Remedy and Recontamination Assessment Array

SERDP SEED Project 2537

Final Report

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List of Acronyms

ADCP	Acoustic Doppler Current Profiler
BRI	Benthic Response Index
CAB	Cellulose Acetate Butyrate
DGT	Diffusive Gradient in Thin Film
DoD	Department of Defense
DO	Dissolved Oxygen
EMNR	Enhanced Monitored Natural Recovery
EPA	Environmental Protection Agency
ERDC	Engineer Research and Development Center
ESTCP	Environmental Security Technology Certification Program
IBI	Index of Benthic Integrity
ISMA	*In situ* Microcosm Arrays
HOC	Hydrophobic Organic Compound
LOD	Limit of Detection
MNR	Monitored Natural Recovery
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OBS	Optical Backscatter
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRB	Passive Reactive Barrier
PRC	Performance Reference Compound
RARA	Remedy and Recontamination Assessment (array)
RBI	Relative Benthic Index
RI/FS	Remedial Investigation/Feasibility Study

RIVPACS	River Invertebrate Prediction and Classification System
SDI	Swartz's Dominance Index
SEA Ring	Sediment Ecosystem Assessment Ring
SERDP	Strategic Environmental Research and Development Program
SSC Pacific	Space and Naval Warfare Systems Center Pacific
SON	Statement of Need
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency

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1. Abstract

1.1 Objective

SERDP Statement of Need (SON) ERSEED-15-01 called for the development of tools to identify the sources of ongoing contaminant influx to sediment sites capable of identifying ongoing contaminant sources that can be accounted for appropriately in remedy selection, design, implementation, and monitoring directly within the area of concern. The objective of this project was to demonstrate proof of concept for a remedy and recontamination assessment (RARA) array that can provide site-specific, direct measurement of recontamination potential and impact on a range of remedies while providing increased realism compared to laboratory treatability studies and reduced cost and complexity compared to large-scale field pilot studies.

1.2 Technical Approach

The technical approach built on our broad experience with the development of *in situ* monitoring and assessment tools in establishing methodologies for *in situ* sediment treatment arrays. Our intention was to leverage the project by building the prototype systems from components that were on-hand or readily available, and testing the arrays at a site where pilot-scale treatment testing was ongoing and recontamination is a potential concern. Development and testing of the RARA array focused the following research tasks: (1) Conceptual design of the array and field methodology; (2) Construction of the prototype arrays and initial pier-side testing of the methodology; (3) Proof-of-concept field deployment of the prototype RARA array, and (4) Initial evaluation of the performance and feasibility of the method. In the first task, the project team developed the conceptual design and methodology while considering the best designs and procedures for moving systems from the lab to the field and providing the capability to sustain the experiments in the field for time periods that are adequate to assess both recontamination and remedy performance. Based on the design developed in task 1, we constructed a prototype array that incorporated the key design features. The methodology developed in task 1 was initially tested pier-side at the SSC Pacific test facility in San Diego Bay.

Using the prototype RARA array and methodology developed in task 2, we then conducted a limited initial proof-of-concept deployment in the field. Contaminated sediments for testing in the array were collected from a nearby Navy sediment site (Naval Base San Diego Chollas Creek) that is currently being investigated under the Total Daily Maximum Loading (TMDL) program. These sediments were treated with thin-layer treatments of clean sand or clean background sediment from a reference area in San Diego Bay. Untreated controls were also included. The array was then placed back in the bay at the SSC Pacific pier and monitored for a period of about 5 months. In the final task, results from the pier-side and field testing were used to provide an initial assessment of the performance and feasibility of the RARA array methodology. The analysis focused on the extent to which this exploratory research was able to address the key questions, and the outcome of the proof-of-concept testing.

1.3 Results

The RARA system was successfully designed and constructed based on the goal of providing an integrated technology for assessing the effectiveness of different sediment remedies when subjected to varying pressures from site conditions and recontamination loadings. The system

design balances requirements for multiple treatments, controls and replication with the constraints of size, weight, deployability and cost. The RARA array allows remedies to be tested *in situ* and on-site while reducing costs that would be associated with costly pilot-scale studies. The system incorporates standard cylindrical sediment traps around the perimeter of the array that provide adequate capture area to collect incoming depositional sediments. The prototype system also incorporated an ADCP, OBS and temperature/dissolved oxygen sensor to monitor conditions during the deployment. The system design allows for a range of measurement endpoint capabilities to provide the basis for the assessment or remedy effectiveness and recontamination.

As part of the proof-of-concept deployment, we used the RARA system to evaluate two aspects of remedy and recontamination performance for the untreated and treated Chollas Creek site sediments. Performance of two sediment treatments including a thin-layer clean sand treatment and a thin-layer clean sediment treatment was evaluated relative to untreated Chollas Creek site sediment. The deployment was also used to evaluate the concept of source influence on the remedies by removing the known source inputs at Chollas Creek by moving the RARA array to an area without significant ongoing sources.

1.3.1 Effects of Removing Site Associated Stressors

To determine the influence of removing localized sources, the T-Zero and T-Final concentrations in the untreated Chollas Creek sediments were compared. Comparing the T-Zero and T-Final concentrations of the untreated Chollas Creek site sediments, both the physical and chemical properties of the bulk sediment remained relatively consistent over the 5-month period. Sediment traps showed moderate deposition rates and contaminant concentrations that were generally lower than the concentrations in the untreated sediments, confirming the effective removal of recontamination from site sources. Porewater trends in the untreated sediments between T-Mid and T-Final were mixed, with most metals, Total PAHs and Total Chlordane showing downward trends, while Total PCBs and Total DDXs showed increases. Over the same time period, bioaccumulation of metals generally remained unchanged, Total PAHs and Total Chlordane showing decreasing uptake, and PCBs and DDXs showed increasing uptake. Benthic community health compared between T-Zero and T-Final in the untreated sediments showed that total abundance was reduced, but virtually every other metric of benthic health improved in association with moving the exposure to the undisturbed location. Based on these findings, we concluded that:

Overall, these results support the conclusion that removing the impacts of the creek sources and physical disturbance that are present at the Chollas Creek site resulted in some minor changes in sediment chemistry and bioavailability, but also resulted in some clear improvements in benthic community health. Because the chemical changes appear to be relatively minor, we suspect that the changes in benthic community health may results primarily from the removal of the physical disturbances that are known to occur at the Chollas Creek site primarily due to ship movements and associates propeller wash. We conclude that the deployment demonstrated the utility of the RARA system to assess changes in source pressure and site conditions on the response of site sediments with potential practical applications to impairment assessment, source control, and the performance of monitored natural recovery remedies.

