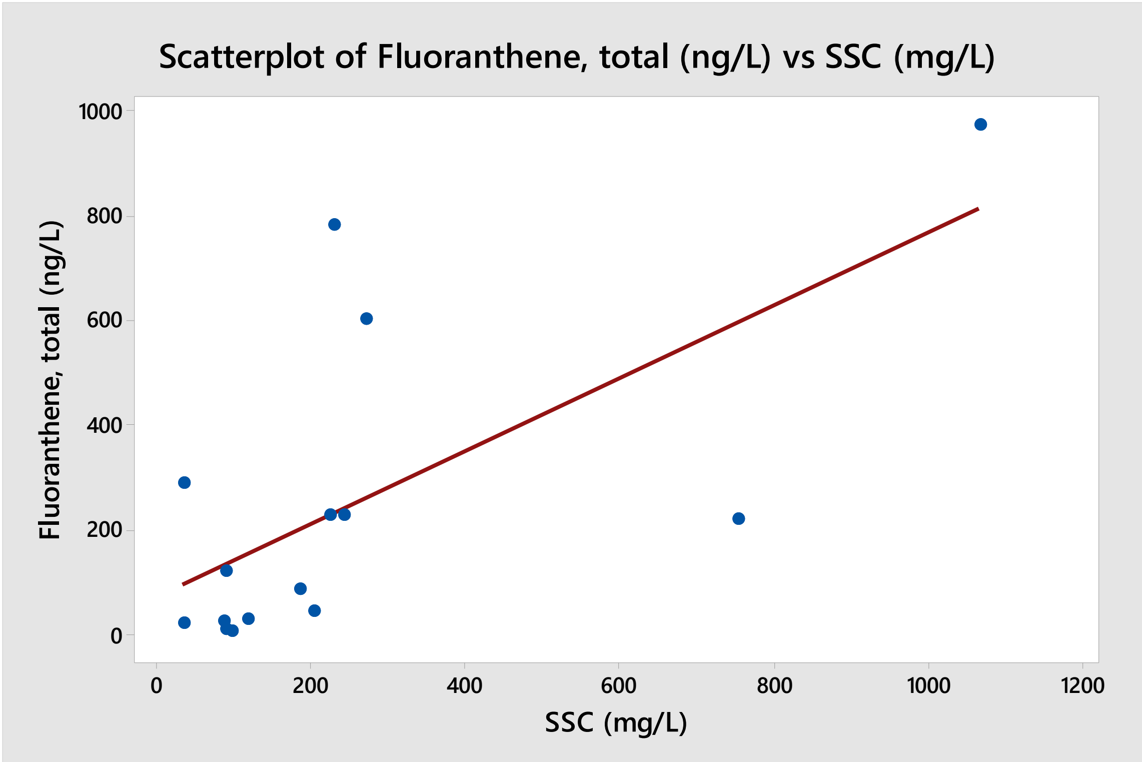


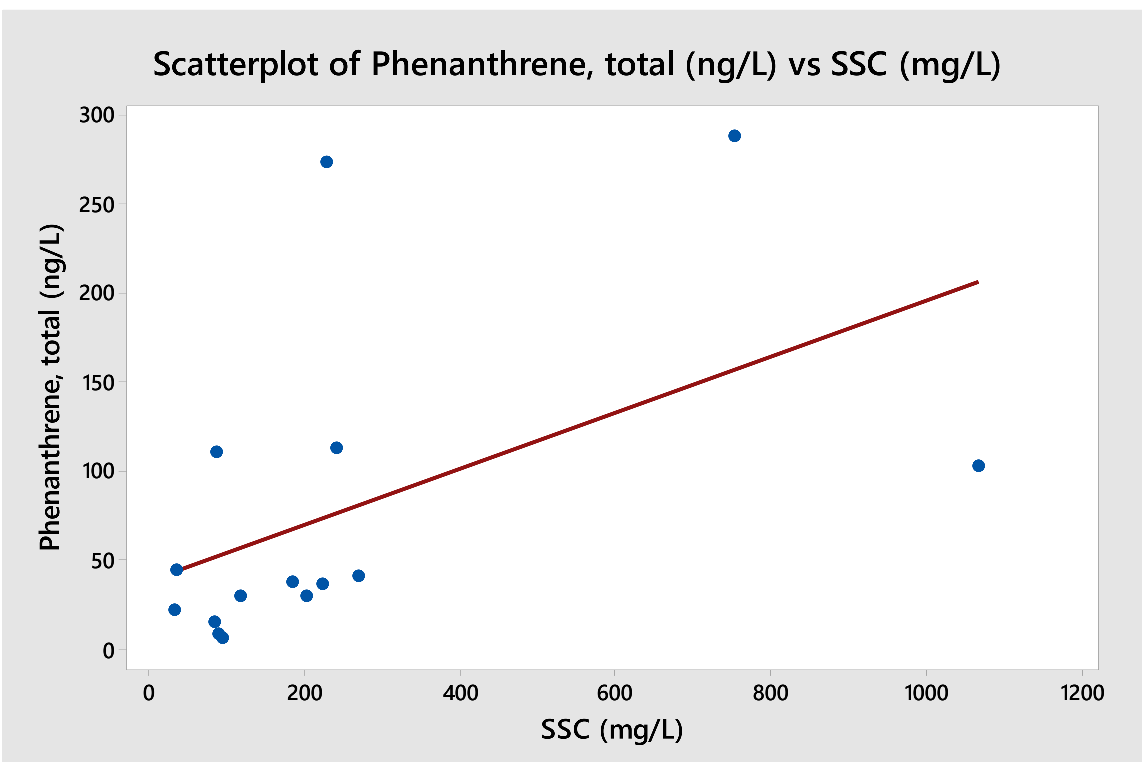

Scatterplot of Benzo[b]fluoranthene, total (ng vs SSC (mg/L)
Benzo[b]fluoranthene, total (ng
400
300
200
100
0
0
200
400
600
800
1000
1200
SSC (mg/L)

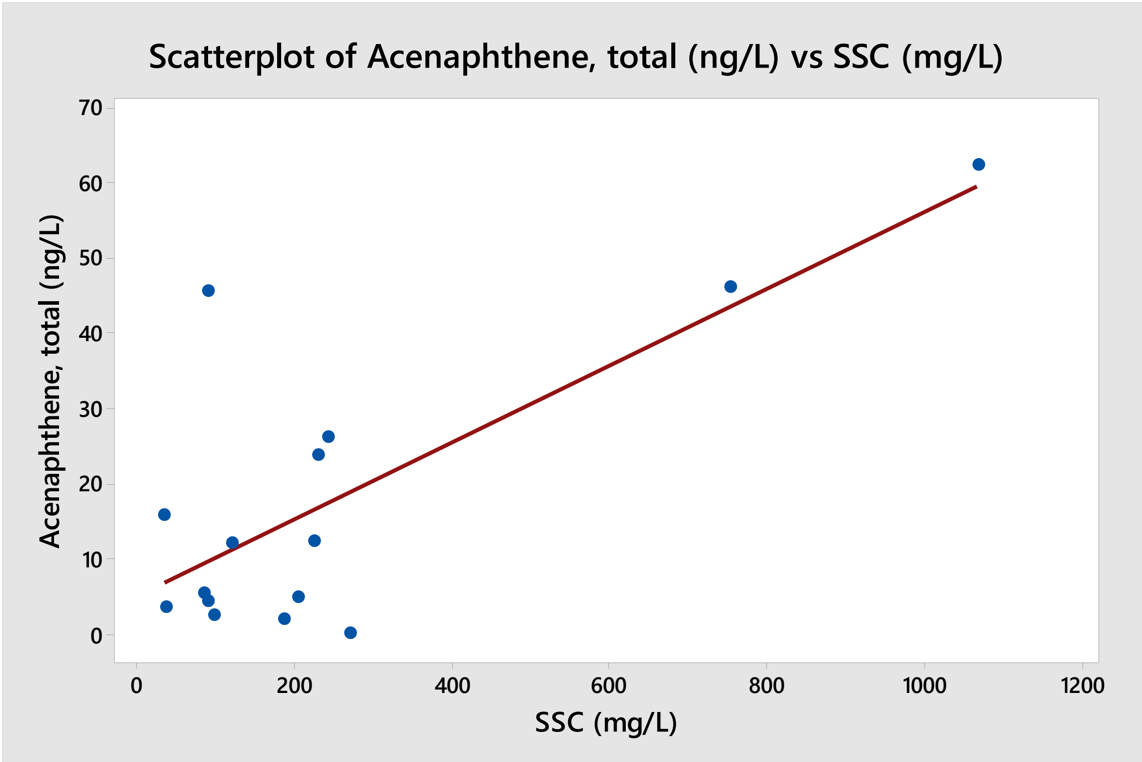

Scatterplot of Benzo[a]anthracene, total (ng/L vs SSC (mg/L)
Benzo[a]anthracene, total (ng/L
200
150
100
50
0
0
200
400
600
800
1000
1200
SSC (mg/L)

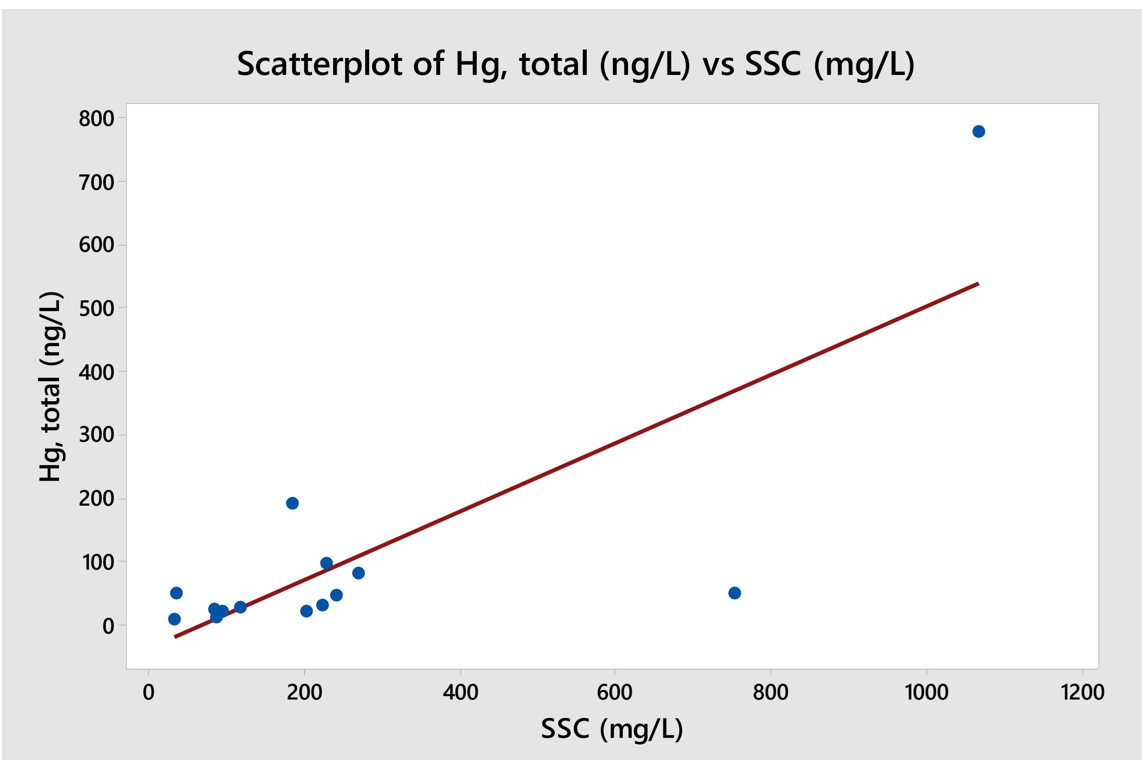

Scatterplot of Chrysene, total (ng/L) vs SSC (mg/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
SSC (mg/L)

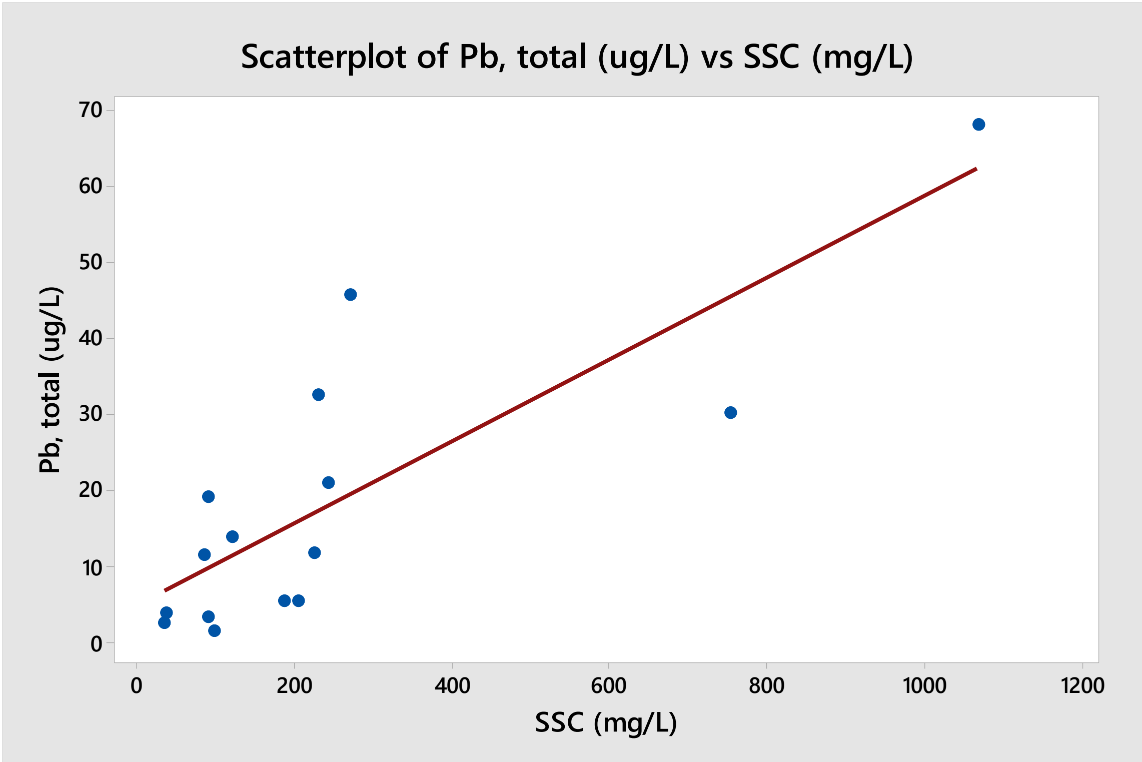

Scatterplot of Pyrene, total (ng/L) vs SSC (mg/L)
Pyrene, total (ng/L)
700
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
SSC (mg/L)

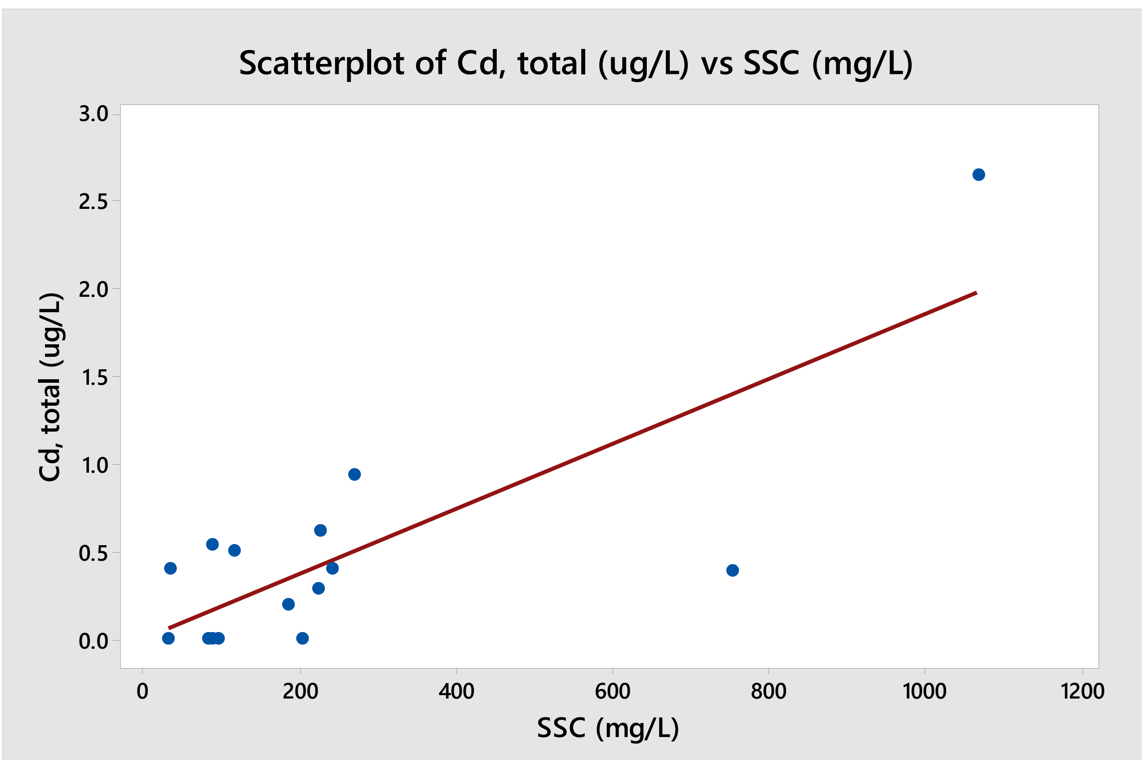

Scatterplot of Fluoranthene, total (ng/L) vs SSC (mg/L)
Fluoranthene, total (ng/L)
SSC (mg/L)
0
200
400
600
800
1000
1200

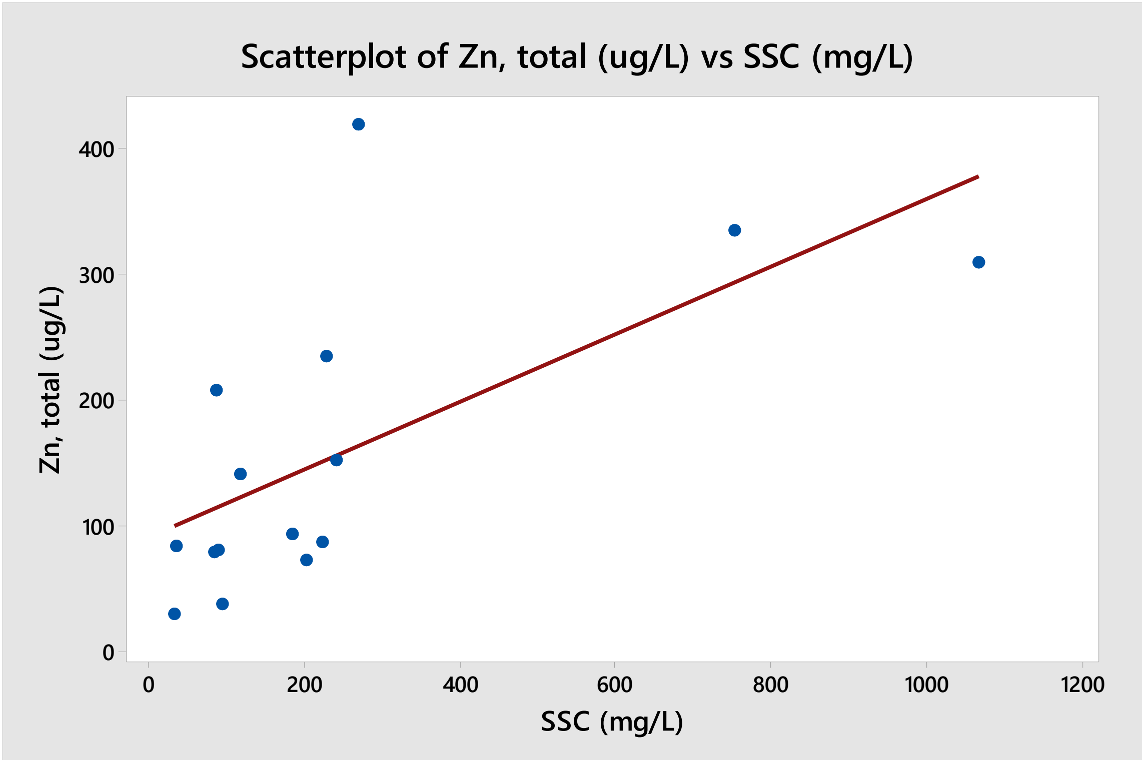

Scatterplot of Phenanthrene, total (ng/L) vs SSC (mg/L)
Phenanthrene, total (ng/L)
SSC (mg/L)
0
50
100
150
200
250
300

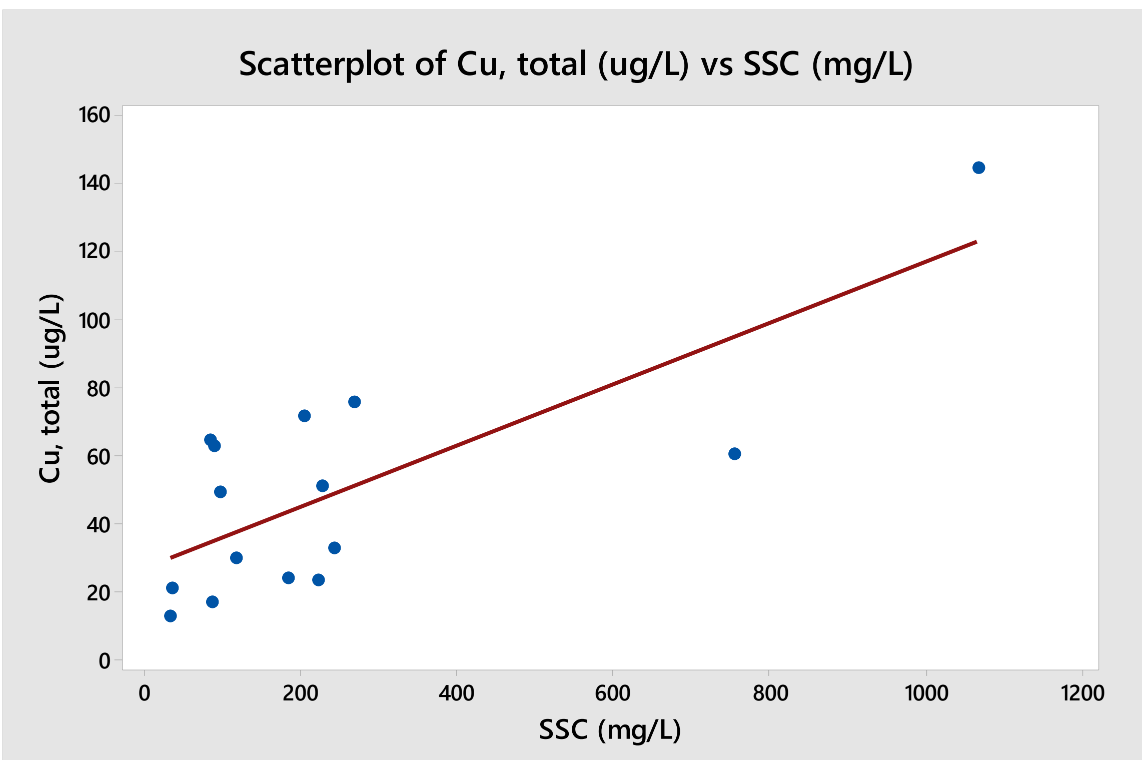

Scatterplot of Acenaphthene, total (ng/L) vs SSC (mg/L)
Acenaphthene, total (ng/L)
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
SSC (mg/L)


Scatterplot of Hg, total (ng/L) vs SSC (mg/L)
Hg, total (ng/L)
800
700
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
SSC (mg/L)

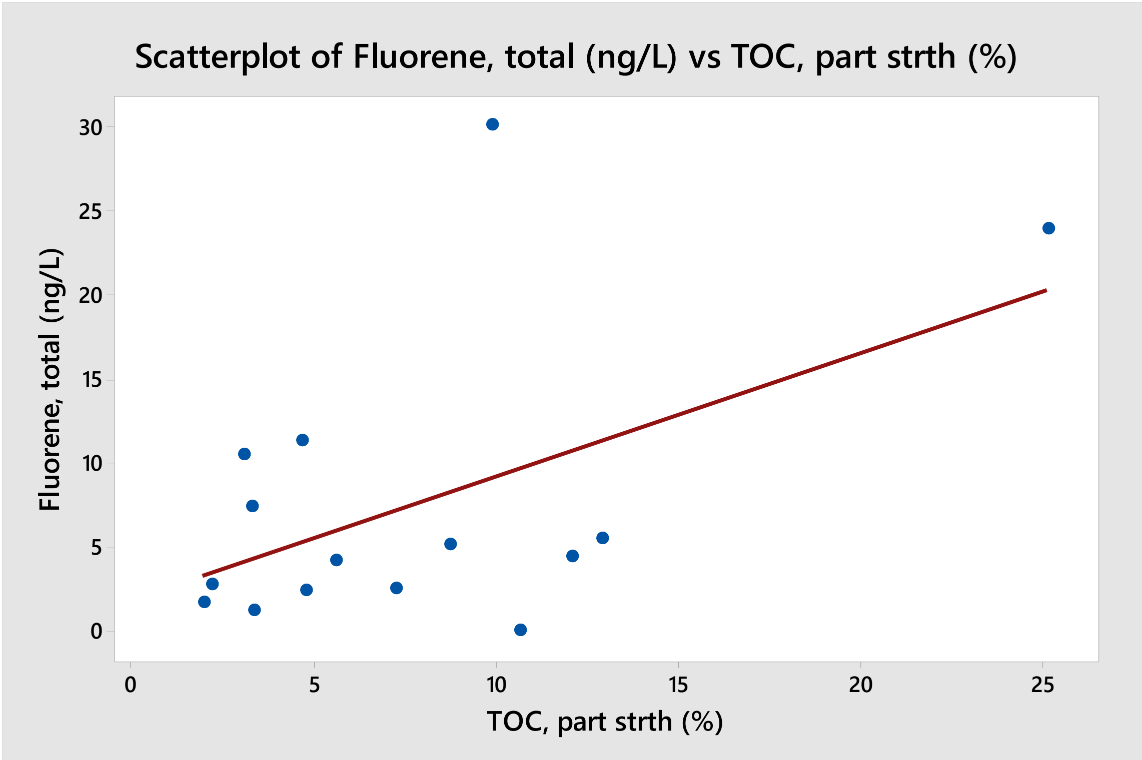

Scatterplot of Pb, total (ug/L) vs SSC (mg/L)
Pb, total (ug/L)
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
1200
SSC (mg/L)


Scatterplot of Cd, total (ug/L) vs SSC (mg/L)
Cd, total (ug/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
SSC (mg/L)

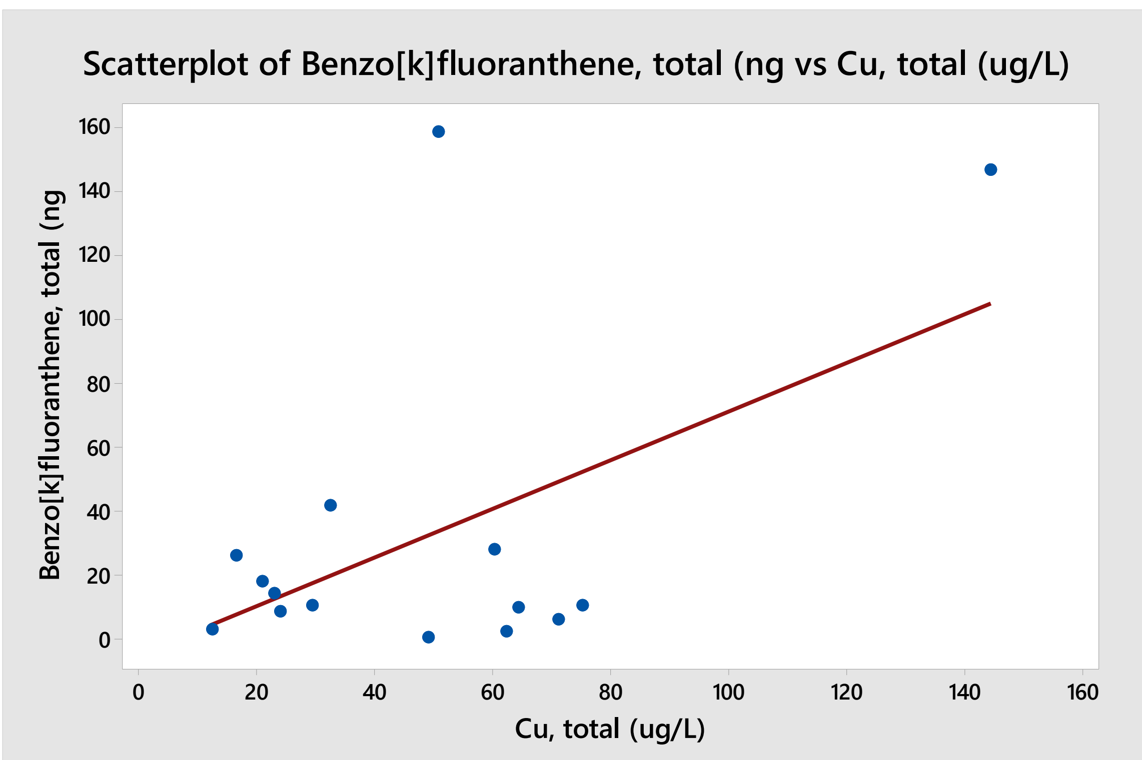


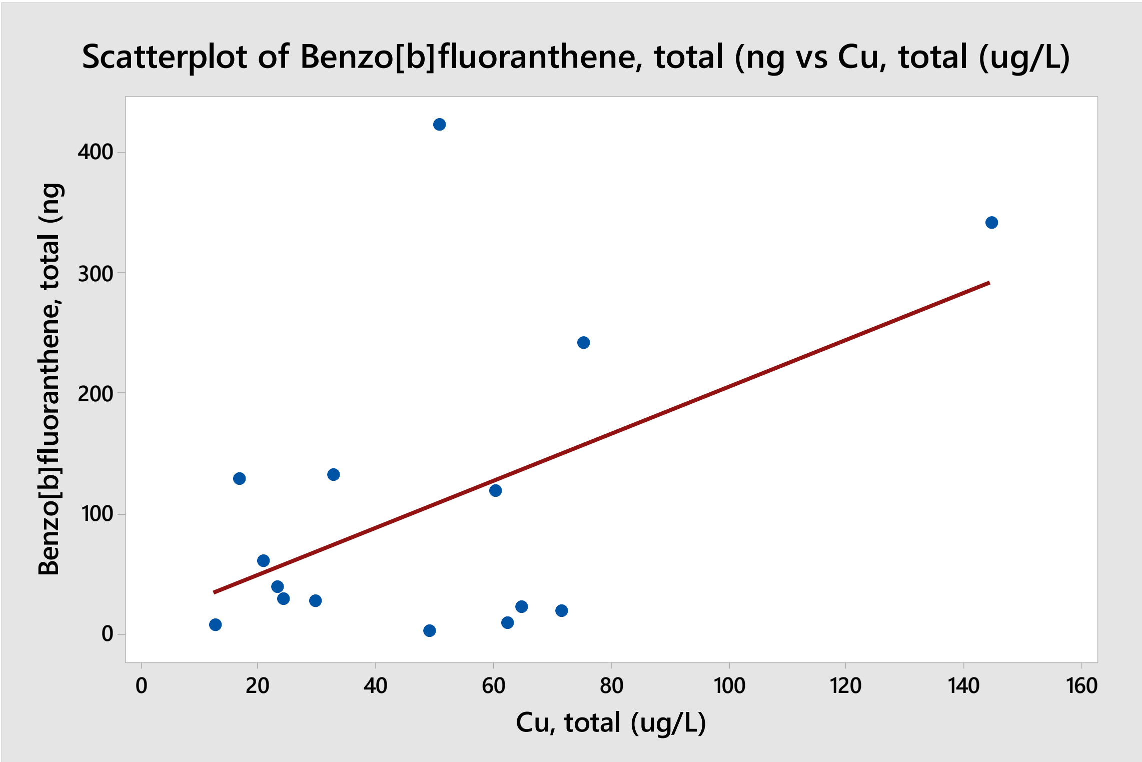


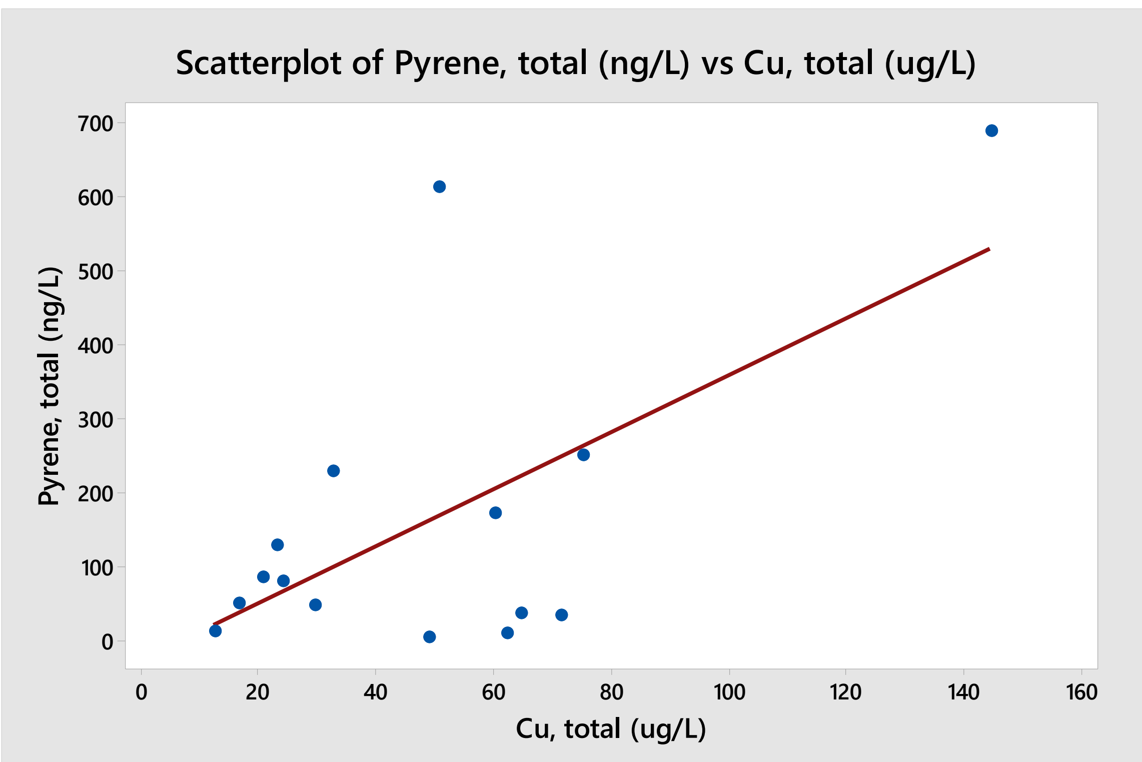
TOC particulate strength correlations

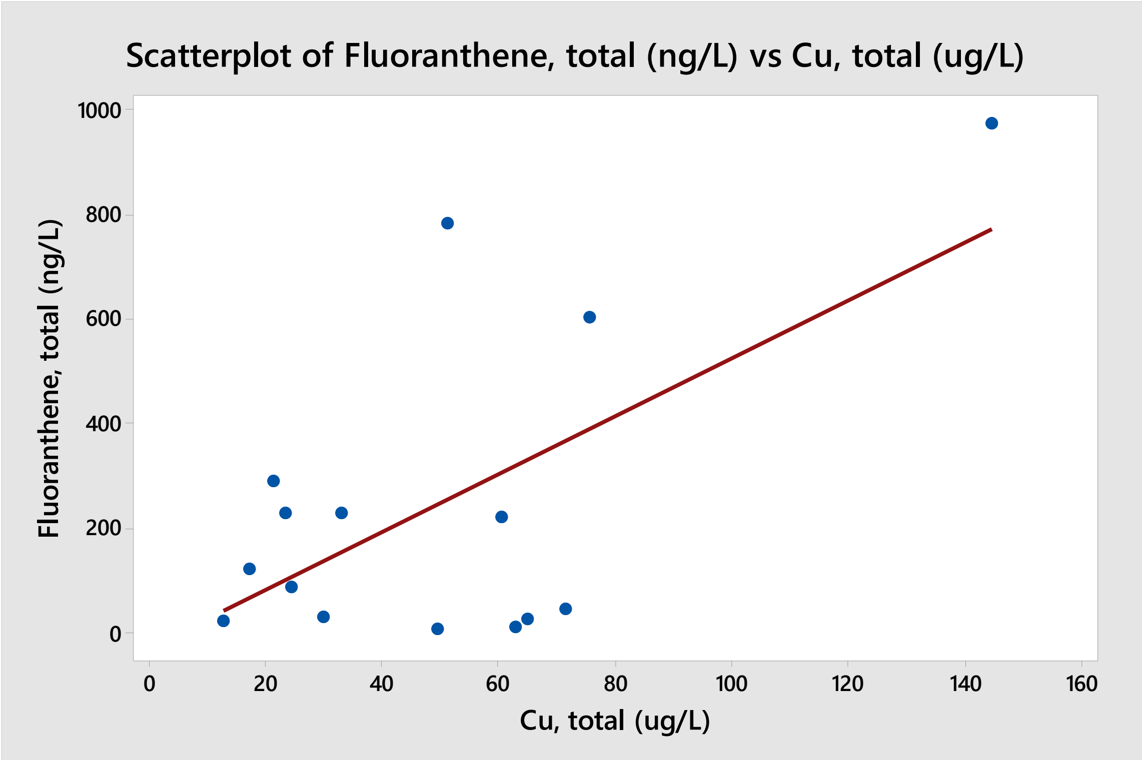


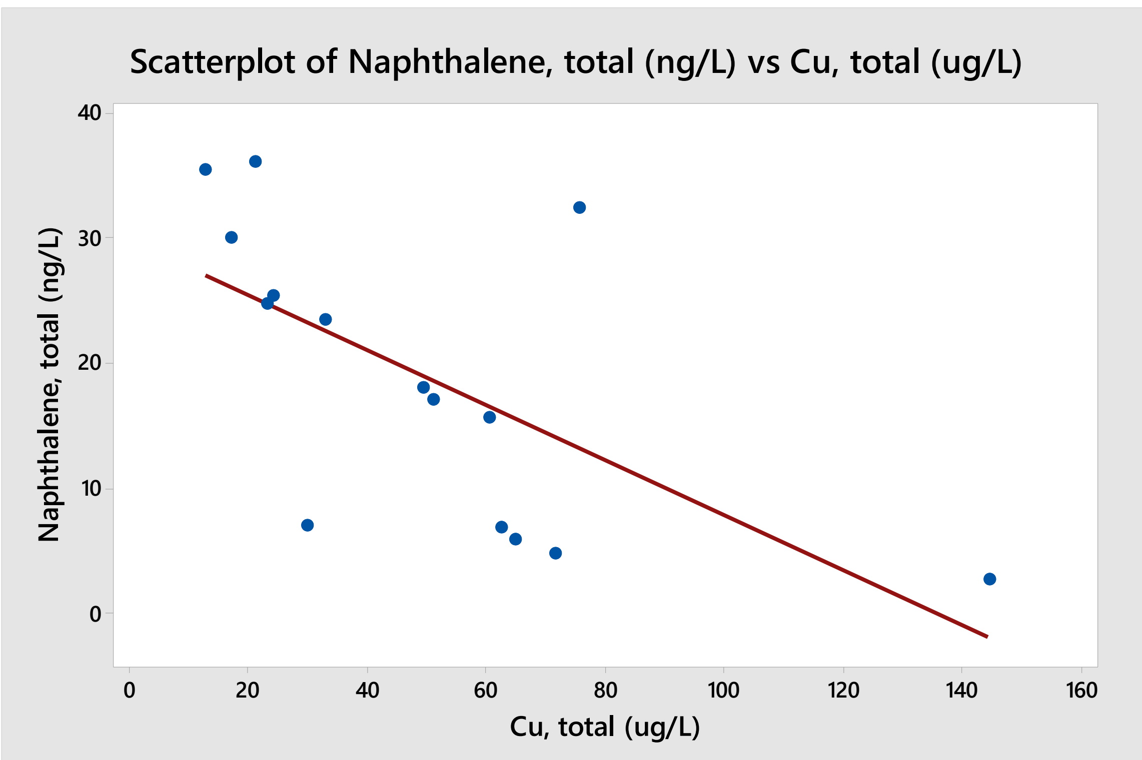
Cu, total, correlations

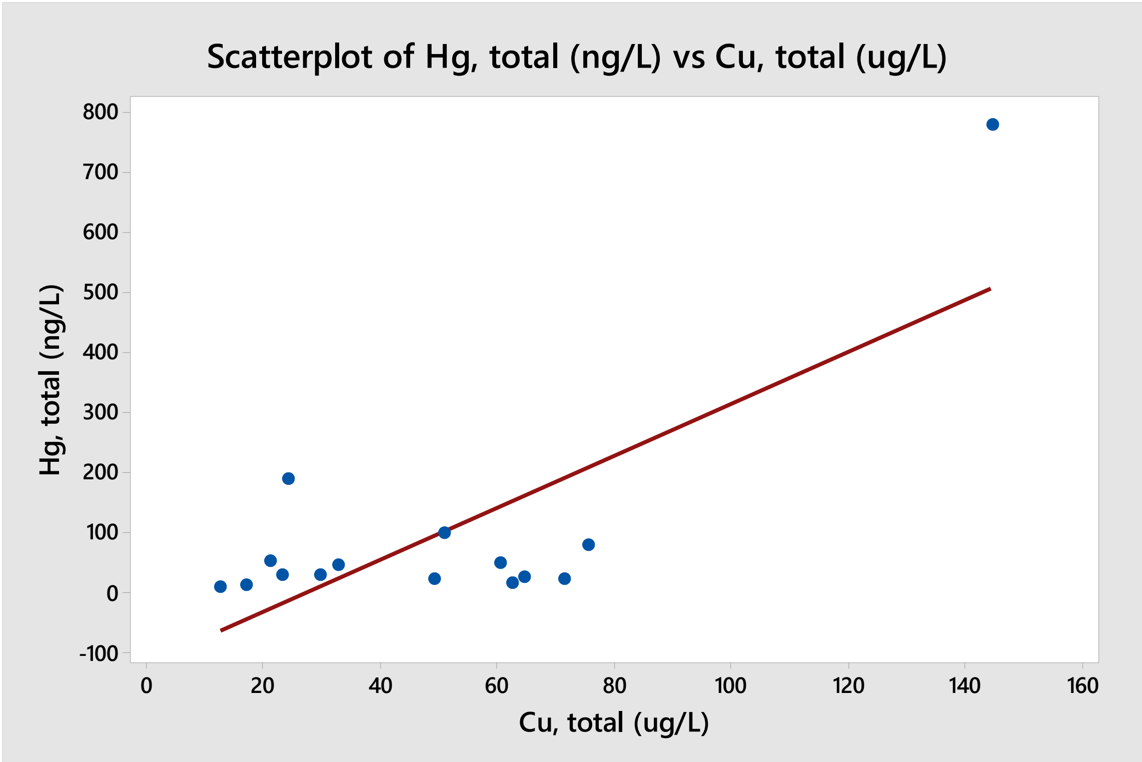


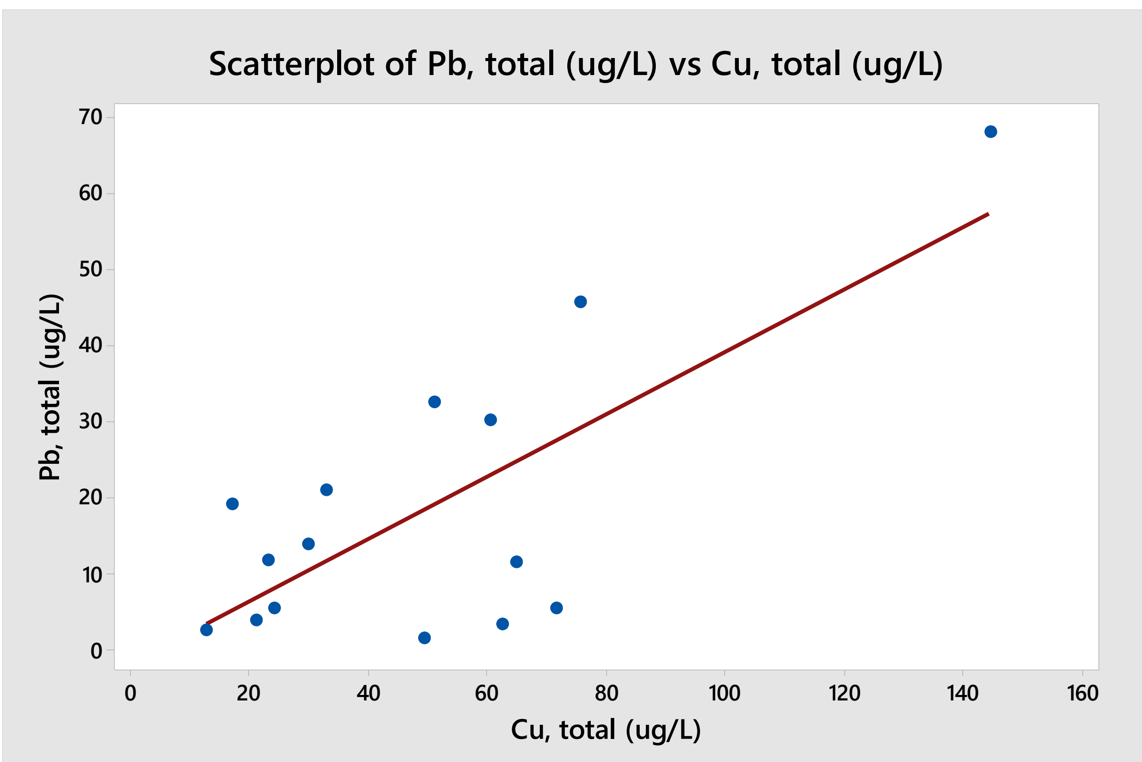

Scatterplot of Benzo[b]fluoranthene, total (ng vs Cu, total (ug/L)
Benzo[b]fluoranthene, total (ng
0
100
200
300
400
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

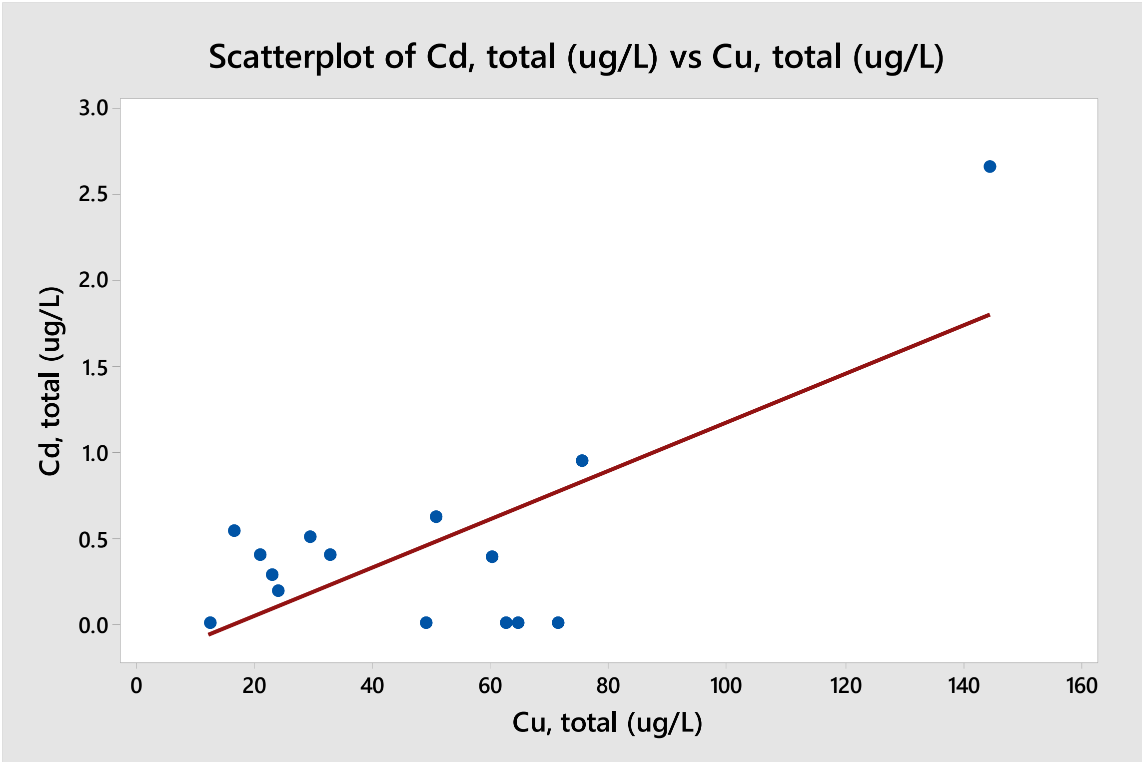

Scatterplot of Pyrene, total (ng/L) vs Cu, total (ug/L)
Pyrene, total (ng/L)
0
100
200
300
400
500
600
700
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

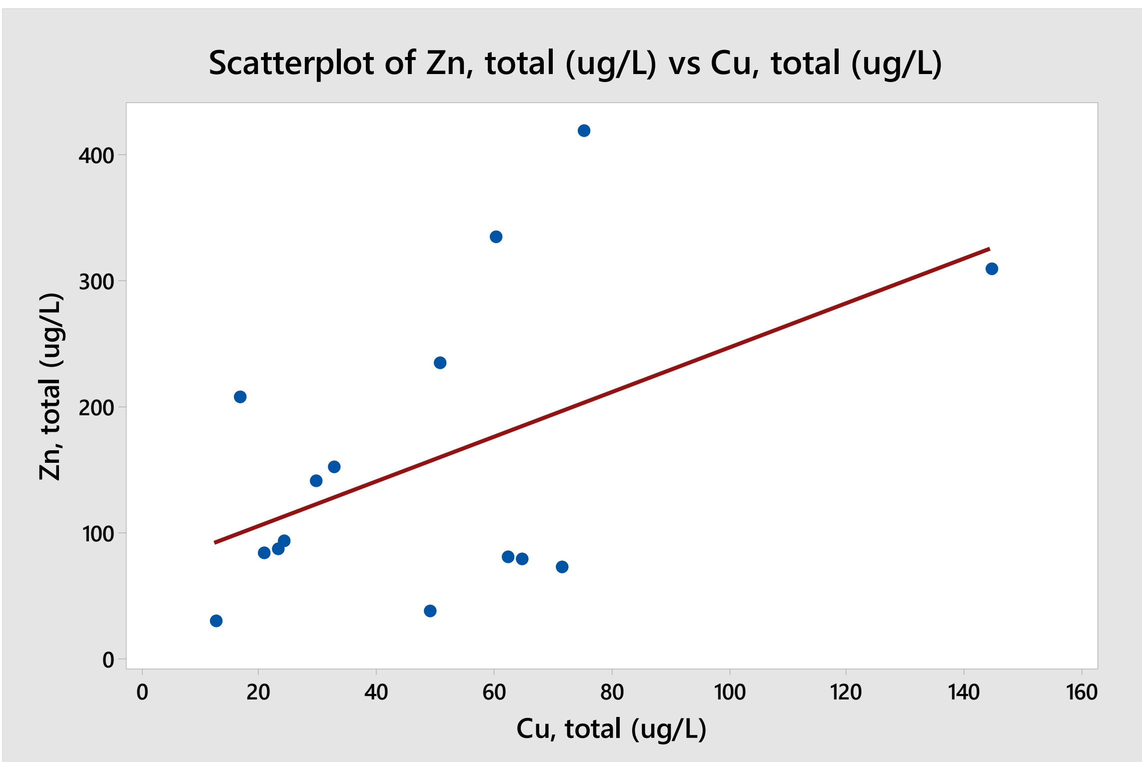

Scatterplot of Fluoranthene, total (ng/L) vs Cu, total (ug/L)
Fluoranthene, total (ng/L)
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

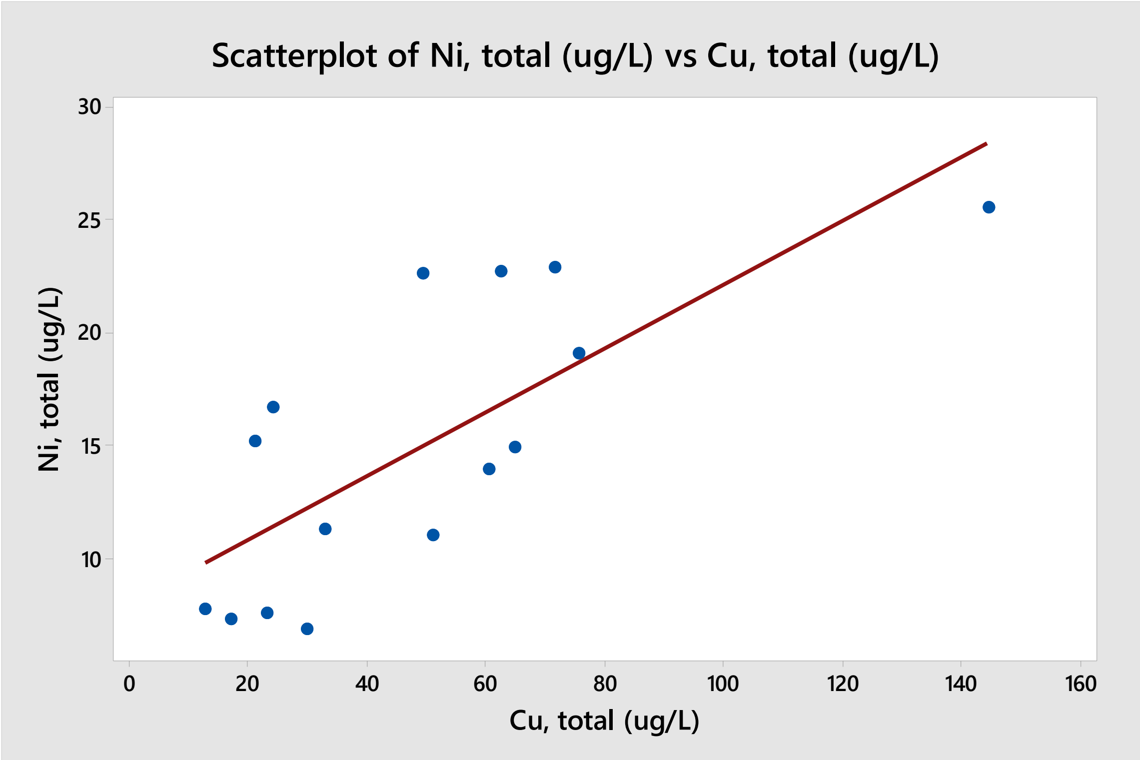

Scatterplot of Naphthalene, total (ng/L) vs Cu, total (ug/L)
Naphthalene, total (ng/L)
40
30
20
10
0
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)


Scatterplot of Hg, total (ng/L) vs Cu, total (ug/L)
Hg, total (ng/L)
800
700
600
500
400
300
200
100
0
-100
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

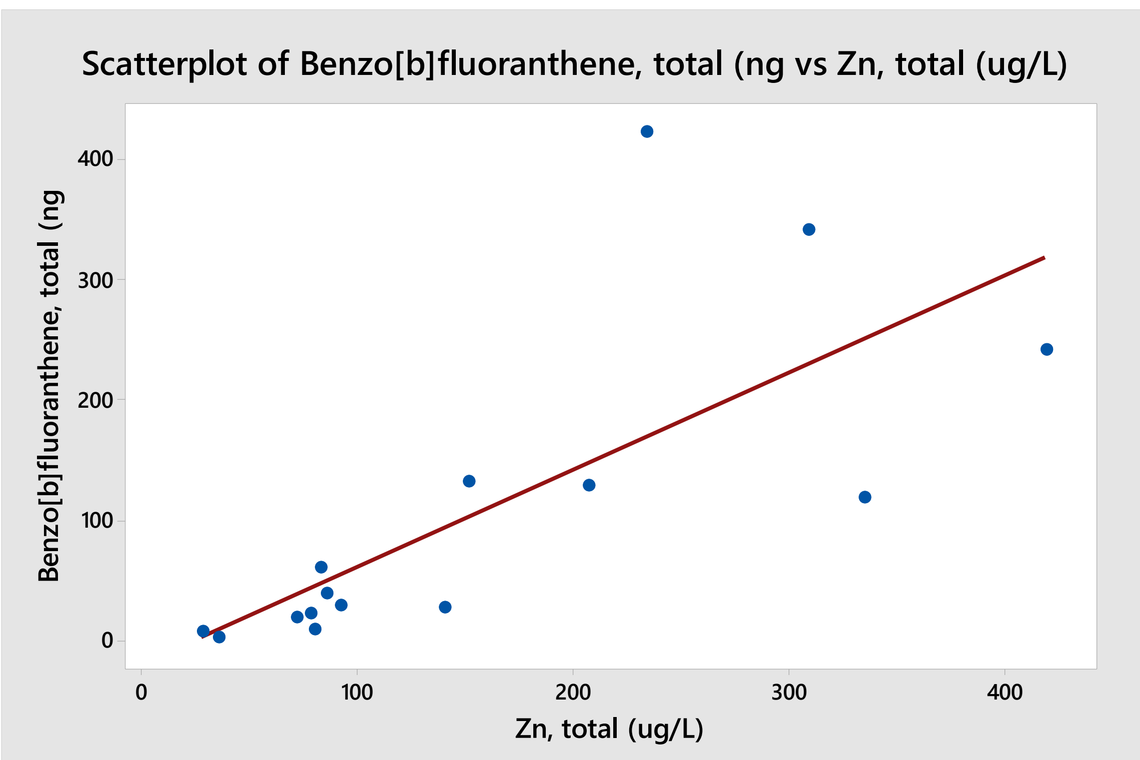

Scatterplot of Pb, total (ug/L) vs Cu, total (ug/L)
Pb, total (ug/L)
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

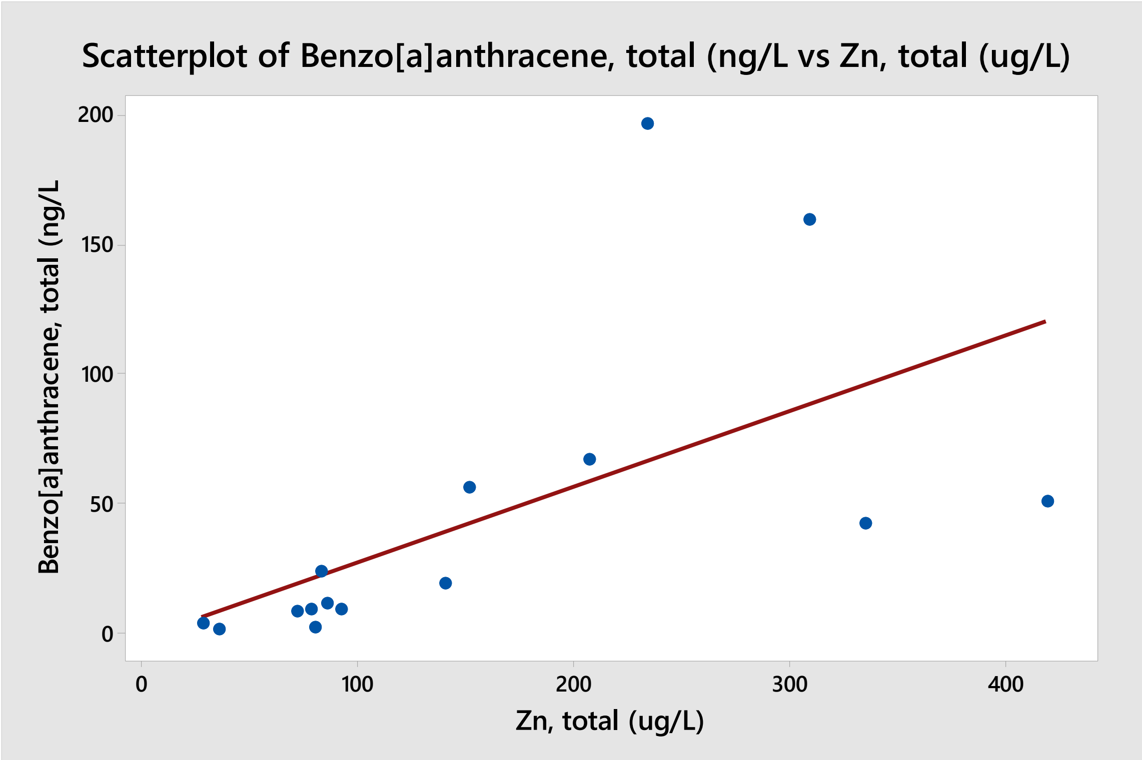

Scatterplot of Cd, total (ug/L) vs Cu, total (ug/L)
Cd, total (ug/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

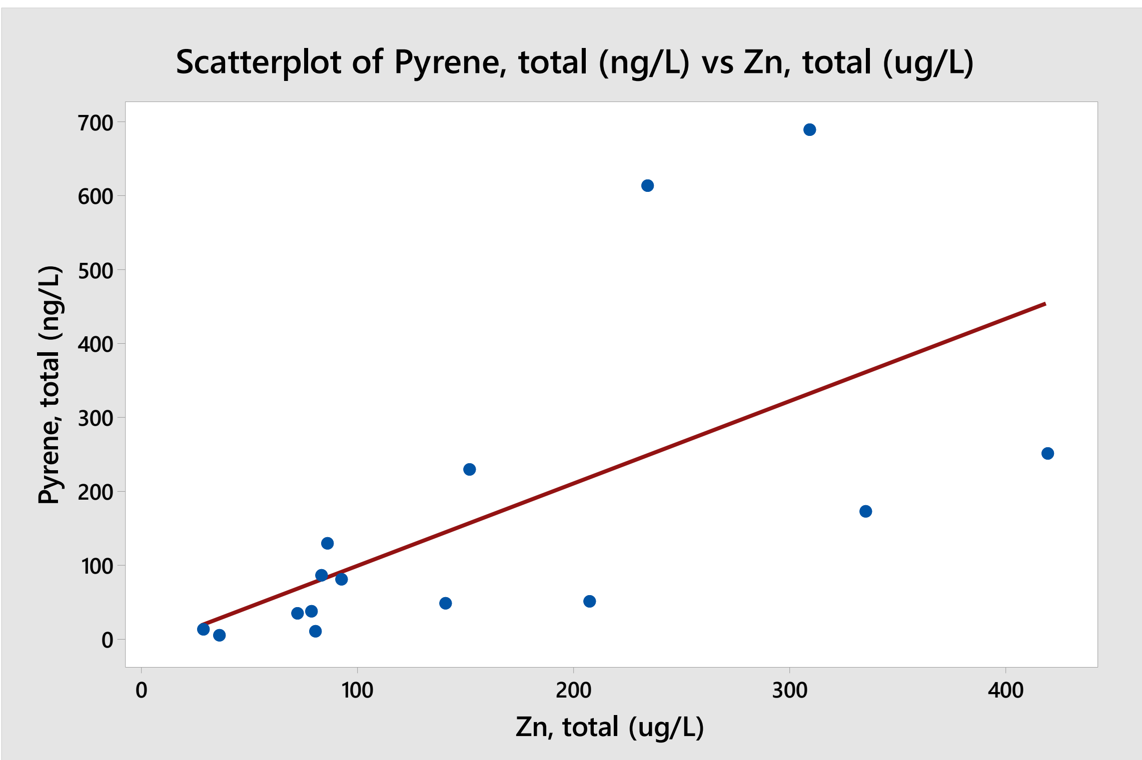

Scatterplot of Zn, total (ug/L) vs Cu, total (ug/L)
Zn, total (ug/L)
400
300
200
100
0
0
20
40
60
80
100
120
140
160
Cu, total (ug/L)

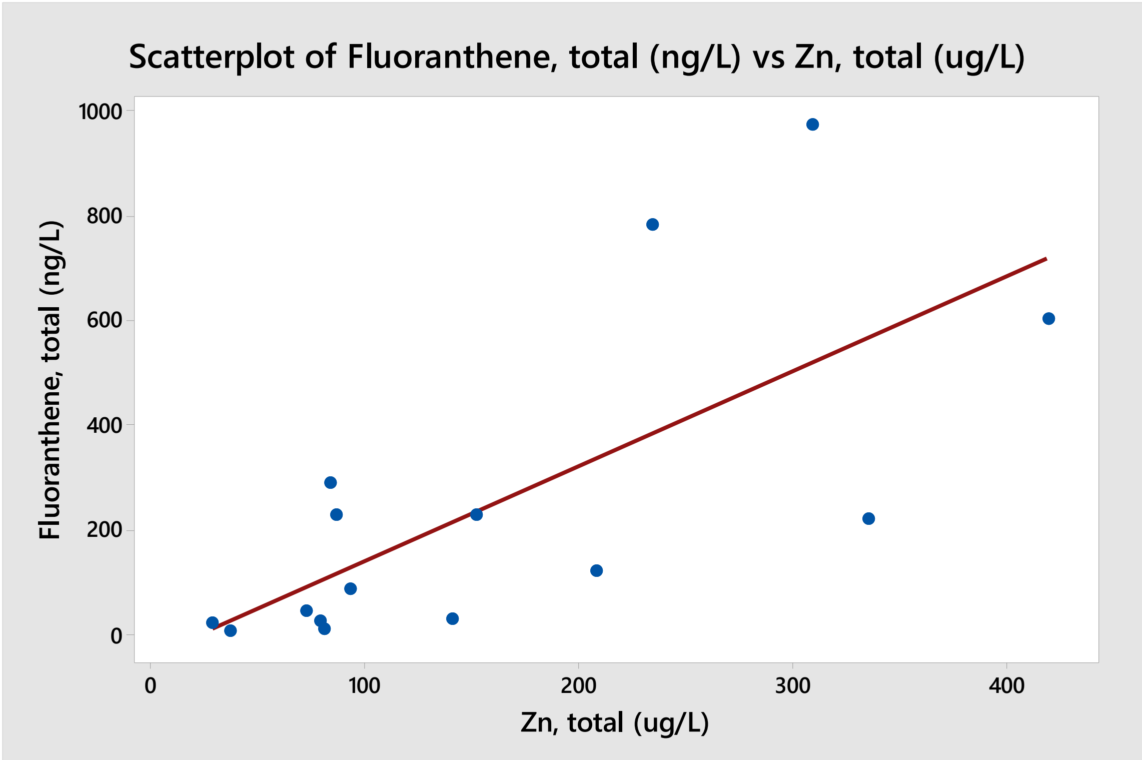


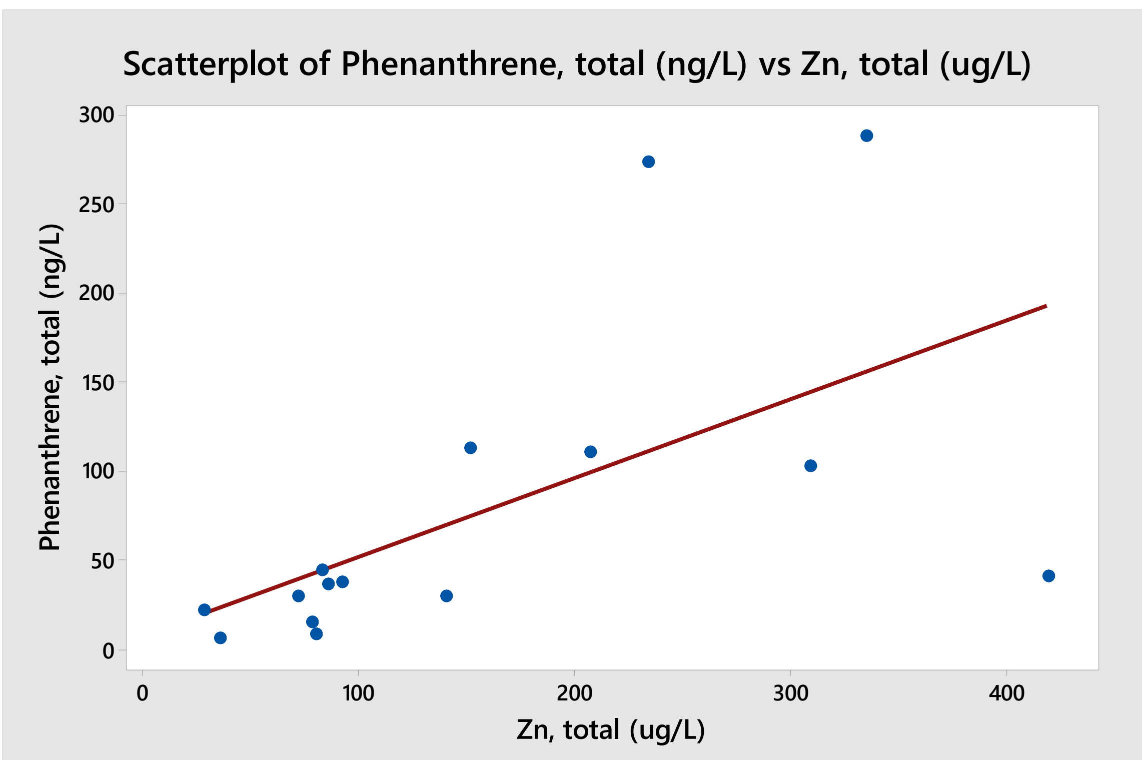
Zn, total, correlations

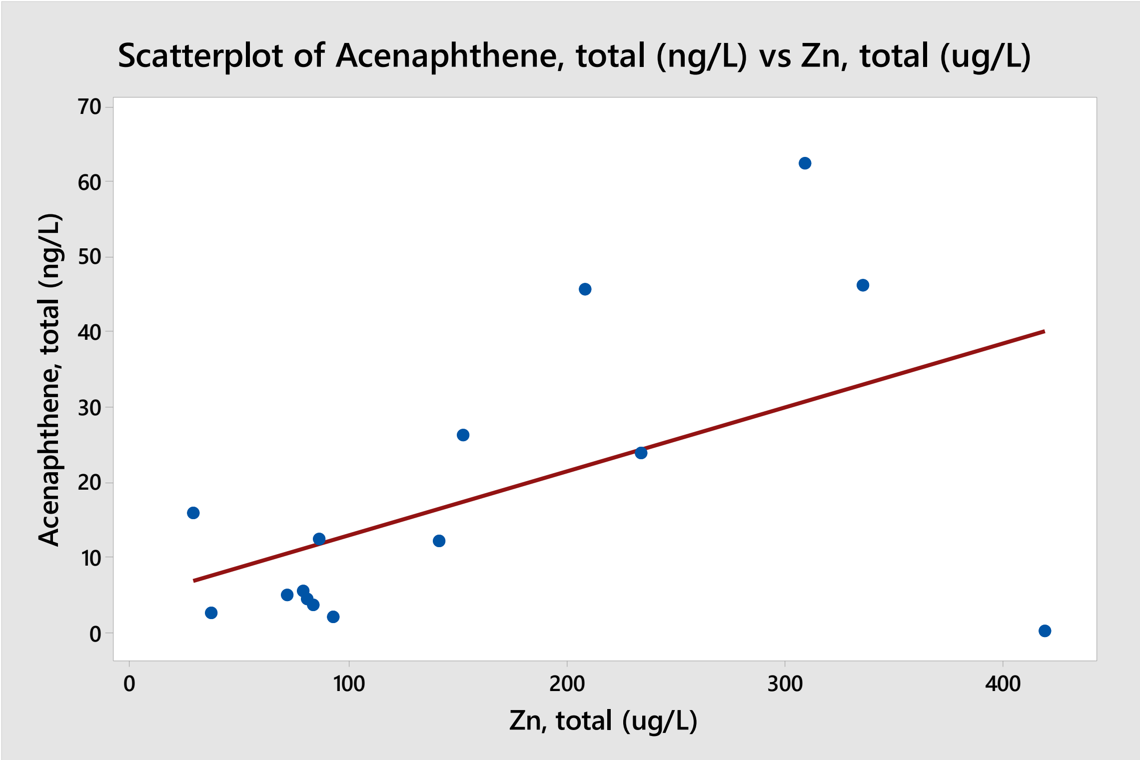


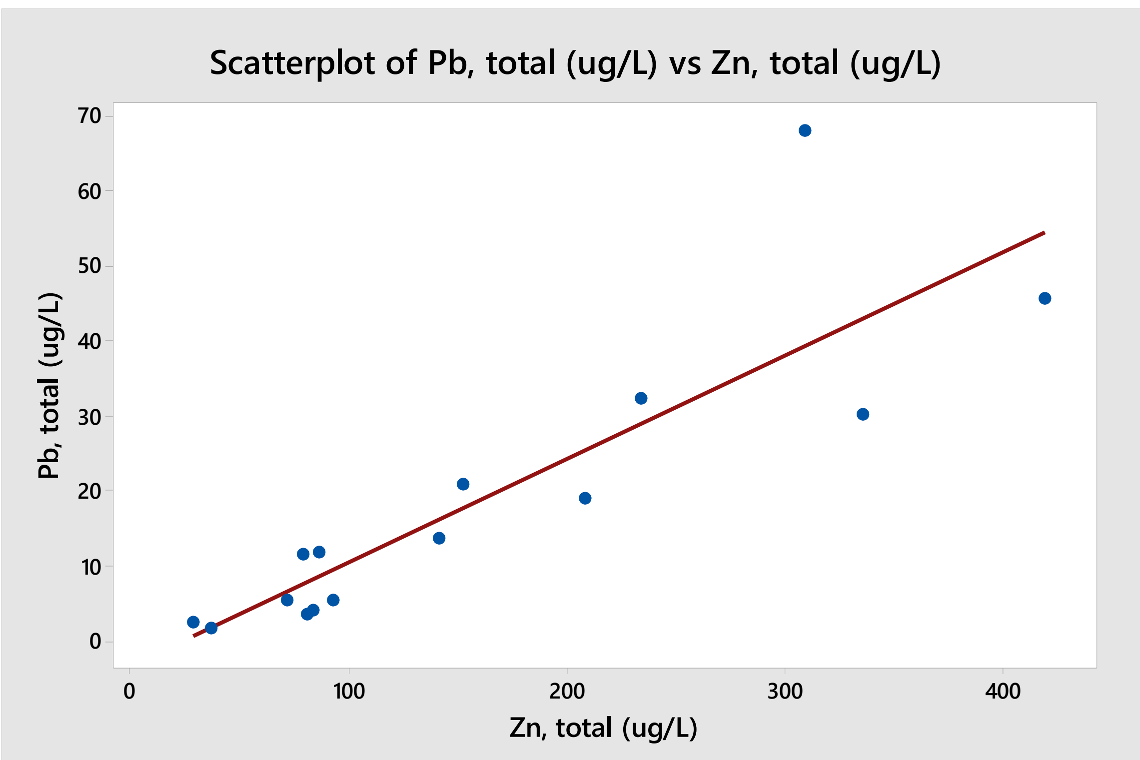

Scatterplot of Benzo[a]anthracene, total (ng/L vs Zn, total (ug/L)
Benzo[a]anthracene, total (ng/L
200
150
100
50
0
0
100
200
300
400
Zn, total (ug/L)

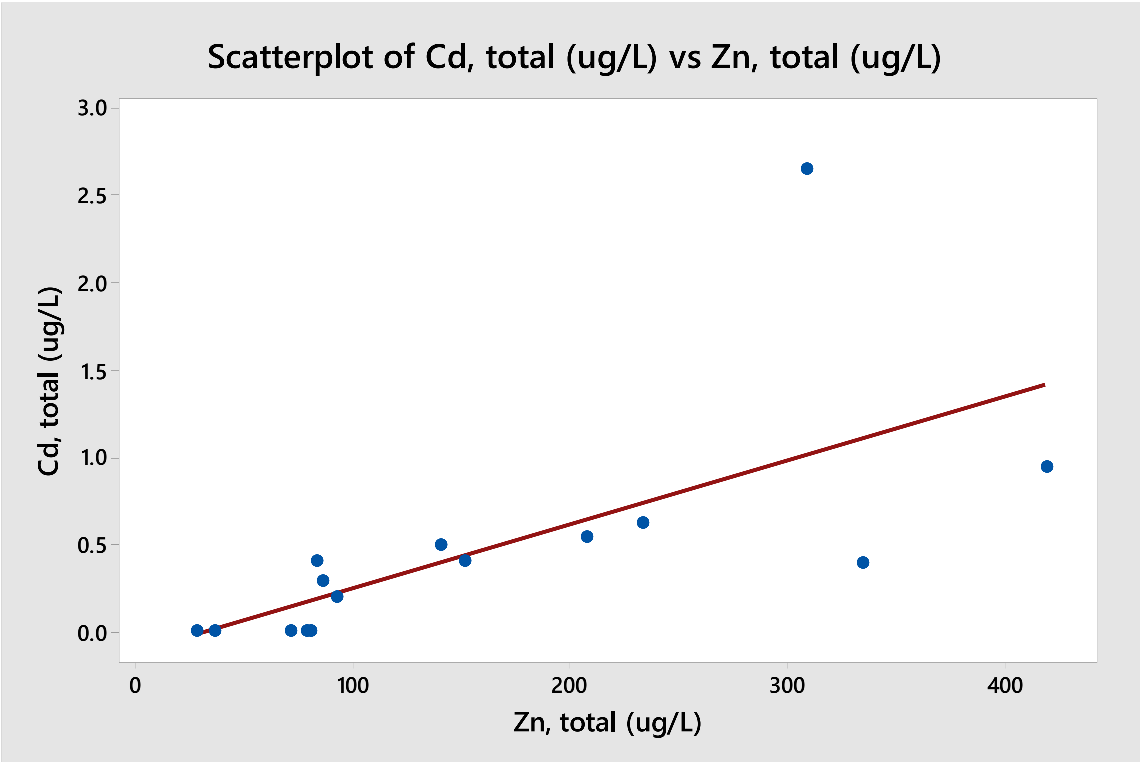

Scatterplot of Pyrene, total (ng/L) vs Zn, total (ug/L)
Pyrene, total (ng/L)
700
600
500
400
300
200
100
0
0
100
200
300
400
Zn, total (ug/L)


Scatterplot of Fluoranthene, total (ng/L) vs Zn, total (ug/L)
Fluoranthene, total (ng/L)
1000
800
600
400
200
0
0
100
200
300
400
Zn, total (ug/L)

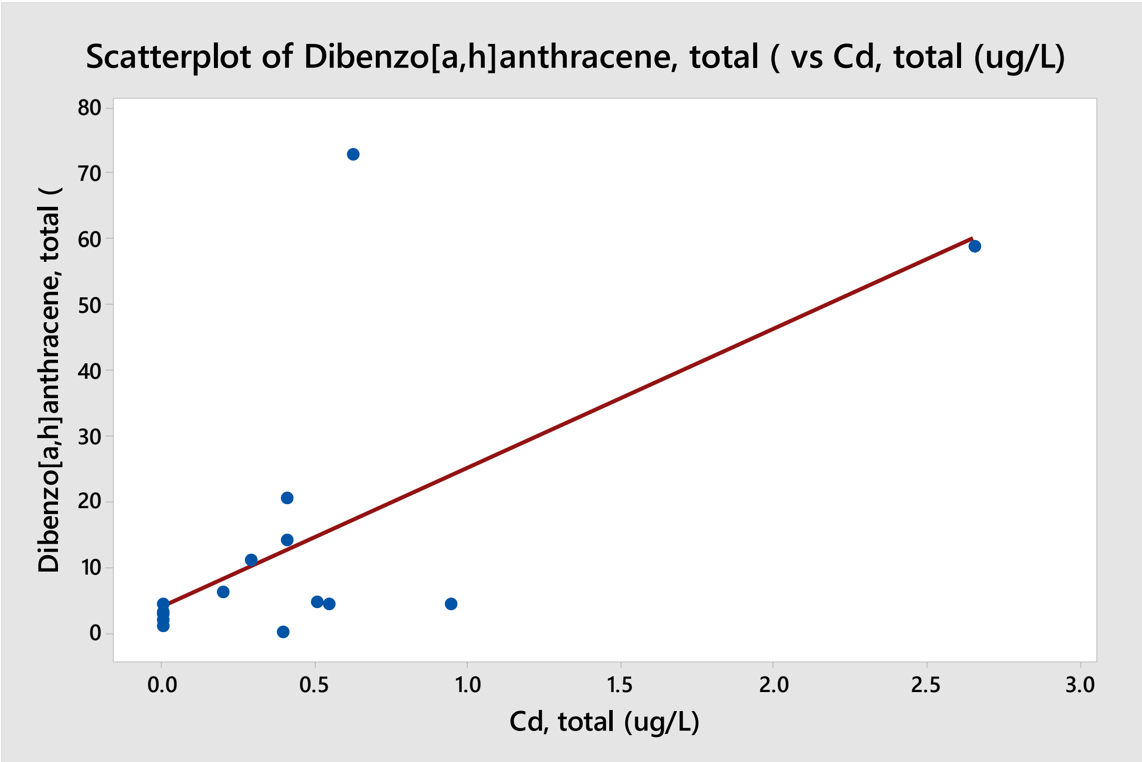

Scatterplot of Phenanthrene, total (ng/L) vs Zn, total (ug/L)
Phenanthrene, total (ng/L)
300
250
200
150
100
50
0
0
100
200
300
400
Zn, total (ug/L)


Scatterplot of Acenaphthene, total (ng/L) vs Zn, total (ug/L)
Acenaphthene, total (ng/L)
70
60
50
40
30
20
10
0
0
100
200
300
400
Zn, total (ug/L)

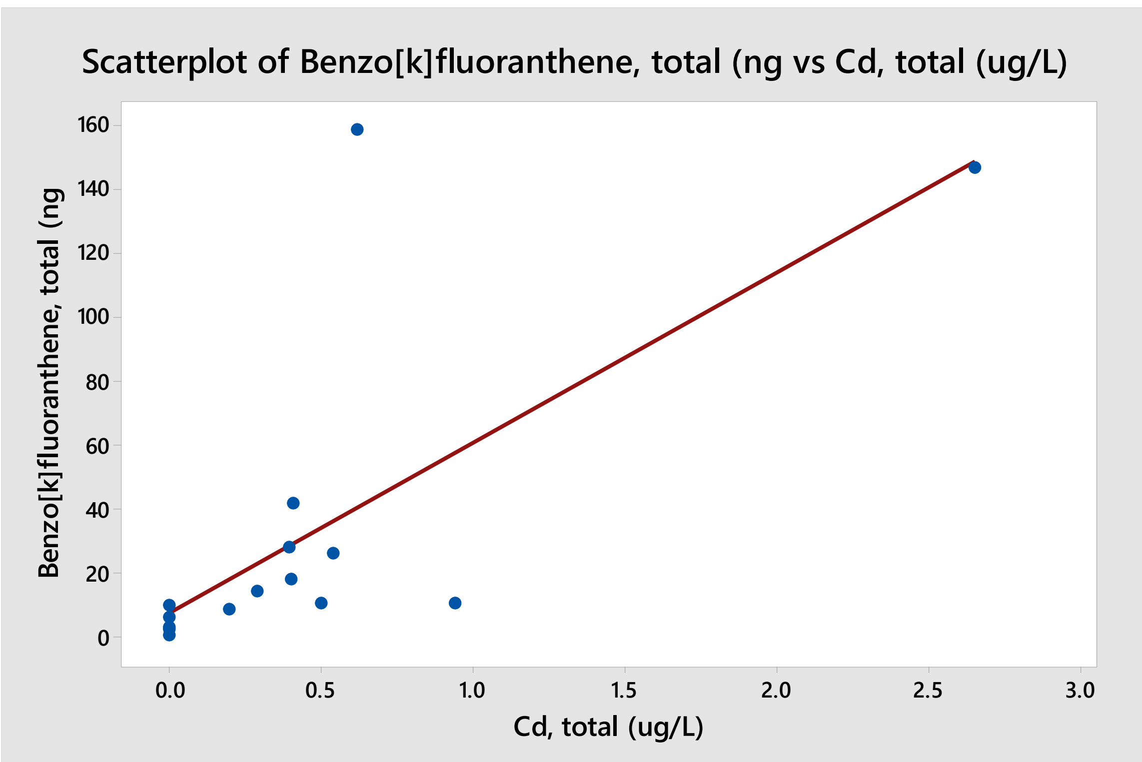

Scatterplot of Pb, total (ug/L) vs Zn, total (ug/L)
Pb, total (ug/L)
70
60
50
40
30
20
10
0
0
100
200
300
400
Zn, total (ug/L)



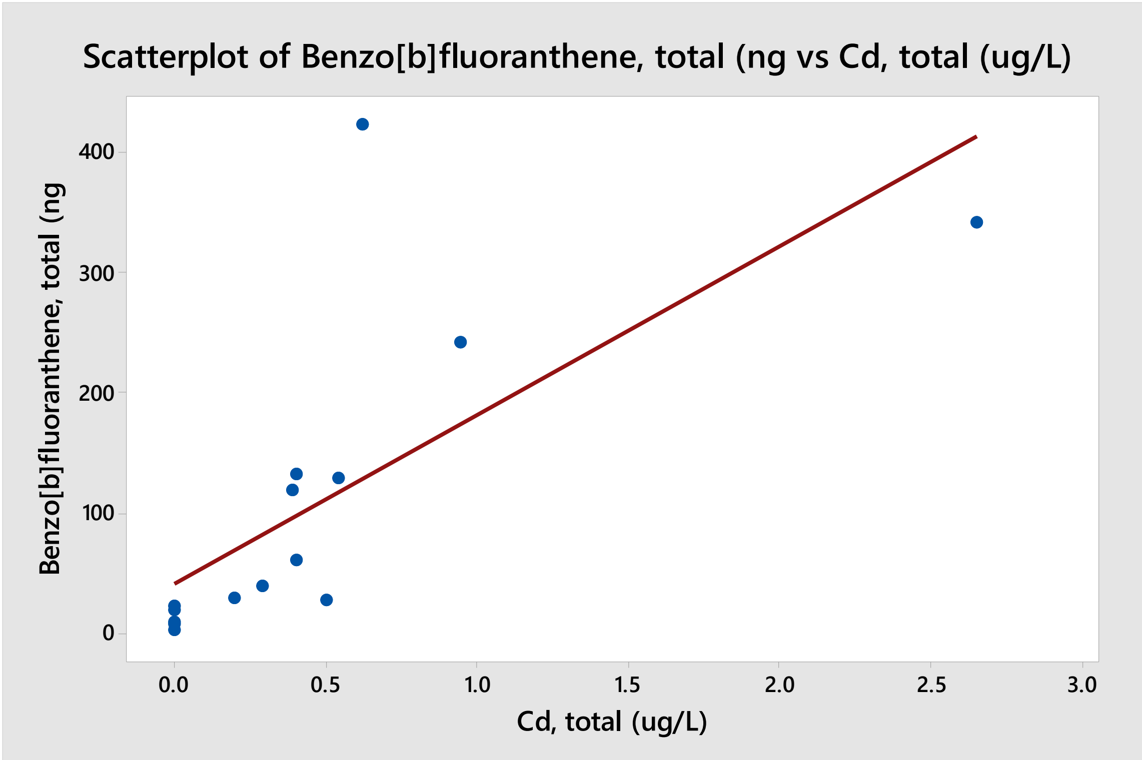
Cd, total, correlations

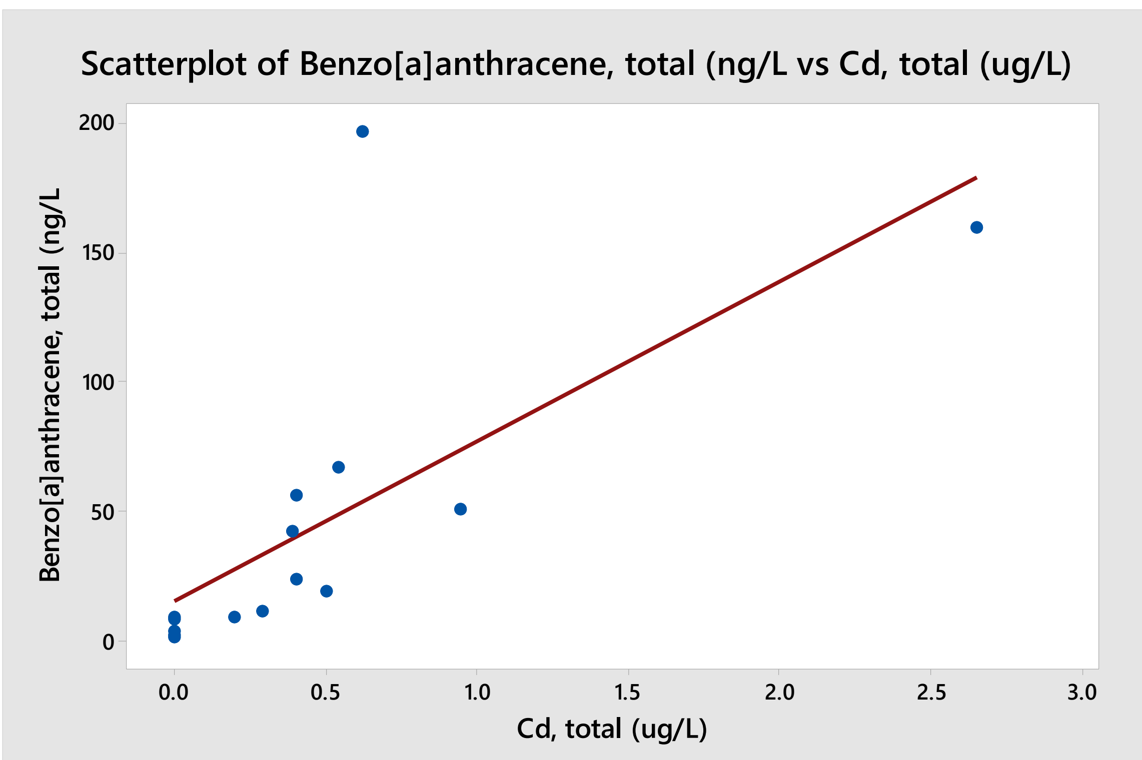


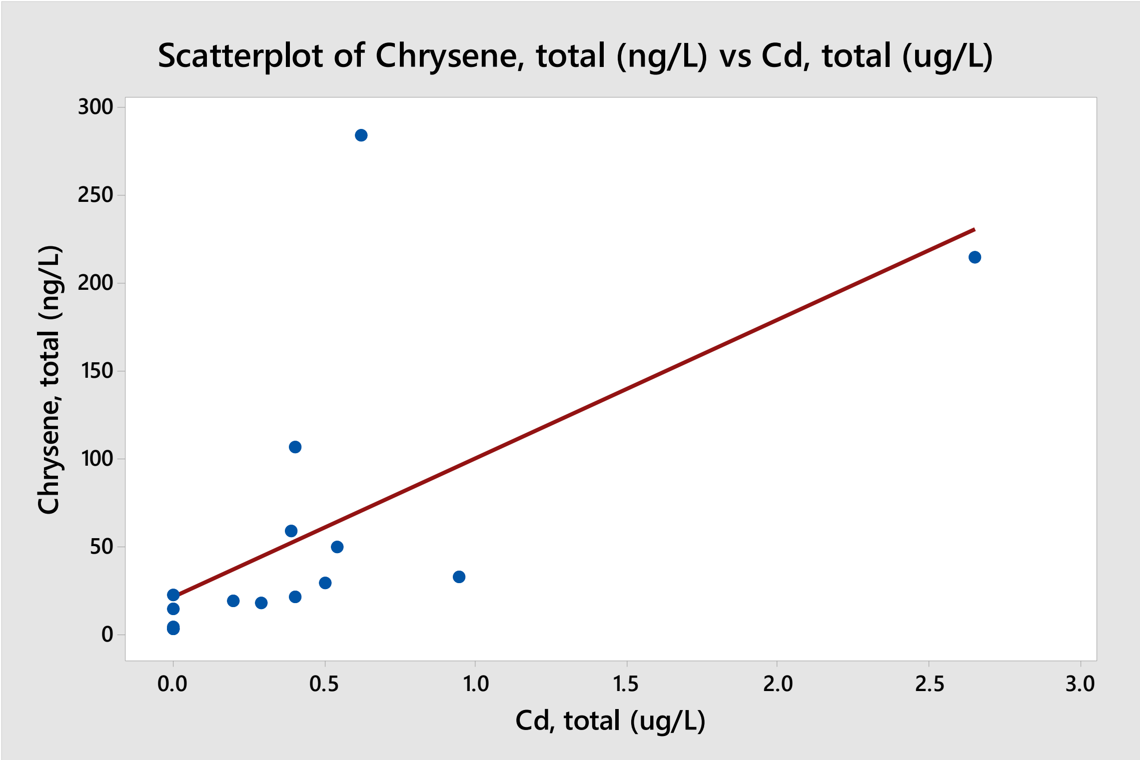
Scatterplot of Dibenzo[a,h]anthracene, total (vs Cd, total (ug/L)
Dibenzo[a,h]anthracene, total (
80
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

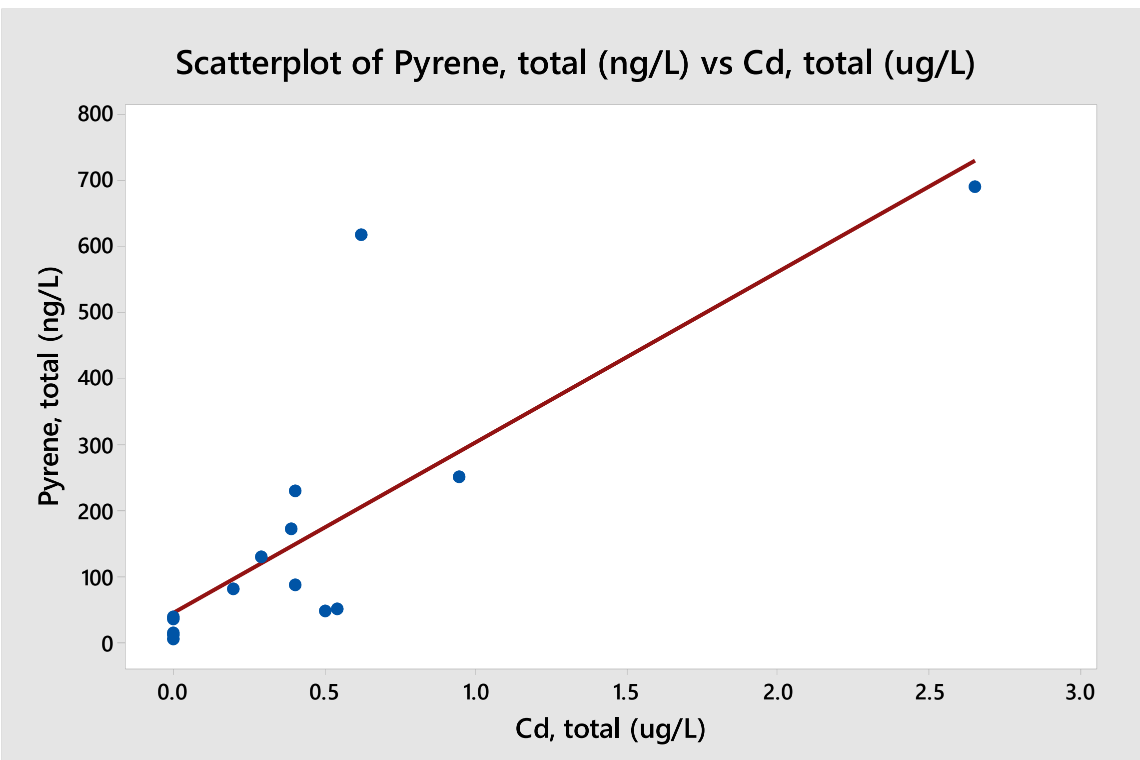


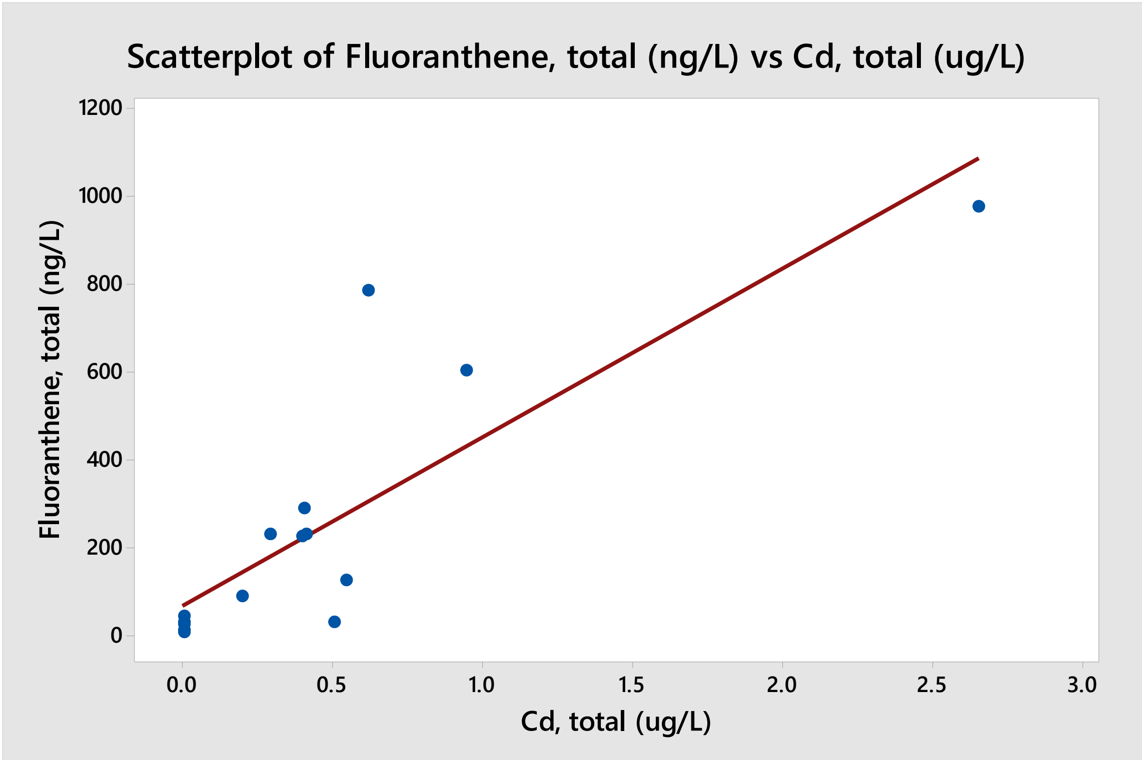
Scatterplot of Benzo[k]fluoranthene, total (ng vs Cd, total (ug/L)
Benzo[k]fluoranthene, total (ng
160
140
120
100
80
60
40
20
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

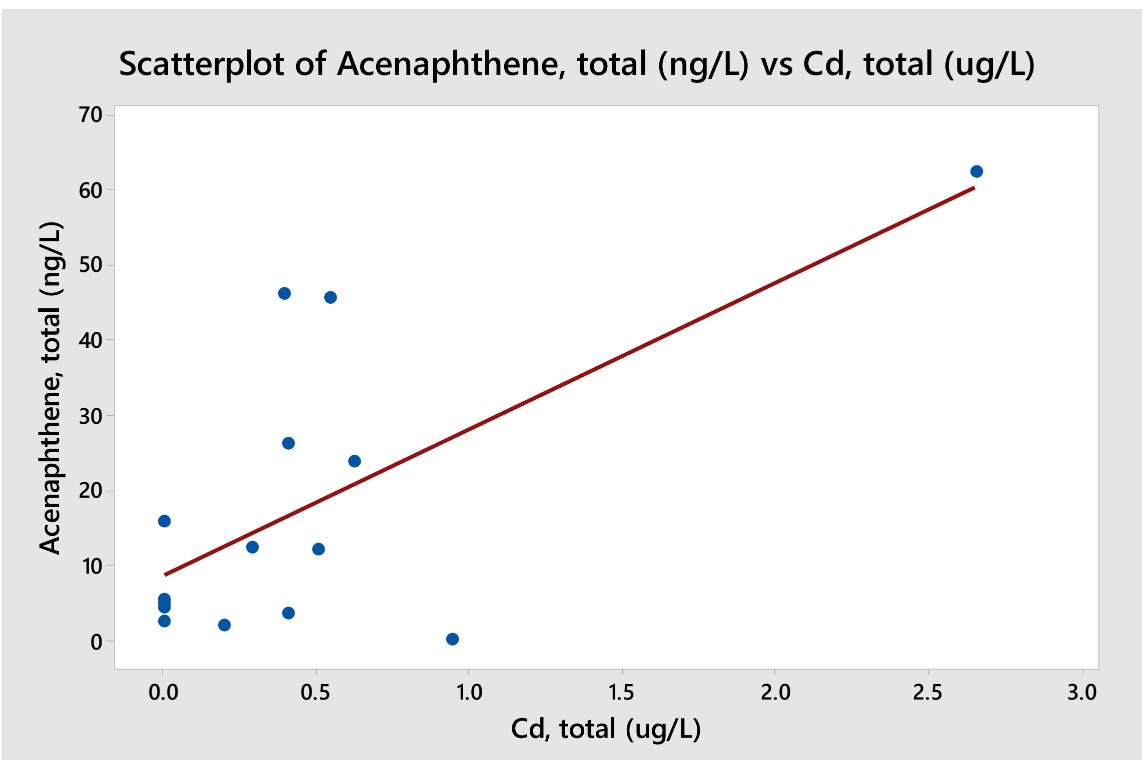

Scatterplot of Benzo[b]fluoranthene, total (ng vs Cd, total (ug/L)
Benzo[b]fluoranthene, total (ng
0
100
200
300
400
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

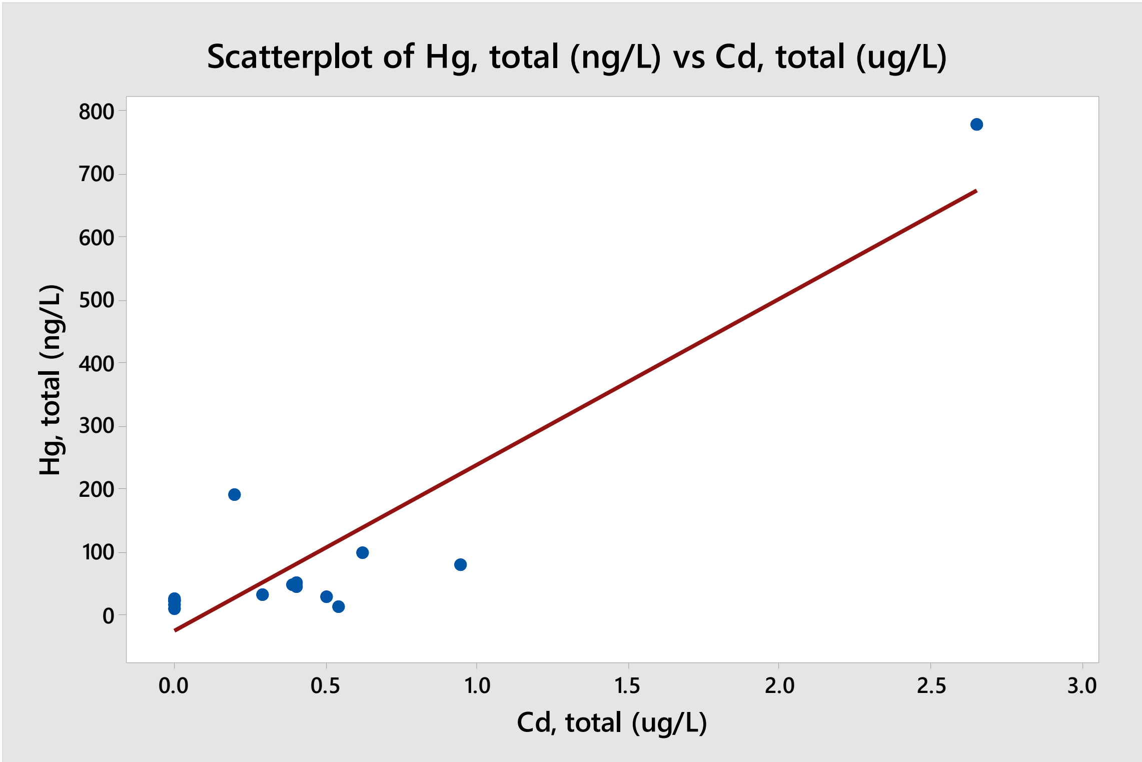

Scatterplot of Benzo[a]anthracene, total (ng/L vs Cd, total (ug/L)
Benzo[a]anthracene, total (ng/L
0
50
100
150
200
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

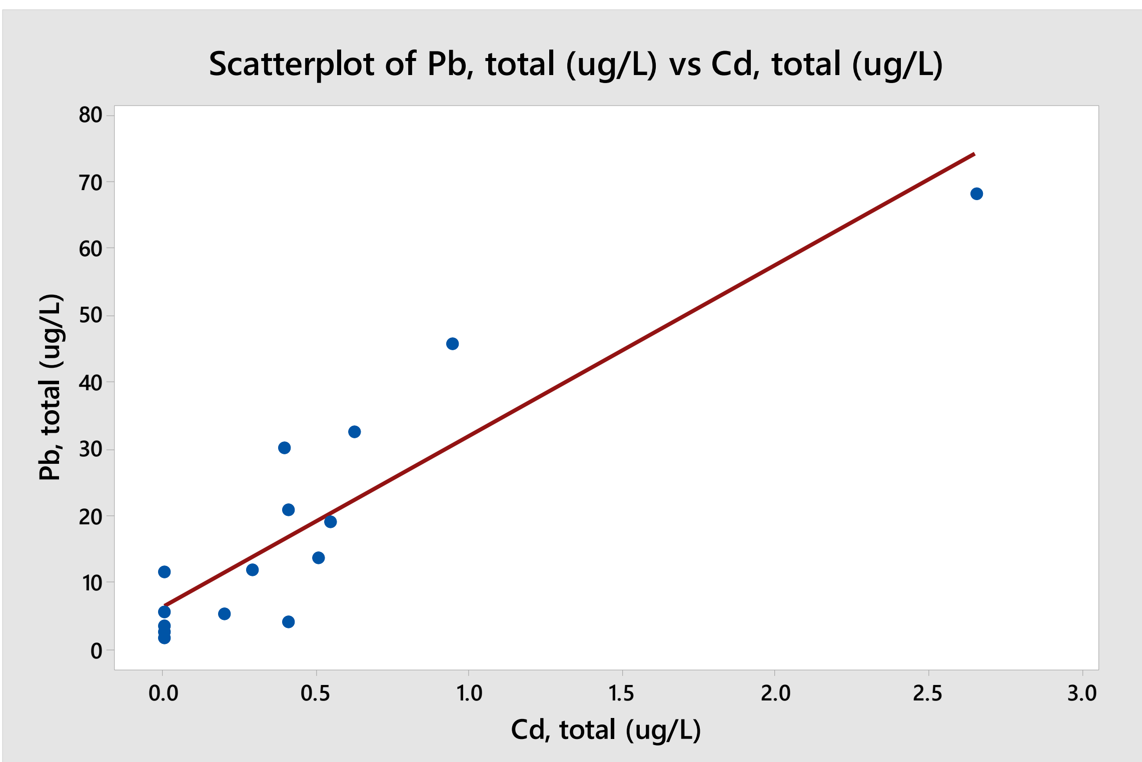

Scatterplot of Chrysene, total (ng/L) vs Cd, total (ug/L)
Chrysene, total (ng/L)
0
50
100
150
200
250
300
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)


Scatterplot of Pyrene, total (ng/L) vs Cd, total (ug/L)
Pyrene, total (ng/L)
0
100
200
300
400
500
600
700
800
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

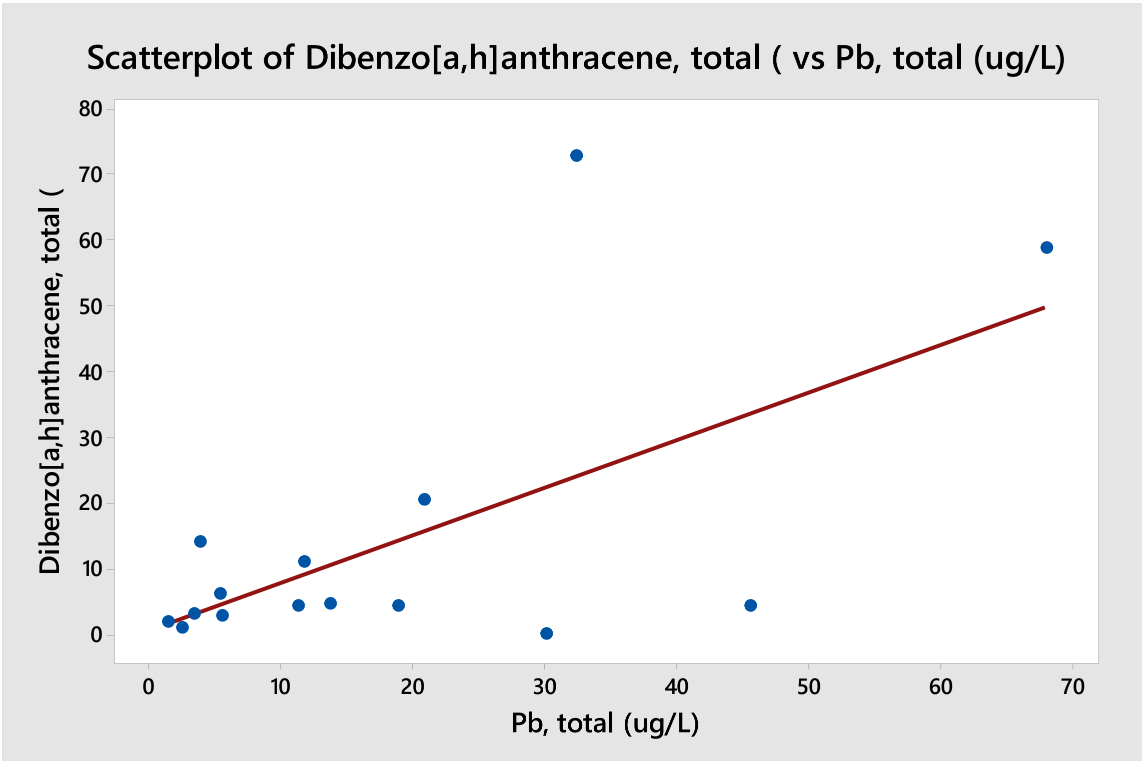

Scatterplot of Fluoranthene, total (ng/L) vs Cd, total (ug/L)
Fluoranthene, total (ng/L)
1200
1000
800
600
400
200
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

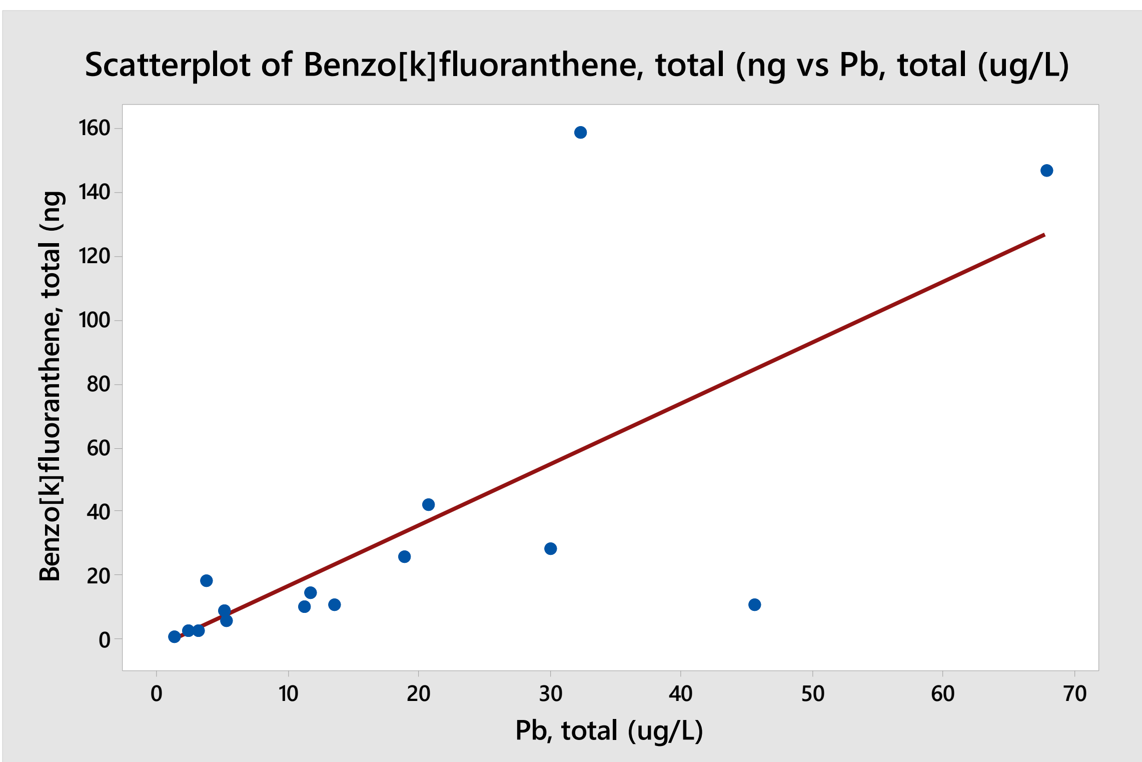

Scatterplot of Acenaphthene, total (ng/L) vs Cd, total (ug/L)
Acenaphthene, total (ng/L)
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

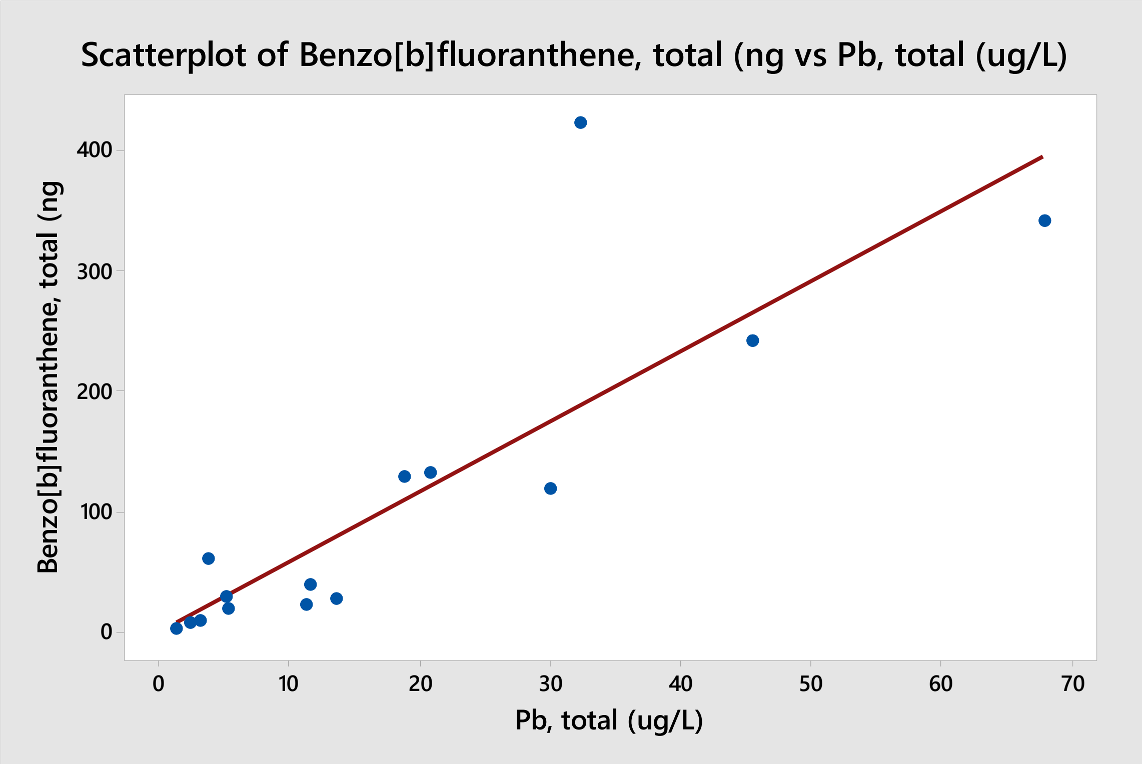

Scatterplot of Hg, total (ng/L) vs Cd, total (ug/L)
Hg, total (ng/L)
800
700
600
500
400
300
200
100
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)


Scatterplot of Pb, total (ug/L) vs Cd, total (ug/L)
Pb, total (ug/L)
80
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Cd, total (ug/L)

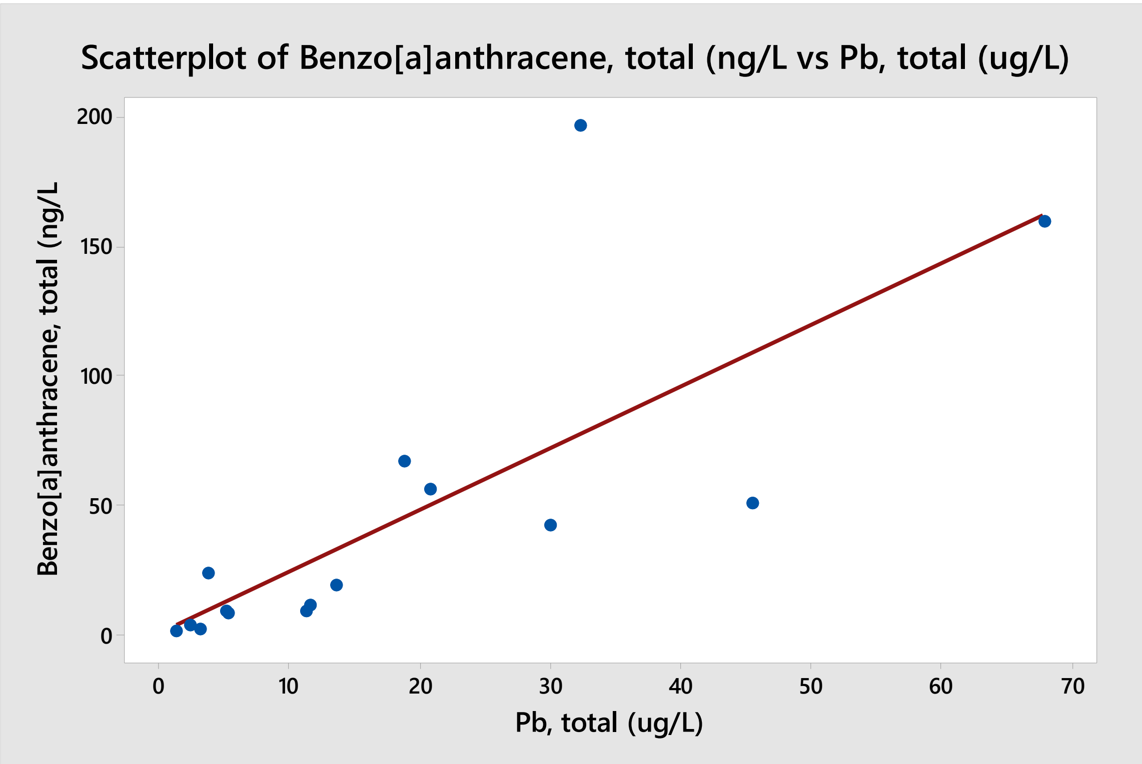
Pb, total, correlations



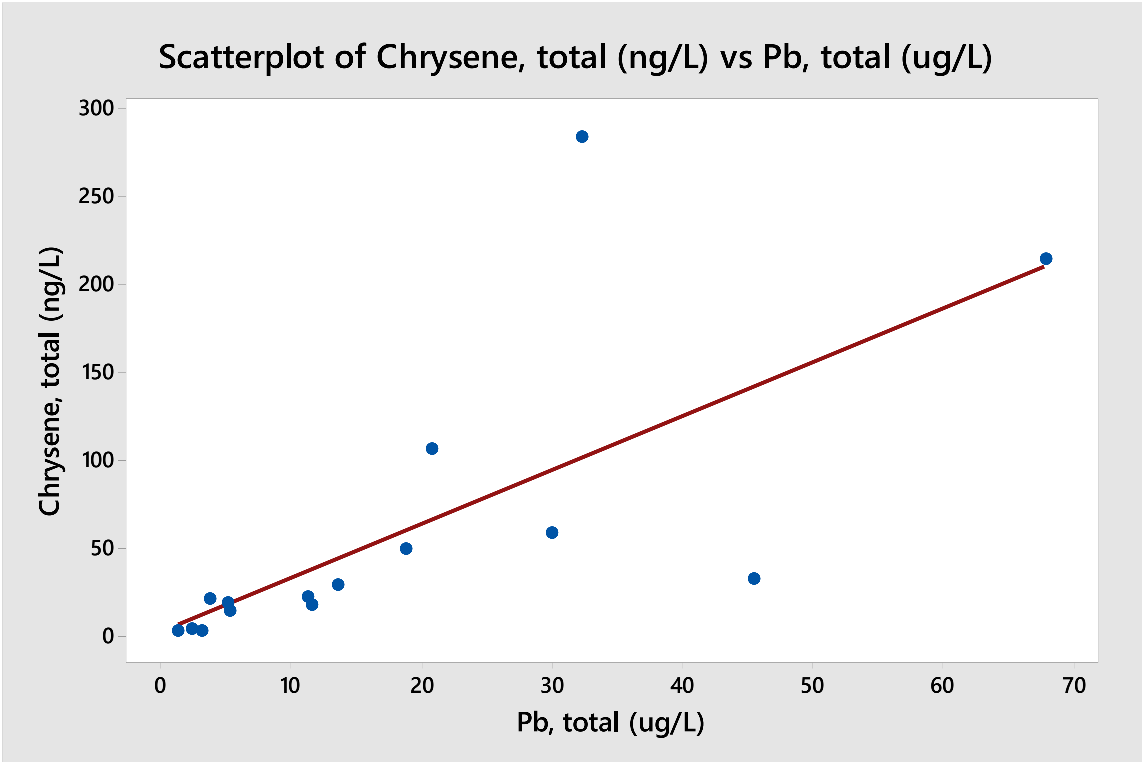


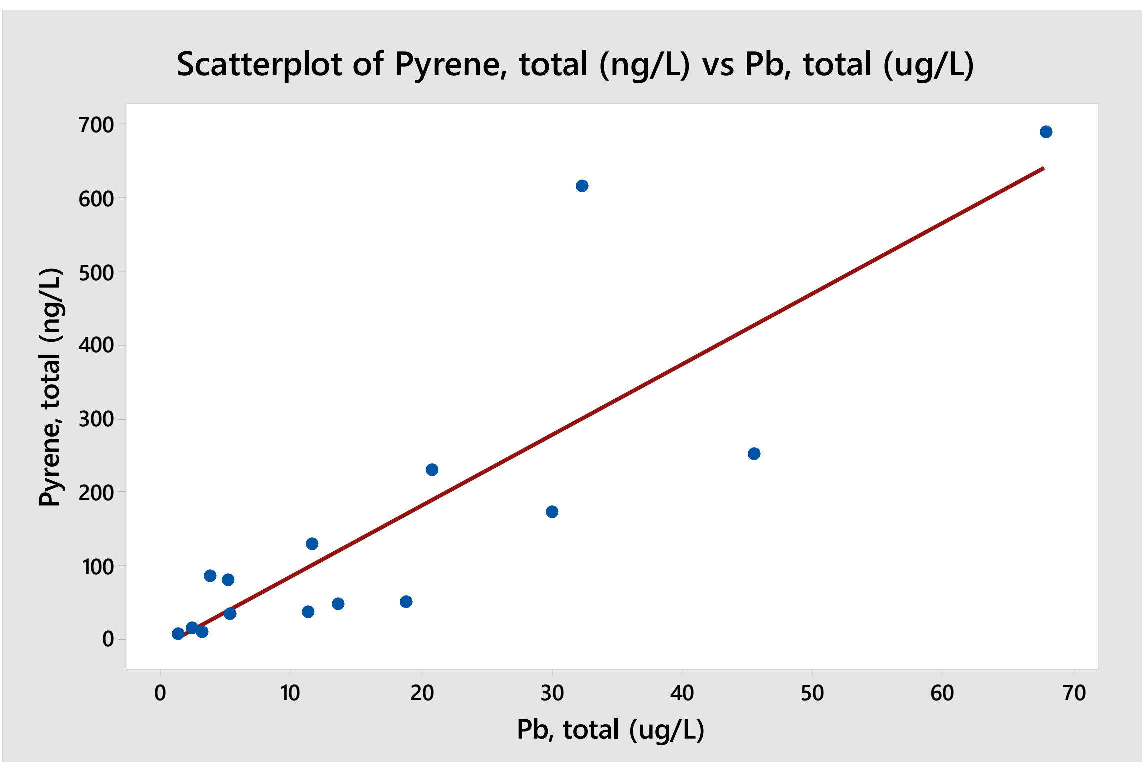


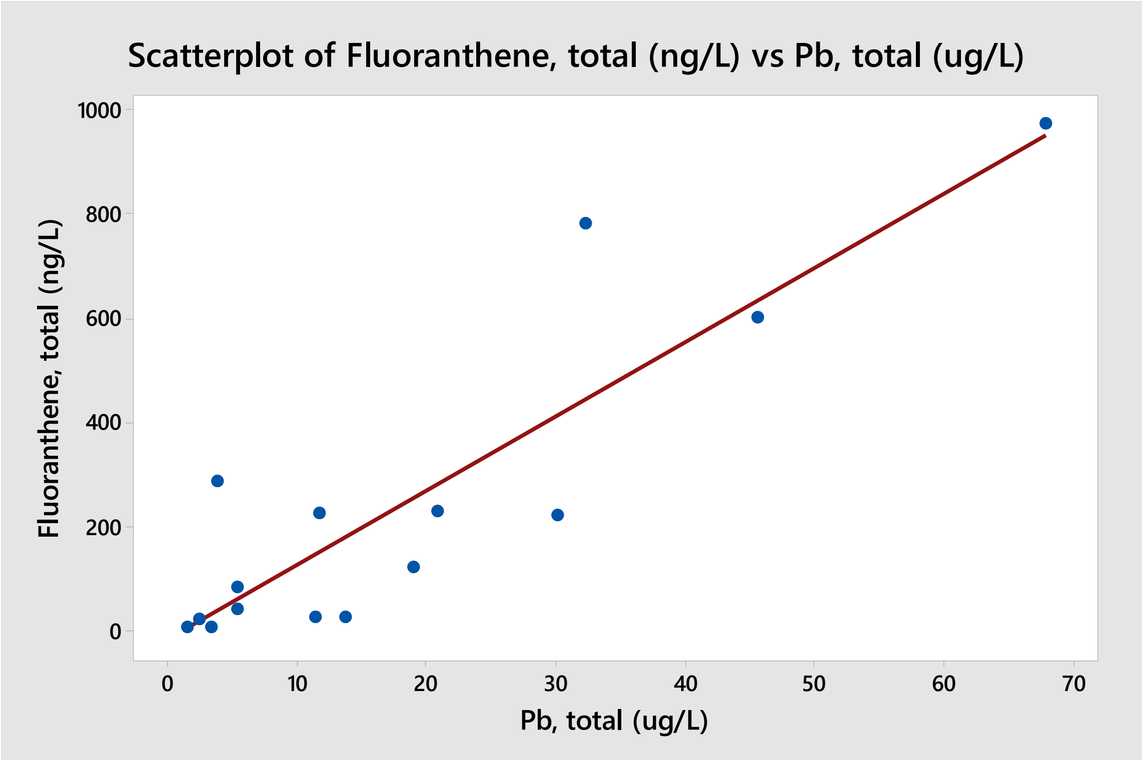
Scatterplot of Benzo[b]fluoranthene, total (ng vs Pb, total (ug/L)
Benzo[b]fluoranthene, total (ng
400
300
200
100
0
0
10
20
30
40
50
60
70
Pb, total (ug/L)



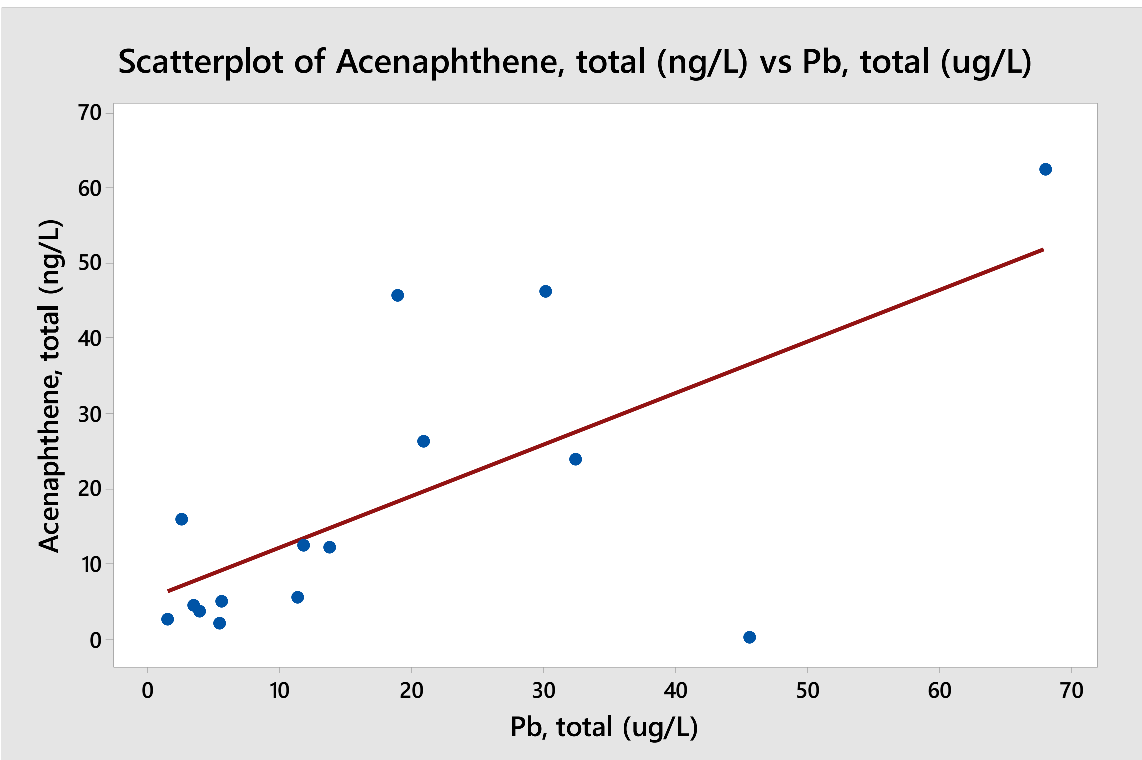
Scatterplot of Benzo[a]anthracene, total (ng/L vs Pb, total (ug/L)
Benzo[a]anthracene, total (ng/L
200
150
100
50
0
0
10
20
30
40
50
60
70
Pb, total (ug/L)


Scatterplot of Chrysene, total (ng/L) vs Pb, total (ug/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
Pb, total (ug/L)

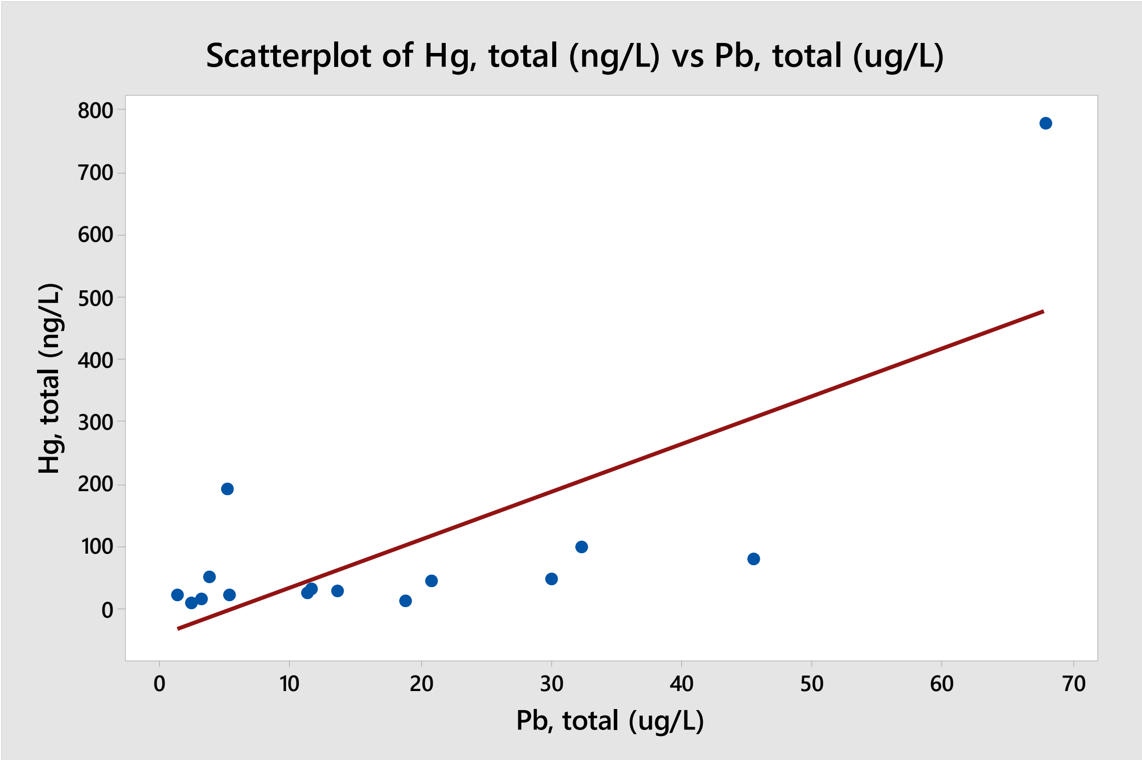

Scatterplot of Pyrene, total (ng/L) vs Pb, total (ug/L)
Pyrene, total (ng/L)
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
Pb, total (ug/L)



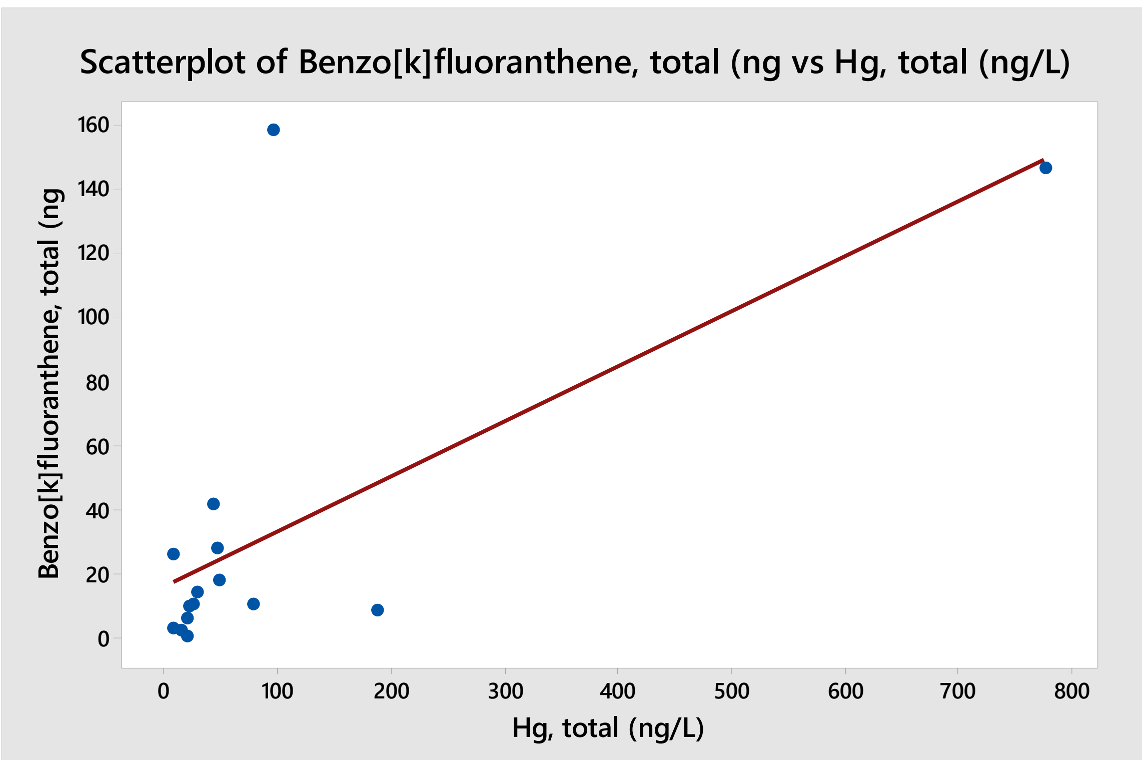
Scatterplot of Fluoranthene, total (ng/L) vs Pb, total (ug/L)
Fluoranthene, total (ng/L)
Pb, total (ug/L)

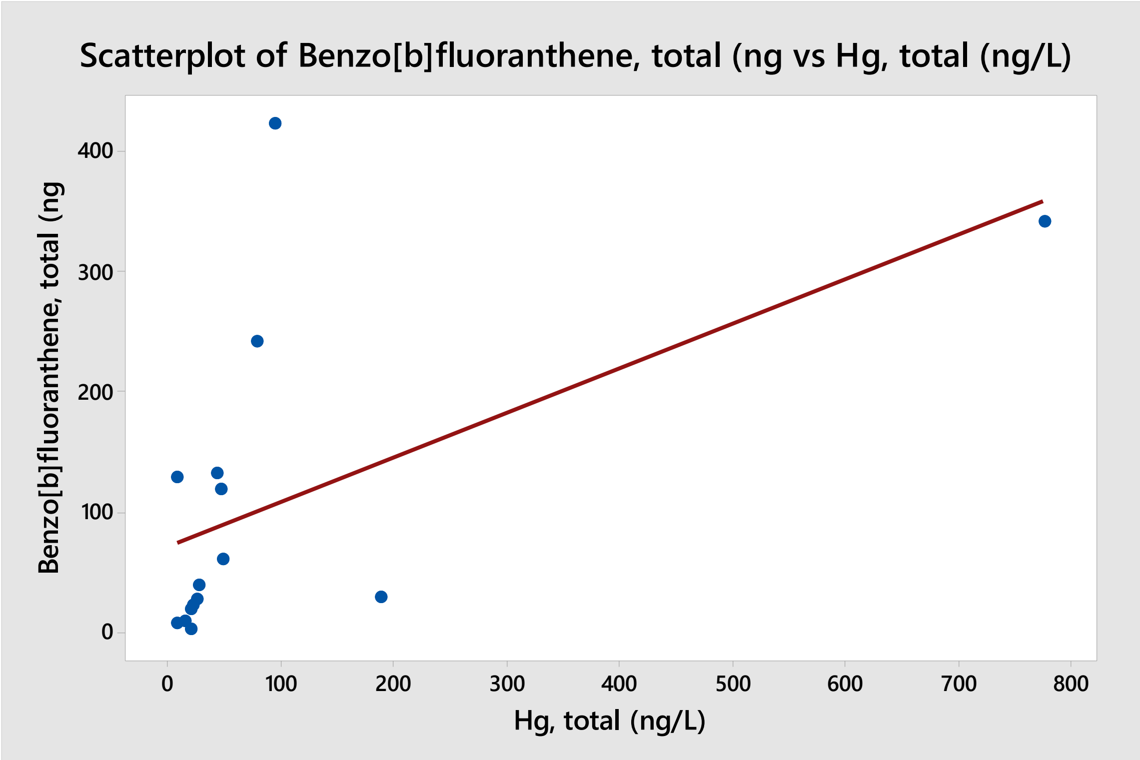


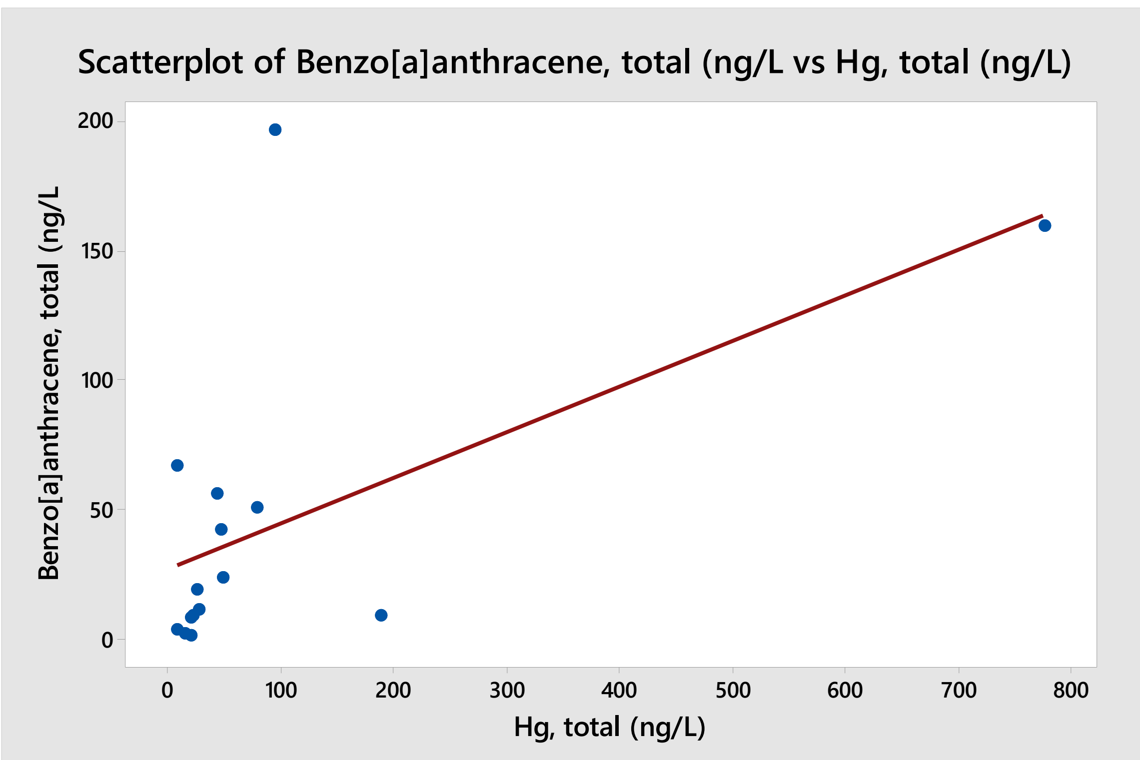
Scatterplot of Acenaphthene, total (ng/L) vs Pb, total (ug/L)
Acenaphthene, total (ng/L)
Pb, total (ug/L)

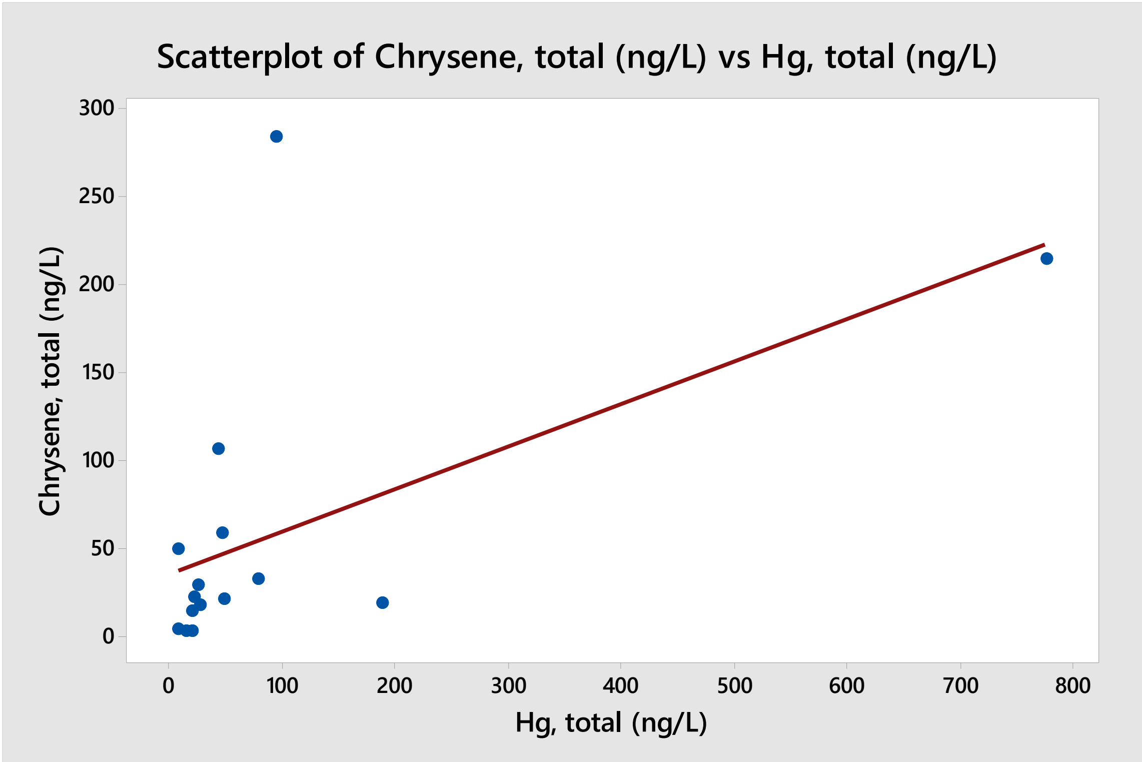


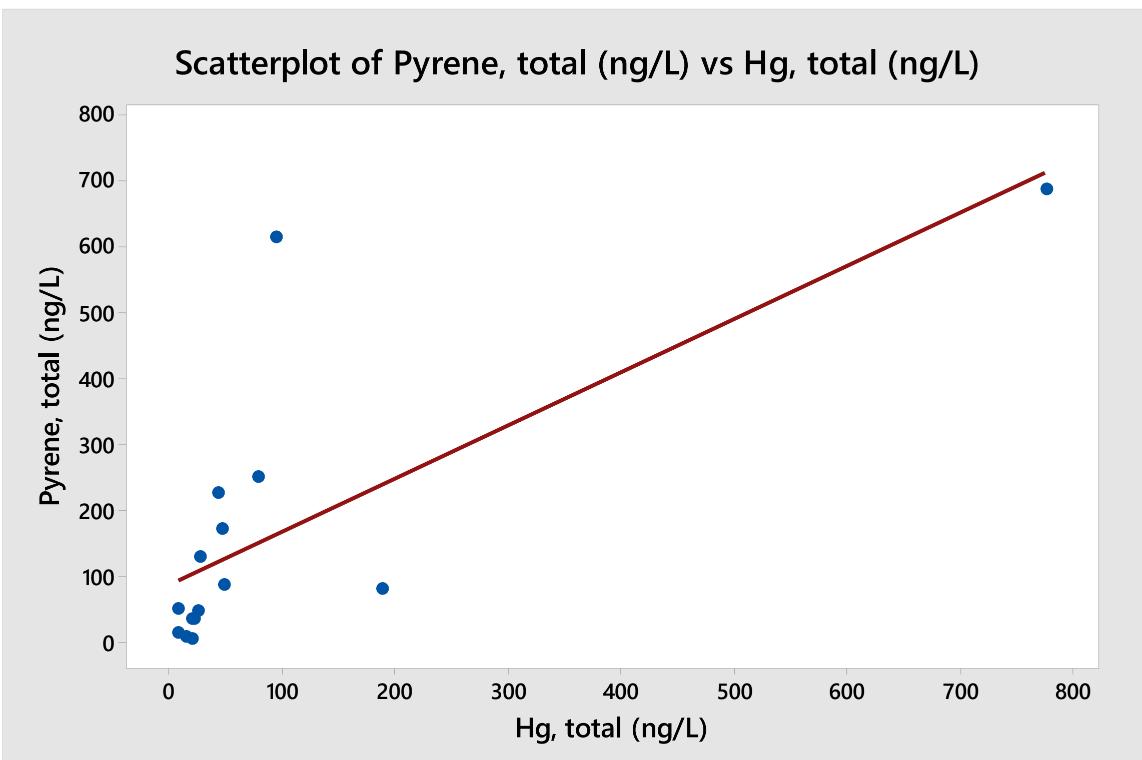
Hg, total, correlations

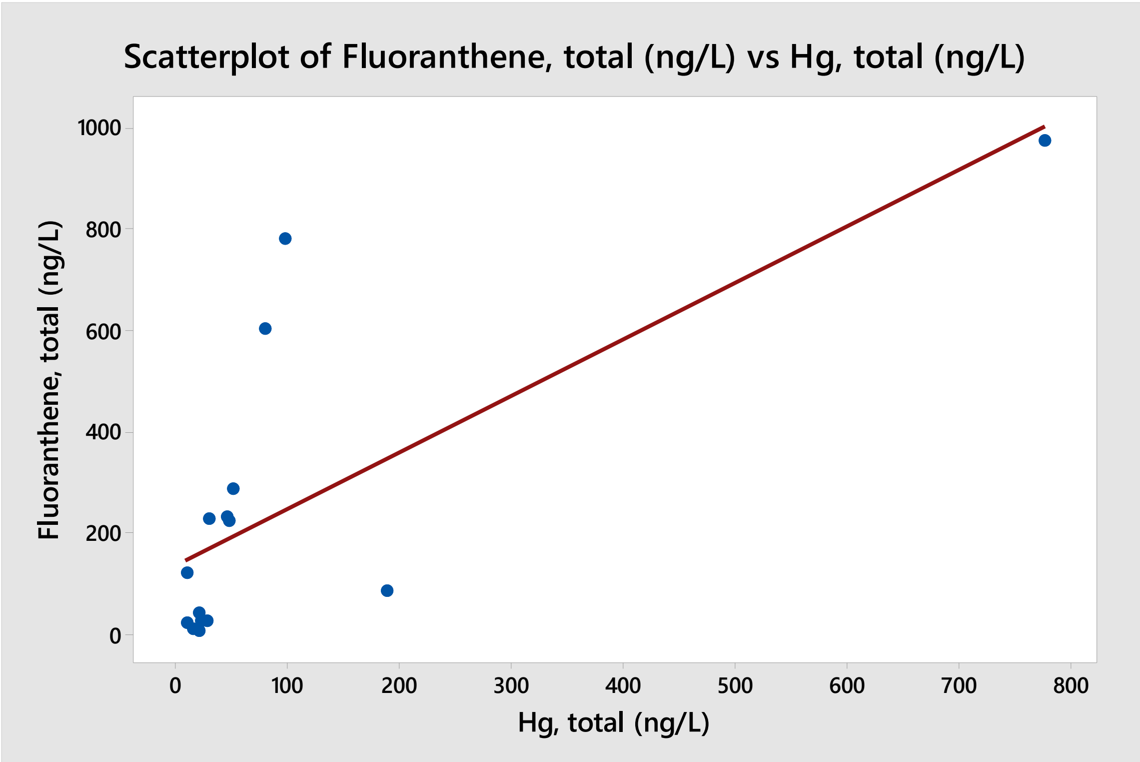


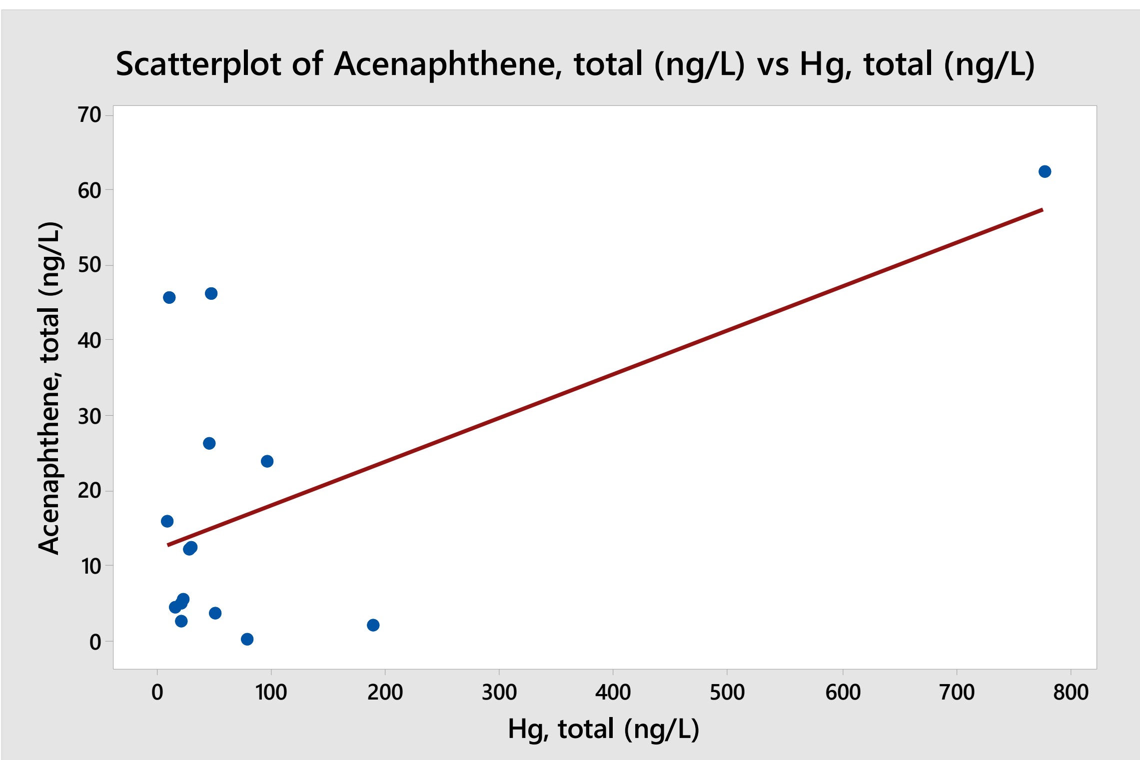

Scatterplot of Benzo[b]fluoranthene, total (ng vs Hg, total (ng/L)
Benzo[b]fluoranthene, total (ng
0
100
200
300
400
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)


Scatterplot of Benzo[a]anthracene, total (ng/L vs Hg, total (ng/L)
Benzo[a]anthracene, total (ng/L
0
50
100
150
200
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)

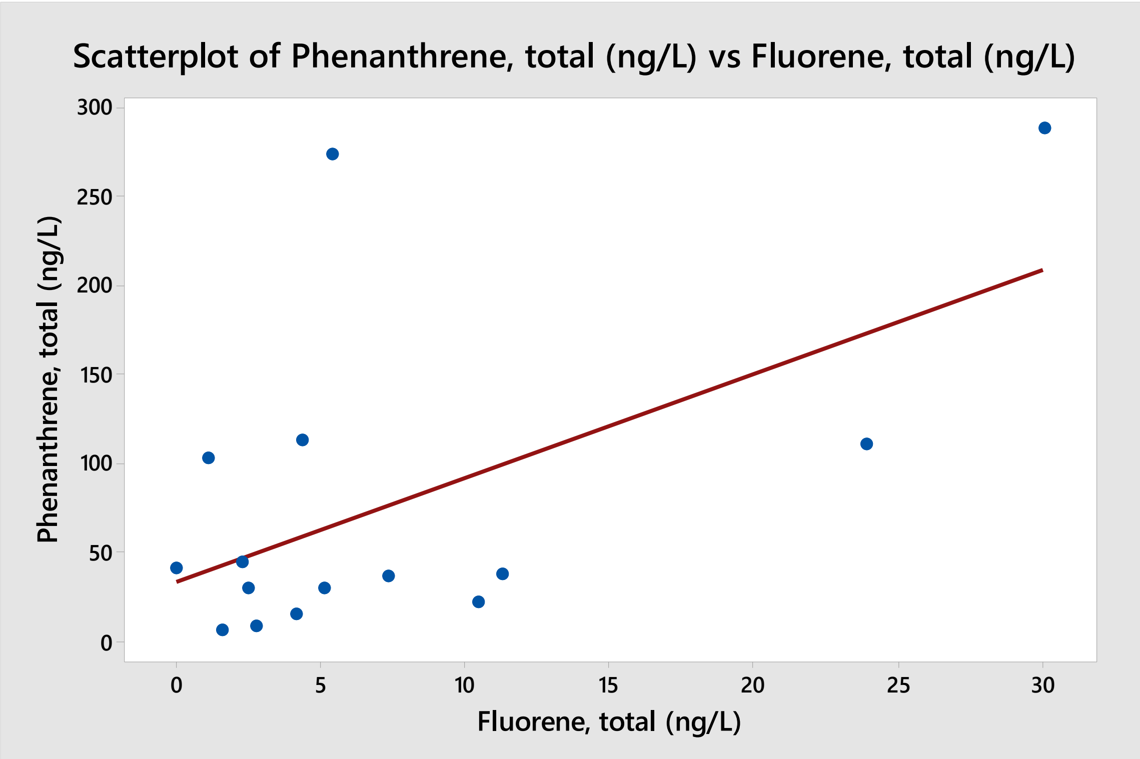

Scatterplot of Chrysene, total (ng/L) vs Hg, total (ng/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)

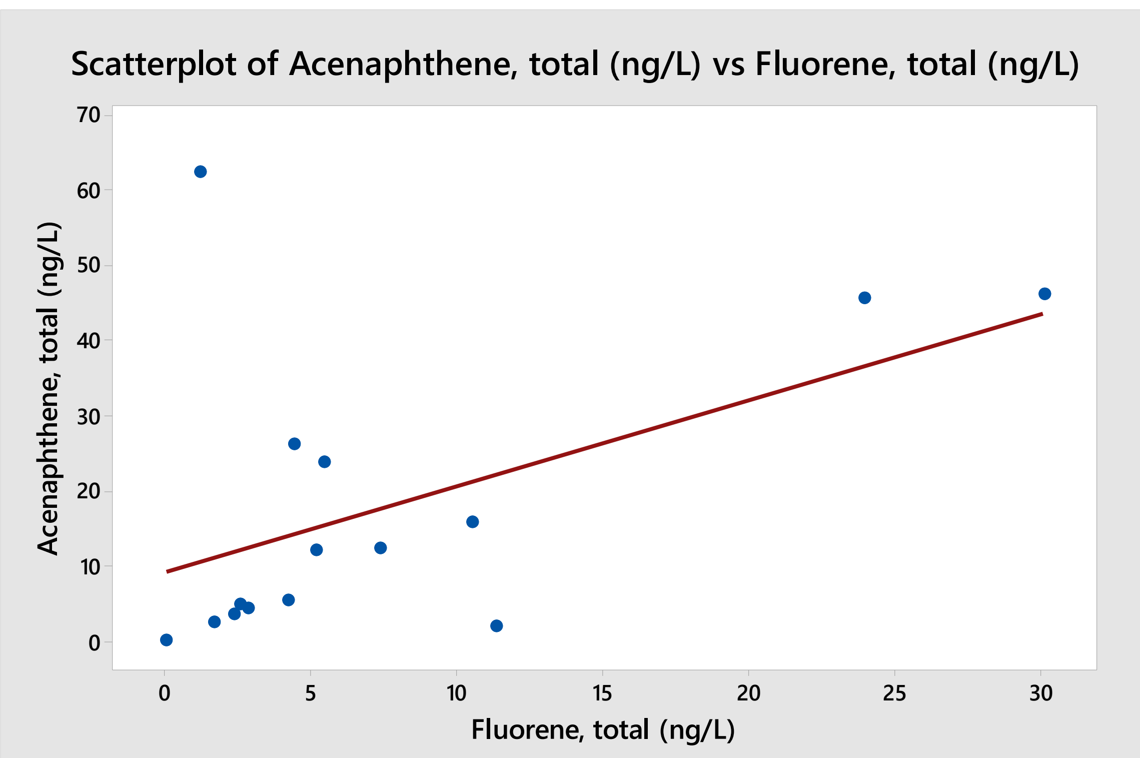

Scatterplot of Pyrene, total (ng/L) vs Hg, total (ng/L)
Pyrene, total (ng/L)
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)


Scatterplot of Fluoranthene, total (ng/L) vs Hg, total (ng/L)
Fluoranthene, total (ng/L)
1000
800
600
400
200
0
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)

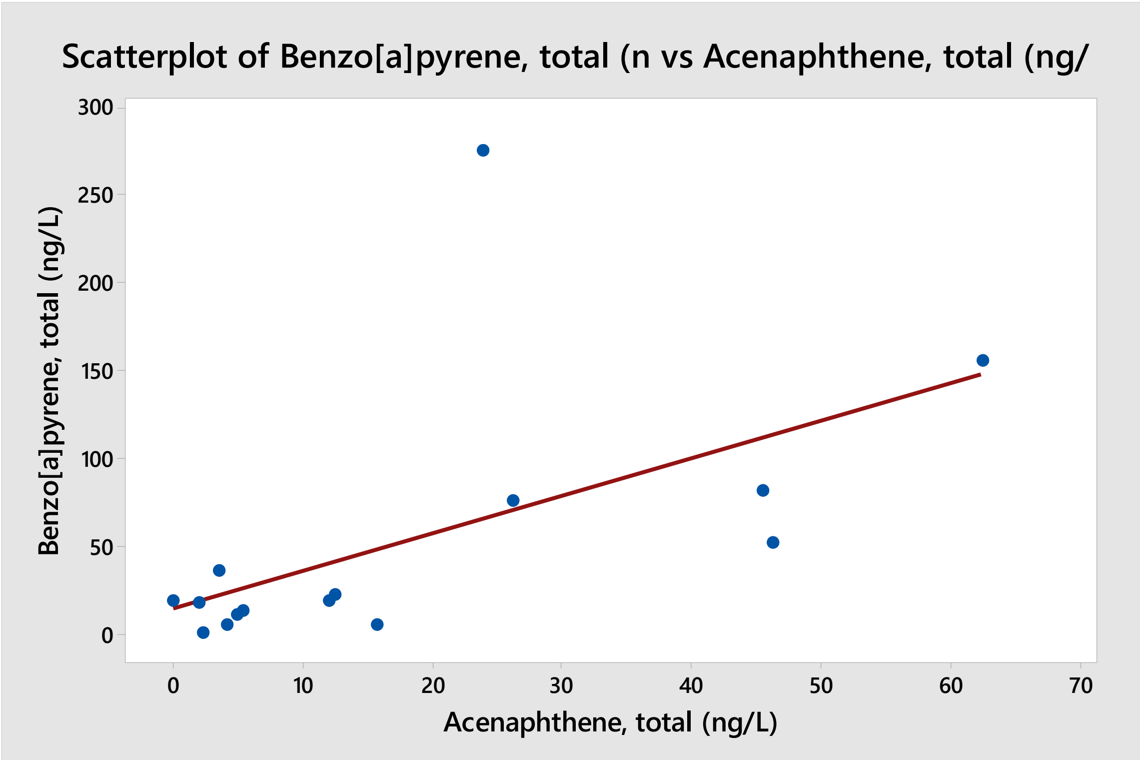

Scatterplot of Acenaphthene, total (ng/L) vs Hg, total (ng/L)
Acenaphthene, total (ng/L)
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
800
Hg, total (ng/L)

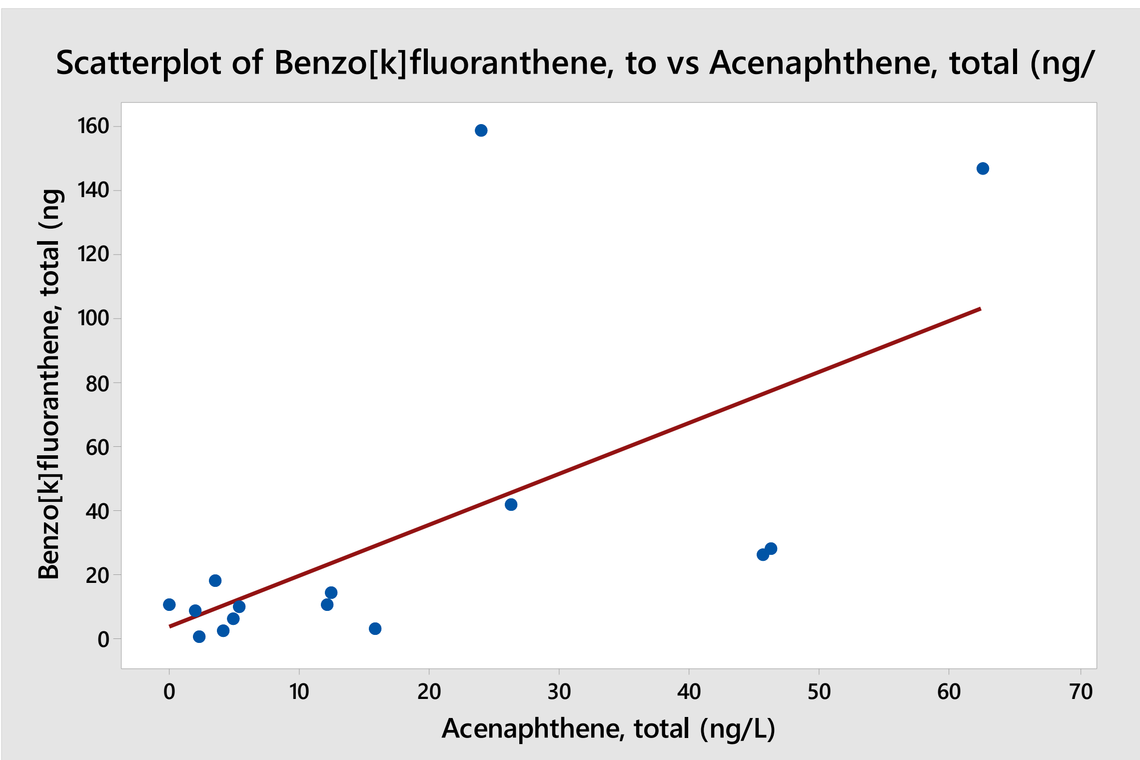
Fluorene, total, correlations

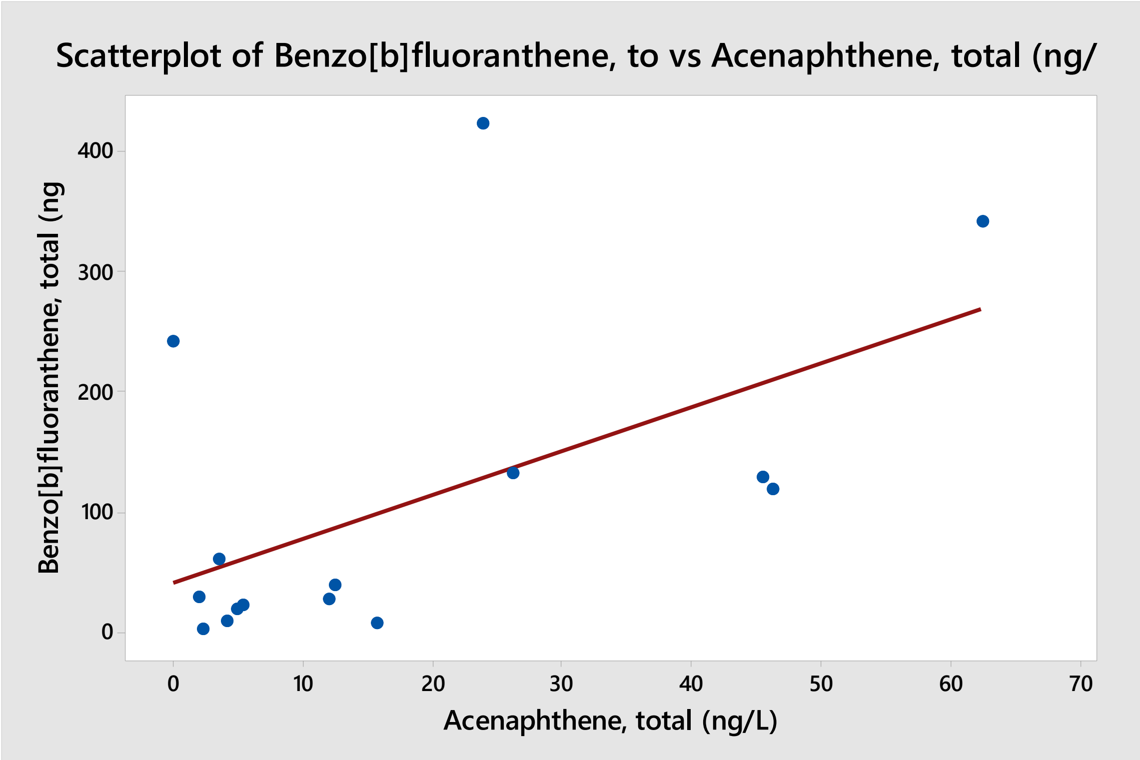


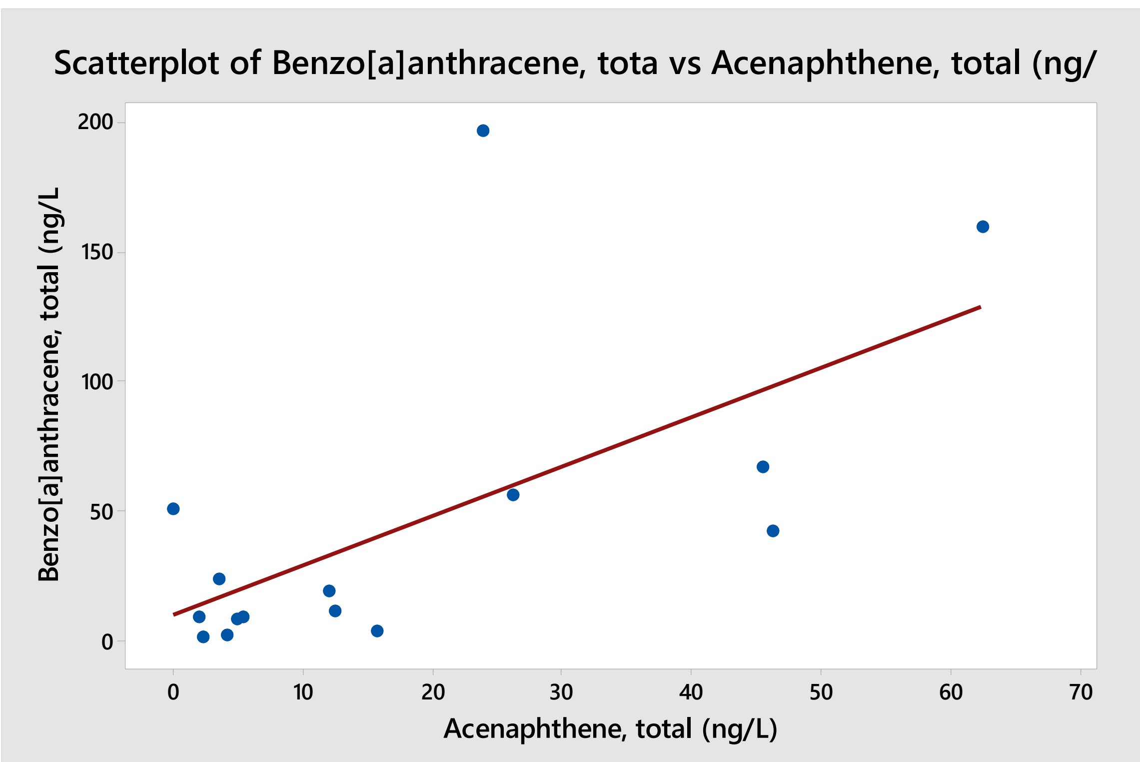


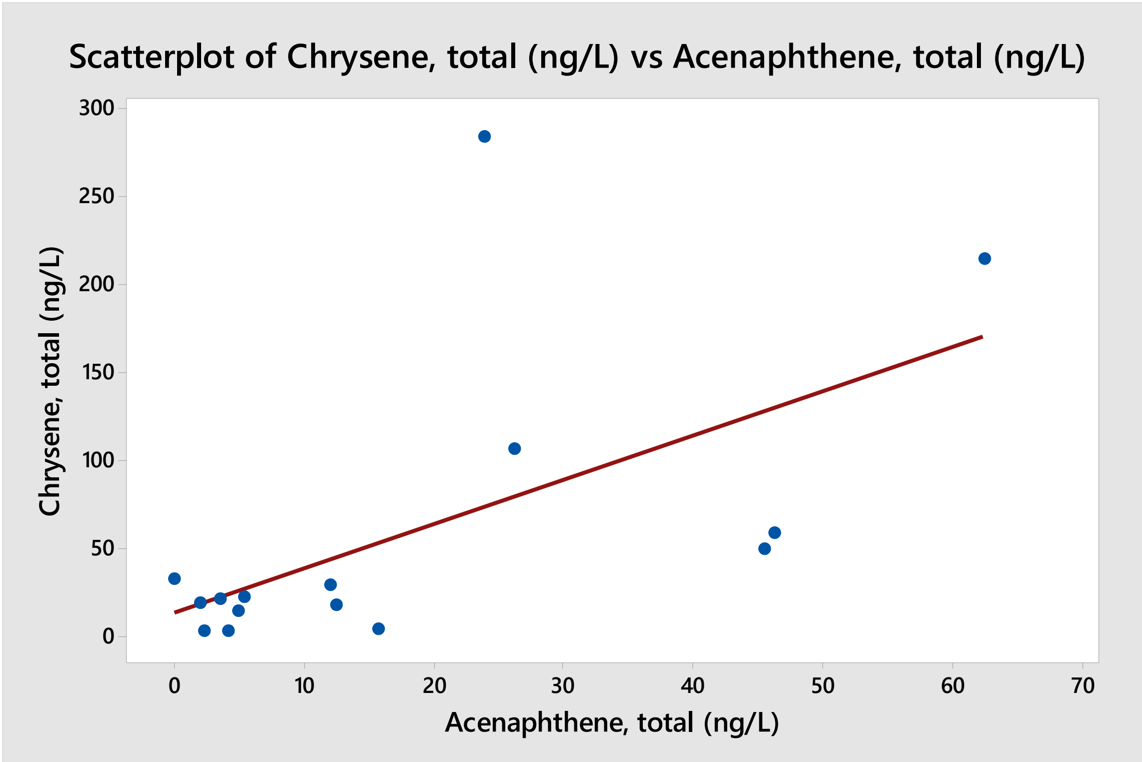
Acenaphthene, total, correlations



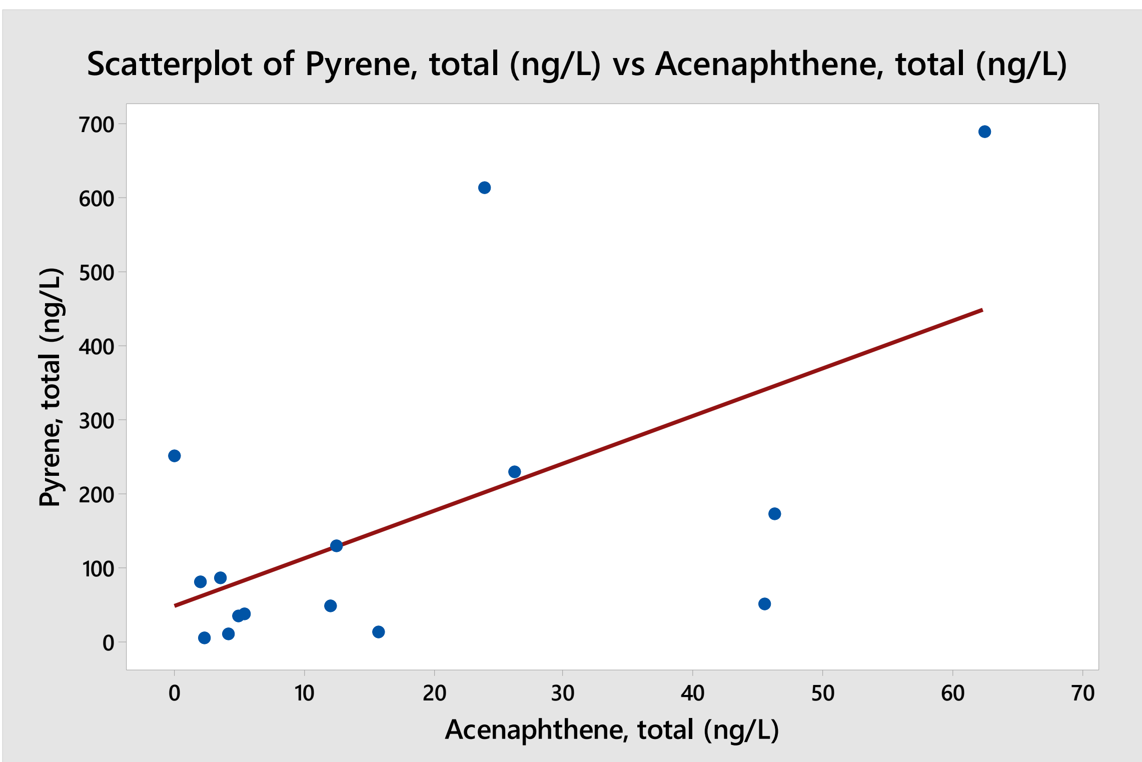



Scatterplot of Benzo[b]fluoranthene, to vs Acenaphthene, total (ng/
Benzo[b]fluoranthene, total (ng
0
100
200
300
400
0
10
20
30
40
50
60
70
Acenaphthene, total (ng/L)

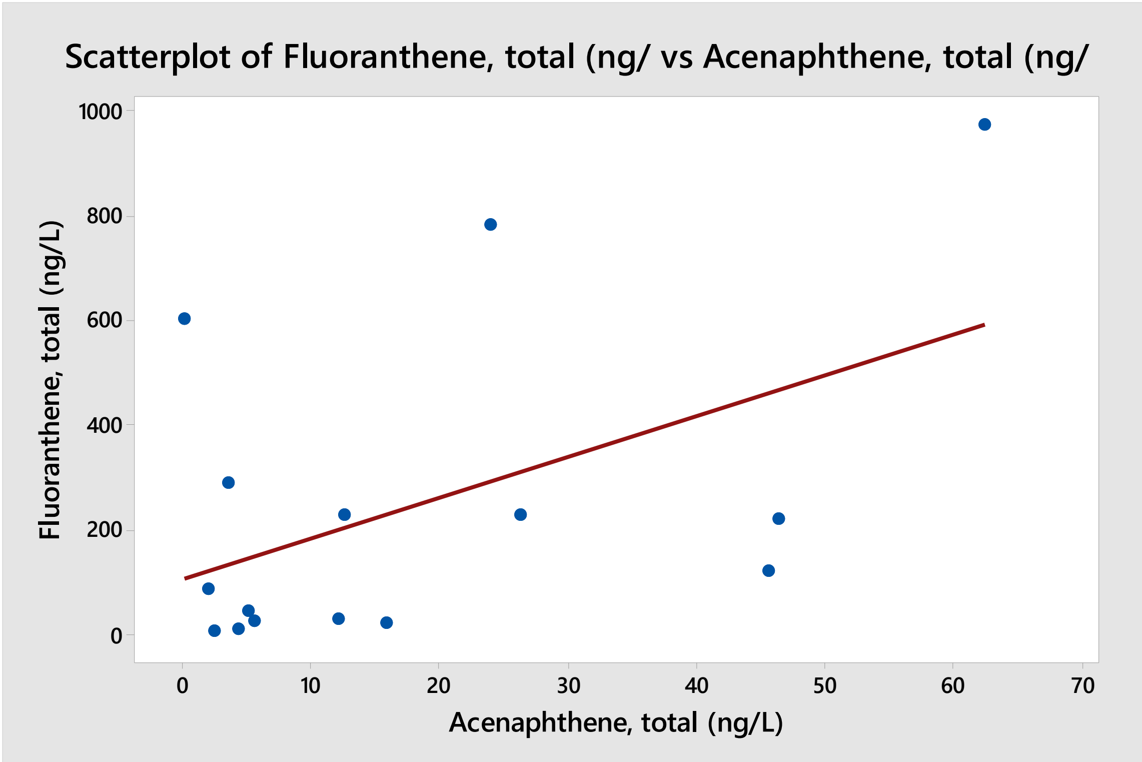

Scatterplot of Benzo[a]anthracene, tota vs Acenaphthene, total (ng/
Benzo[a]anthracene, total (ng/L
0
50
100
150
200
0
10
20
30
40
50
60
70
Acenaphthene, total (ng/L)

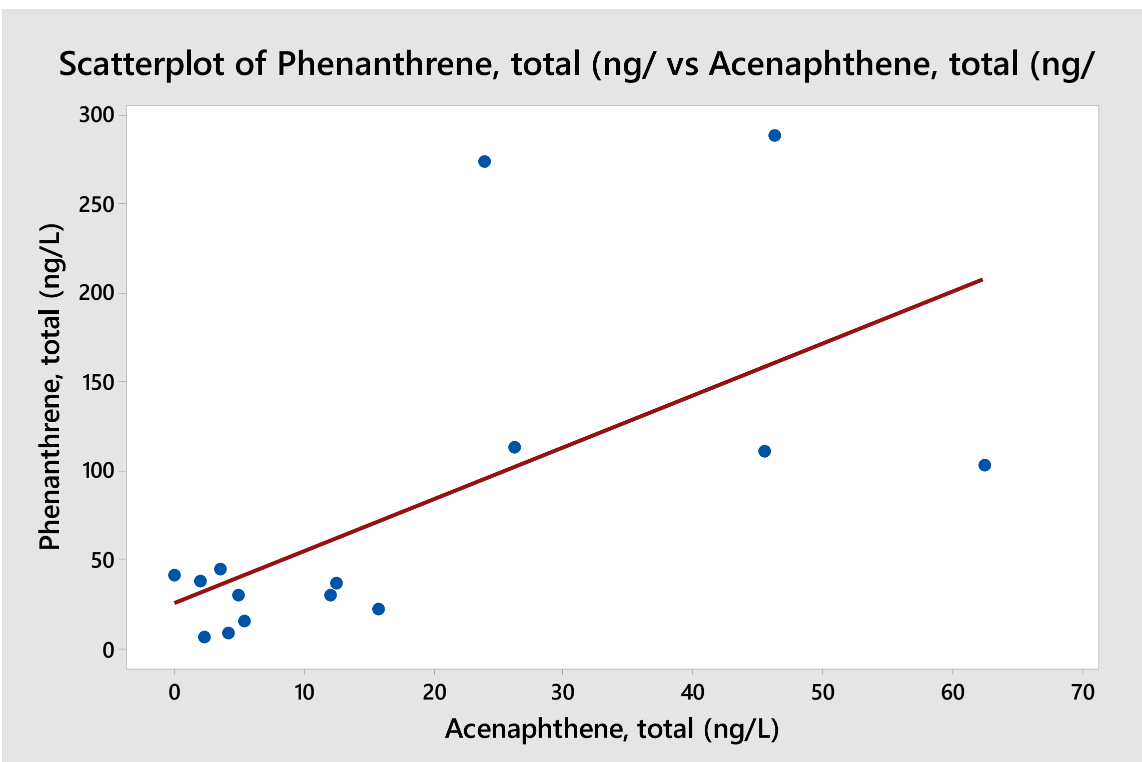


Scatterplot of Chrysene, total (ng/L) vs Acenaphthene, total (ng/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
Acenaphthene, total (ng/L)

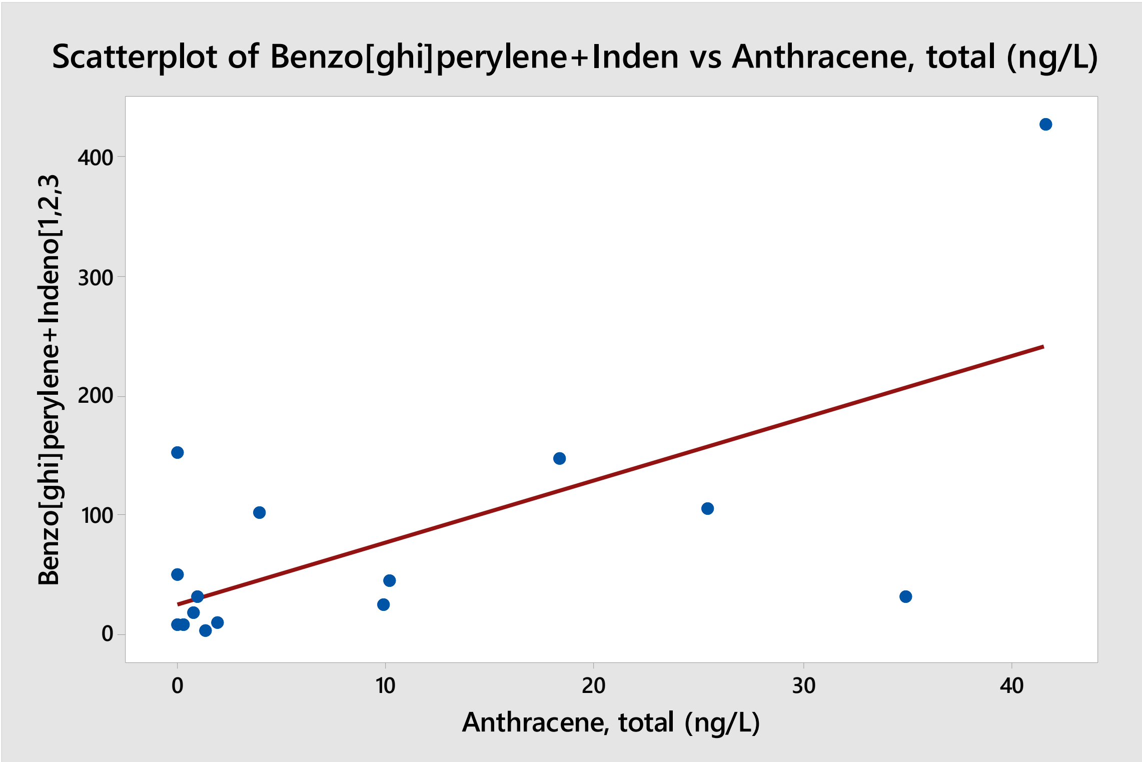


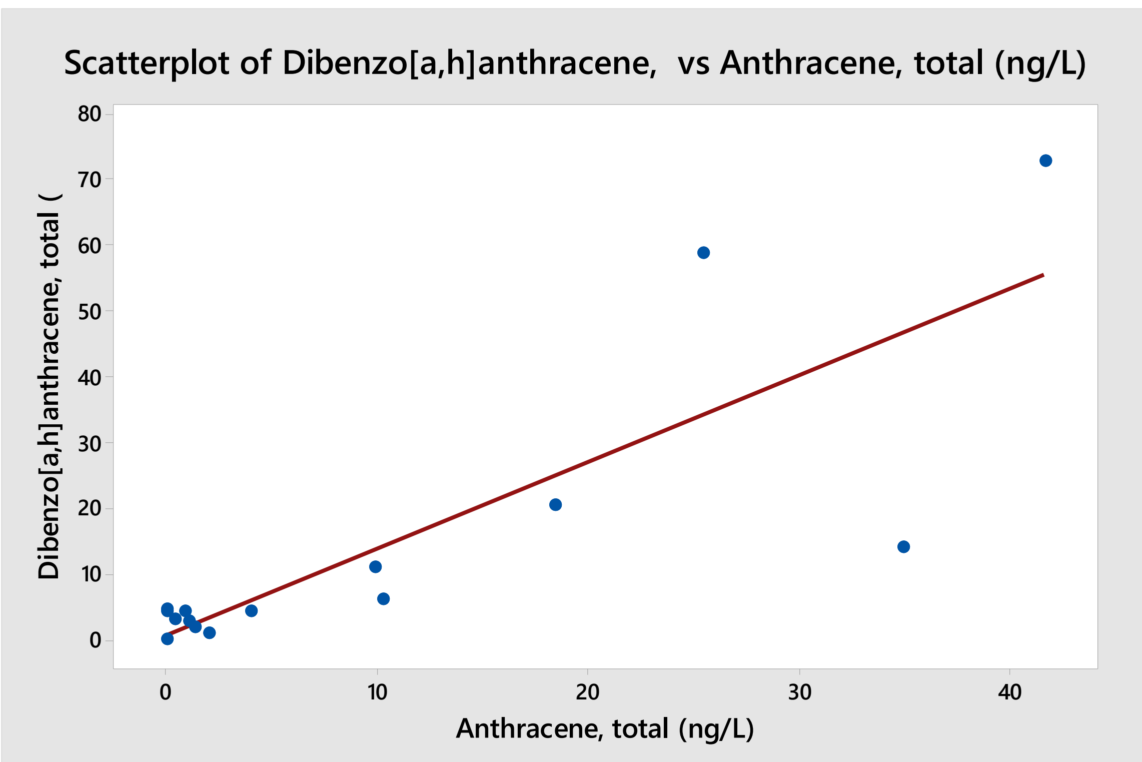
Scatterplot of Pyrene, total (ng/L) vs Acenaphthene, total (ng/L)
Pyrene, total (ng/L)
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
Acenaphthene, total (ng/L)

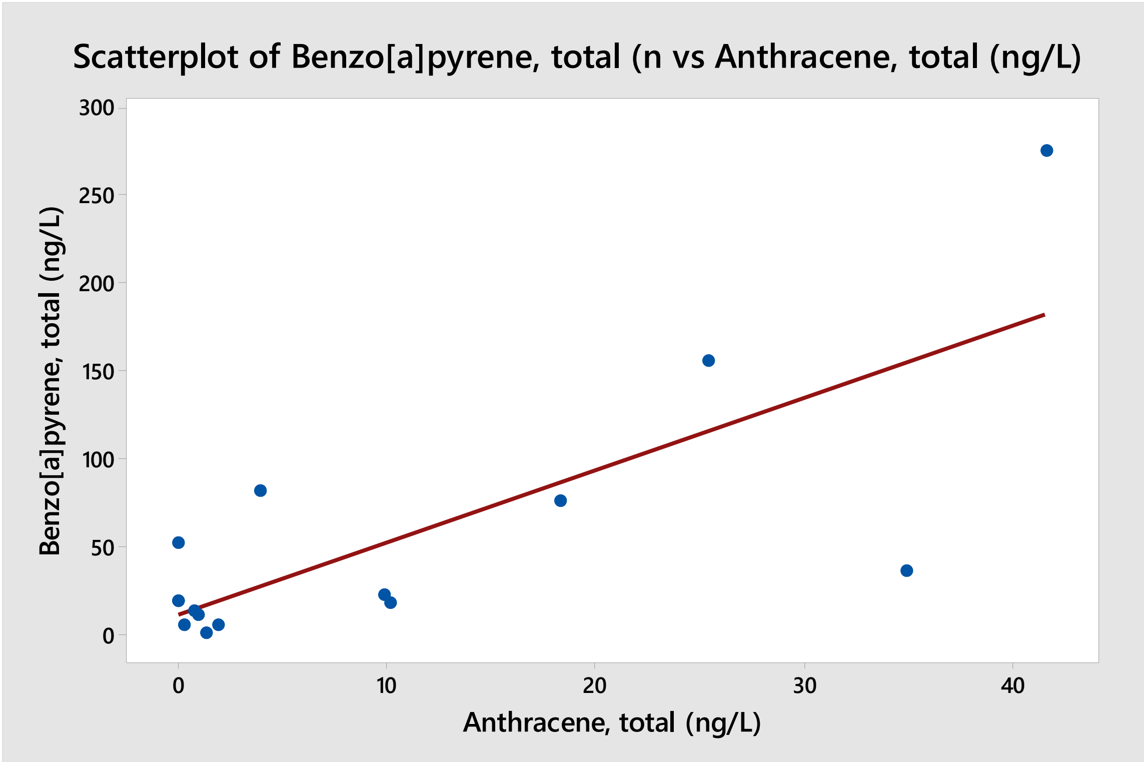

Scatterplot of Fluoranthene, total (ng/ vs Acenaphthene, total (ng/
Fluoranthene, total (ng/L)
Acenaphthene, total (ng/L)
0
200
400
600
800
1000
0
10
20
30
40
50
60
70

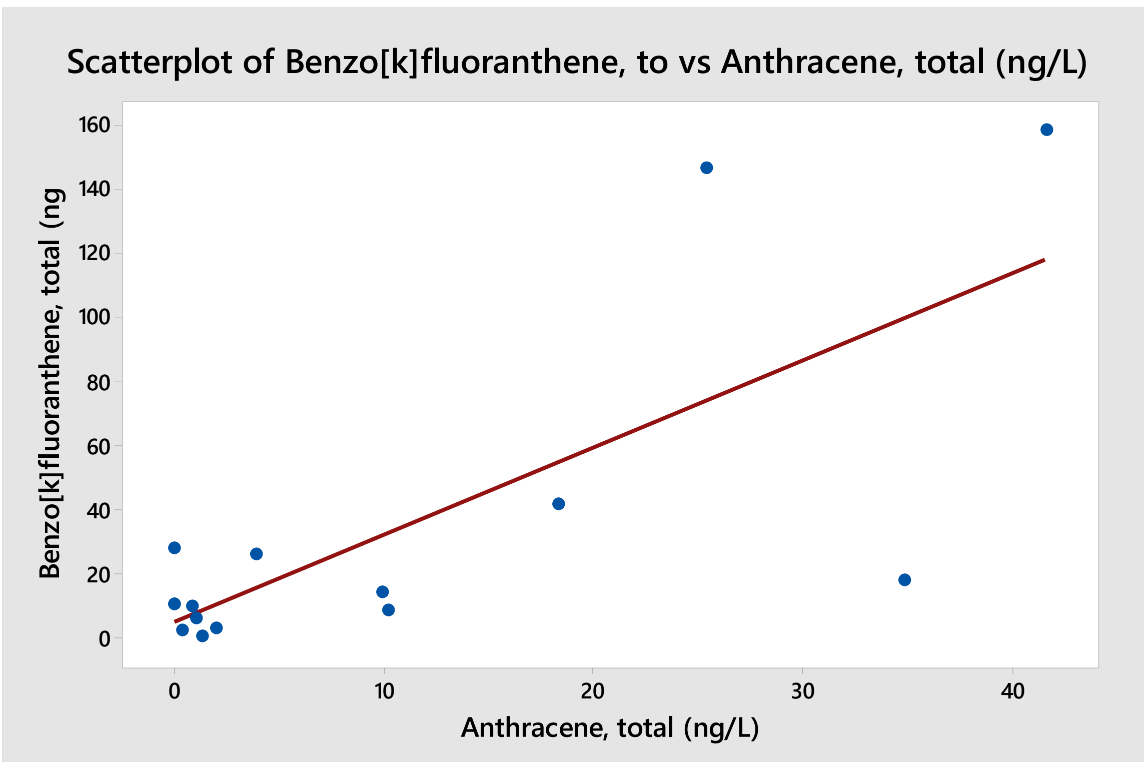

Scatterplot of Phenanthrene, total (ng/ vs Acenaphthene, total (ng/
Phenanthrene, total (ng/L)
Acenaphthene, total (ng/L)
0
50
100
150
200
250
300
0
10
20
30
40
50
60
70

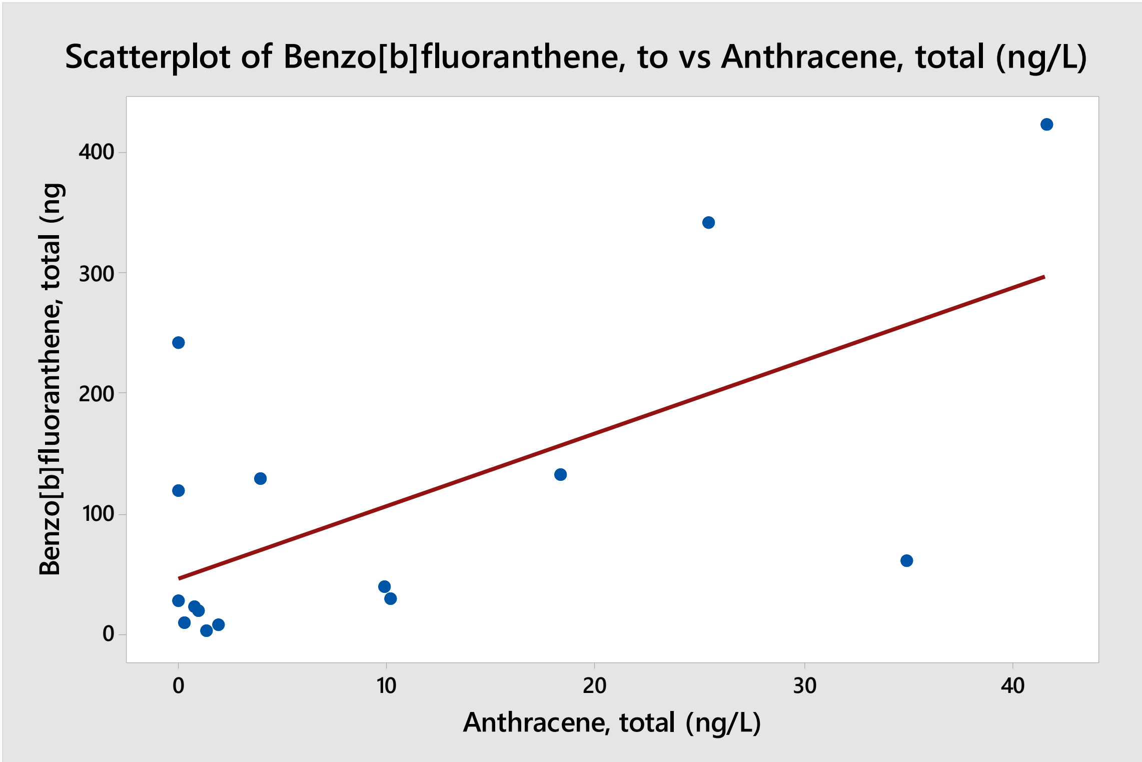
Anthracene, total, correlations

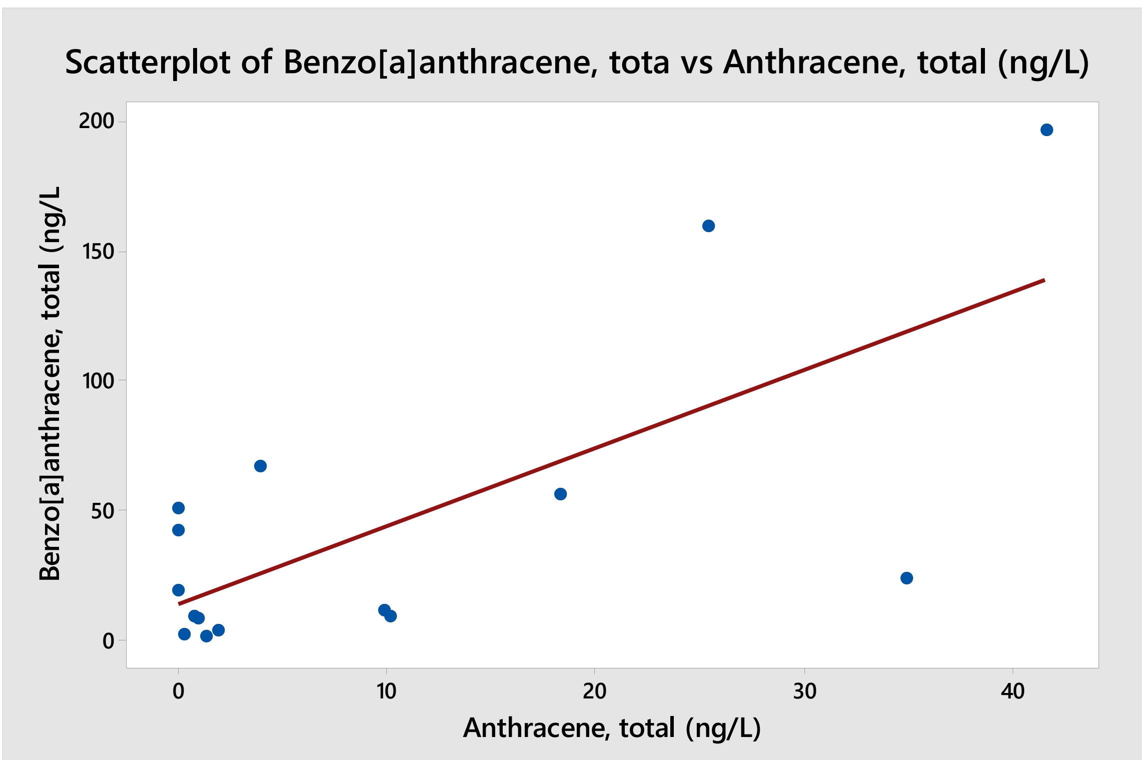


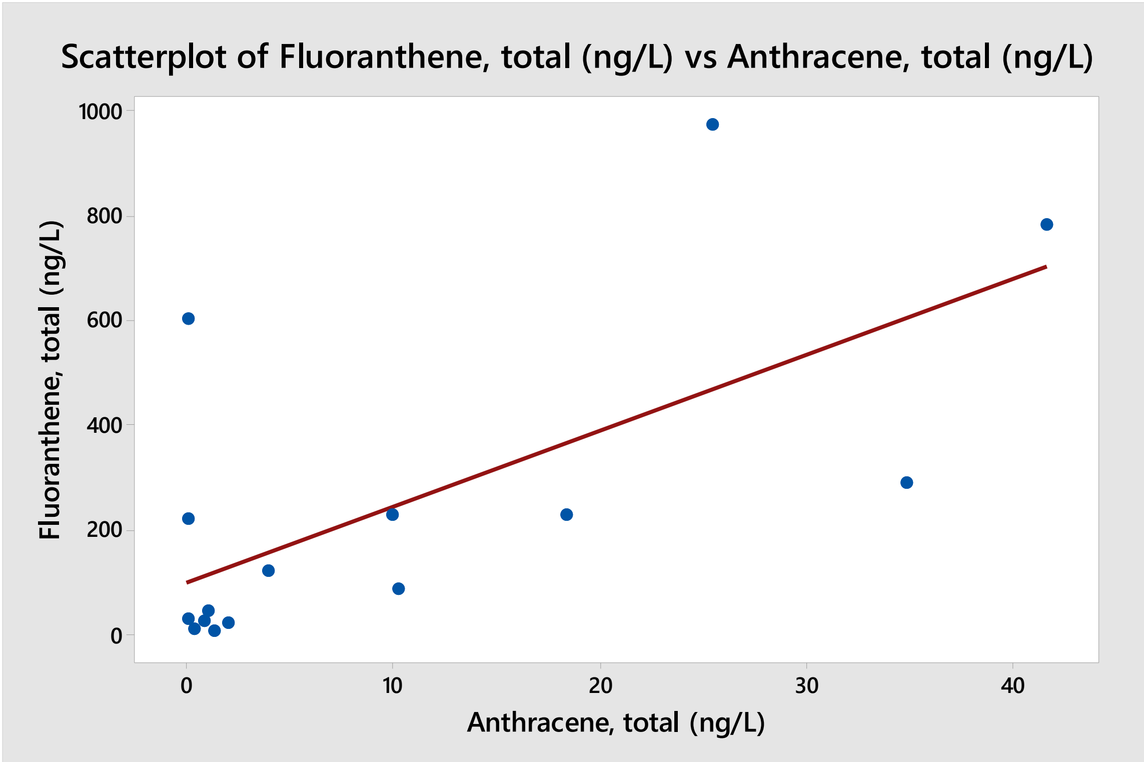


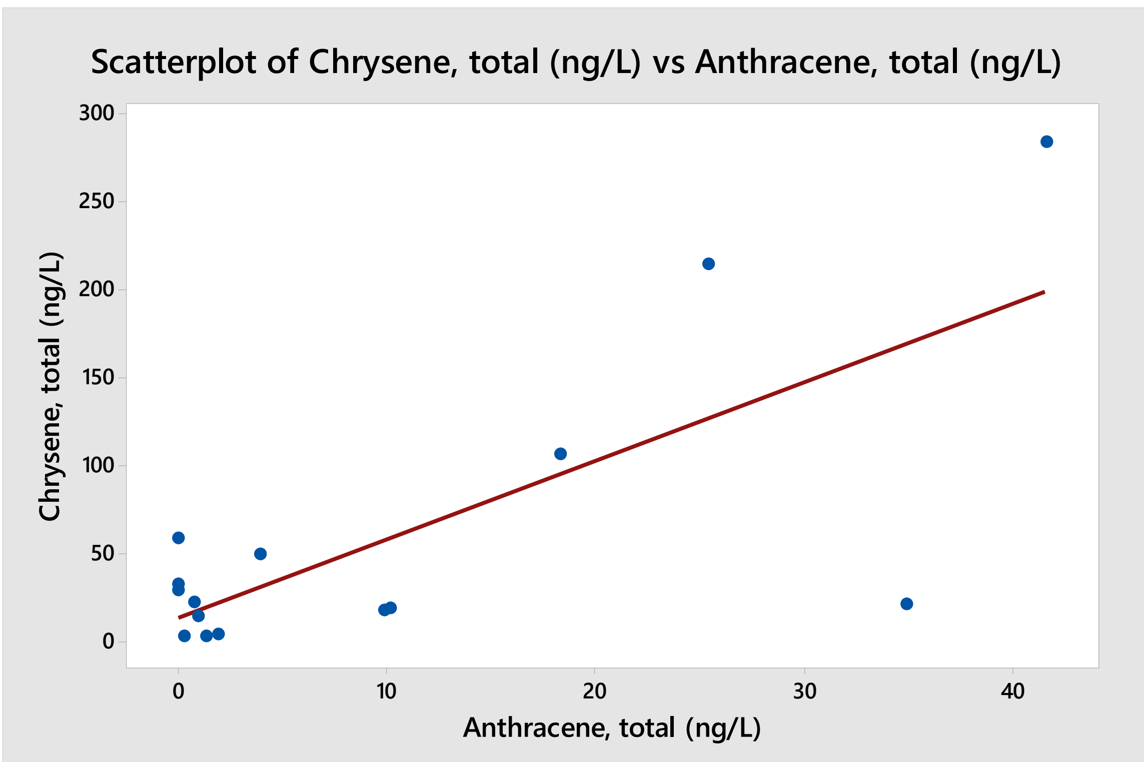

Scatterplot of Benzo[a]pyrene, total (n vs Anthracene, total (ng/L)
Benzo[a]pyrene, total (ng/L)
300
250
200
150
100
50
0
0
10
20
30
40
Anthracene, total (ng/L)

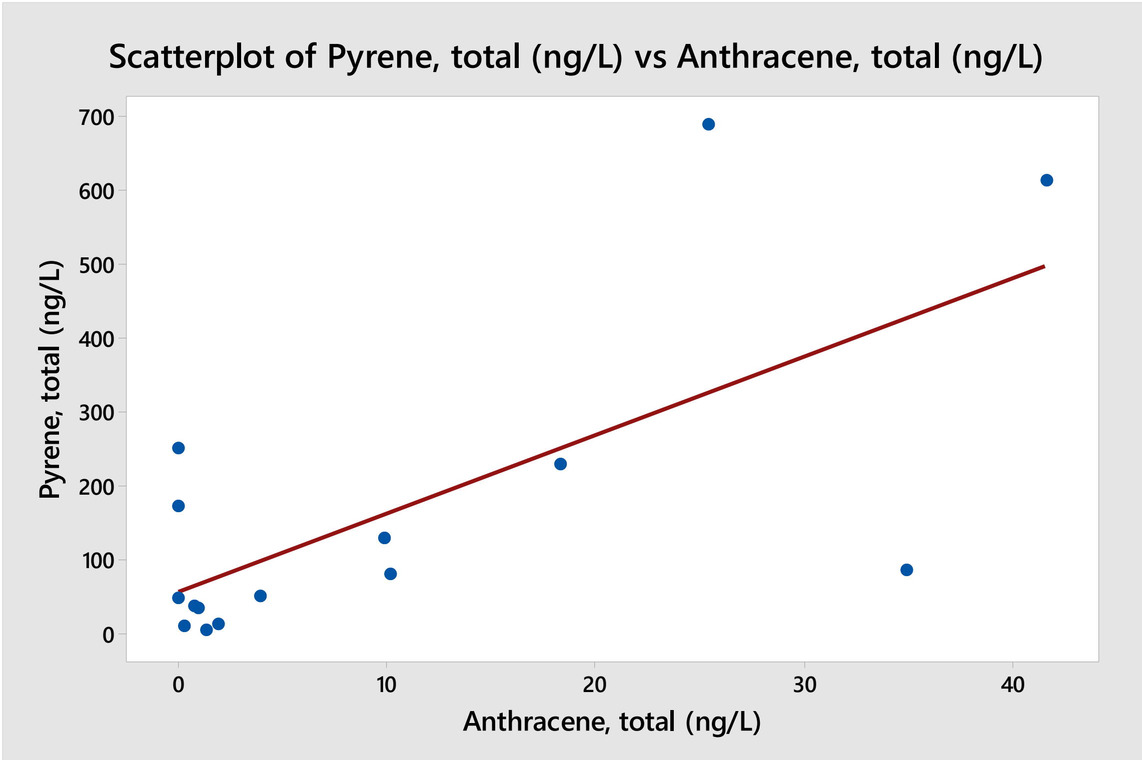

Scatterplot of Benzo[k]fluoranthene, to vs Anthracene, total (ng/L)
Benzo[k]fluoranthene, total (ng
160
140
120
100
80
60
40
20
0
0
10
20
30
40
Anthracene, total (ng/L)


Scatterplot of Benzo[b]fluoranthene, to vs Anthracene, total (ng/L)
Benzo[b]fluoranthene, total (ng
400
300
200
100
0
0
10
20
30
40
Anthracene, total (ng/L)

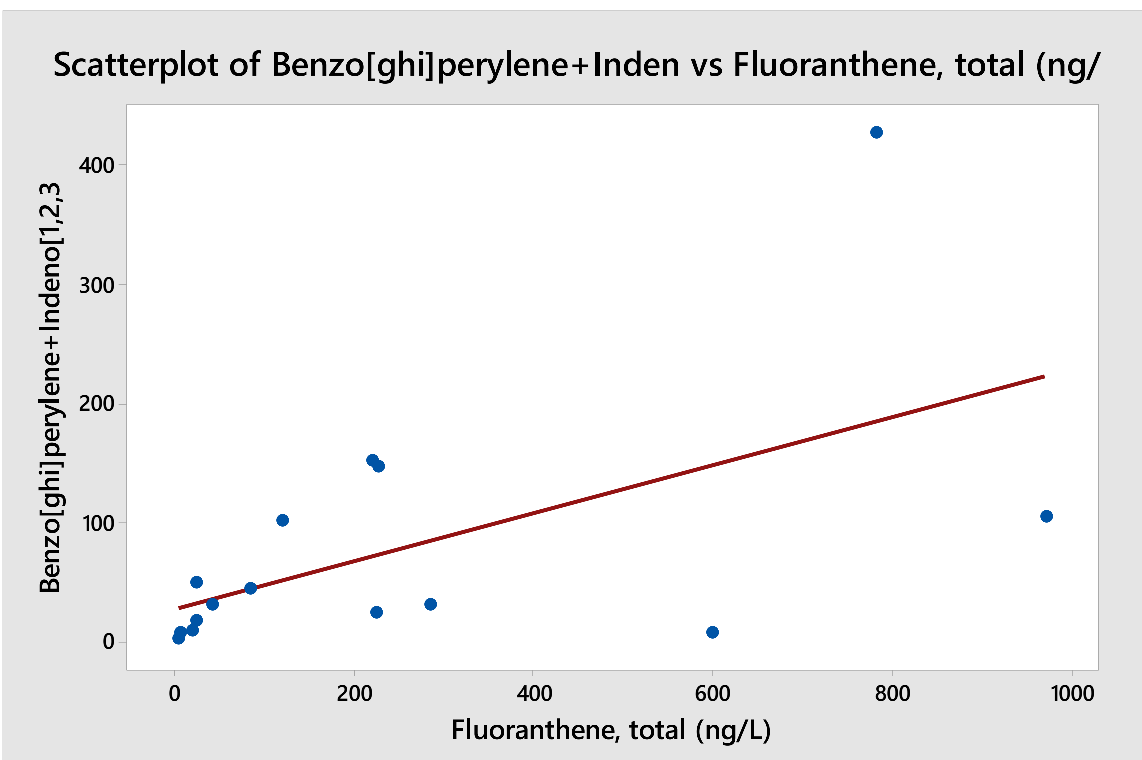

Scatterplot of Benzo[a]anthracene, tota vs Anthracene, total (ng/L)
Benzo[a]anthracene, total (ng/L
200
150
100
50
0
0
10
20
30
40
Anthracene, total (ng/L)

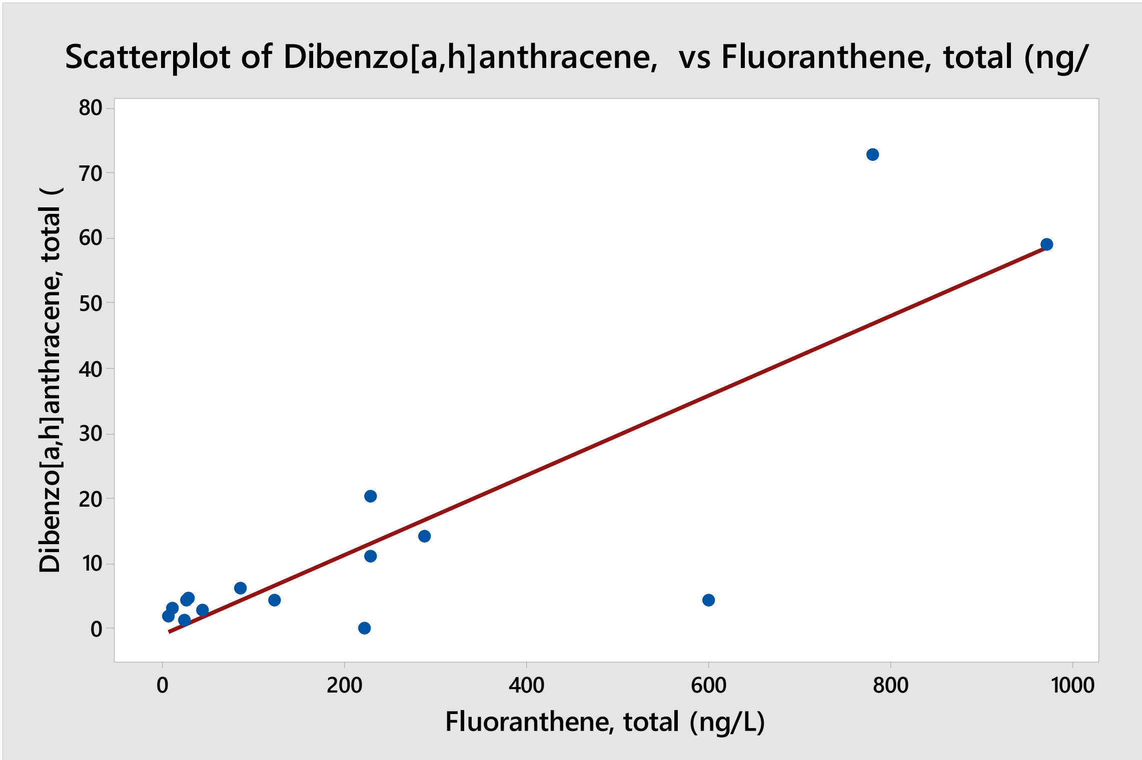

Scatterplot of Fluoranthene, total (ng/L) vs Anthracene, total (ng/L)
Fluoranthene, total (ng/L)
1000
800
600
400
200
0
0
10
20
30
40
Anthracene, total (ng/L)

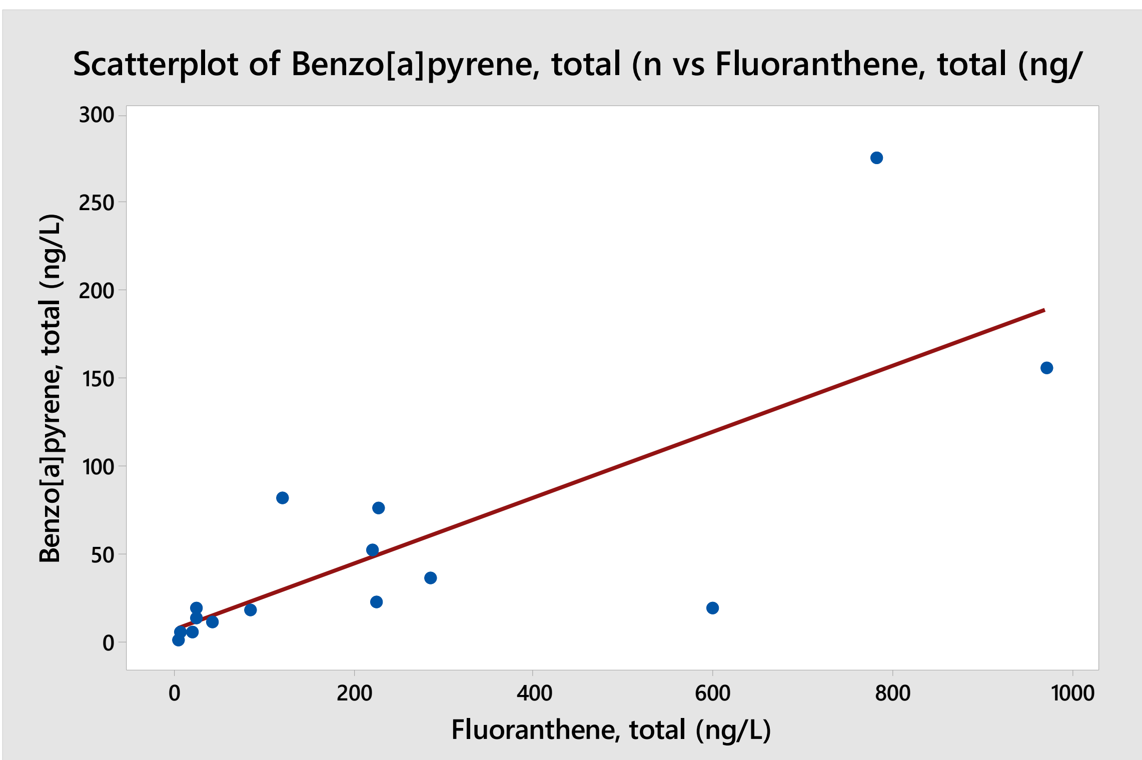

Scatterplot of Chrysene, total (ng/L) vs Anthracene, total (ng/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
10
20
30
40
Anthracene, total (ng/L)