1.3.2 *Effects of the Applied Treatments*

To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment at the T-Zero, T-Mid and T-Final conditions (depending on the measurement endpoint).

Comparing bulk sediment concentrations in treatments to untreated controls, we found reductions in a broad range of contaminant levels with the largest magnitude of reductions in the sand treatment, followed by the clean sediment treatment. Changes in bulk sediment concentrations appeared to be driven primarily by the treatment application as opposed to new deposition as indicated by the sediment traps. Comparison of trap sediment concentrations to treated sediment concentrations indicated that depositing sediments generally had contaminant concentrations that were higher than the sand treatments, but lower or comparable to the sediment treatments. These results suggest that incoming sediments would exert some upward pressure on the thin-sand treatments, but would generally have only a small downward pressure on the thin-sediment treatments. Sediment porewater concentrations measured in both treatments were generally comparable to untreated controls for metals and Total PAHs, while showing reductions in Total PCBs. Bioaccumulation results indicated that bioavailability in the sediment treatments was comparable to the untreated sediments for all contaminants with the exception of zinc which was slightly reduced in the sand treatment. The bioaccumulation measurements generally indicate minimal effects of the treatments with respect to reduction in bioavailability. Comparing the T-Zero untreated Chollas Creek site sediment to the T-Final treated sediments, we found broad improvements in benthic community metrics. These improving trends were stronger for the sediment treatment compared to the sand treatment.

Overall, the treatment results support the conclusion that both the clean sediment and sand treatments were effective in reducing bulk sediment concentrations when compared to untreated sediments. However, more direct measures of bioavailability including porewater and bioaccumulation indicated minimal improvement for both treatments compared to untreated controls. In contrast, direct measurements of benthic community health showed broad improvements especially in the clean sediment treatments. We conclude that the deployment demonstrated the utility of the RARA system to assess changes associated with sediment treatments using multiple lines of evidence, and that the system is effective in determining the relative performance of different sediment treatments relative to untreated controls.

1.4 Benefits

The RARA system was successfully designed and constructed based on the goal of providing an integrated technology for assessing the effectiveness of different sediment remedies when subjected to varying pressures from site conditions and recontamination loadings. The system design balances requirements for multiple treatments, controls and replication with the constraints of size, weight, deployability and cost. The RARA array allows remedies to be tested *in situ* and on-site while reducing costs that would be associated with costly pilot-scale studies. The method incorporates a broad range of measurement endpoints including surface sediment chemistry, sediment trap depositional mass and chemistry, porewater passive sampler chemistry, bioaccumulation, toxicity, benthic infauna, and sediment tracers. The system is well-suited to assess a range of remedies including thin caps, amendments, geofabrics, and natural recovery. Overall, the RARA system represents a new paradigm in cost-effective, realistic remedy performance assessment that was previously unattainable.

A key aspect for future applications of the RARA system is the potential for order-of-magnitude cost savings compared to more complex and expensive pilot scale treatability studies. Pilot scale studies at multiple DoD sites including Puget Sound Naval Shipyard, Pearl Harbor, and Hunters Point all indicate costs in excess of $1M compared to RARA costs which are much closer to $100K for a comparable assessment. Future research and applications with the RARA system have the potential to significantly reduce cost and complexity while still providing much more realistic and defensible data than can be obtained from laboratory treatability studies. To achieve this, future applications should consider optimization of the system and field design to achieve a higher degree of statistical power while balancing this against costs. We envision this could be achieved by replicating the array (so the system is still physically manageable) and deploying multiple units. Using multiple units would allow the study design to be scaled up and down based on site-specific requirements.

The RARA system has clear future applications for DoD sediments in the RI/FS process. The primary application should be in reducing uncertainties associated with remedy selection for site-specific conditions. While there is a broad range of guidance on remedy selection for sediments, understanding of how these remedies will perform under site specific conditions is still a very challenging area of research and practice. Future applications of the RARA system can provide a cost-effective means of providing site-specific and remedy-specific empirical data to reduce this uncertainty and thus improve the likelihood of remedy success. This has major implications for cost avoidance associated with overly conservative assumptions during remedy selection, and potential remedy failures due to inadequate consideration of site-specific conditions.

Another aspect of future demonstrations and applications should focus on the assessment of recontamination. The RARA system provides a methodology that could be standardized for assessment of recontamination potential at specific targeted points of interest. Because the system incorporates pre-characterized sediments that can be deployed and retrieved relatively easily, monitoring of changes associated with ongoing sources is greatly enhanced. This is also supported by the onboard instrumentation that provides documentation of conditions and potential discharge and disturbance events.

Important next steps for the RARA technology include optimization of the array and associated instrumentation, development of hardware and methodologies to support the deployment of multiple systems, broader demonstration at DoD contaminated sediment sites under a range of conditions, and transition into application with standard processes including RI/FS and TMDL.

2. Objective

The SERDP Statement of Need ERSEED-15-01 called for the development of tools to identify the sources of ongoing contaminant influx to sediment sites capable of identifying ongoing contaminant sources that can be accounted for appropriately in remedy selection, design, implementation, and monitoring directly within the area of concern. Experience has shown that in most urban and industrial harbors and rivers, complete elimination of sources prior to implementing remediation is often unfeasible [1,2]. Continued exposure to low-level sources from permitted discharges, upstream contaminated sites, or from stormwater discharge can potentially slow or even reverse the improvements achieved through remediation. This in turn can drive significant additional costs for re-assessment and additional cleanup efforts [3]. The research described here was motivated by a need to develop a systematic method to assess recontamination potential, and remedy resilience so that these impacts can be effectively weighed within the feasibility study and as a context for the planning and interpretation of remedy effectiveness monitoring. There is currently no defined methodology to achieve this, and recontamination potential is generally poorly understood, and only marginally evaluated at most contaminated sediment sites. Fundamentally, we demonstrated a proof of concept for a generalized capability to assess recontamination potential on a site specific basis and in the context of anticipated remedial actions. The capability provided a basis for (1) quantifying the ongoing contaminant influx to sediment sites, (2) characterizing the interaction of this influx with both existing sediments and remediated sediments, and (3) conducting site-specific, *in situ* treatability studies that incorporate interaction with recontamination sources. Thus this work is both highly relevant to the SERDP statement of need, and critically important to long-term remedy success at DoD contaminated sediment sites.

The objective of this study was to demonstrate proof of concept for a remedy and recontamination assessment (RARA) array providing site-specific, direct measurement of recontamination potential and impact on a range of remedies while providing increased realism compared to laboratory treatability studies and reduced cost and complexity compared to large-scale field pilot studies. The goal was to determine if the integration of an in situ treatment microcosm with measures of flux, exposure and bioavailability could provide a simple and effective tool for site specific assessment of both the level of recontamination at the site and the effectiveness of proposed remedies under realistic conditions that include recontamination flux. Given the limited-scope nature of the SEED proposal, key research questions to be pursued were limited to the following:

- Can microcosm experiments that are traditionally run in the laboratory be effectively replicated in the RARA field array?
- Can the experiments be sustained for time periods that are relevant to the assessment of both recontamination and remedy performance?
- Can differences be detected by the arrays as a function of sediment treatment?
- Can differences be detected by the arrays as a function of recontamination exposure?

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3. Background

Research and practical guidance, including United States Environmental Protection Agency (USEPA) and DoD documents stress the importance of source control in effective sediment remediation [4,5]. For example, EPA Risk Management Principles for Contaminated Sediment Sites [6] stress the need to "control sources early" and Navy policy on sediment site investigations and response actions [7] "specifies that the source must be identified and controlled before cleanup." There is also broad recognition that source control is not always completely achievable due to the complexity of many sediment sites, the diversity of on- and off-site sources, the difficulty of controlling non-point (e.g. stormwater, aerial deposition; [8,9]; Figure 1) and point sources (e.g. Combined Sewage Overflows, NPDES discharges; [10,11], as well as the potential for nearby and off-site sediments to continue to act as sources [1,12]. In recognition of these challenges, EPA and DoD guidance recommend that the potential for recontamination be factored into the remedy selection process and into the long-term monitoring plan for the site [1,13]. However, even with significant effort during the remedial investigation and feasibility study, it may be difficult to adequately factor recontamination into the remedy [14]. Recent evidence from a number of sites and a review of remediated sites highlights the difficulty of the problem, and the uncertainty associated with source control at contaminated sediment sites [2,15-20]. The review identified twenty sites (including several DoD sites) where recontamination has been reported, arising from a range of inputs including uncontrolled point sources, and incomplete remediation in adjacent and upstream areas [2]. Given that the cost of remediating DoD sediments is estimated to approach $2 billion, the implications for recontamination at these sites are significant [3].

The SERDP/ESTCP sediment workshop held in 2012 outlined priority and critical research needs that still require effort to accomplish long-term management goals [1]. Among the highlighted ***critical needs*** were:

- Improved Understanding of Off-Site Source Assessment and Potential Recontamination of Sites
- Improved Assessment of Parameters that Impact Long-Term Effectiveness of *In situ* Amendments and Amended Caps

As noted in the workshop, the first need was "specifically relevant to the assessment of incoming off-site contaminant loads and methods to quantify how those loads might directly change the surface sediment concentrations on a remediated sediment surface." This included (1) the development of methods to determine how ongoing sources could be accounted for in remedy selection, design, implementation and monitoring, and (2) the development of monitoring tools to quantify source characteristics and load and connect these to downstream surface sediment concentrations. The second need included a focus on screening tests and pilot-scale demonstrations to "evaluate the ability of amendments and amended caps to be effective in the face of continued low-level sources and determine their assimilation capacity." These critical needs are directly addressed by the research proposed here.

Figure 1. Stormwater plume carrying particulate and urban runoff to the coastal zone in Southern California (from [21]).

Microcosms have been widely used to study sediment processes in the laboratory for many decades [22-24]. Their use has spanned a broad range of applications including assessment of sediment oxygen demand, redox and diagenesis studies, nutrient cycling and eutrophication, biodegradation assessment, toxicity testing, and evaluation of bioaccumulation to name a few [25-28]. Aspects of this testing have been effectively moved to field application including *in situ* toxicity and bioaccumulation testing [29,30], as well as assessment of benthic infaunal recolonization ([31-33]; see Figure 2 for example). Recently we have demonstrated the ability to standardize aspects of these tests using the SEA Ring technology and provide reliable control approaching what can be achieved in the laboratory while gaining the benefit of realistic field exposure conditions [34,35]. A similar evolution is taking place in groundwater assessments particularly for the assessment of remedial technologies as illustrated by the recent ESTCP-funded effort ER-200914 which demonstrated *in situ* microcosm arrays (ISMAs) for "Parallel *In situ* Screening of Remediation Strategies for Improved Decision Making, Remedial Design, and Cost Savings."