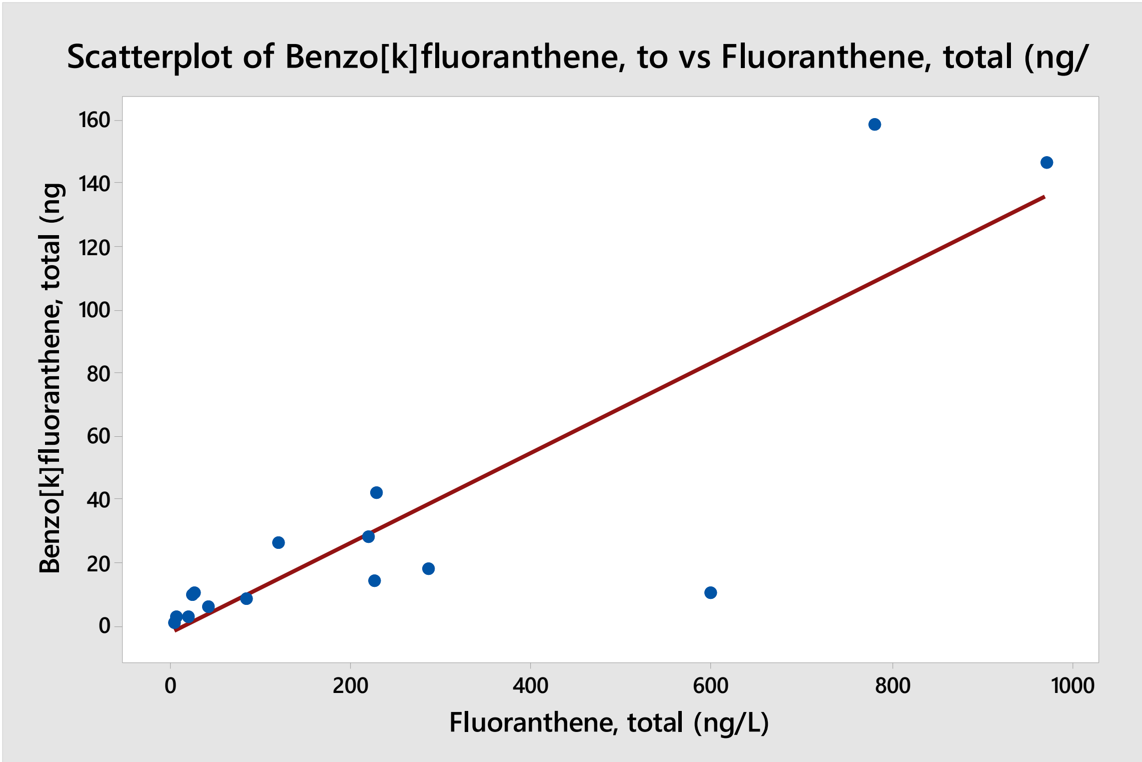


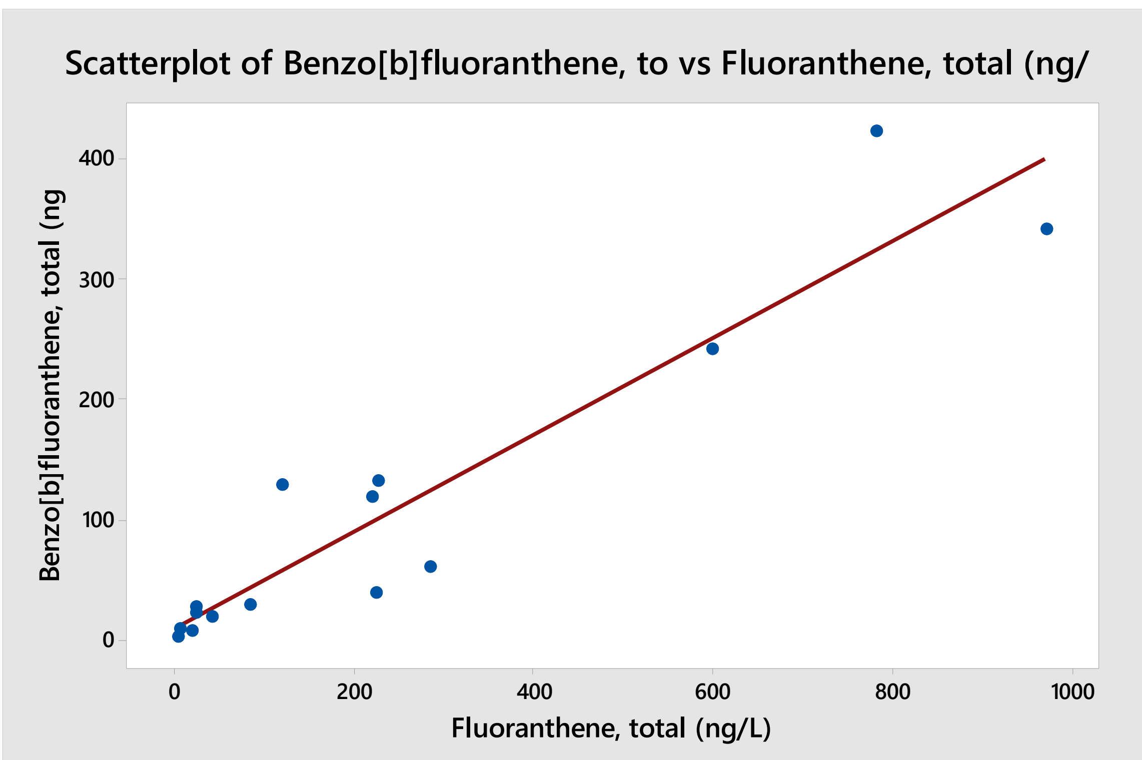
Fluoranthene, total, correlations

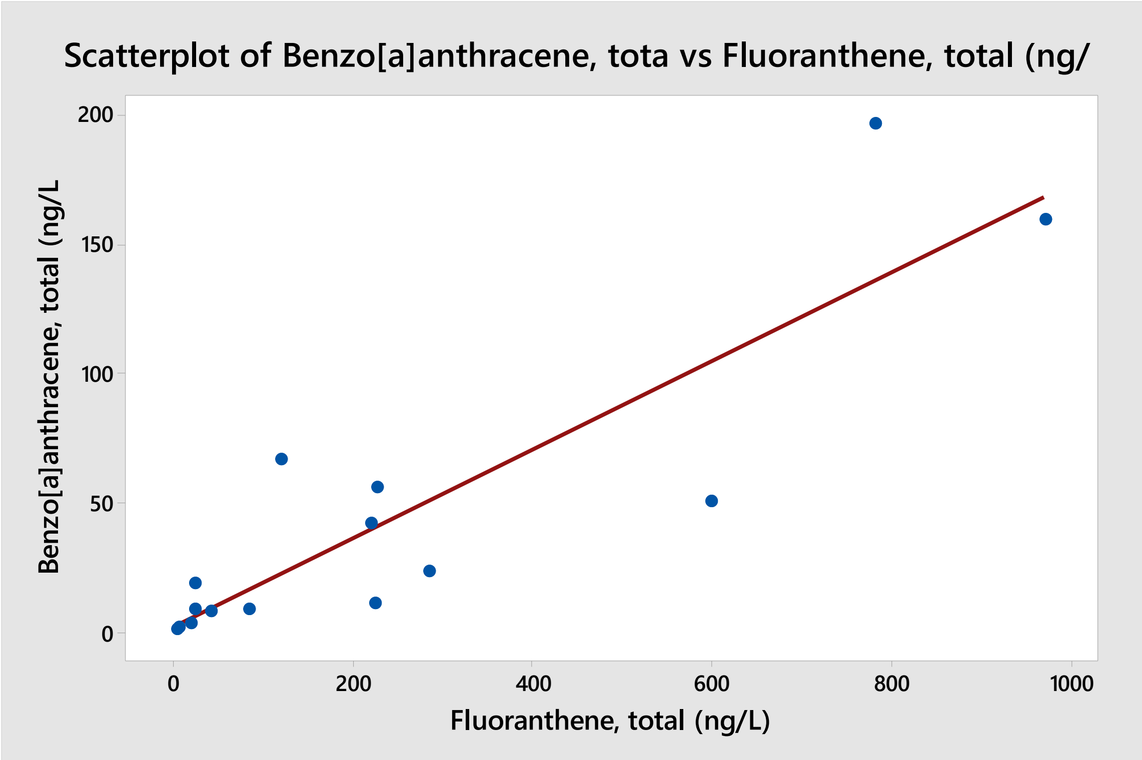


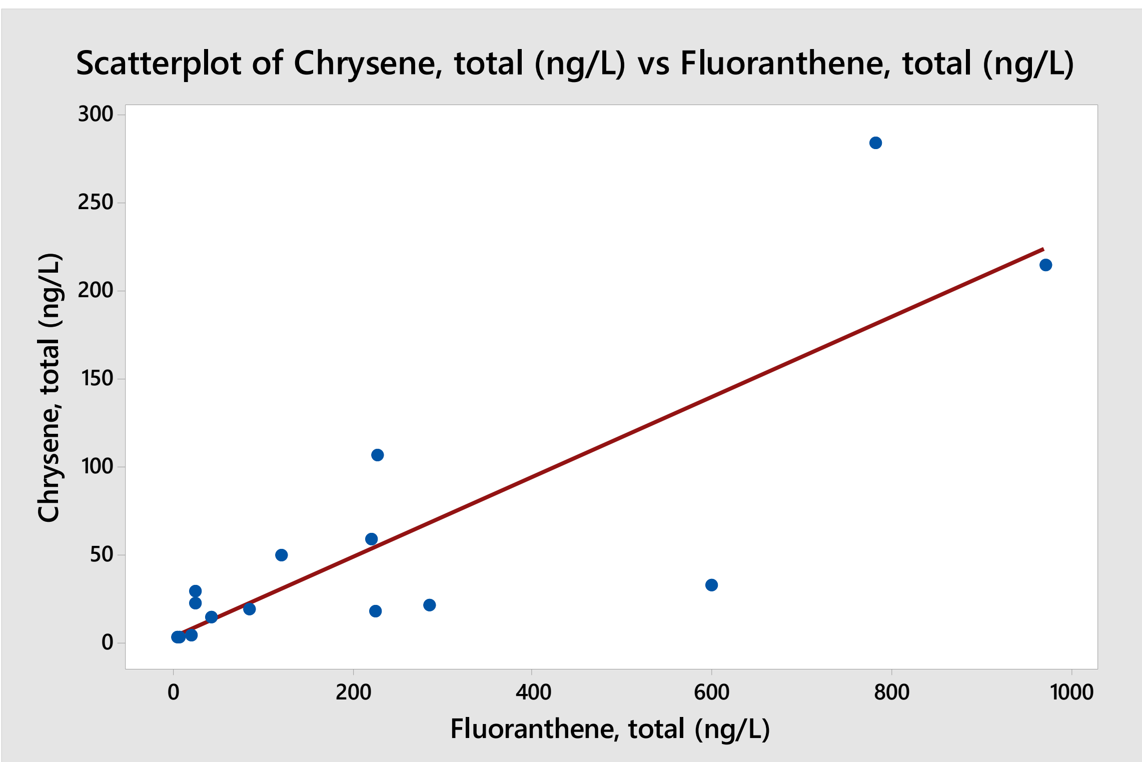

Scatterplot of Dibenzo[a,h]anthracene, vs Fluoranthene, total (ng/
Dibenzo[a,h]anthracene, total (
80
70
60
50
40
30
20
10
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)

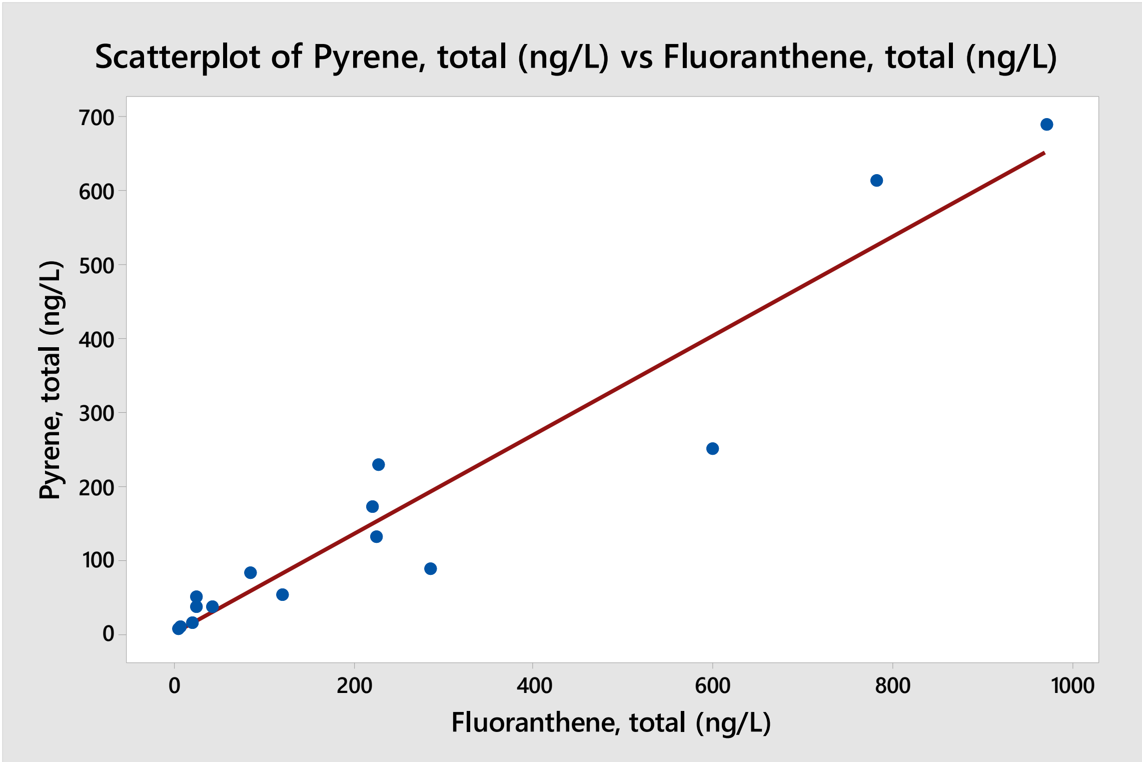

Scatterplot of Benzo[a]pyrene, total (n vs Fluoranthene, total (ng/
Benzo[a]pyrene, total (ng/L)
300
250
200
150
100
50
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)


Scatterplot of Benzo[k]fluoranthene, to vs Fluoranthene, total (ng/
Benzo[k]fluoranthene, total (ng
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)

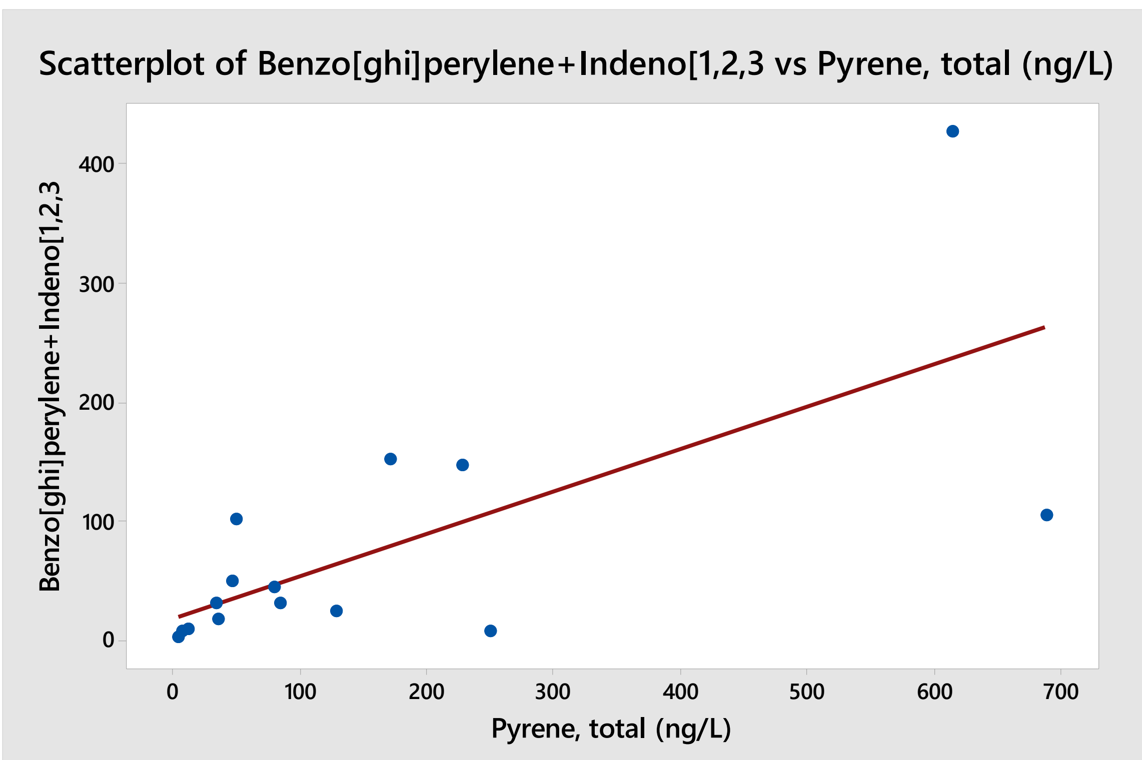

Scatterplot of Benzo[b]fluoranthene, to vs Fluoranthene, total (ng/
Benzo[b]fluoranthene, total (ng
400
300
200
100
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)

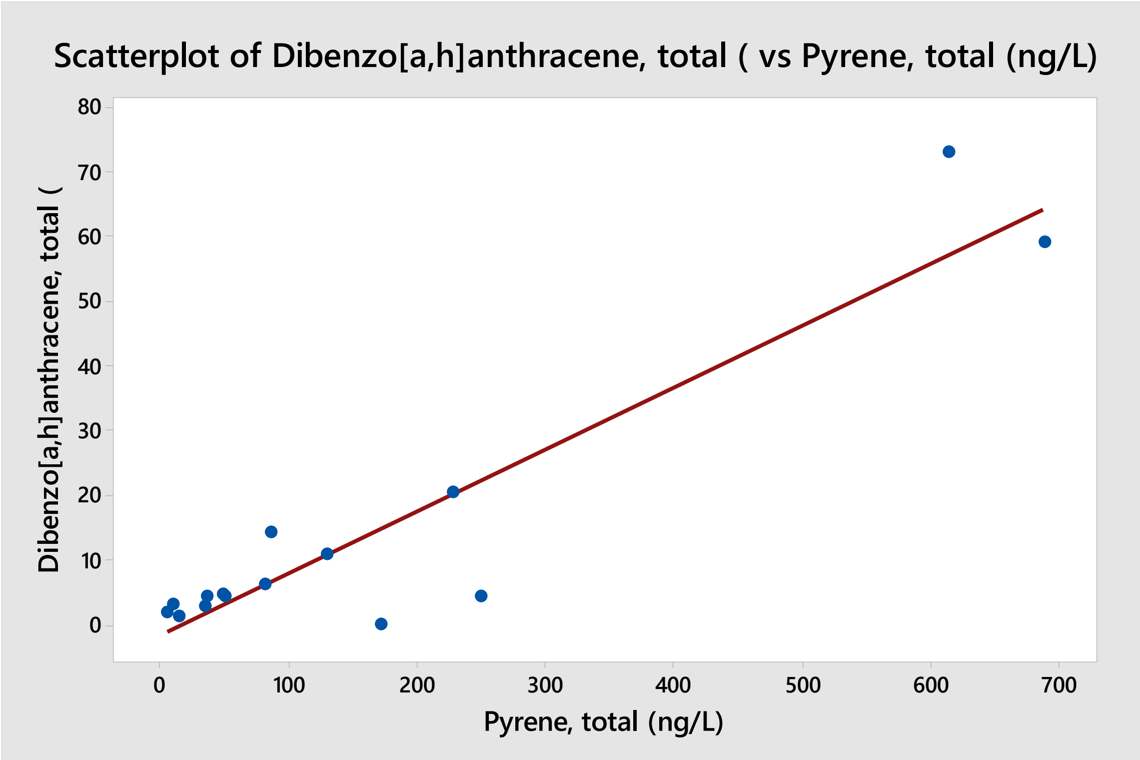

Scatterplot of Benzo[a]anthracene, tota vs Fluoranthene, total (ng/
Benzo[a]anthracene, total (ng/L
200
150
100
50
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)

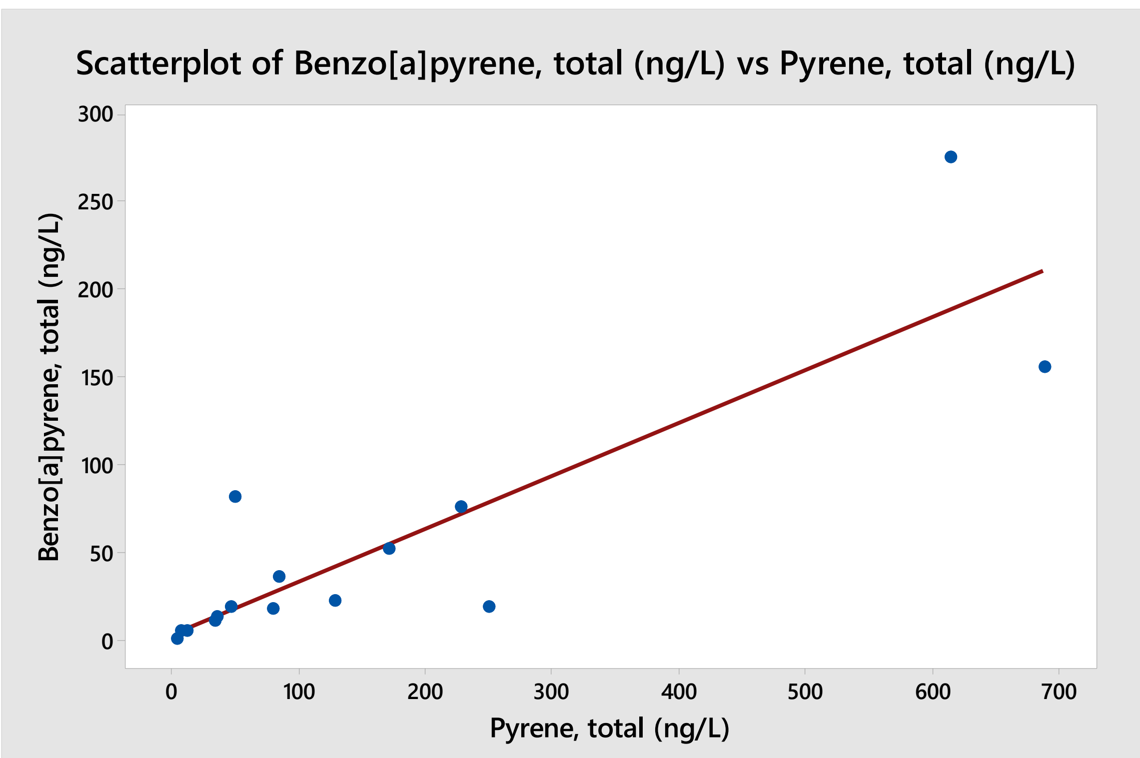

Scatterplot of Chrysene, total (ng/L) vs Fluoranthene, total (ng/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
200
400
600
800
1000
Fluoranthene, total (ng/L)

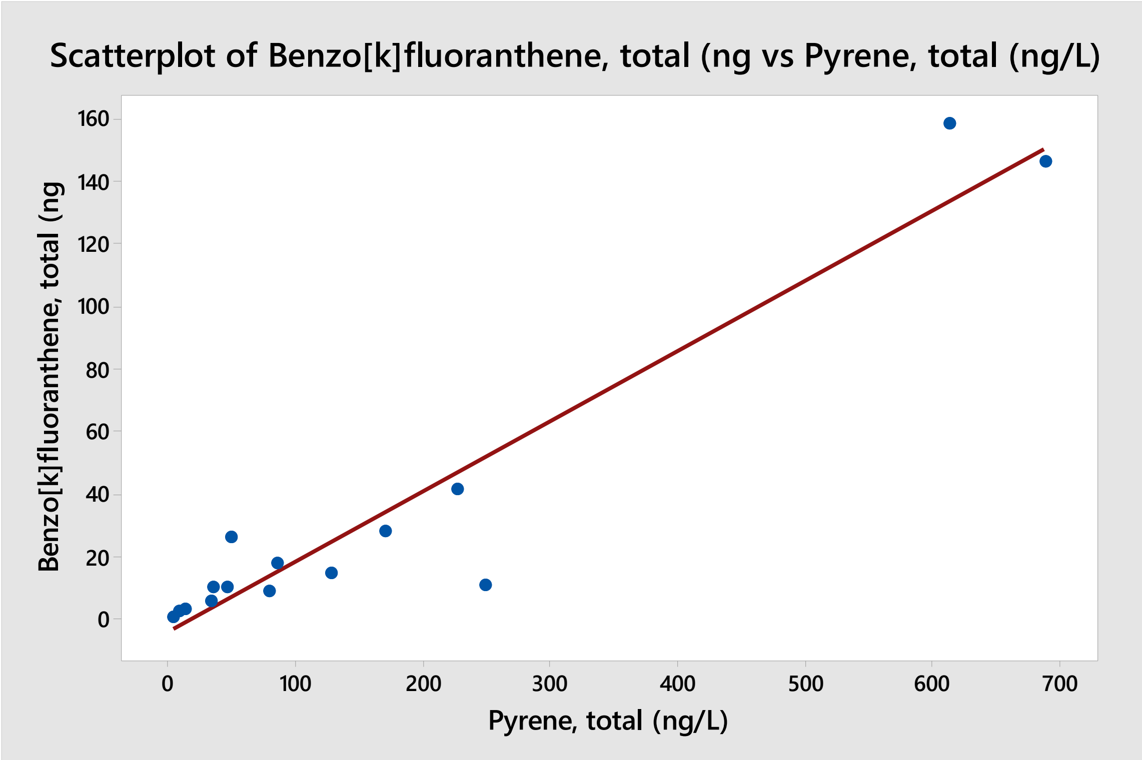


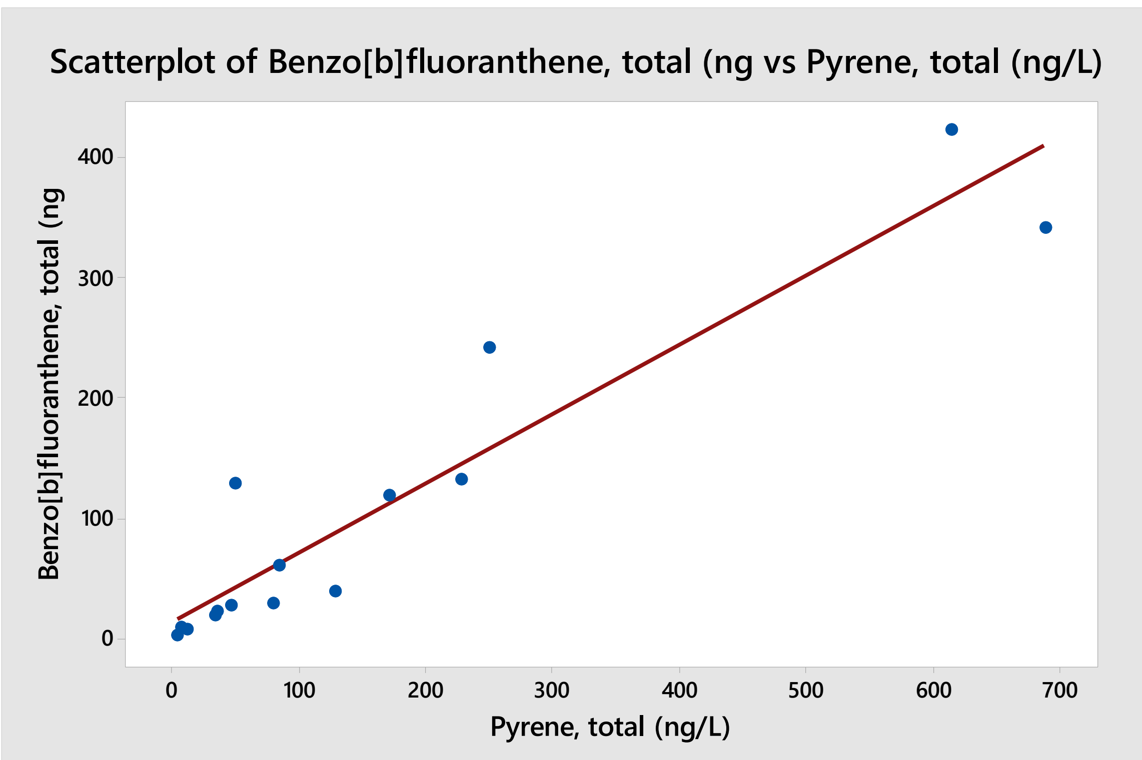
Pyrene, total, correlations

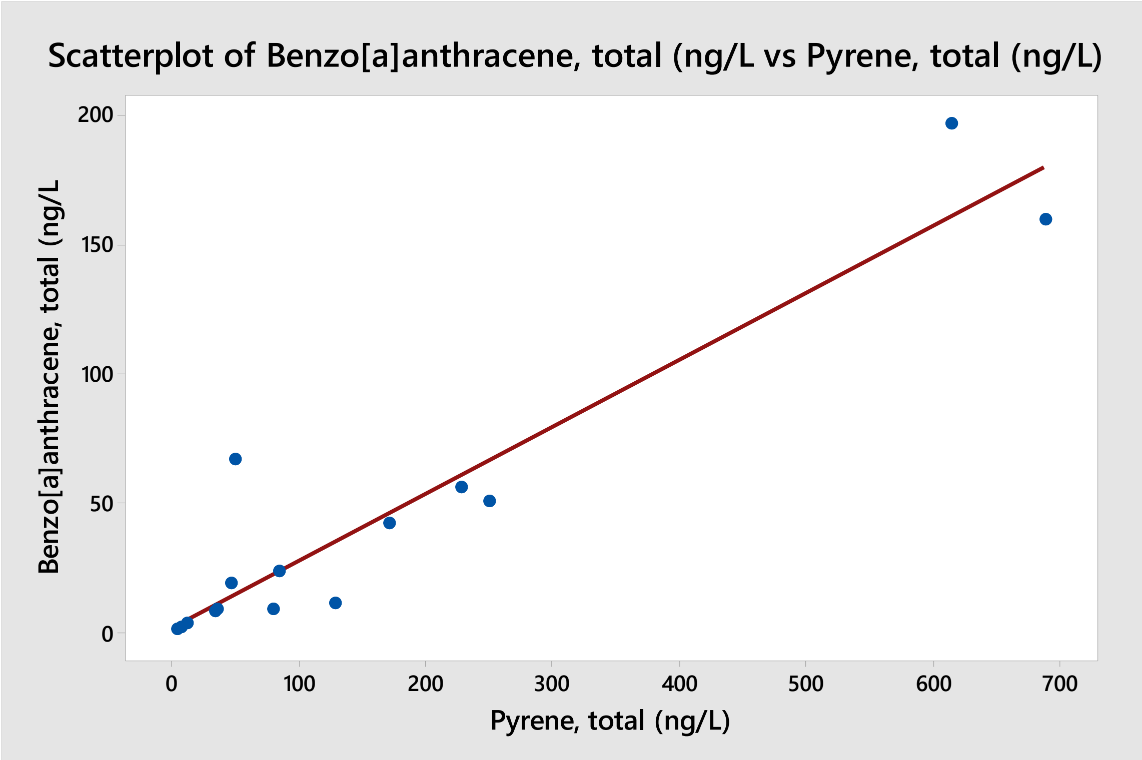


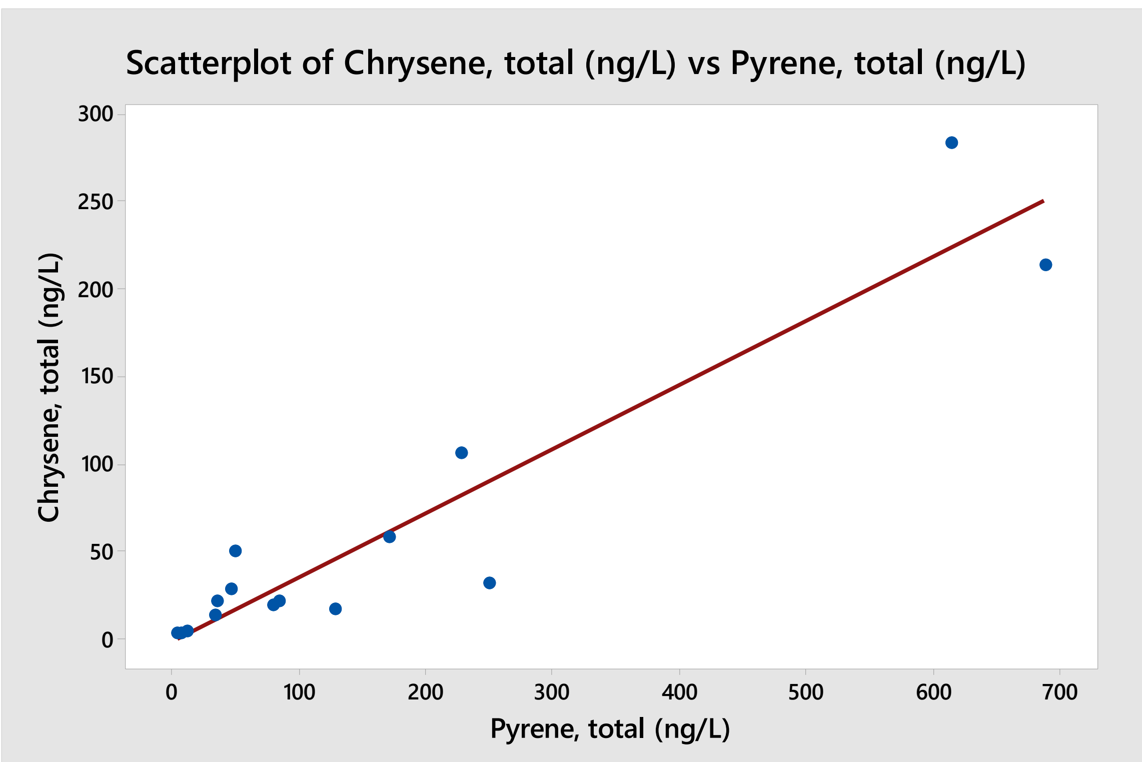

Scatterplot of Dibenzo[a,h]anthracene, total (vs Pyrene, total (ng/L)
Dibenzo[a,h]anthracene, total (
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)


Scatterplot of Benzo[a]pyrene, total (ng/L) vs Pyrene, total (ng/L)
Benzo[a]pyrene, total (ng/L)
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)

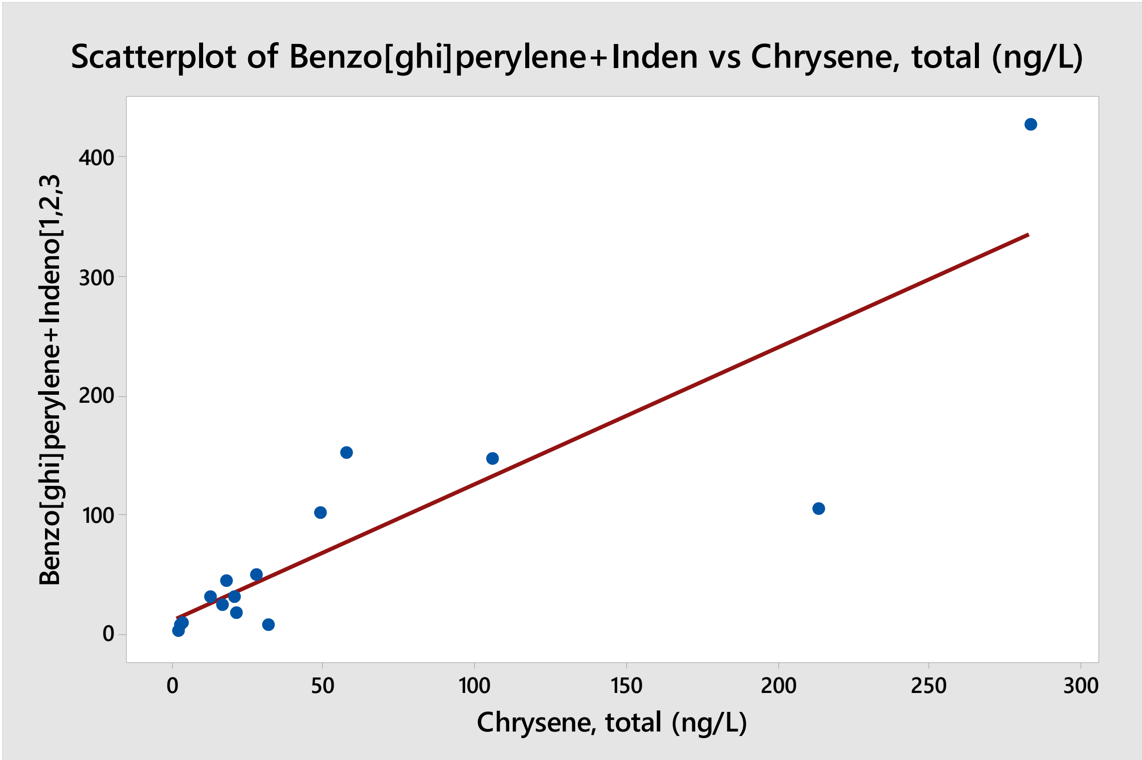

Scatterplot of Benzo[k]fluoranthene, total (ng vs Pyrene, total (ng/L)
Benzo[k]fluoranthene, total (ng
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)

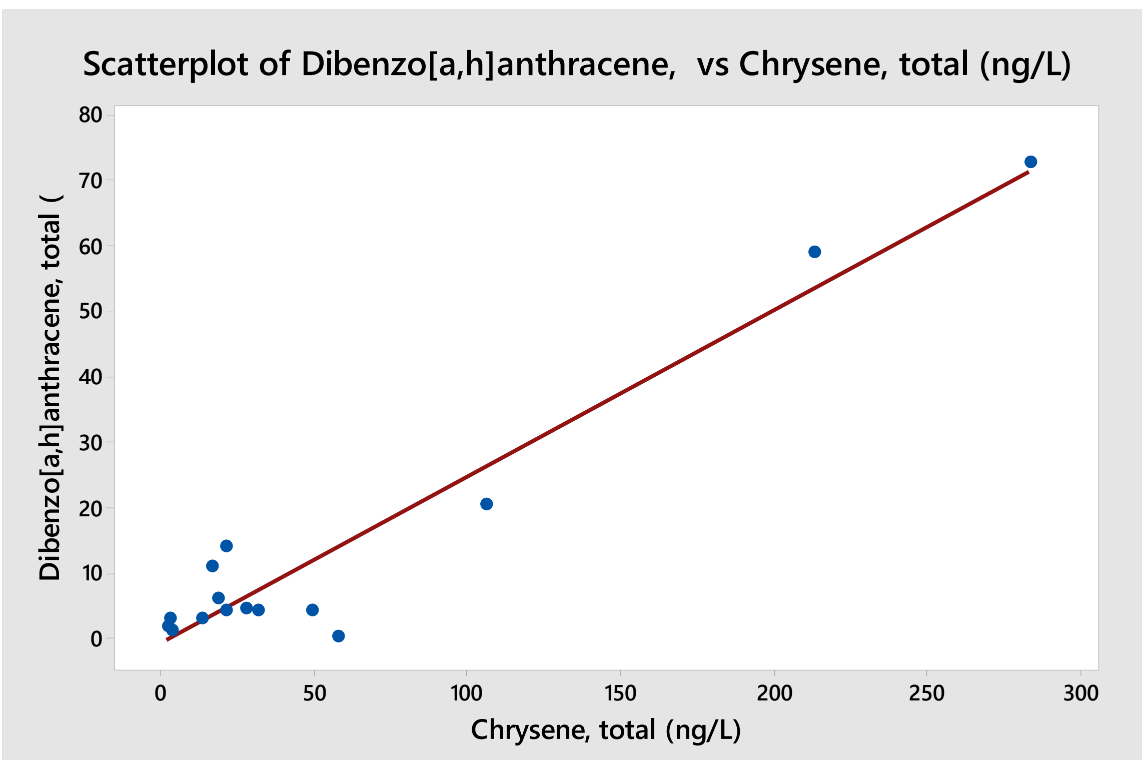

Scatterplot of Benzo[b]fluoranthene, total (ng vs Pyrene, total (ng/L)
Benzo[b]fluoranthene, total (ng
400
300
200
100
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)

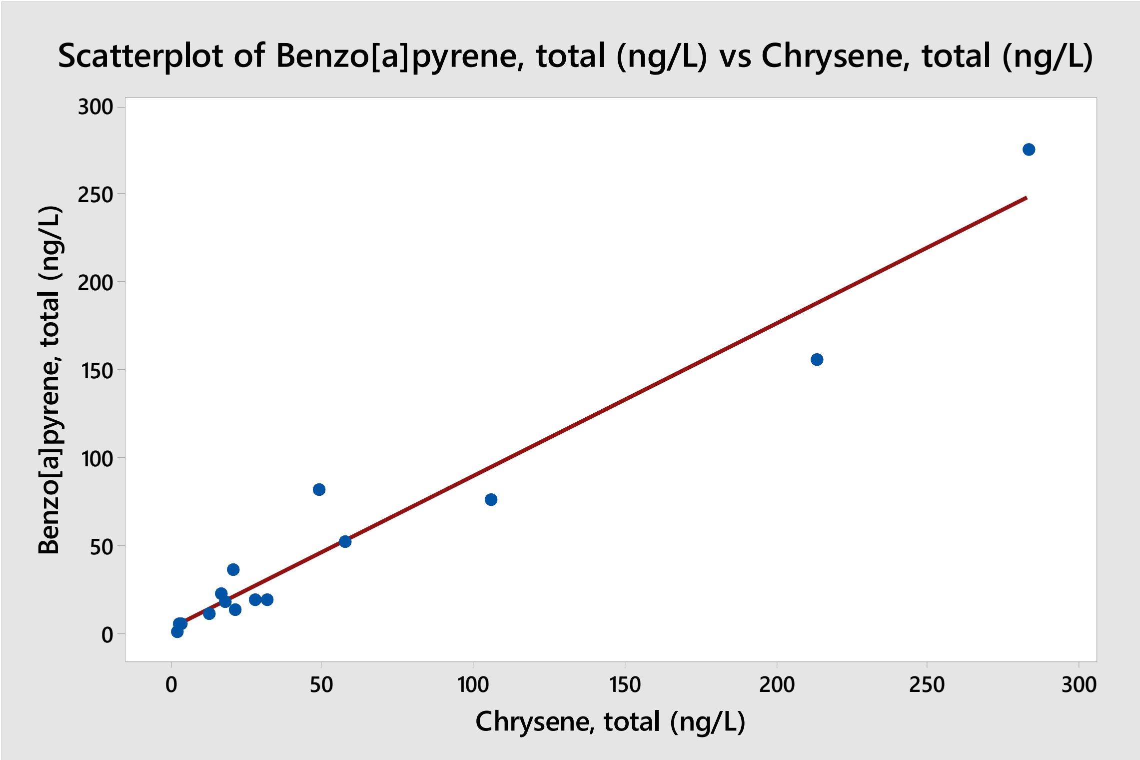

Scatterplot of Benzo[a]anthracene, total (ng/L vs Pyrene, total (ng/L)
Benzo[a]anthracene, total (ng/L
200
150
100
50
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)

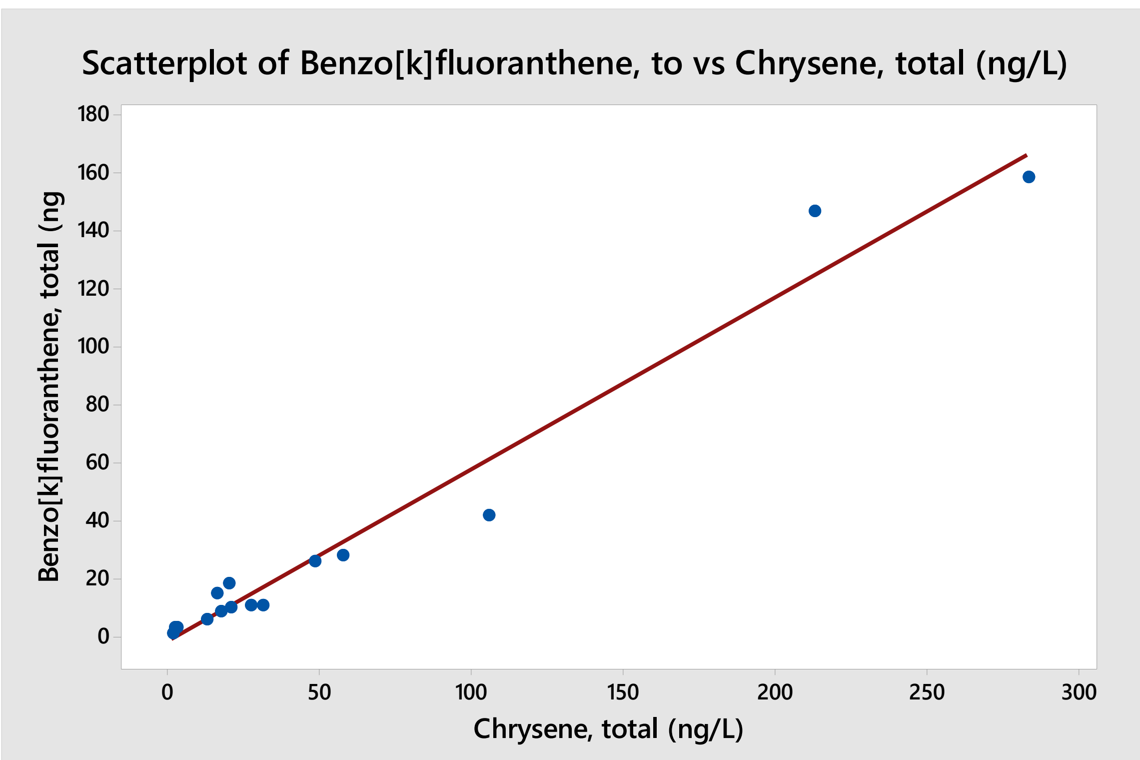

Scatterplot of Chrysene, total (ng/L) vs Pyrene, total (ng/L)
Chrysene, total (ng/L)
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
Pyrene, total (ng/L)

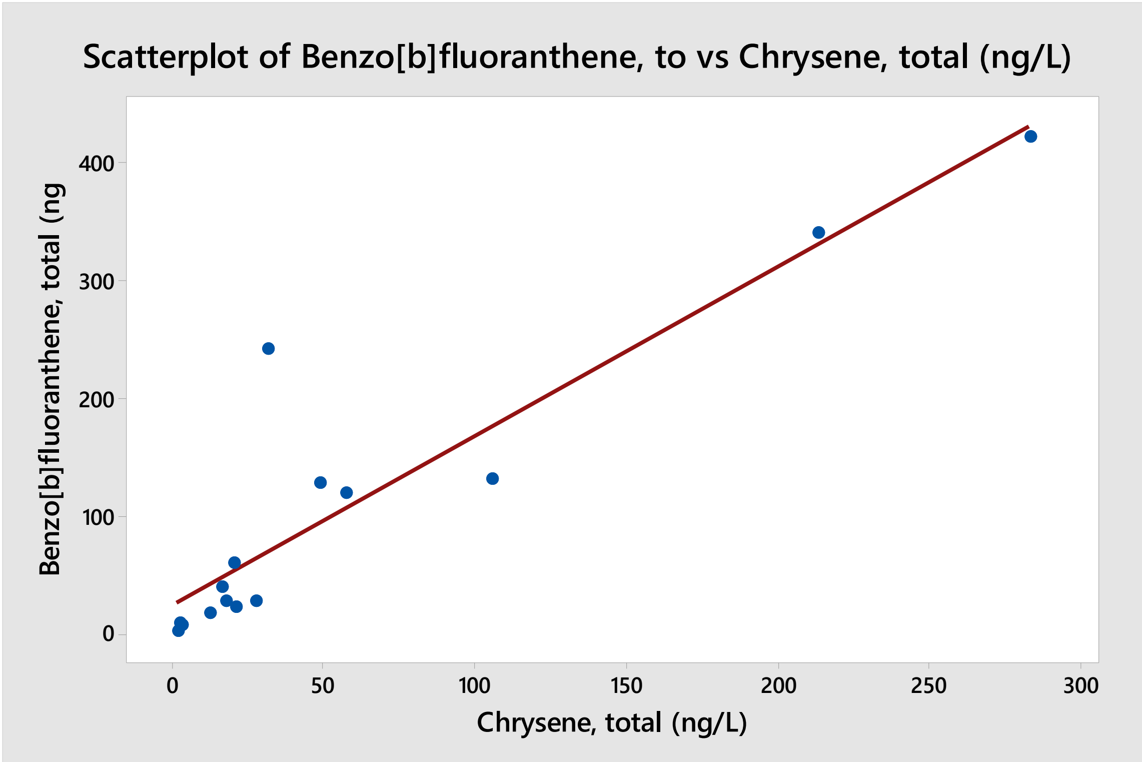
Chrysene, total, correlations

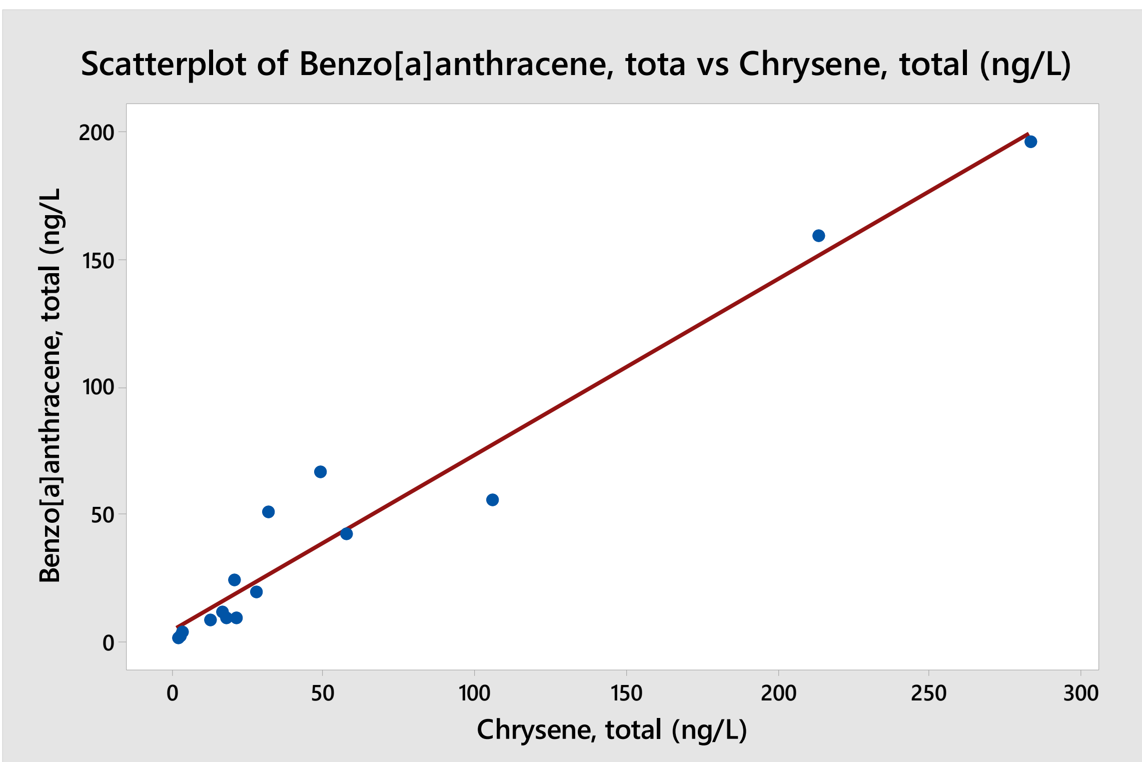




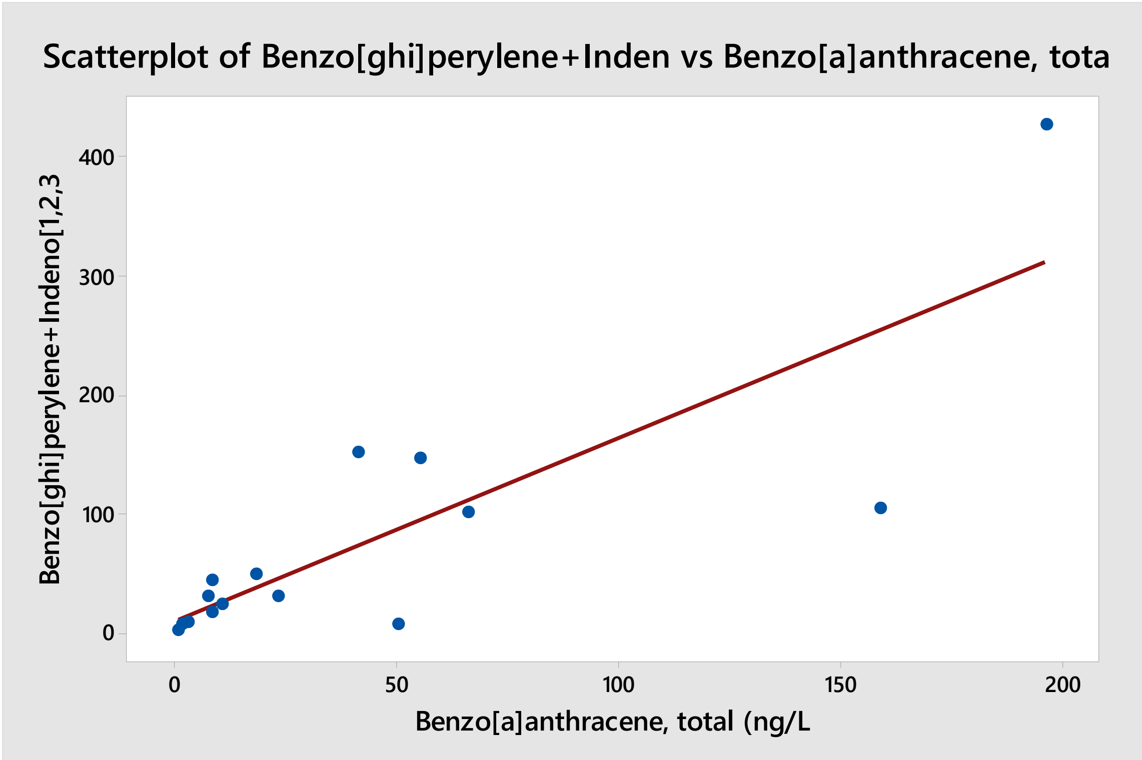

Scatterplot of Benzo[a]pyrene, total (ng/L) vs Chrysene, total (ng/L)
Benzo[a]pyrene, total (ng/L)
300
250
200
150
100
50
0
0
50
100
150
200
250
300
Chrysene, total (ng/L)

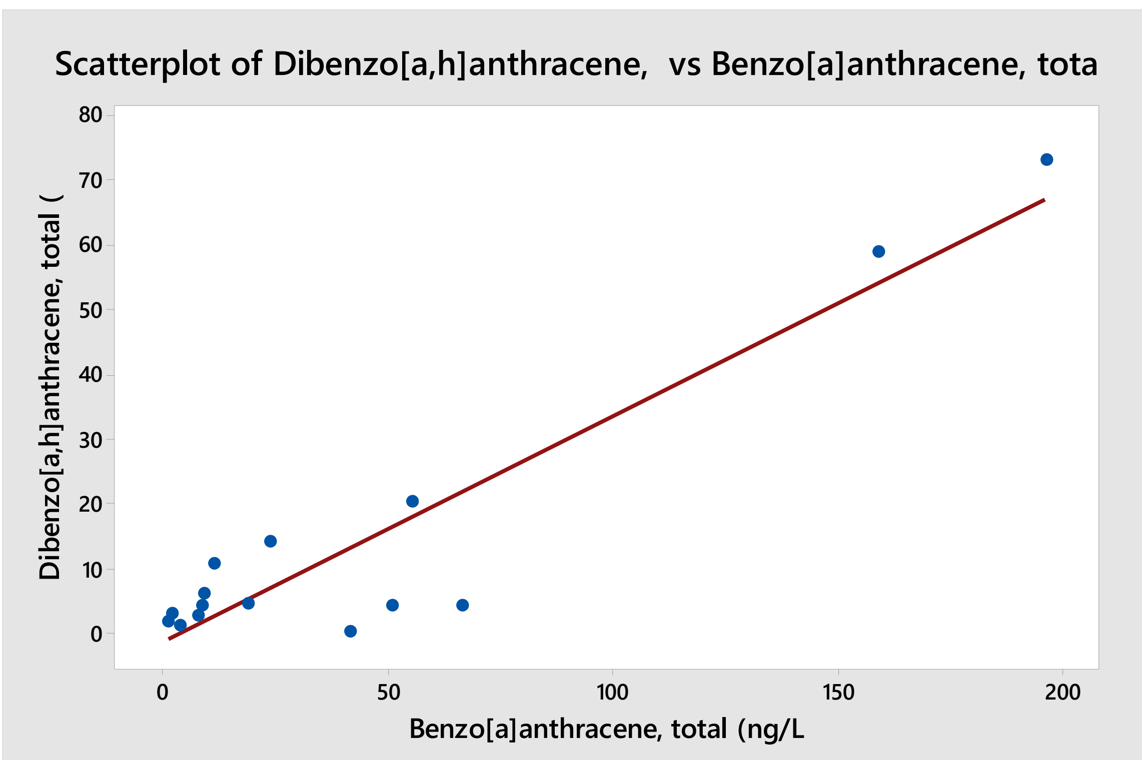

Scatterplot of Benzo[k]fluoranthene, to vs Chrysene, total (ng/L)
Benzo[k]fluoranthene, total (ng
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
Chrysene, total (ng/L)

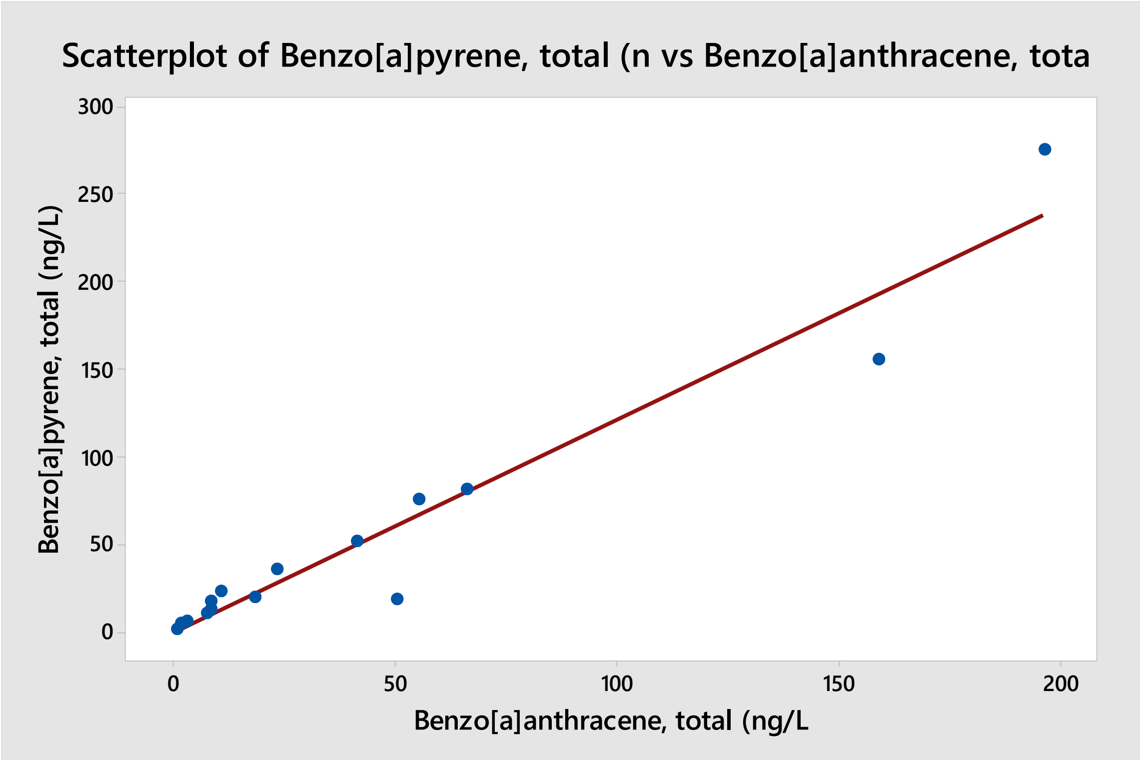

Scatterplot of Benzo[b]fluoranthene, to vs Chrysene, total (ng/L)
Benzo[b]fluoranthene, total (ng
0
100
200
300
400
0
50
100
150
200
250
300
Chrysene, total (ng/L)

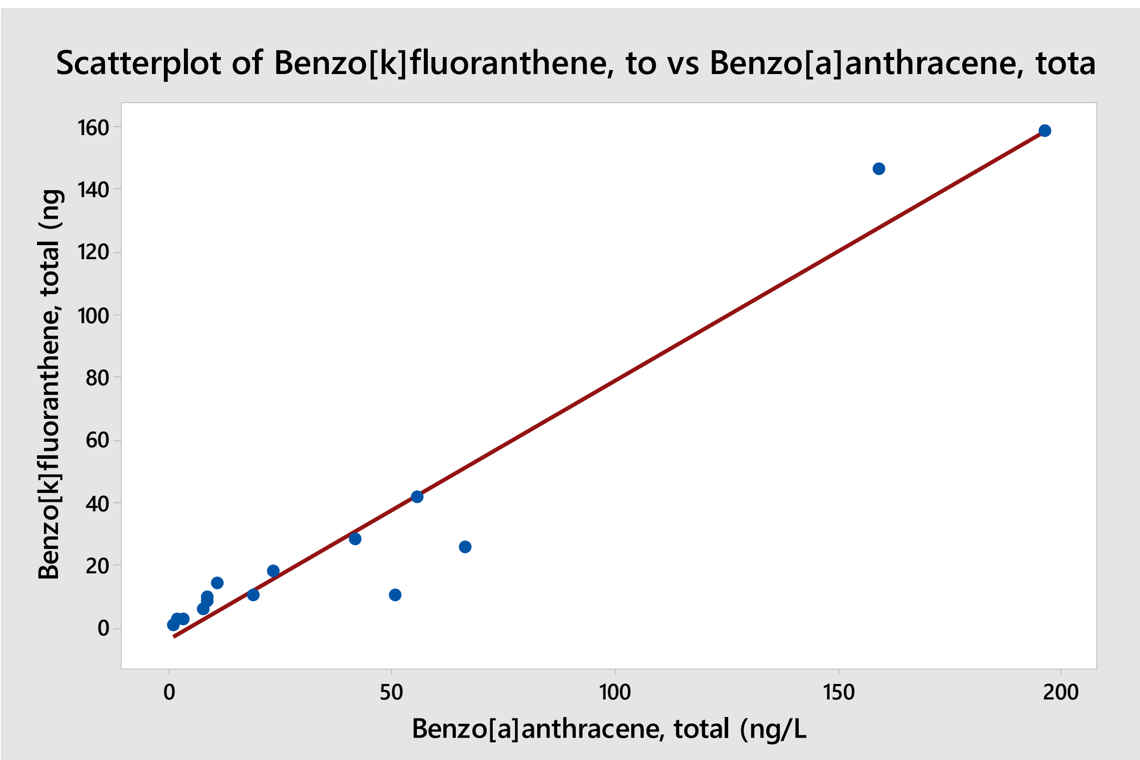

Scatterplot of Benzo[a]anthracene, tota vs Chrysene, total (ng/L)
Benzo[a]anthracene, total (ng/L
0
50
100
150
200
0
50
100
150
200
250
300
Chrysene, total (ng/L)

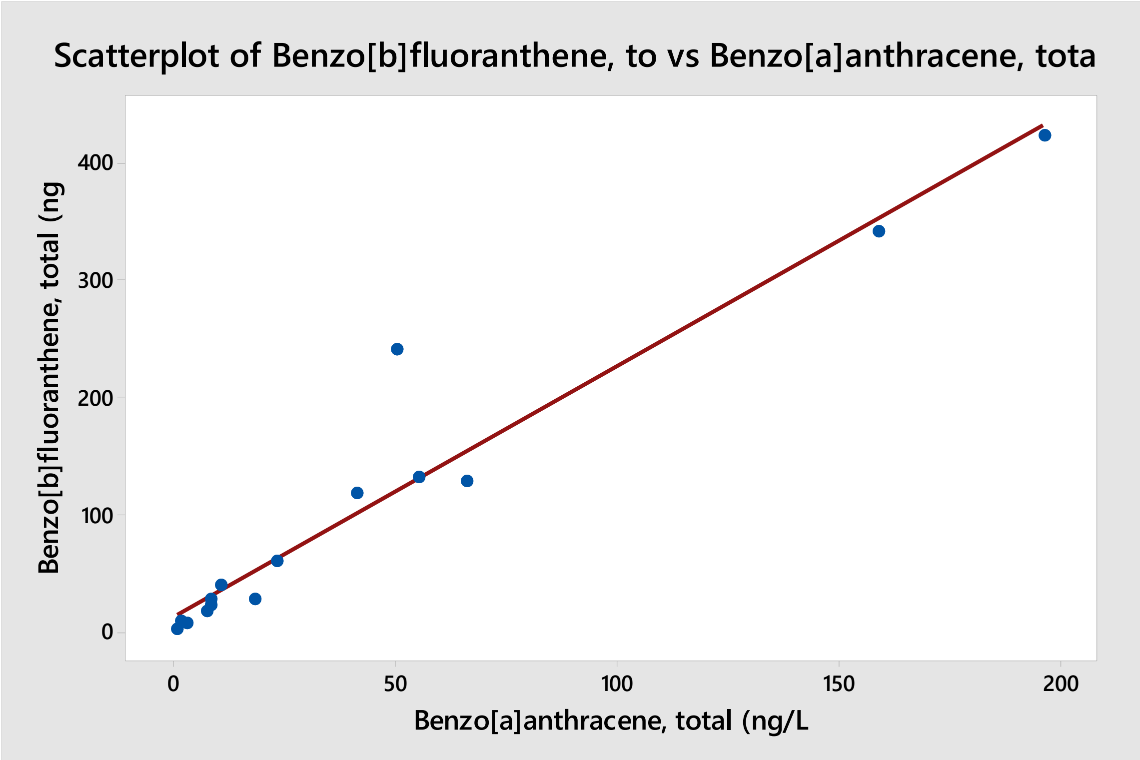
Benzo[a]anthracene, total, correlations



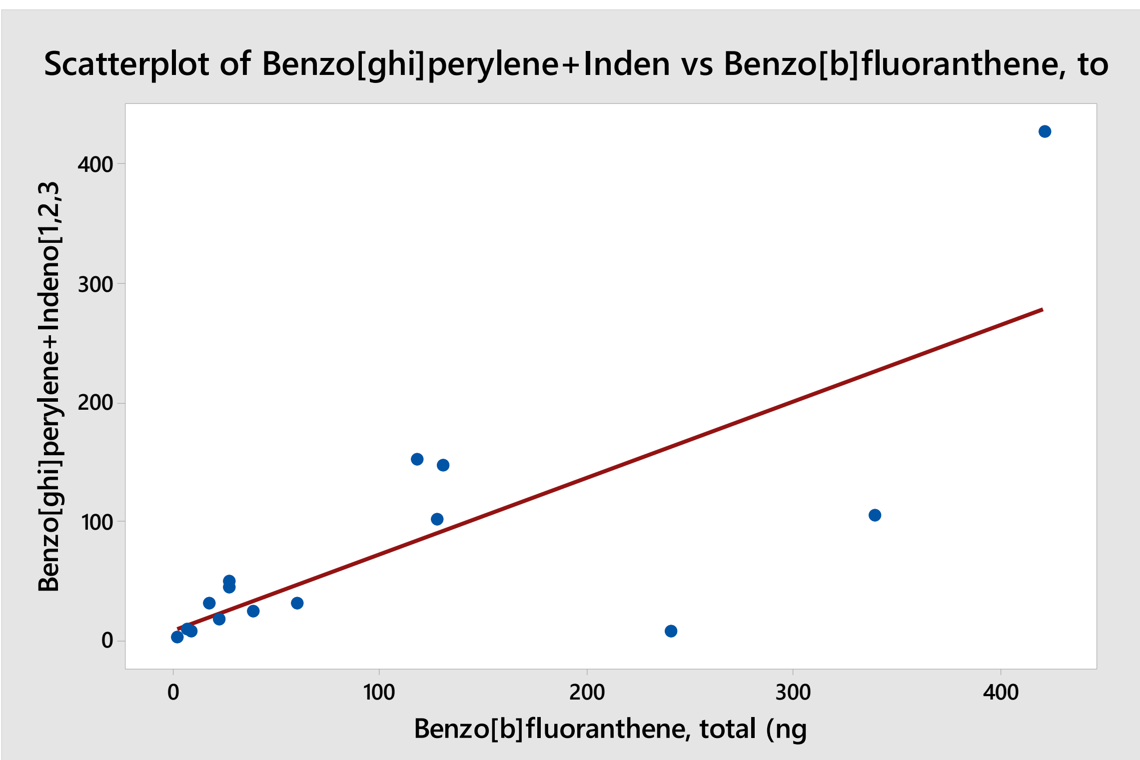


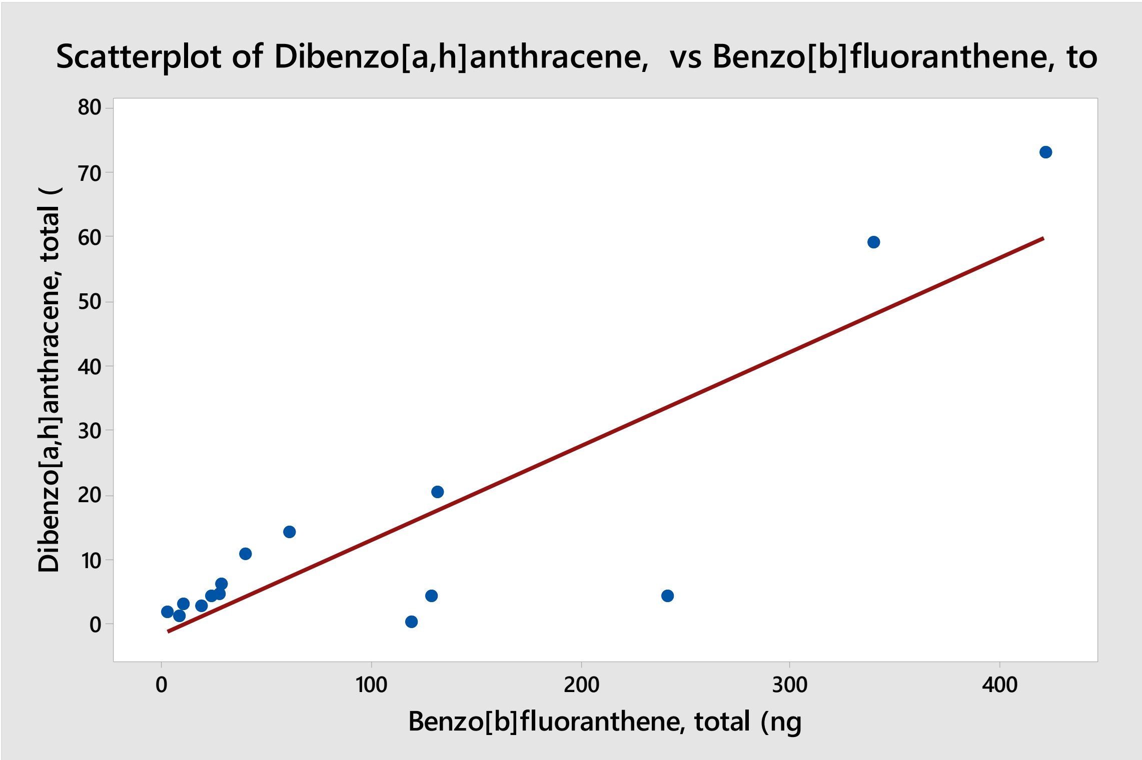

Scatterplot of Benzo[a]pyrene, total (n vs Benzo[a]anthracene, tota
Benzo[a]pyrene, total (ng/L)
300
250
200
150
100
50
0
0
50
100
150
200
Benzo[a]anthracene, total (ng/L

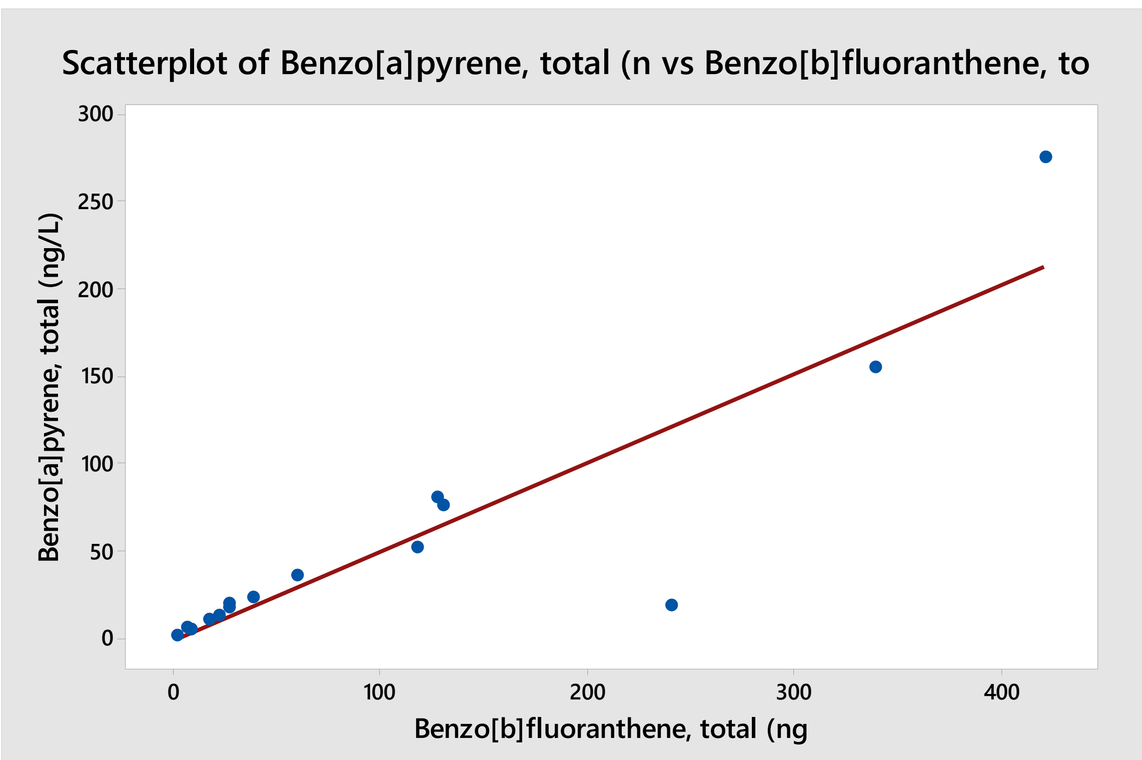

Scatterplot of Benzo[k]fluoranthene, to vs Benzo[a]anthracene, tota
Benzo[k]fluoranthene, total (ng
160
140
120
100
80
60
40
20
0
0
50
100
150
200
Benzo[a]anthracene, total (ng/L

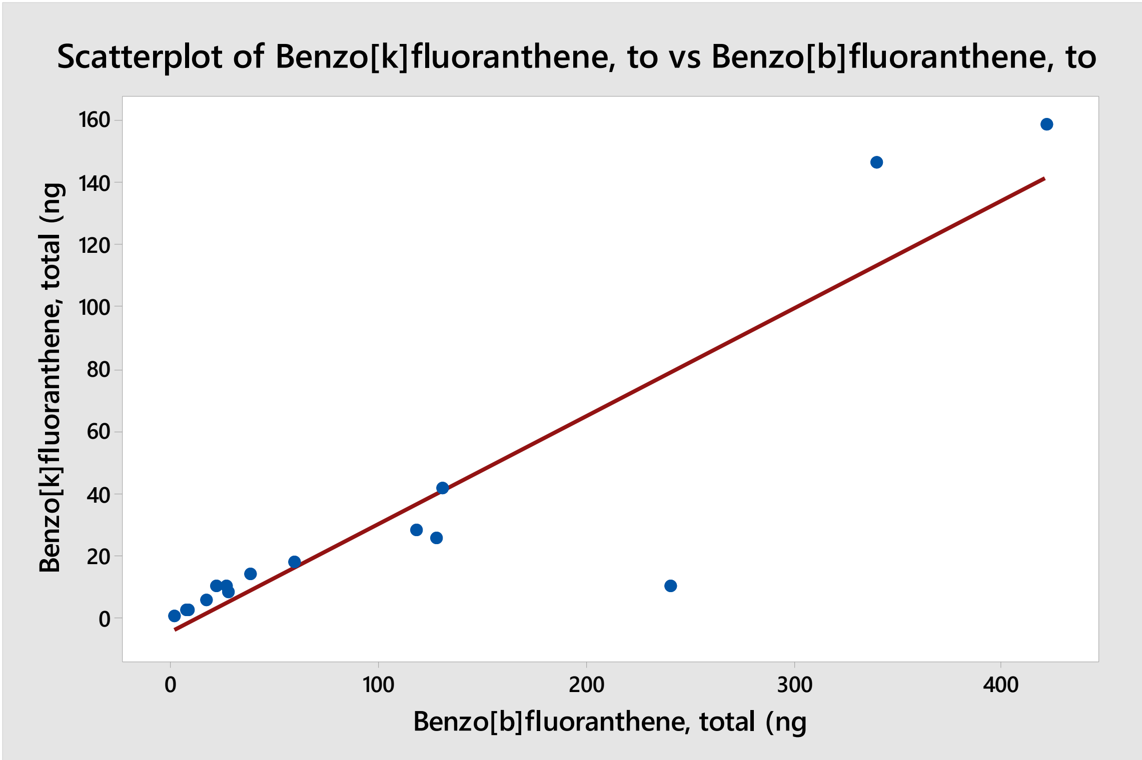


Benzo[b]fluoranthene, total, correlations

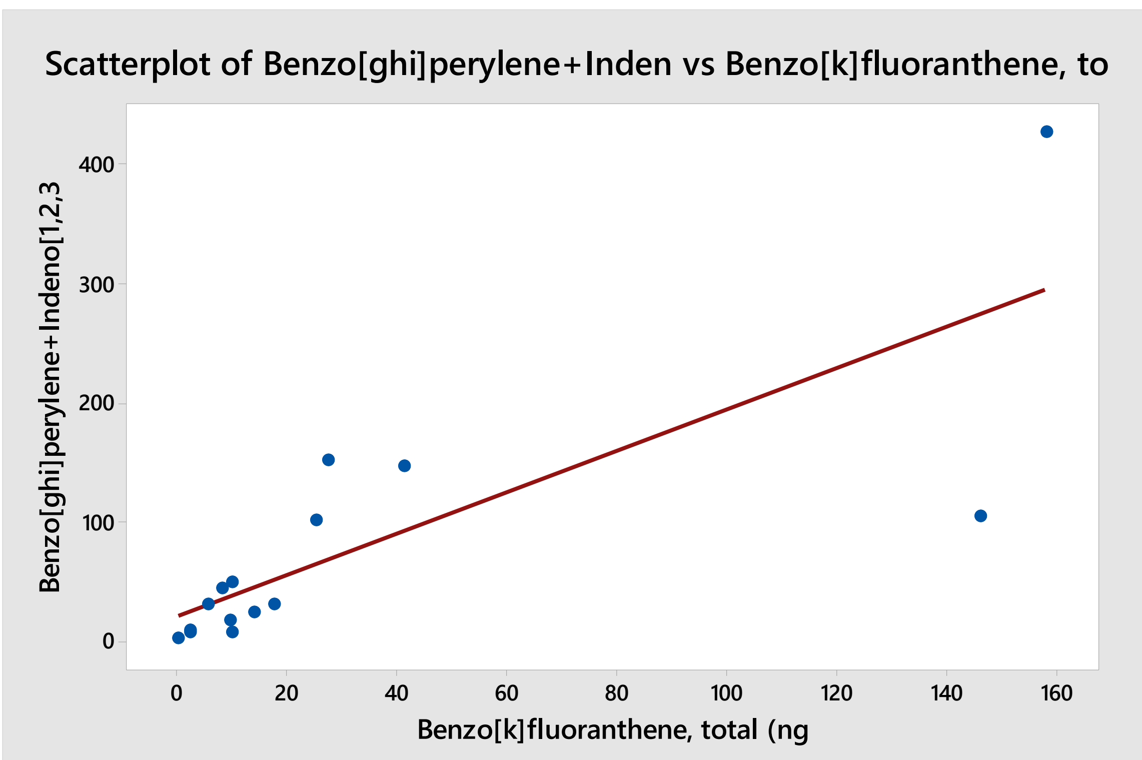


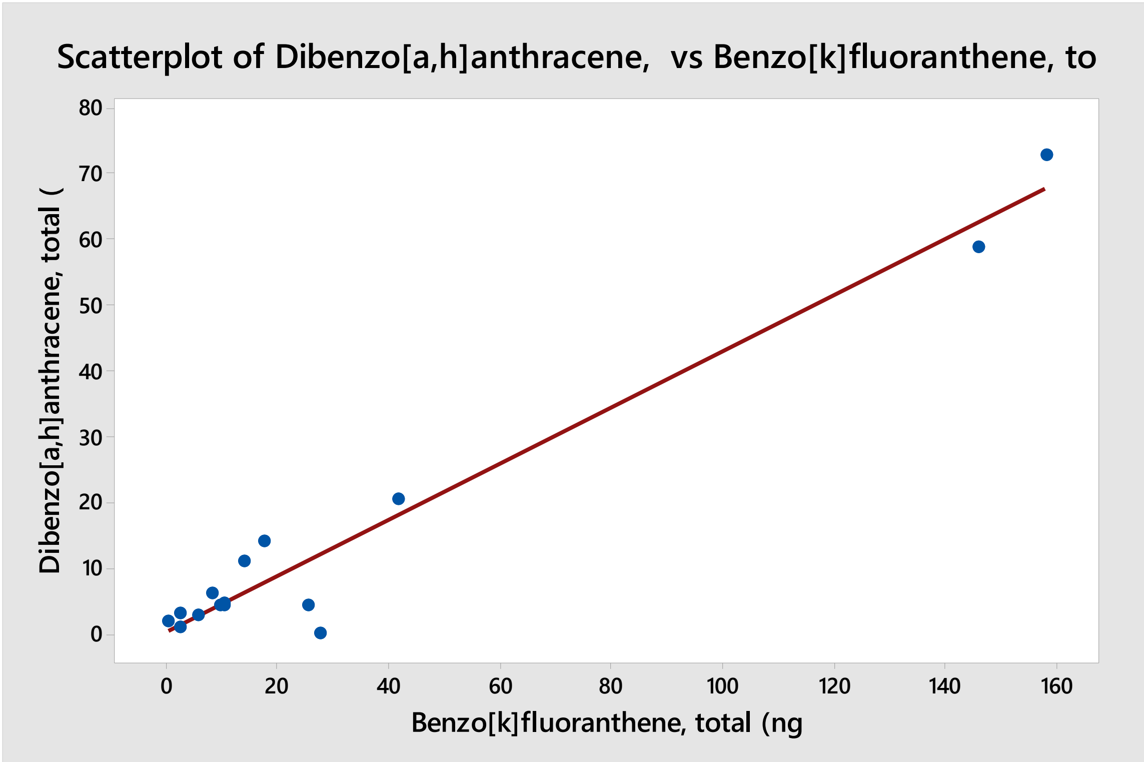

Scatterplot of Dibenzo[a,h]anthracene, vs Benzo[b]fluoranthene, to
Dibenzo[a,h]anthracene, total (
Benzo[b]fluoranthene, total (ng
80
70
60
50
40
30
20
10
0
0
100
200
300
400


Scatterplot of Benzo[a]pyrene, total (n vs Benzo[b]fluoranthene, to
Benzo[a]pyrene, total (ng/L)
Benzo[b]fluoranthene, total (ng
300
250
200
150
100
50
0
0
100
200
300
400

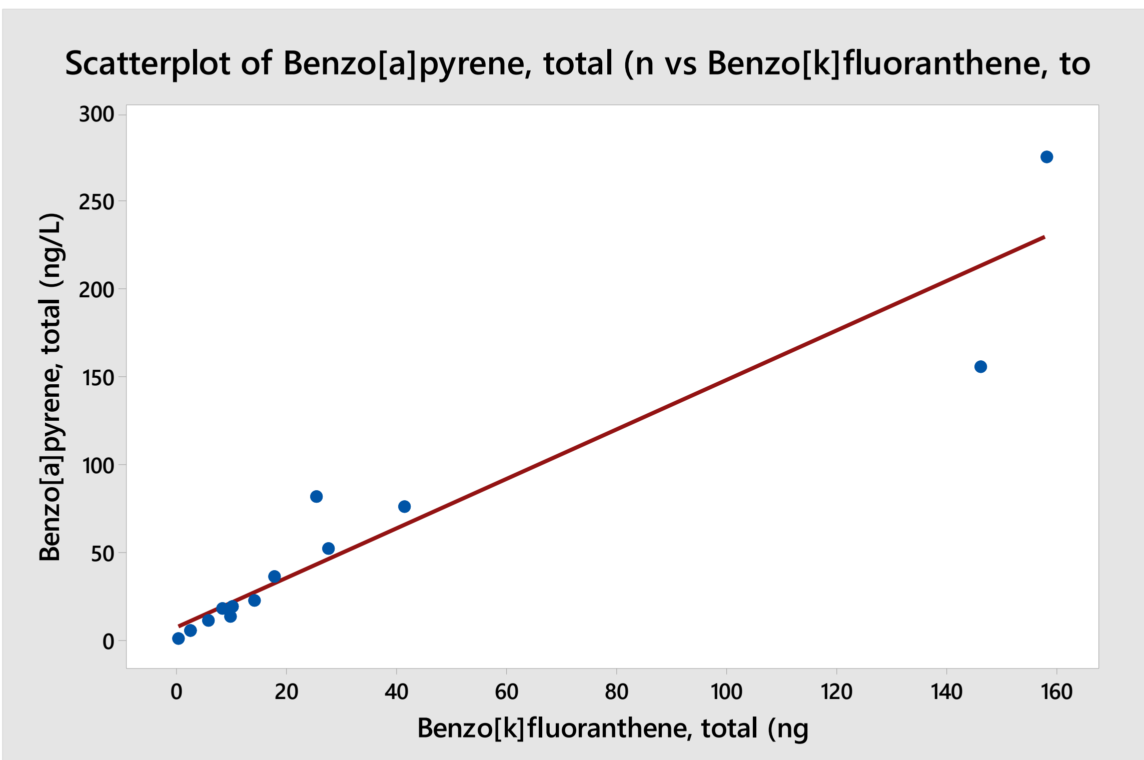


Benzo[k]fluoranthene, total, correlations



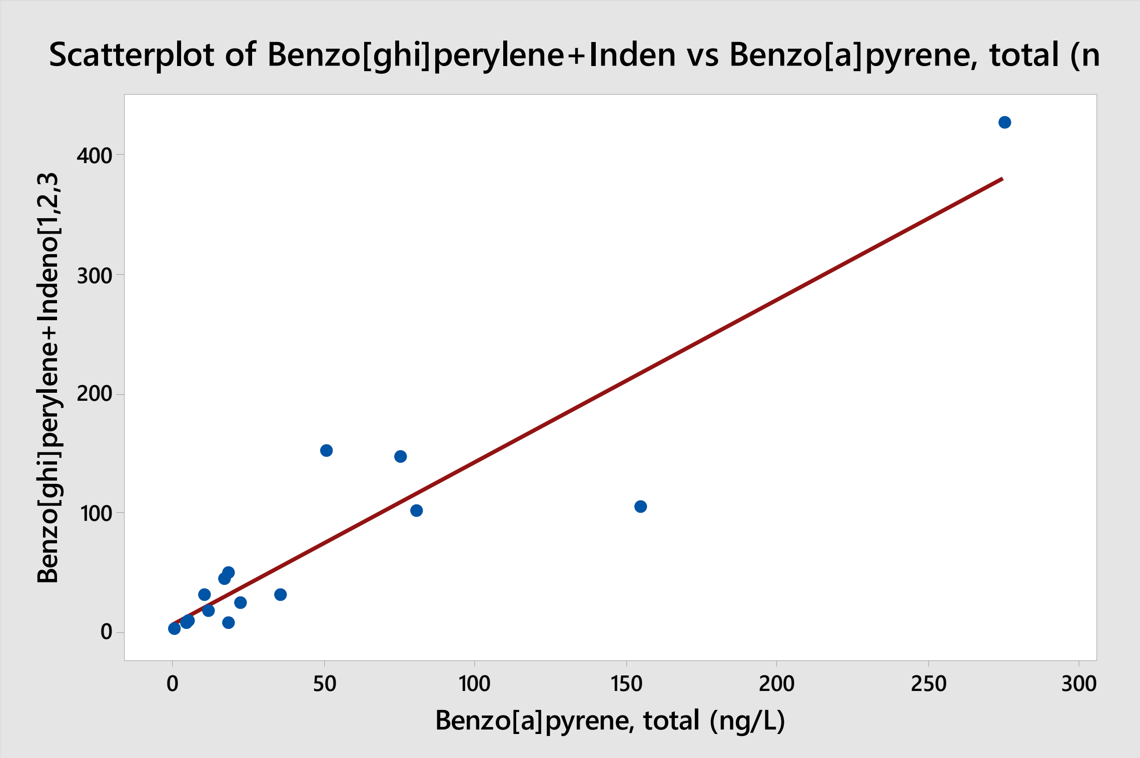


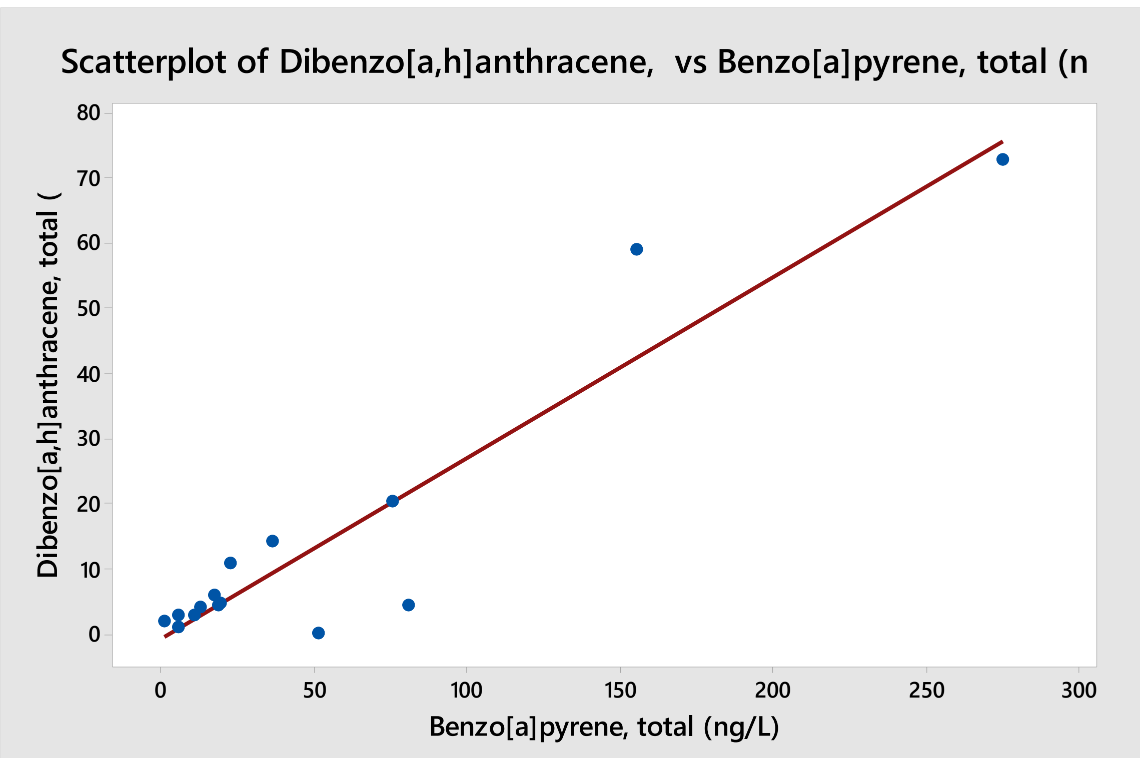
Scatterplot of Dibenzo[a,h]anthracene, vs Benzo[k]fluoranthene, to
Dibenzo[a,h]anthracene, total (
Benzo[k]fluoranthene, total (ng
0
10
20
30
40
50
60
70
80
0
20
40
60
80
100
120
140
160



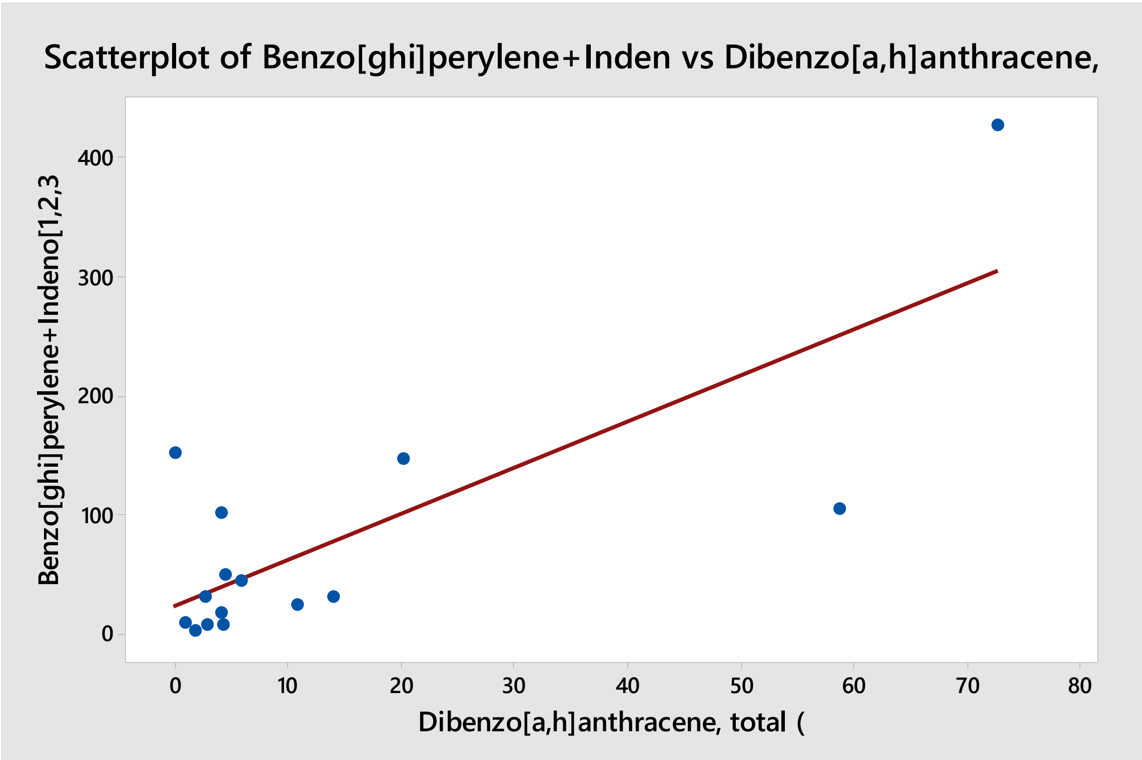
Scatterplot of Benzo[a]pyrene, total (n vs Benzo[k]fluoranthene, to
Benzo[a]pyrene, total (ng/L)
Benzo[k]fluoranthene, total (ng
0
50
100
150
200
250
300
0
20
40
60
80
100
120
140
160

Benzo[a]pyrene, total, correlations





Dibenzo[a,h]anthracene, total, correlations



Appendix H: Regressions for Scatterplots Identified with Significant Pearson Correlations

Contents

Zn vs. Pb
X vs. y

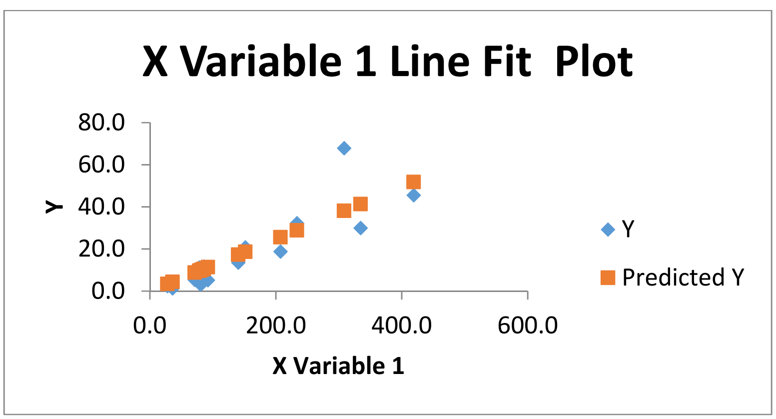
SUMMARY OUTPUT

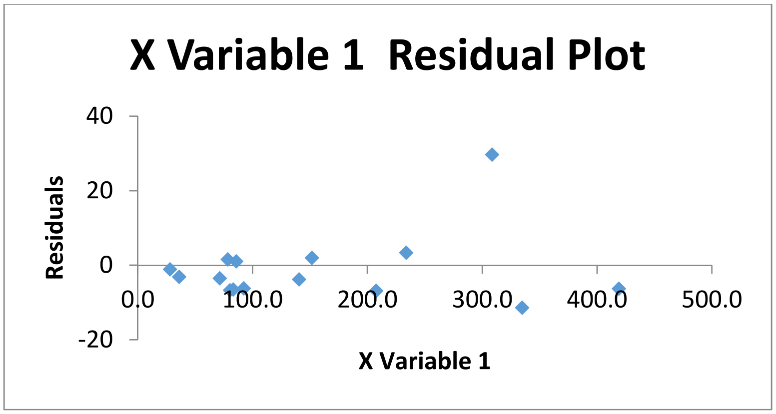
Regression Statistics	
Multiple R	0.933344
R Square	0.87113
Adjusted R Square	0.799702
Standard Error	9.563272
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8655.115	8655.115	94.63676	2.47E-07
Residual	14	1280.386	91.45616		
Total	15	9935.502			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.123672	0.012713	9.728143	1.31E-07	0.096406	0.150938





Zn vs. Cd

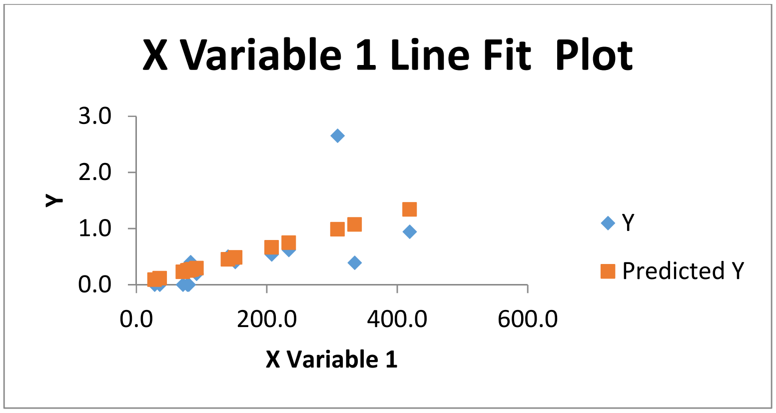
SUMMARY OUTPUT

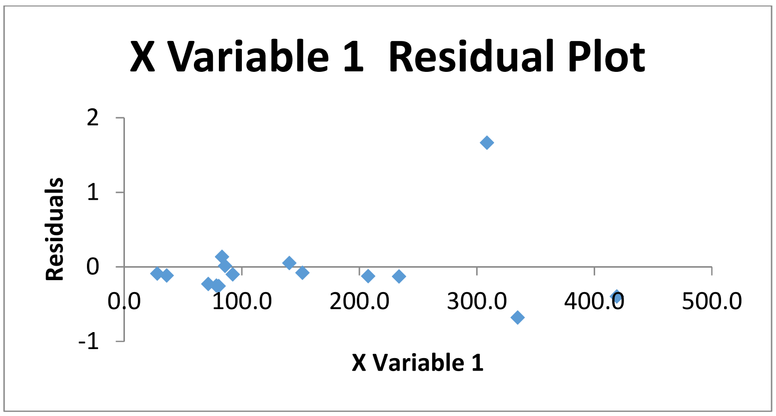
Regression Statistics	
Multiple R	0.782434
R Square	0.612202
Adjusted R Square	0.540774
Standard Error	0.511591
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5.784466	5.784466	22.1013	0.000414
Residual	14	3.664153	0.261725		
Total	15	9.448618			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.003197	0.00068	4.701201	0.00034	0.001739	0.004656





Cd vs. Benzo(b)fluoranthene

X vs, y

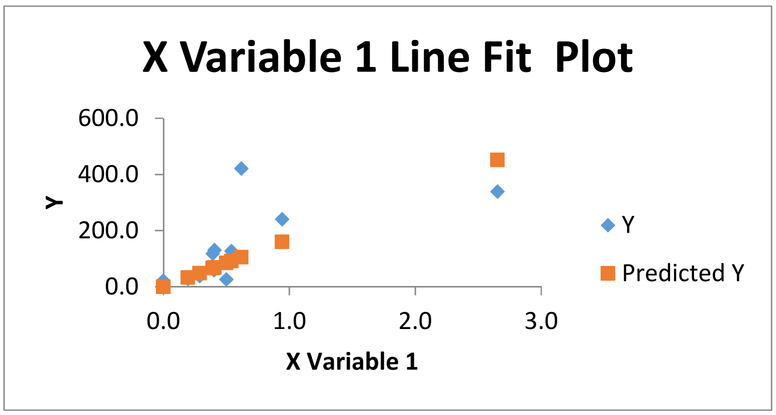
SUMMARY OUTPUT

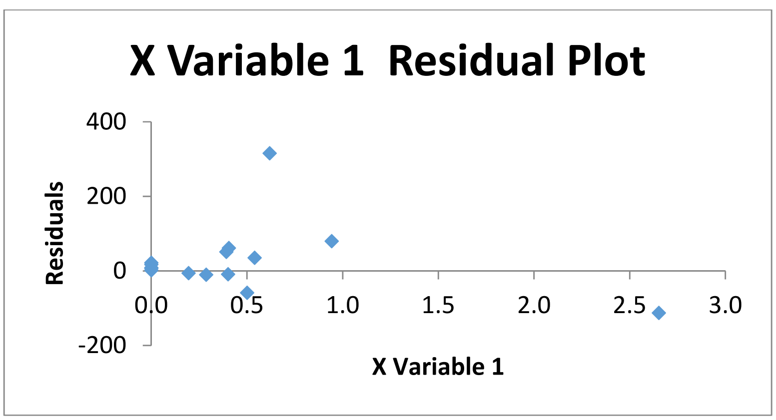
Regression Statistics	
Multiple R	0.822614
R Square	0.676695
Adjusted R Square	0.605266
Standard Error	96.75613
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	274324.5	274324.5	29.3027	0.000118
Residual	14	131064.5	9361.748		
Total	15	405389			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	170.392	31.47707	5.413197	9.14E-05	102.88	237.9032





Cd vs. anthracene

X vs, y

SUMMARY OUTPUT

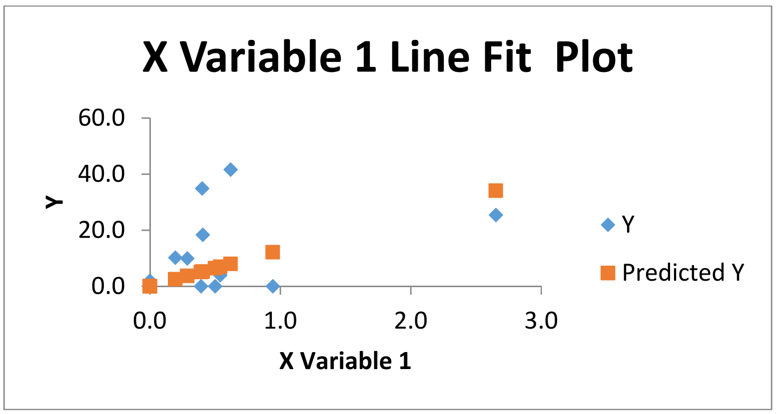
Regression Statistics

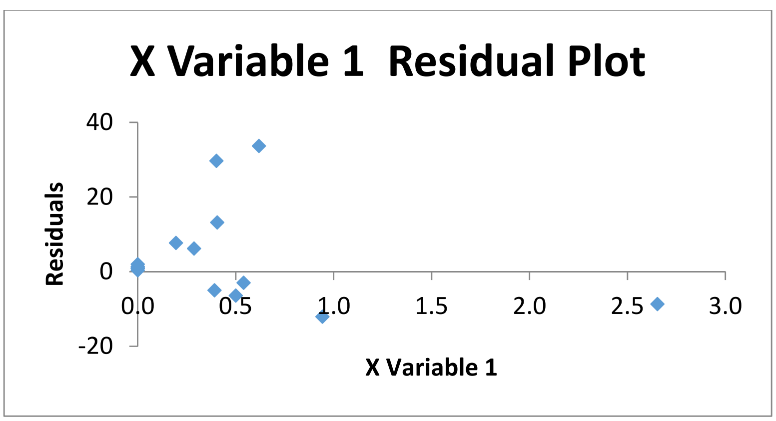
Multiple R	0.61328
R Square	0.376117
Adjusted R Square	0.304689
Standard Error	13.59729
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1560.464	1560.464	8.440121	0.012285
Residual	14	2588.41	184.8864		
Total	15	4148.874			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	12.8512	4.423524	2.9052	0.0115	3.364	22.339





Cd vs. pyrene

X vs. y

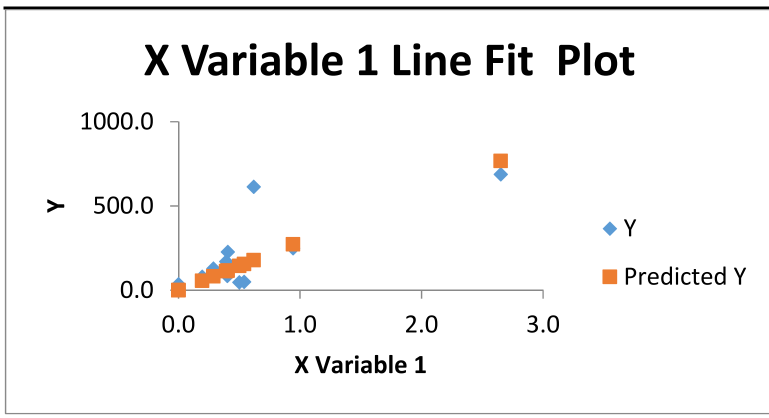
SUMMARY OUTPUT

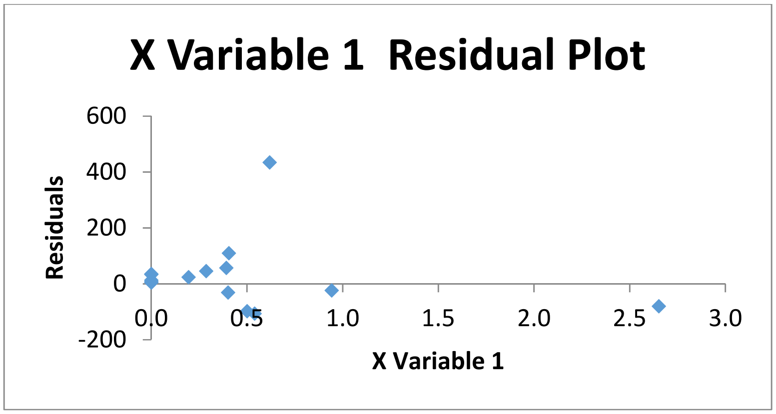
Regression Statistics	
Multiple R	0.876858
R Square	0.768881
Adjusted R Square	0.697452
Standard Error	130.4464
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	792528.6	792528.6	46.57476	1.22E-05
Residual	14	238227.7	17016.27		
Total	15	1030756			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	289.6165	42.43733	6.824571	8.26E-06	198.5975	380.6355





Pb vs. Benzo(b)fluoranthene

X vs. y

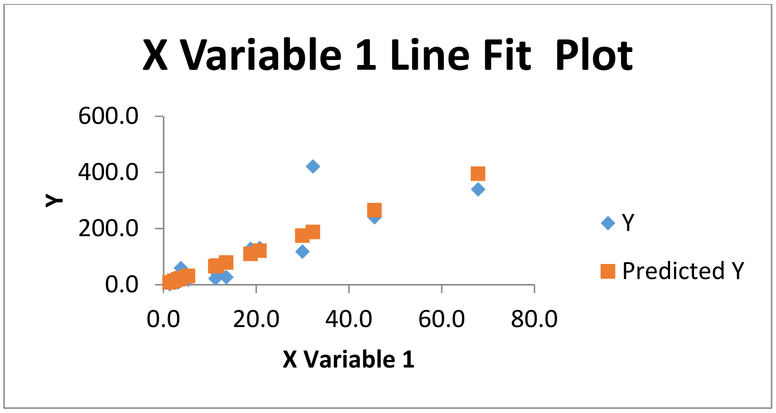
SUMMARY OUTPUT

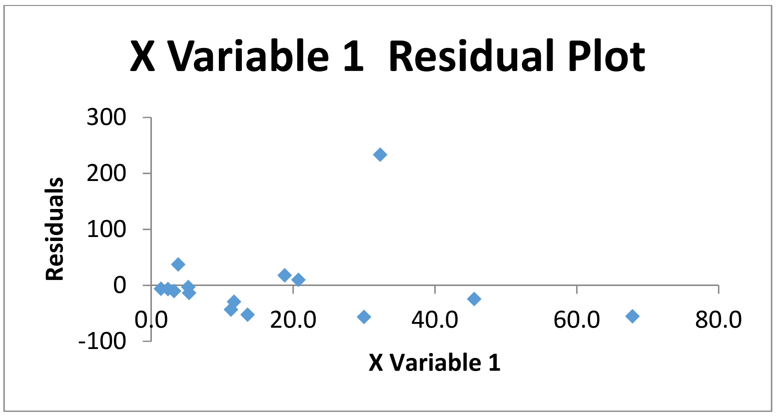
Regression Statistics	
Multiple R	0.910861
R Square	0.829668
Adjusted R Square	0.758239
Standard Error	70.22957
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	336338.3	336338.3	68.19245	1.58E-06
Residual	14	69050.69	4932.192		
Total	15	405389			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	5.818262	0.704572	8.257872	9.45E-07	4.307106	7.329418





Pb vs. anthracene

X vs. y

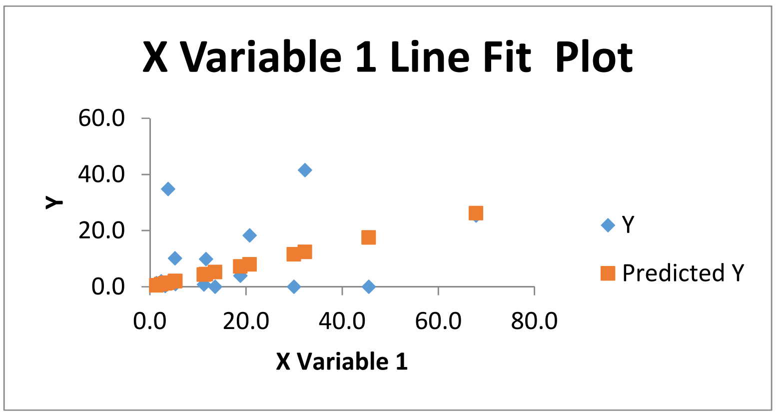
SUMMARY OUTPUT

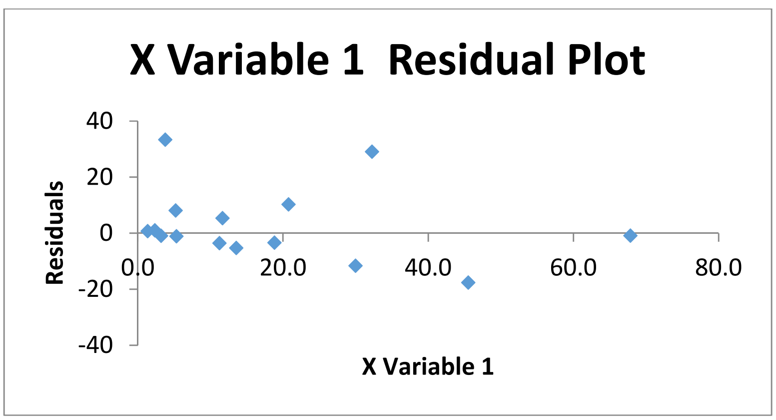
Regression Statistics	
Multiple R	0.598231
R Square	0.35788
Adjusted R Square	0.286452
Standard Error	13.7946
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1484.8	1484.8	7.802788	0.015222
Residual	14	2664.074	190.291		
Total	15	4148.874			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.38658	0.138393	2.793347	0.014367	0.089756	0.683403





Pb vs. pyrene

X vs. y

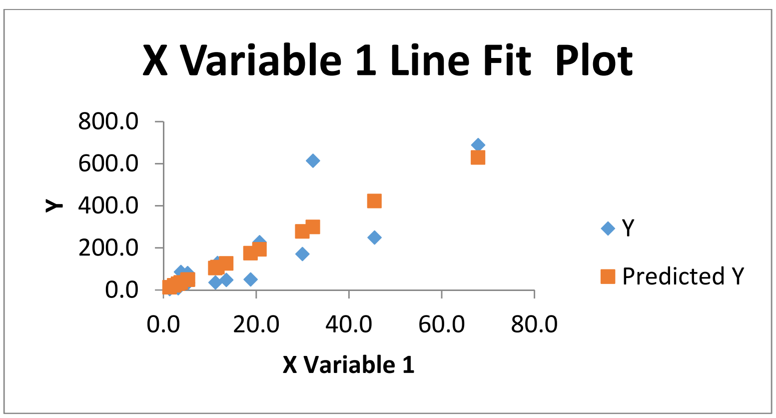
SUMMARY OUTPUT

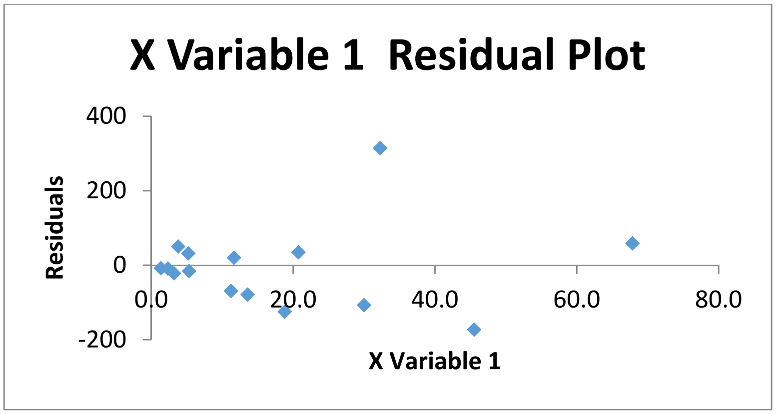
Regression Statistics	
Multiple R	0.910504
R Square	0.829017
Adjusted R Square	0.757589
Standard Error	112.1992
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	854515	854515	67.87969	1.62E-06
Residual	14	176241.4	12588.67		
Total	15	1030756			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	9.273954	1.125628	8.238913	9.71E-07	6.859722	11.68819





Anthracene vs. Dibenzo[a,h]anthracene

X vs. y

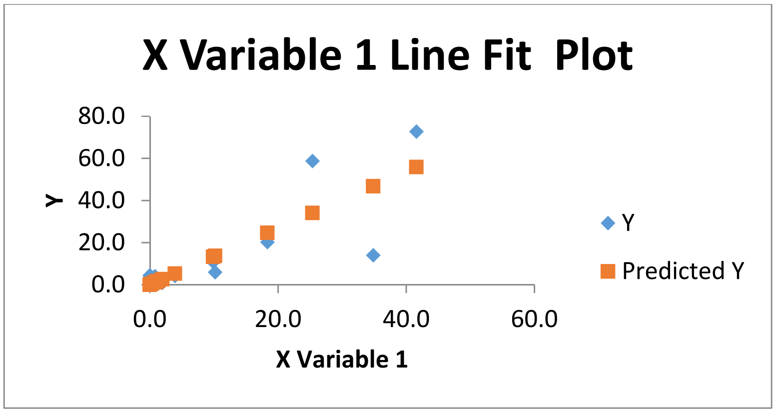
SUMMARY OUTPUT

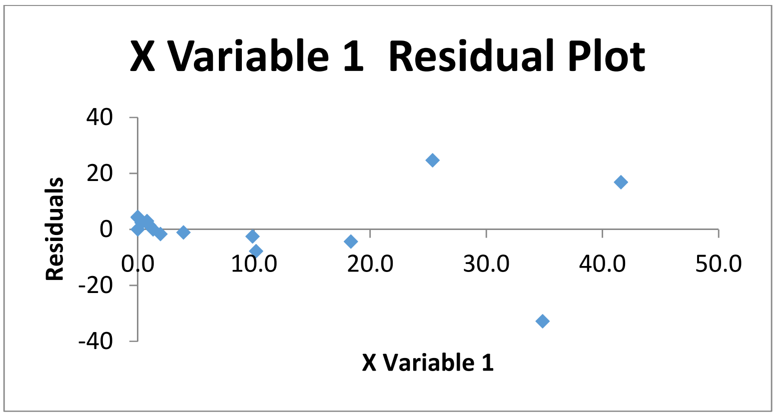
Regression Statistics	
Multiple R	0.882889
R Square	0.779494
Adjusted R Square	0.708065
Standard Error	12.28677
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7471.292	7471.292	49.49029	8.87E-06
Residual	14	2113.507	150.9648		
Total	15	9584.799			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	1.341939	0.190754	7.034934	5.91E-06	0.932813	1.751065





Anthracene vs. Benzo[a]pyrene

X vs. y

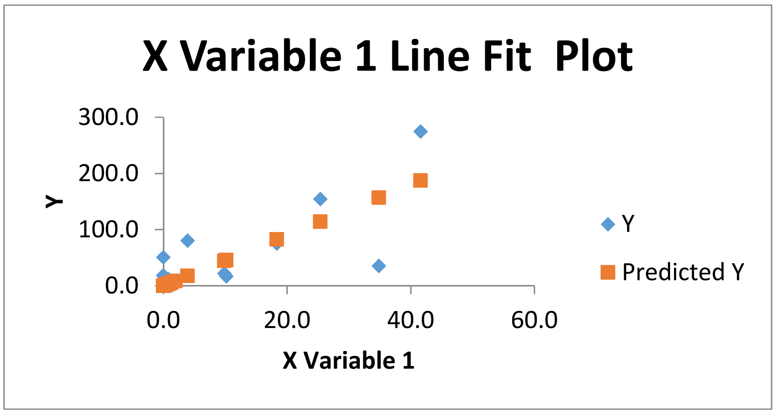
SUMMARY OUTPUT

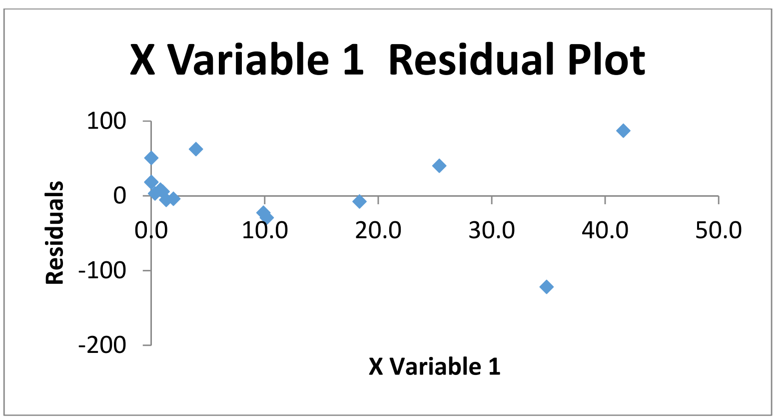
Regression Statistics	
Multiple R	0.84858
R Square	0.720088
Adjusted R Square	0.648659
Standard Error	48.40374
Observations	15

ANOVA

	df	SS	MS	F	Significance F
Regression	1	84381.99	84381.99	36.0157	4.44E-05
Residual	14	32800.91	2342.922		
Total	15	117182.9			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
X Variable 1	4.509826	0.751474	6.001309	3.25E-05	2.898075	6.121577





fluoranthene vs. Dibenzo[a,h]anthracene

X vs. y

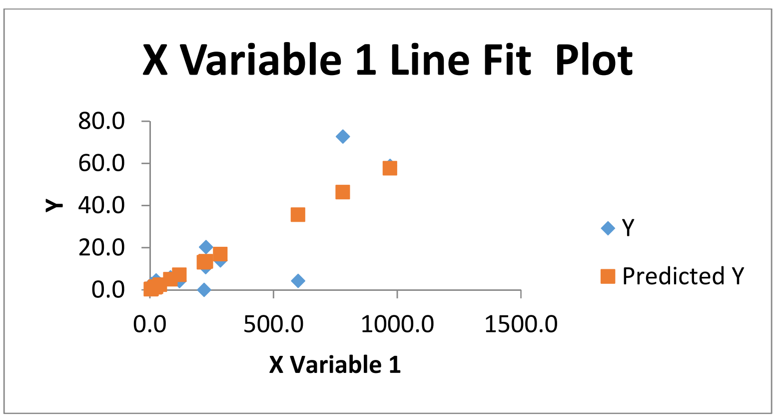
SUMMARY OUTPUT

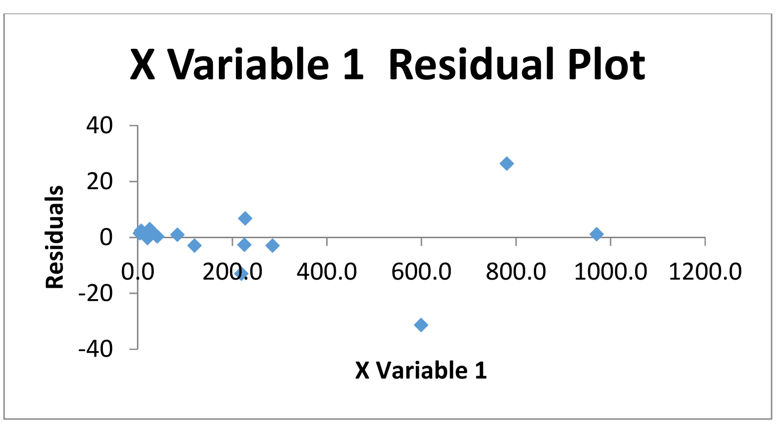
Regression Statistics	
Multiple R	0.89286
R Square	0.7972
Adjusted R Square	0.725771
Standard Error	11.78316
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	7641	7641	55.03347	5.06E-06
Residual	14	1943.799	138.8428		
Total	15	9584.799			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.059385	0.008005	7.418455	3.26E-06	0.042216	0.076553





fluoranthene vs. Benzo[k]fluoranthene

X vs. y

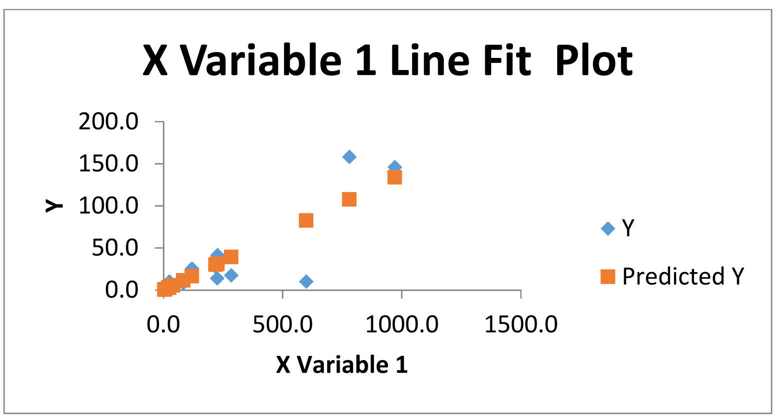
SUMMARY OUTPUT

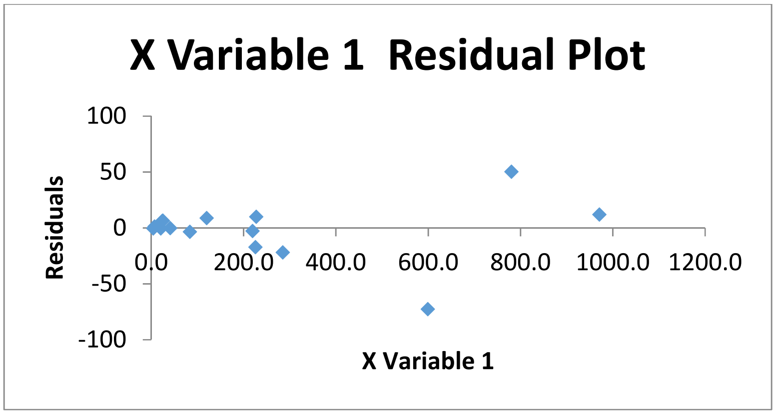
Regression Statistics	
Multiple R	0.906265
R Square	0.821317
Adjusted R Square	0.749888
Standard Error	25.34156
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	41325.91	41325.91	64.35105	2.17E-06
Residual	14	8990.728	642.1948		
Total	15	50316.64			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.138105	0.017216	8.021911	1.33E-06	0.10118	0.17503





fluoranthene vs. Benzo[b]fluoranthene

X vs. y

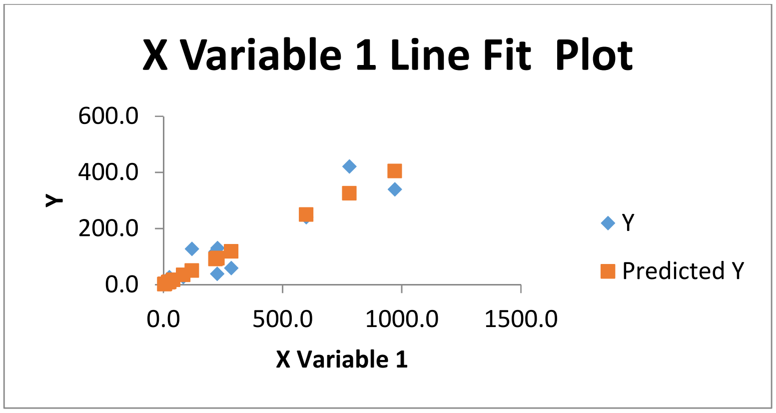
SUMMARY OUTPUT

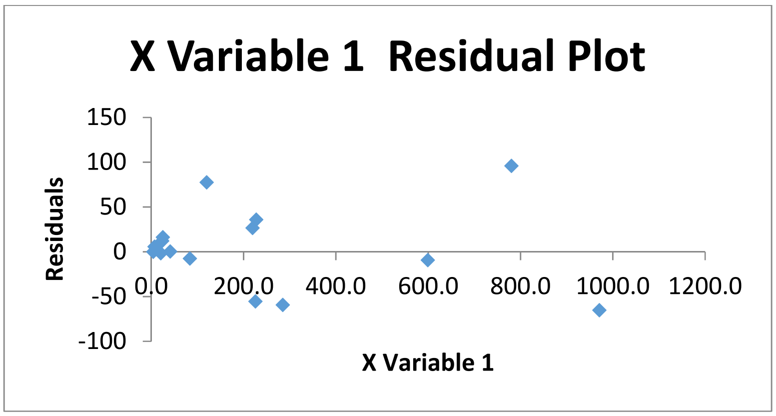
Regression Statistics	
Multiple R	0.964039
R Square	0.929372
Adjusted R Square	0.857943
Standard Error	45.22322
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	376757	376757	184.2207	4.71E-09
Residual	14	28631.95	2045.139		
Total	15	405389			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.416993	0.030723	13.57279	1.9E-09	0.351099	0.482887





fluoranthene vs. Benzo[a]anthracene

X vs. y

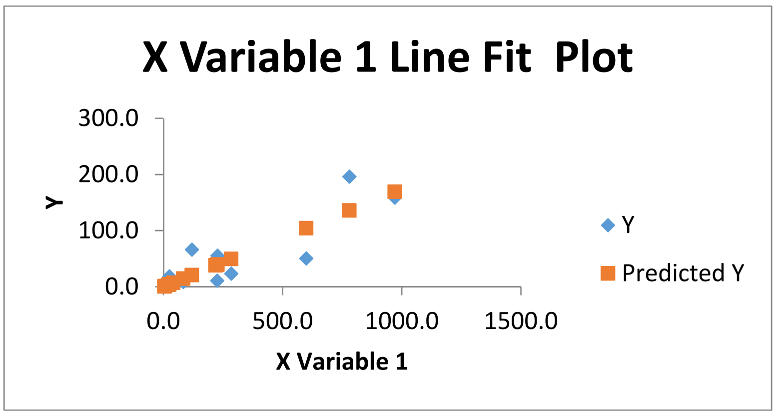
SUMMARY OUTPUT

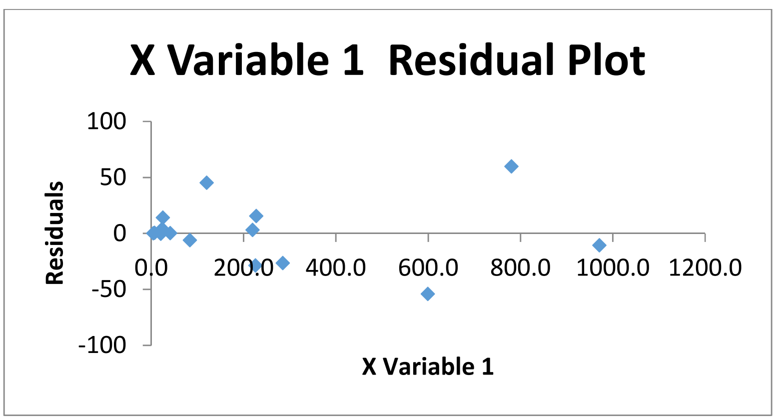
Regression Statistics	
Multiple R	0.927637
R Square	0.86051
Adjusted R Square	0.789081
Standard Error	27.63895
Observations	15

ANOVA

	df	SS	MS	F	Significance F
Regression	1	65975.74	65975.74	86.36565	4.18E-07
Residual	14	10694.77	763.9118		
Total	15	76670.51			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
X Variable 1	0.174498	0.018777	9.293312	2.3E-07	0.134226	0.21477





fluoranthene vs. pyrene

X vs. y

SUMMARY OUTPUT

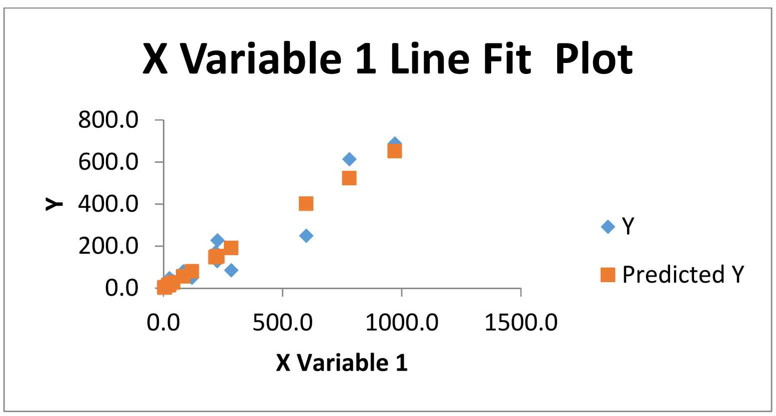
Regression Statistics

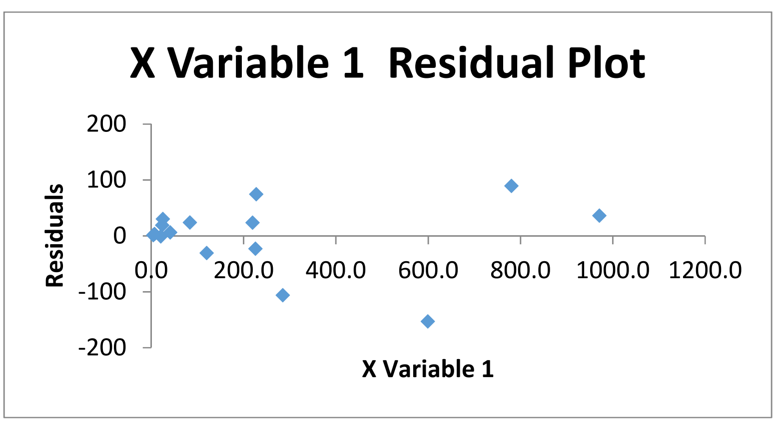
Multiple R	0.973697
R Square	0.948087
Adjusted R Square	0.876658
Standard Error	61.82354
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	977246.3	977246.3	255.6798	6.26E-10
Residual	14	53510.09	3822.15		
Total	15	1030756			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.671584	0.042	15.98999	2.18E-10	0.581502	0.761666





pyrene vs. benzo[a]pyrene

X vs. y

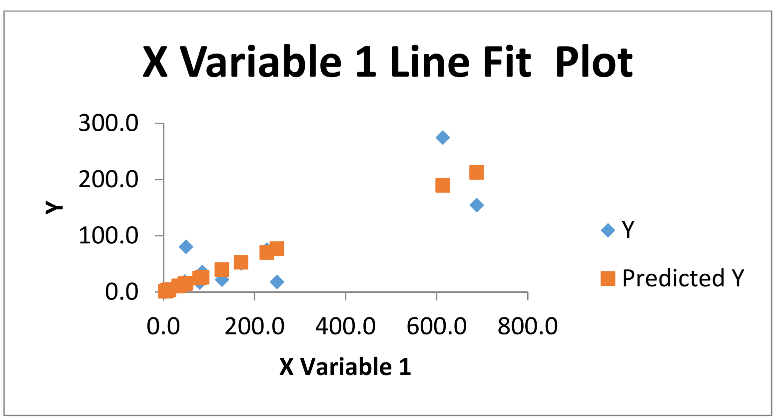
SUMMARY OUTPUT

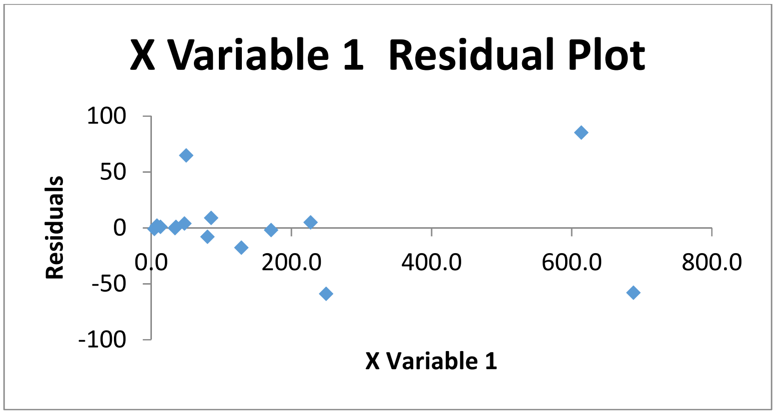
Regression Statistics	
Multiple R	0.916206
R Square	0.839433
Adjusted R Square	0.768004
Standard Error	36.66032
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	98367.2	98367.2	73.19103	1.06E-06
Residual	14	18815.7	1343.979		
Total	15	117182.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.308921	0.036109	8.555176	6.22E-07	0.231474	0.386367





pyrene vs. benzo[k]fluoranthene

X vs. y

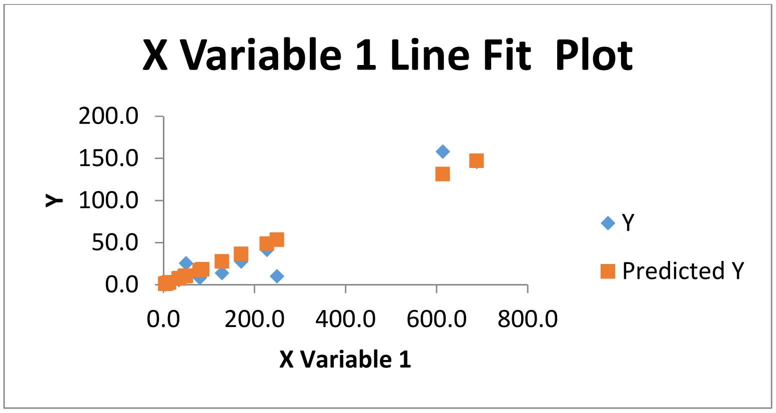
SUMMARY OUTPUT

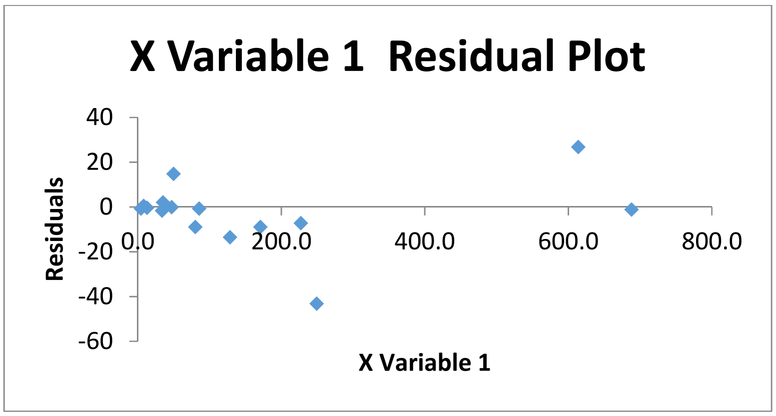
Regression Statistics	
Multiple R	0.967631
R Square	0.936309
Adjusted R Square	0.86488
Standard Error	15.12974
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	47111.91	47111.91	205.8106	2.39E-09
Residual	14	3204.727	228.9091		
Total	15	50316.64			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.21379	0.014902	14.3461	9.17E-10	0.181828	0.245752





pyrene vs. benzo[b]fluoranthene

X vs. y

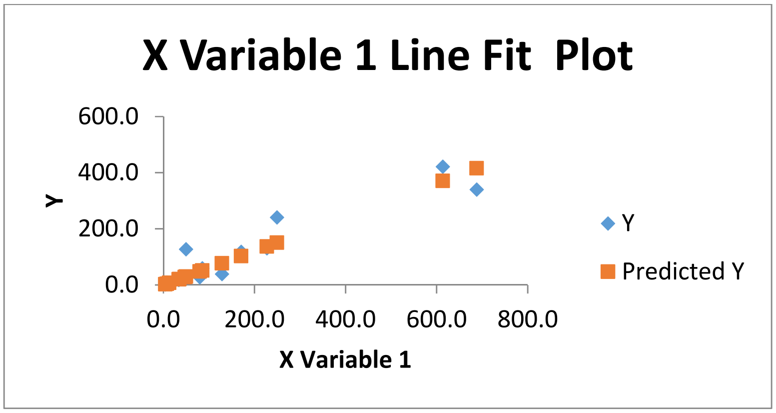
SUMMARY OUTPUT

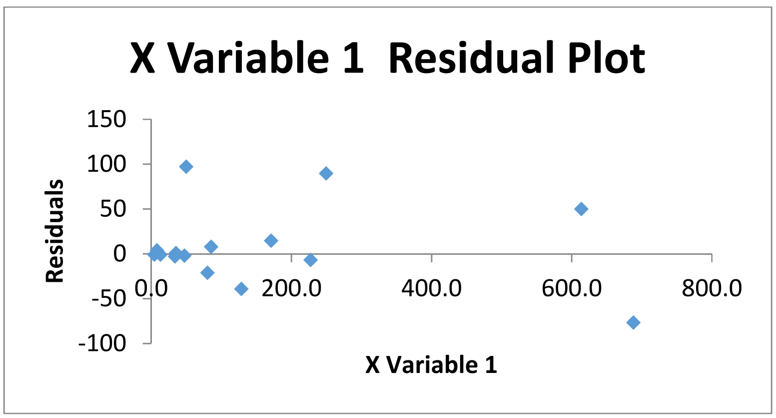
Regression Statistics	
Multiple R	0.964563
R Square	0.930381
Adjusted R Square	0.858952
Standard Error	44.89896
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	377166.2	377166.2	187.0941	4.28E-09
Residual	14	28222.83	2015.917		
Total	15	405389			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
X Variable 1	0.604907	0.044224	13.67824	1.71E-09	0.510056	0.699758





pyrene vs. benzo[a]anthracene

X vs. y

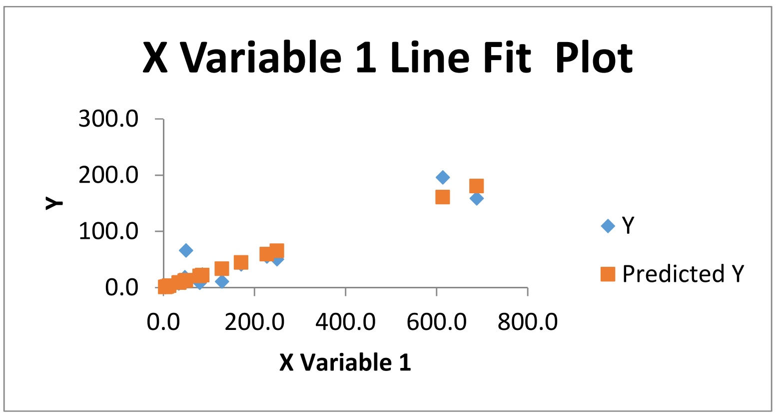
SUMMARY OUTPUT

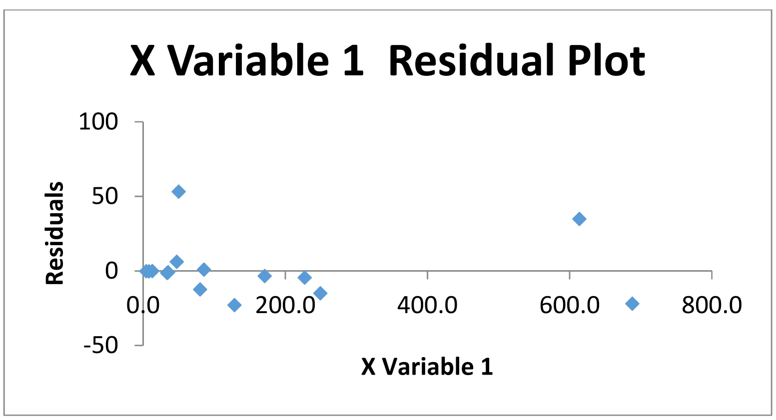
Regression Statistics	
Multiple R	0.963453
R Square	0.928242
Adjusted R Square	0.856813
Standard Error	19.82379
Observations	15

ANOVA

	df	SS	MS	F	Significance F
Regression	1	71168.75	71168.75	181.0989	5.23E-09
Residual	14	5501.759	392.9828		
Total	15	76670.51			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
X Variable 1	0.262764	0.019526	13.4573	2.12E-09	0.220886	0.304643





pyrene vs. chrysene

X vs. y

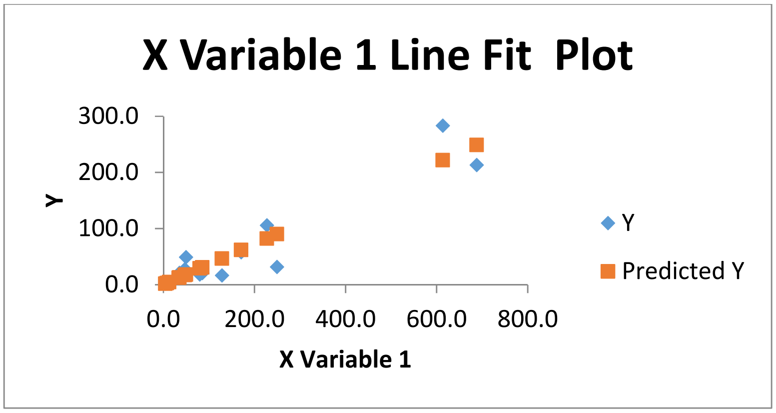
SUMMARY OUTPUT

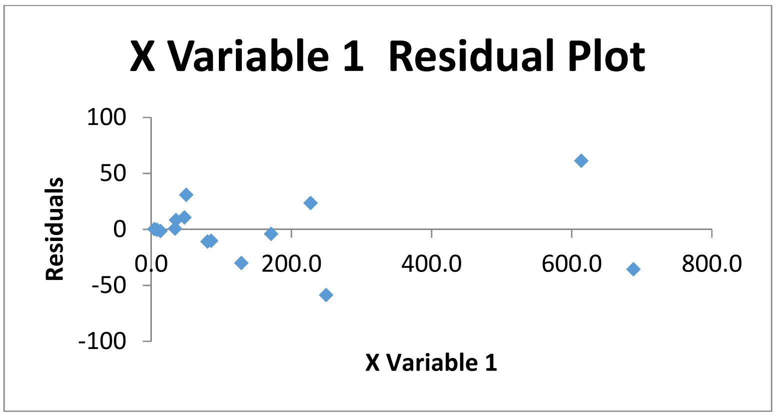
Regression Statistics	
Multiple R	0.960563
R Square	0.922681
Adjusted R Square	0.851253
Standard Error	28.39236
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	134678.5	134678.5	167.0688	8.53E-09
Residual	14	11285.77	806.1263		
Total	15	145964.3			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.361469	0.027966	12.92551	3.58E-09	0.301489	0.421449





chyrsene vs. benzo[ghi]perlene + Indeno.....

X vs. y

SUMMARY OUTPUT

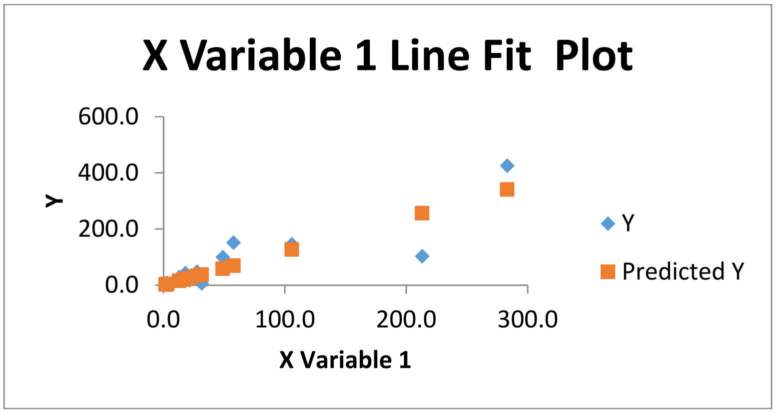
Regression Statistics	
Multiple R	0.914331
R Square	0.836002
Adjusted R Square	0.764573
Standard Error	54.46537
Observations	15

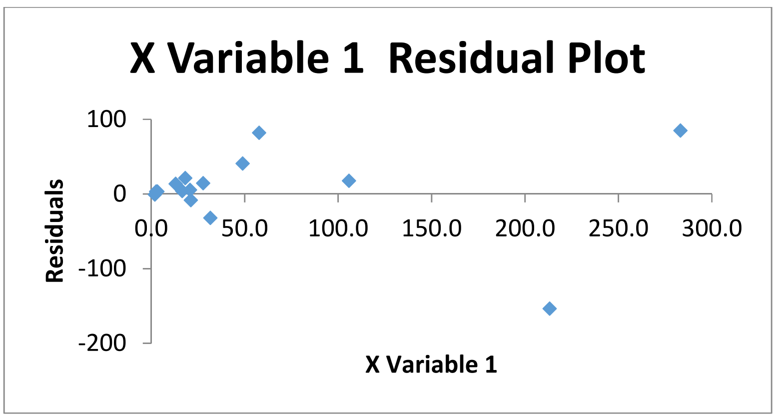
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	211707.9	211707.9	71.36677	1.23E-06

Residual	14	41530.67	2966.477
Total	15	253238.5	

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	1.204329	0.14256	8.447886	7.22E-07	0.898569	1.510089





chrysene vs. benzo[a]pyrene

X vs. y

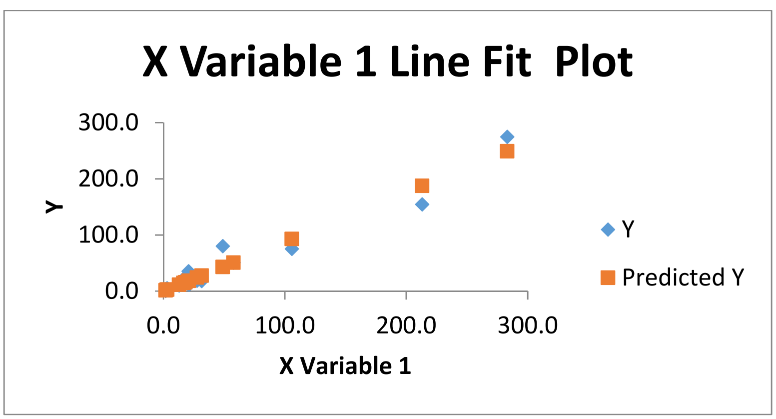
SUMMARY OUTPUT

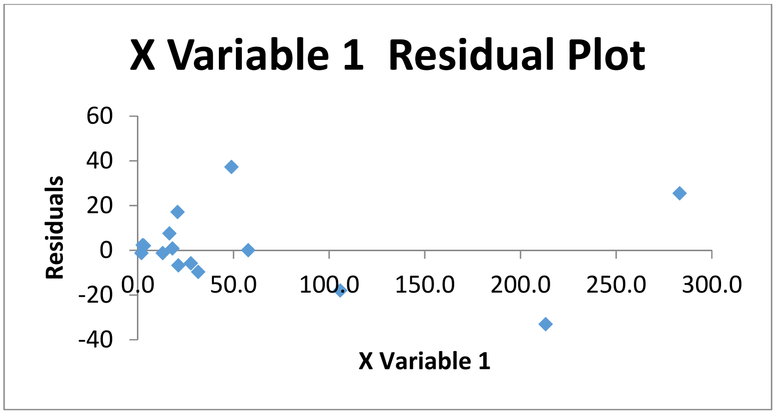
Regression Statistics	
Multiple R	0.982835
R Square	0.965964
Adjusted R Square	0.894535
Standard Error	16.87868
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	113194.4	113194.4	397.3272	3.96E-11
Residual	14	3988.457	284.8898		
Total	15	117182.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.880621	0.044179	19.93307	1.13E-11	0.785867	0.975376





chrysene vs. benzo[k]fluoranthene

X vs. y

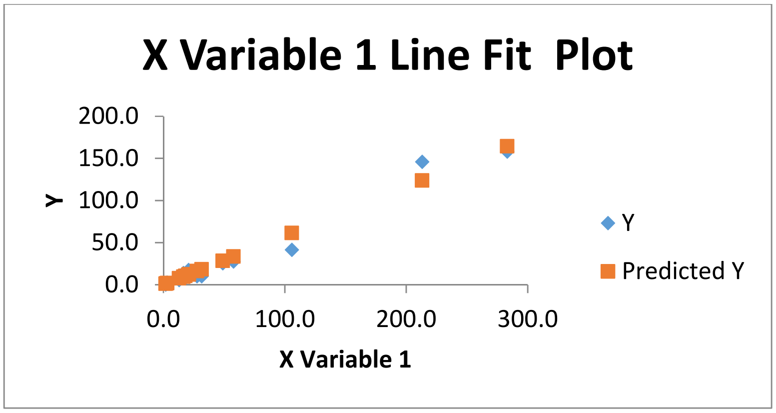
SUMMARY OUTPUT

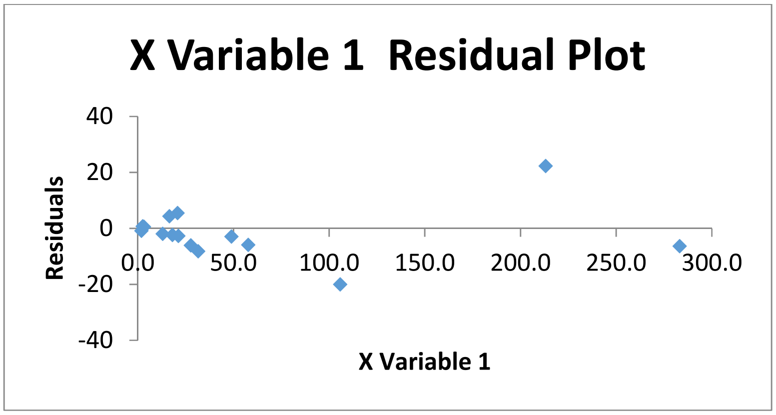
Regression Statistics	
Multiple R	0.98849
R Square	0.977112
Adjusted R Square	0.905683
Standard Error	9.069837
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	49164.97	49164.97	597.6637	2.98E-12
Residual	14	1151.667	82.26194		
Total	15	50316.64			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.58037	0.02374	24.44716	6.96E-13	0.529453	0.631286





chrysene vs. benzo[b]fluoranthene

X vs. y

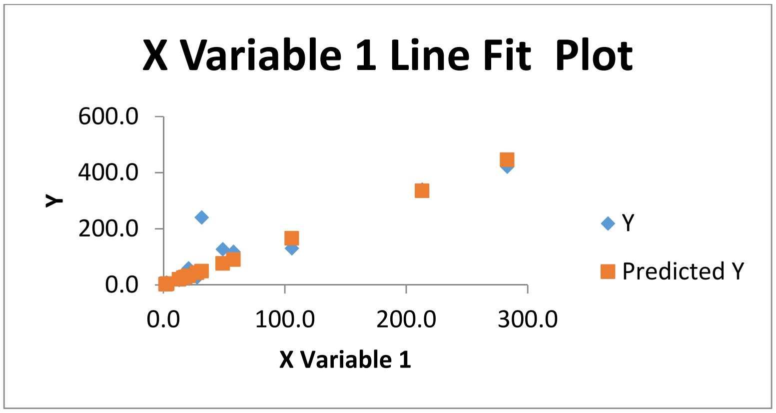
SUMMARY OUTPUT

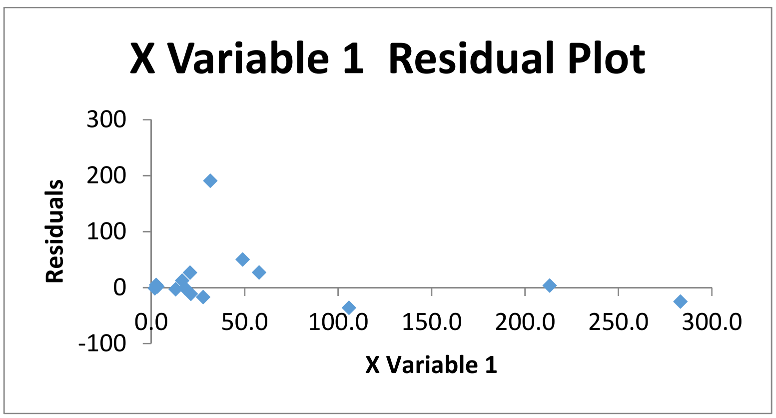
Regression Statistics	
Multiple R	0.945574
R Square	0.89411
Adjusted R Square	0.822682
Standard Error	55.37315
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	362462.4	362462.4	118.2128	6.76E-08
Residual	14	42926.61	3066.186		
Total	15	405389			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	1.575826	0.144936	10.87257	3.28E-08	1.264969	1.886682





chrysene vs. benzo[a]anthracene

X vs. y

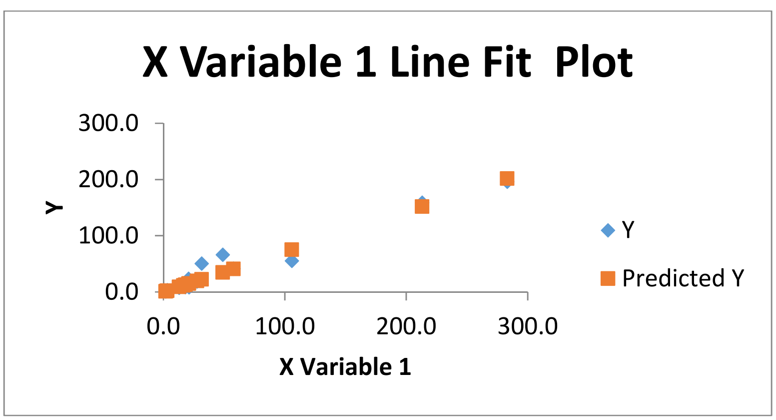
SUMMARY OUTPUT

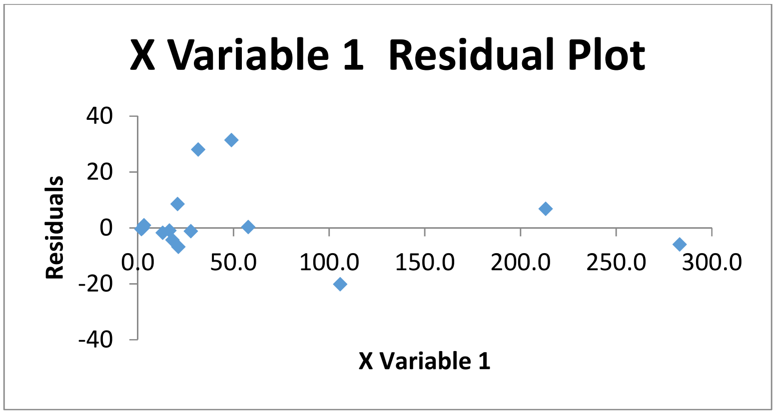
Regression Statistics	
Multiple R	0.984192
R Square	0.968635
Adjusted R Square	0.897206
Standard Error	13.10614
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	74265.71	74265.71	432.3534	2.32E-11
Residual	14	2404.792	171.7709		
Total	15	76670.51			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.713298	0.034305	20.79311	6.34E-12	0.639722	0.786874





benzo[a]anthracene vs. benzo[a]pyrene

X vs. y

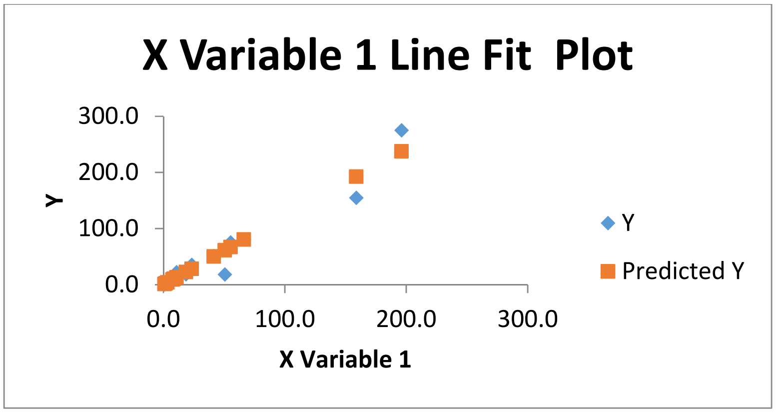
SUMMARY OUTPUT

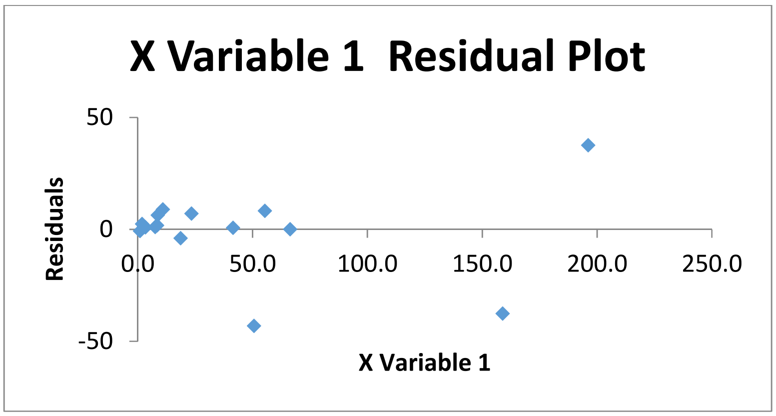
Regression Statistics	
Multiple R	0.978675
R Square	0.957806
Adjusted R Square	0.886377
Standard Error	18.79295
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	112238.4	112238.4	317.7984	1.61E-10
Residual	14	4944.45	353.175		
Total	15	117182.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	1.20992	0.06787	17.8269	5.08E-11	1.064352	1.355488





benzo[a]anthracene vs. benzo[b]fluoranthene

X vs. y

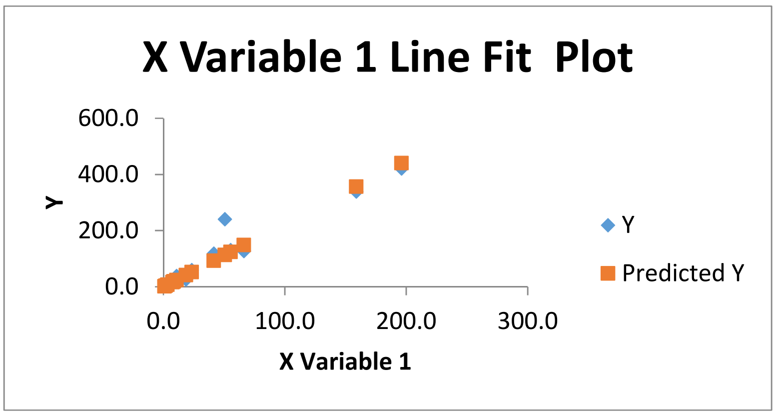
SUMMARY OUTPUT

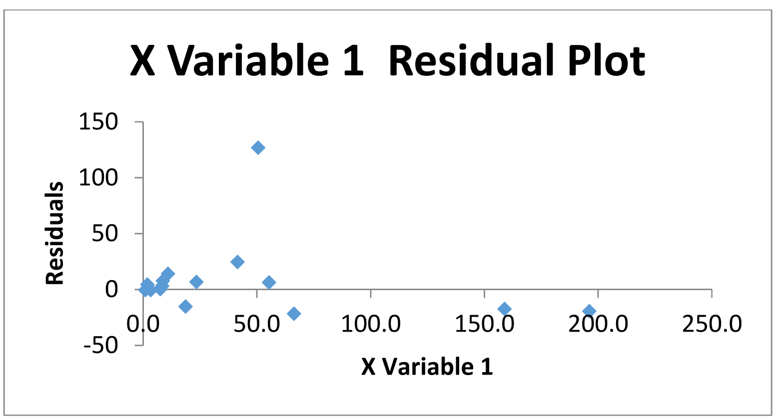
Regression Statistics	
Multiple R	0.976947
R Square	0.954425
Adjusted R Square	0.882996
Standard Error	36.32748
Observations	15

ANOVA

	df	SS	MS	F	Significance F
Regression	1	386913.4	386913.4	293.1861	2.67E-10
Residual	14	18475.6	1319.685		
Total	15	405389			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
X Variable 1	2.246429	0.131196	17.12268	8.73E-11	1.965041	2.527817





benzo[a]anthracene vs. benzo[k]fluoranthene

X vs. y

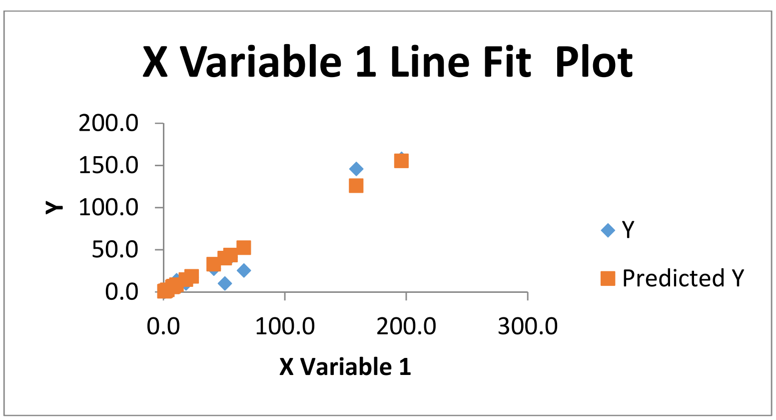
SUMMARY OUTPUT

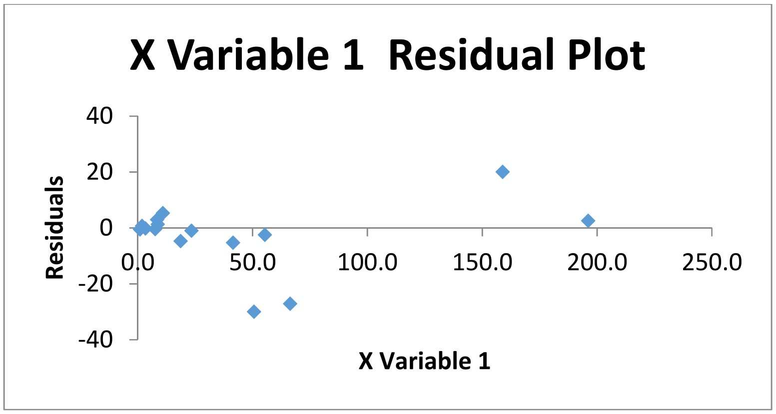
Regression Statistics	
Multiple R	0.978527
R Square	0.957515
Adjusted R Square	0.886086
Standard Error	12.35692
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	48178.93	48178.93	315.527	1.69E-10
Residual	14	2137.709	152.6935		
Total	15	50316.64			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.79271	0.044627	17.76308	5.33E-11	0.696995	0.888425





benzo[b]fluoranthene vs. benzo[a]pyrene

X vs. y

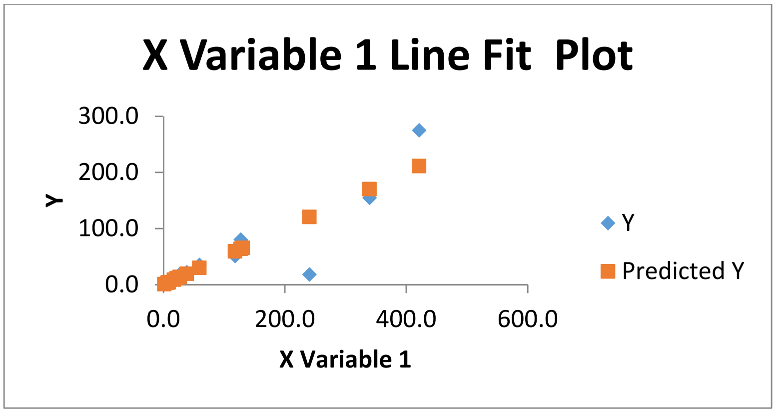
SUMMARY OUTPUT

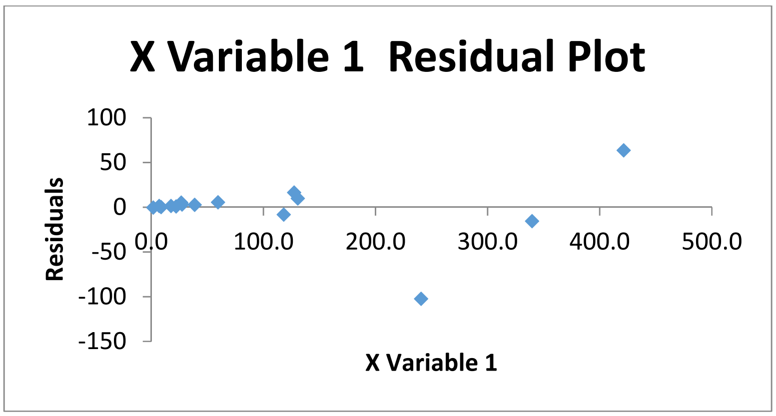
Regression Statistics	
Multiple R	0.93241
R Square	0.869389
Adjusted R Square	0.79796
Standard Error	33.06424
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	101877.5	101877.5	93.18823	2.7E-07
Residual	14	15305.42	1093.244		
Total	15	117182.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.501306	0.051931	9.653405	1.44E-07	0.389926	0.612686





benzo[b]fluoranthene vs. benzo[k]fluoranthene

X vs. y

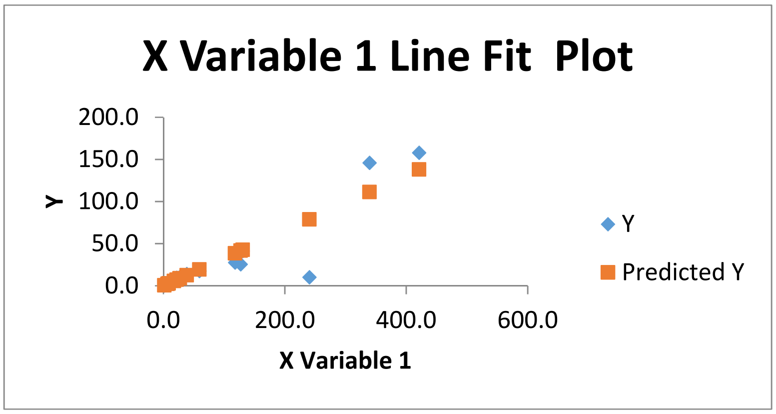
SUMMARY OUTPUT

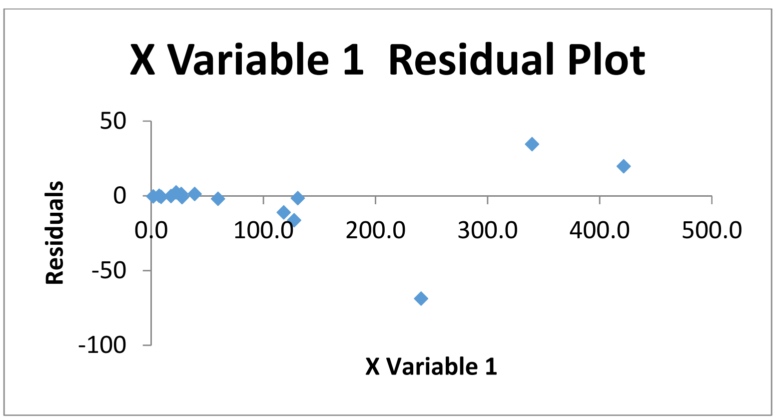
Regression Statistics	
Multiple R	0.930789
R Square	0.866368
Adjusted R Square	0.79494
Standard Error	21.91526
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	43592.74	43592.74	90.76551	3.15E-07
Residual	14	6723.901	480.2787		
Total	15	50316.64			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.327922	0.03442	9.527093	1.7E-07	0.254099	0.401746





benzo[k]fluoranthene vs. dibenzo[a,h]anthracene

X vs. y

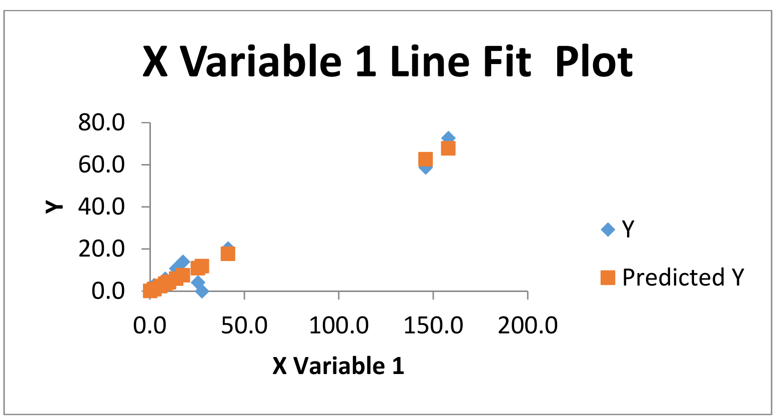
SUMMARY OUTPUT

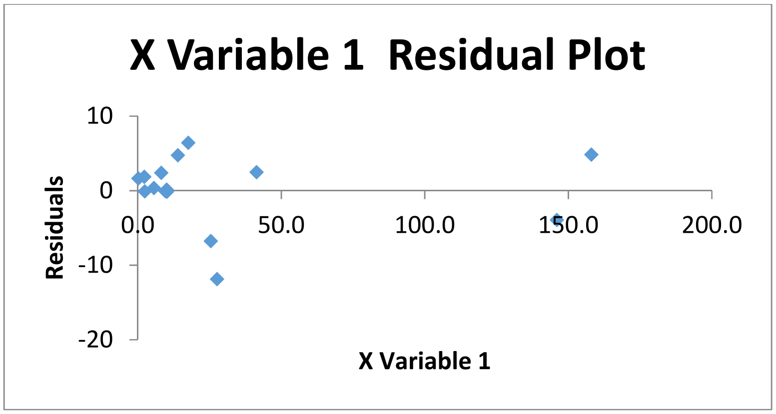
Regression Statistics	
Multiple R	0.98382
R Square	0.967903
Adjusted R Square	0.896474
Standard Error	4.687726
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9277.152	9277.152	422.1729	2.7E-11
Residual	14	307.6468	21.97477		
Total	15	9584.799			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	0.42939	0.020898	20.54685	7.46E-12	0.384568	0.474212





benzo[k]fluoranthene vs. benzo[a]pyrene

X vs. y

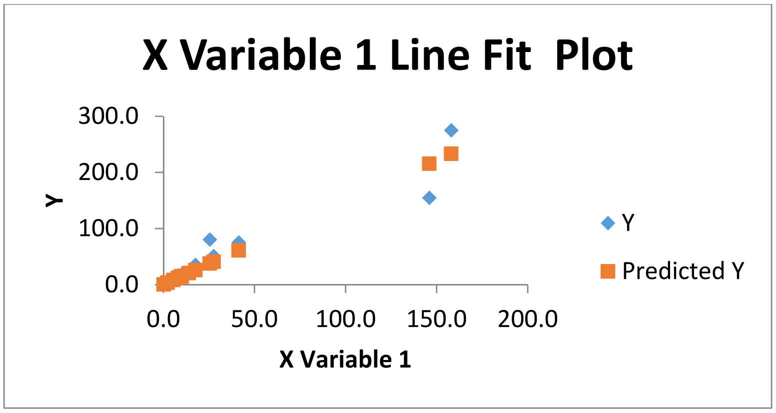
SUMMARY OUTPUT

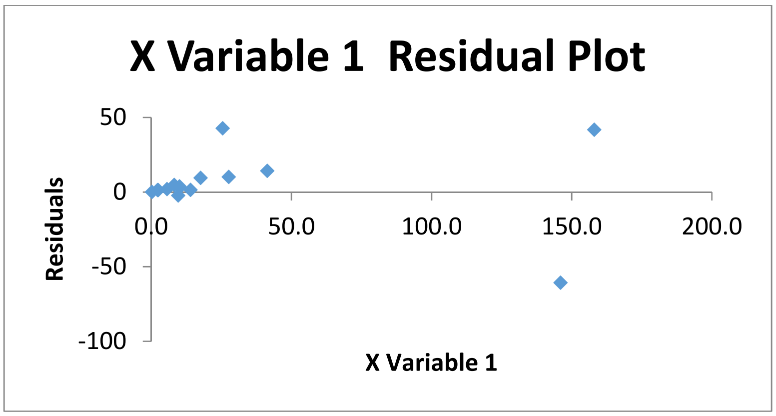
Regression Statistics	
Multiple R	0.966516
R Square	0.934152
Adjusted R Square	0.862724
Standard Error	23.47677
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	109466.7	109466.7	198.6119	2.97E-09
Residual	14	7716.221	551.1586		
Total	15	117182.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
X Variable 1	1.474977	0.10466	14.09297	1.16E-09	1.250502	1.699451


X Variable 1 Line Fit Plot
300.0
200.0
100.0
0.0
Y
0.0
50.0
100.0
150.0
200.0
X Variable 1
Y
Predicted Y


X Variable 1 Residual Plot
50
0
-50
-100
Residuals
0.0
50.0
100.0
150.0
200.0
X Variable 1

Appendix I: Metal Concentrations and Mass Yields by Land Use and Particle Size

Contents

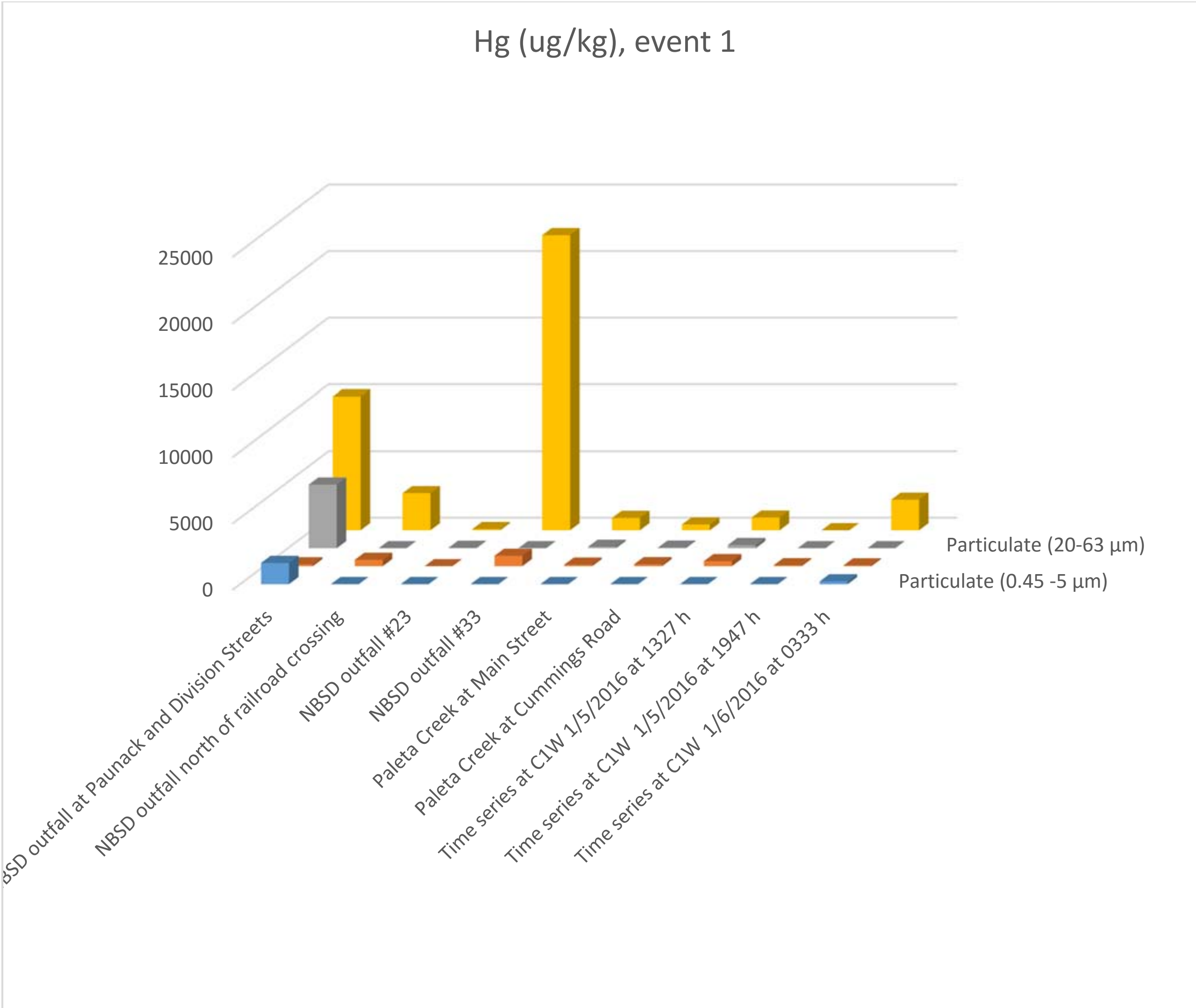
Mercury

Hg (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	1,606	na*	na	nd	nd	nd	na	na	213
Particulate (5-20 µm)	138	483	nd**	781	115	147	381	76.3	67.1
Particulate (20-63 µm)	4,804	na	31.0	nd	113	47.3	240	nd	na
Particulate (> 63 µm)	10,048	2,800	91.7	22,143	933	433	962	na	2,310

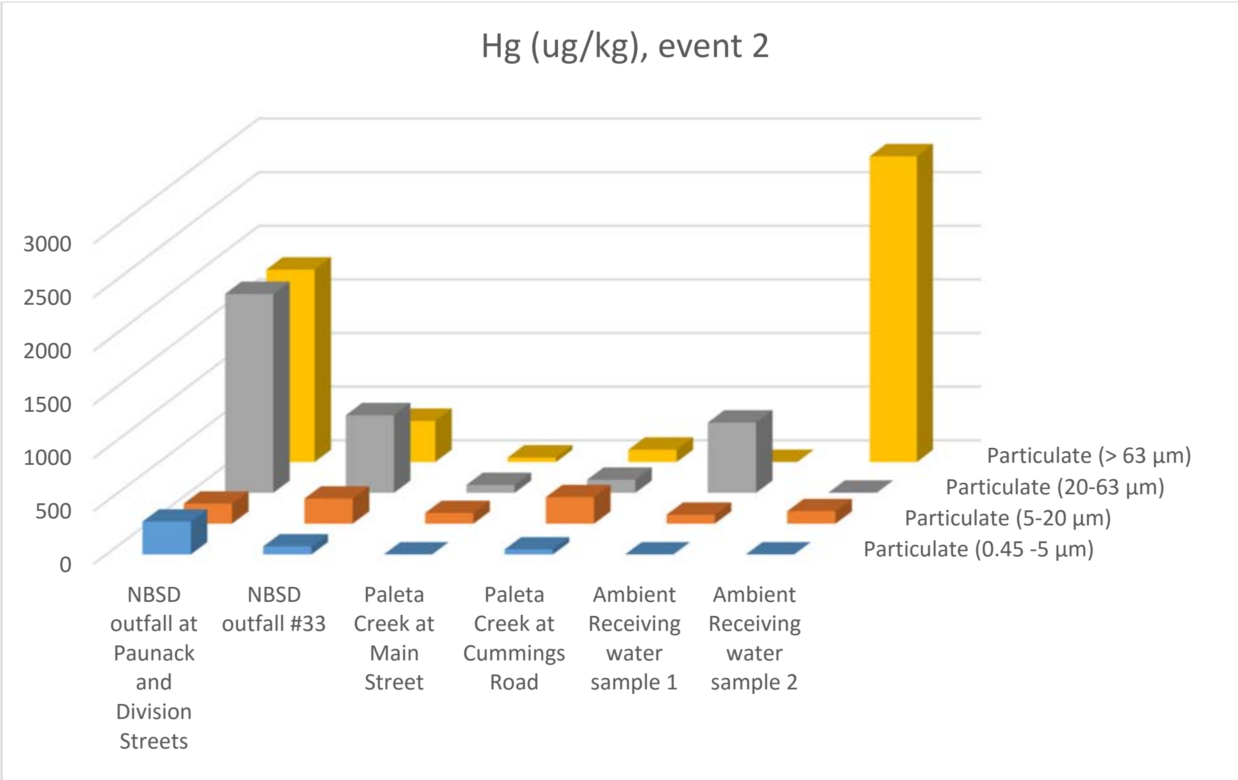
* SSC was not detected; particulate strength could not be calculated and assumed to be zero

** not detected; particulate strength could not be calculated and assumed to be zero

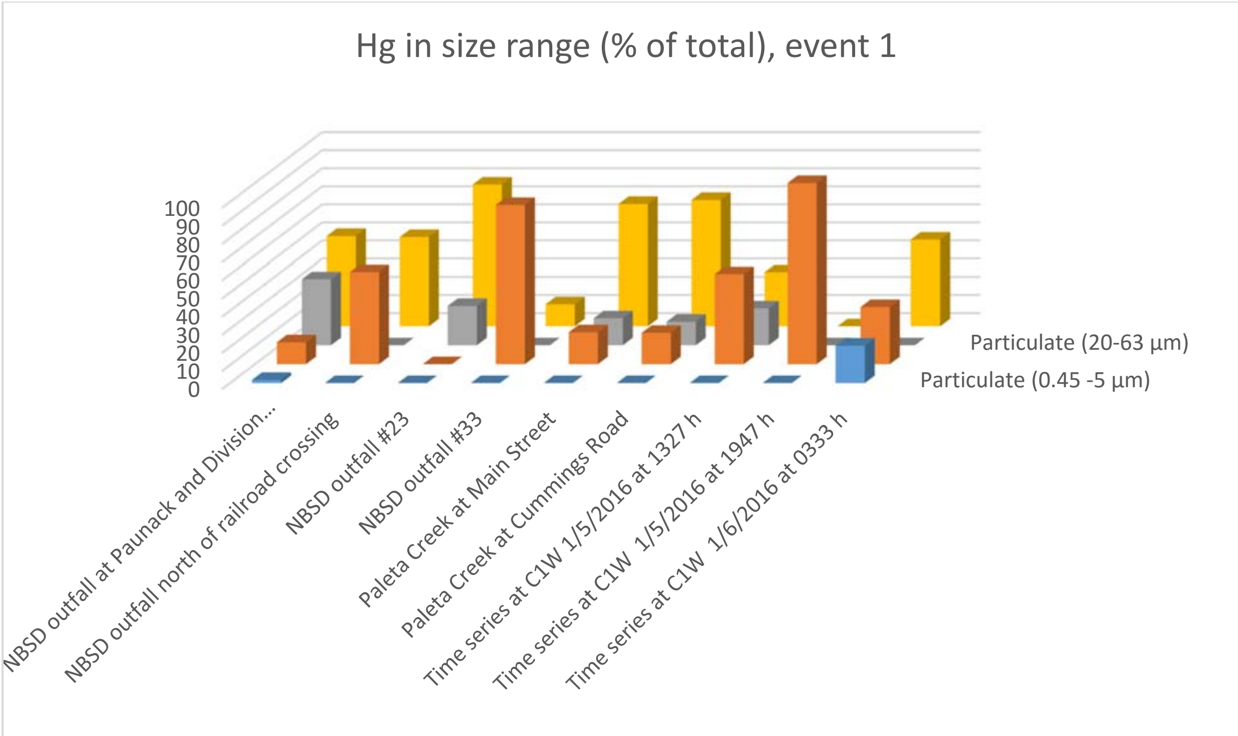
Hg (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	310	75.7	na	46.6	na	nd
Particulate (5-20 µm)	189	237	101	250	84	118
Particulate (20-63 µm)	1,859	728	75.0	124	659	2.4
Particulate (> 63 µm)	1,795	384	42.1	115	nd	2,850

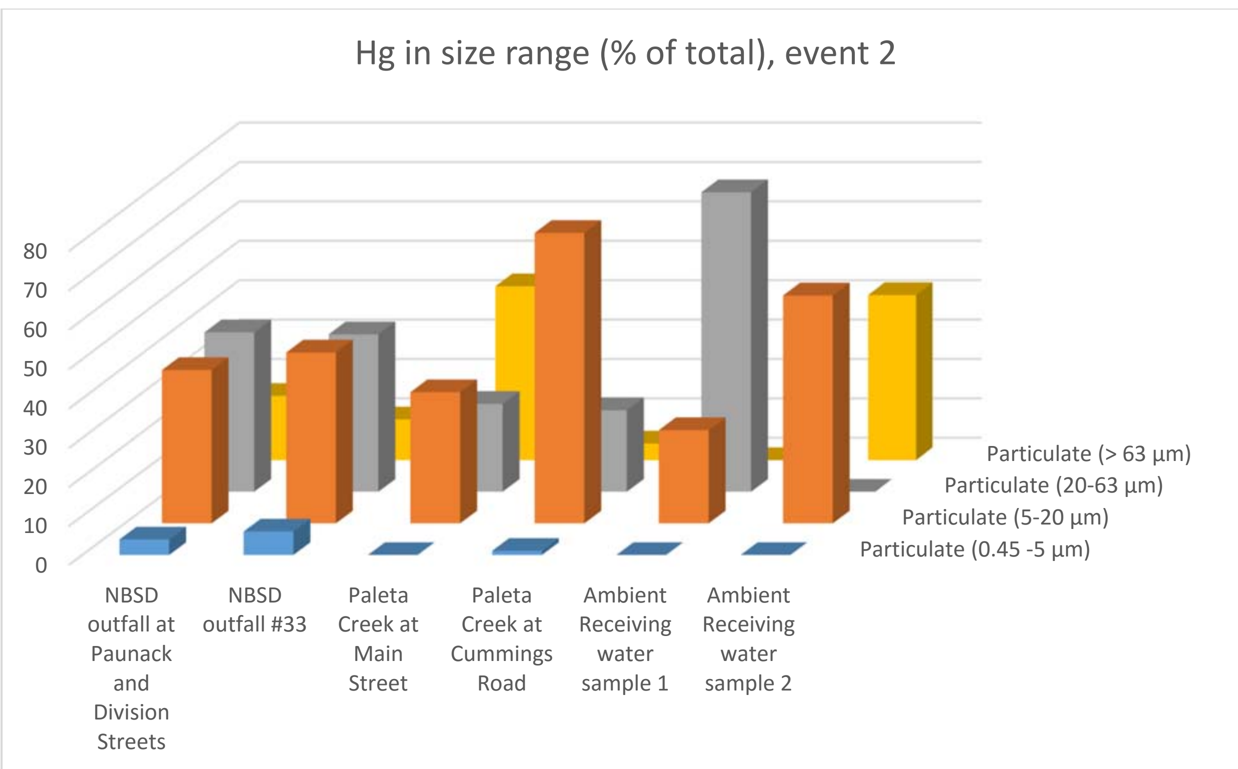


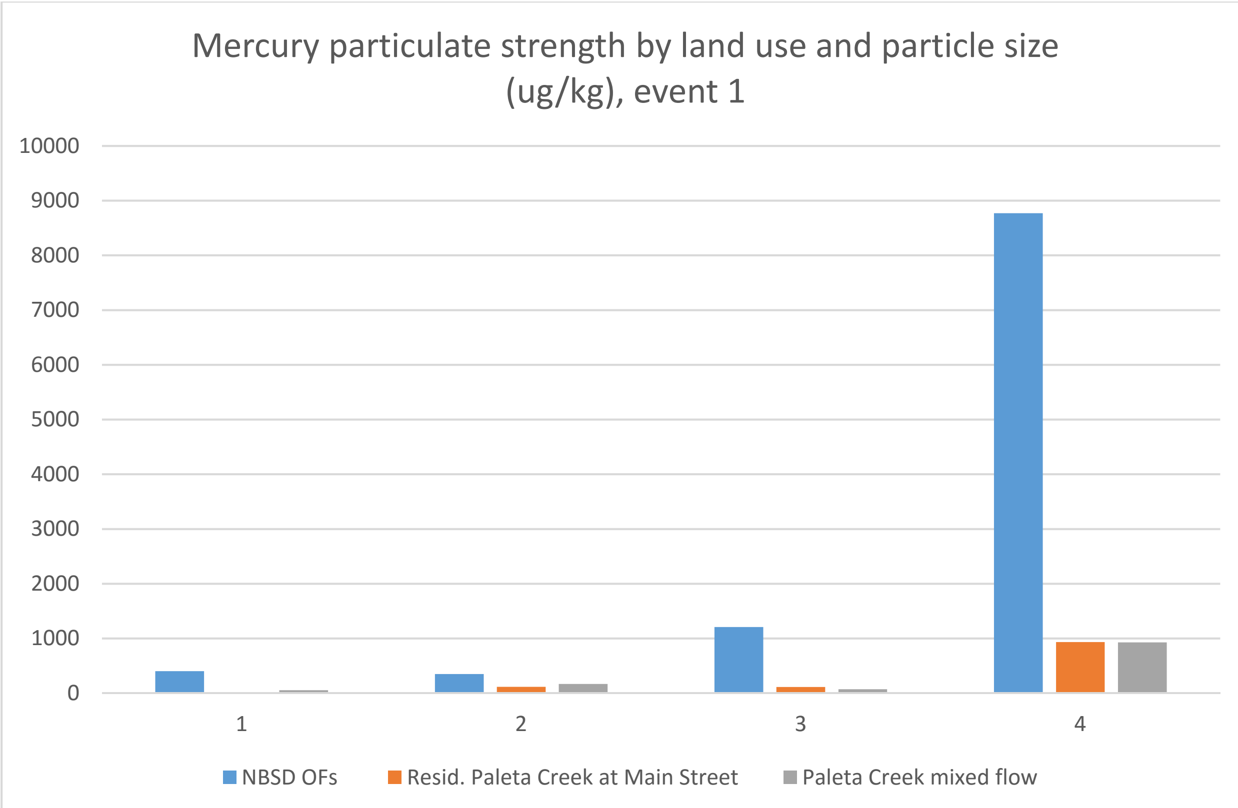
Hg (ug/kg), event 1
25000
20000
15000
10000
5000
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h

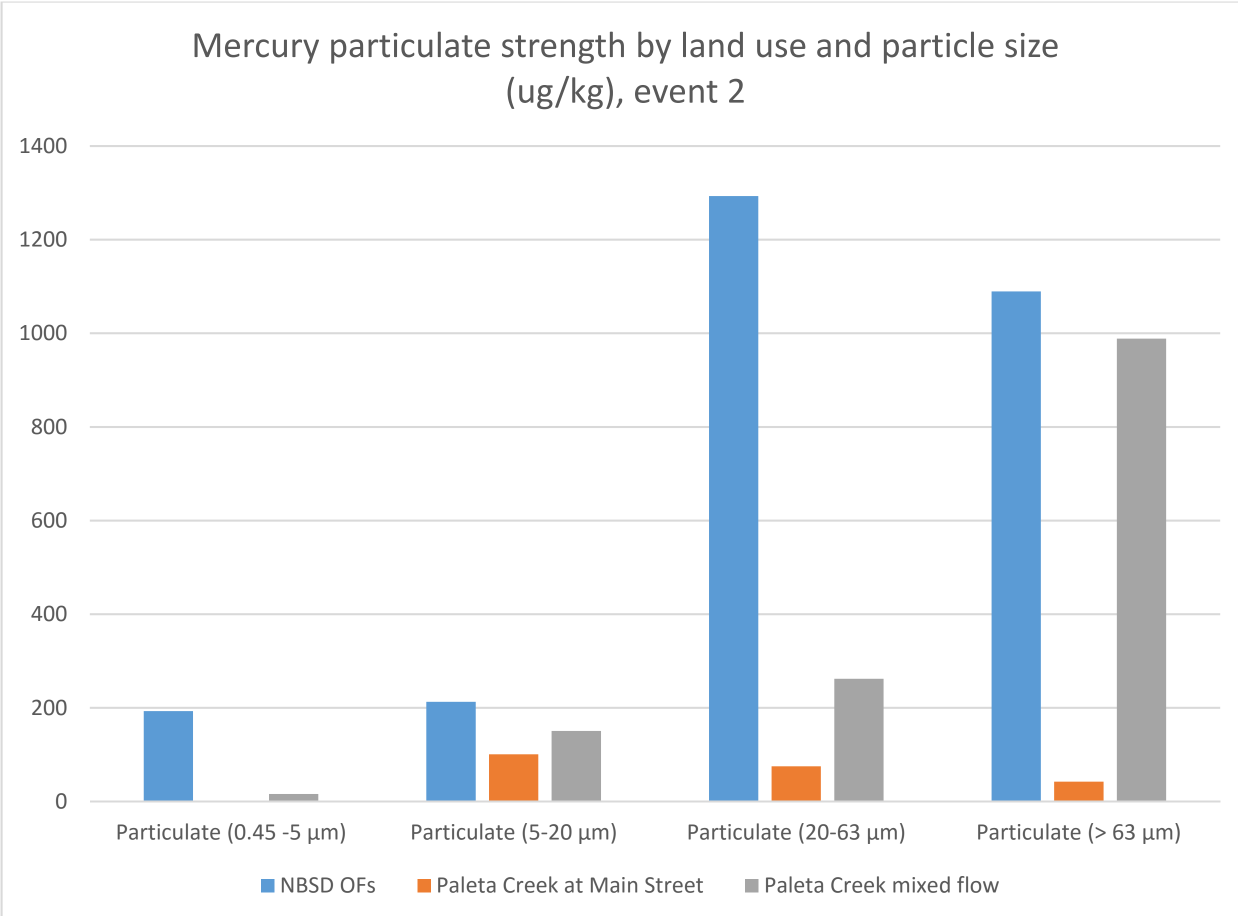


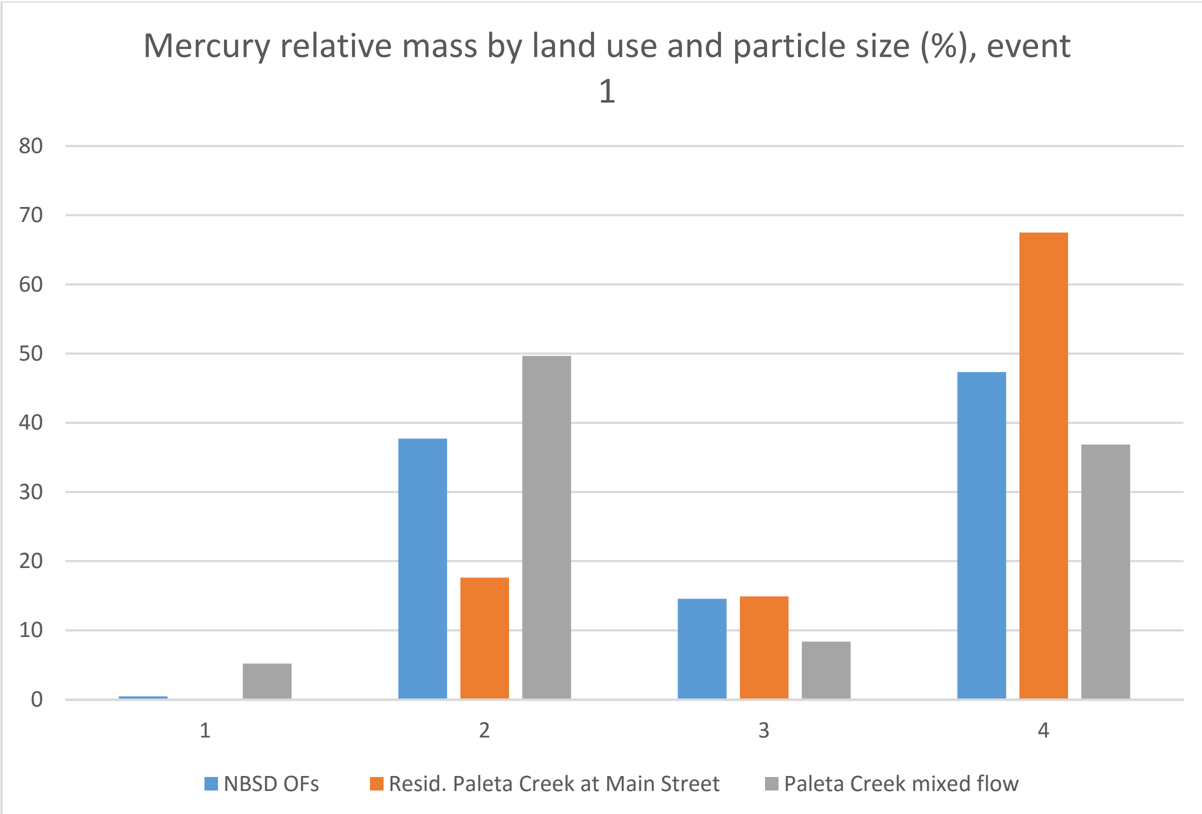
Hg (ug/kg), event 2
3000
2500
2000
1500
1000
500
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

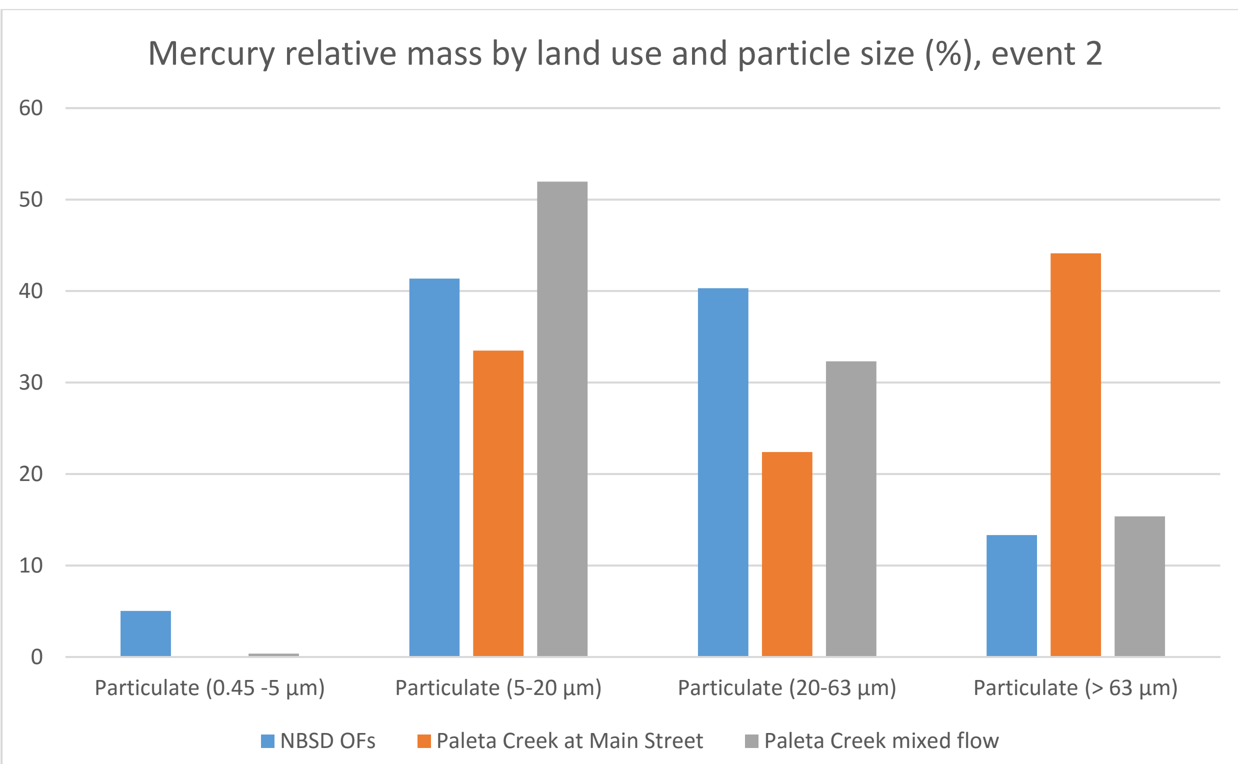

Hg in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h


Hg in size range (% of total), event 2
80
70
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Mercury particulate strength by land use and particle size (ug/kg), event 1
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Mercury particulate strength by land use and particle size (ug/kg), event 2
1400
1200
1000
800
600
400
200
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Mercury relative mass by land use and particle size (%), event 1
80
70
60
50
40
30
20
10
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Mercury relative mass by land use and particle size (%), event 2
60
50
40
30
20
10
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

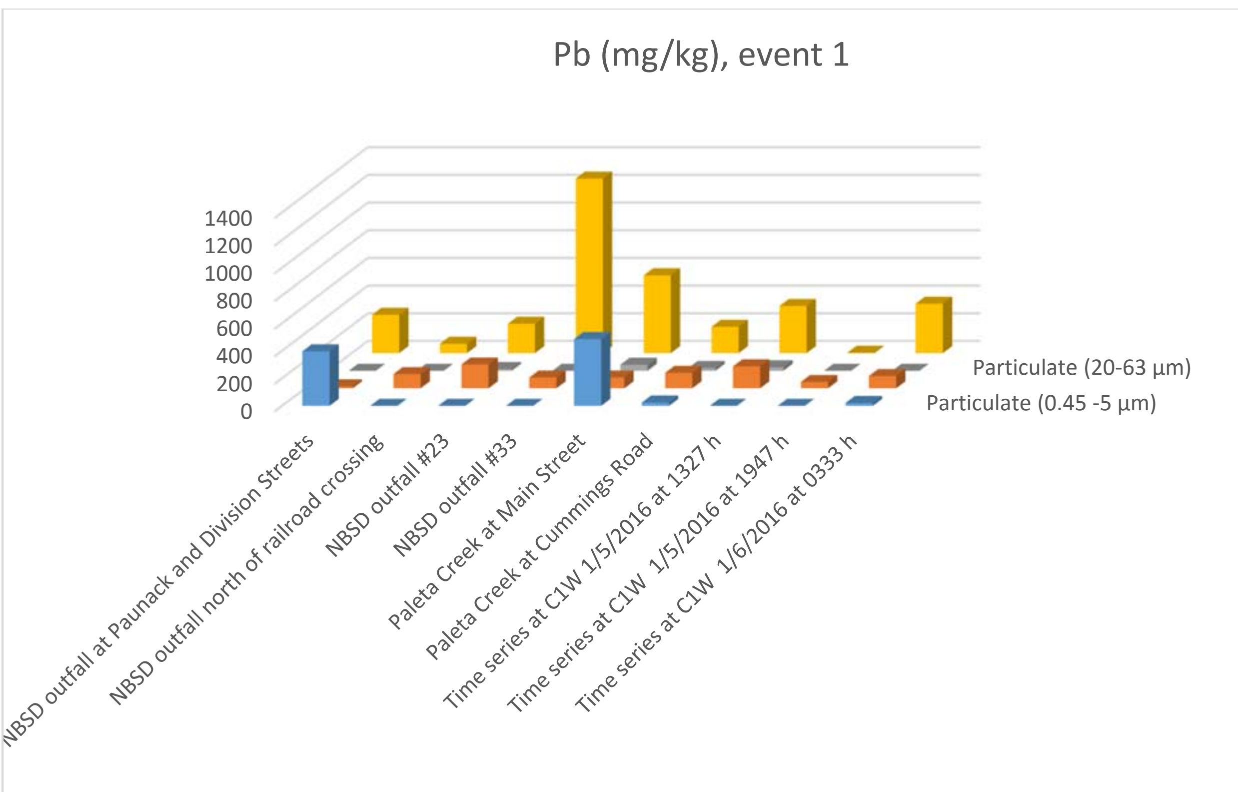
Lead

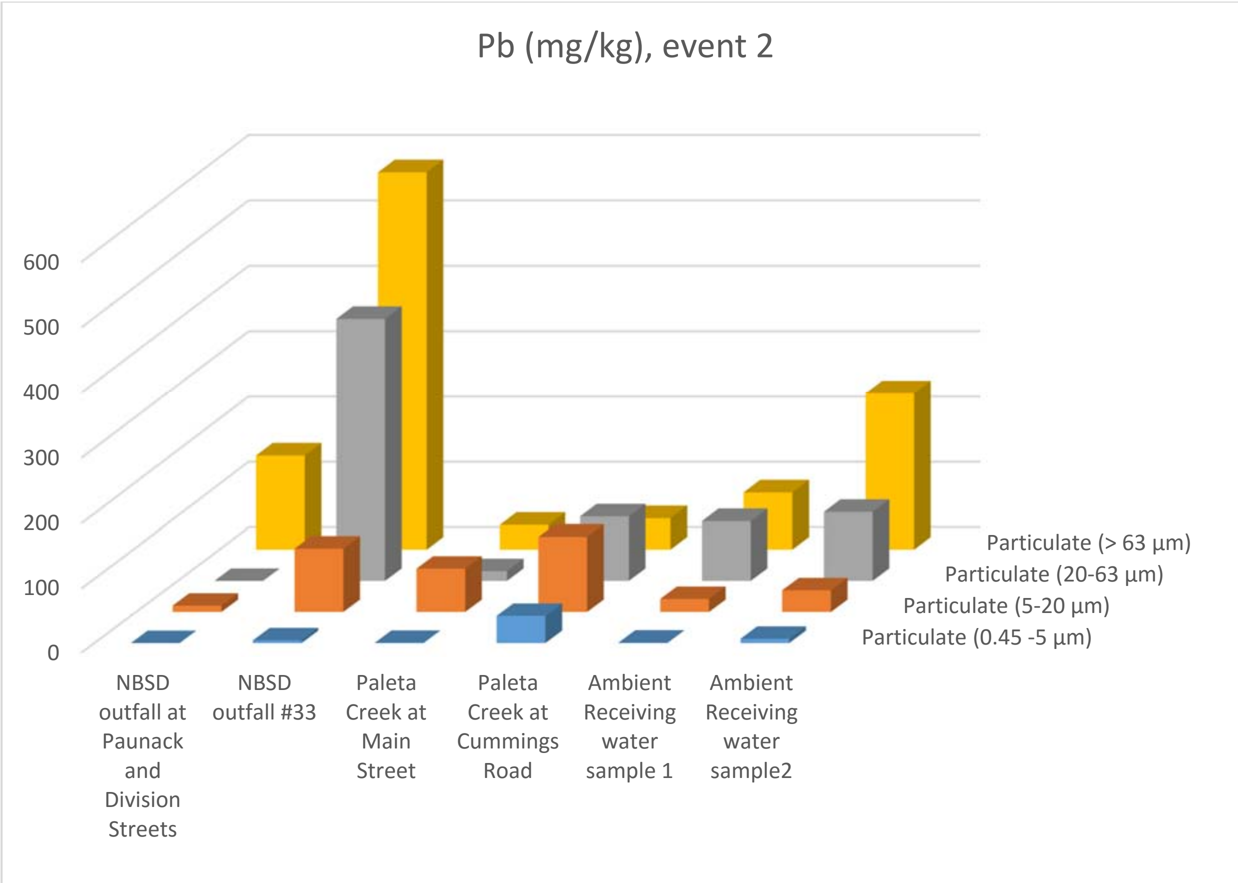
Pb (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	396	na*	na	0.1	485	24.7	na	na	21.5
Particulate (5-20 µm)	14.1	103	173	78.1	78.0	112	160	46.2	89.2
Particulate (20-63 µm)	nd**	na	12.9	nd	44.1	20.3	24.9	nd	na
Particulate (> 63 µm)	278	68.3	213	1262	563	192	342	na	358

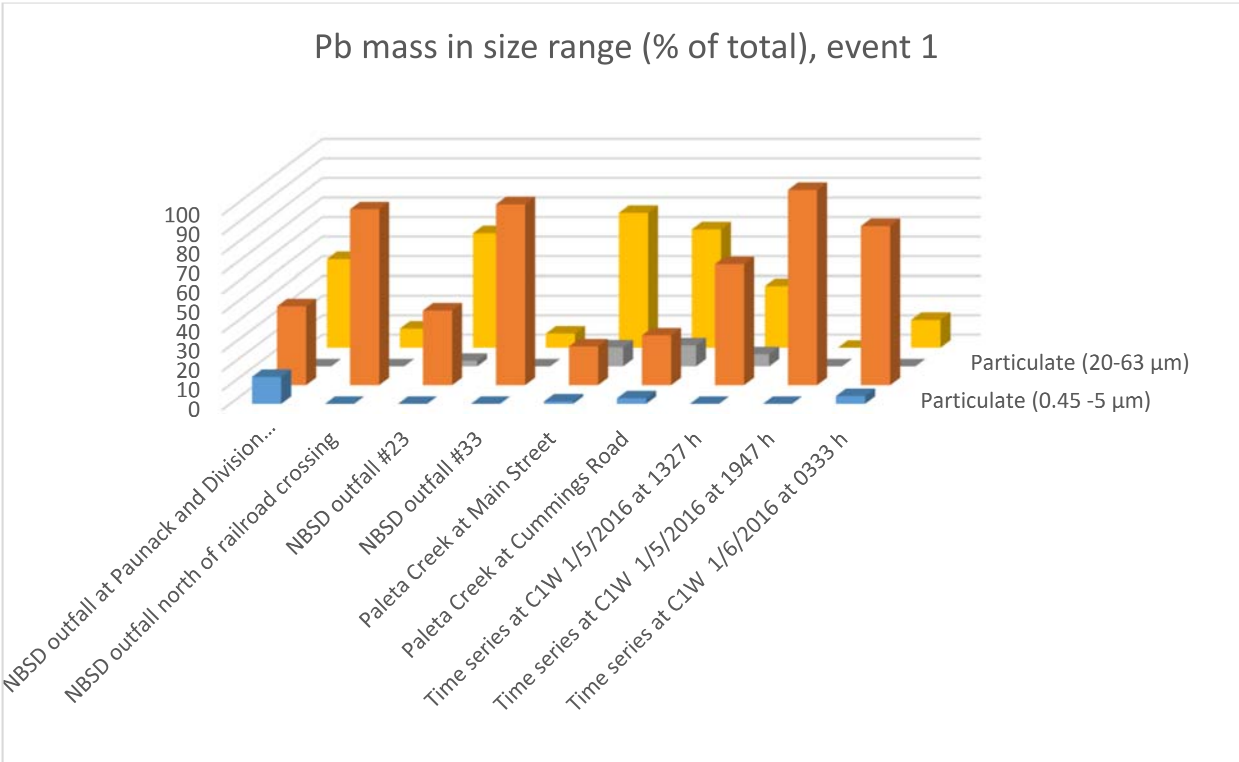
* SSC was not detected; particulate strength could not be calculated and assumed to be zero

** not detected; particulate strength could not be calculated and assumed to be zero

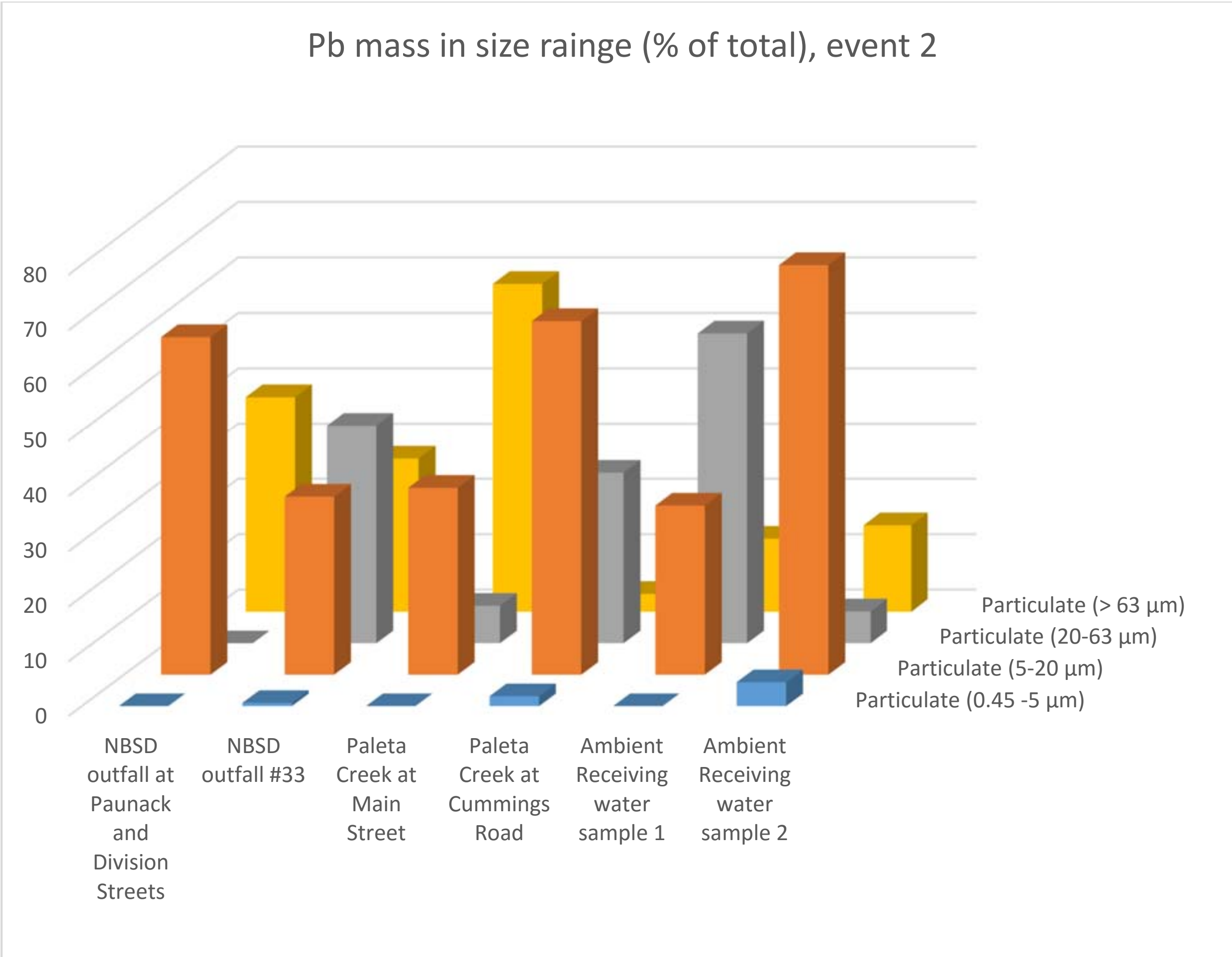
Pb (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	nd	4.1	na	42.4	na	6.6
Particulate (5-20 µm)	9.9	98.3	67.5	116	20.3	33.7
Particulate (20-63 µm)	nd	401	15.2	98.6	91.5	105
Particulate (> 63 µm)	143	577	37.4	47.5	86.9	238



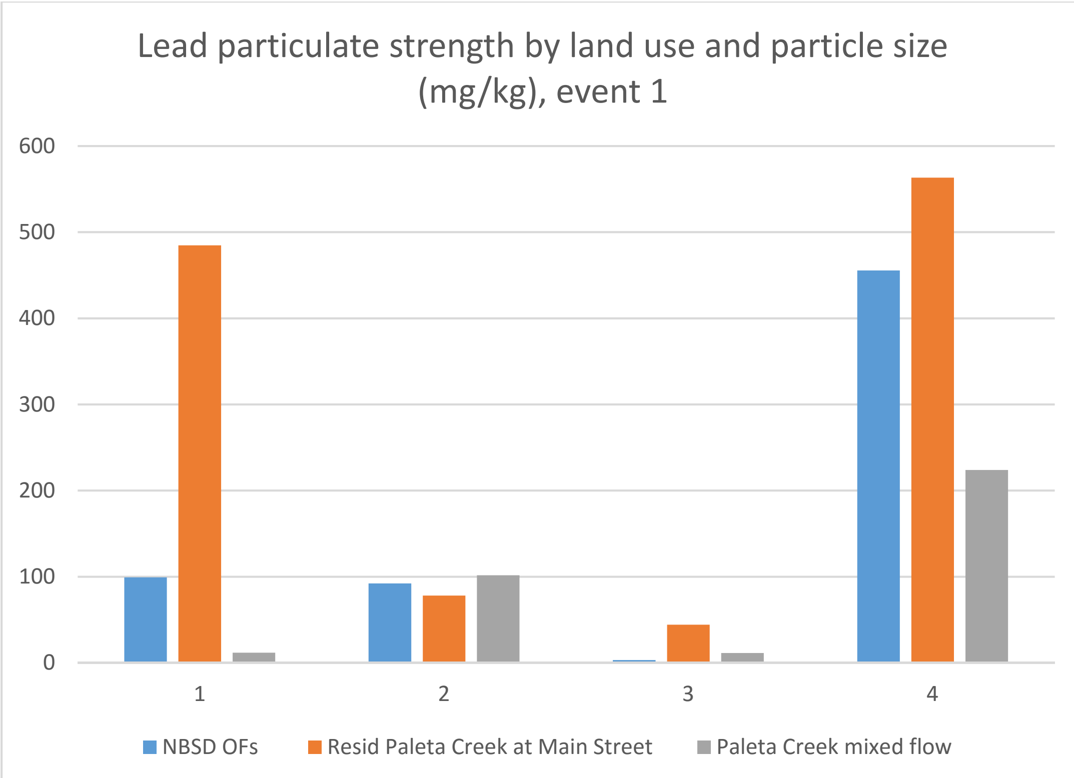

Pb (mg/kg), event 2
600
500
400
300
200
100
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample2



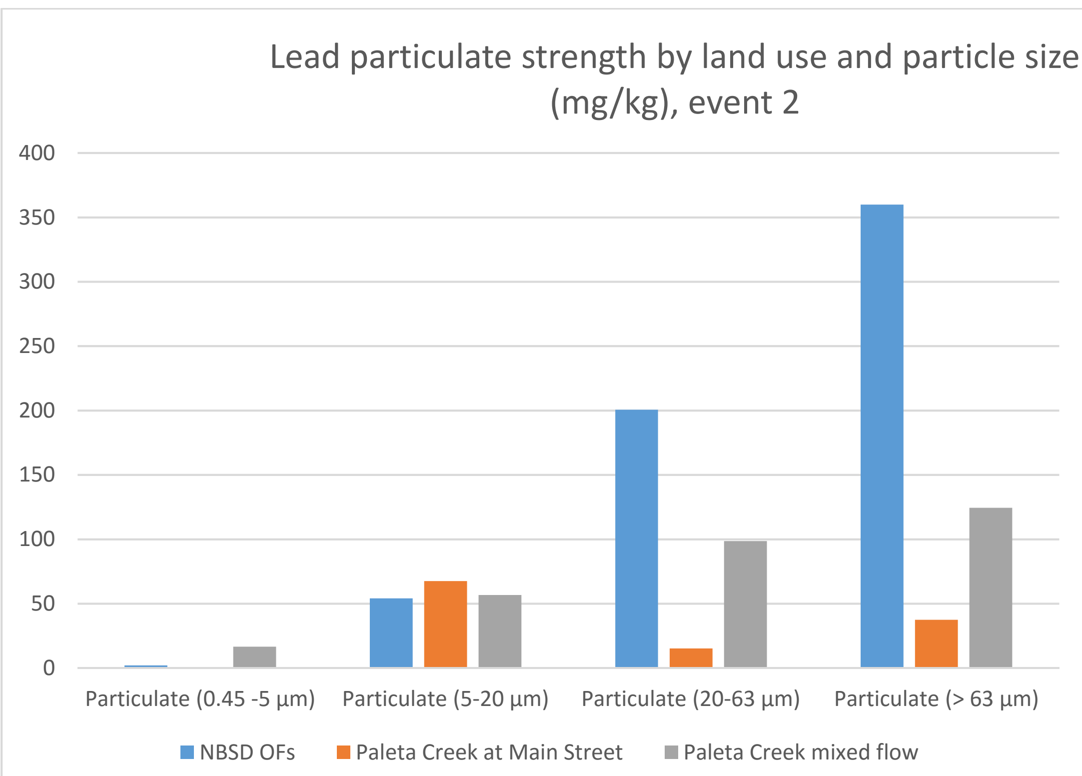
Pb mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h