There are key fundamental advantages of these *in situ* strategies when considering the critical challenges in assessing remedy effectiveness under conditions of ongoing low-level contamination including that: they provide a direct means of evaluating remedy performance under site specific conditions; they naturally incorporate the influence of ongoing sources into the performance assessment; and, they represent a significant improvement in realism over laboratory treatability studies while also providing significant potential cost savings over pilot-scale testing (often exceeding $1M). Currently there is no standardized technology or methodology for conducting these tests in sediment. Thus *we hypothesize that a new capability as envisioned by the RARA array could provide the basis of a scientifically-sound, cost-effective methodology for including source assessment during sediment remedy selection, and also provide a basis for reducing costs by potentially replacing larger-scale pilot studies.*

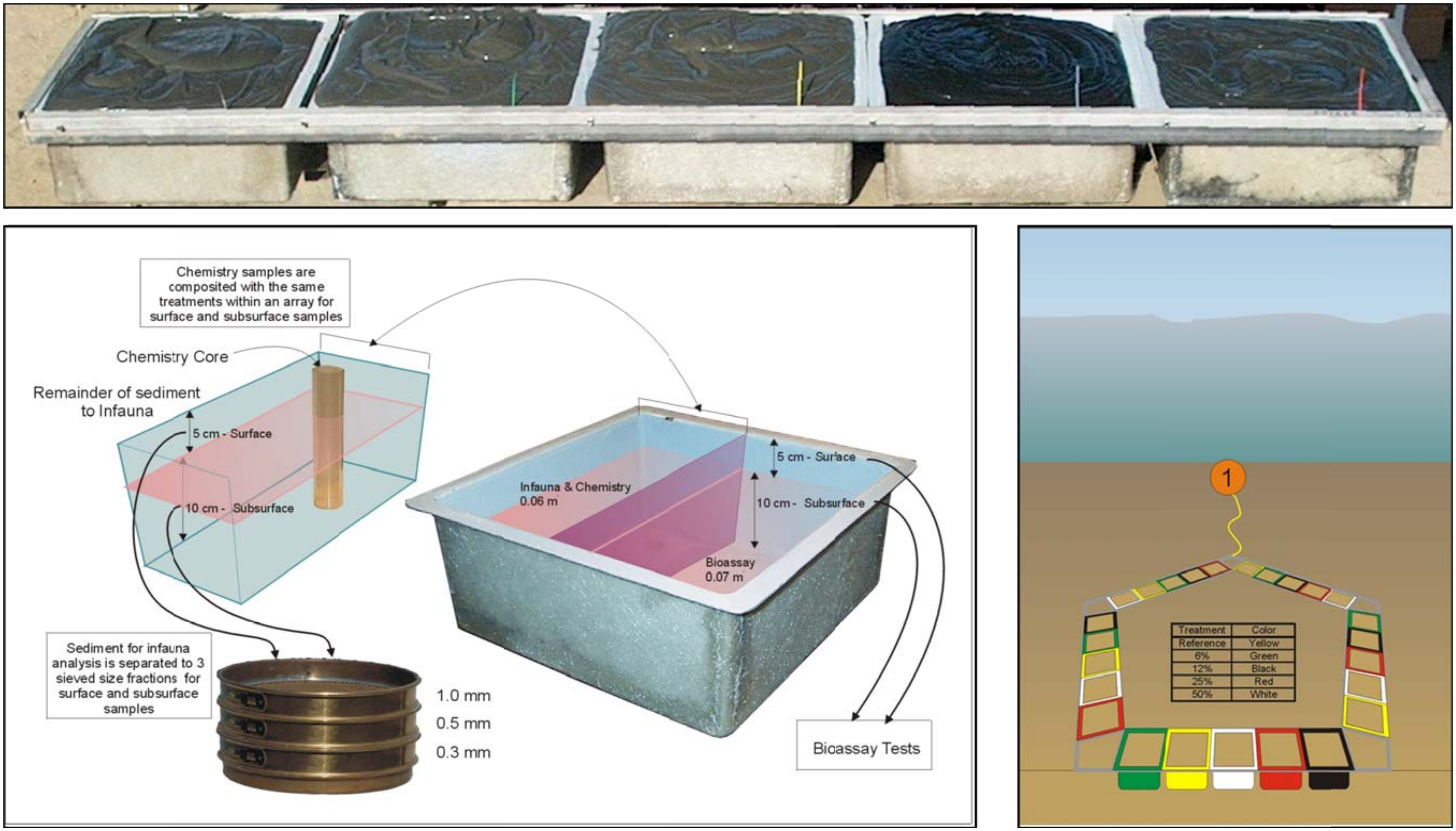

Figure 2. An example of an in situ microcosm array developed and applied by MEC, 2003 [33] in the Port of Los Angeles, California showing the multi-container array (top), schematic for replicate array configurations (lower left), and the methodology used to process the sediment treatments from each array (lower right).

4. Materials and Methods

The technical approach built on our broad experience with the development of *in situ* monitoring and assessment tools and the initial work of Moore et al [30] in establishing methodologies for *in situ* sediment treatment arrays. Due to the limited-scope nature of the effort, our intention was to leverage the project by building the prototype systems from components that are on-hand or readily available, and testing the arrays at a local area that was easily accessible without complicated permitting or access requirements but where recontamination is a potential concern. Development and testing of the RARA array focused on addressing the key questions identified above through the following tasks: (1) Conceptual design of the array and field methodology; (2) Construction of the prototype arrays and initial pier-side testing of the methodology; (3) Proof-of-concept field deployment of the prototype RARA array, and (4) Initial evaluation of the performance and feasibility of the method.

4.1 Project Tasks

4.1.1 Task 1) Conceptual design of the array and field methodology

In this task, the project team met to develop the conceptual design and methodology. The purpose of the meeting was to evaluate key requirements for the system and associated design and methodology features that we felt were responsive to the project research questions listed above. Specific design considerations that were addressed at the meeting included discussion of the number of treatment and control cells, replication requirements, the size of the cells, the types of measurement endpoints to use, the types of treatment to test, instrumentation to include, and the overall configuration of the system including considerations for size, weight and deployability. The meeting also focused on developing a draft approach for a typical field application as the basis for the draft RARA methodology, and a schedule of events and milestones for the remainder of the project. The meeting resulted in a bulleted outline of the conceptual design, a design sketch, an outline of the methodology, and a proposed schedule. Based on the conceptual design, an engineering design was then completed and circulated to the team for approval prior to construction in Task 2. Results of Task 1 are discussed below.

4.1.2 Task 2) Construction of the prototype arrays and pier-side testing of the methodology

Based on the design developed in Task 1, the focus of Task 2 was to construct the prototype system and conduct limited pier-side testing to work out any bugs in the system and refine the draft methodology. We constructed a prototype array that incorporated the key design features. The prototype includes 6 replicate microcosms constructed from off-the-shelf Chem-Tainers installed in a rigid aluminum or fiberglass frame with instrumentation and sediment traps housed in the central portion of the array. The depth, volume and particle trapping characteristics of the microcosms can then be adjusted by using containers of different height. The bottom of the chambers can include screened ports in the bottom to allow for groundwater migration through the system if desired, and the tops can be fitted with mesh to minimize predation and can also accommodate lids to control particle influx. As opposed to the SEA Ring systems in which multiple small cores are pushed directly into the existing sediment bed, the RARA array can be pre-filled with sufficient sediment volume to assess remedy performance and response to contamination. Instead of being pushed into the sediment the RARA is designed to simply be set on top of the existing sediment bed. The methodology developed in task 1 was initially tested pier-side at the SSC Pacific test facility in San Diego Bay. This facility provided full access to bay surface water and sediment in water depths ranging from about 0-20 feet, and sandy to sandy silt substrates. The prototype system and methodology we developed are described in the results section below.

4.1.3 Task 3) Proof-of-concept field deployment of the prototype RARA array

Using the prototype RARA array and methodology developed in task 2, we conducted a limited initial proof-of-concept deployment at the SSC pier location using site sediments collected from Naval Base San Diego Chollas Creek TMDL site. The Chollas Creek TMDL site was selected because of specific interest from the Navy related to potential recontamination at that site from the upstream creek sources, and the opportunity to leverage historical and ongoing characterization efforts at the site. The focus of this field deployment was to (1) evaluate the utility of the RARA array for assessing performance of sand and natural sediment thin-layer placements in comparison to untreated sediments, and (2) evaluate the utility of the RARA array to quantify the improvement that would occur by removing the influx of recontamination. This testing addressed the last two key research questions posed above of: *Can differences be detected by the arrays as a function of sediment treatment*, and; *Can differences be detected by the arrays as a function of recontamination exposure?*

Thus our field design included replicate microcosms representing treated and untreated site sediments moved to an area where the recontamination source was no longer present to represent future conditions when creek sources had been controlled. Incoming fluxes were monitored using the sediment traps as well as the onboard acoustic Doppler current profiler (ADCP) and optical sensors. Bioaccumulation and passive sampler uptake were used as the primary measures of performance in the different treatments and exposures. The deployments extended over a period of about 5 months and included the following events (Table 1).

- T-Zero: Site and treatment sediment collection, setup and deployment of the array in late April
- T-Mid: Exposure and sampling event spanning from late May to late June
- T-Final: Exposure and sampling event spanning from mid-July to mid-August

4.1.4 Task 4) Initial evaluation of the performance and feasibility of the method

Results from the pier-side field testing were used to provide an initial assessment of the performance and feasibility of the RARA array methodology. The analysis focused on the key research questions posed above, the extent to which this exploratory research was able to address these questions, and the outcome of the proof-of-concept testing (see Table 2). The ability to effectively transfer microcosm methods to the field was evaluated based on the success in performing the passive sampler and biological testing on multiple treatments while simultaneously monitoring relevant recontamination fluxes and related site environmental conditions. The assessment also evaluated the ability to sustain testing over time durations sufficient to detect both performance differences and recontamination fluxes. Finally, an initial analysis was performed to determine if the system could detect difference based on sediment treatment and recontamination exposure under real field conditions. The results from these tasks allowed us to evaluate proof of concept for the RARA array and determine if further research and development is warranted for this promising concept.

Table 1. Field event schedule for the RARA array deployment and monitoring.

Field Event	Date
T-Zero Sediment Collection	4/20/2016
T-Zero Treatment Preparation	4/21/2016
T-Zero Collect Initial Sediment Samples	4/21/2016
T-Zero Deployment	4/22/2016
T-Mid Clam and Passive Sampler Installation	5/24/2016
T-Mid DGT Sampler Retrieval	6/1/2016
T-Mid Clam and PE Sampler Retrieval	6/21/2016
T-Final Clam and Passive Sampler Installation	7/18/2016
T-Final DGT Sampler Retrieval	7/25/2016
T-Final Clam and PE Sampler Retrieval	8/15/2016
T-Final Sediment Coring and Bethic Community Sampling	8/15/2016

Table 2. Research questions and associated performance measures.