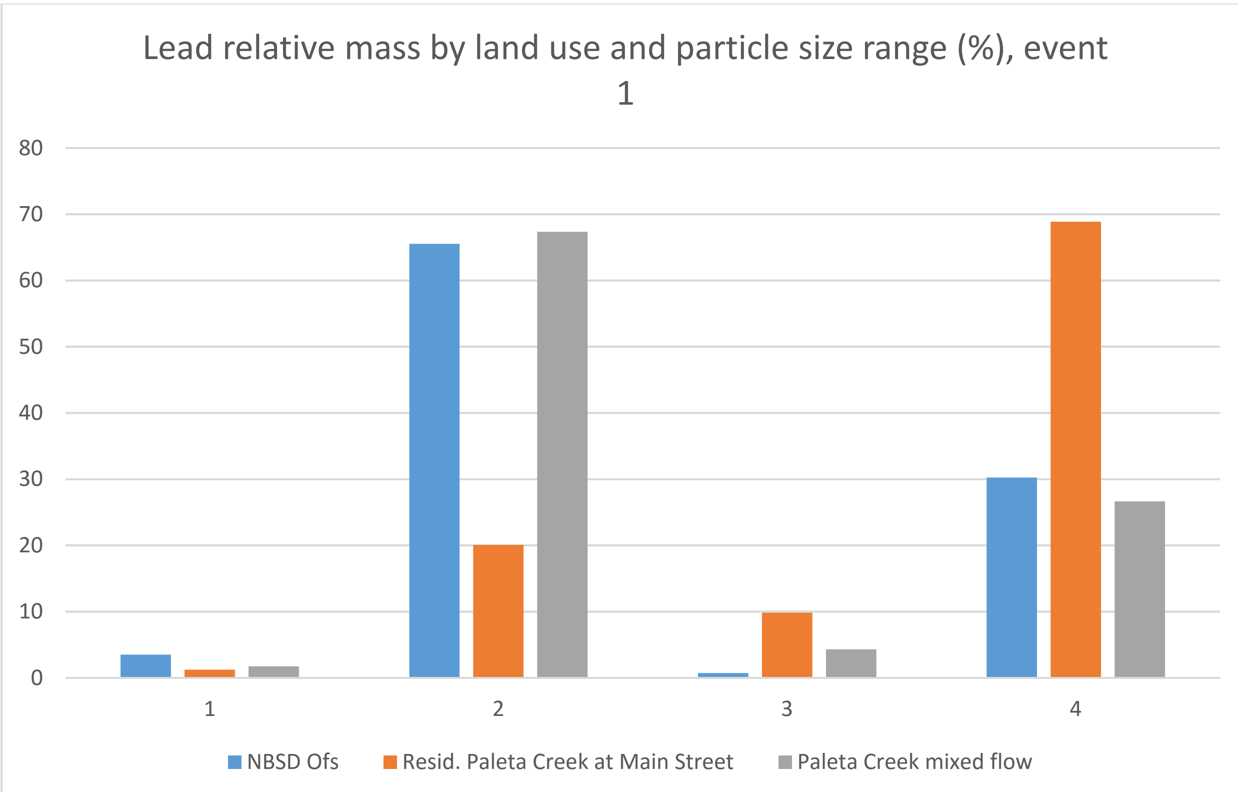
Pb mass in size rainge (% of total), event 2
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)

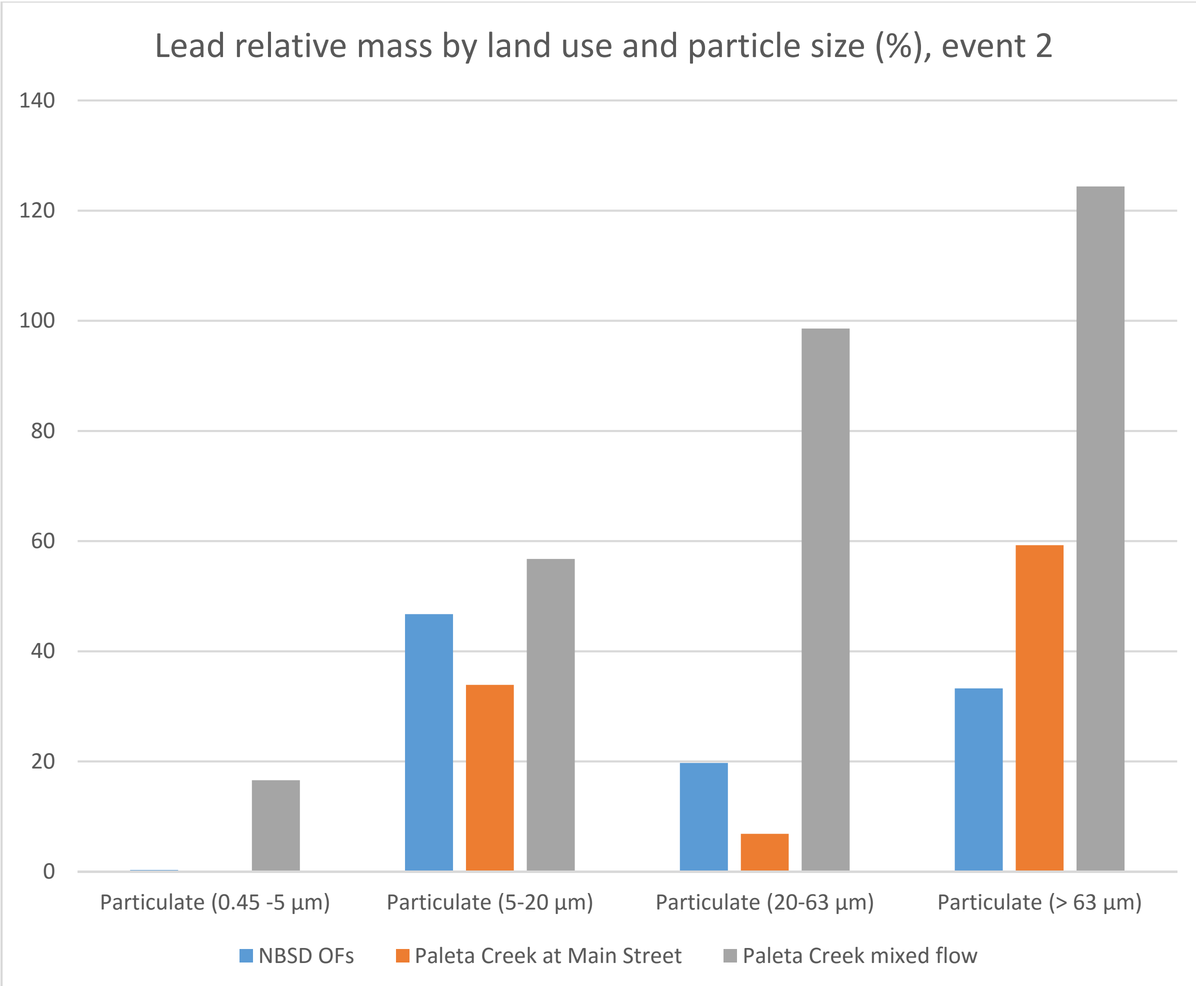


Lead particulate strength by land use and particle size (mg/kg), event 1
600
500
400
300
200
100
0
1
2
3
4
NBSD OFs
Resid Paleta Creek at Main Street
Paleta Creek mixed flow



Lead particulate strength by land use and particle size (mg/kg), event 2
400
350
300
250
200
150
100
50
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Lead relative mass by land use and particle size range (%), event 1
80
70
60
50
40
30
20
10
0
1
2
3
4
NBSD Ofs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Lead relative mass by land use and particle size (%), event 2
140
120
100
80
60
40
20
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

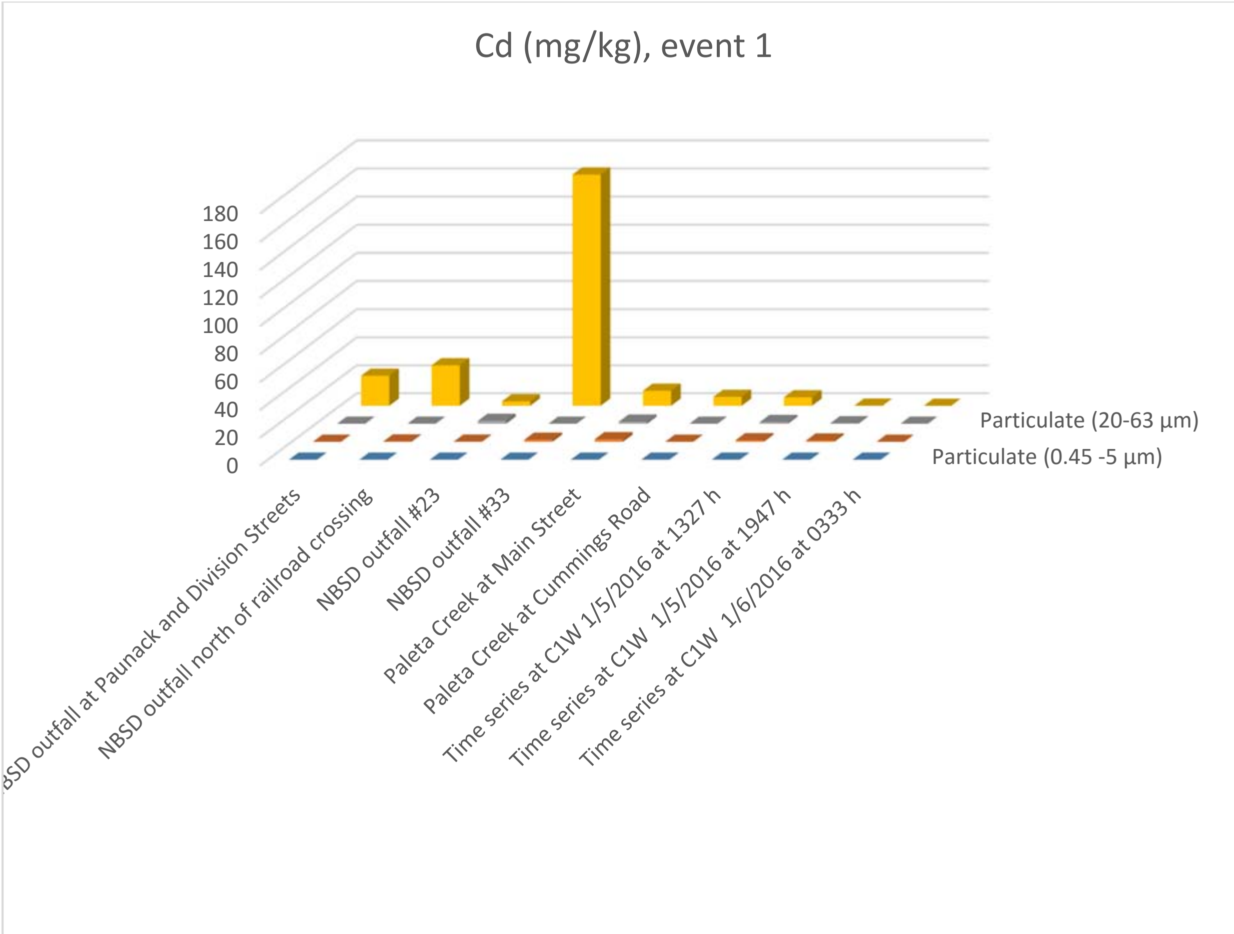
Cadmium

Cd (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	nd**	na*	na	nd	nd	nd	na	na	nd
Particulate (5-20 µm)	nd	0.2	0.1	1.4	1.8	nd	1.2	0.9	nd
Particulate (20-63 µm)	nd	na	2.1	na*	1.5	nd	1.2	0.3	na
Particulate (> 63 µm)	21.6	29.1	3.2	165	10.8	6.4	6.0	na	nd

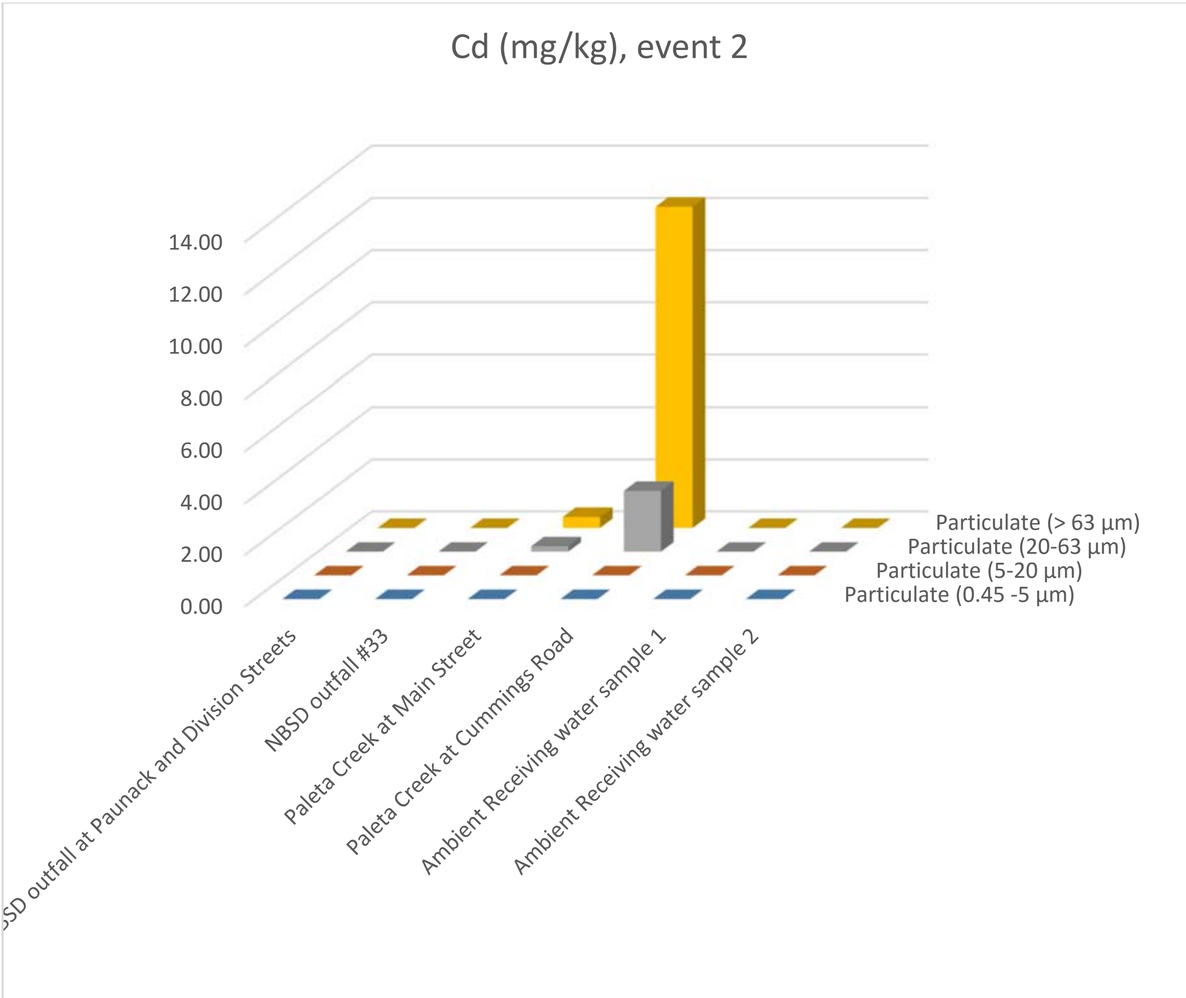
* SSC was not detected; particulate strength could not be calculated and assumed to be zero

** not detected; particulate strength could not be calculated and assumed to be zero

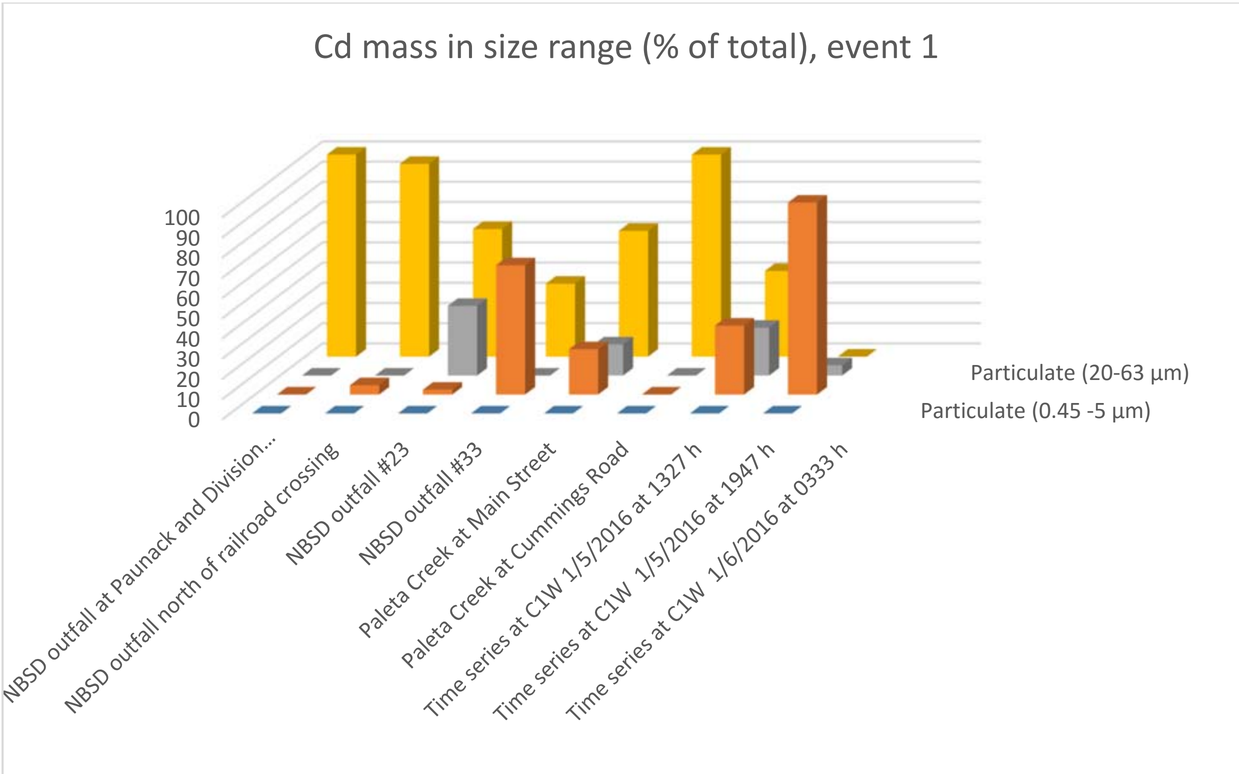
Cd (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	nd	nd	na	nd	na	nd
Particulate (5-20 µm)	nd	nd	nd	nd	nd	nd
Particulate (20-63 µm)	nd	nd	0.21	2.3	nd	nd
Particulate (> 63 µm)	nd	nd	0.43	12.3	nd	nd

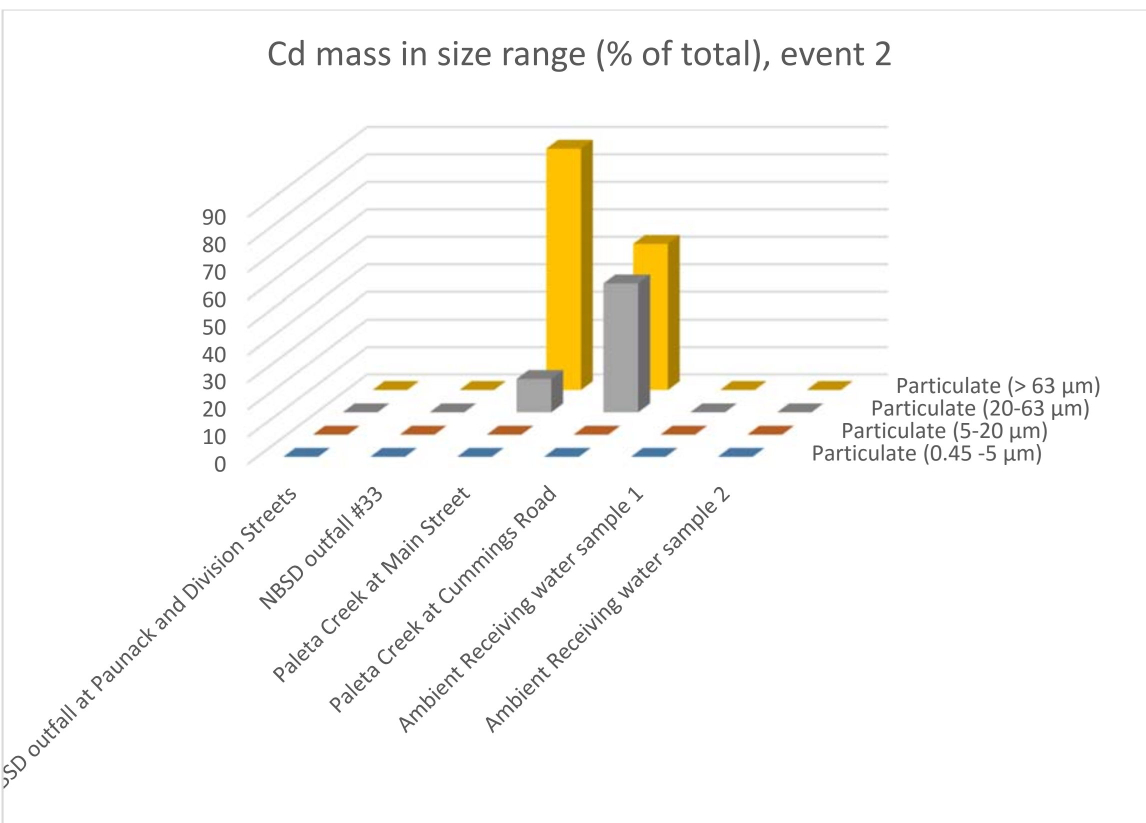


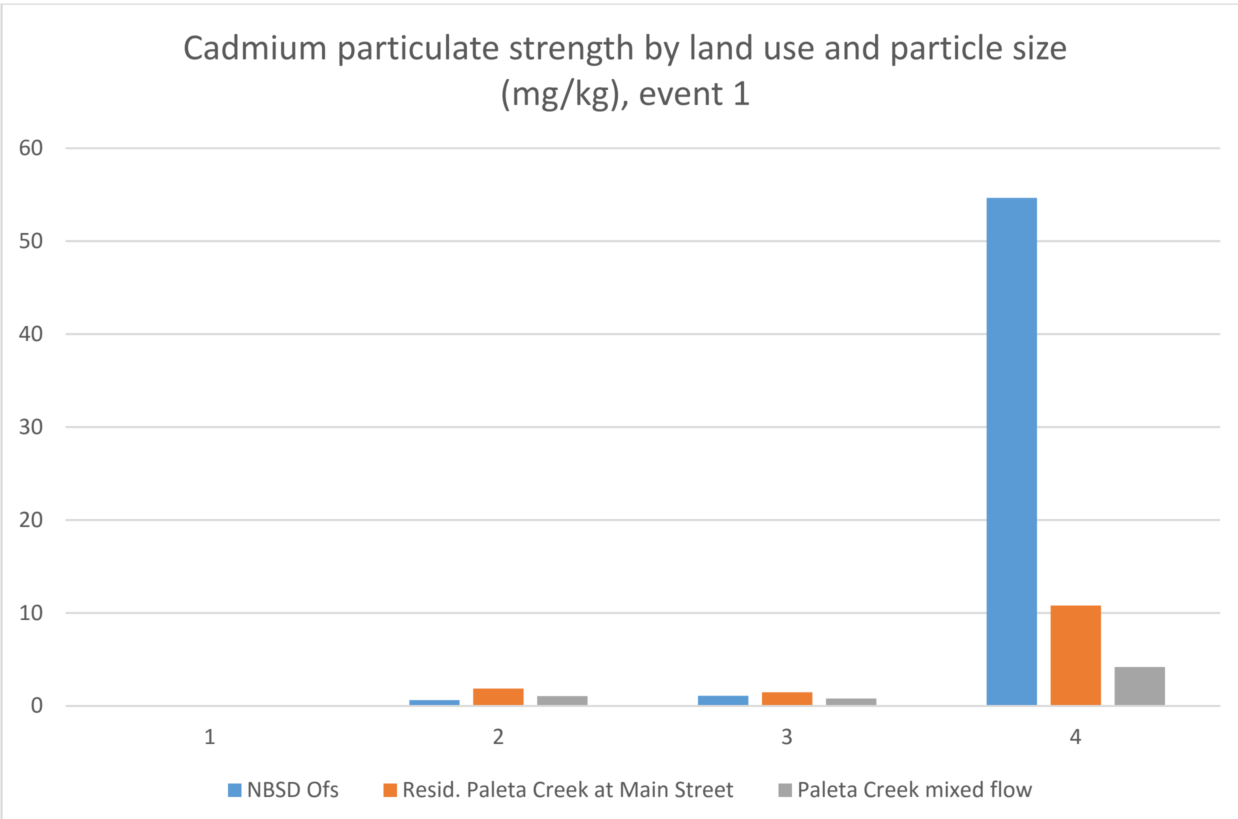
Cd (mg/kg), event 1
180
160
140
120
100
80
60
40
20
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h

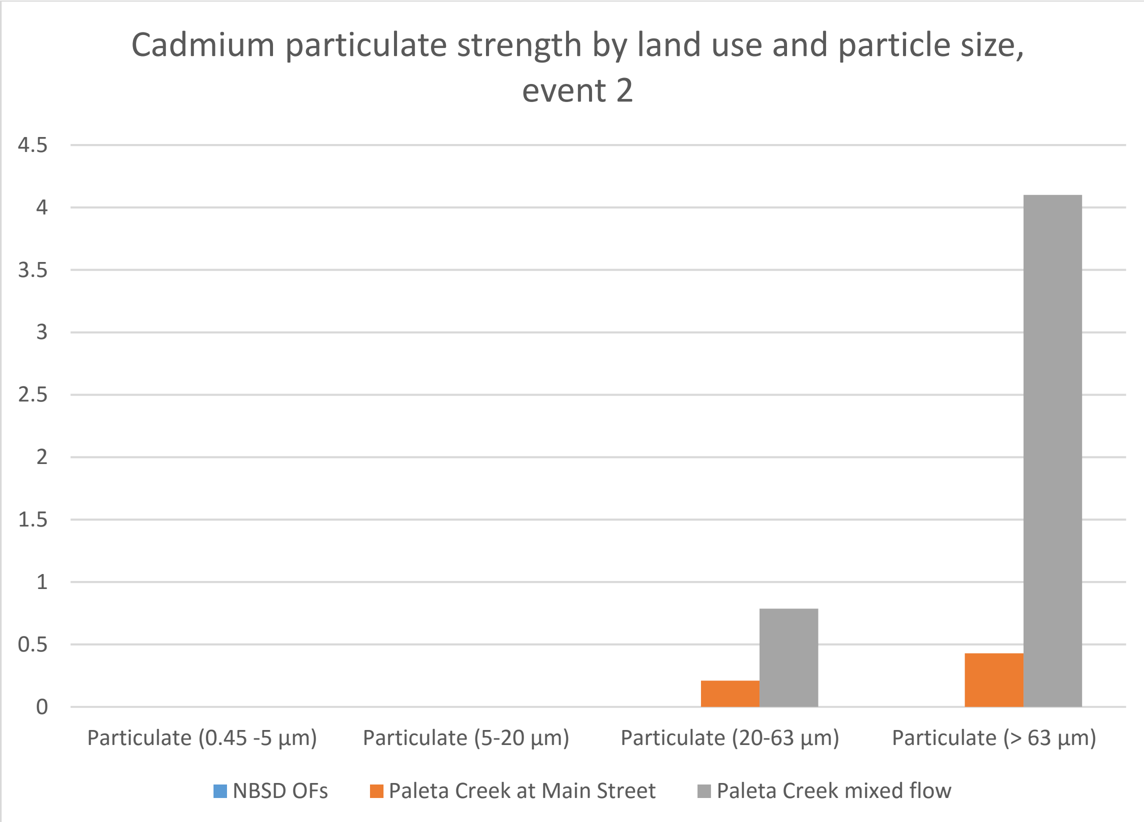


Cd (mg/kg), event 2
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
SD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

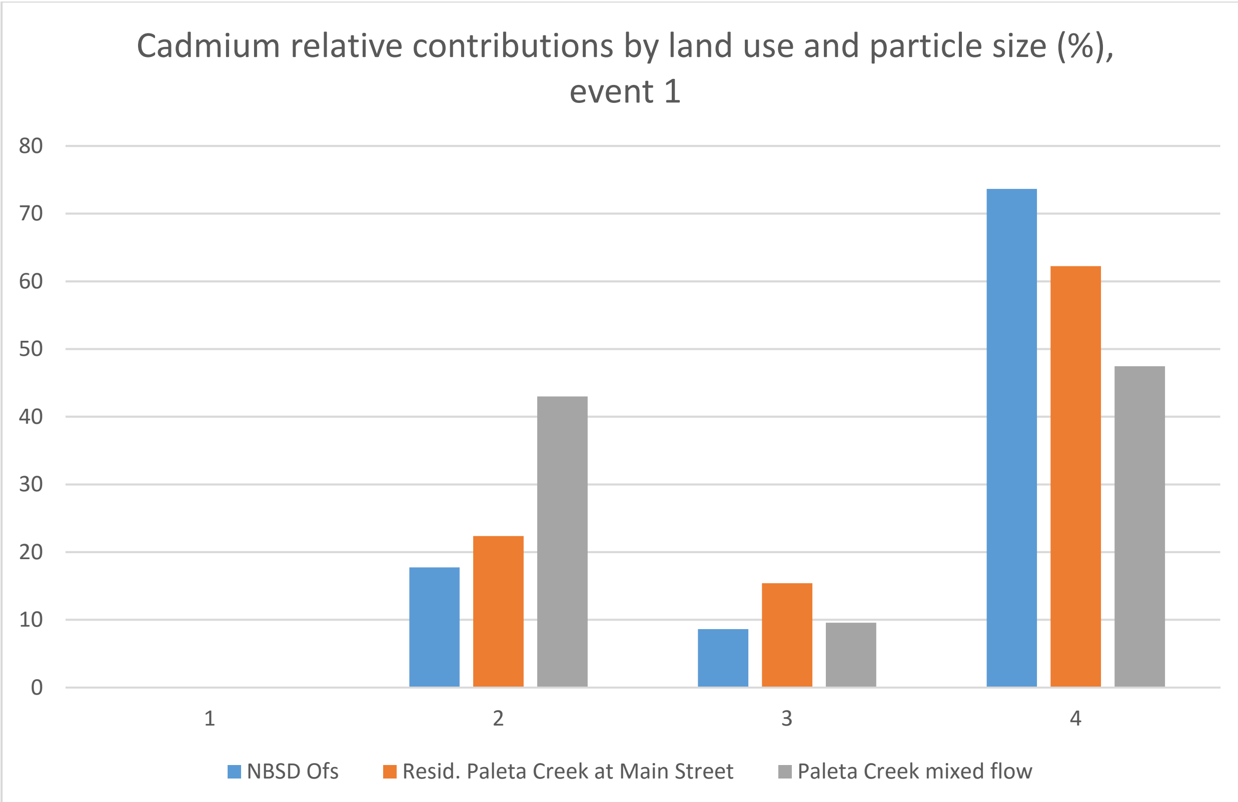

Cd mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h

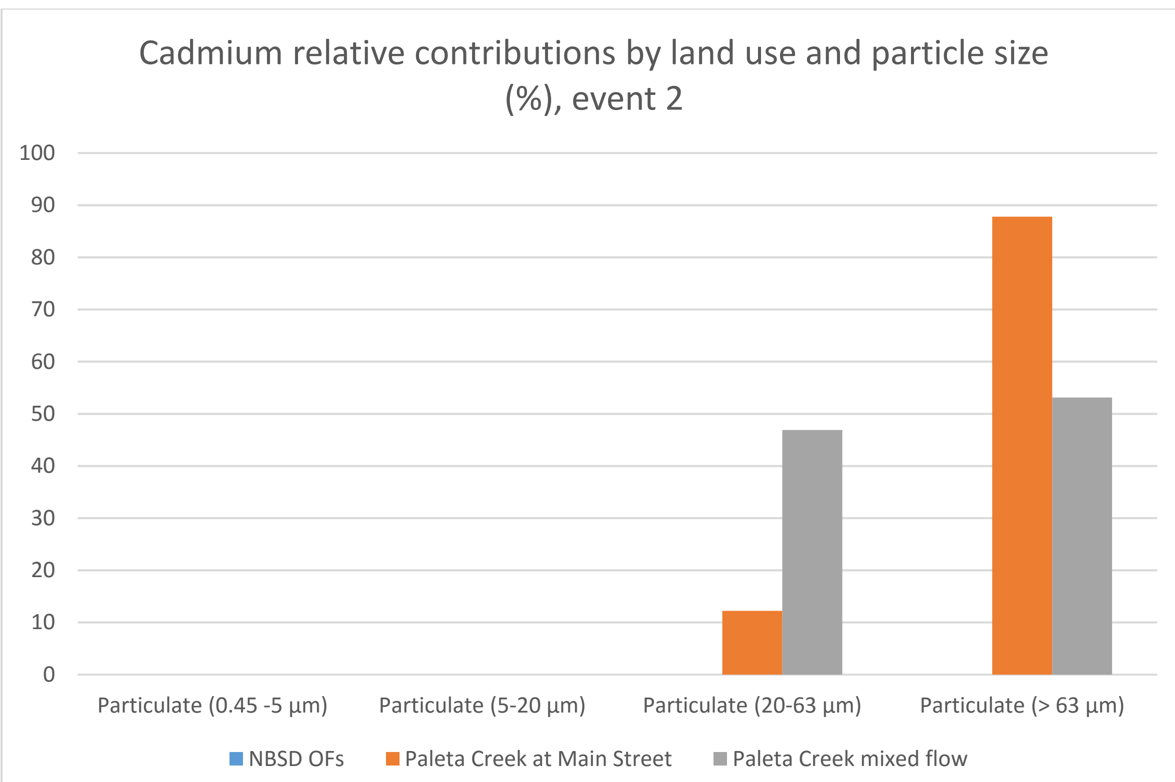

Cd mass in size range (% of total), event 2
90
80
70
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
SD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Cadmium particulate strength by land use and particle size (mg/kg), event 1
60
50
40
30
20
10
0
1
2
3
4
NBSD Ofs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow



Cadmium particulate strength by land use and particle size, event 2
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Cadmium relative contributions by land use and particle size (%), event 1
80
70
60
50
40
30
20
10
0
1
2
3
4
NBSD Ofs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow

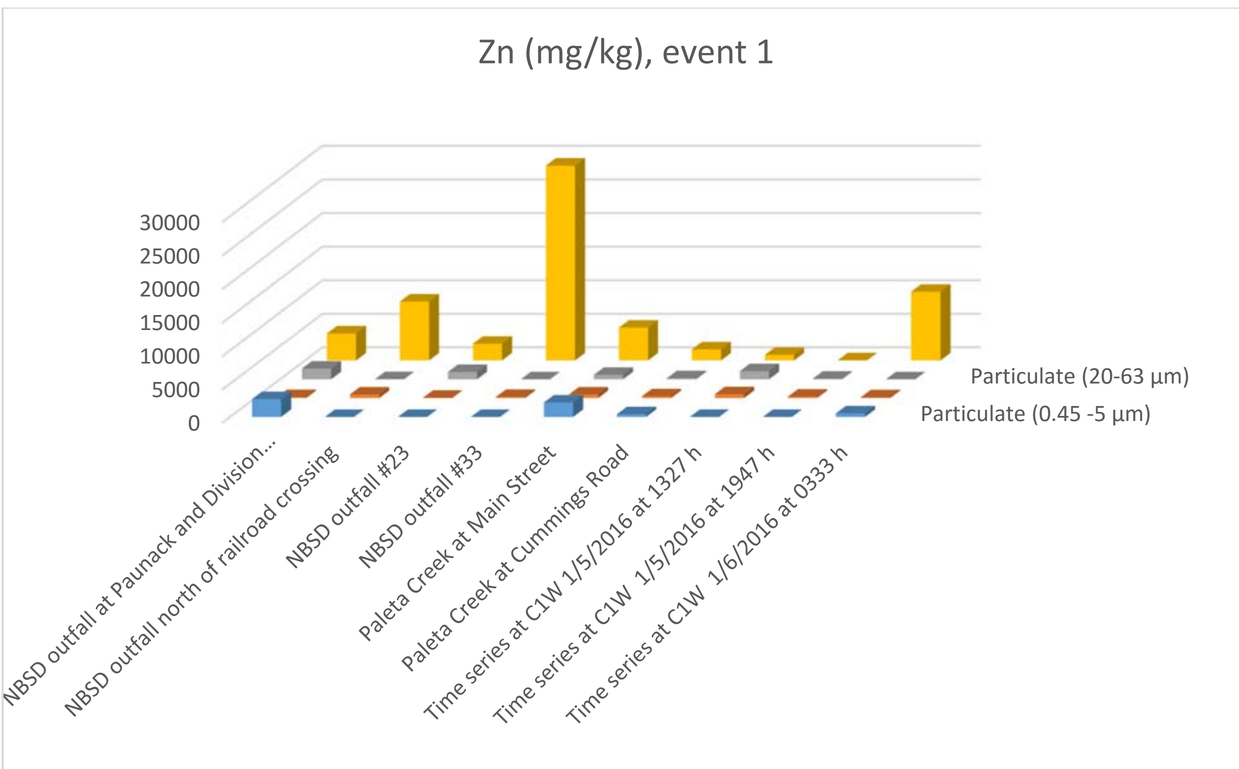

Cadmium relative contributions by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

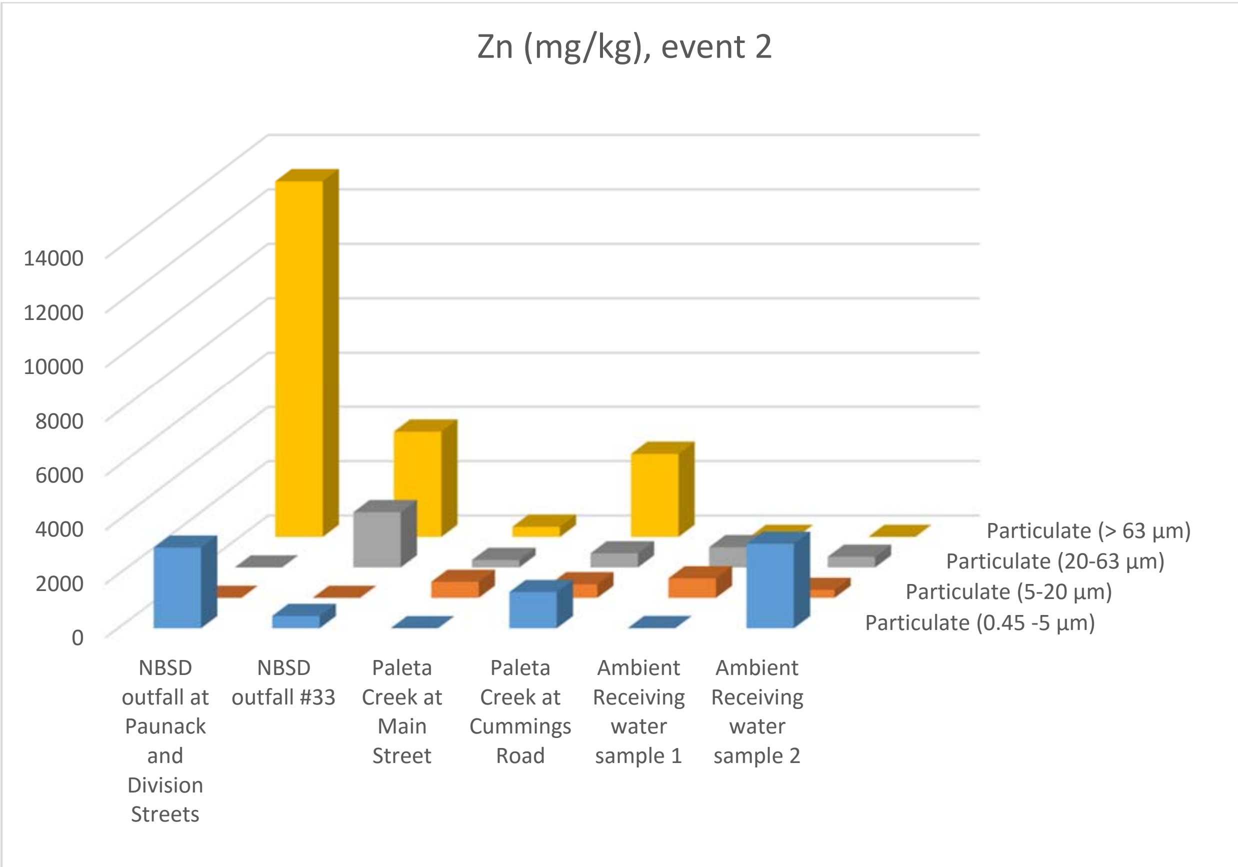
Zinc

Zn (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	2,667	na*	na	nd**	2,169	414	na	na	533
Particulate (5-20 µm)	146	546	42.6	173	543	265	590	211	131
Particulate (20-63 µm)	1,610	na	1,098	nd	659	161	1,226	86.1	na
Particulate (> 63 µm)	4,046	8,797	2,505	29,021	4,917	1,657	842	na	10,254

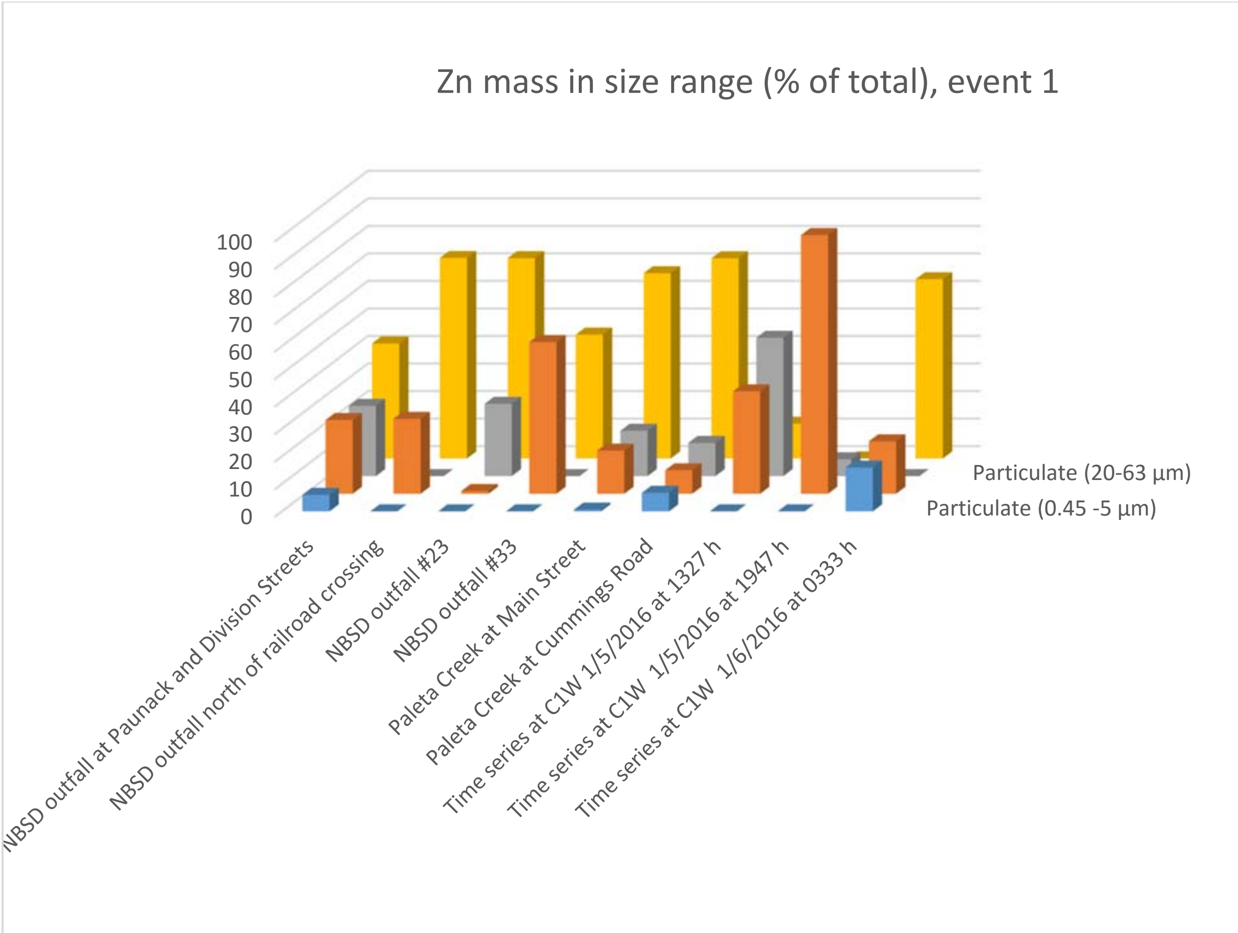
* SSC was not detected; particulate strength could not be calculated and assumed to be zero
** not detected; particulate strength could not be calculated and assumed to be zero

Zn (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	2,995	454	na	1,343	na	3,138
Particulate (5-20 µm)	nd	nd	595	502	726	298
Particulate (20-63 µm)	nd	2,039	274.	523	749	394
Particulate (> 63 µm)	13,086	3,875	375	3,054	nd	nd

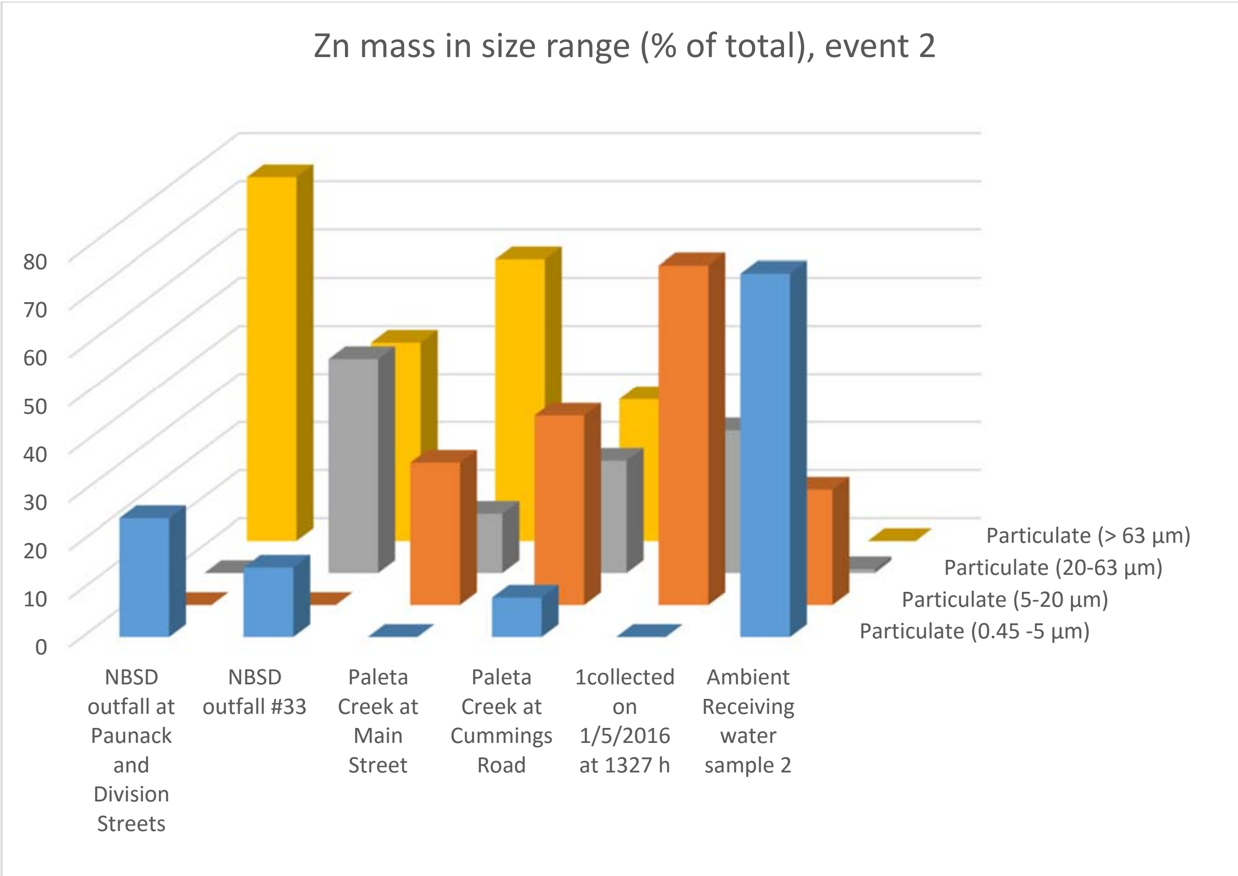




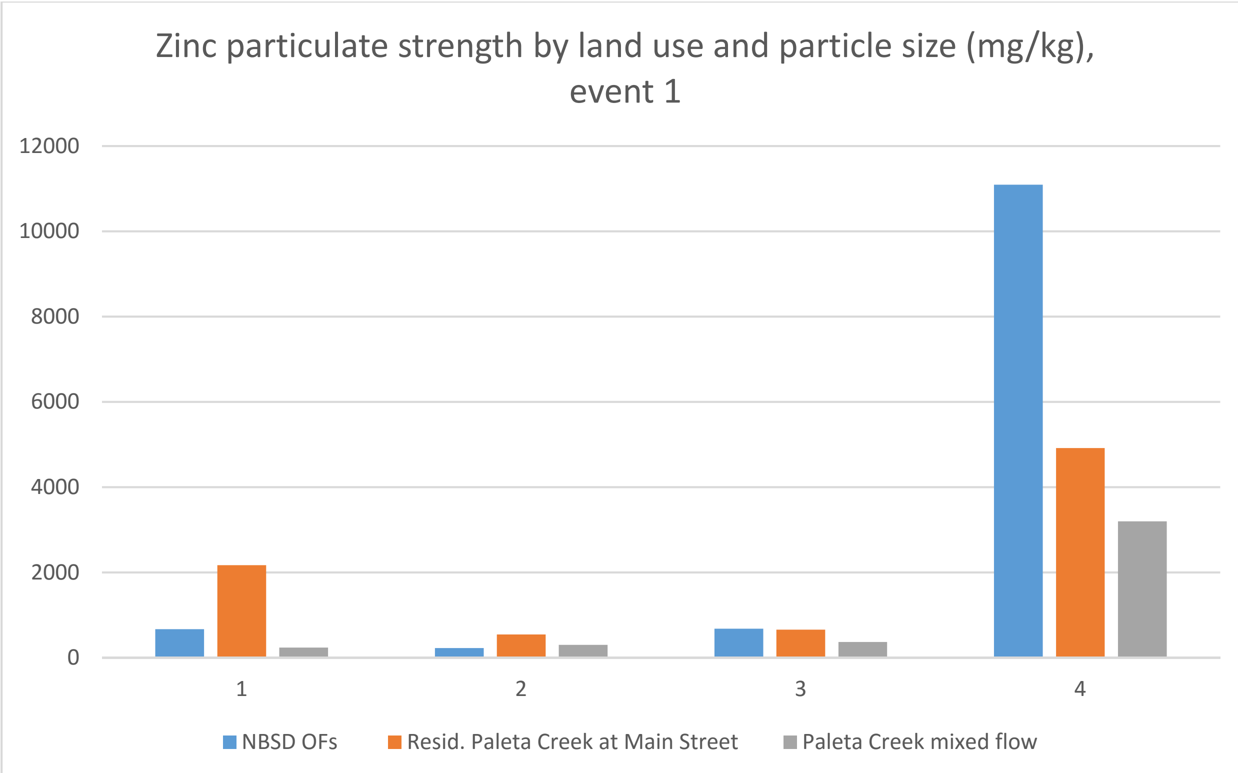
Zn (mg/kg), event 2
14000
12000
10000
8000
6000
4000
2000
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

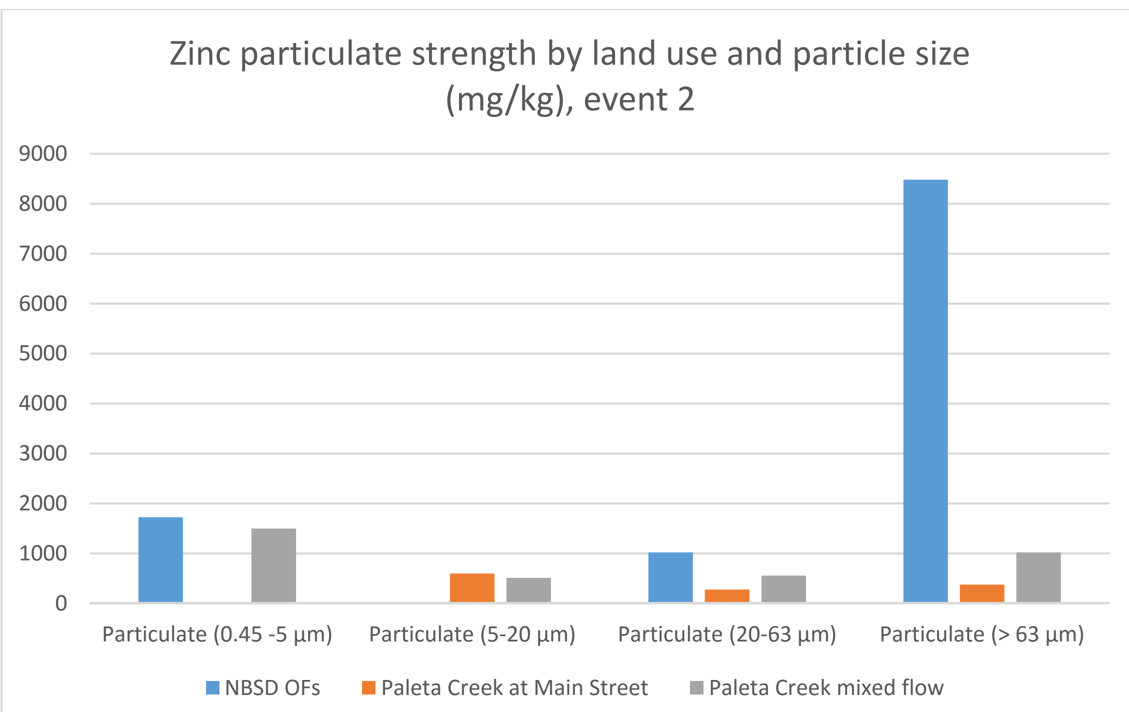


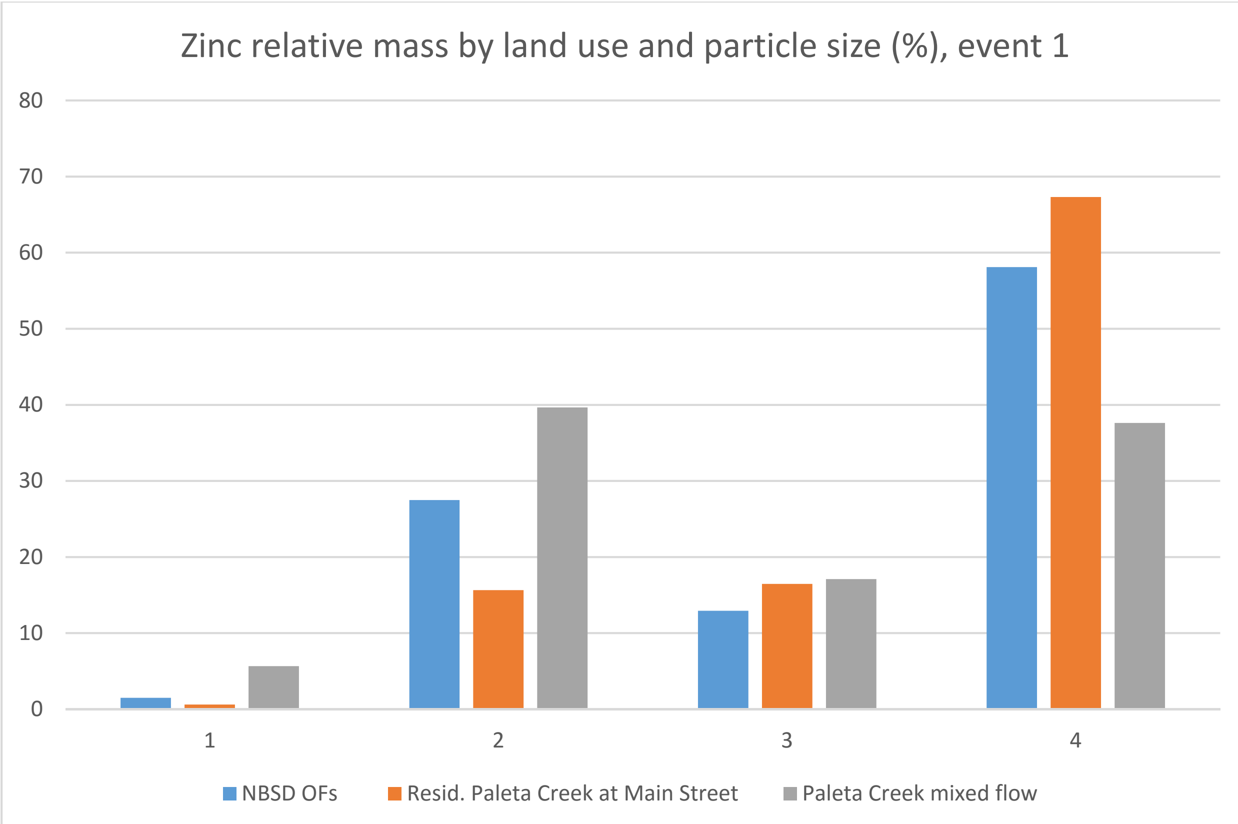
Zn mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h



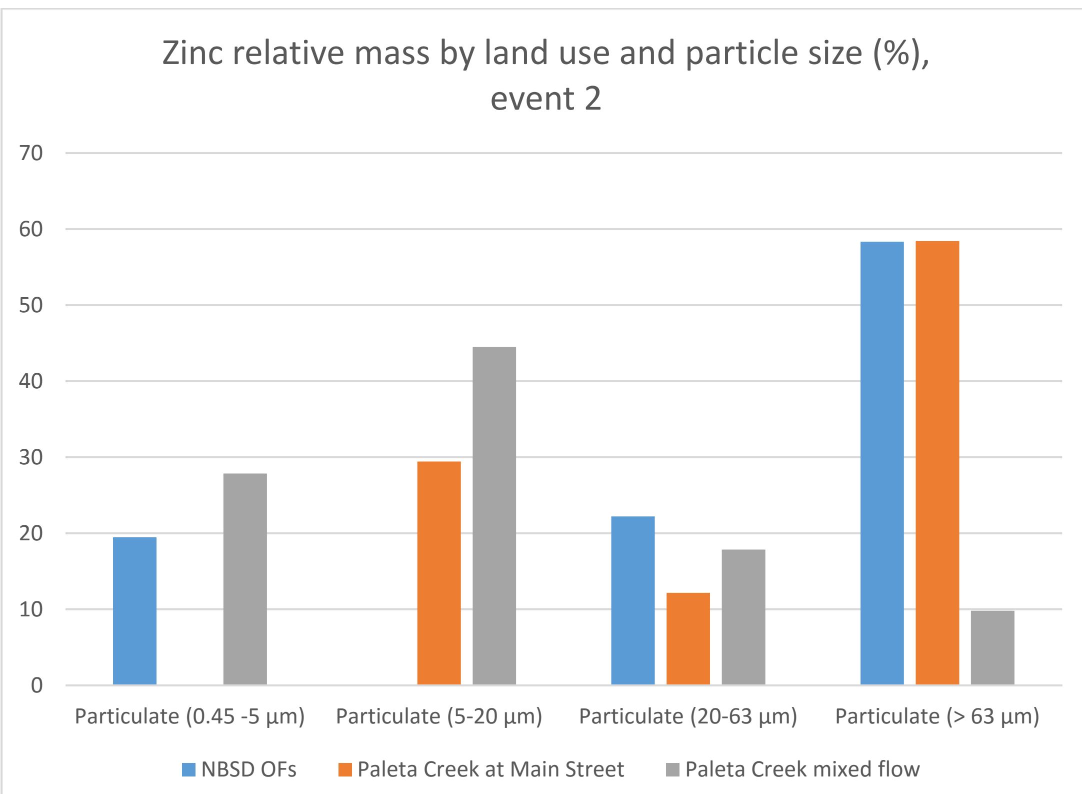
Zn mass in size range (% of total), event 2
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
1collected on 1/5/2016 at 1327 h
Ambient Receiving water sample 2
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)


Zinc particulate strength by land use and particle size (mg/kg), event 1
12000
10000
8000
6000
4000
2000
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Zinc particulate strength by land use and particle size (mg/kg), event 2
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Zinc relative mass by land use and particle size (%), event 1
80
70
60
50
40
30
20
10
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow



Zinc relative mass by land use and particle size (%), event 2
70
60
50
40
30
20
10
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

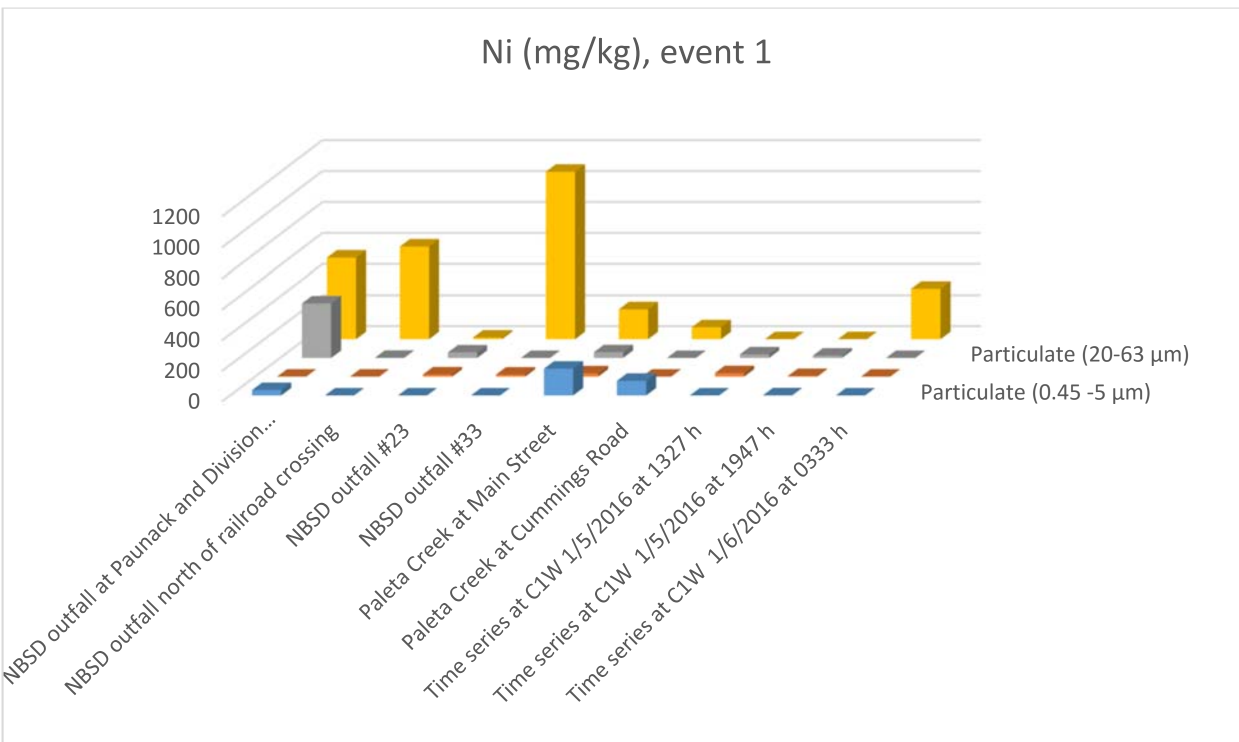
Nickel

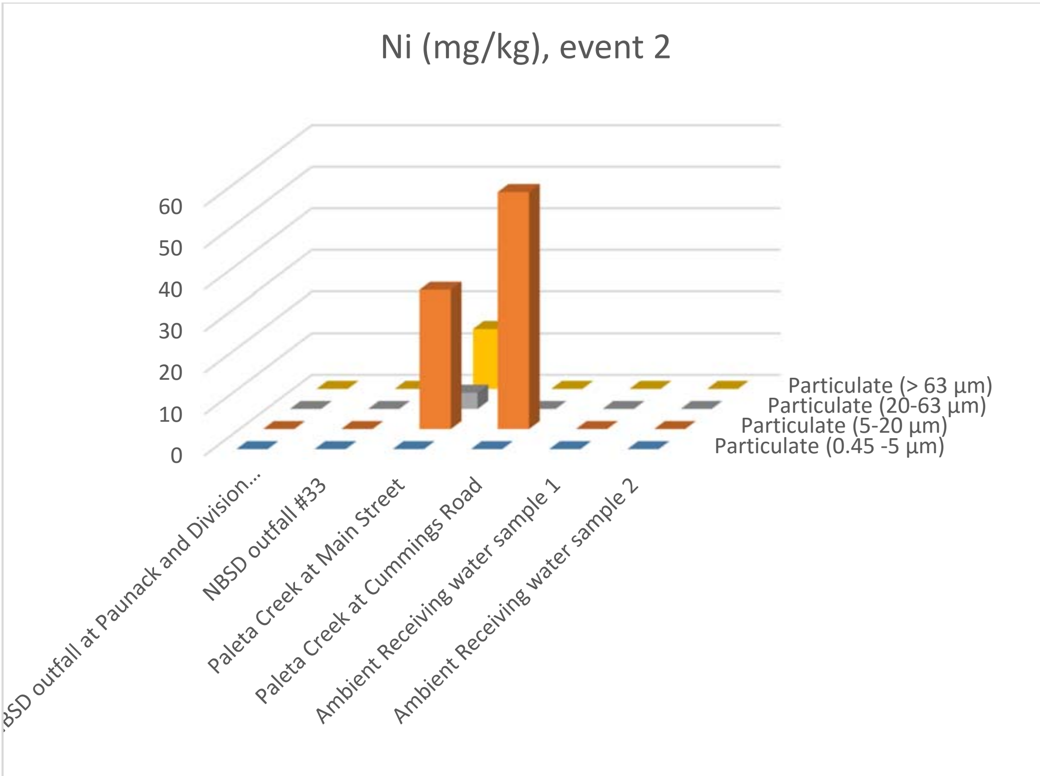
Ni (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	34.8	na*	na	nd	175	95.3	na	na	nd
Particulate (5-20 µm)	nd**	nd	14.5	13.6	22.1	nd	23.5	4.7	nd
Particulate (20-63 µm)	356	na	36.0	nd	37.8	nd	23.7	15.2	na
Particulate (> 63 µm)	526	597	10.2	1,080	195	78.4	nd	na	327

* SSC was not detected; particulate strength could not be calculated and assumed to be zero

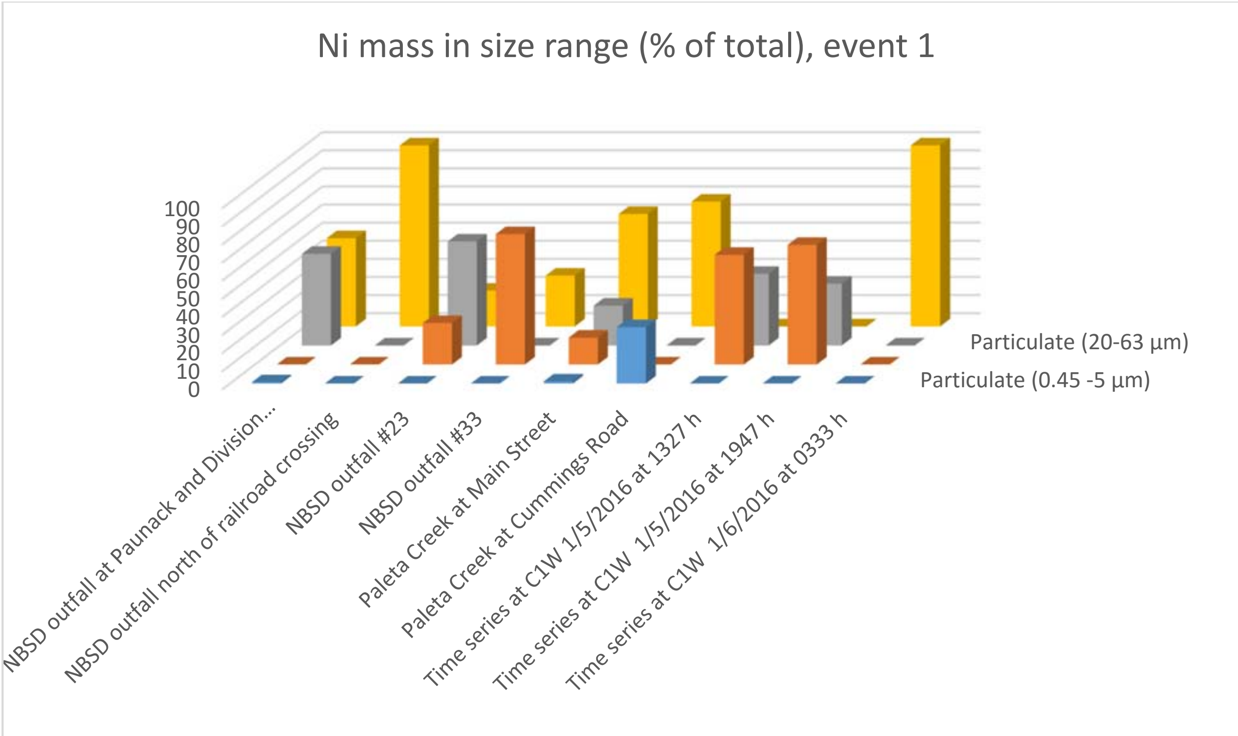
** not detected; particulate strength could not be calculated and assumed to be zero

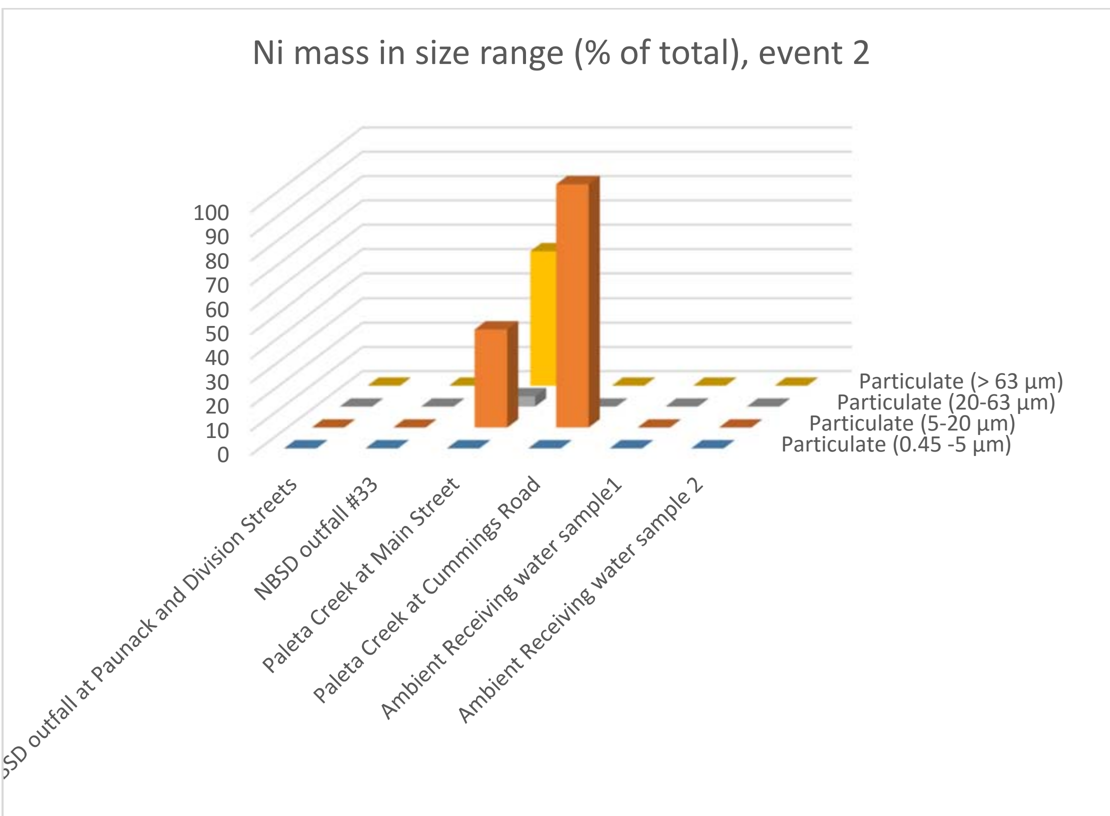
Ni (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	nd	nd	na	0	na	nd
Particulate (5-20 µm)	nd	nd	33.4	56.9	nd	nd
Particulate (20-63 µm)	nd	nd	3.9	nd	nd	nd
Particulate (> 63 µm)	nd	nd	14.4	nd	nd	nd

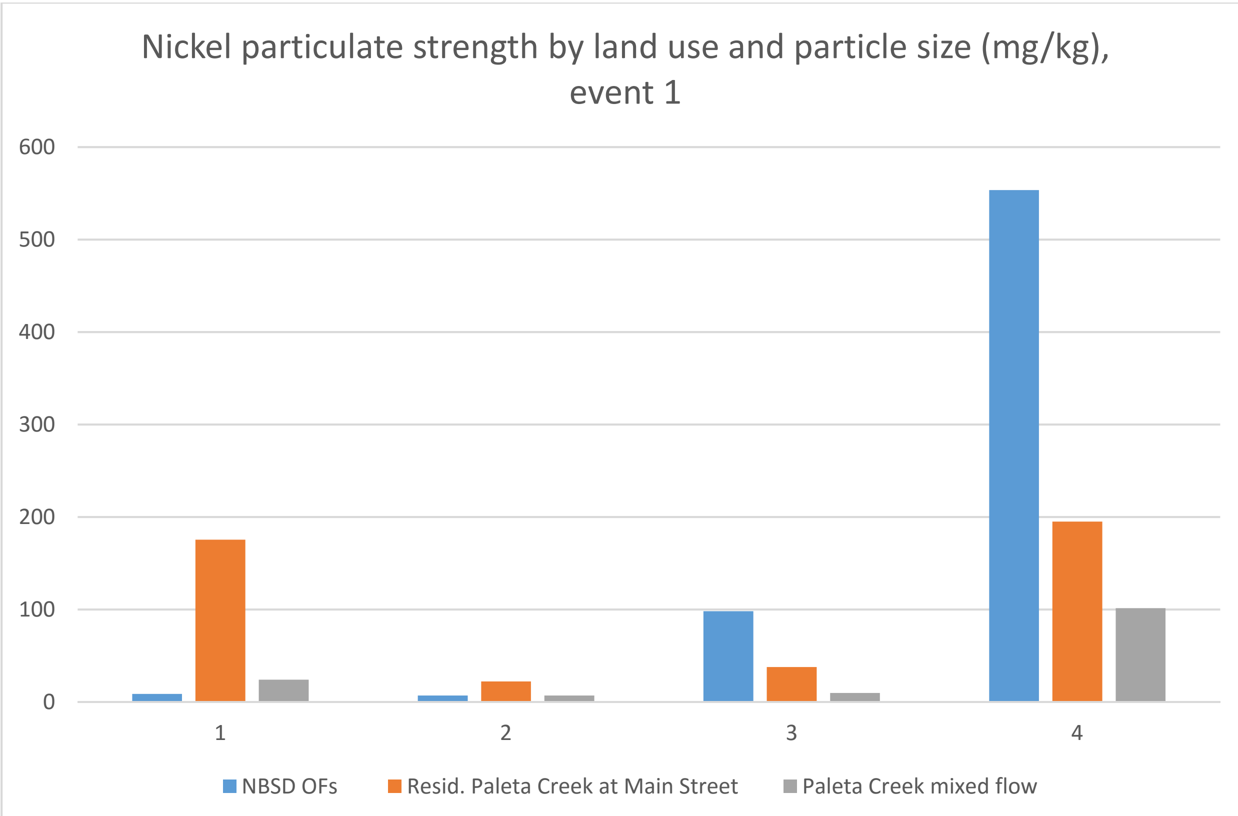


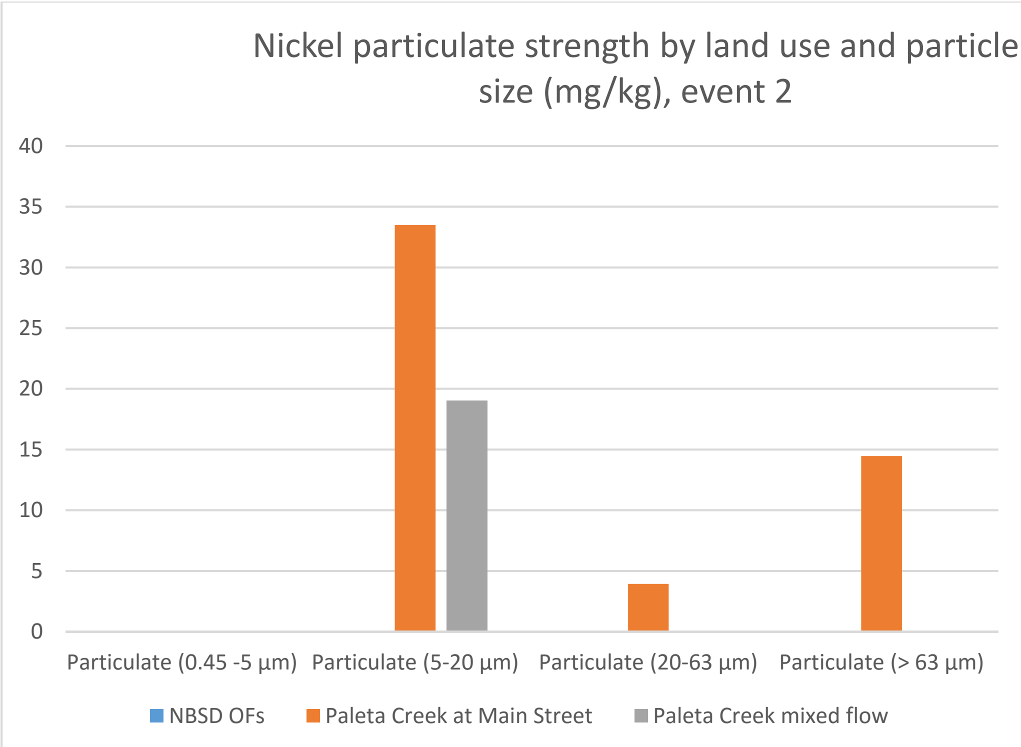


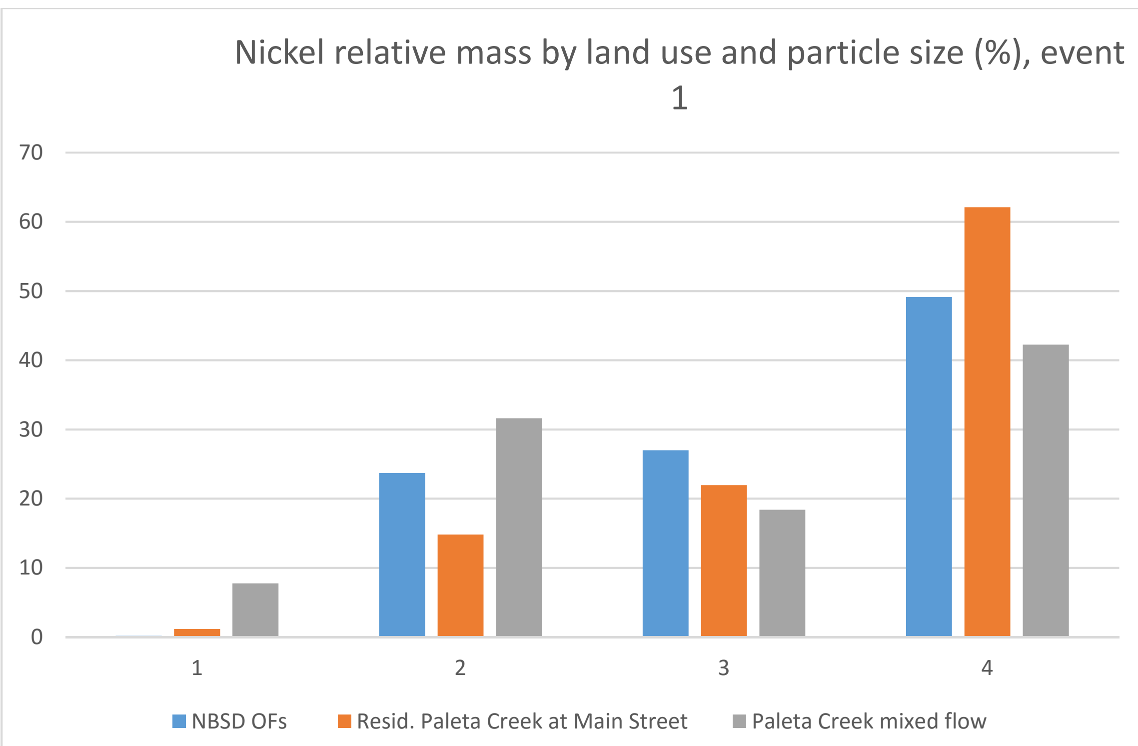
Ni (mg/kg), event 2
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
BSD outfall at Paunack and Division...
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

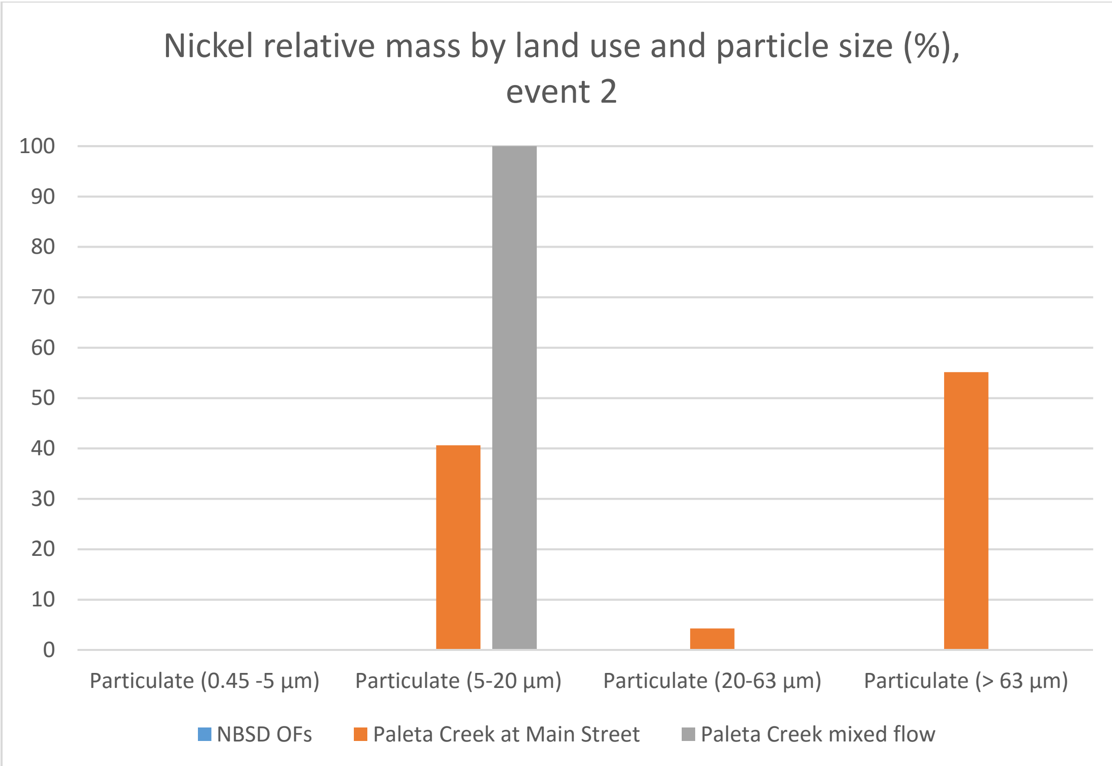

Ni mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h


Ni mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
SD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample1
Ambient Receiving water sample 2


Nickel particulate strength by land use and particle size (mg/kg), event 1
600
500
400
300
200
100
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Nickel particulate strength by land use and particle size (mg/kg), event 2
40
35
30
25
20
15
10
5
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Nickel relative mass by land use and particle size (%), event 1
70
60
50
40
30
20
10
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow



Nickel relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

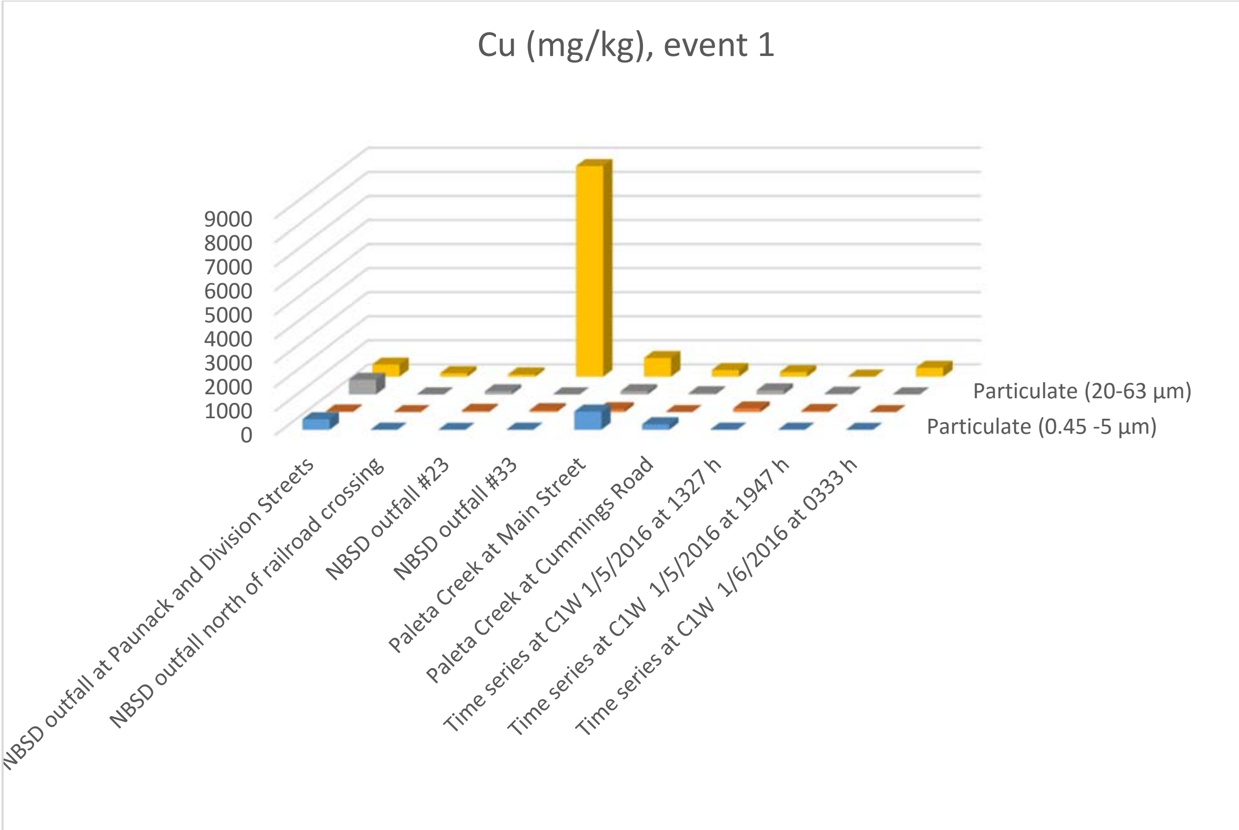
Copper

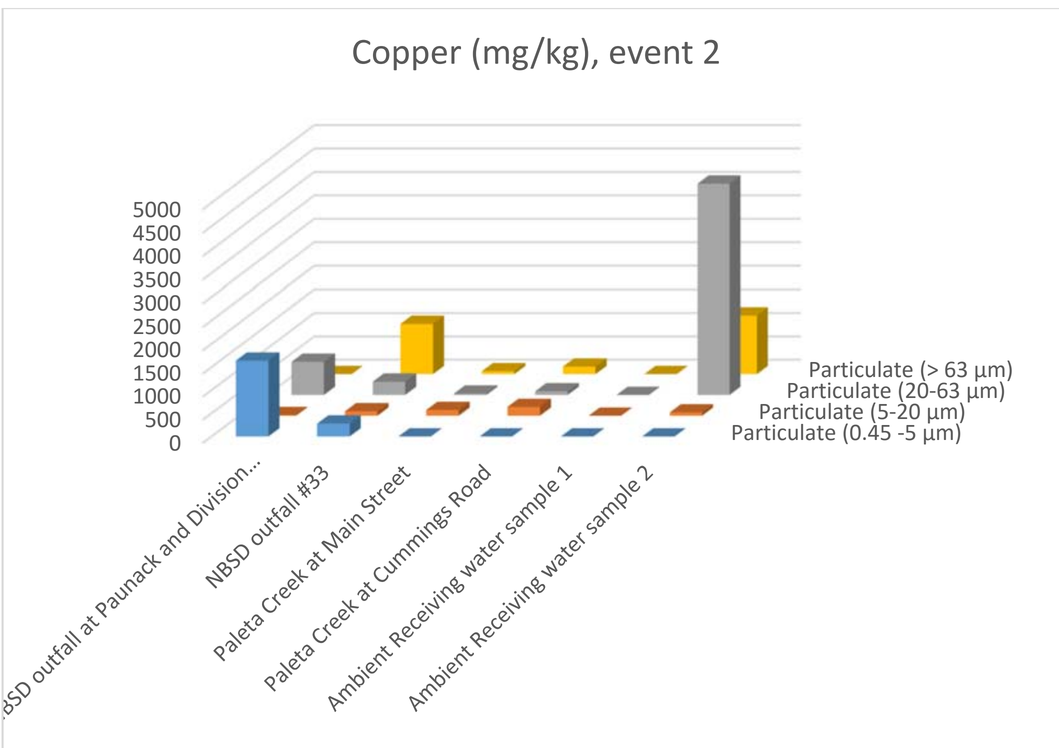
Cu (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	436	na	na	1.2	752	226	na	na	nd
Particulate (5-20 µm)	28.5	nd	55.7	76.0	116	nd	154	46.4	nd
Particulate (20-63 µm)	608	na	128	nd	136	47.8	168	31.7	na
Particulate (> 63 µm)	505	146	96.6	8,751	773	278	192	na	370

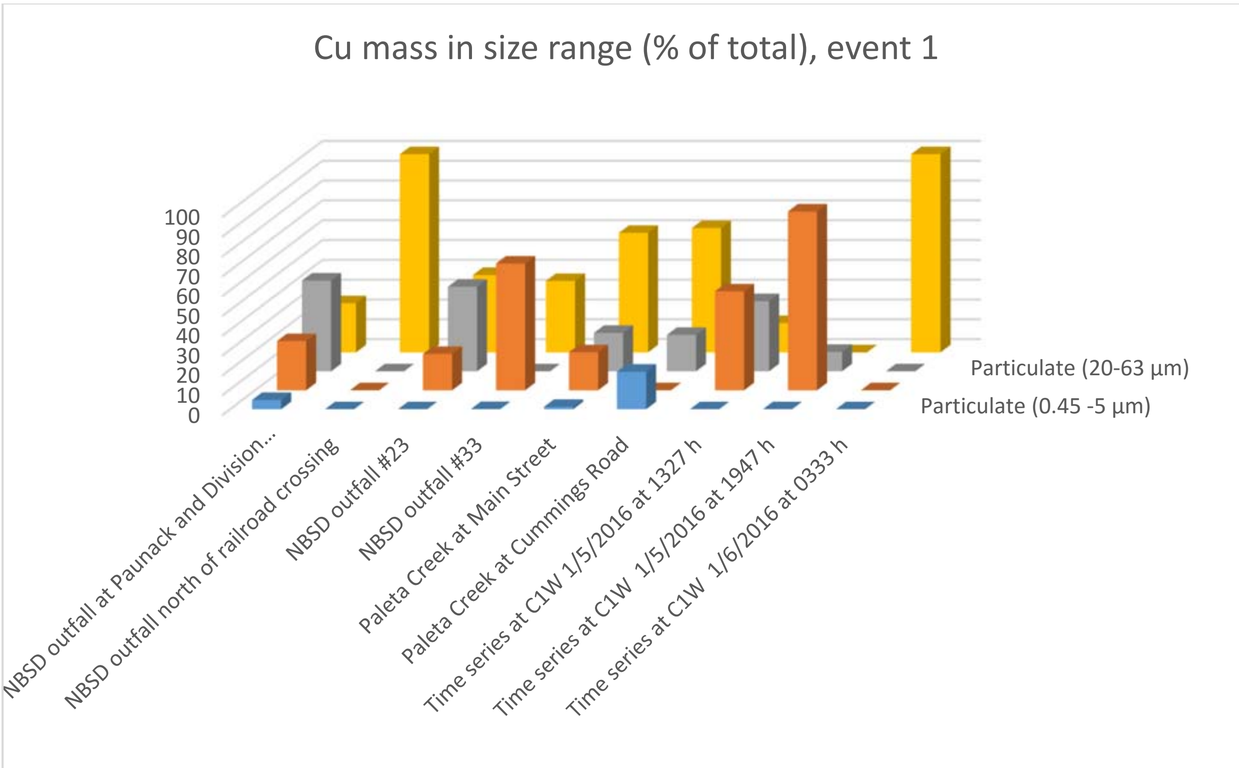
* SSC was not detected; particulate strength could not be calculated and assumed to be zero

** not detected; particulate strength could not be calculated and assumed to be zero

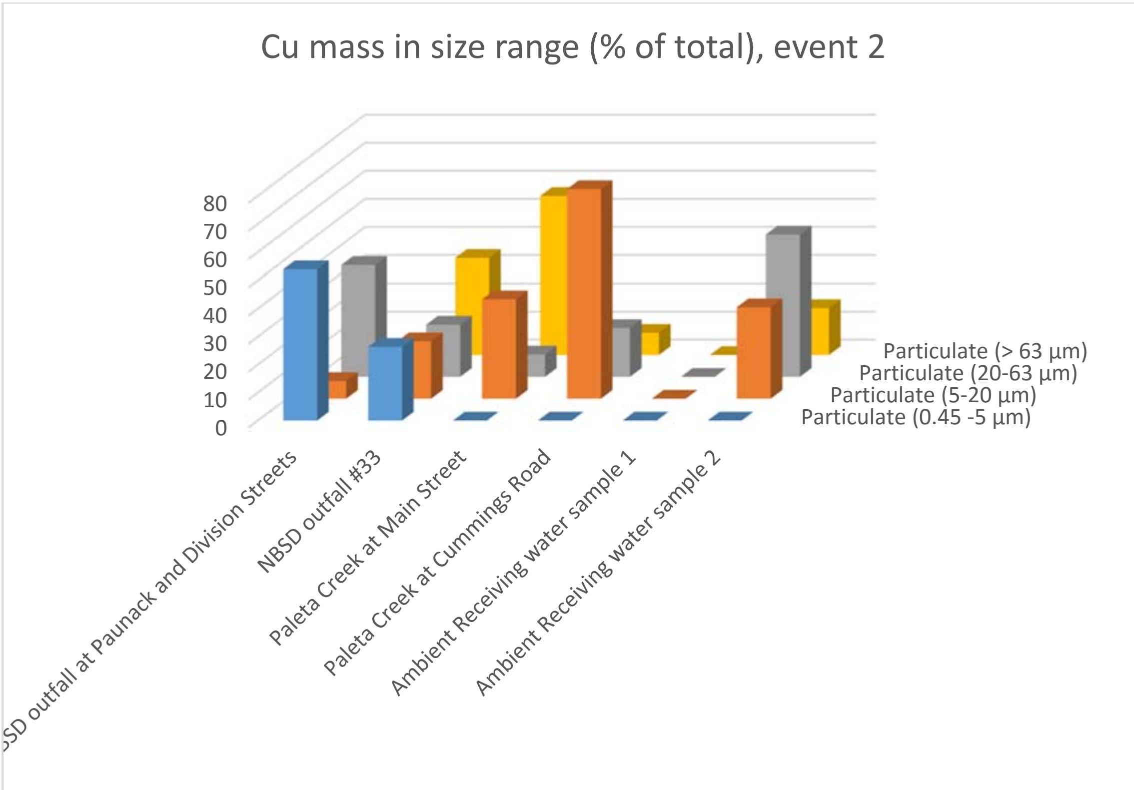
Cu (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	1,638	278	na	nd	na	nd
Particulate (5-20 µm)	12.0	94.3	122	189	nd	73.3
Particulate (20-63 µm)	714	286	30.9	78.3	nd	4,510
Particulate (> 63 µm)	nd	1,081	62.1	164	nd	1,259

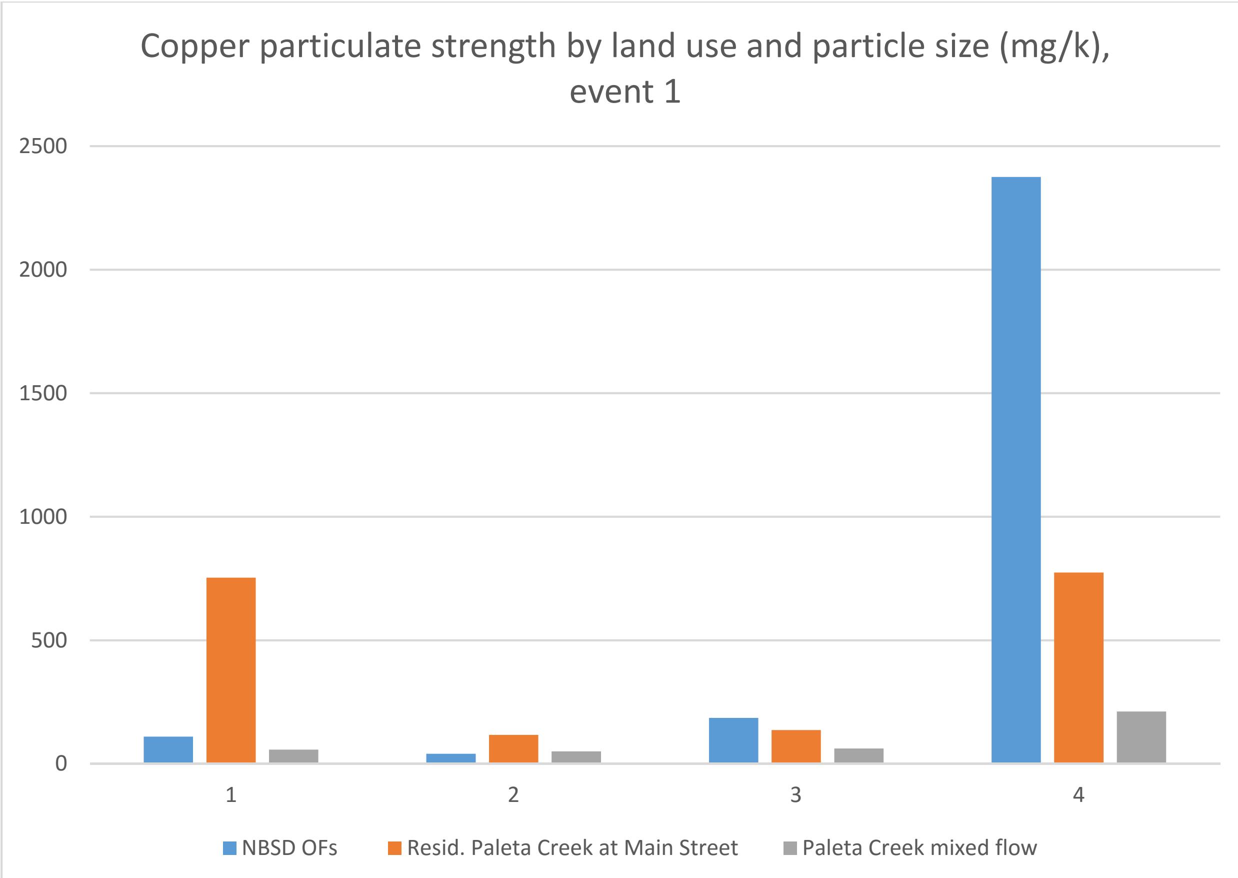

Cu (mg/kg), event 1
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h

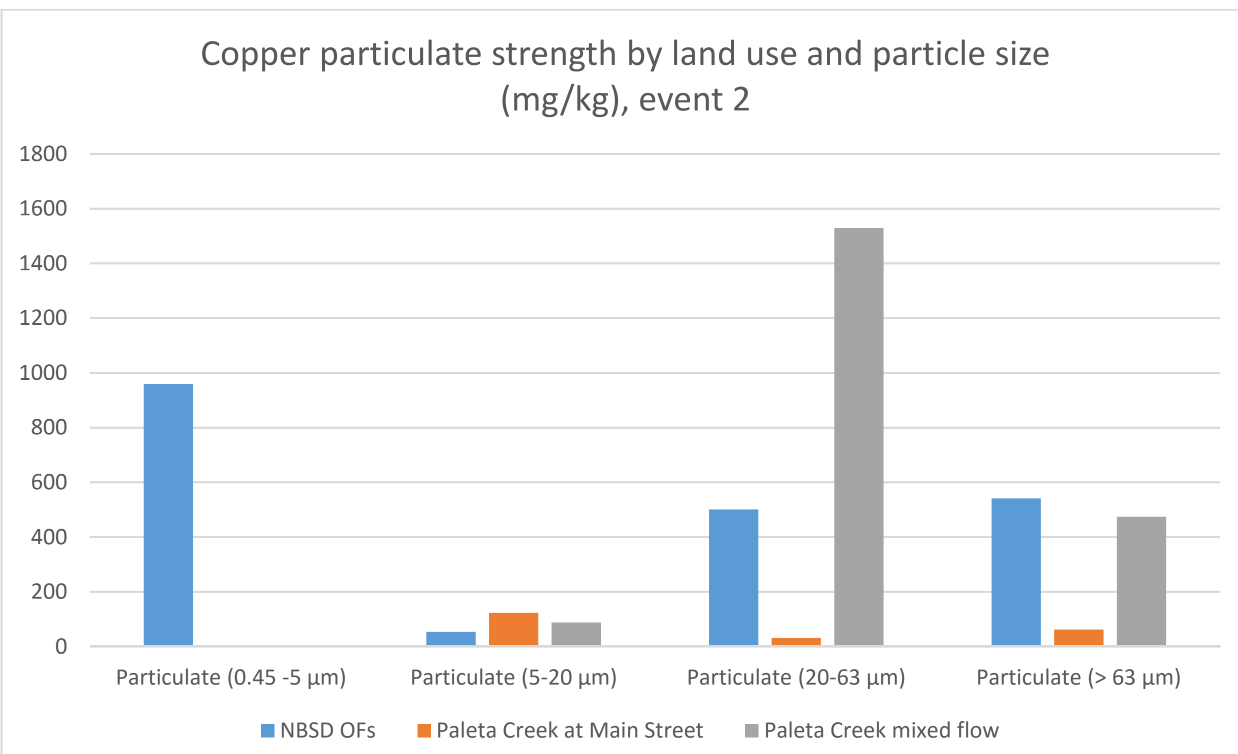

Copper (mg/kg), event 2
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division...
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

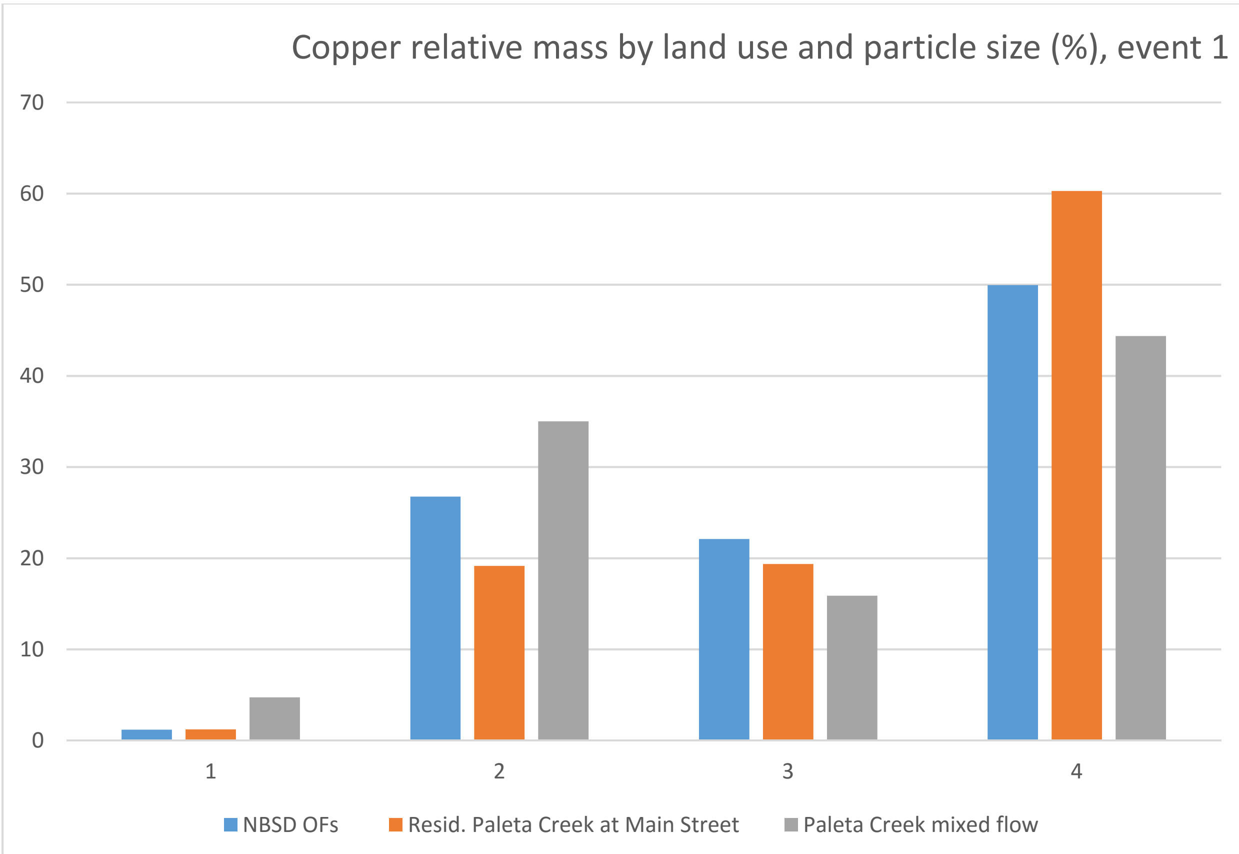


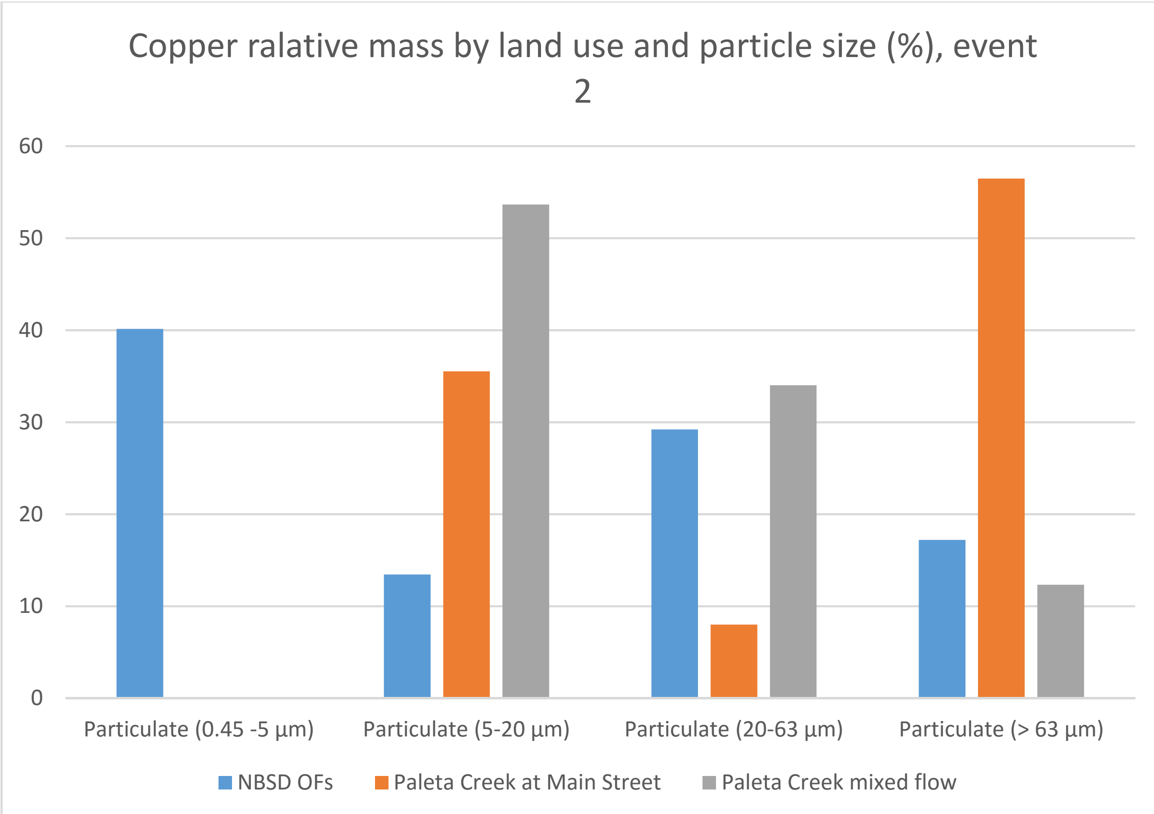
Cu mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h


Cu mass in size range (% of total), event 2
80
70
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
SSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Copper particulate strength by land use and particle size (mg/k), event 1
2500
2000
1500
1000
500
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Copper particulate strength by land use and particle size (mg/kg), event 2
1800
1600
1400
1200
1000
800
600
400
200
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

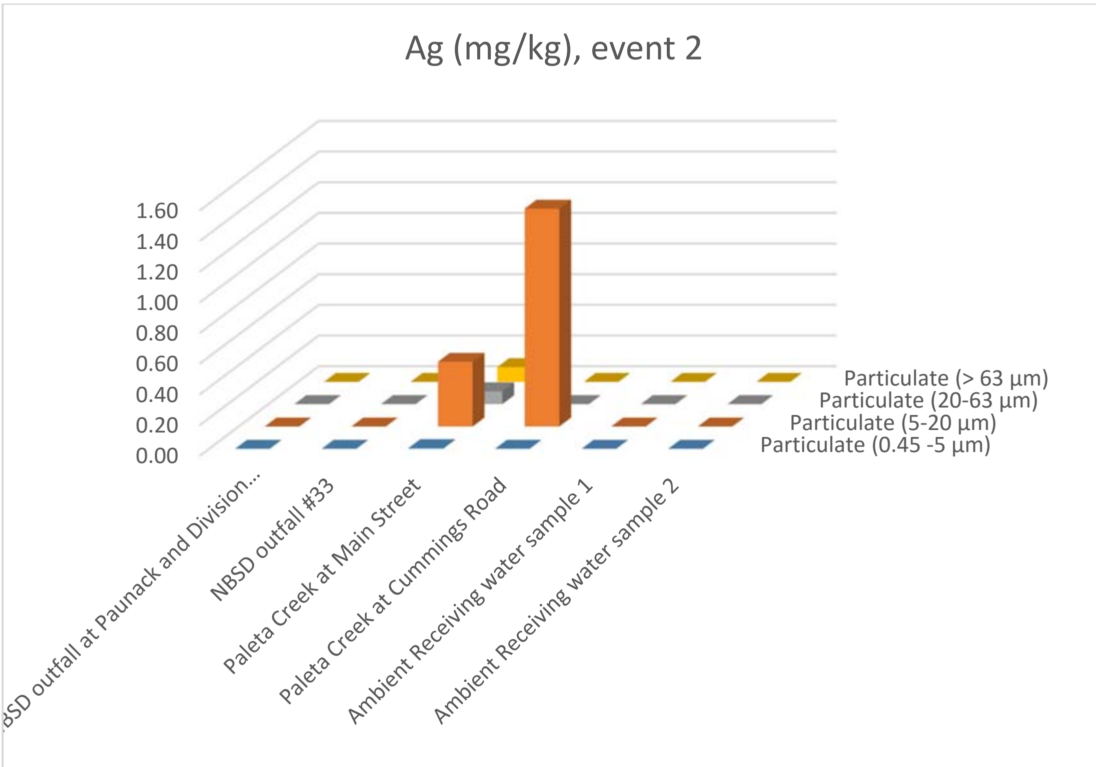

Copper relative mass by land use and particle size (%), event 1
70
60
50
40
30
20
10
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow

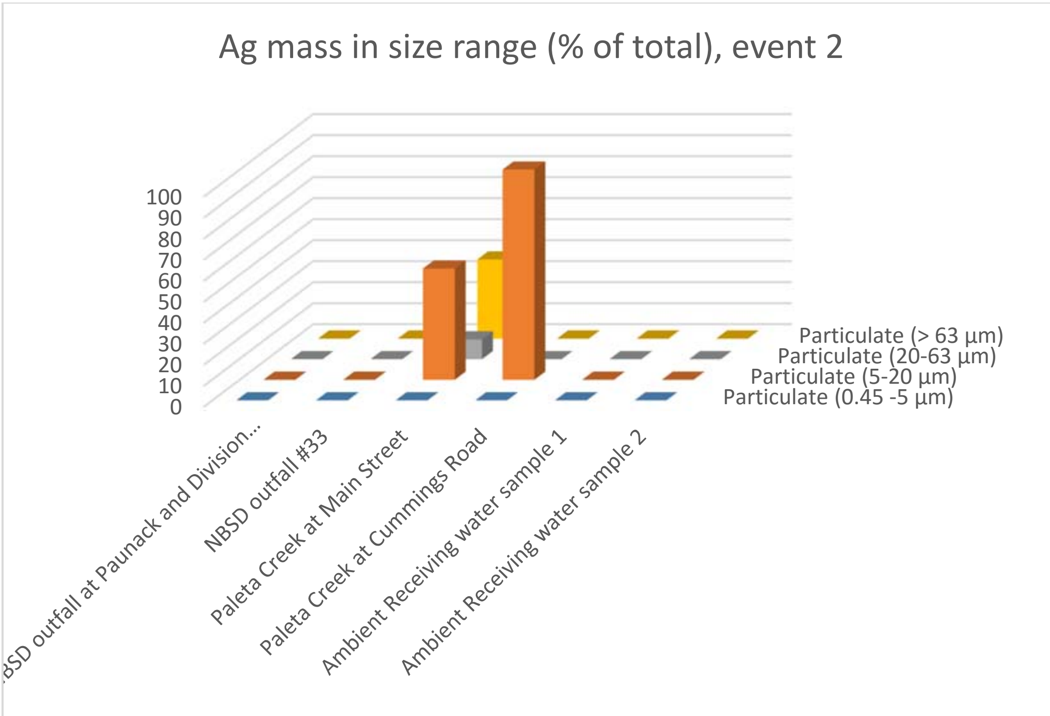

Copper ralative mass by land use and particle size (%), event 2
60
50
40
30
20
10
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

Silver

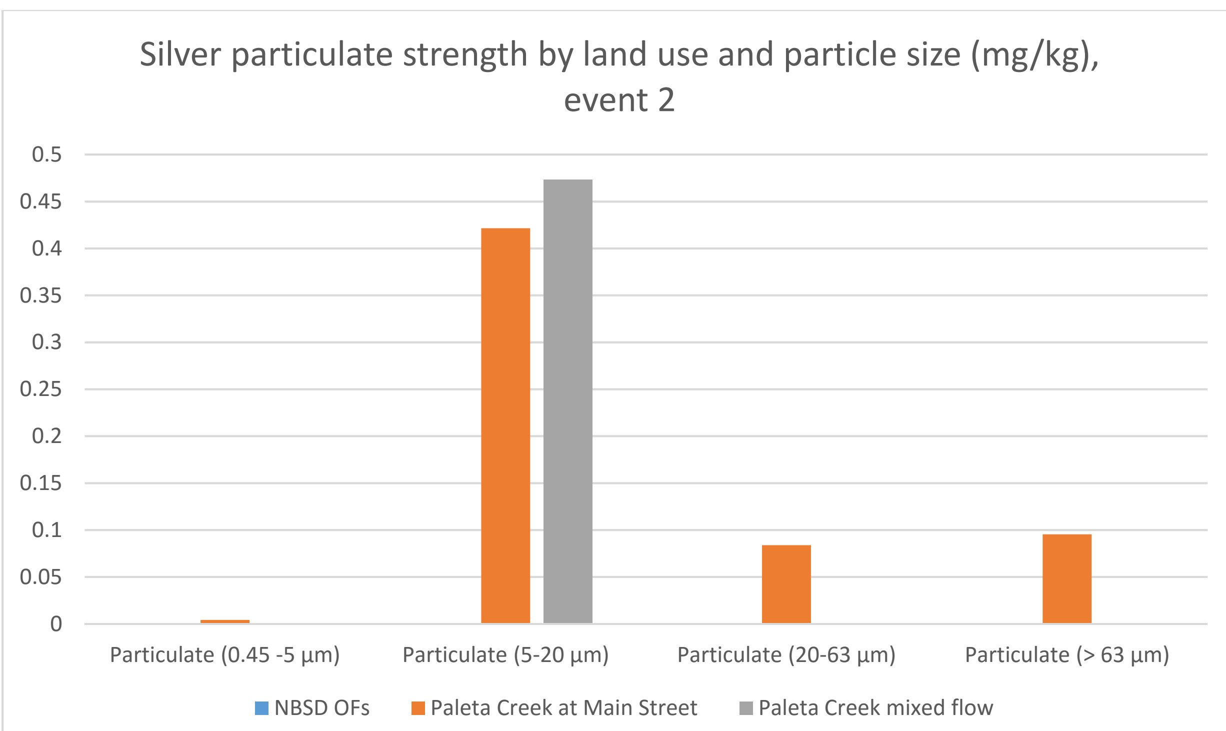
Ag (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	nd	nd	na*	nd	na	nd
Particulate (5-20 µm)	nd	nd	0.4	1.4	nd	nd
Particulate (20-63 µm)	nd	nd	0.1	nd	nd	nd
Particulate (> 63 µm)	nd	nd	0.1	nd	nd	nd

* SSC was not detected; particulate strength could not be calculated and assumed to be zero
** not detected; particulate strength could not be calculated and assumed to be zero

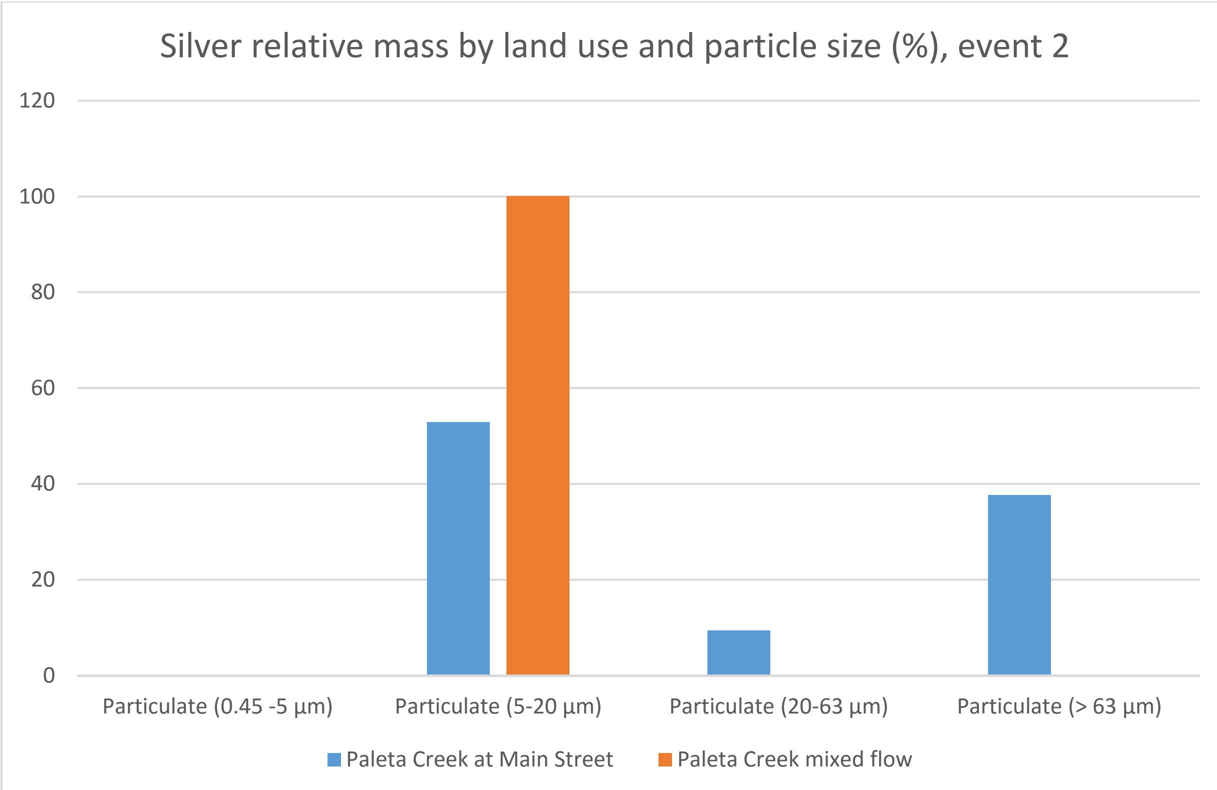




Ag mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
BSD outfall at Paunack and Division...
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2



Silver particulate strength by land use and particle size (mg/kg), event 2
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Silver relative mass by land use and particle size (%), event 2
120
100
80
60
40
20
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
Paleta Creek at Main Street
Paleta Creek mixed flow

Arsenic

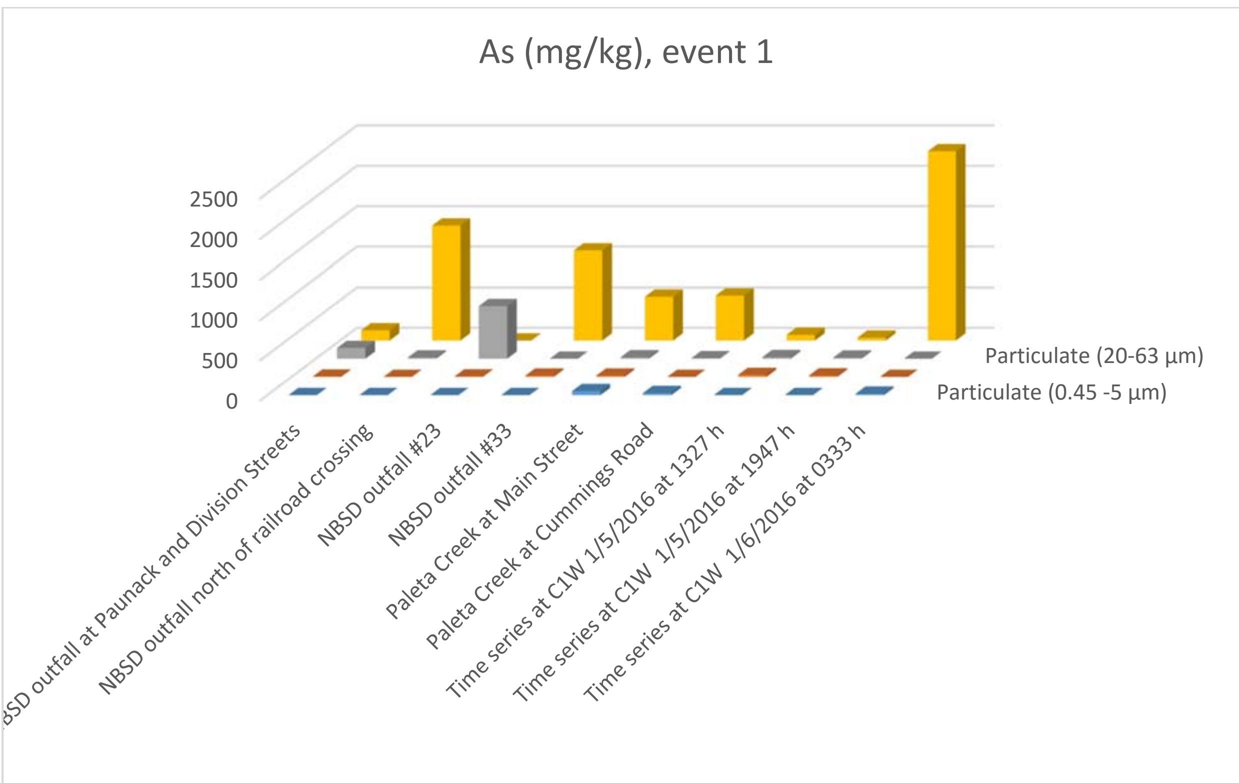
As (mg/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	nd	na*	na	nd	50.4	25.6	na	na	17.8
Particulate (5-20 µm)	5.2	1.3	6.2	16.9	16.9	nd	24.7	17.8	nd
Particulate (20-63 µm)	134	na	655	nd	18.0	7.3	19.6	13.8	na
Particulate (> 63 µm)	128	1,418	nd	1,111	544	559	71.5	na	2,338

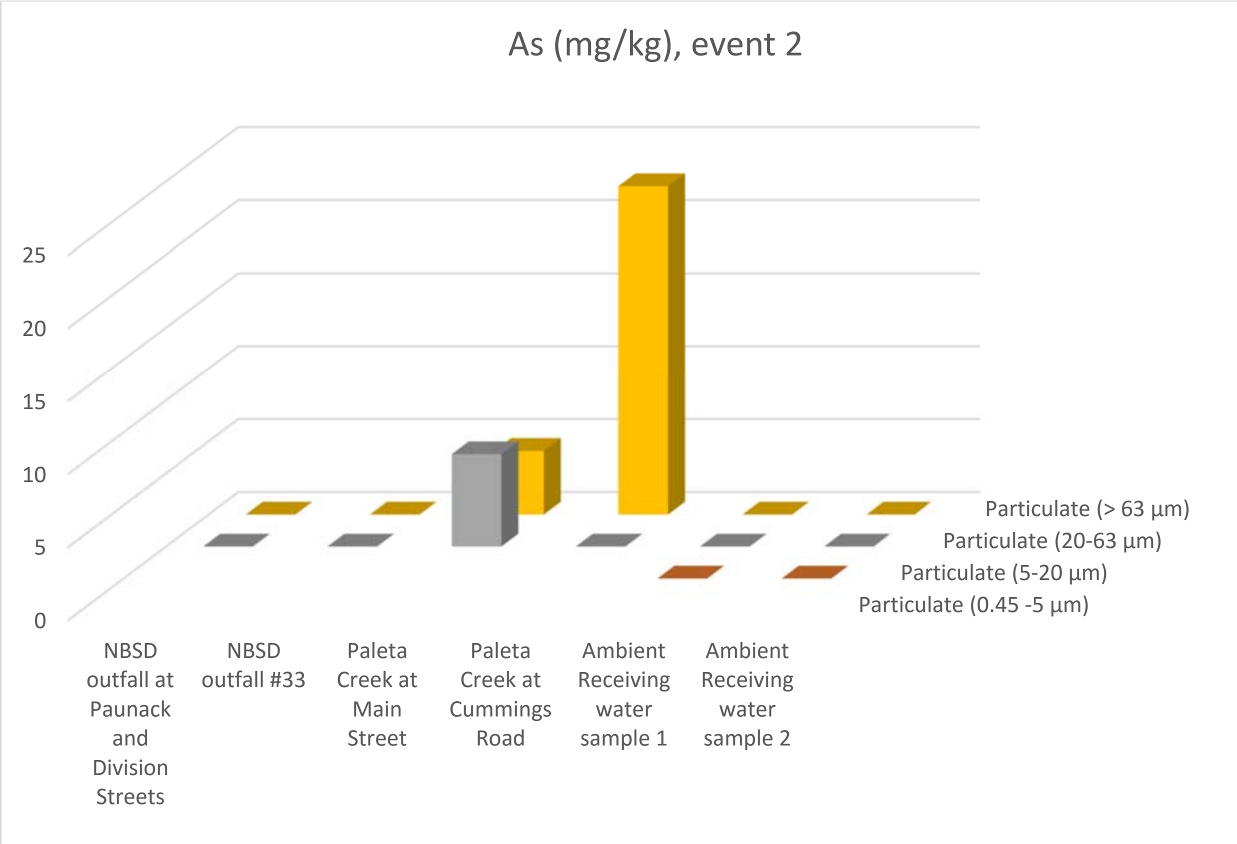
* SSC was not detected; particulate strength could not be calculated and assumed to be zero

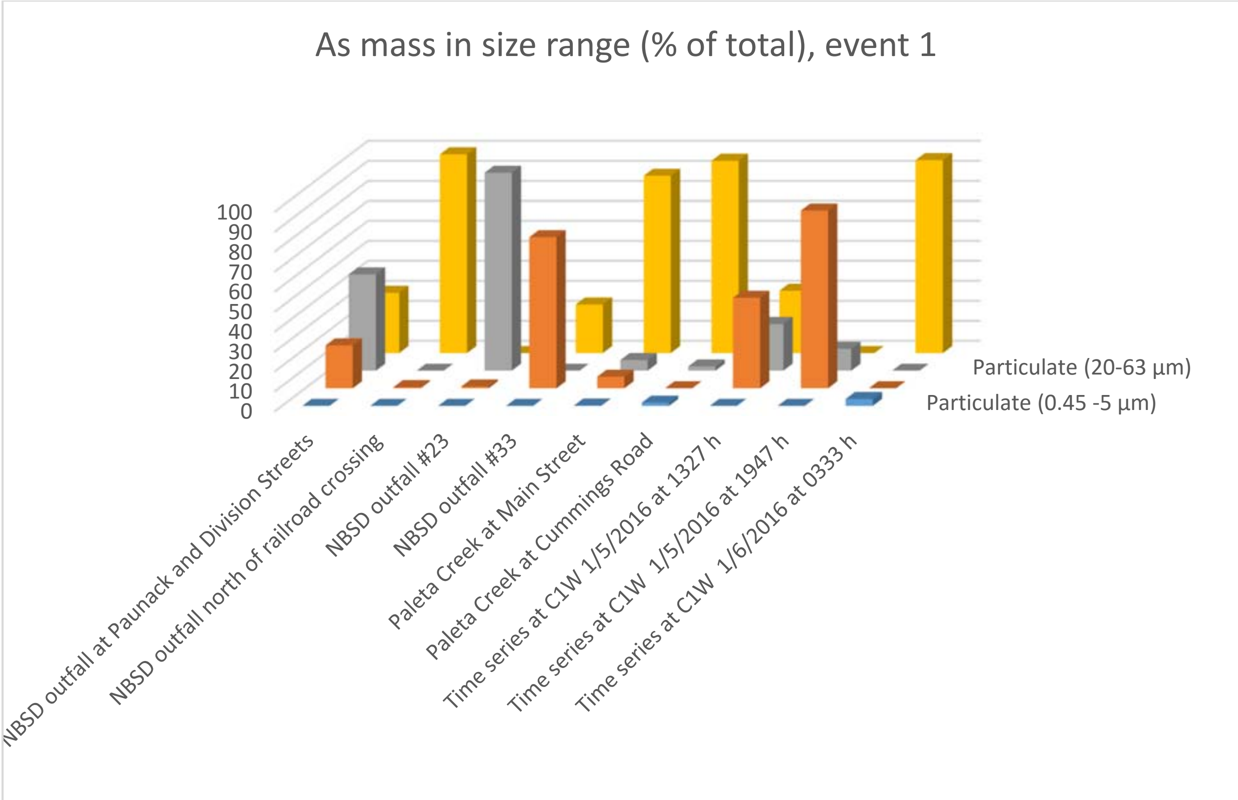
** not detected; particulate strength could not be calculated and assumed to be zero

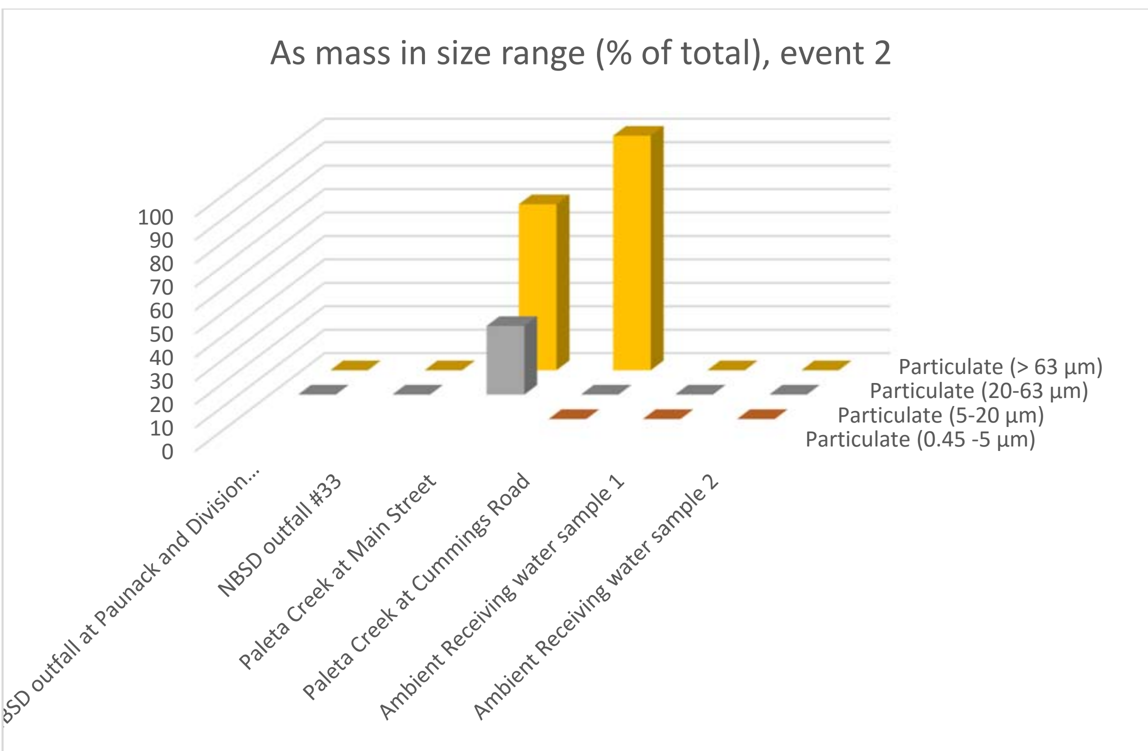
As (mg/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)			na		na	
Particulate (5-20 µm)					nd	nd
Particulate (20-63 µm)	nd	nd	6.3	nd	nd	nd
Particulate (> 63 µm)	nd	nd	4.3	22.4	nd	nd

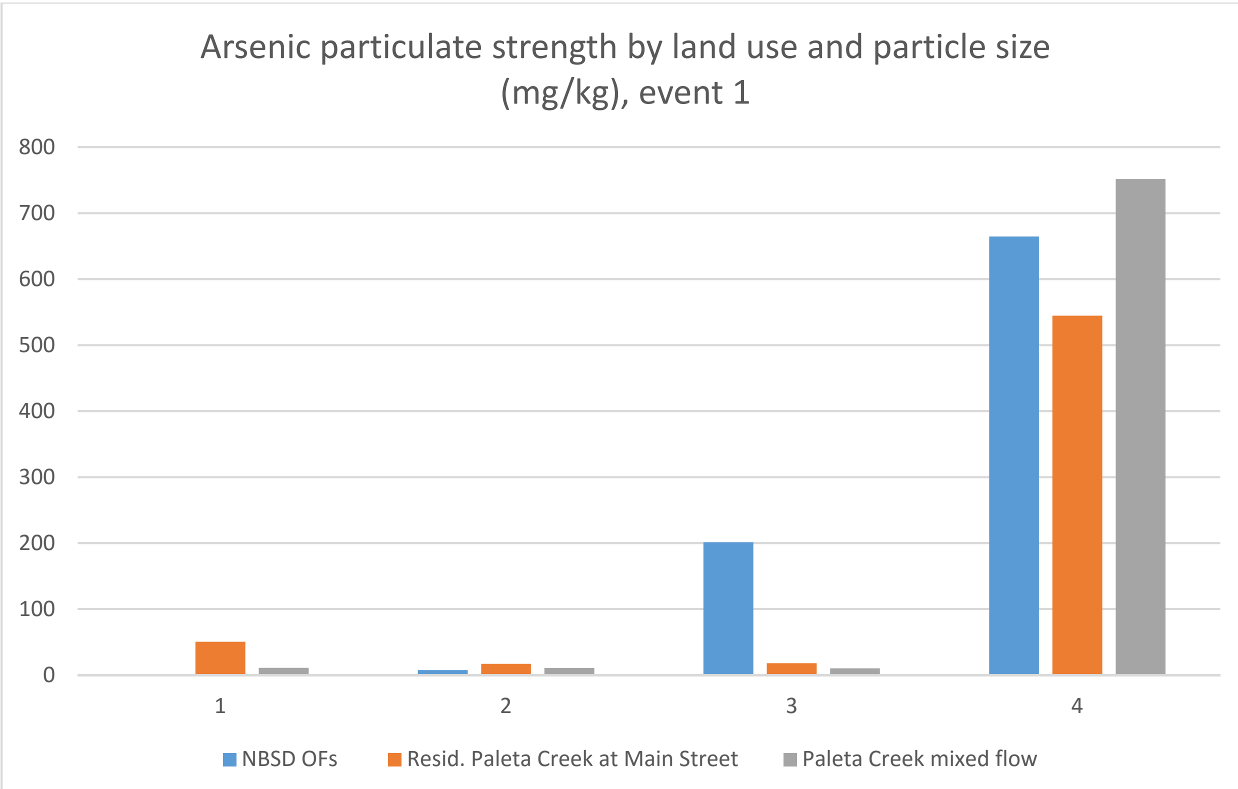
Blanks are missing data

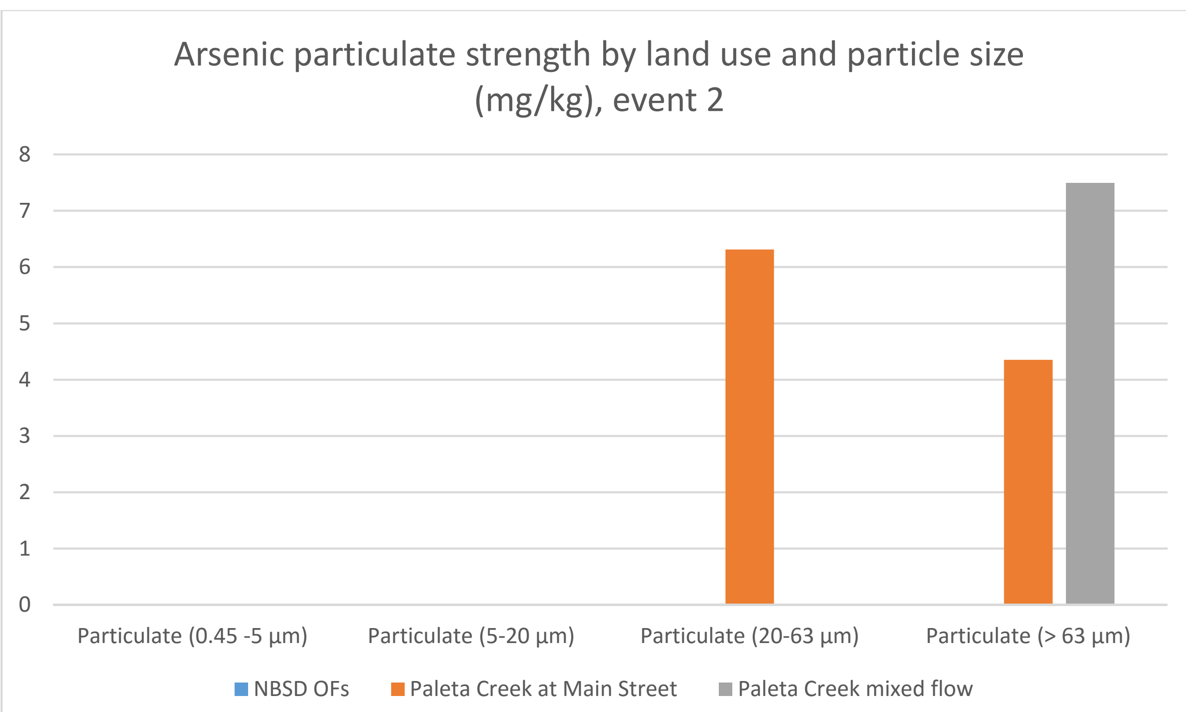


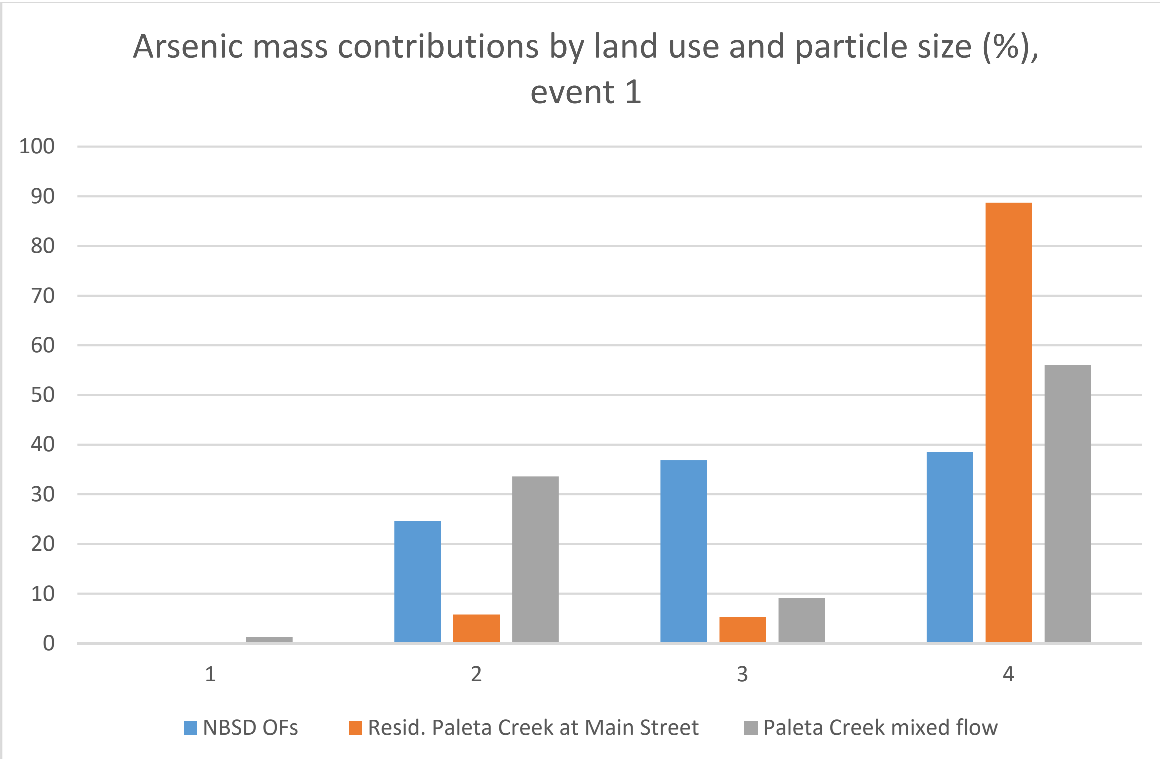

As (mg/kg), event 2
25
20
15
10
5
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

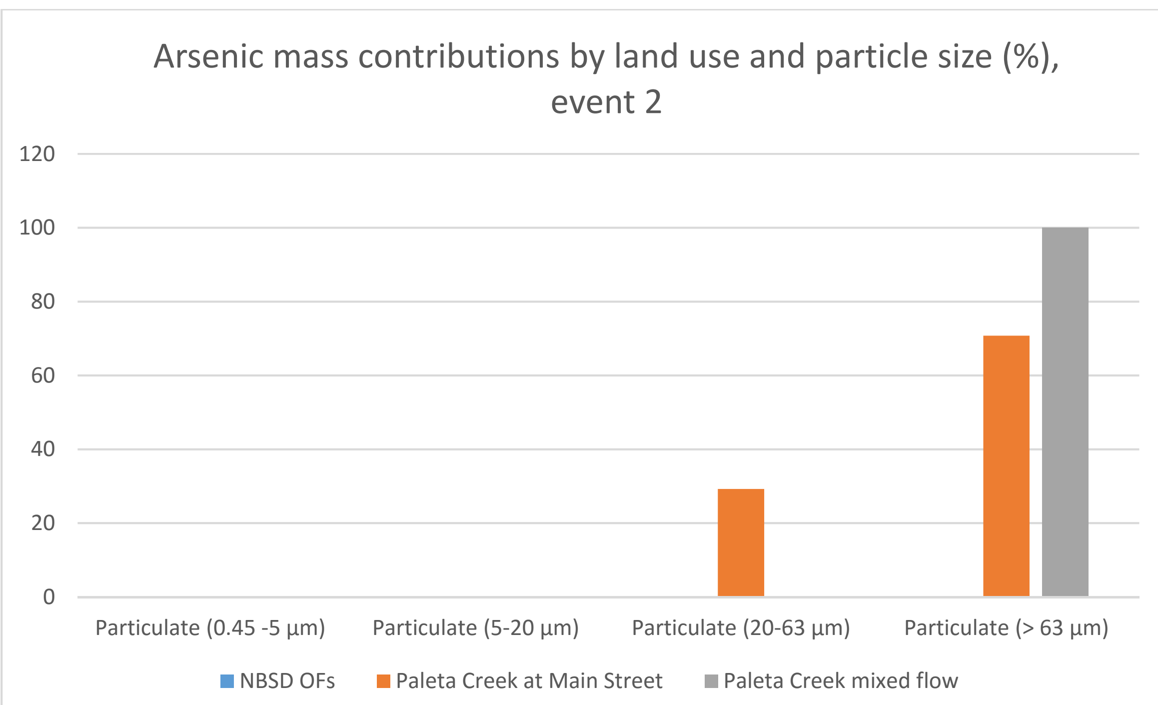

As mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h


As mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

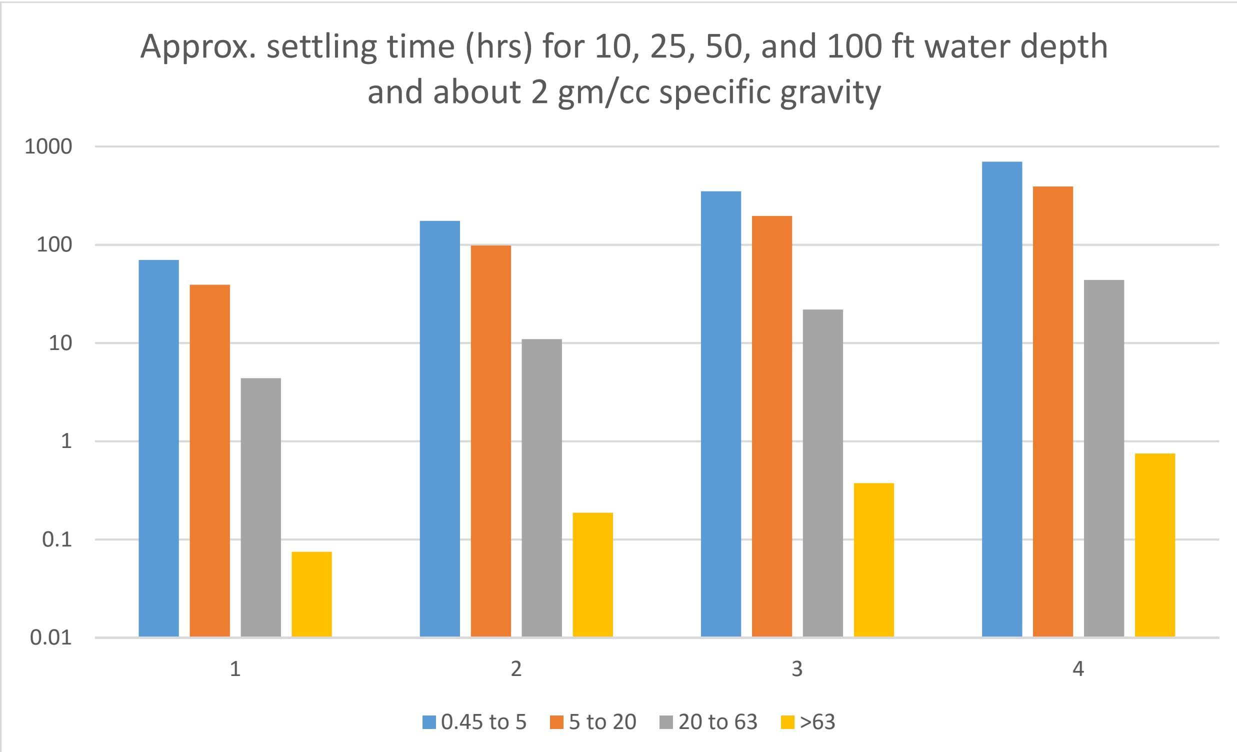

Arsenic particulate strength by land use and particle size (mg/kg), event 1
800
700
600
500
400
300
200
100
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Arsenic particulate strength by land use and particle size (mg/kg), event 2
8
7
6
5
4
3
2
1
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Arsenic mass contributions by land use and particle size (%), event 1
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow


Arsenic mass contributions by land use and particle size (%), event 2
120
100
80
60
40
20
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

Settling Rates



TOC

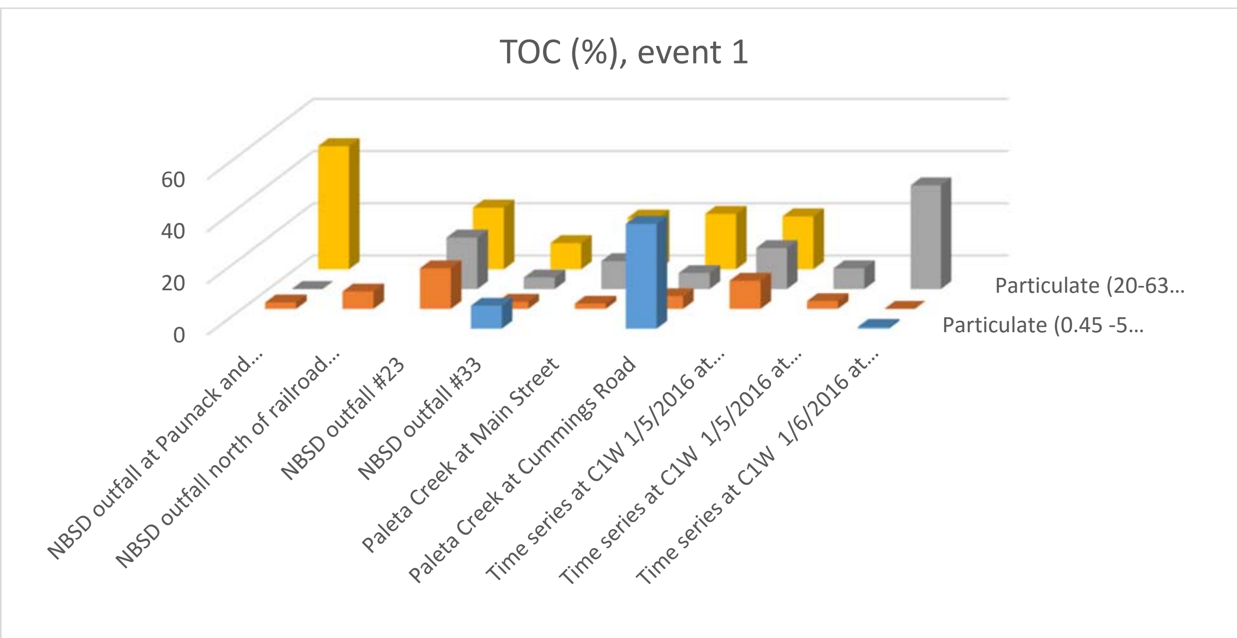
TOC (%), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)		na*	na	8.8		40.5	na	na	0.7
Particulate (5-20 µm)	2.4	6.7	15.7	2.7	2.0	4.9	10.9	3.0	nd
Particulate (20-63 µm)	nd	na	19.9	4.4	10.9	6.2	15.9	8.1	na
Particulate (> 63 µm)	47.2		23.6	10.0	19.8	21.3	20.3	na	

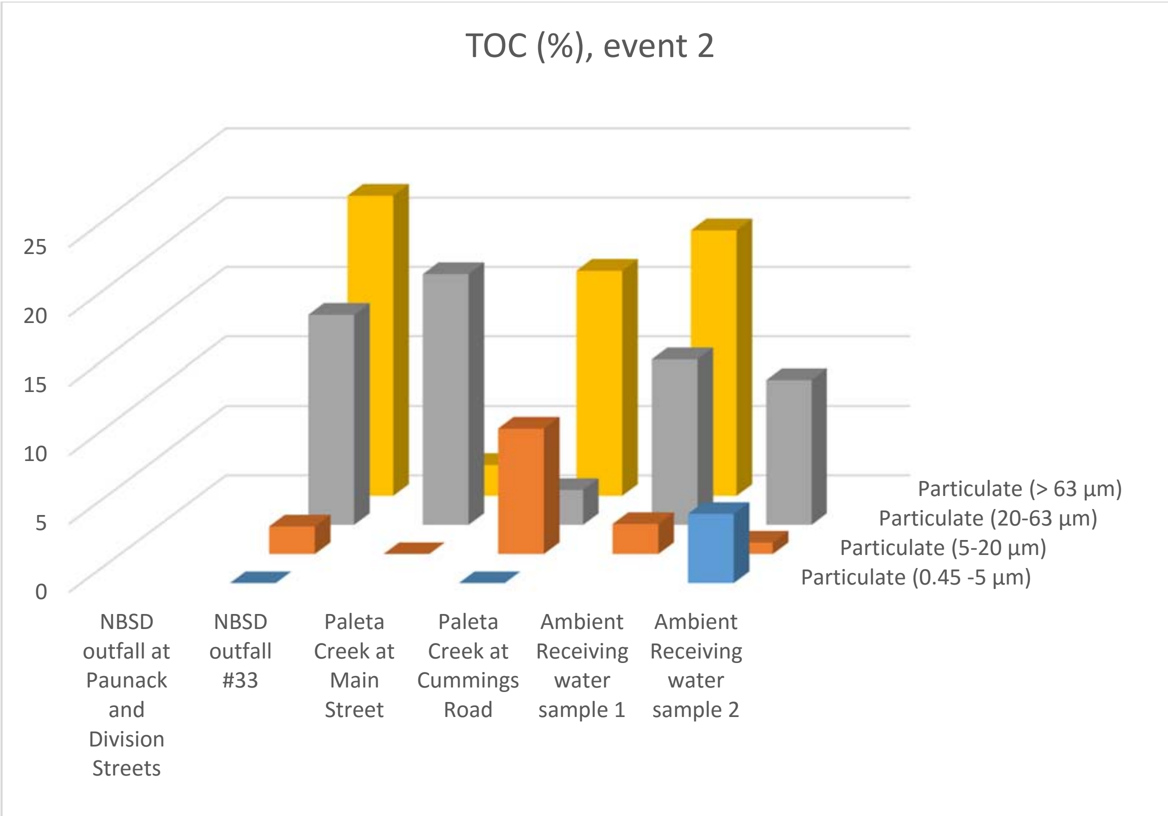
* SSC was not detected; particulate strength could not be calculated and assumed to be zero

** not detected; particulate strength could not be calculated and assumed to be zero

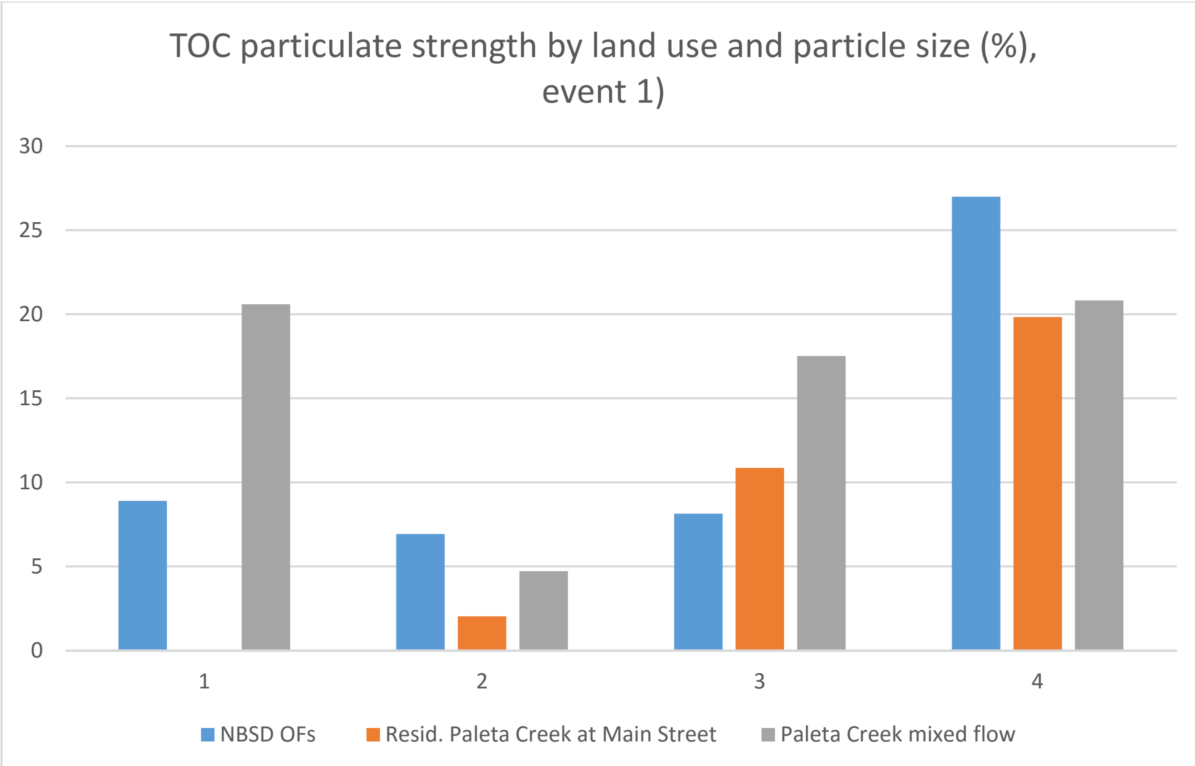
TOC (%), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)		nd	na	nd	na	5.1
Particulate (5-20 µm)		2.0	nd	9.1	2.2	0.8
Particulate (20-63 µm)		15.2	18.1	2.6	12.0	10.5
Particulate (> 63 µm)		21.6	2.2	16.2	19.1	

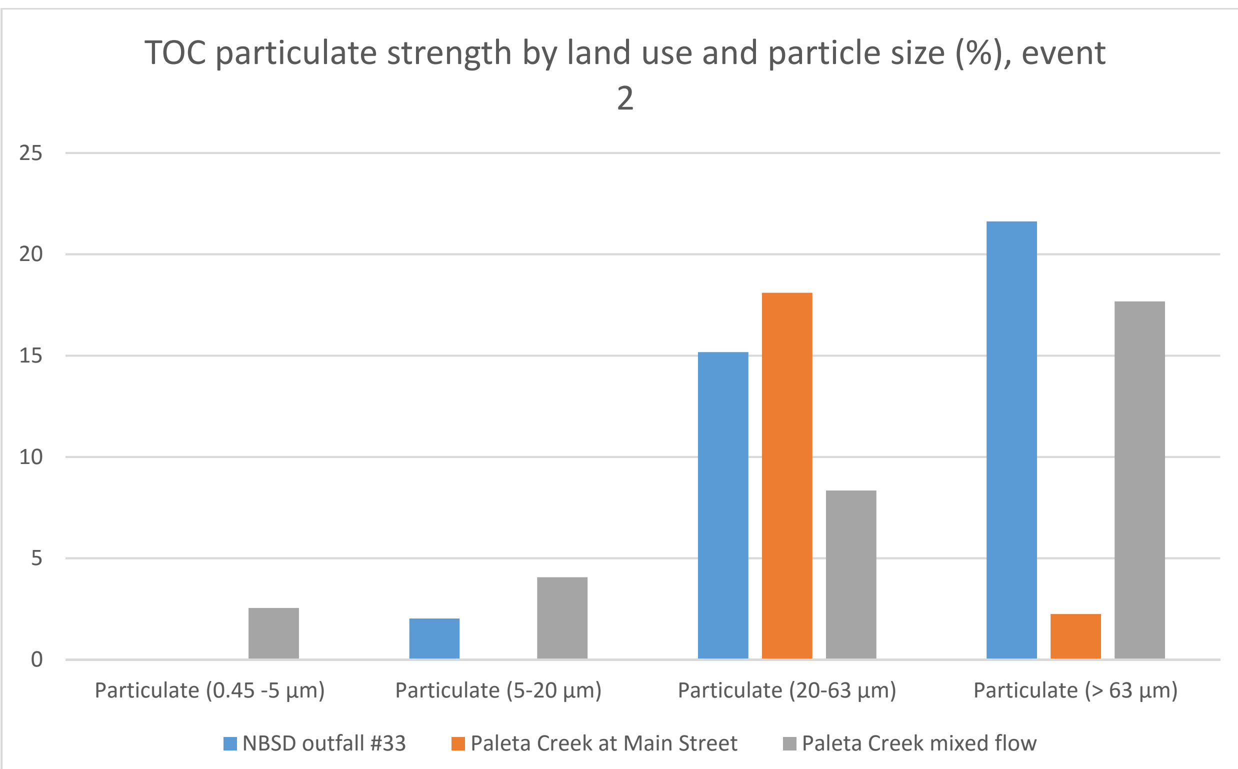
Blanks are missing data





TOC (%), event 2
0
5
10
15
20
25
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


TOC particulate strength by land use and particle size (%), event 1)
30
25
20
15
10
5
0
1
2
3
4
NBSD OFs
Resid. Paleta Creek at Main Street
Paleta Creek mixed flow

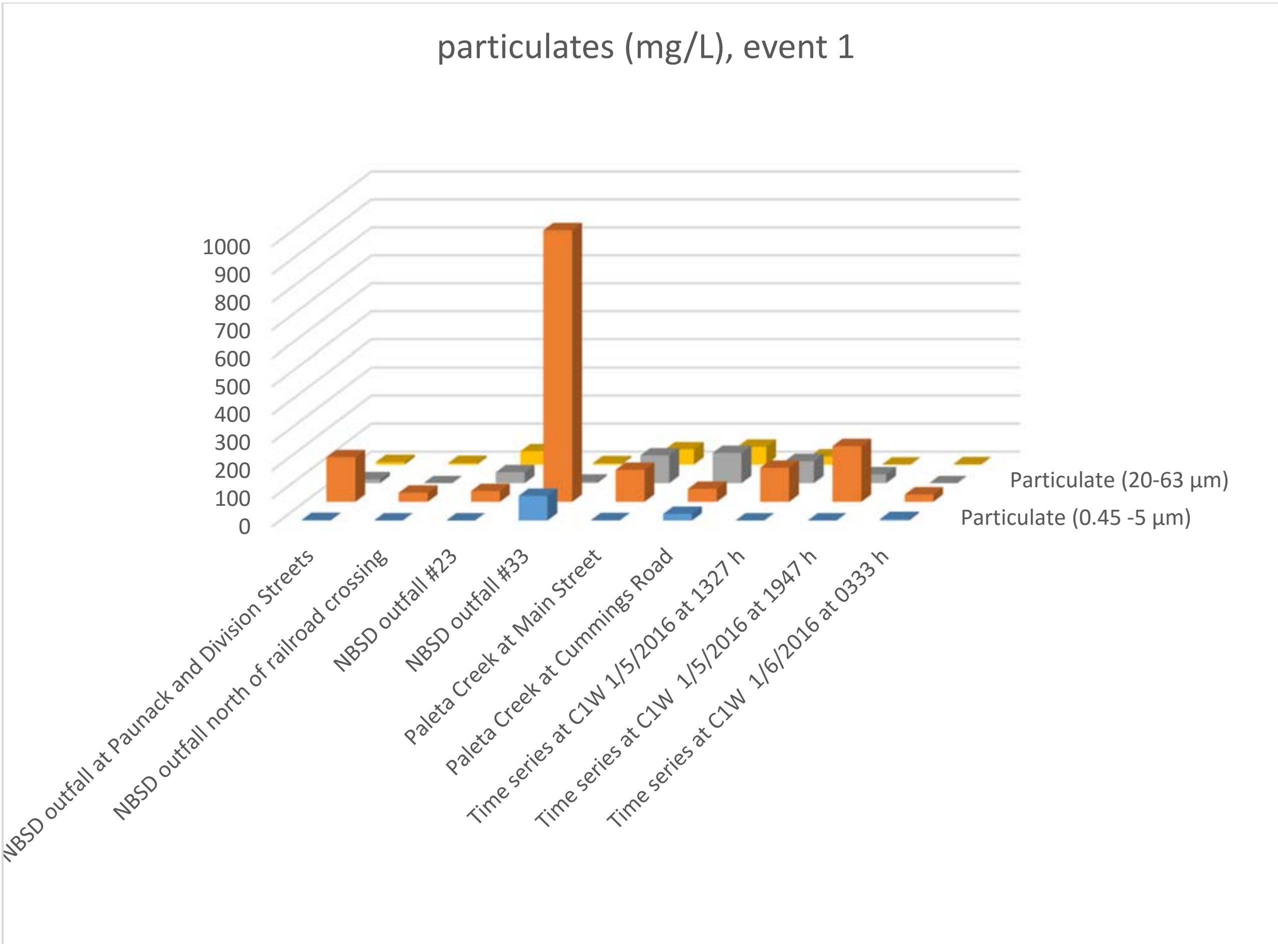

TOC particulate strength by land use and particle size (%), event 2
25
20
15
10
5
0
Particulate (0.45 -5 µm)
Particulate (5-20 µm)
Particulate (20-63 µm)
Particulate (> 63 µm)
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek mixed flow

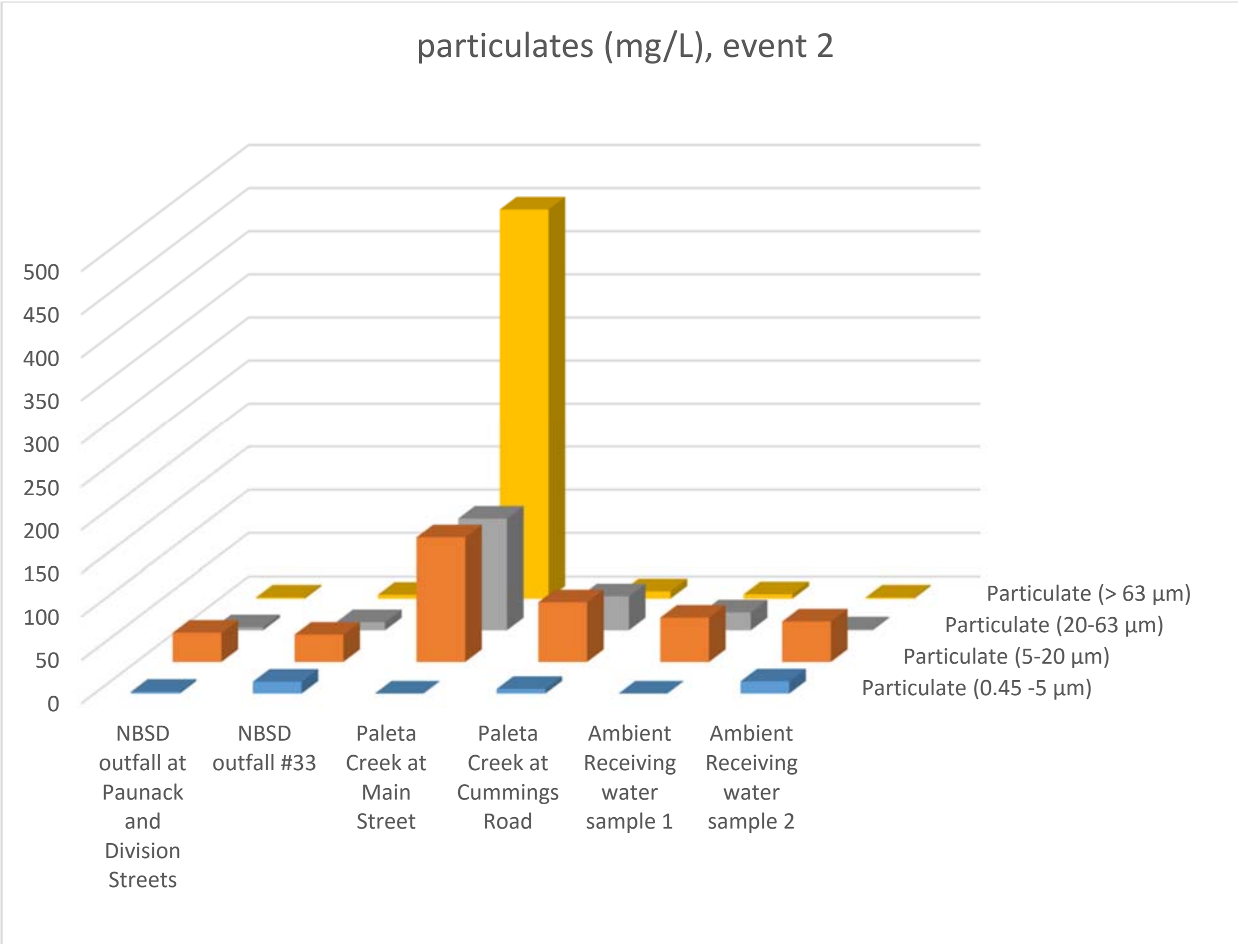
SSC (Suspended Sediment Concentration) and Particle Size Distribution

particulates (mg/L), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Time series at C1W 1/5/2016 at 1327 h	Time series at C1W 1/5/2016 at 1947 h	Time series at C1W 1/6/2016 at 0333 h
Particulate (0.45 -5 µm)	1.9	nd*	nd	87.8	1.1	23.5	nd	nd	5.4
Particulate (5-20 µm)	160	32	38.7	969	114	46.3	122	199	26.4
Particulate (20-63 µm)	14	nd	39.0	5.3	99.2	108	79.1	31.6	nd
Particulate (> 63 µm)	9	5.4	47.5	4.7	54.4	63.5	28.9	nd	1.2
total	184	37.8	125	1067	269	242	230	231	33.0

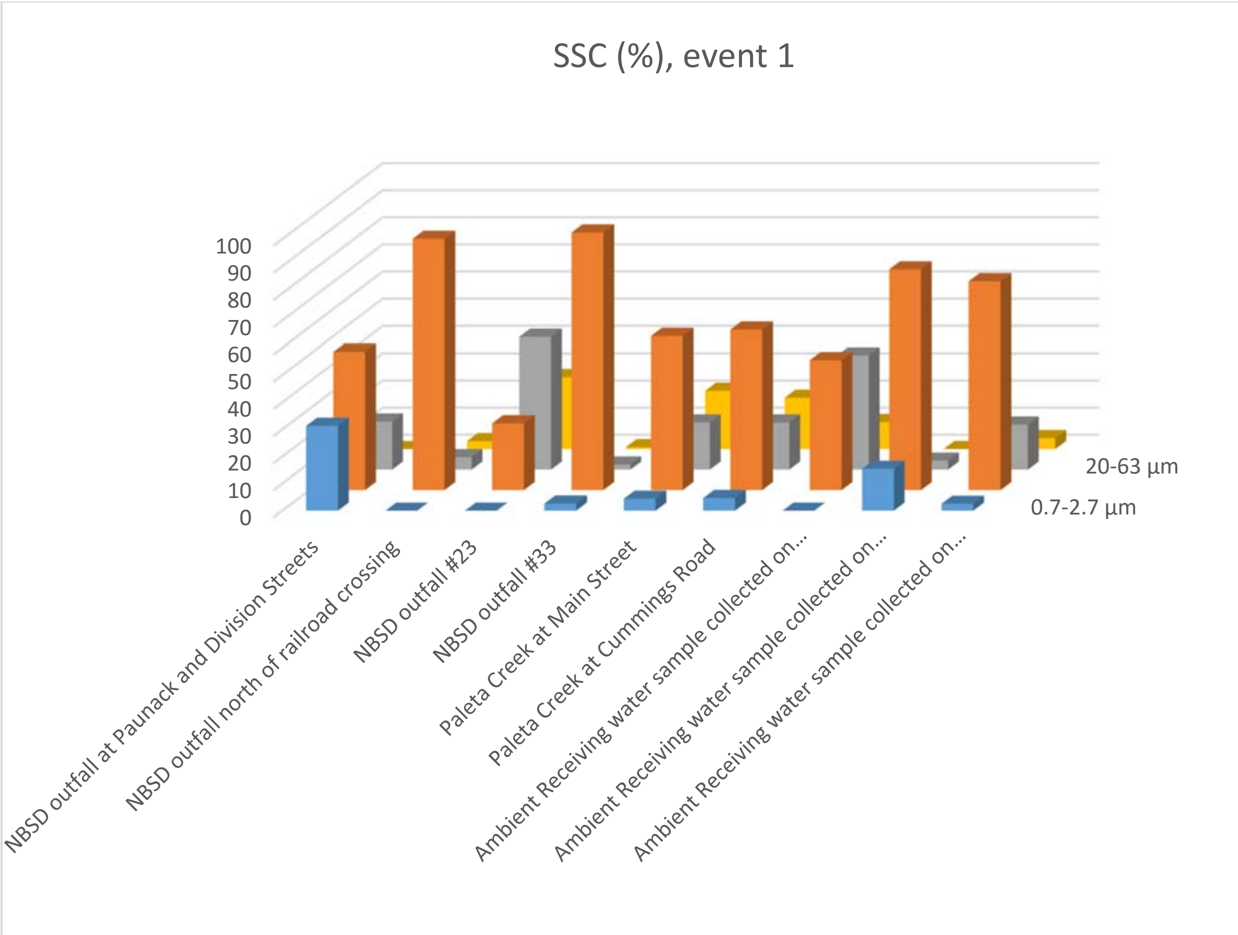
* SSC was not detected and assumed to be zero

particulates (mg/L), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
Particulate (0.45 -5 µm)	2.1	13.7	nd	5.4	nd	14.1
Particulate (5-20 µm)	33.7	31.6	143	68.9	51.1	46.6
Particulate (20-63 µm)	3.5	9.4	128	39.1	20.8	1.2
Particulate (> 63 µm)	1.5	4.6	451	8.5	5.2	1.4
total	40.8	59.4	723	122	77.1	63.3

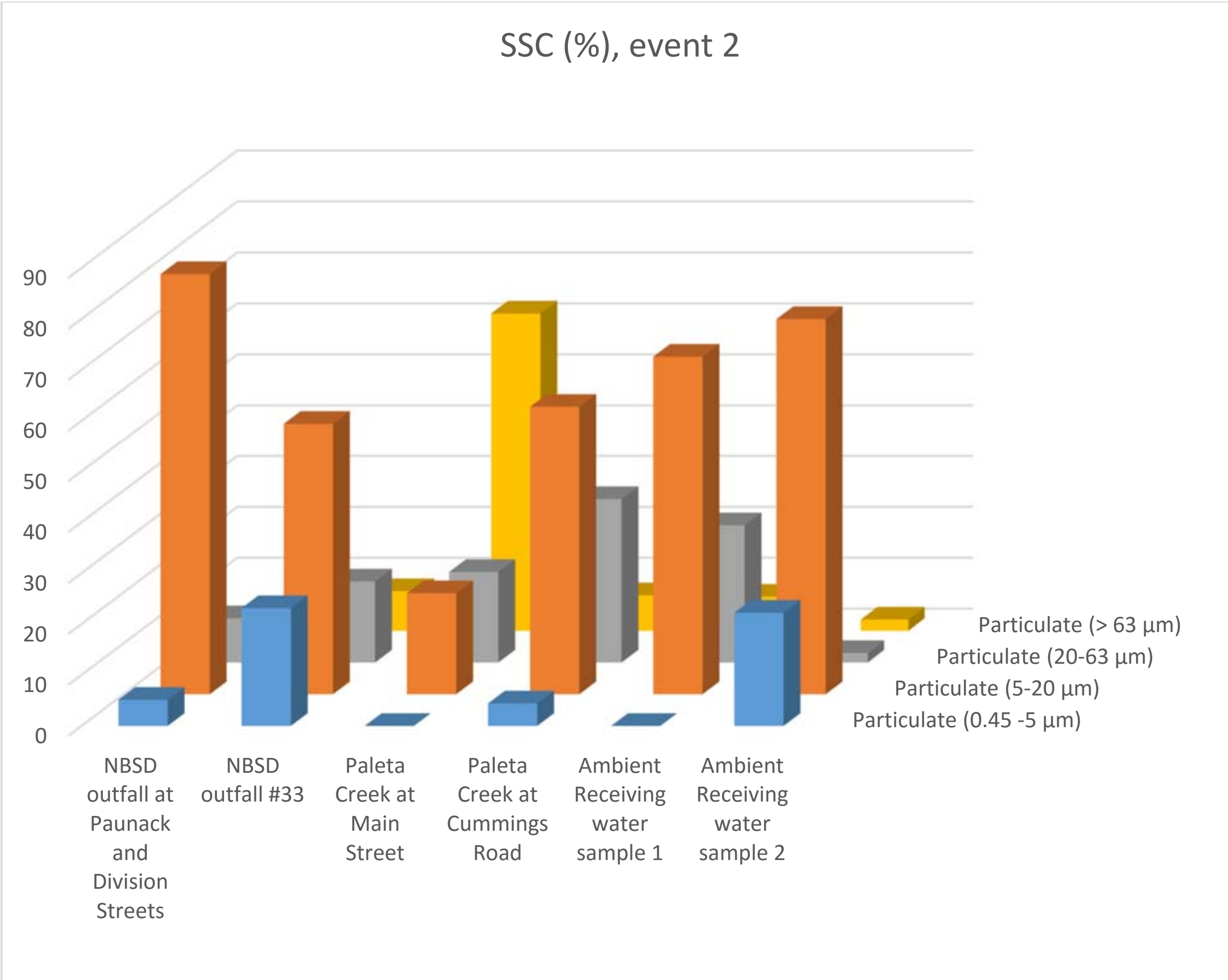

particulates (mg/L), event 1
1000
900
800
700
600
500
400
300
200
100
0
Particulate (20-63 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Time series at C1W 1/5/2016 at 1327 h
Time series at C1W 1/5/2016 at 1947 h
Time series at C1W 1/6/2016 at 0333 h



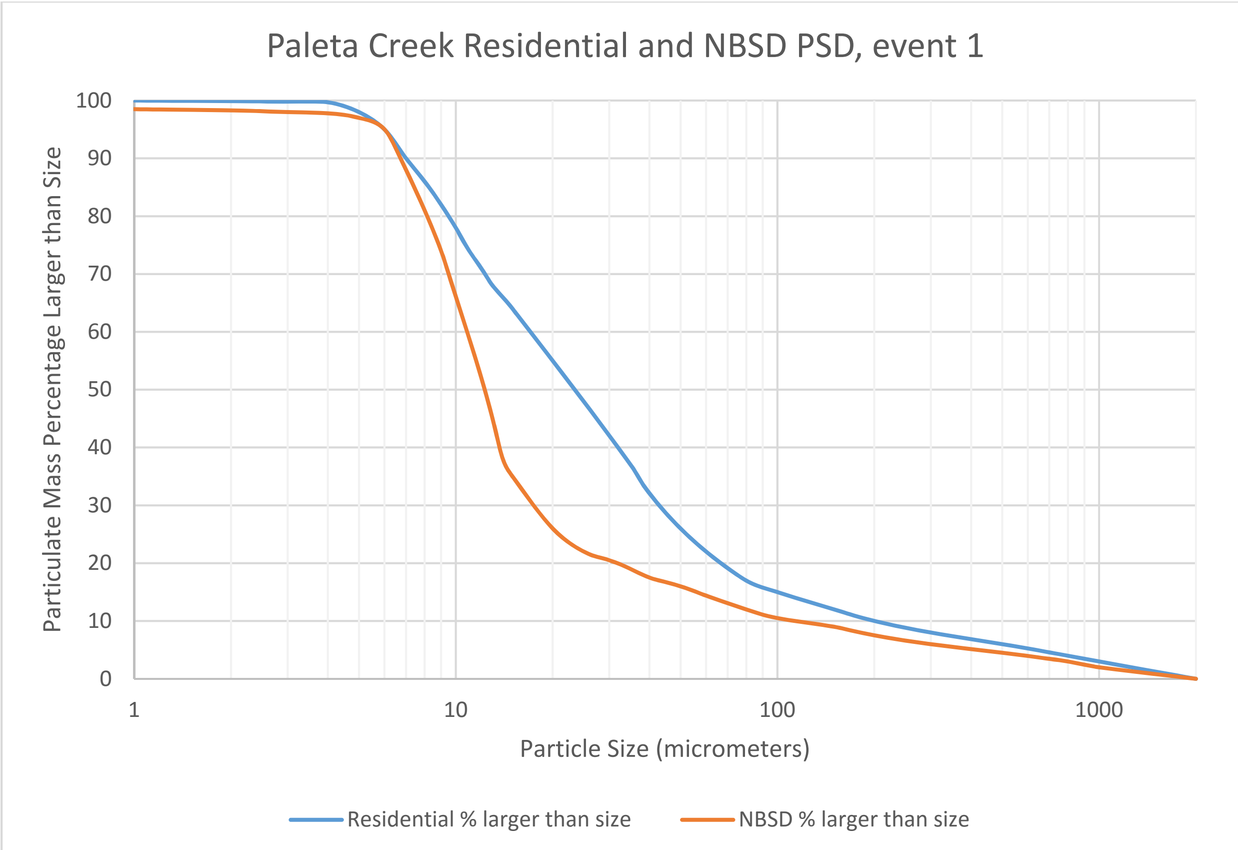
particulates (mg/L), event 2
500
450
400
350
300
250
200
150
100
50
0
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

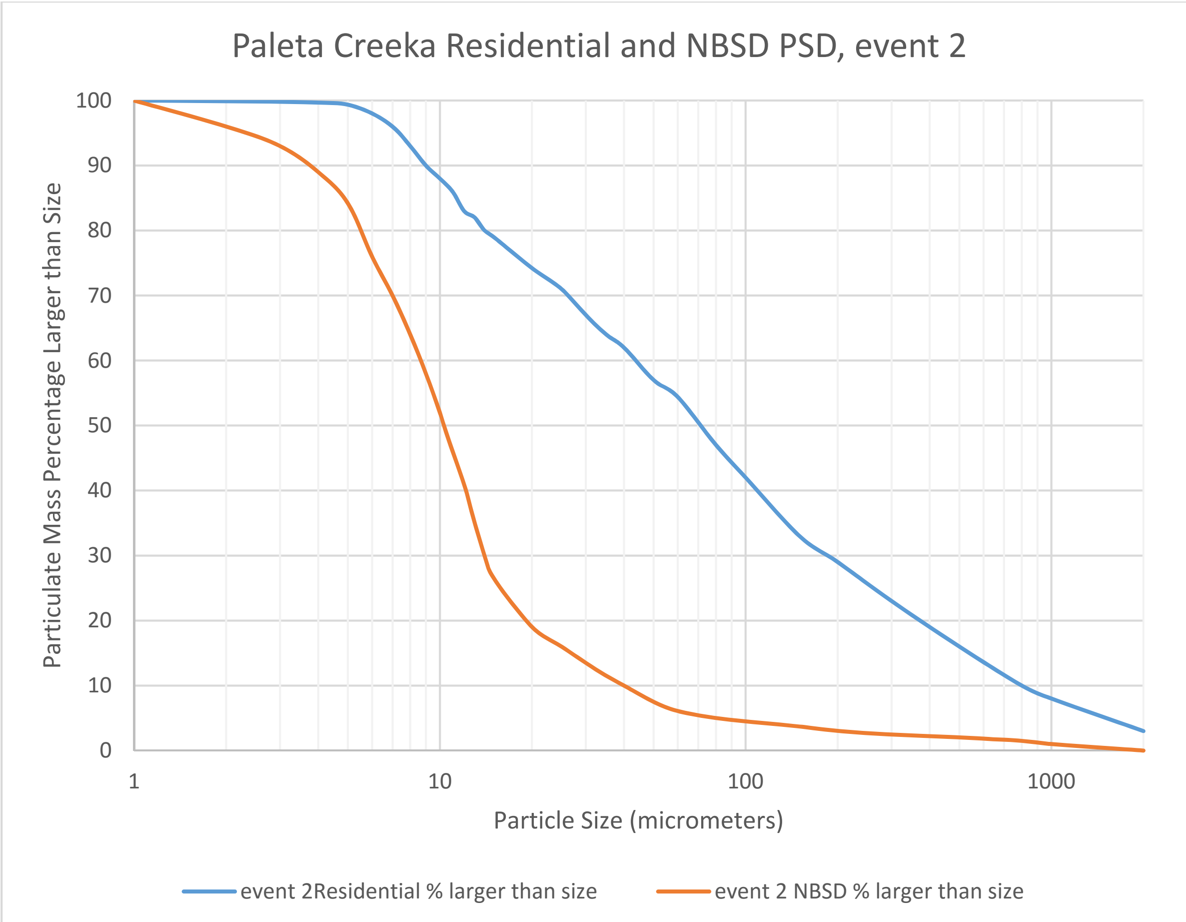


SSC (%), event 1
100
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...



SSC (%), event 2
0
10
20
30
40
50
60
70
80
90
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
Particulate (> 63 µm)
Particulate (20-63 µm)
Particulate (5-20 µm)
Particulate (0.45 -5 µm)


Paleta Creek Residential and NBSD PSD, event 1
Particulate Mass Percentage Larger than Size
100
90
80
70
60
50
40
30
20
10
0
1
10
100
1000
Particle Size (micrometers)
Residential % larger than size
NBSD % larger than size



Paleta Creeka Residential and NBSD PSD, event 2
100
90
80
70
60
50
40
30
20
10
0
Particulate Mass Percentage Larger than Size
1
10
100
1000
Particle Size (micrometers)
event 2Residential % larger than size
event 2 NBSD % larger than size

Appendix J: PAH Concentrations and Mass Yields by Land Use and Particle Size

Contents

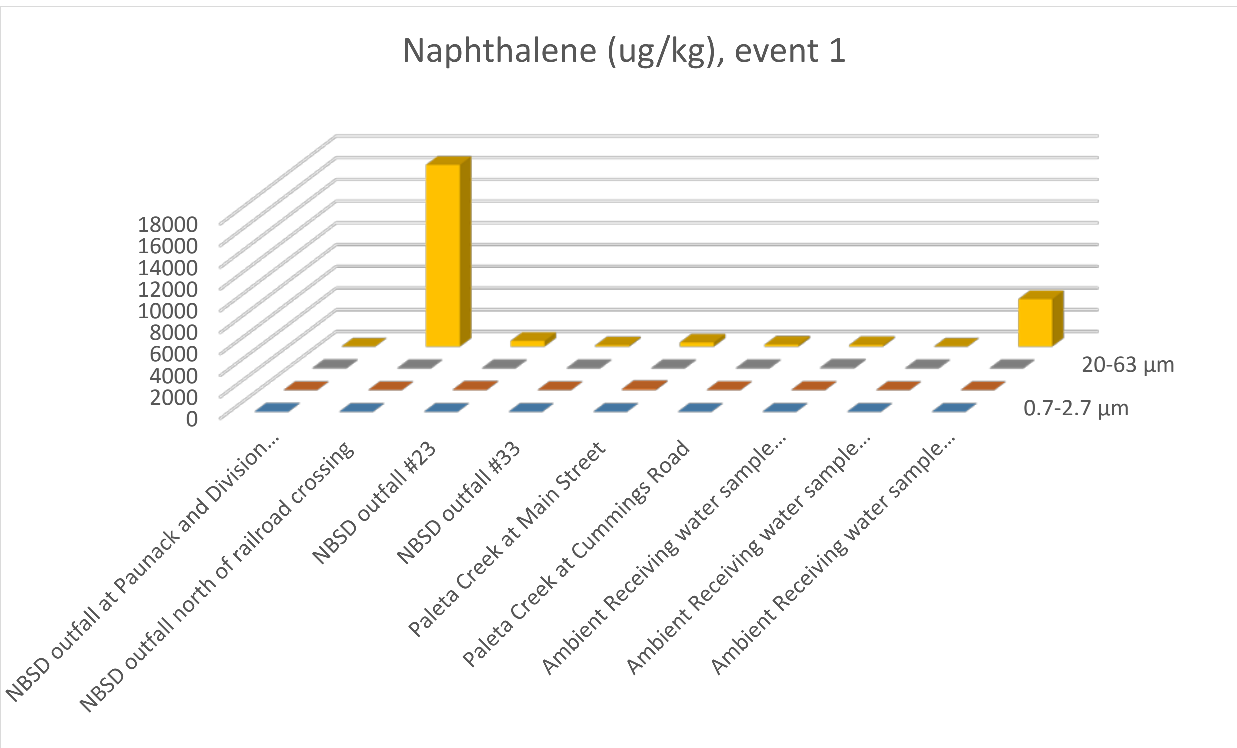
Naphthalene

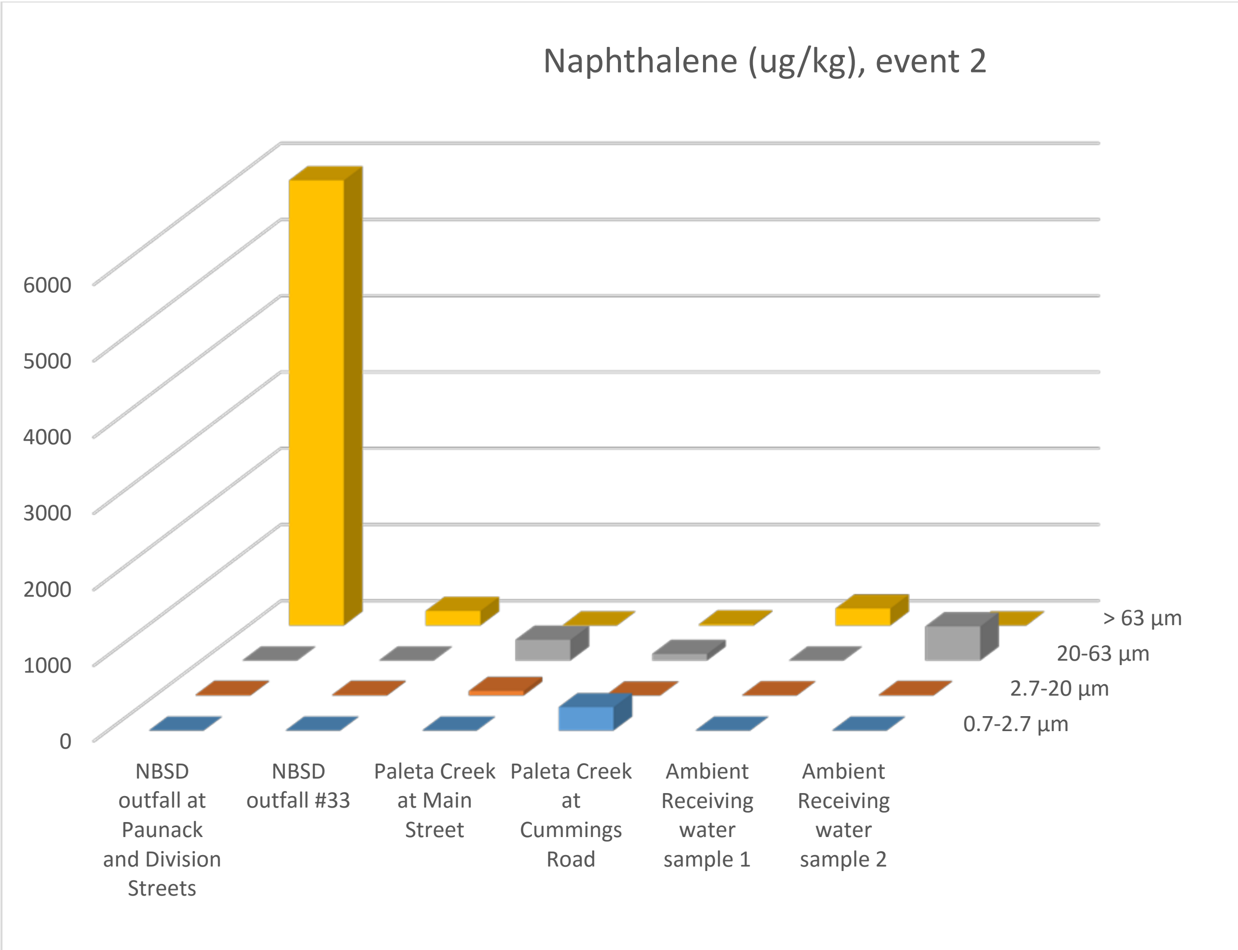
Naphthalene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	24.7	na	nd	nd	nd	nd	nd	nd	nd
2.7-20 µm	nd*	nd	47.2	2.0	97.9	15.6	16.6	nd	nd
20-63 µm	27.3	nd	nd	nd	nd	4.4	68.4	nd	nd
> 63 µm	na**	16,755	528	116	392	182	144	na	4,388

* not detected; particulate strength not calculated, assumed to be zero

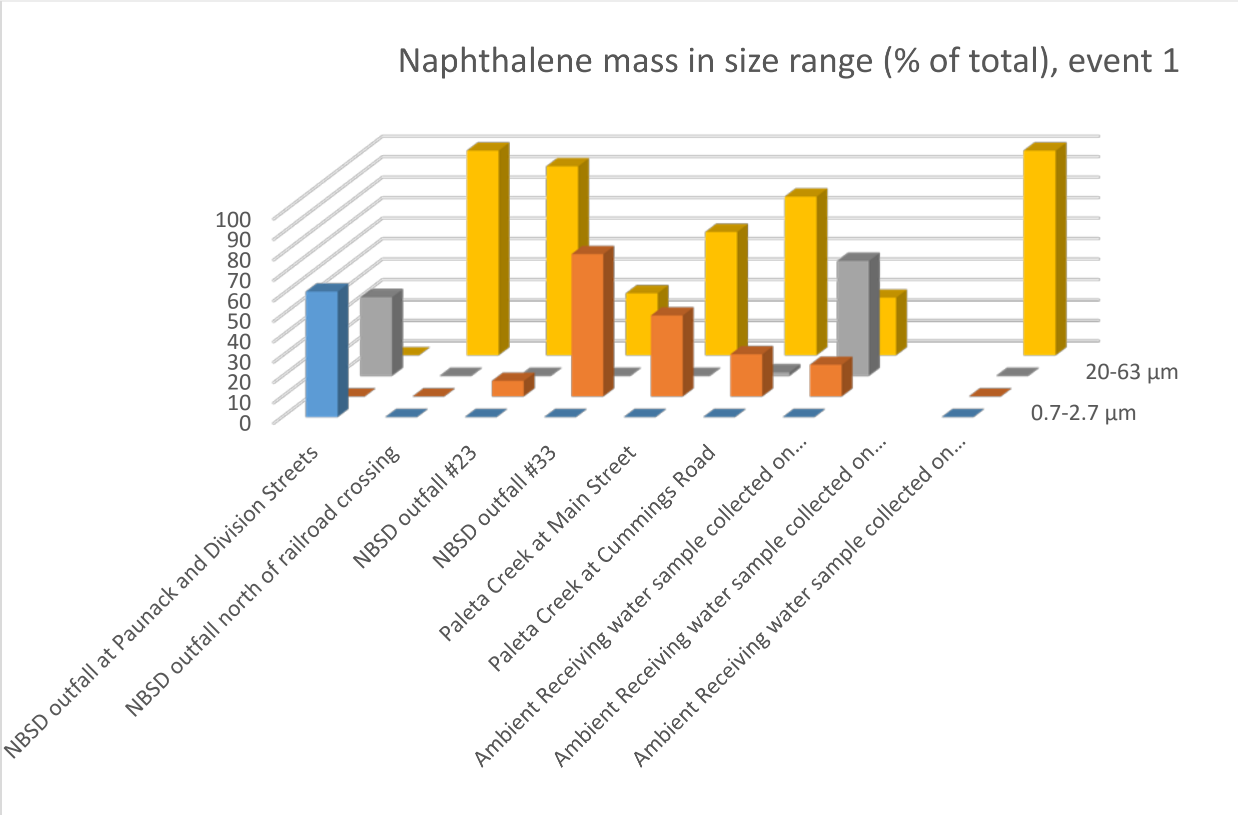
** SSC not detected; particulate strength not calculated, assumed to be zero

Naphthalene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	310	nd	na
2.7-20 µm	9.9	10.4	60.7	nd	5.0	8.1
20-63 µm	nd	nd	274	86.3	nd	451
> 63 µm	5,837	191	nd	14.5	223	na

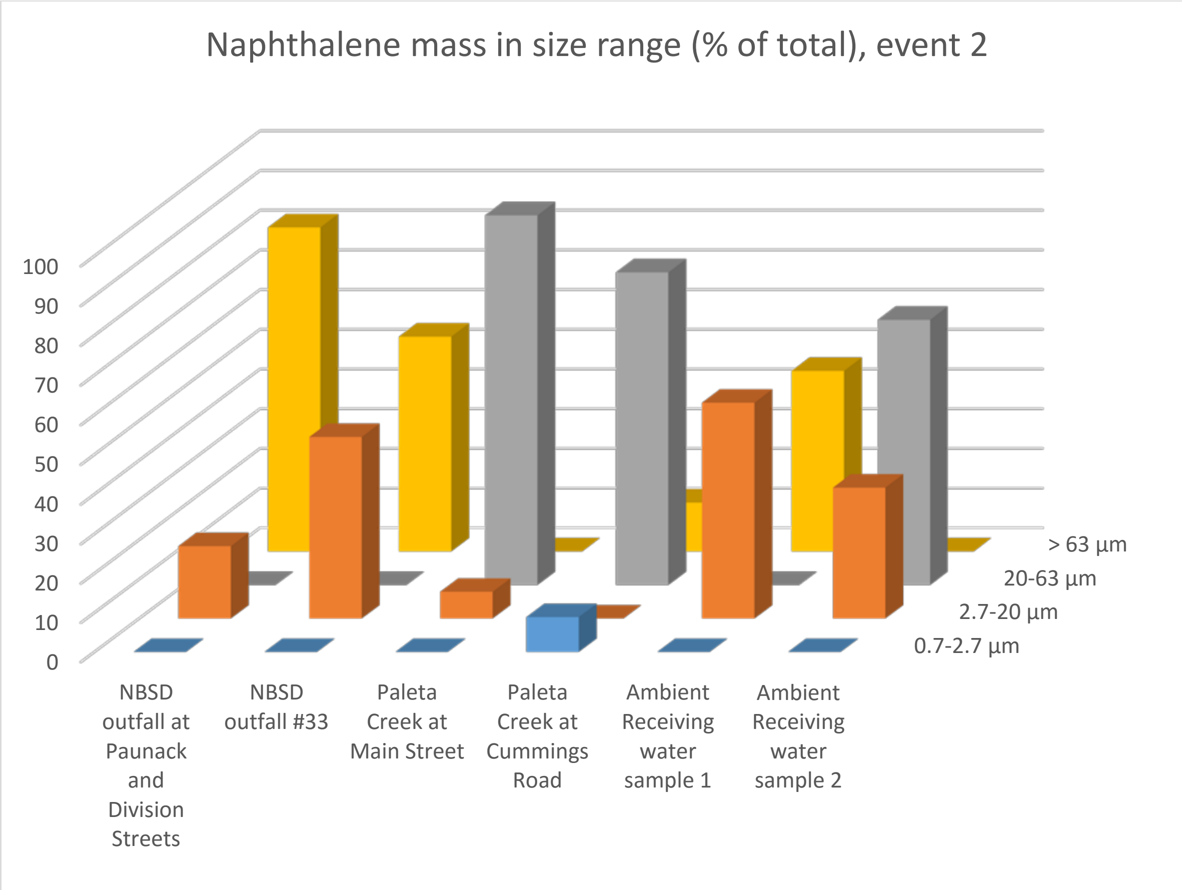




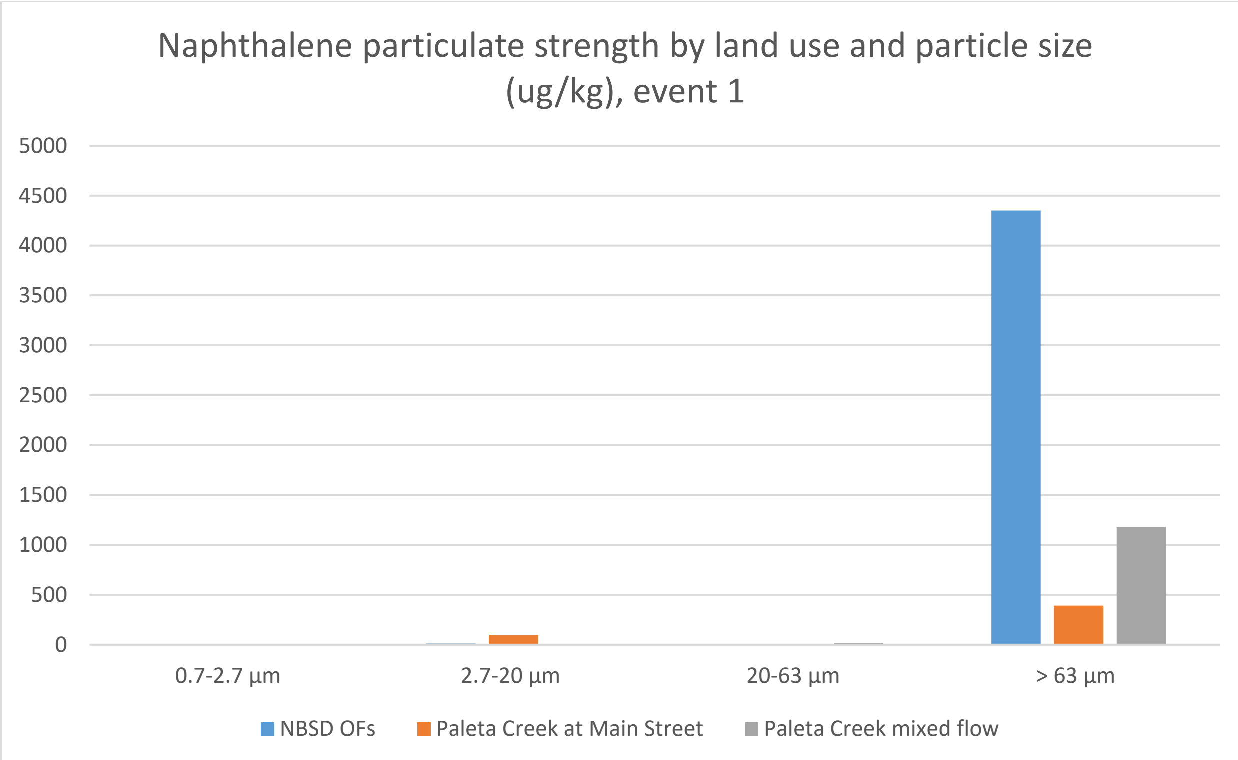
Naphthalene (ug/kg), event 2
6000
5000
4000
3000
2000
1000
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

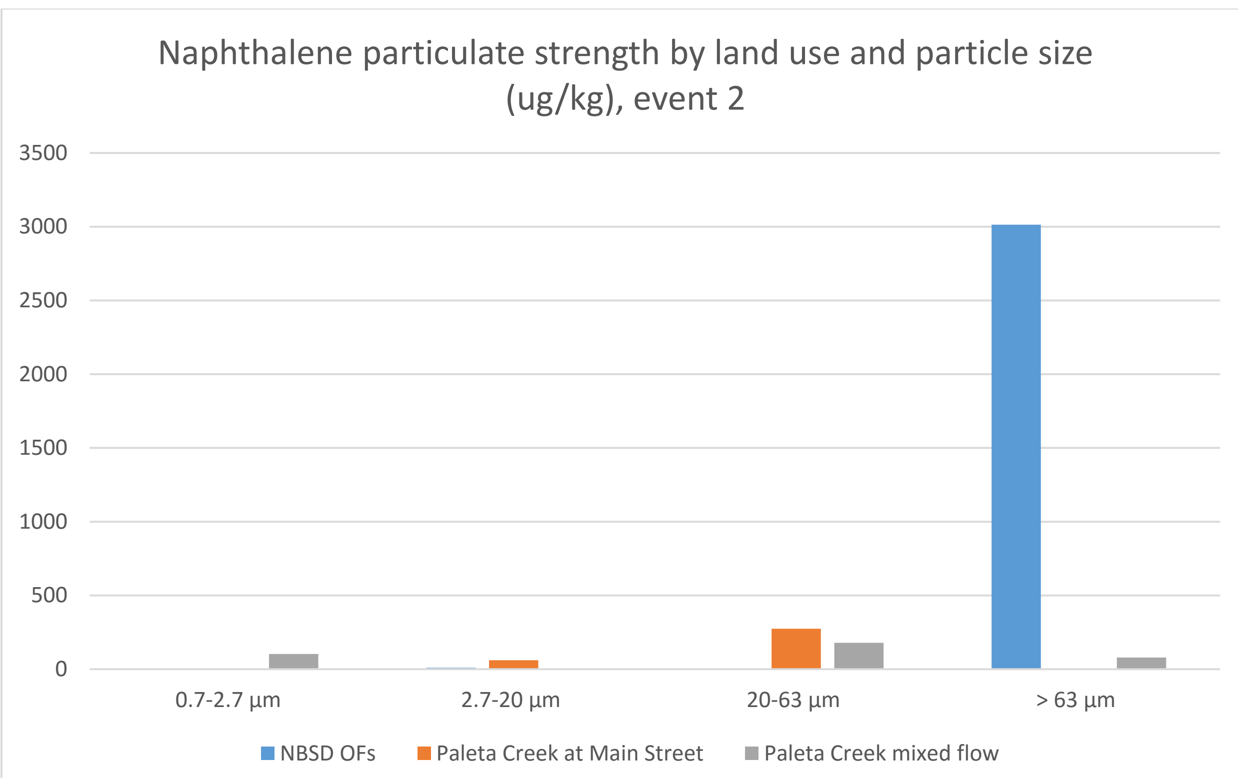


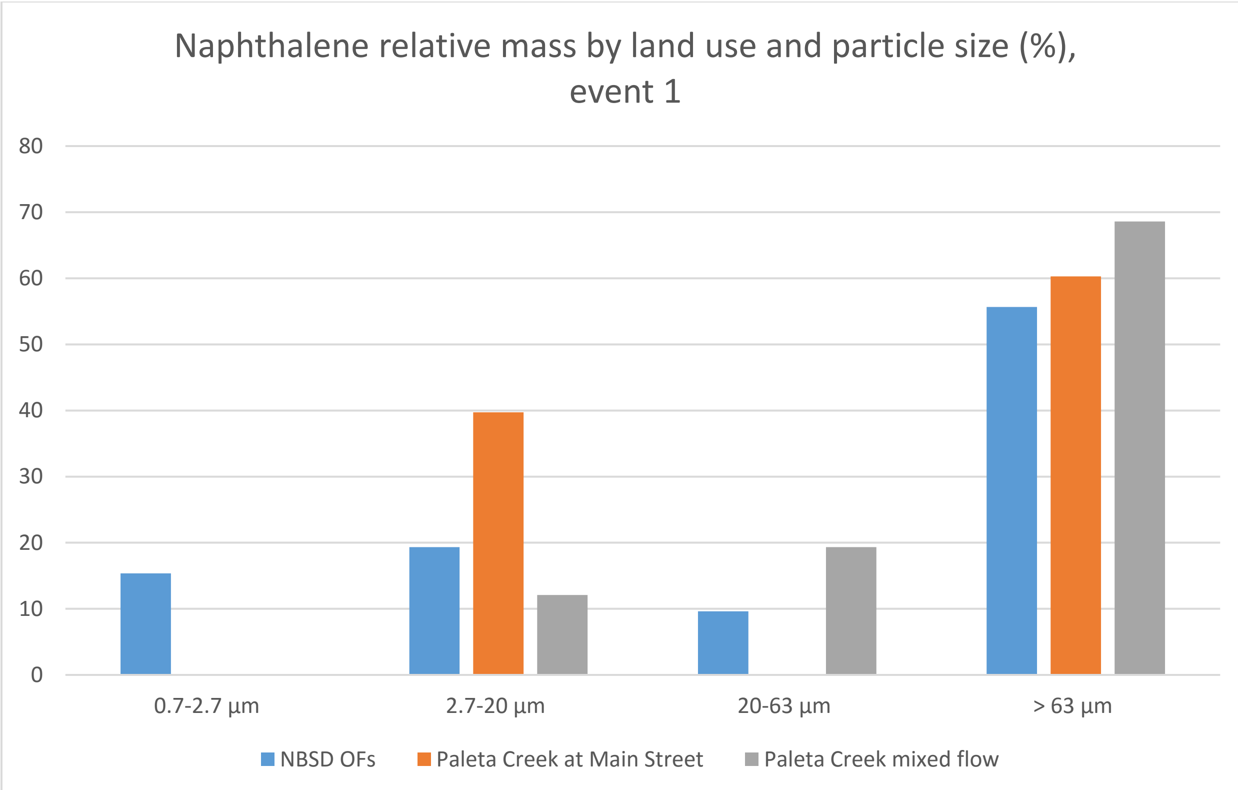
Naphthalene mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

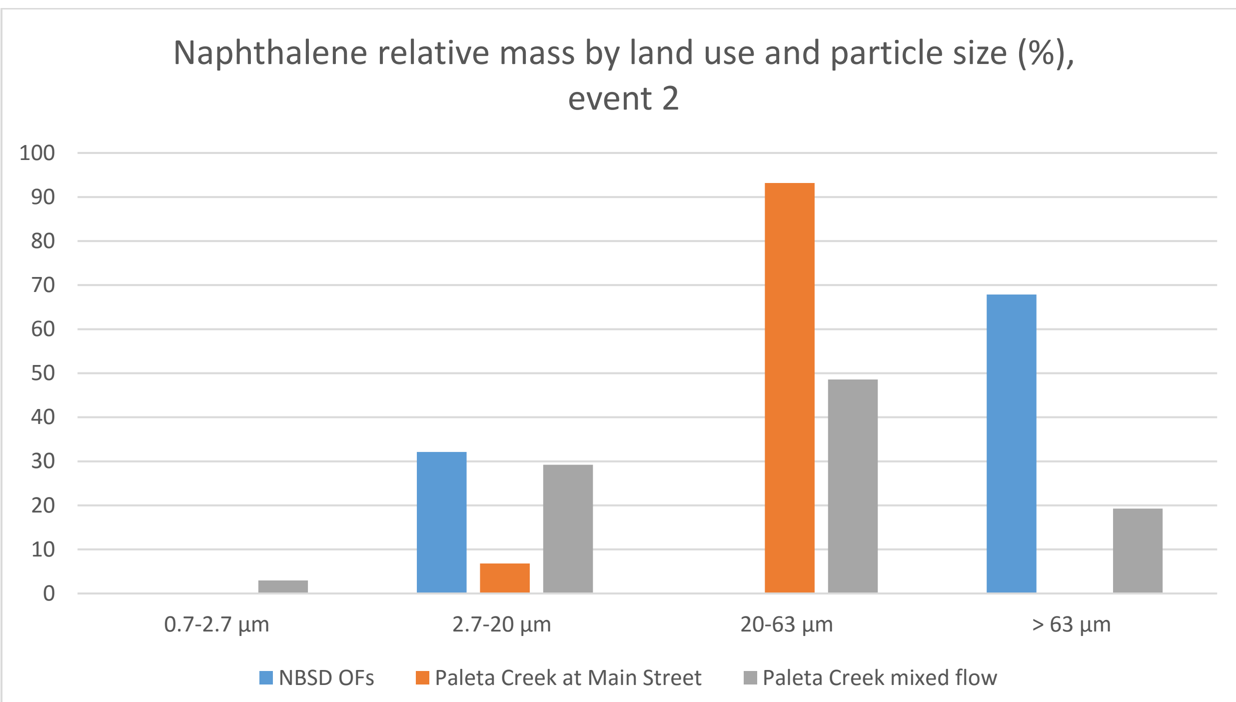


Naphthalene mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Naphthalene particulate strength by land use and particle size (ug/kg), event 1
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Naphthalene particulate strength by land use and particle size (ug/kg), event 2
3500
3000
2500
2000
1500
1000
500
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Naphthalene relative mass by land use and particle size (%), event 1
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Naphthalene relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

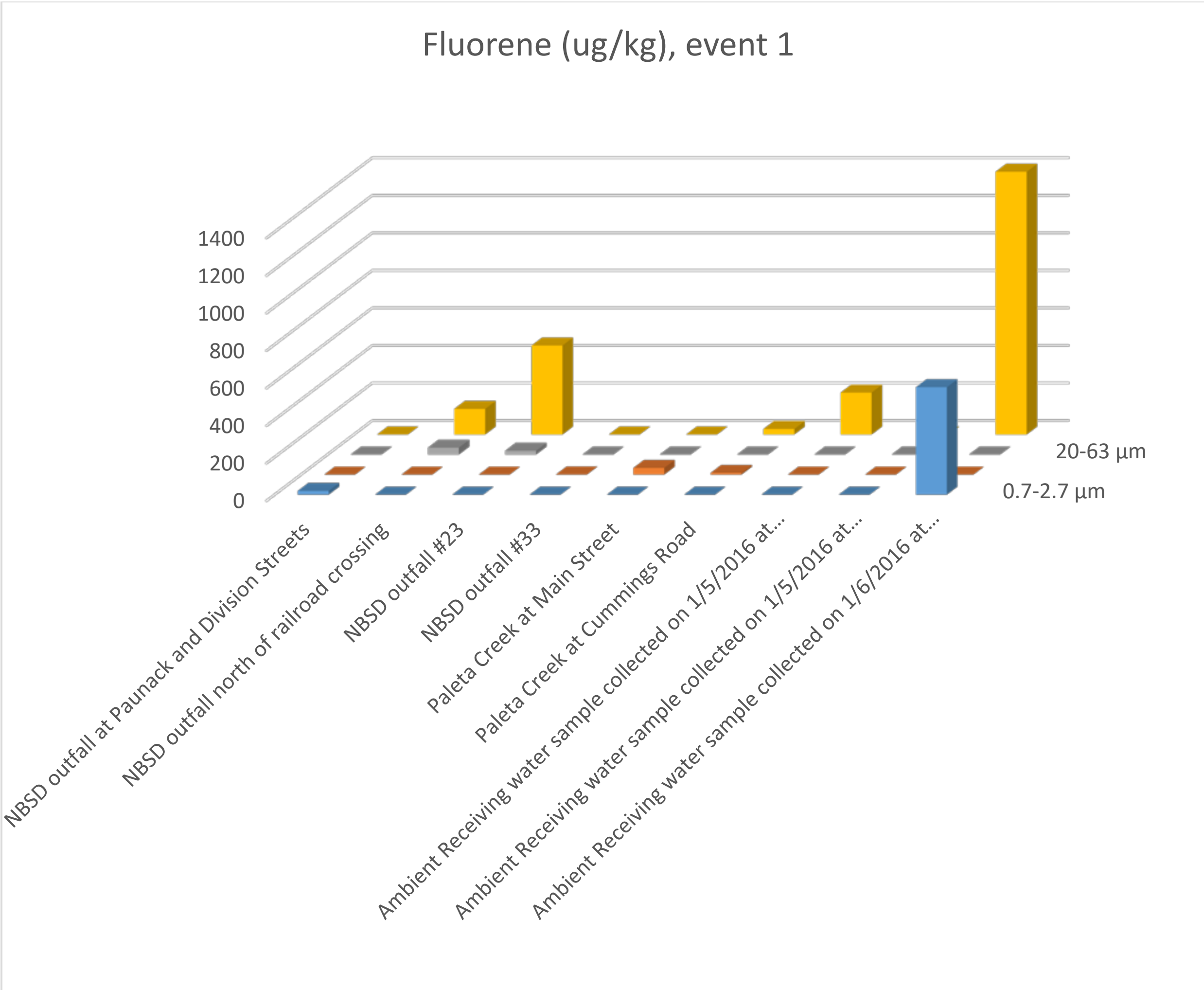
Fluorene

Fluorene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	20.3	na	na	nd	nd	nd	na	nd	572
2.7-20 µm	nd*	nd	nd	0.86	35.6	8.8	nd	nd	nd
20-63 µm	nd	36.6	20.3	nd	nd	0	nd	nd	nd
> 63 µm	na**	136	474	nd	nd	29.5	223	na	1,399

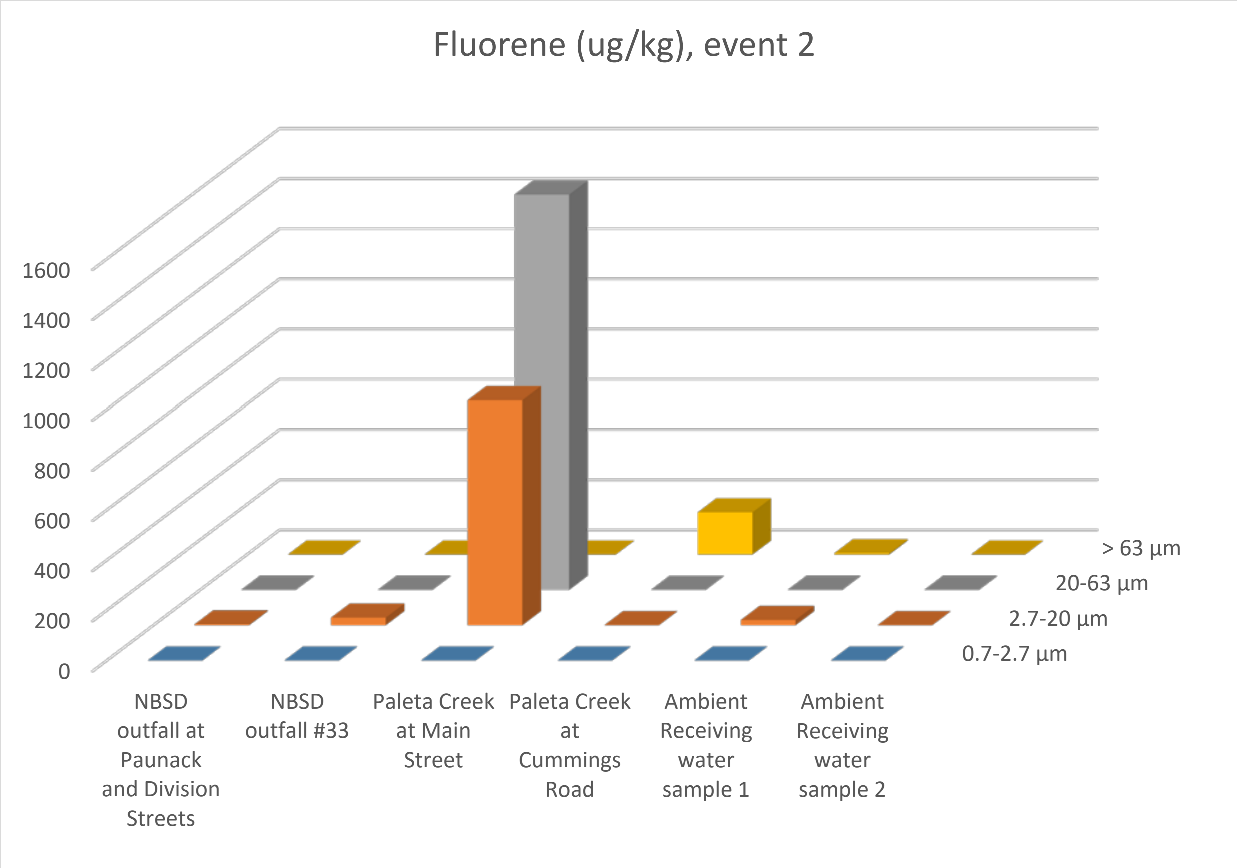
* not detected; particulate strength not calculated, assumed to be zero

** SSC not detected; particulate strength not calculated, assumed to be zero

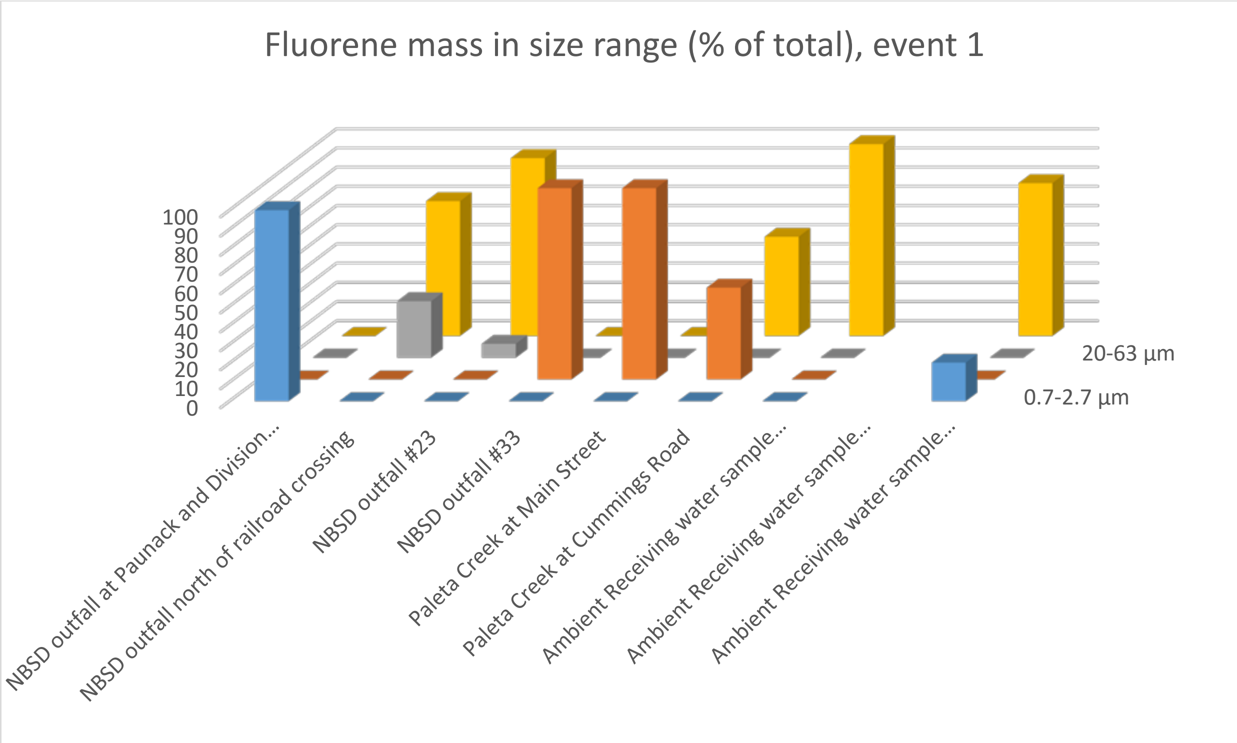
Fluorene (ug/kg)nt 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	nd	nd	na
2.7-20 µm	3	30	896	nd	20.9	nd
20-63 µm	nd	nd	1,576	0.4	nd	nd
> 63 µm	nd	nd	nd	169	5.5	na



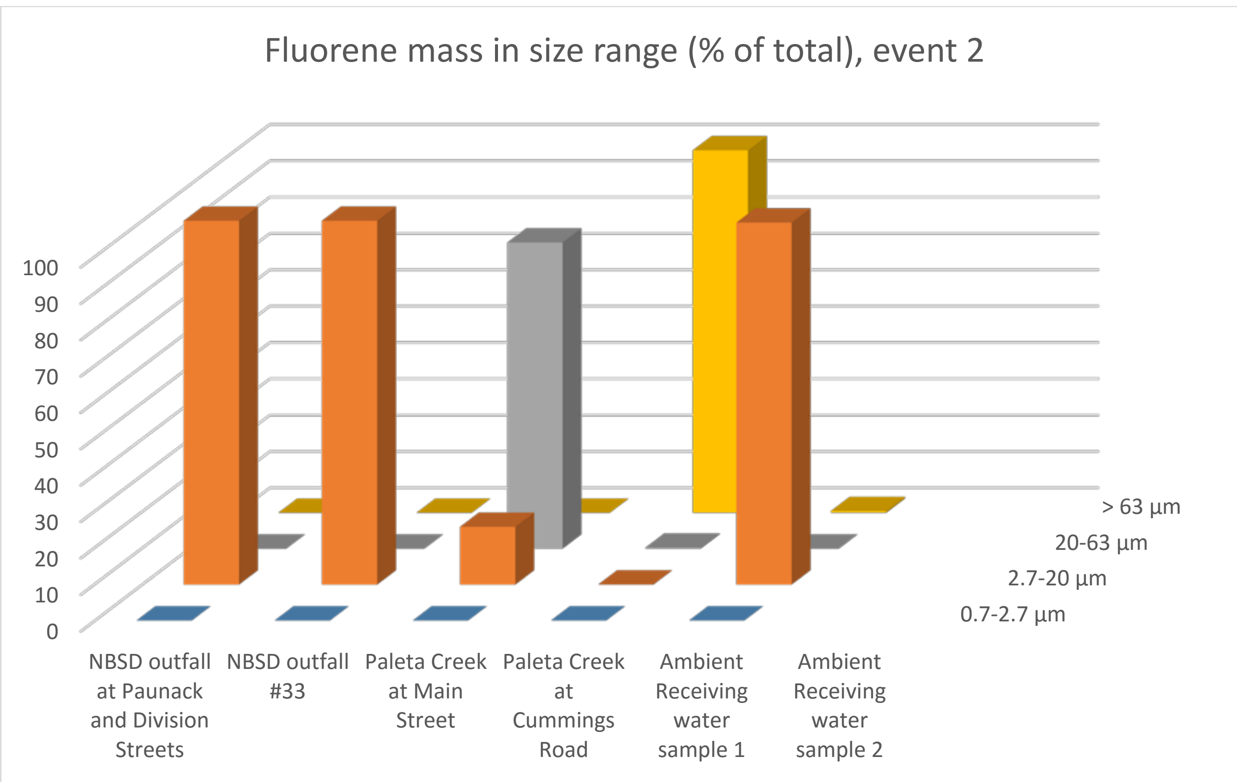
Fluorene (ug/kg), event 1
1400
1200
1000
800
600
400
200
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on 1/5/2016 at...
Ambient Receiving water sample collected on 1/5/2016 at...
Ambient Receiving water sample collected on 1/6/2016 at...