Research Question	Performance Measures	Success Criteria
Can microcosm experiments that are traditionally run in the laboratory be effectively replicated in the RARA field array?	Development of prototype system, establish form factor and physical requirements, integration of measurements and monitoring systems, address quality control and replication	Adequate physical requirements to replicate lab microcosms, adequate monitoring to provide assessment of conditions during deployment, adequate replication to address localized variability
Can the experiments be sustained for time periods that are relevant to the assessment of both recontamination and remedy performance?	Initial pier side testing and subsequent proof-of-concept deployment	Equipment functions properly for deployment period, deployments can be sustained for weeks to months
Can differences be detected by the arrays as a function of sediment treatment?	Compare baseline sediments to thin cap and/or carbon treatment cells	Passive sampler and/or tissue concentrations measurably different in different treatments
Can differences be detected by the arrays as a function of recontamination exposure?	Comparison of T0 cell conditions to Tfinal cell conditions and evaluation of sediment trap contents	Passive sampler and/or tissue concentrations measurably different in T0 vs Tfinal and reflected in traps sediments

4.2 Field and Laboratory Methods

Because one aspect of the project was development of the RARA methodology, details of the method associated with the RARA are described in the results section. Common procedures used in support of the RARA field testing are described below.

4.2.1 Sediment Collection

Site sediments were collected by Van Veen grab from the collection site at Chollas Creek (area of historical stations C02 and C03; [36]) with the coordinates 32.68524 degrees north latitude (NAD83), 117.134925 degrees west longitude (NAD83) and a depth of approximately 40 ft MLLW (Figure 3). Sediments from the grab were placed in a pre-cleaned mixing tray and gently stirred. The material was then subdivided into the six RARA sediment cells, and a seventh cell used for the T-Zero sampling for benthic community analysis and physical and chemical analysis. Between each grab the sampler and the tray were rinsed with surface water. The process was repeated until the sediment cells had been filled to the desired level (~15 grabs). Grab samples with evidence of washout, overflow, or other quality issues were discarded away from the sampling area and re-taken.

Sediments from the reference site used for the clean sediment treatment were collected using the same Van Veen grab procedure from a reference site (NS2233) located at 32.685810 degrees north latitude (NAD83) and 117.151735 degrees west longitude (NAD83) in a water depth of about 12 ft MLLW. Sufficient numbers of grabs (~5) were collected to provide the volume required for the RARA treatments, along with physical and chemical samples. The material was homogenized, and then screened through a 1 mm sieve to remove the benthic community. A subsample of the homogenized and screened sediment was collected into the containers for the physical and chemical analysis.

Sediment for the sand treatment was Quikrete Play Sand (Model # 111351). An adequate volume of sand for the treatments and samples was placed in a large tub, homogenized and rinsed with unfiltered deployment site water. A subsample was collected for physical and chemical analysis.

Site sediment and treatment sediments were held in the sediment cells or tubs with overlying surface water under cool conditions overnight prior to application of the treatments and deployment of the RARA.

At the beginning (T-Zero) and end (T-Final) of the RARA deployment, sediment samples were collected directly from the sediment cells for physical and chemical analysis as well as benthic community analysis. Sediment coring procedures are described below. Samples for benthic community analysis were collected by separating off one undisturbed quadrant of the sediment cell with acrylic barriers (Figure 19), and then scooping sediment from this quadrant to a depth of about 20 cm (comparable to the Van Veen sediment grab depth). In the T-Zero sample, two quadrants of sediment were collected for the sample. In the T-final samples, quadrant samples from the two replicate RARA sediment cells were combined into a single benthic community sample of approximately the same volume as the T-Zero sample.

4.2.2 Sediment Coring

Sediment cores were collected from the RARA sediment cells at the beginning (T-Zero) and end (T-Final) of the experiment were collected using hand-pushed 7 cm diameter plastic core liners cut to a length of about 30 cm. For the T-Zero event, the cores were collected from a seventh sediment cell filled specifically for that purpose so as not to disturb the six cells being used during the RARA testing. The cores were collected from an undisturbed quadrant of the RARA sediment cells after separation with the acrylic panels as shown in Figure 19. The cores were pushed to a depth of about 25 cm. The remainder of the core liner was then filled with to the top with surface water, a cap was placed on the top, and the core was removed and immediately capped on the bottom. Caps were secured with electrical tape. A total of two cores were collected from each cell and numbered by cell number (1-6) and replicate letter (a or b). The cores were allowed to settle overnight in the refrigerator at -4 C. The following day, photos were taken of every core from each cell. The cores were then extruded to remove the top 10 cm from each core. Replicate samples from each cell were homogenized to create a single sample, and the samples for each cell were then shipped to the laboratory at ERDC for analyses.

4.2.3 Benthic Community

Benthic community analyses were conducted for the original site sediments from Chollas Creek, and for the T-Final RARA event for the site sediment control, clean sediment treatment and sand treatment cells. Sediments were collected as described in the Sediment Collection section above. Sediments were sieved on site through a 1 mm sieve. The sieve-retained fraction was transferred to a glass jar and preserved with formalin. Samples were maintained under cold and dark conditions until shipment to EcoAnalysts in Moscow, ID for analysis.

EcoAnalysts sorted and identified macrobenthic invertebrate in the samples to the lowest possible taxonomic level of benthic invertebrates as described in the SOP for benthic community census sample taxonomy provided in Appendix A. Benthic community data were provided as counts per sample (by taxa) for each sample. Eleven biological indices commonly used to assess benthic community health included:

- Total abundance
- Taxa richness
- Species diversity, as measured by Shannon-Wiener Diversity Index (H')
- Species evenness, as measured by the Pielou’s Evenness Index [37]
- Species dominance, as measured by Swartz’s Dominance Index (SDI, [38])
- Pollution tolerance, as measured by the Benthic Response Index (BRI, [39])
- Community response to stress, as measured by the Index of Biological Integrity (IBI, [40])
- Composite response, as measured by the Relative Benthic Index (RBI, [41])
- Reference relationship, as measured by the River Invertebrate Prediction and Classification System index (RIVPACS, [42])
- Composite response, as measured by the Integrated Benthic Index [43]

4.2.4 SP3™ Passive Samplers

Polyethylene passive samplers were used to measure porewater organic contaminant concentrations during the T-Mid and T-Final measurement periods. SP3™ samplers consist of a polyethylene strip encased in a protective stainless steel mesh [44]. The samplers used for the RARA events measures 4 × 10 cm. The samplers are pre-loaded with performance reference compounds and the SiREM service provides both the analytical and partitioning analysis to directly report final porewater concentrations. SP3^{TM} passive samplers were shipped to SSC Pacific from SiREM in coolers on ice and maintained in the dark below 4 C until deployment.

At deployment, the passive sampler was removed from the sample bag using gloved hands, and the sample location within the RARA was logged on the sampling bag and in the log book. A zip tie was attached to the sampler through the stainless steel mesh, and the sampler was inserted vertically into the sediment so it was centered at a depth of about 10 cm below the sediment water interface. The zip tie was left protruding from the sediment for subsequent retrieval. One sampler was placed in each of the sediment cells, so that replicate samples were collected for each control and treatment. The time of deployment was recorded for each sampler. The samplers were left in place for an exposure period of 28 days.

During retrieval, the samplers were pulled out of the sediment using the protruding ziptie and gloved hands. The samplers were gently rinsed with surface water and then DI water to remove residual sediment. The samplers were then placed in their respective sample bag, all of the bags were placed in secondary bags, and loaded into a cooler with ice and shipped to the laboratory for processing and analyses.

At the laboratory, the stainless steel mesh envelope was unfolded and the polyethylene sheet placed on aluminum foil on the laboratory benchtop. All processing used gloved hands, cleaned stainless steel forceps or scissors, and cleaned aluminum foil, following clean laboratory techniques. Both sides of the strip were wiped with a Kimwipe moistened with ultrapure water to remove any remaining particles, mud, or biofilms. The strip was placed in a 15-mL pre-cleaned amber glass vial without folding. The vial was then spiked with surrogate recovery compounds per standard laboratory procedures for analyses, and sufficient volume (e.g., 5 to 10 mL) of methylene chloride, ultrapure grade or equivalent, was added to completely submerge the polyethylene strip. After 12 or more hours, the solvent was transferred and retained in another sample vessel (amber glass to avoid photodegradation). An additional aliquot (e.g., 5 to 10 mL) of solvent (e.g., methylene chloride) was added to the original vial with the strip, and the sample agitated for 10 or more minutes on a shaker table.

The two extracts were combined into a single vessel for pre-concentration. The polyethylene strip was removed from the vial, allowed to air dry, and weight recorded to ± 0.0001 g. The combined extracts were then concentrated using rotary evaporation or equivalent and transferred to the autosampler vial for GCMS analysis according to standard laboratory procedures. Following pre-concentration, appropriate injection standards were added, and samples analyzed for polychlorinated biphenyl congeners (PCBs), polycyclic aromatic hydrocarbons (PAHs), and chlorinated pesticides by GCMS. For each sample, the mass of the polyethylene and concentration of organic analytes in polyethylene on a dry weight basis (i.e., ng analyte per g PE [dry weight basis]) were reported. These results were then converted to porewater concentrations based on performance reference compound corrections by SiREM. The standard operating procedure for the SP3 samplers is included in Appendix B.

4.2.5 DGT Passive Samplers

DGTs were acquired from DGT Research, Lancashire, UK. We utilized the disk style LSNM loaded DGTs for metals that can be used to measure a range of cationic metals including Cd, Co, Cu, Fe, Mn, Ni, Pb, Zn. The DGTs consisted of a plastic molded base (2.5 cm diameter) and a plastic top with a 3.14 cm2 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.

Prior to deployment, DGTs were stored in sealed, clean plastic bags at 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 transported to the field site in coolers with Blue Ice to maintain temperature. Just prior to deployment, 2 DGTs were removed from individual bags and inserted approximately 10 cm deep into the sediment inside each of the six RARA cells. The DGTs were connected to a colored zip-tie to facilitate recovery. DGTs were deployed for a period of 7 days. The time of each individual DGT deployment and recovery was recorded to the minute for subsequent concentration determination. Additionally, temperature data loggers were deployed concurrently to measure average temperature during the DGT deployment.

During retrieval, the samplers were pulled out of the sediment using the protruding ziptie. Each DGT was rinsed thoroughly with deionized water from a wash-bottle and excess water was shaken off. The DGTs were placed in a labeled and clean plastic bag with minimal airspace and stored in the refrigerator at 4°C until processed.

In the laboratory the 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-HNO3) 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 H2O) acidified to pH 2 with Q-HNO3 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 HNO_3 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 (0.8mm) plus the thickness of the filter membrane (typically 0.14 mm), D is the diffusion coefficient of metal in the gel (see Table 1), t is deployment time and A is exposure area ($A=3.14\ cm^2$).

Analytical quantification of metals included blanks, standard reference materials (SRM), samples analyzed in duplicate, and spiked samples in each ICP-MS run. A blank made up or 18 MΩ/cm H2O acidified to pH 2 with Q-HNO_3 is included after every 5 samples in the ICP-MS run. The standard deviation of the measured blank concentrations (StdDevBlanks) was used to estimate the limit of detection (LOD= 3*StdDevBlanks) and the limit of reporting (LOR=10*StdDevBlanks. The trace metal certified SRM 1643e, Trace Elements in Water, from the National Institute of Standards & Technology was also analyzed several times in each ICP-MS run. The SRM is also diluted in pH 2 18 MΩ/cm H2O to a level commensurate with the calibration curve. At least one diluted sample was spiked with Perkin Elmer Multi-Element Solution 3 (PEMES 3) and included in each ICP-MS run. In general the QA/QC was accepted when the expected values for SRM are within 15% of the certified concentration.