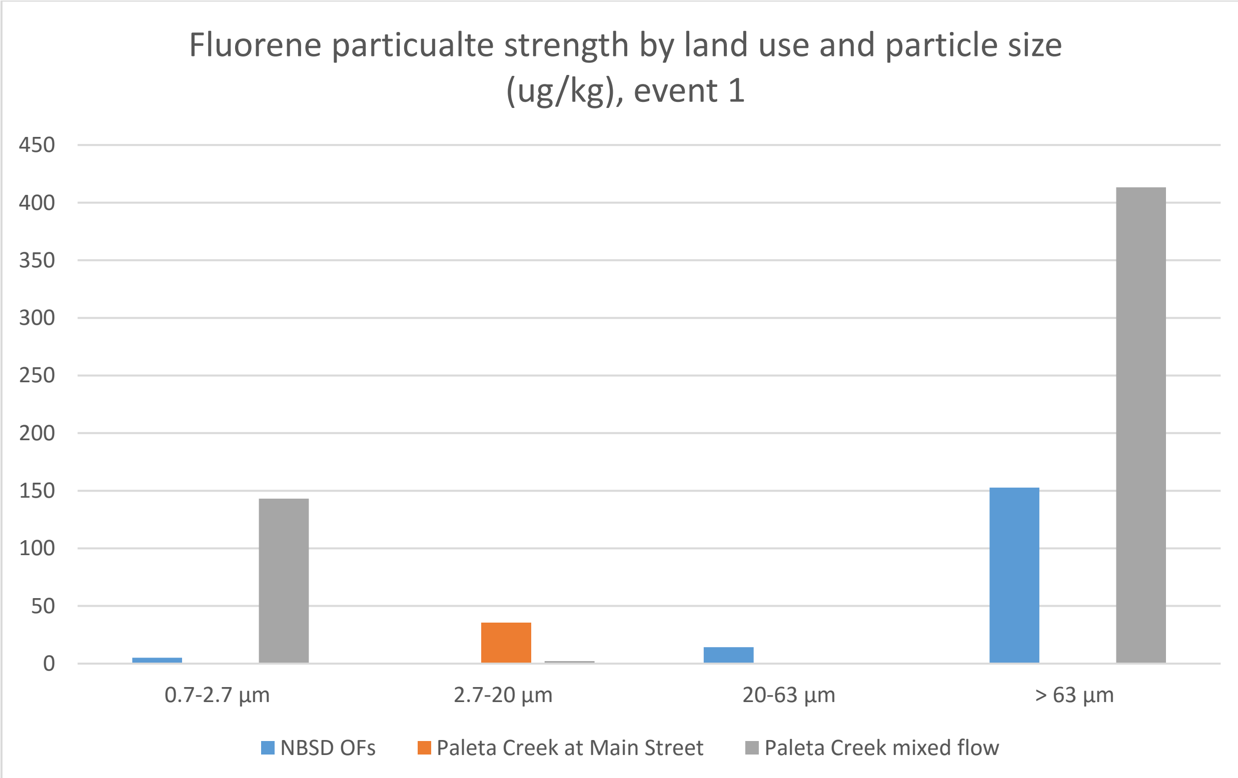
Fluorene (ug/kg), event 2
1600
1400
1200
1000
800
600
400
200
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

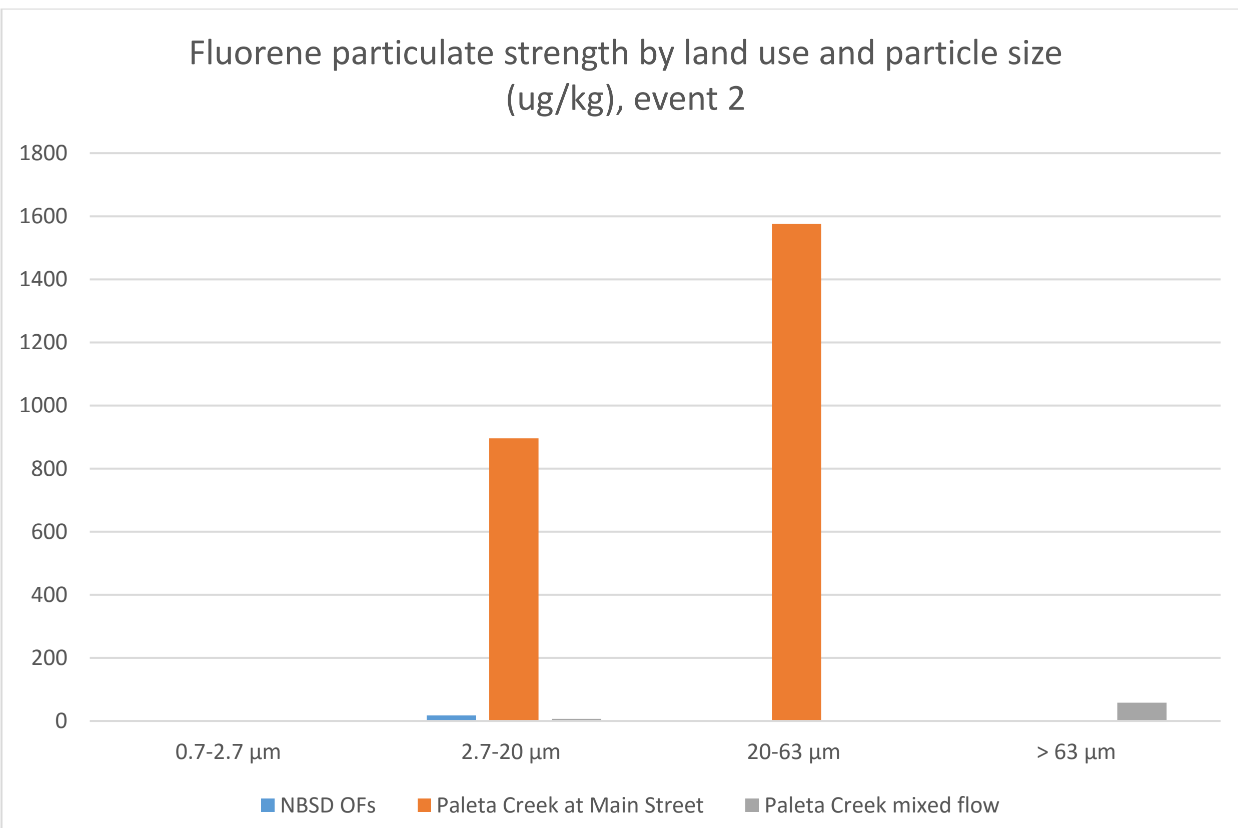


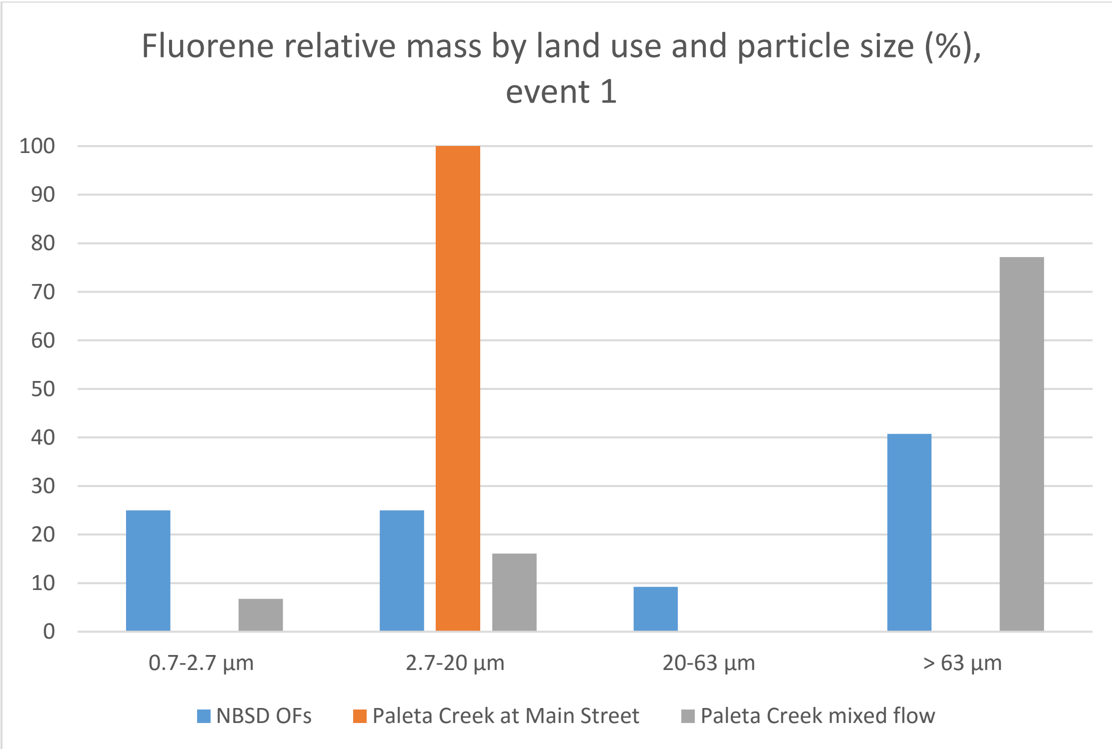
Fluorene mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample...
Ambient Receiving water sample...
Ambient Receiving water sample...
20-63 µm
0.7-2.7 µm

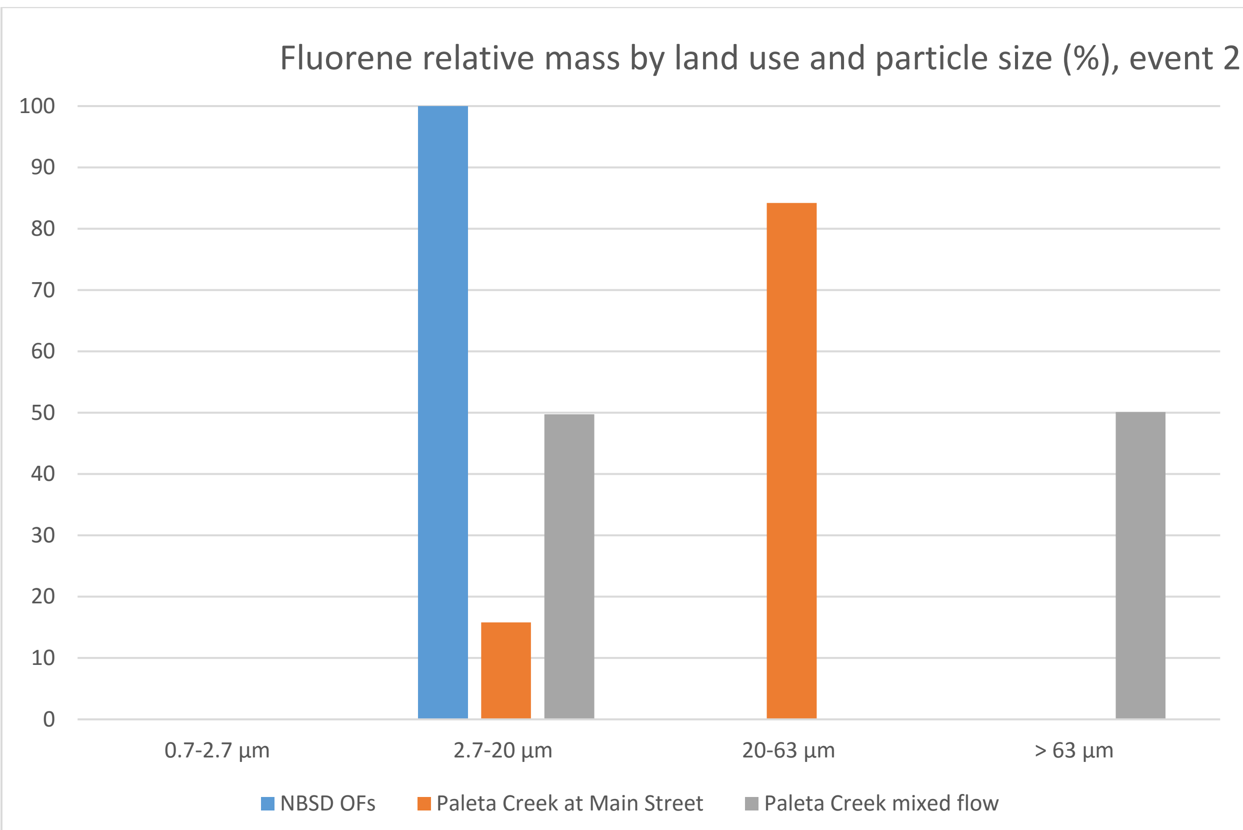


Fluorene mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Fluorene particualte strength by land use and particle size (ug/kg), event 1
450
400
350
300
250
200
150
100
50
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Fluorene particulate strength by land use and particle size (ug/kg), event 2
1800
1600
1400
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Fluorene relative mass by land use and particle size (%), event 1
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Fluorene relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

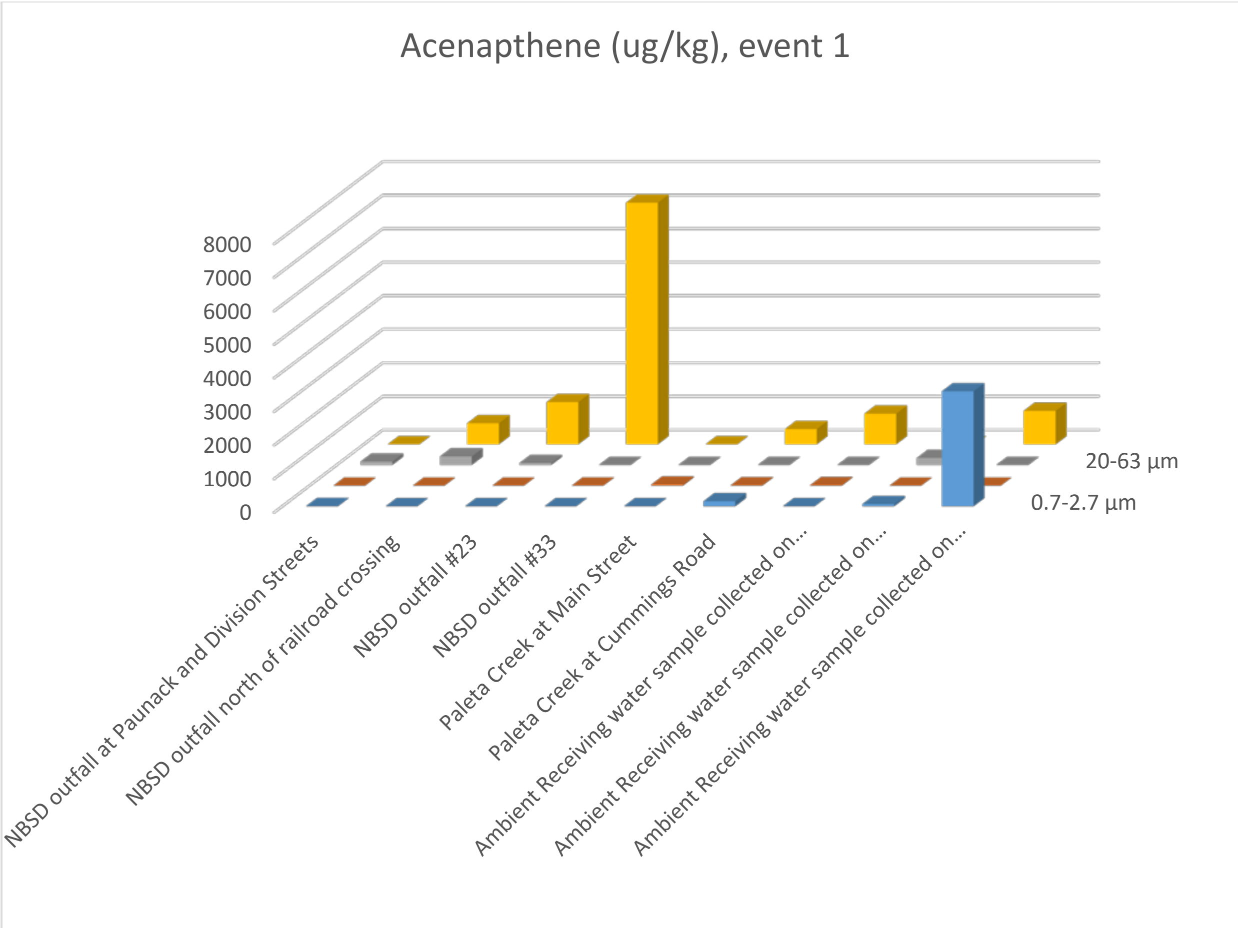
Acenapthene

Acenaphthene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	6.0	na	na	nd	nd	148	na	65.2	3,420
2.7-20 µm	nd*	nd	nd	1.5	29.8	9.9	12.4	nd	nd
20-63 µm	98.6	254	56.6	nd	nd	nd	nd	207	nd
> 63 µm	na**	627	1,255	7,203	nd	453	911	na	995

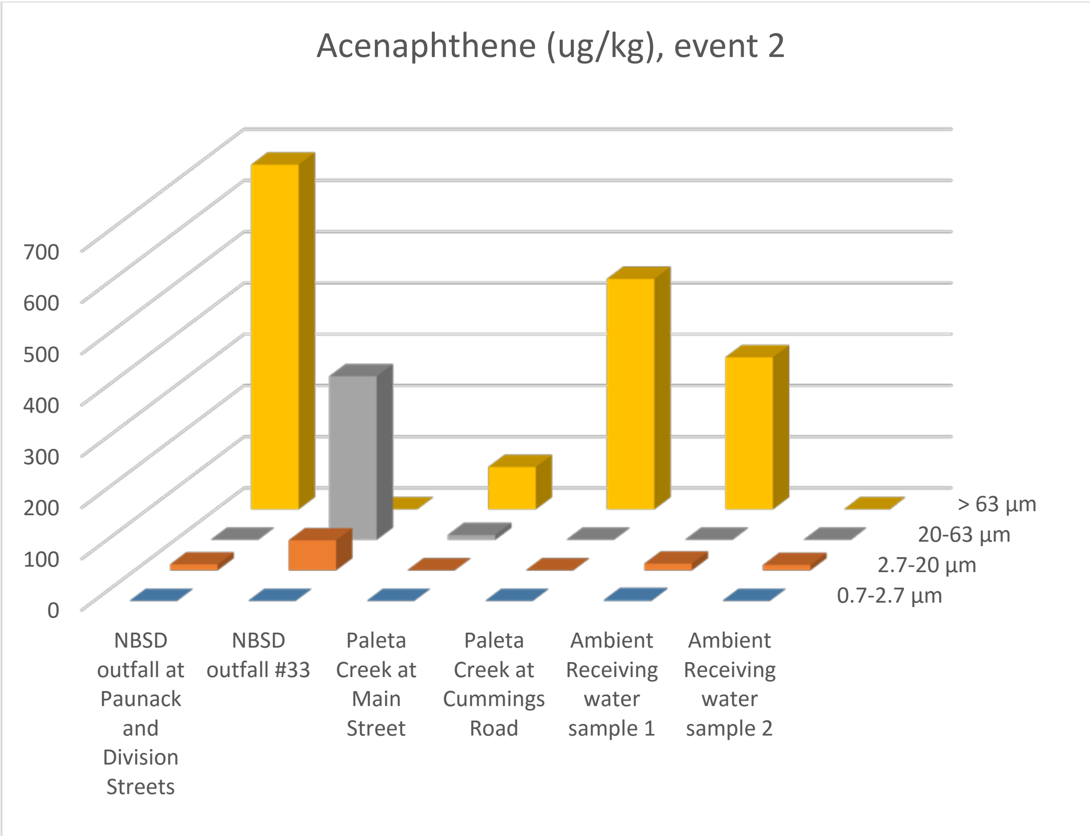
* not detected; particulate strength not calculated, assumed to be zero

** SSC not detected; particulate strength not calculated, assumed to be zero

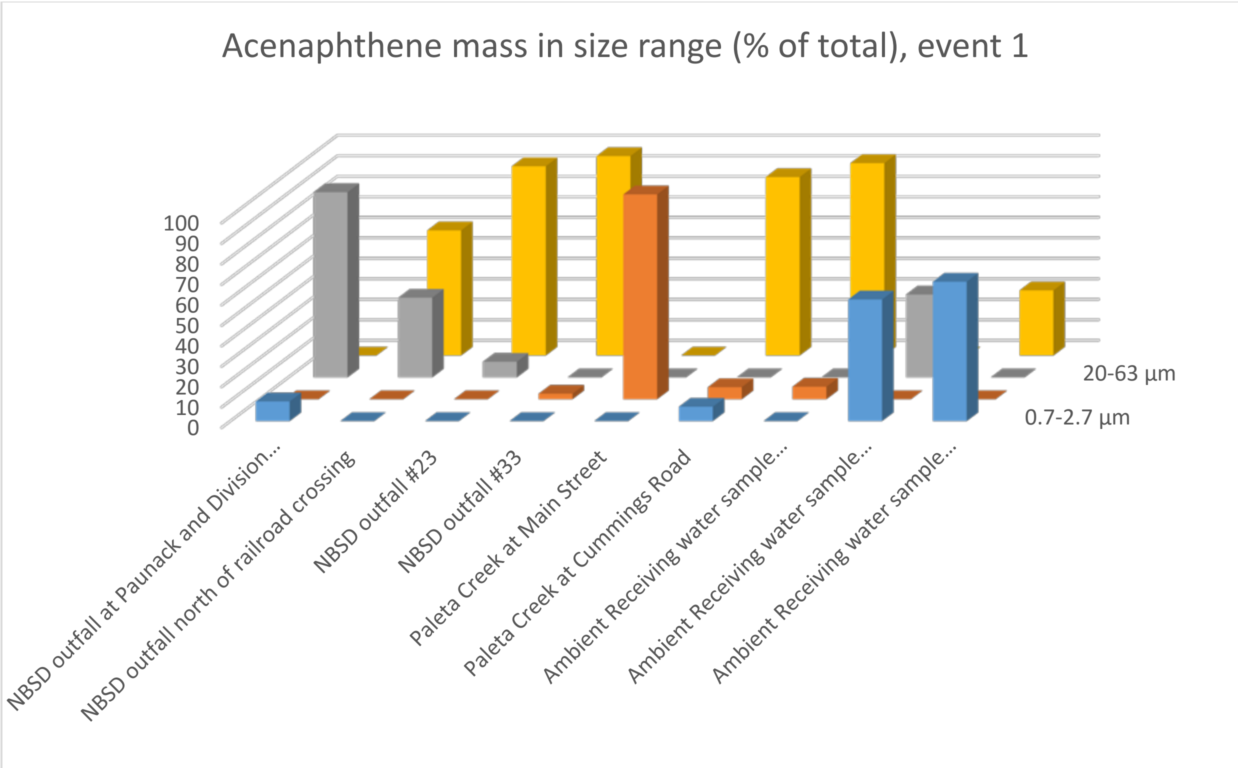
Acenaphthene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	nd	1.5	na
2.7-20 µm	12	59	nd	nd	13.1	10.5
20-63 µm	nd	319	9.4	nd	nd	nd
> 63 µm	672	nd	83	450	296	na



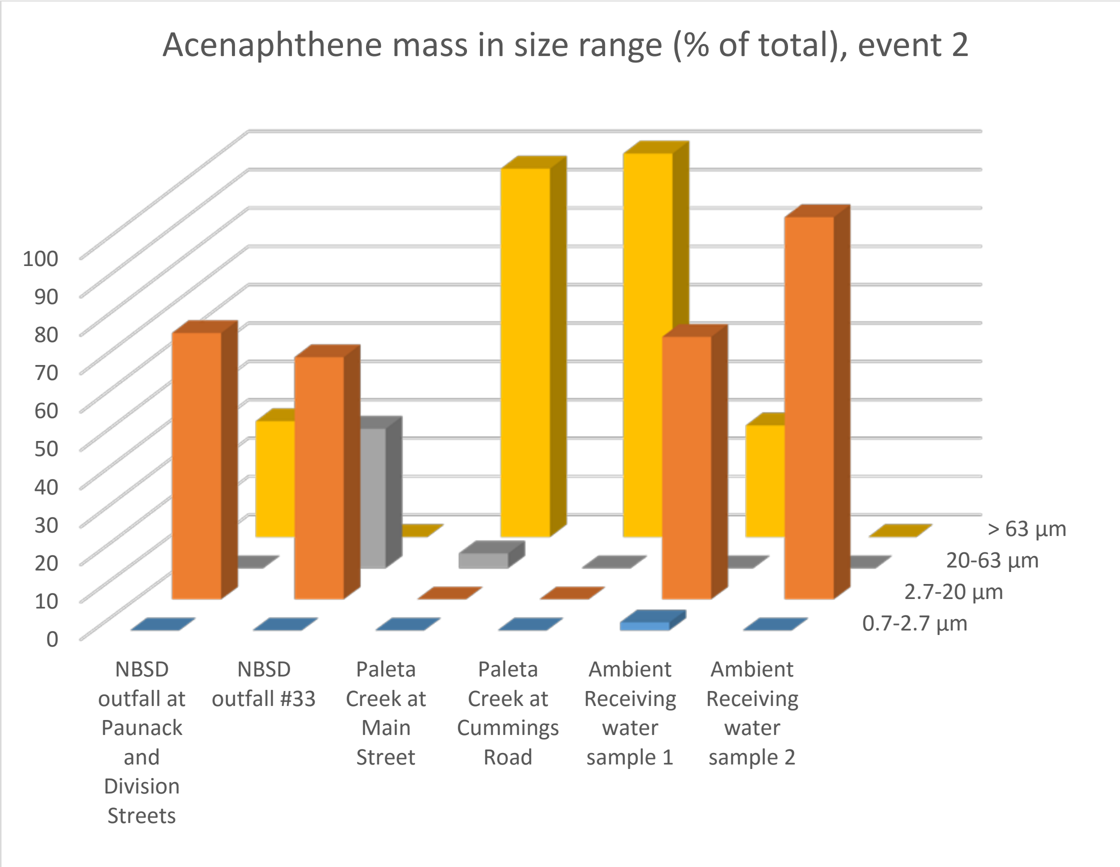
Acenapthene (ug/kg), event 1
8000
7000
6000
5000
4000
3000
2000
1000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...



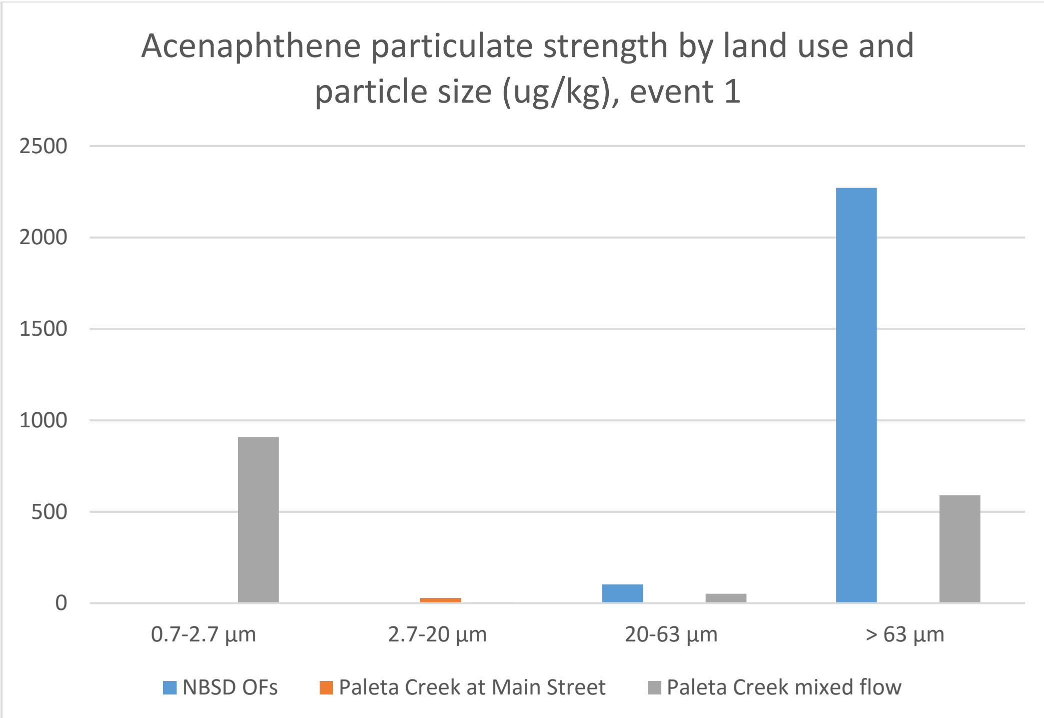
Acenaphthene (ug/kg), event 2
700
600
500
400
300
200
100
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

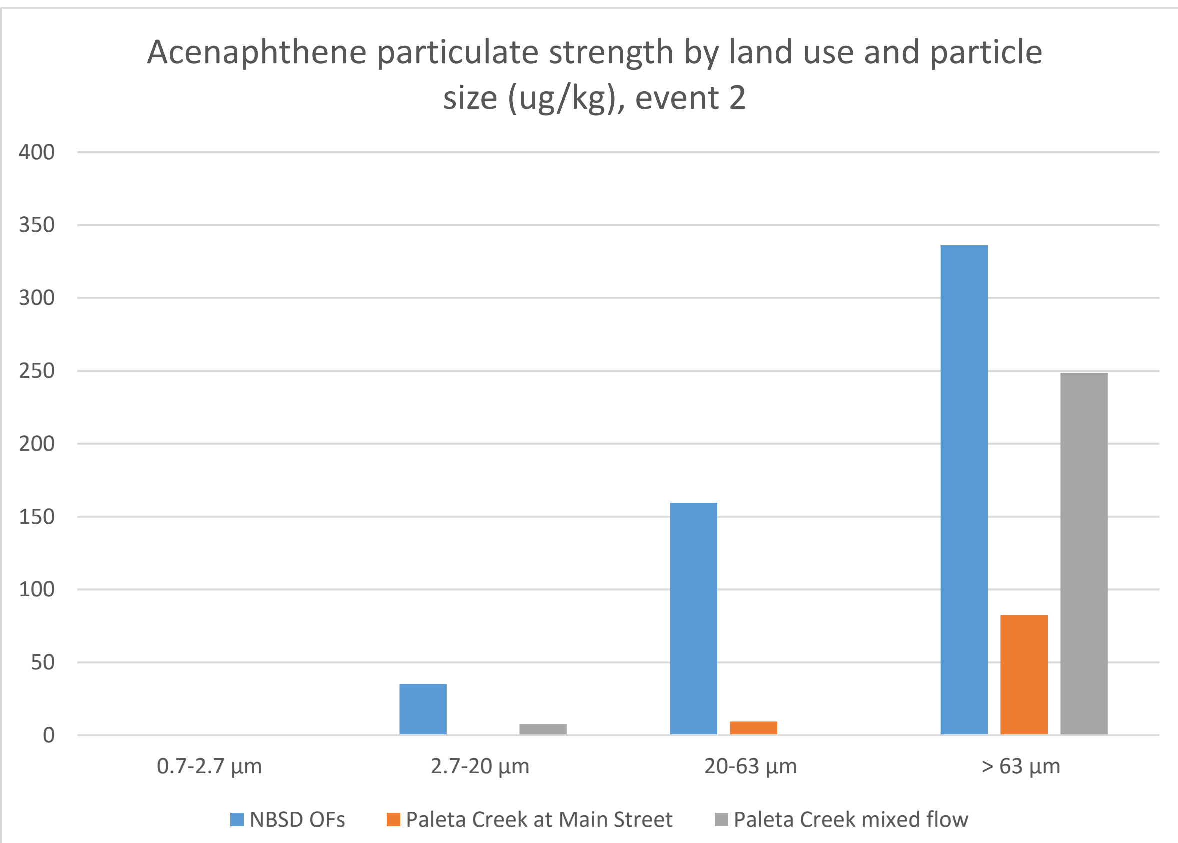


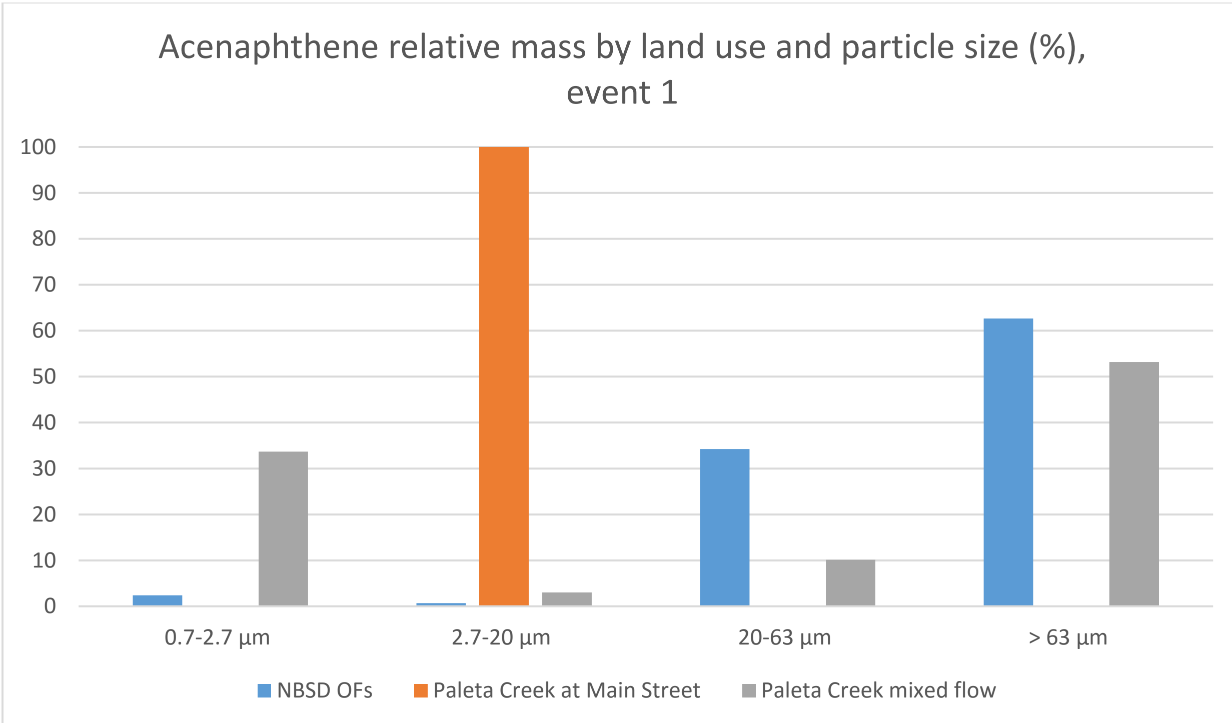
Acenaphthene mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample...
Ambient Receiving water sample...
Ambient Receiving water sample...

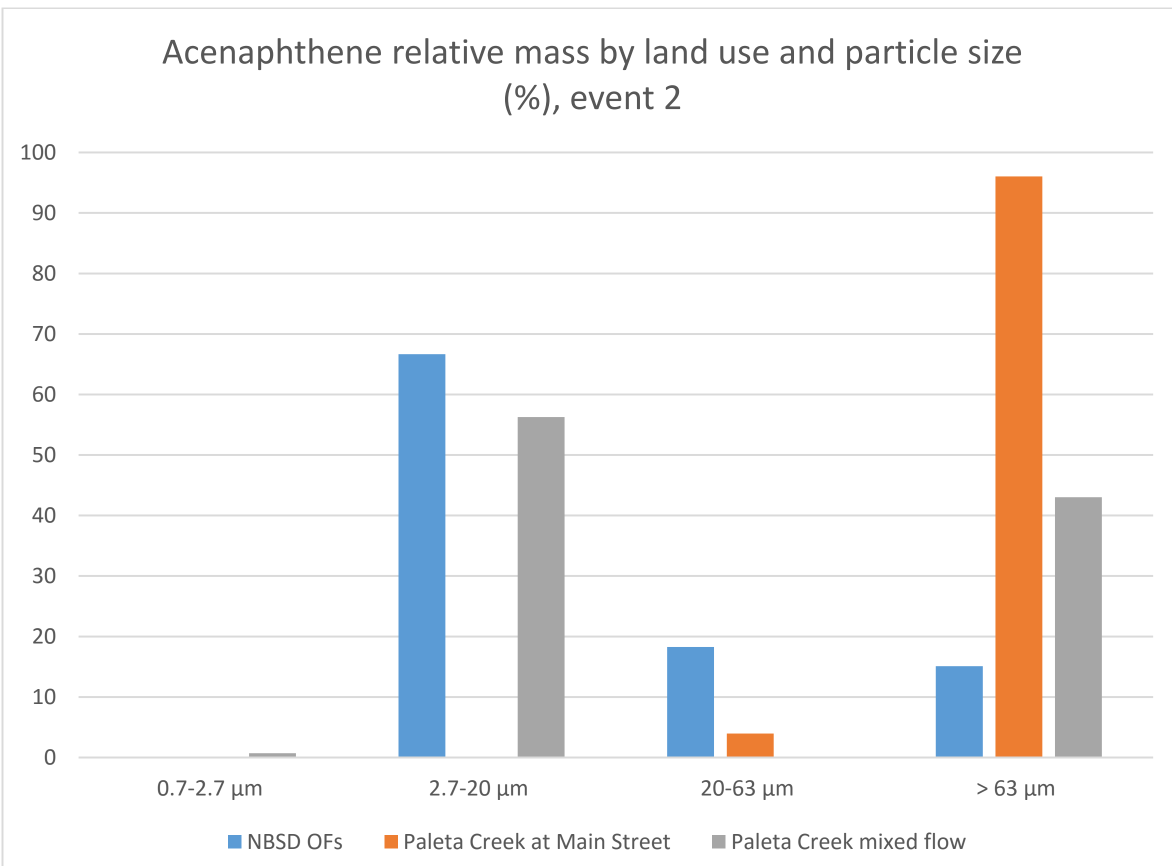


Acenaphthene mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Acenaphthene particulate strength by land use and particle size (ug/kg), event 1
2500
2000
1500
1000
500
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Acenaphthene particulate strength by land use and particle size (ug/kg), event 2
400
350
300
250
200
150
100
50
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Acenaphthene relative mass by land use and particle size (%), event 1
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Acenaphthene relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

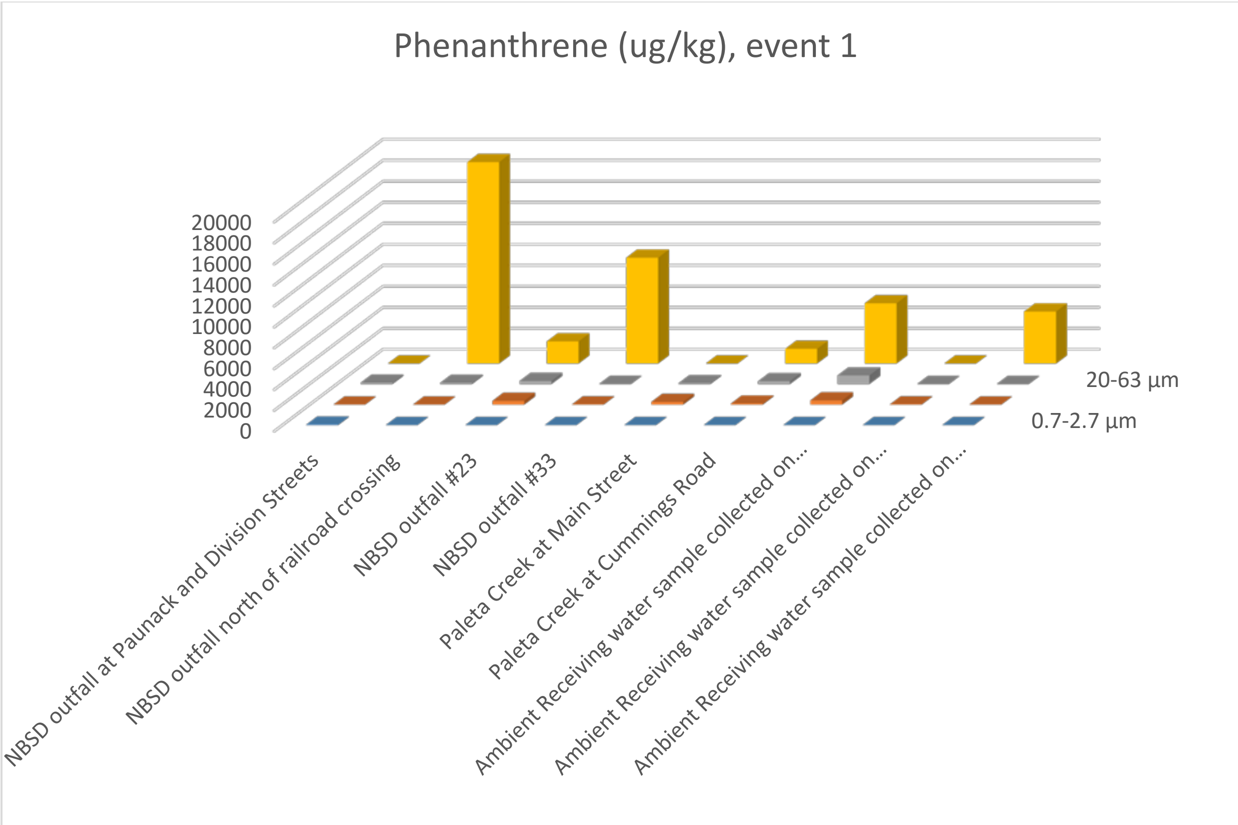
Phenanthrene

Phenanthrene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	45.8	na	na	nd	nd	nd	na	nd	nd
2.7-20 µm	nd*	nd	359	13.8	260	94.4	405	17.2	nd
20-63 µm	120	109	296	6.5	86.5	275	829	nd	nd
> 63 µm	na**	19,198	2,125	10,098	nd	1,416	5,757	na	4,971

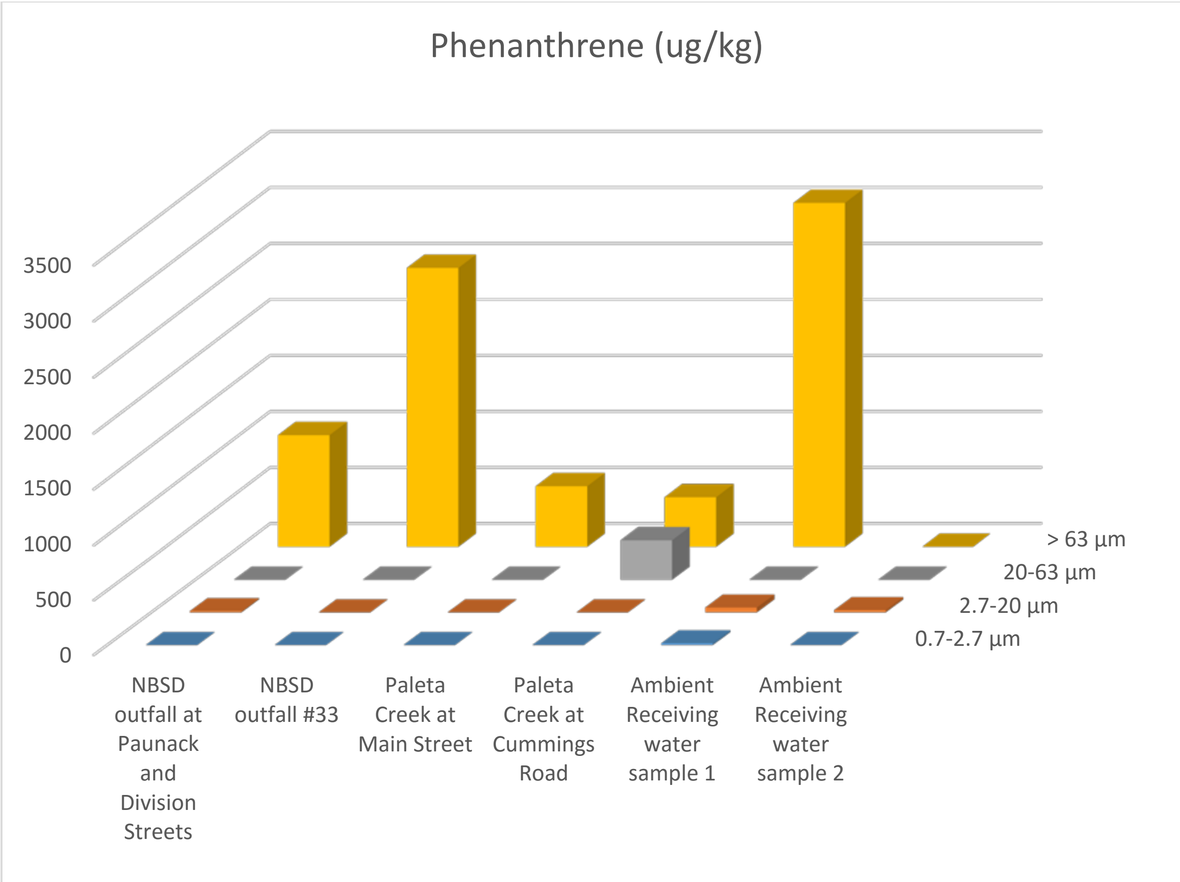
* not detected; particulate strength not calculated, assumed to be zero

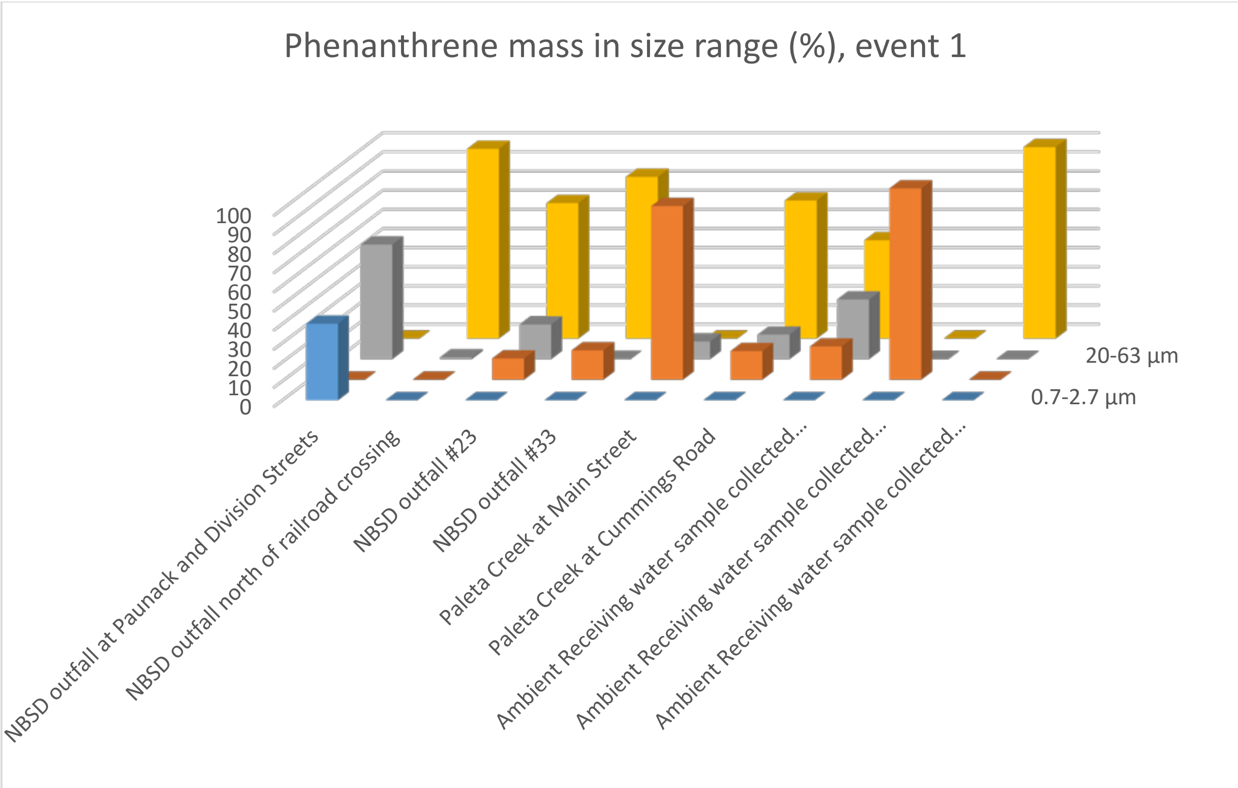
** SSC not detected; particulate strength not calculated, assumed to be zero

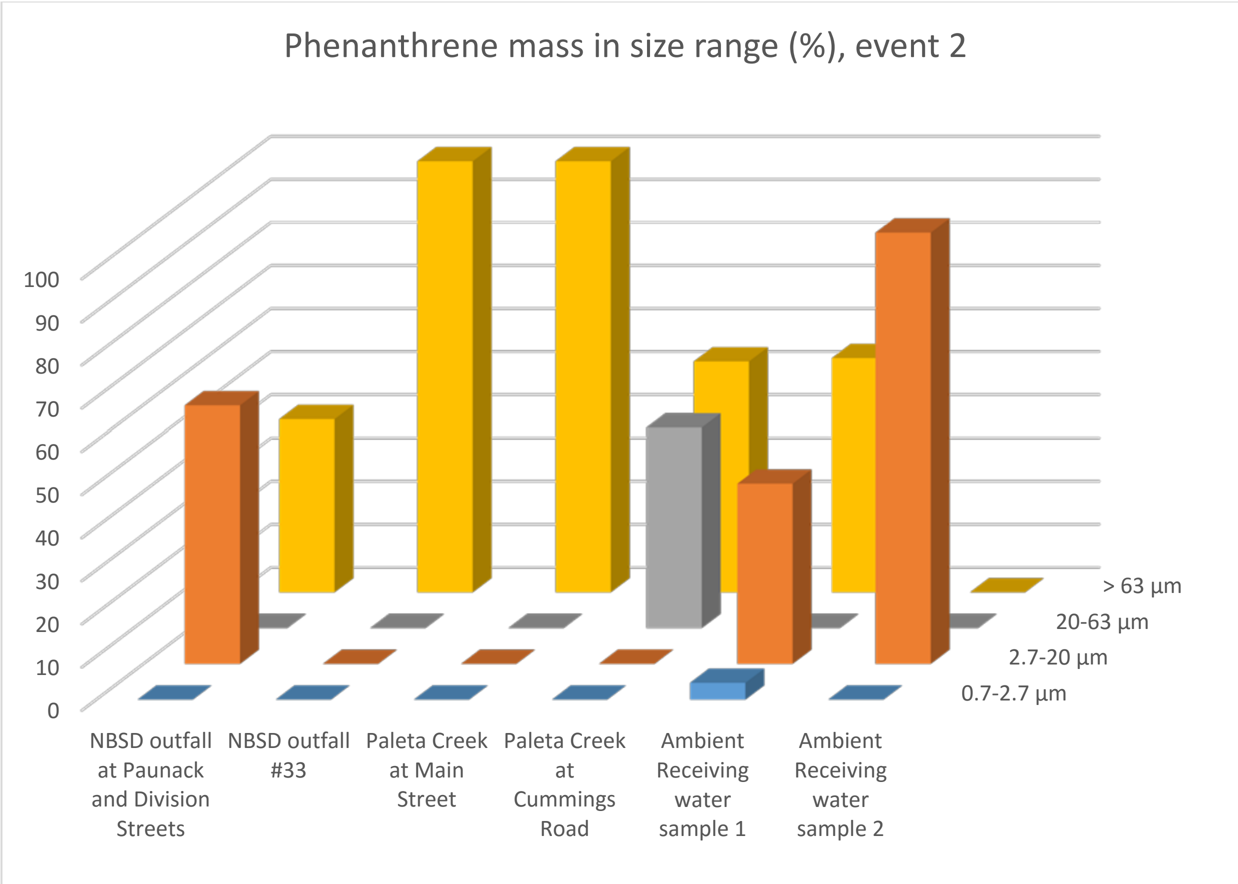
Phenanthrene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	nd	16	na
2.7-20 µm	11	nd	nd	0.1	44	21
20-63 µm	nd	nd	nd	357	nd	nd
> 63 µm	997	2,490	541	443	3,070	na

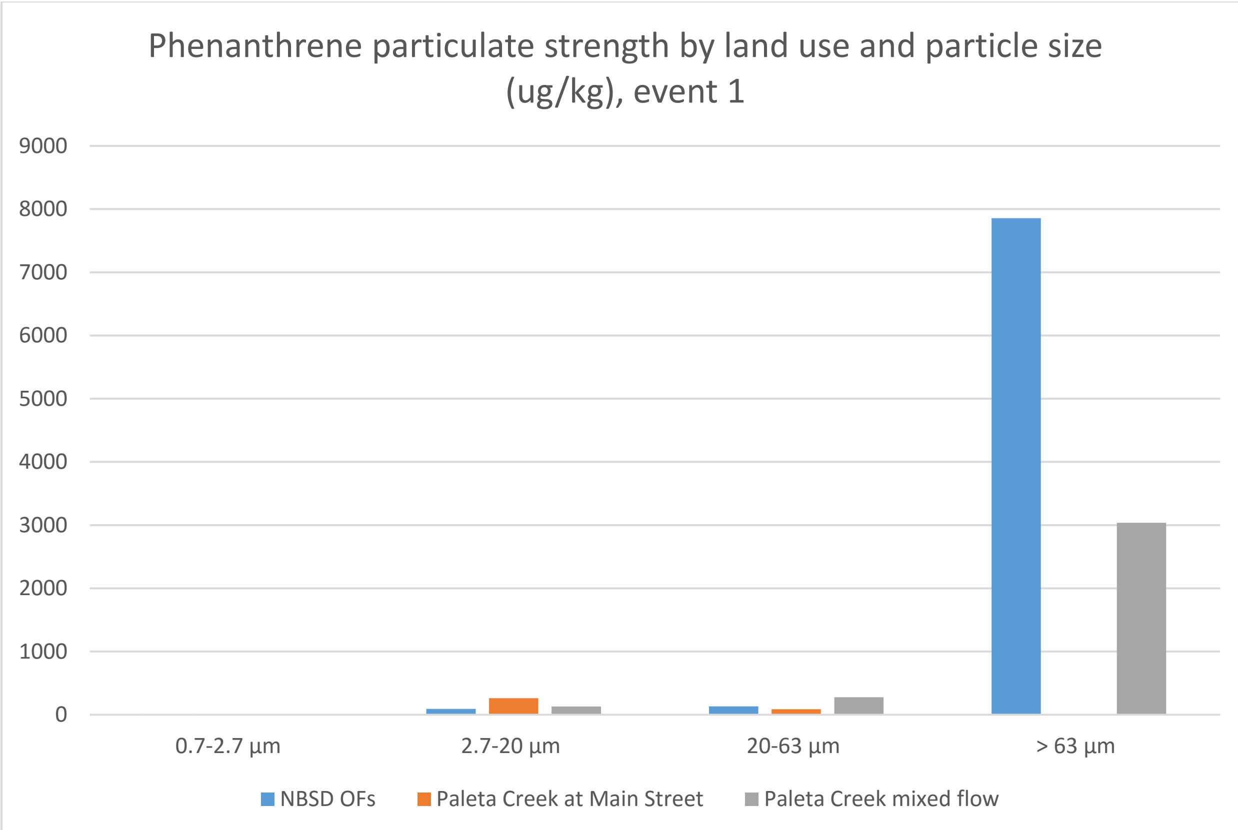


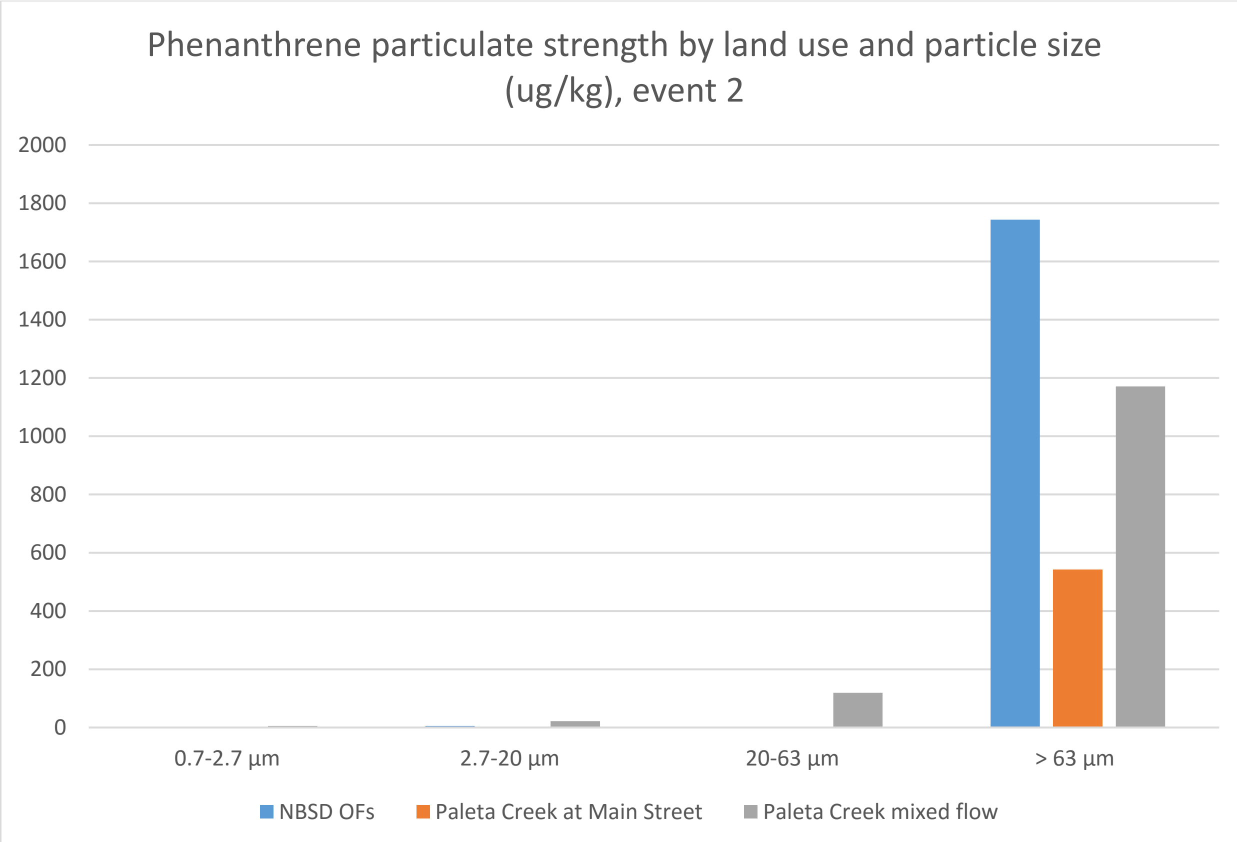
Phenanthrene (ug/kg), event 1
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

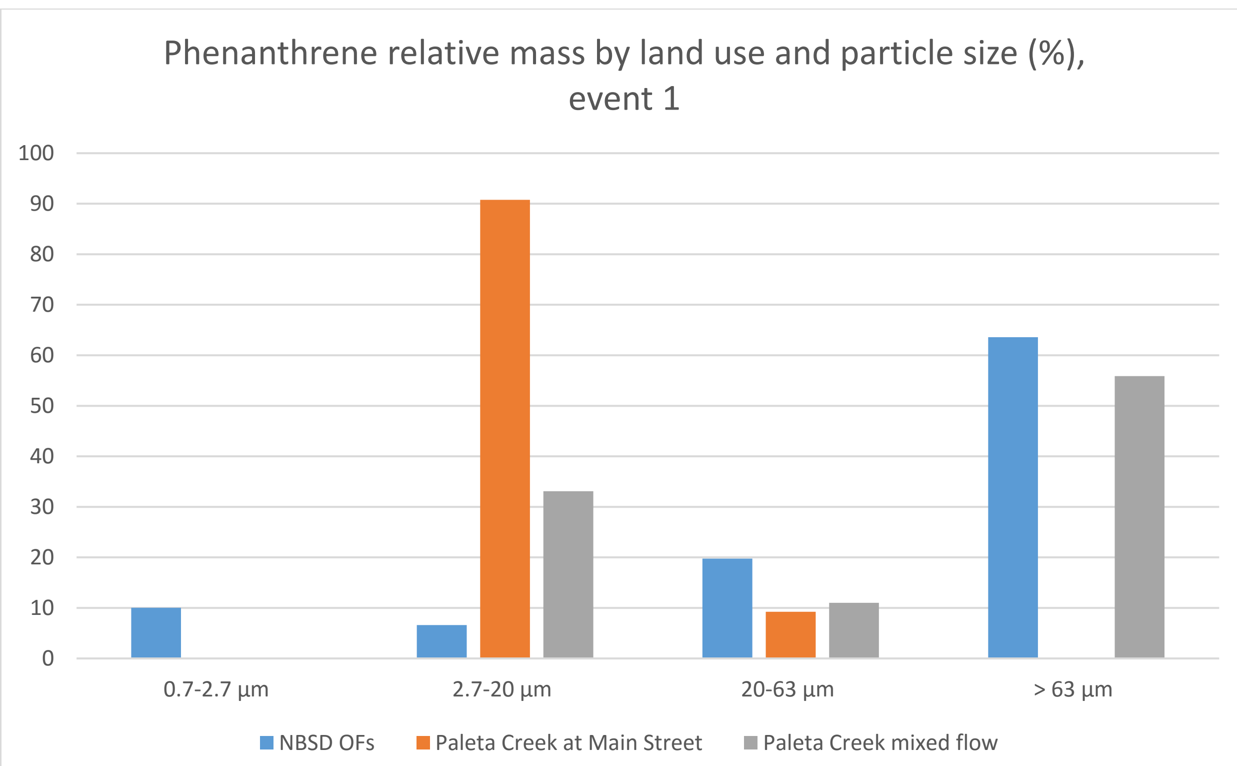

Phenanthrene (ug/kg)
3500
3000
2500
2000
1500
1000
500
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm

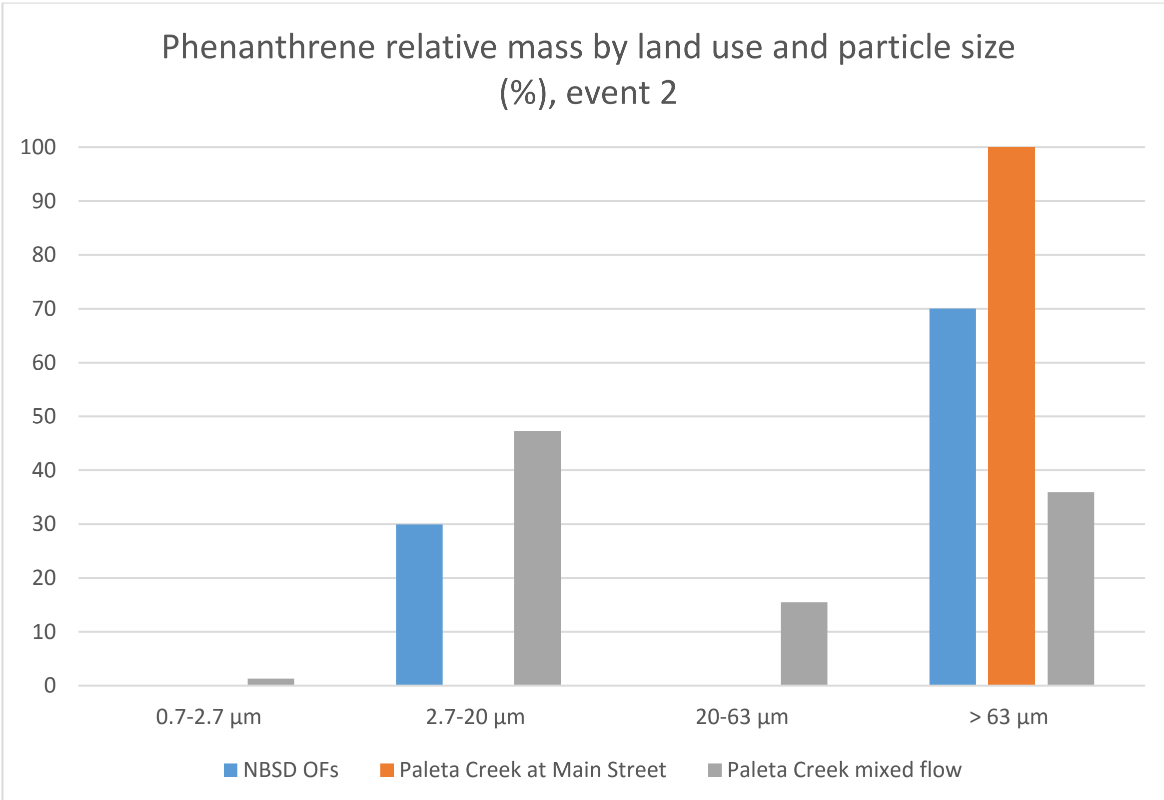

Phenanthrene mass in size range (%), event 1
100
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...


Phenanthrene mass in size range (%), event 2
100
90
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Phenanthrene particulate strength by land use and particle size (ug/kg), event 1
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Phenanthrene particulate strength by land use and particle size (ug/kg), event 2
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Phenanthrene relative mass by land use and particle size (%), event 1
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Phenanthrene relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

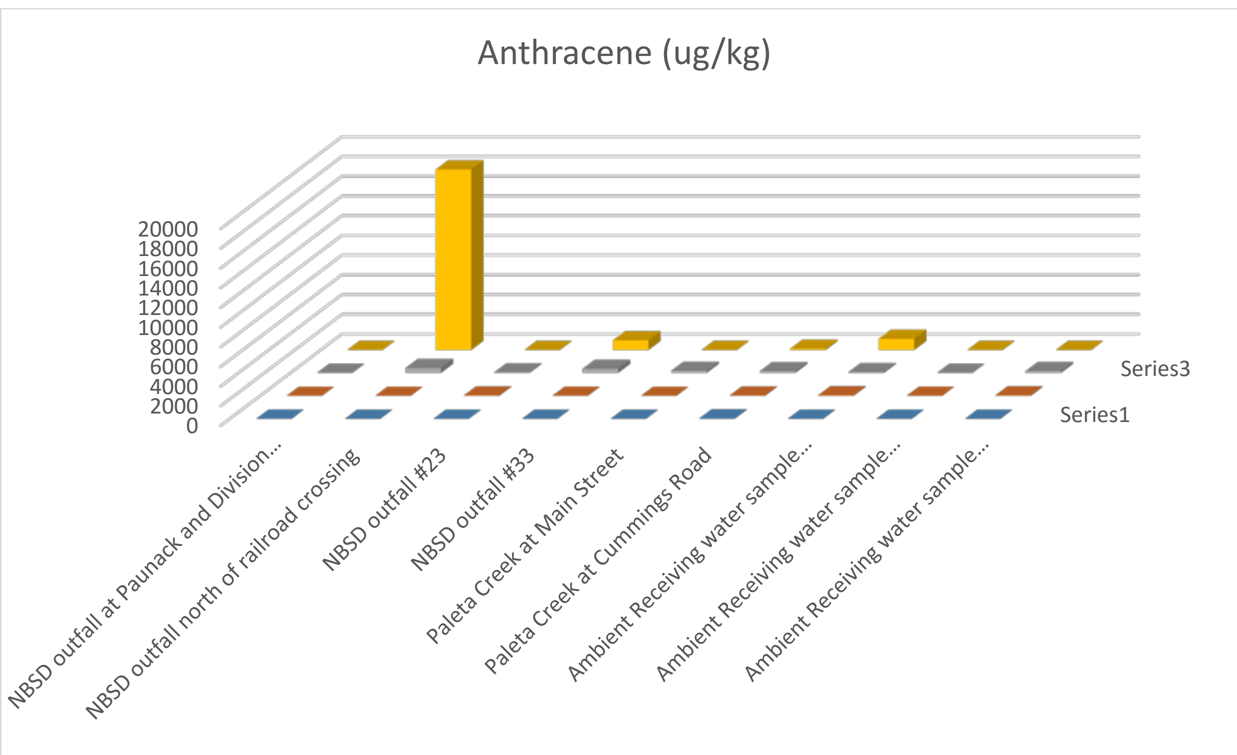
Anthracene

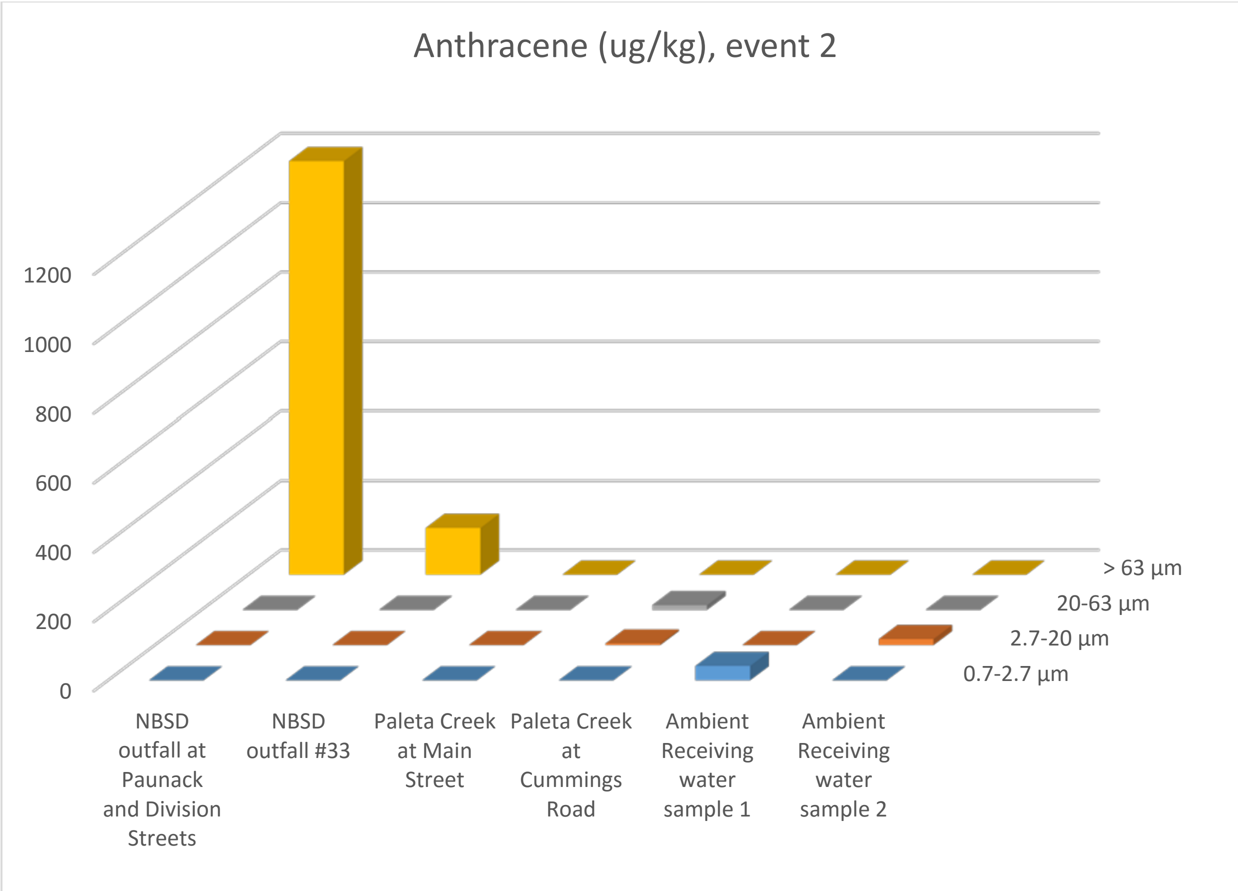
Anthracene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cumming s Road	Ambient Receivin g water sample collected on 1/5/2016 at 1327 h	Ambient Receivin g water sample collected on 1/5/2016 at 1947 h	Ambient Receivin g water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	6.6	na	na	nd	nd	30.0	na	nd	nd
2.7-20 µm	nd*	nd	32.3	4.8	nd	19.8	47.8	4.5	35.6
20-63 µm	nd	493	48.2	419	212	169	79.2	nd	184
> 63 µm	na**	18,310	nd	985	nd	118	1,141	na	nd

* not detected; particulate strength not calculated, assumed to be zero

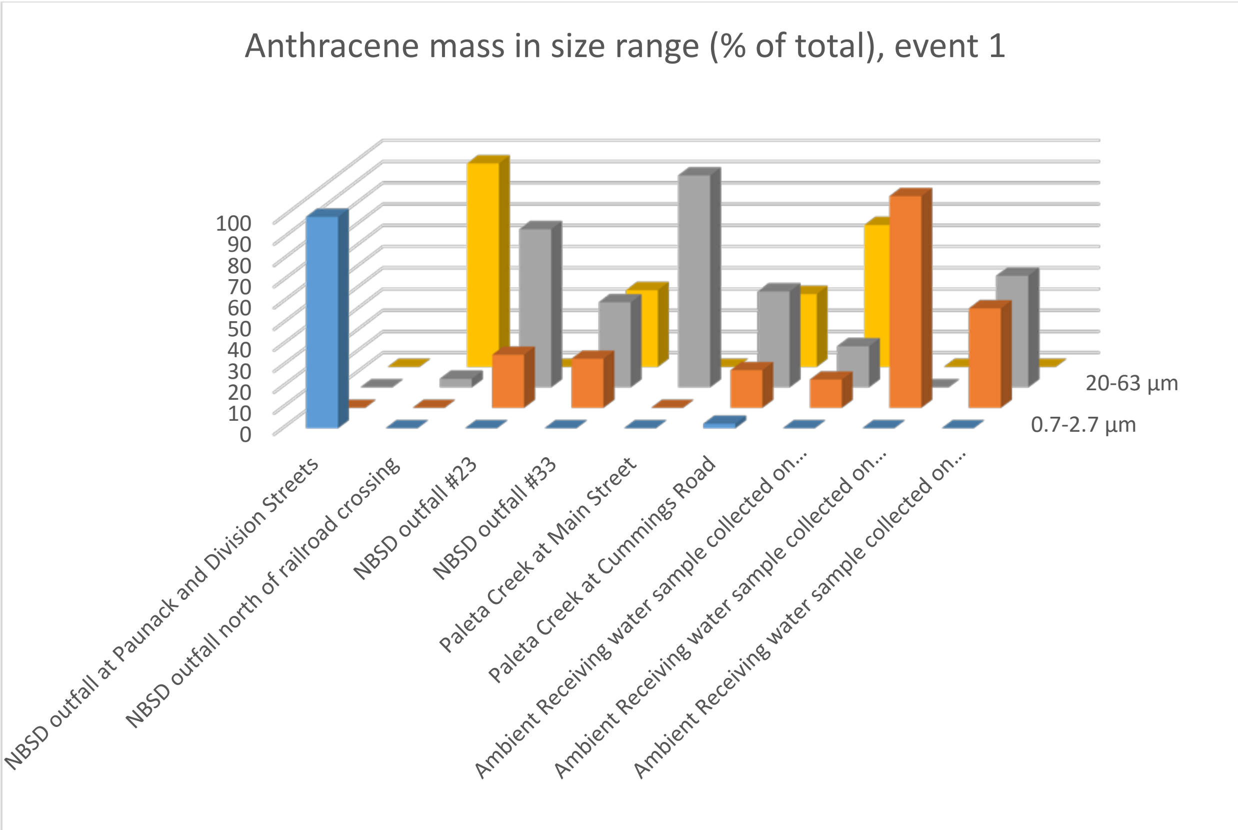
** SSC not detected; particulate strength not calculated, assumed to be zero

Anthracene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	nd	41.5	na
2.7-20 µm	nd	nd	nd	4.8	nd	17.5
20-63 µm	nd	nd	nd	14	nd	nd
> 63 µm	1,191	135	nd	nd	nd	na

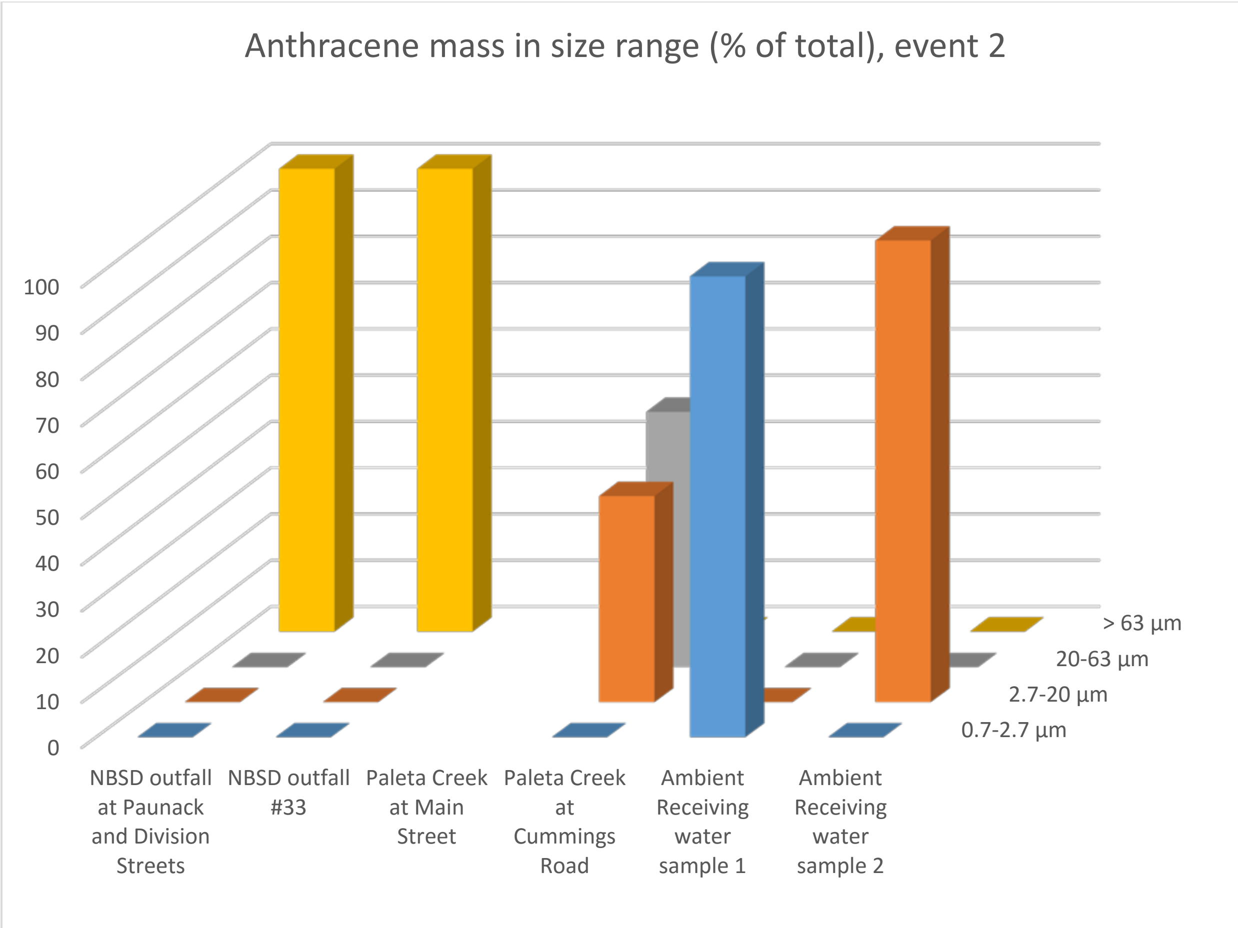


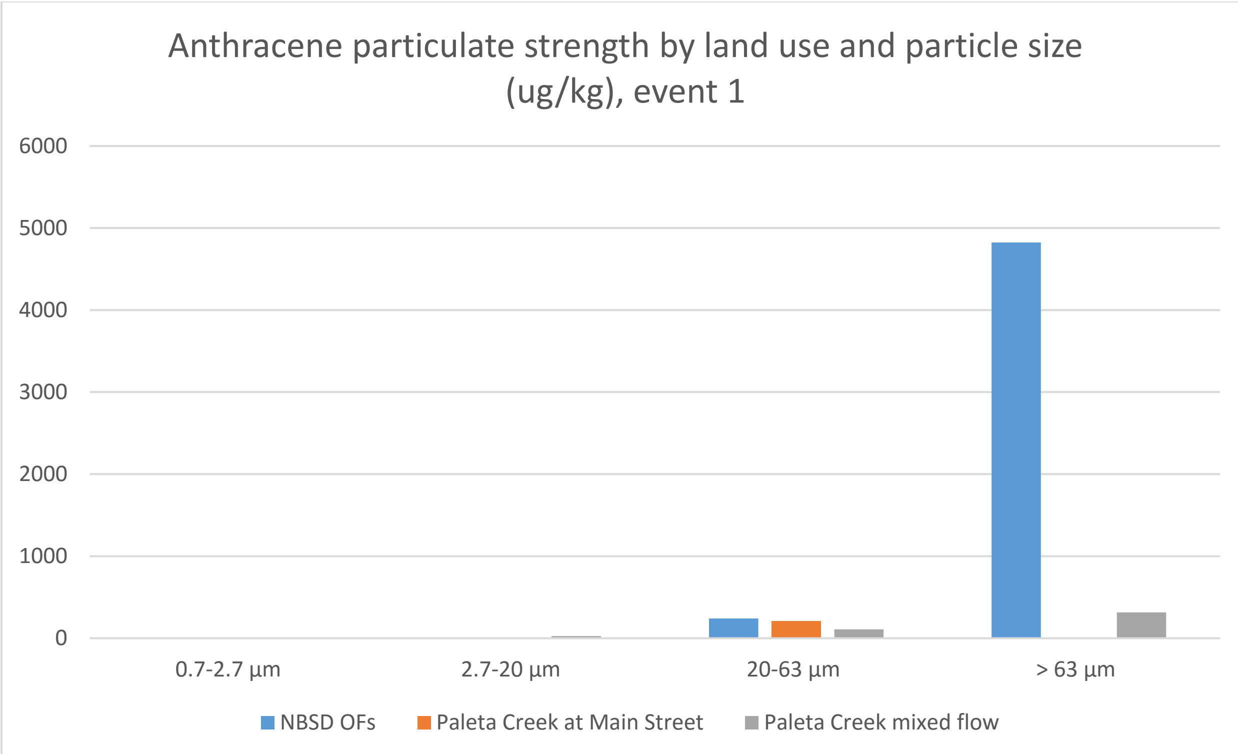


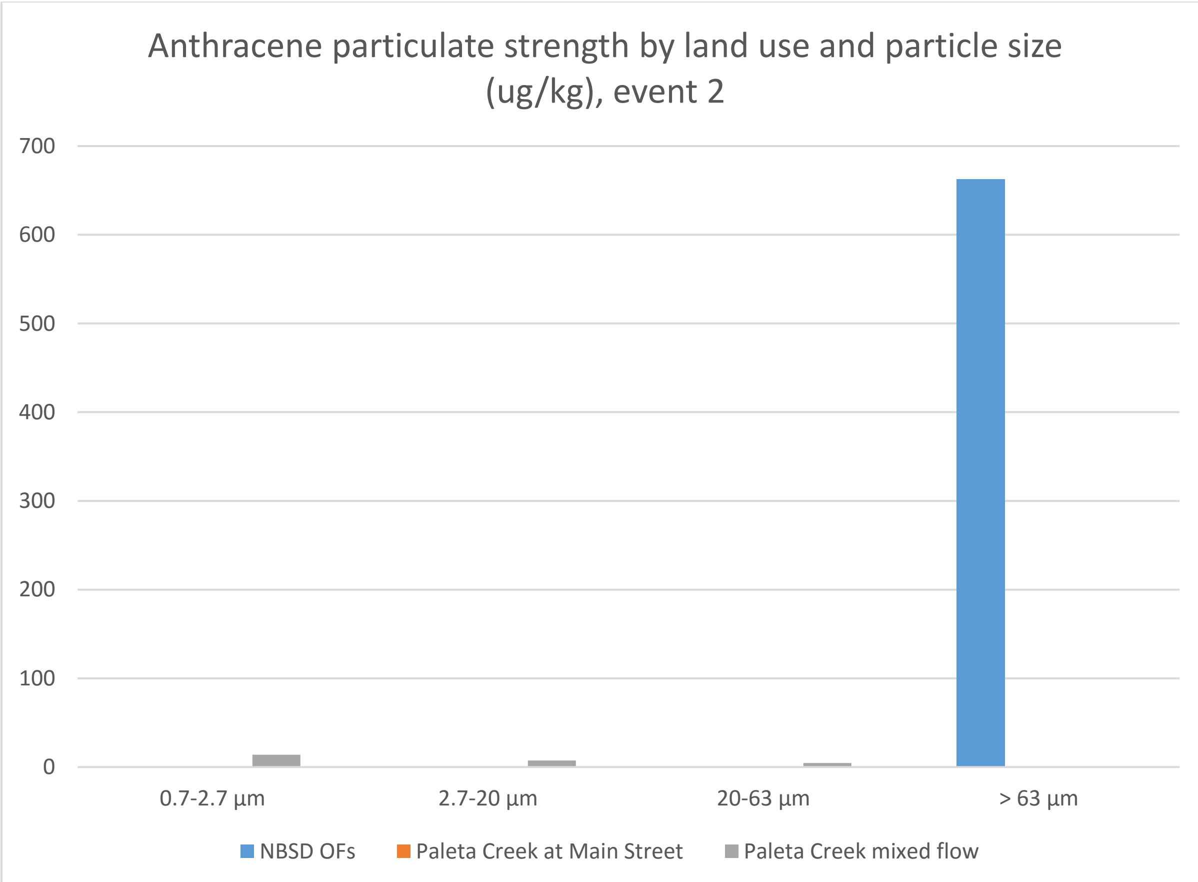
Anthracene (ug/kg), event 2
1200
1000
800
600
400
200
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

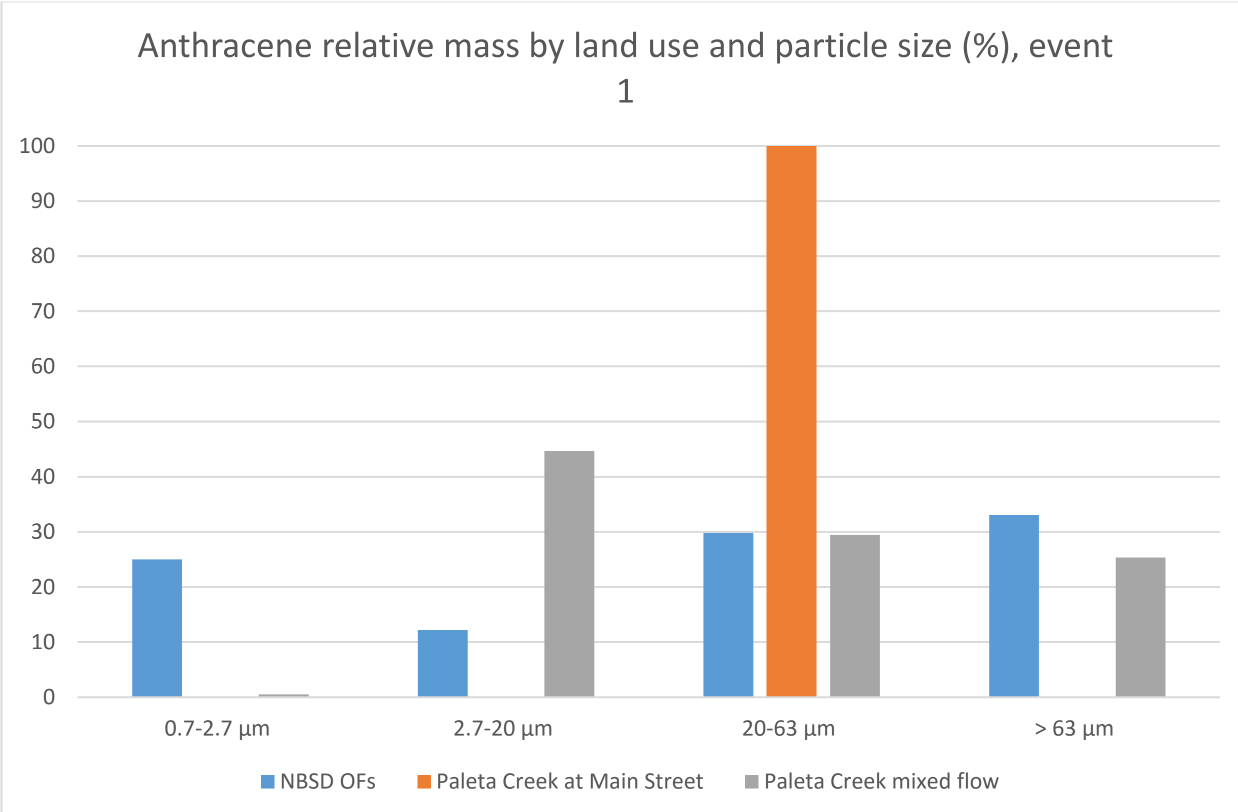


Anthracene mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

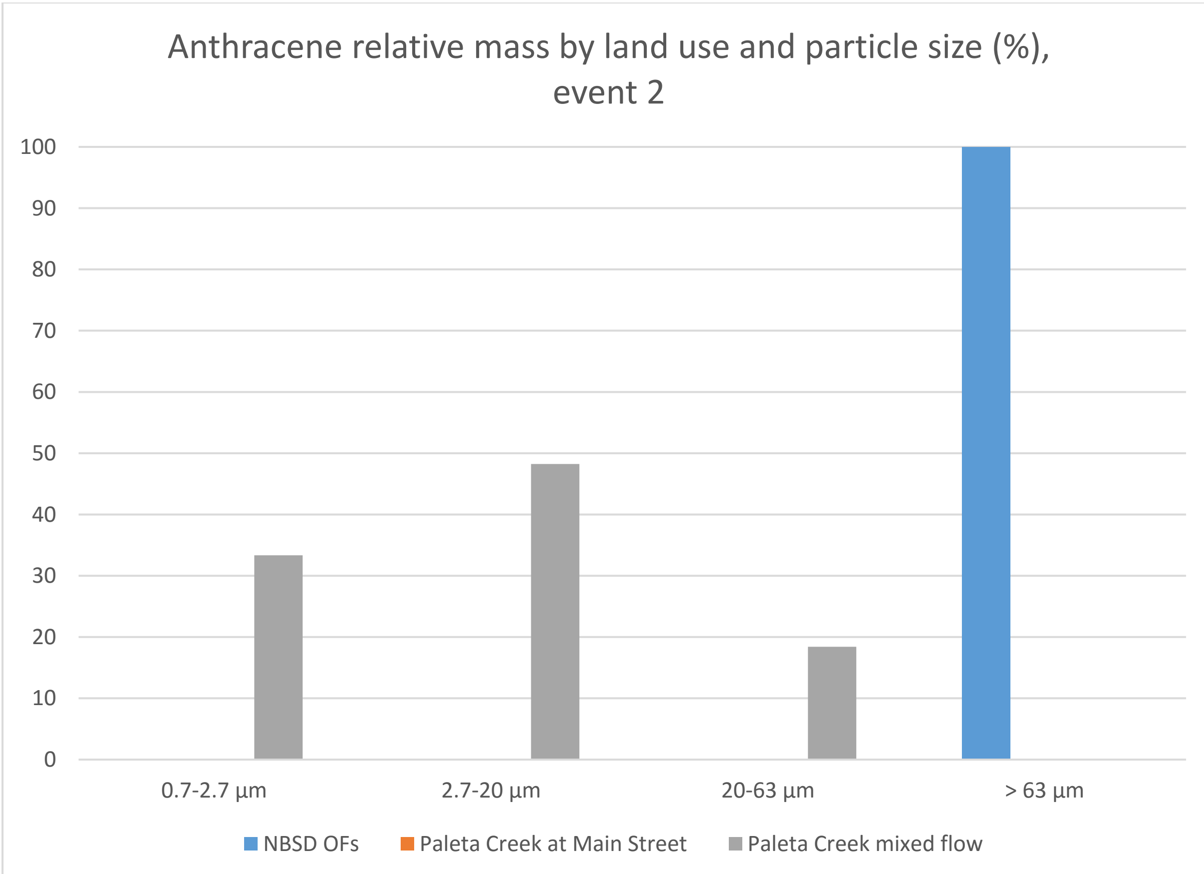

Anthracene mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Anthracene particulate strength by land use and particle size (ug/kg), event 1
6000
5000
4000
3000
2000
1000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Anthracene particulate strength by land use and particle size (ug/kg), event 2
700
600
500
400
300
200
100
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Anthracene relative mass by land use and particle size (%), event 1
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Anthracene relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

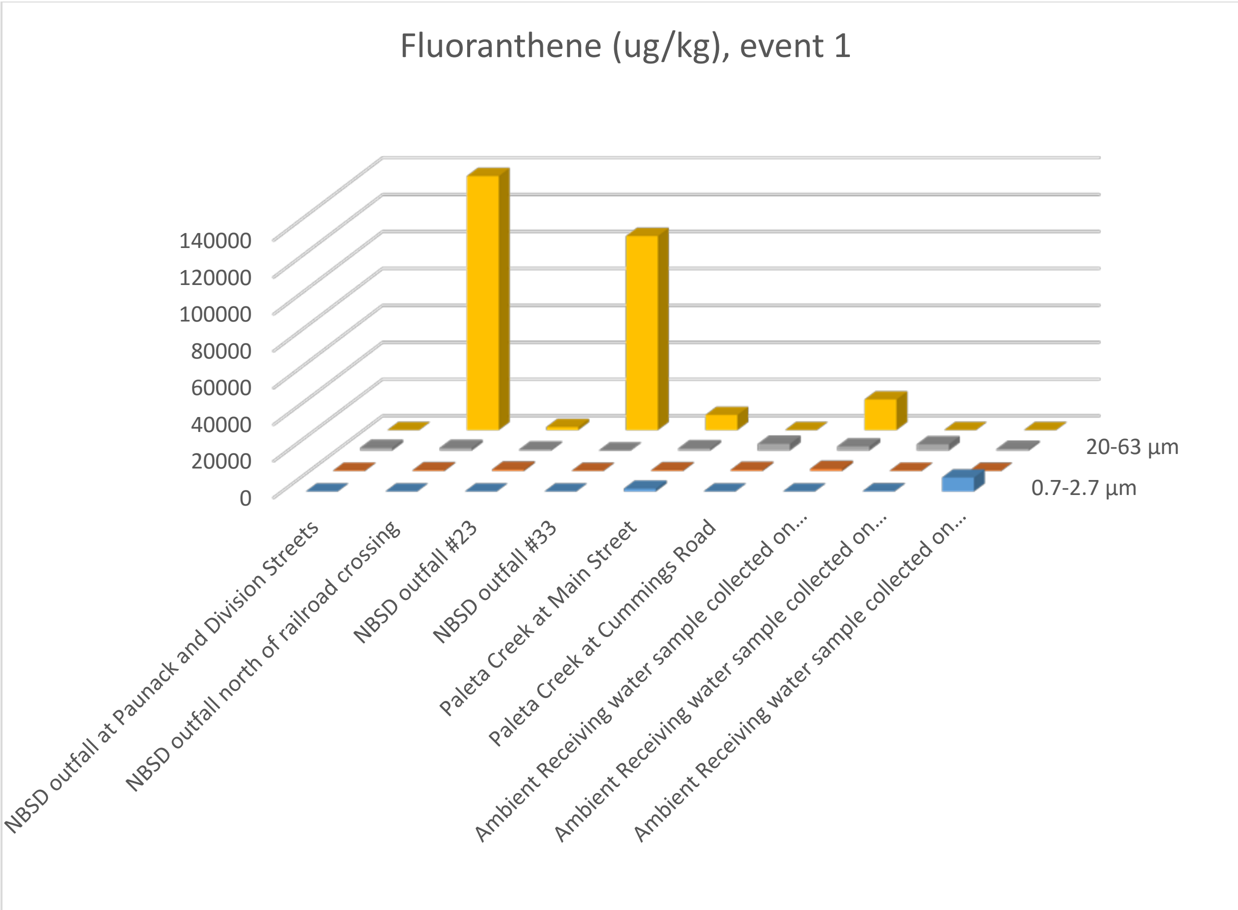
Fluoranthene

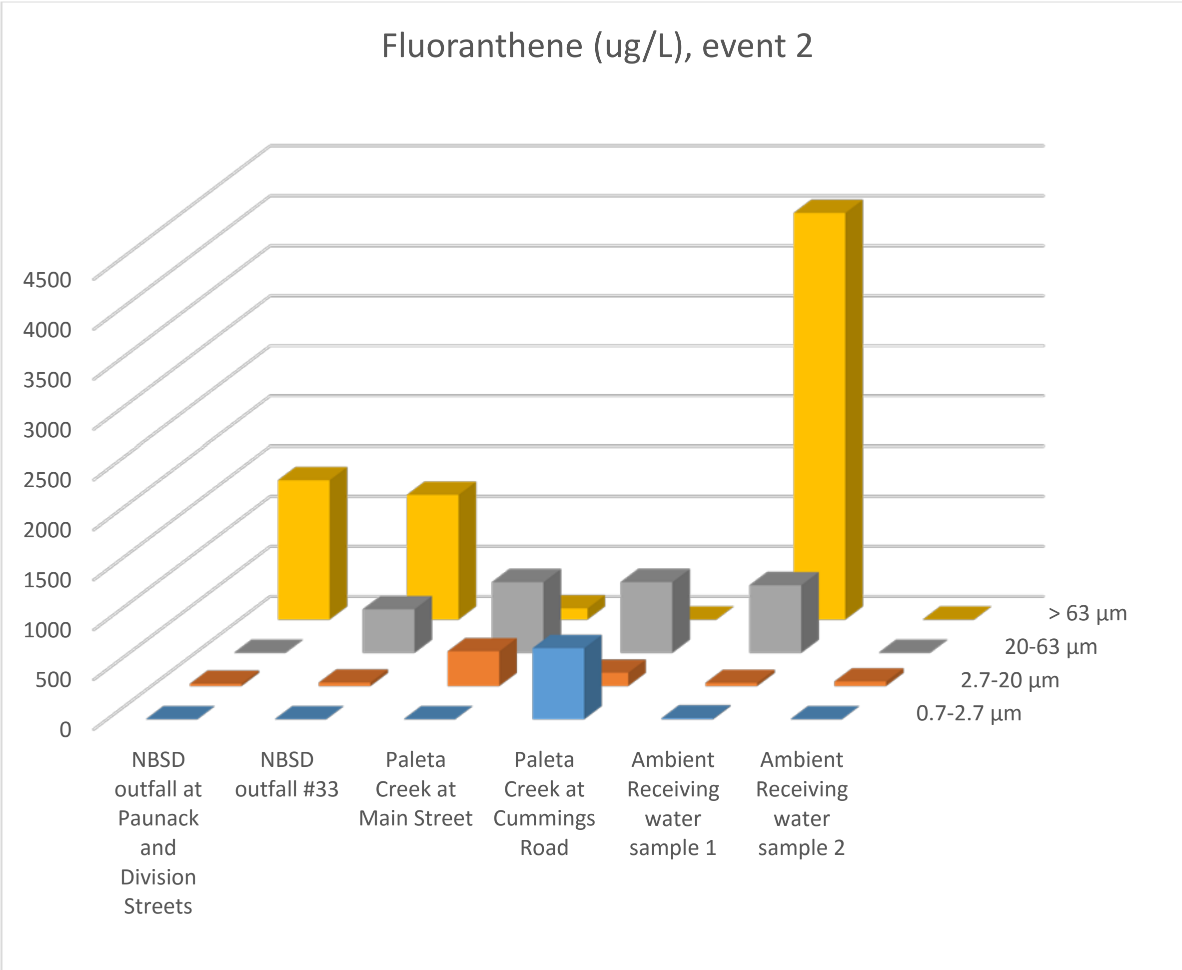
Fluoranthene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	nd*	na	na	nd	1,587	nd	na	95.3	7,636
2.7-20 µm	186	385	810	94.8	382	645	1,187	171	141
20-63 µm	1,467	1,403	579	nd	1,169	3,645	2,269	3,443	838
> 63 µm	na**	137,838	1,710	105,345	8,307	nd	16,768	na	nd

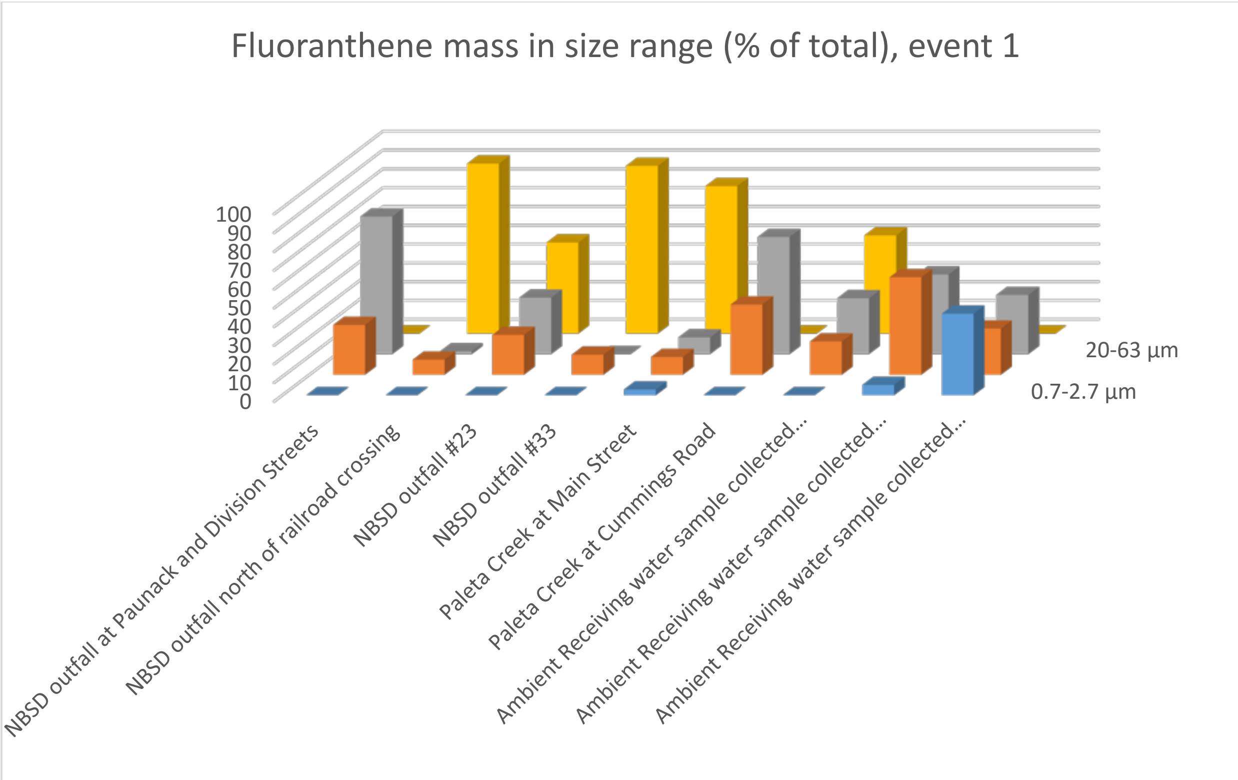
* not detected; particulate strength not calculated, assumed to be zero

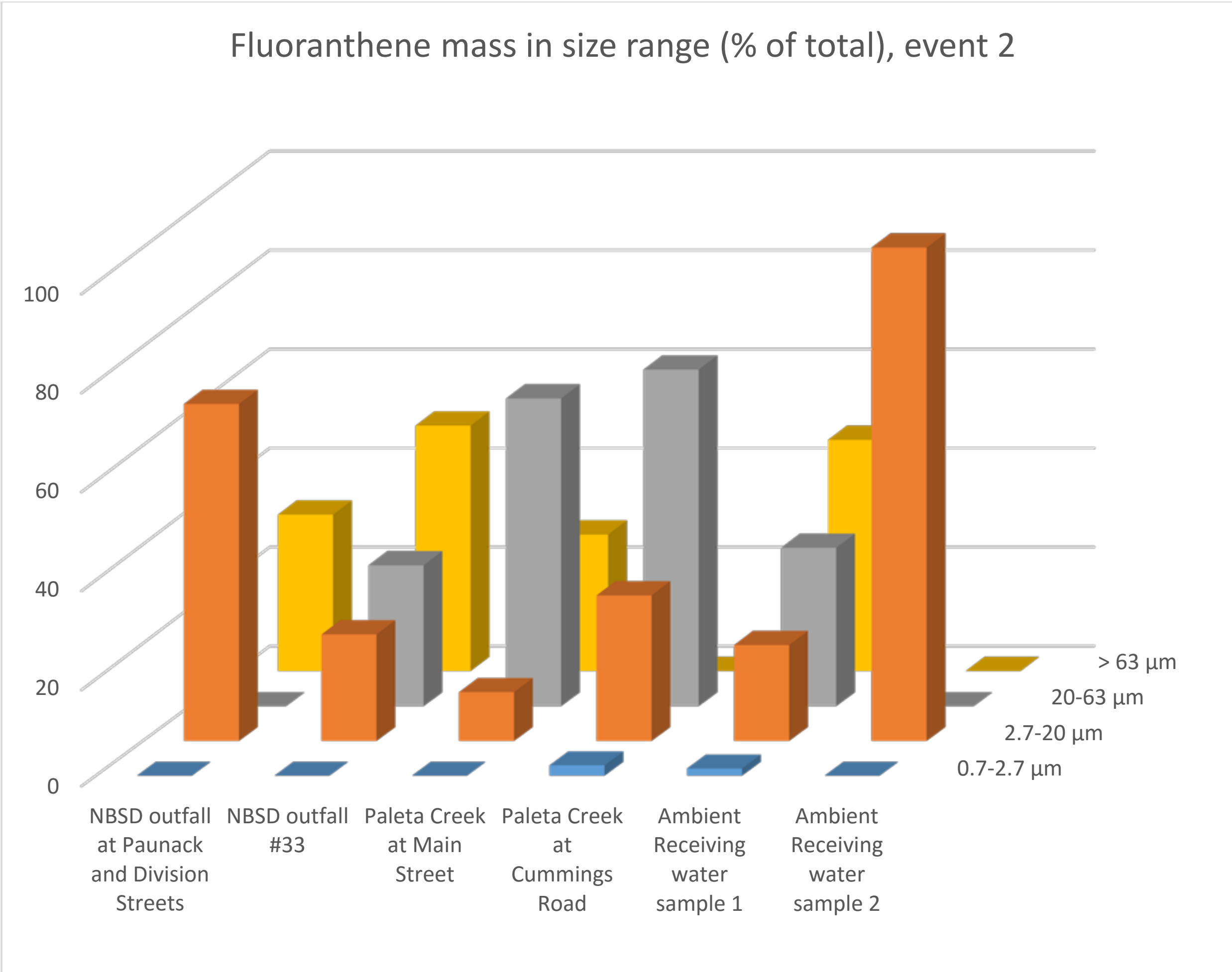
** SSC not detected; particulate strength not calculated, assumed to be zero

Fluoranthene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	715	9.3	na
2.7-20 µm	23	35	349	134	32.0	46.2
20-63 µm	nd	438	708	709	677	nd
> 63 µm	1,395	1,249	113	nd	4,061	na

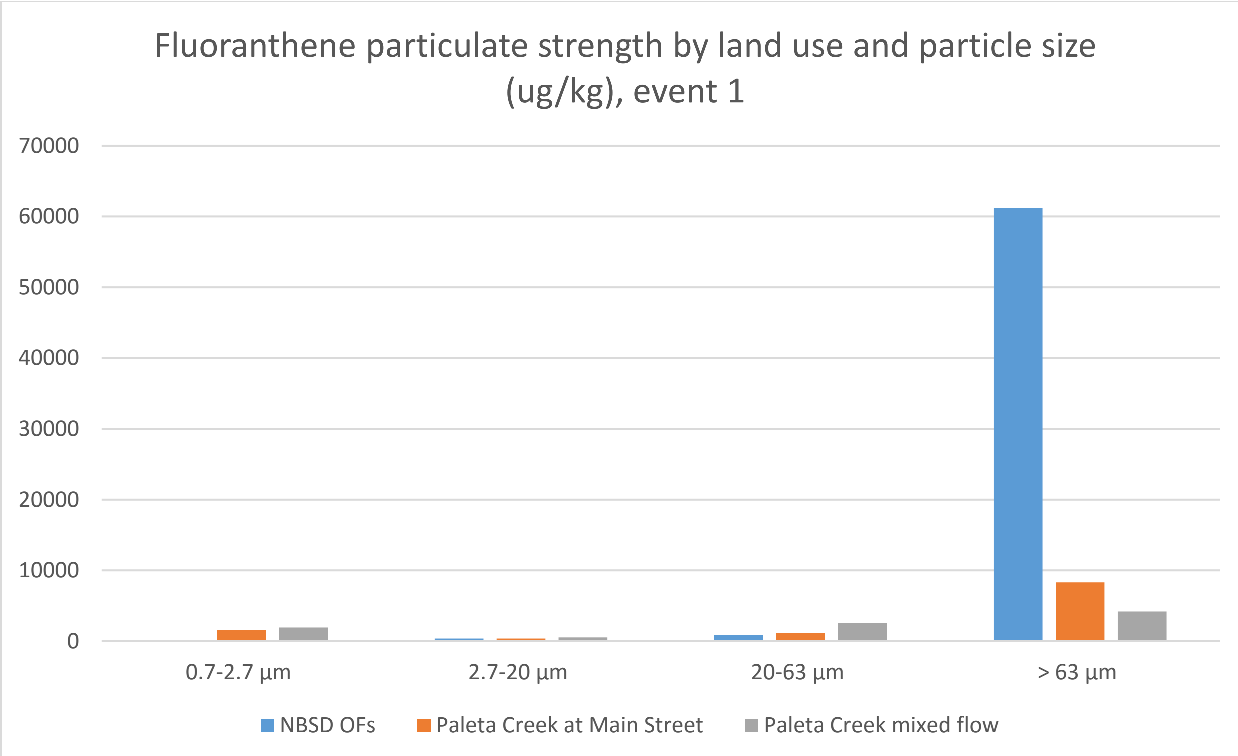

Fluoranthene (ug/kg), event 1
140000
120000
100000
80000
60000
40000
20000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

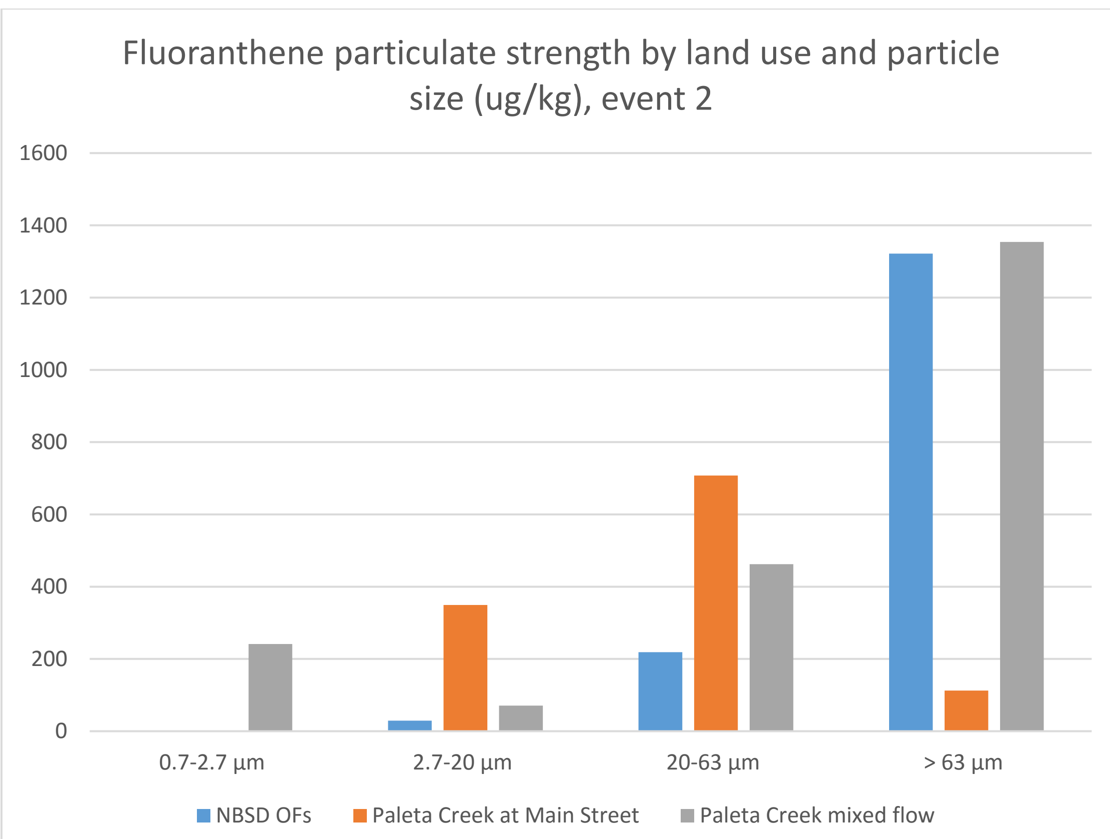

Fluoranthene (ug/L), event 2
4500
4000
3500
3000
2500
2000
1500
1000
500
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

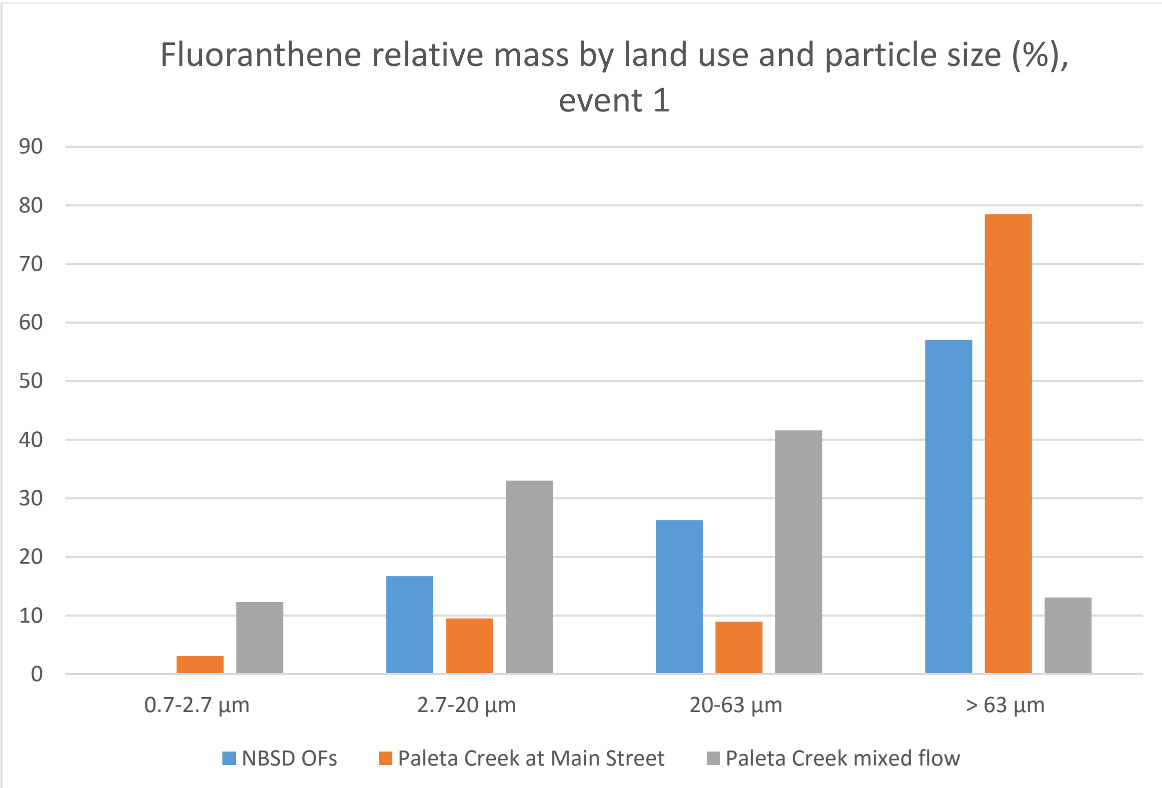

Fluoranthene mass in size range (% of total), event 1
100
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...

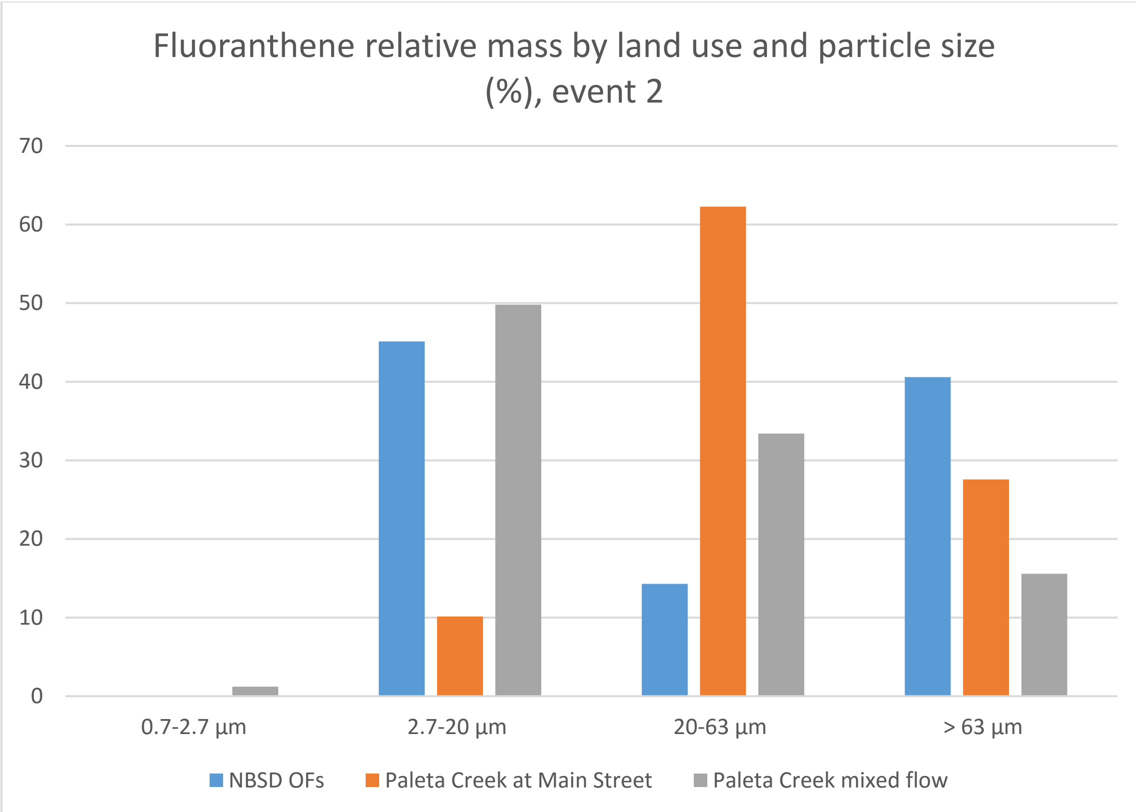


Fluoranthene mass in size range (% of total), event 2
100
80
60
40
20
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Fluoranthene particulate strength by land use and particle size (ug/kg), event 1
70000
60000
50000
40000
30000
20000
10000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Fluoranthene particulate strength by land use and particle size (ug/kg), event 2
1600
1400
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Fluoranthene relative mass by land use and particle size (%), event 1
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Fluoranthene relative mass by land use and particle size (%), event 2
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

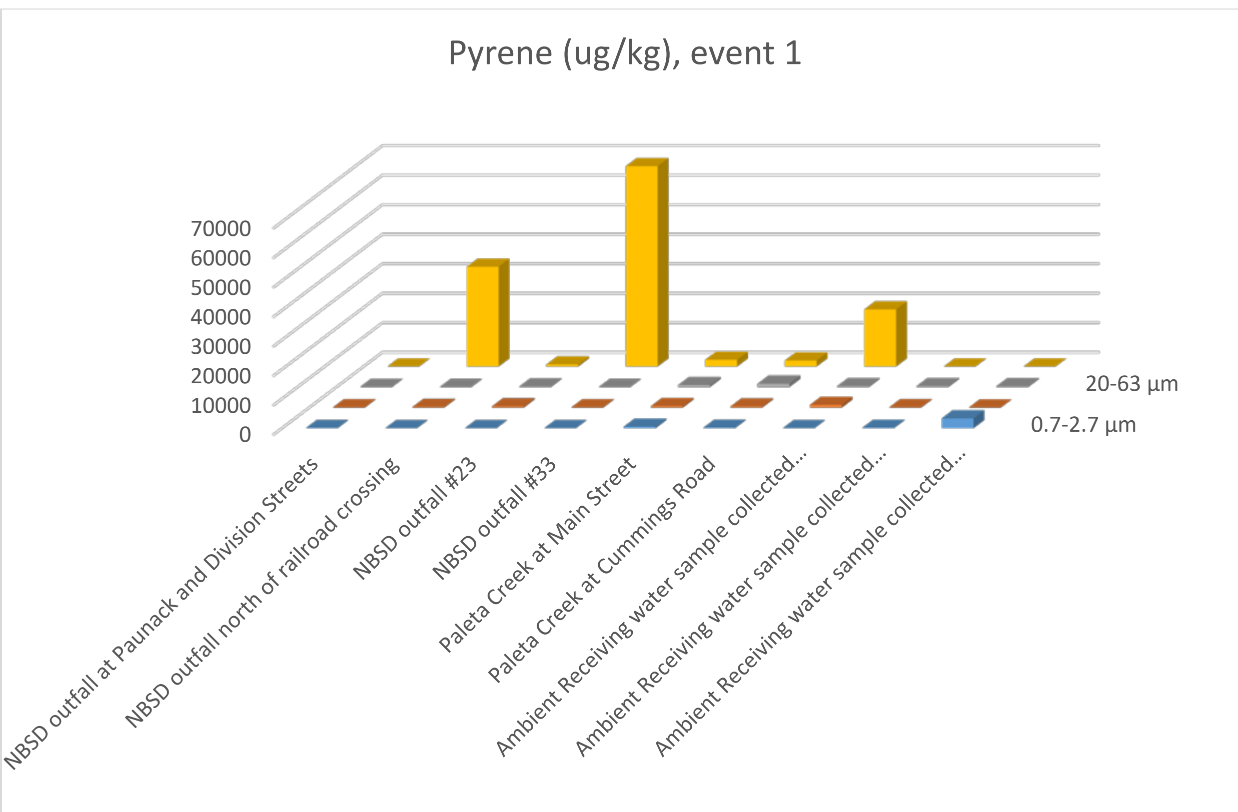
Pyrene

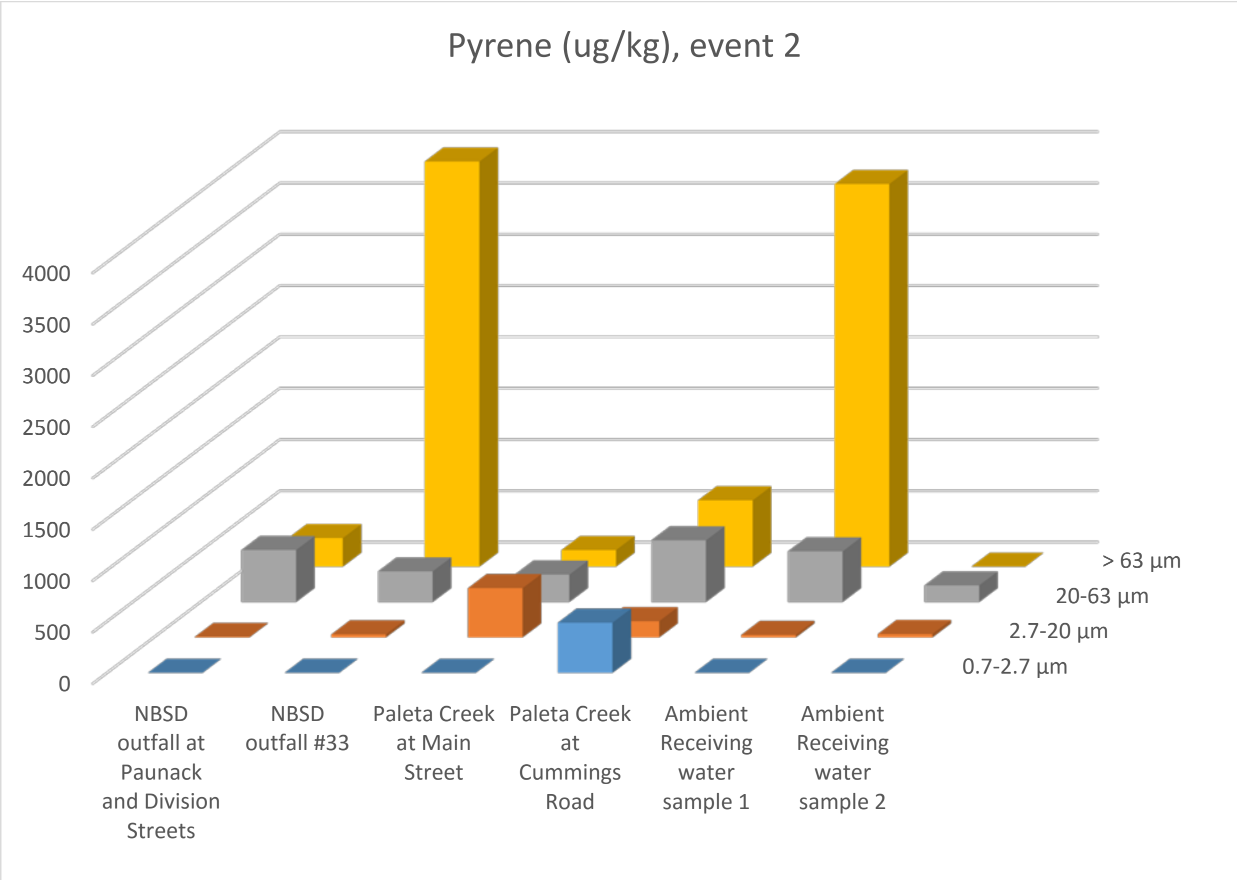
Pyrene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	20.4	na	na	nd	504	129	na	115	3,336
2.7-20 µm	114	230	433	110	511	372	933	145	58.0
20-63 µm	65.0	nd*	163	nd	685	1,163	307	320	217
> 63 µm	na**	33,845	686	67,884	2,314	2,042	19,374	na	nd

* not detected; particulate strength not calculated, assumed to be zero

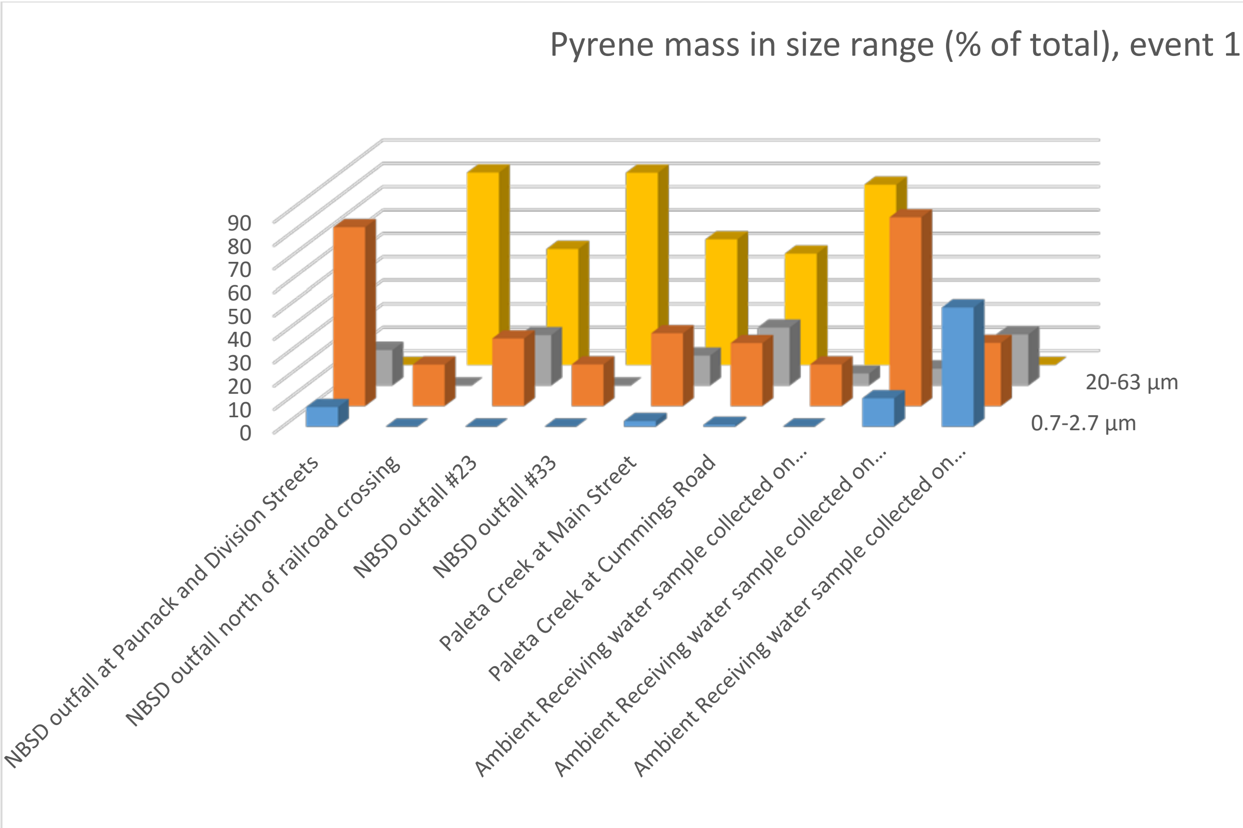
** SSC not detected; particulate strength not calculated, assumed to be zero

Pyrene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	488	nd	na
2.7-20 µm	4.8	30	479	159	24.5	33.4
20-63 µm	507	299	267	601	493	162
> 63 µm	279	3,950	162	648	3,730	na

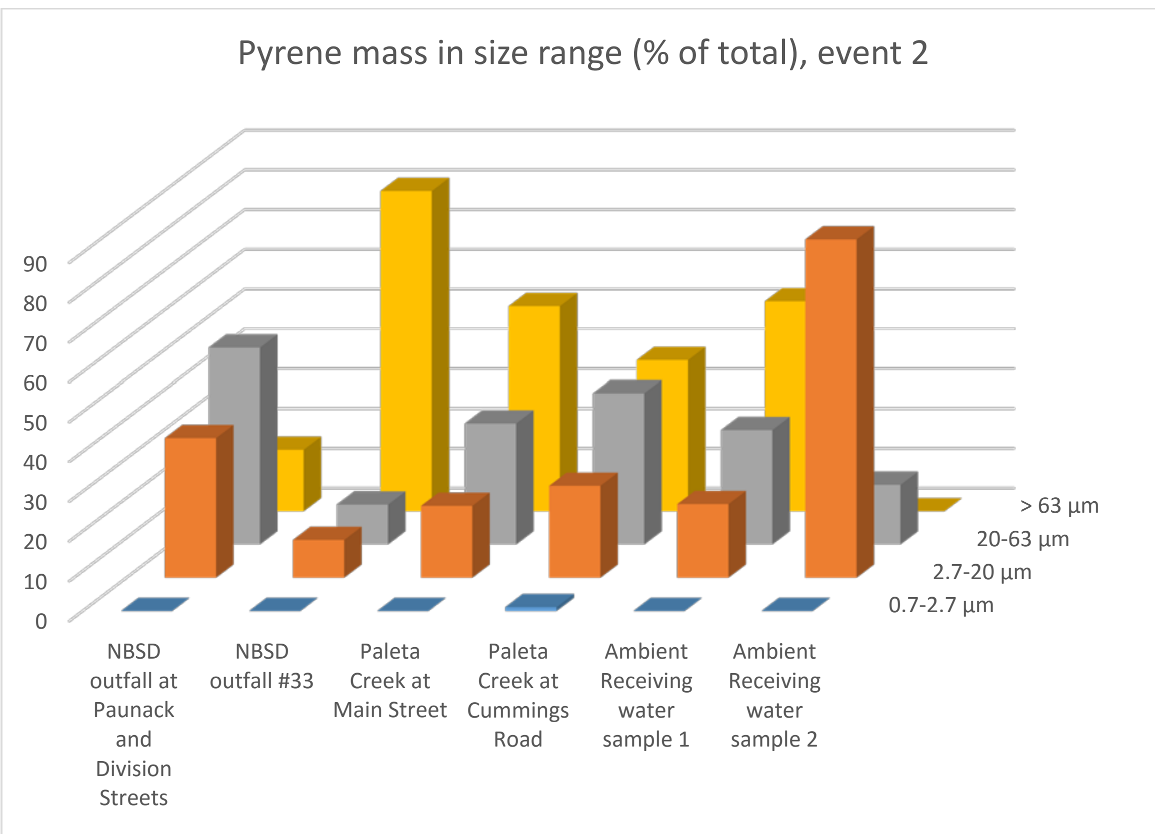




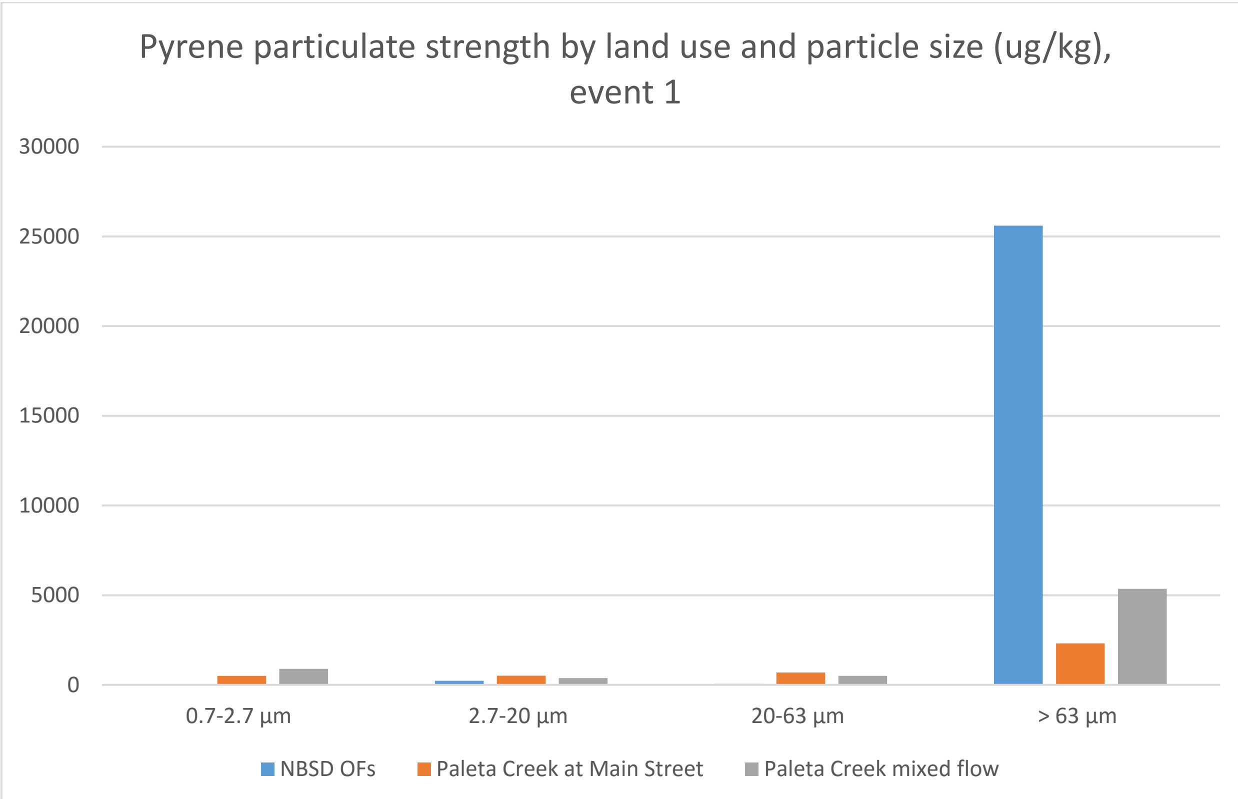
Pyrene (ug/kg), event 2
4000
3500
3000
2500
2000
1500
1000
500
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm

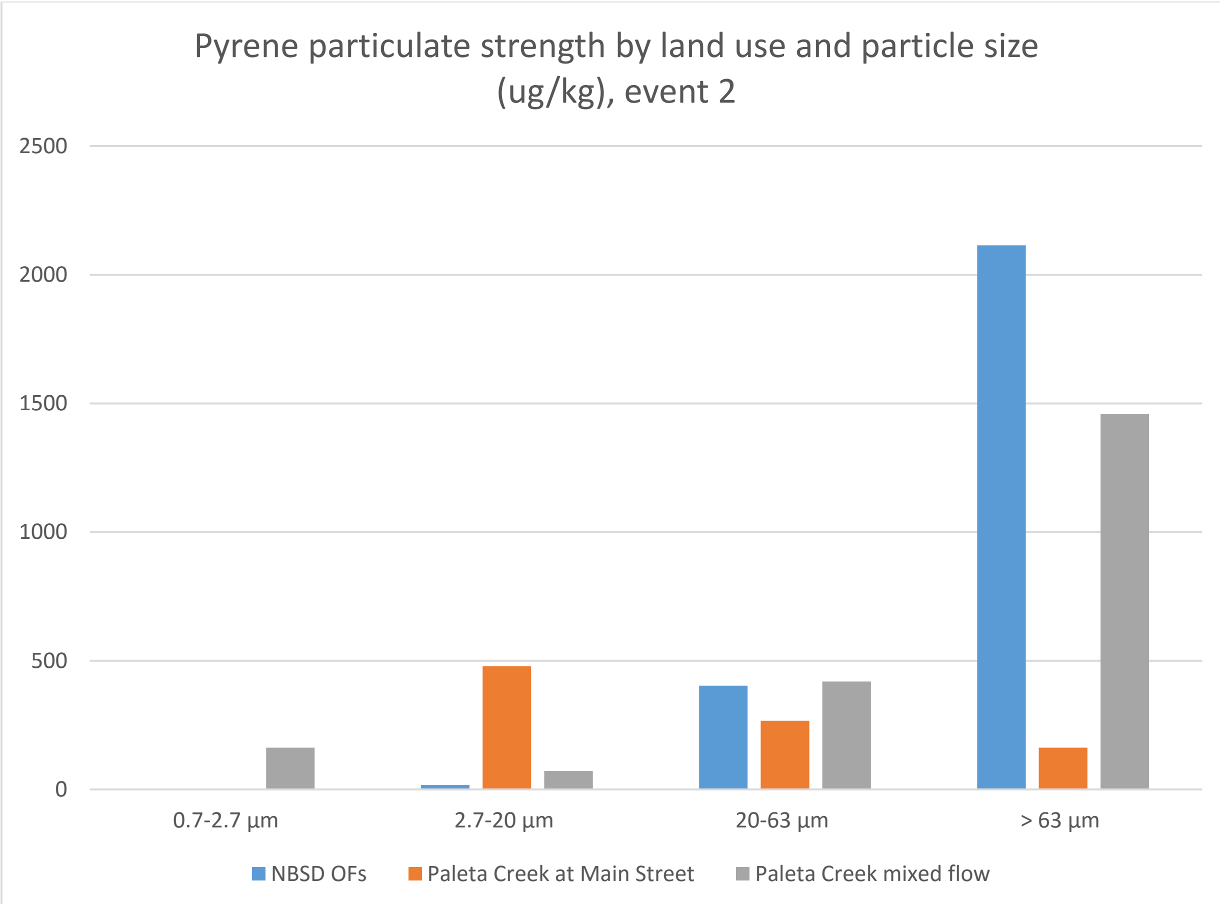


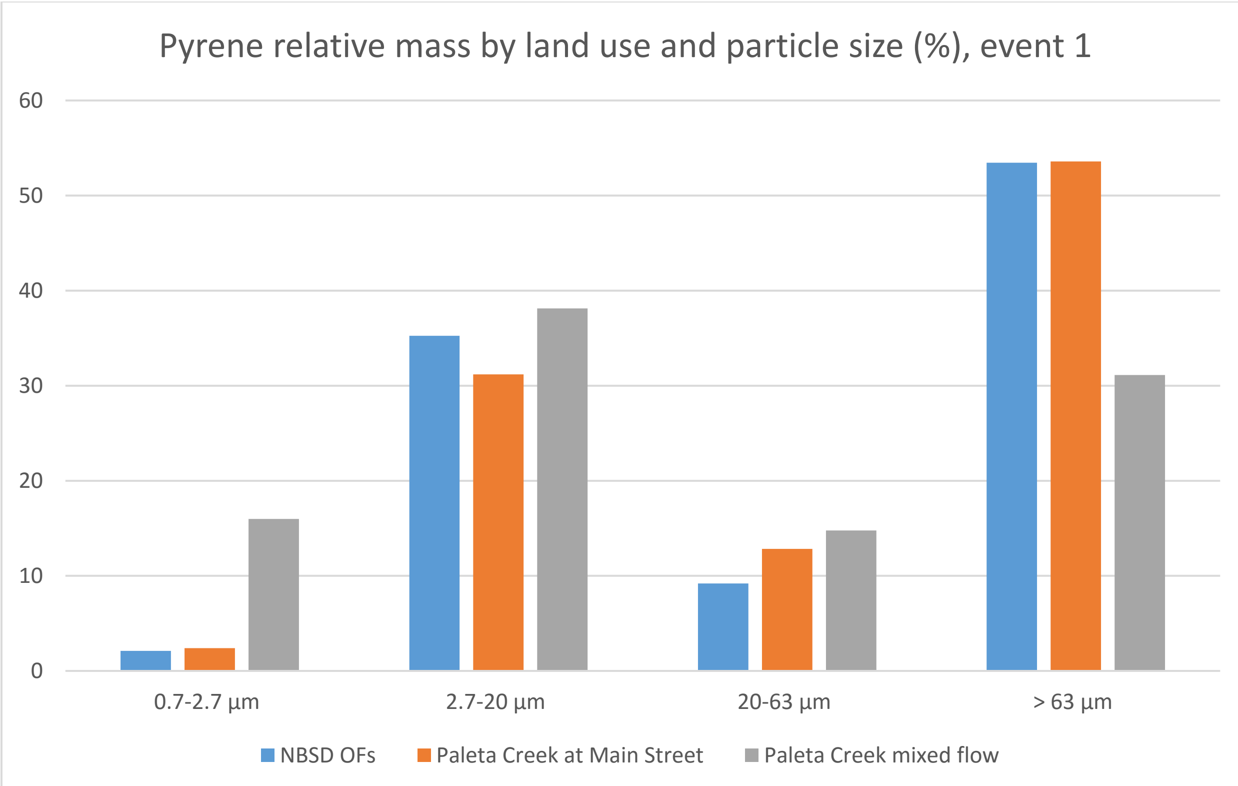
Pyrene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

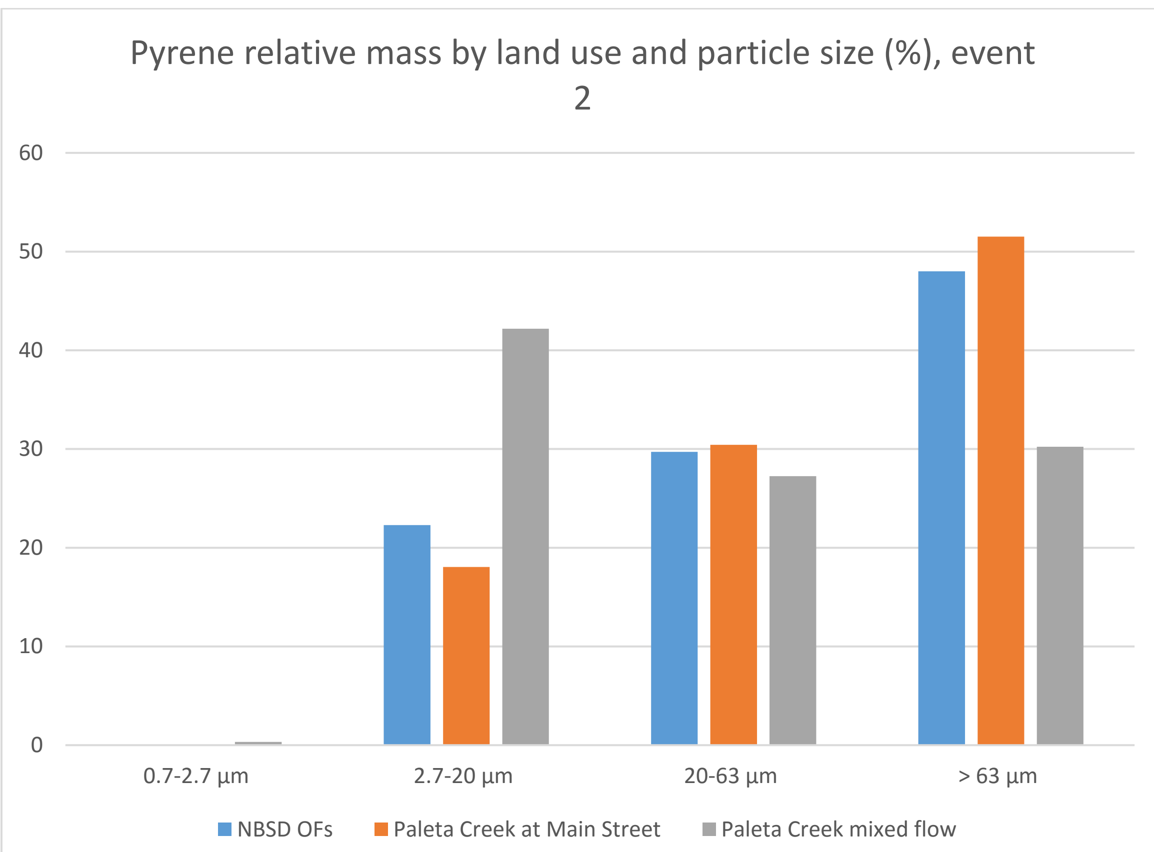


Pyrene mass in size range (% of total), event 2
90
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Pyrene particulate strength by land use and particle size (ug/kg), event 1
30000
25000
20000
15000
10000
5000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Pyrene particulate strength by land use and particle size (ug/kg), event 2
2500
2000
1500
1000
500
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Pyrene relative mass by land use and particle size (%), event 1
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Pyrene relative mass by land use and particle size (%), event 2
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

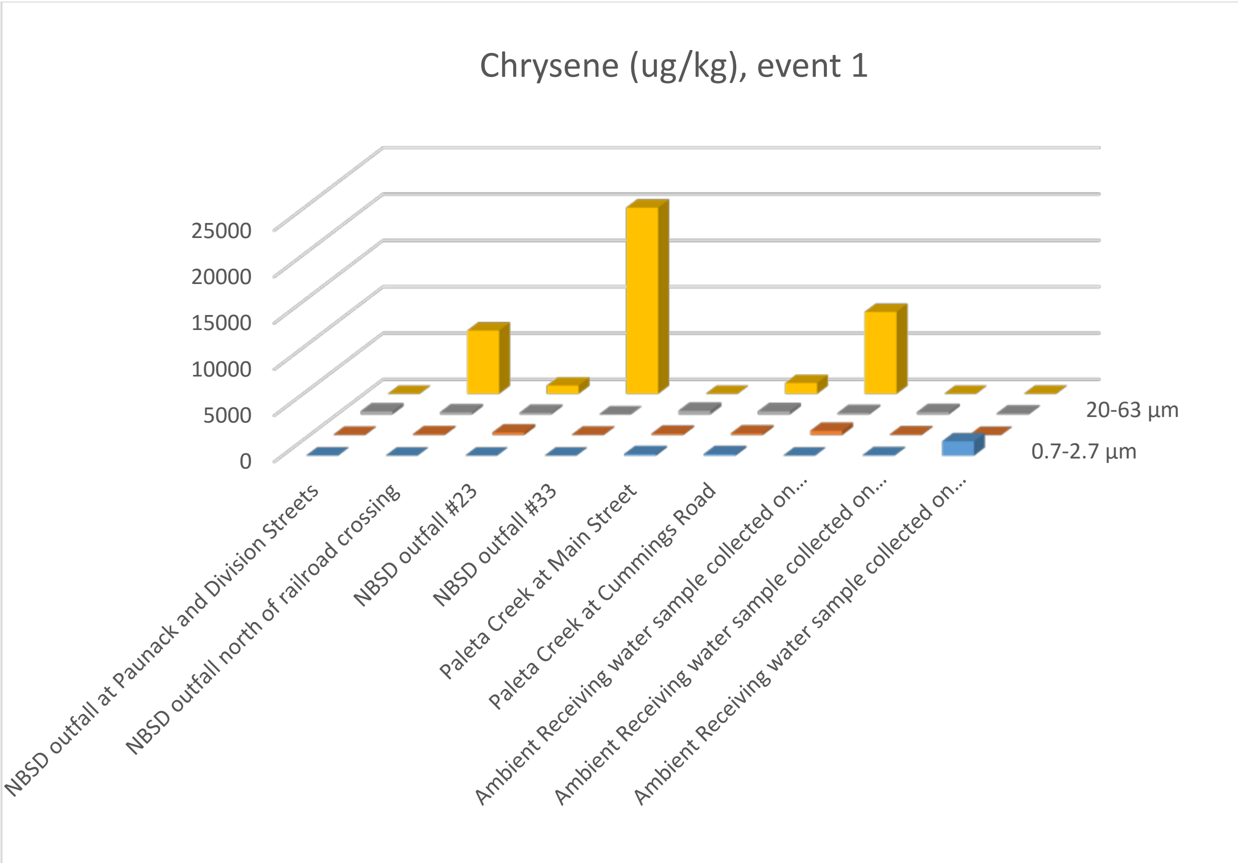
Chrysene

Chrysene (ug/kg)	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	8.7	na	na	nd	165	152	na	48.6	1,546
2.7-20 µm	34.4	91.1	264	43.6	132	171	458	65.4	6.1
20-63 µm	328	230	170	0.0	397	343	150	249	99.4
> 63 µm	na**	6,837	892	20,093	nd	1,175	8,843	na	11.1

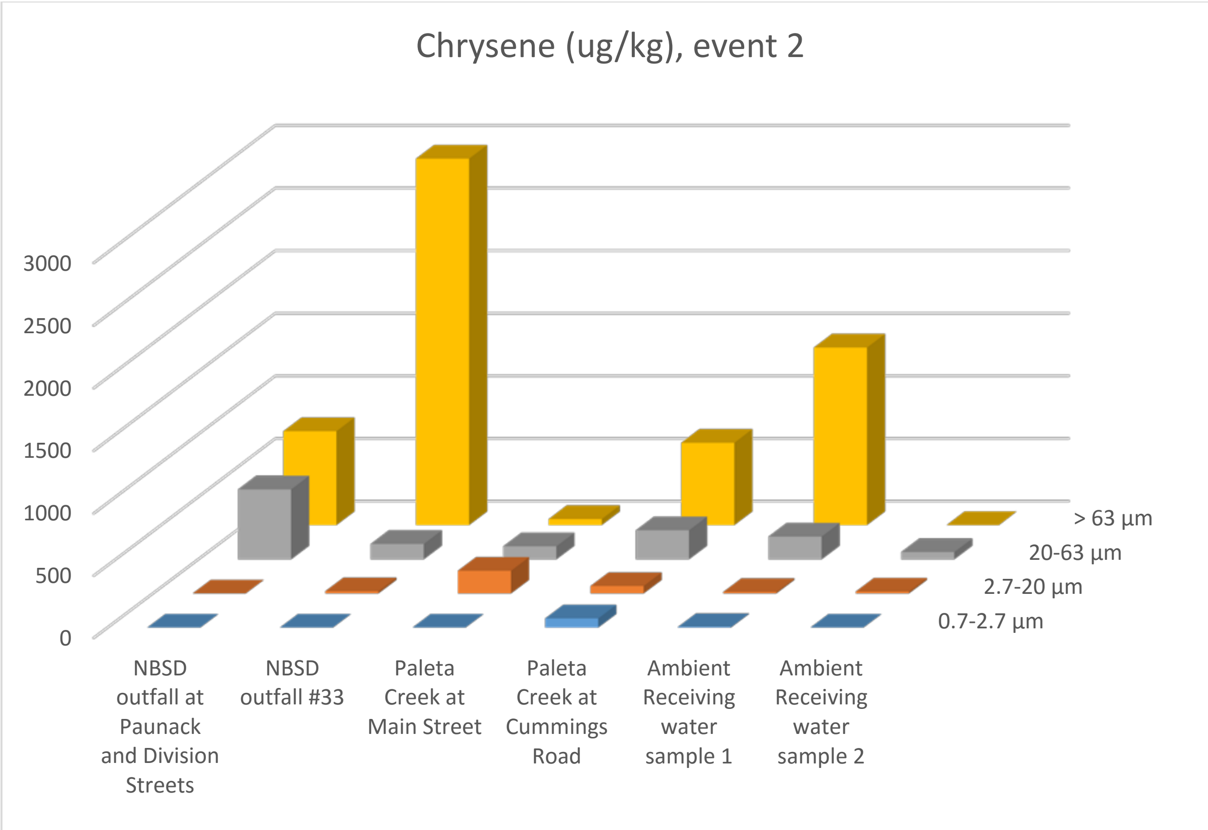
* not detected; particulate strength not calculated, assumed to be zero

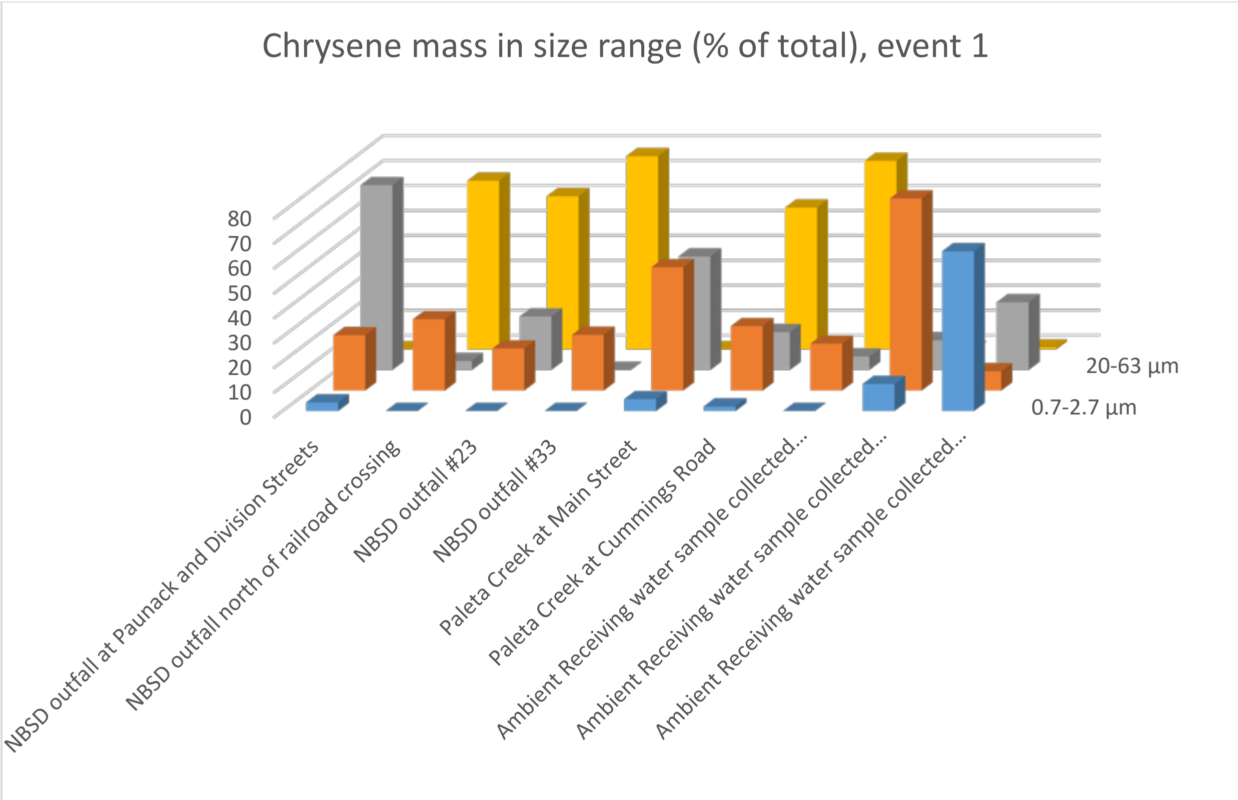
** SSC not detected; particulate strength not calculated, assumed to be zero

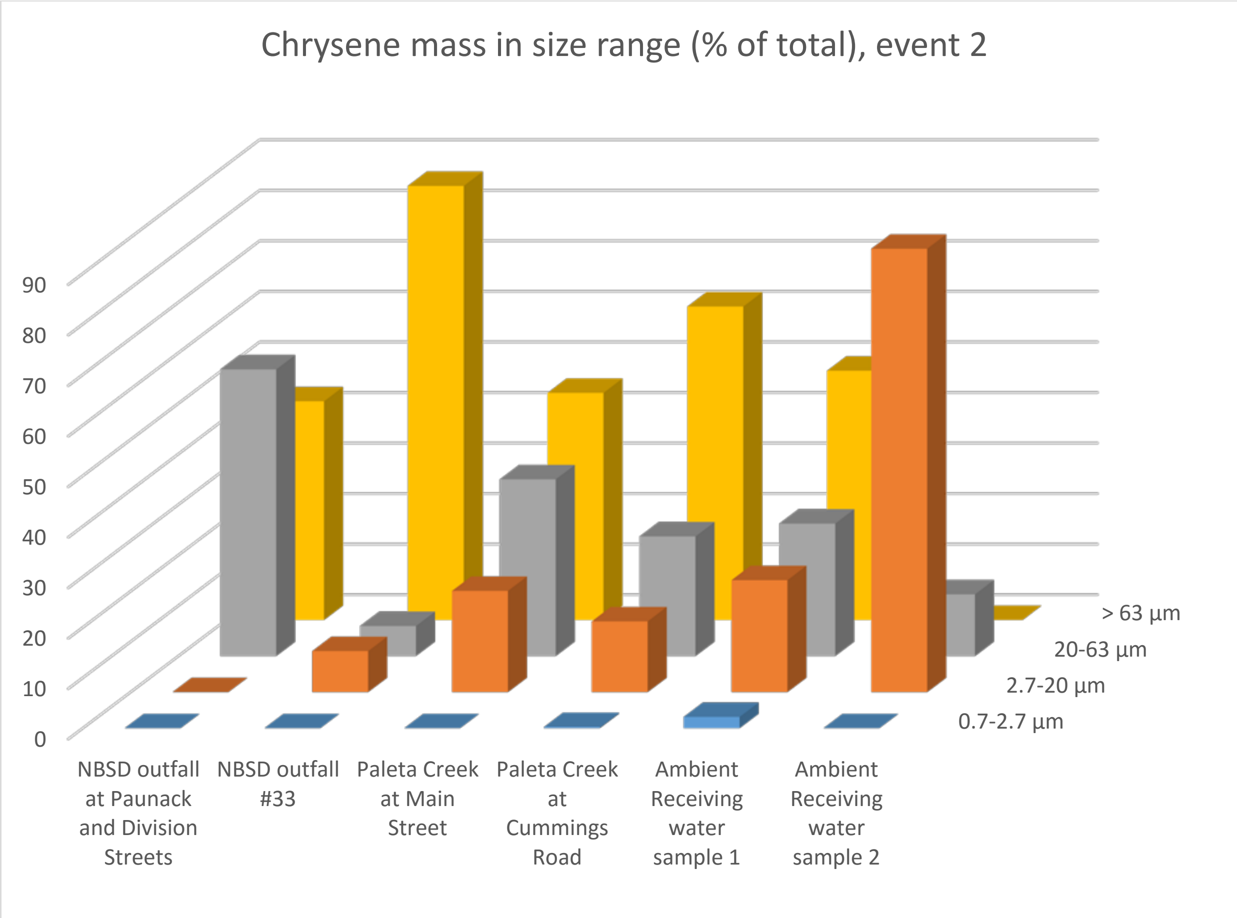
Chrysene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	74	4.6	na
2.7-20 µm	nd	18	183	60	11.9	15.2
20-63 µm	559	124	105	233	183	58.4
> 63 µm	750	2,926	49	658	1,418	na



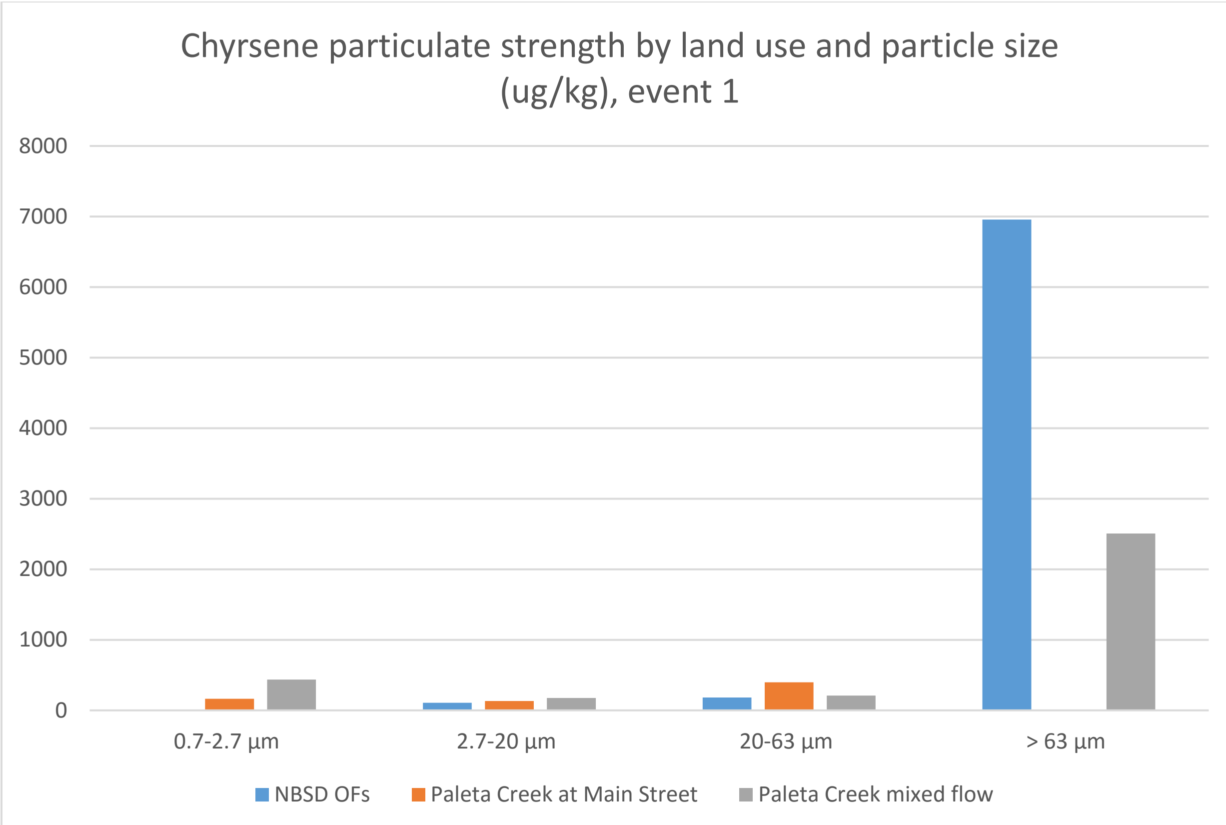
Chrysene (ug/kg), event 1
25000
20000
15000
10000
5000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

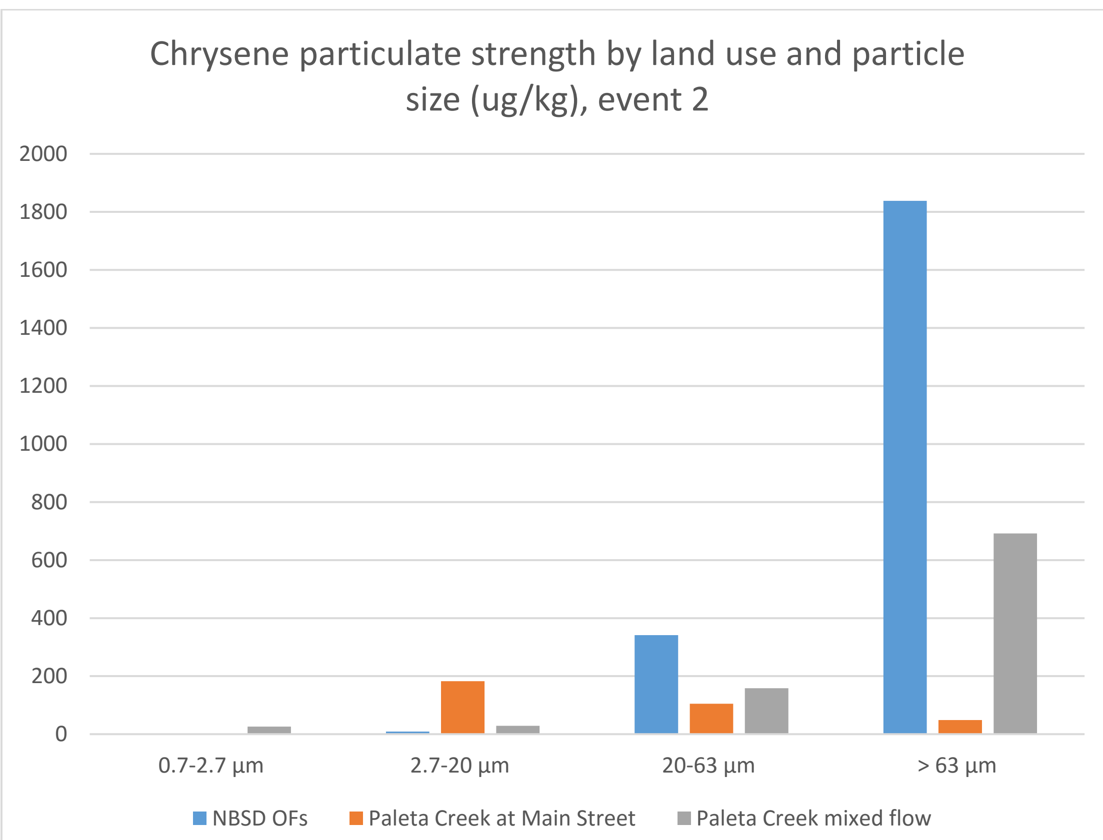

Chrysene (ug/kg), event 2
3000
2500
2000
1500
1000
500
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

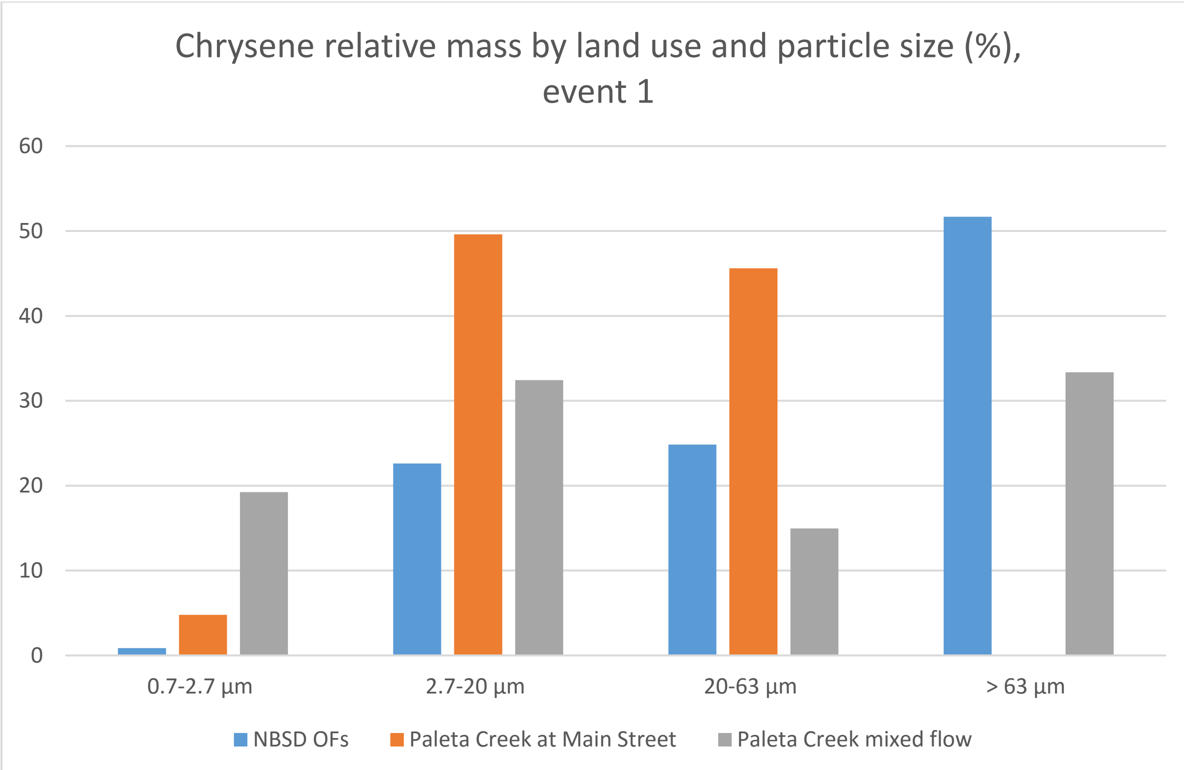

Chrysene mass in size range (% of total), event 1
0
10
20
30
40
50
60
70
80
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...

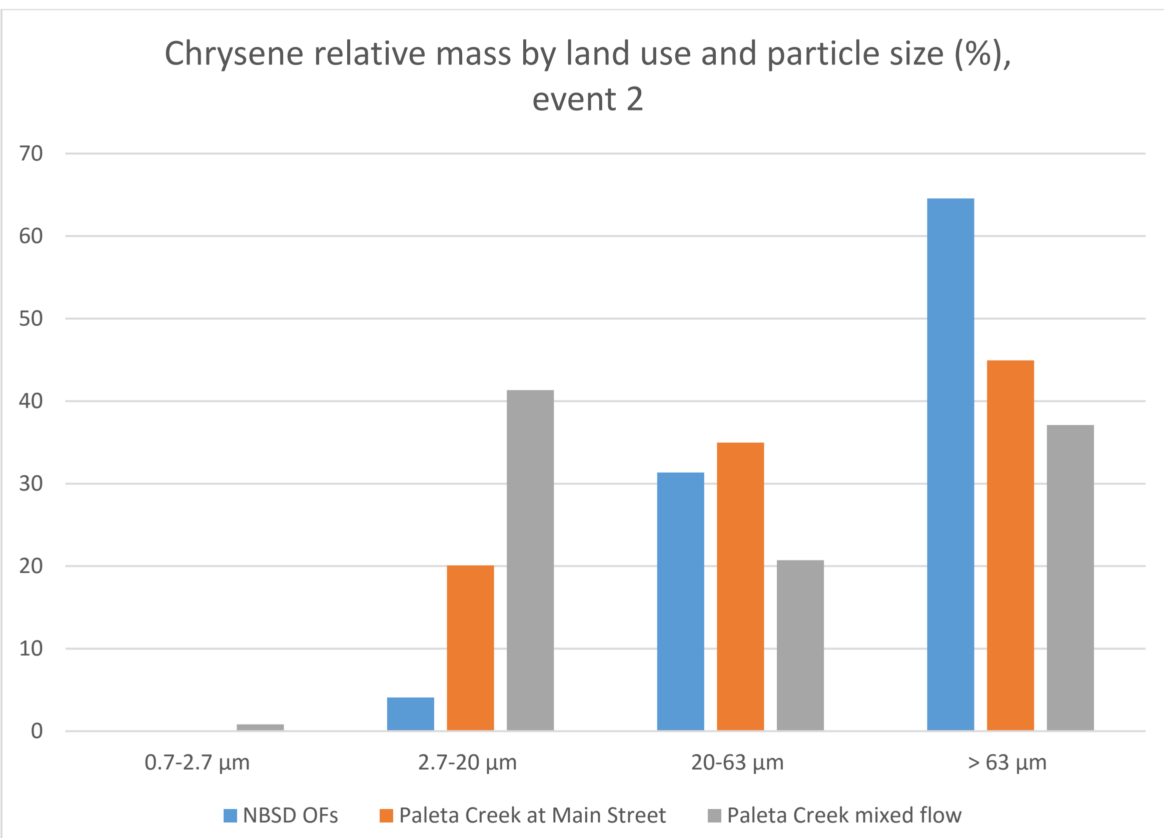


Chrysene mass in size range (% of total), event 2
0
10
20
30
40
50
60
70
80
90
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Chyrsene particulate strength by land use and particle size (ug/kg), event 1
8000
7000
6000
5000
4000
3000
2000
1000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Chrysene particulate strength by land use and particle size (ug/kg), event 2
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Chrysene relative mass by land use and particle size (%), event 1
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Chrysene relative mass by land use and particle size (%), event 2
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

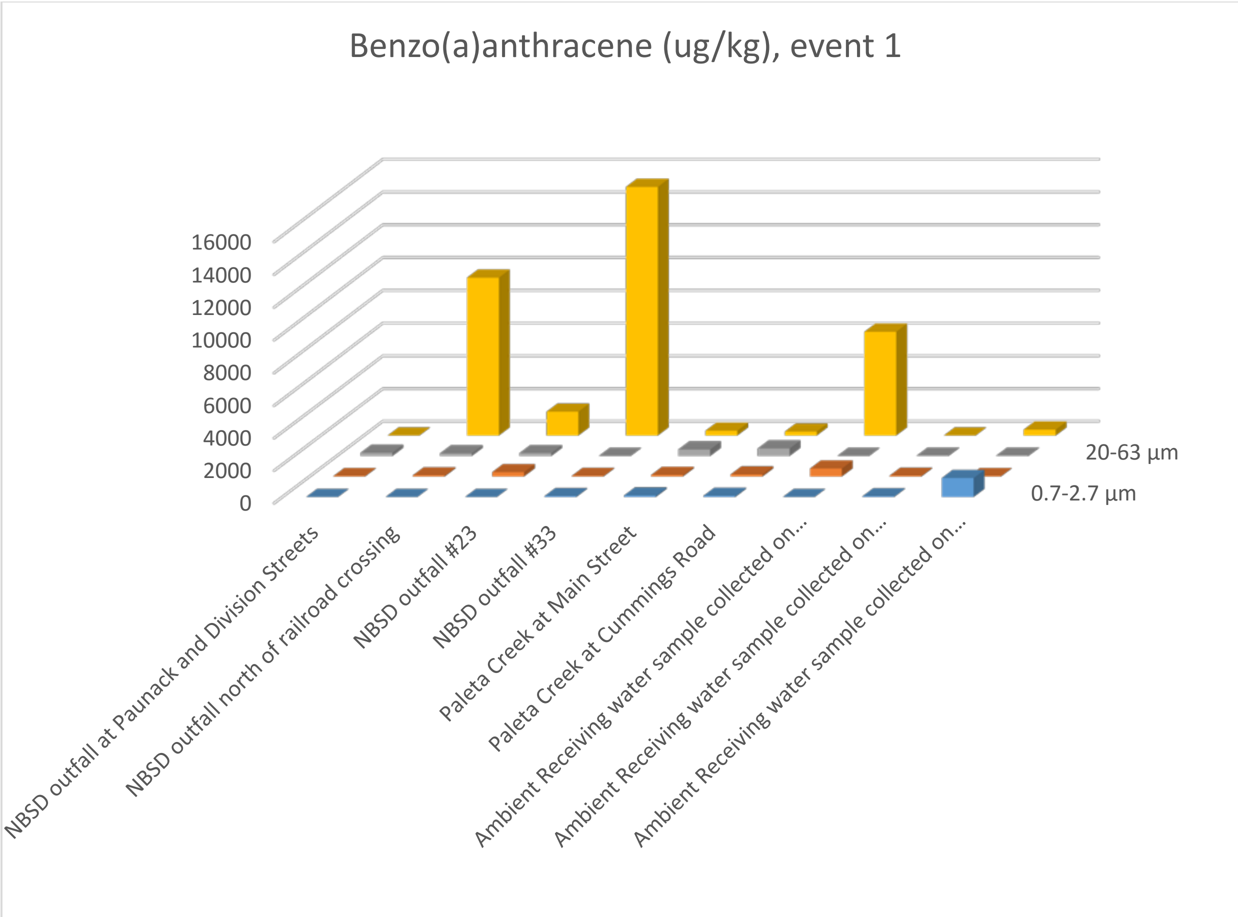
Benzo(a)anthracene

Benzo[a]anthracene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	nd*	na	na	50.0	90.1	68.7	na	36.5	1,166
2.7-20 µm	22.4	68.0	266	32.0	95.2	125	490	43.9	23.6
20-63 µm	193	159	174	nd	400	464	nd	22.3	23.7
> 63 µm	na**	9,652	1,468	15,188	294	246	6,350	na	361

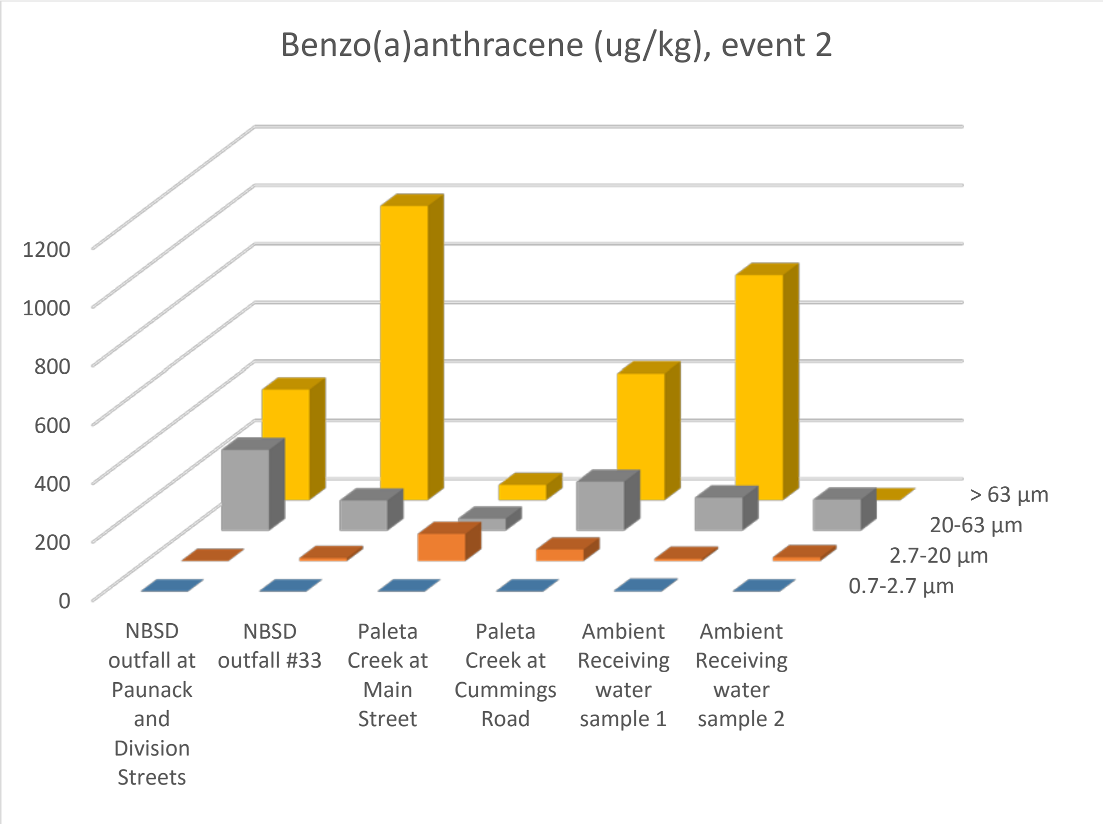
* not detected; particulate strength not calculated, assumed to be zero

** SSC not detected; particulate strength not calculated, assumed to be zero

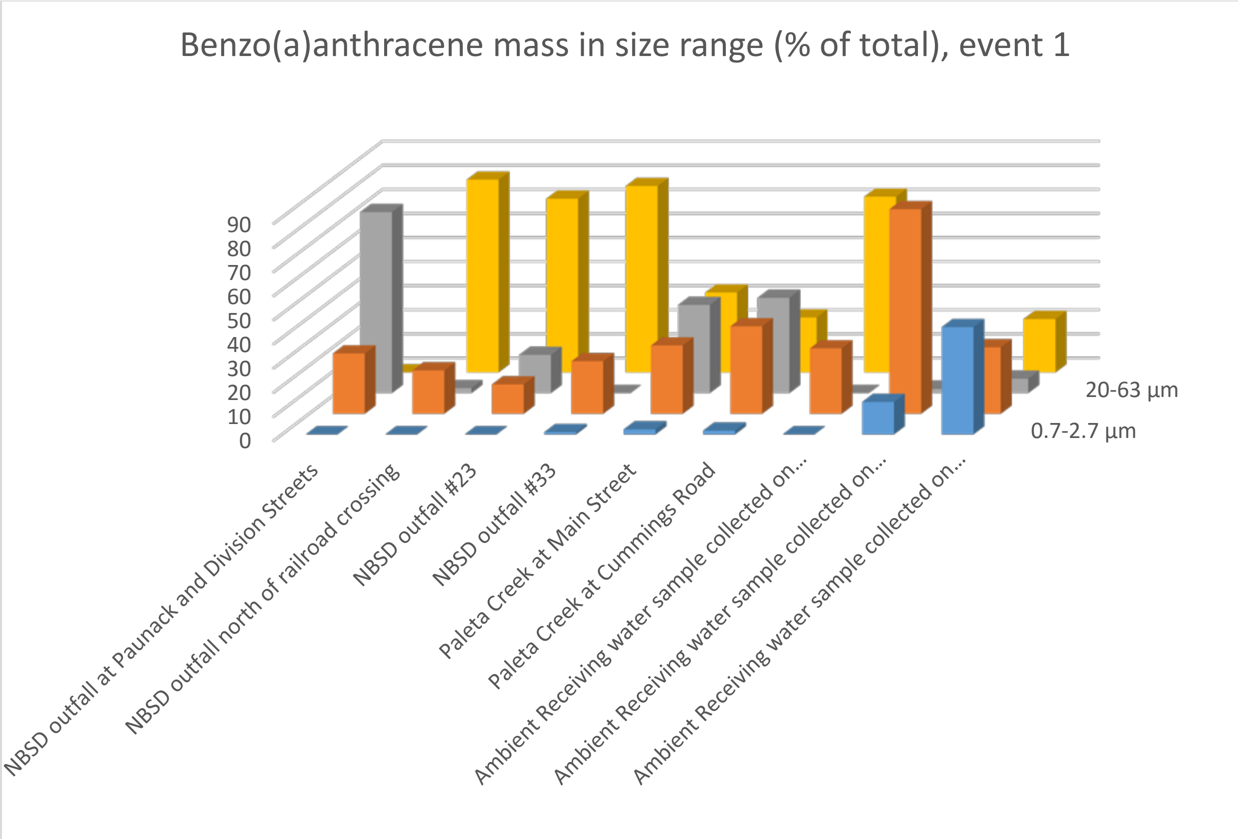
Benzo[a]anthracene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	nd	2.6	na
2.7-20 µm	nd	10	93	39	7.6	12.8
20-63 µm	276	103	41	167	112	106
> 63 µm	377	1,000	52	431	766	na

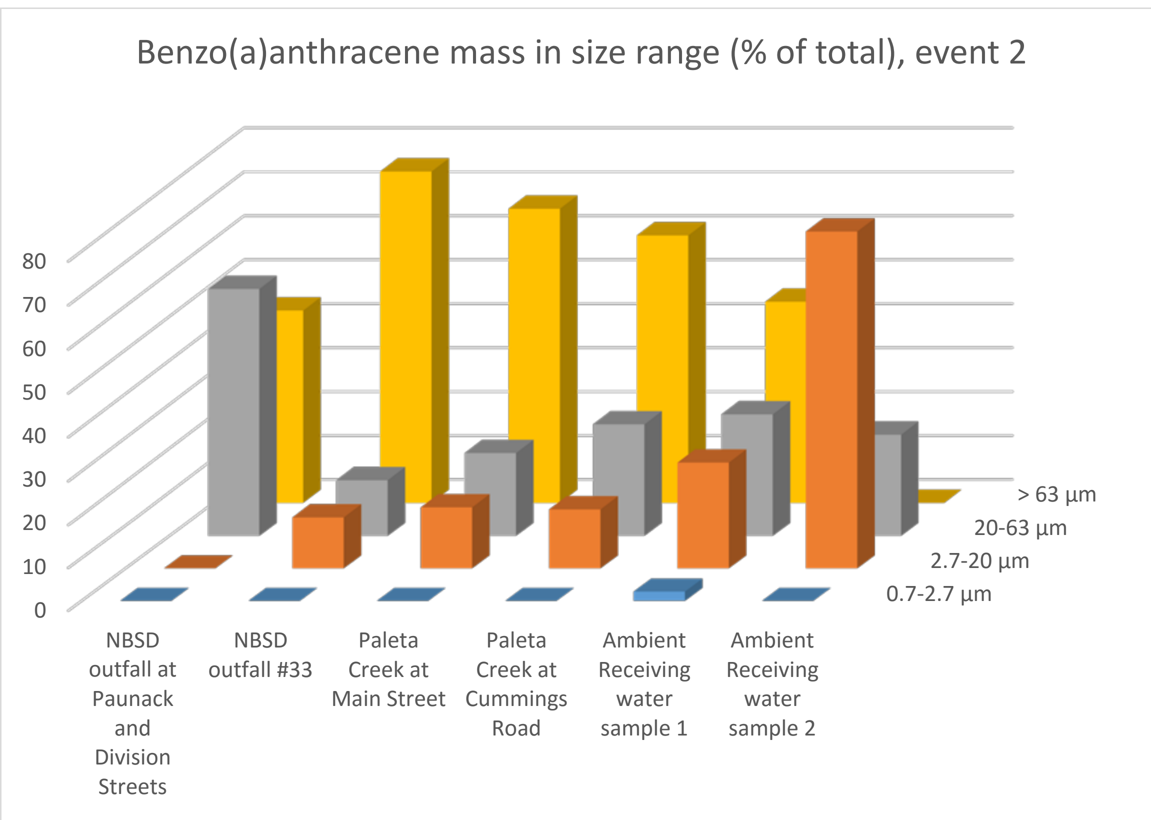


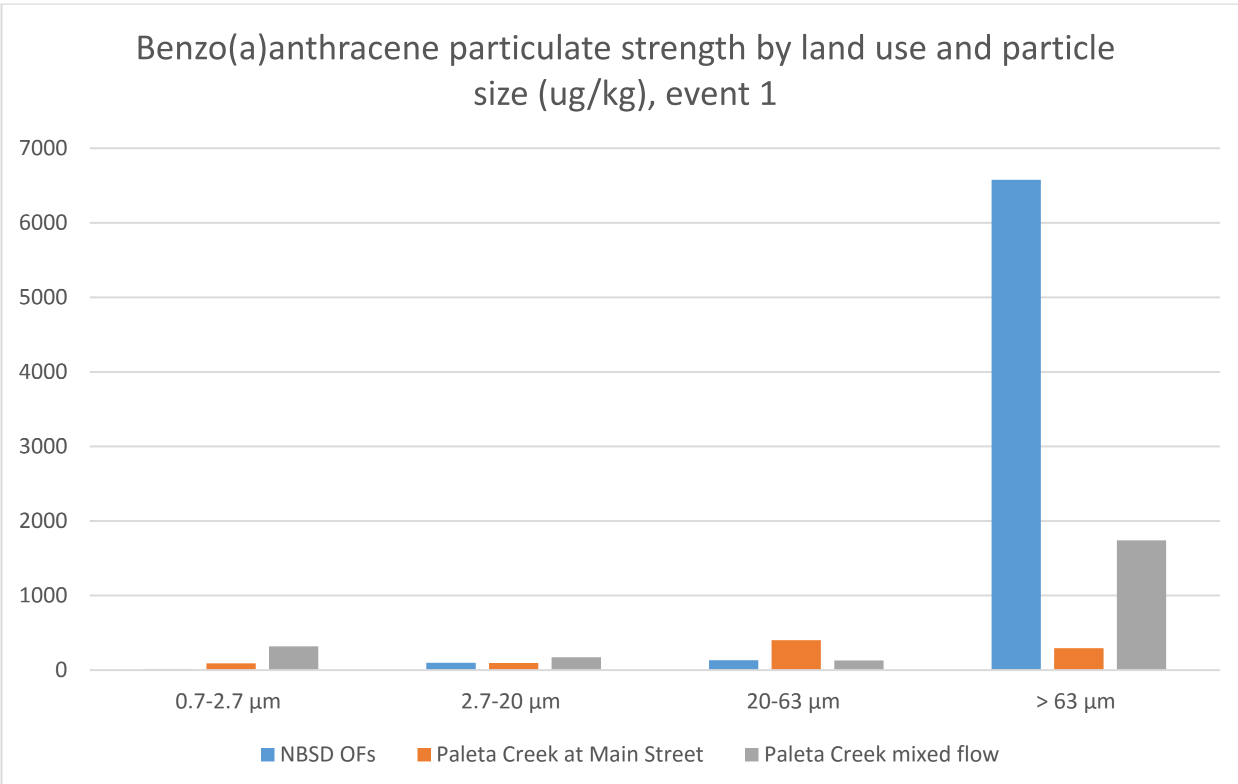
Benzo(a)anthracene (ug/kg), event 1
16000
14000
12000
10000
8000
6000
4000
2000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

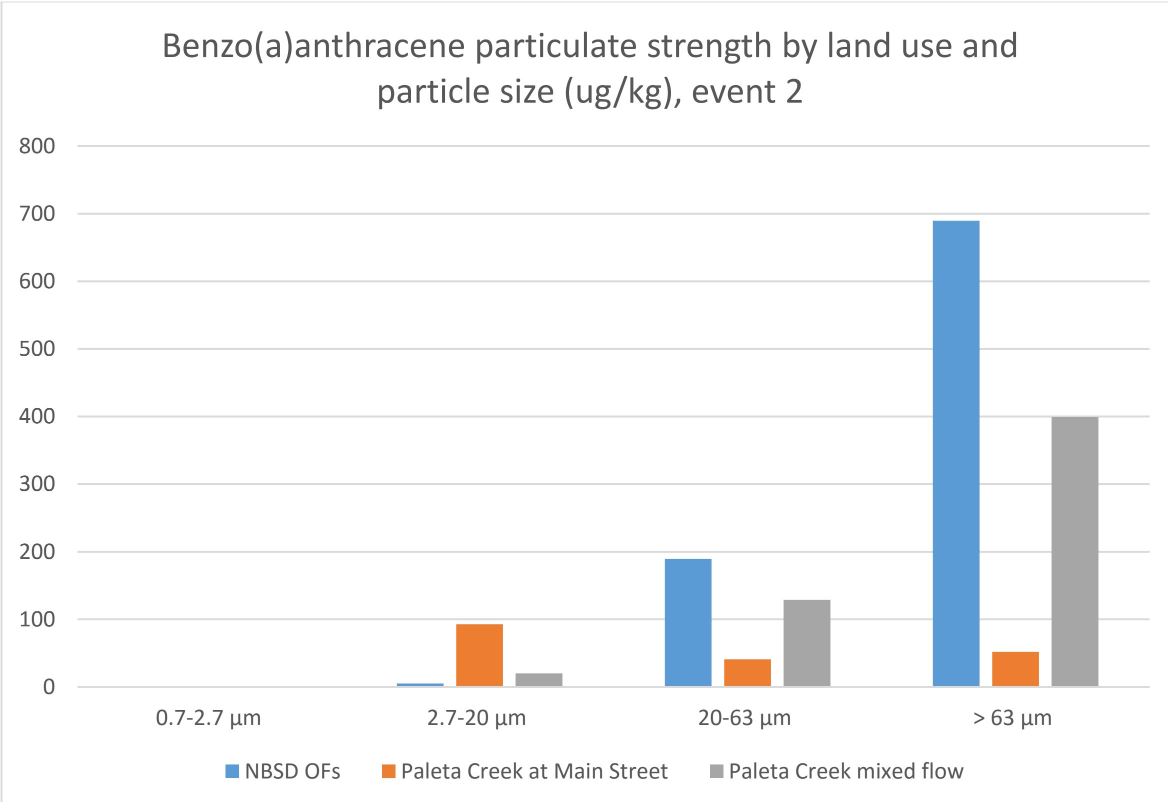


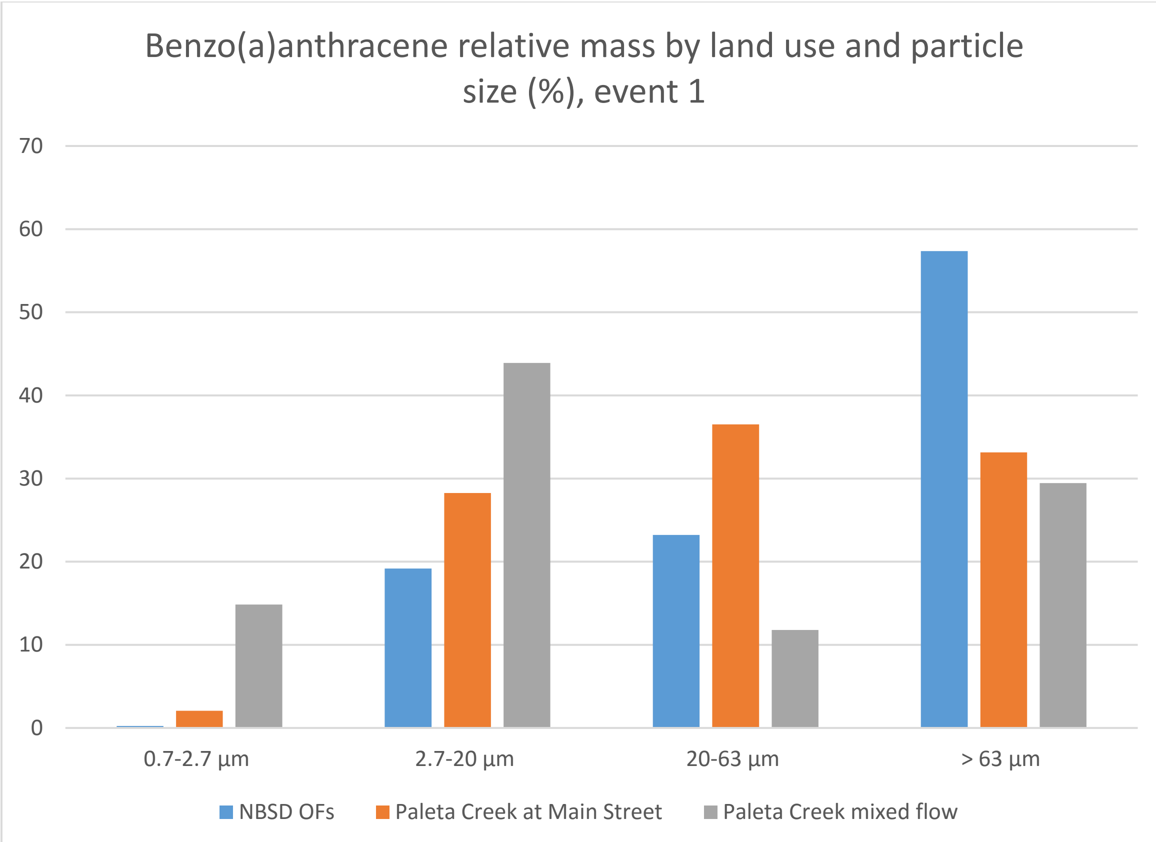
Benzo(a)anthracene (ug/kg), event 2
1200
1000
800
600
400
200
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

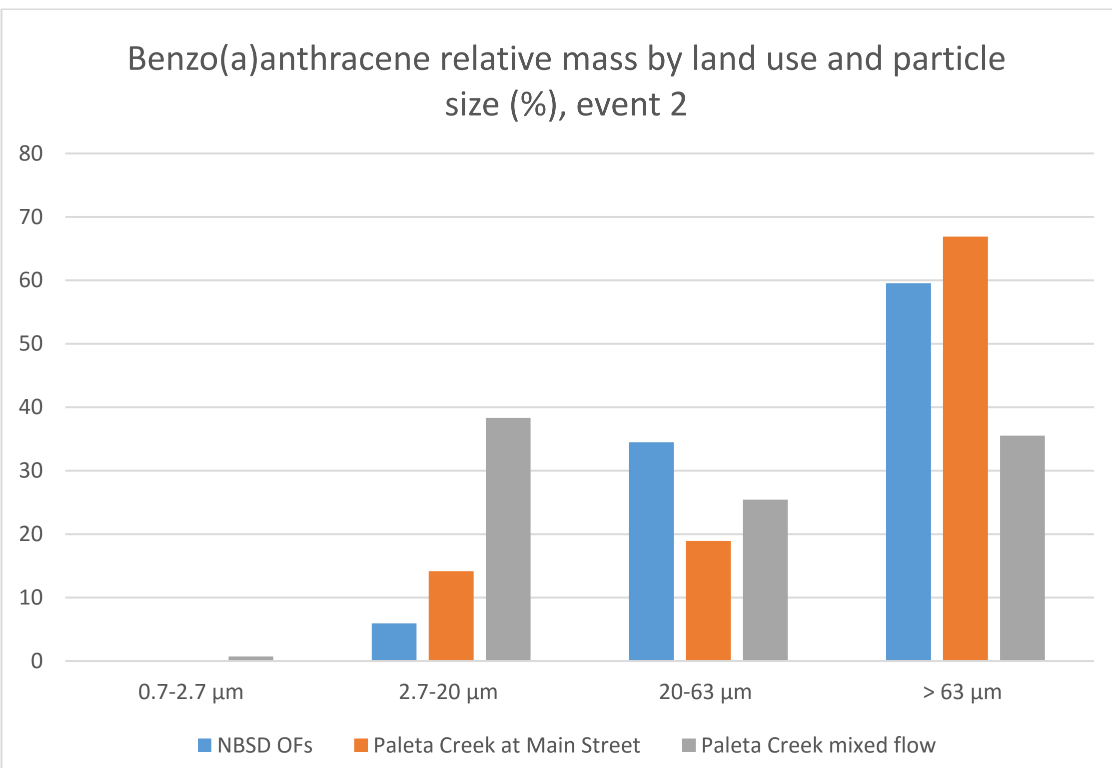

Benzo(a)anthracene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
20-63 µm
0.7-2.7 µm


Benzo(a)anthracene mass in size range (% of total), event 2
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Benzo(a)anthracene particulate strength by land use and particle size (ug/kg), event 1
7000
6000
5000
4000
3000
2000
1000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(a)anthracene particulate strength by land use and particle size (ug/kg), event 2
800
700
600
500
400
300
200
100
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(a)anthracene relative mass by land use and particle size (%), event 1
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(a)anthracene relative mass by land use and particle size (%), event 2
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

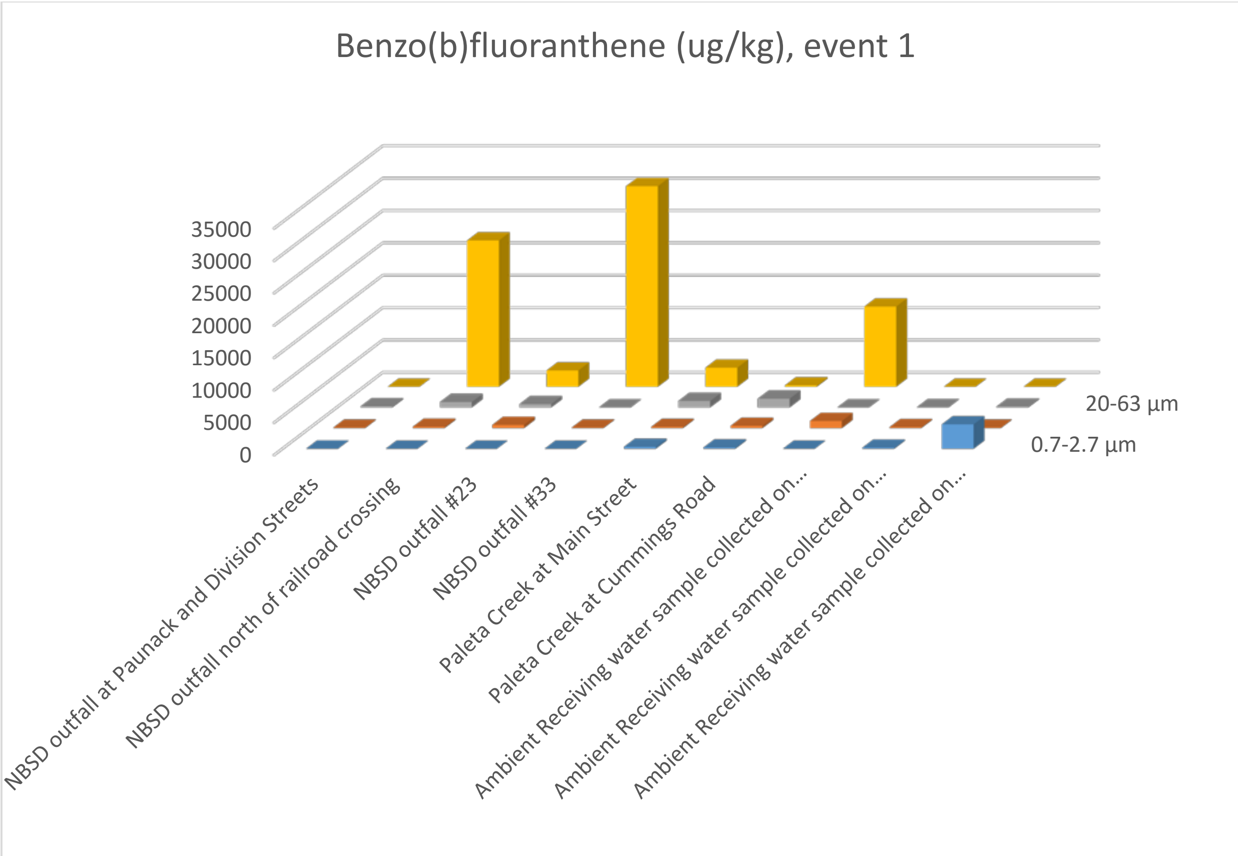
Benzo(b)fluoranthene

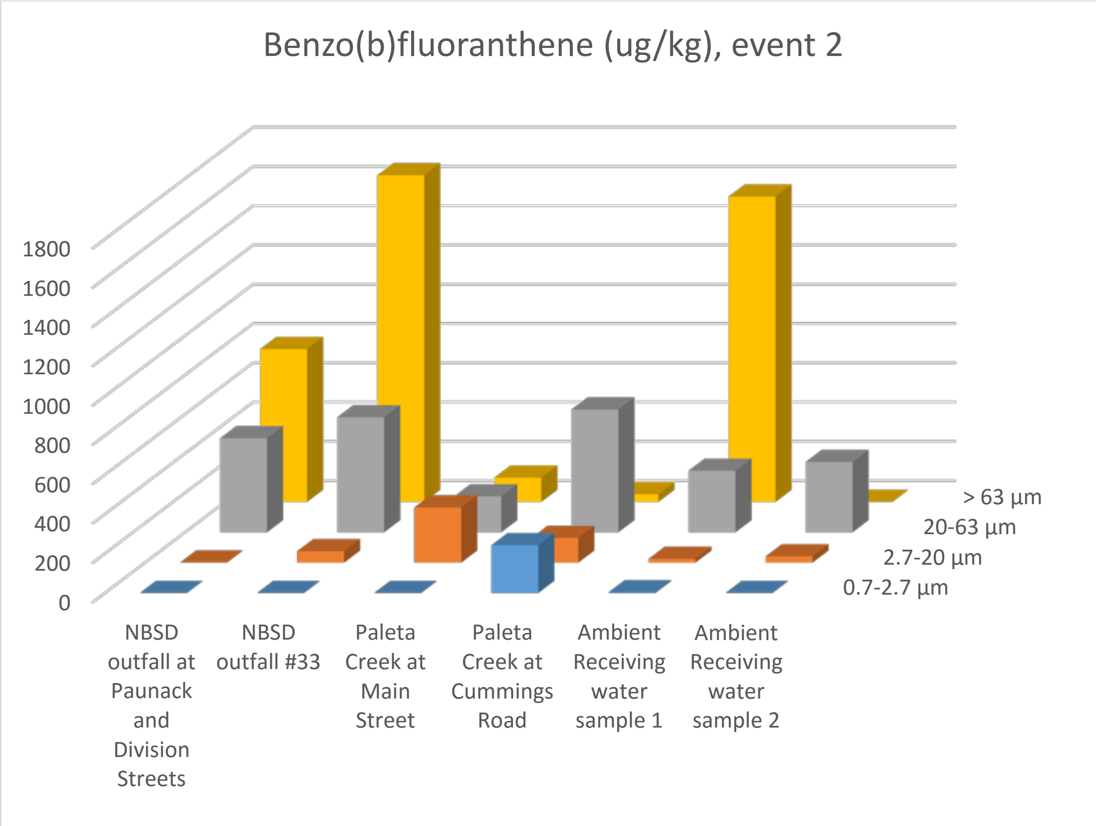
Benzo[b]fluoranthene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	18.9	na	na	nd*	300	191	na	160	3,769
2.7-20 µm	78.2	203	492	74.0	182	343	1,105	146	72.2
20-63 µm	144	833	507	nd	997	1,347	nd	17.8	104
> 63 µm	na**	22,596	2,514	30,989	2,944	210	12,385	na	nd

* not detected; particulate strength not calculated, assumed to be zero

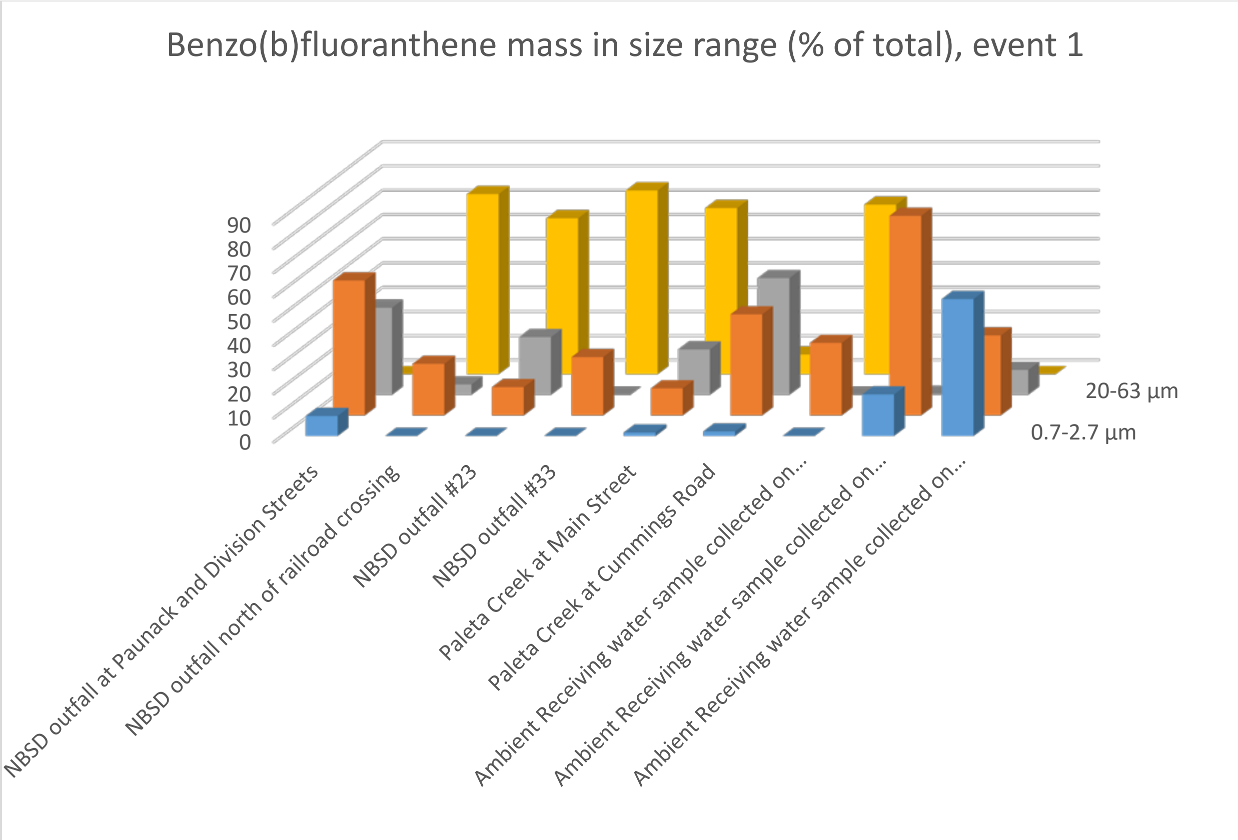
** SSC not detected; particulate strength not calculated, assumed to be zero

Benzo[b]fluoranthene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	241	2.8	na
2.7-20 µm	nd	58	280	125	19	31
20-63 µm	478	585	182	624	312	356
> 63 µm	778	1,663	123	39	1,554	na

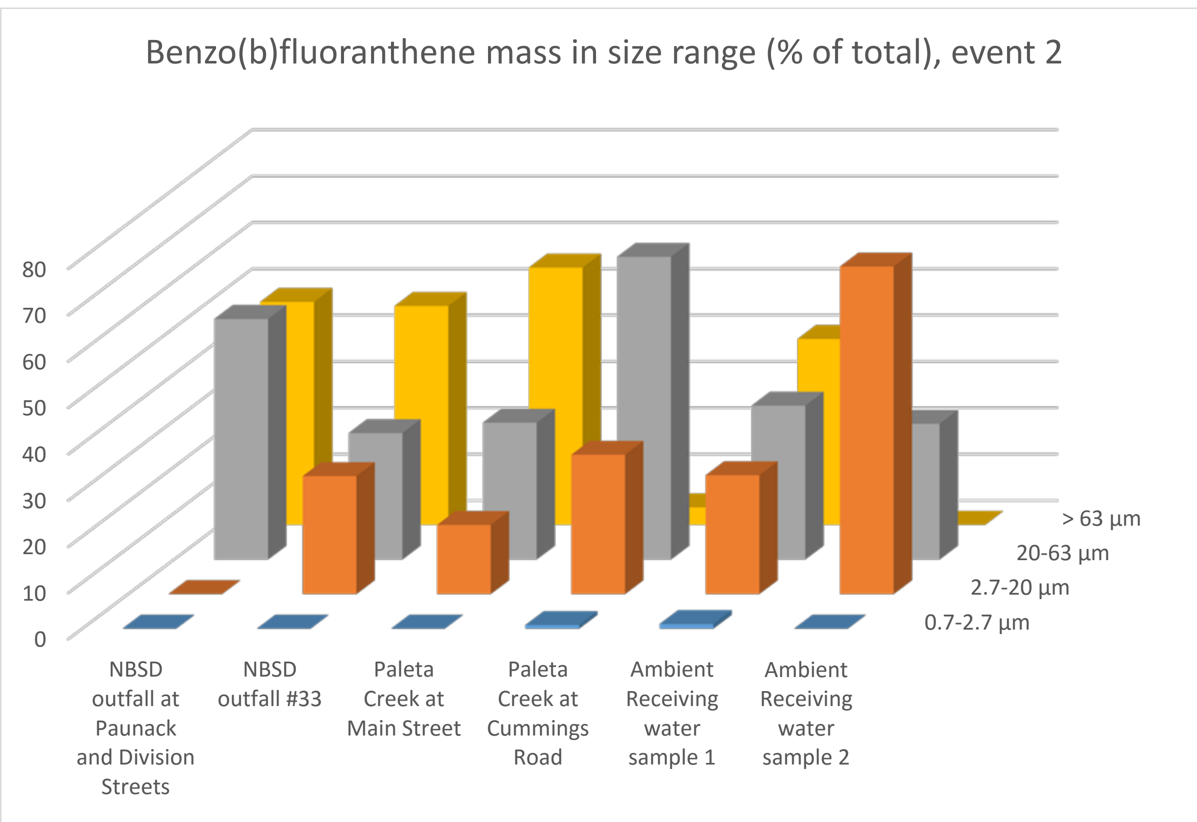

Benzo(b)fluoranthene (ug/kg), event 1
35000
30000
25000
20000
15000
10000
5000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...



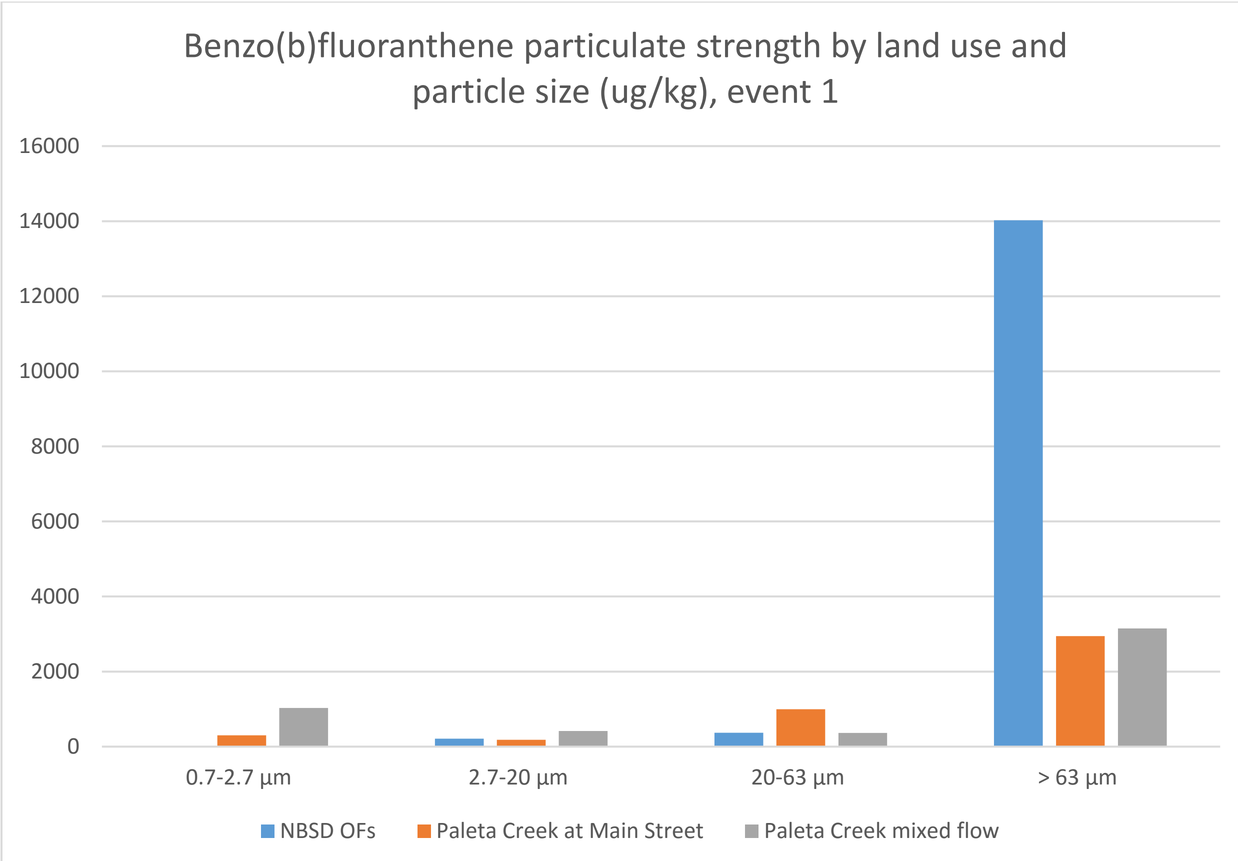
Benzo(b)fluoranthene (ug/kg), event 2
1800
1600
1400
1200
1000
800
600
400
200
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm

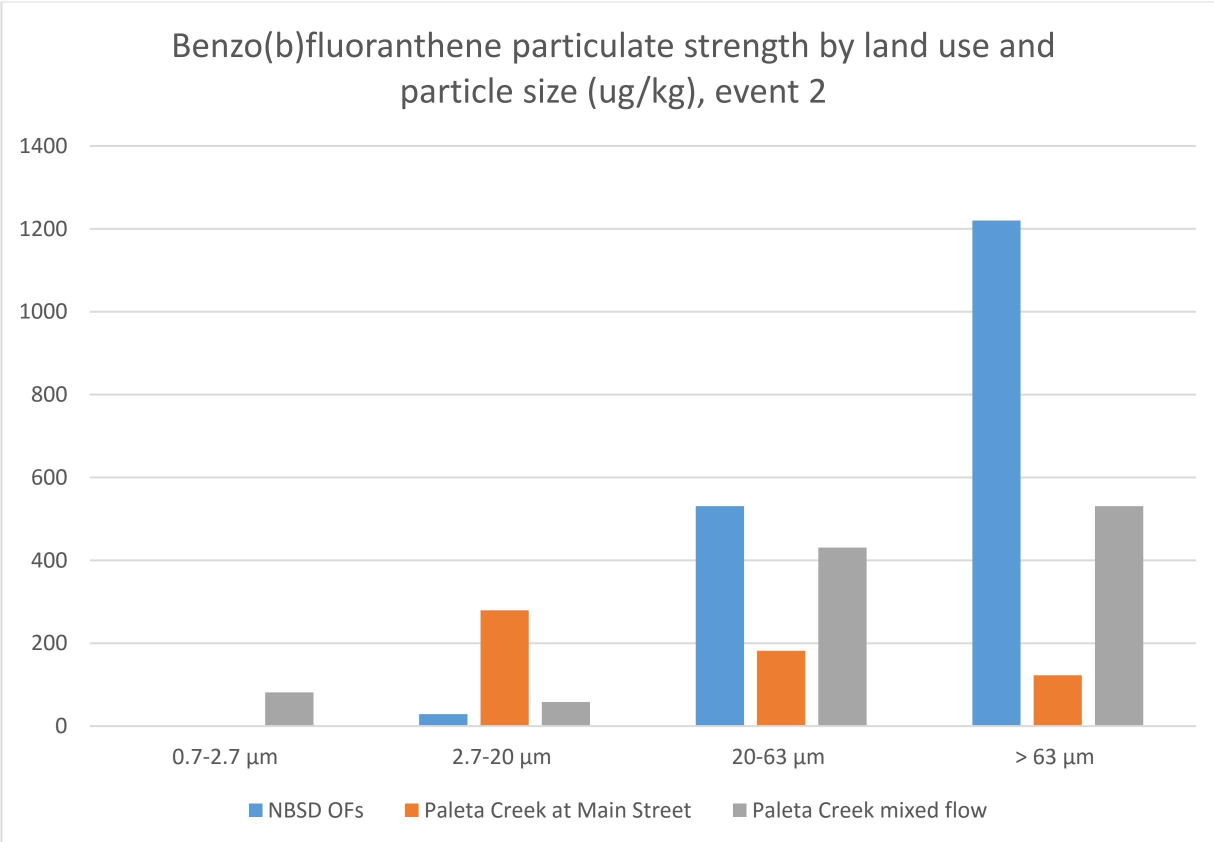


Benzo(b)fluoranthene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

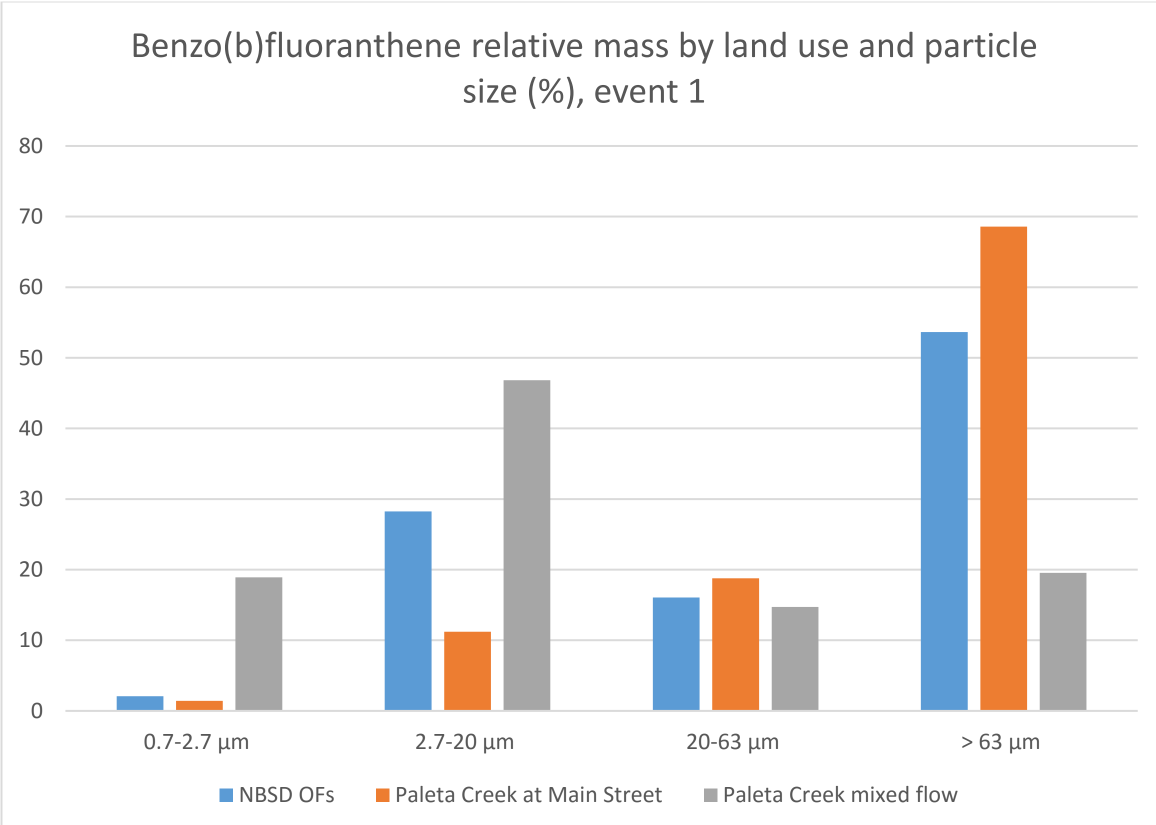


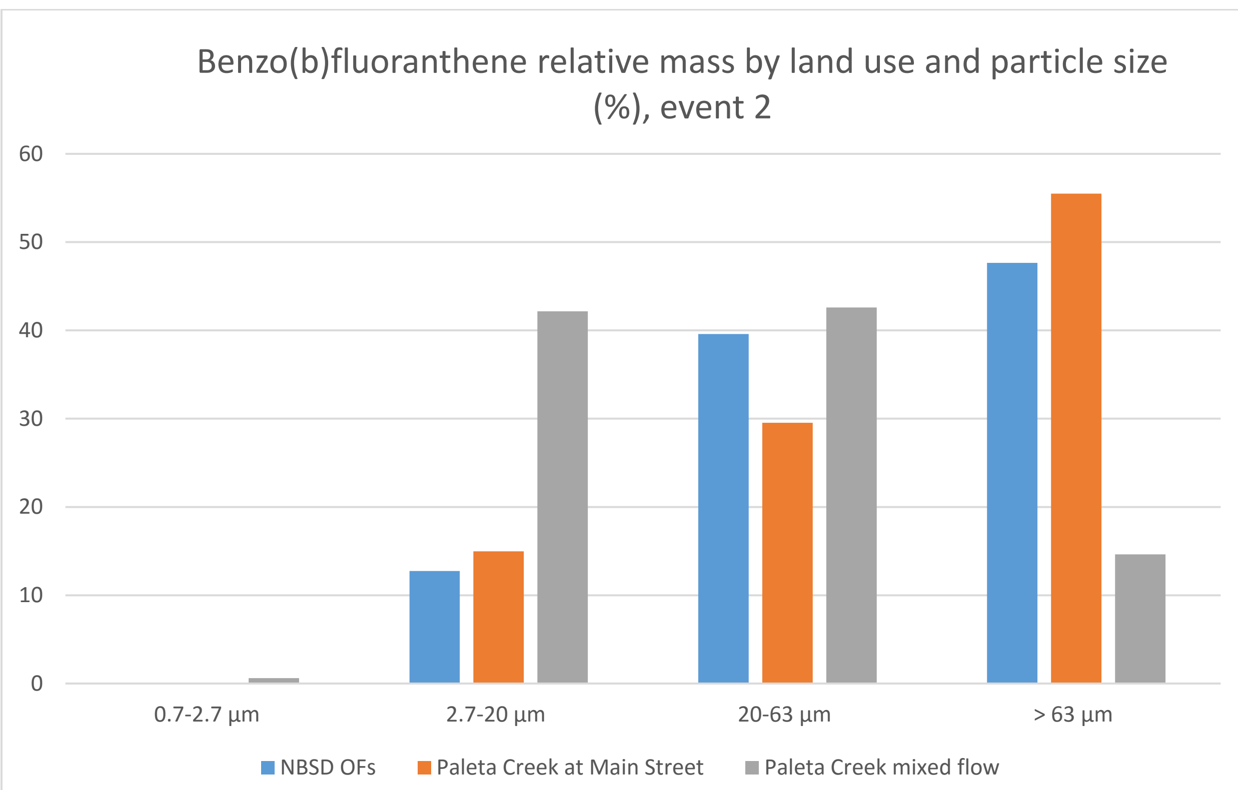
Benzo(b)fluoranthene mass in size range (% of total), event 2
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Benzo(b)fluoranthene particulate strength by land use and particle size (ug/kg), event 1
16000
14000
12000
10000
8000
6000
4000
2000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Benzo(b)fluoranthene particulate strength by land use and particle size (ug/kg), event 2
1400
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(b)fluoranthene relative mass by land use and particle size (%), event 1
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(b)fluoranthene relative mass by land use and particle size (%), event 2
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

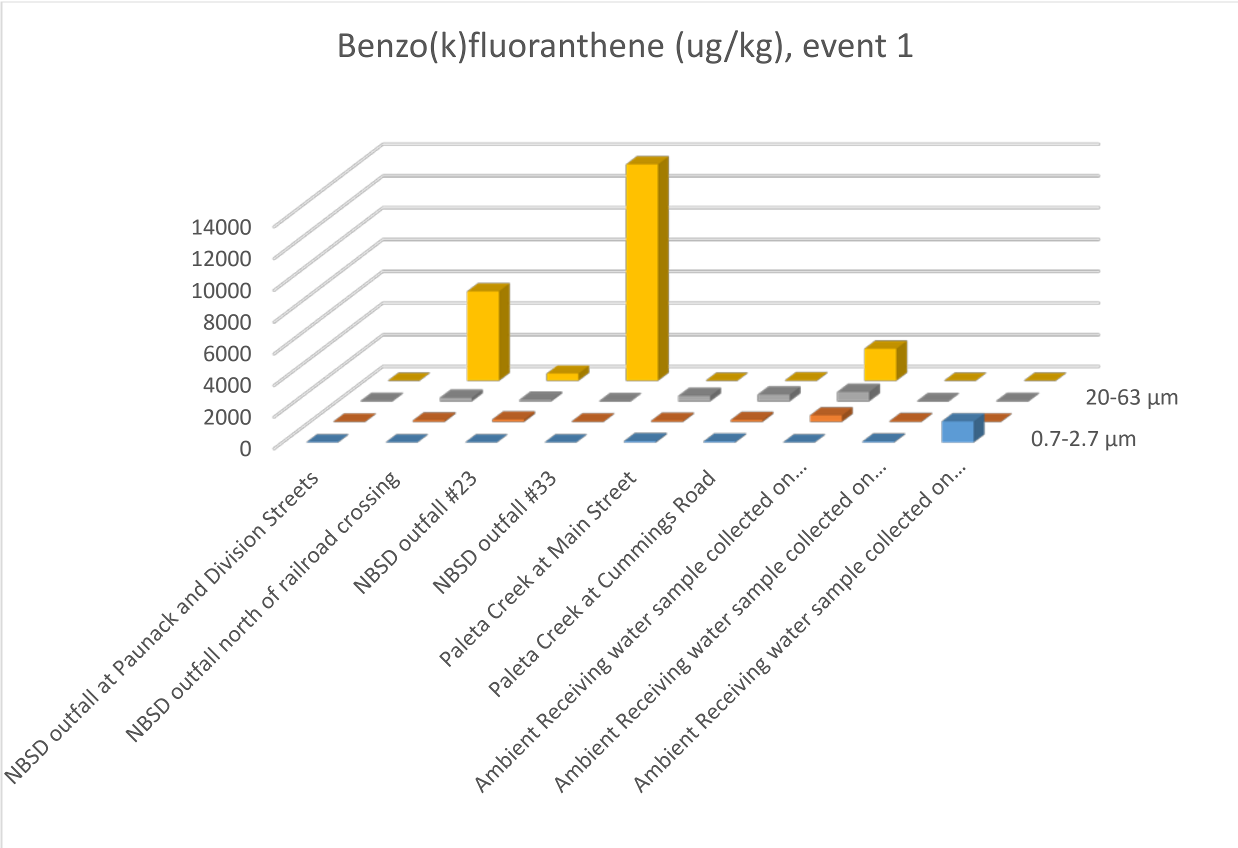
Benzo(k)fluoranthene

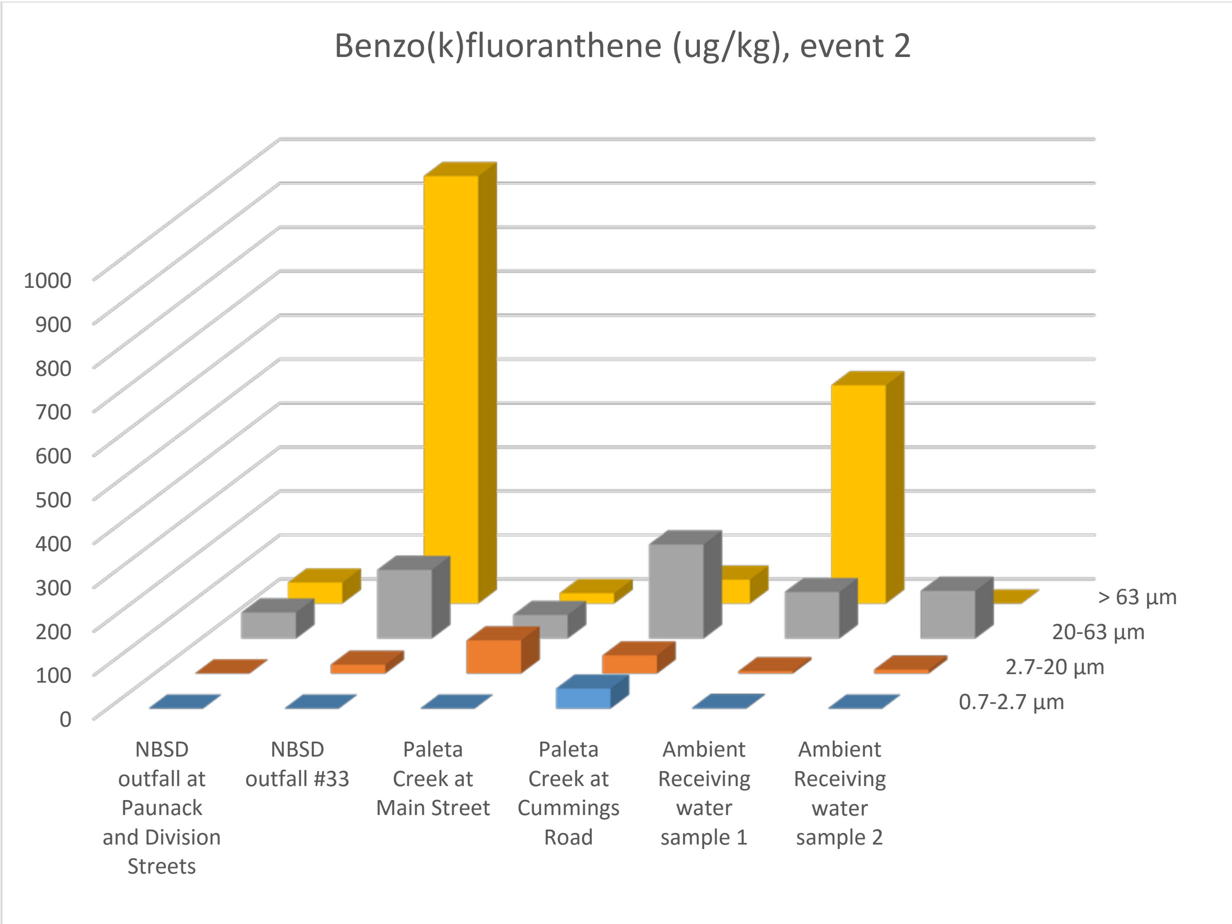
Benzo[k]fluoranthene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	2.4	na	na	nd*	83.3	58.3	na	51.0	1,332
2.7-20 µm	20.9	86.0	150	31.0	68.1	119	412	50.9	25.3
20-63 µm	20.7	229	90.0	nd	344	430	593	nd	24.5
> 63 µm	na**	5,641	461	13,632	nd	29.5	2,032	na	nd

* not detected; particulate strength not calculated, assumed to be zero

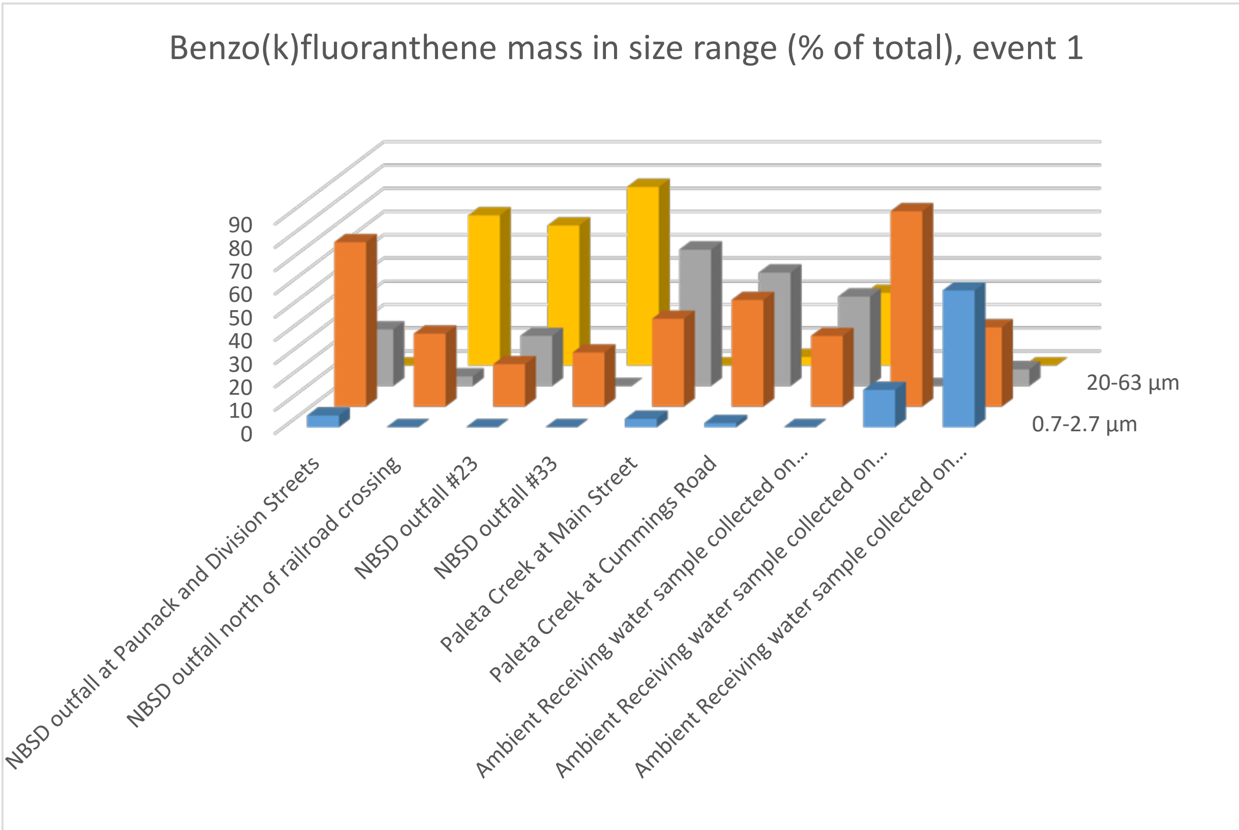
** SSC not detected; particulate strength not calculated, assumed to be zero

Benzo[k]fluoranthene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	46	1.2	na
2.7-20 µm	0.4	20	76	42	5.4	9.0
20-63 µm	60	156	54	214	106	109
> 63 µm	48	972	24	54	496	na

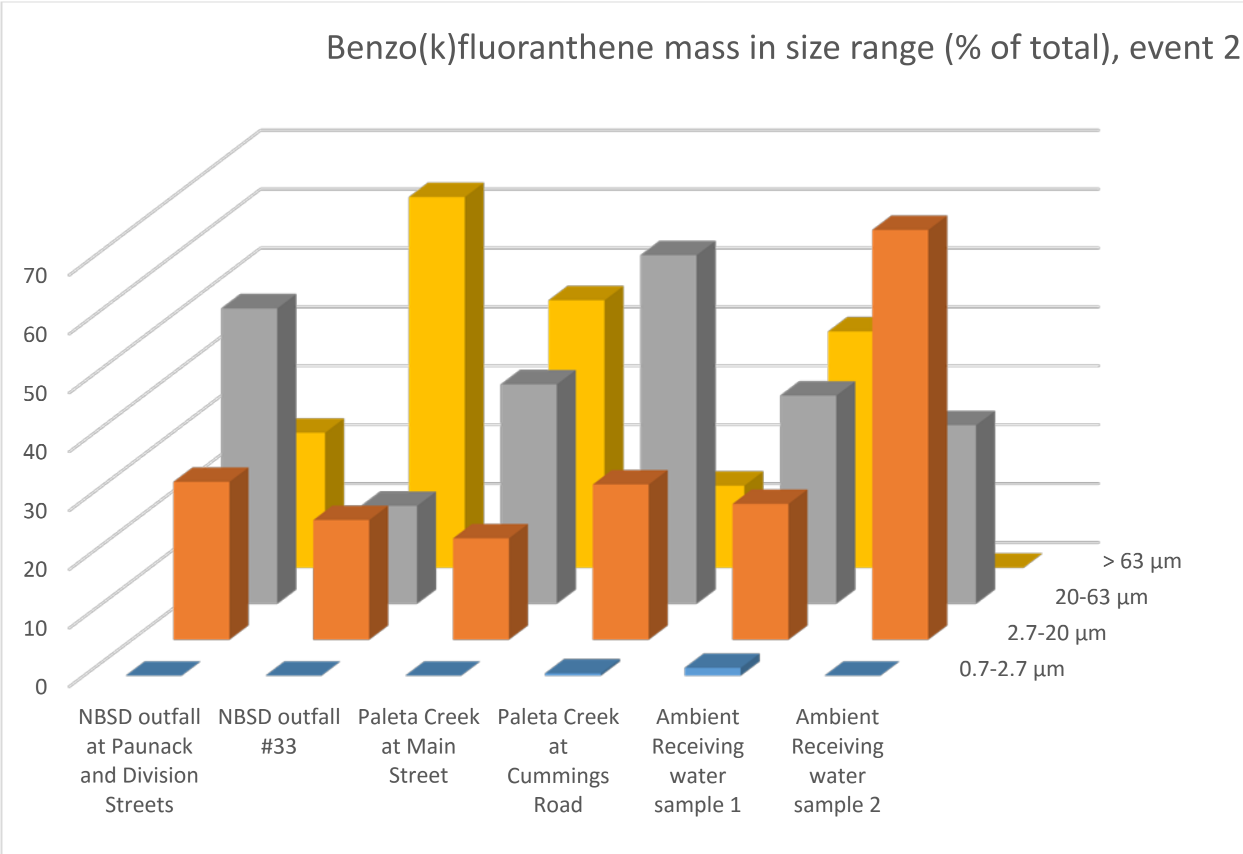

Benzo(k)fluoranthene (ug/kg), event 1
14000
12000
10000
8000
6000
4000
2000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

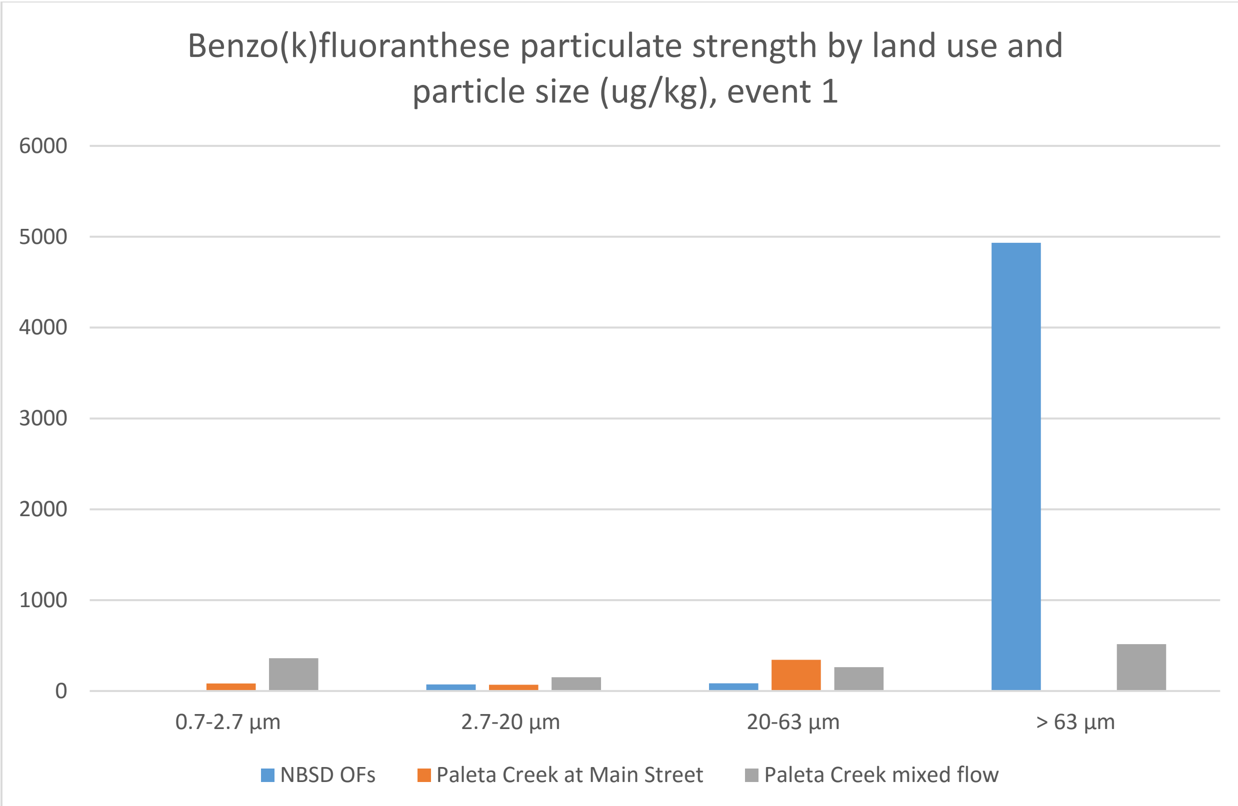


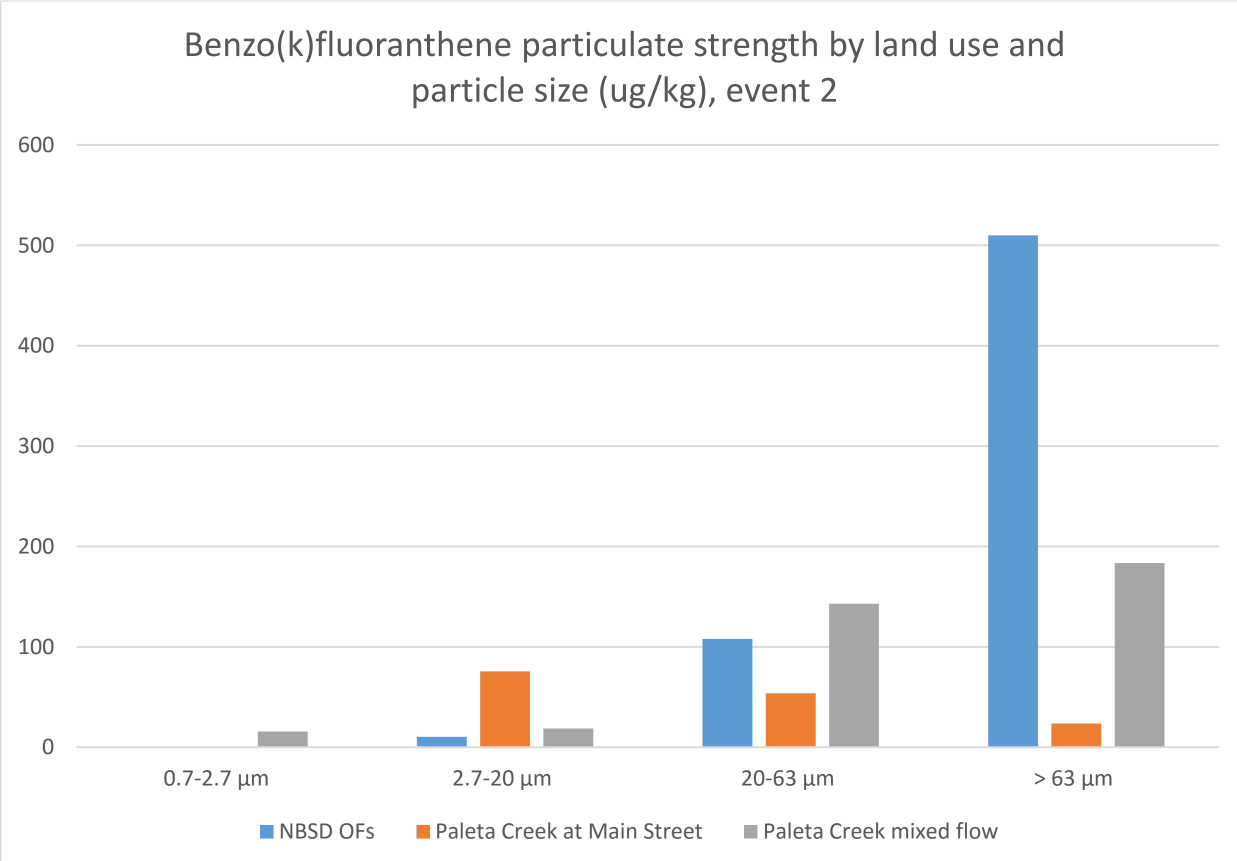
Benzo(k)fluoranthene (ug/kg), event 2
1000
900
800
700
600
500
400
300
200
100
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

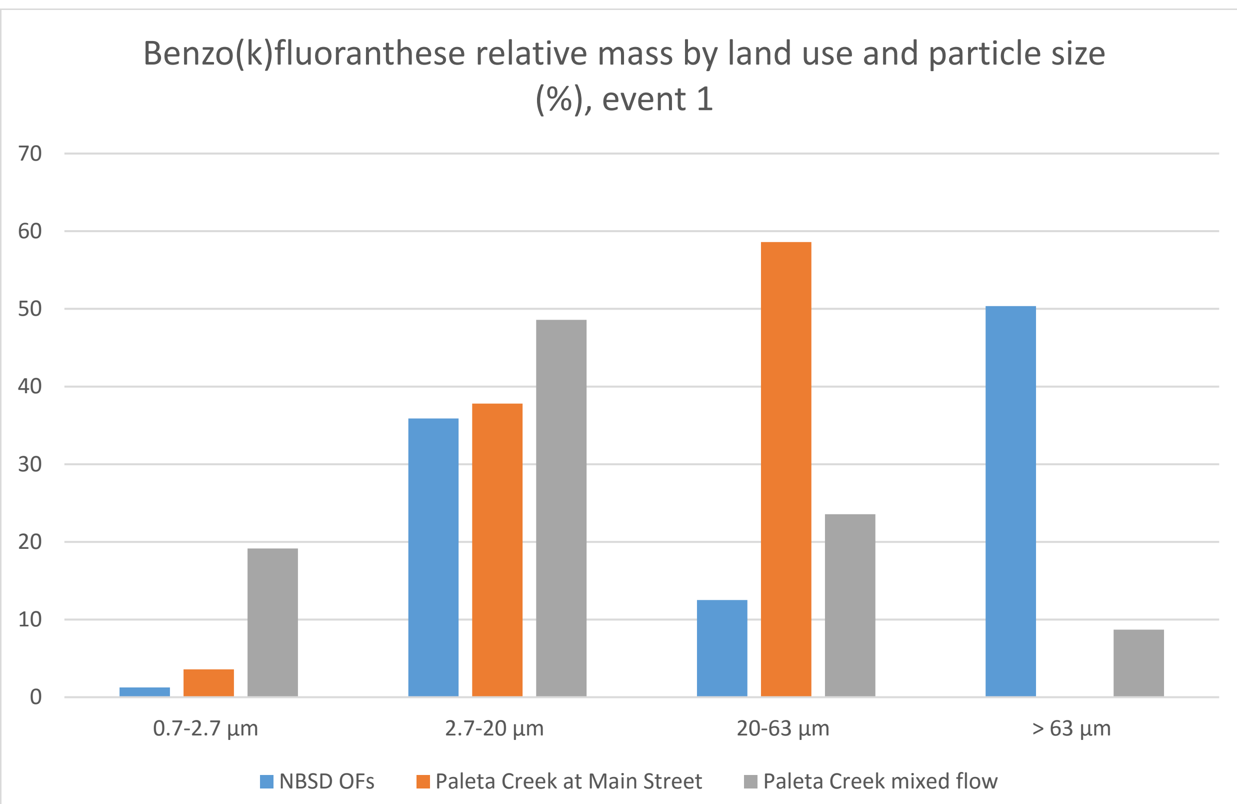


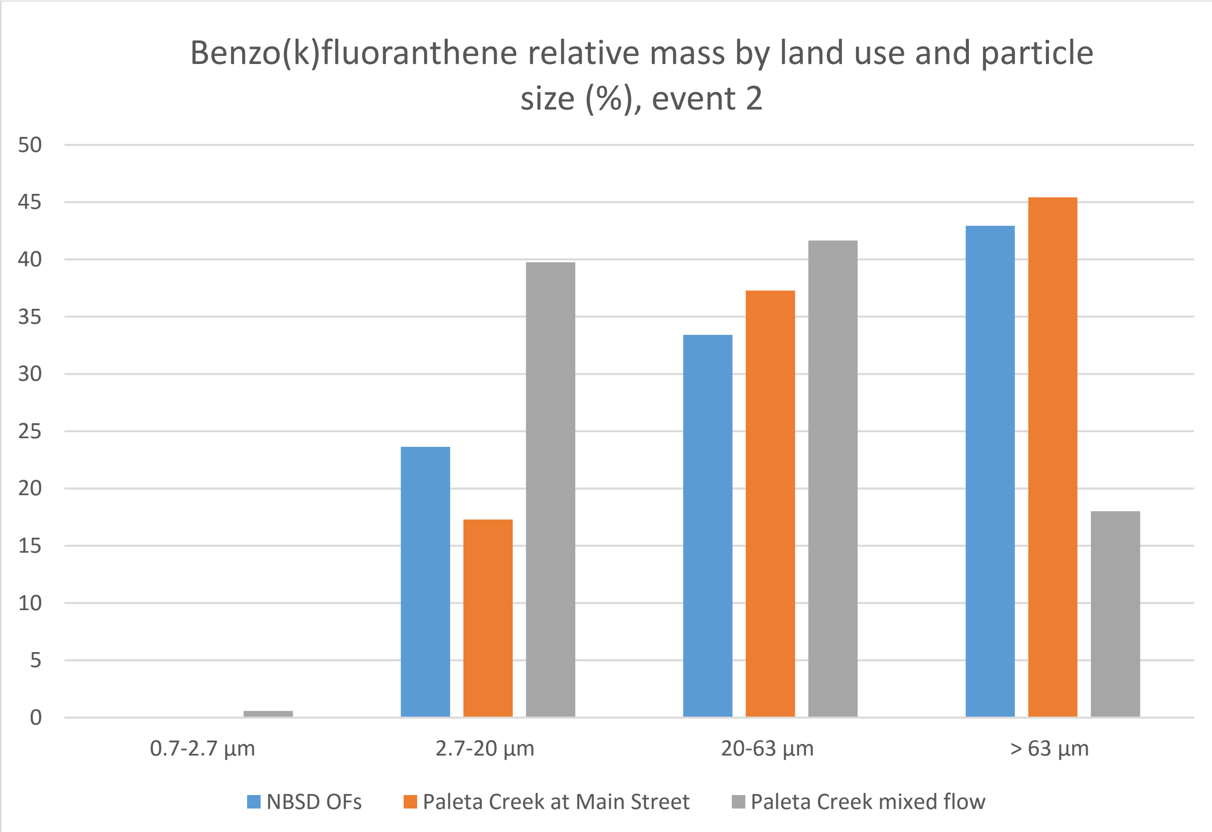
Benzo(k)fluoranthene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...


Benzo(k)fluoranthene mass in size range (% of total), event 2
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Benzo(k)fluoranthese particulate strength by land use and particle size (ug/kg), event 1
6000
5000
4000
3000
2000
1000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(k)fluoranthene particulate strength by land use and particle size (ug/kg), event 2
600
500
400
300
200
100
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(k)fluoranthese relative mass by land use and particle size (%), event 1
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Benzo(k)fluoranthene relative mass by land use and particle size (%), event 2
50
45
40
35
30
25
20
15
10
5
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

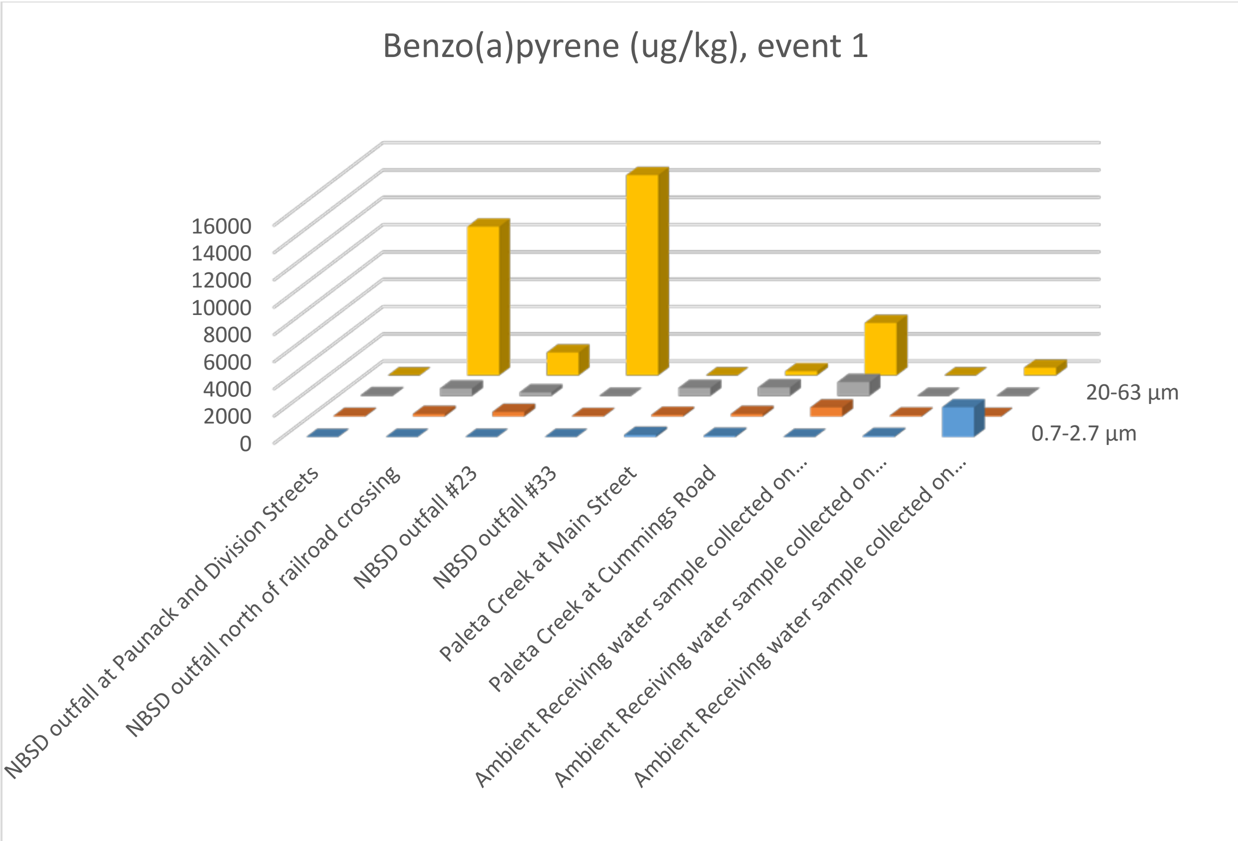
Benzo(a)pyrene

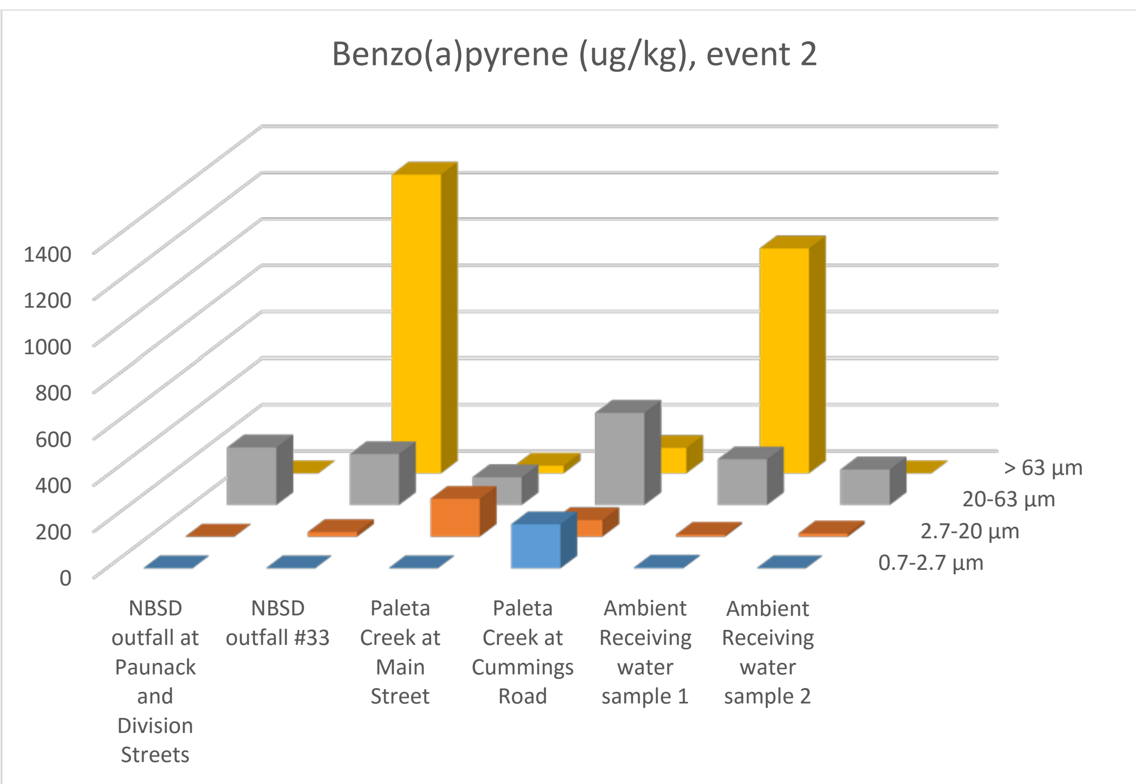
Benzo[a]pyrene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	0.2	na	na	nd*	148	85.5	na	71.6	2,190
2.7-20 µm	39.3	183	330	31.4	117	183	662	68.9	38.7
20-63 µm	45.0	546	260	nd	591	624	1,022	nd	18.1
> 63 µm	na**	10,906	1,687	14,676	nd	308	3,851	na	570

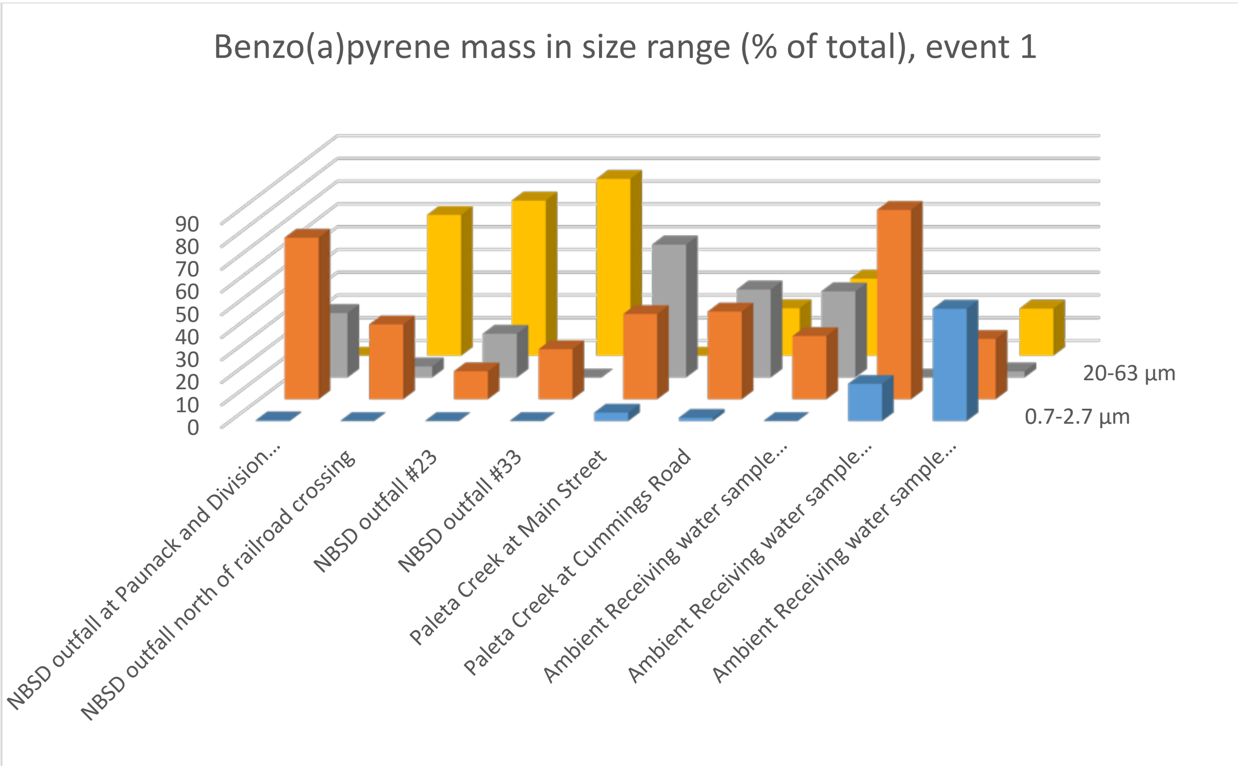
* not detected; particulate strength not calculated, assumed to be zero

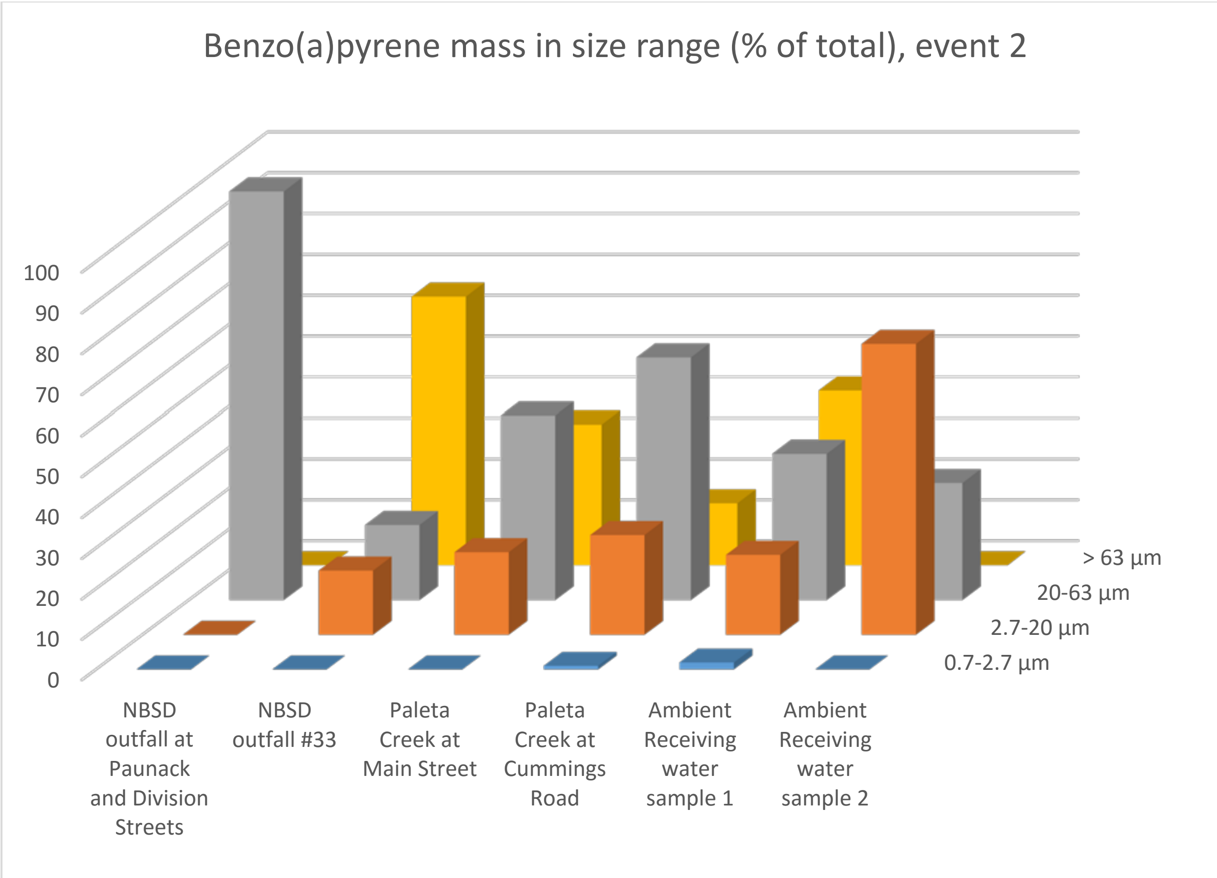
** SSC not detected; particulate strength not calculated, assumed to be zero

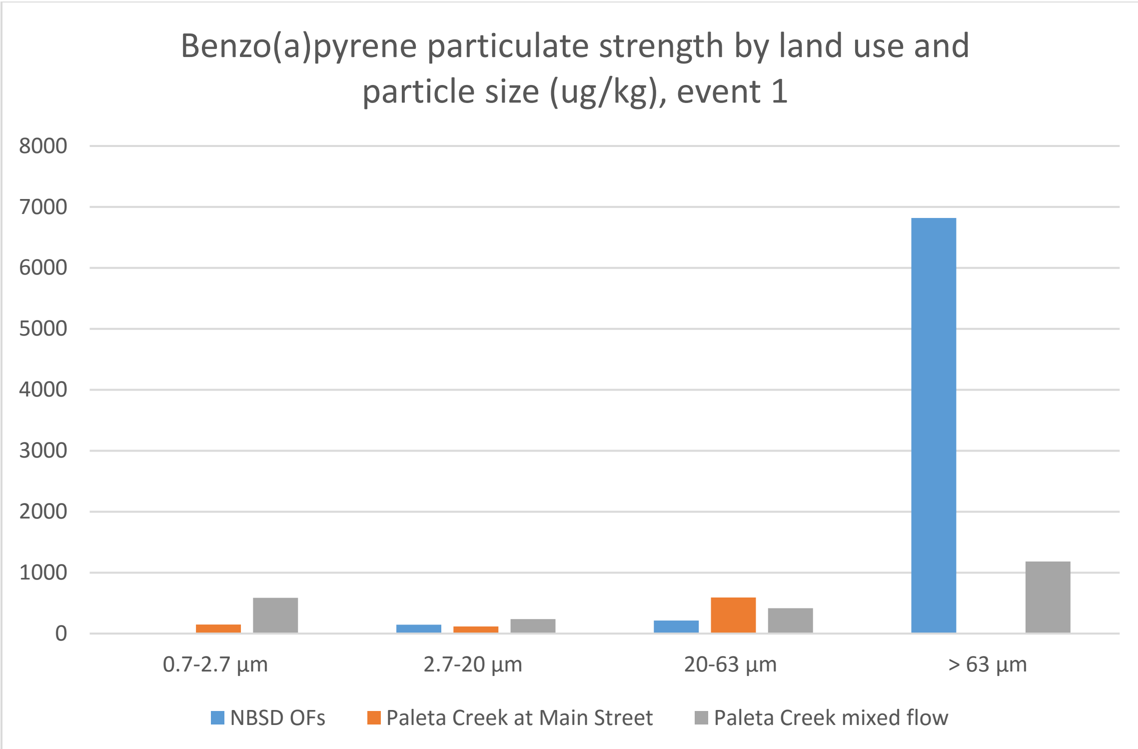
Benzo[a]pyrene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	191	2.8	na
2.7-20 µm	nd	20	164	72	8.4	14
20-63 µm	248	220	120	398	198	153
> 63 µm	nd	1,290	33	110	967	na

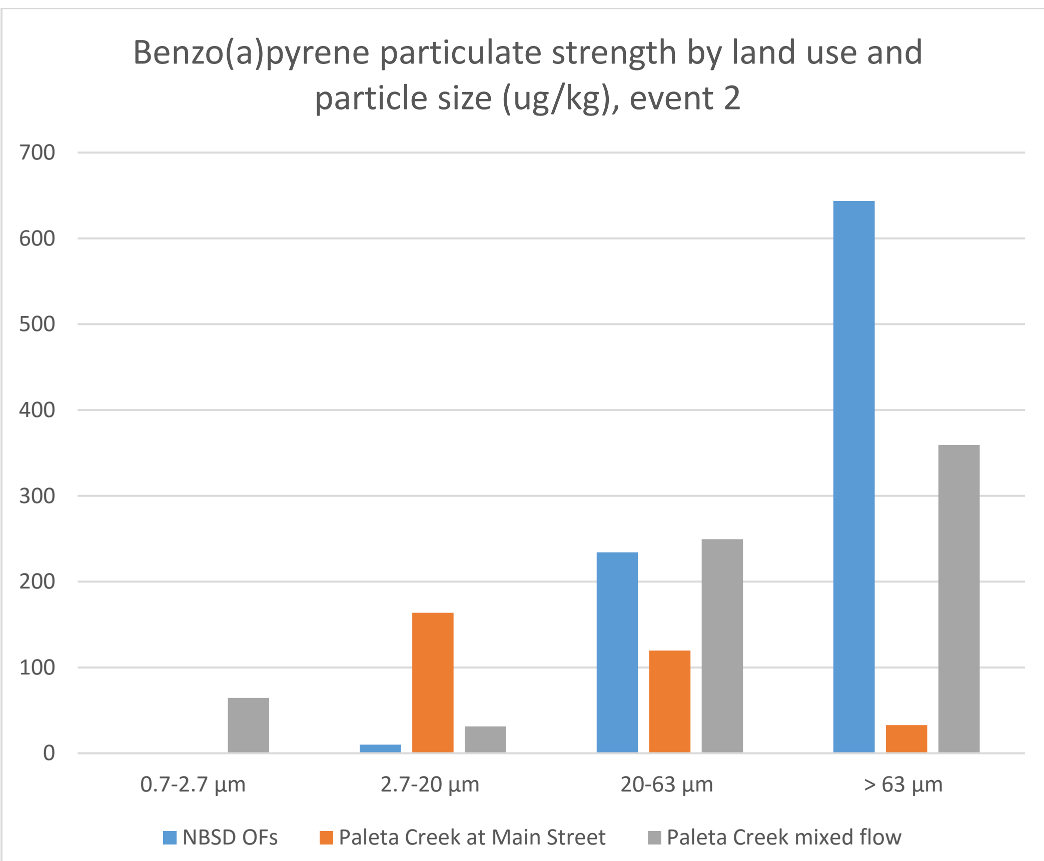

Benzo(a)pyrene (ug/kg), event 1
16000
14000
12000
10000
8000
6000
4000
2000
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...
Ambient Receiving water sample collected on...

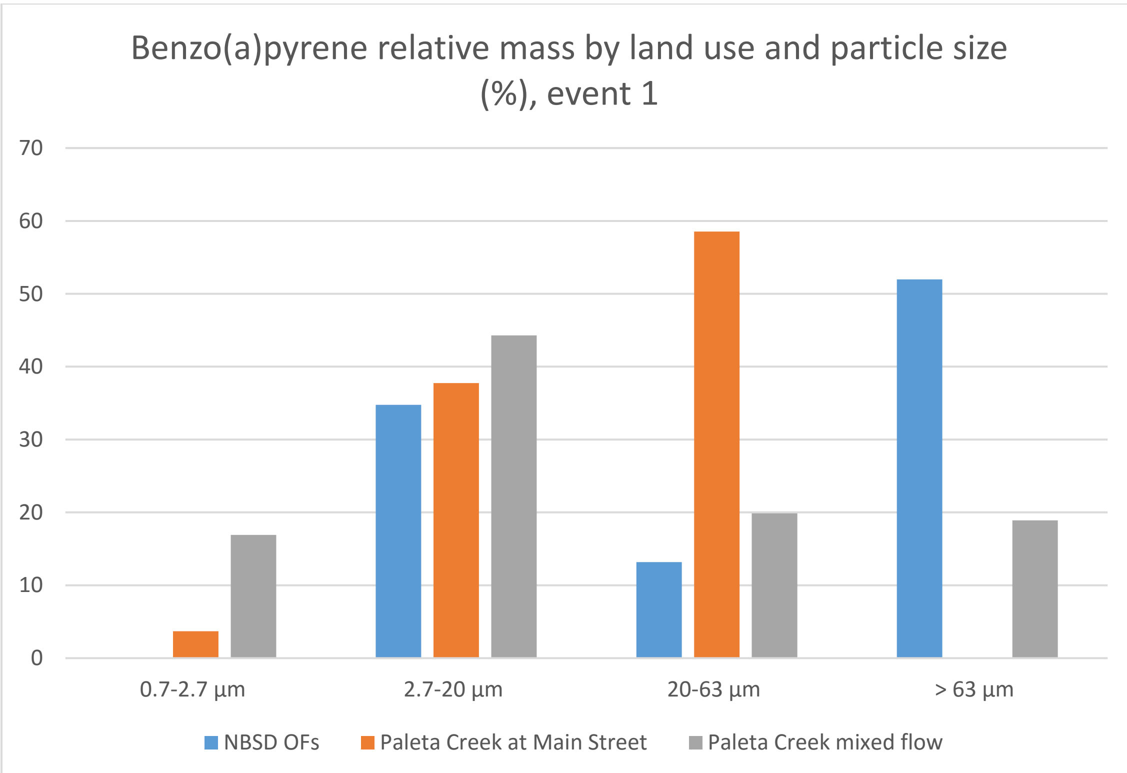

Benzo(a)pyrene (ug/kg), event 2
1400
1200
1000
800
600
400
200
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

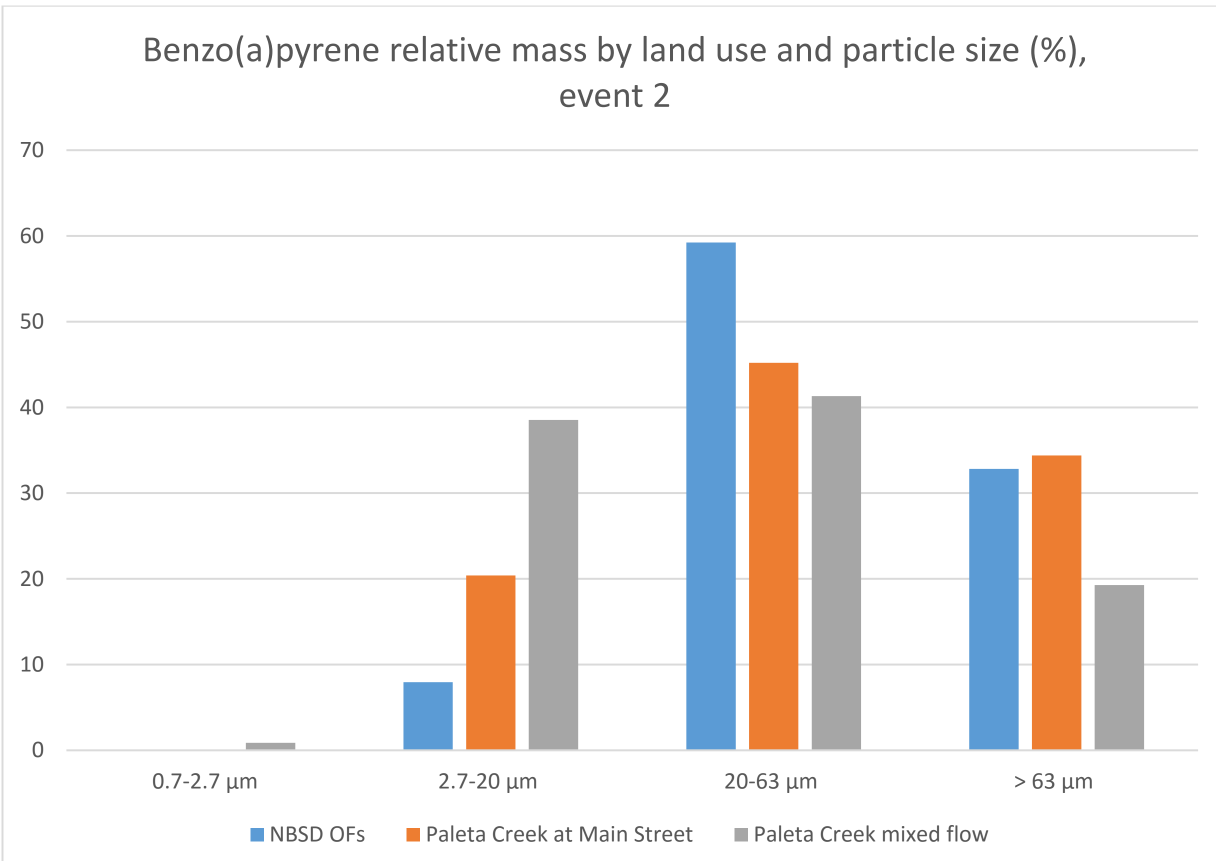

Benzo(a)pyrene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample...
Ambient Receiving water sample...
Ambient Receiving water sample...


Benzo(a)pyrene mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Benzo(a)pyrene particulate strength by land use and particle size (ug/kg), event 1
8000
7000
6000
5000
4000
3000
2000
1000
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(a)pyrene particulate strength by land use and particle size (ug/kg), event 2
700
600
500
400
300
200
100
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(a)pyrene relative mass by land use and particle size (%), event 1
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(a)pyrene relative mass by land use and particle size (%), event 2
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

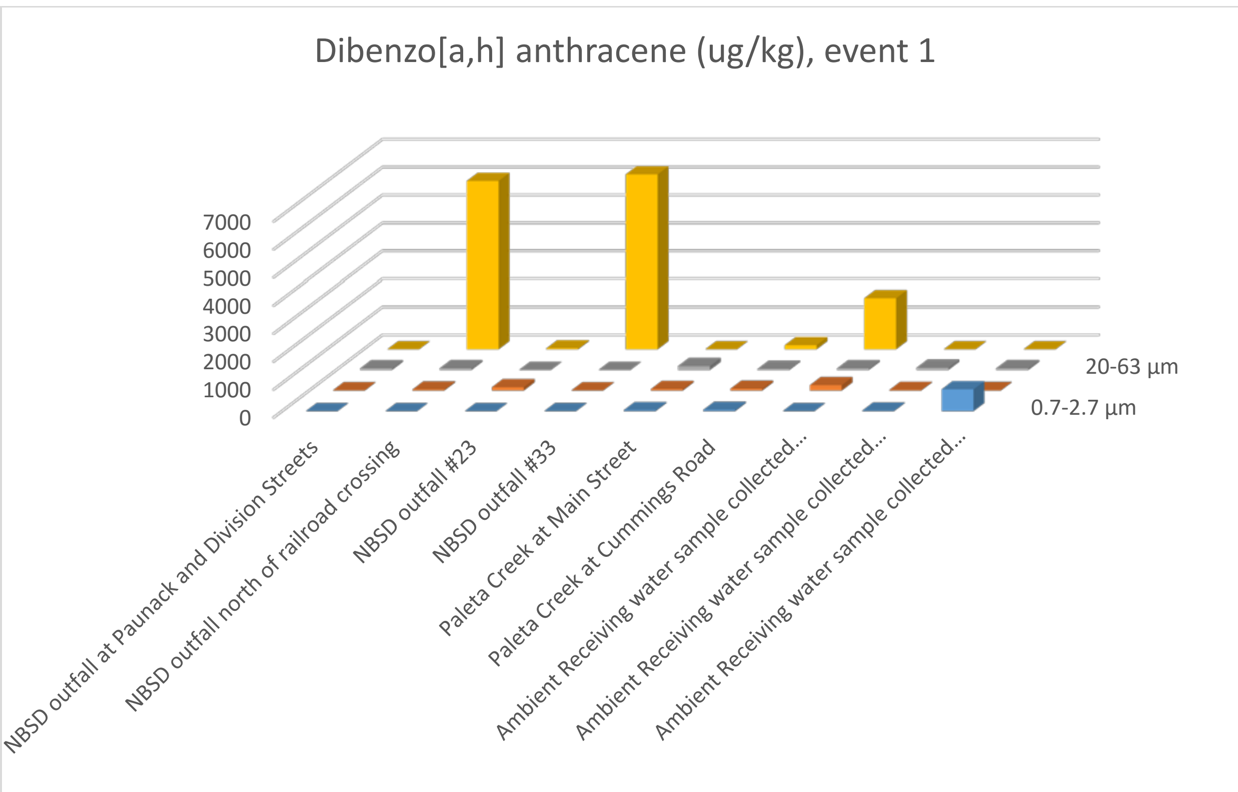
Dibenzo(a,h)anthracene

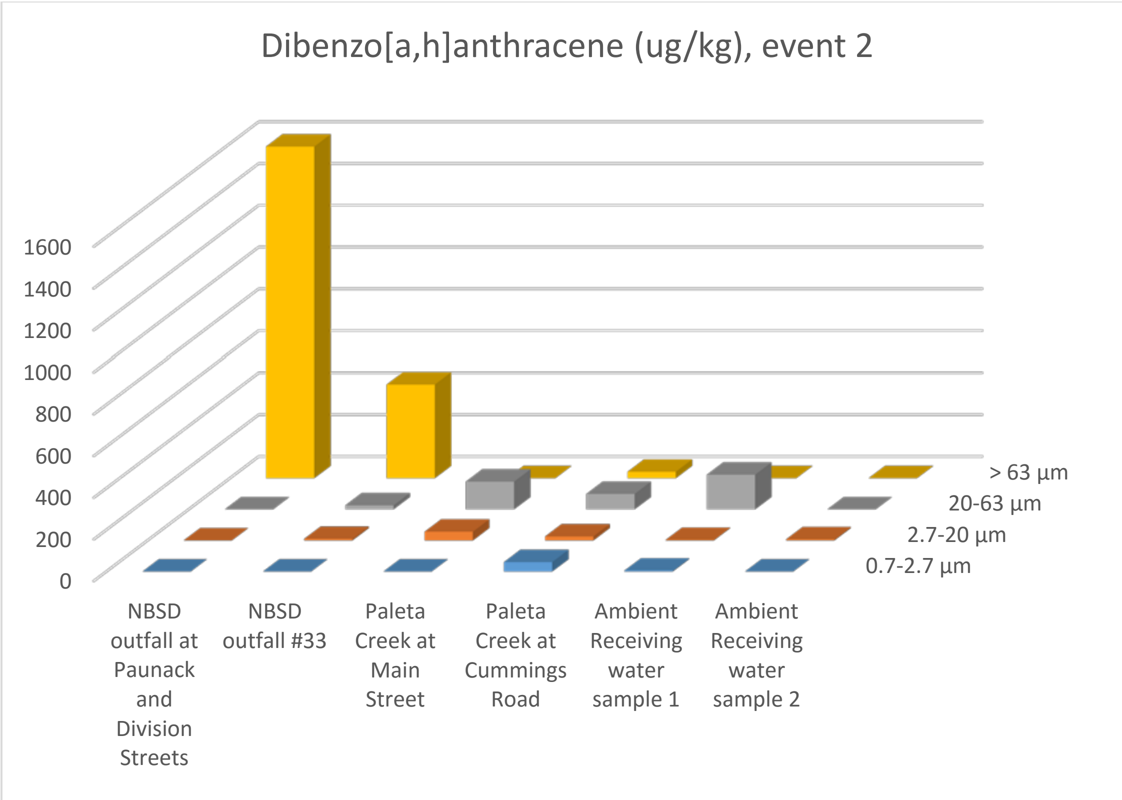
Dibenzo[a,h]anthracene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cumming s Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	nd*	na	na	2.8	34.0	44.6	na	18.4	782
2.7-20 µm	11.7	37.0	119	6.4	52.7	63.6	193	21.2	18.0
20-63 µm	52.6	54.8	nd	nd	137	34.3	53.5	77.6	54.7
> 63 µm	na**	6,018	33.2	6,254	nd	147	1,828	na	nd

* not detected; particulate strength not calculated, assumed to be zero

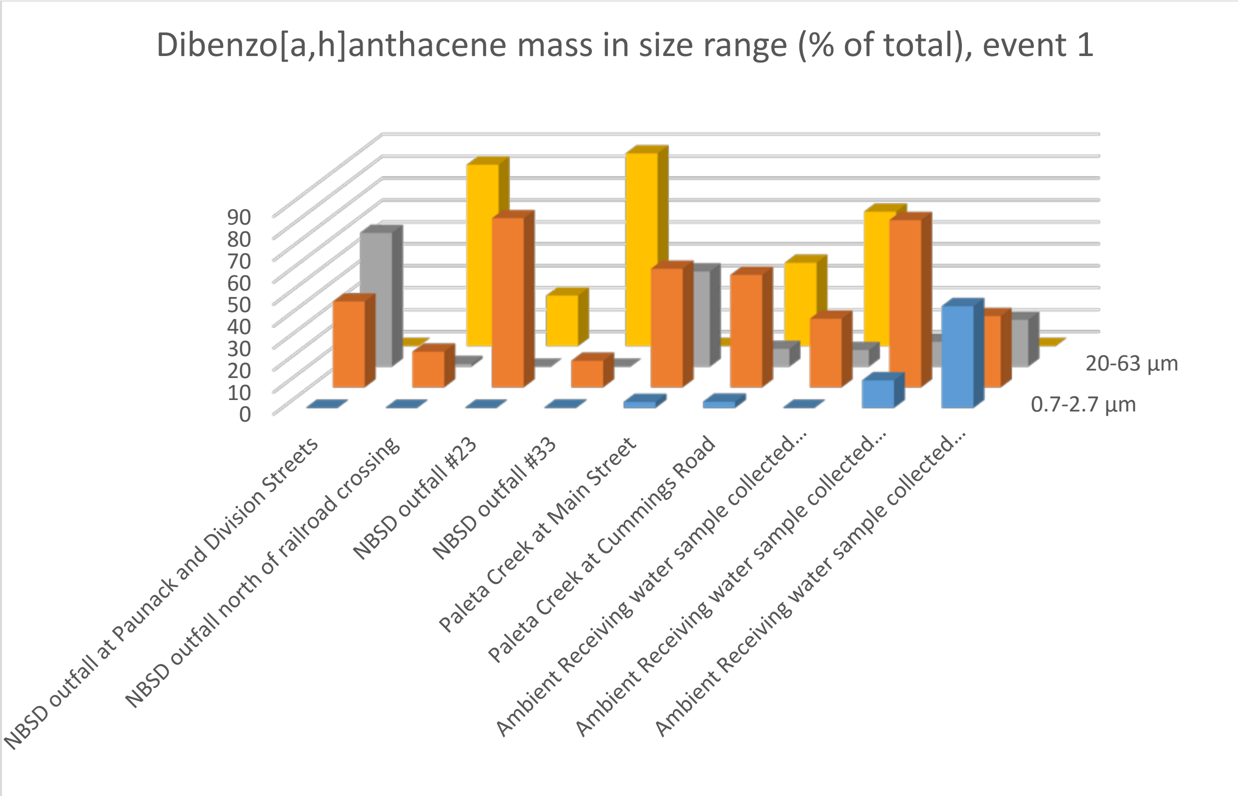
** SSC not detected; particulate strength not calculated, assumed to be zero

Dibenzo[a,h]anthracene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	46	4.5	na
2.7-20 µm	nd	7.5	42	19	2.5	5.4
20-63 µm	nd	19	133	74	166	nd
> 63 µm	1,585	448	nd	31	nd	na

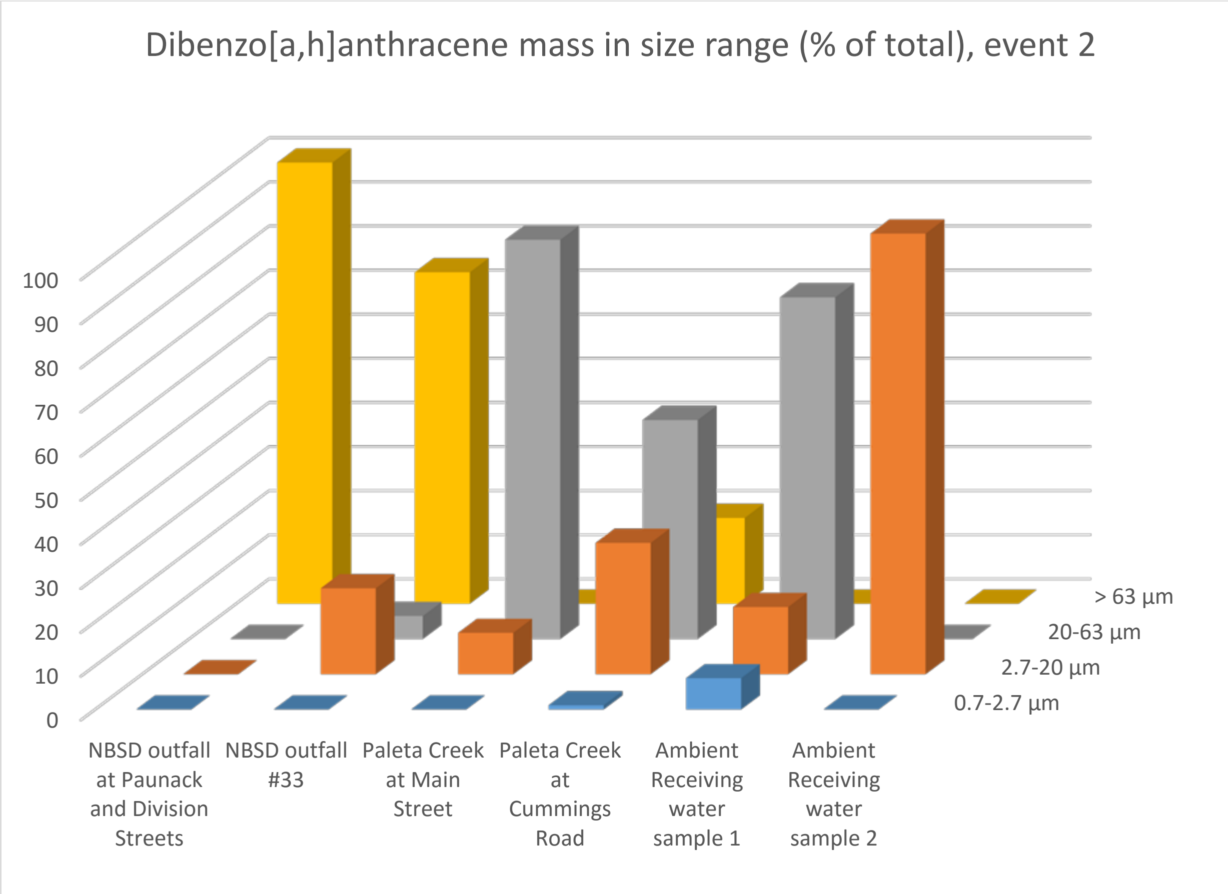




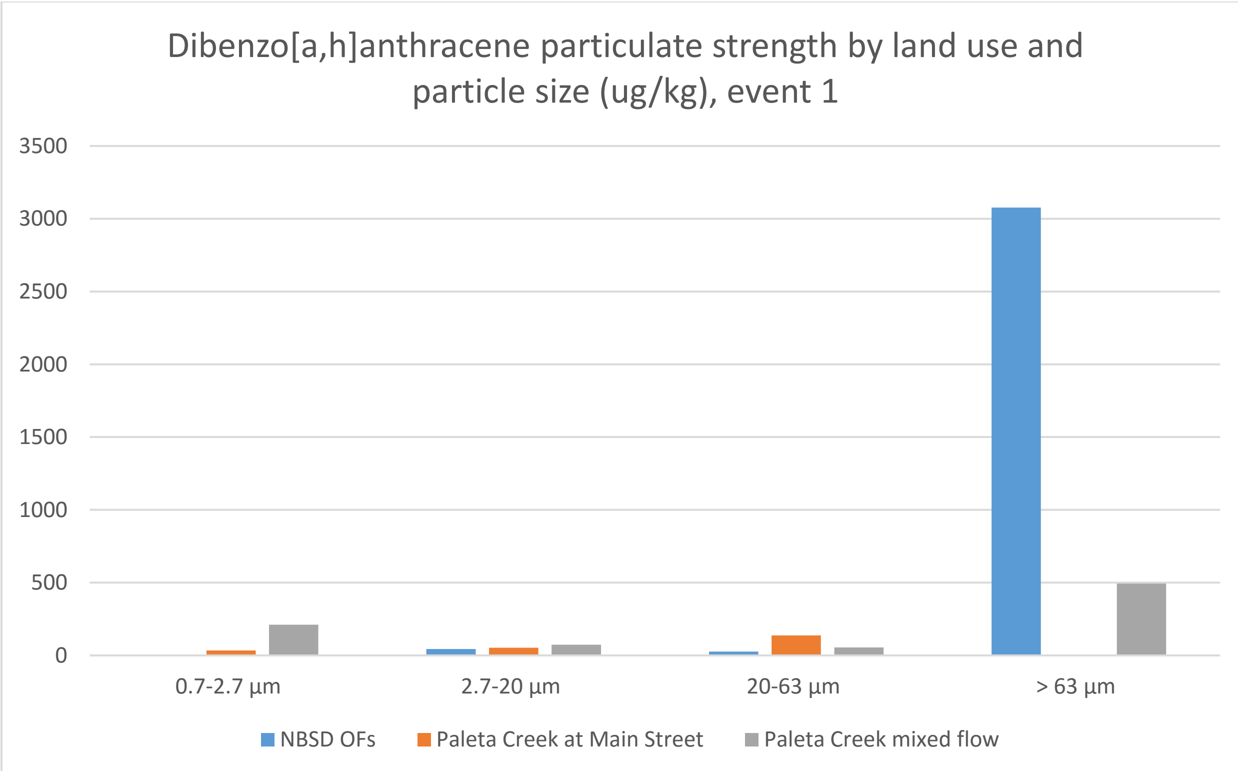
Dibenzo[a,h]anthracene (ug/kg), event 2
1600
1400
1200
1000
800
600
400
200
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

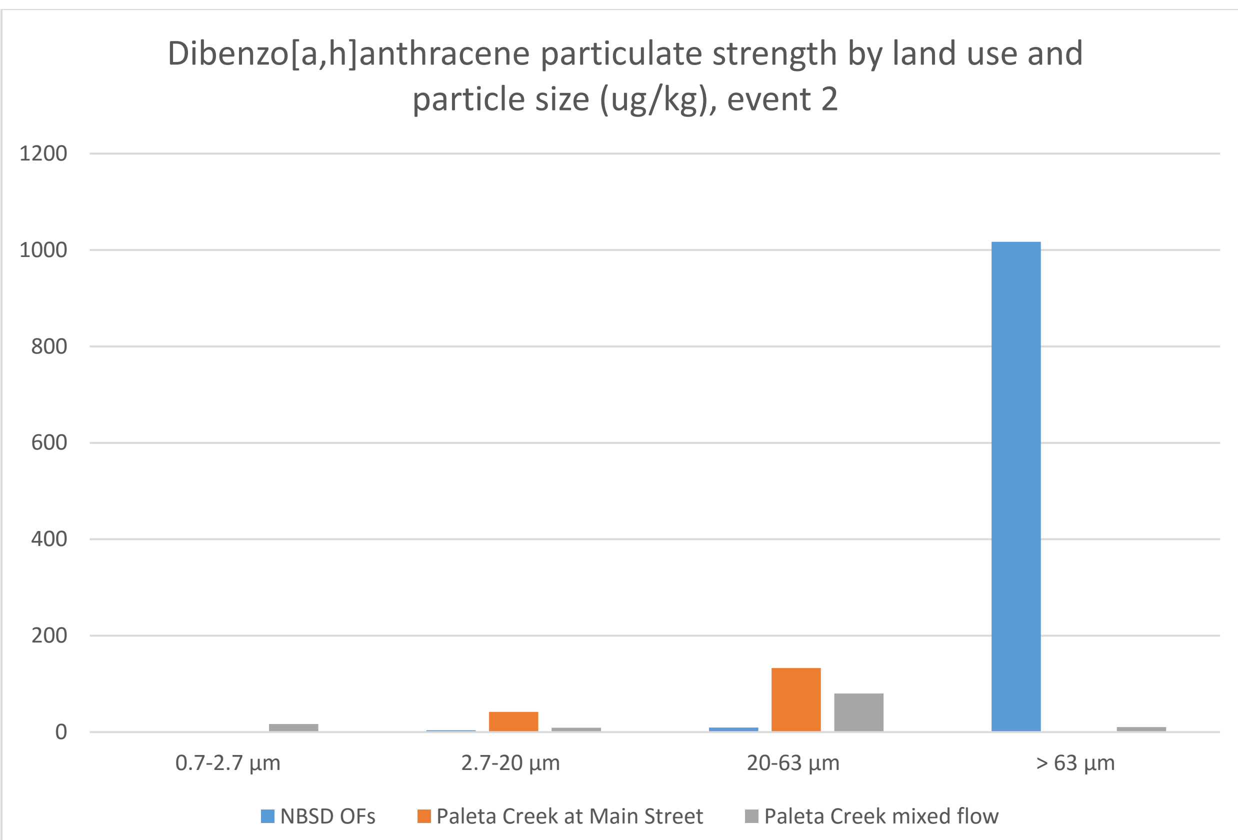


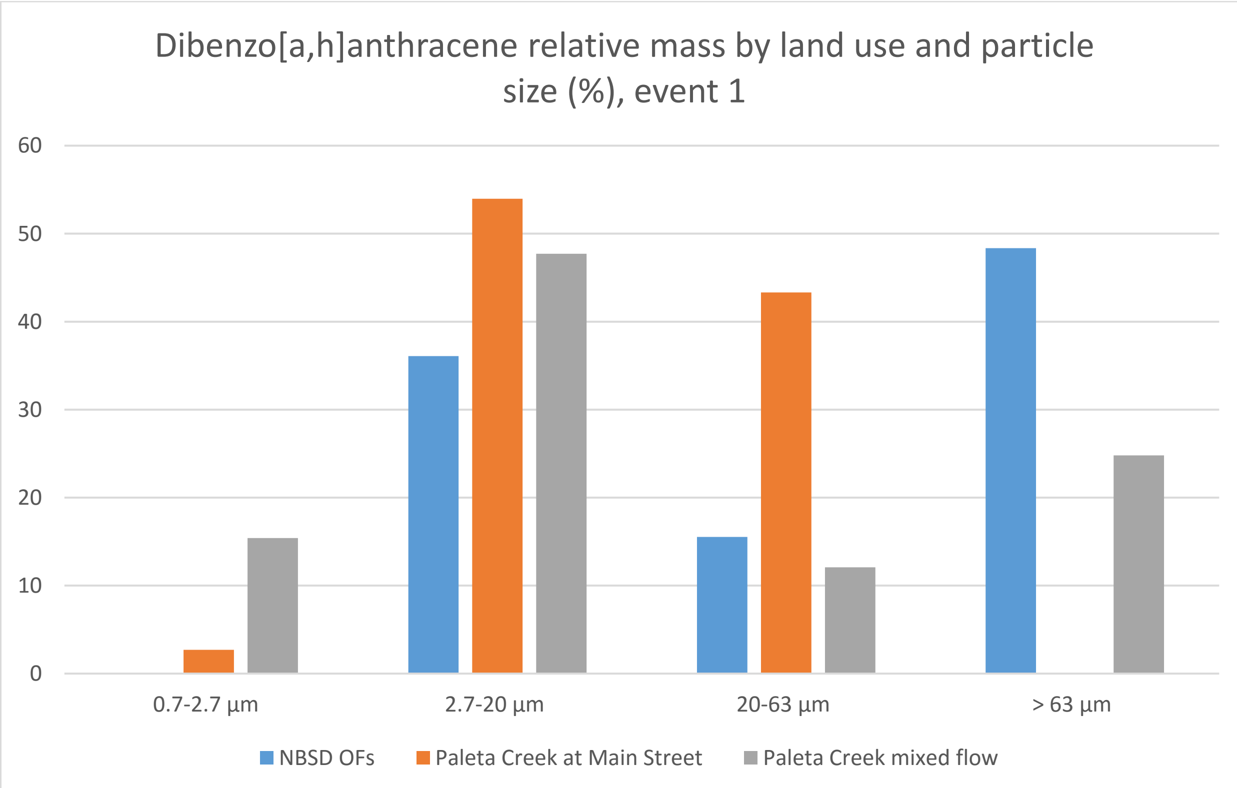
Dibenzo[a,h]anthacene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...



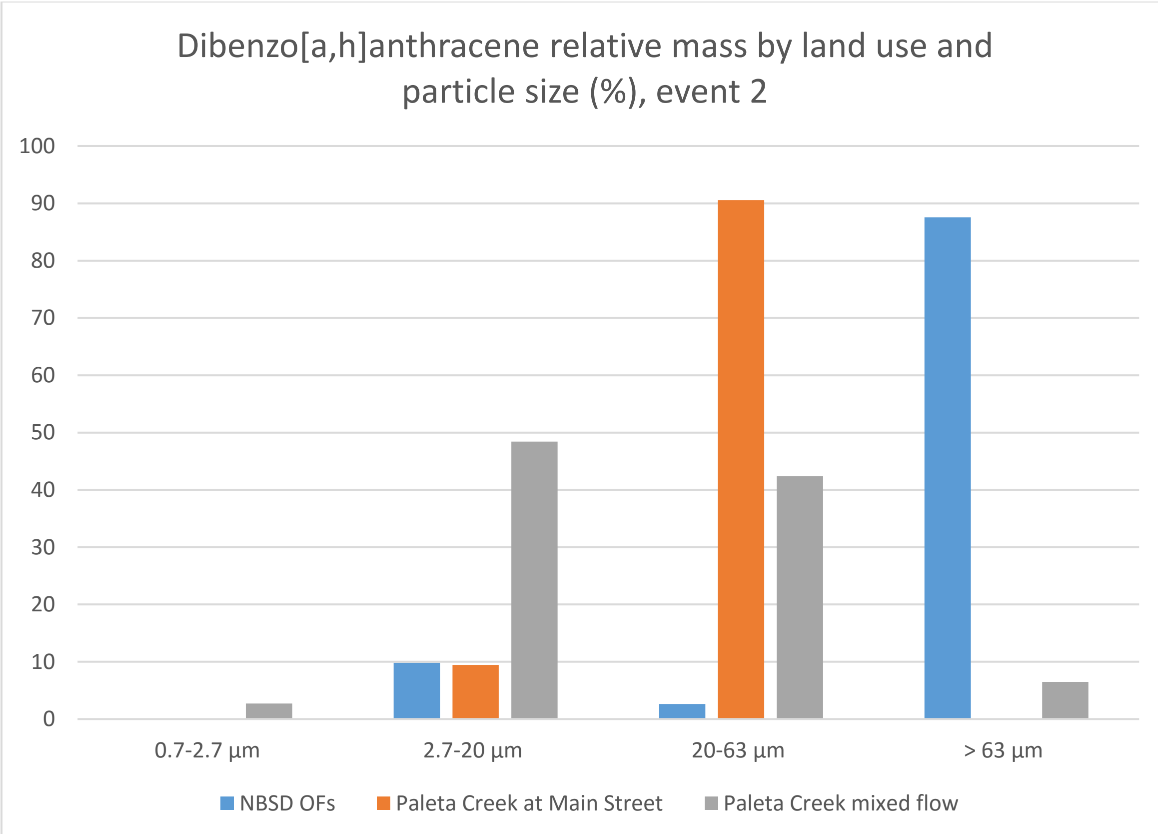
Dibenzo[a,h]anthracene mass in size range (% of total), event 2
100
90
80
70
60
50
40
30
20
10
0
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm


Dibenzo[a,h]anthracene particulate strength by land use and particle size (ug/kg), event 1
3500
3000
2500
2000
1500
1000
500
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Dibenzo[a,h]anthracene particulate strength by land use and particle size (ug/kg), event 2
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Dibenzo[a,h]anthracene relative mass by land use and particle size (%), event 1
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Dibenzo[a,h]anthracene relative mass by land use and particle size (%), event 2
100
90
80
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

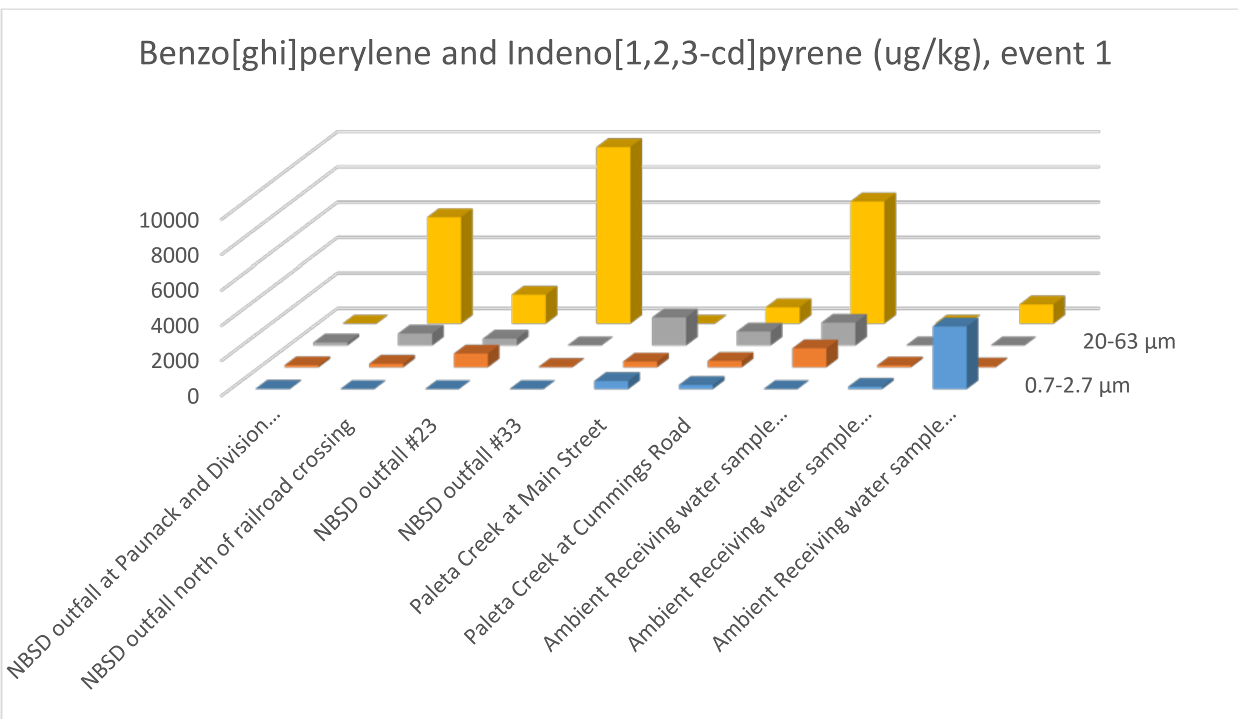
Benzo[ghi]perylene and Indeno[1,2,3-cd]pyrene

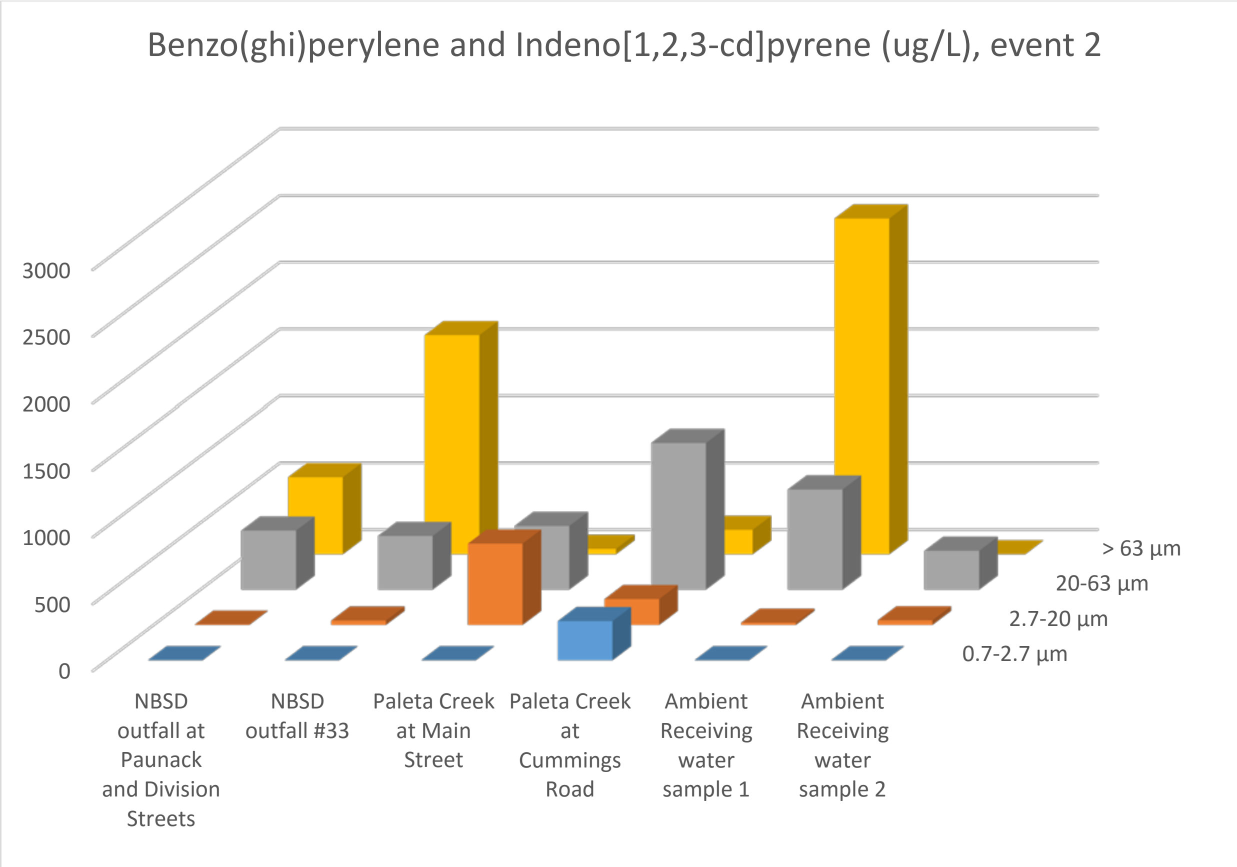
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene (ug/kg), event 1	NBSD outfall at Paunack and Division Streets	NBSD outfall north of railroad crossing	NBSD outfall #23	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample collected on 1/5/2016 at 1327 h	Ambient Receiving water sample collected on 1/5/2016 at 1947 h	Ambient Receiving water sample collected on 1/6/2016 at 0333 h
0.7-2.7 µm	26.0	na	na	3.8	459	233	na	131	3,568
2.7-20 µm	116	203	779	18.9	326	363	1,081	107	45.1
20-63 µm	174	681	383	nd*	1,597	791	1,296	nd	nd
> 63 µm	na**	6,010	1,644	9,990	nd	930	6,900	na	1,094

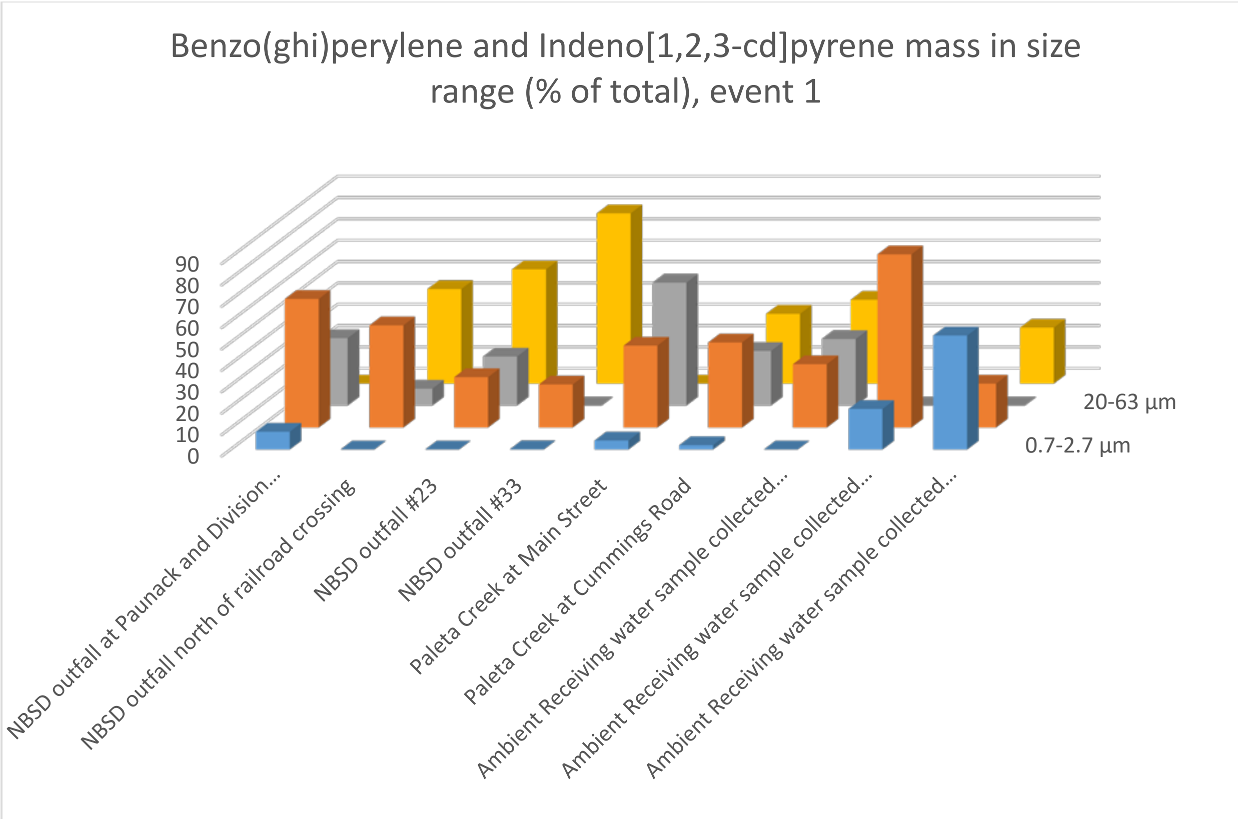
* not detected; particulate strength not calculated, assumed to be zero

** SSC not detected; particulate strength not calculated, assumed to be zero

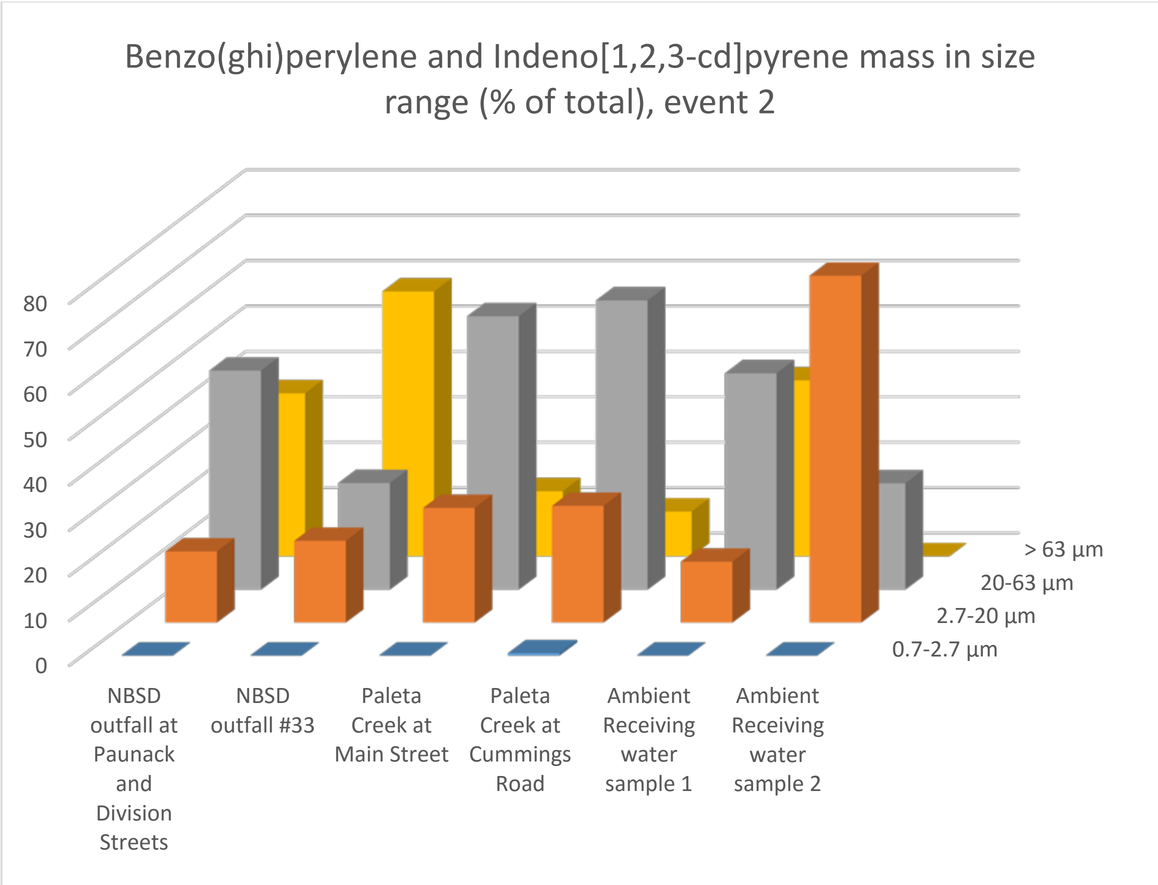
Benzo[ghi]perylene+Indeno[1,2,3-cd]pyrene (ug/kg), event 2	NBSD outfall at Paunack and Division Streets	NBSD outfall #33	Paleta Creek at Main Street	Paleta Creek at Cummings Road	Ambient Receiving water sample 1	Ambient Receiving water sample 2
0.7-2.7 µm	na	na	na	293	nd	na
2.7-20 µm	1.9	33	609	194	16.4	34.3
20-63 µm	442	402	476	1,098	749	290
> 63 µm	578	1,638	41	183	2,512	na

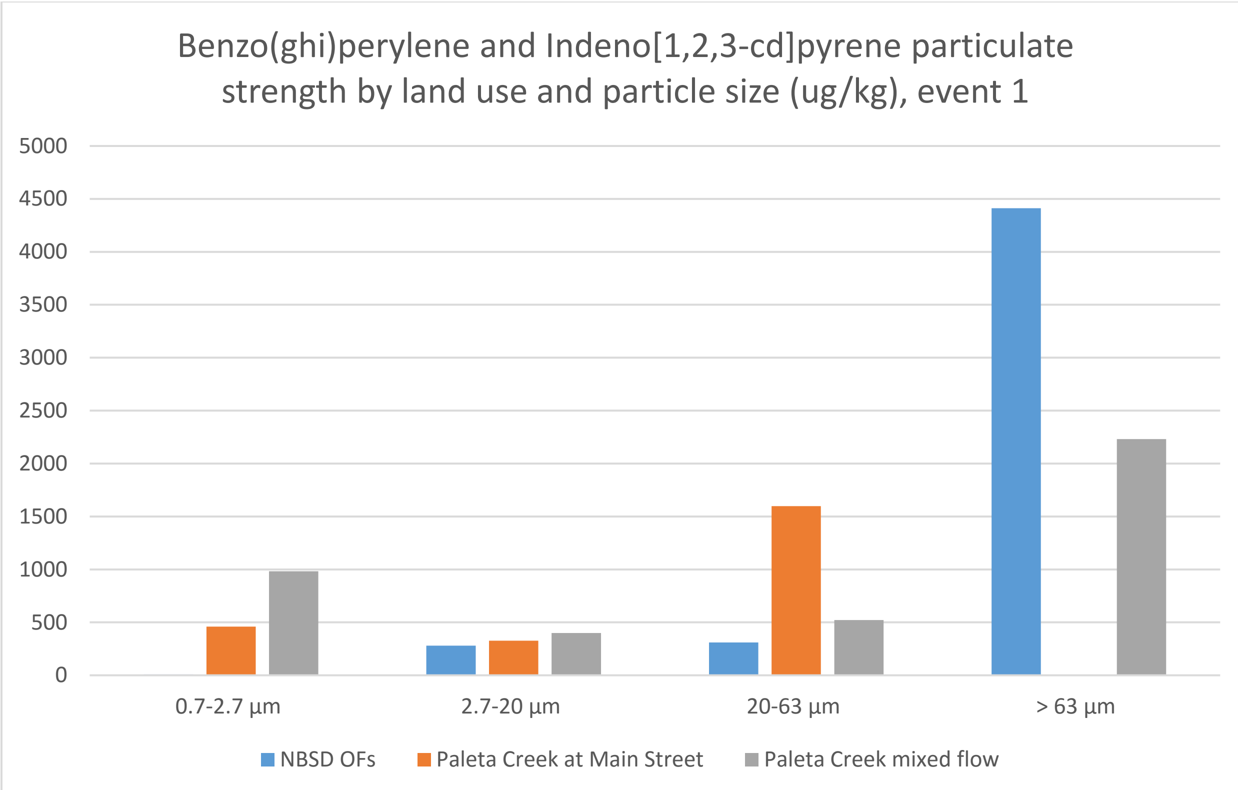


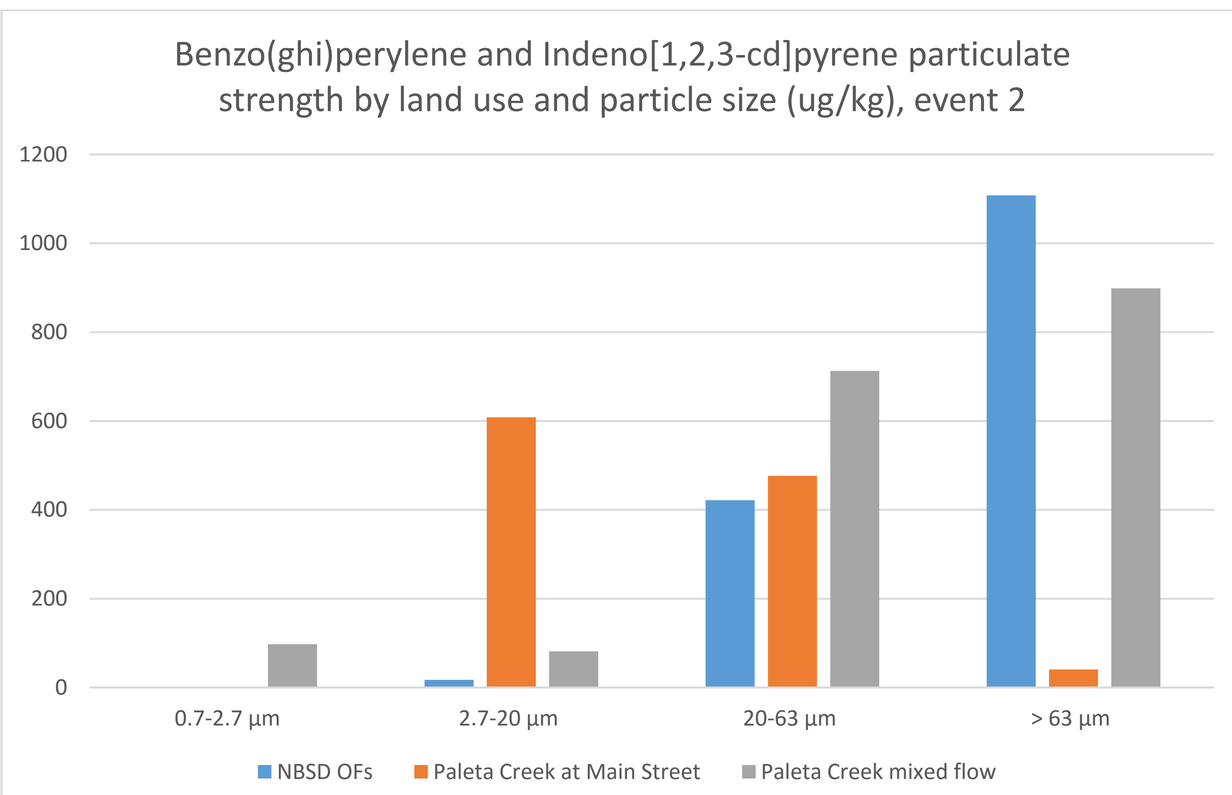

Benzo(ghi)perylene and Indeno[1,2,3-cd]pyrene (ug/L), event 2
3000
2500
2000
1500
1000
500
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2

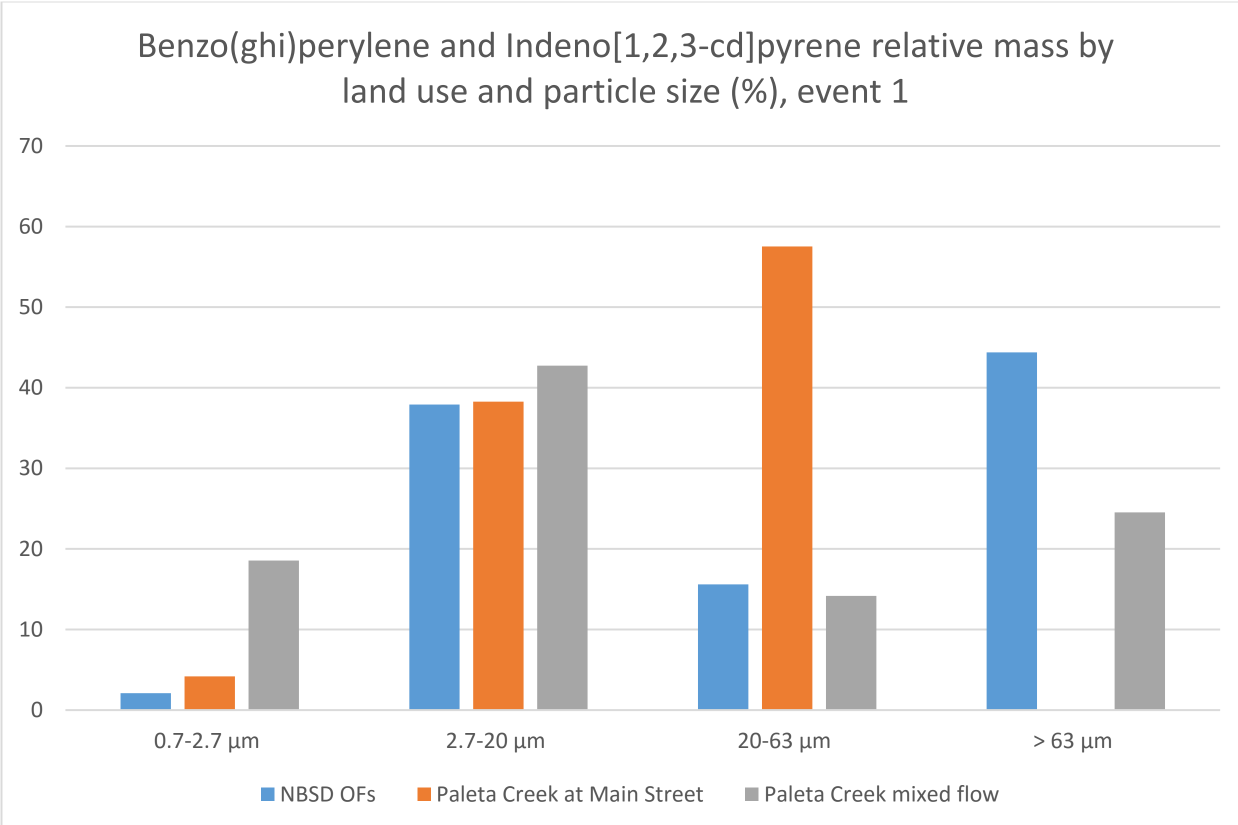


Benzo(ghi)perylene and Indeno[1,2,3-cd]pyrene mass in size range (% of total), event 1
90
80
70
60
50
40
30
20
10
0
20-63 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division...
NBSD outfall north of railroad crossing
NBSD outfall #23
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...
Ambient Receiving water sample collected...

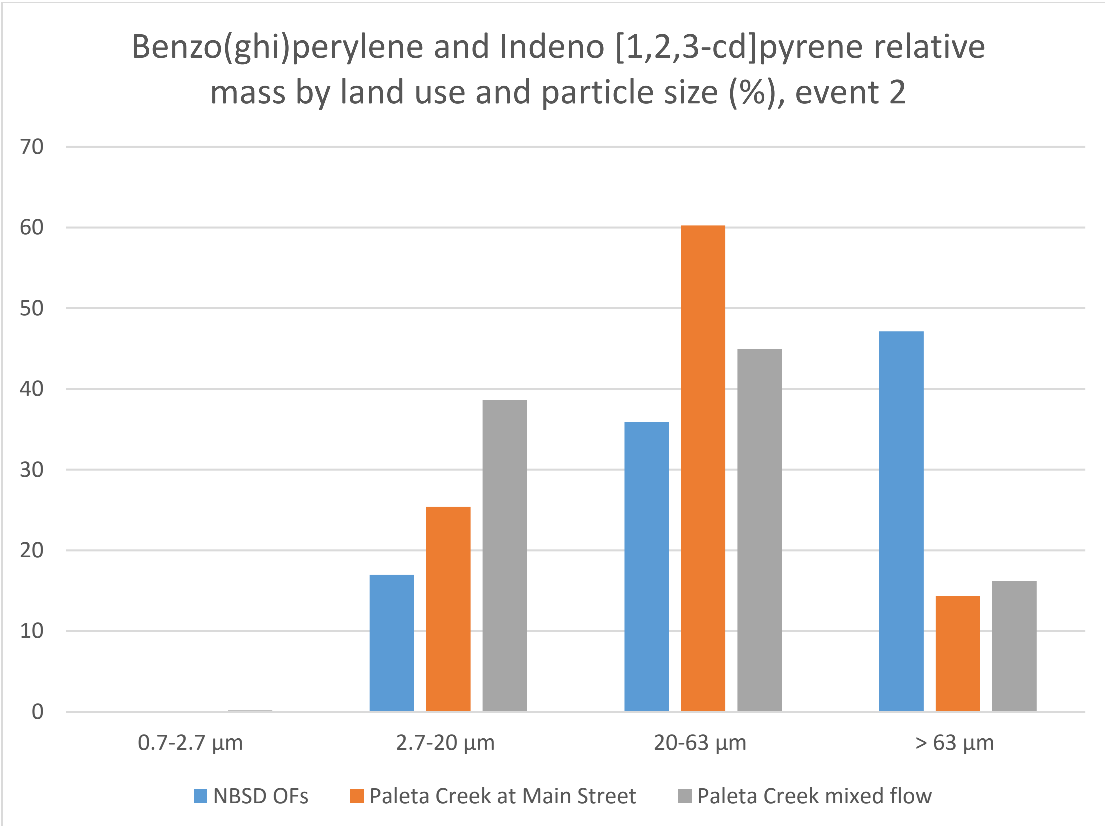

Benzo(ghi)perylene and Indeno[1,2,3-cd]pyrene mass in size range (% of total), event 2
80
70
60
50
40
30
20
10
0
> 63 µm
20-63 µm
2.7-20 µm
0.7-2.7 µm
NBSD outfall at Paunack and Division Streets
NBSD outfall #33
Paleta Creek at Main Street
Paleta Creek at Cummings Road
Ambient Receiving water sample 1
Ambient Receiving water sample 2


Benzo(ghi)perylene and Indeno[1,2,3-cd]pyrene particulate strength by land use and particle size (ug/kg), event 1
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow


Benzo(ghi)perylene and Indeno[1,2,3-cd]pyrene particulate strength by land use and particle size (ug/kg), event 2
1200
1000
800
600
400
200
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow



Benzo(ghi)perylene and Indeno[1,2,3-cd]pyrene relative mass by land use and particle size (%), event 1
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

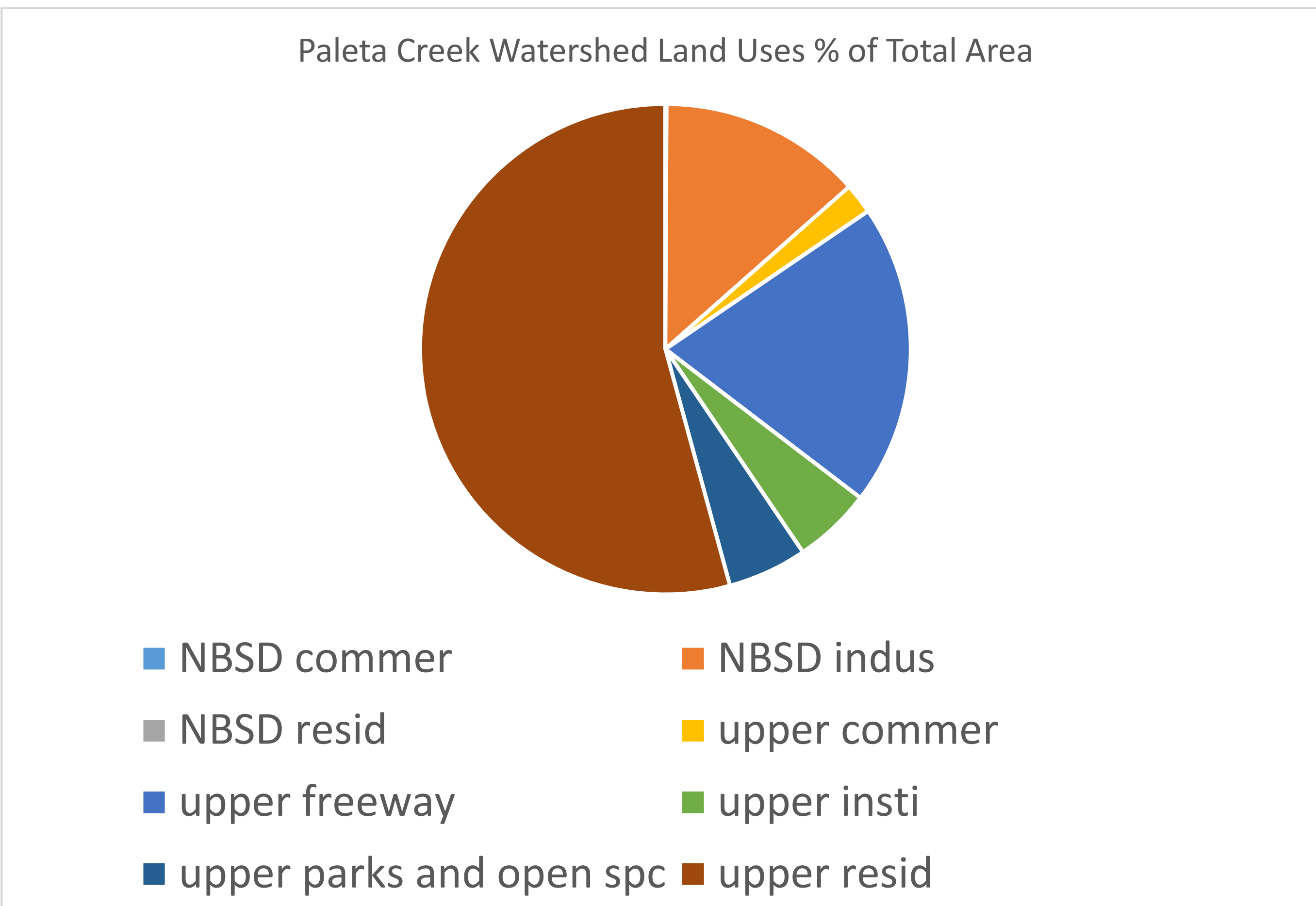

Benzo(ghi)perylene and Indeno [1,2,3-cd]pyrene relative mass by land use and particle size (%), event 2
70
60
50
40
30
20
10
0
0.7-2.7 µm
2.7-20 µm
20-63 µm
> 63 µm
NBSD OFs
Paleta Creek at Main Street
Paleta Creek mixed flow

Appendix K. Paleta Creek Watershed Stormwater Metal and PAH Discharges by Land Use and Particle Size

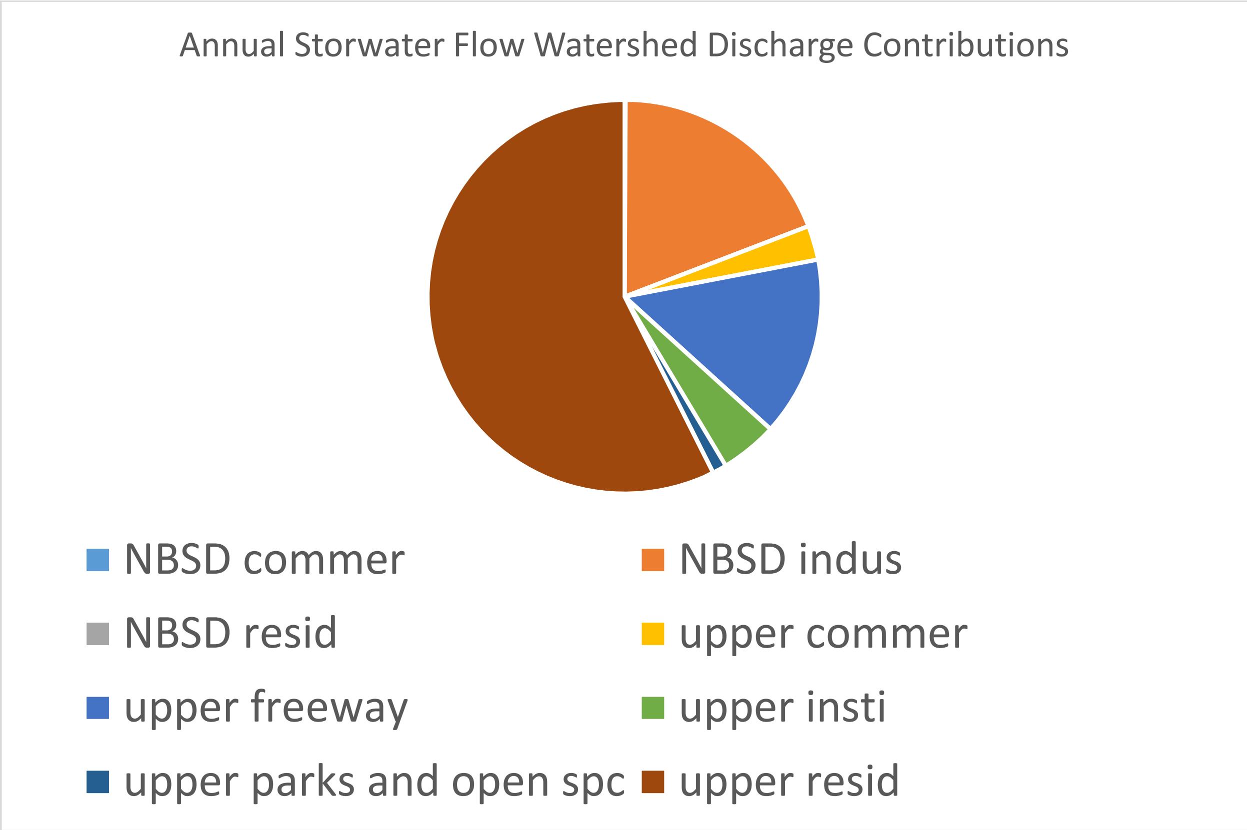
Contents

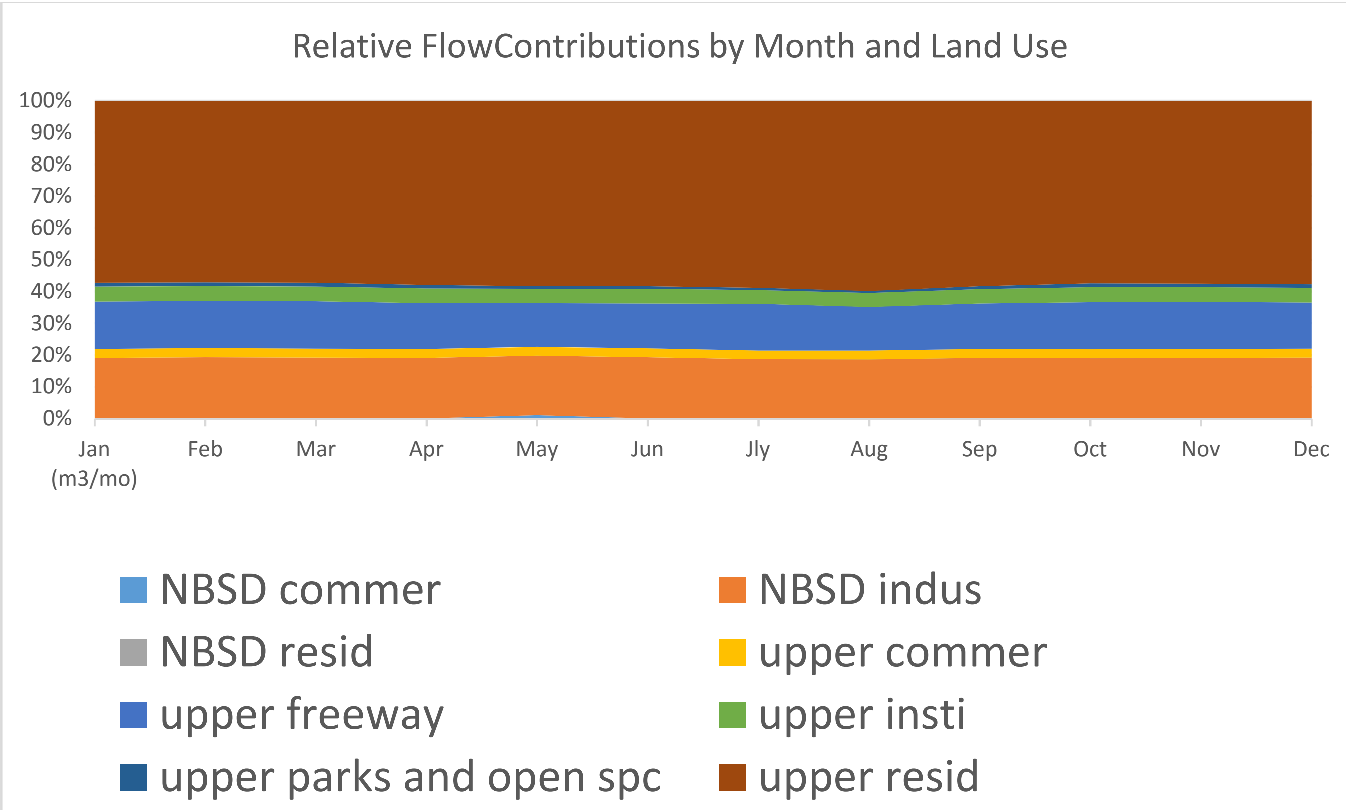
Paleta Creek Watershed Land Use Areas

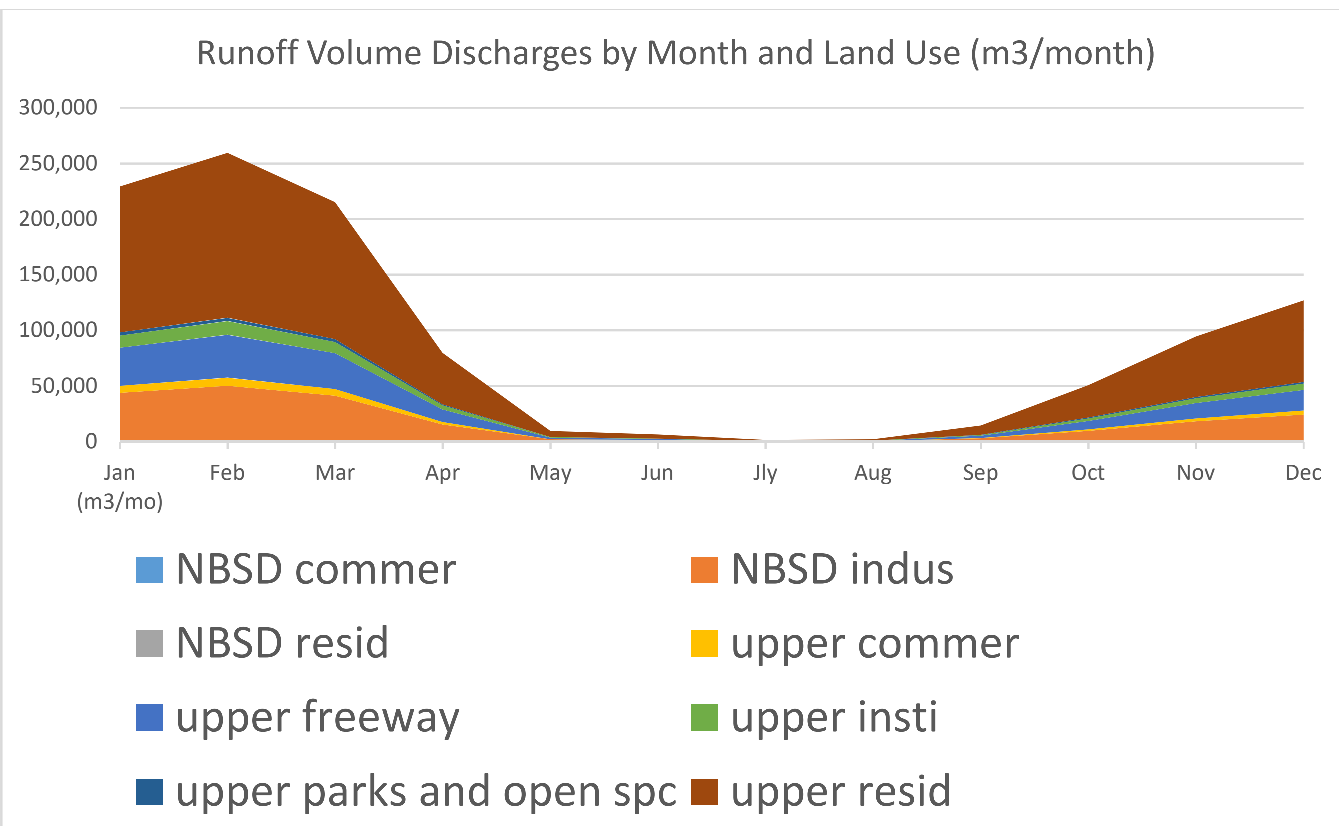
land use	area	% of total area
NBSD commercial	1.3	0.1
NBSD industrial	268.16	13.4
NBSD residential	0.11	0.0
upper commercial	40.04	2.0
upper freeway	397.64	19.9
upper institutional	103.2	5.2
upper parks and open space	104.76	5.2
upper residential	1084.66	54.2
sum:	1999.87	100

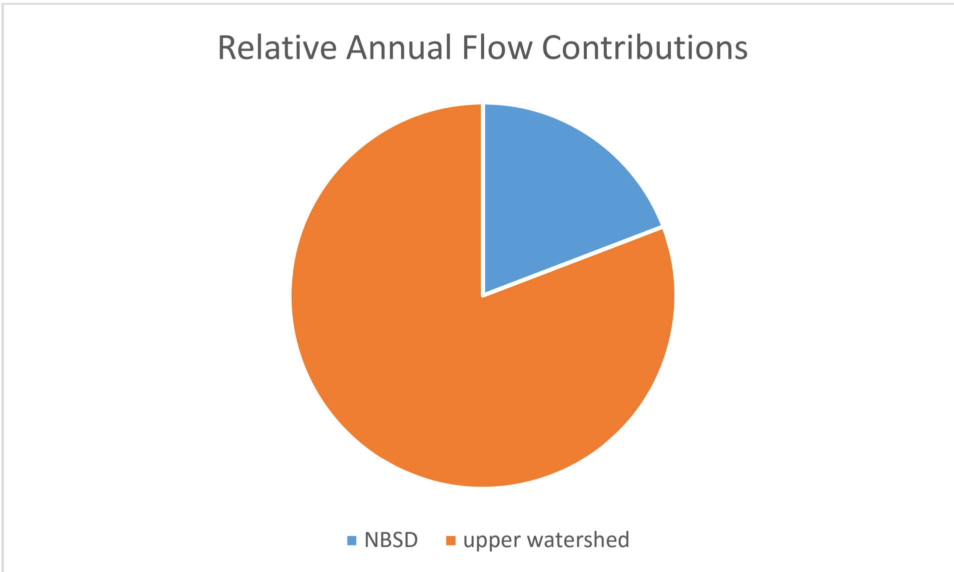


Annual Paleta Creek Stormwater Runoff Volume Discharges

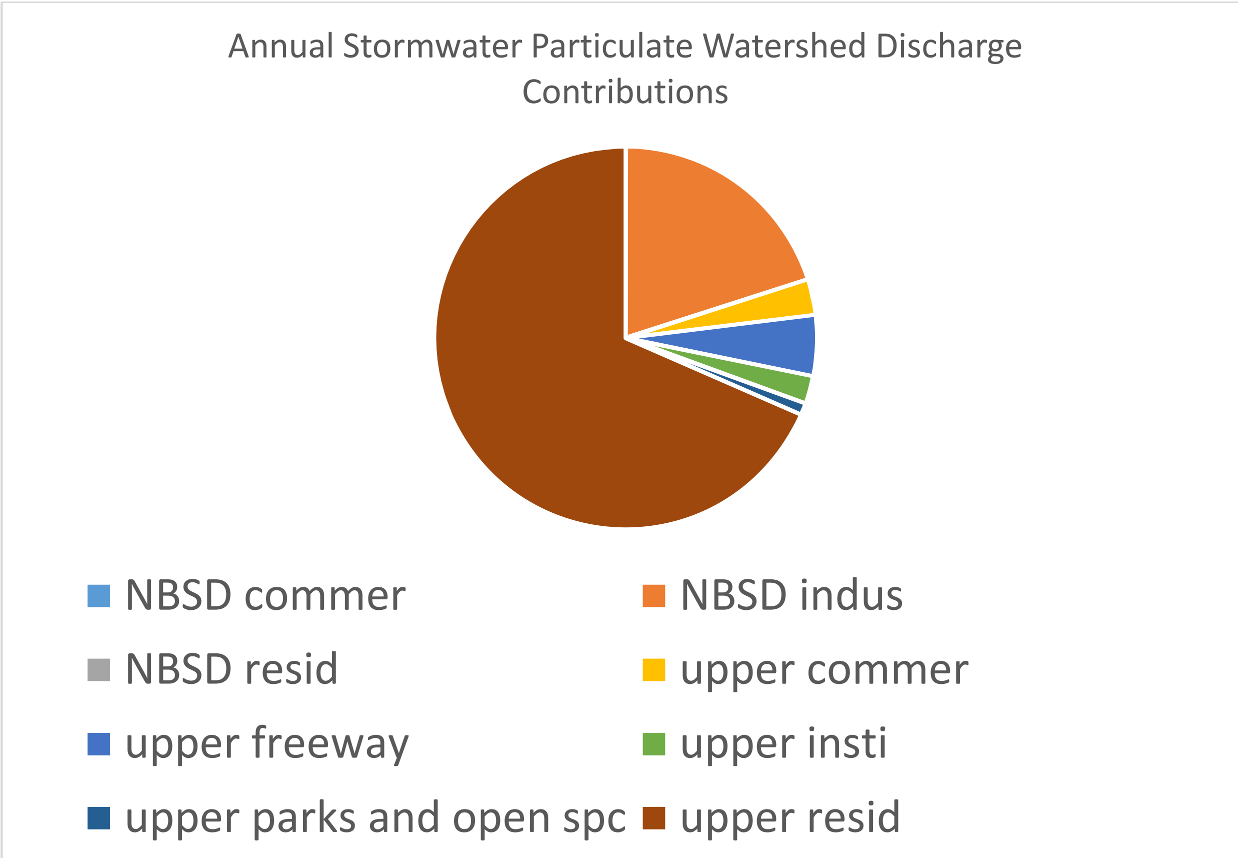


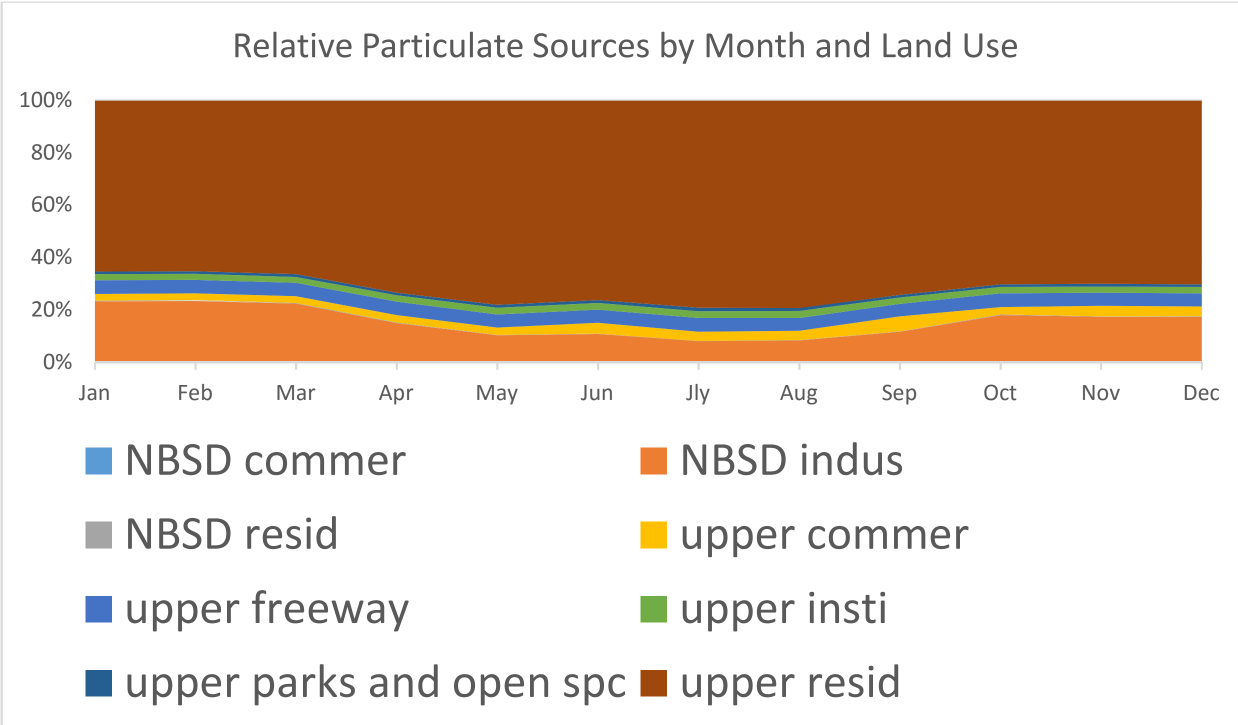

Relative FlowContributions by Month and Land Use
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Jan (m3/mo)
Feb
Mar
Apr
May
Jun
Jly
Aug
Sep
Oct
Nov
Dec
NBSD commer
NBSD indus
NBSD resid
upper commer
upper freeway
upper insti
upper parks and open spc
upper resid

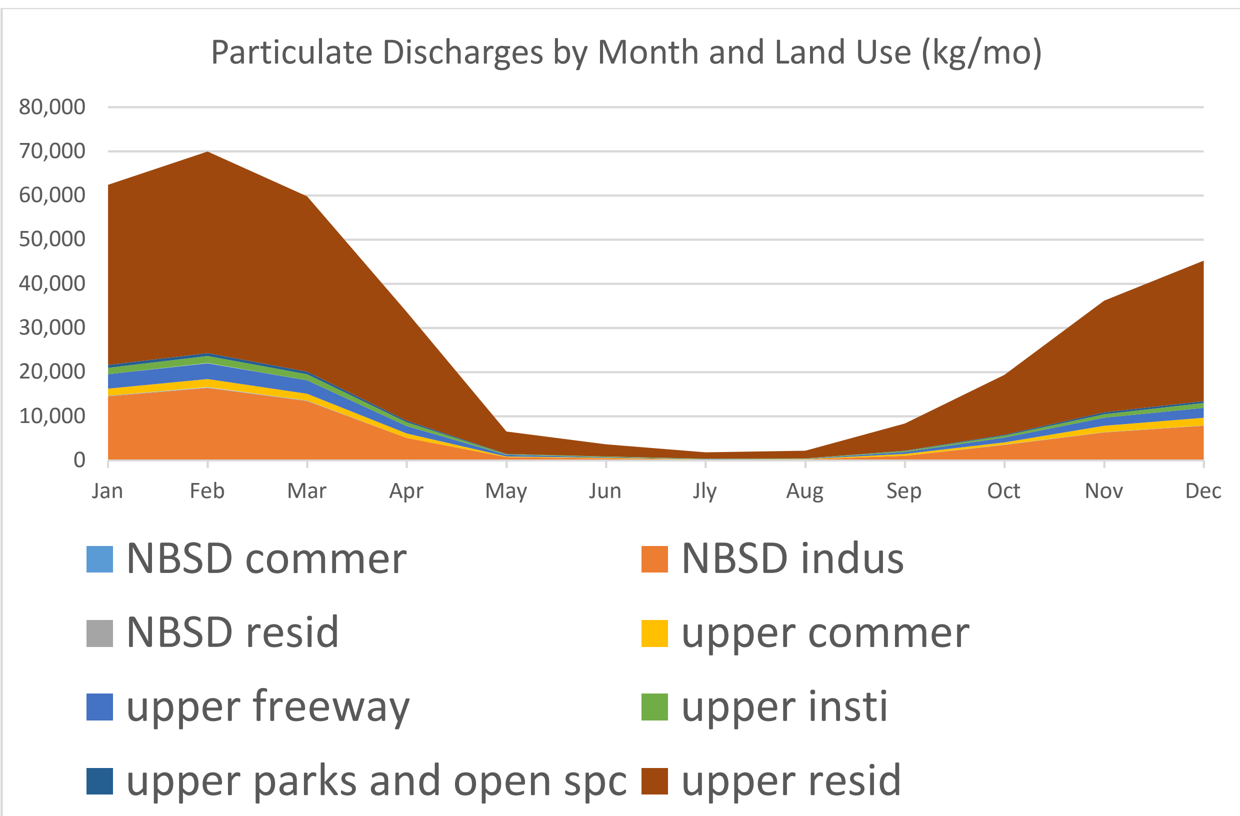

Runoff Volume Discharges by Month and Land Use (m3/month)
300,000
250,000
200,000
150,000
100,000
50,000
0
Jan (m3/mo)
Feb
Mar
Apr
May
Jun
Jly
Aug
Sep
Oct
Nov
Dec
NBSD commer
NBSD indus
NBSD resid
upper commer
upper freeway
upper insti
upper parks and open spc
upper resid

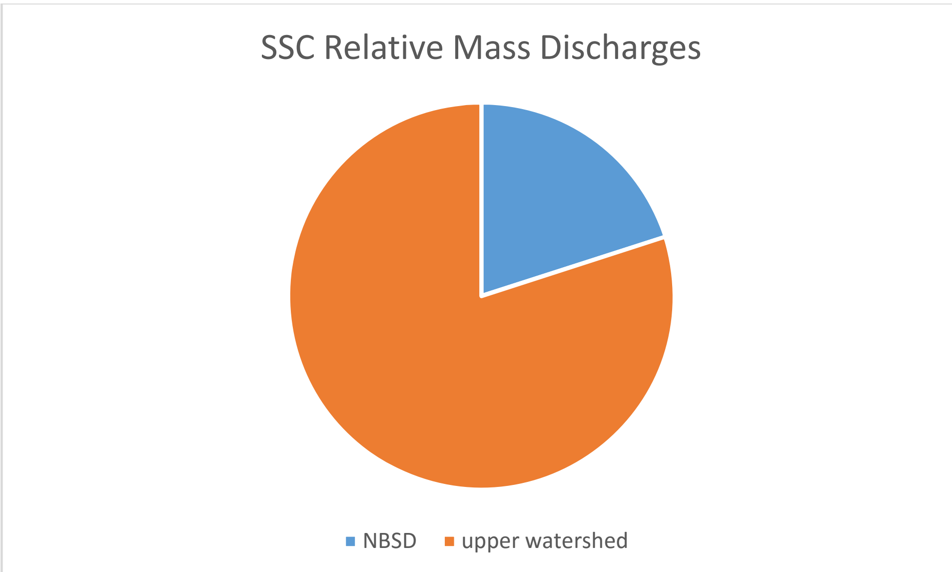

Relative Annual Flow Contributions
NBSD
upper watershed

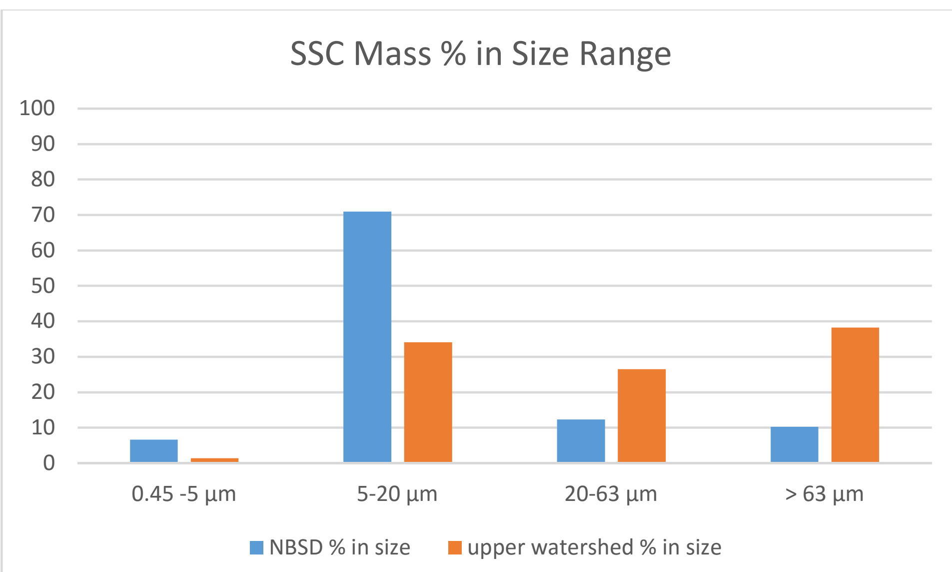
Annual Paleta Creek Stormwater SSC Mass Discharges



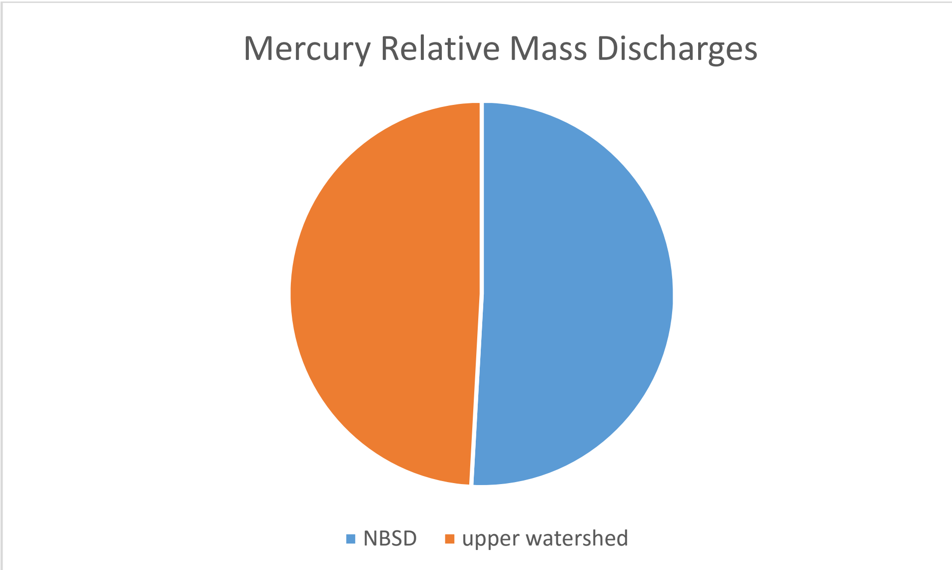

Relative Particulate Sources by Month and Land Use
100%
80%
60%
40%
20%
0%
Jan
Feb
Mar
Apr
May
Jun
Jly
Aug
Sep
Oct
Nov
Dec
NBSD commer
NBSD indus
NBSD resid
upper commer
upper freeway
upper insti
upper parks and open spc
upper resid

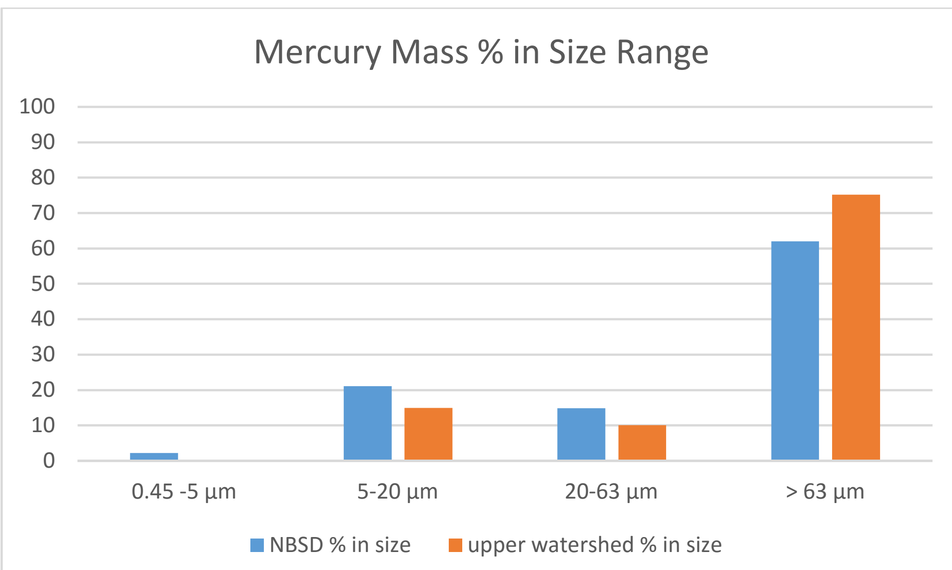

Particulate Discharges by Month and Land Use (kg/mo)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan
Feb
Mar
Apr
May
Jun
Jly
Aug
Sep
Oct
Nov
Dec
NBSD commer
NBSD indus
NBSD resid
upper commer
upper freeway
upper insti
upper parks and open spc
upper resid


SSC Relative Mass Discharges
NBSD
upper watershed

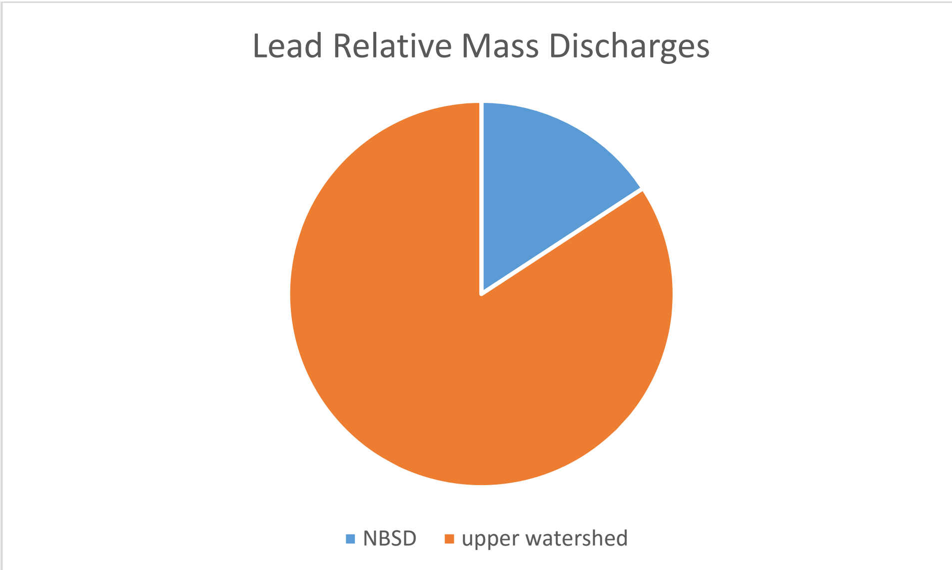

SSC Mass % in Size Range
100
90
80
70
60
50
40
30
20
10
0
0.45 -5 µm
5-20 µm
20-63 µm
> 63 µm
NBSD % in size
upper watershed % in size

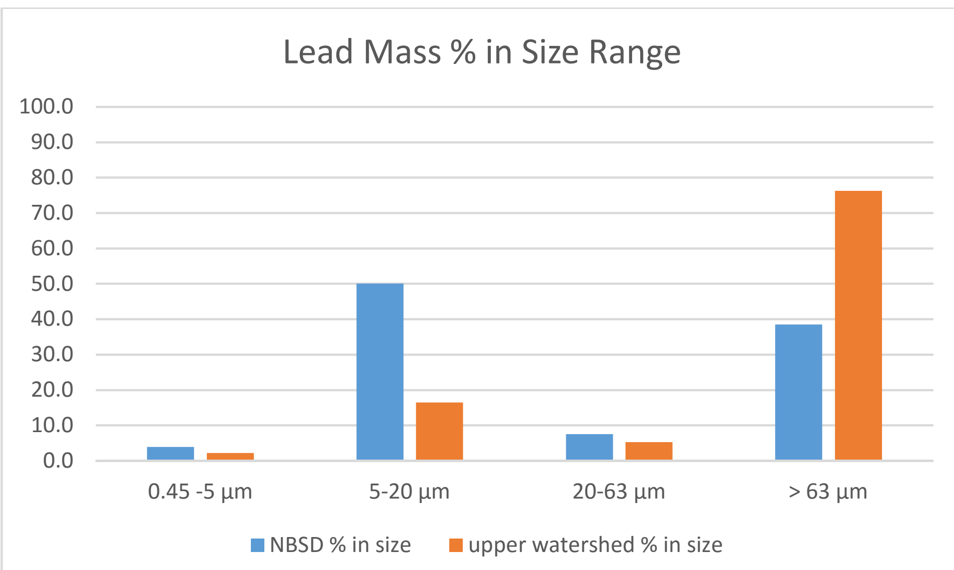
Annual Paleta Creek Stormwater Mercury Mass Discharges



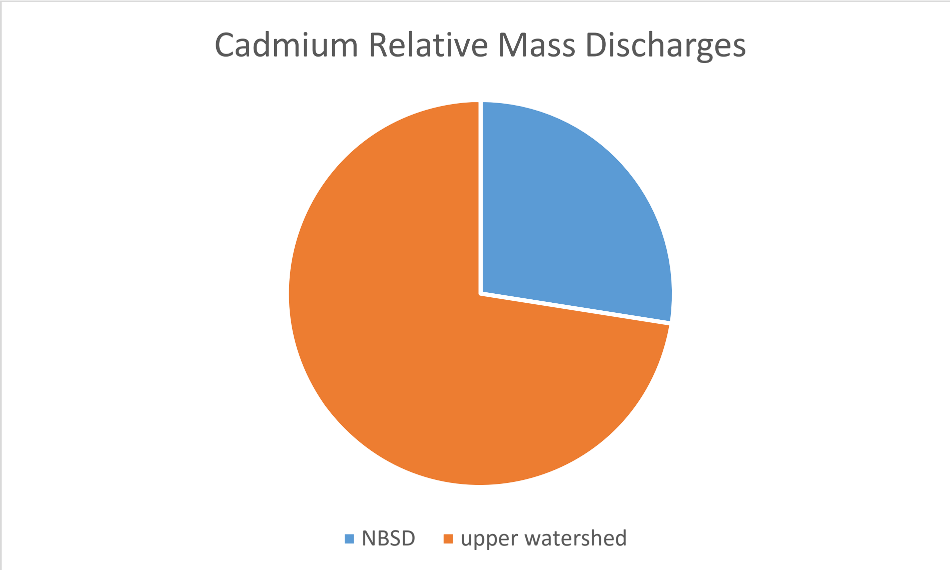


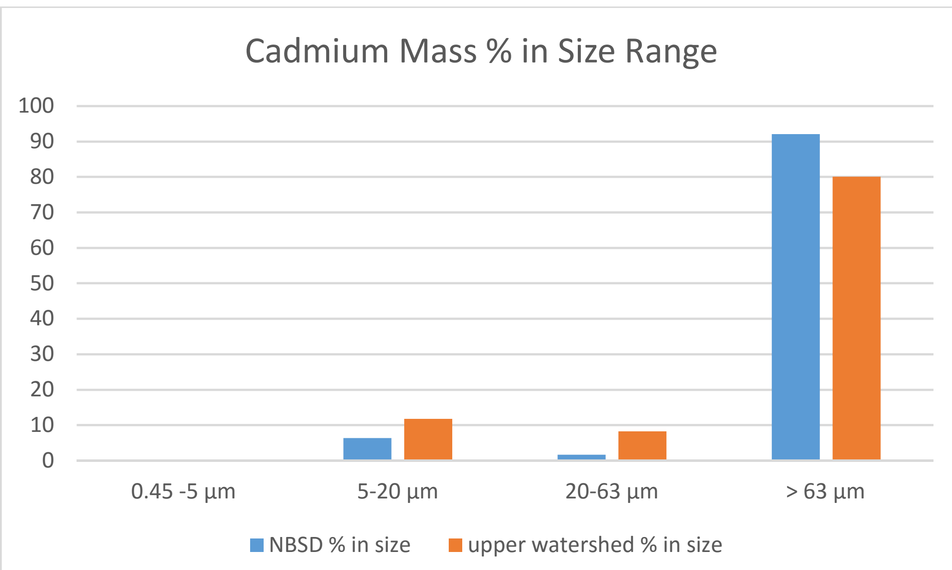
Annual Paleta Creek Stormwater Lead Mass Discharges



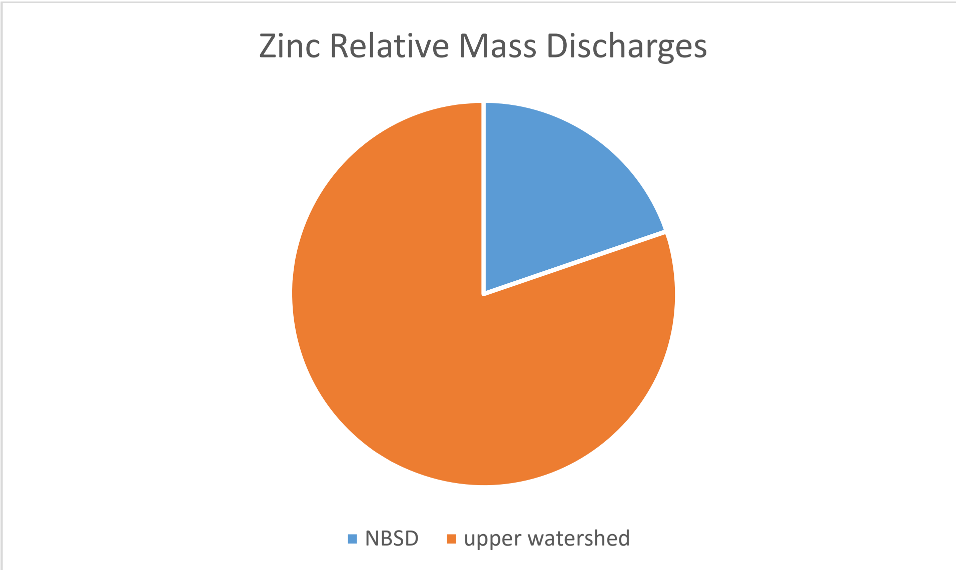


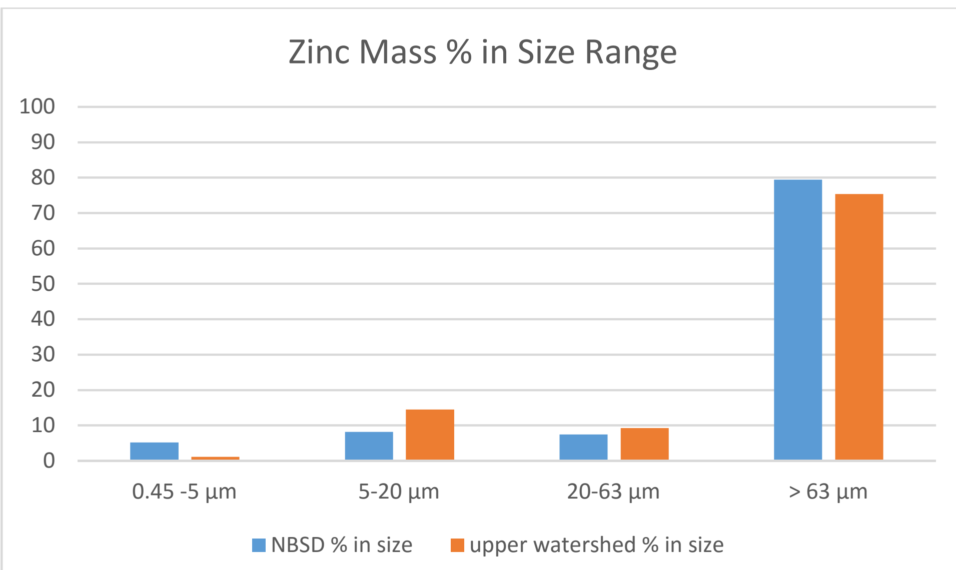
Annual Paleta Creek Stormwater Cadmium Mass Discharges



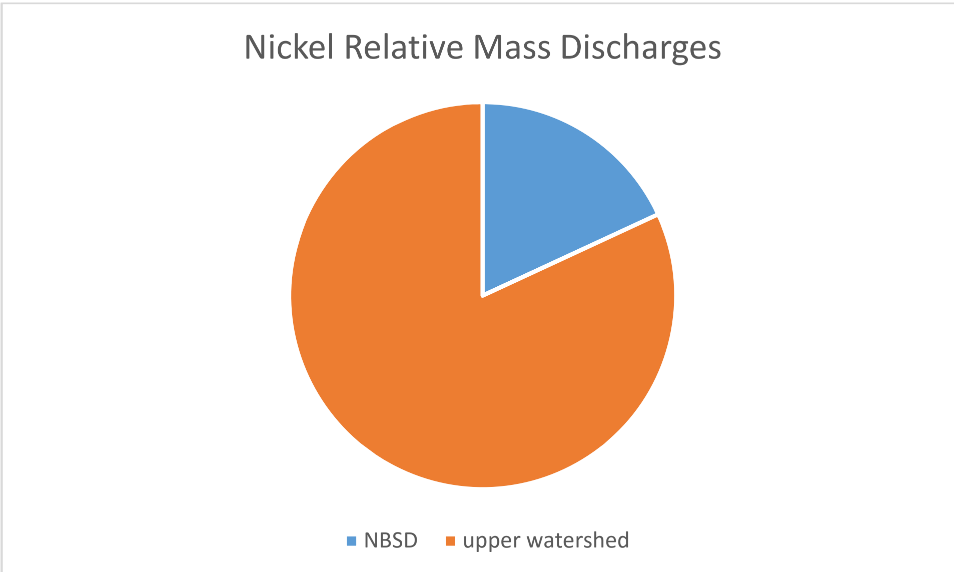


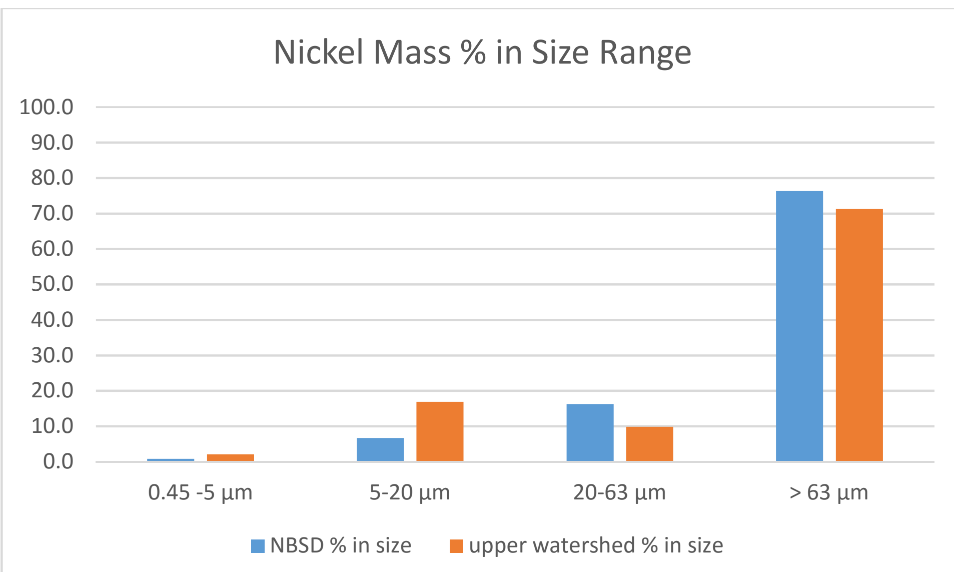
Annual Paleta Creek Stormwater Zinc Mass Discharges



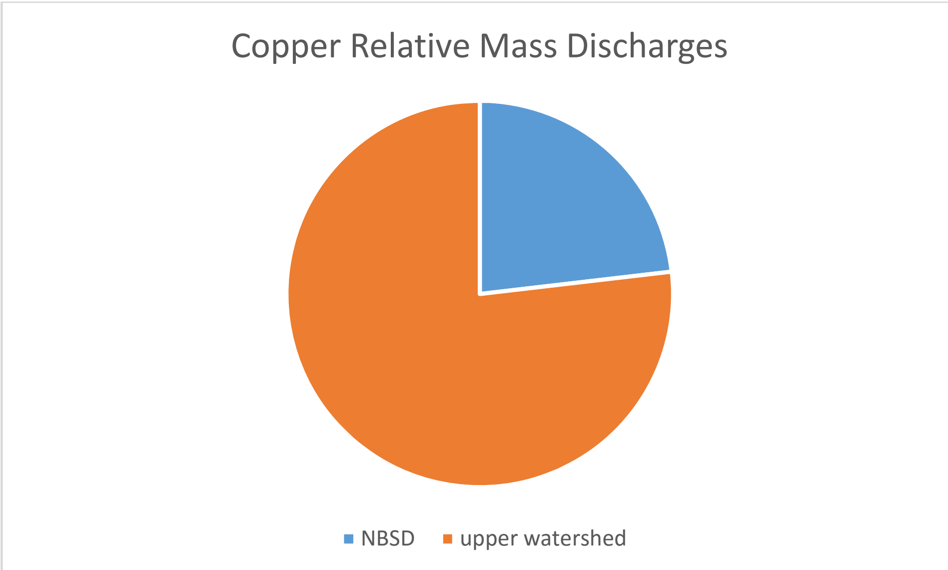


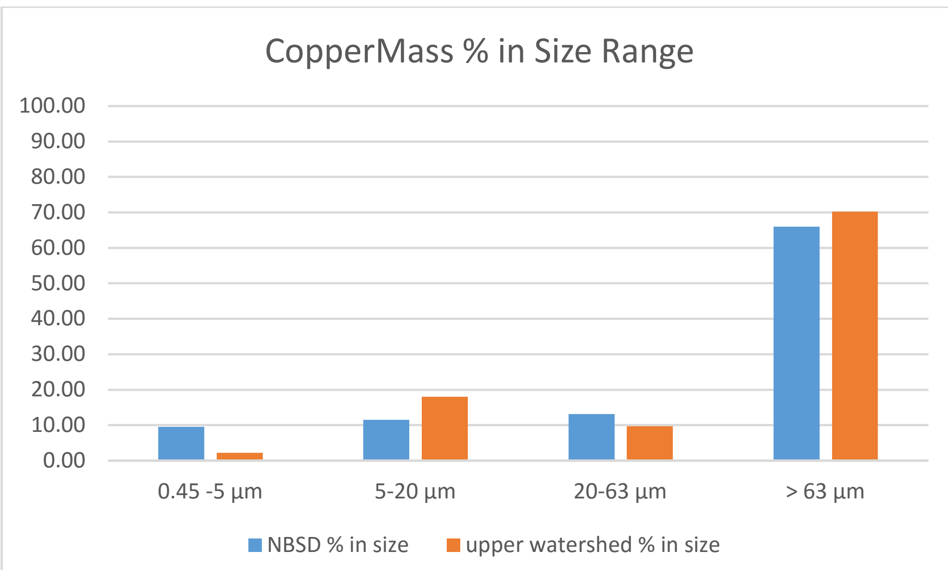
Annual Paleta Creek Stormwater Nickel Mass Discharges



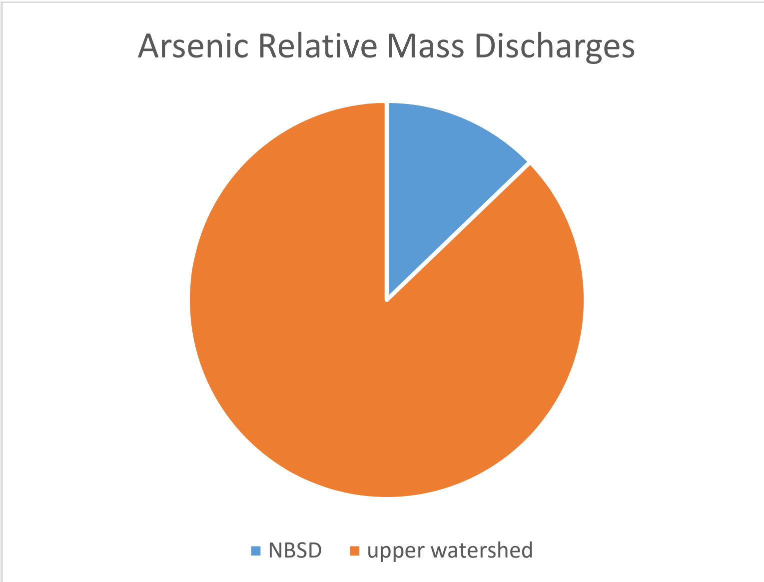


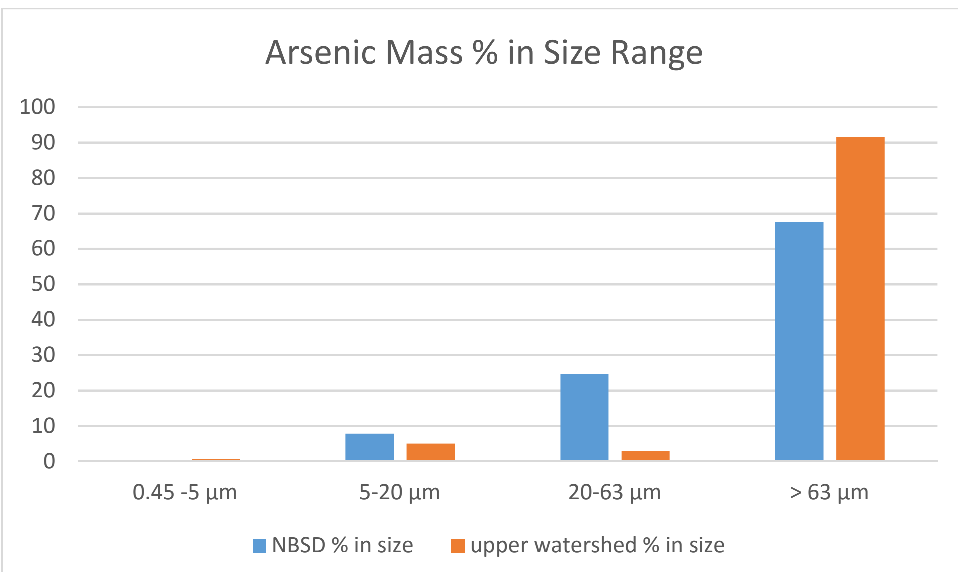
Annual Paleta Creek Stormwater Copper Mass Discharges



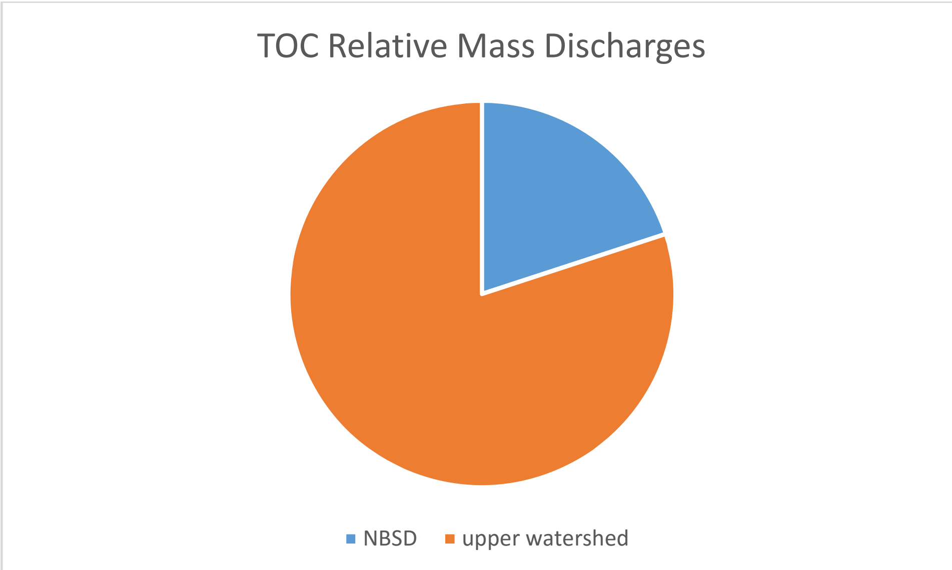


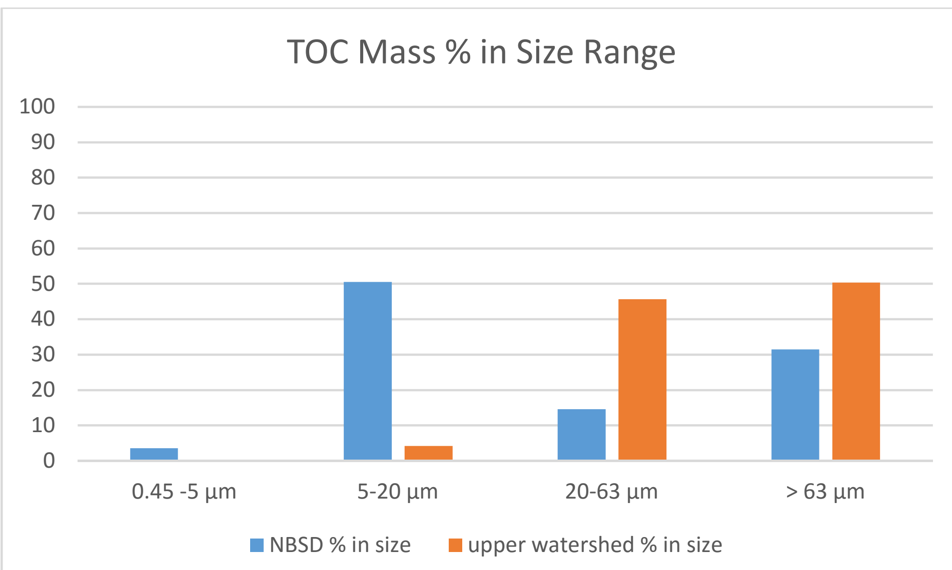
Annual Paleta Creek Stormwater Arsenic Mass Discharges



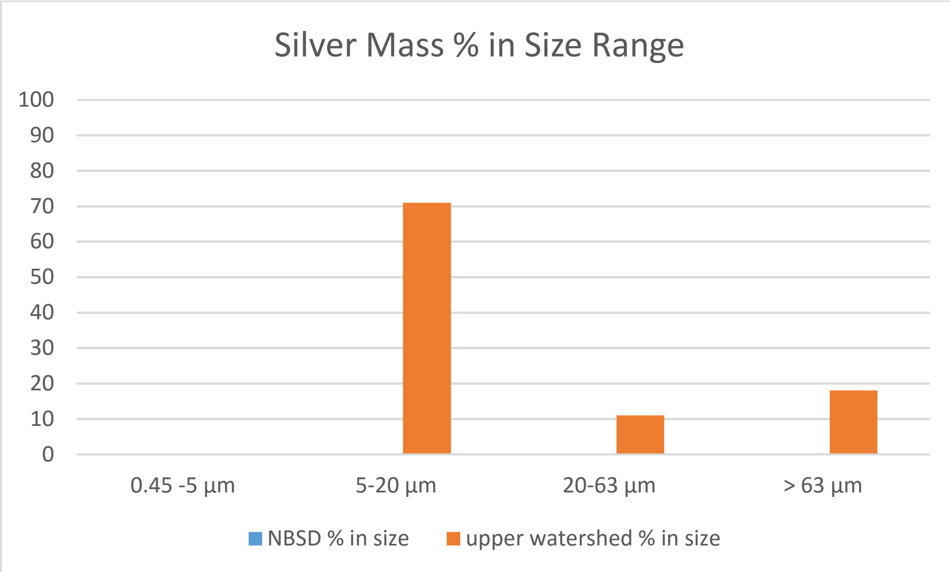


Annual Paleta Creek Stormwater TOC Mass Discharges

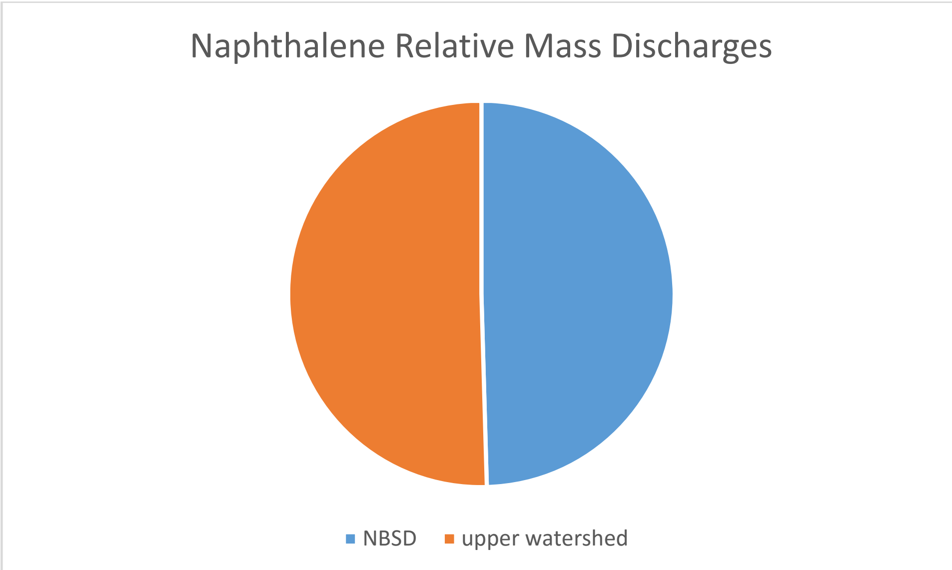


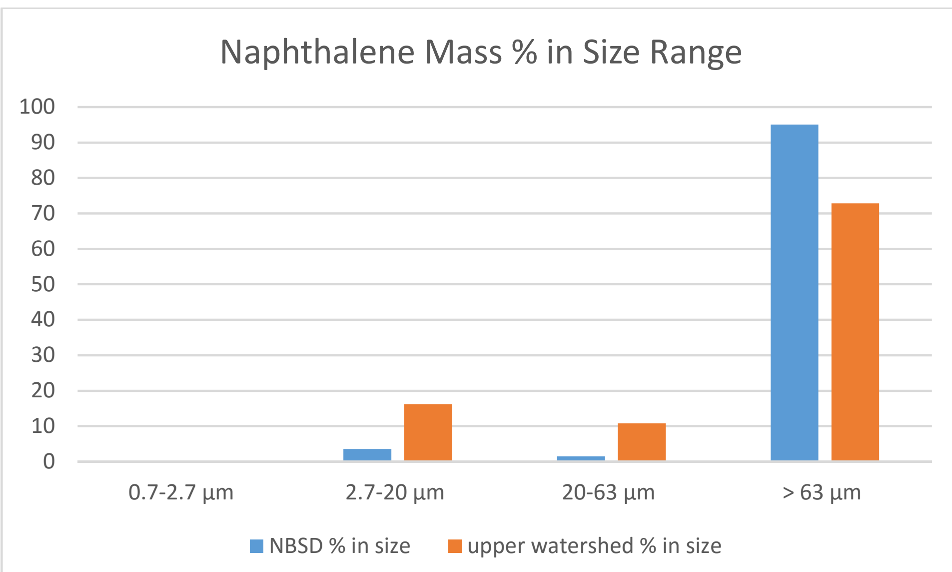


Annual Paleta Creek Stormwater Silver Mass Discharges

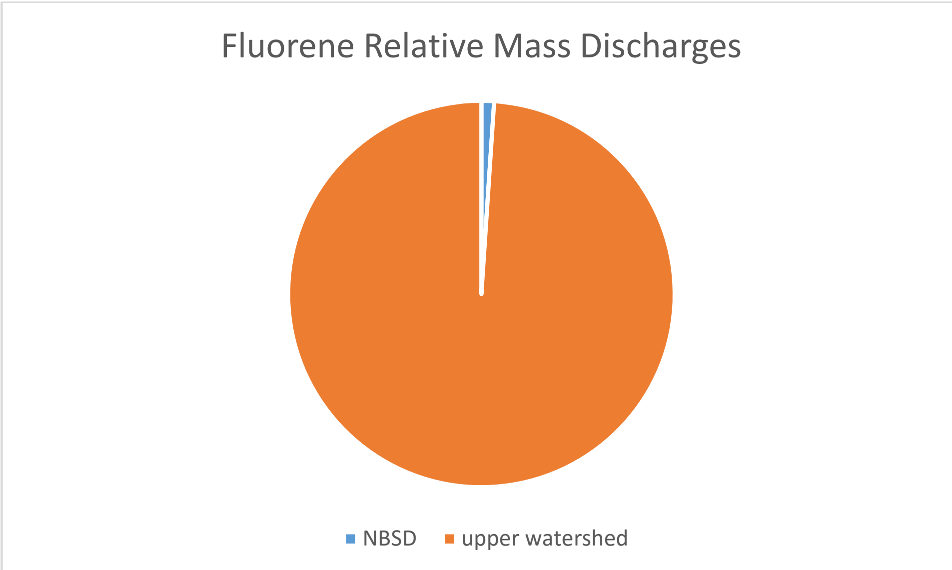


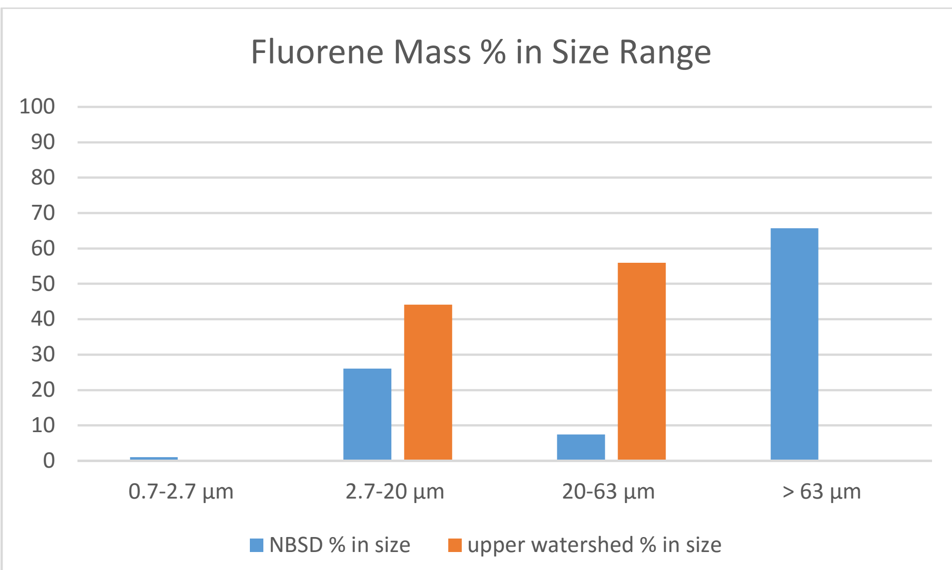
Annual Paleta Creek Stormwater Naphthalene Mass Discharges



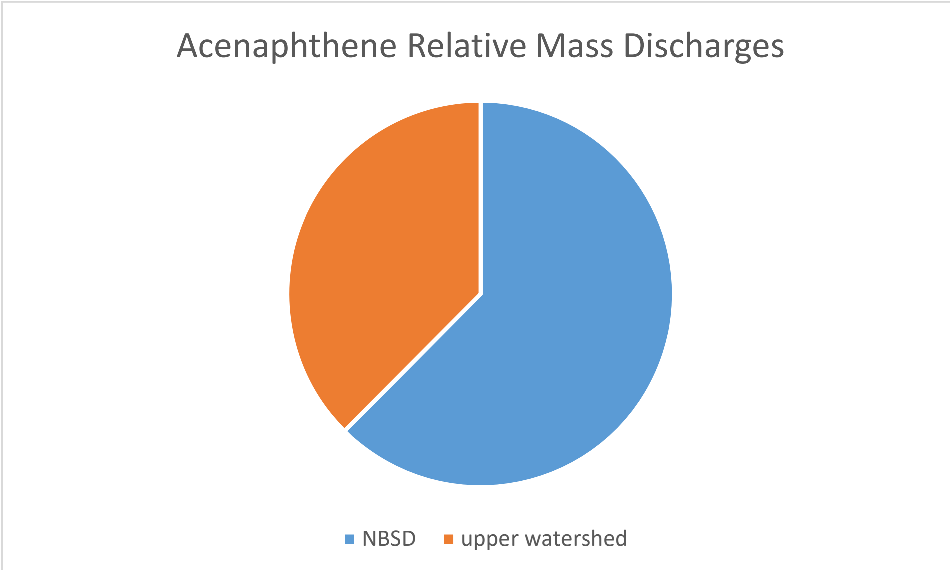


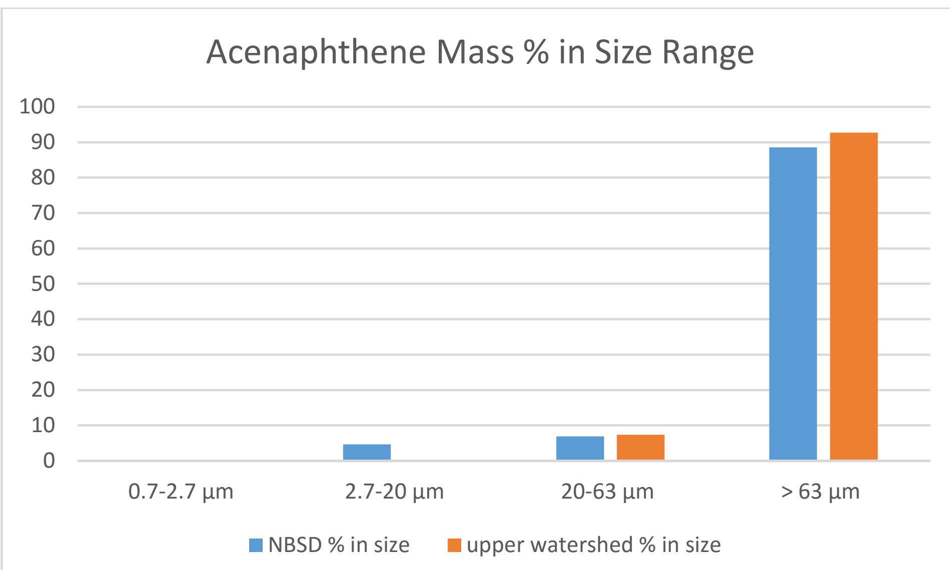
Annual Paleta Creek Stormwater Fluorene Mass Discharges



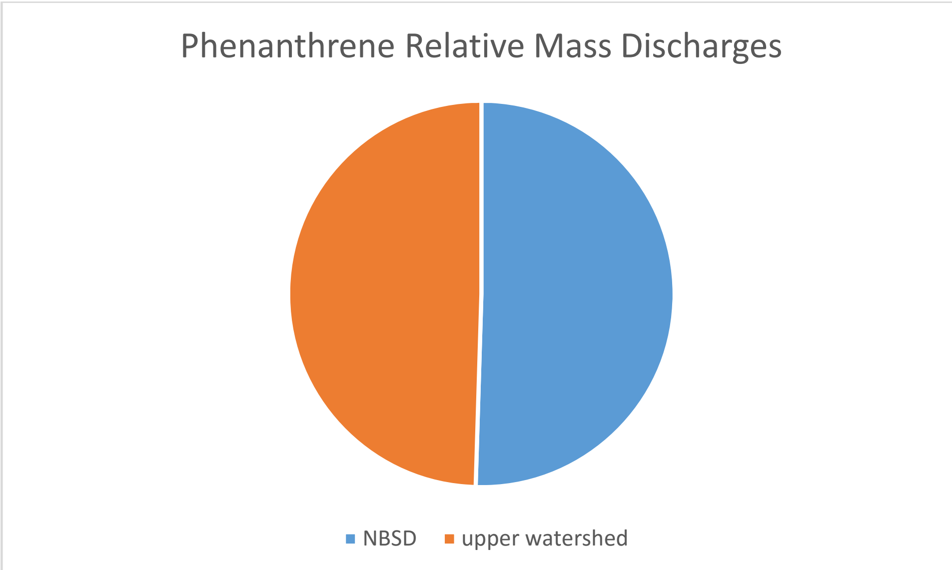


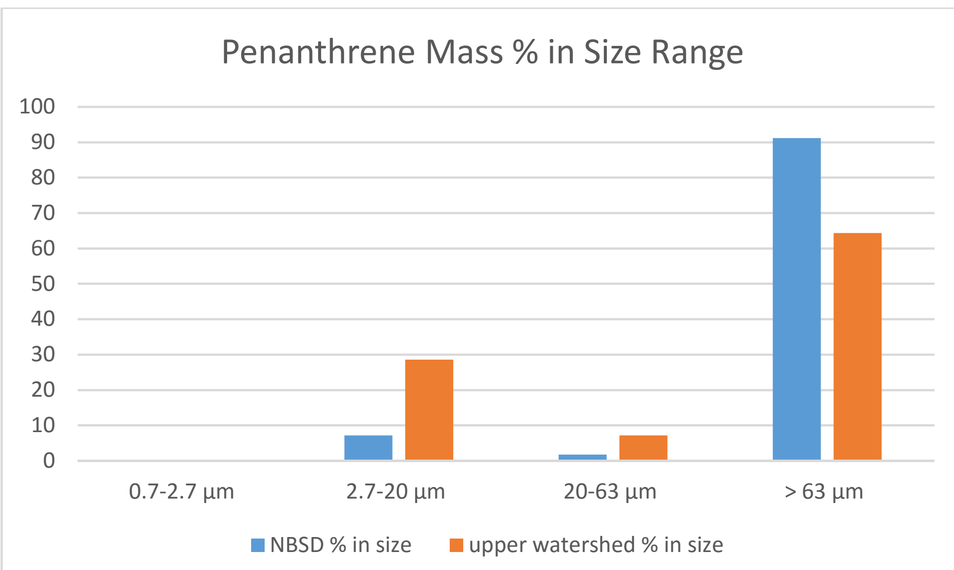
Annual Paleta Creek Stormwater Acenaphthene Mass Discharges





Annual Paleta Creek Stormwater Phenanthrene Mass Discharges





Appendix L: Regional NPDES Summary Report

Review of SCCWRP Report

This appendix analyzes the data provided in the following report:
Stein, E.D., L.L. Tiefenthaler, and K.C. Schiff. *Sources, Patterns and Mechanisms of Storm Water Pollutant Loading from Watersheds and Land Uses of the Greater Los Angeles Area, California, USA*. Southern California Coastal Water Resources Project. Costa Mesa, CA. Technical Report 510, March 2007.

The following is part of the summary provided in this report describing the sampling effort and specific goals of the project. "… the Southern California Coastal Water Research Project (SCCWRP) conducted a storm water sampling program over five seasons (2000-01 through 2004-2005). Constituent concentrations were measured over the entire storm duration from eight different land use types over 11 storm events in five watersheds in the greater Los Angeles, CA region (Figure ES-1). In addition, runoff samples were also collected from twelve mass emission sites (in-river) during 15 different storm events. A total of 71 site-events were sampled, comprised of 33 land use site-events and 38 mass-emission site events. These data were collected to better characterize contributions of specific land use types to loading of bacteria, trace metals, and organic compounds and to provide data for watershed model calibration. The specific goals of this study were (1) to examine constituent event mean concentrations (EMC), fluxes, and mass loadings associated with storm water runoff from representative land uses; (2) to investigate within storm and within season factors that affect constituent concentrations and fluxes; (3) to evaluate how constituent loadings compare to loadings from point sources, and (4) to assess how the concentrations of constituents in runoff compare to published data and water quality criteria.

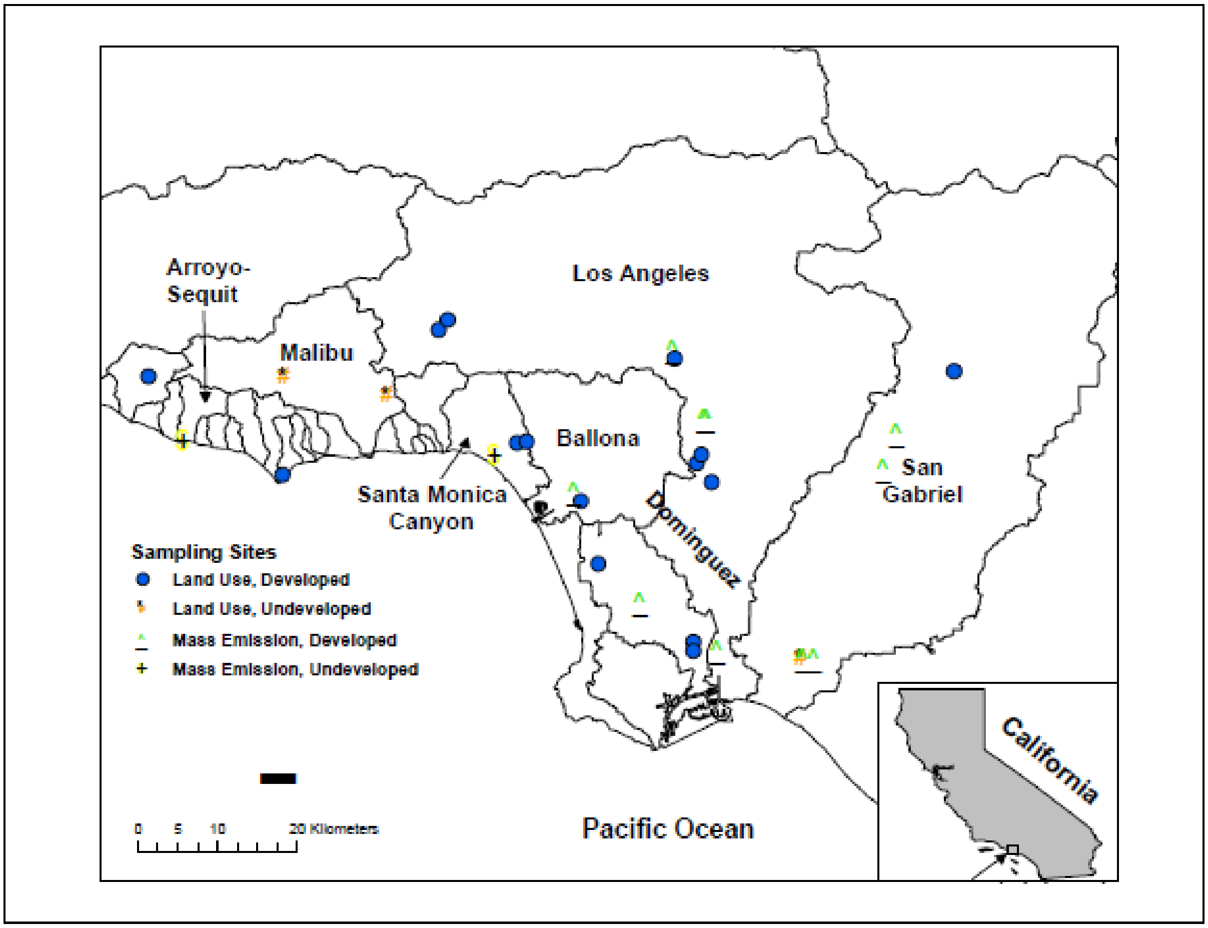


Figure ES-1. Map of in-river mass emission and land use sampling sites and watersheds within the greater Los Angeles region, California, USA."

The following are the general conclusions provided in this mass emission report:

"1. Storm water runoff from watershed and land use based sources is a significant contributor of pollutant loading and often exceeds water quality standards. Results of this study indicate that urban storm water is a substantial source of a variety of constituents to downstream receiving waters. Substantially high constituent concentrations were observed throughout the study at both mass emission (ME) and land use (LU) sites. Constituent concentrations frequently exceeded water quality criteria. Storm water concentrations of trace metals exceeded California Toxic Rule (USEPA 2000) water quality criteria in more than 80% of the wet weather samples collected at ME sites. This was partly due to industrial land use sites where 100% and 87% of runoff samples exceeded water quality criteria for zinc and copper, respectively. Furthermore, fecal indicator bacteria (FIB) at both ME and LU sites consistently exceeded California single-sample water quality standards. In fact levels of FIB at the recreational (horse) and agricultural LU sites were as high as those found in primary wastewater effluent in the U.S., with densities of 10^6 - 10^7 MPN/100mL.

2. All constituents were strongly correlated with total suspended solids. Land use had a strong influence on constituent concentrations. Total suspended solids (TSS) was strongly correlated with constituent EMCs at most land use sites, although not all correlations were statistically significant. This correlation was primarily influenced by highly urbanized land uses and a single undeveloped open space land use. High TSS loads in rivers contribute to water quality impairments, habitat loss and to excessive turbidity resulting in impairments in recreational, fish/wildlife, and water supply designated uses of the rivers. These results suggest that controlling TSS at specific land uses may result in reducing other particle-bound constituents.

3. Storm water EMCs, fluxes and loads were substantially lower from undeveloped open space areas when compared to developed urbanized watersheds. Storms sampled from less developed watersheds (i.e., Santa Monica Canyon and Arroyo Sequit) produced constituent EMCs and fluxes that were one to two orders of magnitude lower than comparably sized storms in urbanized watersheds (i.e., Los Angeles River and Ballona Creek) (Figure ES-2). Furthermore, the higher fluxes from developed watersheds were generated by substantially less rainfall than the lower fluxes from the undeveloped watersheds, presumably due to increased impervious surface area in developed watersheds. Stein and Yoon (2007) reported similar wet weather runoff results from undeveloped land uses while investigating pollutant contributions from natural sources. The contrasts between the different watershed scale mass-emission sites were also apparent at the small, homogeneous land use sites.

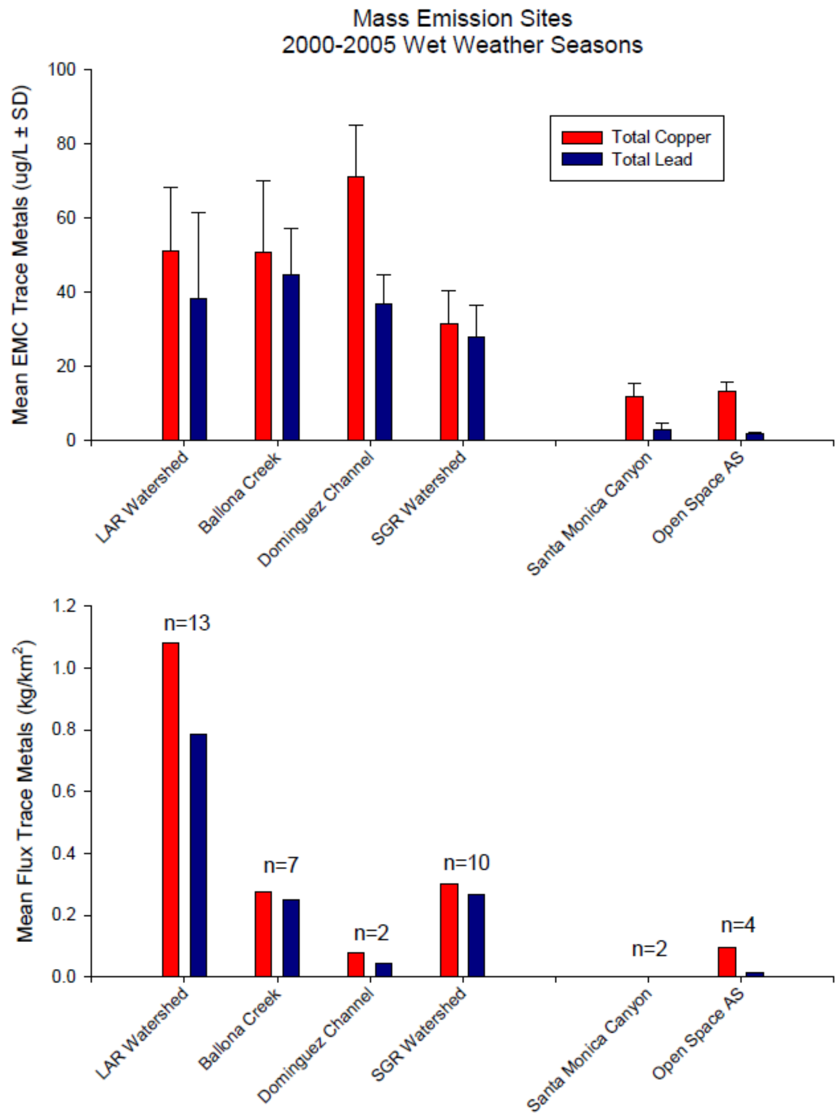


Figure ES-2. Average event mean concentrations (EMCs; a) and fluxes b) of total copper and lead loading from southern California watersheds during the 2000-2001 to –2004-2005 storm seasons. A similar pattern of higher loadings for the mass emission sites was observed for all other constituents measured in the study as well. Los Angeles River (LAR), San Gabriel River (SGR), and Arroyo Sequit (AS), number of storm events (n), and standard deviation (SD).

4. Land use based sources of pollutant concentrations and fluxes varied by constituent. No single land use type was responsible for contributing the highest loading for all constituents measured. For example industrial land use sites, contributed higher storm EMCs and fluxes of all trace metals than other land use types (Figure ES-3). Recreational (horse) land use sites contributed significantly higher storm fluxes for *E. coli* while agricultural land use sites contributed the highest TSS fluxes. Substantially higher TSS fluxes were also observed at the industrial sites. PAHs were not preferentially generated by any one land use type, rather analyses of individual PAHs demonstrated a consistent predominance of high molecular

weight (HMW) PAH compounds indicative of regional pyrogenic PAHs (i.e., atmospheric deposition) as a major source material of the PAHs found in urban storm water.

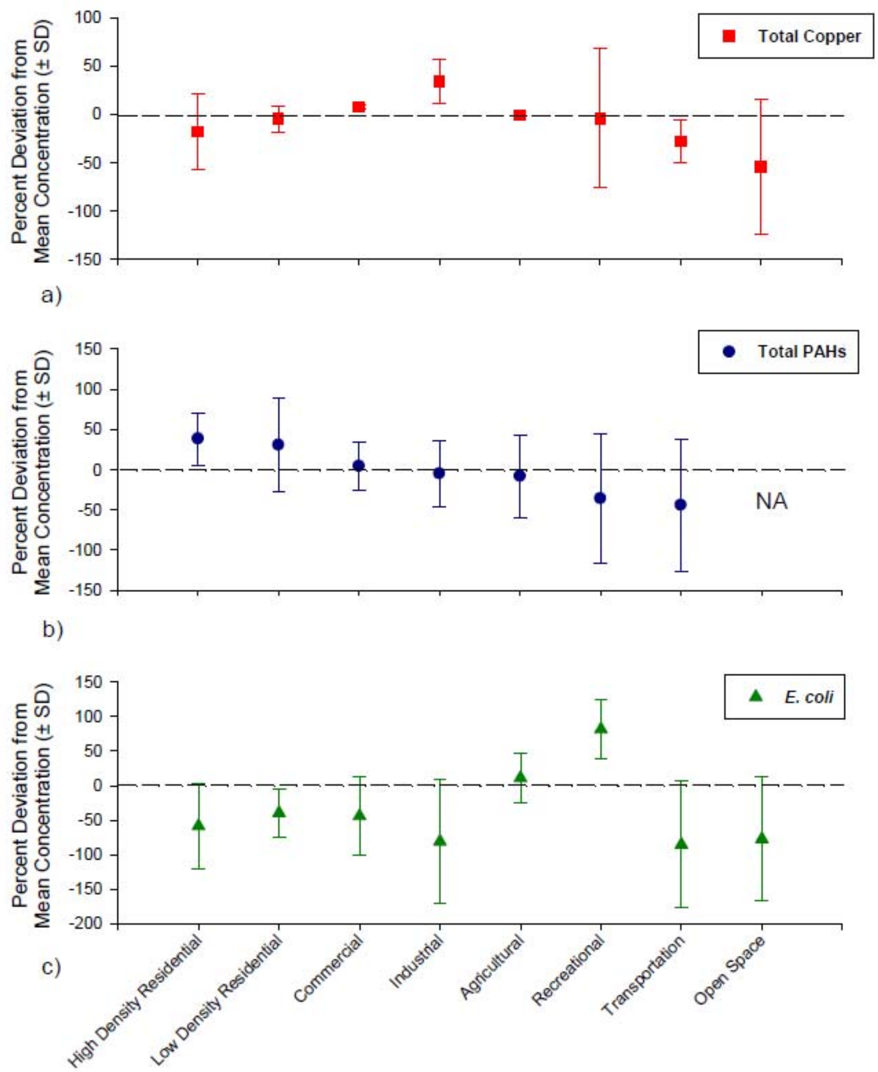


Figure ES-3. Percent deviation from mean concentration of total PAHs a), total copper b) and *E. coli* c) in storm water runoff from land use sites during the 2001-2005 storm seasons. The dashed line represents the overall mean concentration for each constituent. Standard deviation (SD). Not analyzed (NA).

5. Storm water runoff contributed a similar range of constituent loading to regional point sources. Storm water runoff of trace metals from the urban watersheds in this study produced a similar range of annual loads as those from point sources; such as large publicly owned treatment plants (Table ES-1). Nevertheless, when combined with dry estimates of pollutant loading from Stein and Tiefenthaler

(2005), the total non-point source contribution from all watersheds in the greater Los Angeles area far exceeds that of the point sources (Table ES-1).

Table ES-1. Mean annual (± 95% confidence intervals) trace metal loading in the Los Angeles coastal region from different sources (mt = metric tons)

Source	Mean Annual Load / Year (mt ± 95% CI)		
	Total Copper	Total Lead	Total Zinc
Point Source Data[1,2] (2000-05)			
Large Publicly Owned Treatment Plants (POTWs)	10.9 ± 6.8	0.8 ± 0.8	13.9 ± 7.6
Low Volume Waste Power Generating Stations (PGS)	0.01	0.00	0.09
Wet Weather Runoff (2000-05)			
Los Angeles River	1.6 ± 1.2	1.4 ± 1.5	9.8 ± 9.4
Ballona Creek	0.7 ± 0.4	0.6 ± 0.3	4.3 ± 2.5
Dominguez Channel	0.4 ± 2.4	0.2 ± 1.1	2.1 ± 11.0
Total Annual Wet Weather Runoff	**2.7 ± 4.0**	**2.2 ± 2.9**	**16.2 ± 22.9**
2000-02 Dry Weather Urban Runoff [3,4]			
Los Angeles River	2.9 ± 19.9	0.1 ± 1.2	10.4 ± 80.6
Ballona Creek	0.2 ± 0.3	0.1 ± 0.4	0.7 ± 0.6
Total Annual Dry Weather Runoff	**3.1 ± 20.2**	**0.2 ± 1.6**	**11.1 ± 81.2**

[1]SCCWRP Biennial Report 2004-06 (Lyons G, Stein E).
[2]SCCWRP Biennial Report 2003-04 (Steinberger A, Stein E); PGS data represents year 2000 only.
[3]American Water Resources Association in Press (Stein E, Ackerman D).
[4]Water, Air and Soil Pollution, 2005. Vol. 164 (Stein E, Tiefenthaler L).

6. The Los Angeles region contributed a similar range of storm water runoff pollutant loads as that of other regions of the United States. Comparison of constituent concentrations in storm water runoff from land use sites from this study reveal median EMCs that are comparable to current U.S. averages reported in the National Storm water Quality Database (NSQD; Pitt, *et. al*, 2003) (Figure ES-4). Comparison to the NSQD data set provides insight to spatial and temporal patterns in constituent concentrations in urban systems. Similarities between levels reported in the NSQD and this study suggest that land-based concentrations in southern California storm water are generally comparable to those in other parts of the country.

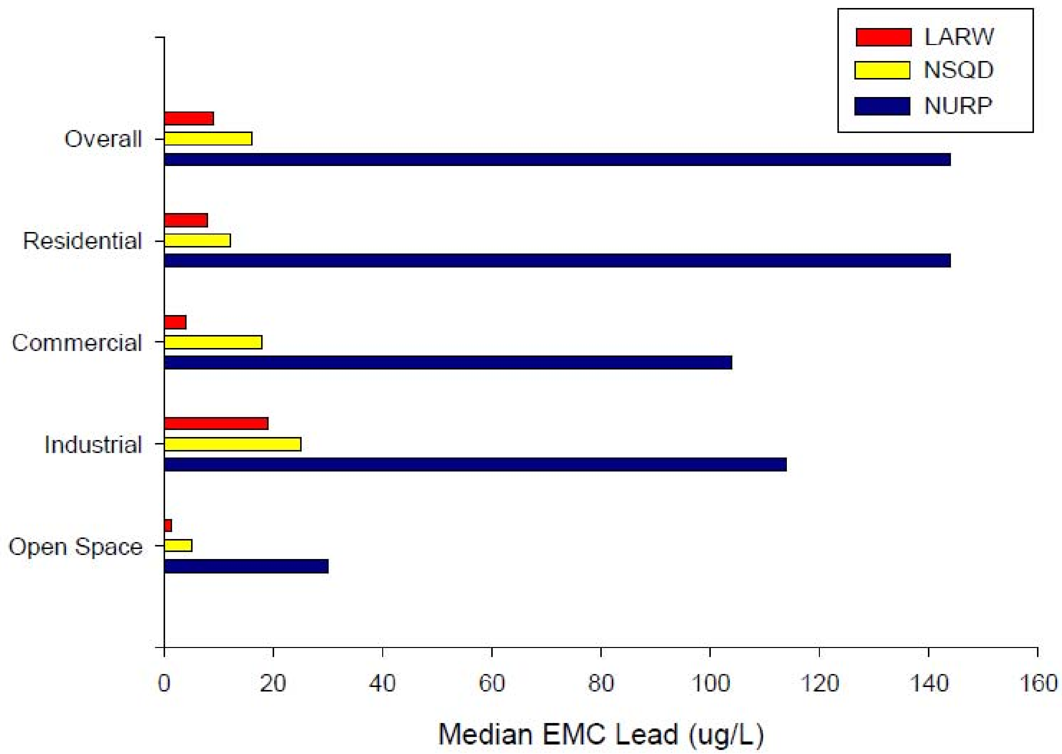


Figure ES-4. Comparison of median lead event mean concentration (EMCs) at specific land use sites during the 1983 Nationwide Urban Runoff Program (NURP, U.S. EPA 1983a), to the 1990 National Storm water Quality Database (NSDQ, Pitt et al. 2003) monitoring study and the 2001-2005 Los Angeles River Wet Weather (LARW) study. A similar pattern was observed for other constituents with the exception of zinc, which showed an increase in median EMCs over the course of the studies.

7. Storm water runoff concentrations improved over time when compared with the Nationwide Urban Runoff Program (NURP. Results showed an improvement in water quality between constituent concentrations reported by NURP in 1983 and those observed in this study (Los Angeles River Watershed (LARW). Long-term overall trends of decreasing median constituent EMCs were observed at all land uses with the exception of total zinc, which showed an increase in median EMCs over the course of the studies (Figure ES-4). For example, lead concentrations have exhibited a 10-fold reduction over the last 20 years. Relatively low lead concentrations may reflect fate and transport characteristics of the particular systems sampled. However, a more likely explanation is that low concentrations of lead observed in these studies can be attributed to regulations banning the use of leaded gasoline.

8. Peak concentrations for all constituents were observed during the early part of the storm. Constituent concentrations varied with time over the course of storm events. For all storms sampled, the highest constituent concentrations occurred during the early phases of storm water runoff with peak

concentrations usually preceding peak flow (Figure ES-5). In all cases, constituent concentrations increased rapidly, stayed high for relatively short periods and often decreased back to base levels within one to two hours. In contrast, the developed LU (recreational (horse) site; Figure ES 1-5c) had a peak concentration followed by intra-storm variable concentrations that mimicked flow. Although the pattern of an early peak in concentration was comparable in both large and small developed watersheds (Ballona Creek; Figure ES-5a, Los Angeles River Figure ES-5b), the peak concentration tended to occur later in the storm and persist for a longer duration in the smaller developed watersheds. Therefore monitoring programs must capture the early portion of storms and account for intra-storm variability in concentration in order to generate accurate estimates of EMC and contaminant loading. Programs that do not initiate sampling until a flow threshold has been surpassed may severely underestimate storm EMCs.

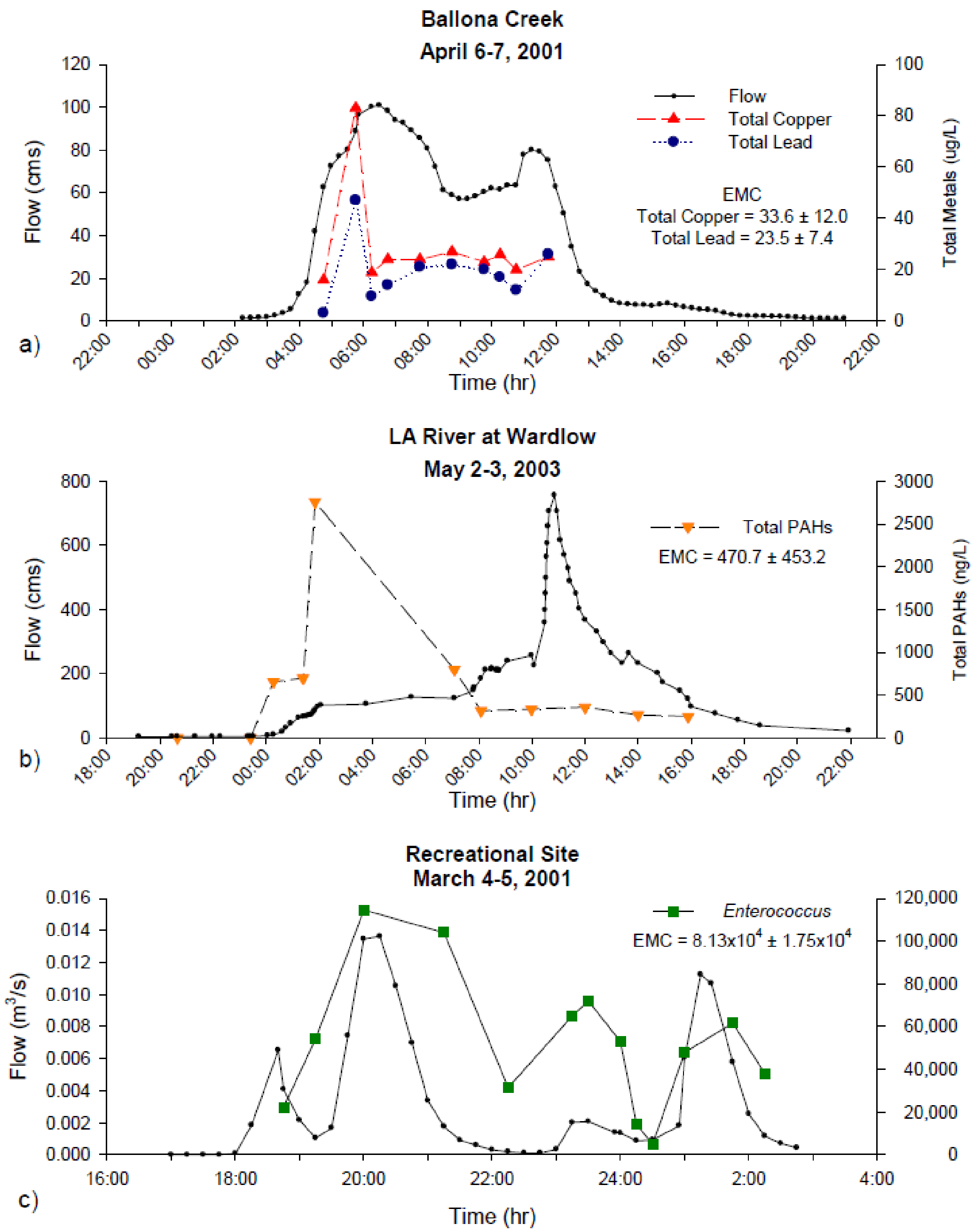


Figure ES-5. Variation in constituent concentrations with time for a storm event in the developed Ballona Creek a) and Los Angeles River watersheds b) and the developed recreational (horse) land use site c).

9. The magnitude of a mass first flush effect at land use sites was a function of watershed size. Storm mass loading is a function of both concentration and magnitude of flow at various points during a storm. Cumulative mass loading of constituents from ME sites generally exhibited a weak “first flush” for trace metals and bacteria. For PAHs, a moderate first flush was observed where between 40% and 60% of the

load was discharged during the first 25% of storm volume. In contrast to the ME sites, cumulative mass loading plots from small, homogenous land use sites exhibited moderate first flush for all constituents sampled. When all developed sites were analyzed together, the magnitude of the first flush effect decreased with increasing watershed size (Figure ES-6). The inverse relationship between first flush and catchment size has several potential mechanistic explanations including differences in relative pervious area, spatial and temporal patterns in rainfall, and pollutant transport through the catchment. Ultimately, the differences in first flush, whether due to imperviousness, travel time, or rainfall variability, suggest that management strategies aimed at capturing constituent loads should focus on more than just the initial portion of the storm at moderate to large catchments.

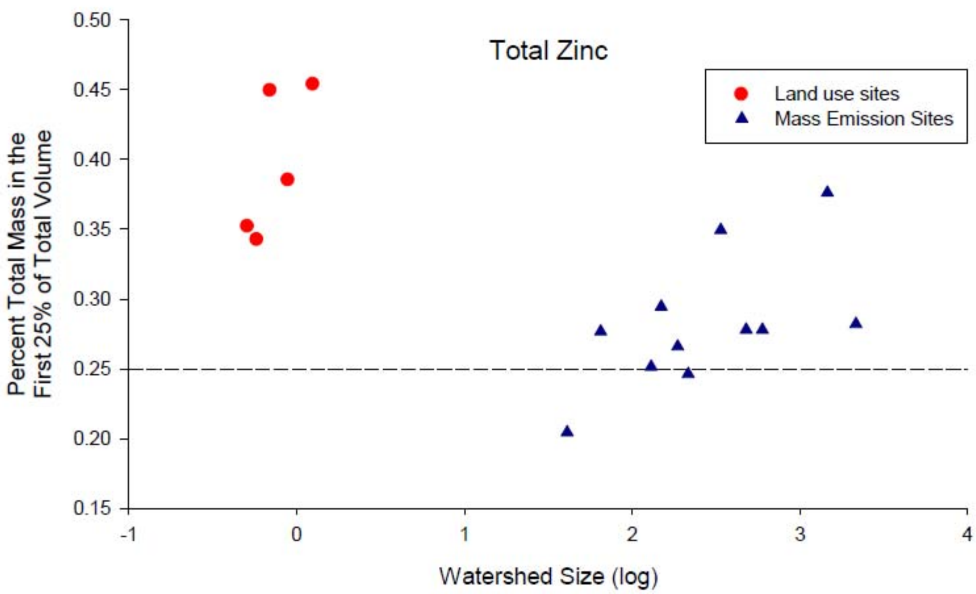


Figure ES-6. First flush patterns of total zinc (a) in relation to watershed size. Watershed size data is log transformed.

10. Highest constituent loading was observed early in the storm season with intra-annual variability driven more by antecedent dry period than amount of rainfall. Seasonal differences in constituent EMCs and loads were consistently observed at both ME and LU sites. In general, early season storms (October – December) produce significantly higher constituent EMCs and loads than late season storms (April-May), even when rainfall quantity was similar (Figure ES-7). This suggests that the magnitude of constituent load associated with storm water runoff depends, at least in part, on the amount of time available for pollutant build-up on land surfaces. The extended dry period that typically occurs in arid climates such as southern California maximizes the time for constituents to build-up on land surfaces, resulting in proportionally higher concentrations and loads during initial storms of the season. This seasonal pattern suggests that focusing management actions on early season storms may provide

relatively greater efficiency than distributing lower intensity management actions throughout the season."

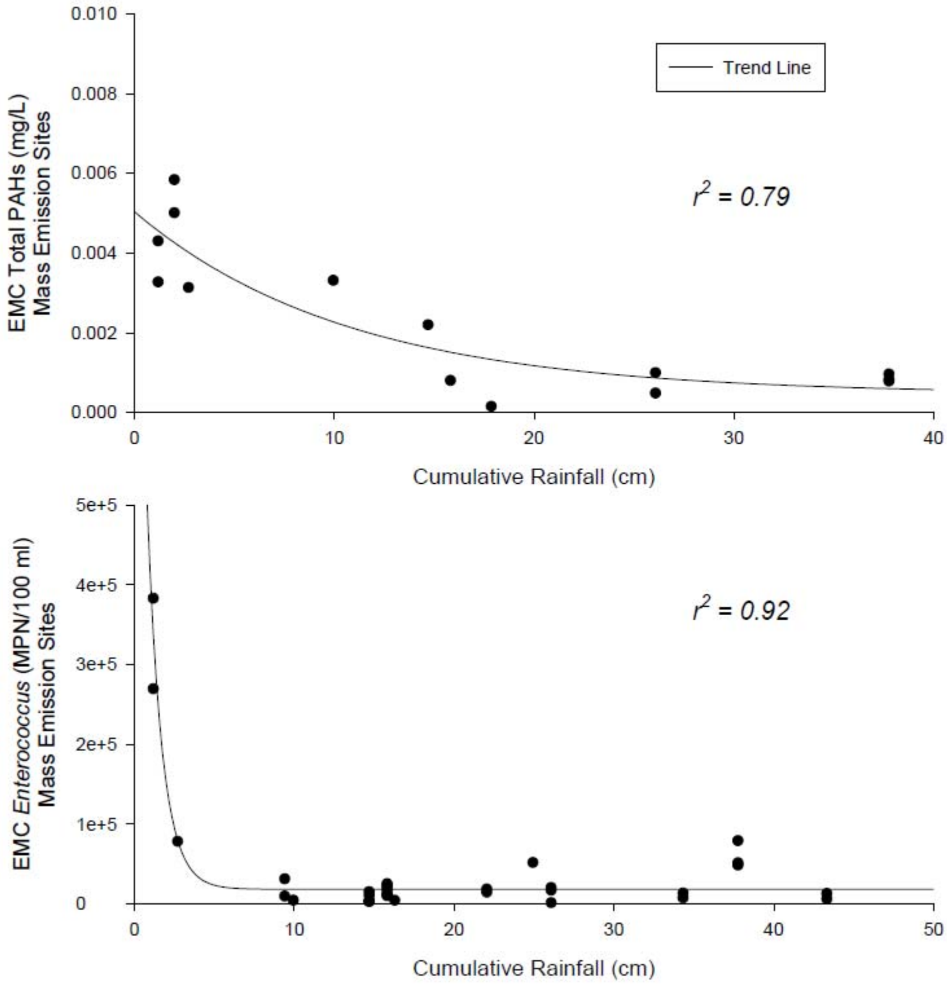


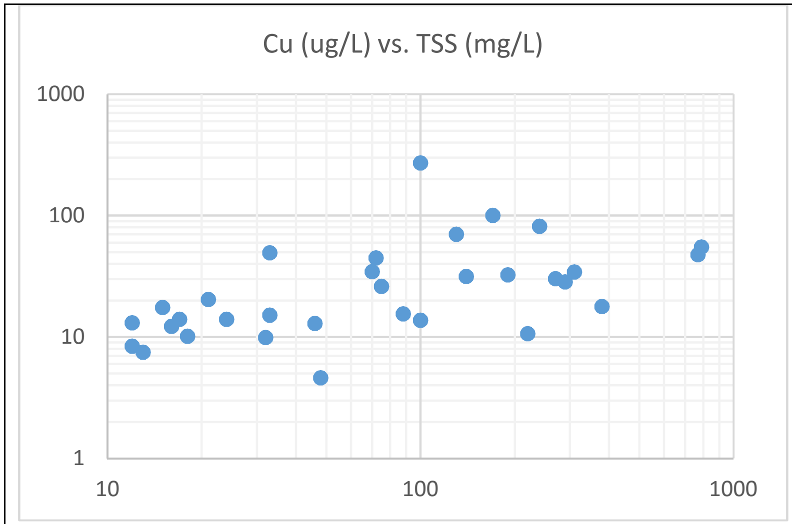
Figure ES-7. Cumulative annual rainfall versus event mean concentration (EMC) for a) polycyclic aromatic hydrocarbons and b) *E. coli*. Plots show data for mass emission sites only.

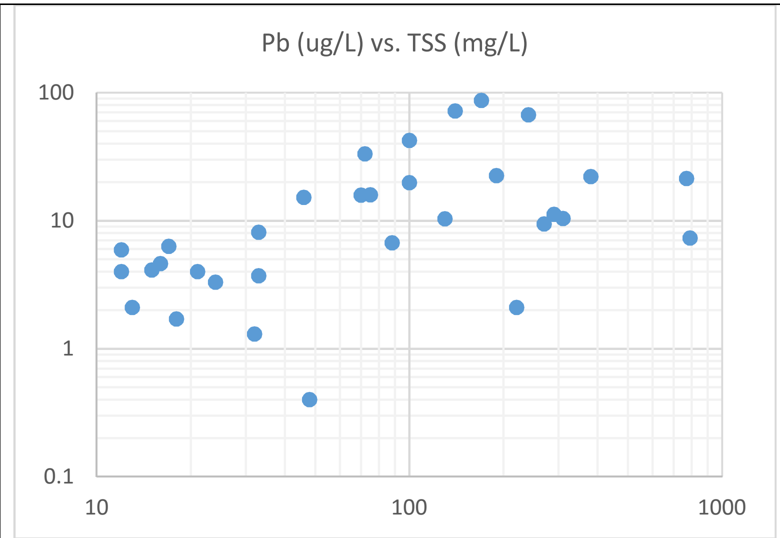
This report also included recommendations for further research, including: "Further research is needed to directly assess the relationship between constituent concentrations and particle-size distributions in storm water runoff from mass emission and land use sites to better understand the fate, transport and treatment of constituents in urban runoff. Storm water borne metals, PAHs and (to a lesser extent) bacteria are typically associated with particulates to varying degrees depending on the constituent and the size distribution of suspended solids in the storm water runoff. Furthermore, the particle size distribution, and constituent partitioning can change over the course of a storm event (Furumai, *et. al,* 2002, Stein and Yoon 2007). Understanding the dynamic partitioning of constituents to various size particles is important to being able to estimate temporal and spatial patterns of constituent deposition in estuaries and harbors, and should be an area of future investigation."

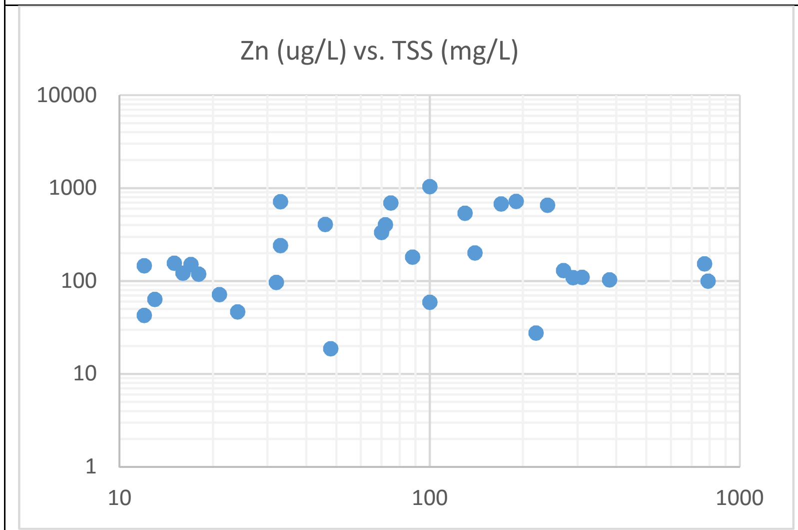
Analysis of SCCWRP Report Stormwater Data for Land Use Categories

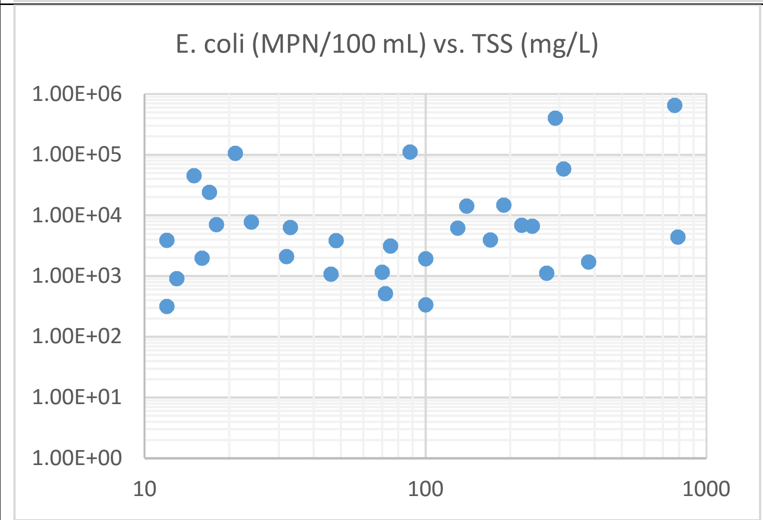
land use site	event date	watershed area (km2)	rain depth (cm)	antecedent dry days	mean flow (m3/s)	peak flow (m3/s)	peak/avg flow ratio	TSS (mg/L)	Cu (ug/L)	Pb (ug/L)	Zn (ug/L)	E. coli (MPN/100 mL)	Enterococci (MPN/100 mL)	Total coliforms (MPN/100 mL)	Total PAHs (ng/L)
High Density Residential #1	2/9-11/2001	0.52	1.93	2	0.082	0.563	6.87	33	15.1	8.1	240.5	6.33E+03	1.54E+04	1.07E+05	
High Density Residential #1	2/18-19/2001	0.52	0.61	4	0.06	0.233	3.88	17	14	6.3	151	2.40E+04	4.60E+03	7.50E+04	
High Density Residential #1	3/17-18/2002	0.52	0.2	10	0	0.003		240	81.5	66.9	656.3	6.69E+03	1.25E+04	8.19E+02	7,840
High Density Residential #2	2/17/2002	0.02	0.89	19	0.001	0.006	6.00	100	13.7	19.8	59.3	3.37E+02	3.27E+04	4.40E+04	1,920
High Density Residential #2	2/2-3/2004	0.02	1.19	29	0.004	0.025	6.25	380	17.8	22.1	103.2	1.71E+03	9.13E+04	1.16E+04	3,310
High Density Residential #3	12/28/2004	1	3.25	0	0.009	0.08	8.89	140	31.5	71.9	201	1.43E+04	2.30E+04	9.07E+05	7
High Density Residential #3	2/11/2005	1	1.35	13	0.004	0.016	4.00	12	8.4	4	42.7	3.91E+03	8.02E+03	5.24E+05	51
Low Density Residential #1	2/18-19/2001	0.98	0.61	4	0.068	0.097	1.43	24	14	3.3	46.6	7.76E+03	7.25E+03	5.54E+04	
Low Density Residential #1	3/4-5/2001	0.98	1.42	6	0.017	0.071	4.18	21	20.3	4	71.6	1.06E+05	2.95E+04	2.70E+05	155
Low Density Residential #1	2/2-3/2004	0.98	2.26	29	0.03	0.143	4.77	790	55.1	7.3	100.3	4.41E+03	1.78E+05	6.26E+03	3,300
Low Density Residential #2	3/17-18/2002	0.18	2.13	19	0.008	0.116	14.50	270	30.1	9.4	129.7	1.12E+03	4.77E+03	3.71E+04	886
Commercial #1	2/17/2002	2.45	0.74	19	0.337	1.34	3.98	170	100.4	86.8	674.5	3.94E+03	1.14E+04	1.99E+03	4,430
Commercial #2	2/17/2002		0.89	19	0.002	0.008	4.00	15	17.5	4.1	155.7	4.53E+04	3.25E+05	1.71E+06	227
Commercial #3	2/18-19/2001	0.06	0.81	4	0.003	0.008	2.67	12	13.1	5.9	146.6	3.17E+02	5.24E+02	2.23E+04	
Commercial #3	4/7/2001	0.06	2.03	31	0.008	0.018	2.25	18	10.1	1.7	118.7	7.06E+03	5.02E+04	5.79E+05	30
Commercial #3	3/17-18/2002	0.06	0.12	9	0	0.001		33	49.4	3.7	715.3		5.91E+01	4.98E+03	208
Industrial #1	2/9-11/2001	2.77	0.81	14	0.253	1.801	7.12	190	32.4	22.5	721.4	1.48E+04	8.46E+04	1.80E+05	
Industrial #1	2/18-19/2001	2.77	0.41	3	0.205	0.774	3.78	75	26	15.9	692.4	3.14E+03	1.15E+04	8.71E+05	
Industrial #1	3/17-18/2002	2.77	0.25	27	0	0.003		100	271.3	42.2	1035.4	1.93E+03	4.71E+03	5.62E+04	4,410
Industrial #2	2/17/2002	0.001	0.74	19	0	0.002		72	44.7	33.2	404	5.14E+02	1.03E+03	2.20E+04	631
Industrial #3	4/7/2001	0.004	2.06	25	0.008	0.017	2.13	70	34.5	15.8	334.3	1.16E+03	2.11E+04	5.43E+03	136
Industrial #4	3/15/2003	0.01	4.5	10	0.117	0.375	3.21	46	12.9	15.2	407	1.08E+03	2.30E+03	2.30E+04	889
Agricultural #1	2/18-19/2001	0.98	0.81	5	0.014	0.042	3.00	32	9.9	1.3	96.9	2.11E+03	1.92E+04	1.92E+05	

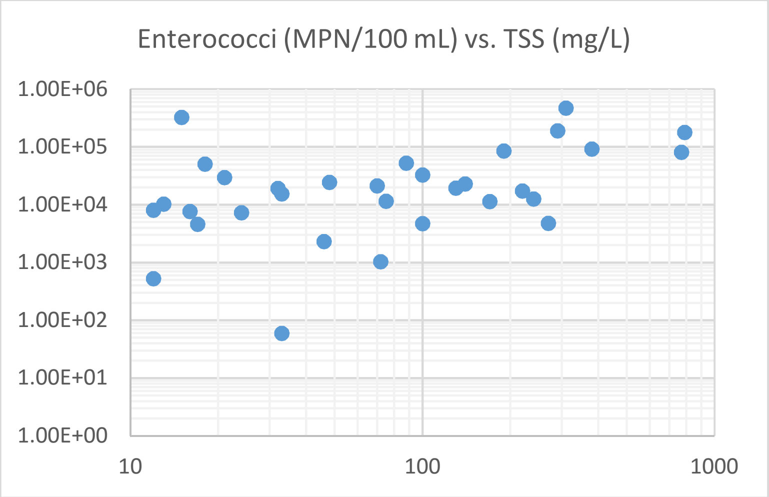
Agricultural #1	3/4-5/2001	0.98	8.13	3	0.021	0.053	2.52	88	15.5	6.7	181.8	1.11E+05	5.21E+04	3.52E+05	683
Agricultural #1	3/17-18/2002	0.98	0.23	9	0.012	0.031	2.58	130	70.2	10.3	537.8	6.16E+03	1.95E+04	4.56E+04	455
Agricultural #1	2/2-3/2004	0.98	1.17	29	0.023	0.128	5.57		32.9	10.5	287.3	2.51E+04	6.02E+04	2.24E+05	1,430
Agricultural #2	4/7/2001	0.8	2.06	25	1.723	3.801	2.21	310	34.3	10.4	110.1	5.83E+04	4.69E+05	2.36E+06	
Recreational (horse)	2/18-19/2001	0.03	0.61	4	0.015	0.044	2.93	290	28.4	11.2	109.4	4.03E+05	1.89E+05	7.38E+05	
Recreational (horse)	3/4-5/2001	0.03	1.42	6	0.003	0.014	4.67	770	47.5	21.3	153.7	6.50E+05	8.13E+04	5.27E+06	458
Transportation #1	4/7/2001	0.01	3.05	25	0.022	0.057	2.59	13	7.5	2.1	63.6	9.15E+02	1.02E+04	1.69E+04	363
Transportation #2	2/17/2002	0.002	0.74	19	0.001	0.006	6.00	16	12.2	4.6	121.5	1.98E+03	7.68E+03	2.56E+05	595
Open Space #1	2/24-25/2003	9.49	3	11	0.16	0.36	2.25	48	4.6	0.4	18.7	3.87E+03	2.45E+04	2.96E+04	
Open Space #2	2/24-25/2003	2.89	2.57	11	0.18	0.68	3.78	220	10.6	2.1	27.6	6.87E+03	1.72E+04	2.15E+04	

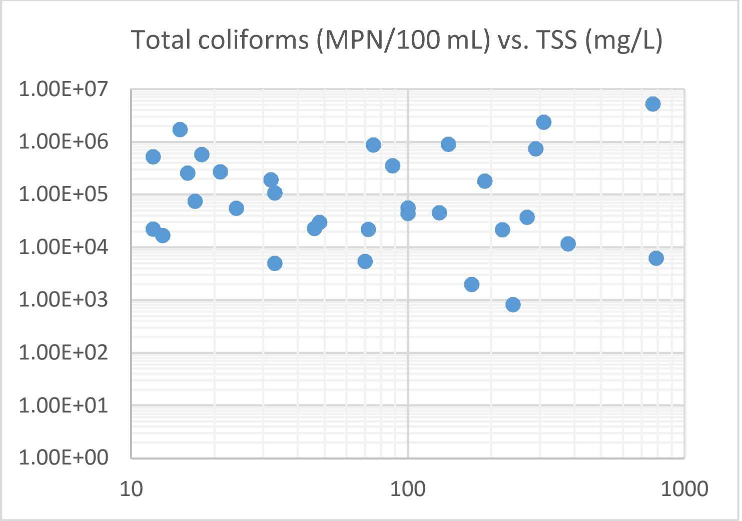

Cu (ug/L) vs. TSS (mg/L)
1000
100
10
1
10
100
1000

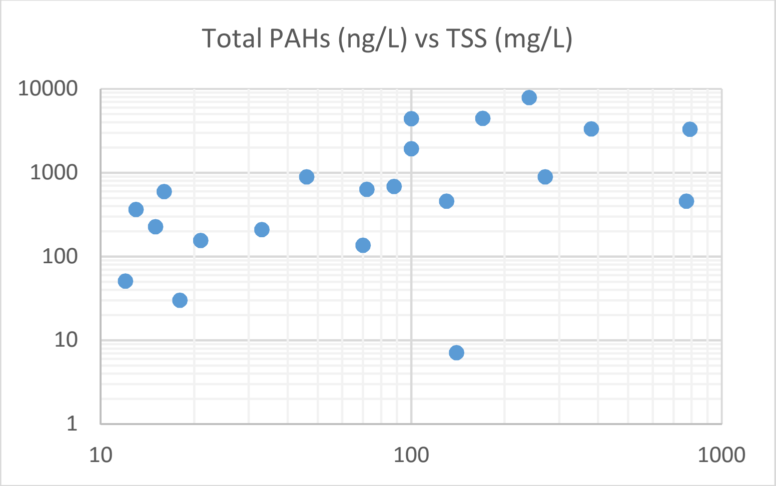

Pb (ug/L) vs. TSS (mg/L)
100
10
1
0.1
10
100
1000

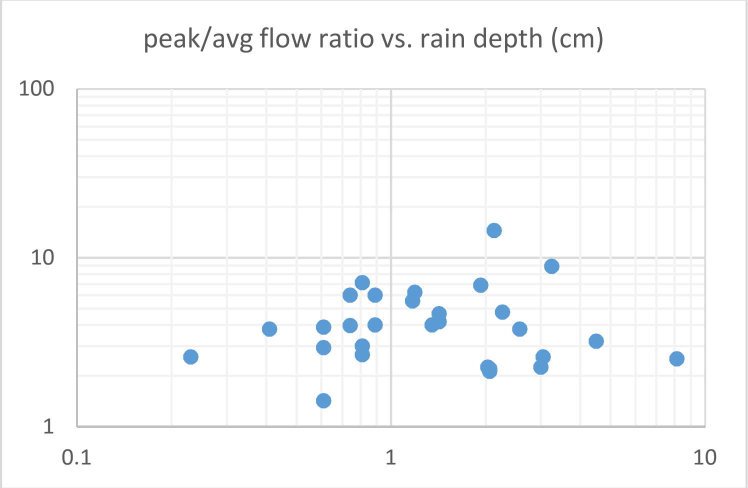

Zn (ug/L) vs. TSS (mg/L)
10000
1000
100
10
1
10
100
1000


E. coli (MPN/100 mL) vs. TSS (mg/L)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
10
100
1000


Enterococci (MPN/100 mL) vs. TSS (mg/L)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
10
100
1000


Total coliforms (MPN/100 mL) vs. TSS (mg/L)
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
10
100
1000


Total PAHs (ng/L) vs TSS (mg/L)
10000
1000
100
10
1
10
100
1000


peak/avg flow ratio vs. rain depth (cm)
100
10
1
0.1
1
10

	rain depth cm	dry days	mean flow m3/s	peak flow m3/s	TSS mg/L	Cu ug/L	Pb ug/L	Zn ug/L	E coli #/100mL	Entero #/100 mL	TC #/100 mL	Total PAHs ng/L
area km2	0.09	-0.08	0.12	0.19	-0.09	0.12	0.02	0.10	-0.16	-0.06	-0.11	0.42
	0.63	0.65	0.50	0.29	0.64	0.53	0.91	0.60	0.39	0.75	0.54	0.06
	32	32	32	32	31	32	32	32	31	32	32	21
rain depth cm		-0.09	0.05	0.02	0.01	-0.28	-0.14	-0.32	0.01	0.02	0.00	-0.28
		0.64	0.76	0.91	0.96	0.12	0.46	0.07	0.96	0.90	0.98	0.20
		33	33	33	32	33	33	33	32	33	33	22
dry days			0.16	0.12	0.21	0.26	0.01	0.04	-0.27	0.28	-0.11	0.20
			0.37	0.49	0.24	0.15	0.98	0.84	0.14	0.11	0.56	0.38
			33	33	32	33	33	33	32	33	33	22
mean flow m3/s				0.95	0.14	-0.01	0.03	-0.02	-0.03	0.69	0.29	0.28
				0.00	0.45	0.98	0.89	0.91	0.87	0.00	0.10	0.21
				33	32	33	33	33	32	33	33	22
peak flow m3/s					0.14	0.00	0.11	0.11	-0.07	0.60	0.23	0.30
					0.46	0.98	0.56	0.53	0.72	0.00	0.21	0.18
					32	33	33	33	32	33	33	22
TSS mg/L						0.15	0.15	-0.08	0.55	0.36	0.52	0.31
						0.41	0.41	0.66	0.00	0.04	0.00	0.18
						32	32	32	31	32	32	21
Cu ug/L							0.51	0.73	0.00	-0.06	-0.03	0.55
							0.00	0.00	0.99	0.72	0.88	0.01
							33	33	32	33	33	22
Pb ug/L								0.53	-0.03	-0.14	0.00	0.62
								0.00	0.87	0.45	0.99	0.00
								33	32	33	33	22
Zn ug/L									-0.15	-0.22	-0.15	0.51
									0.40	0.23	0.40	0.02
									32	33	33	22
E coli #/100mL										0.23	0.79	-0.17
										0.20	0.00	0.46
										32	32	21
Entero #/100 mL											0.47	-0.04
											0.01	0.86
											33	22
TC #/100 mL												-0.23
												0.30
												22

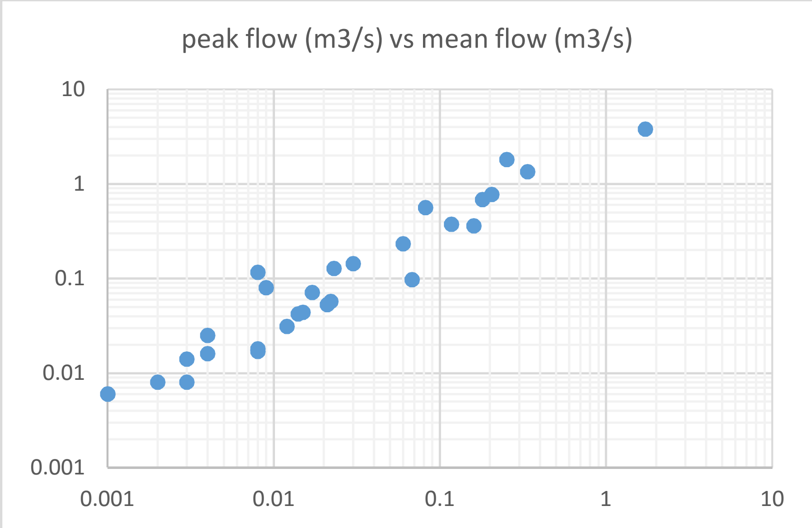
Cell contents:

Correlation coefficient

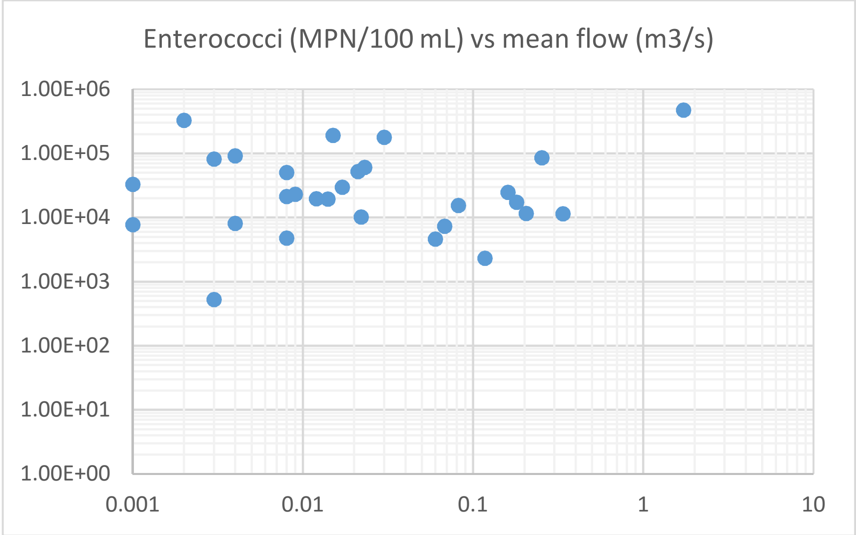
P value (significant correlations high-lighted having p <= 0.05)

Number of samples

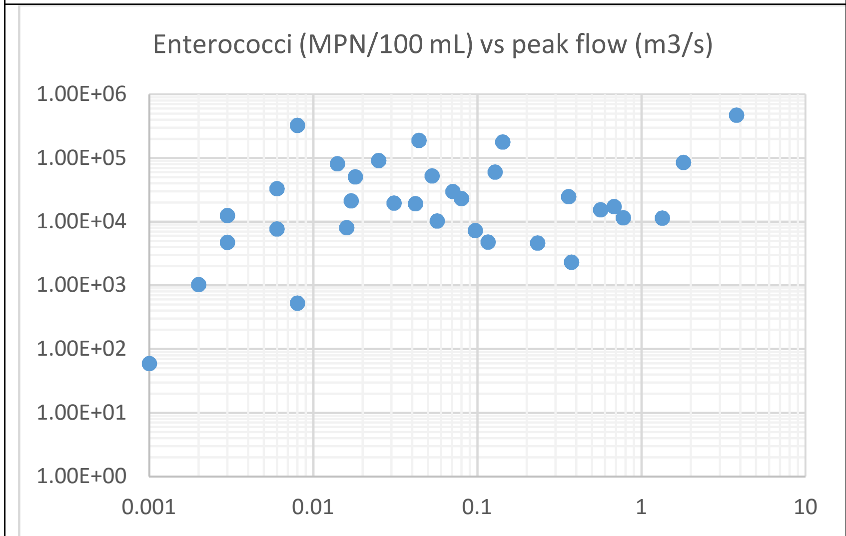
Significant 2-way correlations (correlation coefficient and P-value):



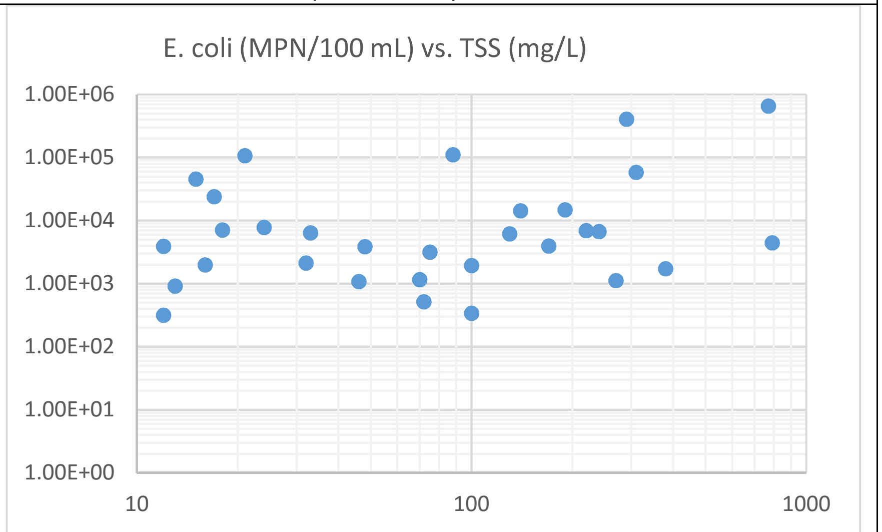
Mean flow – peak flow (0.95, <0.01)



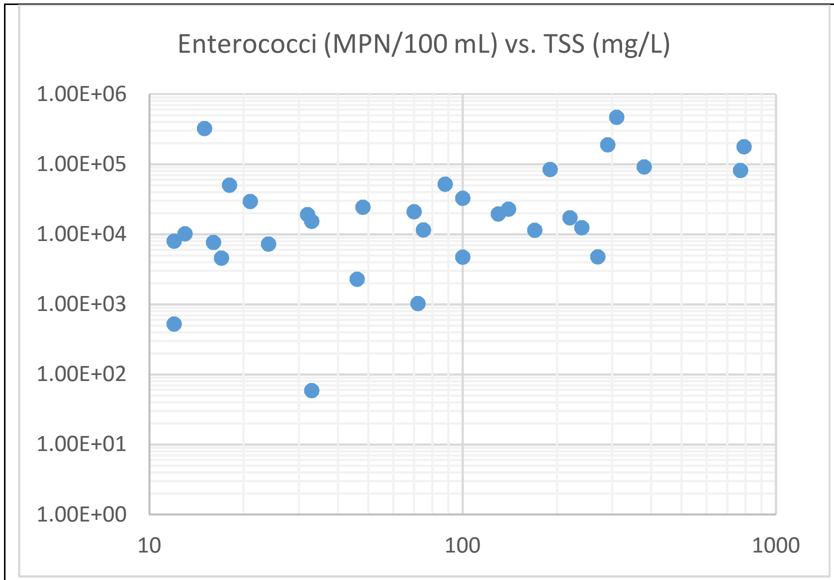
Mean flow – enterococci (0.69, <0.01)



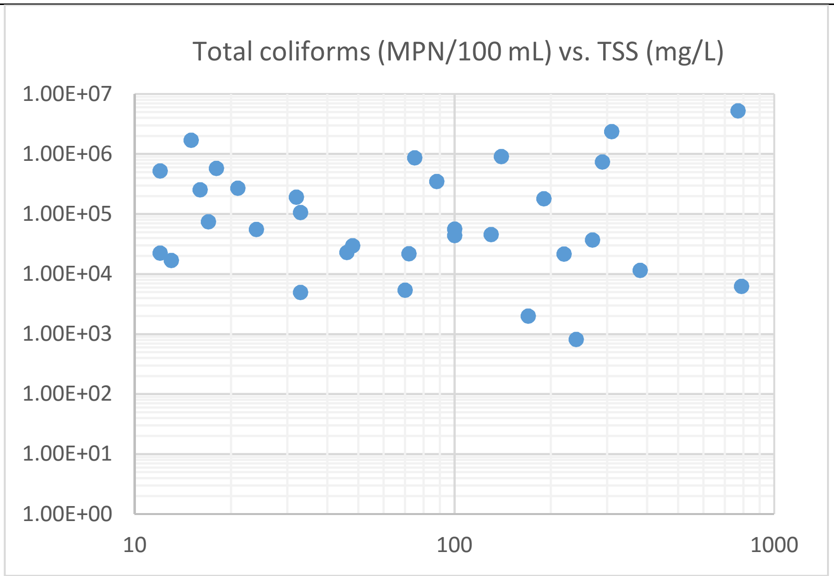
Peak flow – enterococci (0.60, <0.01)



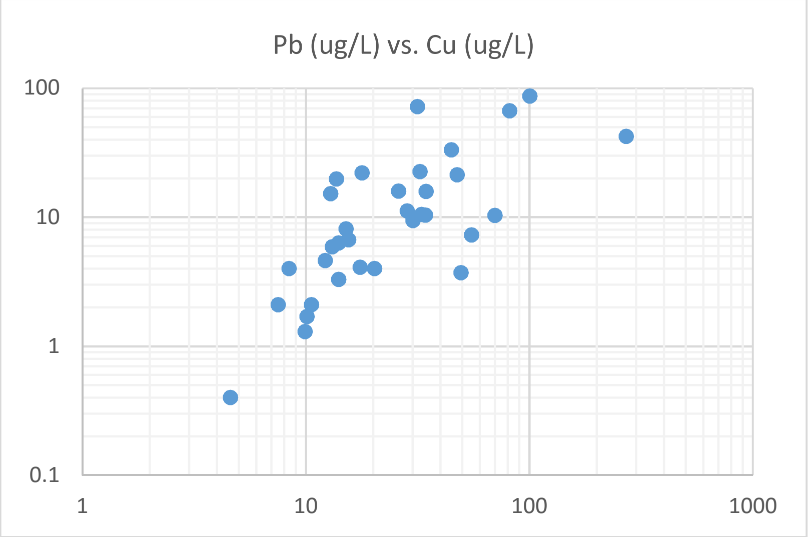
TSS – E. coli (0.55, <0.01)



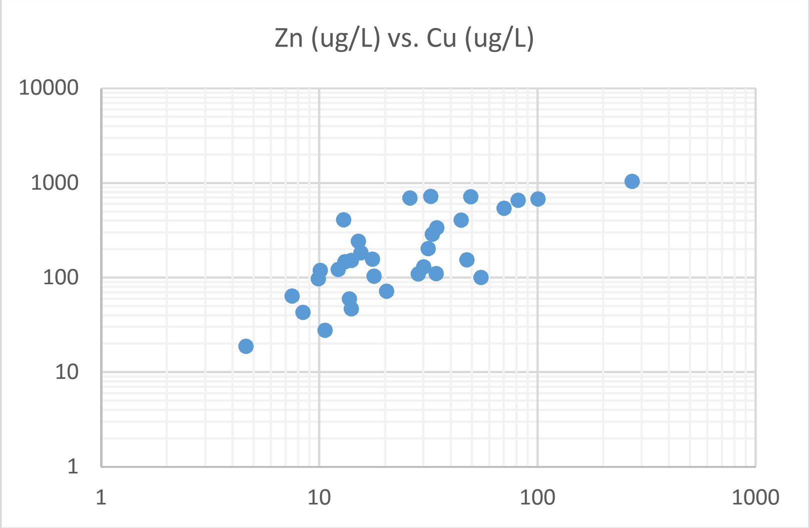
TSS – enterococci (0.36, 0.04)



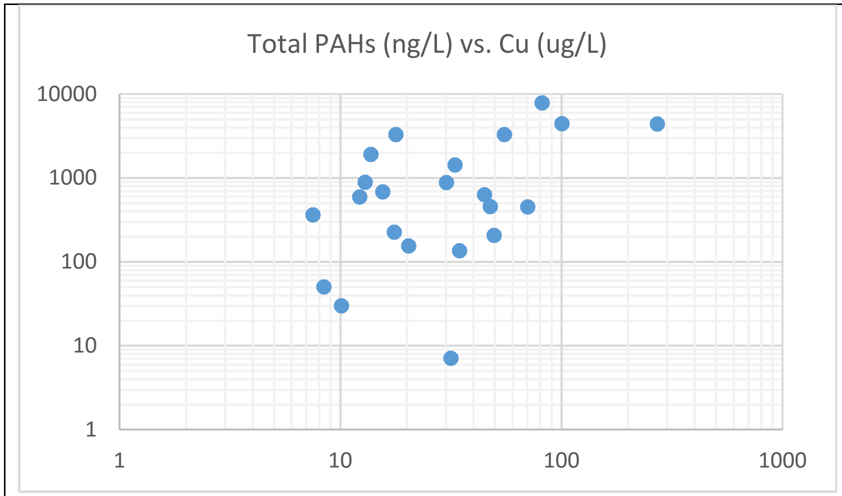
TSS – total coliforms (0.52, <0.01)



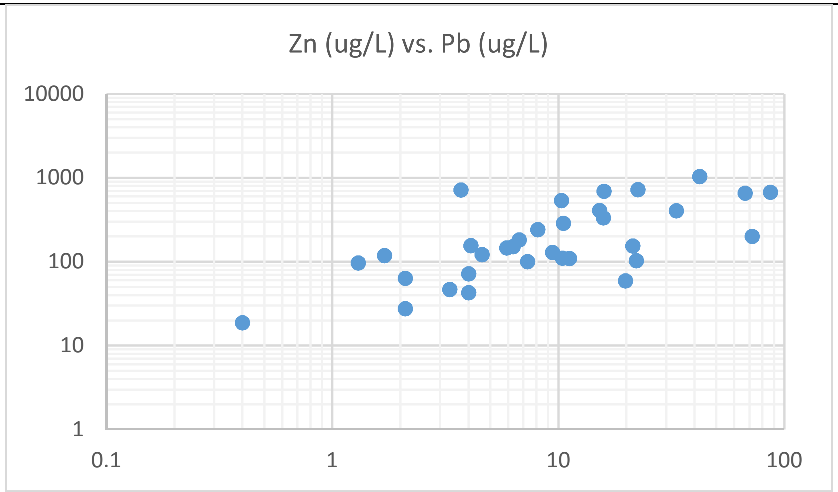
Copper – Lead (0.51, <0.01)



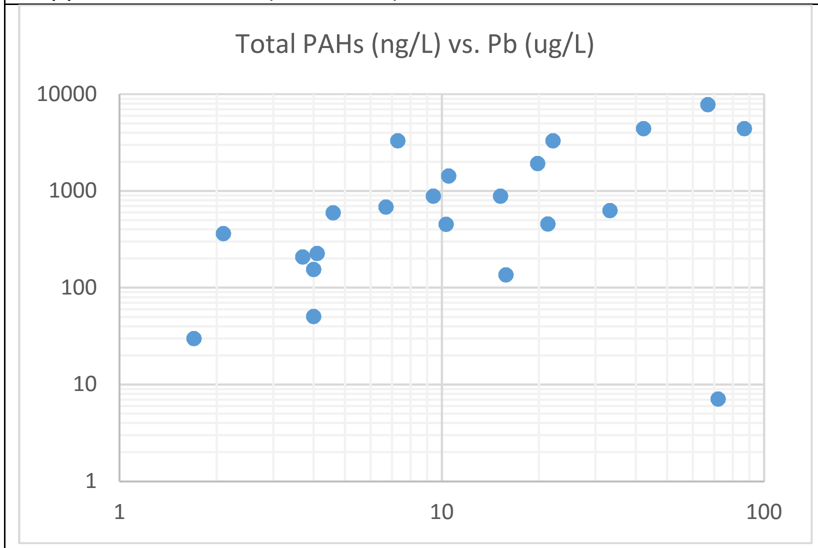
Copper – Zinc (0.73, <0.01)



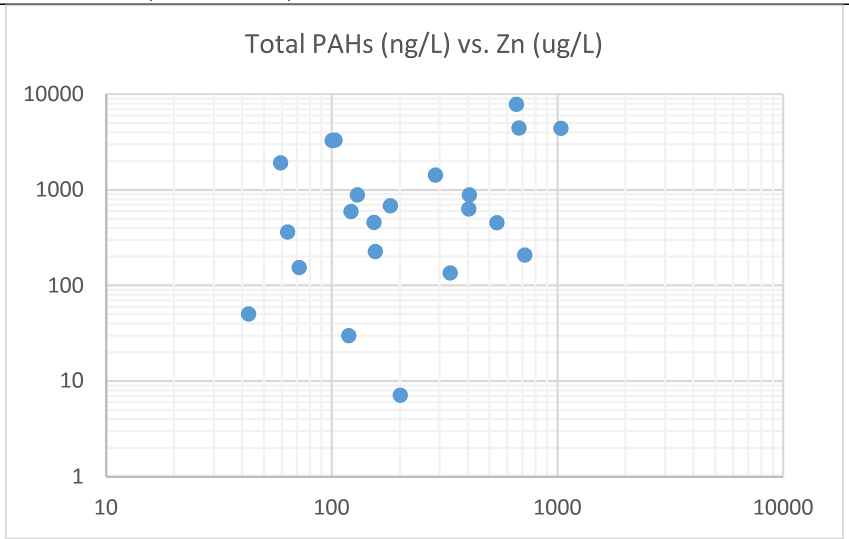
Copper – total PAHs (0.55, 0.01)



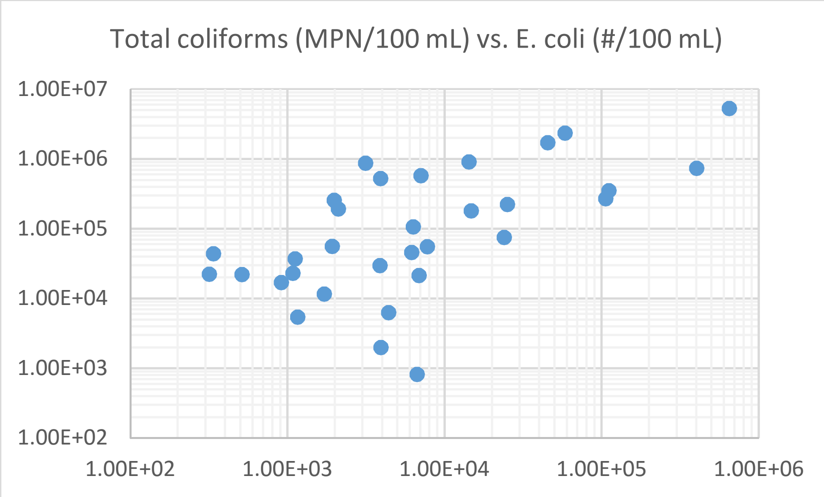
Lead – Zinc (0.53, <0.01)



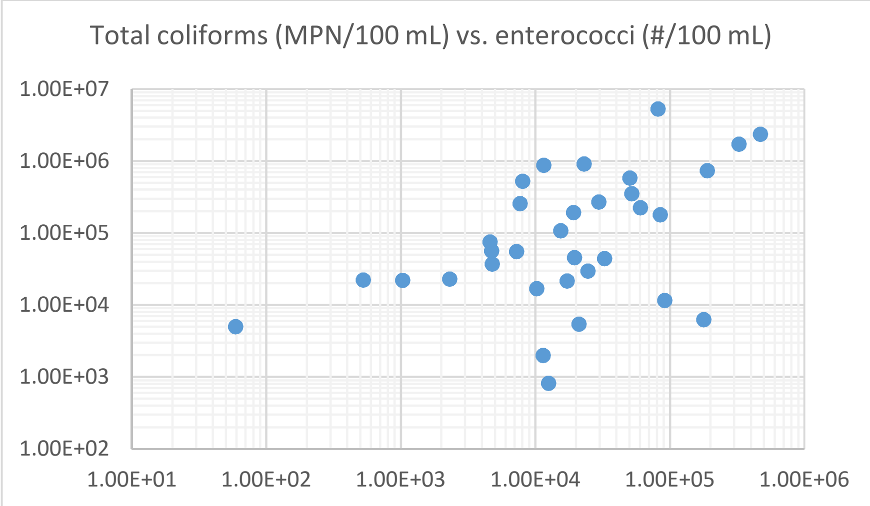
Lead – total PAHs (0.62, <0.01)



Zinc – total PAHs (0.51, 0.02)



E. coli – total coliforms (0.79, <0.01)

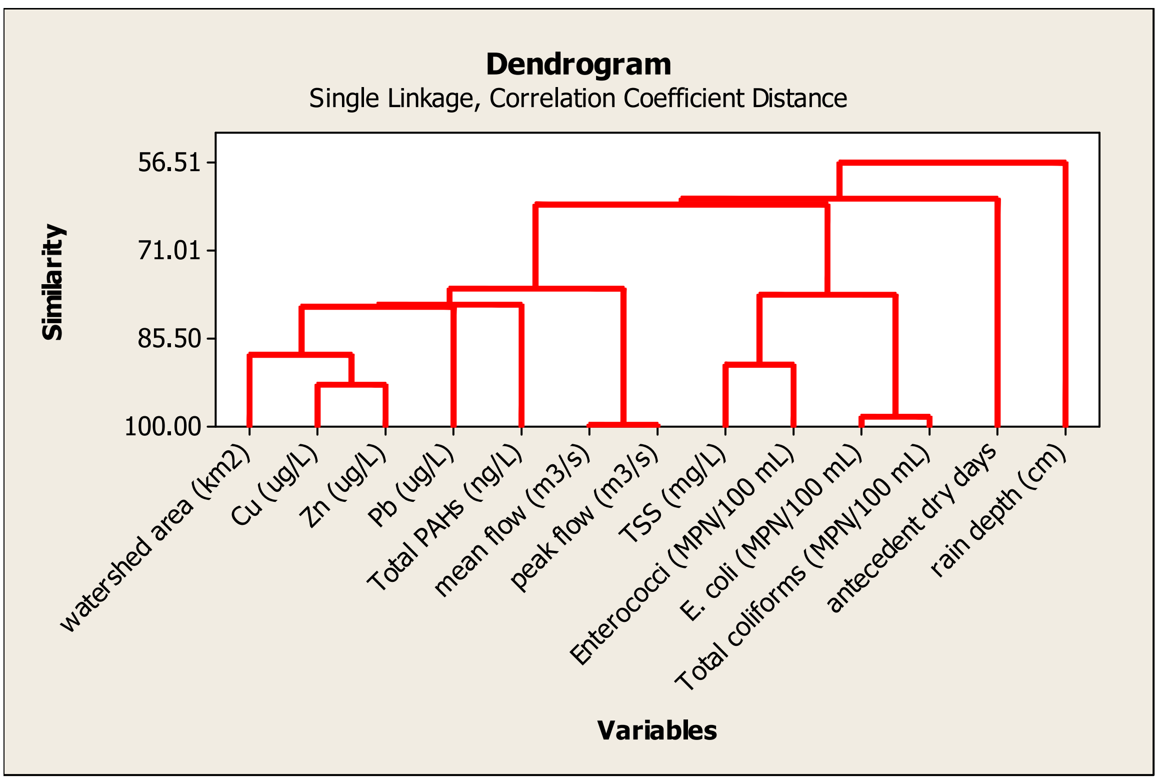


Enterococci – total coliforms (0.47, 0.01)

Cluster Analysis of Variables: watershed ar, rain depth (, antecedent d, ...

```
Correlation Coefficient Distance, Single Linkage
Amalgamation Steps
```

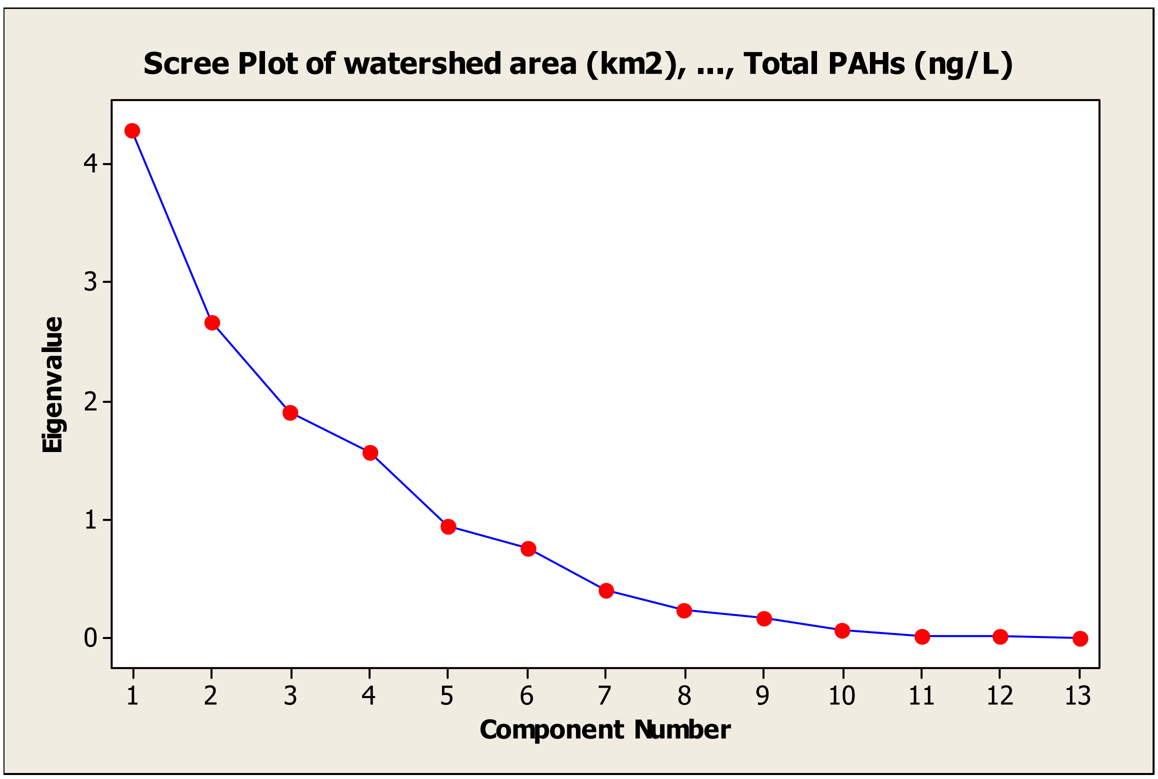
Step	Number of clusters	Similarity level	Distance level	Clusters joined		New cluster	Number of obs. in new cluster
1	12	99.7108	0.005784	4	5	4	2
2	11	98.2688	0.034624	10	12	10	2
3	10	93.2597	0.134807	7	9	7	2
4	9	89.9246	0.201508	6	11	6	2
5	8	88.1858	0.236284	1	7	1	3
6	7	80.2261	0.395477	1	8	1	4
7	6	79.9588	0.400824	1	13	1	5
8	5	78.3899	0.432202	6	10	6	4
9	4	77.2596	0.454807	1	4	1	7
10	3	63.6730	0.726539	1	6	1	11
11	2	62.6239	0.747523	1	3	1	12
12	1	56.5134	0.869731	1	2	1	13

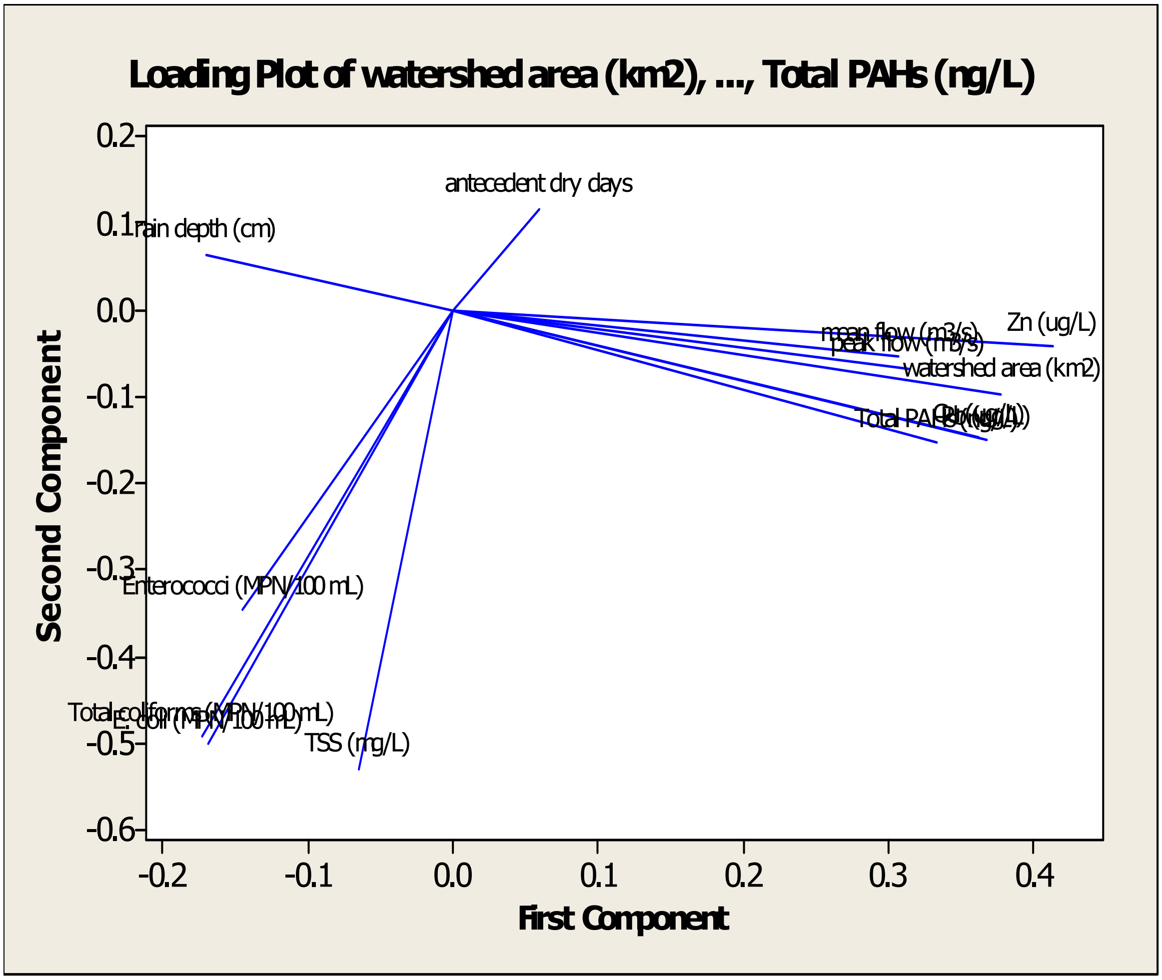


Principal Component Analysis: watershed ar, rain depth (, antecedent d, mean fl

```
Eigenanalysis of the Correlation Matrix
19 cases used, 14 cases contain missing values

Eigenvalue   4.2767  2.6696  1.9056  1.5720  0.9336  0.7483  0.3997  0.2312
Proportion    0.329   0.205   0.147   0.121   0.072   0.058   0.031   0.018
Cumulative    0.329   0.534   0.681   0.802   0.874   0.931   0.962   0.980
```

Variable	PC1	PC2	PC3	PC4
watershed area (km2)	0.378	-0.096	-0.049	0.054
rain depth (cm)	-0.171	0.064	-0.355	-0.174
antecedent dry days	0.059	0.117	0.511	-0.346
mean flow (m3/s)	0.307	-0.054	-0.374	-0.406
peak flow (m3/s)	0.314	-0.068	-0.359	-0.411
TSS (mg/L)	-0.066	-0.530	0.202	-0.231
Cu (ug/L)	0.362	-0.147	0.245	0.291
Pb (ug/L)	0.368	-0.151	-0.161	0.060
Zn (ug/L)	0.413	-0.042	0.073	0.284
E. coli (MPN/100 mL)	-0.169	-0.503	-0.179	0.206
Enterococci (MPN/100 mL)	-0.145	-0.347	0.277	-0.438
Total coliforms (MPN/100 mL)	-0.174	-0.492	-0.169	0.227
Total PAHs (ng/L)	0.333	-0.154	0.270	-0.076





Total Suspended Solids Concentrations by Land Use

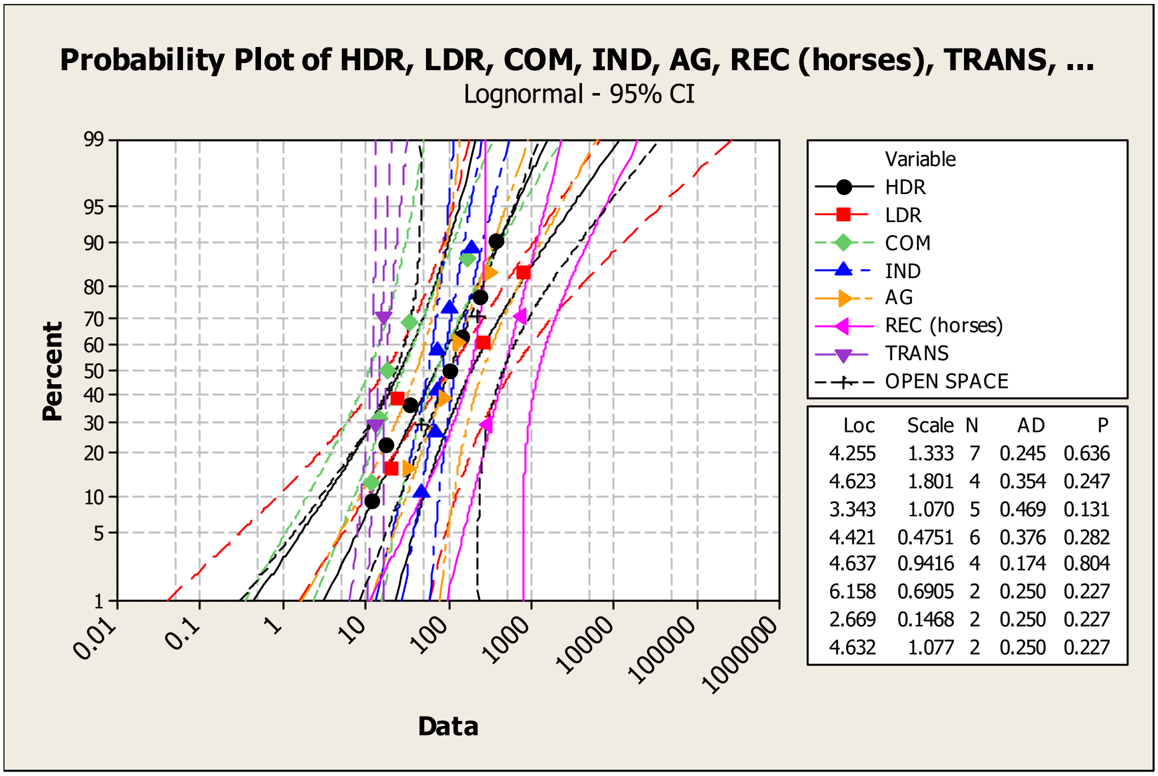
Kruskal-Wallis One Way Analysis of Variance on Ranks

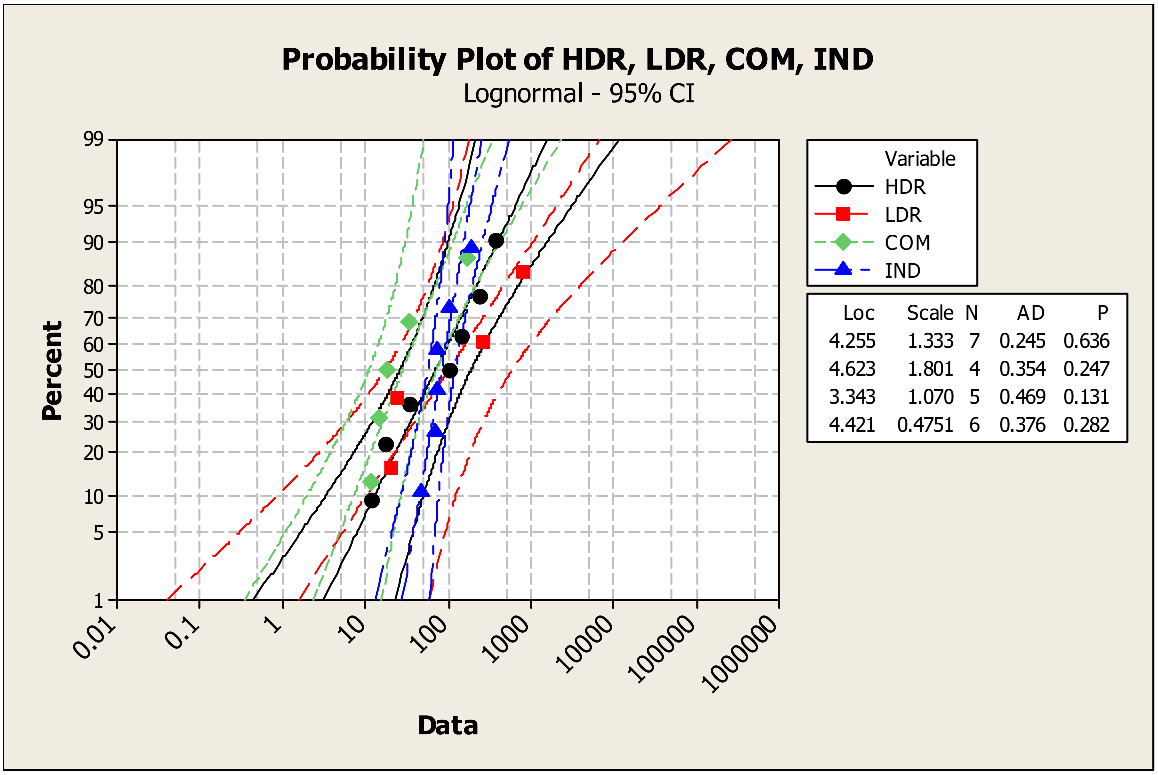
Group	N	Missing	Median	25%	75%
HDR	7	0	100.000	17.000	240.000
LDR	4	0	147.000	21.750	660.000
COM	5	0	18.000	13.500	101.500
IND	6	0	73.500	64.000	122.500
AGRIC	4	0	109.000	46.000	265.000
horse	2	0	530.000	290.000	770.000
TRANS	2	0	14.500	13.000	16.000

OPEN SPACE2	0	134.000	48.000	220.000

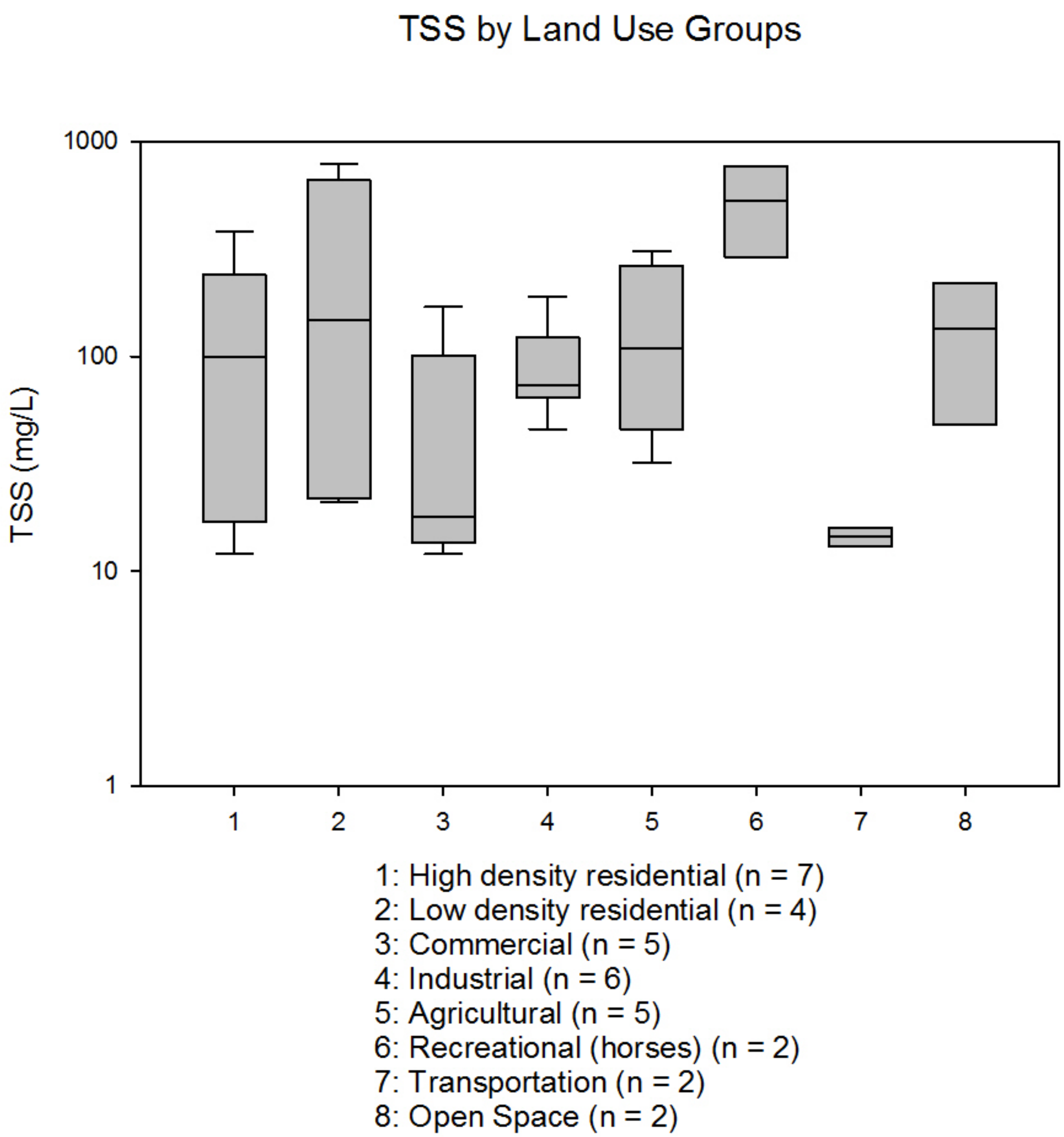
H = 11.219 with 7 degrees of freedom. (P = 0.129)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.129)





Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
Data
99
95
90
80
70
60
50
40
30
20
10
5
1
0.01
0.1
1
10
100
1000
10000
100000
1000000
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
4.255 1.333 7 0.245 0.636
4.623 1.801 4 0.354 0.247
3.343 1.070 5 0.469 0.131
4.421 0.4751 6 0.376 0.282



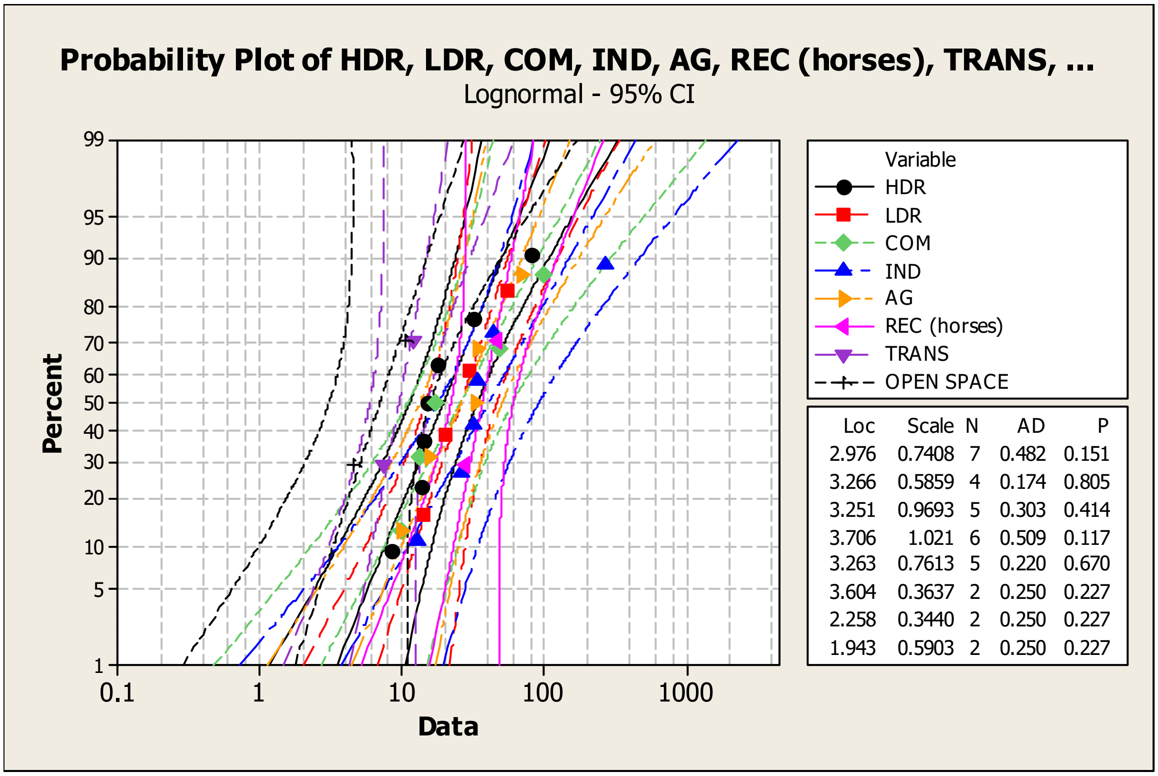
Copper Concentrations by Land Use

Kruskal-Wallis One Way Analysis of Variance on Ranks

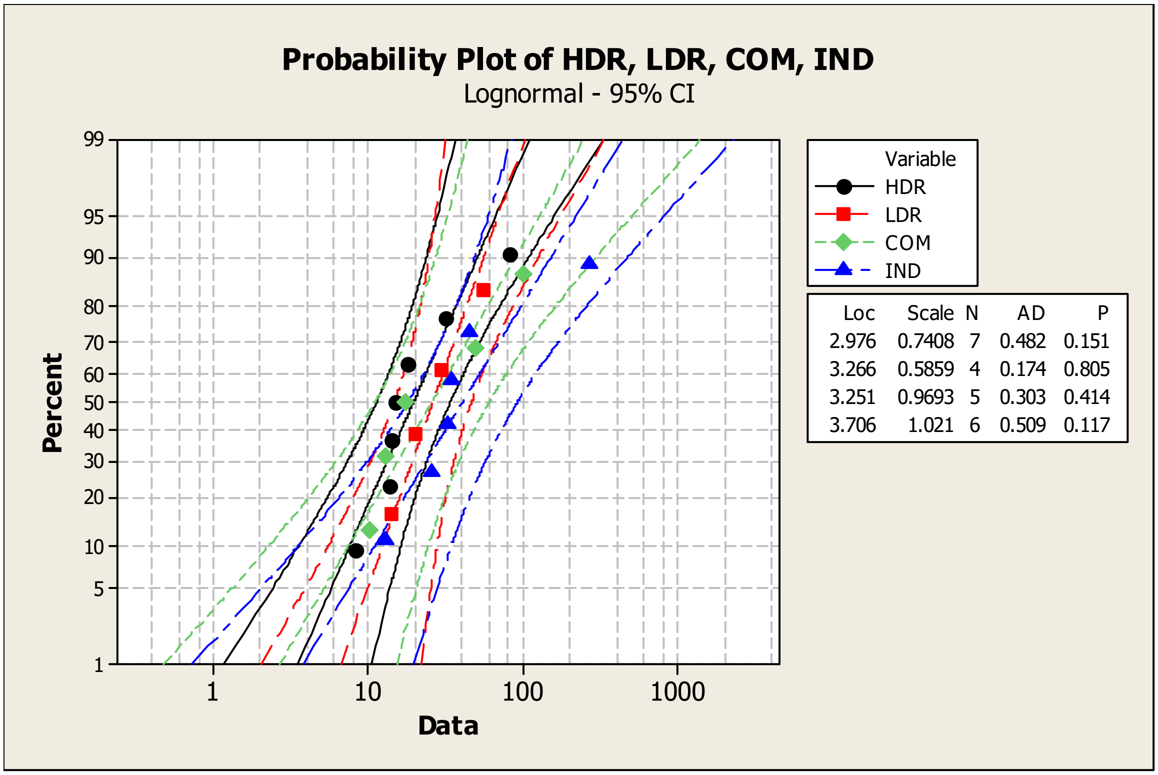
Group	N	Missing	Median	25%	75%
HDR	7	0	15.100	13.700	31.500
LDR	4	0	25.200	15.575	48.850
COM	5	0	17.500	11.600	74.900
IND	6	0	33.450	22.725	101.350
AG	5	0	32.900	12.700	52.250
REC (horses)	2	0	37.950	28.400	47.500
TRANS	2	0	9.850	7.500	12.200
OPEN SPACE	2	0	7.600	4.600	10.600

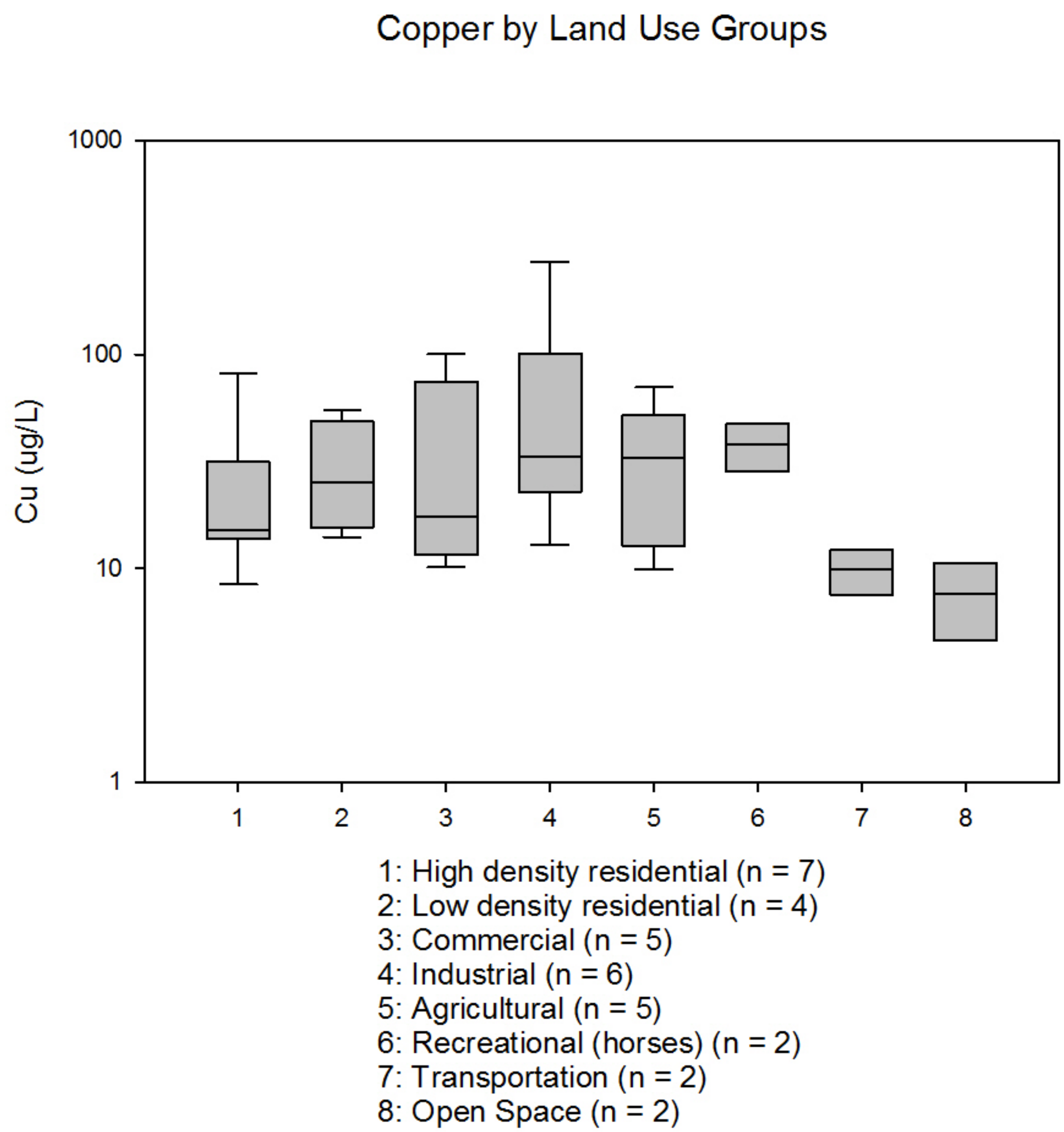
H = 10.385 with 7 degrees of freedom. (P = 0.168)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.168)



Loc	Scale	N	AD	P
2.976	0.7408	7	0.482	0.151
3.266	0.5859	4	0.174	0.805
3.251	0.9693	5	0.303	0.414
3.706	1.021	6	0.509	0.117
3.263	0.7613	5	0.220	0.670
3.604	0.3637	2	0.250	0.227
2.258	0.3440	2	0.250	0.227
1.943	0.5903	2	0.250	0.227


Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
1
10
100
1000
Data
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
2.976 0.7408 7 0.482 0.151
3.266 0.5859 4 0.174 0.805
3.251 0.9693 5 0.303 0.414
3.706 1.021 6 0.509 0.117



Lead Concentrations by Land Use

Kruskal-Wallis One Way Analysis of Variance on Ranks

Group	N	Missing	Median	25%	75%
HDR	7	0	19.800	6.300	66.900
LDR	4	0	5.650	3.475	8.875
COM	5	0	4.100	2.700	46.350
IND	6	0	19.200	15.650	35.450
AG	5	0	10.300	4.000	10.450
REC (horses)	2	0	16.250	11.200	21.300
TRANS	2	0	3.350	2.100	4.600
OPEN SPACE	2	0	1.250	0.400	2.100

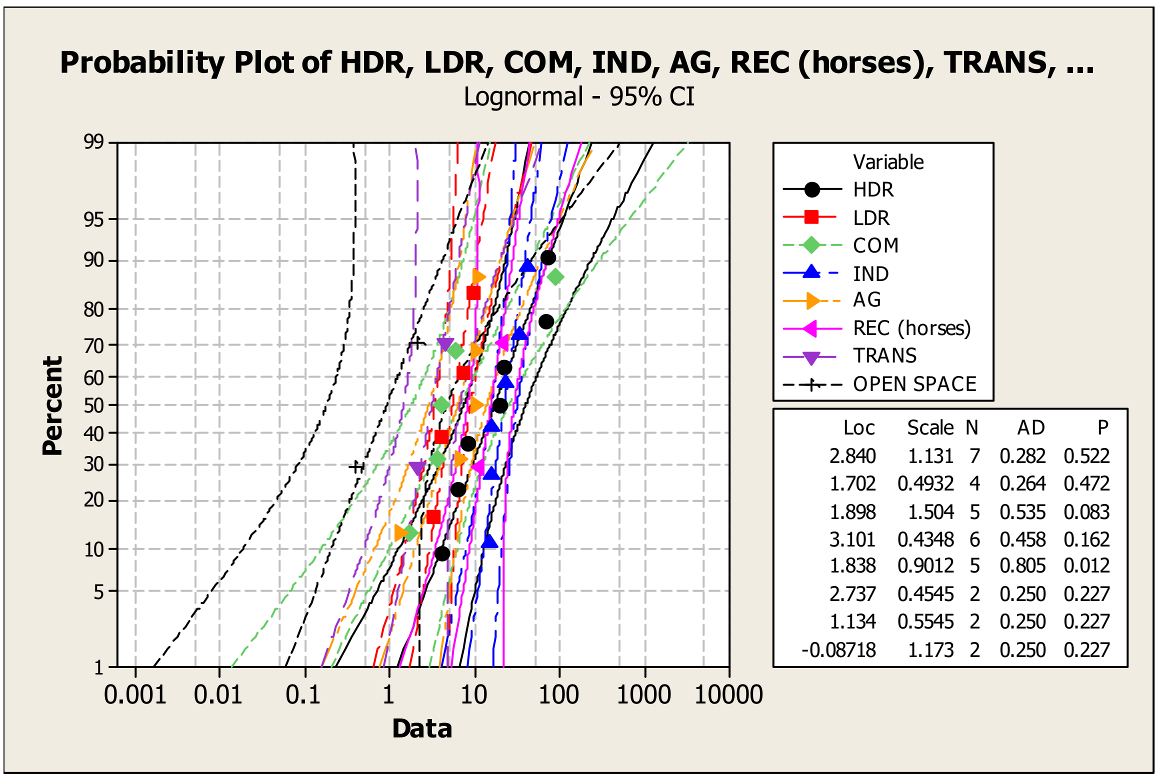
H = 16.395 with 7 degrees of freedom. (P = 0.022)

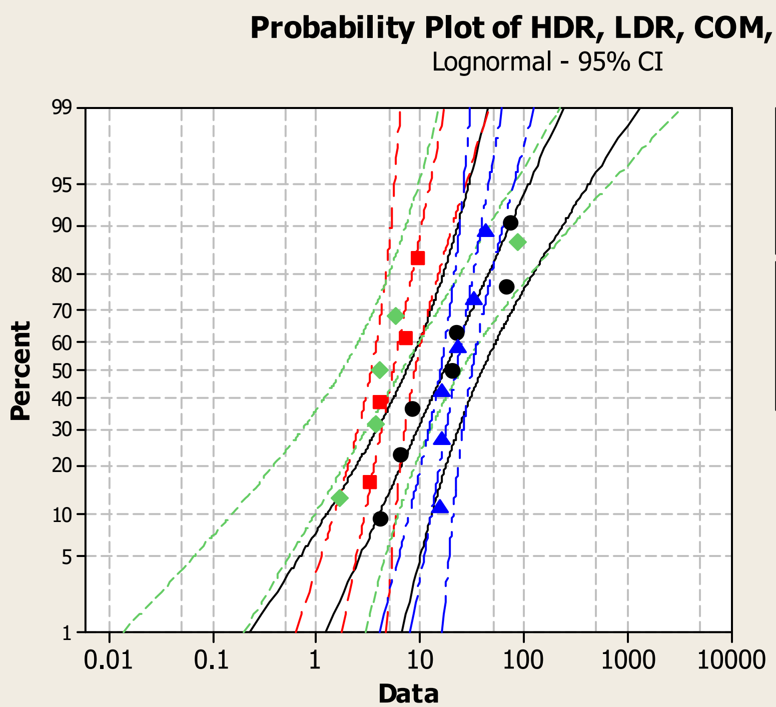
The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.022)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Dunn's Method), but the following had the smallest P, but was still >0.05:

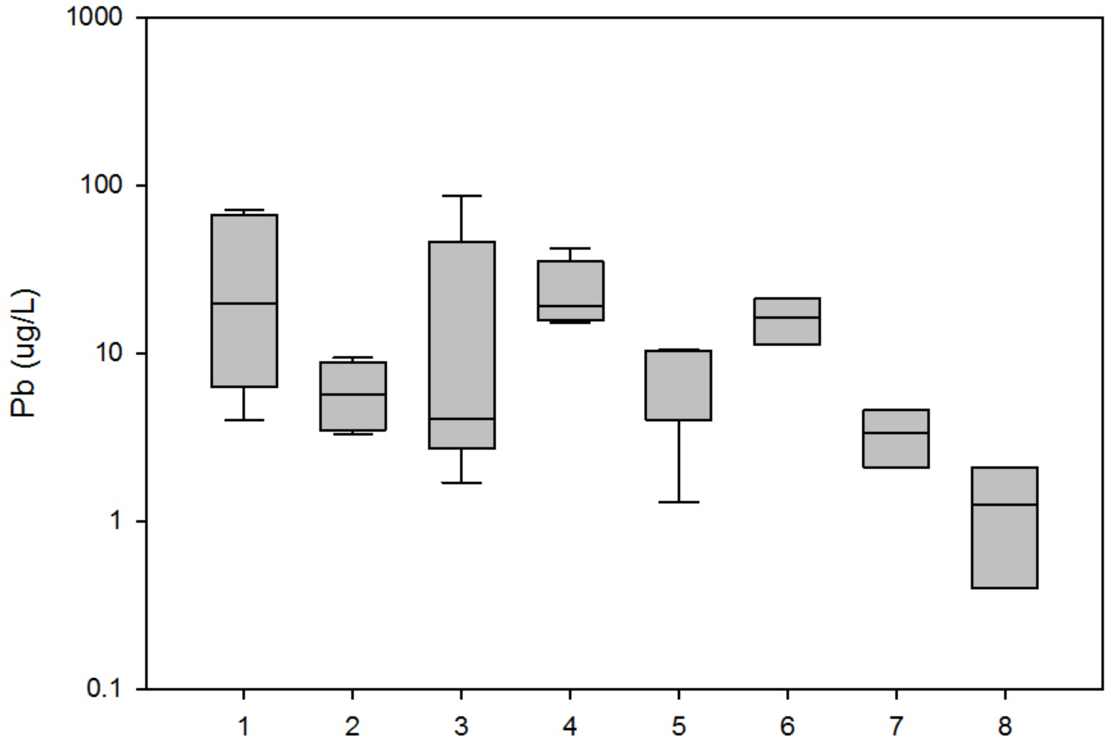
Comparison	**Diff of Ranks**	**Q**	**P**
IND vs OPEN SPACE	23.250	2.945	0.090





Loc	Scale	N	AD	P
2.840	1.131	7	0.282	0.522
1.702	0.4932	4	0.264	0.472
1.898	1.504	5	0.535	0.083
3.101	0.4348	6	0.458	0.162

Lead by Land Use Groups



1: High density residential (n = 7)
2: Low density residential (n = 4)
3: Commercial (n = 5)
4: Industrial (n = 6)
5: Agricultural (n = 5)
6: Recreational (horses) (n = 2)
7: Transportation (n = 2)
8: Open Space (n = 2)

Zinc Concentrations by Land Use

Kruskal-Wallis One Way Analysis of Variance on Ranks

Group	N	Missing	Median	25%	75%
HDR	7	0	151.000	59.300	240.500
LDR	4	0	85.950	52.850	122.350
COM	5	0	155.700	132.650	694.900
IND	6	0	549.700	386.575	799.900
AG	5	0	181.800	103.500	412.550
REC (horses)	2	0	131.550	109.400	153.700
TRANS	2	0	92.550	63.600	121.500
OPEN SPACE	2	0	23.150	18.700	27.600

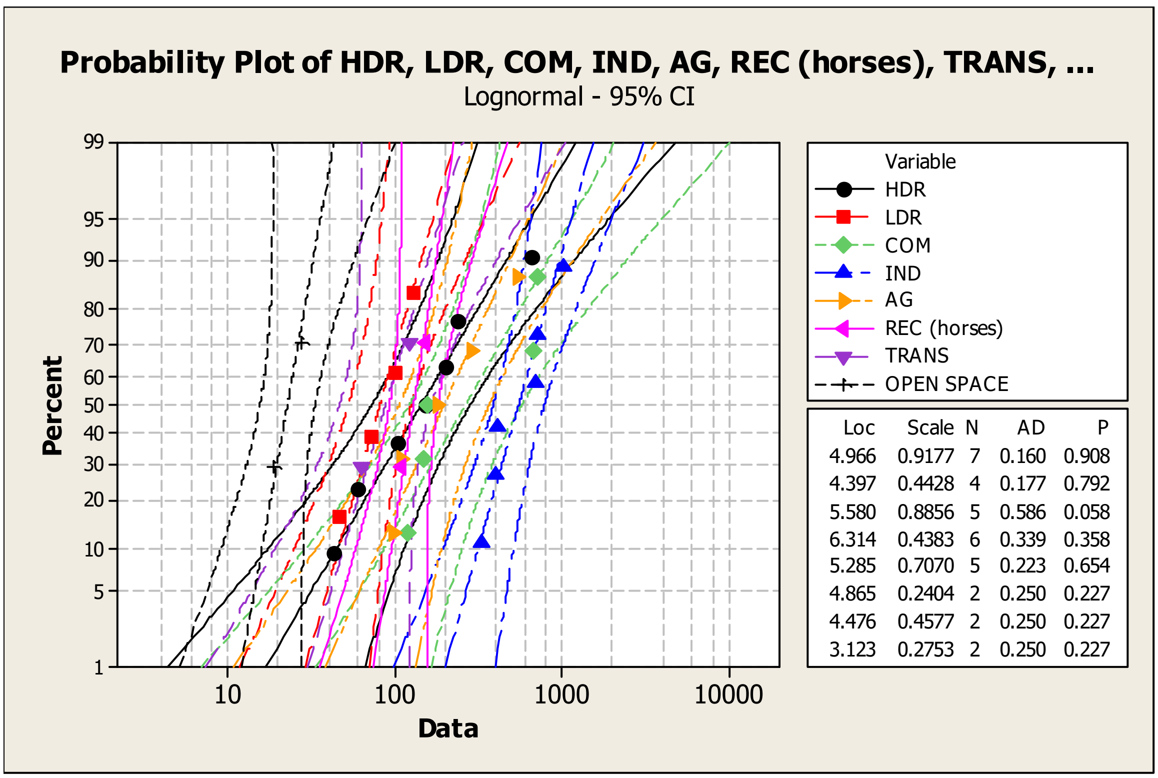
H = 18.918 with 7 degrees of freedom. (P = 0.008)

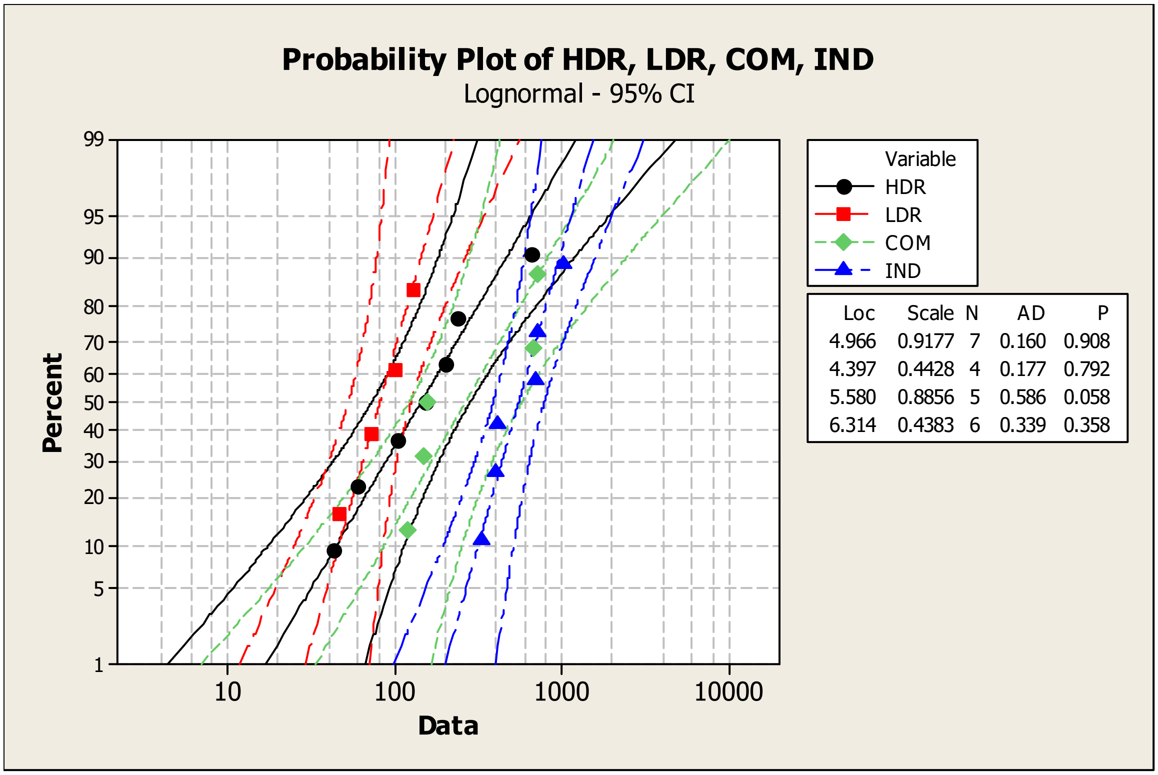
The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.008)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

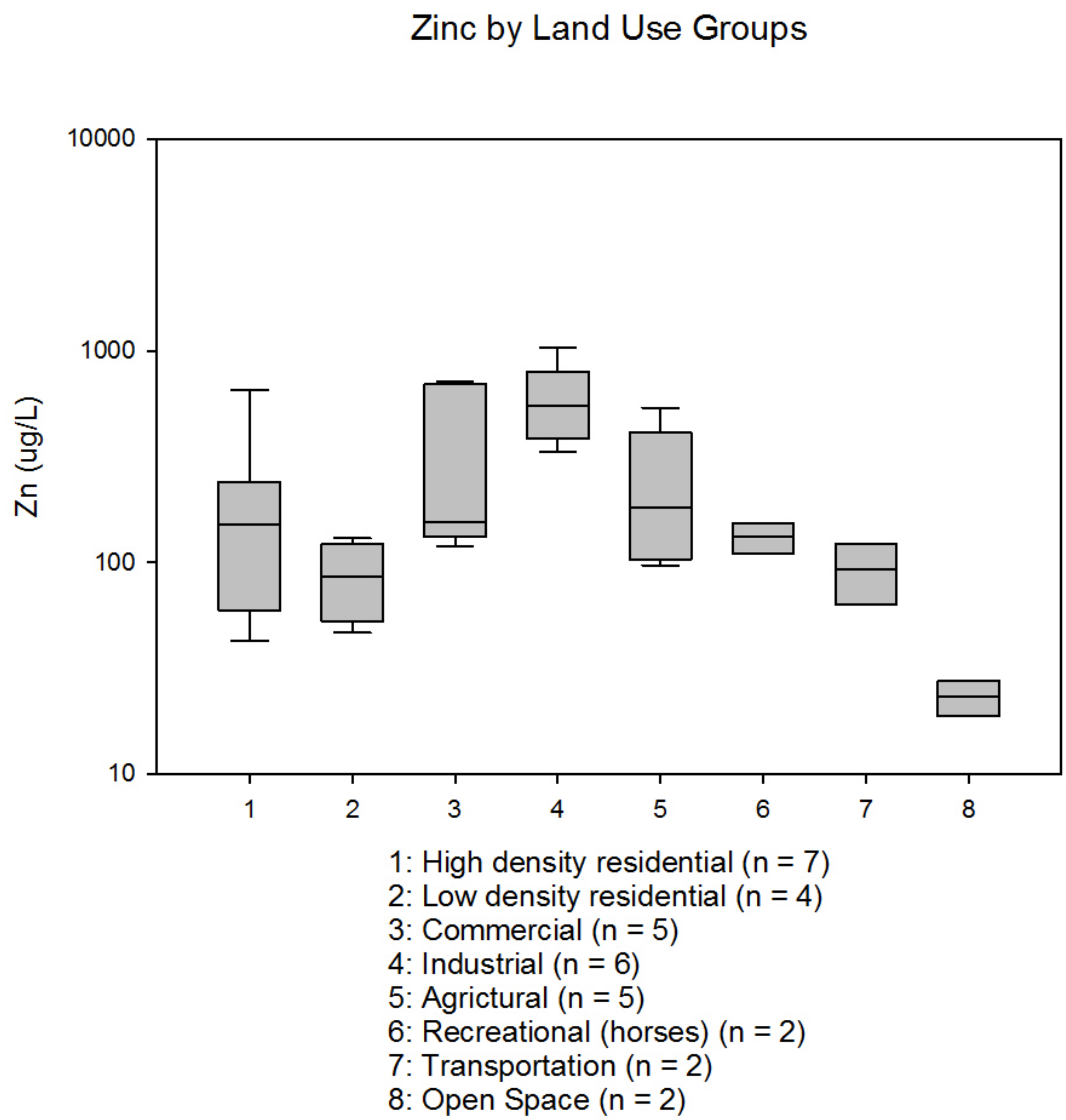
All Pairwise Multiple Comparison Procedures (Dunn's Method) :

Comparison	**Diff of Ranks**	**Q**	**P**
IND vs OPEN SPACE	26.833	3.399	0.019
IND vs LDR	19.583	3.138	0.048





Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
Data
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
4.966 0.9177 7 0.160 0.908
4.397 0.4428 4 0.177 0.792
5.580 0.8856 5 0.586 0.058
6.314 0.4383 6 0.339 0.358



E. Coli by Land Use

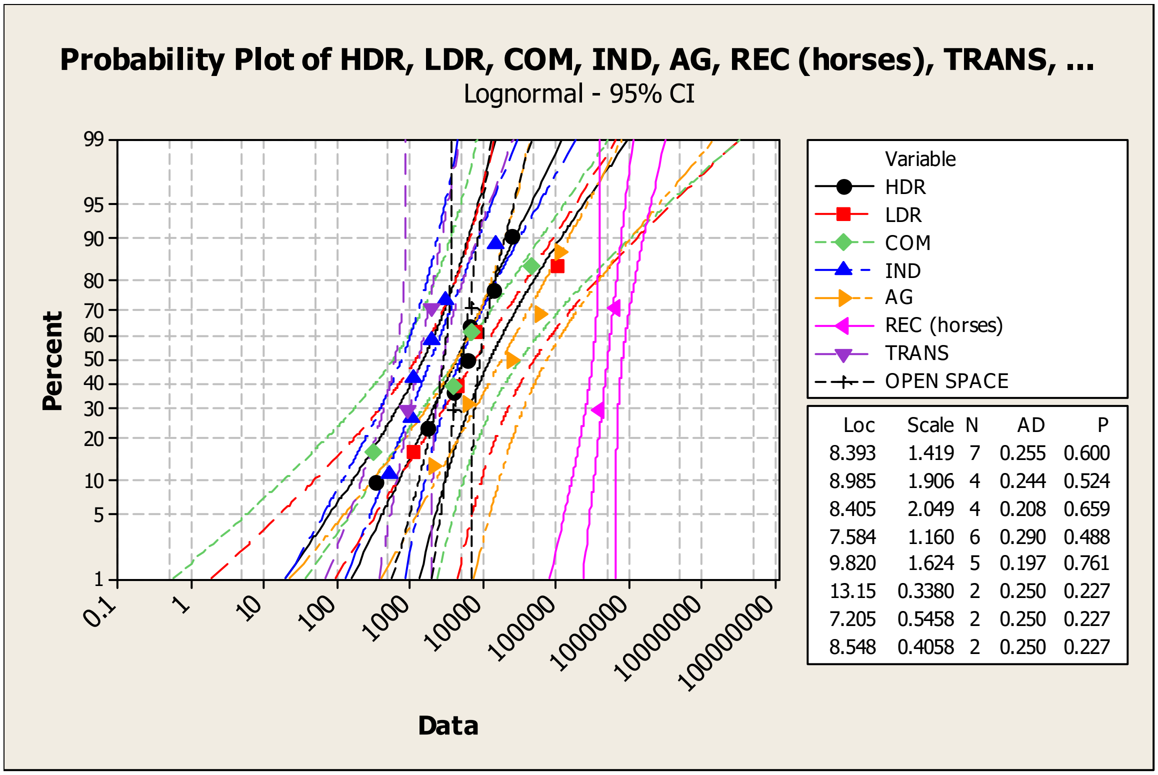
Kruskal-Wallis One Way Analysis of Variance on Ranks

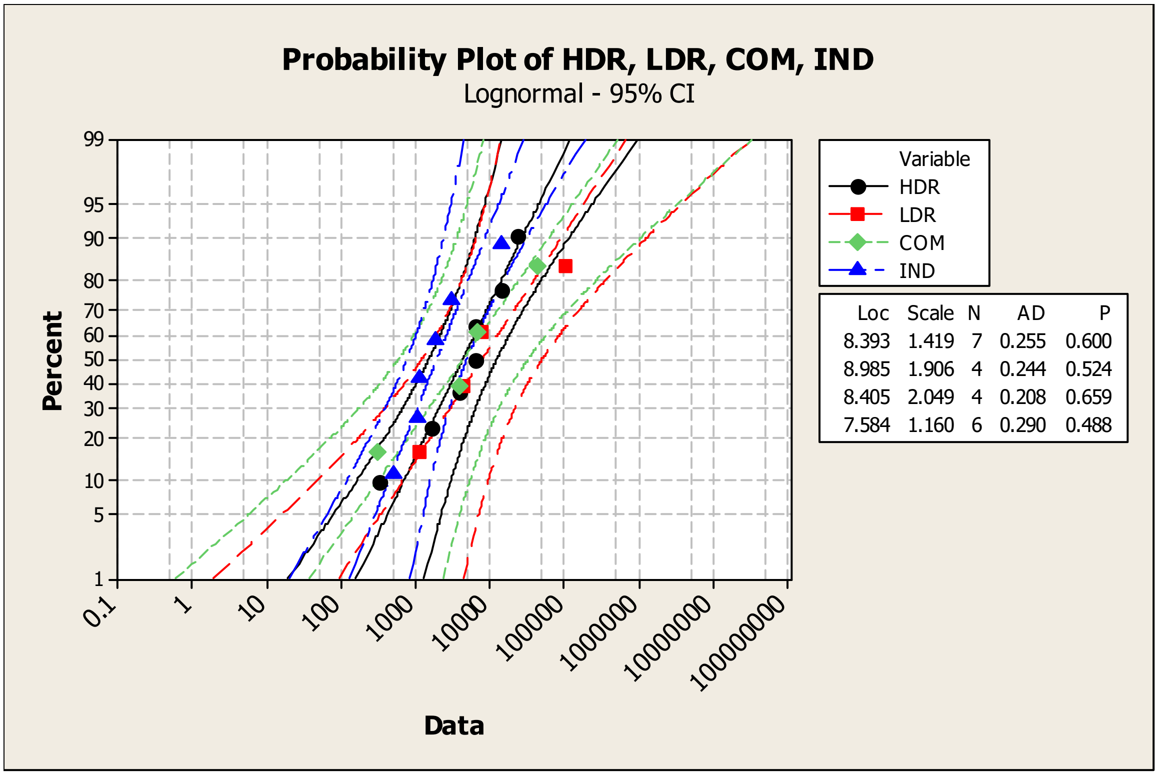
Group	N	Missing	Median	25%	75%
HDR	7	0	6330.000	1710.000	14300.000
LDR	4	0	6085.000	1942.500	81440.000
COM	4	0	5500.000	1222.750	35740.000
IND	6	0	1545.000	938.500	6055.000
AG	5	0	25100.000	4135.000	84650.000
REC (horses)	2	0	526500.000	403000.000	650000.000
TRANS	2	0	1447.500	915.000	1980.000

OPEN SPACE 2 0 5370.000 3870.000 6870.000

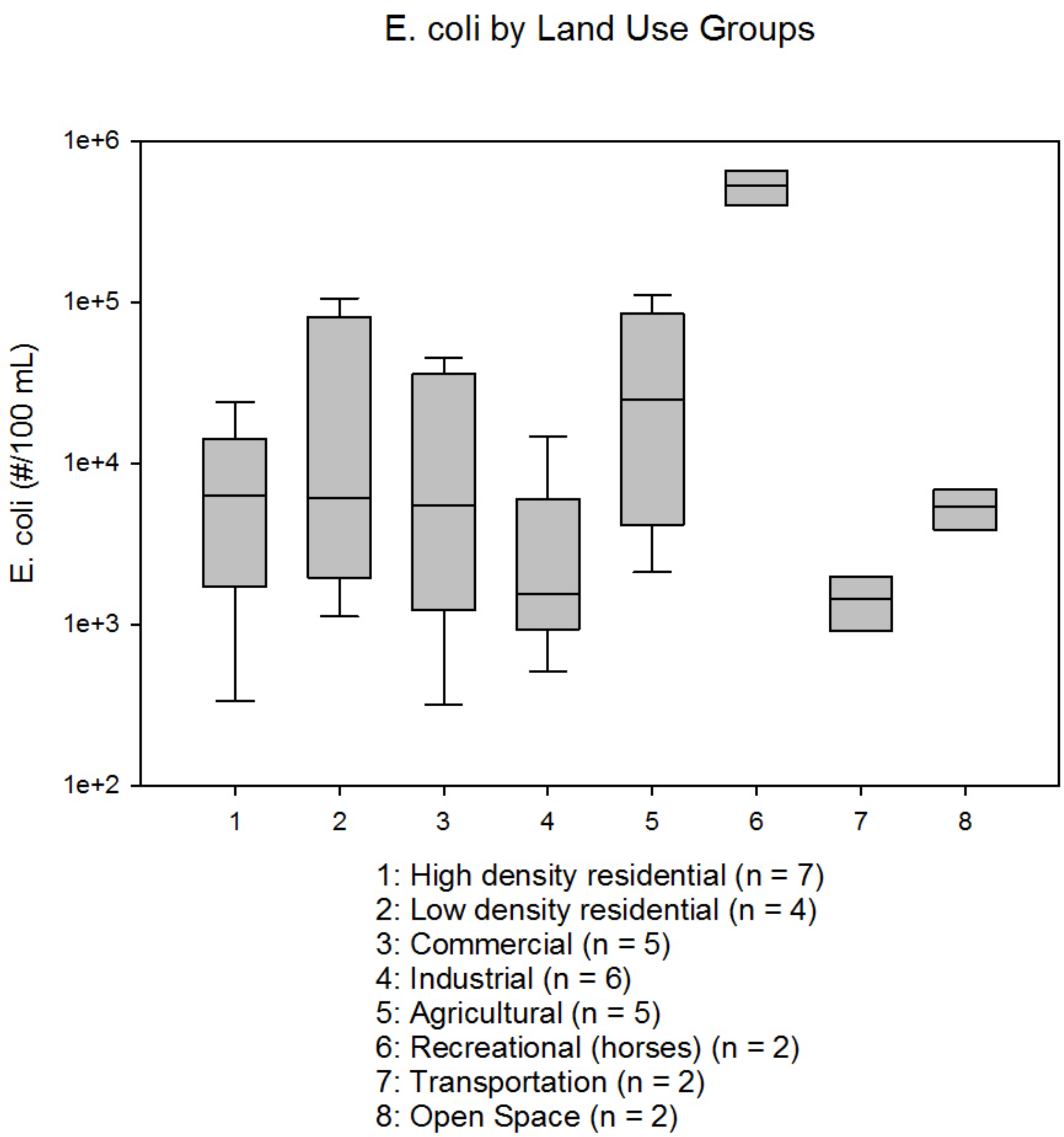
H = 12.242 with 7 degrees of freedom. (P = 0.093)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.093)





Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
1
10
100
1000
10000
100000
1000000
10000000
100000000
Data
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
8.393 1.419 7 0.255 0.600
8.985 1.906 4 0.244 0.524
8.405 2.049 4 0.208 0.659
7.584 1.160 6 0.290 0.488



Enterococci by Land Use

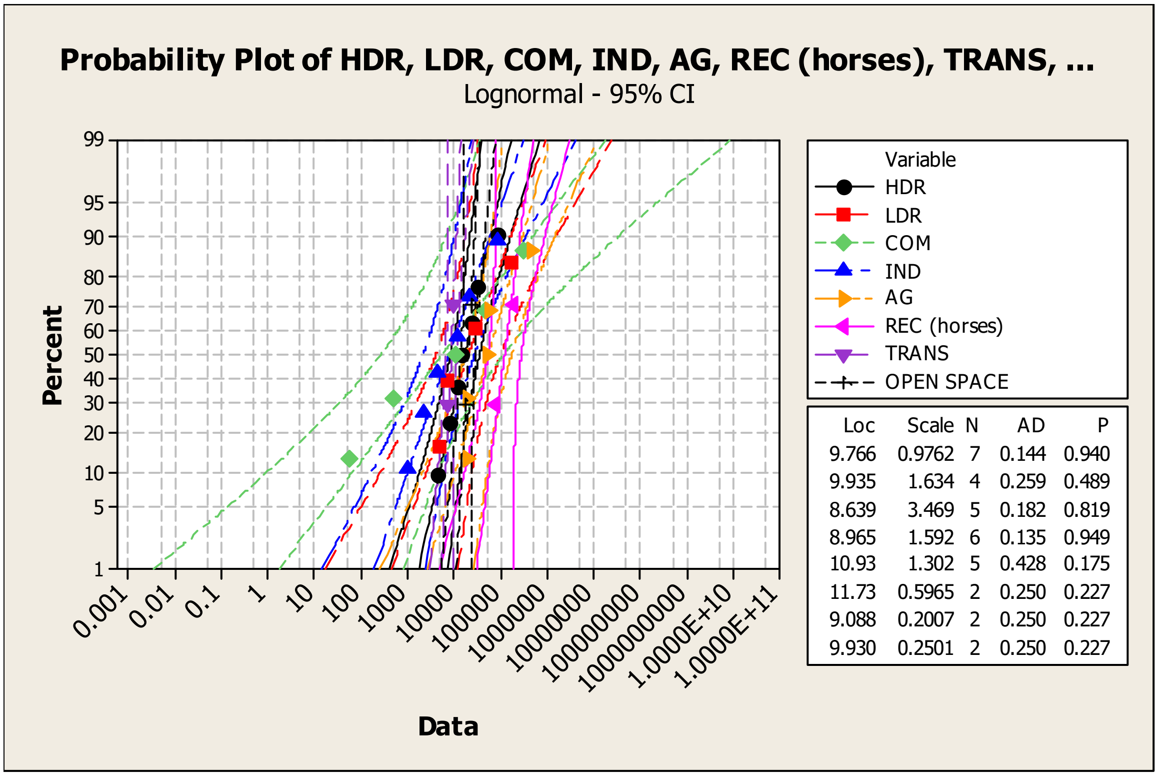
Kruskal-Wallis One Way Analysis of Variance on Ranks

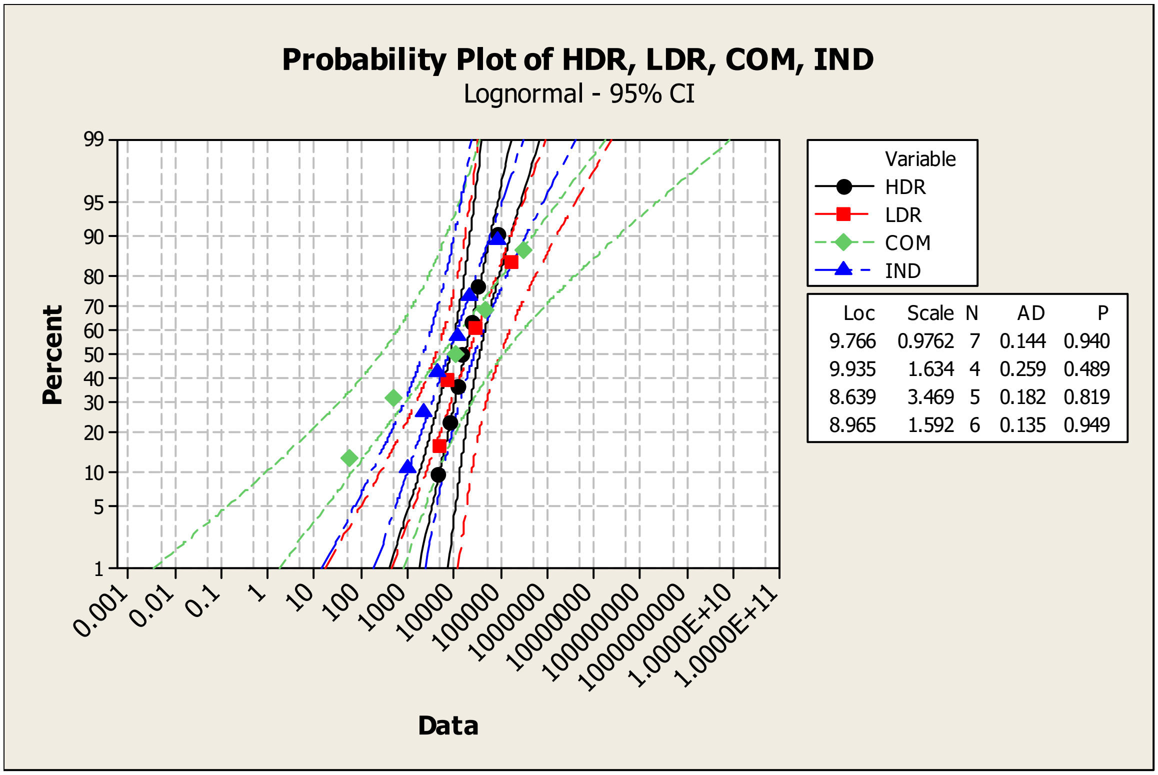
Group	N	Missing	Median	25%	75%
HDR	7	0	15400.000	8020.000	32700.000
LDR	4	0	18375.000	5390.000	140875.000
COM	5	0	11400.000	291.550	187600.000
IND	6	0	8105.000	1982.500	36975.000
AG	5	0	52100.000	19350.000	264600.000
REC (horses)	2	0	135150.000	81300.000	189000.000
TRANS	2	0	8940.000	7680.000	10200.000

OPEN SPACE 2 0 20850.000 17200.000 24500.000

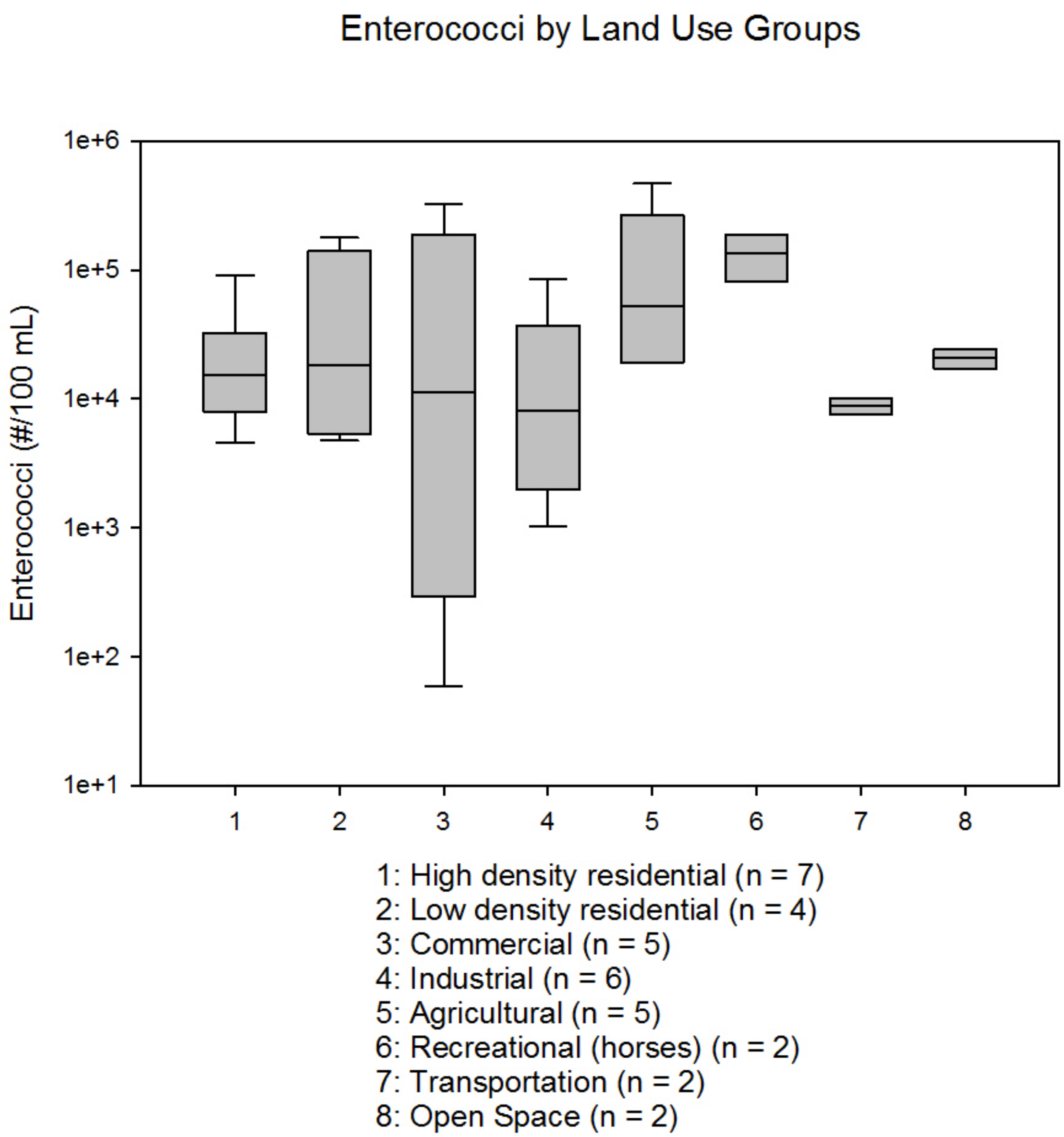
H = 8.584 with 7 degrees of freedom. (P = 0.284)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.284)





Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.001
0.01
0.1
1
10
100
1000
10000
100000
1000000
10000000
100000000
1000000000
1.0000E+10
1.0000E+11
Data
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
9.766 0.9762 7 0.144 0.940
9.935 1.634 4 0.259 0.489
8.639 3.469 5 0.182 0.819
8.965 1.592 6 0.135 0.949



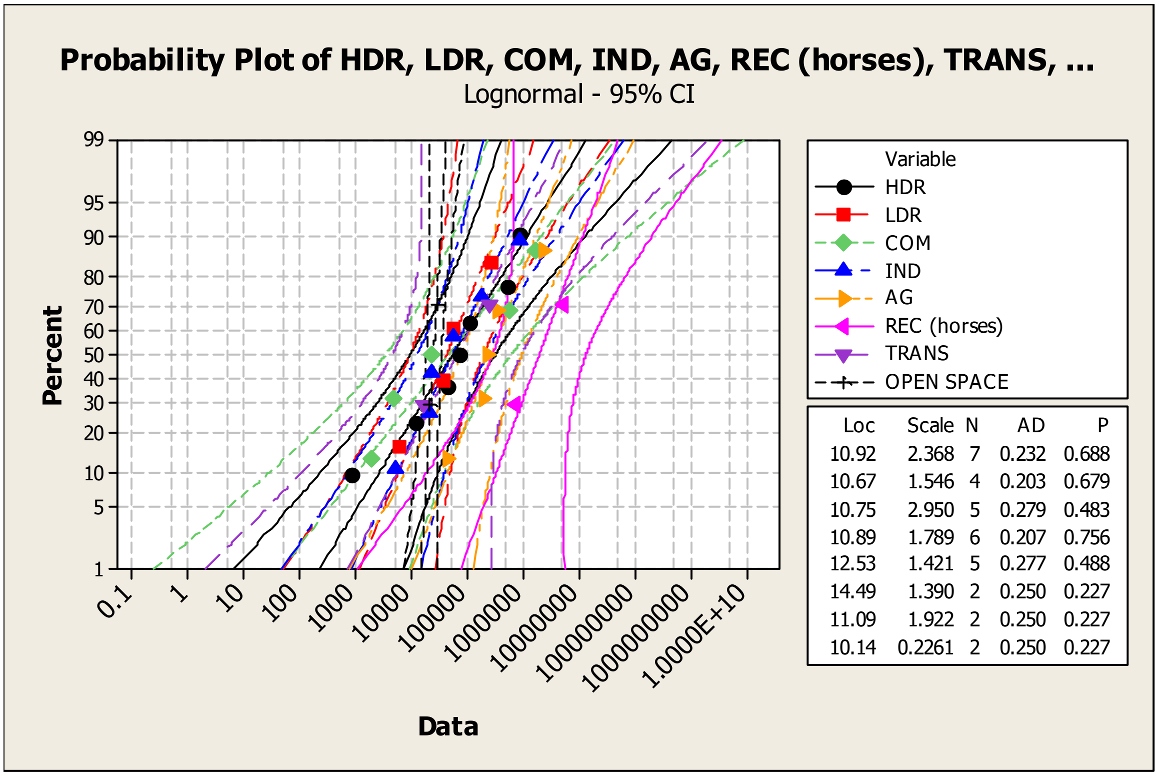
Total Coliforms by Land Use

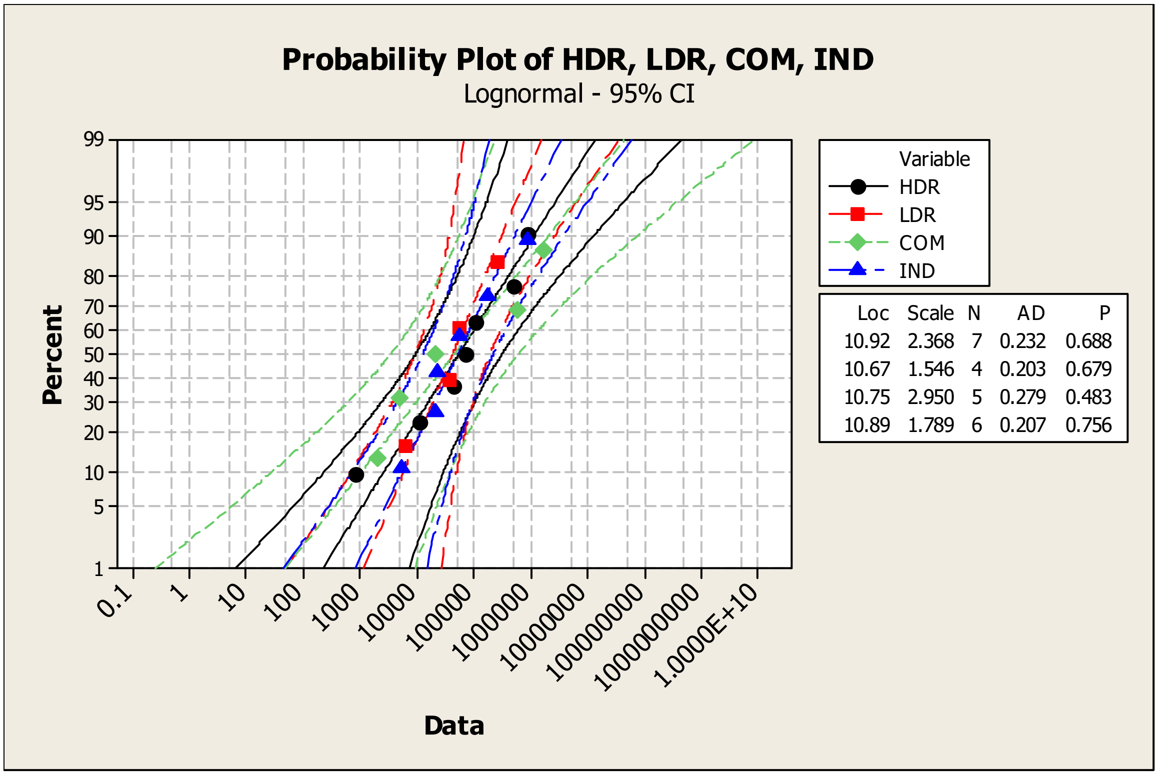
Kruskal-Wallis One Way Analysis of Variance on Ranks

Group	N	Missing	Median	25%	75%
HDR	7	0	75000.000	11600.000	524000.000
LDR	4	0	46250.000	13970.000	216350.000
COM	5	0	22300.000	3485.000	1144500.000
IND	6	0	39600.000	17857.500	352750.000
AG	5	0	224000.000	118800.000	1356000.000
REC (horses)	2	0	3004000.000	738000.000	5270000.000
TRANS	2	0	136450.000	16900.000	256000.000
OPEN SPACE	2	0	25550.000	21500.000	29600.000

H = 7.828 with 7 degrees of freedom. (P = 0.348)

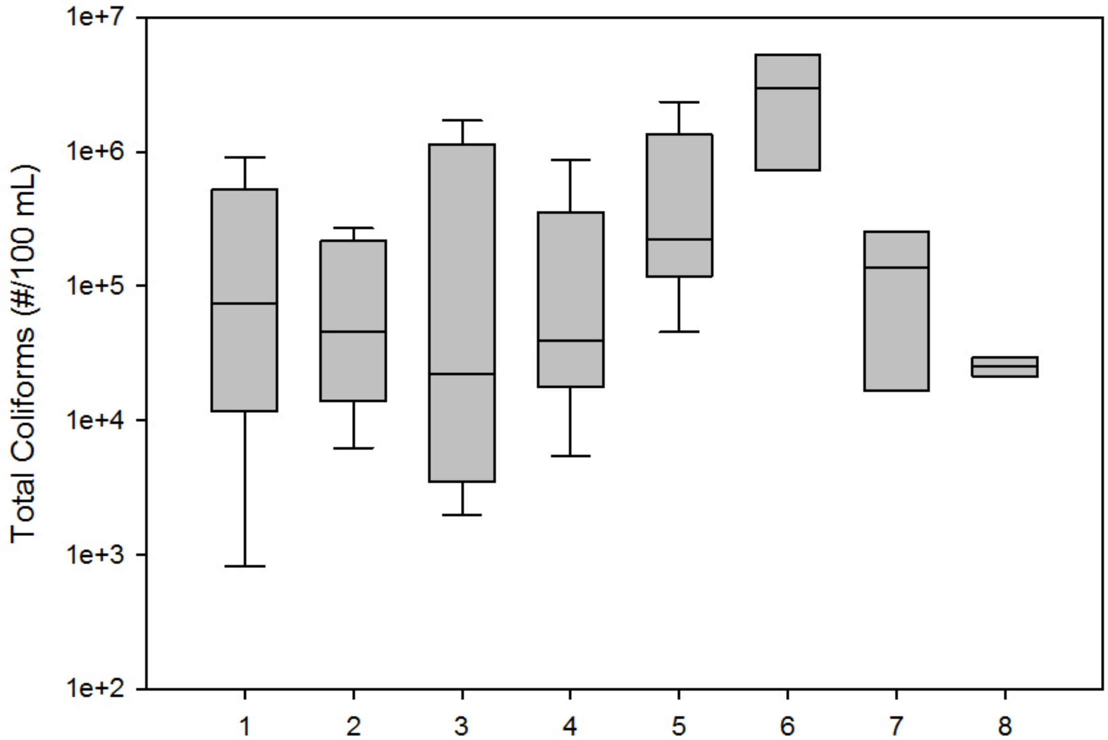
The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.348)





Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
1
10
100
1000
10000
100000
1000000
10000000
100000000
1000000000
1.0000E+10
Data
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
10.92 2.368 7 0.232 0.688
10.67 1.546 4 0.203 0.679
10.75 2.950 5 0.279 0.483
10.89 1.789 6 0.207 0.756

Total Coliforms by Land Use Groups



1: High density residential (n = 7)
2: Low density residential (n = 4)
3: Commercial (n = 5)
4: Industrial (n = 6)
5: Agricultural (n = 5)
6: Recreational (horses) (n = 2)
7: Transportation (n = 2)
8: Open Space (n = 2)

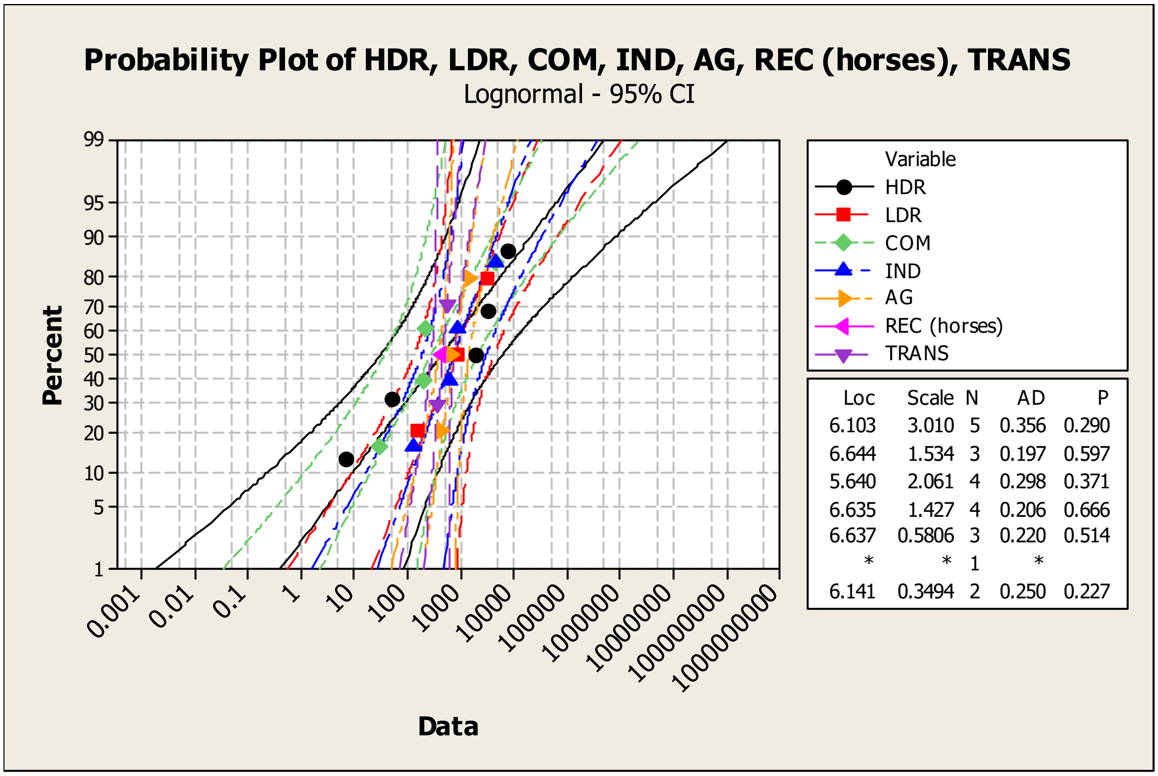
Total PAHs by Land Use

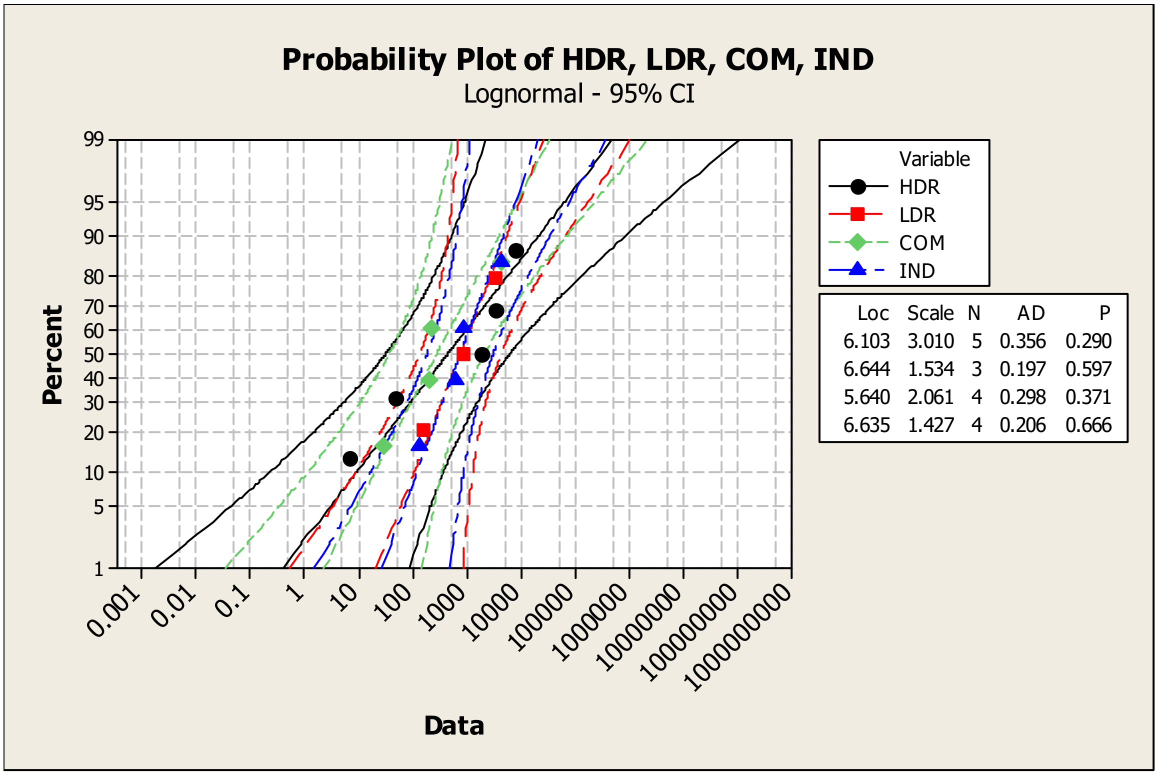
Kruskal-Wallis One Way Analysis of Variance on Ranks

Group	N	Missing	Median	25%	75%
HDR	5	0	1920.000	28.855	5575.000
LDR	3	0	886.000	155.000	3300.000
COM	4	0	217.500	74.500	3379.250
IND	4	0	760.000	259.750	3529.750
AG	3	0	683.000	455.000	1430.000
REC (horses)	1	0	458.000	458.000	458.000
TRANS	2	0	479.000	363.000	595.000

H = 1.226 with 6 degrees of freedom. (P = 0.976)

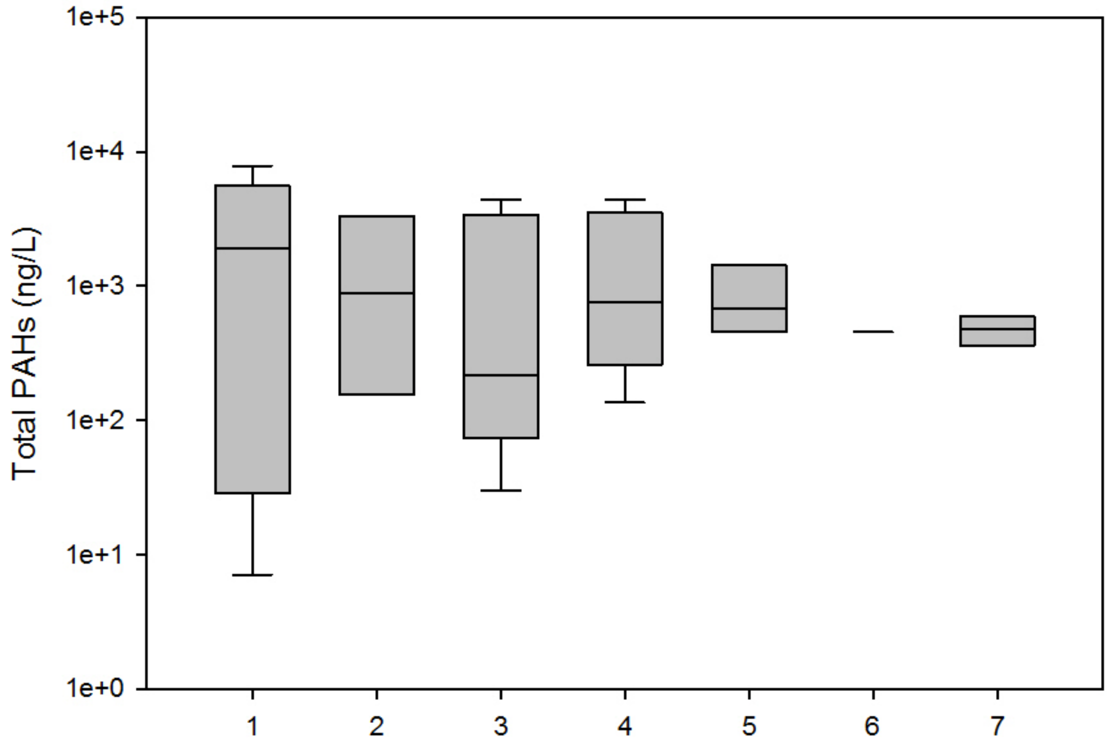
The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.976)





Probability Plot of HDR, LDR, COM, IND
Lognormal - 95% CI
Percent
Data
99
95
90
80
70
60
50
40
30
20
10
5
1
0.001
0.01
0.1
1
10
100
1000
10000
100000
1000000
10000000
100000000
1000000000
Variable
HDR
LDR
COM
IND
Loc Scale N AD P
6.103 3.010 5 0.356 0.290
6.644 1.534 3 0.197 0.597
5.640 2.061 4 0.298 0.371
6.635 1.427 4 0.206 0.666

Total PAHs by Land Use Groups



1: High density residential (n = 5)
2: Low density residential (n = 3)
3: Commercial (n = 4)
4: Industrial (n = 4)
5: Agricultural (n = 3)
6: Recreational (horses) (n = 1)
7: Transportation (n = 2)

Appendix M: PCB Congeners Particle Size Fractions and Loadings

Contents

Particulate Size Fractions and Loadings: PCB Congeners 001, 002, 003, 004, and 010

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	001 Results	001 fraction in size	002 Results	002 fraction in size	003 Results	003 fraction in size	004 Results	004 fraction in size	010 Results	010 fraction in size
average mass fraction in size 0.7 to 27 um		0.32		0.44		0.25		0.04		0.23
average mass fraction in size 2.7 to 20 um		0.33		0.29		0.45		0.54		0.31
average mass fraction in size 20 to 63 um		0.18		0.16		0.17		0.29		0.30
average mass fraction in size >63 um		0.17		0.10		0.12		0.13		0.15
particulate bound mass unit area complete watershed discharges (kg/yr)	2.17E-06		3.26E-06		6.62E-06		-2.04E-07		1.52E-06	
particulate discharge in size 0.7 to 27 um (kg/yr)		7.05E-07		1.44E-06		1.67E-06		-8.05E-09		3.53E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		7.06E-07		9.52E-07		2.99E-06		-1.11E-07		4.69E-07
particulate discharge in size 20 to 63 um (kg/yr)		3.99E-07		5.38E-07		1.14E-06		-5.89E-08		4.61E-07
particulate discharge in size >63 um (kg/yr)		3.59E-07		3.33E-07		8.20E-07		-2.61E-08		2.35E-07
Filtered mass complete watershed discharges (kg/yr)	6.20E-06		8.72E-06		1.36E-05		1.96E-05		6.17E-06	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	8.36E-06		1.20E-05		2.02E-05		1.94E-05		7.69E-06	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	001 Results	001 fraction in size	002 Results	002 fraction in size	003 Results	003 fraction in size	004 Results	004 fraction in size	010 Results	010 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.11		0.17		0.17		0.00		0.01
average mass fraction in size 20 to 63 um		0.33		0.36		0.36		0.54		0.99
average mass fraction in size >63 um		0.56		0.47		0.47		0.46		0.00
particulate bound mass unit area upper watershed discharges (kg/yr)	1.51E-04		2.34E-04		2.90E-04		1.27E-04		-1.18E-06	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		1.65E-05		4.01E-05		4.95E-05		0.00E+00		-1.23E-08
particulate discharge in size 20 to 63 um (kg/yr)		5.00E-05		8.38E-05		1.05E-04		6.85E-05		-1.17E-06
particulate discharge in size >63 um (kg/yr)		8.50E-05		1.10E-04		1.36E-04		5.88E-05		0.00E+00

Filtered mass upper watershed discharges (kg/yr)	1.04E-05		1.48E-05		1.98E-05		2.14E-05		2.85E-06	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	1.62E-04		2.49E-04		3.10E-04		1.49E-04		1.66E-06	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	001 Results	001 fraction in size	002 Results	002 fraction in size	003 Results	003 fraction in size	004 Results	004 fraction in size	010 Results	010 fraction in size
average mass fraction in size 0.7 to 27 um		0.16		0.17		0.17		0.08		0.13
average mass fraction in size 2.7 to 20 um		0.49		0.45		0.17		0.67		0.58
average mass fraction in size 20 to 63 um		0.35		0.27		0.47		0.16		0.27
average mass fraction in size >63 um		0.00		0.11		0.19		0.08		0.02
particulate bound mass unit area NBSD discharges (kg/yr)	7.87E-07		6.75E-07		2.68E-06		6.35E-07		3.43E-07	
particulate discharge in size 0.7 to 27 um (kg/yr)		3.82E-07		3.03E-07		4.63E-07		4.26E-07		1.98E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		2.77E-07		1.80E-07		1.25E-06		1.04E-07		9.32E-08
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		7.50E-08		5.02E-07		5.14E-08		8.21E-09
particulate discharge in size >63 um (kg/yr)		7.87E-07		6.75E-07		2.68E-06		6.35E-07		3.43E-07
Filtered mass NBSD discharges (kg/yr)	3.30E-06		3.79E-06		5.83E-06		5.67E-06		2.62E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	4.09E-06		4.47E-06		8.51E-06		6.30E-06		2.96E-06	

Particulate Size Fractions and Loadings: PCB Congeners 009, 007, 006, 008, and 005

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	009 Results	009 fraction in size	007 Results	007 fraction in size	006 Results	006 fraction in size	008 Results	008 fraction in size	005 Results	005 fraction in size
average mass fraction in size 0.7 to 27 um		0.20		0.40		0.06		0.16		0.15
average mass fraction in size 2.7 to 20 um		0.46		0.40		0.35		0.37		0.36
average mass fraction in size 20 to 63 um		0.24		0.20		0.51		0.46		0.48
average mass fraction in size >63 um		0.10		0.00		0.08		0.01		0.01
particulate bound mass unit area complete watershed discharges (kg/yr)	5.82E-07		1.26E-06		2.90E-06		2.16E-05		1.41E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.14E-07		5.00E-07		1.85E-07		3.56E-06		2.12E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		2.68E-07		5.10E-07		1.01E-06		7.92E-06		5.04E-06
particulate discharge in size 20 to 63 um (kg/yr)		1.42E-07		2.54E-07		1.47E-06		9.87E-06		6.79E-06
particulate discharge in size >63 um (kg/yr)		5.85E-08		0.00E+00		2.37E-07		2.30E-07		1.78E-07
Filtered mass complete watershed discharges (kg/yr)	4.53E-06		3.63E-06		6.45E-06		2.77E-05		1.83E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	5.11E-06		4.90E-06		9.35E-06		4.92E-05		3.24E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	009 Results	009 fraction in size	007 Results	007 fraction in size	006 Results	006 fraction in size	008 Results	008 fraction in size	005 Results	005 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.02		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.00		0.00		0.00		0.00		0.00
average mass fraction in size 20 to 63 um		0.50		0.50		0.48		1.00		1.00
average mass fraction in size >63 um		0.50		0.50		0.50		0.00		0.00
particulate bound mass unit area upper watershed discharges (kg/yr)	1.37E-05		1.49E-05		7.25E-05		-9.13E-06		-2.61E-06	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		1.34E-06		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		4.89E-08		0.00E+00		3.46E-07		0.00E+00		0.00E+00
particulate discharge in size 20 to 63 um (kg/yr)		6.86E-06		7.45E-06		3.49E-05		-9.13E-06		-2.61E-06
particulate discharge in size >63 um (kg/yr)		6.81E-06		7.45E-06		3.59E-05		0.00E+00		0.00E+00

Filtered mass upper watershed discharges (kg/yr)	3.88E-06		3.89E-06		5.24E-06		1.98E-05		1.05E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	1.76E-05		1.88E-05		7.77E-05		1.07E-05		7.93E-06	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	009 Results	009 fraction in size	007 Results	007 fraction in size	006 Results	006 fraction in size	008 Results	008 fraction in size	005 Results	005 fraction in size
average mass fraction in size 0.7 to 27 um		0.13		0.11		0.13		0.09		0.09
average mass fraction in size 2.7 to 20 um		0.38		0.35		0.57		0.62		0.61
average mass fraction in size 20 to 63 um		0.50		0.50		0.21		0.28		0.28
average mass fraction in size >63 um		0.00		0.05		0.09		0.02		0.02
particulate bound mass unit area NBSD discharges (kg/yr)	5.35E-08		4.49E-07		1.20E-06		6.80E-06		5.29E-06	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.02E-08		1.56E-07		6.85E-07		4.21E-06		3.24E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		2.66E-08		2.25E-07		2.51E-07		1.88E-06		1.50E-06
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		2.38E-08		1.04E-07		1.12E-07		1.02E-07
particulate discharge in size >63 um (kg/yr)		5.35E-08		4.53E-07		1.20E-06		6.82E-06		5.31E-06
Filtered mass NBSD discharges (kg/yr)	1.77E-06		1.62E-06		2.16E-06		1.02E-05		7.04E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	1.82E-06		2.07E-06		3.36E-06		1.70E-05		1.23E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 019, 018, 017, 015, and 027

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	019 Results	019 fraction in size	018 Results	018 fraction in size	017 Results	017 fraction in size	015 Results	015 fraction in size	027 Results	027 fraction in size
average mass fraction in size 0.7 to 27 um		0.31		0.11		0.09		0.26		0.16
average mass fraction in size 2.7 to 20 um		0.38		0.36		0.30		0.44		0.49
average mass fraction in size 20 to 63 um		0.31		0.45		0.50		0.20		0.18
average mass fraction in size >63 um		0.00		0.09		0.12		0.11		0.16
particulate bound mass unit area complete watershed discharges (kg/yr)	2.23E-06		3.57E-05		-4.32E-06		4.97E-05		-4.42E-06	
particulate discharge in size 0.7 to 27 um (kg/yr)		6.88E-07		3.81E-06		-3.79E-07		1.29E-05		-7.28E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		8.44E-07		1.27E-05		-1.28E-06		2.16E-05		-2.15E-06
particulate discharge in size 20 to 63 um (kg/yr)		6.98E-07		1.61E-05		-2.14E-06		9.95E-06		-8.17E-07
particulate discharge in size >63 um (kg/yr)		0.00E+00		3.10E-06		-5.20E-07		5.23E-06		-7.22E-07
Filtered mass complete watershed discharges (kg/yr)	2.72E-06		3.91E-05		2.96E-05		3.69E-05		1.30E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	4.95E-06		7.48E-05		2.53E-05		8.65E-05		8.57E-06	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	019 Results	019 fraction in size	018 Results	018 fraction in size	017 Results	017 fraction in size	015 Results	015 fraction in size	027 Results	027 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		0.04		0.00
average mass fraction in size 2.7 to 20 um		0.00		0.00		0.00		0.03		0.15
average mass fraction in size 20 to 63 um		1.00		0.50		0.50		0.46		0.60
average mass fraction in size >63 um		0.00		0.50		0.50		0.47		0.25
particulate bound mass unit area upper watershed discharges (kg/yr)	-3.73E-06		2.27E-04		2.61E-04		5.58E-04		5.62E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		1.99E-05		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		0.00E+00		1.39E-07		1.64E-05		8.44E-06
particulate discharge in size 20 to 63 um (kg/yr)		-3.73E-06		1.13E-04		1.30E-04		2.59E-04		3.40E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		1.13E-04		1.30E-04		2.63E-04		1.38E-05

Filtered mass upper watershed discharges (kg/yr)	4.61E-06		5.63E-05		1.11E-04		7.63E-05		5.48E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	8.82E-07		2.83E-04		3.72E-04		6.35E-04		1.11E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	019 Results	019 fraction in size	018 Results	018 fraction in size	017 Results	017 fraction in size	015 Results	015 fraction in size	027 Results	027 fraction in size
average mass fraction in size 0.7 to 27 um		0.05		0.05		0.02		0.14		0.01
average mass fraction in size 2.7 to 20 um		0.55		0.56		0.66		0.50		0.74
average mass fraction in size 20 to 63 um		0.40		0.22		0.21		0.34		0.25
average mass fraction in size >63 um		0.00		0.21		0.12		0.02		0.00
particulate bound mass unit area NBSD discharges (kg/yr)	5.57E-07		4.47E-06		4.04E-06		1.21E-05		4.30E-07	
particulate discharge in size 0.7 to 27 um (kg/yr)		3.06E-07		2.49E-06		2.67E-06		5.98E-06		3.18E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		2.21E-07		9.82E-07		8.58E-07		4.13E-06		1.08E-07
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		9.33E-07		5.02E-07		2.69E-07		0.00E+00
particulate discharge in size >63 um (kg/yr)		5.57E-07		4.63E-06		4.12E-06		1.21E-05		4.30E-07
Filtered mass NBSD discharges (kg/yr)	2.00E-06		1.48E-05		1.03E-05		1.67E-05		5.35E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	2.56E-06		1.93E-05		1.43E-05		2.87E-05		5.78E-06	

Particulate Size Fractions and Loadings: PCB Congeners: 024, 032, 016, 034, and 029

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	024 Results	024 fraction in size	032 Results	032 fraction in size	016 Results	016 fraction in size	034 Results	034 fraction in size	029 Results	029 fraction in size
average mass fraction in size 0.7 to 27 um		0.19		0.25		0.09		n/a		n/a
average mass fraction in size 2.7 to 20 um		0.41		0.66		0.51		n/a		n/a
average mass fraction in size 20 to 63 um		0.20		0.09		0.33		n/a		n/a
average mass fraction in size >63 um		0.21		0.00		0.07		n/a		n/a
particulate bound mass unit area complete watershed discharges (kg/yr)	-1.59E-06		1.76E-05		1.76E-05		nd		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		-3.00E-07		4.36E-06		1.52E-06		n/a		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		-6.50E-07		1.17E-05		9.01E-06		n/a		n/a
particulate discharge in size 20 to 63 um (kg/yr)		-3.14E-07		1.54E-06		5.78E-06		n/a		n/a
particulate discharge in size >63 um (kg/yr)		-3.28E-07		0.00E+00		1.27E-06		n/a		n/a
Filtered mass complete watershed discharges (kg/yr)	1.82E-05		1.32E-05		1.40E-05		nd		nd	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.66E-05		3.08E-05		3.16E-05		nd		nd	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	024 Results	024 fraction in size	032 Results	032 fraction in size	016 Results	016 fraction in size	034 Results	034 fraction in size	029 Results	029 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		n/a		n/a
average mass fraction in size 2.7 to 20 um		0.16		0.45		0.57		n/a		n/a
average mass fraction in size 20 to 63 um		0.42		0.55		0.43		n/a		n/a
average mass fraction in size >63 um		0.43		0.00		0.00		n/a		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	3.35E-04		-4.92E-06		4.03E-06		nd		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		n/a		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		5.29E-05		-2.23E-06		2.28E-06		n/a		n/a
particulate discharge in size 20 to 63 um (kg/yr)		1.39E-04		-2.69E-06		1.75E-06		n/a		n/a
particulate discharge in size >63 um (kg/yr)		1.43E-04		0.00E+00		0.00E+00		n/a		n/a

Filtered mass upper watershed discharges (kg/yr)	6.82E-05		1.51E-05		1.36E-05		nd		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	4.03E-04		1.02E-05		1.77E-05		nd		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	024 Results	024 fraction in size	032 Results	032 fraction in size	016 Results	016 fraction in size	034 Results	034 fraction in size	029 Results	029 fraction in size
average mass fraction in size 0.7 to 27 um		0.07		0.09		0.08		n/a		n/a
average mass fraction in size 2.7 to 20 um		0.72		0.66		0.54		n/a		n/a
average mass fraction in size 20 to 63 um		0.21		0.24		0.25		n/a		n/a
average mass fraction in size >63 um		0.00		0.01		0.14		n/a		n/a
particulate bound mass unit area NBSD discharges (kg/yr)	1.13E-06		5.15E-06		5.84E-06		nd		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		8.18E-07		3.42E-06		3.14E-06		n/a		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		2.36E-07		1.21E-06		1.44E-06		n/a		n/a
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		3.52E-08		8.11E-07		n/a		n/a
particulate discharge in size >63 um (kg/yr)		1.13E-06		5.15E-06		5.84E-06		n/a		n/a
Filtered mass NBSD discharges (kg/yr)	6.84E-06		5.20E-06		5.68E-06		nd		nd	
NBSD mass discharge (particulate plus filtered) (kg/yr)	7.96E-06		1.03E-05		1.15E-05		nd		nd	

Particulate Size Fractions and Loadings: PCB Congeners: 026, 025, 031, 028, and 020

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	026 Results	026 fraction in size	025 Results	025 fraction in size	031 Results	031 fraction in size	028 Results	028 fraction in size	020 Results	020 fraction in size
average mass fraction in size 0.7 to 27 um		0.47		0.34		0.17		0.27		0.19
average mass fraction in size 2.7 to 20 um		0.20		0.25		0.38		0.40		0.35
average mass fraction in size 20 to 63 um		0.31		0.31		0.38		0.33		0.40
average mass fraction in size >63 um		0.02		0.10		0.07		0.00		0.05
particulate bound mass unit area complete watershed discharges (kg/yr)	1.49E-05		-3.17E-06		7.58E-05		9.70E-05		5.85E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		7.06E-06		-1.09E-06		1.29E-05		2.65E-05		1.14E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		2.98E-06		-8.01E-07		2.88E-05		3.84E-05		2.07E-05
particulate discharge in size 20 to 63 um (kg/yr)		4.55E-06		-9.66E-07		2.91E-05		3.21E-05		2.33E-05
particulate discharge in size >63 um (kg/yr)		2.79E-07		-3.08E-07		4.98E-06		0.00E+00		3.04E-06
Filtered mass complete watershed discharges (kg/yr)	1.36E-05		2.16E-05		7.40E-05		3.07E-05		4.66E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	2.85E-05		1.84E-05		1.50E-04		1.28E-04		1.05E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	026 Results	026 fraction in size	025 Results	025 fraction in size	031 Results	031 fraction in size	028 Results	028 fraction in size	020 Results	020 fraction in size
average mass fraction in size 0.7 to 27 um		0.06		0.00		0.00		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.00		0.35		0.02		0.05		0.03
average mass fraction in size 20 to 63 um		0.94		0.17		0.52		0.51		0.54
average mass fraction in size >63 um		0.00		0.48		0.46		0.43		0.43
particulate bound mass unit area upper watershed discharges (kg/yr)	1.37E-06		6.35E-04		6.09E-04		2.11E-04		4.32E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		8.36E-08		0.00E+00		0.00E+00		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		2.25E-04		1.27E-05		1.14E-05		1.30E-05
particulate discharge in size 20 to 63 um (kg/yr)		1.29E-06		1.08E-04		3.17E-04		1.08E-04		2.34E-04
particulate discharge in size >63 um (kg/yr)		0.00E+00		3.01E-04		2.79E-04		9.12E-05		1.85E-04

Filtered mass upper watershed discharges (kg/yr)	9.19E-06		5.65E-05		1.74E-04		4.10E-05		1.13E-04	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	1.06E-05		6.91E-04		7.83E-04		2.52E-04		5.45E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	026 Results	026 fraction in size	025 Results	025 fraction in size	031 Results	031 fraction in size	028 Results	028 fraction in size	020 Results	020 fraction in size
average mass fraction in size 0.7 to 27 um		0.19		0.12		0.06		0.06		0.06
average mass fraction in size 2.7 to 20 um		0.37		0.47		0.44		0.57		0.57
average mass fraction in size 20 to 63 um		0.44		0.27		0.50		0.18		0.26
average mass fraction in size >63 um		0.00		0.14		0.00		0.19		0.11
particulate bound mass unit area NBSD discharges (kg/yr)	8.07E-06		4.03E-06		2.23E-05		2.44E-05		1.55E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.99E-06		1.90E-06		9.83E-06		1.39E-05		8.78E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		3.52E-06		1.09E-06		1.12E-05		4.35E-06		4.09E-06
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		5.62E-07		0.00E+00		4.60E-06		1.67E-06
particulate discharge in size >63 um (kg/yr)		8.07E-06		4.03E-06		2.23E-05		2.44E-05		1.55E-05
Filtered mass NBSD discharges (kg/yr)	7.24E-06		8.16E-06		2.06E-05		9.99E-06		1.09E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	1.53E-05		1.22E-05		4.29E-05		3.44E-05		2.64E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 022, 045, 046, 069, and 052

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	022 Results	022 fraction in size	045 Results	045 fraction in size	046 Results	046 fraction in size	069 Results	069 fraction in size	052 Results	052 fraction in size
average mass fraction in size 0.7 to 27 um		0.15		0.04		n/a		n/a		0.22
average mass fraction in size 2.7 to 20 um		0.43		0.45		n/a		n/a		0.39
average mass fraction in size 20 to 63 um		0.30		0.46		n/a		n/a		0.38
average mass fraction in size >63 um		0.12		0.05		n/a		n/a		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	2.05E-05		1.42E-05		nd		nd		1.77E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		3.05E-06		5.53E-07		n/a		n/a		3.89E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		8.85E-06		6.40E-06		n/a		n/a		6.98E-05
particulate discharge in size 20 to 63 um (kg/yr)		6.17E-06		6.50E-06		n/a		n/a		6.77E-05
particulate discharge in size >63 um (kg/yr)		2.43E-06		7.20E-07		n/a		n/a		7.07E-07
Filtered mass complete watershed discharges (kg/yr)	2.23E-05		1.52E-05		nd		nd		9.80E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	4.27E-05		2.93E-05		nd		nd		2.75E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	022 Results	022 fraction in size	045 Results	045 fraction in size	046 Results	046 fraction in size	069 Results	069 fraction in size	052 Results	052 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.01		n/a		n/a		0.00
average mass fraction in size 2.7 to 20 um		0.13		0.50		n/a		n/a		0.16
average mass fraction in size 20 to 63 um		0.46		0.49		n/a		n/a		0.42
average mass fraction in size >63 um		0.41		0.00		n/a		n/a		0.41
particulate bound mass unit area upper watershed discharges (kg/yr)	9.75E-05		-1.56E-05		nd		nd		2.31E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		-1.38E-07		n/a		n/a		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		1.24E-05		-7.80E-06		n/a		n/a		3.81E-05
particulate discharge in size 20 to 63 um (kg/yr)		4.48E-05		-7.66E-06		n/a		n/a		9.80E-05

particulate discharge in size >63 um (kg/yr)		4.03E-05		0.00E+00		n/a		n/a		9.49E-05
Filtered mass upper watershed discharges (kg/yr)	4.79E-05		2.07E-05		nd		nd		7.77E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	1.45E-04		5.08E-06		nd		nd		3.09E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	022 Results	022 fraction in size	045 Results	045 fraction in size	046 Results	046 fraction in size	069 Results	069 fraction in size	052 Results	052 fraction in size
average mass fraction in size 0.7 to 27 um		0.06		0.07		n/a		n/a		0.08
average mass fraction in size 2.7 to 20 um		0.41		0.52		n/a		n/a		0.46
average mass fraction in size 20 to 63 um		0.33		0.23		n/a		n/a		0.23
average mass fraction in size >63 um		0.20		0.18		n/a		n/a		0.22
particulate bound mass unit area NBSD discharges (kg/yr)	8.18E-06		4.29E-06		nd		nd		1.14E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		3.37E-06		2.22E-06		n/a		n/a		5.32E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		2.73E-06		9.91E-07		n/a		n/a		2.67E-05
particulate discharge in size 20 to 63 um (kg/yr)		1.60E-06		7.57E-07		n/a		n/a		2.49E-05
particulate discharge in size >63 um (kg/yr)		8.18E-06		4.29E-06		n/a		n/a		1.14E-04
Filtered mass NBSD discharges (kg/yr)	7.00E-06		4.81E-06		nd		nd		5.73E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	1.52E-05		9.10E-06		nd		nd		1.72E-04	

Particulate Size Fractions and Loadings: PCB Congeners: 047, 048, 044, 042, and 037

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	047 Results	047 fraction in size	048 Results	048 fraction in size	044 Results	044 fraction in size	042 Results	042 fraction in size	037 Results	037 fraction in size
average mass fraction in size 0.7 to 27 um		0.36		0.31		0.25		0.17		0.26
average mass fraction in size 2.7 to 20 um		0.32		0.25		0.42		0.49		0.30
average mass fraction in size 20 to 63 um		0.32		0.32		0.33		0.33		0.44
average mass fraction in size >63 um		0.00		0.12		0.00		0.02		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	4.67E-05		2.74E-05		1.62E-04		5.32E-05		7.58E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.67E-05		8.54E-06		4.11E-05		8.92E-06		1.95E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		1.51E-05		6.83E-06		6.76E-05		2.60E-05		2.27E-05
particulate discharge in size 20 to 63 um (kg/yr)		1.49E-05		8.84E-06		5.36E-05		1.73E-05		3.36E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		3.15E-06		0.00E+00		9.66E-07		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	1.63E-05		5.84E-06		4.65E-05		8.44E-06		2.24E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	6.30E-05		3.32E-05		2.09E-04		6.17E-05		9.82E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	047 Results	047 fraction in size	048 Results	048 fraction in size	044 Results	044 fraction in size	042 Results	042 fraction in size	037 Results	037 fraction in size
average mass fraction in size 0.7 to 27 um		0.03		0.01		0.00		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.00		0.08		0.14		0.08		0.33
average mass fraction in size 20 to 63 um		0.97		0.91		0.47		0.92		0.67
average mass fraction in size >63 um		0.00		0.00		0.39		0.00		0.00
particulate bound mass unit area upper watershed discharges (kg/yr)	-8.77E-06		2.83E-07		1.61E-04		-1.85E-06		1.56E-07	
particulate discharge in size 0.7 to 27 um (kg/yr)		-3.03E-07		1.58E-09		0.00E+00		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		2.27E-08		2.29E-05		-1.45E-07		5.09E-08
particulate discharge in size 20 to 63 um (kg/yr)		-8.47E-06		2.58E-07		7.49E-05		-1.71E-06		1.05E-07

particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		6.30E-05		0.00E+00		0.00E+00
Filtered mass upper watershed discharges (kg/yr)	1.79E-05		3.28E-06		3.39E-05		7.35E-06		2.17E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	9.08E-06		3.57E-06		1.95E-04		5.49E-06		2.18E-05	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	047 Results	047 fraction in size	048 Results	048 fraction in size	044 Results	044 fraction in size	042 Results	042 fraction in size	037 Results	037 fraction in size
average mass fraction in size 0.7 to 27 um		0.19		0.08		0.08		0.06		n/a
average mass fraction in size 2.7 to 20 um		0.30		0.47		0.49		0.58		n/a
average mass fraction in size 20 to 63 um		0.41		0.27		0.37		0.14		n/a
average mass fraction in size >63 um		0.10		0.19		0.07		0.23		n/a
particulate bound mass unit area NBSD discharges (kg/yr)	2.22E-05		3.84E-05		6.04E-05		1.96E-05		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		6.69E-06		1.79E-05		2.93E-05		1.13E-05		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		9.00E-06		1.03E-05		2.22E-05		2.66E-06		n/a
particulate discharge in size 20 to 63 um (kg/yr)		2.20E-06		7.29E-06		4.22E-06		4.49E-06		n/a
particulate discharge in size >63 um (kg/yr)		2.22E-05		3.84E-05		6.04E-05		1.96E-05		n/a
Filtered mass NBSD discharges (kg/yr)	1.45E-05		4.22E-06		2.80E-05		7.78E-06		nd	
NBSD mass discharge (particulate plus filtered) (kg/yr)	3.68E-05		4.27E-05		8.85E-05		2.74E-05		nd	

Particulate Size Fractions and Loadings: PCB Congeners: 071, 041, 103, 040, and 067

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	071 Results	071 fraction in size	041 Results	041 fraction in size	103 Results	103 fraction in size	040 Results	040 fraction in size	067 Results	067 fraction in size
average mass fraction in size 0.7 to 27 um		0.20		0.07		0.42		0.15		n/a
average mass fraction in size 2.7 to 20 um		0.51		0.57		0.09		0.53		n/a
average mass fraction in size 20 to 63 um		0.28		0.35		0.49		0.31		n/a
average mass fraction in size >63 um		0.01		0.00		0.00		0.02		n/a
particulate bound mass unit area complete watershed discharges (kg/yr)	4.62E-05		1.83E-04		1.11E-04		3.09E-05		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		9.27E-06		1.35E-05		4.66E-05		4.56E-06		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		2.35E-05		1.05E-04		9.73E-06		1.64E-05		n/a
particulate discharge in size 20 to 63 um (kg/yr)		1.29E-05		6.48E-05		5.51E-05		9.46E-06		n/a
particulate discharge in size >63 um (kg/yr)		5.62E-07		0.00E+00		0.00E+00		5.02E-07		n/a
Filtered mass complete watershed discharges (kg/yr)	9.32E-06		3.12E-05		6.70E-05		1.55E-05		nd	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	5.55E-05		2.15E-04		1.78E-04		4.64E-05		nd	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	071 Results	071 fraction in size	041 Results	041 fraction in size	103 Results	103 fraction in size	040 Results	040 fraction in size	067 Results	067 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		0.00		n/a
average mass fraction in size 2.7 to 20 um		0.04		0.02		0.28		0.05		n/a
average mass fraction in size 20 to 63 um		0.50		0.56		0.72		0.95		n/a
average mass fraction in size >63 um		0.45		0.43		0.00		0.00		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	2.46E-04		2.72E-04		1.21E-05		-5.71E-06		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		0.00E+00		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		1.09E-05		4.66E-06		3.34E-06		-2.86E-07		n/a
particulate discharge in size 20 to 63 um (kg/yr)		1.24E-04		1.52E-04		8.72E-06		-5.43E-06		n/a
particulate discharge in size >63 um (kg/yr)		1.11E-04		1.16E-04		0.00E+00		0.00E+00		n/a

Filtered mass upper watershed discharges (kg/yr)	2.77E-05		4.60E-05		4.00E-05		1.29E-05		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	2.74E-04		3.18E-04		5.20E-05		7.15E-06		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	071 Results	071 fraction in size	041 Results	041 fraction in size	103 Results	103 fraction in size	040 Results	040 fraction in size	067 Results	067 fraction in size
average mass fraction in size 0.7 to 27 um		0.04		0.07		0.13		0.10		n/a
average mass fraction in size 2.7 to 20 um		0.50		0.48		0.49		0.50		n/a
average mass fraction in size 20 to 63 um		0.29		0.31		0.13		0.22		n/a
average mass fraction in size >63 um		0.17		0.14		0.25		0.18		n/a
particulate bound mass unit area NBSD discharges (kg/yr)	1.77E-05		5.93E-05		6.56E-06		7.71E-06		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		8.82E-06		2.83E-05		3.22E-06		3.83E-06		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		5.14E-06		1.84E-05		8.26E-07		1.69E-06		n/a
particulate discharge in size 20 to 63 um (kg/yr)		2.95E-06		8.33E-06		1.64E-06		1.42E-06		n/a
particulate discharge in size >63 um (kg/yr)		1.77E-05		5.93E-05		6.56E-06		7.71E-06		n/a
Filtered mass NBSD discharges (kg/yr)	9.34E-06		1.92E-05		1.21E-05		6.07E-06		nd	
NBSD mass discharge (particulate plus filtered) (kg/yr)	2.70E-05		7.85E-05		1.86E-05		1.38E-05		nd	

Particulate Size Fractions and Loadings: PCB Congeners: 074, 070, 066, 095, and 093

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	074 Results	074 fraction in size	070 Results	070 fraction in size	066 Results	066 fraction in size	095 Results	095 fraction in size	093 Results	093 fraction in size
average mass fraction in size 0.7 to 27 um		0.35		0.38		0.26		0.33		0.36
average mass fraction in size 2.7 to 20 um		0.43		0.42		0.45		0.37		0.38
average mass fraction in size 20 to 63 um		0.20		0.20		0.29		0.28		0.25
average mass fraction in size >63 um		0.02		0.00		0.00		0.01		0.01
particulate bound mass unit area complete watershed discharges (kg/yr)	1.76E-05		6.17E-05		1.55E-04		1.46E-04		1.47E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		6.21E-06		2.33E-05		4.05E-05		4.85E-05		5.23E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		7.55E-06		2.61E-05		6.94E-05		5.46E-05		5.54E-05
particulate discharge in size 20 to 63 um (kg/yr)		3.50E-06		1.23E-05		4.47E-05		4.09E-05		3.70E-05
particulate discharge in size >63 um (kg/yr)		3.41E-07		0.00E+00		0.00E+00		2.01E-06		2.02E-06
Filtered mass complete watershed discharges (kg/yr)	1.10E-05		1.78E-05		2.87E-05		6.33E-05		6.28E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	2.86E-05		7.95E-05		1.83E-04		2.09E-04		2.09E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	074 Results	074 fraction in size	070 Results	070 fraction in size	066 Results	066 fraction in size	095 Results	095 fraction in size	093 Results	093 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		0.14		0.00
average mass fraction in size 2.7 to 20 um		0.07		0.09		0.09		0.13		0.34
average mass fraction in size 20 to 63 um		0.09		0.00		0.46		0.34		0.29
average mass fraction in size >63 um		0.84		0.91		0.44		0.39		0.38
particulate bound mass unit area upper watershed discharges (kg/yr)	1.04E-04		3.86E-04		4.25E-04		2.48E-04		2.48E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		3.46E-05		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		7.75E-06		3.49E-05		3.92E-05		3.16E-05		8.33E-05
particulate discharge in size 20 to 63 um (kg/yr)		9.03E-06		0.00E+00		1.98E-04		8.51E-05		7.09E-05
particulate discharge in size >63 um (kg/yr)		8.75E-05		3.52E-04		1.88E-04		9.62E-05		9.33E-05

Filtered mass upper watershed discharges (kg/yr)	9.73E-06		3.40E-05		3.54E-05		3.81E-05		3.81E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	1.14E-04		4.20E-04		4.61E-04		2.86E-04		2.86E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	074 Results	074 fraction in size	070 Results	070 fraction in size	066 Results	066 fraction in size	095 Results	095 fraction in size	093 Results	093 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.06		0.04		0.04
average mass fraction in size 2.7 to 20 um		0.43		0.37		0.51		0.46		0.46
average mass fraction in size 20 to 63 um		0.44		0.60		0.38		0.47		0.47
average mass fraction in size >63 um		0.13		0.02		0.05		0.04		0.04
particulate bound mass unit area NBSD discharges (kg/yr)	1.28E-06		2.46E-06		9.09E-05		8.67E-05		8.66E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		5.53E-07		9.15E-07		4.61E-05		3.99E-05		3.98E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		5.70E-07		1.48E-06		3.42E-05		4.03E-05		4.04E-05
particulate discharge in size 20 to 63 um (kg/yr)		1.60E-07		6.02E-08		4.96E-06		3.05E-06		3.07E-06
particulate discharge in size >63 um (kg/yr)		1.28E-06		2.46E-06		9.09E-05		8.67E-05		8.66E-05
Filtered mass NBSD discharges (kg/yr)	1.36E-06		3.89E-06		2.83E-05		4.05E-05		4.07E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	2.64E-06		6.35E-06		1.19E-04		1.27E-04		1.27E-04	

Particulate Size Fractions and Loadings: PCB Congeners: 056, 060, 092, 084, and 101

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	056 Results	056 fraction in size	060 Results	060 fraction in size	092 Results	092 fraction in size	084 Results	084 fraction in size	101 Results	101 fraction in size
average mass fraction in size 0.7 to 27 um		0.16		0.15		0.16		0.34		0.27
average mass fraction in size 2.7 to 20 um		0.54		0.55		0.44		0.36		0.44
average mass fraction in size 20 to 63 um		0.30		0.30		0.29		0.31		0.29
average mass fraction in size >63 um		0.00		0.00		0.11		0.00		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	6.70E-05		6.69E-05		8.40E-05		9.21E-05		4.44E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.05E-05		1.00E-05		1.37E-05		3.11E-05		1.18E-04
particulate discharge in size 2.7 to 20 um (kg/yr)		3.65E-05		3.68E-05		3.68E-05		3.28E-05		1.97E-04
particulate discharge in size 20 to 63 um (kg/yr)		2.01E-05		2.00E-05		2.40E-05		2.83E-05		1.30E-04
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		9.47E-06		0.00E+00		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	2.34E-05		2.22E-05		4.04E-05		3.10E-05		1.52E-04	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	9.04E-05		8.90E-05		1.24E-04		1.23E-04		5.96E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	056 Results	056 fraction in size	060 Results	060 fraction in size	092 Results	092 fraction in size	084 Results	084 fraction in size	101 Results	101 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.07		0.05		0.08		0.10		0.09
average mass fraction in size 20 to 63 um		0.48		0.50		0.43		0.46		0.48
average mass fraction in size >63 um		0.45		0.45		0.49		0.44		0.43
particulate bound mass unit area upper watershed discharges (kg/yr)	3.13E-04		3.18E-04		3.95E-03		1.15E-04		8.93E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		2.13E-05		1.60E-05		3.03E-04		1.12E-05		7.93E-05
particulate discharge in size 20 to 63 um (kg/yr)		1.52E-04		1.60E-04		1.69E-03		5.32E-05		4.32E-04
particulate discharge in size >63 um (kg/yr)		1.40E-04		1.42E-04		1.96E-03		5.08E-05		3.82E-04

Filtered mass upper watershed discharges (kg/yr)	3.97E-05		3.88E-05		6.15E-05		2.65E-05		1.20E-04	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	3.53E-04		3.57E-04		4.01E-03		1.42E-04		1.01E-03	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	056 Results	056 fraction in size	060 Results	060 fraction in size	092 Results	092 fraction in size	084 Results	084 fraction in size	101 Results	101 fraction in size
average mass fraction in size 0.7 to 27 um		0.06		0.06		0.06		0.07		0.06
average mass fraction in size 2.7 to 20 um		0.53		0.52		0.56		0.46		0.50
average mass fraction in size 20 to 63 um		0.39		0.38		0.37		0.43		0.41
average mass fraction in size >63 um		0.03		0.04		0.00		0.03		0.03
particulate bound mass unit area NBSD discharges (kg/yr)	2.43E-05		2.41E-05		5.26E-05		5.44E-05		3.17E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.28E-05		1.26E-05		2.97E-05		2.51E-05		1.59E-04
particulate discharge in size 2.7 to 20 um (kg/yr)		9.36E-06		9.16E-06		1.96E-05		2.35E-05		1.29E-04
particulate discharge in size 20 to 63 um (kg/yr)		7.46E-07		9.16E-07		0.00E+00		1.82E-06		1.07E-05
particulate discharge in size >63 um (kg/yr)		2.43E-05		2.41E-05		5.26E-05		5.44E-05		3.17E-04
Filtered mass NBSD discharges (kg/yr)	1.08E-05		1.02E-05		2.43E-05		2.47E-05		1.11E-04	
NBSD mass discharge (particulate plus filtered) (kg/yr)	3.51E-05		3.43E-05		7.68E-05		7.91E-05		4.29E-04	

Particulate Size Fractions and Loadings: PCB Congeners: 099, 119, 083, 087, and 081

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	099 Results	099 fraction in size	119 Results	119 fraction in size	083 Results	083 fraction in size	087 Results	087 fraction in size	81 Results	081 fraction in size
average mass fraction in size 0.7 to 27 um		0.26		0.00		0.00		0.13		0.00
average mass fraction in size 2.7 to 20 um		0.46		0.00		1.00		0.53		0.58
average mass fraction in size 20 to 63 um		0.28		1.00		0.00		0.33		0.42
average mass fraction in size >63 um		0.00		0.00		0.00		0.00		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	1.68E-04		4.07E-07		3.99E-06		3.35E-04		1.01E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		4.39E-05		0.00E+00		0.00E+00		4.51E-05		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		7.67E-05		0.00E+00		3.99E-06		1.78E-04		5.87E-06
particulate discharge in size 20 to 63 um (kg/yr)		4.74E-05		4.07E-07		0.00E+00		1.12E-04		4.19E-06
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	6.96E-05		4.30E-06		1.28E-05		6.76E-05		5.54E-06	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	2.38E-04		4.71E-06		1.68E-05		4.02E-04		1.56E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	099 Results	099 fraction in size	119 Results	119 fraction in size	083 Results	083 fraction in size	087 Results	087 fraction in size	81 Results	081 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		n/a		n/a		0.00		n/a
average mass fraction in size 2.7 to 20 um		0.08		n/a		n/a		0.06		n/a
average mass fraction in size 20 to 63 um		0.49		n/a		n/a		0.52		n/a
average mass fraction in size >63 um		0.43		n/a		n/a		0.42		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	5.85E-04		nd		nd		3.41E-04		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		n/a		n/a		0.00E+00		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		4.61E-05		n/a		n/a		2.00E-05		n/a
particulate discharge in size 20 to 63 um (kg/yr)		2.88E-04		n/a		n/a		1.77E-04		n/a
particulate discharge in size >63 um (kg/yr)		2.51E-04		n/a		n/a		1.44E-04		n/a

Filtered mass upper watershed discharges (kg/yr)	1.05E-04		nd		nd		4.79E-05		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	6.91E-04		nd		nd		3.89E-04		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	099 Results	099 fraction in size	119 Results	119 fraction in size	083 Results	083 fraction in size	087 Results	087 fraction in size	81 Results	081 fraction in size
average mass fraction in size 0.7 to 27 um		0.05		0.04		0.00		0.01		0.14
average mass fraction in size 2.7 to 20 um		0.53		0.96		1.00		0.72		0.86
average mass fraction in size 20 to 63 um		0.38		0.00		0.00		0.19		0.00
average mass fraction in size >63 um		0.05		0.00		0.00		0.08		0.00
particulate bound mass unit area NBSD discharges (kg/yr)	1.85E-04		1.74E-05		-6.15E-06		1.38E-04		1.27E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		9.75E-05		1.67E-05		-6.15E-06		9.93E-05		1.10E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		6.96E-05		0.00E+00		0.00E+00		2.66E-05		0.00E+00
particulate discharge in size 20 to 63 um (kg/yr)		8.67E-06		0.00E+00		0.00E+00		1.12E-05		0.00E+00
particulate discharge in size >63 um (kg/yr)		1.85E-04		1.74E-05		-6.15E-06		1.38E-04		1.27E-05
Filtered mass NBSD discharges (kg/yr)	5.98E-05		3.93E-06		2.29E-05		4.92E-05		5.55E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	2.45E-04		2.13E-05		1.68E-05		1.88E-04		1.82E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 115, 136, 110, 077, and 082

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	115 Results	115 fraction in size	136 Results	136 fraction in size	110 Results	110 fraction in size	77 Results	077 fraction in size	082 Results	082 fraction in size
average mass fraction in size 0.7 to 27 um		0.23		0.15		0.12		0.24		0.10
average mass fraction in size 2.7 to 20 um		0.43		0.54		0.56		0.50		0.53
average mass fraction in size 20 to 63 um		0.34		0.32		0.31		0.22		0.37
average mass fraction in size >63 um		0.00		0.00		0.00		0.04		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	1.26E-04		7.95E-05		6.97E-04		9.26E-05		7.68E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.92E-05		1.19E-05		8.69E-05		2.20E-05		7.74E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		5.44E-05		4.26E-05		3.93E-04		4.60E-05		4.05E-05
particulate discharge in size 20 to 63 um (kg/yr)		4.27E-05		2.51E-05		2.17E-04		2.07E-05		2.85E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		3.85E-06		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	3.20E-05		1.87E-05		1.22E-04		2.84E-05		3.69E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.58E-04		9.82E-05		8.19E-04		1.21E-04		1.14E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	115 Results	115 fraction in size	136 Results	136 fraction in size	110 Results	110 fraction in size	77 Results	077 fraction in size	082 Results	082 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.00		0.00		0.01
average mass fraction in size 2.7 to 20 um		0.14		0.14		0.05		0.05		0.07
average mass fraction in size 20 to 63 um		0.86		0.64		0.52		0.50		0.43
average mass fraction in size >63 um		0.00		0.21		0.44		0.45		0.49
particulate bound mass unit area upper watershed discharges (kg/yr)	1.41E-05		2.43E-05		1.70E-03		6.56E-04		1.72E-03	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		0.00E+00		1.28E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		1.93E-06		3.48E-06		7.96E-05		3.37E-05		1.21E-04
particulate discharge in size 20 to 63 um (kg/yr)		1.22E-05		1.57E-05		8.81E-04		3.28E-04		7.37E-04
particulate discharge in size >63 um (kg/yr)		0.00E+00		5.15E-06		7.41E-04		2.94E-04		8.49E-04

Filtered mass upper watershed discharges (kg/yr)	1.83E-05		1.19E-05		1.00E-04		5.29E-05		2.92E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	3.24E-05		3.61E-05		1.80E-03		7.09E-04		1.75E-03	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	115 Results	115 fraction in size	136 Results	136 fraction in size	110 Results	110 fraction in size	77 Results	077 fraction in size	082 Results	082 fraction in size
average mass fraction in size 0.7 to 27 um		0.02		0.06		0.04		0.07		0.07
average mass fraction in size 2.7 to 20 um		0.73		0.48		0.51		0.55		0.46
average mass fraction in size 20 to 63 um		0.25		0.41		0.28		0.39		0.22
average mass fraction in size >63 um		0.00		0.05		0.17		0.00		0.25
particulate bound mass unit area NBSD discharges (kg/yr)	6.80E-05		2.64E-05		3.43E-04		2.20E-05		3.02E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		4.94E-05		1.25E-05		1.75E-04		1.20E-05		1.39E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		1.70E-05		1.09E-05		9.63E-05		8.47E-06		6.61E-06
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		1.30E-06		5.77E-05		0.00E+00		7.63E-06
particulate discharge in size >63 um (kg/yr)		6.80E-05		2.64E-05		3.43E-04		2.20E-05		3.02E-05
Filtered mass NBSD discharges (kg/yr)	2.62E-05		1.25E-05		1.08E-04		1.47E-05		1.54E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	9.42E-05		3.89E-05		4.51E-04		3.66E-05		4.57E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 151, 135, 144, 147, and 107

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	151 Results	151 fraction in size	135 Results	135 fraction in size	144 Results	144 fraction in size	147 Results	147 fraction in size	107 Results	107 fraction in size
average mass fraction in size 0.7 to 27 um		0.19		0.10		0.20		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.51		0.63		0.40		0.00		0.39
average mass fraction in size 20 to 63 um		0.30		0.27		0.40		0.32		0.61
average mass fraction in size >63 um		0.00		0.00		0.00		0.68		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	1.53E-04		6.11E-05		4.40E-05		1.93E-05		-6.24E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.84E-05		5.93E-06		8.77E-06		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		7.87E-05		3.87E-05		1.76E-05		0.00E+00		-2.41E-05
particulate discharge in size 20 to 63 um (kg/yr)		4.58E-05		1.65E-05		1.77E-05		6.21E-06		-3.83E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		1.31E-05		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	2.93E-05		1.11E-05		6.99E-06		7.78E-06		1.04E-04	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.82E-04		7.23E-05		5.10E-05		2.71E-05		4.21E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	151 Results	151 fraction in size	135 Results	135 fraction in size	144 Results	144 fraction in size	147 Results	147 fraction in size	107 Results	107 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.03		n/a		0.67
average mass fraction in size 2.7 to 20 um		0.06		0.06		0.00		n/a		0.00
average mass fraction in size 20 to 63 um		0.51		0.49		0.97		n/a		0.33
average mass fraction in size >63 um		0.43		0.45		0.00		n/a		0.00
particulate bound mass unit area upper watershed discharges (kg/yr)	3.00E-04		1.34E-04		3.11E-06		nd		-4.88E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		7.90E-08		n/a		-3.25E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		1.75E-05		8.39E-06		0.00E+00		n/a		0.00E+00
particulate discharge in size 20 to 63 um (kg/yr)		1.53E-04		6.52E-05		3.03E-06		n/a		-1.63E-05
particulate discharge in size >63 um (kg/yr)		1.30E-04		6.08E-05		0.00E+00		n/a		0.00E+00

Filtered mass upper watershed discharges (kg/yr)	3.27E-05		6.96E-06		4.06E-06		nd		6.07E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	3.33E-04		1.41E-04		7.16E-06		nd		1.19E-05	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	151 Results	151 fraction in size	135 Results	135 fraction in size	144 Results	144 fraction in size	147 Results	147 fraction in size	107 Results	107 fraction in size
average mass fraction in size 0.7 to 27 um		0.03		0.04		0.00		0.07		0.24
average mass fraction in size 2.7 to 20 um		0.49		0.55		0.75		0.93		0.72
average mass fraction in size 20 to 63 um		0.41		0.27		0.06		0.00		0.02
average mass fraction in size >63 um		0.07		0.14		0.19		0.00		0.02
particulate bound mass unit area NBSD discharges (kg/yr)	4.85E-05		1.81E-05		1.95E-05		1.04E-05		1.77E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.39E-05		1.00E-05		1.45E-05		9.73E-06		1.27E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		1.97E-05		4.91E-06		1.12E-06		0.00E+00		3.91E-07
particulate discharge in size 20 to 63 um (kg/yr)		3.26E-06		2.51E-06		3.75E-06		0.00E+00		3.46E-07
particulate discharge in size >63 um (kg/yr)		4.85E-05		1.81E-05		1.95E-05		1.04E-05		1.77E-05
Filtered mass NBSD discharges (kg/yr)	2.09E-05		7.70E-06		8.34E-06		4.02E-06		1.68E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	6.93E-05		2.58E-05		2.78E-05		1.45E-05		3.45E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 123, 149, 118, 134, and 114

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	123 Results	123 fraction in size	149 Results	149 fraction in size	118 Results	118 fraction in size	134 Results	134 fraction in size	114 Results	114 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.12		0.07		0.00		0.00
average mass fraction in size 2.7 to 20 um		0.00		0.58		0.61		0.75		0.27
average mass fraction in size 20 to 63 um		1.00		0.30		0.31		0.25		0.32
average mass fraction in size >63 um		0.00		0.00		0.01		0.00		0.41
particulate bound mass unit area complete watershed discharges (kg/yr)	-1.13E-06		5.80E-04		3.61E-04		1.40E-05		5.09E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		6.79E-05		2.43E-05		0.00E+00		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		3.37E-04		2.19E-04		1.05E-05		1.38E-05
particulate discharge in size 20 to 63 um (kg/yr)		-1.13E-06		1.75E-04		1.14E-04		3.57E-06		1.64E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		4.74E-06		0.00E+00		2.08E-05
Filtered mass complete watershed discharges (kg/yr)	1.10E-05		7.44E-05		4.48E-05		2.60E-07		1.52E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	9.91E-06		6.54E-04		4.06E-04		1.43E-05		6.61E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	123 Results	123 fraction in size	149 Results	149 fraction in size	118 Results	118 fraction in size	134 Results	134 fraction in size	114 Results	114 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		0.00		0.03		n/a		n/a
average mass fraction in size 2.7 to 20 um		n/a		0.04		0.04		n/a		n/a
average mass fraction in size 20 to 63 um		n/a		0.53		0.61		n/a		n/a
average mass fraction in size >63 um		n/a		0.43		0.32		n/a		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		1.11E-03		3.60E-04		nd		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		0.00E+00		1.04E-05		n/a		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		4.86E-05		1.57E-05		n/a		n/a
particulate discharge in size 20 to 63 um (kg/yr)		n/a		5.83E-04		2.20E-04		n/a		n/a
particulate discharge in size >63 um (kg/yr)		n/a		4.75E-04		1.14E-04		n/a		n/a

Filtered mass upper watershed discharges (kg/yr)	nd		6.19E-05		1.83E-05		nd		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		1.17E-03		3.78E-04		nd		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	123 Results	123 fraction in size	149 Results	149 fraction in size	118 Results	118 fraction in size	134 Results	134 fraction in size	114 Results	114 fraction in size
average mass fraction in size 0.7 to 27 um		0.05		0.03		0.05		0.08		0.00
average mass fraction in size 2.7 to 20 um		0.95		0.63		0.63		0.92		0.33
average mass fraction in size 20 to 63 um		0.00		0.25		0.20		0.00		0.67
average mass fraction in size >63 um		0.00		0.09		0.12		0.00		0.00
particulate bound mass unit area NBSD discharges (kg/yr)	1.07E-05		2.02E-04		2.10E-04		1.41E-05		-1.63E-06	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.02E-05		1.27E-04		1.32E-04		1.30E-05		-5.38E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		5.06E-05		4.21E-05		0.00E+00		-1.10E-06
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		1.86E-05		2.51E-05		0.00E+00		0.00E+00
particulate discharge in size >63 um (kg/yr)		1.07E-05		2.02E-04		2.10E-04		1.41E-05		-1.63E-06
Filtered mass NBSD discharges (kg/yr)	5.19E-06		6.22E-05		6.80E-05		3.14E-06		3.61E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	1.59E-05		2.64E-04		2.78E-04		1.72E-05		1.98E-06	

Particulate Size Fractions and Loadings: PCB Congeners: 131, 146, 153, 132, and 105

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	131 Results	131 fraction in size	146 Results	146 fraction in size	153 Results	153 fraction in size	132 Results	132 fraction in size	105 Results	105 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.11		0.10		0.09		0.10
average mass fraction in size 2.7 to 20 um		0.00		0.59		0.60		0.55		0.62
average mass fraction in size 20 to 63 um		0.00		0.30		0.28		0.34		0.28
average mass fraction in size >63 um		1.00		0.00		0.01		0.01		0.01
particulate bound mass unit area complete watershed discharges (kg/yr)	4.26E-06		1.16E-04		7.72E-04		2.79E-04		2.71E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		1.25E-05		7.93E-05		2.58E-05		2.60E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		6.80E-05		4.65E-04		1.54E-04		1.69E-04
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		3.47E-05		2.19E-04		9.53E-05		7.51E-05
particulate discharge in size >63 um (kg/yr)		4.26E-06		5.69E-07		8.48E-06		3.96E-06		1.42E-06
Filtered mass complete watershed discharges (kg/yr)	0.00E+00		1.43E-05		6.88E-05		2.63E-05		3.67E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	4.26E-06		1.30E-04		8.41E-04		3.06E-04		3.08E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	131 Results	131 fraction in size	146 Results	146 fraction in size	153 Results	153 fraction in size	132 Results	132 fraction in size	105 Results	105 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		0.01		0.00		0.00		0.01
average mass fraction in size 2.7 to 20 um		n/a		0.05		0.05		0.04		0.06
average mass fraction in size 20 to 63 um		n/a		0.51		0.52		0.52		0.51
average mass fraction in size >63 um		n/a		0.43		0.43		0.43		0.42
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		2.97E-04		1.55E-03		5.16E-04		5.68E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		2.67E-06		0.00E+00		1.47E-06		2.89E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		1.57E-05		7.46E-05		2.16E-05		3.61E-05
particulate discharge in size 20 to 63 um (kg/yr)		n/a		1.51E-04		8.10E-04		2.71E-04		2.92E-04
particulate discharge in size >63 um (kg/yr)		n/a		1.28E-04		6.67E-04		2.22E-04		2.38E-04

Filtered mass upper watershed discharges (kg/yr)	nd		1.34E-05		6.52E-05		2.70E-05		8.15E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		3.10E-04		1.62E-03		5.43E-04		6.50E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	131 Results	131 fraction in size	146 Results	146 fraction in size	153 Results	153 fraction in size	132 Results	132 fraction in size	105 Results	105 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		0.04		0.03		0.02		0.05
average mass fraction in size 2.7 to 20 um		n/a		0.56		0.66		0.57		0.49
average mass fraction in size 20 to 63 um		n/a		0.23		0.18		0.20		0.34
average mass fraction in size >63 um		n/a		0.17		0.13		0.21		0.12
particulate bound mass unit area NBSD discharges (kg/yr)	nd		3.99E-05		2.66E-04		6.12E-05		1.19E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		2.25E-05		1.75E-04		3.51E-05		5.84E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		9.14E-06		4.75E-05		1.24E-05		4.04E-05
particulate discharge in size 20 to 63 um (kg/yr)		n/a		6.60E-06		3.44E-05		1.26E-05		1.41E-05
particulate discharge in size >63 um (kg/yr)		n/a		3.99E-05		2.66E-04		6.12E-05		1.19E-04
Filtered mass NBSD discharges (kg/yr)	nd		1.48E-05		7.77E-05		2.26E-05		3.81E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	nd		5.47E-05		3.43E-04		8.38E-05		1.57E-04	

Particulate Size Fractions and Loadings: PCB Congeners: 141, 179, 163, 138, and 158

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	141 Results	141 fraction in size	179 Results	179 fraction in size	163 Results	163 fraction in size	138 Results	138 fraction in size	158 Results	158 fraction in size
average mass fraction in size 0.7 to 27 um		0.08		0.13		0.08		0.08		0.00
average mass fraction in size 2.7 to 20 um		0.61		0.36		0.61		0.61		0.20
average mass fraction in size 20 to 63 um		0.30		0.51		0.29		0.29		0.47
average mass fraction in size >63 um		0.00		0.00		0.02		0.02		0.33
particulate bound mass unit area complete watershed discharges (kg/yr)	2.17E-04		6.49E-05		5.46E-04		5.46E-04		2.75E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.80E-05		8.20E-06		4.34E-05		4.45E-05		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		1.32E-04		2.35E-05		3.34E-04		3.34E-04		5.51E-06
particulate discharge in size 20 to 63 um (kg/yr)		6.59E-05		3.32E-05		1.59E-04		1.58E-04		1.28E-05
particulate discharge in size >63 um (kg/yr)		7.74E-07		0.00E+00		9.55E-06		9.63E-06		9.17E-06
Filtered mass complete watershed discharges (kg/yr)	2.39E-05		3.93E-06		2.96E-05		3.16E-05		1.21E-06	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	2.41E-04		6.88E-05		5.75E-04		5.78E-04		2.87E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	141 Results	141 fraction in size	179 Results	179 fraction in size	163 Results	163 fraction in size	138 Results	138 fraction in size	158 Results	158 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.03		0.01		0.02		n/a
average mass fraction in size 2.7 to 20 um		0.03		0.00		0.04		0.04		n/a
average mass fraction in size 20 to 63 um		0.52		0.97		0.52		0.51		n/a
average mass fraction in size >63 um		0.44		0.00		0.43		0.44		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	4.51E-04		6.70E-06		1.08E-03		1.22E-03		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		1.91E-07		1.51E-05		2.64E-05		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		1.58E-05		0.00E+00		4.07E-05		4.47E-05		n/a
particulate discharge in size 20 to 63 um (kg/yr)		2.35E-04		6.51E-06		5.59E-04		6.19E-04		n/a
particulate discharge in size >63 um (kg/yr)		2.00E-04		0.00E+00		4.67E-04		5.35E-04		n/a

Filtered mass upper watershed discharges (kg/yr)	2.73E-05		8.53E-07		2.79E-05		3.04E-05		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	4.78E-04		7.56E-06		1.11E-03		1.25E-03		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	141 Results	141 fraction in size	179 Results	179 fraction in size	163 Results	163 fraction in size	138 Results	138 fraction in size	158 Results	158 fraction in size
average mass fraction in size 0.7 to 27 um		0.06		0.01		0.04		0.04		0.02
average mass fraction in size 2.7 to 20 um		0.64		0.52		0.49		0.49		0.51
average mass fraction in size 20 to 63 um		0.21		0.29		0.30		0.25		0.21
average mass fraction in size >63 um		0.09		0.18		0.17		0.22		0.26
particulate bound mass unit area NBSD discharges (kg/yr)	4.49E-05		2.13E-05		1.40E-04		1.40E-04		3.12E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.88E-05		1.11E-05		6.87E-05		6.89E-05		1.59E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		9.46E-06		6.20E-06		4.13E-05		3.55E-05		6.52E-06
particulate discharge in size 20 to 63 um (kg/yr)		4.14E-06		3.74E-06		2.42E-05		3.04E-05		8.23E-06
particulate discharge in size >63 um (kg/yr)		4.49E-05		2.13E-05		1.40E-04		1.40E-04		3.12E-05
Filtered mass NBSD discharges (kg/yr)	1.69E-05		6.68E-06		3.88E-05		3.89E-05		1.16E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	6.18E-05		2.80E-05		1.79E-04		1.79E-04		4.28E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 178, 126, 187, 183, and 128

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	178 Results	178 fraction in size	126 Results	126 fraction in size	187 Results	187 fraction in size	183 Results	183 fraction in size	128 Results	128 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.09		0.08		n/a
average mass fraction in size 2.7 to 20 um		0.52		0.65		0.58		0.61		n/a
average mass fraction in size 20 to 63 um		0.48		0.35		0.33		0.31		n/a
average mass fraction in size >63 um		0.00		0.00		0.00		0.00		n/a
particulate bound mass unit area complete watershed discharges (kg/yr)	7.66E-06		1.03E-05		2.55E-04		1.35E-04		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		2.33E-05		1.05E-05		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		3.97E-06		6.67E-06		1.48E-04		8.28E-05		n/a
particulate discharge in size 20 to 63 um (kg/yr)		3.69E-06		3.66E-06		8.32E-05		4.21E-05		n/a
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		0.00E+00		0.00E+00		n/a
Filtered mass complete watershed discharges (kg/yr)	2.78E-06		7.13E-06		1.33E-05		2.77E-06		nd	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.04E-05		1.75E-05		2.68E-04		1.38E-04		nd	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	178 Results	178 fraction in size	126 Results	126 fraction in size	187 Results	187 fraction in size	183 Results	183 fraction in size	128 Results	128 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		n/a		0.01		0.02		n/a
average mass fraction in size 2.7 to 20 um		n/a		n/a		0.03		0.08		n/a
average mass fraction in size 20 to 63 um		n/a		n/a		0.50		0.45		n/a
average mass fraction in size >63 um		n/a		n/a		0.45		0.45		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		nd		6.75E-04		2.58E-04		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		n/a		9.61E-06		4.89E-06		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		n/a		2.20E-05		2.13E-05		n/a
particulate discharge in size 20 to 63 um (kg/yr)		n/a		n/a		3.39E-04		1.15E-04		n/a
particulate discharge in size >63 um (kg/yr)		n/a		n/a		3.03E-04		1.17E-04		n/a

Filtered mass upper watershed discharges (kg/yr)	nd		nd		1.49E-05		2.05E-06		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		nd		6.89E-04		2.60E-04		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	178 Results	178 fraction in size	126 Results	126 fraction in size	187 Results	187 fraction in size	183 Results	183 fraction in size	128 Results	128 fraction in size
average mass fraction in size 0.7 to 27 um		0.02		0.11		0.00		0.01		n/a
average mass fraction in size 2.7 to 20 um		0.77		0.78		0.54		0.40		n/a
average mass fraction in size 20 to 63 um		0.00		0.00		0.14		0.25		n/a
average mass fraction in size >63 um		0.21		0.11		0.32		0.34		n/a
particulate bound mass unit area NBSD discharges (kg/yr)	3.19E-05		9.55E-06		9.41E-05		3.01E-05		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		2.45E-05		7.43E-06		5.05E-05		1.21E-05		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		0.00E+00		1.27E-05		7.59E-06		n/a
particulate discharge in size 20 to 63 um (kg/yr)		6.84E-06		1.03E-06		3.05E-05		1.02E-05		n/a
particulate discharge in size >63 um (kg/yr)		3.19E-05		9.55E-06		9.41E-05		3.01E-05		n/a
Filtered mass NBSD discharges (kg/yr)	4.45E-06		6.02E-06		2.64E-05		8.52E-06		nd	
NBSD mass discharge (particulate plus filtered) (kg/yr)	3.63E-05		1.56E-05		1.21E-04		3.86E-05		nd	

Particulate Size Fractions and Loadings: PCB Congeners: 167, 174, 177, 171, and 156

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	167 Results	167 fraction in size	174 Results	174 fraction in size	177 Results	177 fraction in size	171 Results	171 fraction in size	156 Results	156 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		0.11		0.09		0.00		0.01
average mass fraction in size 2.7 to 20 um		n/a		0.59		0.56		0.62		0.63
average mass fraction in size 20 to 63 um		n/a		0.30		0.35		0.38		0.37
average mass fraction in size >63 um		n/a		0.00		0.00		0.00		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	nd		2.53E-04		1.42E-04		1.60E-05		6.66E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		2.67E-05		1.31E-05		0.00E+00		4.41E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		1.51E-04		7.94E-05		9.92E-06		4.18E-05
particulate discharge in size 20 to 63 um (kg/yr)		n/a		7.59E-05		4.96E-05		6.09E-06		2.43E-05
particulate discharge in size >63 um (kg/yr)		n/a		0.00E+00		0.00E+00		0.00E+00		7.43E-08
Filtered mass complete watershed discharges (kg/yr)	nd		1.02E-05		7.86E-06		0.00E+00		8.02E-06	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	nd		2.64E-04		1.50E-04		1.60E-05		7.47E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	167 Results	167 fraction in size	174 Results	174 fraction in size	177 Results	177 fraction in size	171 Results	171 fraction in size	156 Results	156 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		0.00		0.00		n/a		0.00
average mass fraction in size 2.7 to 20 um		n/a		0.03		0.03		n/a		0.02
average mass fraction in size 20 to 63 um		n/a		0.58		0.52		n/a		0.13
average mass fraction in size >63 um		n/a		0.39		0.45		n/a		0.85
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		2.33E-04		1.73E-04		nd		2.57E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		7.80E-08		0.00E+00		n/a		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		8.11E-06		5.13E-06		n/a		5.46E-06
particulate discharge in size 20 to 63 um (kg/yr)		n/a		1.35E-04		8.95E-05		n/a		3.36E-05
particulate discharge in size >63 um (kg/yr)		n/a		9.00E-05		7.80E-05		n/a		2.18E-04

Filtered mass upper watershed discharges (kg/yr)	nd		7.83E-06		4.61E-06		nd		6.41E-06	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		2.41E-04		1.77E-04		nd		2.63E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	167 Results	167 fraction in size	174 Results	174 fraction in size	177 Results	177 fraction in size	171 Results	171 fraction in size	156 Results	156 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		0.06		0.01		0.03		0.01
average mass fraction in size 2.7 to 20 um		n/a		0.48		0.42		0.97		0.52
average mass fraction in size 20 to 63 um		n/a		0.15		0.22		0.00		0.28
average mass fraction in size >63 um		n/a		0.31		0.35		0.00		0.19
particulate bound mass unit area NBSD discharges (kg/yr)	nd		5.24E-05		3.13E-05		1.05E-05		4.44E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		2.52E-05		1.31E-05		1.01E-05		2.32E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		8.07E-06		6.80E-06		0.00E+00		1.25E-05
particulate discharge in size 20 to 63 um (kg/yr)		n/a		1.62E-05		1.10E-05		0.00E+00		8.32E-06
particulate discharge in size >63 um (kg/yr)		n/a		5.24E-05		3.13E-05		1.05E-05		4.44E-05
Filtered mass NBSD discharges (kg/yr)	nd		1.90E-05		1.18E-05		2.85E-06		1.43E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	nd		7.14E-05		4.30E-05		1.33E-05		5.87E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 157, 173, 172, 197, and 180

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	157 Results	157 fraction in size	173 Results	173 fraction in size	172 Results	172 fraction in size	197 Results	197 fraction in size	180 Results	180 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		n/a		0.00		0.51		0.07
average mass fraction in size 2.7 to 20 um		1.00		n/a		0.21		0.17		0.60
average mass fraction in size 20 to 63 um		0.00		n/a		0.20		0.33		0.32
average mass fraction in size >63 um		0.00		n/a		0.58		0.00		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	4.76E-06		nd		2.43E-05		2.57E-06		7.29E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		n/a		0.00E+00		1.30E-06		5.41E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		4.76E-06		n/a		5.12E-06		4.25E-07		4.39E-04
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		n/a		4.99E-06		8.45E-07		2.36E-04
particulate discharge in size >63 um (kg/yr)		0.00E+00		n/a		1.42E-05		0.00E+00		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	5.25E-06		nd		6.21E-06		9.28E-07		3.07E-05	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.00E-05		nd		3.05E-05		3.50E-06		7.60E-04	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	157 Results	157 fraction in size	173 Results	173 fraction in size	172 Results	172 fraction in size	197 Results	197 fraction in size	180 Results	180 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		n/a		0.00		0.00		0.01
average mass fraction in size 2.7 to 20 um		n/a		n/a		0.00		0.63		0.05
average mass fraction in size 20 to 63 um		n/a		n/a		0.07		0.37		0.52
average mass fraction in size >63 um		n/a		n/a		0.93		0.00		0.43
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		nd		7.68E-04				1.05E-03	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		n/a		0.00E+00		0.00E+00		5.92E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		n/a		0.00E+00		0.00E+00		4.85E-05
particulate discharge in size 20 to 63 um (kg/yr)		n/a		n/a		5.31E-05		0.00E+00		5.41E-04
particulate discharge in size >63 um (kg/yr)		n/a		n/a		7.15E-04		0.00E+00		4.54E-04

Filtered mass upper watershed discharges (kg/yr)	nd		nd		4.36E-05		1.21E-06		3.75E-05	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		nd		8.11E-04		1.21E-06		1.09E-03	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	157 Results	157 fraction in size	173 Results	173 fraction in size	172 Results	172 fraction in size	197 Results	197 fraction in size	180 Results	180 fraction in size
average mass fraction in size 0.7 to 27 um		0.07		n/a		0.01		0.26		0.03
average mass fraction in size 2.7 to 20 um		0.93		n/a		0.57		0.49		0.66
average mass fraction in size 20 to 63 um		0.00		n/a		0.12		0.25		0.17
average mass fraction in size >63 um		0.00		n/a		0.30		0.00		0.14
particulate bound mass unit area NBSD discharges (kg/yr)	9.37E-06		nd		1.59E-05		8.18E-07		1.57E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		8.70E-06		n/a		9.09E-06		4.03E-07		1.03E-04
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		n/a		1.92E-06		2.04E-07		2.74E-05
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		n/a		4.73E-06		0.00E+00		2.18E-05
particulate discharge in size >63 um (kg/yr)		9.37E-06		n/a		1.59E-05		8.18E-07		1.57E-04
Filtered mass NBSD discharges (kg/yr)	3.42E-06		nd		6.96E-06		5.73E-07		3.81E-05	
NBSD mass discharge (particulate plus filtered) (kg/yr)	1.28E-05		nd		2.28E-05		1.39E-06		1.95E-04	

Particulate Size Fractions and Loadings: PCB Congeners: 193, 191, 169, 170, and 190

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	193 Results	193 fraction in size	191 Results	191 fraction in size	169 Results	169 fraction in size	170 Results	170 fraction in size	190 Results	190 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		n/a		n/a		0.09		0.00
average mass fraction in size 2.7 to 20 um		0.04		n/a		n/a		0.52		0.51
average mass fraction in size 20 to 63 um		0.96		n/a		n/a		0.38		0.32
average mass fraction in size >63 um		0.00		n/a		n/a		0.00		0.17
particulate bound mass unit area complete watershed discharges (kg/yr)	5.39E-06		nd		nd		4.36E-04		3.23E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		n/a		n/a		4.06E-05		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		2.09E-07		n/a		n/a		2.28E-04		1.64E-05
particulate discharge in size 20 to 63 um (kg/yr)		5.18E-06		n/a		n/a		1.68E-04		1.04E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		n/a		n/a		0.00E+00		5.57E-06
Filtered mass complete watershed discharges (kg/yr)	5.17E-06		nd		nd		2.56E-05		6.15E-07	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.06E-05		nd		nd		4.62E-04		3.29E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	193 Results	193 fraction in size	191 Results	191 fraction in size	169 Results	169 fraction in size	170 Results	170 fraction in size	190 Results	190 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		n/a		n/a		0.05		n/a
average mass fraction in size 2.7 to 20 um		n/a		n/a		n/a		0.03		n/a
average mass fraction in size 20 to 63 um		n/a		n/a		n/a		0.52		n/a
average mass fraction in size >63 um		n/a		n/a		n/a		0.40		n/a
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		nd		nd		3.87E-04		nd	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		n/a		n/a		1.84E-05		n/a
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		n/a		n/a		1.24E-05		n/a
particulate discharge in size 20 to 63 um (kg/yr)		n/a		n/a		n/a		2.02E-04		n/a
particulate discharge in size >63 um (kg/yr)		n/a		n/a		n/a		1.55E-04		n/a

Filtered mass upper watershed discharges (kg/yr)	nd		nd		nd		1.82E-06		nd	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		nd		nd		3.89E-04		nd	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	193 Results	193 fraction in size	191 Results	191 fraction in size	169 Results	169 fraction in size	170 Results	170 fraction in size	190 Results	190 fraction in size
average mass fraction in size 0.7 to 27 um		0.44		n/a		n/a		0.01		0.01
average mass fraction in size 2.7 to 20 um		0.56		n/a		n/a		0.53		0.51
average mass fraction in size 20 to 63 um		0.00		n/a		n/a		0.30		0.35
average mass fraction in size >63 um		0.00		n/a		n/a		0.17		0.13
particulate bound mass unit area NBSD discharges (kg/yr)	8.07E-06		nd		nd		7.08E-05		1.32E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		4.53E-06		n/a		n/a		3.73E-05		6.71E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		n/a		n/a		2.13E-05		4.62E-06
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		n/a		n/a		1.17E-05		1.69E-06
particulate discharge in size >63 um (kg/yr)		8.07E-06		n/a		n/a		7.08E-05		1.32E-05
Filtered mass NBSD discharges (kg/yr)	3.34E-06		nd		nd		1.66E-05		3.44E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	1.14E-05		nd		nd		8.74E-05		1.66E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 198, 203, 196, 189, and 208

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	198 Results	198 fraction in size	203 Results	203 fraction in size	196 Results	196 fraction in size	189 Results	189 fraction in size	208 Results	208 fraction in size
average mass fraction in size 0.7 to 27 um		0.10		0.11		0.10		0.00		0.09
average mass fraction in size 2.7 to 20 um		0.61		0.61		0.62		0.47		0.47
average mass fraction in size 20 to 63 um		0.29		0.28		0.28		0.53		0.45
average mass fraction in size >63 um		0.00		0.00		0.00		0.00		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	1.59E-04		9.40E-05		9.34E-05		1.21E-06		1.54E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		1.55E-05		1.05E-05		8.96E-06		0.00E+00		1.32E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		9.68E-05		5.71E-05		5.81E-05		5.67E-07		7.23E-06
particulate discharge in size 20 to 63 um (kg/yr)		4.66E-05		2.62E-05		2.62E-05		6.44E-07		6.89E-06
particulate discharge in size >63 um (kg/yr)		0.00E+00		2.36E-07		1.54E-07		0.00E+00		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	4.97E-06		3.92E-06		4.10E-06		2.16E-07		1.67E-07	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.64E-04		9.79E-05		9.75E-05		1.43E-06		1.56E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	198 Results	198 fraction in size	203 Results	203 fraction in size	196 Results	196 fraction in size	189 Results	189 fraction in size	208 Results	208 fraction in size
average mass fraction in size 0.7 to 27 um		0.02		0.01		0.01		n/a		0.01
average mass fraction in size 2.7 to 20 um		0.06		0.07		0.06		n/a		0.00
average mass fraction in size 20 to 63 um		0.52		0.54		0.55		n/a		0.73
average mass fraction in size >63 um		0.40		0.39		0.38		n/a		0.26
particulate bound mass unit area upper watershed discharges (kg/yr)	2.32E-04		8.78E-05		7.43E-05		nd		1.89E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		4.60E-06		1.06E-06		9.61E-07		n/a		1.48E-07
particulate discharge in size 2.7 to 20 um (kg/yr)		1.33E-05		5.71E-06		4.53E-06		n/a		0.00E+00
particulate discharge in size 20 to 63 um (kg/yr)		1.21E-04		4.70E-05		4.09E-05		n/a		1.38E-05
particulate discharge in size >63 um (kg/yr)		9.33E-05		3.40E-05		2.79E-05		n/a		4.91E-06

Filtered mass upper watershed discharges (kg/yr)	3.07E-06		2.83E-06		2.35E-06		nd		1.03E-07	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	2.35E-04		9.06E-05		7.66E-05		nd		1.90E-05	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	198 Results	198 fraction in size	203 Results	203 fraction in size	196 Results	196 fraction in size	189 Results	189 fraction in size	208 Results	208 fraction in size
average mass fraction in size 0.7 to 27 um		0.01		0.06		0.05		0.05		0.11
average mass fraction in size 2.7 to 20 um		0.68		0.61		0.62		0.95		0.55
average mass fraction in size 20 to 63 um		0.14		0.17		0.18		0.00		0.22
average mass fraction in size >63 um		0.17		0.16		0.15		0.00		0.11
particulate bound mass unit area NBSD discharges (kg/yr)	6.38E-05		3.58E-05		3.56E-05		3.09E-07		1.04E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		4.34E-05		2.20E-05		2.21E-05		2.94E-07		5.72E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		9.18E-06		6.19E-06		6.27E-06		0.00E+00		2.28E-06
particulate discharge in size 20 to 63 um (kg/yr)		1.06E-05		5.55E-06		5.48E-06		0.00E+00		1.19E-06
particulate discharge in size >63 um (kg/yr)		6.38E-05		3.58E-05		3.56E-05		3.09E-07		1.04E-05
Filtered mass NBSD discharges (kg/yr)	1.60E-05		9.04E-06		8.84E-06		1.79E-07		2.45E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	7.97E-05		4.48E-05		4.45E-05		4.88E-07		1.28E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 195, 207, 194, 205, and 206

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)										
Solid Fraction	195 Results	195 fraction in size	207 Results	207 fraction in size	194 Results	194 fraction in size	205 Results	205 fraction in size	206 Results	206 fraction in size
average mass fraction in size 0.7 to 27 um		0.00		0.00		0.13		0.00		0.07
average mass fraction in size 2.7 to 20 um		0.38		0.45		0.60		1.00		0.54
average mass fraction in size 20 to 63 um		0.62		0.55		0.27		0.00		0.34
average mass fraction in size >63 um		0.00		0.00		0.00		0.00		0.05
particulate bound mass unit area complete watershed discharges (kg/yr)	1.10E-05		1.95E-06		2.00E-04		1.97E-06		8.71E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		0.00E+00		0.00E+00		2.58E-05		0.00E+00		6.23E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		4.17E-06		8.67E-07		1.20E-04		1.97E-06		4.67E-05
particulate discharge in size 20 to 63 um (kg/yr)		6.80E-06		1.08E-06		5.42E-05		0.00E+00		3.00E-05
particulate discharge in size >63 um (kg/yr)		0.00E+00		0.00E+00		5.56E-07		0.00E+00		4.27E-06
Filtered mass complete watershed discharges (kg/yr)	9.64E-07		3.17E-07		7.45E-06		1.36E-06		3.22E-06	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	1.19E-05		2.26E-06		2.08E-04		3.33E-06		9.04E-05	
Upper watershed flows (mostly residential): C2W (2 samples)										
Solid Fraction	195 Results	195 fraction in size	207 Results	207 fraction in size	194 Results	194 fraction in size	205 Results	205 fraction in size	206 Results	206 fraction in size
average mass fraction in size 0.7 to 27 um		n/a		n/a		0.00		n/a		0.06
average mass fraction in size 2.7 to 20 um		n/a		n/a		0.06		n/a		0.08
average mass fraction in size 20 to 63 um		n/a		n/a		0.50		n/a		0.61
average mass fraction in size >63 um		n/a		n/a		0.43		n/a		0.26
particulate bound mass unit area upper watershed discharges (kg/yr)	nd		nd		4.69E-04		nd		1.66E-04	
particulate discharge in size 0.7 to 27 um (kg/yr)		n/a		n/a		1.48E-06		n/a		9.39E-06
particulate discharge in size 2.7 to 20 um (kg/yr)		n/a		n/a		2.97E-05		n/a		1.28E-05
particulate discharge in size 20 to 63 um (kg/yr)		n/a		n/a		2.35E-04		n/a		1.01E-04
particulate discharge in size >63 um (kg/yr)		n/a		n/a		2.02E-04		n/a		4.25E-05

Filtered mass upper watershed discharges (kg/yr)	nd		nd		0.00E+00		nd		8.19E-06	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	nd		nd		4.69E-04		nd		1.74E-04	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)										
Solid Fraction	195 Results	195 fraction in size	207 Results	207 fraction in size	194 Results	194 fraction in size	205 Results	205 fraction in size	206 Results	206 fraction in size
average mass fraction in size 0.7 to 27 um		0.06		0.00		0.06		0.00		0.07
average mass fraction in size 2.7 to 20 um		0.94		1.00		0.42		1.00		0.27
average mass fraction in size 20 to 63 um		0.00		0.00		0.39		0.00		0.60
average mass fraction in size >63 um		0.00		0.00		0.13		0.00		0.06
particulate bound mass unit area NBSD discharges (kg/yr)	6.48E-06		4.00E-06		5.66E-05		3.84E-05		4.74E-05	
particulate discharge in size 0.7 to 27 um (kg/yr)		6.07E-06		3.99E-06		2.38E-05		3.84E-05		1.29E-05
particulate discharge in size 2.7 to 20 um (kg/yr)		0.00E+00		0.00E+00		2.22E-05		0.00E+00		2.83E-05
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		0.00E+00		7.22E-06		0.00E+00		2.90E-06
particulate discharge in size >63 um (kg/yr)		6.48E-06		4.00E-06		5.66E-05		3.84E-05		4.74E-05
Filtered mass NBSD discharges (kg/yr)	2.63E-06		7.25E-07		1.12E-05		9.00E-06		9.65E-06	
NBSD mass discharge (particulate plus filtered) (kg/yr)	9.10E-06		4.73E-06		6.78E-05		4.74E-05		5.70E-05	

Particulate Size Fractions and Loadings: PCB Congeners: 209 and Total Sum of PCB Congeners

Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)				
Solid Fraction	209 Results	209 fraction in size	SUM	SUM fraction in size
average mass fraction in size 0.7 to 27 um		0.11		0.14
average mass fraction in size 2.7 to 20 um		0.33		0.56
average mass fraction in size 20 to 63 um		0.53		0.30
average mass fraction in size >63 um		0.02		0.00
particulate bound mass unit area complete watershed discharges (kg/yr)	3.00E-05		1.13E-02	
particulate discharge in size 0.7 to 27 um (kg/yr)		3.40E-06		1.59E-03
particulate discharge in size 2.7 to 20 um (kg/yr)		9.92E-06		6.33E-03
particulate discharge in size 20 to 63 um (kg/yr)		1.59E-05		3.33E-03
particulate discharge in size >63 um (kg/yr)		7.33E-07		0.00E+00
Filtered mass complete watershed discharges (kg/yr)	2.87E-06		2.42E-03	
Total watershed mass discharge (particulate plus filtered) (kg/yr)	3.28E-05		1.37E-02	
Upper watershed flows (mostly residential): C2W (2 samples)				
Solid Fraction	209 Results	209 fraction in size	SUM	SUM fraction in size
average mass fraction in size 0.7 to 27 um		0.21		0.00
average mass fraction in size 2.7 to 20 um		0.03		0.04
average mass fraction in size 20 to 63 um		0.76		0.51
average mass fraction in size >63 um		0.00		0.45
particulate bound mass unit area upper watershed discharges (kg/yr)	1.71E-05		2.96E-02	
particulate discharge in size 0.7 to 27 um (kg/yr)		3.60E-06		0.00E+00
particulate discharge in size 2.7 to 20 um (kg/yr)		4.73E-07		1.27E-03
particulate discharge in size 20 to 63 um (kg/yr)		1.30E-05		1.51E-02
particulate discharge in size >63 um (kg/yr)		0.00E+00		1.33E-02

Filtered mass upper watershed discharges (kg/yr)	2.78E-06		2.75E-03	
Upper watershed mass discharge (particulate plus filtered) (kg/yr)	1.99E-05		3.23E-02	
NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)				
Solid Fraction	209 Results	209 fraction in size	SUM	SUM fraction in size
average mass fraction in size 0.7 to 27 um		0.10		0.06
average mass fraction in size 2.7 to 20 um		0.41		0.58
average mass fraction in size 20 to 63 um		0.50		0.30
average mass fraction in size >63 um		0.00		0.06
particulate bound mass unit area NBSD discharges (kg/yr)	2.30E-05		4.50E-03	
particulate discharge in size 0.7 to 27 um (kg/yr)		9.39E-06		2.62E-03
particulate discharge in size 2.7 to 20 um (kg/yr)		1.14E-05		1.36E-03
particulate discharge in size 20 to 63 um (kg/yr)		0.00E+00		2.63E-04
particulate discharge in size >63 um (kg/yr)		2.30E-05		4.50E-03
Filtered mass NBSD discharges (kg/yr)	3.10E-06		1.70E-03	
NBSD mass discharge (particulate plus filtered) (kg/yr)	2.61E-05		6.19E-03	

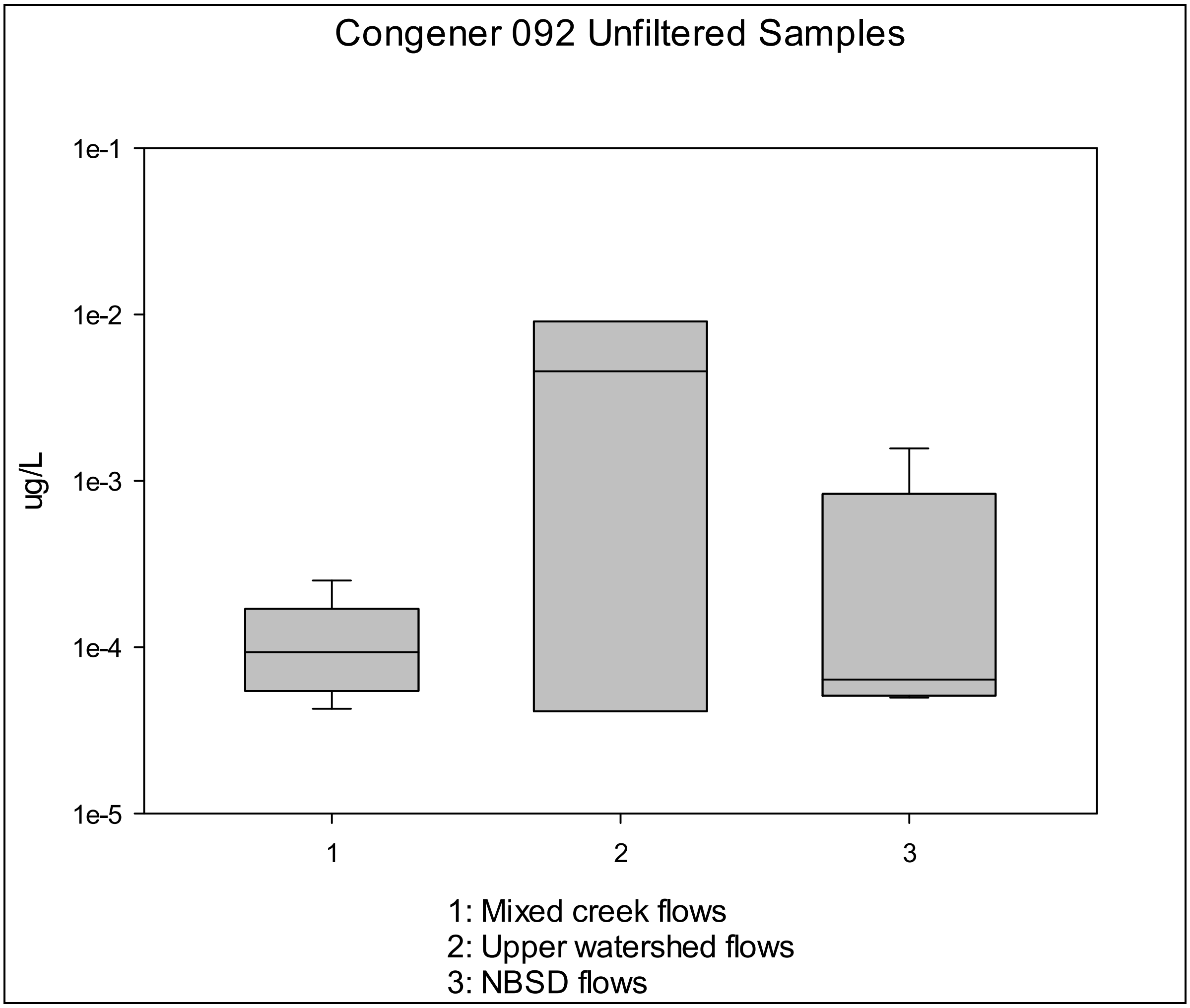
Appendix N: Selected PCB Congener Concentration and Particulate Strength Characteristics

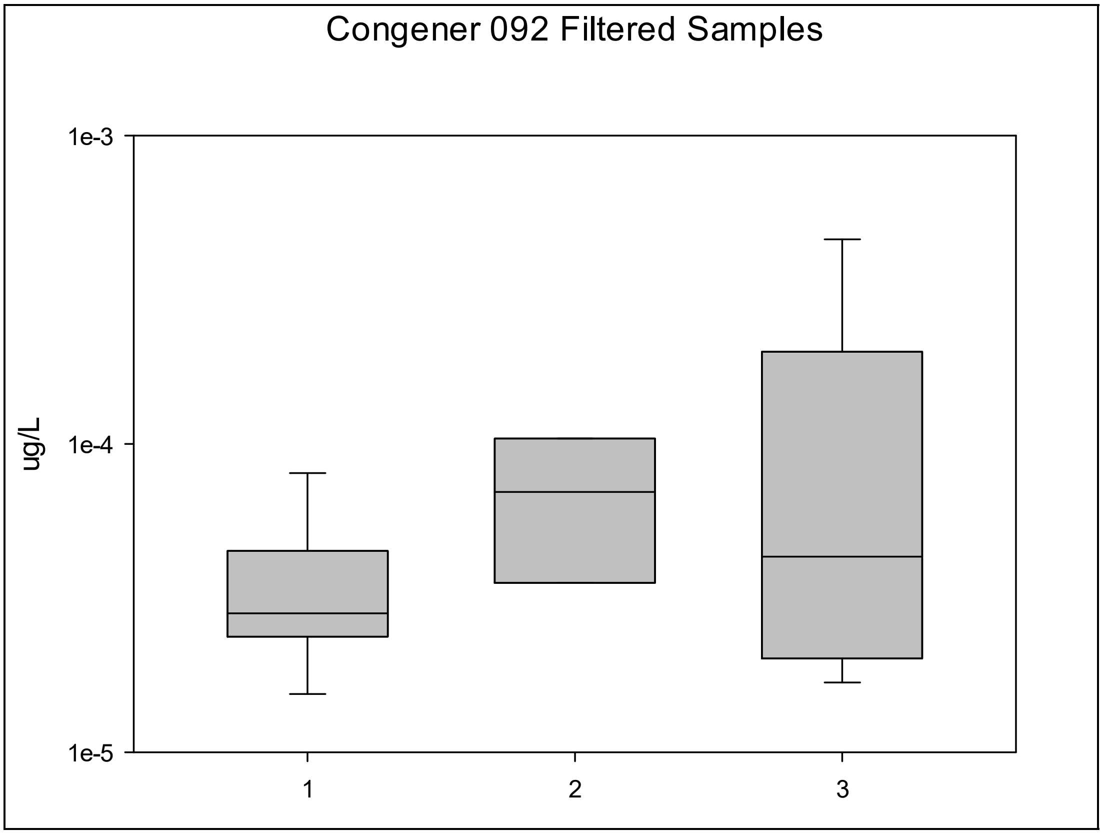
Contents

Congener 092 Characteristics

Observed Concentrations for PCB Congener 092 (µg/L)

092 mixed bulk flows	092 upper watershed bulk flows	092 NBSD bulk flows	092 mixed filtered flows	092 upper watershed filtered flows	092 NBSD filtered flows	092 all bulk combined	092 all filtered combined
1.44E-04	4.14E-05	5.28E-05	2.83E-05	3.54E-05	6.22E-05	1.44E-04	2.83E-05
4.27E-05	9.08E-03	1.57E-03	3.94E-05	1.04E-04	4.61E-04	4.27E-05	3.94E-05
5.86E-05		6.40E-05	2.73E-05		1.68E-05	5.86E-05	2.73E-05
7.64E-05		4.99E-05	1.54E-05		2.13E-05	7.64E-05	1.54E-05
2.53E-04		1.02E-04	2.37E-05		2.40E-05	2.53E-04	2.37E-05
1.11E-04			8.04E-05		1.12E-04	1.11E-04	8.04E-05
			4.49E-05			4.14E-05	4.49E-05
						9.08E-03	3.54E-05
						5.28E-05	1.04E-04
						1.57E-03	6.22E-05
						6.40E-05	4.61E-04
						4.99E-05	1.68E-05
						1.02E-04	2.13E-05
							2.40E-05
							1.12E-04
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.96			0.60				

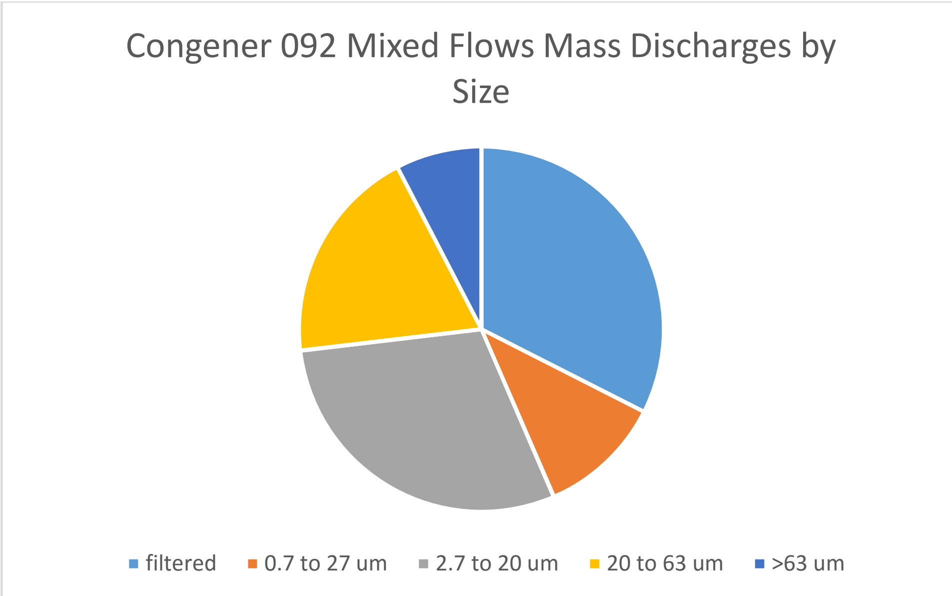

Congener 092 Unfiltered Samples
ug/L
1e-1
1e-2
1e-3
1e-4
1e-5
1
2
3
1: Mixed creek flows
2: Upper watershed flows
3: NBSD flows

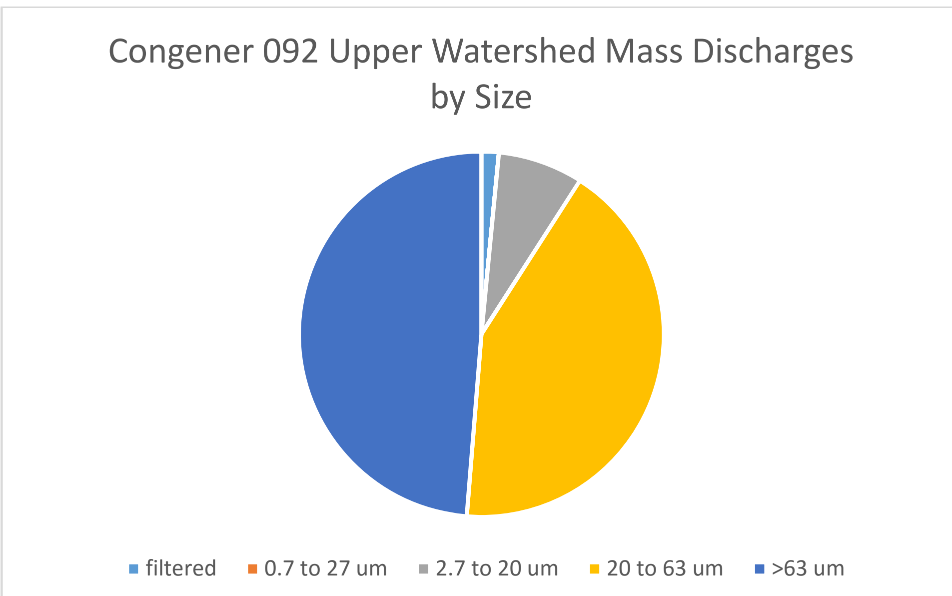


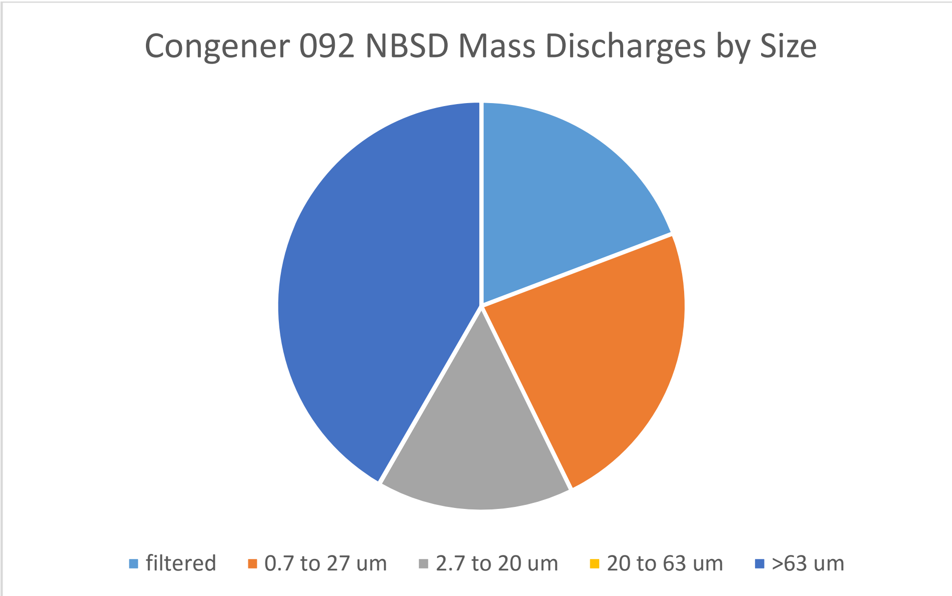
Congener 092 Concentrations (µg/L)

Column	Count	Mean	Std Dev	COV	Max	Min	Median
092 all bulk	13	8.96E-04	2.49E-03	2.78	9.08E-03	4.14E-05	7.64E-05
092 all filtered	15	7.31E-05	1.12E-04	1.53	4.61E-04	1.54E-05	3.54E-05

PCB Congener 092	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.16	0.00	0.06
average mass fraction in size 2.7 to 20 um	0.44	0.08	0.56
average mass fraction in size 20 to 63 um	0.29	0.43	0.37
average mass fraction in size >63 um	0.11	0.49	0.00


Congener 092 Mixed Flows Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

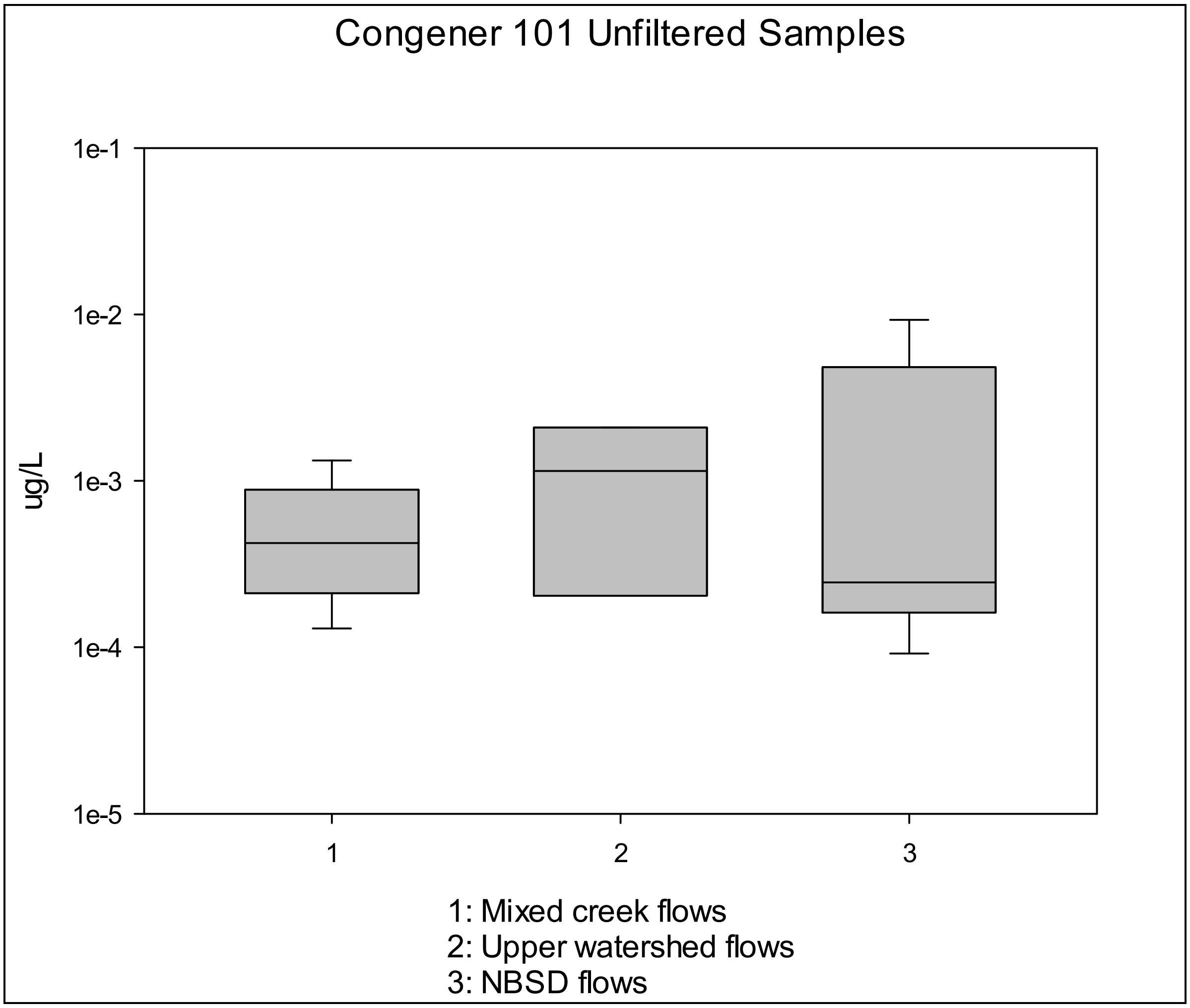

Congener 092 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

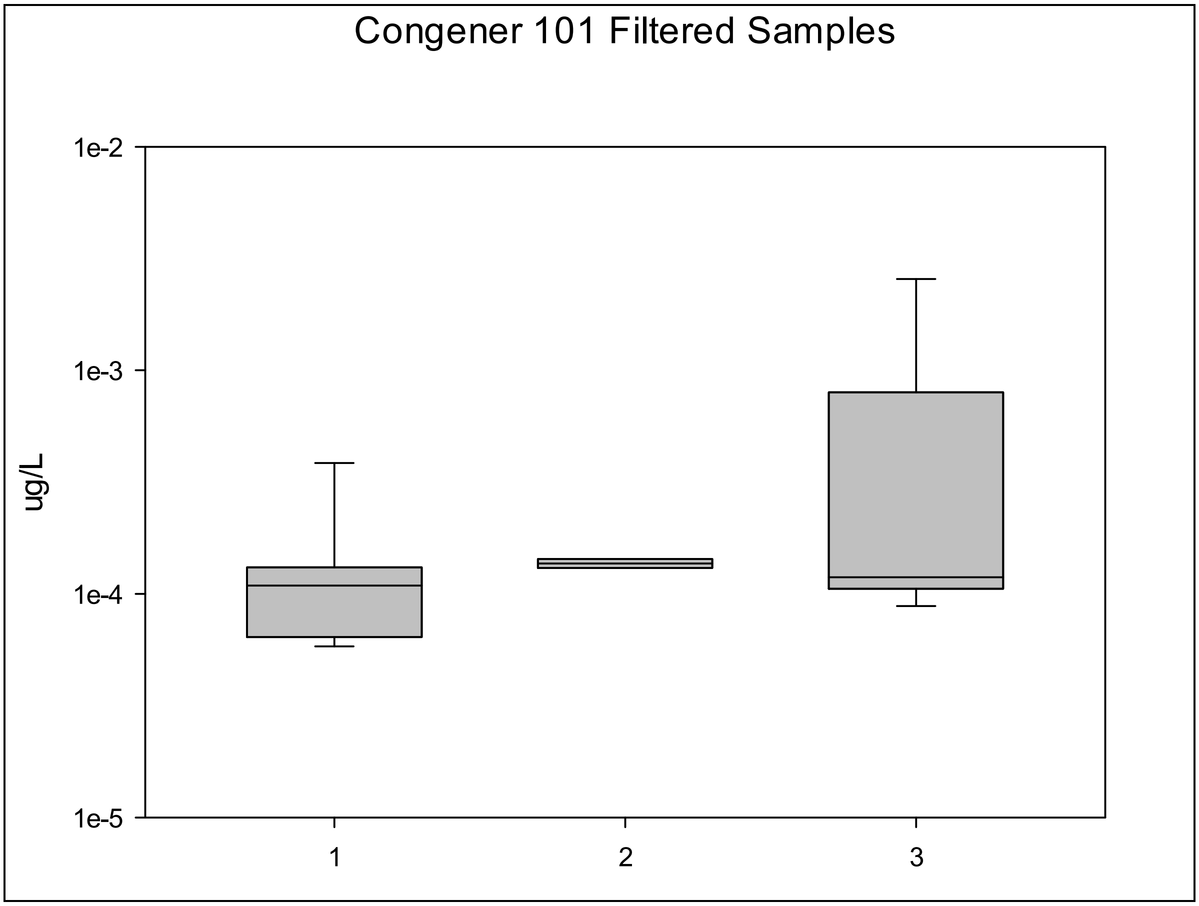

Congener 092 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 101 Characteristics

Observed Concentrations for PCB Congener 101 (μg/L)

101 mixed bulk flows	101 upper watershed bulk flows	101 NBSD bulk flows	101 mixed filtered flows	101 upper watershed filtered flows	101 NBSD filtered flows	101 all bulk combined	101 all filtered combined
7.40E-04	2.05E-04	2.31E-04	1.09E-04	1.43E-04	2.07E-04	7.40E-04	1.09E-04
2.39E-04	2.10E-03	9.30E-03	6.40E-05	1.31E-04	2.56E-03	2.39E-04	6.40E-05
2.77E-04		3.90E-04	1.20E-04		8.80E-05	2.77E-04	1.20E-04
1.30E-04		2.46E-04	5.82E-05		1.23E-04	1.30E-04	5.82E-05
1.33E-03		9.17E-05	1.09E-04		1.14E-04	1.33E-03	1.09E-04
5.71E-04			3.85E-04		1.11E-04	5.71E-04	3.85E-04
			1.32E-04			2.05E-04	1.32E-04
						2.10E-03	1.43E-04
						2.31E-04	1.31E-04
						9.30E-03	2.07E-04
						3.90E-04	2.56E-03
						2.46E-04	8.80E-05
						9.17E-05	1.23E-04
							1.14E-04
							1.11E-04
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.91			0.37				

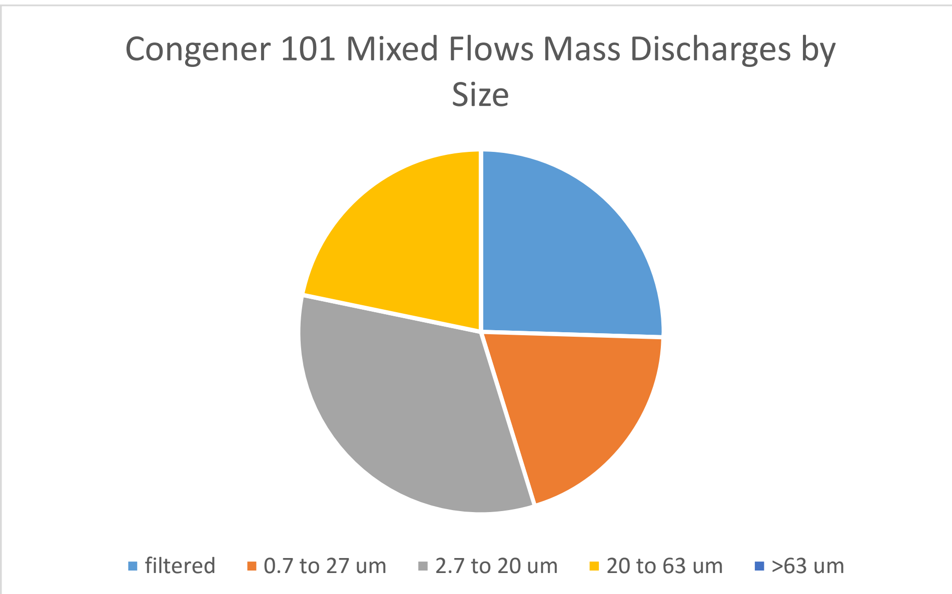

Congener 101 Unfiltered Samples
1e-1
1e-2
1e-3
1e-4
1e-5
ug/L
1
2
3
1: Mixed creek flows
2: Upper watershed flows
3: NBSD flows

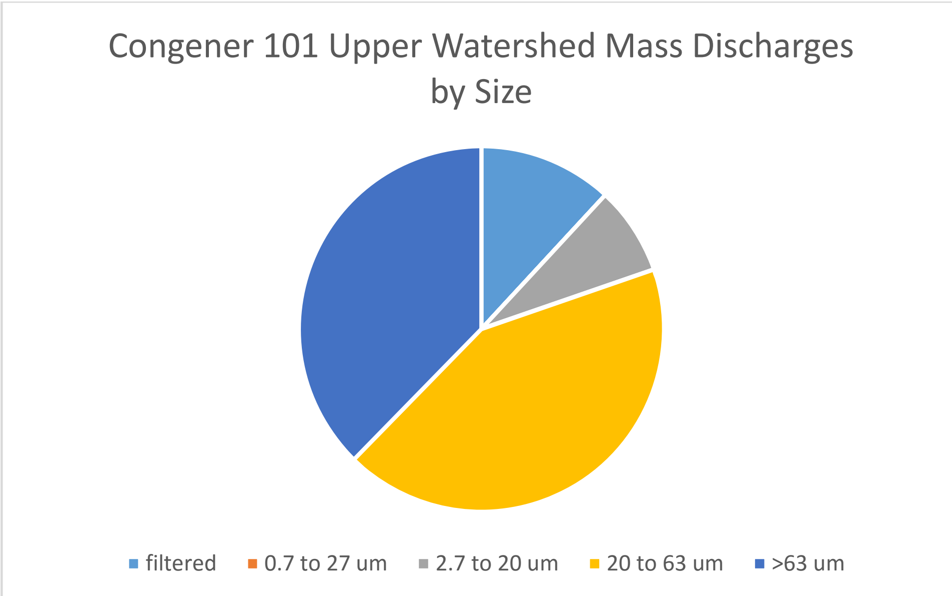


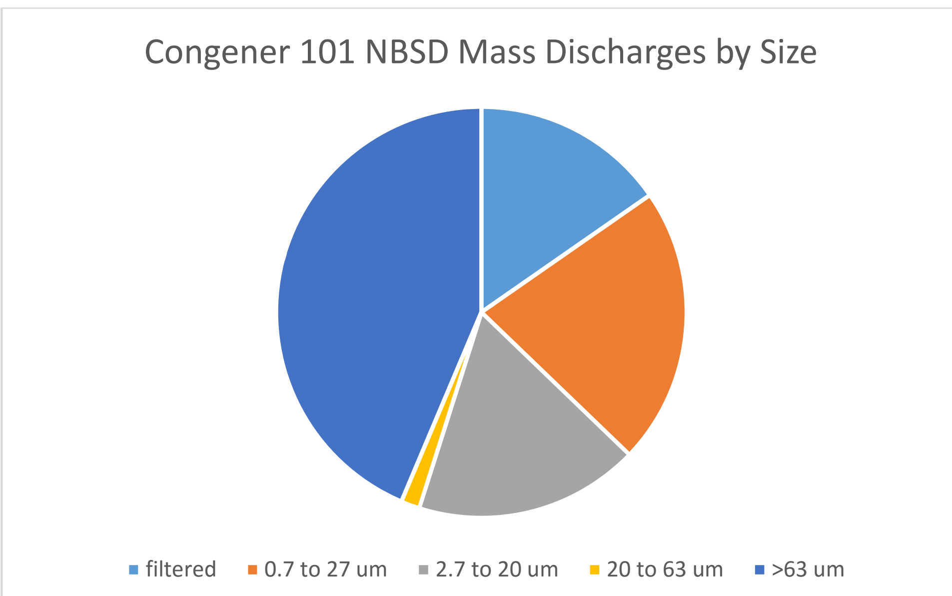
Congener 101 Concentrations (µg/L)

	Count	Mean	Std Dev	COV	Max	Min	Median
101 all bulk	13	1.22E-03	2.50E-03	2.05	9.30E-03	9.17E-05	2.77E-04
101 all filtered	15	2.97E-04	6.31E-04	2.12	2.56E-03	5.82E-05	1.20E-04

PCB Congener 101	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.27	0.00	0.06
average mass fraction in size 2.7 to 20 um	0.44	0.09	0.50
average mass fraction in size 20 to 63 um	0.29	0.48	0.41
average mass fraction in size >63 um	0.00	0.43	0.03



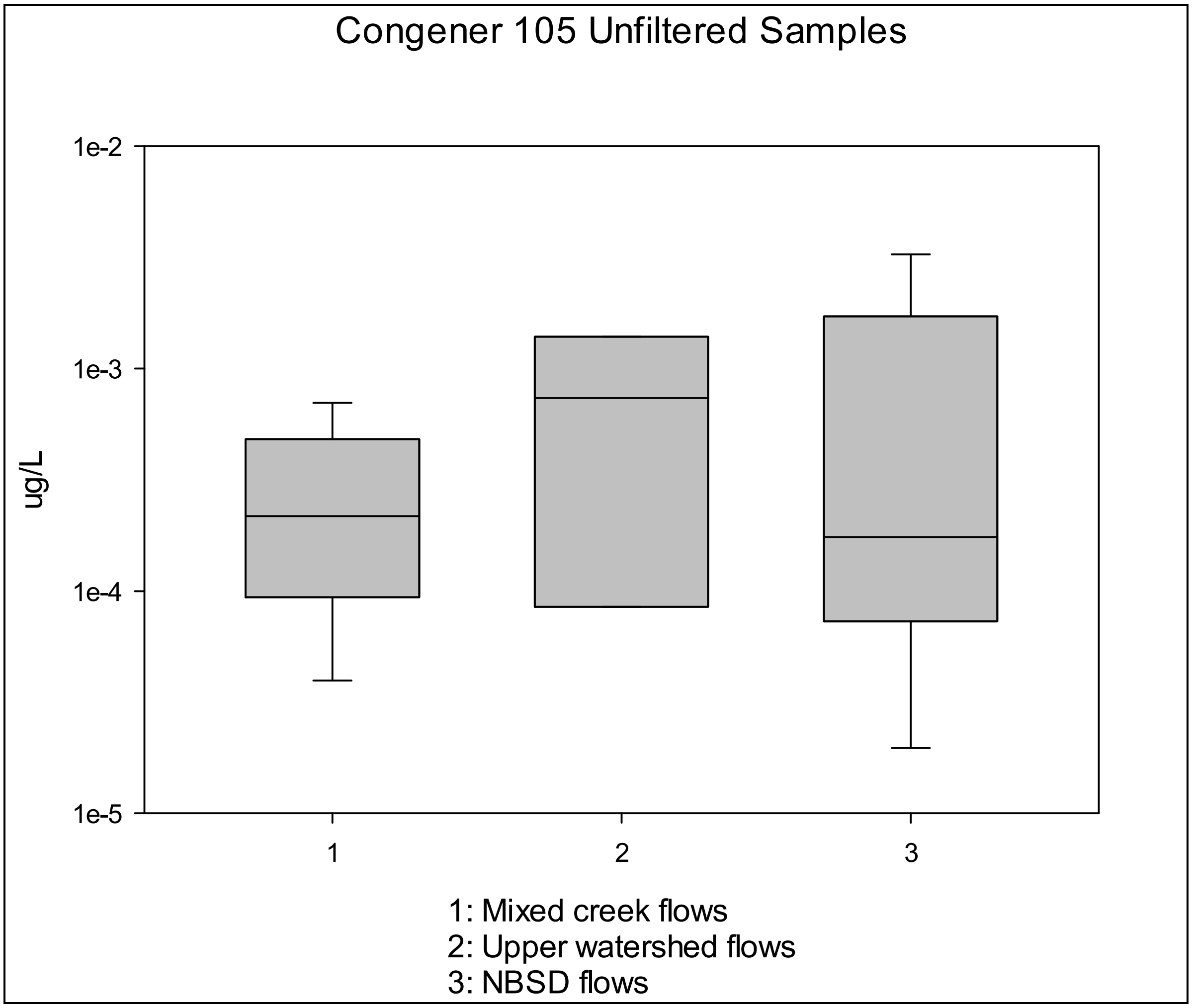

Congener 101 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

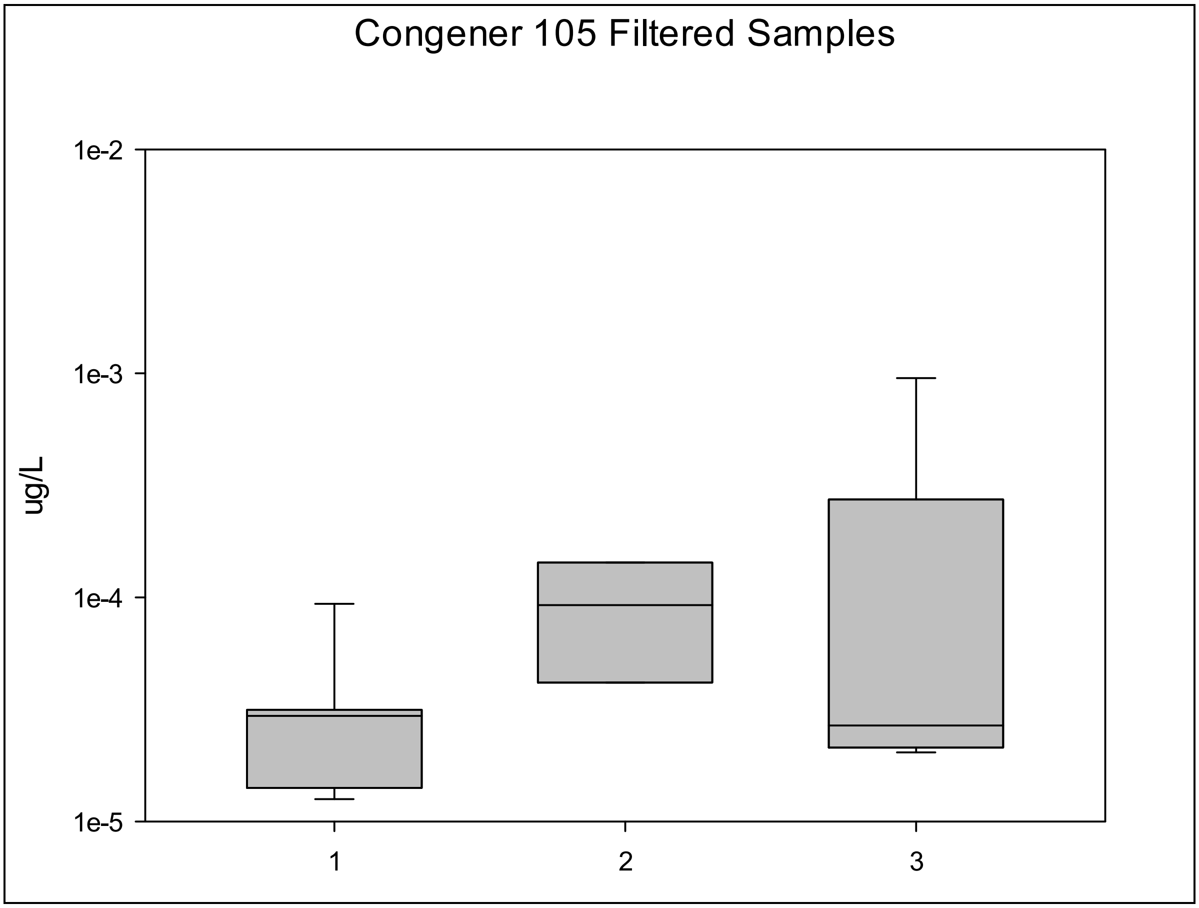

Congener 101 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 105 Characteristics

Observed Concentrations for PCB Congener 105 (µg/L)

105 mixed bulk flows	105 upper watershed bulk flows	105 NBSD bulk flows	105 mixed filtered flows	105 upper watershed filtered flows	105 NBSD filtered flows
4.09E-04	8.49E-05	1.26E-04	3.15E-05	4.17E-05	4.83E-05
1.12E-04	1.39E-03	3.27E-03	1.41E-05	1.43E-04	9.52E-04
1.45E-04		1.76E-04	2.97E-05		2.17E-05
3.96E-05		1.75E-04	1.26E-05		2.59E-05
7.01E-04		1.97E-05	3.05E-05		2.78E-05
2.89E-04			9.38E-05		2.04E-05
			2.38E-05		
Kruskal-Wallis One Way Analysis of Variance on Ranks					
0.98			0.29		

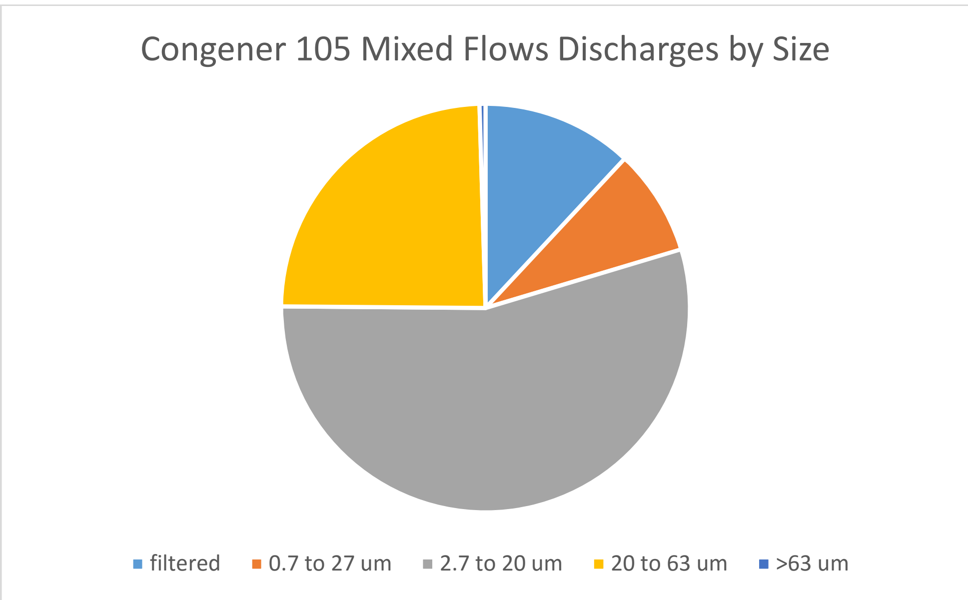

Congener 105 Unfiltered Samples
1e-2
1e-3
1e-4
1e-5
ug/L
1
2
3
1: Mixed creek flows
2: Upper watershed flows
3: NBSD flows

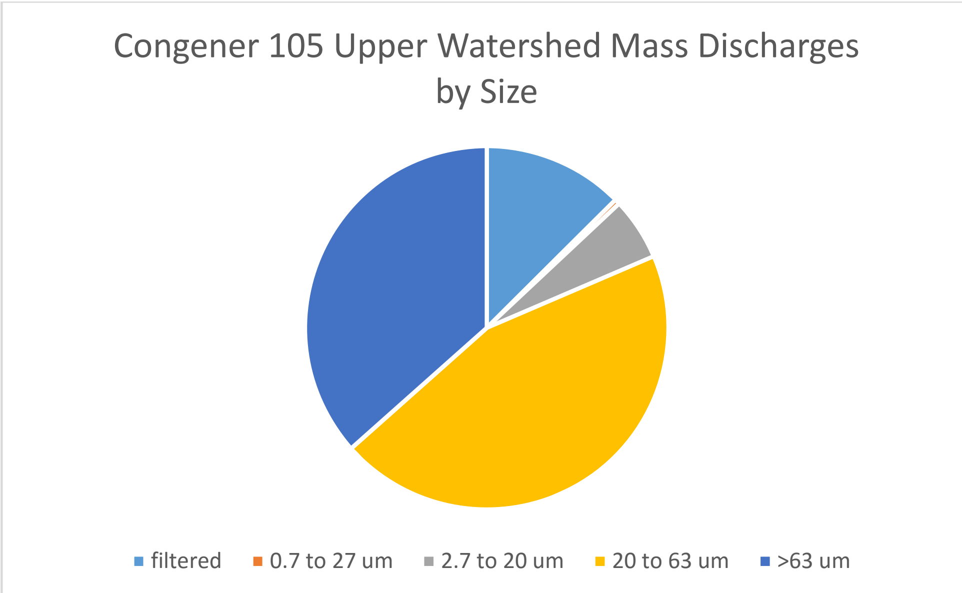


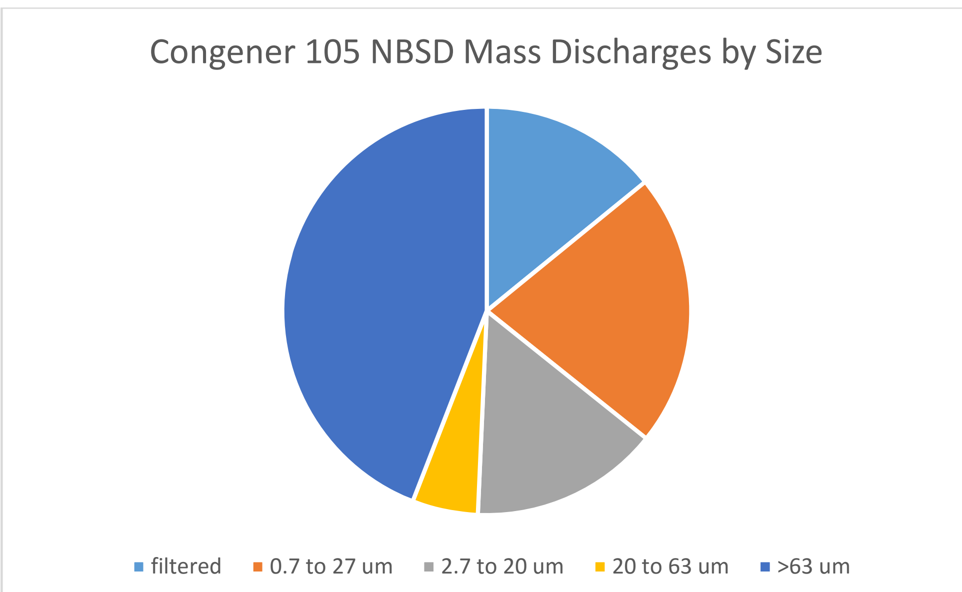
Congener 105 Concentrations (µg/L)

Column	Count	Mean	Std Dev	COV	Max	Min	Median
105 all bulk flows	13	5.34E-04	9.03E-04	1.69	3.27E-03	1.97E-05	1.75E-04
105 all filtered flows	15	1.01E-04	2.38E-04	2.36	9.52E-04	1.26E-05	2.97E-05

PCB Congener 105	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.10	0.01	0.05
average mass fraction in size 2.7 to 20 um	0.62	0.06	0.49
average mass fraction in size 20 to 63 um	0.28	0.51	0.34
average mass fraction in size >63 um	0.01	0.42	0.12



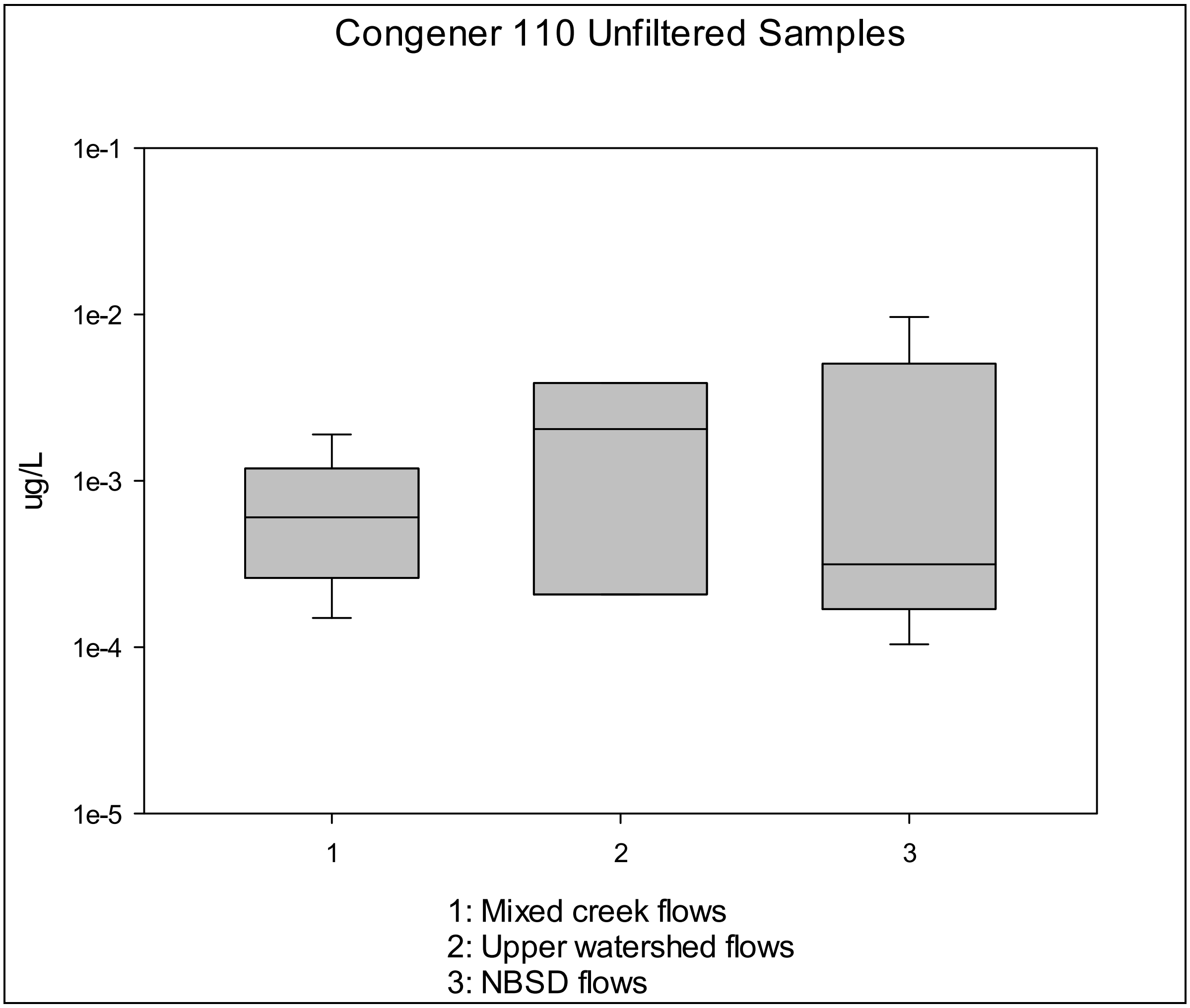

Congener 105 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

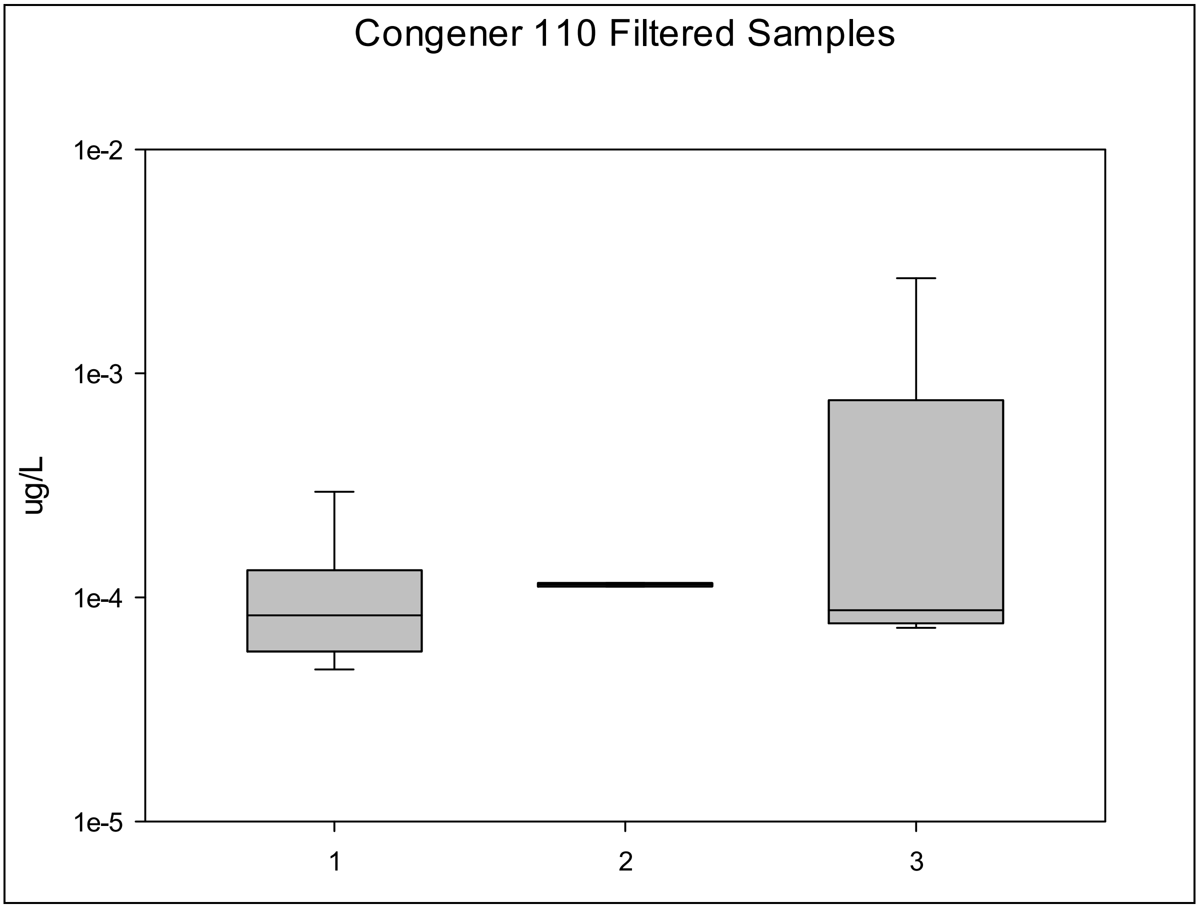

Congener 105 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 110 Characteristics

Observed Concentrations for PCB Congener 110 (µg/L)

110 mixed bulk flows	110 upper watershed bulk flows	110 NBSD bulk flows	110 mixed filtered flows	110 upper watershed filtered flows	110 NBSD filtered flows	110 all bulk combined	110 all filtered combined
9.50E-04	2.08E-04	2.36E-04	8.33E-05	1.12E-04	1.24E-04	9.50E-04	8.33E-05
2.99E-04	3.89E-03	9.69E-03	5.74E-05	1.16E-04	2.66E-03	2.99E-04	5.74E-05
3.67E-04		4.61E-04	7.92E-05		8.13E-05	3.67E-04	7.92E-05
1.50E-04		3.16E-04	4.78E-05		7.33E-05	1.50E-04	4.78E-05
1.90E-03		1.04E-04	8.79E-05		7.76E-05	1.90E-03	8.79E-05
8.45E-04			2.96E-04		9.43E-05	8.45E-04	2.96E-04
			1.33E-04			2.08E-04	1.33E-04
						3.89E-03	1.12E-04
						2.36E-04	1.16E-04
						9.69E-03	1.24E-04
						4.61E-04	2.66E-03
						3.16E-04	8.13E-05
						1.04E-04	7.33E-05
							7.76E-05
							9.43E-05
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.91			0.64				

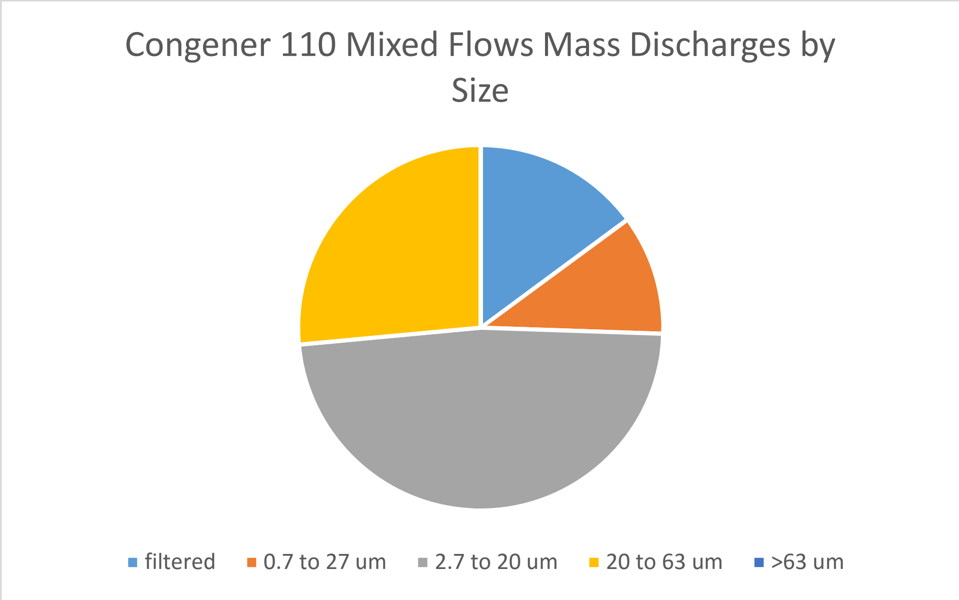

Congener 110 Unfiltered Samples
ug/L
1e-1
1e-2
1e-3
1e-4
1e-5
1
2
3
1: Mixed creek flows
2: Upper watershed flows
3: NBSD flows

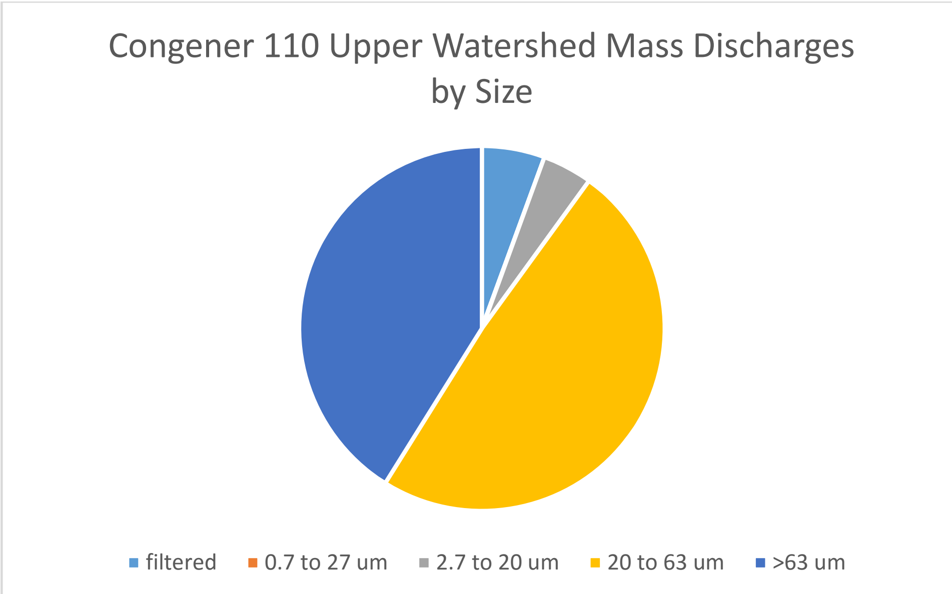


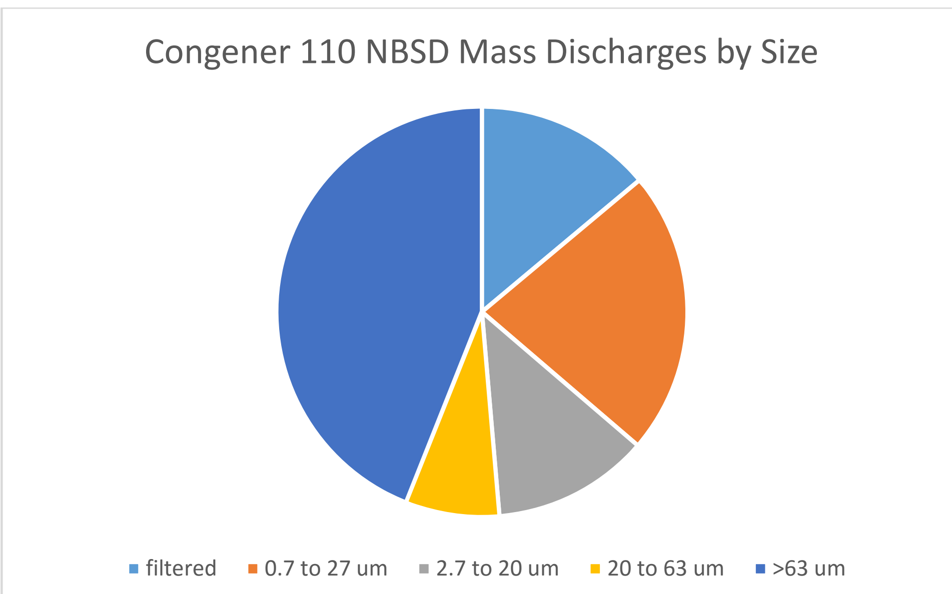
Congener 110 Concentrations (µg/L)

Column	Count	Mean	Std Dev	COV	Max	Min	Median
110 all bulk	13	1.49E-03	2.68E-03	1.80	9.69E-03	1.04E-04	3.67E-04
110 all filtered	15	2.75E-04	6.64E-04	2.41	2.66E-03	4.78E-05	8.79E-05

PCB Congener 110	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.12	0.00	0.04
average mass fraction in size 2.7 to 20 um	0.56	0.05	0.51
average mass fraction in size 20 to 63 um	0.31	0.52	0.28
average mass fraction in size >63 um	0.00	0.44	0.17




Congener 110 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um


Congener 110 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 114 Characteristics

Observed Concentrations for PCB Congener 114 (µg/L)

114 mixed bulk flows	114 upper watershed bulk flows	114 NBSD bulk flows	114 mixed filtered flows	114 upper watershed filtered flows	114 NBSD filtered flows	114 all bulk combined	114 all filtered combined
2.39E-04	nd	4.73E-05	4.67E-05	nd	1.04E-04	2.39E-04	4.67E-05
1.02E-04	nd	nd	5.11E-05	nd	nd	1.02E-04	5.11E-05
2.30E-05		nd	nd		nd	2.30E-05	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd			nd		nd	nd	nd
			nd			nd	nd
						nd	nd
						4.73E-05	nd
						nd	1.04E-04
						nd	nd
						nd	
						nd	
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.98			0.73				

Too few detectable values to plot

Congener 114 Concentrations (µg/L)

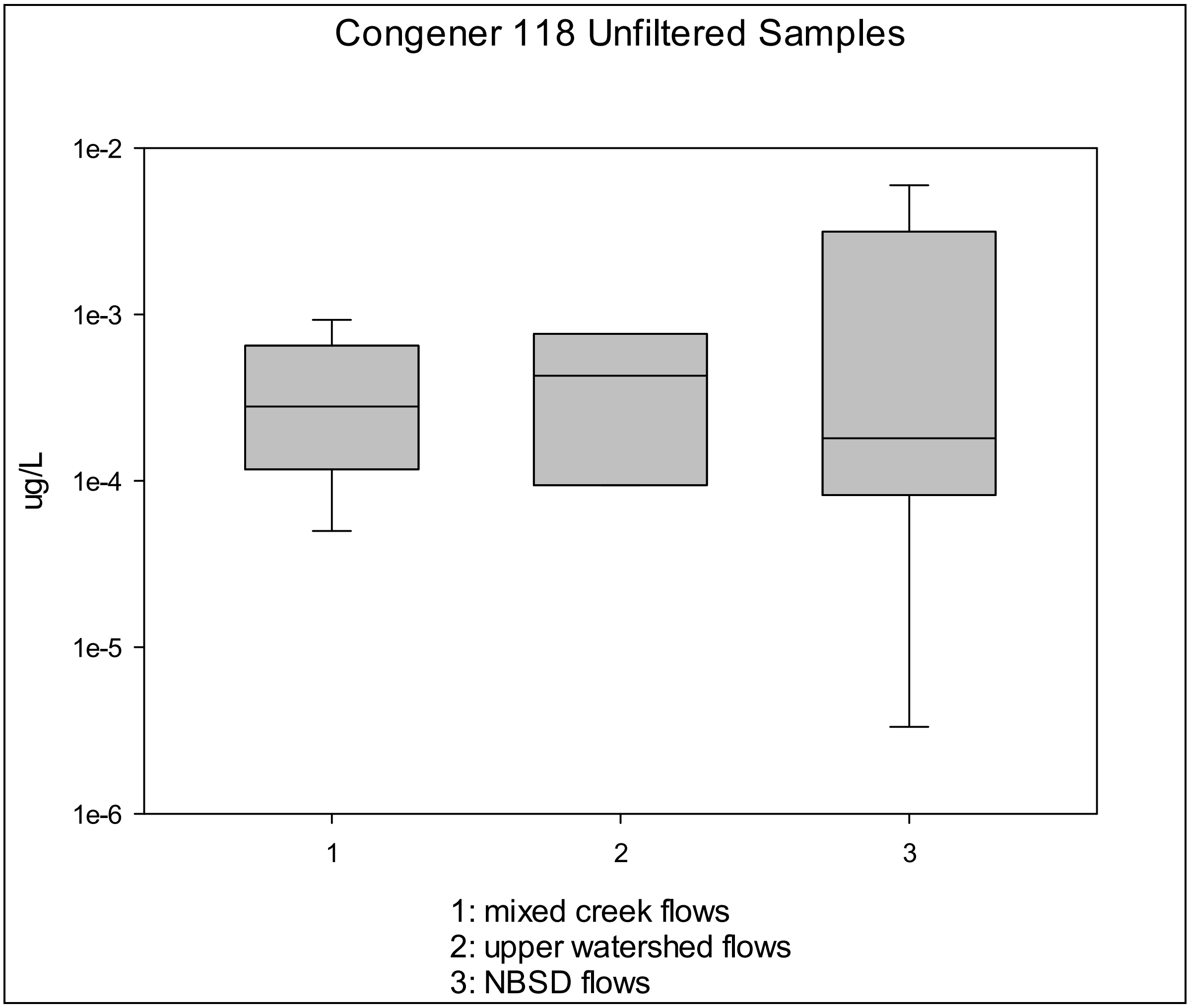
Column	Count	Mean	Std Dev	COV	Max	Min	Median
114 all bulk	13	3.17E-05	6.91E-05	2.18	2.39E-04	nd	nd
114 all filtered	11	1.83E-05	3.45E-05	1.89	1.04E-04	nd	nd

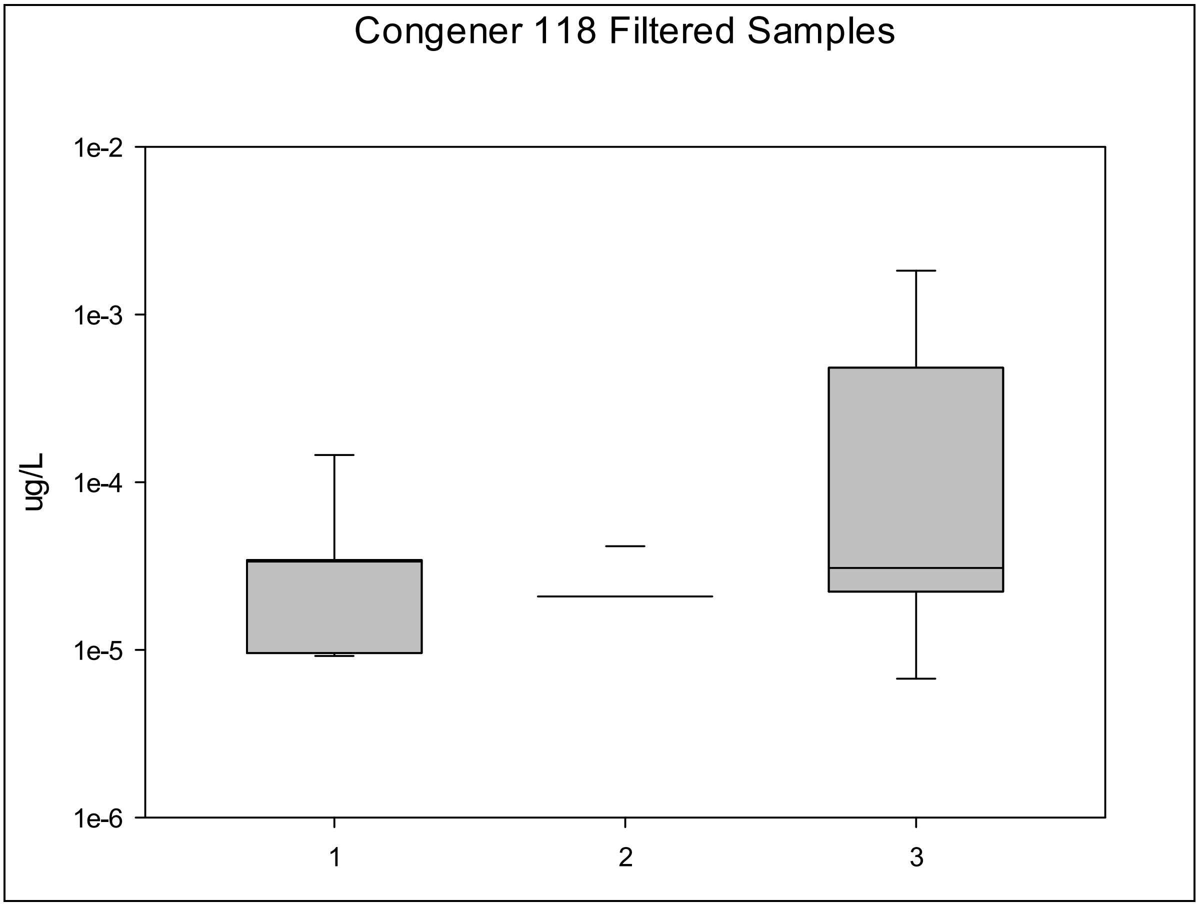
PCB Congener 114	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.00	n/a	n/a
average mass fraction in size 2.7 to 20 um	0.27	n/a	n/a
average mass fraction in size 20 to 63 um	0.32	n/a	n/a
average mass fraction in size >63 um	0.41	n/a	n/a

Congener 118 Characteristics

Observed Concentrations for PCB Congener 118 (µg/L)

118 mixed bulk flows	118 upper watershed bulk flows	118 NBSD bulk flows	118 mixed filtered flows	118 upper watershed filtered flows	118 NBSD filtered flows	118 all bulk combined	118 all filtered combined
5.58E-04	9.46E-05	1.62E-04	3.37E-05	4.15E-05	3.05E-05	5.58E-04	3.37E-05
1.40E-04	7.65E-04	6.00E-03	9.15E-06	nd	1.83E-03	1.40E-04	9.15E-06
1.71E-04		3.02E-04	3.42E-05		3.23E-05	1.71E-04	3.42E-05
5.02E-05		1.80E-04	9.52E-06		2.73E-05	5.02E-05	9.52E-06
9.30E-04		3.33E-06	3.36E-05		3.09E-05	9.30E-04	3.36E-05
3.89E-04			1.45E-04		6.70E-06	3.89E-04	1.45E-04
			2.31E-05			9.46E-05	2.31E-05
						7.65E-04	4.15E-05
						1.62E-04	nd
						6.00E-03	3.05E-05
						3.02E-04	1.83E-03
						1.80E-04	3.23E-05
						3.33E-06	2.73E-05
							3.09E-05
							6.70E-06
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.99			0.92				

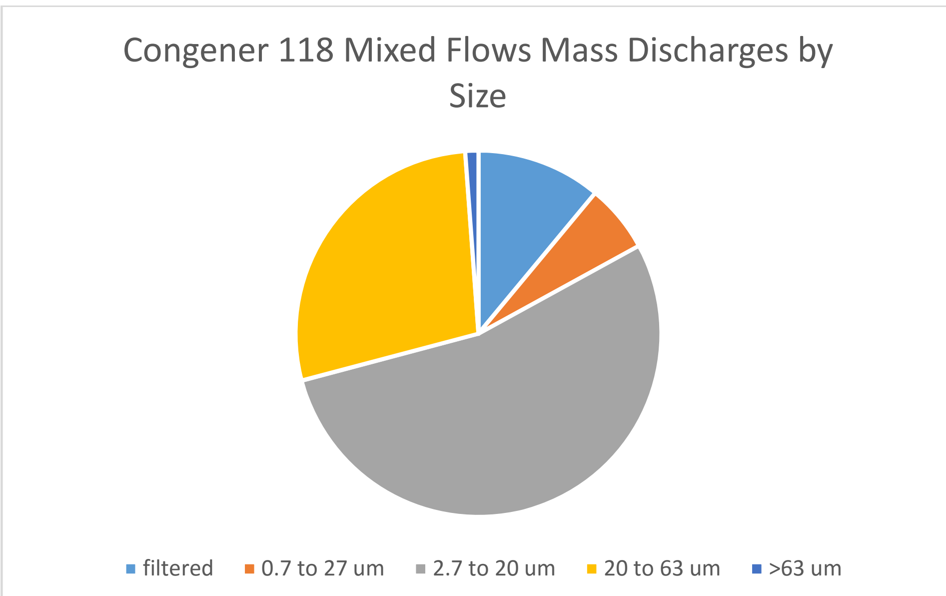

Congener 118 Unfiltered Samples
1e-2
1e-3
1e-4
1e-5
1e-6
ug/L
1
2
3
1: mixed creek flows
2: upper watershed flows
3: NBSD flows

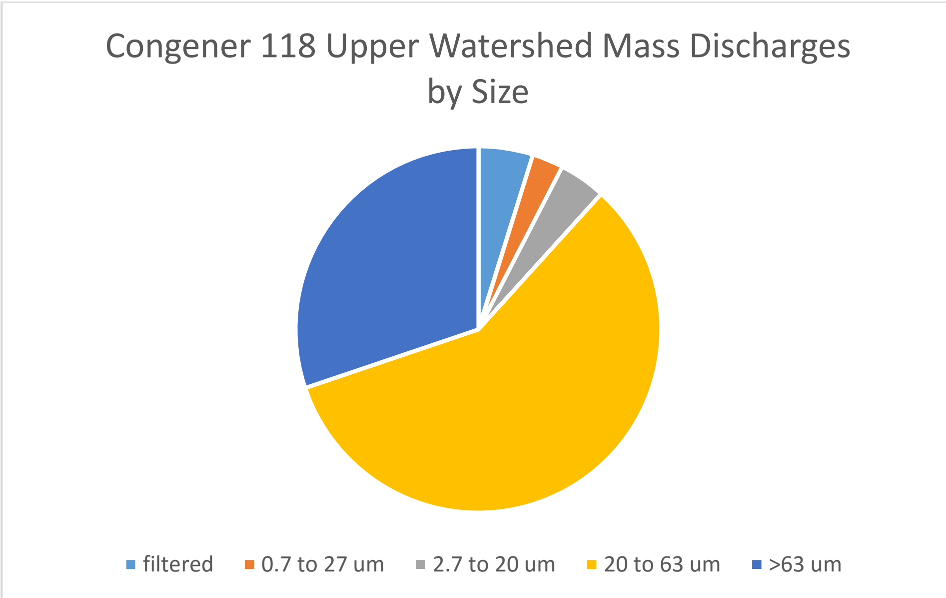


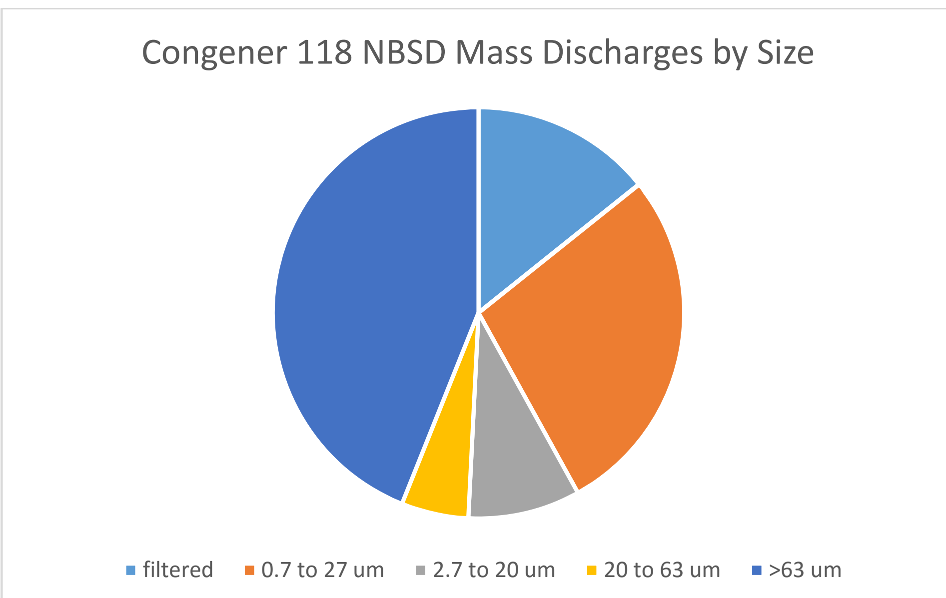
Congener 118 Concentrations (μg/L)

Column	Count	Mean	Std Dev	COV	Max	Min	Median
118 all bulk	13	7.50E-04	1.60E-03	2.13	6.00E-03	3.33E-06	1.80E-04
118 all filtered	15	1.52E-04	4.64E-04	3.05	1.83E-03	0.00E+00	3.09E-05

PCB Congener 118	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.07	0.03	0.05
average mass fraction in size 2.7 to 20 um	0.61	0.04	0.63
average mass fraction in size 20 to 63 um	0.31	0.61	0.20
average mass fraction in size >63 um	0.01	0.32	0.12




Congener 118 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um


Congener 118 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 123 Characteristics

Observed Concentrations for PCB Congener 123 (µg/L)

123 mixed bulk flows	123 upper watershed bulk flows	123 NBSD bulk flows	123 mixed filtered flows	123 upper watershed filtered flows	123 NBSD filtered flows	123 all bulk combined	123 all filtered combined
5.46E-05	nd	nd	7.09E-05	nd	nd	5.46E-05	7.09E-05
nd	nd	3.80E-04	nd	nd	1.49E-04	nd	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd			nd		nd	nd	nd
			nd			nd	nd
						nd	nd
						nd	nd
						3.80E-04	nd
						nd	1.49E-04
						nd	nd
						nd	nd
							nd
							nd
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.93			0.83				

Too many non-detects to plot

Congener 123 Concentrations (µg/L)

Column	Count	Mean	Std Dev	COV	Max	Min	Median
123 all bulk	13	3.34E-05	1.05E-04	3.14	3.80E-04	nd	nd
123 all filtered	15	1.47E-05	4.14E-05	2.82	1.49E-04	nd	nd

PCB Congener 123	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	n/a	n/a	0.05
average mass fraction in size 2.7 to 20 um	n/a	n/a	0.95
average mass fraction in size 20 to 63 um	n/a	n/a	0.00
average mass fraction in size >63 um	n/a	n/a	0.00

Congener 126 Characteristics

Observed Concentrations for PCB Congener 126 (µg/L)

126 mixed bulk flows	126 upper watershed bulk flows	126 NBSD bulk flows	126 mixed filtered flows	126 upper watershed filtered flows	126 NBSD filtered flows	126 all bulk combined	126 all filtered combined
9.62E-05	nd	nd	4.58E-05	nd	nd	9.62E-05	4.58E-05
nd	nd	3.73E-04	nd	nd	1.73E-04	nd	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd			nd		nd	nd	nd
			nd			nd	nd
						nd	nd
						nd	nd
						3.73E-04	nd
						nd	1.73E-04
						nd	nd
						nd	nd
							nd
							nd
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.88			0.90				

Too many non-detects to plot

Congener 126 Concentrations (µg/L)

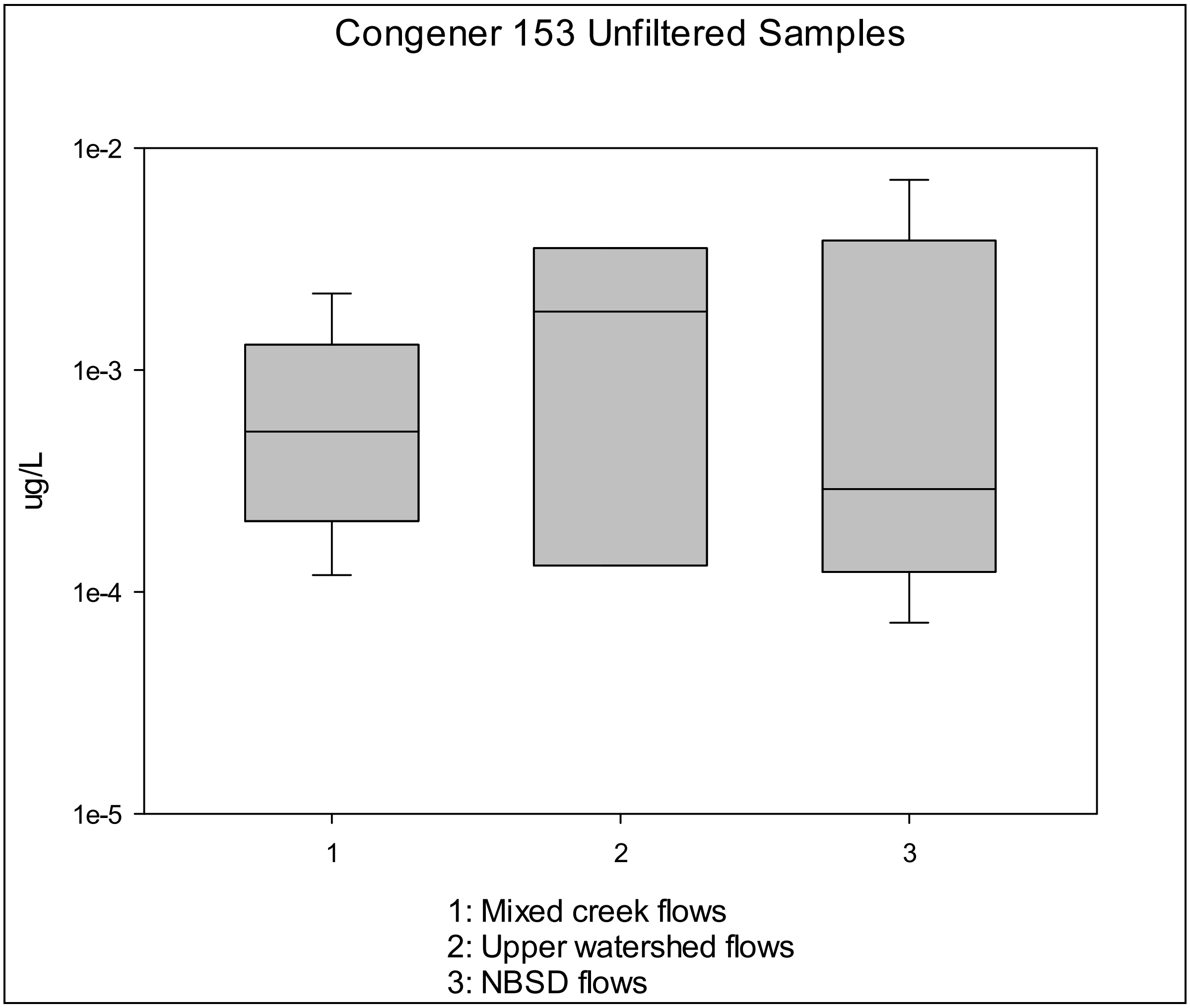
Column	Count	Mean	Std Dev	COV	Max	Min	Median
126 all bulk	13	3.11E-05	1.08E-04	3.47	3.73E-04	nd	nd
126 all filtered	15	1.24E-05	4.62E-05	3.73	1.73E-04	nd	nd

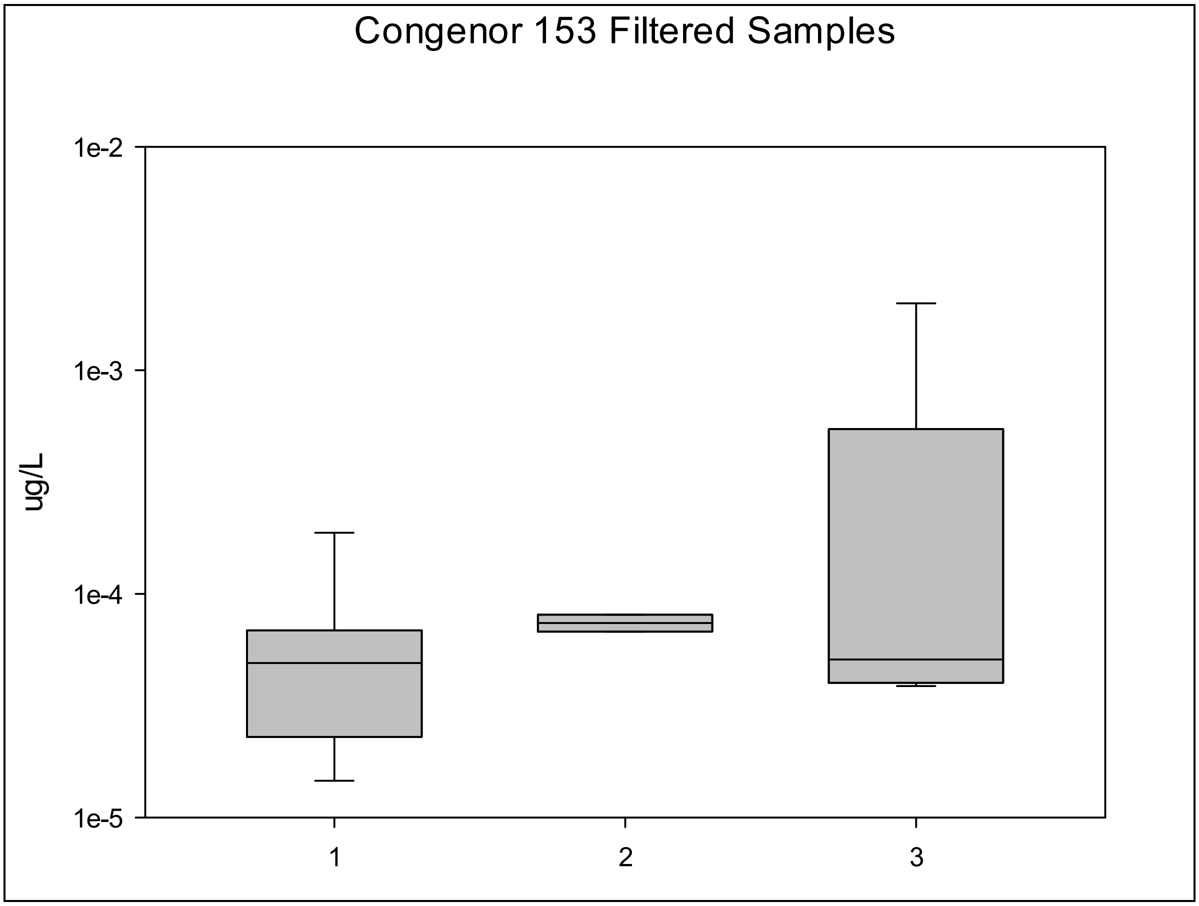
PCB Congener 126	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.00	n/a	0.11
average mass fraction in size 2.7 to 20 um	0.65	n/a	0.78
average mass fraction in size 20 to 63 um	0.35	n/a	0.00
average mass fraction in size >63 um	0.00	n/a	0.11

Congener 153 Characteristics

Observed Concentrations for PCB Congener 153 (µg/L)

153 mixed bulk flows	153 upper watershed bulk flows	153 NBSD bulk flows	153 mixed filtered flows	153 upper watershed filtered flows	153 NBSD filtered flows	153 all bulk combined	153 all filtered combined
9.99E-04	1.31E-04	2.91E-04	4.90E-05	6.76E-05	5.59E-05	9.99E-04	4.90E-05
2.39E-04	3.54E-03	7.22E-03	2.29E-05	8.06E-05	1.99E-03	2.39E-04	2.29E-05
3.86E-04		4.70E-04	3.89E-05		4.56E-05	3.86E-04	3.89E-05
1.19E-04		1.74E-04	1.46E-05		3.87E-05	1.19E-04	1.46E-05
2.22E-03		7.26E-05	6.87E-05		4.04E-05	2.22E-03	6.87E-05
6.72E-04			1.87E-04		6.33E-05	6.72E-04	1.87E-04
			6.08E-05			1.31E-04	6.08E-05
						3.54E-03	6.76E-05
						2.91E-04	8.06E-05
						7.22E-03	5.59E-05
						4.70E-04	1.99E-03
						1.74E-04	4.56E-05
						7.26E-05	3.87E-05
							4.04E-05
							6.33E-05
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.91			0.38				

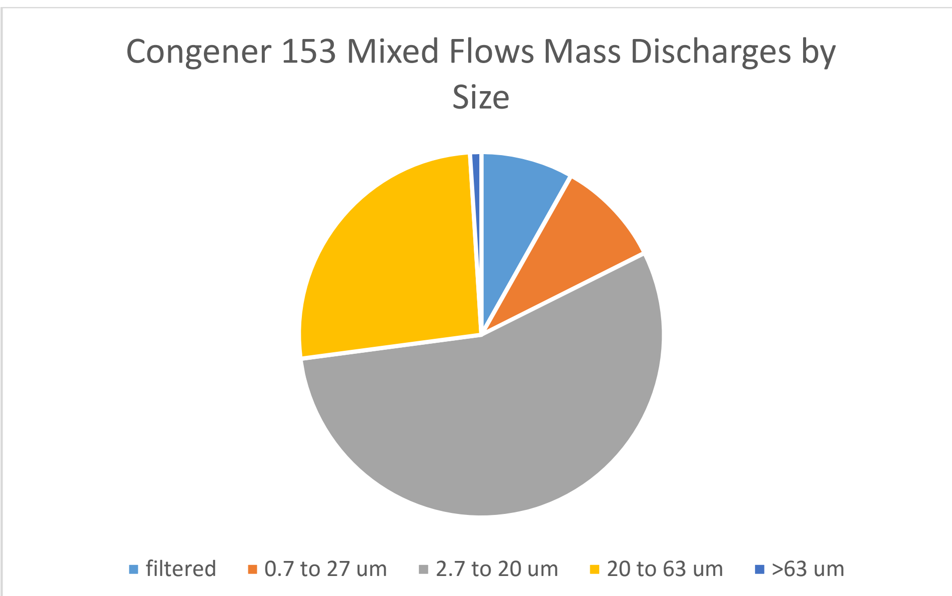

Congener 153 Unfiltered Samples
1e-2
1e-3
1e-4
1e-5
ug/L
1
2
3
1: Mixed creek flows
2: Upper watershed flows
3: NBSD flows

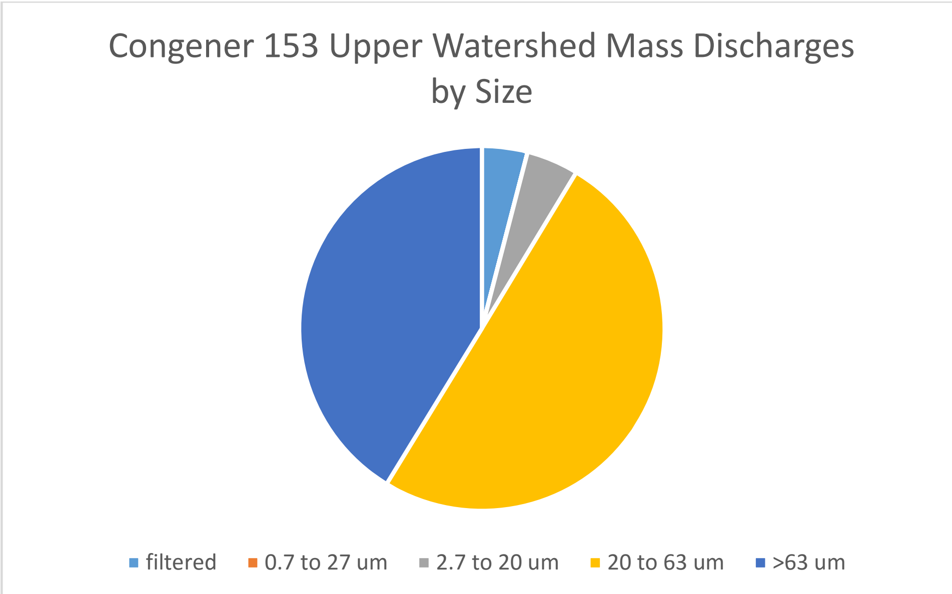


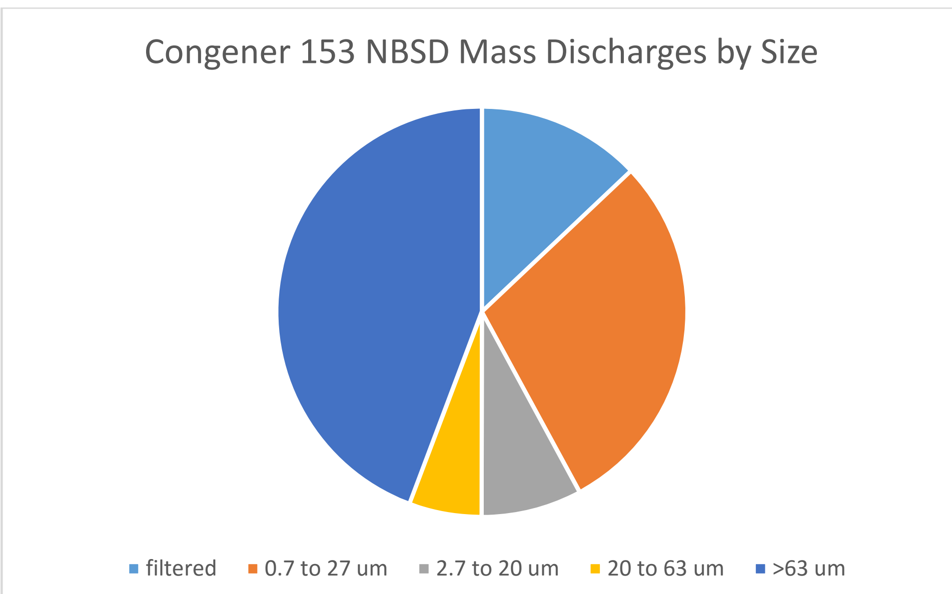
Congener 153 Concentrations (μg/L)

Column	Count	Mean	Std Dev	COV	Max	Min	Median
153 all bulk	13	1.27E-03	2.05E-03	1.61	7.22E-03	7.26E-05	3.86E-04
153 all filtered	15	1.88E-04	5.00E-04	2.66	1.99E-03	1.46E-05	5.59E-05

PCB Congener 153	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.10	0.00	0.03
average mass fraction in size 2.7 to 20 um	0.60	0.05	0.66
average mass fraction in size 20 to 63 um	0.28	0.52	0.18
average mass fraction in size >63 um	0.01	0.43	0.13



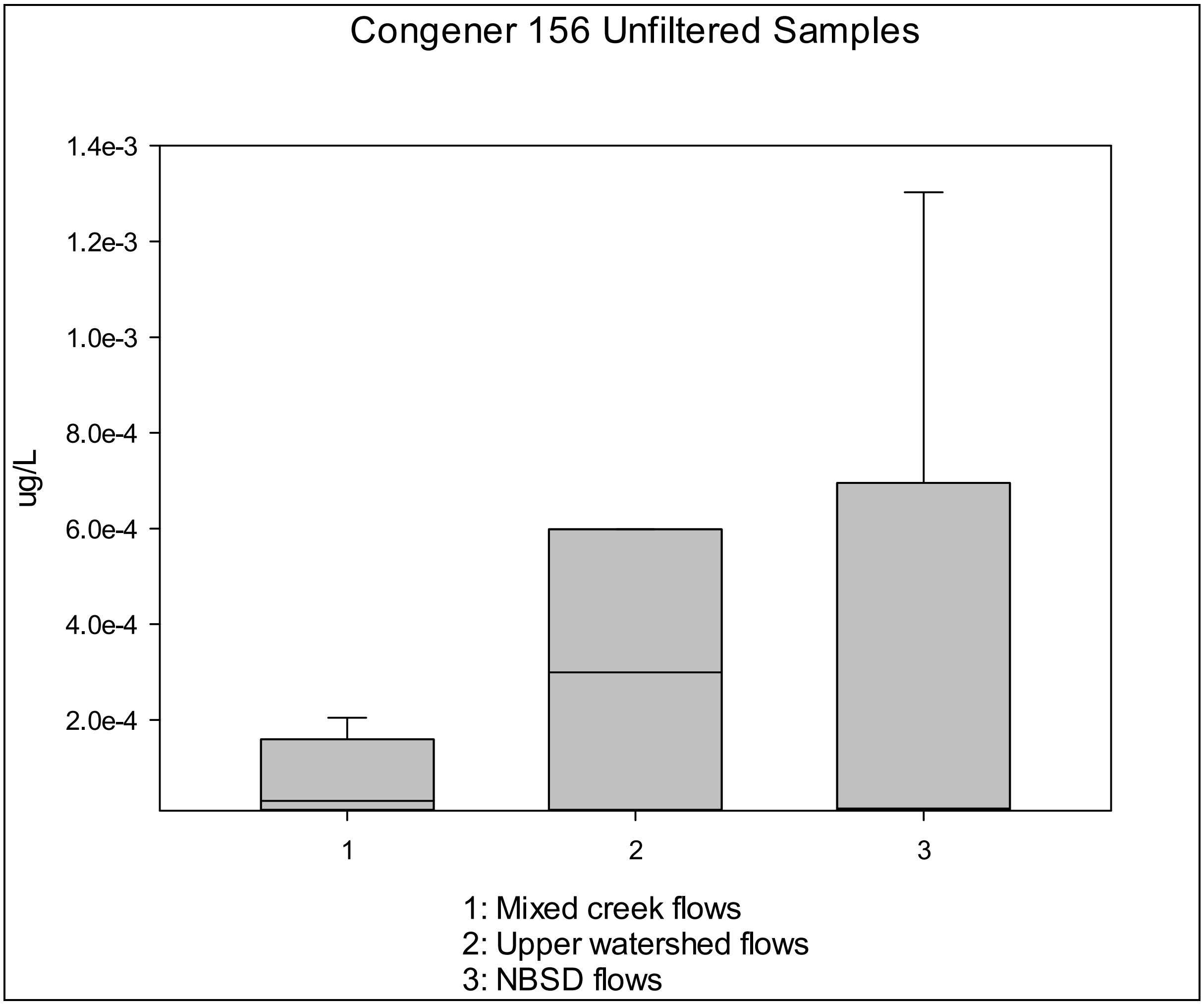

Congener 153 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

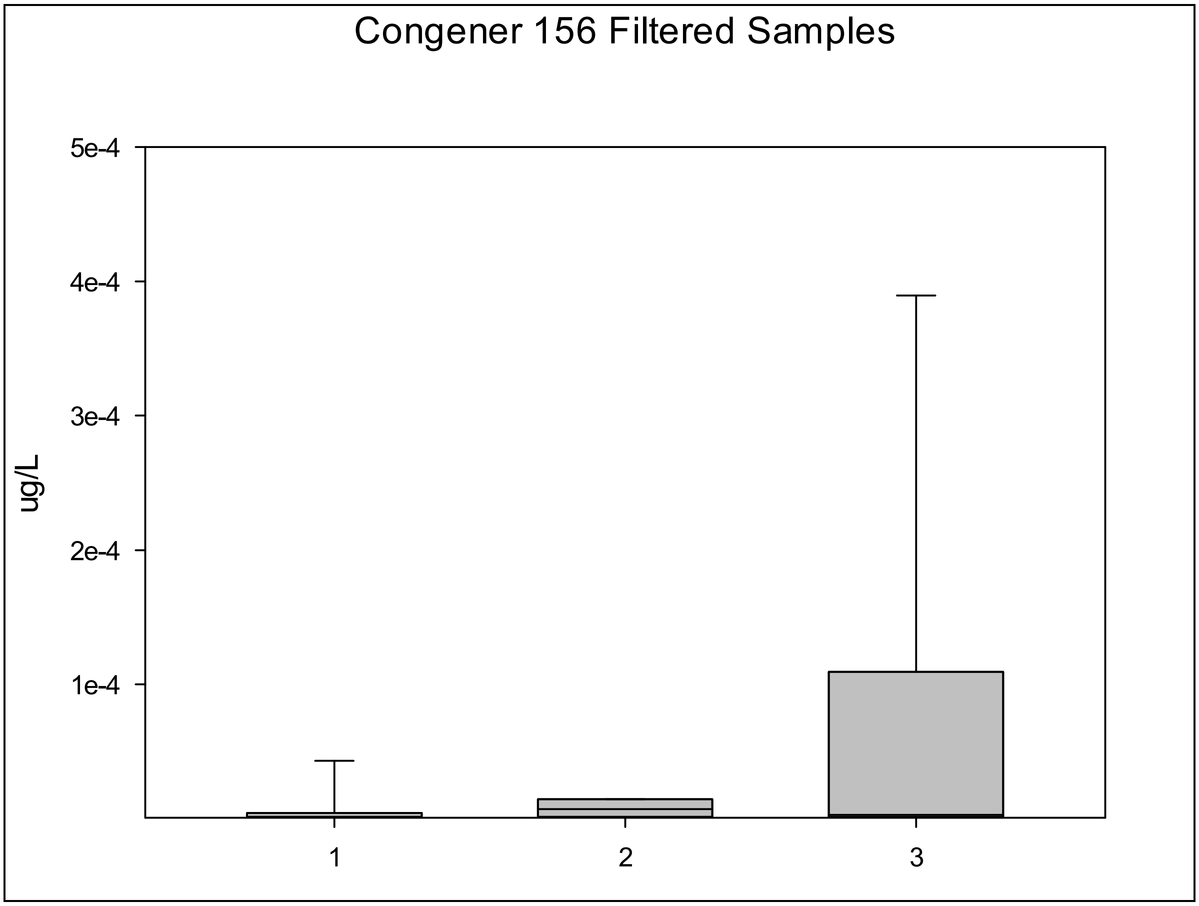

Congener 153 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 156 Characteristics

Observed Concentrations for PCB Congener 156 (µg/L)

156 mixed bulk flows	156 upper watershed bulk flows	156 NBSD bulk flows	156 mixed filtered flows	156 upper watershed filtered flows	156 NBSD filtered flows	156 all bulk combined	156 all filtered combined
2.05E-04	nd	nd	4.33E-05	nd	nd	2.05E-04	4.33E-05
4.41E-05	5.99E-04	1.30E-03	4.34E-06	1.46E-05	3.89E-04	4.41E-05	4.34E-06
nd		8.86E-05	nd		5.99E-06	nd	nd
1.72E-05		nd	3.89E-06		nd	1.72E-05	3.89E-06
nd		1.55E-05	nd		nd	nd	nd
1.45E-04			nd		1.61E-05	1.45E-04	nd
			nd			nd	nd
						5.99E-04	nd
						nd	1.46E-05
						1.30E-03	nd
						8.86E-05	3.89E-04
						nd	5.99E-06
						1.55E-05	nd
							nd
							1.61E-05
Kruskal-Wallis One Way Analysis of Variance on Ranks							
0.98			0.81				

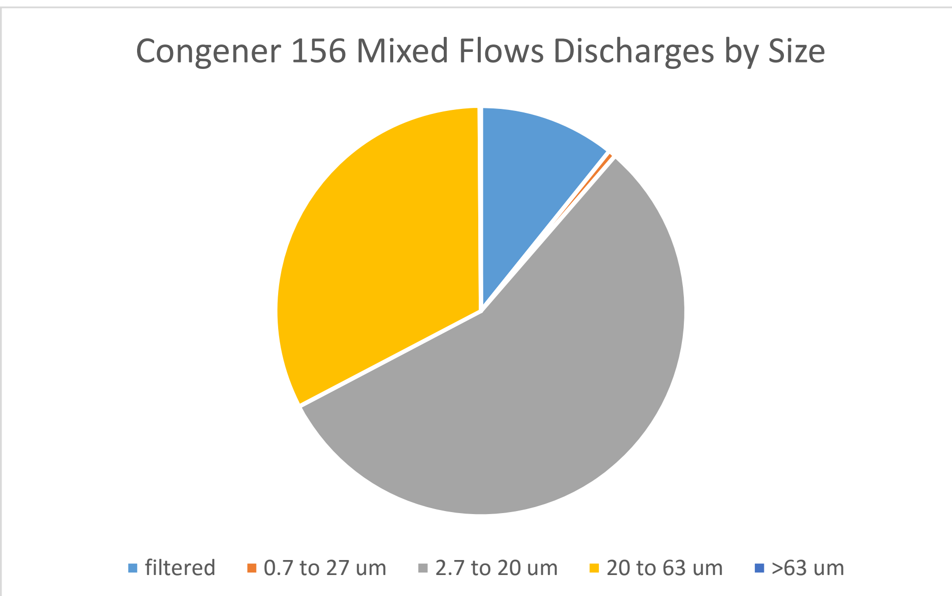

Congener 156 Unfiltered Samples
1.4e-3
1.2e-3
1.0e-3
8.0e-4
6.0e-4
4.0e-4
2.0e-4
ug/L
1
2
3
1: Mixed creek flows
2: Upper watershed flows
3: NBSD flows

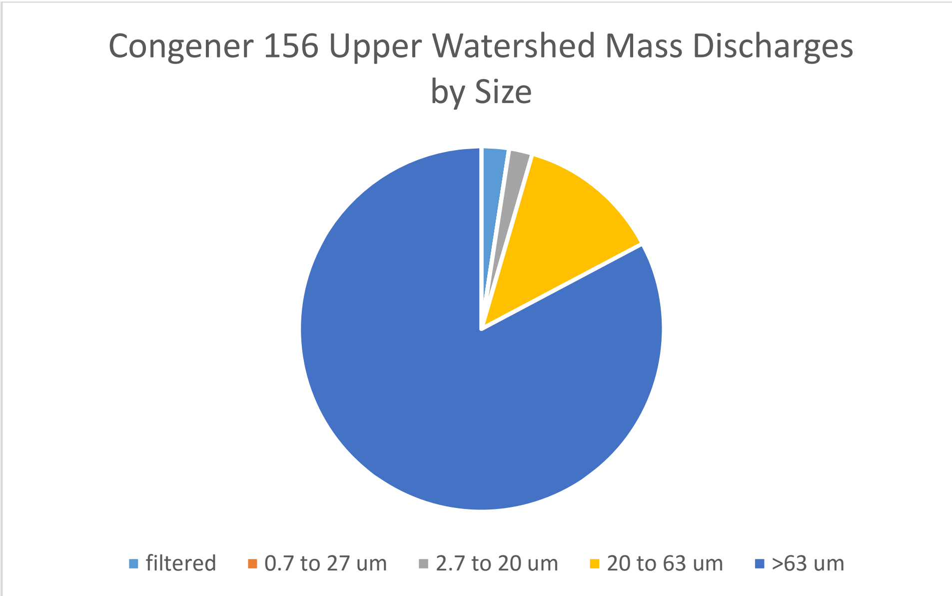


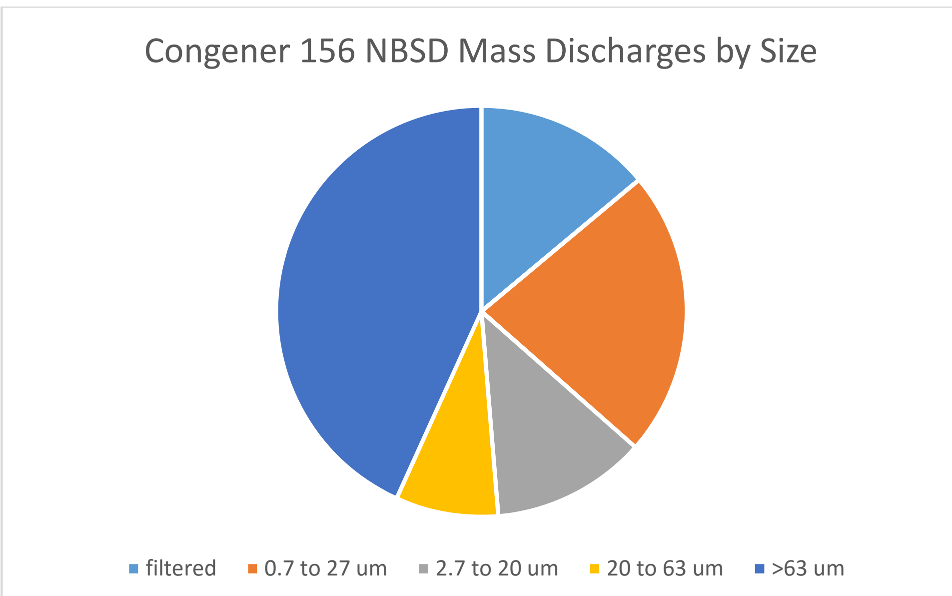
Congener 156 Concentrations (µg/L)

Column	count	Mean	Std Dev	COV	Max	Min	Median
156 all bulk	13	1.86E-04	3.74E-04	2.01	1.30E-03	nd	1.72E-05
156 all filtered	15	3.18E-05	9.96E-05	3.13	3.89E-04	nd	nd

PCB Congener 156	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.01	0.00	0.01
average mass fraction in size 2.7 to 20 um	0.63	0.02	0.52
average mass fraction in size 20 to 63 um	0.37	0.13	0.28
average mass fraction in size >63 um	0.00	0.85	0.19




Congener 156 Upper Watershed Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um


Congener 156 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Congener 157 Characteristics

Observed Concentrations for PCB Congener 157 (µg/L)

157 mixed bulk flows	157 upper watershed bulk flows	157 NBSD bulk flows	157 mixed filtered flows	157 upper watershed filtered flows	157 NBSD filtered flows	157 all bulk combined	157 all filtered combined
5.52E-05	nd	nd	3.38E-05	nd	nd	5.52E-05	3.38E-05
nd	nd	3.06E-04	nd	nd	9.83E-05	nd	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd		nd	nd		nd	nd	nd
nd			nd		nd	nd	nd
			nd			nd	nd
						nd	nd
						nd	nd
						3.06E-04	nd
						nd	9.83E-05
						nd	nd
						nd	nd
							nd
							nd

mostly non-detects

PCB Congener 157	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.00	n/a	0.07
average mass fraction in size 2.7 to 20 um	1.00	n/a	0.93
average mass fraction in size 20 to 63 um	0.00	n/a	0.00
average mass fraction in size >63 um	0.00	n/a	0.00

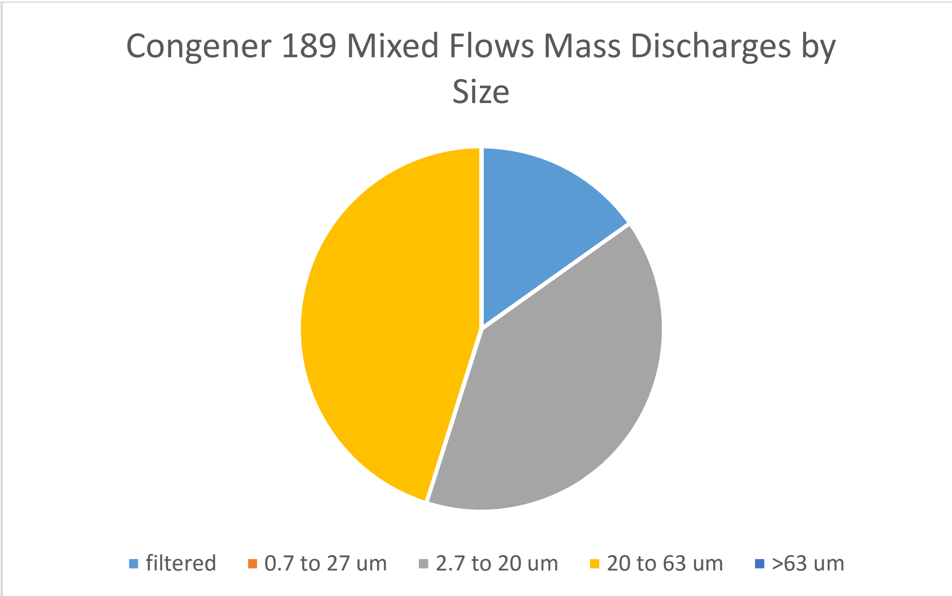
Congener 189 Characteristics

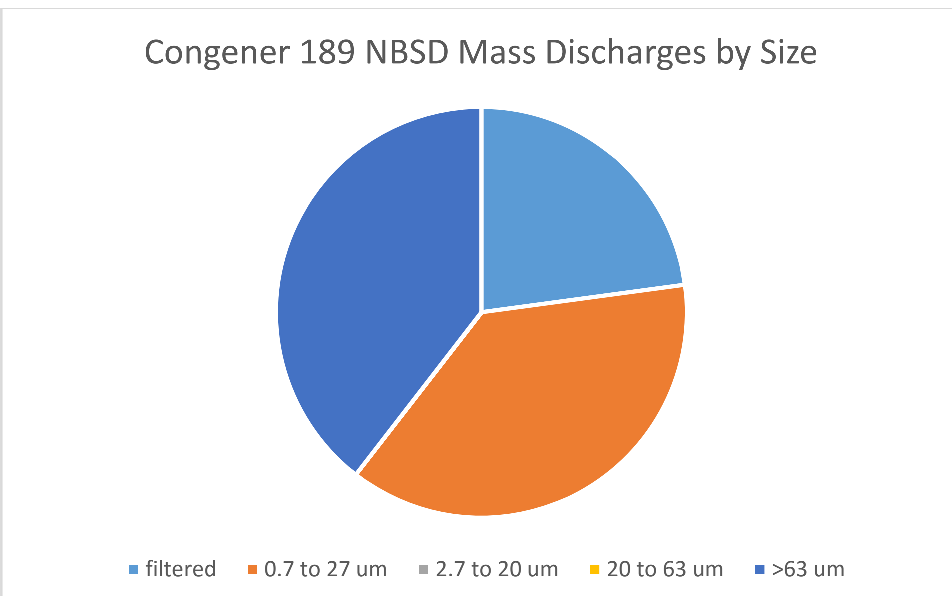
Observed Concentrations for PCB Congener 189 (µg/L)

189 mixed bulk flows	189 upper watershed bulk flows	189 NBSD bulk flows	189 mixed filtered flows	189 upper watershed filtered flows	189 NBSD filtered flows
7.87E-06	nd	nd	1.39E-06	nd	nd
nd	nd	1.17E-05	nd	nd	5.14E-06
nd		nd	nd		nd
nd		nd	nd		nd
nd		nd	nd		nd
nd			nd		nd
			nd		

mostly non-detects

PCB Congener 189	Mixed Flows: A1W, A2W, A3W, and C1W (7 samples)	Upper watershed flows (mostly residential): C2W (2 samples)	NBSD watershed flows (mostly industrial): O1W, O2W, O3W, O4W (6 samples)
average mass fraction in size 0.7 to 27 um	0.00	n/a	0.05
average mass fraction in size 2.7 to 20 um	0.47	n/a	0.95
average mass fraction in size 20 to 63 um	0.53	n/a	0.00
average mass fraction in size >63 um	0.00	n/a	0.00


Congener 189 Mixed Flows Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um


Congener 189 NBSD Mass Discharges by Size
filtered
0.7 to 27 um
2.7 to 20 um
20 to 63 um
>63 um

Appendix IV In-Situ TIE
Final Report

G. Allen Burton, Jr., Co-Principal Investigator

University of Michigan

September 18, 2017

Submitted to:
Danny Reible, PI
Tetra Tech University

Assessment and Management of Stormwater Impacts on Sediment Recontamination

SERDP ER-2428

Background

As a Co-Principal Investigator, the University of Michigan (G. Allen Burton, Jr.) contributed to the project in two primary ways. First, advice was provided on stormwater sampling, including sample collection methods, quality assurance and quality control issues associated with stormwater and sediment sampling, biological effects characterizations, interpreting results, and advancing the technology of identifying which stormwater stressors are most important. This last task consisted of optimizing the "in situ Toxicity Identification Evaluation" (iTIE) method approach to determine if which chemicals are the primary toxicants at test sites. The development of the iTIE and associated beta testing are described below.

Methods

Optimizing the iTIE system

During the first two years of this project, research was conducted on optimizing the iTIE system for two M.S. thesis studies (Steigmeyer 2015, Meyer 2016). Steigmeyer research concentrated on Contaminants of Emerging Concern (CECs) such as pharmaceuticals, antibiotics, and other personal care products as well as various metals with a goal to develop a device capable of autonomous *in situ* TIE experiments. Steigmeyer developed the iTIE system to improve the pumping system and evaluated several methodological issues (Table 1). Four iTIE system models were tested by Steigmeyer (Fig. 1). Each model was designed and tested by considering the functional requirements and experiment goals outlined in Table 1. The final model he developed was successfully designed and tested in a series of laboratory fractionation tests.

Meyer thesis studies aimed to optimize the iTIE system through the evaluation of different resins (chelex, activated carbon, and zeolite) and contaminant (ammonia, zinc, nickel, and vanadium) combinations. Extensive detail of her methods, design and findings are provided in her thesis (Meyer 2016) and will not be repeated here.

A critical shortcoming of previous iTIE systems developed by the Co-PI has been the pumping system. A more robust pumping system was needed that could pump at very low rates (e.g., 25 ml/hr) so as not to exceed the resin adsorption capacity and not create a zone of withdrawal in pore water systems that extracted surface waters. To this end, in the final year of this project, we were able to obtain Quad Peristaltic Pump Units (Welco) and accompanying Pelican cases that were optimized and tested by SeaView Systems, Dexter, MI. Each Pelican case was equipped with 4 peristaltic pumps, with corresponding inlet/outlet ports on sides (Figure 1 and Figure 2). Currently, 3 Quad Peristaltic Pump Units have been manufactured, allowing for 12 iTIE units to be tested. Pumping capacity is from zero to 500 mL/hour. These units were pretested in the laboratory to ensure they would be appropriate for field deployments in relatively shallow waters.

The final verson of the iTIE system was field tested with SPAWAR at Paleta Creek and their pier. Those methods are provided below. Previous versions of the iTIE system that were the subject of the Steigmeyer and Meyer theses, are not described here, but are described in detail in each of their thesis and the publication in Environmental Toxicology and Chemistry (Steigmeyer et al., 2017).

iTIE units (Figure 3) were acid cleaned (12% hydrochloric acid) prior to deployment. Each iTIE unit was connected to a HDPE sample bottle (1 liter or 500 mL, Fisher) via silicone tubing (Cole-Parmer) with additional silicone tubing and a check valve to prevent backflow into sample bottles. The resins which extract differing types of chemicals, were preweighed (5 g each, dry) and moistened with deionized water. Resins chosen for deployment included activated carbon (AC) (Marineland), HLB (Sigma-Aldrich), Chelex (Bio-Rad Laboratories), and glass wool (Sigma-Aldrich). AC, HLB, and Chelex were chosen as active resins while glass wool represents a control resin. These resins are optimal for selecting for nonpolar organics and metals – which were the primary chemicals of concern at the Paleta test site.

The iTIE systems needed to be purged of air and the resins pre-rinsed. Pumps were set to 100 mL/hour the night before deployment and pumping initiated. The resin HLB is viscous when wet, thus the HLB iTIE units had difficulty pumping at 100 mL/hour. A high rate of pumping is initially necessary to remove any associated contaminates. Approximately 1 g of HLB was removed from each iTIE in an attempt to reduce the pumping resistance. The pump rate was increased to 200 mL/hour and then 400 mL/hour. This pumping rate was sufficient for all iTIE units.

The toxicity test organisms were *Americamysis bahia* (*A. bahia*) and *Leptocheirus plumulosus* (*L. plumulosus*). These were early life stage (the most sensitive to toxicants) and obtained from Aquatic Research Organisms (Hampton, NH). The iTIEs received 10 organisms of each species the day of deployment.

Space and Naval Warfare Systems Command (SPAWAR) San Diego properties served as a reference site for this study. The reference site was located off SPAWAR pier at Naval Base Point Loma (Figure 6) while Paleta Creek at Cummings Road was chosen as the exposure site due to its known contamination and ease of access (Figure 7 and Figure 8). Reference iTIE unit (4 glass wool resins) and exposure iTIE units (2 HLB, 2 AC, 2 Chelex, 1 glass wool) were deployed and set to pump at 100 mL/hour for a 24 h exposure (Figure 9). iTIEs were deployed on 8 August 2017 and recovered on 9 August 2017.

Organism mortality was assessed upon recovery of units. Water samples from collection bottles were taken for metals analyses (dissolved and particulate). Dissolved samples were filtered with 0.45 micron syringe filters. All metals samples were preserved to 2% trace metal grade nitric acid.

Results and Discussion

Thousands of unregulated contaminants are broadly distributed in our natural waters and have either gone undetected until recently, or are now being detected in greater concentrations. Contaminants of Emerging Concern (CECs) are trace chemicals that may pose serious ecological and human health risks. The exact sources and prevalence of these compounds are largely unknown and difficult to assess. Some known CECs are components of pharmaceuticals, antibiotics, and other personal care products, which are ubiquitous and commonly discharged, untreated, from wastewater management facilities. It is usually not fiscally or technologically feasible to filter, extract, or degrade all these chemicals, so individual targeting of specific compounds is the most viable treatment option. Finding a causal link between observed toxicity and a specific compound or group of compounds is difficult when thousands exist in wastewater effluent, with significant variations in spatial and temporal concentrations. Toxicity Identification and Evaluation (TIE) is an EPA-developed experimental approach to take a complicated matrix with established toxicity and partition the components to identify the exact compound(s) responsible. The United States Environmental Protection Agency developed toxicity identification evaluation (TIE) protocols for evaluating sediment and surface water toxicity in a laboratory setting. Following this framework, Burton and Nordstrom developed an in-situ toxicity identification evaluation (iTIE) system, which allows for the toxicity analysis to be done in the field to avoid artifacts introduced when samples are transported to the laboratory. Though TIE methods have been applied to wastewater effluent before, most tests are conducted in a laboratory environment, in which contamination and other artifacts can significantly affect the accuracy of final results. This research aimed to develop a device capable of autonomous *in situ* TIE experiments, providing unparalleled accuracy in the identification of toxicity sources. Deployed directly in the aquatic environment of concern, the device can continuously collect the source water, fractionate its complex chemical mixture with sorbent resins, and conduct bioassay exposures.

The first field version deployed in environments with observed biological impairment successfully targeted specific compounds for extraction, reducing their concentration by 100% in some treatments. Through a series of selective extractions, the possible source(s) of toxicity in a complex solution become clearer. After addressing mechanical issues with the first model, another iTIE system was designed and tested in a series of laboratory fractionation tests, which demonstrated its ability to reliably conduct autonomous TIE experiments. These lab results also demonstrated that genetic methods could be used in conjunction with the iTIE system to identify sub-lethal toxicity, which can be difficult to assess amidst an intricate web of natural and anthropogenic variables. The in situ TIE System can begin to fractionate and isolate confounding variables in a complex system, and help identify indistinct biological threats in the environment.

The 2004 Burton/Nordstrom Model and Field Version I were only tested for mechanical functions in the lab and ultimately rejected for fieldwork due to serious design flaws (Figure 1). Field Version II was deployed at three field sites. Following the field deployments, redesign efforts to address problems encountered with Version II, resulted in Field Version III. Field Version III was used in a laboratory validation study and is undergoing further development to incorporate the internal mechanisms into a field-ready version (Figures 2-9).

The ideal flow rate for effective resin sorption is 25ml/hr [Burton and Nordstrom 2005]. Flow must be consistent and constant through each iTIE cylinder throughout the test, and the flow rate must be the same for all cylinders/treatments deployed

There must be sufficient resin to continually extract target compounds without becoming saturated during the test. The resin powders must be compact and fully cover the circumference of the resin chamber. There can be no pockets where water can seep through or around and never contact the resin.

All resin particles must stay in the resin chamber and not enter the organism chamber Organism should be easily put in chamber without experiencing excessive stress.

The system must store processed samples in individual containers, sealed to prevent contamination from other treatments or the open water. The stand holding the iTIE cylinders in place must be stable and easily submerged.

The stand, iTIE cylinders, and other components must be portable. If some components cannot be waterproofed (like the power source, pumps, etc.) then all conduits must be long enough to allow for minimal restrictions on deployment. The whole system should be as inconspicuous as possible to prevent vandalism The pump(s) used must consume as little power as possible. They must run on a portable battery that can power them for at least 24h. Ideally, the battery is as light as possible for shipping purposes. The system must continuously filter stream water for 24h without failing or requiring maintenance

The field expeditions provided a preliminary assessment of the trace compounds present in wastewater effluent and demonstrated the iTIE system's ability to fractionate this complex mixture. Although the system suffered from serious mechanical problems and other inherent design flaws, the data showed promise for the concept.

There were some obvious differences in the ability of different types of resins to target particular compounds. HLB, a resin designed with an affinity for organic compounds in general, was more effective at removing organic compounds than chelex, a resin designed to remove metals. These expected differences are important for general risk assessment studies to help narrow the field of focus. Narrowing the field even further, though, is the ultimate goal of this system and data from these tests suggests that Phase II TIE fractionation is possible. Activated Carbon and Sep-Pak both target organics in general, but Carbon seems to have a higher affinity for 4-Nonylphnol than Sep-Pak. The removal of specific compounds during exposure tests will help identify those that pose the greatest risk and use that information to guide treatment protocol.

Identifying risks associated with these compounds will require a different approach than a simple 24h survival test. Compounds that lack acute toxicity, but which cause genetic effects that only manifest over time, will not necessarily be apparent in a general risk assessment. Incorporating a genetic analysis into the iTIE protocol was considered and later employed, but fixing the iTIE system design flaws was the first priority.

The experimental results indicate that at least 3-5 grams of resin is needed for significant contaminant removal, the system flow must be maintained below 14 ml/min, and the iTIEs can transition successfully into Phase II of the TIE protocol by allowing for specific contaminant characterization.

Tests performed demonstrated that genetic methods could be used in conjunction with the iTIE system to identify sublethal toxicity and potential to serve as early detection of molecular biomarkers (Steigmeyer 2015 and Steigmeyer et al 2017).

The final iTIE system was successfully tested in the laboratory and in San Diego Bay (SPAWAR and Paleta Creek) (Figures 10-13). The improved pumping system was set to 25 mL/hr and was consistent during the 24 hr deployment period. Initially, a high pumping rate (100 mL/hr) was used to prime the system and saturate the resins, but after several minutes this pumping rate was reduced to 25 mL/hr. Physiochemical parameters of site water are presented in 2 and remained stable during the pumping period. During recovery, *A. bahia* were observed eating *L. plumulosus,* which likely explains low *L. plumulosus* survival in Reference and Paleta units (Tables 2-5). The average number of organisms alive by resin and by site are shown in Tables 3-5, respectively. Dissolved and particulate metals results are provided in Tables 6 and 7.

Copper, the metal of most interest at Paleta, was analyzed for potential differences between resins. To accommodate data normality, a natural log transformation was performed. Results of ANOVA indicated significance differences across resin types for Cu sorption ($p = 0.03$). Tukey HSD results showed significant differences between glass wool and Chelex treatments ($p = 0.039$). Though not statistically significant, HLB and Chelex had a p-value of 0.059.

Pyrethroids are known to be a potential concern at this site; however, the ability to collect water samples that could be tested with appropriate detection limits and QA/QC were doubtful, given how few laboratories can perform these analyses.

In summary, the iTIE system currently shows promise as a diagnostic tool for determining which chemicals are most responsible for causing aquatic toxicity. The system will be further developed in 2018 with new SERDP Seed Grant funding.

References

Steigmeyer, AJ (2015). The *in situ* Toxicity Identification and Evaluation (TIE) Device: A Novel Method for Assessing the Source of Toxicity in Aquatic Systems. Master's thesis, The University of Michigan, Ann Arbor, Michigan.

Steigmeyer, AJ, Zhang, J., Daley, JM, Zhang, X, and Burton Jr, GA. (2017). An *in situ* Toxicity Identification and Evaluation Water Analysis System: Laboratory Validation. Environmental Toxicology and Chemistry, 36, 1636-43.

Meyer, KA (2016). Optimizing the *in situ* Toxicity Identification Evaluation System: Ammonia and Zinc as Examples. Master's thesis, The University of Michigan, Ann Arbor, Michigan.

Tables

Table 1. Functional Requirements for a field iTIE System

Parameter Description
Slow Flow Rate
Consistent Flow Rate
Sufficient Resin Coverage of Chemical Classes
Resin Held in Place
Organisms
Sample Collection
Stable Stand Portable System
Inconspicuous Power Source (to avoid detection and vandalization)

Table 2: Water Physiochemical Parameters

Water Physiochemical Parameters					
Site	**Date**	**Salinity**	**Temp °C**	**DO (mg/L)**	**pH**
Reference	8.Aug.17	32.5	21.2	5.12	7.72
Reference	9.Aug.17	32.5	20.8	5.18	7.88
Paleta	8.Aug.17	32.5	26.4	4.09	7.65
Paleta	9.Aug.17	32.5	24.8	4.18	8.28

Table 3: Organism survival post 24 h exposure

Site	iTIE Unit	Resin	*# A. bahia alive*	*# L. plumulosus ailve*
Paleta	HLB-A	HLB	10	1
Paleta	HLB-B	HLB	10	6
Paleta	AC-A	AC	10	5
Paleta	AC-B	AC	10	2
Paleta	CHELEX-A	CHELEX	9	3
Paleta	CHELEX-B	CHELEX	10	2
Paleta	GW A	GW	8	4
Reference	W (glass wool)	GW	7	3
Reference	X (glass wool)	GW	6	4
Reference	Y (glass wool)	GW	8	1
Reference	Z (glass wool)	GW	7	1
Lab control	--	--	10	6
Lab control	--	--	10	6
Lab control	--	--	10	4
Lab control	--	--	10	8
Travel control	--	--	10	7
Travel control	--	--	10	8
Travel control	--	--	9	8
Travel control	--	--	9	6

Table 4: Average Number of Organisms Alive by Resin

Resin	Avg *A. bahia* alive	Standard Deviation(+/-)	Avg *L. plumulosus* alive	Standard Deviation(+/-)
AC	10	0	3.5	2.1
Chelex	9.5	0.71	2.5	0.71
Glass Wool	7.2	0.84	2.6	1.5
HLB	10	0	3.5	3.5

Table 5: Average Number of Organisms Alive by Site

Site	Avg *A. bahia* alive	Standard Deviation(+/-)	Avg *L. plumulosus* alive	Standard Deviation(+/-)
Paleta	9.6	0.79	3.3	1.8
Reference	7	0.82	2.3	1.5
Travel Control	9.5	0.58	7.3	0.96
Lab Control	10	0	6	1.6

Table 6: ICP-MS Metals Results of Dissolved Water Samples

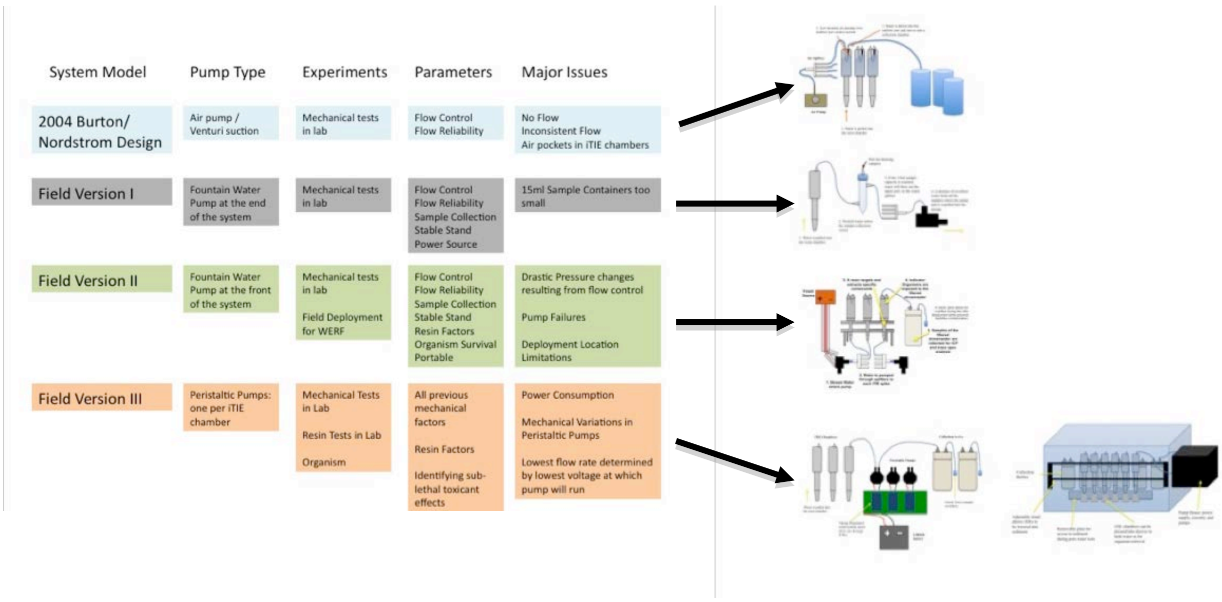
Sample_ID	Ni (ppb)	Cu (ppb)	Fe (ppb)	Mn (ppb)	Zn (ppb)	Cr (ppb)
Paleta_Glass wool a	63.90	933.45	781.44	6.00	34.96	1.18
Paleta_chelex a	49.17	366.79	515.38	0.35	152.53	0.83
Paleta_chelex b	54.76	415.76	521.61	0.46	11.40	0.90
Paleta_charcoal a	44.33	488.53	535.47	6.59	55.57	1.03
Paleta_charcoal b	38.99	544.89	548.19	6.66	9.96	1.24
Paleta_HLB a	44.23	565.78	539.59	4.81	33.25	1.22
Paleta_HLB b	46.08	586.88	553.84	4.58	31.51	1.23
Reference _glass wool w	29.64	578.58	583.31	1.05	10.37	1.43
Reference _glass wool x	16.21	525.25	615.88	1.02	6.78	1.67
Reference_glass wool y	18.41	523.17	688.78	1.05	7.27	1.99
Reference _glass wool z	16.96	596.07	883.44	1.09	7.36	3.60

Table 7: ICP-MS Metals Results of Particulate Water Samples

Sample_ID	Ni (ppb)	Cu (ppb)	Fe (ppb)	Mn (ppb)	Zn (ppb)	Cr (ppb)
Paleta_Glass wool a	56.86	458.04	550.07	5.45	32.30	0.73
Paleta_chelex a	48.74	409.45	517.65	0.47	425.99	0.95
Paleta_chelex b	54.27	447.57	521.79	0.52	8.26	1.05
Paleta_charcoal a	43.72	528.46	539.82	6.47	34.28	1.13
Paleta_charcoal b	38.61	542.65	552.95	6.67	13.59	1.21
Paleta_HLB a	43.83	563.27	540.47	4.76	43.29	1.26
Paleta_HLB b	45.86	615.00	560.77	4.55	30.03	1.46
Reference_glass wool w	29.61	589.11	604.87	1.25	9.22	1.45
Reference _glass wool x	16.59	537.49	642.42	1.31	6.71	1.83
Reference _glass wool y	19.51	570.67	775.50	1.48	6.73	2.58
Reference _glass wool z	17.50	580.65	975.89	1.50	11.10	3.62

Figures

Fig. 1 Outline of the four iTIE Systems tested in the Steigmeyer research.. There is a chronological and technological progression from top to bottom in the chart as various mechanical and experimental factors were tested. System diagrams on the right are explained in detail in their respective sections.



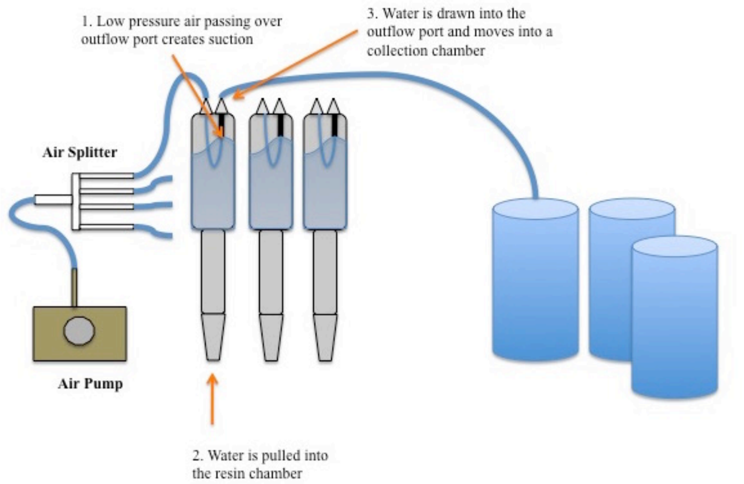


Fig. 2 Overview of the Burton/Nordstrom (air pump-based) design. This system used an air pump to create suction in the organism chambers via the Venturi Effect.

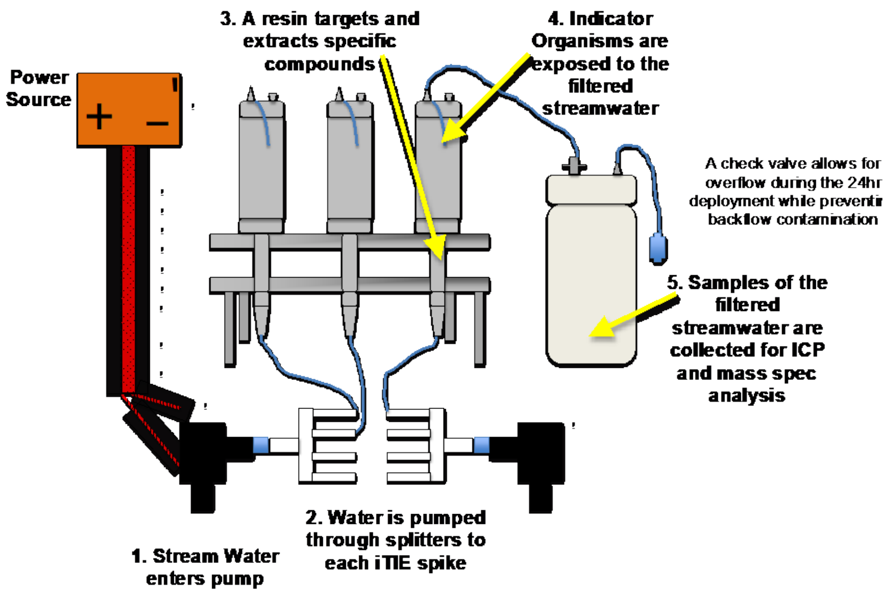


Fig. 3 Field Version II, used for WERF study *in situ* deployments. For Denver and Schaumberg field tests, each iTIE system had one pump driving 8 iTIE chambers. For Boise tests, each stand had 2 pumps (one pump per 4 iTIE chambers).

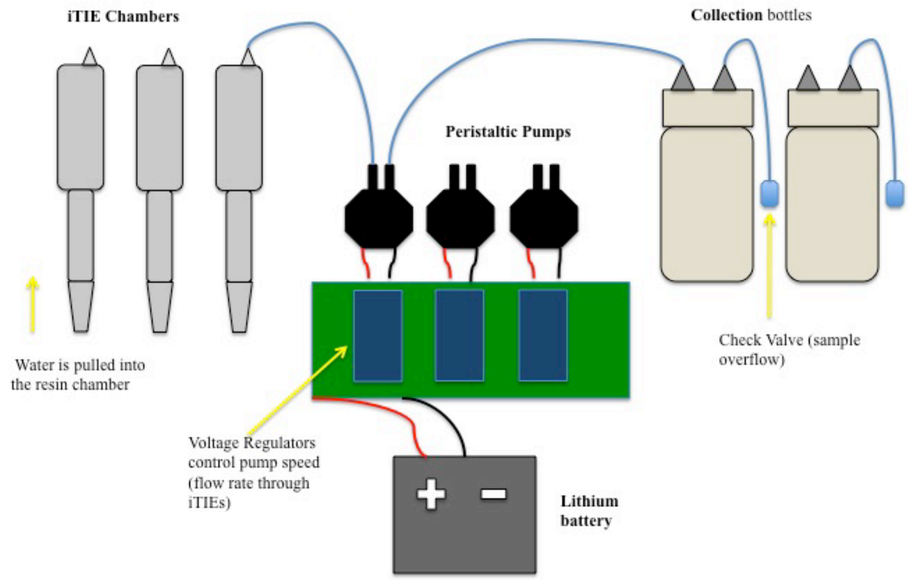


Fig. 4 Overview of the iTIE system design used for chemical fractionation and exposure tests.

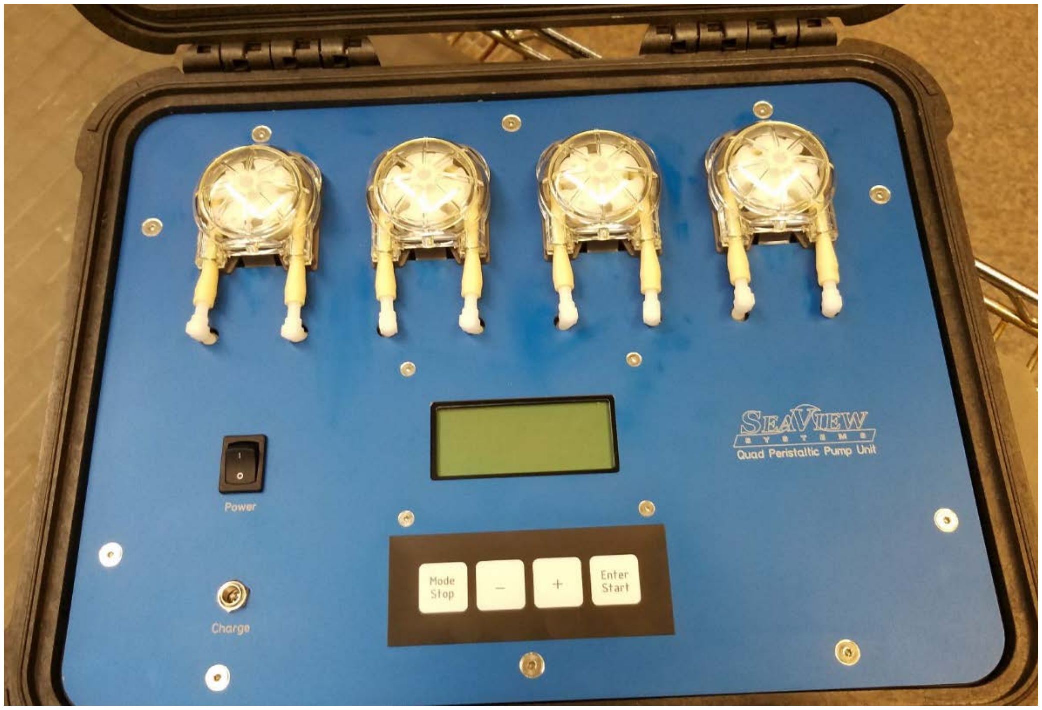


Figure 5: Quad Peristaltic Pump Unit

Figure 6: Side view with inlet/outlet ports corresponding to pumps.

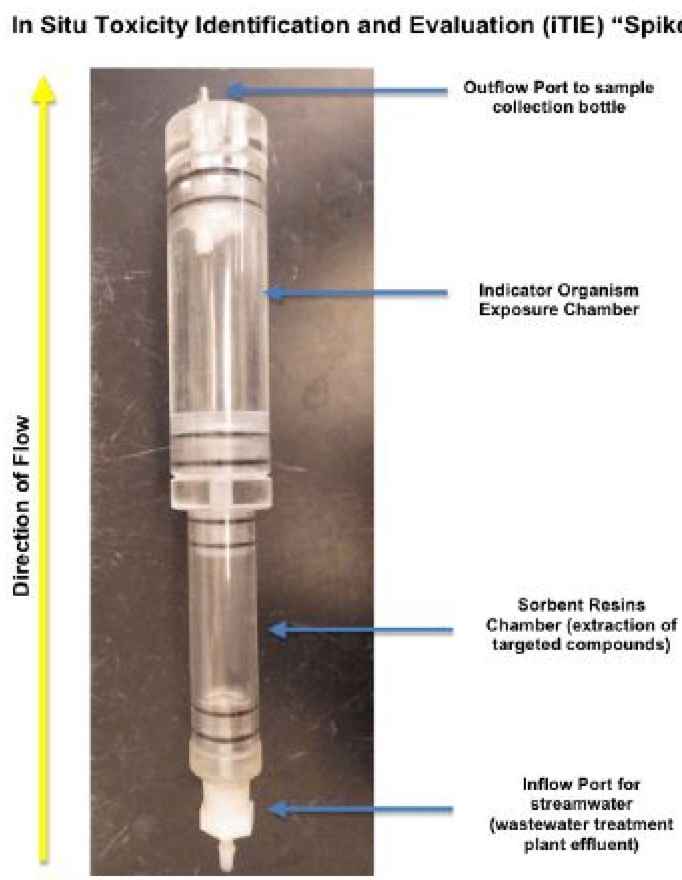


Figure 7: iTIE unit

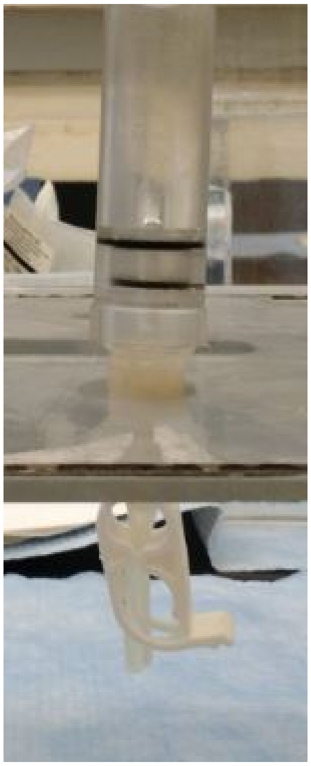


Figure 8: Clamp used to prevent water loss from iTIEs (Crude set-up for pilot testing).

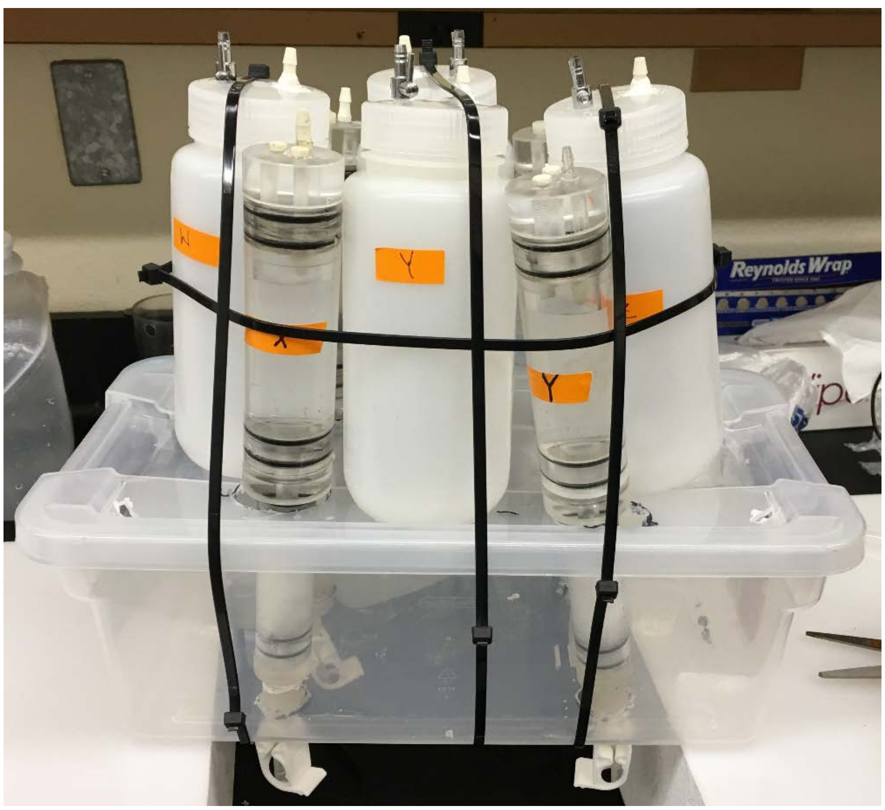


Figure 9: Reference system loaded with organisms.

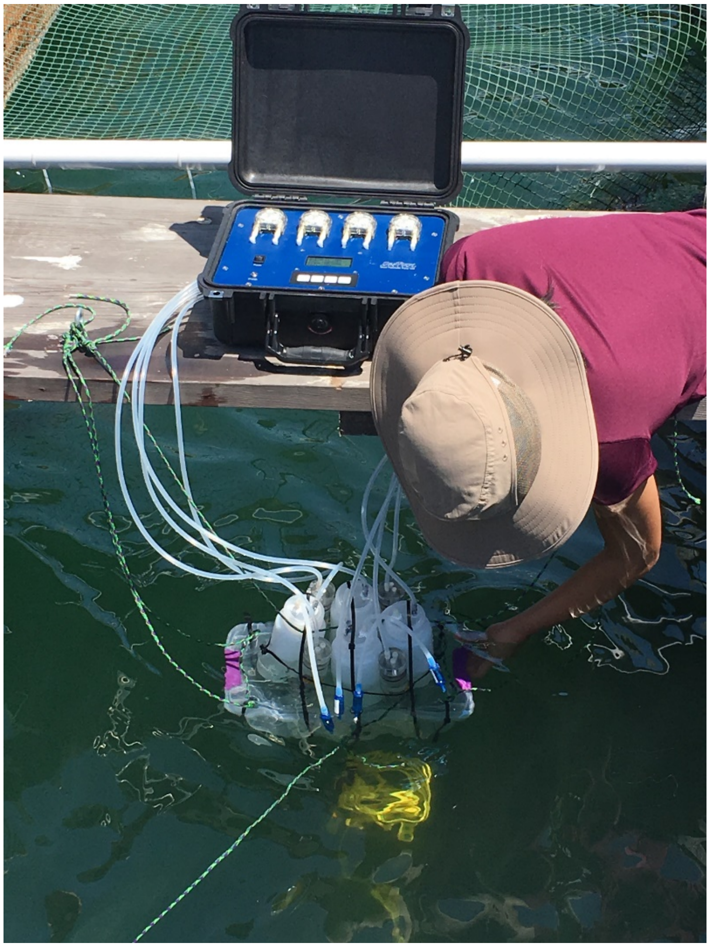


Figure 10: Deploying Reference unit.

Figure 11**: **Satellite image** (Google Maps) **of Paleta Creek at Cummings Road

Figure 12: Floating piers provide easy access to hang exposure unit and secure Pelican cases

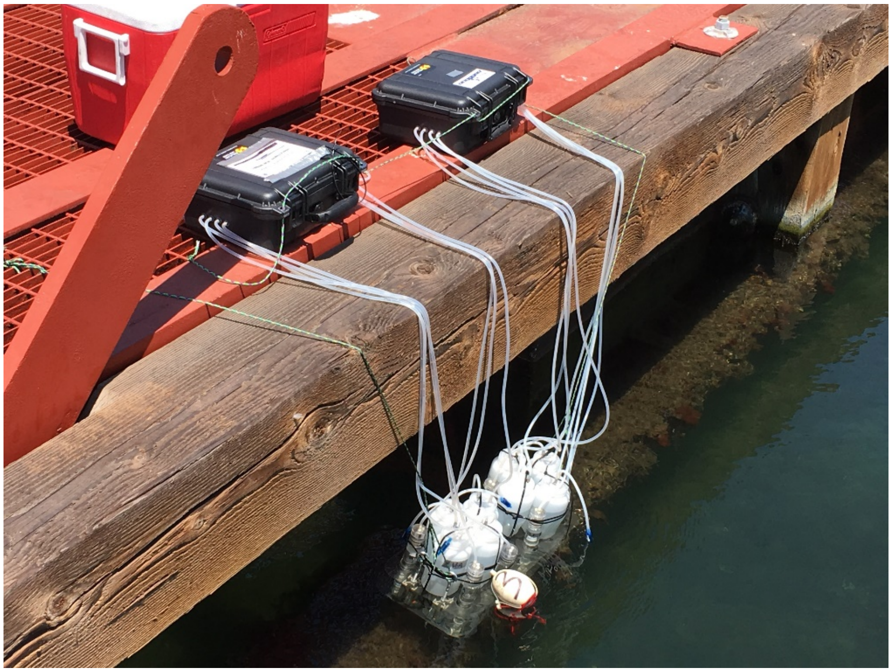
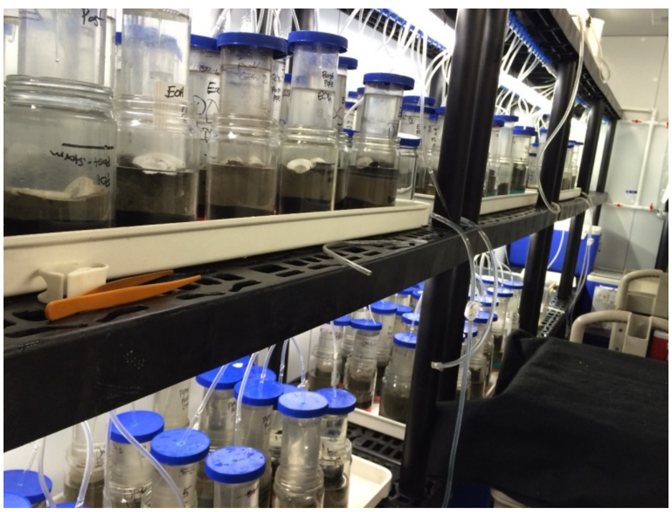


Figure 13: Paleta Creek unit deployed

APPENDIX V

Estuary Model for San Diego Bay

SERDP Project: ER-2428



Prepared by Dr. P.F. Wang
SPAWAR Systems Center Pacific

November 2017

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1. ESTUARY MODEL FOR SAN DIEGO BAY

Modeling studies on the hydrodynamics and contaminant transport in San Diego Bay have been undertaken by SSC SD for over 10 years. Using a 2-dimensional hydrodynamic model, TRIM, SSC SD scientists studied the hydrodynamics and transport patterns in San Diego Bay (Wang, 1998). The same model has been used for a number of fate and transport studies, including sewage spills near the entrance of the bay and the south bay, copper discharge from the convention center de-watering facility, migration of contaminated sediments resuspended by propeller wash (Wang et al., 2000) and copper concentrations in the bay (Wang et al., 2006).

While the performance and predictive capabilities of the TRIM model have been demonstrated, it is limited by the fact that it is a 2-D model, which assumes that the water is fully mixed vertically. To further extend the modeling capability from 2D to 3D, SSC SD scientists have applied the 3-dimensional CH3D (Curvilinear Hydrodynamics in 3-Dimensions) model to a number of Navy-EPA joint projects addressing issues including TMDL of fecal coliform in Sinclair Inlet (ENVVEST Project, Wang et al., 1999), Sediment Transport in Pearl Harbor, and Fate and Transport of Copper Speciation and Toxicity in San Diego Bay (DoD's ESTCP Project, Chadwick, 2008). Thus, CH3D was selected for this study based on a history of successful experience and application with the model for application to San Diego Bay.

2. METHODS

2.1. CURVILINEAR HYDRODYNAMICS IN 3D (CH3D) MODEL SETUP

CH3D is a boundary-fitted, finite difference, Z-coordinate model developed at the U.S. Army Corps of Engineers Waterways Experiment Station (Johnson et al., 1991). CH3D simulates hydrodynamic currents in 3D (x,y,z spatial plus time) and the fate and transport of contaminants in harbors, under the forcing of tides, wind and freshwater inflows (Sheng et al., 1989; Wang and Richter, 1999). The CH3D model has been applied to a number of Navy-EPA joint projects (mentioned above), including those associated with San Diego Bay. The existing CH3D-San Diego Bay model domain covers an area of approximately 110 km^2 and uses a total of approximately 6214 grid elements, with an average resolution of approximately 100 meters.

The CH3D model simulates water currents and tides in San Diego Bay. Tidal harmonic constants, obtained by calibration, were prescribed at the open ocean boundaries (Figure 2-1). CH3D model simulation started from quiescent initial conditions (zero water surface level for the entire Bay) and simulated water surface elevations and tidal currents at every grid cell at a time step of 1 minute (60 seconds). Steady state hydrodynamic conditions in San Diego Bay were reached within the first 48 hours of simulation.

In order to provide sufficient spatial resolution for the local transport, the model grid was refined with resolutions of ~20-50 meters at the creek mouths, including the Paleta Creek mouth. The mouth areas were defined as shown graphically in Figure 2-2. Since the piers north of the Paleta Creek are of circular piling types through which water can flow.

The model boundary was set outside the mouth of San Diego Bay, where tidal heights from the Pacific Ocean were prescribed as the boundary condition. The water column was defined as multiple vertical layers, each of which was prescribed with a fixed thickness of 2.2 meters.

Vertical mixing was governed by the k-ε closure algorithm, which accounts for the momentum balance of turbulence in the water column. As required by the model stability criteria, a time step of 60 seconds was selected for the CH3D estuary model runs.

For all the model calibration/verification runs, the model was run for a period of at least 48 hours before the freshwater inflows and TSS load begin in the simulation. The 48-hour spin-up time was required to let the model reach a steady state hydrodynamic condition.

Figure 2-1. The CH3D model grid for San Diego Bat. Color scale is the bathymetry in meters.

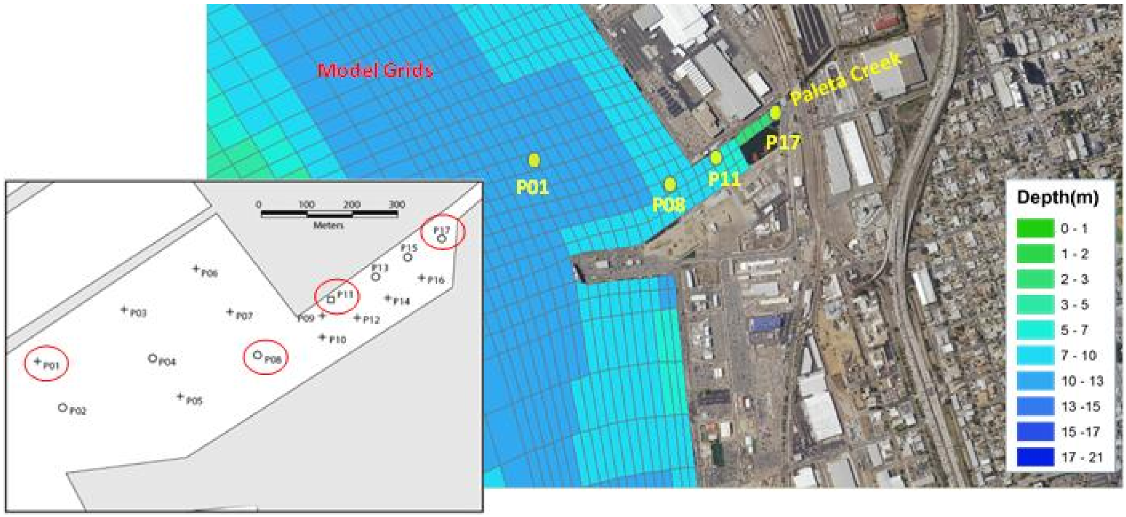

Figure 2-2. The CH3D model grid near the Paleta Creek Mouth (background), Note high density grids in the creek mouth areas. Sediment trap deployment sites: P17, P11, P08, P01 (left lower figure) and the corresponding locations of the model grids.

2.2. FIELD DATA

Field data of creek flowrates and solid concentrations of three particle sizes, including clay, silt and sand were collected during two storm events in 2016. Measurements of creek flow rates and associated solid concentrations of clay, silt and sand were conducted. For Event 1, measurements started at 22:15, Jan 4 and ended at 9:15, Jan 7, a total of about 59 hours. For Event 2, measurements started from 8:00, Jan 30 and ended at 8:45, Feb 1 with a total of about 48.75 hours (see Table 2-1) and Figure 2-3 and Figure 2-4. These two datasets measured during these two-time windows were used to estimate the creek inflow and the associated sediment loads through the Paleta Creek into the receiving water of San Diego Bay. The sediment loads to the fate and transport CH3D model were calculated based on the following equation:

$$S_i = FC_i \left(\frac{30.48^3}{10^6} \right)$$

where S_I represents the sediment load (grams/sec) for particle size i, i=1,2,3 for clay, silt and sand, respectively, F is the creek flow rate (cubic feet per second) and C_i is the solid concentrations (mg/L) for the particle size, i. The number in the parenthesis is the conversion constant.

Table 2-1. Periods, Measured Flow Rates and Solid Concentrations for Wet Weather Event 1 (5 Jan 2016) and Event 2 (31 Jan 2016).

	Event 1	Event 2
Flow Start Date/Time:	1/4/2016 22:15	1/30/2016 8:00
Flow End Date/Time:	1/7/2016 9:15	2/1/2016 8:45
Average Runoff Rate (cfs):	16.37	24.4
CLAY (mg/L)	23.5	5.4
SILT (mg/L)	154.6	108.0
SAND (mg/L)	63.5	8.5

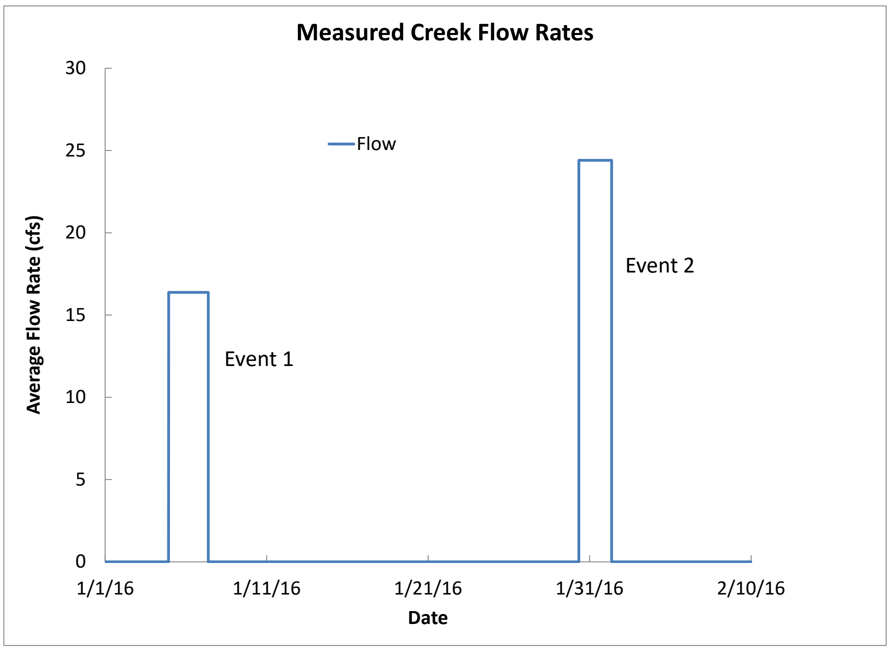

Figure 2-3. Time series of measured creek flow rates for Wet Weather Event 1 (5 Jan 2016) and Event 2 (31 Jan 2016).

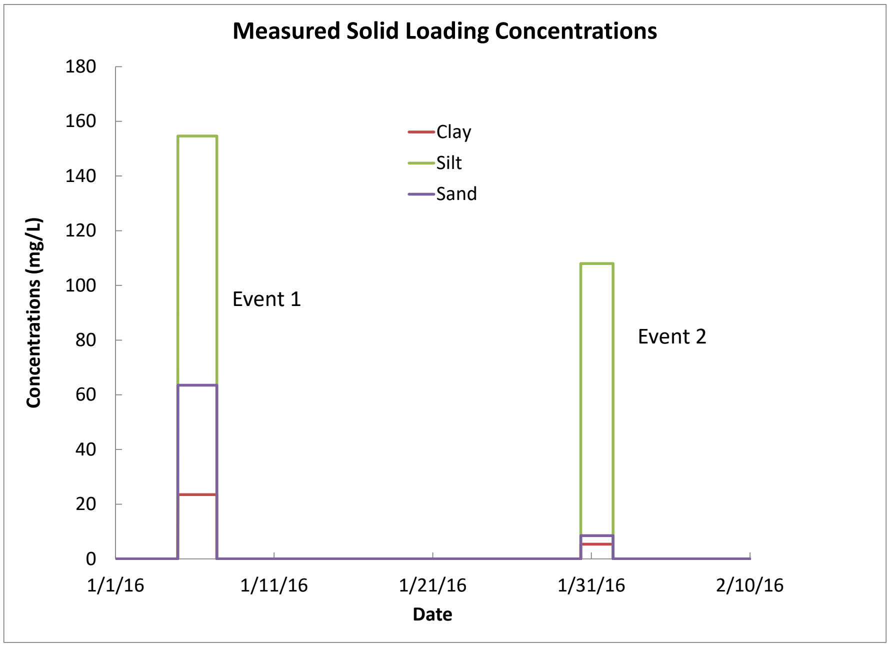

Figure 2-4. Time series of measured creek solid concentrations for Wet Weather Event 1 (5 Jan 2016) and Event 2 (31 Jan 2016).

Model simulations were conducted for Wet Weather Event 1 (5 Jan 2016) and Event 2 (31 Jan 2016). For each event, model simulation was run for 15 days, with the first 48 hours for hydrodynamics only. The initial 48-hour simulation enables the hydrodynamics to reach a quasi-steady state and then the creek flow and the sediment loads were initiated and continued for another 13 days. Model output of net sediment deposition mass (g/cm^2) for clay silt and sand particles were stored. Simulated sediment deposition rates (g/cm2/day) were calculated by dividing the net simulated sediment deposition mass by the total time period (days) for each event.

3. RESULTS – MODEL OUTPUT AND ANALYSIS

Figure 3-1 and Figure 3-2 show the model/data comparisons of the water surface elevation near the Paleta creek mouth for the two time periods of both storm events. As shown in the figures, measured data fluctuate with mixed diurnal and semi-diurnal cycles and are in close agreements with the CH3D model predicted values for both events. Such excellent agreement of hydrodynamics between the CH3D model predictions and measurements, which have been demonstrated in the previous studies, lays the solid foundation for the fate and transport modeling study for San Diego Bay.

Figure 3-3 shows the net depositions of clay, silt, sand particles and sum of them at the end of 15 days of simulation. Although clay particle loads constitute only about 10% (Event 1) and 4.4% (Event 2) of the total sediment loads, they are dispersed and deposit over wider regions than those of the sand particle. Of the three particles, silt deposition dominates over the clay and sand particles in the vicinity of the mouth region. This is because silt particle constitutes over 66% and 88% of the total sediment loads for Event 1 and Event 2, respectively. In addition, silt particles have a settling velocity larger than that of clay particles and smaller than that of sand particles (Table 3-1). Therefore, silt particle deposition resembles that of the total sediment deposition patterns. The net depositions of clay, silt, sand particles and sum of them for Event 2 (Figure 3-4) exhibit patterns similar to those for Event 1 (Figure 3-3), but with smaller magnitude due to the loads with smaller magnitudes.

Figure 3-5 shows the deposition patterns of the three particles of the sum of both events. Similar to both events, silt particle deposition dominates over the clay and sand particle depositions, but with larger magnitudes.

Figure 3-6 shows the comparison between simulated and measured deposition rates at the four sediment trap sites, P01, P08, P11 and P17. The simulated net sediment deposition (in blue, g/cm^2) show a typical source-dispersion pattern with the peak (source) around P17 with the magnitude of deposition gradually reducing with distance, along the P11-P08-P01 direction into San Diego Bay. In the same figure, simulated averaged deposition rates (in red) are estimated by dividing the net deposition by the total length of the time window of the loads (107.75 hours). The selection of the time window is representative of the storm event loads during which field data were measured. Compared to the simulated deposition, which exhibits a dispersion pattern with a source from P17, measured deposition rate (in green) attains a maximum at P17 (similar to model result), and the magnitudes reduce along the P01-P08-P11 direction, which trends against the source-dispersion pattern with the Paleta Creek load as the source, as discussed above. In order to fit the measured patterns, it seems appropriate to add additional source(s) around P01, which is then dispersed along the P01-P08-P11-P17 direction. This hypothesis of additional source(s) is shown in Figure 3-7 with the orange bars representing the difference between the measured rates (in green) and the simulated rates (in blue). With the two dashed lines, one can assume two sources, one near P17 (e.g., Paleta Creek) and the other around P01. Measured deposition rates can be obtained or validated by the following equation:

True Deposition Rate = Simulated Deposition Rate (with source from Paleta Creek) + Assumed Deposition Rate (with hypothetical source around P01)

The above assumption of additional source(s) may also include scenarios of re-suspension and re-distribution of the bottom sediment by propeller wash and/or storm flushing. Wang et al., (2016) demonstrated that propeller wash is the major mechanism to re-suspend sediments in the naval pier regions of San Diego Bay and then to re-distribute the sediment plumes with deposition to wider regions including both the pier regions and the regions outside the piers. It is likely that sediment around the piers near the Paleta Creek is disturbed and resuspended by the boat and ship activities. Once resuspended, the sediment plume is then dispersed by the hydrodynamics of the Bay water, which would result in a deposition pattern similar to the hypothesized source-dispersion pattern we discussed here.

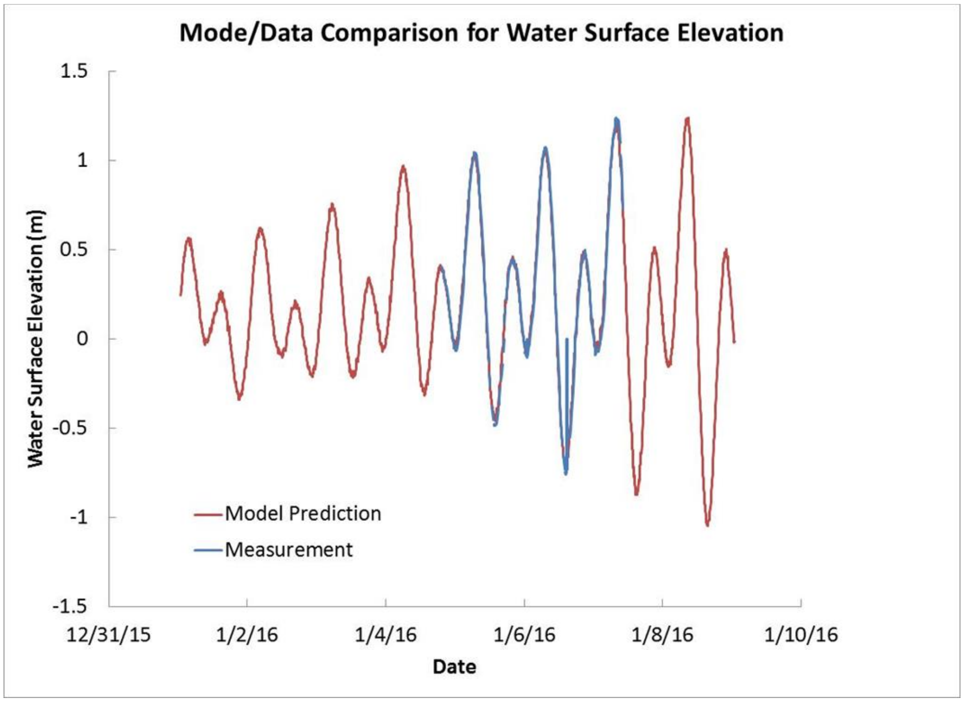

Figure 3-1. Model/data comparison of water surface elevation near the Paleta Creek mouth for Wet Weather Event 1 (5 Jan 2016).

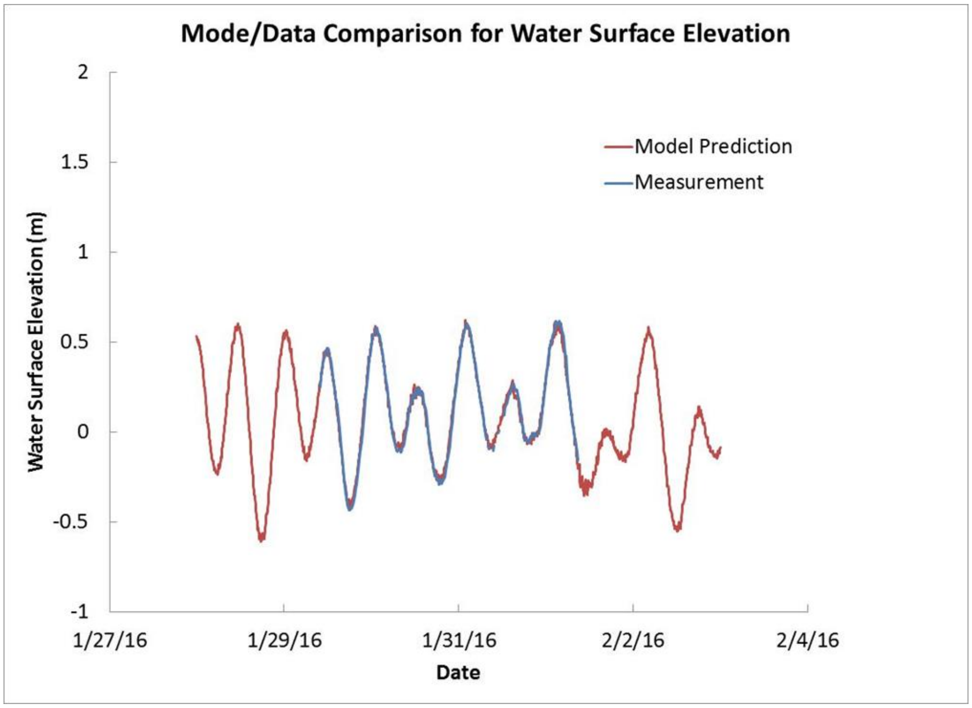

Figure 3-2. Model/data comparison of water surface elevation near the Paleta Creek mouth for Wet Weather Event 2 (31 Jan 2016).

Table 3-1. Particle size categories and the settling velocity (Stokes' Law).

Particles	Typical Sizes (µm)	Estimated Stokes Settling Velocities (m/sec)
Clay	0.45-5 (use 5 µm for estimating settling velocity)	1.1×10^{-5}
Silt	(use 20 µm for estimating settling velocity)	1.7×10^{-4}
Sand	> 63 (use 65 µm for estimating settling velocity)	1.8×10^{-3}

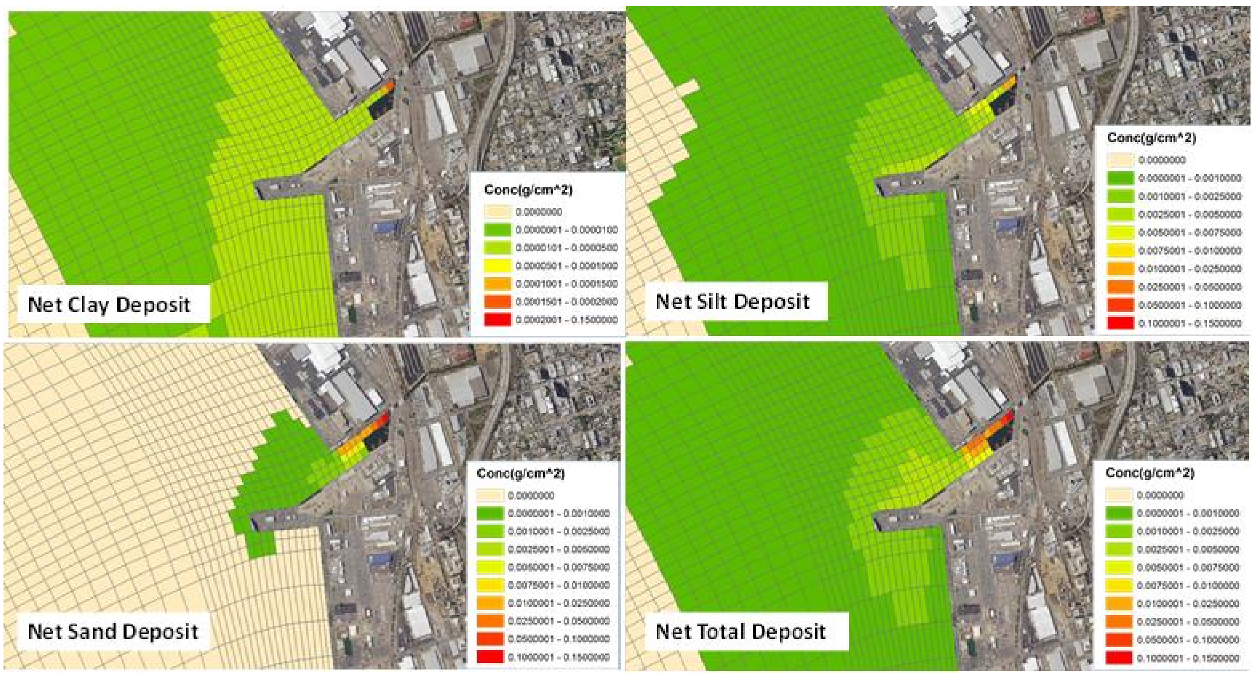

Figure 3-3. Model simulated net sediment depositions for clay, silt, sand and total particles for Wet Weather Event 1 (5 Jan 2016).

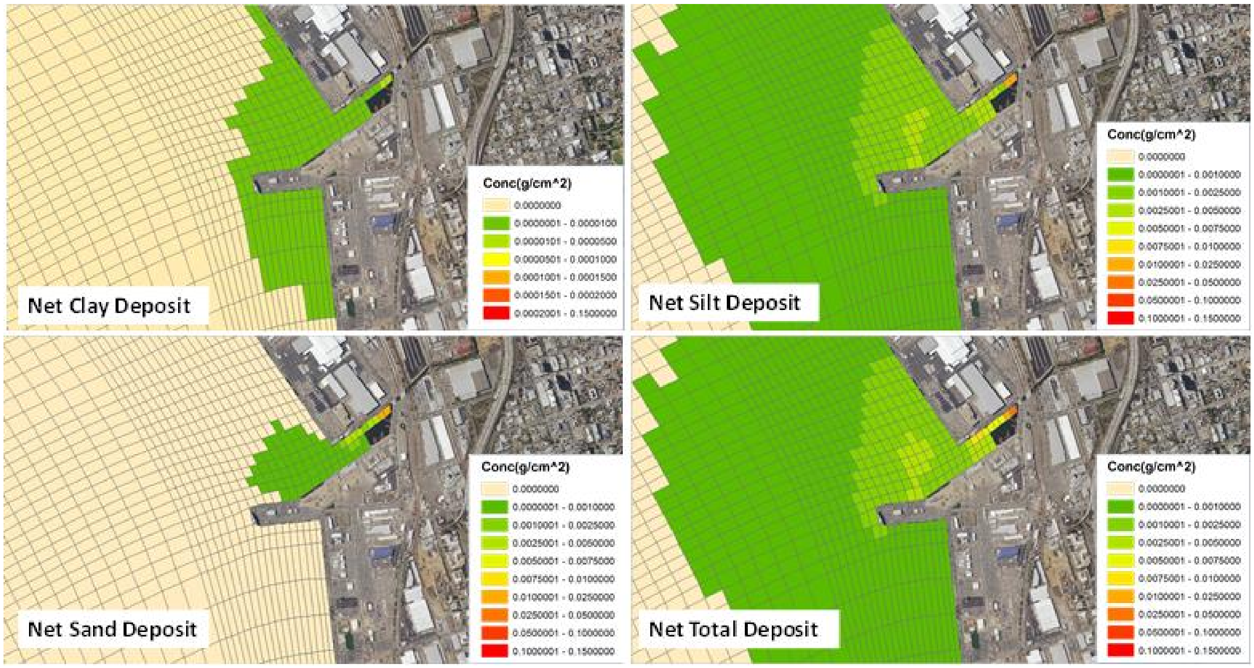

Figure 3-4. Model simulated net sediment depositions for clay, silt, sand and total particles for Wet Weather Event 2 (31 Jan 2016).

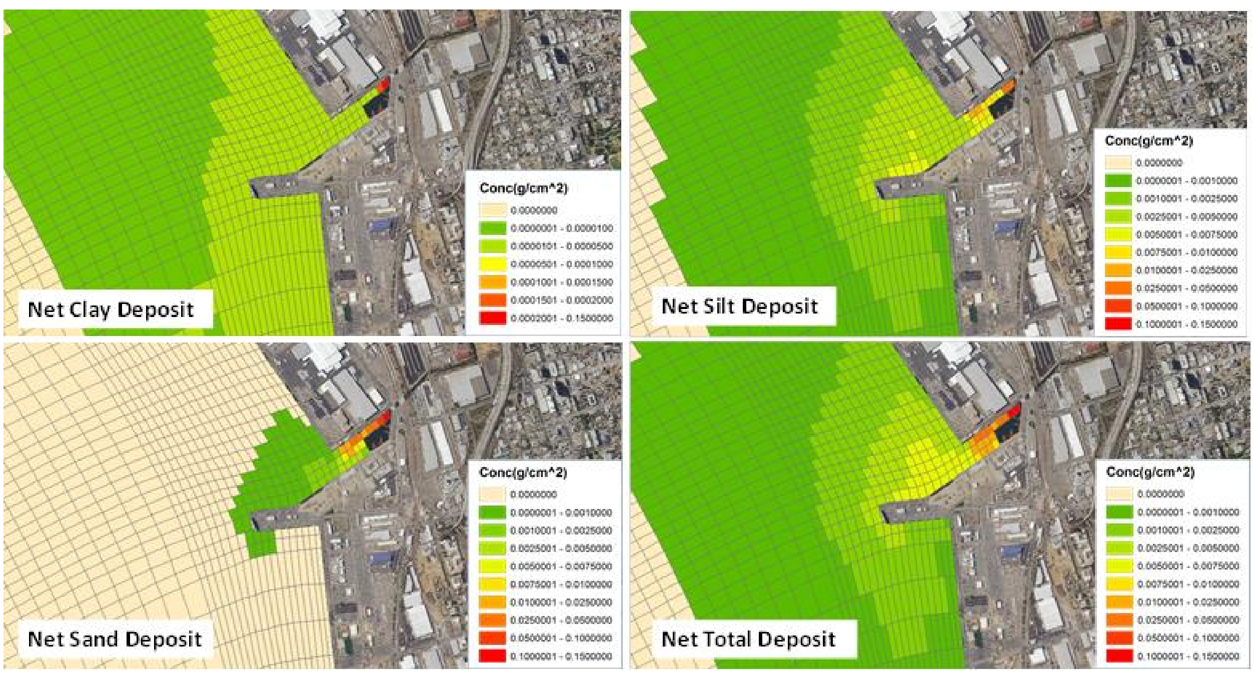

Figure 3-5. Model simulated net sediment depositions for clay, silt, sand and total particles combined for Wet Weather Event 1 (5 Jan 2016) and Event 2 (31 Jan 2016).

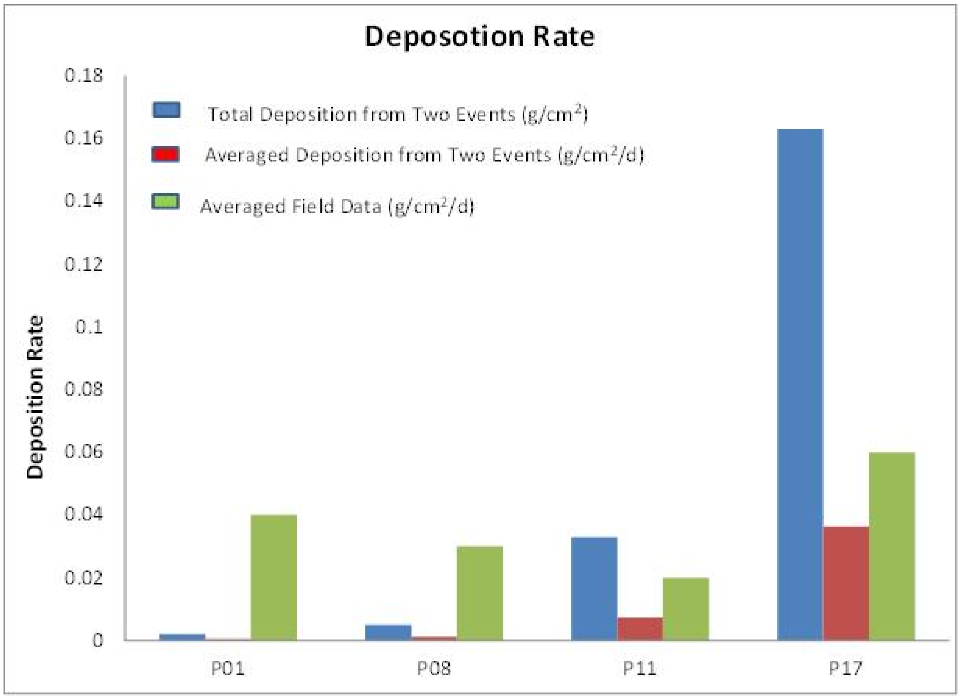

Figure 3-6. Simulated net sediment depositions at four sediment trap sites (blue) and calculated (red) and measured (green) averaged deposition rates (g/cm^2/d).

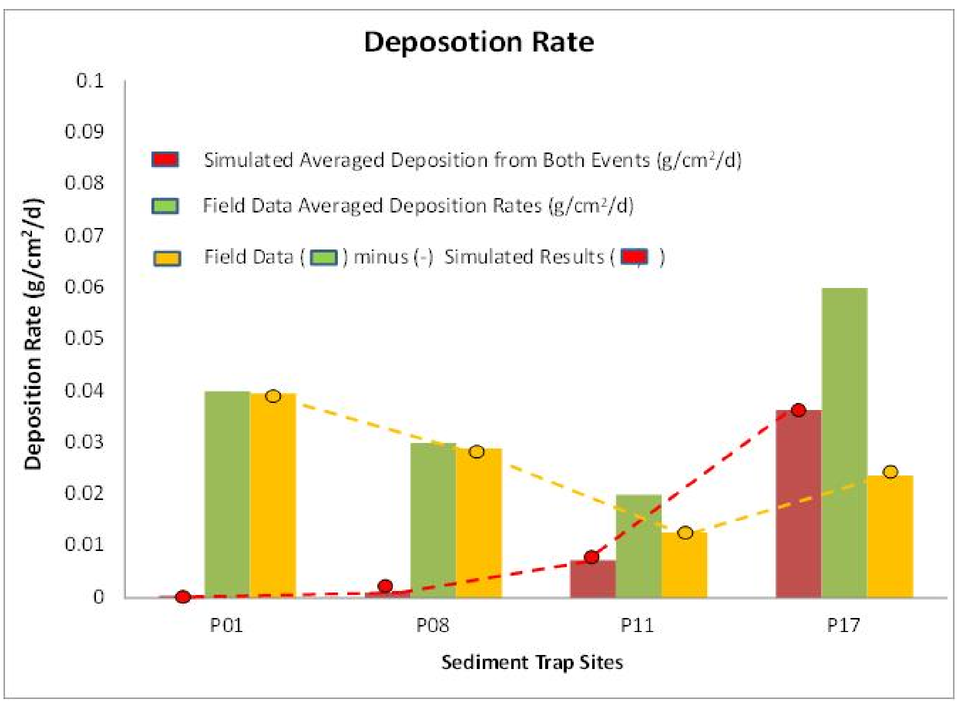

Figure 3-7. Simulated and measured averaged deposition rates (g/cm^2/d) at the four sediment trap locations (the two dashed lines denote the two-source theory with one source from the Paleta Creek (red line) and the other source presumably from out-of-the mouth region (e.g., P01). Measured deposition rates match well with the contributions from both sources).

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Assessment and Management of Stormwater Impacts on Sediment Recontamination (ER-2428)

Appendix VI

TTU Analytical Methods and Standard

Operating Procedures (SOPs)

TTU Sample Processing Summary

The objective of this document is to describe the physiochemical characterization by Texas Tech University (TTU) of water, sediment and tissue samples generated at Paleta Creek and Pudget Sound Naval Shipyard (PSNS) sites. A summary of the physiochemical methods is provided in table A1. In addition, the document also contain a brief description of the sampling procedures. For a detailed account of the sampling please refer to the SPAWAR (Space and naval warfare systems command) and Geosyntec reports in appendices XX and YY.

Stormwater Samples

All water bottles collected and processed at the site were shipped on ice to TTU for further processing and analytical measurements. The wet weather water samples collected from Paleta Creek site was split by SPAWAR personnel. The splitting was performed by placing 7 Amber glass and 3 High Density Poly-ethylene (HDPE) bottles under the Teflon™ Dekaport splitter (Figure 1). About 10L of thoroughly mixed stormwater sample was poured into the splitter at a rate that would allow consistent flow through all the tubings of the splitter. After the split, all 7 Amber glass bottles and one HDPE bottle were capped and placed in two plastic Ziploc. The remaining 2 HDPE bottles were then passed through the Dekaport again (approximately 2L of sample) into 5 HDPE bottles. The bottles generated at SPAWAR were then capped and placed in two plastic Ziploc bags for storage and transport to TTU. For the second stormwater collection event at the Paleta creek where 20L were collected in some locations, these methods were duplicated for the additional 10L of sample volume that was collected. The Dekaport was thoroughly rinsed with Milli-Q de-ionized (DI) water between samples. The water samples from the PSNS site was collected by SPAWAR personnel and sent to TTU for Dekaport splitting. The splitting procedure at TTU was similar as mentioned above, however, the amber and HDPE bottles generated from the split were immediately processed for particle size fractionation.

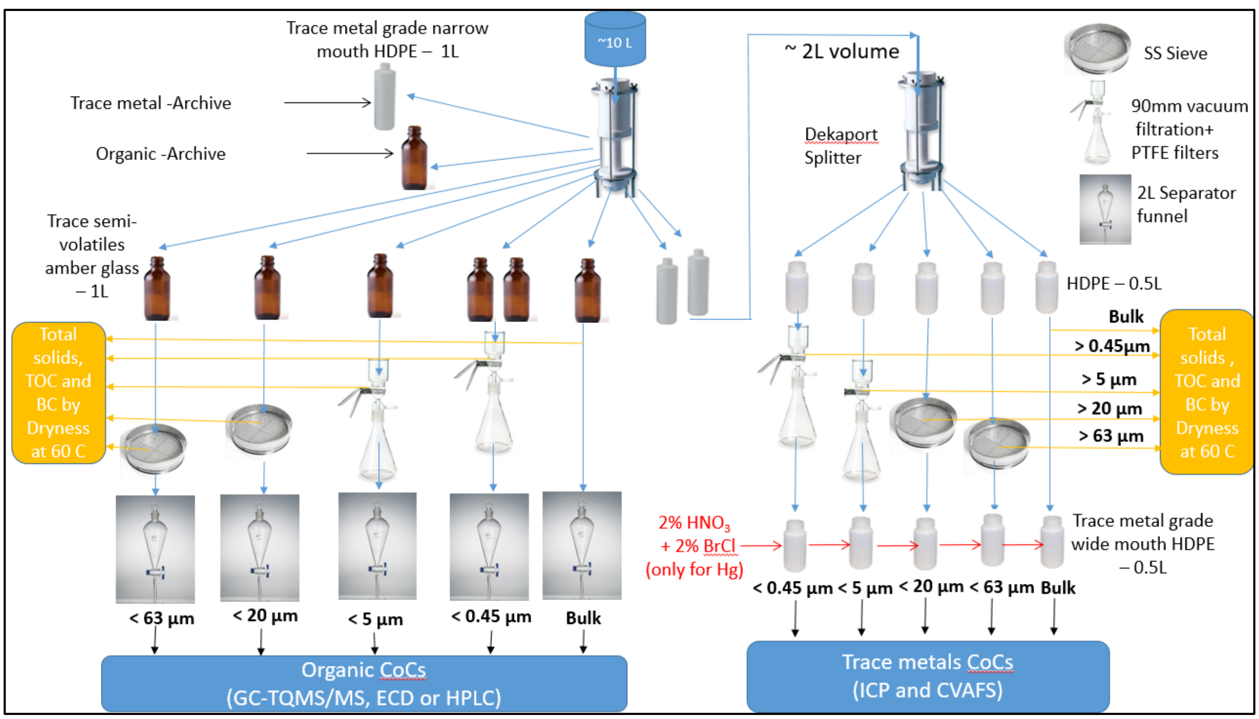

Figure 1. Composite sample splitting schematic for stormwater samples collected Jan-2016.

Particle size fractionation and chemical characterization

The bulk water sample in the amber and HDPE bottles were filtered with 63, 20, 5 (2.7 for POPs) and 0.45μm (0.7 for POPs) sieves/membrane-filters to determine the concentration associated with the obtained particle fractions (Figure 1 and Figure 2). After passing through the sieves/filters the water filtrate fraction in the amber and HDPE bottles were subjected to liquid-liquid extraction using a separatory funnel (EPA method 3510) and hot-plate digestion (EPA 200.8 and 1931E) for organic and metal chemicals of concerns (COCs), respectively. The solvent extracted fractions was then concentrated using the Thermo Scientific™ Rocket™ Evaporator to low level volumes to obtain desirable detection of persistent organic pollutants (POPs). Deuterated polycyclic aromatic compounds (PAHs) was employed to check the extraction efficiencies. The solids accumulated on the sieves were transferred into a 45 mm TEFLON membrane filter (0.45 micron opening). The solids for the individual size fractions was measured by the difference in mass of the filter due to the accumulation of solids from the particle size separation. After measurements, the filters were stored at 4 ^{0}C.

Calculations for particle and chemical size distribution

The calculations for the chemical of concern size based distribution is illustrated in the following figure and equations. The term in the denominator of the equation represents the total fraction solids of the associated size fractions normalized for the total water volume. The term in the numerator represents the water concentrations of the COCs for the corresponding size fractions.

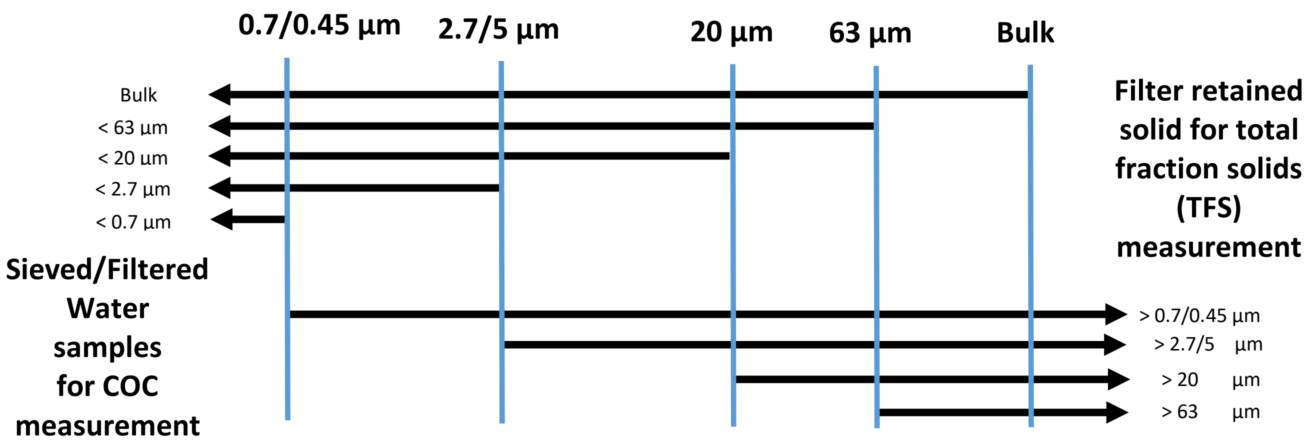

Figure 2. Illustrates the bulk water and size fractions for the representative water and solid components obtained from the sieving and filtration of the field samples. For the bulk analysis, the received field water was extracted without any size fractionation.

<u>**Equation used to obtain COCs solid normalized concentrations in the different size fractions:**</u>

Particle size range: > 0.7/0.45 µm

$$\frac{C_{bulk}\left(\frac{ng}{L}\right) - C_{<0.7/0.45\,\mu m}\left(\frac{ng}{L}\right)}{TFS_{>0.7um}\left(\frac{mg}{L}\right)} \times 1000\ \frac{\mu g}{kg}$$

Particle size range: 0.7/0.45 to 2.7/5 µm

$$\frac{C_{<2.7/5\ \mu m}\left(\frac{ng}{L}\right) - C_{<0.7/0.45\ \mu m}\left(\frac{ng}{L}\right)}{\{TFS_{>0.7/0.45\ \mu m}\left(\frac{mg}{L}\right) - TFS_{>2.7/5\ \mu m}\left(\frac{mg}{L}\right)\}} \times 1000\ \frac{\mu g}{kg}$$

Particle size range: 2.7/5 to 20 µm

$$\frac{C_{<20\ \mu m}\left(\frac{ng}{L}\right) - C_{<2.7/5\ \mu m}\left(\frac{ng}{L}\right)}{\{TFS_{>2.7/5\ \mu m}\left(\frac{mg}{L}\right) - TFS_{>20\ \mu m}\left(\frac{mg}{L}\right)\}} \times 1000\ \frac{\mu g}{kg}$$

Particle size range: 20 to 63 µm

$$\frac{C_{<63\ \mu m}\left(\frac{ng}{L}\right) - C_{<20\ \mu m}\left(\frac{ng}{L}\right)}{\{TFS_{>20\ \mu m}\left(\frac{mg}{L}\right) - TFS_{>63\ \mu m}\left(\frac{mg}{L}\right)\}} \times 1000\ \frac{\mu g}{kg}$$

Particle size range: > 63 µm

$$\frac{C_{bulk}\left(\frac{ng}{L}\right) - C_{<63\ \mu m}\left(\frac{ng}{L}\right)}{\{TFS_{>63\ \mu m}\left(\frac{mg}{L}\right)\}} \times 1000\ \frac{\mu g}{kg}$$

Where,

"C" represents the concentration of the bulk water, filtered or sieved water with the representative size fraction in the subscript.

"TFS" represents the total fraction solids (in mass per volume of processed water) as captured on the filter membrane or sieve for the size fraction represented in the subscript

RECEIVING WATER SEDIMENT CORES AND TRAPS

Intact sediment cores before (pre) and after (post) the storm season were collected in the receiving water at designated locations. One set of pre-storm/dry-weather cores were kept at SPAWAR for bioassay treatments while the rest were shipped to TTU for physical, and chemical characterization.

The sediment traps were deployed at same locations as the sediment cores and were retrieved at the end of the wet weather season. The material settled in the retrieved sediment trap was then processed for removal of the overlying water and the remaining material was collected for further processing (i.e. physical, chemical or bioassay analysis).

Particle size fractionation
The sediment sample were first dried and then, 1% w/v sodium hexametaphosphate was added as a dispersant. After eliminating any flocculation of the sample, the sample was mixed by shaking. The homogenized sample was then sieved with 63µm opening size stainless steel sieve, the solids retained on the sieve was collected to measure the quantity of the sand fraction (> 63 µm). The particles in the water that passed through the sieve (< 63 µm) was collected and further size fractioned using the pipette method to separate the clay (< 2µm), fine silt (2-20µm) and coarse silt (20-63µm) fractions (Table A1, SOP-1).

Chemical Characterization
Each solid sample was homogenized and an aliquot was dried at 35ºC to minimize losses of volatiles (e.g. Naphthalene) and its moisture content was determined. Two aliquots were then used for total organic carbon (TOC) and black carbon (BC) analysis as well as accelerated solvent extraction (ASE). The ASE samples (0.5-1g) were mixed with Diatomaceous Earth (DE) to absorb remaining moisture and disperse the solids. Extraction of PAHs, polychlorinated biphenyls (PCBs) and Chlordanes were carried out with the accelerated solvent extraction system (Dionex ASE 350) and is a variation of EPAs method 3545A (Pressurized fluid extraction). Metal extraction was performed using nitric acid/hydrogen peroxide (HNO_3/H_2O_2) and cold aqua-regia digestion for trace metals and mercury (Hg), respectively (Table A1).

Porewater Characterization
Solid Phase Micro-Extraction (SPME) fibers were used to measure sediment porewater for organic contaminants. SPMEs were provided by TTU and were impregnated with performance reference compounds (PRCs) to infer the fraction steady-state achieved after termination of the exposure period. Trace metal Diffusive Gradients in Thin-films (DGTs) were acquired from DGT Research, Lancashire, UK. The disk-style DGT was used for measurement of Cu, Zn, Ni, Pb, As, Ag and Cd. DGTs for the measurement of Hg were provided by TTU (Table A1, SOP-10). The DGTs under-went pre-treatment prior to use by nitrogen (N_2) purging in a 10 milli-molar (mM) solution of sodium nitrate ($NaNO_3$) with resin-gel strips. Upon termination of exposure periods, both trace metal and Hg DGTs were rinsed immediately with Milli-Q DI water to remove sediment. SPMEs and DGTs after retrieval were shipped to TTU for analysis.

TISSUE SAMPLES
Bioaccumulation studies were conducted both in situ and ex situ sediment exposures. In situ bioaccumulation involved the use of Sediment Ecosystem Assessment Rings (SEA Rings) and subsequent processing of tissue samples. Ex situ exposures were performed in laboratory-based exposures conducted at the SSC Pacific Bioassay Laboratory.

Chemical Characterization

Upon retrieval from a field location or from laboratory based experiments, the biota were sent to TTU for chemical characterization. The tissue samples were homogenized and extracted with a 4:1 ratio of Hexane:Acetone followed by clean-up steps for POP analysis (Table A1). For metal extraction the tissue samples were digested with HNO_3/sulfuric acid (H_2SO_4) and HNO_3 for Hg and other trace metal analysis, respectively (Table A1).

Table A1. Types and techniques of chemical and passive sampling methods considered for the wet weather events

Physio-chemical Parameter	Matrix	Extraction/Processing Method	Analytical Method†	Lab	TTU SOP No.
Particle size distribution	Water	Solids retained on filter and sieves	Gravimetric	TTU	*(1)*
Organic Carbon	Sediments	Acidification to remove inorganic carbonates	Combustion based carbon analyzer	TTU	*(2, 3)*
Black Carbon		Thermal oxidation at 375 °C followed by acidification			
Dissolved Organic Carbon	Water	Acidification to remove inorganic carbonates			
Trace metals except Hg	Water	Hot plate digestion with HNO_3 and HCl	ICP-MS and GFAA	TTU and SPAWAR	*(4-7)*
	Tissues	HNO_3 digestion	ICP-MS	TTU	
	Sediments	Hot plate digestion with HNO_3 and H_2O_2			
	Porewater	DGT Passive sampler	ICP-MS		
Hg	Water	Hot plate digestion with HNO_3 and HCl	EPA method 1631E using CVAFS	TTU	*(8-11)*
	Tissues	HNO_3/H_2SO_4 digestion			
	Sediment	Cold Aqua-regia extraction			
	Porewater	DGT sampler and HCl elution			
PAHs, PCBs and Chlordanes	Water	Liquid-liquid extraction using separatory funnel (modified EPA 3510C)	Modified EPA 8310 for HPLC and; GC-TQMS for PAH-38 and PCB 209 congeners	TTU	*(12-15)*
	Tissues	Pressurized Liquid Extraction using Dionex ASE 350 with in-cell clean up (modified EPA 3545A)			
	Sediment	Pressurized Liquid Extraction using Dionex ASE 350 with in-cell clean up (modified EPA 3545A)			
	Overyling water and porewater	SPME passive sampling			

Table A1 Notes:

In most cases, the departure for the TTU based SOPs from the referenced EPA methods are essentially with regards to sample/extraction/analysis volume, calibration range and method detection limits. Specific modifications with respect to extraction are mentioned in the corresponding SOPS

Abbreviations:

TTU – Texas Tech University
SPAWAR – Space and naval warfare systems command
NA – Not applicable
DGT – Diffusive gradient in thin-film passive samplers (both trace metal and Hg probes)
ICP-MS – Inductively coupled plasma mass spectrometry
Hg – Mercury
HNO_3 – Concentrated nitric acid
CVAFS – Cold vapor atomic fluorescence spectroscopy
Aqua-regia – Mixture of concentrated hydrochloric acid and nitric acid
HCl – Hydrochloric acid
PAH – Polycyclic aromatic hydrocarbons
HPLC – High-performance liquid chromatography
PCB – Polychlorinated Biphenyls
ASE – Accelerated solvent extractor
SPME – Solid phase micro extractionGC-ECD - Gas chromatography coupled with electron capture detector
GC-TQMS – Gas chromatography coupled with triple quadrupole mass spectrometer

List of PAHs and PCBs analyzed by HPLC and GC-TQMS

Table A2. List of metals that were analyzed by ICP-MS, GFAA and MERX-T.

	Metals	Lower calibration level (µg/L)	Higher calibration level (µg/L)
1	**Cd**	0.2	50
2	**Pb**	0.5	50
3	**Cu**	1	500
4	**Ni**	1	500
5	**Zn**	1	500
6	**As**	1	100
7	**Cr**	3	30
		Lower calibration level (pg)	**Higher calibration level (pg)**
8	**THg**	25	2,500

Table A2. List of 15 PAHs for analysis by HPLC

	Compound	Lowest Calibration level	Highest calibration level
1	Naphthalene	0.5 µg/L	200 µg/L
2	Acenaphthene		
3	Fluorene		
4	Anthracene		
5	Phenanthrene		
6	Pyrene		
7	Fluoranthene		
8	Benz[a]anthracene		
9	Chrysene		
10	Benzo[a]pyrene		
11	Benzo[b]fluoranthene		
12	Benzo[k]fluoranthene		
13	Benzo[ghi]perylene + Indeno[1,2,3-cd]pyrene		
14	Dibenz[a,h]anthracene		

Table A3. List of 38 PAHs to be analyzed by GC-TQMS method developed at TTU

	Compound	Lowest Calibration level	Highest calibration level
1	naphthalene	0.5 µg/L	100 µg/L
2	2-methylnaphthalene		
3	1-methylnaphthalene		
4	2-ethylnaphthalene		
5	1-ethylnaphthalene		
6	2.6-dimethylnaphthalene		
7	1.3-dimethylnaphthalene		
8	2-isopropylnaphthalene		
9	acenaphthylene		
10	1.2-dimethylnaphthalene		
11	1.8-dimethylnaphthalene		
12	acenaphthene		
13	2.3.5-trimethylnaphthalene		
14	fluorene		
15	1-methylfluorene		
16	phenanthrene		
17	anthracene		
18	2-methylphenanthrene		
19	2-methylanthracene		
20	1-methylphenanthrene		
21	9-methylanthracene		
22	2-ethylanthracene		
23	fluoranthene		
24	pyrene		
25	9.10-dimethylanthracene		
26	2-tertbutylanthracene		
27	1-methylpyrene		
28	benz(a)anthracene		
29	chrysene		
30	benzo(b)fluoranthene		
31	7.12-methylbenz(a)anthracene		
32	benzo(k)fluoranthene		
33	benzo(e)pyrene		
34	benzo(a)pyrene		
35	perylene		
36	indeno(123-cd)pyrene		
37	dibenzo(ah)anthracene		
38	benzo(ghi)perylene		

Table A4. List of PCB congeners analyzed by GC-TQMS at TTU. All Congener congeners were evaluated using calibration curves generated using 0.2 and 20 µg/L as the lowest and highest calibration points, respectively.

	PCB congener No		PCB congener No		PCB congener No
chloro	**1**	pentachloro	**103**	pentachloro	**105**
chloro	**2**	tetrachloro	**40**	hexachloro	**141**
chloro	**3**	tetrachloro	**67**	heptachloro	**179**
dichloro	**4**	tetrachloro	**74**	hexachloro	**163**
dichloro	**10**	tetrachloro	**70**	hexachloro	**138**
dichloro	**9**	tetrachloro	**66**	hexachloro	**158**
dichloro	**7**	pentachloro	**95**	heptachloro	**178**
dichloro	**6**	pentachloro	**93**	pentachloro	**126**
dichloro	**8**	tetrachloro	**56**	heptachloro	**187**
dichloro	**5**	pentachloro	**60**	heptachloro	**183**
trichloro	**19**	tetrachloro	**92**	hexachloro	**128**
trichloro	**18**	pentachloro	**84**	hexachloro	**167**
trichloro	**17**	pentachloro	**101**	heptachloro	**174**
dichloro	**15**	pentachloro	**99**	heptachloro	**177**
trichloro	**27**	pentachloro	**119**	heptachloro	**171**
trichloro	**24**	pentachloro	**83**	hexachloro	**156**
trichloro	**32**	pentachloro	**87**	hexachloro	**157**
trichloro	**16**	tetrachloro	**81**	heptachloro	**173**
trichloro	**34**	pentachloro	**115**	heptachloro	**172**
trichloro	**29**	pentachloro	**136**	octachloro	**197**
trichloro	**26**	hexachloro	**110**	heptachloro	**180**
trichloro	**25**	pentachloro	**77**	heptachloro	**193**
trichloro	**31**	tetrachloro	**82**	heptachloro	**191**
trichloro	**28**	pentachloro	**151**	hexachloro	**169**
trichloro	**20**	hexachloro	**135**	heptachloro	**170**
trichloro	**22**	hexachloro	**144**	heptachloro	**190**
tetrachloro	**45**	hexachloro	**147**	octachloro	**198**
tetrachloro	**46**	pentachloro	**107**	octachloro	**203**
tetrachloro	**69**	hexachloro	**123**	octachloro	**196**
tetrachloro	**52**	hexachloro	**149**	octachloro	**189**
tetrachloro	**47**	pentachloro	**118**	nonachloro	**208**
tetrachloro	**48**	hexachloro	**134**	octachloro	**195**
tetrachloro	**44**	pentachloro	**114**	nonachloro	**207**
trichloro	**42**	hexachloro	**131**	octachloro	**194**
tetrachloro	**37**	hexachloro	**146**	octachloro	**205**
tetrachloro	**71**	hexachloro	**153**	nonachloro	**206**
tetrachloro	**41**	hexachloro	**132**	decachloro	**209**

Standard Operating Procedures

SOP-1.

Standard Operating Procedure for particle size distribution (PSF) using the pipette method and sieving

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for the size distribution of particles in sediments using sieving and the pipette method.

2. SUMMARY OF METHOD

The sediment sample is dried. Then, 1% w/v sodium hexametaphosphate is added as a dispersant. After eliminating any flocculation of the sample, mix it with shaking. Sieve the sample with a sieve with 63µm opening size, collect the solids that retain in the sieve and measure the quantity of the sand fraction (>63µm). Using the pipette method in the filtrate sample (<63µm), measure the quantity of clay (< 2µm), fine silt (2-20µm) and coarse silt (20-63µm) using the Stoke's equation. The size fraction to be measured can be modified using the Stoke's equation depending on the needs of the user.

3. APPARATUS AND MATERIALS

3.1. 10mL Pasteur pipette with suction bulb.
3.2. Thermometer.
3.3. Glass cylinder bottle (1L capacity).
3.4. Aluminum pans.
3.5. Analytical balance capable of accurate weighing to 0.001g.
3.6. Sonication machine.
3.7. Stainless steel sieving set with 63µm opening size.
3.8. 0.45µm PTFE membrane filters.
3.9. 90 mm vacuum filtration unit and pumps and accessories.
3.10. 20mL scintillation vials.
3.11. Shaker device.
3.12. Drying oven at 45^{o}C and 95^{o}C.

4. REAGENTS

4.1. Ultra-pure water (purity ≤18MΩ.cm).

4.2. 10%w/v sodium hexametaphosphate (SHMP) (Sigma-Aldrich).

5. PROCEDURE

5.1. Note the temperature of the lab and allow the sediment and the water solution to reach the lab temperature. If the sediment sample is taken from the cold room this may take >2h. In case of doubt, use a thermometer to ensure equilibrium in the solution temperature.
5.2. Measure ~20g of wet sediment sample to obtain a dry weight concentration of 1-2% w/v in 800mL total volume of sample (this assumes that the water content of the sediment is ~50%).
5.3. Dry the wet sediment sample in the drying oven at 45^{o}C overnight. Note down the dried weight.

5.4. Dry the 0.45μm PTFE filter in the drying oven at 45°C overnight. Note down the dried weight.

5.5. Prepare the solution of 1%w/v sodium hexametaphosphate (SHMP). Add 10g of sodium hexametaphosphate in 1L ultra-pure water. Extract an aliquot of 10mL and dry it at 35°C for 1-3h. Then, weigh the dry sample of the dispersant in order to subtract the dispersant's weight from the measured final sediment sample.

5.6. Transfer the dry sediment sample to the 1L glass cylinder bottle; add 10mL of 1%w/v SHMP solution and 400mL of ultra-pure water (purity~18MΩ.cm) to the bottle.

5.7. Smash and mix well the big particles of the sediment sample.

5.8. Use ultra-sonication if necessary to disperse the sample.

5.9. Add a cap to the glass cylinder bottle, secure it (make sure it is a water-tight fit) and place it on the bench containing the shaker device. Allow the shaker bottles to mix overnight (or a minimum 8h).

5.10. Make sure that the solution has no particles or flocculation. Otherwise, repeat step 5.7 to 5.8.

5.11. Assemble a clean sieve with 63μm opening with the bottom of the sieve attached to a clean pan.

5.12. Gently transfer the sample from the bottle into the sieve while ensuring the sample passes freely through the sieve mesh.

5.13. Once all water sample has been passed through the sieve, add up to 400 mL of ultra-pure water into the bottle to rinse out any solids attached to the bottle or cap into the sieve.

5.14. Using an ultra-pure water funnel quirt bottle transfer the solids that are retained on the sieve into a clean filtration system with 0.45μm PFTE filter to collect the solids (>63μm).

5.15. Stop filtration and carefully remove the membrane filter, fold it and place it in the oven at 45°C overnight.

5.16. Weigh with 0.001g accuracy the dried filter with the solids to calculate the sand fraction (>63μm); Value as **S**, after subtracting the weight of the SHMP and the weight of the dried 0.45μm filter.

5.17. After measuring the weight of the dried filter with the solids, transfer it to a 20mL scintillation vial and store it in the 4°C cold room.

5.18. Wash the initial bottle of step 5.13 with ultra-pure water.

5.19. Carefully transfer the filtrate water that is collected in the sieve pan into the bottle.

5.20. Add ultra-pure water to the bottle in order to have a final volume of 800mL.

5.21. Sonicate the bottle with the mixture for 15min.

5.22. Place the bottle on the bench containing the shaker device. Allow the shaker bottles to mix overnight (or a minimum 8h).

5.23. Hand shake the bottle for 1min.

5.24. For measuring the fraction of coarse silt 20-63μm:

a. Immediately after shaking, place the glass cylinder bottle on a vibration-free table, remove stopper and immediately immerse the pipette at the center of the bottle mouth and draw 8mL at the depth of 4cm from top liquid layer of the bottle.
b. Transfer the aliquot to an aluminum pan and evaporate to dryness overnight at 95°C.
c. Remove the aluminum pan from drying oven, and let it cool.
d. Weigh with 0.001g accuracy; Value as **CS**, after subtracting the weight of the SHMP and the aluminum pan.

5.25 For measuring the fraction of fine silt 2-20µm:

a. Place the cylinder on a vibration-free table.
b. Using the Stokes equation (equation 1) calculate the time required for the particles <20 µm to settle at 4 cm from the top of the bottle.
c. Exactly at the above calculated time, place the glass cylinder bottle on a vibration-free table, remove stopper and immediately immerse the pipette at the center of the bottle mouth and draw 8mL at the depth of 4cm from top liquid layer of the bottle.
d. Transfer the aliquot to an aluminum pan and evaporate to dryness overnight at 95°C.
e. Remove the aluminum pan from drying oven, and let it cool.
f. Weigh with 0.001g accuracy; Value as F**S**, after subtracting the weight of the SHMP and the aluminum pan.

5.26 For measuring the fraction of clay <2µm:

a. Place the cylinder on a vibration-free table.
b. Using the Stokes equation (equation 1) calculate the time required for the particles <2µm to settle at 4 cm from the top of the bottle.
c. Exactly at the above calculated time, place the glass cylinder bottle on a vibration- free table, remove stopper and immediately immerse the pipette at the center of the bottle mouth and draw 8mL at the depth of 4cm from top liquid layer of the bottle
d. Transfer the aliquot to an aluminum pan and evaporate to dryness overnight at 95°C.
e. Remove the aluminum pan from drying oven, and let it cool.
f. Weigh with 0.001g accuracy; Value as **C**, after subtracting the weight of the SHMP and the aluminum pan.

A. CALCULATIONS

The pipette method described here is based on sampling 8mL of suspension with a 10mL pipette. Therefore, in the calculations a multiplication factor of 800/8 =100 is used. Unless a calibrated volumetric pipette is used, calibration of the pipette is necessary.

A.1. <u>Calculations for the mass of clay, fine silt, coarse silt and sand:</u>

S = weight of fraction that is >63µm (g)

CS = weight of the pipette fraction that is 20-63µm (g)

FS = weight of the pipette fraction that is 2-20µm (g)

C = weight of the pipette fraction that is < 2µm (g)

Clay (<2µm) = C x 100

Fine silt (2-20) = (FS x 100) – (C x 100)

Coarse silt (20-63) = (CS x 100) – (FS x 100) – (C x 100)

Sand (>63µm) = S

Total sample weight = Clay + Fine Silt + Coarse Silt + Sand

A.2. <u>Correlation between the height of the settled particle and the time required to reach current height (Stoke's Law):</u>

$$t = 18 \cdot h \cdot \eta / [(\rho_p - \rho_l) \cdot g \cdot D_p^2] \qquad \text{(Eq. 1)}$$

Where t is the time required to reach current height (min), h is the height/distance of the settled particle (m), η is the dynamic viscosity of the medium (ultra-pure water) in Pa·s (kg/(m·s)), ρ_p is density of the particle (kg/m^3), ρ_l is density of liquid medium (kg/m^3), D_m is the particle diameter (m) and g is the acceleration due to gravity (9.81 m^2/s).

B. REFERENCE

Douglas W. Haywick. 2004. Pipette and Sieve Grain Size Analysis: Procedures Guide.

SOP-2.

Standard Operating Procedure for the measurement of total organic carbon (TOC) and black carbon (BC) in solid samples

Texas Tech University (TTU)

1. **SCOPE AND APPLICATION**

1.1. This method is an operating procedure for the measurement of total measured carbon (TC) as total organic carbon (TOC) and black carbon (BC) in solid samples using Vario TOC Select.

1.2. The BC method is derived from the CTO_375 technique used in Gustafsson et al., 1997.[1]

1.3. The Vario TOC Select can be used for both solid samples and liquid samples. This method is applicable to solid samples only.

2. **SUMMARY OF METHOD**

2.1. For the TOC analysis, the solid samples will be weighted exactly in Ag and Tin boats and burned in the furnace inside the machine. The solid samples will be pre-treated with hydrochloric acid (HCl) to remove inorganic carbon (mainly carbonates) before analysis. For BC analysis, the samples will be heated in a muffle furnace at 375 ^{0}C for 24 h before proceeding with the acidification step and subsequent analysis

2.2. The organic carbon content that excludes the BC fraction can be obtained by difference between TOC and BC (i.e., % OC = % TOC- % BC)

2.3. The software can detect the TC Area and calculate the TC concentration (TC%) based on the TC Area and the samples weight. A series of calibration and QC checks are used to help calculate and check accuracy.

3. **CAUTIONS**

3.1. The temperature of the furnace can be very high (850 ^{0}C-950 ^{0}C). The replacement of heated tubes must only be performed by means of the furnished protective gloves and other protective equipment. Only trained personnel is allowed to perform this procedure.

3.2. Always work accurate and neat, because of safety and quality assurance.

3.3. Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic.

3.4. Combustion analysis of larger quantities of the substance can cause damage to the instrument

3.5. The final pelletized sample size must be smaller than the size of the hole in the autosampler carousel

3.6. Make sure all parts of the instrument are properly tightened before turning on gas.

4. **APPARATUS AND MATERIALS**

4.1. Vario TOC select system with 80 sample cells

4.2. Tin boats (for calibration reagents and blanks)

4.3. Ag boats (for sample acidification and blanks)

4.4. Tweezers

4.5. Balance with high precision

4.6. Disposable Antistatic Micro spatulas

4.7. Pasteur’s pipet with suction tool

4.8. Aluminum pans

4.9. Oven at 105 ^{0}C

4.10. Clean box for samples
4.11. Kimwipes
4.12. Gas cylinder
4.13. Desiccator
4.14. Muffle furnace (for Black Carbon)
4.15. Porcelain crucibles (for Black Carbon)
4.16. Sheath tube (in Combustion tube)
4.17. Ash figure (in Combustion tube)
4.18. Quartz wool (in Combustion tube)
4.19. Copper oxide (in Combustion tube)
4.20. Al_2O_3 (in Combustion tube)
4.21. Silicon

5. REAGENTS

5.1. 1M hydrochloric acid-HCl (for acidification)
5.2. OC STD (for calibration)
5.3. sodium carbonate-Na_2CO_3 (for calibration)
5.4. Potassium hydrogen phthalate - KHP (for calibration)
5.5. Standard Reference Material- SRM (for ICV check)

6. PREPARATION AND HANDLING

6.1. Preparation of Calibrations
6.1.1. Weigh about 2mg, 5mg, 10mg, 20mg, 40mg TOC-STD in tin boats respectively.
6.1.2. Note down the exact weights.
6.1.3. Weigh about 20mg, 40mg Na_2CO_3 in tin boats respectively.
6.1.4. Note down the exact weights.
6.1.5. Weigh about 20mg Na_2CO_3 in tin boats as QC checks.
6.1.6. Note down the exact weights.
6.1.7. 3 tin boats as blanks.
6.1.8. Wrap the edges of tin boats carefully then put them in a box in order.
6.1.9. The calibrations are ready for analysis.

6.2. <u>Preparation of Samples for TOC</u>

6.2.1. Sediment should be homogenized
6.2.2. Dry the samples (in triplicates) in oven at 105 ^{0}C overnight then keep in a desiccator to cool down the samples to lab temperature.
6.2.3. Weigh dried samples in a Ag boat (typically about 10-40mg is enough for TOC analysis). If the TC value is high, re-analyze by adding more sample mass and vice-versa.
6.2.4. Note down the dry weights.
6.2.5. Put the Ag boat in a Al pan and marked the pan.
6.2.6. Weigh about 30mg SRM in a Ag boat.
6.2.7. Note down the weight.
6.2.8. Drop-wise add 1M HCl inside the Ag boats until the sample is completely wet.

6.2.9. Observe for effervesce indicating the presence of carbonates (i.e., CO_2 evolution).
6.2.10. Let the acid react with the solids for at least 1h.
6.2.11. If effervescence was observed earlier, then add more acid to check if the CO_2 evolution has stopped.
6.2.12. Put the Al pans containing Ag boats in the drying oven for 1h at 105 ^{0}C.
6.2.13. Use at least 2 empty Ag boats in Al pans as blanks.
6.2.14. Put the Ag boats in a bigger tin boat and wrap the edges carefully; first for the Ag boats and then for the tin boats.
6.2.15. Pelletize the tin boat in the pelletizer ensuring the size and diameter of the capsule is within the dimensions of the auto-sampler cells.

6.3. <u>Preparation of samples for BC</u>

6.3.1. Sediment should be homogenized entirely.
6.3.2. Dry the samples in oven at 105 ^{0}C overnight then keep in a desiccator.
6.3.2.1. Note: In the Gustafsson et al., 2001 method, the pre-acid and post-acid drying temperature was 60 C and we are using 105 C. This seemed to work fine for the SRM TOC but can be changed to 60 C if there is any issues with regards to Black Carbon analysis.
6.3.3. Take the samples and SRM to CEE basement
6.3.3.1. Note: Contact Mr. Brad Thornhill to use the muffle furnace.
6.3.4. Transfer samples and SRM into a clean porcelain crucible for muffle furnace.
6.3.5. Weigh the exact mass of each samples along with SRM before they are put into muffle furnace.
6.3.6. Heat the sample in the muffle furnace in CEE at 375 ^{0}C for 24h.
6.3.7. Turn off the oven, take out the samples and SRM using a metal tong with insulated handle and let the samples cool down outside to room temperature.
6.3.8. Transport the samples and SRM from CEE to MERC inside a desiccator.
6.3.9. Weigh the mass of the samples and SRM after muffle furnace to get the percentage of the violate compounds.
6.3.10. Weigh dried samples in a Ag boat (about 30mg).
6.3.11. Note down the dry weights.
6.3.12. Put the Ag boat in an Al pan and mark the pan.
6.3.13. Do triplicates or duplicates.
6.3.14. Weigh about 30mg SRM in a Ag boat.
6.3.15. Note down the weight.
6.3.16. Drop-wise add 1M HCl inside the Ag boats until the sample is completely wet.
6.3.17. Observe for effervesce indicating the presence of carbonates (i.e., CO_2 evolution).
6.3.18. Let the acid react with the solids for at least 1h.
6.3.19. If effervescence was observed earlier, then add more acid to check if the CO_2 evolution has stopped.
6.3.20. Put the Al pans containing Ag boats in the drying oven for 1h at 105 ^{0}C.

6.3.21. Use at least 2 empty Ag boats in Al pans as blanks.
6.3.22. Put the Ag boats in a bigger tin boat and wrap the edges carefully; first for the Ag boats and then for the tin boats.
6.3.23. Pelletize the tin boat in the pelletizer ensuring the size and diameter of the capsule is within the dimensions of the auto-sampler cells.
6.3.24. The samples are ready for analysis.

6.4. Analysis procedure

6.4.1. Preparation

6.4.1.1. Open the software or wake up the machine (Options—Settings—Sleep/Wake up).
6.4.1.2. Make sure gas is on.
6.4.1.3. About the flow is typically about 200ml/min while the pressure is about 1000mbar and wait for stable.

6.4.2. Leak test

6.4.2.1. Options—Diagnose—Leak test, follow the instruction windows.

6.4.3. <u>Performing the total measured carbon analysis</u>

6.4.3.1. <u>The following procedure is the same for both TOC and BC analysis</u>

6.4.3.1.1. <u>The analysis can be performed only when the leak test passed.</u>

6.4.3.2. Open a new file and name it.
6.4.3.3. Set up a series of samples (A complete set of appropriate guidelines can be found in Table 1).
6.4.3.4. Input samples data (names, weights, calibration, solid TC method, etc).
6.4.3.5. Put the carousel to reference run (System—Carousel Position—Reference Run)
6.4.3.6. Put the samples into the sampler cell in order.
6.4.3.7. Start the analysis by clicking Auto or Single button.

6.5. Calibration

6.5.1. Create a calibration in the menu Wizards—Calibration.
6.5.2. After completion of the analysis run a calibration can be carried out by means of the menu Calibration—Calibrate—Polynomial number: 1—press the blue arrow button to finish automatically.
6.5.3. The calibration samples can show the theoretical concentration or the measured concentration (Math.—Standard samples display).

6.6. Export data

6.6.1. Save files and copy the data to Excel.

7. Calculation

7.1. Set up a new Excel file and name it.
7.2. Input the sample data (number, name, weight, etc).
7.3. Copy the Samples TC Ares, measured TC (%) and Theoretical (TC) % from software.

7.3.1. Calculation for %BC in the original sample

$$[\%BC]_{sample} = [\%TC]_{375-sample} \times \frac{Wieght\ o\ sample\ after\ muffle\ furnace\ (mg)}{Weight\ of\ f\ 105\ ^{0}C\ dried\ sample\ before\ muffle\ furnace\ (mg)}$$

Where $[\%TC]_{375\text{-sample}}$ is the measured TC value of the sample after heating it in the muffle furnace at 375 ^{0}C

7.3.2. Calculation of % OC of the original sample

% OC = % TOC- % BC

8. QUALITY CONTROL & METHOD PERFORMANCE

8.1. Blanks (1 per 10 extract samples) must be included in the analysis.

8.2. Chemical Analysis: The QAQC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all must meet the acceptance criterion set in Table 2.

8.3.

Table1. EXPECTED SRM VALUCE FOR TOC & BC ANALYSIS

Regular STD	Expected	Measured	%Recovery
SRM 1941b- TOC	3.1 +/- 0.3%	3.075%	99.19%
SRM 1941b- BC	0.58 +/- 0.05%	0.572%	98.62%

$$\%Recovery = \frac{Measured\ \ TOC/BC\ of\ the\ standard\ sample\ (mg)}{Expected\ \ TOC/BC\ of\ the\ standard\ sample\ (mg)} \times 100$$

9. Reference

[1]. Gustafsson, O., Haghseta F., Chan C., Macfarlane J. & Gschwend P. (1997). Quantification of the dilute sedimentary soot phase: Implications for PAH speciation and bioavailability. *Environ. Sci. Technol.***1997**, 31, 203-209.

Table2. SEQUENCE & QA/QC FOR TOC ANALYSIS

SI No	Sample ID	Description	Preparation	No of samples	QA/QC criteria
1	RunIns	For analytical system rinse	No foil, boat or samples (Solid or liquid)	2-3	NA
2	Calibration Blank	A sample of analyte-free media which is used to establish the low range of a calibration. Also, can be used as zero standard.	Solids—Ag-Tin Foil/boat (Use the same container that is used for making the standards)	2	≤ 20 % of the lowest calibration standard
3	Calibration standards	It is used to calibrate the instrument response with respect to analyte concentration.	Solids- Low organic carbon TOC standard (1.55 %), and/or pure carbon compounds (e.g., phthalate)	≥ 5 point	$R^2 \geq 0.995$ % RSD of Avg. Relative Calibration Factor ≤ 20 % % RSD of individual calibration standard ≤ 20 %
4	Blank	Used to determine sample/standard carry over, and determine the contribution of reagents	Solids—Ag-Tin Foil/boat	1	≤ 20 % of the lowest calibration standard
5	ICV	Initial calibration verification - used to verify that a calibration is accurate. Typically prepared from source other than the one used for calibration standard (e.g., SRM 1941b)	Initial Calibration Verification using an external standard- E.g., SRM 1941b	1	Within 20 % of the theoretical expected value
6	Samples	Unknown	Solids—Samples in Ag-Tin Foil/boat	10	Values fall within the calibration range
7	Blank	Used to determine sample/standard carry over, and determine the contribution of reagents	Solids—Ag-Tin Foil/boat	1 every 10 samples	≤ 20 % of the lowest calibration standard
8	CCV	Continuing Calibration Verification—An analytical standard prepared from the same source as the calibration standards that is analyzed periodically after 10 samples to verify the continued accuracy of an instrument calibration.	Solids- Low organic carbon TOC standard (1.55 %)	1 every 10 samples	Within 20 % of the theoretical expected value

9	RunIns	For analytical system rinse	No foil, boat or samples (Solid or liquid)	≥ 2	No criteria

SOP-3.

Standard Operating Procedure for the measurement of dissolved organic carbon (DOC) in water samples

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for the measurement of total measured carbon (TC) as dissolved organic carbon (DOC) using Vario TOC Select.

1.2. The Vario TOC Select can be used for both solid samples and liquid samples. This method is applicable to water samples only.

2. SUMMARY OF METHOD

2.1. For the DOC analysis, the water samples will be filtered or centrifuged to remove particles ≥ 0.45 micron size. The filtered/centrifuged samples will be pre-treated with hydrochloric acid (HCl) to remove inorganic carbon (carbonates) before analysis. The samples will then be introduced directly by the instrument into the combustion furnace that will be maintained at 850 °C.

2.2. The instrument measures the carbon dioxide evolved from the combustion furnace and the software calculates the TC concentration (TC%) based on the calibration curve generated using standards. A series of blank and QC checks are used to help check the analytical integrity of the run.

3. SAFETY PRECAUTIONS

3.1. The temperature of the furnace can be very high (850 ^{0}C-950 ^{0}C). The replacement of heated tubes must only be performed by means of the furnished protective gloves and other protective equipment. **Only trained personnel are allowed to perform this procedure.**

3.2. Always wear a laboratory coat, gloves and safety glasses.

4. APPARATUS AND MATERIALS

4.1. Vario TOC select system with 32 sample cells
4.2. Brass wool (Elementar, Art. No.: 38.00-0124)
4.3. Water absorber pellets (Aquatak)
4.4. Glass Pasteur pipet with suction bulb
4.5. Syringe or vacuum filtration apparatus
4.6. Centrifuge with appropriate rotor
4.7. TOC glass vials
4.8. Clean box for samples
4.9. Kimwipes
4.10. Gas cylinder – Air

5. REAGENTS

5.1. Concentrated hydrochloric acid—HCl (for acidification; purity = 35-37 %)
5.2. Potassium hydrogen phthalate— KHP (for calibration and quality check standards)

6. SAMPLE PREPARATION HANDLING AND ANALYSIS

6.1. Preparation of Blanks and Calibration Standards

6.1.1. Prepare 200 mg-C/L DOC stock standard using KHP in ultra-pure water.

6.1.2. Dilute the stock solution to five calibration standards (e.g., 2, 5, 10, 20, 50 mg-C/L) in ultrapure water.

6.1.3. Prepare appropriate amount of quality checks (e.g., 10 mg-C/L), calibration blanks, RunIn blanks and reagent blanks.

6.1.3.1. Runin blanks consists of ultrapure water without acid.

6.1.3.2. A minimum of 2 RunIn blanks must be included at the beginning and 3 RunIn blanks at end of the sample sequence. This step is to ensure that the acid/salts in the lines and the syringe are flushed before and after analysis.

6.2. Preparation of DOC samples

Note: Any concentrated acid addition to samples should be performed in a working fumehood.

6.2.1.1. All water samples, except the RunIn blanks, prepared for DOC including, calibration and blanks, is treated with a drop of conc. HCl. This should lower the pH of the samples to ~ 2. If in doubt, check the pH with a pH paper strip. If pH is greater than 2 add more acid.

6.3. Analysis procedure

Note: The instrument should be in liquid mode to perform these operations. If it is not, please contact trained personnel to make the change. The procedure for changing the modes is not a part of this SOP.

6.3.1. Check the instrument maintenance indicator at the bottom of the software. If the maintenance indicator is > 50 %, click on the indicator and proceed to replace parts and/or material accordingly.

6.3.2. Ensure that the brass wool and the water absorption columns are < 50 % saturated. Otherwise, repack the columns with new materials.

6.3.3. Place the water samples in the autosampler rack. Note that the number on the autosampler for a given sample should match the vial number in the software.

6.3.3.1. Open the software or wake up the machine (Options—Settings—Sleep/Wake up).

6.3.3.2. Make sure gas is on.

6.3.3.3. The gas flow is typically ~ 200ml/min when the pressure is ~ 1000 mbar.

6.3.4. Leak test

6.3.4.1. Options—Diagnose—Leak test, follow the instruction windows.

Note: The analysis can be performed only when the leak test passed.

6.3.5. Performing the dissolved organic carbon analysis

6.3.5.1. Open a new file and name it.

6.3.5.2. Set up a series of samples (A complete set of appropriate guidelines can be found in Table 1).

6.3.5.3. Input sample and method data (sample ids, injection volume (working range – 0.1 to 2 mL), method (typically NPOC-fast), etc.).

6.3.5.4. Put the carousel to reference run (System—Carousel Position—Reference Run)

6.3.5.5. Put the samples into the sampler cell in same order corresponding to the position number in the software.

6.3.5.6. Start the analysis by clicking Auto (for full sequence analysis) or Single button (for a single sample analysis).

6.4. Calibration

6.4.1. Create a calibration file in the menu Calibration—Coefficients.

6.4.1.1. Typically the calibration file consists of the date in the format YYMMDD

6.4.2. After completion of the analysis run a calibration can be carried out by means of the menu Calibration—Calibrate—Polynomial number: 1—press the blue arrow button to finish automatically.

6.4.3. The calibration samples can show the theoretical concentration or the measured concentration (Math.—Standard samples display).

6.5. Export data

6.5.1. Save files and copy the data to Excel.

6.6. Calculation

6.7. Set up a new Excel file and name it.

6.8. Input the sample and analysis data.

6.9. Copy the data set from the instrument software to the Excel spreadsheet

6.9.1. If the calibration standards and the QCs meets all the criteria (as defined in Table 1), the instrument measured DOC concentration for the samples are reliable. If not, troubleshoot the issue and re-analyze the sample

6.9.2. Note down the calibration slope, intercept and R^2 in a spreadsheet that is setup in the instrument desktop.

6.9.2.1. If a considerable deviation (> 30%) is noticed in the slope compared to normal values , check for issues and rectify.

6.9.3. If the measured DOC falls above the calibration range dilute the sample accordingly and re-analyze.

6.9.4. If the measured DOC falls between the method detection and the method reporting limit, apply a J-flag to the results.

7. QUALITY CONTROL & METHOD PERFORMANCE

7.1. Chemical Analysis: The QAQC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in Table 1.

Table1. SEQUENCE & QA/QC FOR DOC ANALYSIS

SI No	Sample ID	Description	Preparation	No of samples	QA/QC criteria
1	RunIn Blanks	For analytical system rinse	Ultra-pure water without acid	2-3	NA
2	Calibration Blank	A sample of analyte-free media which is used to establish the low range of a calibration. Also, can be used as zero standard.	Ultra-pure water	2	≤ 33 % of the lowest calibration standard
3	Calibration standards	A solution prepared from the dilution of stock standard solutions. It is used to calibrate the instrument response with respect to analyte concentration.	Potassium hydrogen phthalate (KHP) working standards in ultra-pure water. (typical range 2 to 20 mg/L)	≥ 5 point calibration	% Recovery of individual calibration standard is between 80 to 120 % *(Note the response factor or slope & intercept of the linear regression line)
4	Reagent Blank	Used to determine sample/standard carry over, and determine the contribution of reagents	Ultra-pure water	1	≤ 33 % of the lowest calibration standard
5	ICV/CCV	Ideally an Initial calibration verification (ICV) - used to verify that a calibration is accurate.	KHP standard approx. at the mid-point of the calibration range (e.g., 5-10 mg/L)	1	Within 80 to 120 % of the theoretical expected value
6	Samples	Unknown	Filtered Water (≤ 0.45 µm)	10	Values fall within the calibration range
7	Blank	Used to determine sample/standard carry over, and determine the contribution of reagents	Ultra-pure water	1 every 10 samples	≤ 33 % of the lowest standard used for calibration
8	CCV	Continuing Calibration Verification—An analytical standard prepared from the same source as the calibration standards that is analyzed periodically after 10 samples to verify the continued accuracy of an instrument calibration.	KHP standard approx. at the mid-point of the calibration range (e.g., 10 mg/L)	1 every 10 samples	Within 80 to 120 % of the theoretical expected value
9	RunIns	For analytical system rinse	Ultra-pure water without acid	≥ 3	No criteria

SOP-4.

Standard Operating Procedure for trace metal extraction of bulk water

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for the trace metal extraction of bulk water using the hot plate digestion.

1.2. This procedure is based on the EPA method 3005A for acid digestion of waters for total recoverable or dissolved metals.

1.3. This procedure generates partial extracts suitable for Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) analysis and total mercury analysis for bulk water.

2. SUMMARY OF METHOD

The entire sample is acidified with nitric acid (HNO_3) and hydrochloric acid (HCl). After that the sample is heated and substantially reduced in volume. The digestate is diluted to a final volume of 35mL, and then is ready for analysis.

3. APPARATUS AND MATERIALS

3.1. Fume hood, acid resistant

3.2. Digestion vessel-40mL trace metal grade vial

3.3. Temperature measuring device capable of measuring at least 125°C

3.4. Brooks Rand LINX Wireless Digestor System (holds maximum of 36 samples)

3.5. Graduated cylinder

3.6. 100mL volumetric flask

4. REAGENTS

4.1. Ultra-pure water (purity ≤18MΩ.cm)

4.2. Concentrated Nitric Acid (HNO_3), 67-70% trace metal grade (Fisher Chemical)

4.3. Concentrated Hydrochloric Acid (HCl), 34-37% trace metal grade (Fisher Chemical)

4.4. Concentrated Bromine monochloride (BrCl) (0.2 N). Bromide monochloride solution– In a fume hood , dissolve 27 g of KBr in 2.5 L of conc. HCl. Place a clean magnetic stir bar in the bottle and stir for approximately 1 h in the fume hood. Slowly add 38 g of KBrO3 to the acid while stirring. When all of the KBrO3 has been added, the solution color should change from yellow to red to orange. Loosely cap the bottle, and allow to stir another hour before tightening the lid.

5. PROCEDURE

5.1. Transfer a 35mL aliquot of bulk water to the digestion vessel.

5.2. Mark the level of the aliquot in the vessel.

5.3. Add 0.7mL of concentrated HNO_3 and 1.75mL of concentrated HCl.

5.4. After the sample has been acidified, place it into the heating block.

5.5. Operating the LINX Wireless Digestor System.

5.5.1. Place the heating block in an acid fume hood.

5.5.2. The heating block can be controlled wirelessly, so any laptop or desktop can use the wireless device that accompanied the apparatus.

5.5.3. Once the wireless USB device is in a computer, click on the program called.

5.5.4. Click on the icon called "Search for Devices". If the device is found, the name of the heating block will appear on a list below the "Search for Devices" icon.

5.5.5. Click on the name of the heating block name.

5.5.6. Temperature is set to degrees Celsius by default so set the temperature anywhere from 90-120 °C. Rising time indicates how long the heating block will need to reach the desired temperature. Input 15min for Rising Time. Stable time indicates the duration at which the desired temperature will be constant, or stable. Set the stable time to 4h.

5.5.7. Click on the "Save" button and name the file.

5.5.8. Ensure that External Temperature is checked.

5.5.9. Once all the settings have been set up, click on the "Send" button to send the set of steps to the heating blocks.

5.5.10. To begin the block Digestor, click on the "Execute" button. The tab called "Monitor" will allow you to view the Rising and Stable time, as well as the temperature during these times.

NOTE: Once "Execute" has been clicked, modifications to the steps cannot be performed. If the heating block needs to be stopped before the Stable Time ends, then on the Steps Tab, click on the "Stop" button.

5.6. Heat the sample to 95°C ± 5°C for 4h.

CAUTION: Do not boil. Antimony is easily lost by volatilization from hydrochloric acid media.

5.7. When the volume of the sample has been reduced to 7-10mL, remove the vial from the Digestor system and allow to cool.

5.8. After cooling, bring the volume of the sample exactly to the level of 35mL using ultra-pure water.

5.9. Take an aliquot of 20mL of the sample, add 2% BrCl in the aliquot and store it at 4^{0}C in the cold room for total mercury analysis.

5.10. Store the remaining sample of 15mL in the 4^0C cold room for ICP-MS analysis.

6. REFERENCE

U. S. Environmental Protection Agency, 1992. Method 3005A. Acid Digestion of waters for total recoverable or dissolved metals for analysis by FLAA or ICP Spectroscopy.

SOP-5.

Trace Metals in Tissue by Acid Digestion for Analysis on Inductively Coupled Mass Spectrometry (ICP-MS)

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This procedure provides sample preparation for quantification of metals in tissues using an inductively coupled plasma with detection by mass spectrometry (ICP-MS).

1.2. The digestion method will involve treatment of cold (room temperature) and hot concentrated nitric acid (HNO_3) followed by the addition of 1 N nitric acid.

1.3. This procedure has been modified from the SOP for Measurement of Trace Metals in Sediment, Tissue, DGT or Water Samples provide by SPAWAR Systems Center Pacific (ICP-MS; USEPA, 1994).

2. SUMMARY OF METHOD

2.1. This procedure is for tissue matrices. In this procedure, a 0.5 - 1 g wet sample is dried at 60°C for a minimum of three days and digested with HNO_3 at room temperature. The digestate is then heated gradually up to 120°C for 1-2 hours. After heating, 1 N HNO_3 is add to the digestate, mixed thoroughly, and allowed to sit overnight to allow particles to settle. Afterwards, the tissue digestate is ready for analysis on the ICP-MS.

3. INTERFERENCES AND SAFETY

3.1. Always work accurate and neat, because of safety and quality assurance.

3.2. Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic and corrosive.

3.3. Use a permanent fume hood when working with concentrated acids.

3.4. Particles may not entirely settle in the tissue samples so centrifugation or filtration will need to be used so not to damage the ICP-MS.

4. APPARATUS AND MATERIALS

4.1. Autosampler vial— MERX trace metal grade total mercury autosampler vials, 40 mL capacity from Brooks Rand™

4.2. 15 mL polypropylene centrifuge tube or equivalent

4.3. Balance—Analytical, capable of weighing 1.0 mg.

4.4. Desiccator

4.5. Laboratory oven capable of reaching 60°C for prolonged periods of time

4.6. Concentrated Trace Metal Grade Nitric Acid (TMG-HNO_3)

4.7. 1 N TMG- HNO_3 made in high-purity - 18 MΩ cm^{-1} water

4.8. Brooks Rand Linx Wireless Digestion System (holds maximum of 36 samples)

4.9. OMNI Homogenizer Blender

5. REAGENTS and STANDARDS

5.1. All chemicals will be reagent grade or better. If necessary, the chemicals used for extraction and analysis be analyzed to ensure total Hg is < 5 pg/mL. All acids will be trace metal grade.

5.2. Reagent grade water (resistivity~18 MΩ.cm)
5.3. Concentrated Nitric Acid ~36 % - trace metal grade
5.4. Nitric Acid (1 N)—Add 89.9 mL of Conc. HNO_3 for every liter of Milli-Q DI water (reagent grade). Add 500 mL of Milli-Q DI water to the pre-labeled "1 N HNO_3" bottle. Carefully pour Conc HNO_3 into the pre-labeled bottle. Once all Conc HNO_3 is poured into the 1 L bottle, top off the bottle with Milli-Q DI until the level with 1 L mark on the bottle.

6. PREPARATION AND HANDLING

Sample Preparation

6.1. Label 40 mL THg vials with sample ID on cap and on the vial. Be sure to include extra vials as Method Blanks and Spike Blanks.
6.2. Place the vials in the oven overnight (minimum) at 60°C.
6.3. Remove the vials from the oven and allow to cool for ~15 minutes in the dessicator.
6.4. Weigh vials with caps on analytical balance—record—**VIAL TARE MASS (g)**.
6.5. Thoroughly homogenize tissue samples to be analyzed with OMNI homogenizer blender.
6.6. Add tissue to vial, 1 ± 0.5 g wet weight.
6.7. Weigh vials, caps and tissue—record—**VIAL + WET TISSUE MASS (g)**.
6.8. Remove the caps and place them by the oven. Place the vials with tissue into the oven for 3 days (minimum) at 60°C. If there appears to be moisture present, let the samples stay in the oven longer.
6.9. Remove the vials from the oven and allow to cool for ~15 minutes in the dessicator.
6.10. Weigh tubes, caps and dried tissue on analytical balance—record—**VIAL + DRY TISSUE MASS (g)**.
6.11. Add 1 mL Concentrated HNO_3 to each vial, loosely cap each vial.
6.12. Let tubes sit overnight in a fume hood.
6.13. Place the loosely capped vials on the Brooks Rand Linx Wireless Digestion System for 1-2 hours.

Operating the Linx Wireless Digestor System

6.14. Place the heating block in a fume hood.
6.15. The heating block can be controlled wirelessly, so any laptop or desktop can use the wireless device that accompanied the apparatus.

NOTE: A designated laptop in Room 103 is used for the Digestor System. Do not move this laptop from its location.

6.16. Once the wireless USB device is in a computer, click on the program called Digestion System.
6.17. Click on the icon called "Search for Devices". If the device is found, the name of the heating block will appear on the list below the "Search for Devices" icon.
6.18. Click on the name of the heating block.
6.19. Click on the "New" to input the temperature and time values needed to digest the tissue.

6.20. Temperature is set to degrees Celsius by default so set the temperature to 50°C. This is the minimum temperature that the heating block can be set to.

6.21. Input 10 minutes for Rising Time and 2 hours for Stable Time.

6.22. Click on the "Save" button and name the file.

6.23. Ensure that External Temperature is checked.

6.24. Once all the setting have been set up, click on the "Send" button to send the step to the heating block.

6.25. Once all the settings have been set up, click on the "Execute" button. The tab called "Monitor" will allow you to view the Rising and Stable Time, as well as the temperature during these times.

NOTE: Once "Execute" has been clicked, modification to the steps cannot be performed. If the heating block needs to be stopped before the Stable Time ends, then on the Steps Tab, click on the "Stop" button.

6.26. Once the program has completed its two hour heating, the block digestor will turn off and begin to cool.

Sample Preparation Continued

6.27. After heating the samples, add 3 mL of 1 N HNO_3 to each vial.

6.28. Weigh the vial with acid—record**—VIAL + DIGESTATE FINAL MASS (g)**.

6.29. Mix each vial thoroughly and let sit overnight to allow particles to settle.

6.30. Centrifuge the samples with a JA 10 Rotor at 5000 rpm for 10 minutes and at 22°C. Set Accelerate to Max and Decelerate to Slow.

6.31. After centrifugation, transfer 2-3 mL to a 15 mL centrifuge tube.

6.32. The tissue digestate is ready for analysis on ICP-MS. Refer to the SOP on how to operate, use the ICP-MS.

7. QUALITY CONTROL & METHOD PERFORMANCE

7.1. Method Blank: Duplicate Method Blanks are carried out through the entire procedure to account for background or contamination.

7.2. Pre-Digestion Spike Addition: An analyte spike is added to the dried tissue matrix prior to the addition of Conc HNO_3. This spike should be recovered to within 75-125 percent of the known values or within the laboratory derived acceptance criteria. The spike addition should be based on the indigenous concentration of each element of interest in the sample. If the spike is not recovered within the specified limits, the sample must be diluted and reanalyzed to compensate for the matrix effect. Results must agree to within 10% of the original determination. Spike one duplicate sample at frequency of one matrix duplicate for every 10 samples.

7.3. Spike Blank: Duplicate Spike Blanks are carried out similarly to the Pre-Digestion Spike Addition, however, no tissue sample is present in the vial.

7.4. Analyze one duplicate sample at a frequency of one matrix duplicate for every 10 samples.

7.4.1. The relative percent difference (RPD) between duplicate determinations must be calculated as follows:

$$RPD = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \times 100$$

where:

RPD = relative percent difference
D_1 = first sample value
D_2 = second sample value (duplicate)

A control limit of 20% RPD should not be exceeded for analyte values greater than 100 times the instrumental detection limit. If this limit is exceeded, the reason for the out-of-control situation must be found and corrected, and any samples analyzed during the out-of-control condition must be reanalyzed.

7.5. Standard Reference Material: Analyze duplicate SRM samples.

7.5.1. For mussel tissue analysis, NIST 2976 Mussel Tissue was used. The table below shows the recoveries from the procedure outlined in this SOP:

Table 1: Recoveries for SRM 2976 Mussel Tissue Derived From This SOP

Element	SRM Mass Fractions (mg/kg)	SRM Extraction Mass (g)	Extraction Volume (mL)	SRM Conc (µg/L)	Analytical Measured Values (µg/L)	% Recovery
Arsenic	13.3 ± 1.8	0.5	2	3325	3792.5	114.1
Cadmium	0.82 ± 0.16	0.5	2	205	200.5	97.8
Copper	4.02 ± 0.33	0.5	2	1005	844.5	84.0
Lead	1.19 ± 0.18	0.5	2	297.5	247.45	83.2
Zinc	137 ± 13	0.5	2	34250	32617.1	95.2
Silver	0.011 ± 0.005	0.5	2	2.75	1.55	56.4
Nickel	0.93 ± 0.12	0.5	2	232.5	300	129.0

8. REFERENCES

U. S. Environmental Protection Agency. (1998) Method 6020A Inductively Coupled Plasma-Mass Spectrometry.

SOP-6.

Standard Operating Procedure for the Digestion of Trace Metals (other than mercury) in Sediment Samples

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for acid digestion for extraction of trace metals from sediment samples

1.1.1. The method is an adaptation of the EPA method 3050B (This method provides only digestion procedure for the preparation of sediments samples for inductively coupled plasma mass spectrometry (ICP-MS).

1.2. The method is applicable to major and trace metals and the focus herein is on trace metals, which include Arsenic (As), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Iron (Fe), Lead (Pb), Molybdenum (Mo), Selenium (Se), and Thallium (Tl).

1.3. This method is not a total digestion technique for most samples. It is a very strong acid digestion that will dissolve almost all elements that could become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

1.4. Samples prepared by this method can be analyzed by ICP-MS for all the listed metals as long as the detection limits are adequate for the required end-use of the data.

2. SUMMARY OF METHOD

2.1. For the digestion of samples, a representative 1-2 gram (wet weight) or 1 gram (dry weight) sample is digested with repeated additions of nitric acid (HNO_3) and hydrogen peroxide (H_2O_2).

2.2. For ICP-MS analysis, the resultant digestate is reduced in volume while heating and then diluted to a final volume of 33mL.

3. INTERFERENCES

3.1. Sludge samples can contain diverse matrix types, each of which may present its own analytical challenge. Spiked samples and any relevant standard reference material should be processed in accordance with the quality control requirements given in Section 7.0 to aid in determining whether Method 3050B is applicable to a given waste.

4. APPARATUS AND MATERIALS

4.1. Acid resistant fume hood

4.2. Digestion vessel-40 mL trace metal grade vial

4.3. Refluxing device (Hot Plate Digestor)

4.4. Drying oven set to 45 °C ± 5 °C

4.5. Temperature measuring device capable of measuring at least 125 °C

4.6. Whatman No. 41 filter paper (optional)

4.7. Beckman Coulter Centrifuge (optional)

4.8. Centrifuge tubes

4.9. Analytical balance capable of accurate weighing to 0.01 g

4.10. Brooks Rand LINX Wireless Digestor System (holds maximum of 36 samples)

4.11. Funnel

4.12. Graduated cylinder

4.13. 100 mL volumetric flask

4.14. Precision balance

5. REAGENTS

5.1. Reagent water

5.2. Concentrated Nitric Acid (HNO_3), 70%, trace metal grade

5.3. Hydrogen Peroxide (H_2O_2), 30%, trace metal grade

6. PROCEDURE

6.1. Homogenization

6.1.1. If the sediment has been stored in freezer/cold room, then allow the sediment samples to thaw to room temperature.

6.1.2. Homogenize the sample using disposable plastic stirrer.

6.2. Place a digestion vessel onto a precision balance and tare the vessel. Transfer 1-2 g of wet sample (or 1g dry sample) into the vessel. Record the mass.

6.3. Add 10 mL of 1:1 HNO_3 to the sample, mix the slurry, and cover with the refluxing device. After all samples have been acidified, place the samples into the heating block.

6.3.1. In the presence of carbonate minerals, the addition of acid may cause significant effervescence. Therefore, this step must be performed carefully by adding the acid in increments.

6.4. Operating the LINX Wireless Digestor System

6.4.1. Place the heating block in an acid fume hood.

6.4.2. The heating block can be controlled wirelessly, so any laptop or desktop can use the wireless device that accompanied the apparatus.

6.4.3. Once the wireless USB device is in a computer, click on the program called.

6.4.4. Click on the icon called “Search for Devices”. If the device is found, the name of the heating block will appear on a list below the “Search for Devices” icon.

6.4.5. Click on the name of the heating block name.

6.4.6. Temperature is set to degrees Celsius by default so set the temperature anywhere from 90-100 °C. Rising time indicates how long the heating block will need to reach the desired temperature. Input 10 minutes for Rising Time. Stable time indicates the duration at which the desired temperature will be constant, or stable. Set the stable time to 15 minutes.

6.4.7. Click on the “Save” button and name the file.

6.4.8. Ensure that External Temperature is checked.

6.4.9. Once all the settings have been set up, click on the “Send” button to send the set of steps to the heating blocks.

6.4.10. To begin the block digestor, click on the “Execute” button. The tab called “Monitor” will allow you to view the Rising and Stable time, as well as the temperature during these times.

NOTE: Once “Execute” has been clicked, modifications to the steps cannot be performed. If the heating block needs to be stopped before the Stable Time ends, then on the Steps Tab, click on the “Stop” button.

6.5. Heat the sample to 95 °C ± 5 °C and then reflux for 10 to 15 minutes without boiling the sample.

6.6. Allow the sample cool and add 5 mL of concentrated HNO_3, replace the refluxing device and reflux for 30 minutes. If brown fumes are generated (see Figure 1), indicating oxidation of the sample by HNO_3, repeat this step once more of adding 5 mL of concentrated HNO_3, until no brown fumes are given off by the sample. A complete reaction with HNO_3 is indicative of no brown fumes. Use the refluxing device to either allow the solution to evaporate to approximately 5 mL without boiling or heat the sample at 95 °C ± 5 °C without boiling for two hours.

Figure 1: Brown fumes released from the oxidation of HNO_3.

6.7. Once step 6.6 has been completed, allow the sample to cool and add 3 mL of 30% H_2O_2. Cover the vial with the refluxing device and return the vessel the heating block to warm and start the peroxide reaction. Excessive vigorous effervescing of the sample can result in losses so care must be taken in this step. Heat until effervescence subsides and cool the vessel.

6.8. Continue to add 30% H_2O_2 in 1 mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.

NOTE: Do not add more than a total of 10 mL 30% H_2O_2.

6.9. Cover the sample with the refluxing device and continue to heat the acid-peroxide digestate until the volume has been reduced to approximately 5 mL (or heat the sample at 95 °C ± 5 °C without boiling for two hours).

6.10. After cooling, dilute to approximately 33 mL with water. Particulates will be disturbed from the addition of water so before the sample is ready for the ICP-MS, removal of the particulates can be performed by:

6.10.1. Filtration via Whatman no 41 filter,

6.10.2. Centrifugation at 5000 rpm for 10 minutes, or

6.10.3. Allowing the particulates to settle.

6.11. The sample is ready for ICP-MS analysis.

7. QUALITY CONTROL

7.1. A method blank should be performed throughout the entire sample preparation and analytical process. These blanks can indicate if samples are being contaminated.

7.2. Spiked duplicate samples should be processed on a routine basis and whenever a new sample matrix is being analyzed. These spiked duplicates can determine the precision and bias of analysis.

7.3. A reference standard sediment (e.g., SRM 1944) should undergo identical digestion procedure and recovery checked for the metals of interest.

8. METHOD PERFORMANCE

8.1. The method performance was checked using the National Institute of Standards and Technology (NIST) sediment standard reference material, 1944. Table 1 presents the SRM 1944 recoveries for particular metals as they have been measured in TTU.

Table 1. SRM 1944 recoveries for method performance.

Metal	Expected value (mg/kg)	TTU measured value (mg/kg)	% Recovery
Copper (Cu)	380	371	97.6
Cadmium (Cd)	8.8	8.7	98.5
Lead (Pb)	330	290	87.9
Nickel (Ni)	76.1	66.4	87.3
Zinc (Zn)	656	645	98.3
Arsenic (As)	18.9	19.5	103.4

9. CALCULATIONS

9.1. $Trace\ metal\ concentration\ in\ sediment\ \left(\frac{mg}{kg{-}dry\ solid}\right) = \frac{M_{ICP-MS}}{W_{dry}}$

$$M_{ICP-MS} = C_{ICP-MS}\left(\frac{mg}{L}\right) \times Volume\ of\ Extraction(L)$$

$$Where, C_{ICP-MS} = Concentration\ of\ Trace\ Metal\ measured\ by\ ICP-MS\ \left(\frac{mg}{L}\right).$$

$$W_{dry} = amount\ of\ dry\ sediment(kg)$$
$$= Wet\ wt.of\ sedment(kg) \times \left(1 - \frac{Moisture\ Content\ (\%)}{100}\right)$$

10. REFERENCES

U. S. Environmental Protection Agency. 1996. Method 3050B Acid Digestion of Sediments, Sludges, and Soils.

SOP-7.

Standard Operating Procedure for Measurement of Trace Metals in DGT

SPAWAR

OBJECTIVE

This method is for quantification of metals in soils, tissues, water or in passive sampling devices using a Perkin-Elmer SCIEX ELAN DRC II inductively coupled plasma with detection by mass spectrometry (ICP-MS; USEPA, 1994).

NECESSARY MATERIALS AND SUPPLIES

- 125 mL LDPE bottle with cap
- Laboratory oven capable of reaching 60°C for prolonged periods of time
- Desiccator
- Concentrated trace metal grade (TMG) hydrochloric acid (TMG-HCl)
- Concentrated TMG nitric acid (TMG-HNO_3)
- 1N TMG- HNO_3 made in high-purity - 18 MΩ cm^{-1} water
- Quartz still-grade nitric acid (Q- HNO_3 made in high-purity - 18 MΩ cm^{-1} water)
- 1N Q- HNO_3 made in high-purity - 18 MΩ cm^{-1} water
- Milli-Q (18 MΩ cm^{-1}) water
- Nitrile gloves
- Kim wipes
- 3mL centrifuge tubes
- 15mL ICP MS centrifuge tubes certified for low metal concentration
- Deionized water
- Analytical balance
- Data sheets
- Pipets, automatic – adjustable, to cover a range of 0.01 to 5 ml and pipette tips
- Safety equipment – lab coats, eye protection, gloves and respirator as required

METHODS

Note: Practice "Clean" techniques throughout all steps of process. Sample preparation shall be conducted in a High Efficiency Particle Air (HEPA) class-100 all polypropylene working area.

Preparation of 1N Q-HNO_3

Add 89.80g (or mL) of Q-HNO_3 (or TMG- Q-HNO_3) for every liter of Milli-Q DI water.

1. Add at least 500mL of Milli-Q DI water to the pre-labeled "1N Q-HNO_3" bottle.
2. Carefully pour Q-HNO_3 to neck of small 125mL bottle and recap bottle.
3. Measure weight on balance and record (i.e. 120g – bottle, cap and acid)
4. Determine the final weight needed once Q-HNO_3 is poured into 1L bottle (i.e. 120 - 89.8 = 30.2).
5. Carefully pour Q-HNO_3 into 1L bottle incrementally.
6. Weigh small bottle and continue to pour off until weight is approximately 30.2g.

7. Once all Q-HNO_3 is poured into 1L bottle, top off bottle with Milli-Q DI until level with 1L mark on bottle.

For preparation of larger volumes of 1N TMG-HNO_3, scale up the ratio of acid:water using the following table:

Number of Liters to Prepare	Acid Volume (mL)	Milli-Q Volume (mL)
1	89.8	910.2
2	179.6	1820.4
3	269.4	2730.6
4	359.2	3640.8
5	449	4551
6	538.8	5461.2
7	628.6	6371.4
8	718.4	7281.6

DGT – Preparation and Digestion

1. Label 3mL centrifuge tubes with sample ID. Be sure to include extra tubes as method blanks.
2. Place tubes in oven overnight (minimum) at 60°C.
3. Add DGT resin layer to centrifuge tube, push resin down to bottom of tube.
4. Weigh tubes, caps and DGT – record **– TUBE AND DGT MASS (g).**
5. Add 0.25mL QHNO_3 to each tube, keep cap loosely on tube.
6. Let tubes sit overnight (minimum)
7. Add 1 mL 1N Q-HNO_3 to each tube.
8. Weigh tube with acid – record **– ACID PLUS DGT MASS (g)**.
9. Mix each tube thoroughly and let sit overnight to settle.
10. Pull 100µL of supernatant from each tube and place into pre-labeled ICP-MS tubes.
11. Add 5mL of pH2 MQ water to ICP-MS tubes.
12. Place into ICP-MS rack and begin programming of ICP-MS analysis.

SOP-8.

Total Mercury in Tissue by Acid Digestion and BrCl Oxidation

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This procedure provides sample preparation for oxidation of total mercury (Hg) in solid and semi-solid sample matrices. This procedure may be used in conjunction with EPA Method 1631B: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry for determination of mercury in tissue and standard reference material. The digestion method will involve treatment of cold (room temperature) hydrochloric acid (HCl) followed by bromine monochloride (BrCl) oxidation.

1.2. This procedure generates extracts suitable for determination of total Hg following the EPA Method 1631E: *Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry* using the MERX Total Hg system of Brooks Rand™.

1.3. This method was modified from EPA-821-R-01-013.

2. SUMMARY OF METHOD

2.1. This procedure is for matrices containing organic metals, such as sludge and plant and animal tissues, because the organic matter is completely destroyed. In this procedure, a 0.5 - 1.5 g sample is digested with HNO_3/H_2SO_4. The digestate is diluted with BrCl solution to destroy the remaining organic material.

3. METHOD DETECTION LIMITS, INTERFERENCES AND SAFETY

3.1. The digestion procedures in conjunction with Method 1631B, allow determination of Hg at concentrations ranging from 1.0 to 5000 ng/g in solid and semi-solid matrices. Higher concentrations can be measured by selections of a smaller sample size and/or dilution of the digestate.

3.2. The addition of BrCl to the sample after it is fully solubilized HNO_3/H_2SO_4 is critical to convert methyl Hg to Hg(II). If the acid digestates are analyzed by Method 1631E without BrCl oxidation of tissues, a significant low bias may occur.

3.3. Always work accurate and neat, because of safety and quality assurance.

3.4. Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic and corrosive.

3.5. Use a permanent fume hood when working with concentrated acids and powerful oxidants.

4. APPARATUS AND MATERIALS

4.1. Digestion and storage vial — 15 ml polypropylene centrifuge tube or equivalent.

4.2. THg Autosampler vial— MERX trace metal grade total mercury autosampler vials, 40 mL capacity from Brooks Rand™

4.3. Balance—Analytical, capable of weighing 1.0 mg.

4.4. Brooks Rand Merx-T Automated Total Mercury System for US EPA Method 1631

4.5. Brooks Rand Linx Wireless Digestion System (holds maximum of 36 samples)

5. REAGENTS and STANDARDS

5.1. All chemicals will be reagent grade or better. If necessary, the chemicals used for extraction and analysis be analyzed to ensure total Hg is < 5 pg/mL. All acids will be trace metal grade.

5.2. Reagent grade water (resistivity~18 MΩ.cm)

5.3. Concentrated Nitric Acid ~36 % - trace metal grade

5.4. Concentrated Sulfuric Acid ~93-98% trace metal grade

5.5. HNO_3/H_2SO_4 Solution-In a fume hood, slowly add 300 mL of concentrated H_2SO_4 to 700 mL of concentrated HNO_3 in a fluoropolymer bottle.

5.6. Potassium Bromide (KBr)

5.7. Potassium Bromate ($KBrO_3$)

5.8. Concentrated (0.2 N) Bromide monochloride solution– In a fume hood , dissolve 27 g of KBr in 2.5 L of conc. HCl. Place a clean, teflon magnetic stir bar in the bottle and stir for approximately 1 hour in the fume hood. Slowly add 38 g of $KBrO_3$ to the acid while stirring. When all of the $KBrO_3$ has been added, the solution color should change from yellow to red to orange. Loosely cap the bottle, and allow to stir another hour before tightening the lid.

5.9. Hydroxylamine Hydrochloric Acid Reagent (HH) —Dissolve 300 g of $NH_2OH.HCl$ in reagent water and bring to 1.0 L. This solution may be purified by the addition of 1.0 mL of $SnCl_2$ solution and purging overnight at 500 mL/min with ultra high purity nitrogen gas. Alternative, certified HH reagent from Brooks Rand Instruments (cat no: 03610, Total mercury < 1 ng/L) can be used.

5.10. Stannous Chloride ($SnCl_2$) —Bring 200 g of $SnCl_2.2H_2O$ and 100 mL concentrated HCl to 1.0 L with reagent water. Purge overnight with ultra high purity nitrogen gas at 500 mL/min to remove all traces of Hg. Store tightly capped. Alternative, certified SnCl reagent from Brooks Rands Instruments (cat no: 03620, Total mercury < 1 ng/L) can be used.

5.11. Stock total mercury standard—certified 1 ppm from Brooks Rand Instruments (cat no: 03600).

5.12. Secondary ICP-MS mercury standard— 1 ppm Hg(II) in 2% Nitric Acid (NO_3).

5.13. Working Hg Standard A—Dilute 0.100 mL of the stock Hg standard to 10 mL in an autosampler vial with reagent water containing 1% by volume BrCl solution. This solution contains 10.0 ng/mL and should be replaced every analysis.

5.14. Working Hg Standard B—Dilute 0.100 mL of working Hg Standard A to 10mL in an autosampler vial with reagent water containing 1% by volume BrCl solution. This solution contains 0.10 ng/mL and should be replaced weekly, or longer if extended stability is demonstrated.

5.15. Nitrogen—Grade 5.0 (ultra high-purity, GC grade) nitrogen.

5.16. Argon—Grade 5.0 (ultra high-purity, GC grade) argon.

6. PROCEDURE

Homogenization

6.1. If the mussel tissues have been stored in a freezer, then allow the mussel tissue samples to thaw to room temperature in a refrigerator maintained at 4 °C.

6.2. Assemble the Omni homogenizer with the appropriate tip. Completely submerge the tip into the sample and slowly start the homogenizer. Adjust speeds according to how much sample is in the container. The mussel tissue will appear creamy and foamy once it is completely homogenized.

6.3. Remove the sample from the homogenizer and set the sample aside. Remove the tip from the Omni homogenizer and place it in a waste container. Always use a new tip for homogenizing other samples.

Weighing Samples

6.4. An analytical balance, 40 mL vials, and a small metal spatula will be required for this step.

6.5. Tare the vial and add 0.5-1.5 grams of mussel tissue. If duplicates or triplicates can be made, ensure that the mass is consistent between the replicates.

6.6. Record the mass.

Sample Digestion

6.7. To each sample, add 10.0 mL of HNO_3/H_2SO_4 solution in a fume hood. Loosely cap each vial. Ensure to include method blanks throughout the procedure.

6.8. Allow the sample to sit in the cold acid for at least 4 hours before heating.

6.9. After digesting at room temperature, place the vial in the Linx Wireless Digestion System in the fume hood and slowly bring to a gentle boil by incrementally increasing the plate temperature over a 1-hour period. If excessive foaming occurs, bring to temperature more slowly.

Operating the Linx Wireless Digestor System

6.10. Place the heating block in an acid fume hood.

6.11. The heating block can be controlled wirelessly, so any laptop or desktop can use the wireless device that accompanied the apparatus.

6.12. Once the wireless USB device is in a computer, click on the program called Digestion System.

6.13. Click on the icon called “Search for Devices”. If the device is found, the name of the heating block will appear on a list below the “Search for Devices” icon.

6.14. Click on the name of the heating block.

6.15. Temperature is set to degrees Celsius by default so to incrementally increase the temperature copy the numbers in the Figure 1.

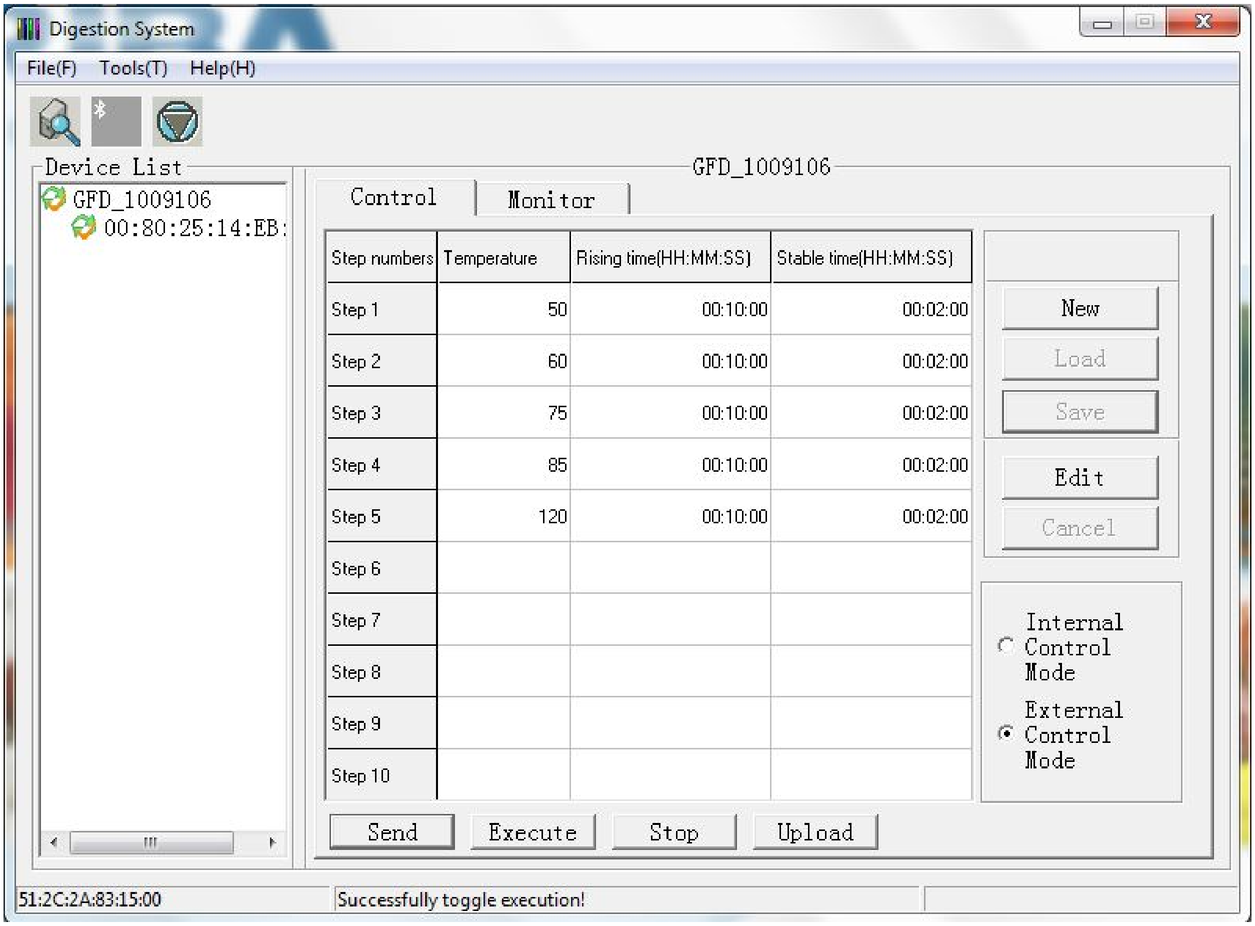

Figure 2: Appropriate values for incrementally rising the temperature for tissue in order to avoid the sample from foaming excessively.

6.16. Click on the "Save" button and name the file.

6.17. Ensure that External Temperature is checked.

6.18. Once all the settings have been set up, click on the "Send" button to send the set of steps to the heating block.

6.19. To begin the block digestor, click on the "Execute" button. The tab called "Monitor" will allow you to view the Rising and Stable Time, as well as the temperature during these times.

> **<u>NOTE:</u>** Once "Execute" has been clicked, modifications to the steps cannot be performed. If the heating block needs to be stopped before the Stable Time ends, then on the Steps Tab, click on the "Stop" button.

6.20. Once the program has reached an hour, the block digestor will turn off and begin to cool. Leaving the vials in the block digestor, reflux for 2-3 hours to fully oxidize any remaining organic matter.

Post Digestion

6.21. After the digestion is complete, bring to the sample to 40 mL ± 0.5 mL with 0.02 N BrCl and mix thoroughly.

6.22. Shake the sample/BrCl solution to homogenize, and allow to sit overnight prior to analysis via CVAFS.

7. ANALYTICAL CALIBRATION

7.1. Place 20 mL of reagent water and 200 µL of concentrated BrCl (1% BrCl, same concentration as the samples) solution in each of 6 40-mL autosampler vials. Prepare the lower end calibration by using Working Hg Standard B. Begin with an aliquout of 250 µL and 1000 µL. Next, using Working Hg Standard A, finish the calibration with sequential aliquots of 25, 50, 250 and 1000 µL.

7.2. Add 100 µL of HH solution. Pick up the vial and gently mix the solution allow until the yellow color disappears.

7.3. Add 100 µL of $SnCl_2$ solution to the individual vials and immediately cap the vial tightly.

7.4. Place into the analysis rack of the THg MERX System.

7.5. Analyze the standards beginning with the lowest concentration and proceeding to the highest. Tabulate the height or area for the Hg peak.

7.6. Prepare and analyze a minimum of 2 system blanks and tabulate the peak heights or areas. Calculate the mean peak area or height for the system blanks.

7.7. For each calibration point, subtract the mean peak height or area of the blanks from the peak height or area of each standard. Calculate the calibration factor (CF_x) for Hg in each of the five standards using the mean bubbler-blank-subtracted peak height or area and the following equation:

$$CF_x = \frac{(A_x - \bar{A}_{SB})}{C_X}$$

Where:

A_x = peak height or area for Hg in standard
$\bar{A}_{SB}$ = mean peak height or area for Hg in calibration blanks
Cx = concentration of standard analyzed (ng/L)

7.8. Calculate the mean calibration factor (CFm), the standard deviation of the calibration factor (SD; n-1), and the relative standard deviation (RSD) of the calibration factor, where RSD = 100 x SD/CFm.

7.9. If RSD ≤ 15%, calculate the recovery for the lowest standard using CFm. If the RSD ≤ 15% and the recovery of the lowest standard is in the range of 75-125%, the calibration is acceptable and CFm may be used to calculate the concentration of Hg in samples. If RSD

> 15% or if the recovery of the lowest standard is not in the range of 75-125%, recalibrate the analytical system and repeat the test.

7.10. Bubbler blanks—Bubbler blanks are analyzed to demonstrate that bubbler systems are free from contamination at levels that could affect data quality. At least two bubbler blanks must be run during calibration and with each analytical batch. Bubbler blanks consist of reagent water, BrCl, HH, and $SnCl_2$.

7.11. Calculate the concentration of Hg in the bubbler blanks using CFm. The bubbler blanks must meet the criteria in Section 9.4.1 of EPA 1631E; otherwise, mercury in the system must be reduced and the calibration repeated until the bubbler blanks meet the criteria.

8. DIGESTATE ANALYSIS

8.1. Diluted digestates are analyzed in a manner analogous to the analysis of standards by Method 1631E.

8.2. BrCl will be tested for Hg-contamination prior to making the dilution (THg < 2 ng/L). Pipet a 0.01- to 5.0-mL volume of diluted digestate directly into an autosampler vial. Dilute samples (HCl extracts) up to 20 mL total volume with 1% or 2% Bromine Monochloride (1% for lab samples, 2% for field samples).

8.3. If the sample is suspected to contain high mercury, the sample can be diluted a 100 times and analyzed to determine the appropriate dilution needed to fit within the calibration.

8.4. Only start processing samples for analysis after a good standard calibration curve is achieved. Therefore, add 100 µL of HH to the diluted sample. Pick up the vial and gently mix until the yellow color disappears.

8.5. Add 100 µL of SnCl2 solution to the individual vials and immediately cap the vial tightly.

8.6. Place into the analysis rack of the THg MERX System.

8.7. See MERX-T Quick Analysis Guide or the MERX-T manual located next to the instrument for details on setting up the instrument for analysis.

9. DATA ANALYSIS and CALCULATIONS

9.1. Calculate the mean peak height or area for Hg in the bubbler blanks measured during system calibration or with the analytical batch (A_{BB}; n = 3 minimum).

9.2. Calculate the concentration of Hg in ng/L (parts-per-trillion; ppt) in each diluted digestate sample according to the following equation:

$$[Hg](ng/L) = \frac{(A_s - \bar{A}_{BB})}{CF_m \times V}$$

Where:

A_s = peak height or area for Hg in sample

$\bar{A}_{BB}$ = mean peak height or area for Hg in bubbler blanks

CF_m = mean calibration factor (as calculated from Section 7)

V= Volume of sample added to the autosampler vials (L) (e.g., 0.1 mL)

9.3. Calculation of solid phase mass: The analytical system in Method 1631E will give analytical results in units of area (or height) for the volume of diluted digestate analyzed. To calculate the $mass_{THg}$ in tissue (dry-mass basis), use the following equation:

$$m_{THg}(\mu g/kg) = \left(\frac{[Hg] \times \frac{V_{Total}}{V_{Analyzed}} \times DF}{[MT]} \right)$$

Where:
[Hg] = Analyzed result from the Merx-T (pg)
[MT] = mass of tissue sample (mg)
V_{Total} = total volume of the sample prior to analysis (40 mL ± 0.5 mL)
$V_{Analyzed}$ = analyzed volume that was used in preparing samples for Merx-T
DF = dilution factor(s)
1 pg/mg = 1 µg/kg

10. QUALITY CONTROL & METHOD PERFORMANCE

10.1. Chemical Analysis: The QAQC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in the analytical methods. A complete set of appropriate guidelines can be found in Table 1.

10.2. QC checks (100 – 5000 ng THg) and bubbler blanks will be run every 10 samples and at the end of the analysis. At least 2 bubbler blanks will be analysed at the end of the analysis.

10.3. At least 3 Standard Reference Material 2976a digestions will be included in each batch. See Table 3 for SRM 2976a recoveries.

Table 1. Quality Guidelines for total Hg by CVAFS as derived from EPA 1631B method.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix A. No analysis shall be allowed by analyst until successful demonstration of capability is complete
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	See text for criteria	Correct problem then repeat initial calibration.	NA	Problem must be corrected. No samples may be run until ICAL has passed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.
Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within established retention time windows. Value of second source for all analytes within ± 15% of expected value (ICAL)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	NA	Problem must be corrected. No samples may be run until calibration has been verified.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch	No analytes detected > ½ RL. and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results	Correct problem, then, If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results Between MDL and MRL.	

Table 2: Sequence & QA/QC for THg MERX Analysis.

SI No	Sample ID	Description	Preparation	No of samples	QA/QC criteria (EPA 1631 Criteria*)
1	Equipment Blanks	For analytical system rinse	Ultra-pure reagent water	2-4	< 0.5 ng/L
2	CalibrationBubbler Blank	A sample of analyte-free media which is used to establish the low range of a calibration. Used to check for reagent contamination and used in internal calculations for background subtraction from the samples.	Ultra-pure reagent water containing BrCl, HH and $SnCl_2$	2	≤ 20 % of the lowest calibration standard (or) ≤ 20 pg Hg response
2	Calibration standards	A solution prepared from the dilution of stock standard solutions. Used to calibrate the instrument response with respect to analyte concentration.	THg standard prepared from 1 ppm stock Brooks Rand (or other certified) standards	≥ 5 point	Linear fit $R^2 \geq 0.995$ (or) % RSD of Relative concentration factor (RCF) ≤ 15 % % RSD of individual calibration standard ≤ 15 %*
3	Reagent Blank	Used to determine sample/standard carry over, and determine the contribution of reagents	Ultra-pure water containing BrCl, HH and $SnCl_2$	1	0.1% of the highest standard used (or) ≤ 20 pg Hg response
4	ICV/VER	Initial calibration verification - used to verify that a calibration is accurate. Typically prepared from source other than the one used for calibration standard. (e.g., ICP-MS 1 ppm standard stock)	Standard in Ultra-pure water containing BrCl, HH and $SnCl_2$	1	Typical ICV used = 250 pg; 79-121% Recovery*
5	Unknown samples	Unknown	Prepared in BrCl, HH and $SnCl_2$	10	Values fall within the calibration range
6	Reagent Blank	Same as above	Same as above	1	Same as above
7	CCV	Continuing Calibration Verification—An analytical standard prepared from the same source as the calibration standards that is analyzed periodically after 10 samples to verify the continued accuracy of an instrument calibration.	Prepared in BrCl, HH and $SnCl_2$	1	Typical CCV used = 250 pg 77-123 % Recovery*

1	Equipment Blanks	For analytical system rinse	Ultra-pure reagent water	2+	No criteria

Table 3: Recoveries for SRM 2976a using MERX-T for CVAFS Analysis Derived from EPA 1631B method.

Samples	Sample m_{THg} (µg/kg dry-mass basis)	Sample Average	Sample Standard Deviation	SRM m_{THg} (µg/kg dry-mass basis)	SRM Standard Deviation	Recovery Range %
MT-1	202.5	206.4	9.7	195	3	104.2-107.5
MT-2	197.6					
MT-3	220.2					
MT-4	205.3					

11. REFERENCES

Department of Defense (DOD). Quality Systems Manual for Environmental Laboratories, Version 4.1. 2006. http://www.navylabs.navy.mil/QSM%20Version%204.1.pdf

Clarisse and Hintelmann (2006), Journal of Environmental Monitoring, 8, 1242-1247

U.S. Environmental Protection Agency (2002): Method 1631, Revision E: Mercury in water by oxidation, purge and trap, and cold vapor atomic fluorescence spectrometry.

Appendix SOP-9.

Standard Operating Procedure for the Extraction and Analysis of Total Mercury in Solid Samples

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for extraction and analysis of sediment samples using digestion by oxidation of total mercury (Hg) in solid and semi-solid samples.

1.2. The method is an adaptation of the EPA document "EPA-821-R-01-013" (Appendix to Method 1631) and is applicable to determination of total Hg in tissue, sludge, sediment, soil, industrial samples, and certified reference materials.

1.3. The digestion method will involve treatment of cold (room temperature) aqua-regia followed by bromine monochloride (BrCl) oxidation.

1.4. This procedure generates extracts suitable for determination of total Hg following the EPA Method 1631E: *Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry* using the MERX total Hg system of Brooks Rand^{TM}.

2. SUMMARY OF METHOD

2.1. An aliquot of the wet sediment (0.5-1.5 g) will be treated with aqua-regia (concentrated hydrochloric acid (HCl) and nitric acid (HNO_3) solution mixture). The resulting mixture will be allowed to digest at room temperature for overnight or 24 h. The acid digested mixture will be further oxidized with concentrated solution (0.2 N) of bromine monochloride (BrCl) (to avoid reabsorption of Hg to carbon particles if present in the sample) and diluted to 40 ± 0.5 mL with reagent grade water. The diluted digestate is now ready for total Hg analysis by Method 1631B.

3. METHOD DETECTION LIMITS, INTERFERENCES AND SAFETY

3.1. The method detection limit (MDL) for Hg is considered to be in the range of 0.24 to 0.48 ng/g when no interferences are present. These levels assume a sample size of 0.5 g.

3.2. At a mercury concentration of 2.5 ng/L and at increasing iodide concentrations from 30 to 100 mg/L, there is potential for reduction in mercury recovery. At iodide concentrations greater than 3 mg/L, to preclude loss of Hg, the additional $SnCl_2$ should be added and subsequent analysis should proceed immediately.

3.3. If iodized coal or other elemental carbon samples are to be analyzed, the final acid concentration in the diluted sample must be greater than 40% (v/v), and all carbon particles must be settled, centrifuged or filtered prior to analysis to avoid re-adsorption of Hg on the carbon and an ensuing low bias.

3.4. Always work accurate and neat, because of safety and quality assurance.

3.5. Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic and corrosive.

3.6. Perform operations involving concentrated acids and powerful oxidants in a fumehood.

4. METHOD LIMITATIONS

4.1. The cold aqua regia procedure leaches but does not dissolve silicate minerals. Crustal elements such as Fe, Al, Cr, Ba, and Si may not be quantitatively recovered in some media using this procedure.

5. APPARATUS AND MATERIALS

5.1. Digestion and storage vial— Trace metal grade VOA vial, glass, 40-mL, with fluoropolymer-lined cap, cleaned per the procedures in Method 1631B, or purchase from Brooks-Rand, I-Chem level 300, trace metal clean, with fluoropolymer-lined cap, or equivalent (or)

5.2. THg Autosampler vial— MERX trace metal grade total mercury autosampler vials, 40 mL capacity from Brooks Rand™

5.3. Balance—Analytical, capable of weighing 1.0 mg.

6. REAGENTS and STANDARDS

6.1. All chemicals will be reagent grade or better. If necessary, the chemicals used for extraction and analysis be analyzed to ensure total Hg is < 5 pg/mL

6.2. Reagent grade water- Ultra-pure water (resistivity ≥ 18 MΩ.cm)

6.3. European Reference Material (ERM-CC580) standard and/or NIST Standard Reference Material (SRM 2702).

6.3.1. This reference standard will be undergo identical treatment along with the samples and the results thus obtained will be used to check the method extraction recovery.

6.4. Trace metal grade concentrated HNO_3 ~ 70 %

6.5. Trace metal grade concentrated HCl~ 36 %

6.6. Potassium Bromide (KBr)

6.7. Potassium Bromate ($KBrO_3$; minimum purity ≥ 99.8 %)

6.8. Concentrated (0.2 N) Bromide monochloride (BrCl) solution– In a fume hood, dissolve 27 g of KBr in 2.5 L of conc. HCl. Place a clean magnetic stir bar in the bottle and stir for approximately 1 h in the fume hood. Slowly add 38 g of $KBrO_3$ to the acid while stirring. When all of the $KBrO_3$ has been added, the solution color should change from yellow to red to orange. Loosely cap the bottle, and allow to stir another hour before tightening the lid.

6.9. 0.07 N bromine monochloride solution—Dilute 300 mL of 0.2N BrCl solution to 1000 mL with reagent water in a clean glass or fluoropolymer bottle.

6.10. Hydroxylamine Hydrogen Chloride (HH) —Dissolve 300 g of $NH_2OH.HCl$ in reagent water and bring to 1.0 L. This solution may be purified by the addition of 1.0 mL of $SnCl_2$ solution and purging overnight at 500 mL/min with Hg-free nitrogen.

6.11. Stannous Chloride ($SnCl_2$) —Bring 200 g of $SnCl_2.2H_2O$ and 100 mL concentrated HCl to 1.0 L with reagent water. Purge overnight with mercury-free N_2 at 500 mL/min to remove all traces of Hg. Store tightly capped.

6.12. Stock mercury standard—certified aqueous Hg solution (e.g., 1 ppm total Hg standard from Brooks Rand).

6.13. For THg analysis using CVAFS, follow the protocol established in that standard operating procedure. Alternatively, the extracts can be analyzed using inductively coupled plasma mass spectrometry (ICP-MS).

6.14. CVAFS Working Hg Standard A (10 μg/L)—In a clean and unused THg vial, add 19.6 mL of reagent grade, followed by, 0.2 mL of conc. BrCl. To this solution, add 0.2 mL of stock Brooks Rand mercury standard containing 1 ppm THg. This solution has a maximum storage period of a week. To minimize degradation, avoid exposure to light and keep the vial double-bagged in dark when not in use.

6.15. CVAFS Working Hg Standard B (0.1 μg/L)— In a clean and unused THg vial, add 19.6 mL of reagent grade, followed by, 0.2 mL of conc. Brcl. To this solution, add 0.2 mL of working Hg standard A. This solution should be discarded at the end of the day. To minimize degradation, avoid exposure to light and keep the vial double-bagged in dark when not in use.

6.16. Nitrogen—Grade 5.0 (ultra high-purity, GC grade) nitrogen.

6.17. Argon—Grade 5.0 (ultra high-purity, GC grade) argon.

7. PREPARATION AND HANDLING

7.1. Sample Preparation

7.1.1. Accurately weigh (to the nearest mg) an aliquot of the sample (and reference material) directly into the bottom of the THg vial glass.

7.1.2. For wet sediments and soils, weigh ~ 0.5-1.5 grams; for dried materials such as coal, ores, and ERMs, weigh 0.25 -1.0 gram. Sediments and soils can be screened through a 2-mm plastic sieve to remove large rocks and sticks before digestion if better homogeneity is necessiated.

7.2. Extraction

7.2.1. In a fumehood suitable for acid digestion, add 8.0 mL of concentrated HCl, swirl, and add 2.0 mL of concentrated HNO_3 to the sample in the digestion vessel. Ensure that sediment sample is completely immersed when the HCl and HNO_3 acid mixture is added.

7.2.2. Loosely cap the vial lightly with fluoropolymer-lined caps. Allow to digest at room temperature for at least overnight (preferably 24 h) and subsequently cap the vials tight.

7.2.3. Include at least 3 method blank digestion vials that will consist the digestion acid mixture and no solid material.

7.2.4. Dilute the digestate to the calibration mark (40 ± 0.5 mL) with 0.07 N BrCl solution and shake the flask to mix thoroughly. After dilution and shaking, allow the sample to settle overnight. Be sure that all fine-grained particles are completely settled prior to analysis.

7.2.5. If gravity settling does not remove all the particles, an aliquot of the digestate may be transferred into a trace-metal clean plastic centrifuge tube and centrifuged at the recommended rpm.For samples known or expected to contain high Hg concentrations, further dilute an aliquot of the diluted digestate with 0.02 N BrCl solution, and analyze a sub-aliquot.

8. DIGESTATE ANALYSIS

8.1. For THg analysis using Brooks Rand CVAFS technique, follow the protocol established in that standard operating procedure. Below is a brief outline of the analytical method.

8.1.1. Alternatively, the extracts can be analyzed using inductively coupled plasma mass spectrometry (ICP-MS).

8.2. Place 20 mL of reagent water and 200 µL of concentrated BrCl solution (~ 1%) in each autosampler vials.

8.3. For unknown samples, add 0.1— 5 mL of the extracts into the solution prepared in step 8.2. Gently swirl the resulting solution to ensure good mixing.

8.4. Add 100 µL of NH_2OH solution to the above mixture. Gently swirl the individual vials until the yellow color of BrCl disappears.

8.5. Finally, add 100 µL of $SnCl_2$ solution and immediately cap the vial tightly. Invert three times to mix and place into the analysis rack of the THg MERX System.

8.6. Ensure that the recovery of the all of the calibrating standards are in the range of 77-123%. If the recovery of the standards is not in the range of 77-123%, recalibrate the analytical system and repeat the analysis.

9. DATA ANALYSIS and CALCULATIONS

9.1. Calculation of solid phase concentrations: The analytical system in Method 1631E will give analytical results in units of area (or height) for the volume of diluted digestate analyzed. To calculate the solid phase concentration, use the following equation:

$$C_{Hg}(ng/g) = \frac{\frac{[Hg]}{V_a} \times DF \times V_d}{w}$$

Where:

[Hg] = amount of THg as calculated by the Brooks Rand Software (in pico-grams)
V_a = volume of diluted or undiluted digestate used for analysis (mL)
DF = dilution factor(s) if applicable; for undiluted samples DF= 1
V_d= Original volume of the digestate (mL).
w = sample weight in dry basis (g)

Note: determine the moisture content of a sample aliquot and use the dry weight as “w” in the equation above.

9.2. Report results as required in Method 1631E except use reporting levels and units appropriate to solid samples (usually µg/kg-dry solids).

10. ANALYTICAL QUALITY ASSURANCE/ QUALITY CONTROL

10.1. Chemical Analysis: The QA/QC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in the appropriate analytical methods. A complete set of appropriate guidelines can be found in Table 1. However, the reader is asked to refer to the THg analysis SOPs to ensure compliance with the analytical QA/QC criteria.

METHOD PERFORMANCE

10.2. The method performance shall be checked using either low-level or high-level Hg sediment reference NIST standard material. For the high-level THg, ERM-CC580 reference material, shall be used whose certified concentration is 132 ± 3 mg/kg-dry basis. For the low-level THg, SRM 2702, shall be used whose certified concentration is 0.447 mg/kg-dry basis.

10.2.1. The measured value based on this SOP should be within 20 % of the certified value.

Table 1. Quality Guidelines for total Hg by CVAFS as derived from EPA 1631B method.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix A. No analysis shall be allowed by analyst until successful demonstration of capability is complete

MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	See text for criteria	Correct problem then repeat initial calibration.	NA	Problem must be corrected. No samples may be run until ICAL has passed.
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are

				acceptable calibration verification.	updated per the method.
Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within established retention time windows. Value of second source for all analytes within ± 15% of expected value (ICAL)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	NA	Problem must be corrected. No samples may be run until calibration has been verified.
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch	No analytes detected > ½ RL. and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results	Correct problem, then, If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results Between MDL and MRL.	

11. REFERENCES

Appendix to US EPA Method 1631 – Total Mercury in Tissue, Sludge, Sediment and Soil by Acid Digestion and BrCl oxidation. Accessed from http://www.brooksrandinc.com/content/uploads/2015/05/Method-app1631.pdf on 7/24/17

Department of Defense (DOD). Quality Systems Manual for Environmental Laboratories, Version 4.1. 2006. http://www.navylabs.navy.mil/QSM%20Version%204.1.pdf

U.S. Environmental Protection Agency. 1986. Test methods for evaluating solid waste physical/chemical methods, 3rd ed. Method 8082. SW-846. Office of Solid Waste and Emergency Response, Washington, DC.

SOP-10.

Agarose Diffusive Gradients in Thin-Film Probe Fabrication

Texas Tech University (TTU)

1. **SCOPE AND APPLICATION**
    1.5. This method is an operating procedure for preparing the resin and diffusive layer of DGTs, as well as, assembly of the DGT body.
    1.6. DGTs can be used in mercury and trace metal uptake studies in the sediment and porewater.
    1.7. This method was adapted from the following references: The method is mainly an adaption of Amirbahman et al. Typically, polyacrylamide gel is used to impregnate the resin beads (see other references for details). However, this procedure describes steps to fabricate agarose based resin-gel layer.

1.3.1. Amirbahman et al., (2014). Assessment of mercury bioavailability to benthic macroinvertebrates using diffusive gradients in thin films (DGT). *Environ. Sci. Processes Impacts*, 2013 (15), 2104

1.3.2. Davison, W., & Zhang, H. (1995). Performance Characteristics of Diffusion Gradients in Thin Films for the In Situ Measurement of Trace Metals in Aqueous Solution. *Analytical Chemistry*, 67 (19), 3391-3400.

1.3.3. Clarisse, O., & Hintelmann, H. (2006). Measurements of Dissolved Methylmercury in Natural Waters Using Diffusive Gradients in Thin Films (DGT). *Journal of Environmental Monitoring*, 8, 1242-1247.

1.3.4. Practical Guide for Making Diffusive Gel and Chelex Gel. From www.dgtresearch.com.

1.3.5. Practical Guide to Assemble DGT Devices. From www.dgtresearch.com.

1.3.6. How to make DGTs **videos** (Dropbox→Reible Group→SOPs)

2. **SUMMARY OF METHOD**
    2.1. Fabricating agarose resin and diffusive layers require ultra-pure water, resin beads, and agarose. Glass plates for casting and gel manipulation will be used, as well as, the type of DGT being fabricated.
    2.2. This method prepares resin gel samples that can be run on ICP-MS, Merx-T and Merx-M.

3. **INTERFERENCES**
    3.1. Interferences largely arise from working in an area that is suspected to have high mercury concentrations or mercury contaminated tools and glassware.
    3.2. Historically, most Hg contamination has occurred during clean-up and N_2 purging steps of the DGTs

4. **APPARATUS AND MATERIALS**

    All glassware and in some cases plasticware must be soap and acid washed with the acid bath in the DGT room.

4.1. Glass plates, two different widths (TTU Chemistry Glass Shop, or can be bought)
4.2. Glass Beaker
4.3. Glass stirring rod
4.4. Teflon magnetic stir bar
4.5. Hot plate and stirrer
4.6. Vial cap that is similar in diameter to the piston body
4.7. Fume hood
4.8. 0.78 mm gasket and spacer kit (Cole Palmer EW-28573-31, EW-28573-04)
4.9. Plastic clamps (Cole Palmer EW-28565-30)
4.10. Glass Syringe, 10 cc
4.11. Clean Oven set to 105 °C
4.12. Plastic spatula and tweezers (Fisher 14-518, Cole Parmer EW-06443-27)
4.13. Gel staining box, Nalgene® (VWR 28196-306)
4.14. Probe holders, piston and sediment shape
4.15. Filters, 0.45 µm, Millapore® – Durapore®,, 25mm diameter, polysulfone: for piston probes (Millipore HVLP02500)
4.16. Filters, 0.45 µm, Millapore® – Durapore®, membrane filter sheet, polysuflone: for sediment probes (Millipore HVLP00010)
4.17. DGT Bodies (Pistons or Depth Profilers, or Sediment Probe)
4.18. Nylon rivets for Depth Profilers

5. REAGENTS

5.1. Ultra-pure water (resistivity~18Ω.cm)
5.2. ISOLUTE Si-Thiol (Biotage, 9180-0100)
5.3. Agarose, Broad Spectrum Range for DNA/RNA (Fisher 1356-100)

6. PROCEDURE

6.1. Resin Gel Construction:
6.1.1. For the resin gel solution, use the following:
6.1.1.1. ISOLUTE Si-Thiol resin - 1 gram per 5 mL of ultra-pure water
6.1.1.2. 2% Agarose – 0.2 gram per 10 mL of ultra-pure water
6.1.2. Two glass plates, of two different widths (3 and 4.1 cm), should be laid flat on one another separated by the desired width PVC spacers and rubber gasket, all held in place with the white plastic clamps (see Figure 1).
6.1.3. Collect a glass syringe and find a plunger that will fit inside the syringe as well as move freely within the syringe. After a plunger has been found, put the glass syringe (not plunger) in the Clean Oven (set to 105°C) to warm up while the resin gel is being prepared.
6.1.4. Combine agarose with desired amount of ultra-pure water into an acid washed beaker. Add a small teflon magnetic stir bar. Set stir setting to maximum setting

and set the heating setting to 7. Place a folded paper towel over the top of the beaker to prevent cooling to the upper portion of the agarose solution.

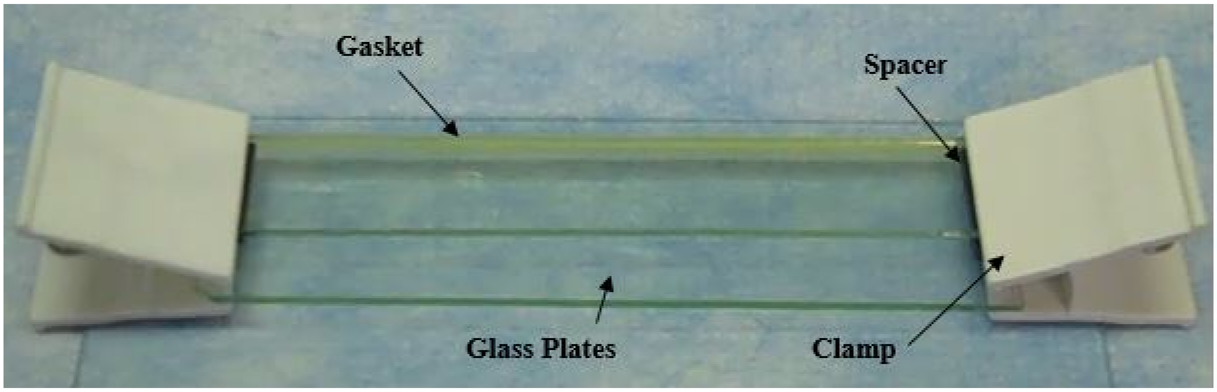

Figure 3: Glass plates, spacers, and gasket ready for gel casting.

6.1.5. The solution will appear cloudy in the beginning. As the agarose solution warms up, the solution becomes clear, like water.

6.1.6. As soon as the solution starts to become clear, retrieve the glass syringe from the oven. Place the plunger in the syringe and set aside.

6.1.7. Remove the beaker once the solution is clear. Add the resin to the beaker. While adding, use an acid washed glass stir rod to mix in the resin. Place the beaker back onto the hot plate and continue to mix the solution for less than 30 seconds.

6.1.8. Once the solution is well mixed, place the beaker near the glass plates. Use an acid washed glass syringe to collect more than 7 mL of solution. Tap the syringe on the beaker to move any bubbles from the spout of the syringe.

6.1.9. Tilt the glass plates while casting the resin gel solution at a constant speed. Casting can be performed from left to right or vice versa depending on what is comfortable.

6.1.10. Repeat if making multiple resin gel strips [1 gel strip = 1 sediment probe or 6 piston probes]

6.1.11. Let the resin get for 45 minutes at room temperature.

6.1.12. Remove clips and any excess resin that is not in between the glass plates. Remove spacers, and gasket and carefully separate glass plates with a plastic spatula; separating slowly as not to tear the new resin gel strip. If the strip is difficult to remove from the glass plates, spray some ultra-pure water in between the glass plates to re-hydrate the resin gel.

6.1.13. After solidifying, the resin beads have settled down on the bottom of the resin gel.

6.2. Diffusive Gel Construction:

6.2.1. Two glass plates of two different widths (3 and 4.1 cm), should be laid flat on one another separated by the desired width PVC spacers and rubber gasket, all held in place with the white plastic clamps (see Figure 1).

6.2.2. Collect a glass syringe and find a plunger that will fit inside the syringe as well as move freely within the syringe. After a plunger has been found, put the glass syringe (not plunger) in the Clean Oven (set to 105°C) to warm up while the resin gel is being prepared.

6.2.3. Add 0.15 grams of Agarose per 10 mL of DI water into a beaker and bring to a boil. Round up to the nearest 10 mL to ensure there is enough gel for casting. While boiling, use a paper towel to cover the beaker to ensure even heating throughout the Agarose/DI solution. 5 mL of Agarose/DI solution will create 1 x 0.75 mm diffusive gel layer but it is best to cast with 6-7 mL of gel in the syringe. This will ensure that no air bubbles are cast between the plates.

6.2.4. The Agarose gel will begin bubble as it heats, so during this time retrieve the glass syringe from the oven. Place the plunger in the syringe and set aside. The Agarose gel is ready to be cast when the solution begins to boil rapidly.

6.2.5. Using a glass syringe and extract Agarose/DI solution from beaker and cast between the glass plates. Use the same technique employed for casting the resin gel.

6.2.6. Let gel solidify for 30 minutes at room temperature.

6.2.7. Using the plastic spatula tool, cut off any excess Agarose that is not in between the glass plates. Remove the top glass plate and cut diffusive gel into the desired shape.

6.2.8. Construct probes immediately when diffusive gel is solidified.

6.3. Piston Construction:

6.3.1. Using a large glass plate, first carefully transfer the resin gel onto the glass plate (ensure that the resin beads are face-up during the transfer).

6.3.2. Using a centrifuge cap, press the cap down into both layers and slowly twist. Repeat for more discs from the strip.

6.3.3. Transfer the resin gel discs onto the piston body. Ensure that the resin beads are face-up when it is placed on the body.

6.3.4. Next, transfer the agarose gel on top of the resin gel.

6.3.5. Cut out discs in the same manner as the resin gel strip.

6.3.6. Place the agarose gel disc on top of the resin gel disc and ensure both are aligned properly.

6.3.7. Apply the filter with sterile plastic forceps. Then place the probe cover down onto the piston body.

6.4. Depth Profiler Construction:

6.4.1. Rinse the profiler body with distilled de-ionized (DDI) water and place on a large glass plate.

6.4.2. Carefully transfer the resin gel strip to the profiler body (ensure that the resin beads are face-up during the transfer).

6.4.3. Carefully transfer the agarose gel strip to the profiler body.
6.4.4. Align the two gel layers until they are both lined up within the indented region of the profiler body. Cut off any remaining resin and agarose.
6.4.5. Using two sterile forceps, place the filter paper on top of the agarose layer. If there are any air bubbles visible, it would be best to run the spatula over the bubbles and push them to the edge of the filter paper.
6.4.6. Align the probe retaining wall onto the profiler body and push down. 8 nylon rivets will be used to hold the probe retaining wall in place. Simply place the rivet over the hole and push down until secure.

Addendum to SOP-10

A1.0 PROBE CONSTRUCTION TIPS

A1.1. Ensure resin gel is sufficiently wet, apply extra ultra-pure water, when cutting resin on large glass cutting plate.
A1.2. To identify which side of the resin gel has the settled resin beads, gently scrape the surface of each side of the resin gel. If the resin gel feels coarse as opposed to smooth, then the coarse side contains the settled resin beads.
A1.3. See Figures 2A and 3A for completed probes dissected by each layer.
A1.4. There are a variety of sediment probe sizes, designed for laboratory or field use. Choose the appropriate probe for your desired use.
A.15. There are two types of piston probe holders, laboratory and field. Laboratory piston holders have a groove along the outside of the cover to hold an o-ring. Field piston probe holders do not have this groove and have holes drilled in the back of the base for tying markers to probes.
A1.6. Probes MUST BE de-aerated before use in 10 mM Sodium Nitrate solution with Ultra High Purity Nitrogen gas.

A2.0 CLEANING PROCEDURE

A2.1. New DGT Bodies
A2.1.1. Etch the DGT bodies with any symbol, number, and/or letter to denote their use for a particular project.
A2.1.2. Log each etched DGT body into the designated DGT Log Book. See A2.2. for the information needed to be logged. An additional digital log book will need the same information and can be found on the MERX-T desktop.
A2.1.3. Soap wash the bodies in an Alconox® soap solution for 24 hours in a clean container. If the DGTs were deployed in sediment, scrub the bodies with a bristle brush until most of the sediment particles are removed before placing in them in the soap bath. Rinse the bodies with DDI water until no soap remains on the body.
A2.1.4. Place the bodies into a 50% acid bath for DGT bodies and allow the bodies to sit for 2 days. Use a container that will solely be used for acid washing DGTs. **DO NOT USE THE GENERAL ACID BATH IN 101 OR 103**. Some batches of

DGTs will need to be rinsed successively to achieve background ≤ 100 pg. Monitor the acid bath to by taking subsamples of the acid bath and analyzing.

A2.1.5. Rinse the DGT bodies with DDI water, or the DGT bodies should be placed in a container and filled with DDI water. The pH of the water that the DGT bodies have been soaking in should be checked with a pH strip or pH probe. The pH should be between 5-6. If the water is very acidic, change the water bath and allow the DGTs to sit in the water bath for about 4 hours before checking the pH again.

A2.1.6. Once the DGTs are dried, they must be returned to their storage container in the DGT room (or other personal storage location).

A2.2. Used Lab and Field DGT Bodies

A2.2.1. Log in the DGT Log Book:

A2.2.2. Date Received

A2.2.3. Project Name

A2.2.4. DGT ID number (or Symbol)

A2.2.5. Damage to the body

A2.2.2. Disassemble the DGT bodies. Dispose of all nylon rivets removed from the DGT (These rivets cannot be acid washed. If they are acid washed, they will either deform or become brittle and break during DGT assembly)

A2.2.3. If the DGT bodies are heavily soiled or show discoloration, use a bathtub brush to scrub the DGT bodies of any sediment particles.

A2.2.4.Soap wash the bodies in an Alconox soap solution for 24 hours.

A2.2.5.Rinse the bodies with DDI water until no soap remains on the body.

A2.2.6.Place the bodies into a designated 50% acid bath for DGT bodies and allow the bodies to sit for 2 days.

NOTE: If O-Rings were used for Lab Piston bodies, do not place the O-Rings in the acid bath. The acid will weaken the O-Ring elasticity.

A2.2.7.Place the bodies into a 2nd designated 50% HCl acid bath for DGT bodies and allow the bodies to sit for another 2 days. (If there is no 2nd designated acid bath, then simply drain the acid and refill the acid bath container.)

A2.2.8. Rinse the DGT bodies with DDI water. The DGT bodies should be placed in a basin and filled with DDI water. The pH of the water that the DGT bodies have been soaking in should be checked with a pH strip or pH probe. The pH should be between 5-6. If the water is very acidic, change the water bath and allow the DGTs to sit in the water bath for about 4 hours before checking the pH again.

A2.2.9. Once the DGTs are dried, they must be returned to their storage container in the DGT room to prevent the deposition of dust and to maintain organization.

A2.3.Cleaning and storage of non-DGT body related items

A2.3.1. All glass and plastic ware (to include probe holders) should be soaked in soapy water (Alconox®) for 24 hours. Glass plates and tools are acid washed after they have been soap washed overnight Ensure an acid bath designated for DGT glassware and tools is used and not the general acid bath. Although contamination is minimal with the DGT acid bath, check the acid bath every 3 months.

A2.3.2. Glass and plastic ware should then be dried in a dust-free environment. To minimize the collection of dust during drying, cut a large sheet of bench paper and cover the drying items.

A2.3.4. All reagents should be stored in a mercury free environment to minimize contamination. Agarose and resin can be stored in the DGT Fabrication room. To minimize contamination, designate a plastic spatula for weighing for agarose and resin.

A2.3.5. All reagents should be reordered annually as some lose reactivity over time.

A3.0. PREPARATION OF DGTs AFTER FABRICATION

A3.1. DGTs Used for Anaerobic Solutions or Sediments

A3.1.2. Use a container that is large enough to accommodate the number of DGTs fabricated.

A3.1.3. Prepare a 10 mM sodium nitrate purging solution in a container. **Always prepare fresh purging solution! Never reuse previously used or old purging solution!**

NOTE: Ensure that the container is not filled to the top. Depending on the number of DGT bodies that have been fabricated, displacement of the purging solution will vary. All DGT bodies must be fully submerged during purging.

A3.1.4. Prior to placing the DGTs into the purging solution, take triplicate subsamples for background analysis. This value should be less than 1 ng/L.

A3.1.5. Place resin gel strip scraps into the purging solution (scraps equivalent to 1 whole resin gel strip or more is sufficient).

A3.1.6. Place the DGTs into the purging solution. Note the time the DGTs began to purge.

A3.1.7. Place the bubbler stone into the purging solution and begin purging. Purge overnight with fast bubbling.

A3.1.8. After the DGTs have been purged, turn off the gas and remove each body and place into a Ziploc bag. Note the final time the DGTs were kept in the purging solution.

A3.1.9. Once all the DGTs have been removed, take triplicate subsamples of the purging solution and run immediately on MERX-T to ensure that the DGTs are not possibly contaminated. The working criteria for the purge solution after DGTs have been purged is 5 ng/L. If the purge solution is > 5 ng/L than the DGTs cannot be trusted and will need to be disassembled and acid washed again.

A3.1.10. If the DGTs will not be used immediately or will be used in the field, this protocol should be used. Take all the purged DGTs to an anaerobic chamber, along with clean Ziploc bags, and place them in the airlock chamber. Ensure that all the Ziploc bags, including the ones with DGTs, are open in the airlock chamber. Begin the airlock control.

A3.1.11. After the airlock chamber is anaerobic, begin to transfer 3 DGT profilers (or 1 piston) per Ziploc bag. Ensure that the profilers are not stacked on top of each other. Seal the Ziploc bag as airtight as possible.

A3.1.12. Place the Ziploc bag with DGTs into another Ziploc Bag.

A3.1.13. Repeat the bagging process until all DGTs have been doubled bagged.

A3.1.14. Place all double bagged DGTs into the airlock chamber for removal from the anaerobic chamber.

A3.1.15. Store the DGTs in a sealable plastic container in a 4 °C room until they are ready to be deployed.

A2.3.2. Small Scale Oxic Ex-Situ Experiments

A2.3.2.1. After DGTs have been fabricated, place them in a Ziploc bag with a small amount of DDI water.

A2.3.2.2. Place the Ziploc bag in another Ziploc bag and place the DGTs in a sealable plastic container in a 4 °C room until they are ready to be deployed.

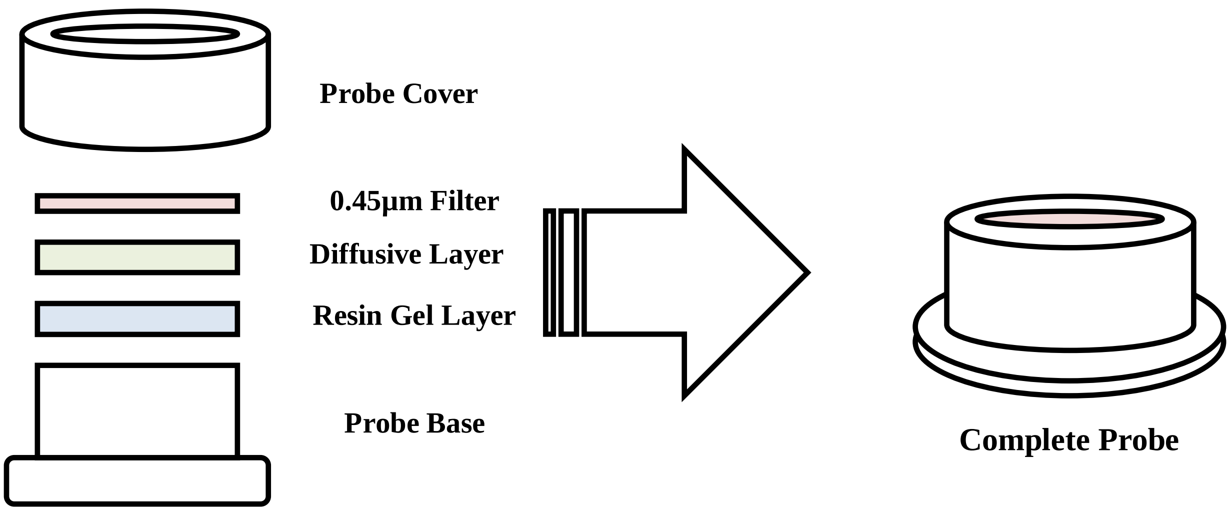

Figure 4A: Completed piston probe by layer.

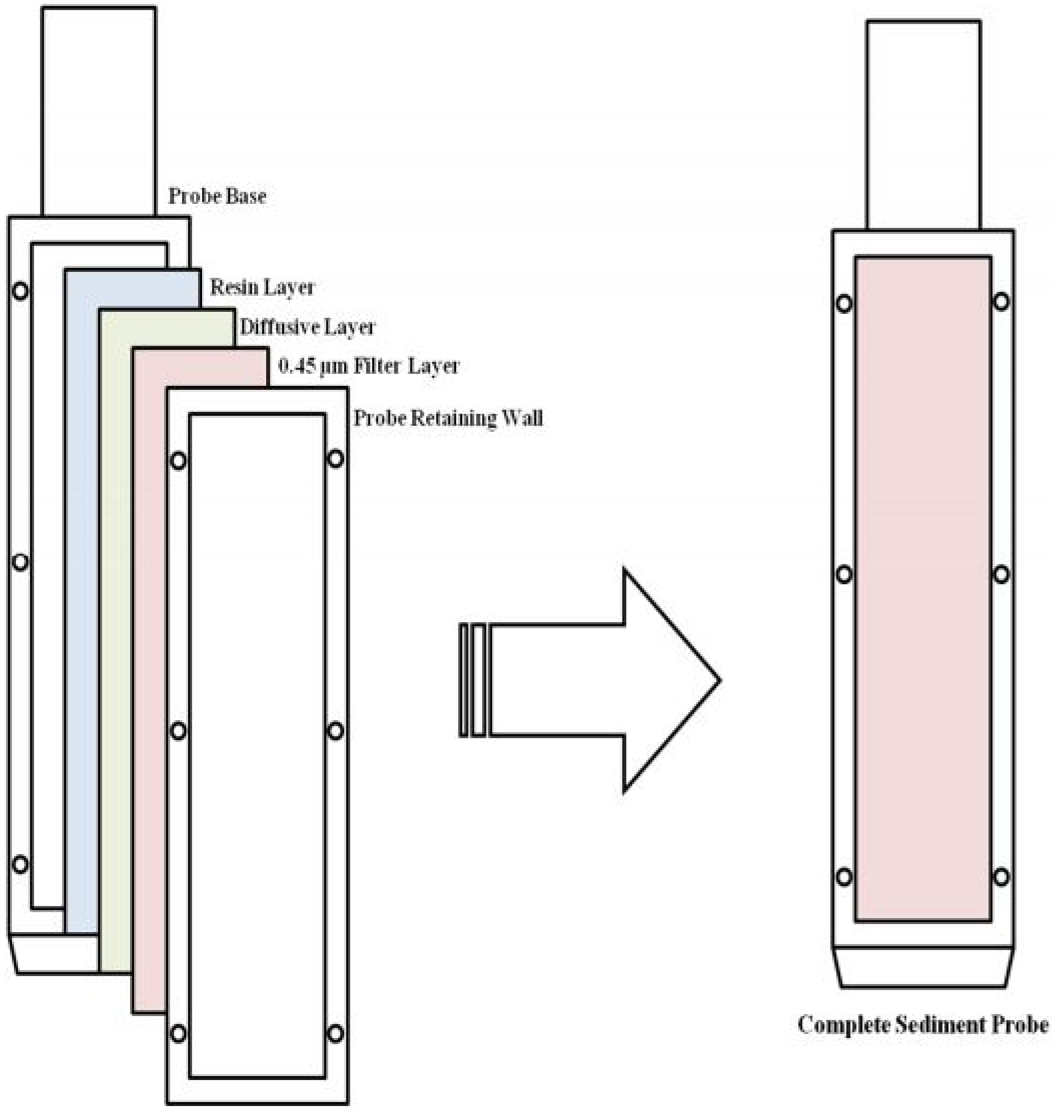

Figure 5A: Expanded view of sediment probe.

SOP-11.

Standard Operating Procedure for the Extraction and Analysis of Total Mercury in Diffusive Gradients in Thin-Films Using Cold Vapor Atomic Fluorescence Spectrometry

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for extraction and analysis of DGT- resin samples using digestion by oxidation of total mercury (Hg) in solid and semi-solid samples.

1.2. The digestion method will involve treatment of cold (room temperature) hydrochloric acid (HCl) followed by bromine monochloride (BrCl) oxidation and sample preservation.

1.3. This procedure generates extracts suitable for determination of total Hg following the EPA Method 1631E: *Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry* using the MERX Total Hg system of Brooks Rand™.

2. SUMMARY OF METHOD

2.1. An aliquot of the DGT resin will be treated with concentrated hydrochloric acid. The solution will be allowed to digest at room temperature for 24 hours. The acid digested solution will be further oxidized with concentrated solution (0.2 N) of bromine monochloride (to avoid reabsorption of Hg to carbon particles if present in the sample) prior to total Hg analysis by Method 1631E.

3. METHOD DETECTION LIMITS, INTERFERENCES AND SAFETY

3.1. The method detection limit (MDL) for Hg is considered to be in the range of 10 -20 ng/L when no interferences are present. These levels assume an exposure area of 1.5 cm^2 and an exposure time of 48 h.

3.2. Always work accurate and neat, because of safety and quality assurance.

3.3. Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic and corrosive.

3.4. Use a permanent fume hood when working with concentrated acids and powerful oxidants.

4. APPARATUS AND MATERIALS

4.1. Digestion and storage vial — 15 ml polypropylene centrifuge tube or equivalent.

4.2. Autosampler vial— MERX trace metal grade total mercury autosampler vials, 40 mL capacity from Brooks Rand™

4.3. Balance—Analytical, capable of weighing 1.0 mg.

5. REAGENTS and STANDARDS

5.1. All chemicals will be reagent grade or better. If necessary, the chemicals used for extraction and analysis be analyzed to ensure total Hg is < 5 pg/mL. All acids will be trace metal grade.

5.2. Reagent grade water (purity~18 MΩ.cm)

5.3. Concentrated HCl~ 36 % - trace metal grade

5.4. Potassium Bromide (KBr)

5.5. Potassium Bromate ($KBrO_3$)

5.6. Concentrated (0.2 N) Bromide monochloride solution– In a fume hood , dissolve 27 g of KBr in 2.5 L of conc. HCl. Place a clean, teflon magnetic stir bar in the bottle and stir for approximately 1 hour in the fume hood. Slowly add 38 g of $KBrO_3$ to the acid while stirring. When all of the $KBrO_3$ has been added, the solution color should change from yellow to red to orange. Loosely cap the bottle, and allow to stir another hour before tightening the lid.

5.7. Hydroxylamine Hydrochloric Acid Reagent (HH) —Dissolve 300 g of $NH_2OH.HCl$ in reagent water and bring to 1.0 L. This solution may be purified by the addition of 1.0 mL of $SnCl_2$ solution and purging overnight at 500 mL/min with ultra high purity nitrogen gas. Alternative, certified HH reagent from Brooks Rand Instruments (cat no: 03610, Total mercury < 1 ng/L) can be used.

5.8. Stannous Chloride ($SnCl_2$) —Bring 200 g of $SnCl_2.2H_2O$ and 100 mL concentrated HCl to 1.0 L with reagent water. Purge overnight with ultra high purity nitrogen gas at 500 mL/min to remove all traces of Hg. Store tightly capped. Alternative, certified SnCl reagent from Brooks Rands Instruments (cat no: 03620, Total mercury < 1 ng/L) can be used.

5.9. Stock total mercury standard—certified 1 ppm from Brooks Rand Instruments (cat no: 03600). Shelf life is 18 months from time of certification.

5.10. Secondary ICP-MS mercury standard— 1 ppm Hg(II) in 2% Nitric Acid (NO_3).

5.11. Working Hg Standard A—Dilute 0.100 mL of the stock Hg standard to 10 mL in an autosampler vial with reagent water containing 1% by volume BrCl solution. This solution contains 10.0 ng/mL and should be replaced every analysis.

5.12. Working Hg Standard B—Dilute 0.100 mL of working Hg Standard A to 10mL in an autosampler vial with reagent water containing 1% by volume BrCl solution. This solution contains 0.10 ng/mL and should be replaced weekly, or longer if extended stability is demonstrated.

5.13. Nitrogen—Grade 5.0 (ultra high-purity, GC grade) nitrogen.

5.14. Argon—Grade 5.0 (ultra high-purity, GC grade) argon.

6. PREPARATION AND HANDLING

Sample Preparation

6.1. Rinse the sampler (DGT piston or depth profiler) with deionized water. Be sure to remove any solids deposited on the outside of the sampler.

6.2 .Remove the plastic cover.

6.3 Separate diffusive layer and filter. These can be wasted.

6.4 Rinse the resin layer with clean water.

6.5 If sectioning, place the resin layer on a clean, acid washed glass plate. Cut the resin gel into desired sections with a razor blade (disposal into sharp container). For a depth profiler DGT, the sections are typically 1-2 cm.

6.6 Place each resin layer sections in a 15 ml polypropylene centrifuge tube.

Extraction

6.7 In a permanent fume hood, add 3 ml of trace metal grade concentrated hydrochloric acid to each tube. Be sure that the resin gel is fully submerged in the acid. For QAQC practices include 3 matrix blanks with concentrated HCL without resin addition for each batch.

6.8 Store in the dark for 24 hours. Do not leave the gel in the acid for longer than 24 hours.

6.9 Transfer 2 mL of the acid from the tube. Be careful not to transfer any particles from the eluted agarose resin gel in the centrifuge tube.

6.9.1 If particles are suspected to be present in the supernatant, centrifuge the samples at 2,500 rpm for 10 minutes. However, care must be taken to avoid spillage or loss of sample during centrifugation. Check the centrifuge for any acid that may have spilled and clean immediately with a wet paper towel.

Analysis

6.10 Analyze the resin-gel acid extract for mercury in compliance with EPA method 1631E (Mercury in water oxidation, purge and trap, and cold vapor atomic fluorescence.

6.11 Dispose of DGT resin in a properly labeled wasted container (or bag).

7. ANALYTICAL CALIBRATION

7.1. Place 20 mL of reagent water and 200 µL of concentrated BrCl (1% BrCl, same concentration as the samples) solution in each of 6 40-mL autosampler vials. Prepare the lower end calibration by using Working Hg Standard B. Begin with an aliquout of 250 µL and 1000 µL. Next, using Working Hg Standard A, finish the calibration with sequential aliquots of 25, 50, 250 and 1000 µL.

7.2. Add 100 µL of HH solution. Pick up the vial and gently mix the solution allow until the yellow color disappears.

7.3. Add 100 µL of $SnCl_2$ solution to the individual vials and immediately cap the vial tightly.

7.4. Place into the analysis rack of the THg MERX System.

7.5. Analyze the standards beginning with the lowest concentration and proceeding to the highest. Tabulate the height or area for the Hg peak.

7.6. Prepare and analyze a minimum of 2 system blanks and tabulate the peak heights or areas. Calculate the mean peak area or height for the system blanks.

7.7. For each calibration point, subtract the mean peak height or area of the Calibration/Bubbler Blanks from the peak height or area of each standard. Calculate the calibration factor (CF_x) for Hg in each of the five standards using the mean bubbler-blank-subtracted peak height or area and the following equation:

$$CF_x = \frac{(A_x - \bar{A}_{SB})}{C_X}$$

Where:

A_x = peak height or area for Hg in standard
$\bar{A}_{SB}$ = mean peak height or area for Hg in calibration blanks
Cx = concentration of standard analyzed (ng/L)

7.8. Calculate the mean calibration factor (CFm), the standard deviation of the calibration factor (SD; n-1), and the relative standard deviation (RSD) of the calibration factor, where RSD = 100 x SD/CFm.

7.9. If RSD ≤ 15%, calculate the recovery for the lowest standard using CFm. If the RSD ≤ 15% and the recovery of the lowest standard is in the range of 75-125%, the calibration is acceptable and CFm may be used to calculate the concentration of Hg in samples. If RSD > 15% or if the recovery of the lowest standard is not in the range of 75-125%, recalibrate the analytical system and repeat the test.

7.10. Bubbler blanks—Bubbler blanks are analyzed to demonstrate that bubbler systems are free from contamination at levels that could affect data quality. At least two bubbler blanks must be run during calibration and with each analytical batch. Bubbler blanks consist of reagent water, BrCl, HH, and $SnCl_2$.

7.11. Calculate the concentration of Hg in the bubbler blanks using CFm. The bubbler blanks must meet the criteria in Section 9.4.1 of EPA 1631E; otherwise, mercury in the system must be reduced and the calibration repeated until the bubbler blanks meet the criteria.

8. DATA ANALYSIS and CALCULATIONS

8.1. Calculate the mean peak height or area for Hg in the bubbler blanks measured during system calibration or with the analytical batch (A_{BB}; n = 3 minimum).

8.2. Calculate the concentration of Hg in ng/L (parts-per-trillion; ppt) in each diluted digestate sample according to the following equation:

$$[Hg](ng/L) = \frac{(A_s - \bar{A}_{BB})}{CF_m \times V}$$

Where:
A_s = peak height or area for Hg in sample
$\bar{A}_{BB}$ = mean peak height or area for Hg in bubbler blanks
CF_m = mean calibration factor (as calculated from Section 7)
V= Volume of sample added to the autosampler vials (L) (e.g., 0.1 mL)

8.3. Calculation of solid phase mass: The analytical system in Method 1631E will give analytical results in units of area (or height) for the volume of diluted digestate analyzed. To calculate the $mass_{THg}$ in resin, use the following equation:

$$m_{THg}(ng) = \frac{[Hg] \times V \times DF}{1000}$$

Where:
[Hg] = concentration of Hg in ng/L (parts-per-trillion; ppt) in each diluted digestate used for analysis
V= Volume of sample added to the autosampler vials (L) (e.g., 0.1 mL)
DF = dilution factor(s)

$$DF = \frac{Final\ Volume}{Aliquot\ Volume}$$

8.4. Calculation of resin concentration: Calculate the total mass that was in the resin gel. This value will give the mercury mass to be used in the flux calculation to solve for the bulk mercury concentration.

$$c_{DGT,THg} = \frac{Dd\ m_{THg}}{D_{eff}\ A_{expousre} t}$$

Where

m_{THg} = mass THg in resin
$A_{exposure}$ = surface area
t = deployment time
Δd = diffusive layer thickness
$C_{DGT,THG}$ = concentration in porewater

Parameter:
$D_{eff,25C} = 5.6*10^{-6}\ cm^2/s$, Δ d = 0.1 cm, Resin disk: $A_{exposure} = 1.57\ cm^2$ – half resin disk or $3.14\ cm^2$ full disk

9. QUALITY CONTROL & METHOD PERFORMANCE

9.1. Chemical Analysis: The QAQC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in the analytical methods. A complete set of appropriate guidelines can be found in Table 1.

9.2. QC checks (100 – 5000 ng THg) and bubbler blanks will be run every 10 samples and at the end of the analysis. At least 2 bubbler blanks will be analysed at the end of the analysis.

9.3. Resin extraction (Sect. 6) At least 3 matrix blanks (HCl_{conc} without resin addition) will be included in each batch.

9.4. Field samples: At least 3 field blanks will be included in each field program and analysed as described in Section. 6. See SOP-DGT Field sampling.

Table 1. Quality Guidelines for total Hg by CVAFS as derived from EPA 1631B method.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix A. No analysis shall be allowed by analyst until successful demonstration of capability is complete
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	See text for criteria	Correct problem then repeat initial calibration.	NA	Problem must be corrected. No samples may be run until ICAL has passed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.
Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within established retention time windows. Value of second source for all analytes within ± 15% of expected value (ICAL)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	NA	Problem must be corrected. No samples may be run until calibration has been verified.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch	No analytes detected > ½ RL. and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results	Correct problem, then, If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results Between MDL and MRL.	

Table 2: Sequence & QA/QC for THg MERX Analysis.

	Sample ID	Description	Preparation	No of samples	QA/QC criteria (EPA 1631 Criteria*)
1	Equipment Blanks	For analytical system rinse	Ultra-pure reagent water	2-4	< 0.5 ng/L
2	CalibrationBubbler Blank	A sample of analyte-free media which is used to establish the low range of a calibration. Used to check for reagent contamination and used in internal calculations for background subtraction from the samples.	Ultra-pure reagent water containing BrCl, HH and $SnCl_2$	2	≤ 20 % of the lowest calibration standard (or) ≤ 20 pg Hg response
2	Calibration standards	A solution prepared from the dilution of stock standard solutions. Used to calibrate the instrument response with respect to analyte concentration.	THg standard prepared from 1 ppm stock Brooks Rand (or other certified) standards	≥ 5 point	Linear fit R^2≥ 0.995 (or) % RSD of Relative concentration factor (RCF) ≤ 15 % % RSD of individual calibration standard ≤ 15 %*
3	Reagent Blank	Used to determine sample/standard carry over, and determine the contribution of reagents	Ultra-pure water containing BrCl, HH and $SnCl_2$	1	0.1% of the highest standard used (or) ≤ 20 pg Hg response
4	ICV/VER	Initial calibration verification - used to verify that a calibration is accurate. Typically prepared from source other than the one used for calibration standard. (e.g., ICP-MS 1 ppm standard stock)	Standard in Ultra-pure water containing BrCl, HH and $SnCl_2$	1	Typical ICV used = 250 pg; 79-121% Recovery*
5	Unknown samples	Unknown	Prepared in BrCl, HH and $SnCl_2$	10	Values fall within the calibration range
6	Reagent Blank	Same as above	Same as above	1	Same as above
7	CCV	Continuing Calibration Verification—An analytical standard prepared from the same source as the calibration standards that is analyzed periodically after 10 samples to verify the continued accuracy of an instrument calibration.	Prepared in BrCl, HH and $SnCl_2$	1	Typical CCV used = 250 pg 77-123 % Recovery*
1	Equipment Blanks	For analytical system rinse	Ultra-pure reagent water	2+	No criteria

10. REFERENCES

Department of Defense (DOD). Quality Systems Manual for Environmental Laboratories, Version 4.1. 2006. http://www.navylabs.navy.mil/QSM%20Version%204.1.pdf

Clarisse and Hintelmann (2006), Journal of Environmental Monitoring, 8, 1242-1247

U.S. Environmental Protection Agency (2002): Method 1631, Revision E: Mercury in water by oxidation, purge and trap, and cold vapor atomic fluorescence spectrometry.

SOP-12.

Standard Operating Procedure for the Extraction, Clean-up and Analysis of Hydrophobic Organic Contaminants (HOCs) from Aqueous Samples

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.1. This method is an operating procedure for extraction and clean-up of water samples using separatory funnel Liquid-Liquid Extraction (LLE).

1.2. The method is applicable to hydrophobic organic contaminants (HOCs).

1.3. This procedure generates extracts suitable for High Performance Liquid Chromatography (HPLC) and Gas Chromatography – Tandem Mass Spectrometry (GC-MS/MS) analysis for priority PAHs and Gas Chromatography-Electron Capture Detector (GC-ECD) analysis for PCBs.

2. SUMMARY OF METHOD

2.1. Water sample (1L) is transferred into a separatory funnel and extracted 3 times with 80mL of dichloromethane. The obtained extract is evaporated to 2 mL and eluted from a column packed with alumina and sodium sulphate using 11 ml of dichloromethane. The eluate is evaporated to 0.1mL. Samples designated for HPLC analysis are exchanged to acetonitrile whereas samples designated for GC-MS/MS or GC-ECD analysis remain in dichloromethane.

3. INTERFERENCES

3.1. Method detection limits are related to compound hydrophobicity and therefore the method must be used with caution when analyzing relatively volatile constituents which exhibit greater losses and relatively poor detection limits.

Always work accurate and neat, because of safety and quality assurance.
Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic. Use a fume hood when working with solvents

4. REAGENTS

4.1. Acetonitrile or equivalent solvent (UHPLC-UV grade, Fisher Chemical)

4.2. Dichloromethane (HPLC grade-Submicron filtered, Fisher Chemical)

4.3. Acetone (picograde)

4.4. Ultrapure Water (MilliQ, Resistivity ≥ 18MΩ●cm)

4.5. Research grade deuterated/C^{13} labeled compounds [Ultra Scientific] as surrogate standards in hexane solution i.e. fluoranthene-d10, chrysene-d12, benzo[b]fluoranthene-d12, dibenzo[*a,h*]anthracene-d14

4.6. Sodium sulphate Na_2SO_4, water free (p.a.; Merck): before use boiled for 4h at 400 ^oC (muffle furnace) in a shallow tray

4.7. Aluminum oxide (basic, Brockmann I, for chromatography, 50-200µm, 60A, ACROS Organics™). Before use, activate by heating at 130 ^{o}C for a minimum of 16 hours and deactivate with 10 % (w/w) water.

4.8. Research grade PAH-16 standards mix [Ultra Scientific]

5. APPARATUS AND MATERIALS

5.1. Separatory funnels (2L) (x4)

5.2. Collection vessels – 60 mL amber/clear glass vials with screw cap

5.3. Rocket evaporator (Genevac) with a chiller

5.4. Nitrogen blow down system

5.5. Columns – (12x)

5.6. Rack for columns

5.7. Concentrator tubes (Kimble™ Kontes™)

5.8. Aluminum foil

5.9. Quartz wool

5.10. Glass cylinders 25 ml (3x)

5.11. Pasteur pipettes (long) with suction tool

5.12. Petri dishes or aluminum weighing trays (12x)

5.13. Standard laboratory set of glasses and tools like Erlenmeyer (conical), beakers etc

5.14. Socorex pipet 1 – 5 mL

5.15. Vortex

5.16. Muffle furnace

5.17. Bench shaker

6. PROCEDURE

6.1 Preparation of inorganics

6.1.1. Approximately 300 grams of sodium sulphate is placed in a porcelain dish in the muffle furnace at 400 ^{o}C for 4 hours (removal of water, contaminants and organic material). Sodium Sulphate is then kept in a desiccator and transferred into a Schott bottle.

6.2. Extraction

6.2.1. Mark the level of sample on the outside of the 1L amber bottle.

6.2.2. Spike the sample with 10-50 μl (depending on the anticipated final dilution) of surrogate standard solution (4 mg/L) (Fluoranthene-d10, Chrysene-d12, Benzo[b]fluoranthene-d12, and Dibenz[a,h]anthracene-d14).

6.2.3. Make sure the stopcock of the separatory funnel is closed and tightened.

6.2.4. Transfer the sample from the bottle (1L) to the separatory funnel.

6.2.5. Use 80 mL of dichloromethane to rinse the bottle (cap and shake for 30sec) and transfer this rinse solvent to the separatory funnel.

6.2.6. Seal and shake the separatory funnel vigorously for 1 - 2 minutes with periodic venting to release excess pressure.(**CAUTION: Especially the 1st venting will be violent**)

6.2.7. Allow the organic layer to separate from the water phase for a minimum of 15 minutes (could potentially take more than 1 hour if a lot of emulsion is formed).

6.2.8. Open the stopcock and transfer the organic extract to a 500 mL Rocket evaporator flask.

6.2.9. Leave the overlying water phase in the separatory funnel.

6.2.10. Repeat the extraction two more times (steps 6.4 to 6.8)

6.3. Evaporation

6.3.1. Concentrate the extracts in the Rocket evaporator flask using Rocket evaporator operated at 30 °C and 190mbar vacuum (using method 1) to approximately 1-2 ml

6.4. Cleanup

6.4.1. Add quartz wool at the bottom of a chromatographic column.

6.4.2. Packed the column with 4g of aluminum oxide (12 % (w/w) water) followed by 4g anhydrous Na_2SO_4

6.4.3. Transfer the extract to the column

6.4.4. Collect the cleaned sample in a concentrator tube (10mL).

6.4.5. Rinse the Rocket evaporator flask 2 times with 3mL of dichloromethane and transfer to the column

6.4.6. Elute columns with 5mL of dichloromethane.

6.5. Final concentration and storage

6.5.1. Concentrate the extracts to 100 μL under a stream of ultra-high purity nitrogen.

6.5.2. Add at least 2mL of acetonitrile in the concentrator tube

6.5.3. Continue to evaporate the sample to the desired final volume (generally clear samples can be evaporated to 100-300µL while pigmented samples, usually yellow, can be evaporated to 300-1000µL for added dilution)

6.5.4. After measuring the dry mass of a capped 2mL vial with/without insert, transfer the final sample from the concentrator tube into the vial with a Pasteur pipette.

6.5.5. Cap the 2mL vial and measure it's mass again

6.5.6. Store the vials in the freezer (-20 ºC) until analysis.

6.5.7. Measure the initial volume of the sample in the 1L bottle (continuation of step 6.1)

6.5.8. Clean the glassware.

6.6. PAH analysis

6.6.1. Non-spiked and spiked samples are prepared for analysis on the HPLC.

6.6.2. **Non-spiked**: Approximately 230 uL of acetonitrile is added to an insert in a 1.5 mL amber vial followed by 20 uL of the sample extract (in hexane) thus achieving a 12.5:1 dilution.

6.6.3. **Analytical Spike**: Approximately 205 uL of acetonitrile is added to an insert in a 1.5 mL amber vial followed by 20 uL of the sample extract and 25 uL of 1 mg/L PAH-16 solution. The vials are closed with screw caps and vortexed for 60 seconds.

6.6.4. The vials are stored in the freezer (-20 ºC) until HPLC analysis.

6.6.5. PAHs will be analyzed on Agilent Technologies 1260 Infinity (Santa Clara, CA, USA) High Performance Liquid Chromatography (HPLC) with an ultraviolet-diode array (1260 DAD VL+) and fluorescence detector (1260 FLD Spectra). The column is a Phenomenex (Torrance, CA, USA) Luna 5µ C18 column (250 x 4.6 mm) set to 40°C. The HPLC is operated under isocratic conditions. The flow rate through the system is 1.0 mL/min at an water to acetonitrile ratio (v:v) of 3:7. The calibration range extends from 0.5µg/L to 200µg/L.

6.7. PCB analysis

6.7.1. The extracts are exchanged to hexane for analysis.

6.7.2. Internal standard containing C13 labeled PCBs (9/118/188) is added to the extracts prior to analysis.

6.7.3. Extracts were directly analyzed for 111 PCB congeners by GCTQMS (Agilent 7890B) using a SIM/SIM mode (Method 1668c).

6.7.4. The method has the following parameters: splitless mode, inlet temperature at 280oC, injection volume 1µL, flow at 1.2mL/min, 60m column and 54.5min runtime. Calibration ranges from 0.2 to 20 µg/L with seven points.

7. Calculation

7.1. PAHs (for example Fluorene) @ HPLC

Step 1 – Contaminant sediment concentration

- Calculate sample concentration C_{flu} from signal area and calibration line
- For M_i/M_f the initial/final mass of the sample vial and d_{ACN} the density of acetonitrile under lab temperature, calculate final volume V_f of the extract as $V_f = (M_i - M_f)/d_{ACN}$
- Calculate contaminant mass M_{flu} in the final extract as $M_{flu} = C_{flu} * V_f$
- For initial dry sediment mass M_{dry}, the contaminant concentration in the sediment C_{sed} is $C_{sed} = M_{flu}/M_{dry}$ *(µg/kg dry)*

Step 2 – Spike % recovery

- Calculate spike concentration C_{spike} from signal area and calibration line
- Calculate spike mass M_{spike} in the final extract as $M_{spike} = C_{spike} * V_f$
- For initial spike volume V_{spike}, with initial concentration C_i, the initial spike mass is $M_i = C_i * V_{spike}$
- Calculate the % recovery as:

$$\% R_i = \frac{M_{spike}}{M_i} \times 100\%$$

Step 3 – Corrected contaminant sediment concentration

- Correct for the recovery: $C_{corr} = Csed \times \frac{100}{\% Ri}$

7.2. PCBs (for example Congener 52) @ GC/MS or GC/MS/MS

Step 1

- Import raw peak area (=*A*)
- Calculate average peak area I.S. (=*B*)
- Correct peak area for I.S.: $C = A_{c52}/A_{IS} \times B$

Step 2

- *Group the corrected peak areas of the calibration standards.*
- Calculate for every calibration standard (1 up to 4) the average corrected peak areas.
- Check if the standard deviations of above mentioned averages are not too high i.e. (<25%)
- Calculate the intercept and the slope of the calibration line.

Correct for sample division for PCB analysis

- Calculate the % recovery using surrogate standards:

$$\% R_i = \frac{Y_i}{X_i} \times 100\%$$

$\%R_i$	=	percent recovery for compound *i*
Y_i	=	measured analyte concentration in sample *i* (measured - original sample Concentration)
X_i	=	known analyte concentration in sample *i*

- Correct for the recovery: $C_{corr} = Csed \times \frac{100}{\% Ri}$

8. Quality Control & Method Performance

8.1. Method blanks (1 per 10 extract samples) must be included in the analysis and processed in the laboratory in the exact same fashion as extract samples

8.2. Chemical Analysis: The QA/QC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in the analytical methods. A complete set of appropriate guidelines can be found in Table 3.

8.3. NIST Standard Reference Material 1941b (Organics in Marine Sediment) (~100mg), was extracted (Table 1) using the established method with the average % recoveries demonstrated in the following table. EPA acceptance criteria is 65%-135%

Table 1. Standard Reference Material (SRM1941b) PAH extraction % recoveries using the method described in this SOP.

PAH	Certified Concentration (ng/L)	Measured Concentration (ng/L)	StdDev	% recovery	% recovery StdDev
Naphthalene	848	440.9	133.9	52.0	15.8
Fluorene	85	32.9	17.8	38.7	20.9
Acenaphthene	38.4	18.4	3.0	48.0	7.8
Phenanthrene	406	291.4	86.1	71.8	21.2
Anthracene	184	138.6	42.6	75.3	23.1
Fluoranthene	651	531.8	125.0	81.7	19.2
Pyrene	581	274.9	38.1	47.3	6.6
Chrysene	291	123.8	23.7	42.6	8.1
Benz[a]anthracene	335	231.4	12.2	69.1	3.6
Benzo[b]fluoranthene	453	445.3	45.0	98.3	9.9
Benzo[k]fluoranthene	225	231.8	29.9	103.0	13.3
Benzo[a]pyrene	358	324.6	50.9	90.7	14.2
Dibenz[a,h]anthracene	53	57.5	5.2	108.5	9.8
Benzo[g,h,i]perylene + Indeno[1,2,3-cd]pyrene	648	371.1	20.6	57.3	3.2

Note: Benzo[g,h,i]perylene and Indeno[1,2,3-cd]pyrene are not separated (co-elute) on the HPLC.

8.4. Blank samples, unfiltered and filtered (0.45µm and 5µm), were extracted using the established method (Table 2) to determine background levels of contamination.

Table 2. DI water PAH extraction using the method described in this SOP.

PAH	Method Blank (ng/L)	Filtered (0.45µm) Blank (ng/L)	Filtered (5µm) Blank (ng/L)
Naphthalene	0.77	1.36	1.04
Fluorene	0.36	0.42	0.84
Acenaphthene	0.10	0.10	0.08
Phenanthrene	0.17	0.11	0.54
Anthracene			0.04
Fluoranthene			0.07
Pyrene			
Chrysene	0.05	0.02	0.22
Benz[a]anthracene		0.00	0.00
Benzo[b]fluoranthene			
Benzo[k]fluoranthene			
Benzo[a]pyrene			
Dibenz[a,h]anthracene		0.01	
Benzo[g,h,i]perylene + Indeno[1,2,3-cd]pyrene			

Note: Benzo[g,h,i]perylene and Indeno[1,2,3-cd]pyrene are not separated (co-elute) on the HPLC.

Table 3. Quality Guidelines for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography (EPA 8310) from DOD QSM Version 4.1.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix A. No analysis shall be allowed by analyst until successful demonstration of capability is complete
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for	Correct problem then repeat initial calibration.	NA	Problem must be corrected. No samples may be run until ICAL has passed.

		second order, 7 points shall be used for third order).			

QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.

Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within established retention time windows. Value of second source for all analytes within ± 15% of expected value (ICAL)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	NA	Problem must be corrected. No samples may be run until calibration has been verified.
Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	NA	
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal standards verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.

Method blank	One per preparator y batch	No analytes detected > ½ RL. and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results	Correct problem, then, If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Retention time window position establishment for each analyte	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	NA	
Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results Between MDL and MRL.	

9. References

Department of Defense (DOD). Quality Systems Manual for Environmental Laboratories, Final Version 3 January 2006. www.dtic.mil/get-tr-doc/pdf?AD=ADA396793

U.S. Environmental Protection Agency. 1986. Test methods for evaluating solid waste physical/chemical methods, 3rd ed. Method 8082. SW-846. Office of Solid Waste and Emergency Response, Washington, DC.

SOP-13.

Standard Operating Procedure for the Extraction, Clean-Up of Tissue for Polycyclic Aromatic Hydrocarbons Using an Accelerated Solvent Extractor

Texas Tech University (TTU)

1. **SCOPE AND APPLICATION**
   1.8. This method is an operating procedure for preparing biological tissue matrix for solvent extraction.
   1.9. The method is applicable to hydrophobic organic contaminants (HOCs) and the focus herein is on polycyclic aromatic hydrocarbons (PAHs).
   1.10. This procedure generates extracts suitable for High Performance Liquid Chromatography (HPLC) analysis for priority pollutant PAHs.
   1.11. This extraction procedure is applicable to other biological tissues.

2. **SUMMARY OF METHOD**
   2.1. Upon retrieval from a field location or from laboratory based experiments, the organisms are counted for mortality. Surviving organisms are collected into glass jars for storage prior to sample preparation. Once sample preparation begins, the tissue samples will be homogenized and then be subject to drying involving homogenization with diatomaceous earth. The tissue matrix will first be extracted with a 4:1 ratio of Hexane:Acetone. The extracts will be reduced to a volume of 1 mL and then prepared for the "clean up" step involving column chromatography using alumina. The extract will be eluted with Hexane. The extracts from the "clean up" are then filtered into a new vial that will be reduced to 200 µL for analysis on the HPLC.

3. **INTERFERENCES**
   3.1. Glassware and metal instruments that have not been solvent rinsed can contribute to contamination of the tissue sample.
   3.2. During preparation of the tissue samples, it is necessary to clean or use new supplies when preparing each sample to be run in order to minimize cross contamination.
   3.3. When using the nitrogen evaporator ensure that the needles are not loose. Failure to check this will result in the needle falling into the sample during the evaporation process and may contribute to contamination.

4. **APPARATUS AND MATERIALS**
   4.1. Fume hood
   4.2. Rocket evaporator (Genevac) with a chiller
   4.3. Dionex, Accelerated Solvent Extractor (ASE) with 34 mL extraction cell
   4.4. Omni homogenizer that uses Soft Tissue Omni Tips (Plastic Homogenizing Probes (7mm x 110m))
   4.5. Nitrogen evaporator
   4.6. Glass Columns
   4.7. Glass Wool
   4.8. Precision balance
   4.9. Diatomaceous earth

4.10. ASE Extraction Filters, Cellulose
4.11. Small metal spatula
4.12. 20 mL, trace grade clean, clear, scintillation vial
4.13. 60 mL, trace grade clean, clear vial
4.14. 60 mL, trace grade clean, amber vial
4.15. 20 mL concentrator tube
4.16. 2 mL amber vial
4.17. 9 mm blue snap cap with PTFE/Silicone Septa
4.18. 200 µL glass inserts
4.19. 10 cc glass syringe
4.20. 0.45 µm PTFE membrane filter
4.21. 9” Pasteur pipette
4.22. Pasteur pipette bulb
4.23. Face mask
4.24. Standard Reference Material (SRM) 2974a
4.25. PAH-16 Working Standards: 0.5 ppb, 1 ppb, 2 ppb, 5 ppb, 10 ppb, 20 ppb, 50 ppb, 100ppb, and 200 ppb
4.26. 4D-PAH-16 Working Standards: 0.5 ppb, 1 ppb, 2 ppb, 5 ppb, 10 ppb, 20 ppb, 50 ppb, 100ppb, and 200 ppb

5. REAGENTS

5.1. Acetone (Meets ACS Standards, VWR Analytical)
5.2. n-Hexane (HPLC Grade-Submicron Filtered, Fisher Chemical)
5.3. Acetonitrile (UHPLC-UV Grade, Fisher Chemical)
5.4. Research Grade PAH-16 Standards Mix (Ultra Scientific)
5.5. Research Grade Deuterated C^{13} Labeled Compounds (Ultra Scientific) (Extraction Spike: Spike 25 µL of 4000 ppb d-4PAH in Acetonitrile to obtain 500 ppb in final extract volume of 200 µL):
    5.5.1. d10-Fluoranthene
    5.5.2. d12-Chrysene
    5.5.3. d12-Benzo[b]fluoranthene
    5.5.4. d14-Dibenz[a,h]anthracene

6. PROCEDURE

6.1. Homogenization
    6.1.1. If the tissues have been stored in a freezer, then allow the tissue samples to thaw to room temperature in a refrigerator maintained at 4 °C.
    6.1.2. Assemble the Omni homogenizer with the appropriate tip. Completely submerge the tip into the sample and slowly start the homogenizer. Adjust speeds according to

how much sample is in the container. The tissue will appear creamy and foamy once it is completely homogenized.

6.1.3. Remove the sample from the homogenizer and set the sample aside. Remove the tip from the Omni homogenizer and place it in a waste container. Always use a new tip for homogenizing other samples.

6.2. Weighing the Sample for ASE Cells

6.2.1. A precision balance, 20 mL scintillation vials, and a small, solvent rinsed metal spatula will be required for this step.

6.2.2. Tare the scintillation vial and add 1.0 gram of wet tissue. If duplicates or triplicates can be made, ensure that the mass is consistent between the replicates.

6.2.3. Record the mass of tissue and cap the vial.

6.3. Weighing SRM for ASE Cells

6.3.1. Using a precision balance, tare a 20 mL scintillation vial and weigh about 100 mg of SRM. Wear a face mask when handling SRM. The particles can be inhaled.

6.3.2. Record the mass.

6.4. Preparing the ASE Cells for Samples and SRM

6.4.1. Use one ASE cellulose filter and push it inside the bottom of the ASE extraction cell.

6.4.2. Fill the cell with 1 to 1.5 cm of diatomaceous earth.

6.5. "Drying" the Tissue and SRM

6.5.1. To dry the samples, diatomaceous earth will be poured into the scintillation vials containing sample and thoroughly mixed. The amount of diatomaceous earth poured into the vial will vary based the mass of the sample. See Figure 1 as a reference for filling the scintillation vial.

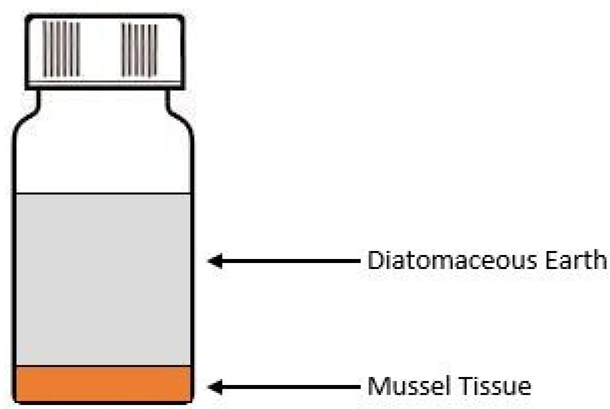

Figure 1: 20 mL scintillation vial with tissue (orange) and diatomaceous earth (gray).

6.5.2. Slowly mix the tissue and diatomaceous earth until the mixture is homogenized and pale orange. Mixing too fast can result in loss of sample, which may come out of the scintillation vial. This step also applies to SRM.

6.6. Adding the Sample to the Extraction Cell

6.6.1. Once the sample is homogenized, carefully pour the contents of the scintillation vial into the prepared ASE cell. It is common for the sample to cling to the bottom and walls of the vial. After pouring the contents of the vial, add about half the amount of diatomaceous earth as depicted in Fig. 1 to the scintillation vial and mix any remaining sample with the newly added diatomaceous earth. Pour the contents into the ASE extraction cell. Ensure that little to no packing occurs within the ASE cell, which would involve tapping the cell with sample inside.

6.6.2. Lightly tap the sides and bottom of the scintillation vial with a small metal spatula to ensure any sample clinging to the walls are in the extraction cell.

6.6.3. Fill any remaining space in the extraction cell with diatomaceous earth. Figure 2 depicts the layers of the extraction cell.

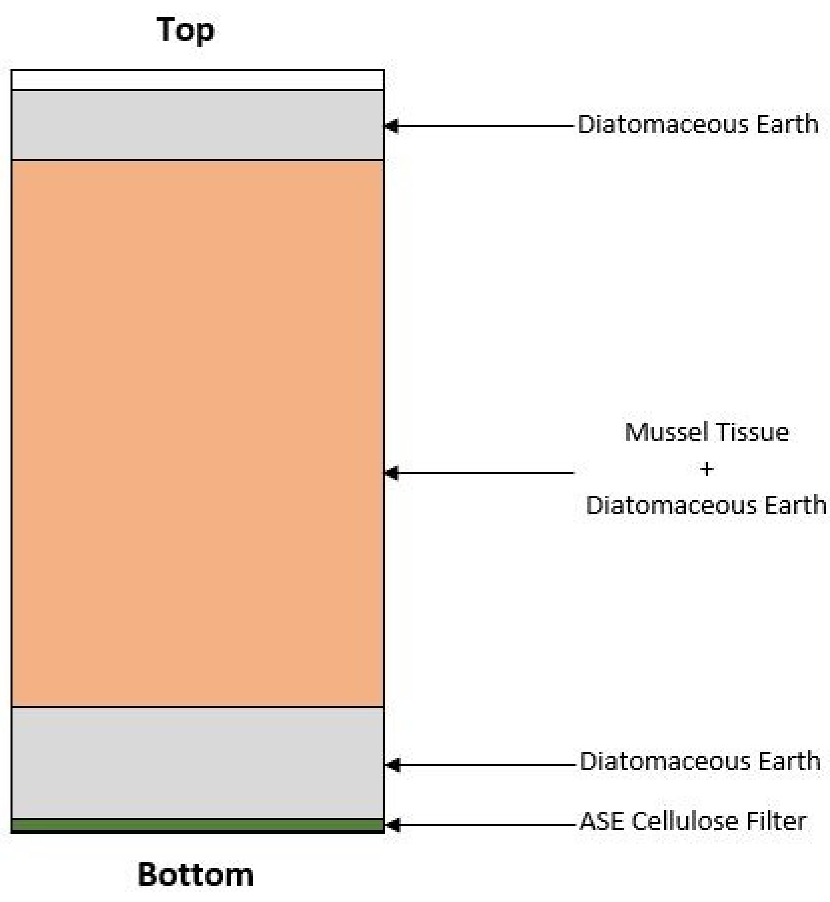

Figure 2: Prepared ASE Extraction Cell Cross-Section for Samples or SRM. Starting from the bottom, the cell is filled with a cellulose filter (green), diatomaceous earth (gray), the mixture of tissue and diatomaceous earth (beige), and another layer of diatomaceous earth (gray).

6.7. Preparing Blanks

6.7.1. Blanks are prepared by pushing an ASE cellulose filter inside the bottom of the ASE extraction cell.

6.7.2. The cell is filled solely with diatomaceous earth to the top of the extraction cell. Figure 3 depicts the layering of a Blank.

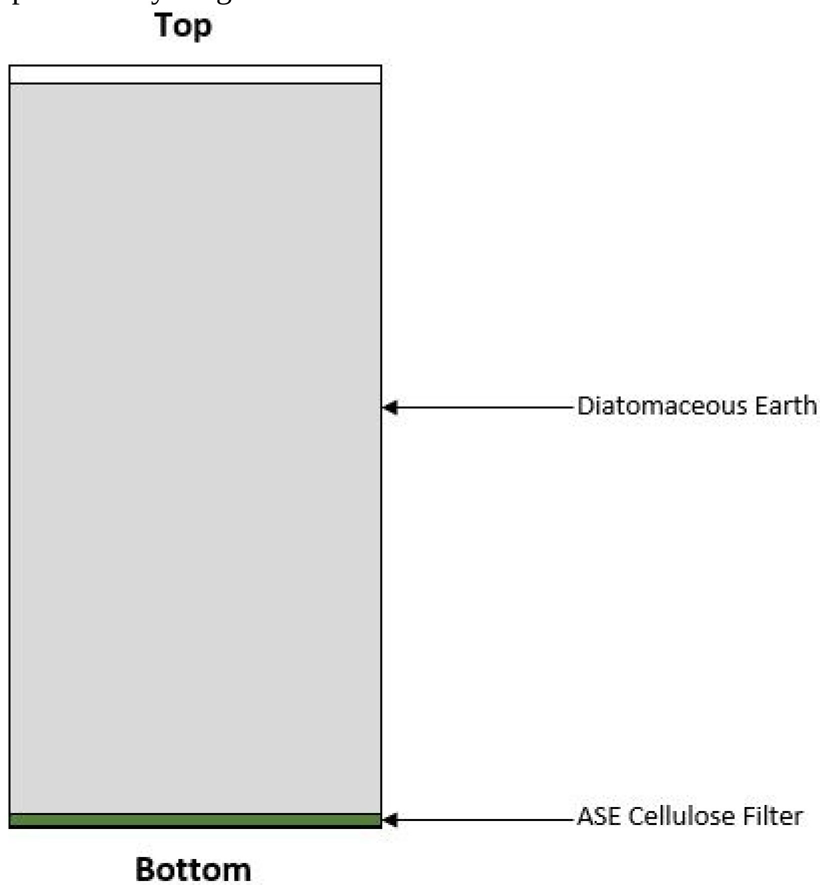

Figure 3: Prepared ASE Extraction Cell Cross-Section of a Blank. Starting from the bottom, the cell is filled with a cellulose filter (green) and diatomaceous earth (gray).

6.8. Spiking the Samples

6.8.1. Before closing the ASE extraction cell, each extraction cell prepared for samples, SRM, and Blanks are spiked with 25 µL from 4 ppm deuterated PAH standard in order to achieve a concentration of 500 ppb in a final volume of 200 µL.

6.8.2. Two Blanks will not be spiked and will serve as Method Blanks.

6.9. Extraction Using Dionex ASE 350

6.9.1. Before turning the machine on, ensure that the nitrogen gas is turned on by turning the valve on the gas cylinder.

6.9.2. Turn on the machine.

6.9.3. On the menu screen, run the Rinse program.

6.9.4. After the Rinse has finished. Ensure that the tops and bottoms of the ASE extraction cells are screwed on tightly. If the tops and bottoms are not secured tightly, a “Hydrocarbon Error” will flash on the screen and the cell will not be extracted fully or at all.

6.9.5. Load the top carousel with the prepared extraction cells.

6.9.6. Load the bottom carousel with clear 60 mL vials.

6.9.7. The top and bottom carousels have numbered slots. Ensure that the numbers match for the vials and extraction cells.

6.9.8. On the menu screen, go into Method Editor and input the following information:

6.9.9. Method Edit #: Any number of your choice

6.9.10. Save To: Any number of your choice (it is best to keep this number the same as the Method Edit #)

6.9.10.1. Temperature: 100 °C

6.9.10.2. Heat: 5 minutes

6.9.10.3. Static Time: 5 minutes

6.9.10.4. Cycles: 2

6.9.10.5. Rinse Volume: 50%

6.9.10.6. Purge: 100s

6.9.10.7. Solvent A (Acetone): 1

6.9.10.8. Solvent B (Hexane): 4

6.9.10.9. Solvent C (Dichloromethane): 0

6.9.10.10. Cell Type: SST

6.9.10.11. Solvent Saver: Off

6.9.11. When the samples are ready to be run, go into Load Method/Sequence and input the following information:

6.9.11.1. Load: Method

6.9.11.2. Number: This is the number that was chosen for the Method Edit #

6.9.11.3. BTL/Vial #: This number will determine the location of start for the analysis. If samples were loaded starting at location 1, then input 1. If a sample does not get extracted due to a “Hydrocarbon Error”, you can input the location of that cell and ASE will start extraction at that particular cell.

6.10. Using the Rocket Evaporator for Reducing the Extracts from ASE

6.10.1. Before using the Rocket, press the stop (red) button to begin cooling the machine. Once the machine reaches a temperature of -10 °C, then the samples can be loaded and run.

6.10.2. Check the water reservoir within the evaporator. If there is no water, then fill the reservoir with distilled deionized water until the grooves are fully submerged.

6.10.3. Remove the vials containing the extracts from ASE. Before opening the vials, wear a face mask. The extracts are very volatile.

6.10.4. The Rocket will be used to reduce the extracts to 1 mL. It is possible to evaporate to dryness so it is crucial to check on the samples every ten minutes.

6.10.5. On the menu screen, choose Low BP.

6.10.5.1. Change the temperature to 40 °C

6.10.6. Ensure the evaporator is loaded symmetrically before running the samples.

6.10.7. Run the samples and check every ten minutes to ensure that the samples are not evaporated to dryness. The samples usually take about 25 to 30 minutes to be reduced to 1 mL. Every time the machine is paused and the samples are checked for solvent volumes, wear a face mask.

6.11. Using a Single Alumina Column for "Clean up"

6.11.1. For any glass column that is to be used for clean up purposes, solvent rinsing will need to be performed first.

6.11.1.1. Rinse the column with Acetone 3 times.

6.11.1.2. Rinse the column with Hexane 3 times.

6.11.2. After the solvent has evaporated and dried, roll a small portion of glass wool into a small ball that is smaller than a pea (depends on spout width of column) and place the wool ball at the tip of the column. The amount of glass wool used will have an effect on the rate at which the extract will drip as well as how well the wool can contain the amount of alumina poured into the column. It is best to keep each wool ball consistent in size if possible.

6.11.3. After the glass wool has been put into the tip of the column, add 4 g of alumina into the column. Do not leave the alumina container open because alumina is hygroscopic.

6.11.4. After the column is filled with alumina, ensure that the column is covered with aluminum foil.

6.11.5. Lastly, a small layer of sodium sulfate is used to cap the alumina. A small amount would be 1 cm or less. Also, do not leave the sodium sulfate uncapped after use.

6.11.6. Put a vessel capable of holding 30 mL of volume under each column.

6.11.7. The columns are rinsed with 25 mL of Hexane first. This is to check the flow through the column and if the alumina is staying within the column. If necessary, columns can be remade if flow is not occurring or if alumina is flowing rapidly out of the column. Always have a layer of solvent on top of the sodium sulfate layer, otherwise the sodium sulfate can harden and reduce flow through the column.

6.11.8. Once the sodium sulfate appears to be close to coming in contact with the air, add 1 mL of your reduced sample to the column using a Pasteur pipette. Then add about 5-10 mL of Hexane to the column.

6.11.9. Switch the vessels that were used for collecting the Hexane for a 60 mL amber vial. Try to minimize splashing any sample onto the sides of the glass.

6.11.10. The sample will be eluted with 30 mL Hexane total, however, the eluant will be added in increments of 5-10 mL. (The remainder of the Hexane needed can be used to rinse the vials that the extract was contained in to ensure most of the sample is recovered.)

6.11.11. Clean up is complete when there is no more eluant and no flow from the column. The sample is ready to be capped and reduced using Rocket.

6.12. Using the Rocket Evaporator for Reducing the Extracts from Column "Clean Up"

6.12.1. Repeat the steps from 6.10. Acetonitrile will take longer to evaporate so expect samples to be near 1 mL after 40 minutes.

6.13. Nitrogen Blow Down

6.13.1. After the samples have been reduced, transfer the extract to a glass concentrator tube. Use a Pasteur pipette to transfer the extract to the concentrator tube.

6.13.2. Place the concentrator tube onto the Nitrogen Evaporator.

6.13.3. Turn on the nitrogen gas and turn on the valves on the Nitrogen Evaporator apparatus. Ensure that flow is constant for all the samples. Flow should not be too fast such that sample is escaping the concentrator tube.

6.13.4. The blow down process can take up to 4 or 5 hours for a sample. Times will vary depending on how much of the sample was reduced.

6.13.5. The final volume to be achieved is 200 µL.

6.13.6. Remove the concentrator tube from the Nitrogen Evaporator and pipette the 200 µL extract volume into a glass insert inserted into a 2 mL amber vial.

6.13.7. Immediately cap the vial and place the sample into a container until all the samples are prepared and ready to be run on the HPLC.

6.13.8. For short term storage, the samples can be stored in a freezer.

6.14. Analyzing Samples on the HPLC

6.14.1. Prepare 9 PAH-16 and 9 4-deuterated PAH calibration standards.

6.14.1.1. Place 200 µL glass inserts into 2 ml amber glass vials.

6.14.1.2. For each calibration point, for example, preparing the 0.5 ppb PAH-16 standard involves pipetting 200 µL of the prepared 0.5 ppb PAH-16 working standard into the 200 µL glass insert and immediately capping the vial with a 9 mm blue snap cap. Repeat this step for the remaining 8 calibration points.

6.14.1.3. Repeat 1.1.1.2 for the 4-deuterated PAH 9 point calibration. Use the prepared 4-deuterated PAH working standards.

6.14.2. Prepare Blanks by filling a 2 mL amber vial with 1.5 mL of acetonitrile.

6.14.3. Ensure that the column you need is installed in the HPLC before use!

6.14.4. Turn on the four modules on the program interface and allow the machine to turn on for about 30 minutes.

6.14.5. Create your sequence table. Start with two blanks followed by the 9 point PAH-16 calibration, a blank, and then last with the 9 point 4d-PAH calibration. After the calibration, set the sequence for a blank, a quality check (QC) of 20 ppb PAH-16, and then a blank again. After the QC, insert 10 samples into the sequence. After every 10 samples, a QC will take place. End the sequence with a blank, but ensure that the Method is Shutdown.

6.14.6. Ensure that the acetonitrile and water are filled above the 300 mL mark on the graduated bottles. If the solvents get below 300 mL, there is a chance for the introduction of air into the system that could affect sample analysis.

6.14.7. Ensure that the waste container does not spill over!

7. STANDARD REFERENCE MATERIAL RECOVERIES

7.1. Table 1 is representative of ~100mg Standard Reference Material 2974a: Organics in Freeze-Dried Mussel Tissue (*Mytilus edulis*). Not all PAH compounds were documented for the SRM as denoted by the black spaces in the table.

7.2. EPA accepted recovery ranges from 65-135%.

Table 2: SRM Recoveries Via Extraction with 4:1 Hexane:Acetone on ASE.

PAH Compound	SRM Mass Fraction µg/kg (dry-mass basis)	SRM Mass Fraction After Extraction µg/kg (dry-mass basis)	Range SRM Mass Fraction After Extraction µg/kg (dry-mass basis)	Recovery %
Naphthalene	9.68 ± 067	303.5	8.8	3135.2
Fluorene		103.3	80.9	
Acenaphthene		14.4	3.32	
Phenanthrene	74.4 ± 47	414.7	96.2	557.4
Anthracene	2.46 ± 0.1	15.0	0.5	608.5
Fluoranthene	287 ± 34	260.7	42.9	90.8
Pyrene	166 ± 21	164.8	65.3	99.3
Chrysene	85.1 ± 1.1	59.0	9.3	69.3
Benz[a]anthracene	31.1 ± 3.9	33.3	5.9	107.0
Benzo[b]fluoranthene	41.5 ± 2.6	45.4	4.1	109.3
Benzo[k]fluoranthene	18.95 ± 0.54	13.6	1.1	71.9
Benzo[a]pyrene		8.4	0.6	

Dibenzo[a,h}anthracene	[redacted]	6.3	1.5	[redacted]
Benzo[ghi]perlyene+Indeno[1,2,3-cd]pyrene	23.70	17.3	4.8	73.1

8. REFERENCES

Kimbrough, K. L., G. G. Lauenstein and W. E. Johnson (Editors). 2006. Organic Contaminant Analytical Methods of the National Status and Trends Program: Update 2000-2006. NOAA Technical Memorandum NOS NCCOS 30. 137 pp.

SOP-14.

Standard Operating Procedure for the Extraction, Clean-up and Analysis of Hydrophobic Organic Contaminants (HOCs) from Sediment Samples using ASE 350

Texas Tech University (TTU)

1. SCOPE AND APPLICATION

1.4. This method is an operating procedure for extraction and clean-up of sediment samples using Accelerated Solvent Extraction (ASE 350, Dionex)

1.5. This method is derived from the EPA Method 3545A (Pressurized Fluid Extraction/PFE). However, adaptations have been made in this SOP including in-cell cleanup, sample mass, number of static cycles, and solvent ratio. These adaptions are not expected to cause negative issues in extraction recovery.

1.6. This procedure generates extracts suitable for High Performance Liquid Chromatography (HPLC) and Gas Chromatography – Tandem Mass Spectrometry (GC-MS/MS) analysis for priority PAHs and PCBs

2. SUMMARY OF METHOD

4.1. Wet sediment is dried with diatomaceous earth and extracted on ASE 350 by a mixture of dichloromethane/hexane (4:1 v/v) at 100^{o}C. During extraction, samples are cleaned with silica and copper inside the extraction cell (i.e., in-cell clean up). The obtained extract is evaporated to 2 mL and eluted from a column packed with sodium sulphate (and alumina when extra cleanup is needed) using 15 ml of dichloromethane. The eluate is evaporated to 1.5mL. Samples designated for HPLC analysis are exchanged to acetonitrile whereas samples designated for GC-MS/MS analysis remain in hexane.

3. INTERFERENCES

9.1. Method detection limits are related to compound hydrophobicity and therefore the method must be used with caution when analyzing relatively volatile constituents which exhibit greater losses and relatively poor detection limits.

Always work accurate and neat, because of safety and quality assurance.
Always wear a laboratory coat, gloves and safety glasses; some chemicals are very toxic. Use a fume hood when working with solvents

4. APPARATUS AND MATERIALS

4.1. Accelerated Solvent Extraction ASE 350 (Dionex) system and 34 mL extraction cells

4.2. Collection vessels – 60 mL amber/clear glass vials with screw cap

4.3. Rocket evaporator (Genevac) with a chiller

4.4. Desiccator

4.5. Columns – (12x)

4.6. Rack for columns

4.7. Ultrasonic bath

4.8. Aluminum foil

4.9. Quartz wool

4.10. ASE Cellulose filter

4.11. Glass cylinders 25 ml (3x)

4.12. Mortar stamper

4.13. Parafilm

4.14. Pasteur pipettes (long) with suction tool

4.15. Petri dishes (12x)

4.16. Porcelain dish

4.17. Standard laboratory set of glasses and tools like Erlenmeyer (conical), beakers, tweezers, scissors and spatulas

4.18. Socorex pipettes 0.1 – 10 mL

4.19. Vortex mixer

4.20. Muffle furnace

5. REAGENTS

5.1. Acetone (Meets ACS standards, VWR Analytical)

5.2. Acetonitrile or equivalent solvent (UHPLC-UV grade, Fisher Chemical)

5.3. Dichloromethane (HPLC grade-Submicron filtered, Fisher Chemical)

5.4. Ultrapure Water (MilliQ, Resistivity $\geq$ 18MΩ●cm)

5.5. Research grade deuterated/C^{13} labeled compounds [Ultra Scientific] as surrogate standards i.e. fluoranthene-d10, chrysene-d12, benzo[b]fluoranthene-d12, dibenzo[*a,h*]anthracene-d14

5.6. Research grade PAH-16 standards mix [Ultra Scientific]

5.7. Aluminum oxide (basic, Brockmann I, for chromatography, 50-200µm, 60A, ACROS Organics™). Before use, activate by heating at 130 ^{o}C for a minimum of 16 hours and deactivate with 10 % (w/w) water

5.8. Silica Gel (high-purity grade (Davisil Grade 923), pore size 30 Å, 100-200 mesh). Before use, activate by heating at 130 ^{o}C in the "Clean" oven for a minimum of 16 hours.

5.10. Copper powder (Spectrum): purified with nitric acid

5.11. Sodium sulphate, water free (p.a.; Merck): before use baked for 4h at 400 ^{o}C (muffle furnace)

5.12. Diatomaceous earth (DE), (food grade pelletized diatomaceous earth that acts as a dispersant and drying agent).

6. PREPARATION AND HANDLING

14.1. Preparation of inorganics

12.1.1. Approximately 300 grams of sodium sulphate is placed in a porcelain dish in the muffle furnace at 400 ^{o}C for 4 hours (removal of water, contaminants and organic material). Sodium Sulphate is then kept in a desiccator and transferred into a Schott bottle.

12.1.2. Diatomaceous earth (400 g) is stored in a 500 ml Duran flask (with purple plastic screw cap)

12.1.3. Copper powder cleaning:

<u>This operation must be performed in a working fumehood</u>

12.1.3.1. Place 200g of copper powder in a glass jar

12.1.3.2. Add 100ml of 0.5N Nitric acid and mix with a plastic spatula

12.1.3.3. Empty the overlying acidic solution in a plastic waste container using a 10mL pipette

12.1.3.4. Repeat 2 more times

12.1.3.5. Add 200ml Ultrapure water and mix with a plastic spatula

12.1.3.6. Empty the overlying acidic solution in the plastic waste container using a 10mL pipette

12.1.3.7. Repeat until pH reaches 7

12.1.3.8. Add 100ml acetone to remove water

12.1.3.9. Empty the overlying solution in a glass waste container using a 10mL pipette

12.1.3.10. Repeat until all water is removed

12.1.3.11. Let acetone evaporate under the hood. Copper is ready once it is back to a fine powder form.

12.1.3.12. Transfer to a clean glass jar and store in room temperature

14.2. Pretreatment of sample and cell preparation

6.2.1. All porcelain dishes are washed with ultrapure water and acetone before use.

6.2.2. Sediment is homogenized entirely (preferably on a roller bank).

6.2.3. An aliquot of wet sediment sample (3-7g w/w) is weighed in a clean porcelain dish on a balance with 4 decimals.

6.2.4. The sample is placed in a 35°C oven until moisture content is reduced by 80%.

6.2.4.1. Moisture content is determined be weighing approx. 5g of sample in an aluminum boat, drying in the oven at 135°C overnight and weighing again

6.2.4.2. $\% \, dry \, weight = \frac{g \, of \, dry \, weight}{g \, of \, total \, weight} * 100$

6.2.4.3. $Moisture \, content = total \, weight - dry \, weight$

6.2.4.4. Perform in duplicates

6.2.5. Diatomaceous earth is added in approximately 3 times of sediment weight and homogenized carefully using a mortar to a fine dry powder.

6.2.6. Cellulose filter is placed in each extraction cell before loading the sample.

6.2.7. Silica gel (7.5g) and Copper powder (4g) are placed in the cell.

6.2.8. The sediment sample is transferred quantitatively to ASE extraction cell.

6.2.9. All sediment samples are spiked with exactly 20-50 µl of surrogate standard solution (d-PAH-4 @ 1-4 mg/L). Surrogate standard spiking is performed using the following procedure: after rinsing with 20-30 µl of surrogate standard: circa 110 µl of standard solution is pulled with the GC syringe. The syringe is held vertically and the volume of standard is reduced to precisely 100 µl. The syringe is wiped off with a tissue and emptied in the extraction cell.

6.2.10. The cell is sealed and ready for extraction.

6.2.11. The porcelain dish, the stamper and the spatulas are washed with hexane and acetone after each sample.

14.3. Extraction

6.3.1. The loaded cells are placed into the upper ASE carousel and the appropriate number of clean, amber collection vials (60 mL) in the lower carousel. The appropriate method (Dichloromethane/Hexane (4:1), 2 static cycles of 5 mins each, 40% rinse volume, 100s purge) is set to start extraction. After the extractions are complete, the collection vials are removed from the lower carousel.

14.4. Evaporation

6.4.1. Following extraction, the collection vials with extracts are placed in the Rocket evaporator and sample extracts are concentrated to 1-2 ml.

14.5. Water removal from sediment extracts and additional cleanup

6.5.1. Preparation

6.5.1.1. 12x 50ml columns are hanged in a rack. To each column a piece of quartz wool is added and pressed down with a Pasteur pipet.

6.5.1.2. All columns are covered with aluminum foil to avoid photo-degradation effects.

6.5.1.3. 60 mL amber (12x) collection vessels with caps are weighted on an analytical balance (4 decimals).

6.5.1.4. To each column 4.0 (3.98 – 4.02) grams of sodium sulfate is added and closed with a petri dish.

6.5.1.5. NOTE: If a sample is determined to need additional cleaning with inorganic sorbents, 4g of alumina is added to the column prior to the addition of sodium sulfate.

6.5.1.6. Each column is then rinsed with 25 ml picograde hexane and closed again with a petri dish. The eluate is collected in a glass beaker and discharged in the waste container.

6.5.1.7. The 60 mL amber (12x) vials are placed under the matching columns.

6.5.1.8. 3 glass cylinders of 25 ml are rinsed well with acetone (2x) and dichloromethane (1x). Each glass cylinder is then filled with 15 ml of dichloromethane.

6.5.2. Procedure

6.5.2.1. After the evaporation process (Sec. 6.4.1) is complete, 1 mL of the extract is transferred from the first three collection vials to the matching columns, using 3 long Pasteur pipets to the upper side of the columns.

6.5.2.2. From each glass cylinder 2 ml of dichloromethane is poured to the matching collection vial (with original extract i.e. 60 mL). The collection vial is vortexed and the extract is then transferred to the first column.

6.5.2.3. The procedure is repeated again with 3 mL of dichloromethane, following a procedure with 5 mL of dichloromethane. As a final step the remaining hexane is poured from the glass cylinders (5 ml) to the collection vials, vortexed and poured to the columns and then closed with a petri dish.

6.5.2.4. The three glass cylinders are re-filled with 15 ml dichloromethane and the next three extracts are transferred with new Pasteur pipets on the matching columns as described above. The procedure is repeated with the remaining extracts.

6.5.2.5. The columns are taken out of the rack and placed carefully on a tissue in the fume hood to dry. After 2 -3 hours, the content is blown out using air to a plastic container. The columns are rinsed using tap water and placed in a dish washer. The 60 mL vials with dichloromethane extracts are placed in the Rocket evaporator and concentrated to 1.5 mL.

6.5.2.7. The final extract is transferred to 2 mL GC amber vials with a pipette.

14.6. PAH analysis

12.6.1. Non-spiked and spiked samples are prepared for analysis on the HPLC.

12.6.2. **Non-spiked**: Approximately 230 uL of acetonitrile is added to an insert in a 1.5 mL amber vial followed by 20 uL of the sample extract (in hexane) thus achieving a 12.5:1 dilution.

12.6.3. **Analytical Spike**: Approximately 205 uL of acetonitrile is added to an insert in a 1.5 mL amber vial followed by 20 uL of the sample extract and 25 uL of 1 mg/L PAH-16 solution. The vials are closed with screw caps and vortexed for 60 seconds.

12.6.4. The vials are stored in the freezer (-20 ºC) until HPLC analysis.

14.6.5. PAHs will be analyzed on Agilent Technologies 1260 Infinity (Santa Clara, CA, USA) High Performance Liquid Chromatography (HPLC) with an ultraviolet-diode array (1260 DAD VL+) and fluorescence detector (1260 FLD Spectra). The column is a Phenomenex (Torrance, CA, USA) Luna 5µ C18 column (250 x 4.6 mm) set to 40°C. The HPLC is operated under isocratic conditions. The flow rate through the system is 1.0

mL/min at an water to acetonitrile ratio (v:v) of 3:7. The calibration range extends from 0.5µg/L to 200µg/L.

14.7. PCB analysis

14.7.1. The extracts are exchanged to hexane for analysis.

14.7.2. Internal standard containing C13 labeled PCBs (9/118/188) is added to the extracts prior to analysis.

14.7.3. Extracts were directly analyzed for 111 PCB congeners by GCTQMS (Agilent 7890B) using a SIM/SIM mode (Method 1668c).

14.7.4. The method has the following parameters: splitless mode, inlet temperature at 280°C, injection volume 1µL, flow at 1.2mL/min, 60m column and 54.5min runtime. Calibration ranges from 0.2 to 20 µg/L with seven points.

9. Calculation

9.1. PAHs (for example Fluorene) @ HPLC

Step 1 – Contaminant sediment concentration

- Calculate sample concentration C_{flu} from signal area and calibration line
- For M_i/M_f the initial/final mass of the sample vial and d_{ACN} the density of acetonitrile under lab temperature, calculate final volume V_f of the extract as $V_f = (M_i - M_f)/d_{ACN}$
- Calculate contaminant mass M_{flu} in the final extract as $M_{flu} = C_{flu} * V_f$
- For initial dry sediment mass M_{dry}, the contaminant concentration in the sediment C_{sed} is $C_{sed} = M_{flu}/M_{dry}$ *(µg/kg dry)*

Step 2 – Spike % recovery

- Calculate spike concentration C_{spike} from signal area and calibration line
- Calculate spike mass M_{spike} in the final extract as $M_{spike} = C_{spike} * V_f$
- For initial spike volume V_{spike}, with initial concentration C_i, the initial spike mass is $M_i = C_i * V_{spike}$
- Calculate the % recovery as:

$$\%\, R_i = \frac{M_{spike}}{M_i} \times 100\%$$

Step 3 – Corrected contaminant sediment concentration

- Correct for the recovery: $C_{corr} = Csed \times \frac{100}{\%\, Ri}$

9.2. PCBs (for example Congener 52) @ GC/MS or GC/MS/MS

Step 1

- Import raw peak area (= A)
- Calculate average peak area I.S. (= B)
- Correct peak area for I.S.: $C = A_{c52}/A_{IS} \times B$

Step 2

- Group the corrected peak areas of the calibration standards.
- Calculate for every calibration standard (1 up to 4) the average corrected peak areas.
- Check if the standard deviations of above mentioned averages are not too high i.e. (<25%)
- Calculate the intercept and the slope of the calibration line.

Correct for sample division for PCB analysis

- Calculate the % recovery using surrogate standards:

$$\% R_i = \frac{Y_i}{X_i} \times 100\%$$

$\%R_i$ = percent recovery for compound i

Y_i = measured analyte concentration in sample i (measured - original sample Concentration)

X_i = known analyte concentration in sample i

- Correct for the recovery: $C_{corr} = Csed \times \frac{100}{\% Ri}$

10. Quality Control & Method Performance

17.1. Method blanks (1 per 10 extract samples) must be included in the analysis and processed in the laboratory in the exact same fashion as extract samples

17.2. Chemical Analysis: The QA/QC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in the analytical methods. A complete set of appropriate guidelines can be found in Table 2.

17.3. Sigma-Aldrich CRM104 Certified Reference Sediment Material, was extracted using the established method with the average % recoveries demonstrated in the following table. EPA acceptance criteria is 65%-135%

Table 1. Certified Reference Material (CRM104) PAH extraction % recoveries using the method described in this SOP.

PAH	Certified Concentration (µg/Kg-dry mass)	Measured Concentration (µg/Kg- dry mass)	StdDev	% recovery	% recovery StdDev
Naphthalene	504	456.3	20.61	90.5	4.1
Fluorene	270	248.9	0.64	92.2	0.2
Acenaphthene	575	501.4	10.25	87.2	1.8
Phenanthrene	202	173.7	1.90	86.0	0.9
Anthracene	542	131.4	24.45	24.2	4.5
Fluoranthene	701	583.4	11.78	83.2	1.7
Pyrene	375	296.7	1.39	79.1	0.4
Chrysene	347	315.6	3.70	90.9	1.1
Benz[a]anthracene	146	99.7	1.96	68.3	1.3
Benzo[b]fluoranthene	283	226.2	2.27	79.9	0.8
Benzo[k]fluoranthene	296	232.5	1.69	78.6	0.6
Benzo[a]pyrene	164	49.6	4.97	30.3	3.0
Dibenz[a,h]anthracene	372	252.9	0.35	68.0	0.1
Benzo[g,h,i]perylene + Indeno[1,2,3-cd]pyrene	635	303.5	5.16	47.8	0.8

Note: Benzo[g,h,i]perylene and Indeno[1,2,3-cd]pyrene are not separated (co-elute) on the HPLC.

17.4. NIST Standard Reference Material 1941b (Organics in Marine Sediment), was extracted using the established method with the average % recoveries demonstrated in the following table. EPA acceptance criteria is 65%-135%

Table 2. Standard Reference Material (SRM1941b) PAH extraction % recoveries using the method described in this SOP.

PAH	Certified Concentration (ug/Kg)	Measured Concentration (ug/Kg)	StdDev	% recovery	% recovery StdDev
Naphthalene	212.0	168.5	11.26	79.5	5.3
Fluorene	21.3	9.6	0.85	45.2	4.0
Acenaphthene	9.6	2.3	0.05	23.7	0.5
Phenanthrene	101.5	95.7	11.44	94.3	11.3
Anthracene	46.0	34.2	10.53	74.4	22.9
Fluoranthene	162.8	111.0	19.46	68.2	12.0
Pyrene	145.3	103.9	3.93	71.5	2.7
Chrysene	72.8	48.6	4.56	66.8	6.3
Benz[a]anthracene	83.8	54.6	6.34	65.2	7.6
Benzo[b]fluoranthene	113.3	105.5	8.18	93.2	7.2
Benzo[k]fluoranthene	56.3	42.0	4.55	74.6	8.1
Benzo[a]pyrene	89.5	54.3	2.34	60.7	2.6
Dibenz[a,h]anthracene	13.3	10.5	2.24	79.1	16.9
Benzo[g,h,i]perylene + Indeno[1,2,3-cd]pyrene	162.0	62.0	4.42	38.3	2.7

Note: Benzo[g,h,i]perylene and Indeno[1,2,3-cd]pyrene are not separated (co-elute) on the HPLC.

Table 3. Quality Guidelines for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography (EPA 8310) from DOD QSM Version 4.1.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix A. No analysis shall be allowed by analyst until successful demonstration of capability is complete
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	NA	Samples cannot be analyzed without a valid MDL.
Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points	Correct problem then repeat initial calibration.	NA	Problem must be corrected. No samples may be run until ICAL has passed.

		shall be used for third order).			

QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**	**Flagging Criteria**	**Comments**
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.

Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within established retention time windows. Value of second source for all analytes within ± 15% of expected value (ICAL)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	NA	Problem must be corrected. No samples may be run until calibration has been verified.
Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	NA	
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Internal standards verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.

Method blank	One per preparator y batch	No analytes detected > ½ RL. and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results	Correct problem, then, If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Retention time window position establishment for each analyte	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	NA	
Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results Between MDL and MRL.	

18. References

19. Department of Defense (DOD). Quality Systems Manual for Environmental Laboratories, Final Version 3 January 2006. www.dtic.mil/get-tr-doc/pdf?AD=ADA396793

U.S. Environmental Protection Agency. 1986. Test methods for evaluating solid waste physical/chemical methods, 3rd ed. Method 8082. SW-846. Office of Solid Waste and Emergency Response, Washington, DC.

SOP-15.

Standard Operating Procedure for the Use, Extraction, and Analysis of Solid Phase Microextraction Polydimethylsiloxane Fibers used as a Passive Sampling Technique in Sediment and Surface Waters

Texas Tech University (TTU)

1. **SCOPE AND APPLICATION**
   1.1. This method is an operating procedure for measurement of sediment pore water concentrations with solid phase microextraction (SPME) using polydimethylsiloxane (PDMS) as the polymer sorbent.
   1.2. The method is applicable to hydrophobic organic contaminants (HOCs) and the focus herein is on polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs).
   1.3. This procedure generates extracts suitable for High Performance Liquid Chromatography (HPLC) and GC-MS analysis for priority and alkyl PAHs (PAH-38) and GC-MS/MS and GC-ECD for PCBs.
   1.4. This extraction procedure is applicable to lab or field exposed PDMS fibers.
2. **SUMMARY OF METHOD**
   2.1. The method can be applied *in situ* (field) or *ex-situ* (laboratory) but both approaches entail exposing PDMS fibers to the sediments by direct insertion into the sediment for a period of time followed by extraction and chemical analysis.
   2.2. A specific length of PDMS is cleaned by consecutive extraction with dichloromethane, hexane, methanol and ultrapure water.
   2.3. Performance reference compounds (PRCs) are loaded onto cleaned PDMS fiber in water-methanol (80:20%) solution.
   2.4. A shaker table is required to facilitate well-mixing of the PRC spiking solution and contact with the PDMS fibers.
   2.5. The PDMS fibers are kept in the PRC solution until preparation for deployment.
   2.6. PDMS fibers are inserted to the sediment or water column and exposed for 21-28 days.
   2.7. Upon retrieval from a field location or from laboratory sediment, any adhering material is removed from the PDMS fiber with a lint-free damp tissue before segmentation into appropriate lengths along the PDMS fiber to acquire a concentration depth profile into the sediment or in the water column. The PDMS fibers are extracted with an appropriate solvent (i.e. acetonitrile or hexane) overnight. The PDMS fibers are removed from the extract before analysis via HPLC or GC methods.
3. **INTERFERENCES**
   3.1. In general, the use of PDMS as an extracting phase limits the amount of extraneous compounds from the sample and provides a phase that is easily extracted. This limits the amount of sample cleanup necessary as well as the need for surrogates to test extraction efficiency. However, both may be necessary under some conditions.
   3.2. PDMS fibers can become contaminated from the atmosphere and surfaces, and therefore techniques to limit the amount of undesired exposure must be followed.
   3.3. Biofilms, adhering sediment, or chemical residues like NAPL residues can be removed by wiping the PDMS fiber with a MiliQ water wetted Kimwipe®

3.4. Method detection limits are related to compound hydrophobicity and therefore the method must be used with caution when analyzing relatively volatile constituents which exhibit greater losses and relatively poor detection limits.

3.5. Sediments that are contaminated with oil or other nonaqueous phase liquid (NAPL) will greatly complicate the interpretation of the results. The NAPL can absorb directly onto the PDMS and will also affect the partitioning into water. Use of the technique in NAPL-contaminated sediments should not be expected to provide quantitation on mobile contaminants

4. APPARATUS AND MATERIALS

4.1. Washing, PRC loading and storage vessel (250 mL, amber/clear glass depending on the analytes of interest) with foil-lined cap. Larger Volumes can be used depending on application.

4.2. Solid phase micro-extraction polydimethylsiloxane fibers – commercially available through suppliers like Polymicro Technologies™ (Molex, Phoenix) and Fiberguide (New Jersey).

4.3. Sampling device/fiber holder –

4.3.1. For *ex situ* use: a septa or mesh bag; Sampling device/fiber holder: a septa or mesh bag; Fibers require neither holder nor protective sheath if used in short lengths in laboratory samples or laboratory slurries although some form of holder (e.g. wire mesh envelope) is useful for locating and retrieving many fibers or smaller fiber sizes (< 500 μm). Their size (< 1 mm diameter) suggests that this can be accomplished with minimal disturbance to the surrounding sediment. Very small fibers may need to be inserted into a septum to aid location and withdrawal.

4.3.2. For *in situ* use: A sheath or holder is typically necessary to both protect the PDMS and to locate the sampler after sediment exposure. Two types of holders have been employed in our laboratory

4.3.2.1. Henry sampler (manufactured by M.H.E. Products) that has been modified. Modifications included 4 mm diameter perforations in the outer sheath, a 2 mm groove in the inner rod of the sampler, and the attachment of a washer that rests at the sediment–water interface during deployments. The groove length of the inner rod dictates the sampling length of the sampler (i.e. 60 or 90 cm). The outer sheath facilitates fiber-porewater contact while protecting the fiber. The inner rod secures the fiber from movement during deployment and retrieval.

4.3.2.2. 30 cm T-bars without the outer sheath attached to a triangle frame (for triplicate measurements, spaced 1 foot apart) can be used for deployment in soft sediments. In this configuration, two 2 mm grooves in the T-rod can accommodate more PDMS for improvement of detection limits especially for monitoring sites after activated carbon addition.

4.4. Extraction vessels – 2 mL amber (for PAHs) or clear glass (for PCBs) autosampler vials.

4.5. 300 µL glass inserts with springs for ultra-low solvent volumes.
4.6. PTFE/Silicone/PTFE screw caps for short-term storage and PTFE lined solid tops for long-term storage.
4.7. Kimwipes®
4.8. Food-grade aluminum foil
4.9. Tweezers
4.10. Single-edge razor
4.11. Ceramic Cutter
4.12. Syringe needle
4.13. Glass tubes
4.14. Shaker table or overhead tumbler

5. REAGENTS

5.1. Sodium azide (NaN_3)
5.2. Dichloromethane (methylene chloride, CH_2Cl_2)
5.3. Hexane
5.4. Acetonitrile
5.5. Methanol
5.6. MiliQ Water (Barnstead, GenPure Pro)
5.7. Research grade deuterated or C^{13} labeled compounds as performance reference compounds (PRCs): d-Fluoranthene, d-Chrysene, d-Benzo(b)Fluoranthene, d-Dibenzo(ah)anthracene and C^{13} mix containing PCBs 28/52/101/153/138/180/209 (Ultra Scientific and Cambridge Isotope Laboratories).
5.8. Research grade deuterated or C^{13} labeled compounds as surrogates or internal standards for GC-MS or GC-TQMS analysis: d-acenapthene, d-phenanthrene and d-perylene for PAHs (working standard concentration of 1000 µg/L in hexane) and C^{13} mix containing PCBs 9/118/188 (working standard concentration of 1000 µg/L in hexane).

Table 1. PRCs and internal standards used for spiking and analysis of PDMS.

Method 8270 and/or 8310		Method 1668	
PRCs	**Internal standard**	**PRC**	**Internal standard**
d-Fluoranthene	**d-acenapthene**	**28**	**9**
d-Chrysene	**d-phenanthrene**	**52**	**118**
d-Benzo(b)Fluoranthene	**d-perylene**	**101**	**188**
d-Dibenzo(ah)anthracene		**153**	
		138	
		180	
		209	

6. HANDLING AND PRESERVATION

6.1. All personnel should wear nitrile or powder-free gloves when handling the sampling devices and the PDMS fiber.
6.2. Clean PDMS should be stored in clean, sealed, glass vessels.

6.3. Solvent rinsed tweezers should be used when handling the PDMS.

6.4. The loaded PDMS fibers should be stored in the PRC solution until further use.

7. **PROCEDURE**

7.1. PDMS fiber is purchased from Polymicro Technologies™ on a spool with a nominal PDMS coating of 35 µm. Other thickness can be used depending on application. The fiber is cut into desired lengths, for example 5 cm, which can be easily inserted in small vials with sediment. The 5 cm lengths can be easily cut into smaller segments (i.e. 2+2+1 cm) for extraction and processing and may also provide replication and/or contingency in situations when 2 cm lengths are used for analysis and data interpretation. Details on the quantity of fiber per sampling exercise are provided in Appendix 1.

7.2. PDMS washing

7.2.1. The cut PDMS fibers are placed in the 250 ml glass vessel and cleaned by washing consecutively with three solvents i.e. dichloromethane (2x), hexane (2x) and methanol (2x) for 30 minutes each on a shaking table. Care should be taken to avoid PDMS breakage during washing with solvents. Therefore, gentle shaking is recommended or unobstructed movement of the PDMS in the washing vessel. After the methanol solvent wash, the fibers are rinsed with MiliQwater at least three times. The rinsed PDMS fibers are then blotted dry with lint-free tissues.

7.2.2. A portion of the cleaned fibers should be checked for residual contamination by pipetting 1 mL of clean hexane or equivalent solvent down the fiber length, collecting the solvent at the bottom of the PDMS fiber, and analytically checking for contamination. The cleaning process is repeated until any analytes of concern are not detected in the test solvent.

7.2.3. The loaded PDMS fibers should be stored in the PRC solution until further use.

7.3. Loading of PDMS with performance reference compounds:

7.3.1. PRCs should be chosen to assess kinetic dissipation/uptake rates during field deployments. PRCs are loaded onto the PDMS before deployment.

7.3.2. 200 mL of spiking solution (water and 20% methanol) is placed in the glass vessel with cleaned PDMS. Deuterated/C^{13} labeled versions of the analytes of interest (**Table 1)** at working concentration of 2500 ng/ml in methanol or acetone are added to the water-20% methanol solution. Higher concentrations of working standards are available for d-PAHs. The levels of PRCs on PDMS should be similar to the target analytes and can be predetermined by using PDMS-water partition. The total volume of water-methanol solution should result in minimum headspace and ensure effective mixing and transfer of PRCs to PDMS. To avoid losses via volatilization during mixing, the outer side of the caps should be covered with parafilm. Note, after exposure of the loaded PDMS with sediment or overlying water, part of the PRCs will leave the fiber resulting in lower concentrations for analysis. Therefore, one may design the loading calculation in such way that the initial concentration of

PRCs in the extract and thus fiber is a factor of 2-3 higher to meet the requirements for detection after PRCs exposure.

7.3.3. The spiking solution with PDMS is agitated (approximately 130 strokes per minute) using a shaker table for a minimum of 8 days with deuterated PAHs and a minimum of three weeks with C^{13} labeled PCBs before using the PRC loaded PDMS. Longer equilibration times may be required for thicker samplers.

7.3.4. The loaded PDMS fibers should be stored in the PRC solution until further use.

7.3.5. PRC loaded PDMS fibers should be used for exposure into sediments and a subset of the simultaneously prepared fibers should be analyzed for initial PRC concentrations in the fibers. At least 6 PRC loaded PDMS fibers should be analyzed for initial PRC concentrations.

7.4. All sampling devices are disassembled and washed with detergent and hot water. Following being washed with detergent and hot water, the sampling devices are sequentially soaked in dichloromethane, hexane, methanol or equivalent solvent based upon analytes of interest, and MiliQ water for at least an hour each. The sampling devices are then dried under the fume hood on clean tissues overnight.

7.4.1. After the process is complete, 3 mL of clean hexane or equivalent solvent is introduced to the inner rod of the sampling device, collected at the bottom of the sampler, and analytically checked for contamination. The cleaning process is repeated until any analytes of concern are not detected in the test solvent.

7.5. Deployment of PDMS in sediment samples

7.5.1. All personnel should wear nitrile or powder-free gloves when handling the sampling devices and the PDMS fiber.

7.5.2. Solvent rinsed tweezers should be used when handling the PDMS.

7.5.3. For *ex situ* deployment: Prior to exposure *ex situ,* all sediment samples (in jars) should be homogenized for 12 hours on a roller-bank. Approximately 22-25 g of wet sediment samples from each sampled location (in triplicate) are weighed into 20 mL amber or clear vials (depending on compounds of interest). The sediment samples should be fully saturated with native water or not exceed 50% dry weight sediment. In case sediment does not appear saturated, a subsample of sediment from original jar should be transferred into a secondary container followed by addition of MiliQ water to ensure saturation and homogenized for 1 hour or a roller-bank.

7.5.4. Sediment samples in 20 mL vials are dosed with sodium azide (NaN_3) to prevent biological activity and homogenized gently with a stainless steel spatula. The addition of NaN_3 should yield a concentration of 100 mg/L in the 20 mL vial.

7.5.5. The loaded PDMS fibers are withdrawn from the PRC solution using clean tweezers, rinsed with MiliQ water and blotted on Kimwipes® to remove any residual methanol.

7.5.6. The loaded PDMS fibers are then inserted into a septa/envelope or placed directly in the 20 ml vials with sediment. Vertical placement is recommended. The vials with sediment and PDMS are closed with an aluminum lined cap and allowed to equilibrate for 21-28 days with gentle shaking on a shaking table at 20ºC.

7.5.7. For *in situ* deployment: the cleaned PDMS fibers are laid into the groove of the sampling device's inner rod and attached with 1 cm or less of waterproof caulk (hydrocarbon free silicon) at both ends of the groove. Care should be taken to avoid any placement of silicon on the active measurement portion of the sampling device or placement of too much silicon so that the cured silicon will hinder insertion or removal of the sampling device's inner rod from its outer sheath. Once the caulk is cured, the sampling device's inner rod is inserted into the outer sheath. The handles of the inner rod and outer sheath are then wrapped together to maintain orientation of the fiber to the screened section of the outer sheath. The sampling devices with PDMS are wrapped in foil and covered with ice for transport.

7.5.8. For *in situ* deployment: before sampling device insertion, buoys are attached via nylon cord to the sampling device to serve as markers for retrieval.

7.5.9. For *in situ* deployment: The sampling devices should be labelled with a waterproof marker on the tape wrapped around the inner rod and outer sheath handles or with an equivalent label that will not be disturbed during deployment.

7.6. Retrieval

7.6.1. All surfaces that the PDMS fiber will come into contact with must be covered with clean food grade aluminum foil.

7.6.2. Hexane or equivalent (other solvents can be selected based upon analytes of interest) rinsed tweezers and ceramic column cutters are used for segmentation of the PDMS fiber.

7.6.3. All laboratory and field personnel must wear nitrile or powder-free gloves when handling the PDMS fiber holder and the PDMS fiber. It is recommended to have two people in the field, one to handle the removal of the PDMS fiber from the holder and cleaning of the PDMS fiber and the other to handle segmentation and extraction. If only one person is available for completing retrieval activities, than the nitrile or latex gloves must be exchanged between the removal/cleaning step and the segmentation/extraction step.

7.6.4. Upon retrieval, the PDMS fiber should be removed from the fiber holder and any biofilms, adhering sediment/particles, or chemical residues should be wiped from its surface using a DI water wetted Kimwipe®. After cleaning, the fiber should be blotted dry prior to segmentation and extraction.

7.6.5. Segmentation of the PDMS fiber should be done as efficiently as possible to minimize volatilization of more volatile analytes of concern.

8. PROCEDURE

8.1. *Ex situ* Retrieval

8.1.1. After 28 d the vials are removed from the shaker table and the PDMS fiber is carefully withdrawn from the sediment. Any adhering sediment, particles, biofilm, or residue is removed from the PDMS fiber using a MiliQ water wetted Kimwipe®. PDMS fibers are then blotted dry before segmentation.

8.1.2. PDMS fibers are segmented using a ceramic column cutter into smaller lengths, for example a 5 cm segment can be cut into 2+2+1 cm lengths.

8.2. Extraction: the 2+2+1 cm fiber segments are then transferred to 2 mL amber vials with glass inserts prefilled with 250 µL of the appropriate solvent depending upon the subsequent analysis. The solvent volume in the insert should be enough for the complete immersion of the PDMS fiber segment. Extraction can also be into a greater volume (e.g. amber vial without insert) if needed, for subsequent processing. The sample can also be reduced in volume by solvent evaporation to concentrate the sample for improvement of detection.

8.2.1. Examples of solvent extract volumes: 250 µL for 5-cm segments of PDMS fiber with a PDMS thickness of greater than or equal to 30 µm and 100 µL for 8 1-cm segments of PDMS fiber with a PDMS thickness of 10 µm

8.2.2. The PDMS fiber segments are left in the solvent overnight and stored at -17°C.

8.2.3. Following overnight extraction vials with inserts containing SPME segments and solvent are sonicated for 1 min.

8.2.4. A portion of the extract should be transferred to a new vial with insert and internal standard (IS) should be added at target concentration before analysis.

8.2.5. Priority pollutant PAHs can be analyzed by EPA Method 8310 or 8270 and PCB congeners by EPA Method 8082/8270 or modified Method 1668.

8.3. *In-situ* retrieval: After removal from the field for in-situ deployments, the sampling device's inner rod is separated from the outer sheath. The PDMS fiber is carefully removed from the inner rod using a single edge razor and any adhering sediment, particles, biofilm, or residue is removed from the PDMS fiber using a MiliQ water wetted Kimwipe®. PDMS fibers are then blotted dry before segmentation. PDMS fibers are segmented using a ceramic column cutter into predetermined lengths at predetermined locations along the PDMS fiber, which correspond to specific depths of interest from the sediment-water interface.

8.4. The SPME PDMS fiber segments are left in the solvent overnight and stored at -17°C. During transportation from a field site, the samples are kept at 4°C until receipt at the laboratory.

8.5. Following overnight extraction vials with inserts containing PDMS segments and solvent are sonicated or vortexed for 1 min (depending on the amount of PDMS in vial or insert).

8.6. If the extracts will be analyzed by another laboratory, the vials will be shipped while maintained at 4°C. The volume of the vials and PRC compounds can be tailored to meet requirements of the receiving laboratory for the analyses planned.

8.7. Priority pollutant PAHs can be analyzed by EPA Method 8310 or 8270 and PCB congeners by EPA Method 8082/8270 or modified Method 1668. Although, these standard methods are more frequently used by research and commercial labs, any method appropriate for the contaminants of concern capable of analyzing a concentrated sample of extract can also be successfully employed.

9. QUALITY CONTROL & METHOD PERFORMANCE

9.1. PRC loading before deployment i.e. @ t=0: 6 samples of loaded PDMS must be collected from different parts of the PDMS fiber, extracted, and analyzed prior to field deployment.

9.2. Blanks

9.2.1. Deployment Blank: For *in situ* deployments, a deployment blank is a sampler that is shipped together with the other samplers to the field, but is shipped back without deployment and processed in the laboratory in the exact same fashion as samplers deployed in the field.

9.2.2. Solvent Blanks: Solvent blanks will be analyzed at the time of filling the vials for shipment i.e. one at the start of filling at one at the end where the same solvent source has been used. If these contain significant levels of contamination, new vials will be filled with a separate source and the process will be repeated. Additional solvent blanks should be shipped with the samples at a frequency of one per 20 samples.

9.2.3. Field Control Samples: For in situ deployments, field control samples are used to track the solvent volume change or contamination during transition if on site processing samplers are needed. The field control samples can be calibration standards or other solutions with known concentrations. The field control samples are treated identically with the other samples. At least five field control samples are needed for each deployment. The average of the concentration change for all compounds and in all field control samples should be within 5% to avoid solvent volume adjustment.

9.3. Chemical Analysis: The QAQC samples for chemical analysis include initial calibration, second source standard checks, and continuous calibration verification checks; all should meet the acceptance criterion set in the analytical methods. A complete set of appropriate guidelines can be found in Table 2.

Table 2. Quality Guidelines for Organic Analysis by Gas Chromatography and High-Performance Liquid Chromatography (EPA 8310) from DOD QSM Version 4.1.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analyst capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method	QC acceptance criteria published by DoD, if available; otherwise method-specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria	NA	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in Appendix A. No analysis shall be allowed by analyst until successful demonstration of capability is complete
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-conduct MDL study	NA	Samples cannot be analyzed without a valid MDL.

Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression: r ≥ 0.995; Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order).	Correct problem then repeat initial calibration.	NA	Problem must be corrected. No samples may be run until ICAL has passed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	Prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence.	All project analytes within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Retention time windows are updated per the method.
Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within established retention time windows. Value of second source for all analytes within ± 15% of expected value (ICAL)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL	NA	Problem must be corrected. No samples may be run until calibration has been verified.
Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	NA	

Internal standards verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.
QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method blank	One per preparatory batch	No analytes detected > ½ RL. and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results	Correct problem, then, If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

Retention time window position establishment for each analyte	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	NA	NA	
Results reported between MDL and MRL	NA	NA	NA	Apply J-flag to all results between MDL and MRL.	

9. Determination of pore water concentrations

The freely-dissolved pore water concentrations can be calculated from the accumulated uptake in the fiber and the fiber-water partition coefficients as shown in the following equation:

$$Cw = \frac{C_{PDMS}}{K_{PDMS-W}} = \frac{A * RSF * V_{solvent}}{L_{fiber} * V_{fiber} * K_{PDMS} * f_{ss}}$$

where:

A = Areas of chromatography peaks
RSF = response factor from calibration curve unique to each HOCs
$V_{solvent}$ = volume of solvent used to extract fiber
L_{fiber} = length of fiber sample
V_{fiber} = specific volume of fiber
K_{PDMS-W} = fiber-water partition coefficient unique to each HOCs
f_{ss}= fractional approach to steady state from PRCs

The fiber-water partition coefficient should correlate with the hydrophobicity of the compound and thus can be correlated with K_{ow} as shown in Ghosh et al. 2014. PRCs will be interpreted employing the methods of Lampert et al. (2015) to determine the fractional approach to steady state, f_{ss}. The fiber-water partition coefficients for dioxins can be extrapolated using the regression parameters for PCBs. Table 2 summarizes typical potential method detection limits by SPME-PDMS for selected PCBs. Expected detection limits for dioxins are provided in Table 3.

Table 3. Method Detection limits (as indicated in porewater) by SPME-PDMS for selected PCB congeners by GC-TQMS. This assumes 150 µL solvent volume and 6 cm of PDMS fiber with 558 µm outside diameter and 497 µm inside diameter.

PCBs	Log KOW[a]	Log Kpdms[b]	MDL pg/L[c]
PCB-18	5.24	4.94528	562.984
PCB-28	5.67	5.35249	220.438
PCB-52	5.84	5.51348	152.159
PCB-66	6.2	5.8544	69.403
PCB-101	6.38	6.02486	46.872
PCB-77	6.35	5.99645	50.041
PCB-118	6.74	6.36578	21.379
PCB-153	6.92	6.53624	14.439
PCB-138	6.83	6.45101	17.570
PCB-187	7.17	6.77299	8.371
PCB-180	7.36	6.95292	5.532
CB-170	7.27	6.86769	6.731
PCB-209	10.54	9.96438	0.005

[a] PCB log KOW values from Hawker and Connell (1988); PAH log KOW values were calculated using the SPARC program (http://archemcalc.com/sparc-web/calc).

[b] Kpdms from Ghosh et al (2014)

[c] MDL using 6 cm of 31 µm PDMS on a 497 µm core

Table 4. Method Detection limits (as indicated in porewater) by SPME-PDMS for selected dioxins. This assumes 150 µL solvent volume and 6 cm of PDMS fiber with 558 µm outside diameter and 497 µm inside diameter.

Compound	Log Kow (SPARC)[a]	Log Kpdms[b]	MDL pg/L[c]
2-MCDD	4.58	4.32026	2374.19
2,3-DiCDD	5.23	4.93581	575.39
2,7/2,8-DiCDD	5.19	4.89793	627.83
2,3,7-TrCDD	5.84	5.51348	152.15
2378-TCDF	6.46	6.10062	39.36
2378-TCDD	6.49	6.12903	36.87
12378-PeCDF	7.15	6.75405	8.74
23478-PeCDF	7.14	6.74458	8.93
12378-PeCDD	7.2	6.8014	7.84
123478-HxCDF	7.87	7.43589	1.81
123678-HxCDF	7.83	7.39801	1.98
234678-HxCDF	7.83	7.39801	1.98
123478-HxCDD	7.95	7.51165	1.52
123678-HxCDD	7.89	7.45483	1.74
123789-HxCDD	7.92	7.48324	1.63
123789-HxCDF	7.87	7.43589	1.81
1234678-HpCDF	8.55	8.07985	0.41
1234678-HpCDD	8.64	8.16508	0.33
1234789-HpCDF	8.56	8.08932	0.40
OCDD	9.35	8.83745	0.07
OCDF	9.27	8.76169	0.08

Dioxin log KOW values were calculated using the SPARC program (http://archemcalc.com/sparc-web/calc).

[b] Kpdms from Ghosh et al (2014)

[c] MDL using 6 cm of 31 µm PDMS on a 497 µm core

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Appendix VII

Stormwater Sediment Recontamination Assessment Recommendations

SERDP Project ER-2428

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May 6, 2018

Cleanup at contaminated sediment sites has often been initiated before background sources have been fully identified, quantified and/or controlled. Under such conditions, remediated sites have become recontaminated by continued inputs from off-site sources, including permitted discharges, transport from upstream areas, or from stormwater discharges. Stormwater sources are particularly difficult to understand and manage because of the generally poor characterization of the irregular, event-driven inputs from such sources and the difficulty of managing diffuse sources of large volumes of runoff. DoD policy is that off-site sources must be identified and controlled prior to implementing cleanup, but the tools available to quantify event-driven irregular sources and their characteristics are limited, as is the ability to relate those sources to resulting chemical and biological impacts in sediments. As noted by the SERDP Environmental Restoration statement of need (SERDP ERSON 14-03) "this requires better scientific and technical capabilities to understand releases from these sources and how these source levels relate to potential recontamination of the sediment bed." SERDP ER-2428 addressed this need and has evaluated a variety of assessment tools for their ability to quantify and evaluate the significance of sediment recontamination by stormwater discharges. The research project evaluated tools providing better characterization of the sources (i.e. the low-level intermittent sources associated with events, including how these sources are affected by drainage systems) and the potential chemical and biological effects in the sediment sinks. These methodologies can then be integrated with models to identify impacts on remedies and, specifically, to identify the resilience of proposed and/or implemented remedies.

The recommended approach to assess and evaluate stormwater discharges and sediment recontamination is based upon the ER-2428 research project but a summary of that project is not included here. The reader is directed to the final report for that project to see how these recommendations were implemented in that particular project. It should also be noted that SERDP has selected a follow-on project to examine the effectiveness of stormwater best management practices (BMPs) relative to the characteristics identified here as contributing to sediment recontamination. The follow-on project (ER18-1371) will examine specific BMPs at use in naval bases for their ability to control contaminant and particulate distributions and the bioavailability of discharging contaminants.

The recommended approach to stormwater characterization for sediment recontamination involves the following steps

1. Watershed characterization
2. Stormwater discharge monitoring
3. Sediment recontamination monitoring
4. Stormwater and receiving water modeling

Watershed characterization is a necessary step to define historical and current land uses, potential stormwater inputs, at-risk receiving waters and potential sampling locations. Stormwater monitoring should involve automated sample collection equipment to allow storm-integrated discharges at appropriate monitoring locations. Receiving water monitoring should identify locations likely to be impacted by stormwater as well as reference locations unlikely to be substantially affected by the stormwater discharges. Modeling is needed to be able to extrapolate from the necessarily finite monitoring program to annual or other long-term average impacts as well as to predict the performance of potential mitigating actions. Each of these will be discussed in more detail below.

1. Watershed characterization

A land development survey of the watershed should be undertaken to determine building along with road and pavement characteristics. Historical information including the identification of potential source areas resulting from past activity should be included in this characterization. Parking conditions and street widths should be noted. Any stormwater management systems should be identified. Photographs and summaries of this survey should be recorded. This information is used to determine expected stormwater loads and to define monitoring locations. Any existing modeling of the stormwater system should be identified. Sediment samples from the stormwater conveyance system and receiving waters should be collected to characterize baseline conditions and identify potential source areas that might be mobilized in a storm event. These data will not directly indicate stormwater recontamination potential but may inform hypotheses about stormwater impacts and help formulate data quality objectives that can be tested in subsequent sampling.

Monitoring locations for subsequent stormwater sampling should be identified as part of the watershed characterizaiton. These locations would normally be used to characterize significant source areas as well as key discharge points to receiving waters. Site selection is also based on sampling crew safety and equipment access. Automatic samplers will likely need to be manually started at the beginning of an event and monitored for successful operation. Photographs and descriptions of each sampling location should be documented.

Potential receiving water impact zones should be identified for each discharge point of interest. Alternative sources and areas subject to potential sediment resuspension and redistribution should be identified as well as quiescent areas that might encourage settling and deposition. Access points for equipment for receiving water characterization must be identified.

2. Stormwater discharge monitoring

Traditional stormwater monitoring is focused on defining the concentration and mass release of contaminants. If the assessment of sediment recontamination is the primary goal, however, this is insufficient. The size and settling characteristics of the stormwater releases is needed as well. The easiest way to do this is to collect sufficient sample to size segregate the solids and associated contaminants in the stormwater. In addition sampling of stormwater from different locations in a watershed may allow separation of the contribution of different land uses such as residential versus naval base contributions.

Stormwater samples should be collected using automatic samplers during storm events so that the cumulative effects of the storm events can be captured. Time dependent sampling to capture a first flush may be useful although the primary concern for sediment recontamination is the average discharges over an event. The sampling should be able separate any flow reversals, e.g. due to tides, from the samples collected. The total stormwater flow as well as large volume water samples should be collected for subsequent analysis. In ER-2428, 10 L water samples were needed to meet the goals of characterizing the stormwater and receiving waters including conducting a variety of chemical analyses and physical characterization and to meet detection and replication requirements. The automated sampling can supplemented as necessary with grab samples of the same volume.

The large volume samples must be split into appropriate fractions and analyzed to determine contaminant loading by size fraction. In ER-2428, composited 10 L samples from each stormwater event were split using a Teflon™ Dekaport splitter and the homogeneous splits subjected to filtration to develop size segregated contaminant and suspended solid concentrations. Rarely is there sufficient solids for direct chemical analysis of the solids filtered out in a given sample. Instead, the contaminant and solid mass in a given size interval is determined by difference between independent analyses of different size fractions. The sample splitting process is illustrated in Figure 1. An aliquot of approximately 100mL was retained from each sample prior to sample splitting for toxicity evaluation.

Briefly, the Dekaport splitter was placed level on the laboratory workbench. The Dekaport was rinsed a minimum of 3 times with Milli-Q DI water. Two analytical blank samples were collected by pouring Milli-Q DI water through the sampler into a HDPE and an Amber glass bottle. Next, 7 Amber glass and 3 HDPE bottles were placed under the Dekaport and 10L of thoroughly mixed stormwater sample was poured into the Dekaport. The amber glass bottles were used for subsequent organic analysis while the HDPE bottles were used for metals analysis. Samples were poured through a 0.5mm sieve to remove debris and were poured at rate that would allow for constant pressure and thus consistent flow through all the tubing of the Dekaport splitter. All 7 Amber glass bottles and one HDPE bottle were capped. The remaining 2 HDPE bottles were then passed through the Dekaport again (approximately 2L of sample) into 5 HDPE bottles; each of which would receive approximately 400mL. These bottles were then capped. For the second stormwater collection event where 20L were collected, these methods were duplicated for the additional 10L of sample volume that was collected. The Dekaport was thoroughly rinsed with Milli-Q DI water between samples. All bottles were shipped on ice to a laboratory (Texas Tech for ER-2428) for further processing and chemical analyses.

At the analysis laboratory, the bulk water samples in the amber and HDPE bottles were filtered with 63, 20, 5 (2.7 for organics) and 0.45µm (0.7 for organics) sieves and glass fiber (organics) and PFTE (metals) membrane filters to provide raw samples for chemical analysis by particle size fraction. The different size fractions for organics and metals were based upon commercial availability of appropriate filters for metals and/or organic contaminants to allow efficient filtration and minimal analyte sorption and loss. After passing through the sieves/filters the water filtrate fractions from the amber bottles were subjected to liquid-liquid extraction using a separatory funnel (EPA method 3510). The solvent extracted fractions were then concentrated using a Thermo Scientific Rocket™ Evaporator to low level volumes to obtain desirable detection of persistent organic pollutants (POPs). Deuterated polycyclic aromatic compounds (PAHs) were employed to check the extraction efficiencies. The samples from the HDPE bottles were subjected to metal extraction using hot plate digestion (modified EPA method 3005A).

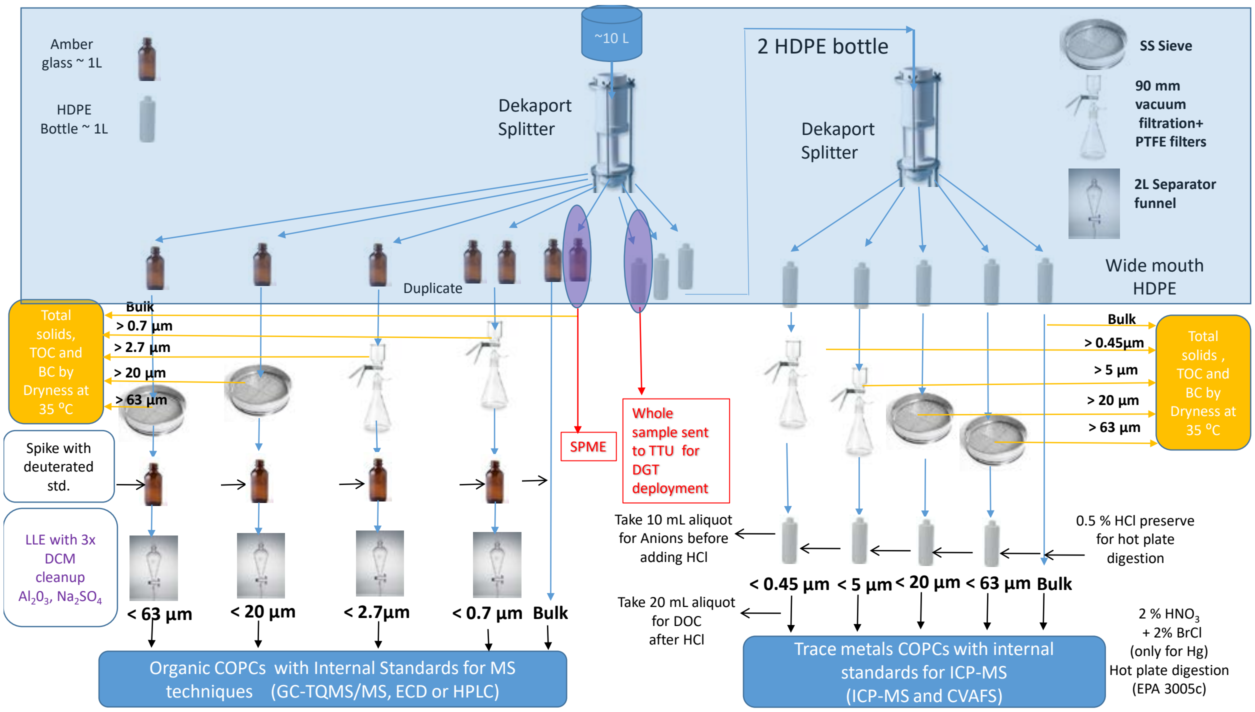

Figure 1 Composite sample splitting schematic for stormwater samples

The solids accumulated on the sieves and filters were used to estimate the mass of solids in individual size fractions by differences. The solids can be further filtered, if necessary, to remove colloidal organic matter retained with the solids and rinsed to remove salts, if from a saline water sample. The solids were dried and the retained solids determined gravimetrically. The difference between filtered solids in two adjacent size filters defines the solids within that size range defined by those filters. For example, the solids and chemical loading in the 20 to 63 µm size range is determined by the difference between the solids mass collected on the 20 µm filter and that on the 63 µm and the contaminant loading by the difference in concentration of the respective filtrates.

A similar approach can be used for chemicals of concern, in this case measuring the contaminant concentration in the filtrate. The calculations for a chemical within a specific size range are illustrated in Figure 2. In short, one of the replicate samples was filtered to remove any contributions from particle sizes larger than that filter and the filtrate was analyzed. The mass of any contaminant or total solids in a particular size fraction was determined by difference (e.g. the total solids or contaminant mass in the >63 µm size fraction was determined by the difference in mass between the bulk samples and the 63 µm filtrate).

The concentration in mass/volume of stormwater in a particular filtered size interval is proportional to the mass of contaminant in the stormwater discharge (concentration x volumetric flow= mass of contaminant released). The concentration can also be normalized by the suspended particle concentration in a particular size fraction to provide an equivalent concentration in mass per mass solids on those solids. The latter represents the maximum bulk solid concentration that can be expected due to sediment recontamination. That is, if the sediment in that size fraction were to settle to the bottom of the receiving waters it is not expected to become more concentrated that at the discharge point. Typically, dilution by other sources or receiving water background sediments would likely reduce the average sediment concentration in most systems.

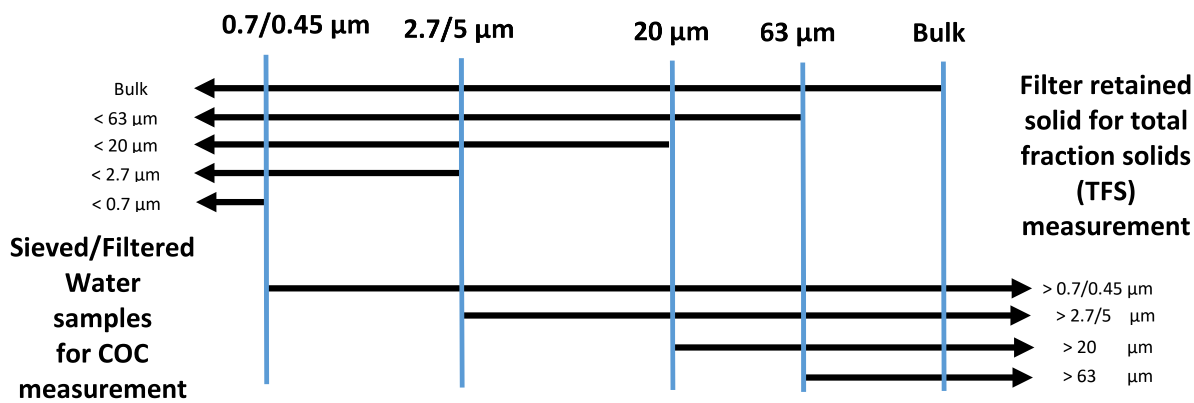

Figure 2 Fractionation of stormwater samples to determine total solids or contaminant mass within a particular size fraction by difference between different filtrate measurements

Stormwater discharges that are expected to lead to significant sediment recontamination would have the following characteristics

1. Sufficiently high mass loading in a particular suspended solids fraction leading to settling within the area of concern (e.g. µg/L of contaminant in a >63 µm for rapid settling near the stormwater discharge location)
2. Contaminant concentration on the solids (e.g. mg/kg) that is greater than background or sediment concentrations generated by other sources

The bulk stormwater samples or the samples in a particular size range may also be subjected to toxicity bioassays or measurement of freely available water concentration via passive sampling. The freely available water concentration is increasingly viewed as a surrogate for biological availability. The evaluation of toxicity through passive sampling or bioassays can identify contaminant fractions that may not be significantly contributing to potential sediment or stormwater toxicity or to identify contaminants of primary concern. Chronic toxicity tests with the purple sea urchin (*Strongylocentrotus purpuratus*) embryos were employed in ER-2428 but any water toxicity test relevant to the contaminants of concern might be used.

The methods outlined above were specific to ER-2428 but these can be applied more generally and may be needed to achieve the goal of size segregated contaminant loads and biological effects.

3. Receiving water monitoring

The stormwater discharges need to be linked directly to sediment recontamination. The particle size distribution can provide clues as to where the stormwater contaminants are likely to settle. Water column modeling can provide further clues as to where deposition of the stormwater is likely to occur leading to the potential for sediment contamination.

The most direct way to measure the deposition of stormwater contaminants is through sediment traps placed both near the stormwater discharge and at different locations leading ultimately to a reference location that is unlikely to be directly impacted by the stormwater discharges. Settling chambers provide a direct indication of what is currently depositing as opposed to sediment samples which represent deposition over time as well as subsequent resuspension and reworking events. The settling traps may need to be in-place over a season or multiple storm events in order to collect enough sample to characterize the newly depositing sediments.

The sediment traps employed in ER-2428 were prefilled with hyper-saline brine and topped off with ambient seawater. The high density brine keeps the sediment in the trap from being resuspended after collection. Traps were capped and lowered into the water to divers whom secured the traps to pre-deployed posts on the sediment surface. Once placement was complete, divers carefully removed caps from each sediment trap. Sediment traps were re-capped when any diving related activities occurred on station to avoid potential deposition from those efforts. Potentially, caps could be placed on the traps or automatically triggered if events occur that are not desired to be monitored (such as navigation activities in the vicinity of the traps). At the termination of sediment trap deployment period, divers placed caps back on the traps and recovered and transferred the traps to the surface crew with the assistance of a boat-mounted davit. Traps were transported back to the laboratory and allowed to settle. Once trap material sufficiently settled, overlying water was removed and the remaining material was collected for further processing (i.e. physical, chemical or bioassay analysis).

The sediment within a sediment trap can be subjected to conventional bulk sediment analysis. The total mass collected within a trap (e.g. mg) can be compared to the load of suspended solids from the stormwater (e.g. mg/L). The ratios of particular size fractions may yield a constant ratio for that size particle from the stormwater to the settling trap if there are no other significant sources. This ratio can be compared for different contaminants to try and identify contaminants that are predominantly contributed by stormwater. The concentration in the sediment trap sediments (e.g. mg/kg) can also be compared to the concentration on the stormwater solids. If the sediment traps exhibit concentrations or masses in excess of that which can be linked to the stormwater discharge, alternative sources should be investigated. For strongly solid associated contaminants and for stormwater dominated contributions to the depositing sediment, the ratio of the particle concentration or total mass in the settling trap to that in the stormwater should be a constant. Deviation from a constant can again be a clue to identify the potential for alternative sources.

Sediment traps that can collect ongoing depositing sediment should be the primary goal of identifying potential sampling locations in receiving waters but other sampling approaches for sediments (surficial sediment and cores) as well as physical characterization of the water (salinity, oxygen content, flow) may be useful or required by regulations. Bulk sediment collection, however, has the potential to be influenced by historical sources and may be dominated by other ongoing sources and so the data from these samples are not directly indicative of sediment recontamination.

Sediment trap and collected sediment material should also be subjected to bioassays and passive sampling to try and evaluate bioavailability and effects. In ER-2428, Cd and PAHs in stormwater were primarily found in large (>63 μm) particles. Bioassays showed minimal bioaccumulation or no change in bioaccumulation of the Cd and PAHs and passive sampling showed no change in porewater concentration in sediment pre and post storm events. These data suggest that the PAHs that were leading to rapid bulk sediment recontamination may have little or no biological significance. In this case, it was due to the presence of PAHs in large carbon particles with limited release of these PAHs from these particles. There is no regulatory framework to routinely take bioavailability into account in stormwater discharges but this information could be a moderating factor in decisions made to manage stormwater.

4. Stormwater and receiving water modeling

The data collected from the stormwater conveyance system and the receiving waters are necessarily limited to a small number of events. The complexity of the size fractionation recommended makes it likely that fewer events can be monitored than by conventional stormwater modeling. It is believed, however, that fewer events with the information needed to assess sediment recontamination is much better than more events with more limited monitoring that will lead to ambiguous results relative to sediment recontamination.

In ER-2428, Paleta Creek stormwater monitoring data was used with the WinSLAMM stormwater quality model that was calibrated for the area during previous projects. This project used the flow calculations from the model (calibrated using the detailed land use and development characteristics for the modeled areas in the Paleta Creek watershed, along with long-term regional rain data). The flow data was used in conjunction with the monitored metal and organic contaminant data for several particle size ranges to allow better predictions of the fates of the discharged stormwater particulates after discharge to the receiving waters. The monitoring data and the modeled results were coupled with measurements of receiving sediment impacts and ecological effects. The stormwater modeling enabled calculations of stormwater discharge characteristics as determined by specific drainage area characteristics and activities in the Paleta Creek watershed allowing extrapolation of individual monitored storm events. These stormwater loading predictions, along with information affecting the fate of the discharged suspended and bedload sediments (e.g. particle size distributions and related settling rates), were used to quantify the recontamination potential of the sediments by stormwater discharges.

Receiving water characteristics and sediment deposition and recontamination can also be explicitly modeled. In ER-2428, CH3D was employed to simulate depositional processes. The primary role of the model was to help determine the deposition distribution of particular size particles and to help in linking sources to that deposition as well as examining long-term behavior. As with WinSLAMM, calibration with the characteristics of a particular receiving water environment is typically necessary for quantitative predictions.

WinSLAMM was developed to evaluate stormwater runoff volumes and pollutant loadings in developed areas during a wide range of rain conditions, not just very large storms that are the focus of conventional drainage design models. WinSLAMM determines the runoff based on local rain records and calculates runoff volumes and pollutant loadings from each individual source area within each land use category for each rain. Examples of source areas include: roofs, streets, paved storage areas, loading docks, small landscaped areas, large landscaped areas, sidewalks, and parking lots.

WinSLAMM can use any length of rainfall record as determined by the user, from single rainfall events to several decades of rains. Besides determining the main sources of the stormwater contaminants of concern, the model can calculate the benefits for a series of stormwater control practices, including rain barrels and water tanks for stormwater irrigation, pavement and roof disconnections, roof rain gardens, infiltration/biofiltration in parking lots and as curb-cut biofilters, street cleaning, wet detention ponds, grass swales, porous pavement, catchbasins, media filters, hydrodynamic devices, selected proprietary devices, and combinations of these practices located throughout the watersheds and at the outfalls. The model evaluates the practices through engineering calculations of the unit processes based on the actual designs and sizes of the controls specified and determines how effectively these practices remove runoff volume and pollutants.

WinSLAMM does not use a percent imperviousness or a curve number to generate runoff volume or pollutant loadings. The model applies volumetric runoff coefficients to each “source area” within a land use category depending on site and rainfall characteristics. Each source area has a different runoff coefficient equation based on factors such as: slope, type and condition of surface, soil properties, etc., and calculates the runoff expected for each rain. The runoff coefficients were developed using monitoring data from typical examples of each site type under a broad range of conditions.

Each source area also has a unique pollutant concentration (event mean concentrations - EMCs - and a probability distribution) assigned to it. The EMCs for a specific source area vary depending on the rain intensity. EMCs of many source area types can be estimated based on extensive monitoring conducted in North America by the USGS, Wisconsin DNR, University of Alabama, and other groups. These monitoring efforts isolated source areas (roofs, lawns, streets, etc.) for different land uses and examined long term data on the runoff quality. The pollutant concentrations are also continuously updated as new research data become available, including information collected from source areas at naval facilities. Nationwide regional calibrations based on the National Stormwater Quality Database are available as initial background that can be supported and modified by local monitoring data (as was done for the Navy).

For each rainfall event in a data set, WinSLAMM calculates the runoff volume and pollutant load (randomized EMC x runoff volume) for each source area. The model then sums the loads from the source areas to generate a land use or drainage basin subtotal load. The model continues this process for the entire rain series described in the rain file. It is important to note that WinSLAMM does not apply a “unit load” to a land use. Each rainfall produces a unique load from a modeled area based on the specific source areas in that modeled area.

The model’s output is comprehensive and customizable, and typically includes:

1. Runoff volume, pollutant loadings and EMCs for a period of record or each event.
2. The above data pre- and post- for each stormwater management practice.
3. Removal by particle size from stormwater management practices
4. Other results can be selected related to flow-duration relationships for the study area, impervious cover model, biological receiving water conditions, and life-cycle costs of the controls.

A full explanation of the model's capabilities, calibration, functions, and applications can be found at www.winslamm.com. For this project, the parameter files were calibrated using the local San Diego naval facility monitoring data (http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Site_Descriptions_Calibration_and_Sources_Feb_17_2014.pdf), supplemented by additional information from regional data from the National Stormwater Quality Database (NSQD), available at: http://bmpdatabase.org/nsqd.html as described in the following report describing regional calibrations of WinSLAMM using NSQD information:

http://unix.eng.ua.edu/~rpitt/Publications/8_Stormwater_Management_and_Modeling/WinSLAMM_modeling_examples/Standard_Land_Use_file_descriptions_final_April_18_2011.pdf.

5. Conclusions

The sampling outlined in the preceding steps is believed to provide the stormwater program manager the best opportunity to evaluate the magnitude and significance of stormwater discharges on sediment recontamination. To make the best use of this information it should be one part of a stormwater assessment and management effort that includes modeling to evaluate how these impacts will change with management actions.

Note that it is possible that there are substantial stormwater impacts on bulk sediment recontamination but even then bioavailability evaluation through toxicity and bioaccumulation testing may indicate that this recontamination is not significant compared to other ongoing sources or background sediment resuspension and settling. There remains no routine regulatory paradigm to take this behavior into account but the information collected by the recommendations herein may provide the basis for a determination of no significance of these ongoing discharges.