4.2.6 Bioaccumulation

Bioaccumulation studies using appropriate sediment dwelling organisms were used to determine if treatments or changes in source exposure in the RARA array led to differences in exposure and uptake to benthic organisms.

The bent-nose clam, *Macoma nausta*, was deployed in the RARA array as a 28-d bioaccumulation endpoint for the tested sediments. The RARA array was deployed off the pier at SSC on April 22nd, 2016. Ten 1-cm perforated, CAB core liners that were 11" in length were placed into the sediment just prior to deployment. The core liners had ½" flexible titanium mesh secured at the bottom to ensure clam recovery but minimize sediment disturbance. The chambers were buried in the sediment and filled in with extra sediment to make sure the height of sediment in the core matched the array.

Clams were deployed in two separate 28-d deployments; the first deployment occurred on May 24th, 2016 and the second deployment occurred on July 18th, 2016. The clams were received 4-6 days prior to deployment and acclimated to site conditions (i.e. 20°C water temperature). During each deployment, 5 clams were placed into 5 core liners and the top was secured with a ¼" stainless steel mesh cap to protect clams from predation. After each deployment, the core liners with clams were removed from the RARA array and the clams were recovered by hand, enumerated and placed in clean 0.45 µm filtered seawater for overnight depuration. The following day, tissues were homogenized and sent to ERDC for analysis. One clam from each replicate (5 clams per treatment), was retained as an archived sample. Time zero samples (unexposed clams frozen immediately after acclimation period) were taken prior to both deployments for baseline tissue analysis.

4.2.7 Chemical Analyses

Chemical analyses were performed on samples collected from the RARA array at different time points and from different samplers and matrices. Analyses for DGTs were performed at SSC Pacific as described under the DGT section. Analyses for all other samples were performed at ERDC following the methods described below and in the previous methodology sections.

Bulk sediment and core samples collected at T-Zero and T-Final were analyzed for grain size, TOC, metals, pesticides, PAHs and PCBs. Samples for grain size were analyzed following ASTM method D422. Total organic carbon was analyzed by the Walkley-Black method. 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. Organochlorine

Pesticides were analyzed by EPA Method 8081A. Polynuclear Aromatic Compounds were analyzed by GC/MS with Selected Ion Monitoring using EPA method 8270C. PCBs were analyzed for congeners by USEPA 8082.

Tissue samples collected at T-Mid and T-Final were analyzed for lipid content, percent moisture, metals, pesticides, PAHs and PCBs. Lipid content was determined by spectrophotometer at 490 nm following homogenization and chloroform/methanol extraction, and calibrated using stock solutions of soybean oil according to Van Handel (1985). Metals in tissue samples 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. Organochlorine Pesticides were analyzed by EPA Method 8081A. Polynuclear Aromatic Compounds were analyzed by GC/MS with Selected Ion Monitoring using EPA method 8270C. PCBs were analyzed for congeners by USEPA 8082.

SP3™ passive samplers collected at T-Mid and T-Final were analyzed for pesticides, PAHs and PCBs. Organochlorine Pesticides were analyzed by EPA Method 8081A. Polynuclear Aromatic Compounds were analyzed by GC/MS with Selected Ion Monitoring using EPA method 8270C. PCBs were analyzed for congeners by USEPA 8082.

4.2.8 Field Instruments

Field instruments deployed with the RARA array included a water quality meter (temperature and dissolved oxygen), an acoustic Doppler current profiler to measure water velocities, and an optical backscatter sensor to measure turbidity.

Temperature and dissolved oxygen (DO) were measured *in situ* using a HOBO logger (Onset© U26-001) mounted to the central area RARA array. The HOBO logger was launched with a 5 minute interval on April 22nd, 2016 at 1200. The logger was recovered at approximately 1-month intervals to download data and relaunch the logger. The data were truncated to represent only the measurements made underwater in the RARA assay.

Water velocities were measured using a Teledyne RD Instruments Workhorse Sentinel 600 kHz ADCP mounted in the central area of the RARA array. The ADCP was launched with a 15 minute interval on April 22nd, 2016 at 1200. The profiler was setup to measure currents and acoustic backscatter at 1-meter intervals between 3 meters above the bottom and the water surface. Data were collected during the entire duration of the deployment. Data collection was terminated when the RARA was retrieved on August 15, 2016. The data were truncated to represent only the measurements made underwater in the RARA assay.

Optical backscatter was measured using a Campbell Scientific OBS-3 system mounted to the central area RARA array. The OBS sensor was launched with a 10 minute interval on April 22nd, 2016 at 1200. The logger was recovered at approximately 1-month intervals to clean the lens, download data and to relaunch the logger. Data were collected during the entire duration of the deployment. Data collection was terminated when the RARA was retrieved on August 15, 2016. The data were truncated to represent only the measurements made underwater in the RARA assay.

Figure 3. Site map of San Diego Bay showing the Chollas Creek sediment site, clean reference sediment site, and the deployment location at Pier 169.

5. Results and Discussion

Results of the design, development, testing and proof-of-concept level performance are summarized below. Conclusions and implications for potential follow-on research are discussed based on these findings in the following section.

5.1 Conceptual design of the array and field methodology

During the period 10/7/2015-10/8/2015, we conducted a 2-day meeting of the principals to evaluate key requirements for the system and associated design features that were responsive to the research questions listed above. Consideration was given to the best designs and procedures for moving systems from the lab to the field and providing the capability to sustain the experiments in the field for time periods that are adequate to assess both recontamination and remedy performance. The conceptual design that we established incorporated replicate treatment microcosms, integrated sediment traps to quantify recontamination flux, an ADCP to document flow a particle plume (via backscatter) dynamics during the deployment, and water quality and optical sensors to track environmental conditions and particle concentrations (Figure 4). Key considerations for the conceptual design of the microcosms themselves required that they (1) provide the ability to evaluate a range of potential treatments and recontamination pathways (2) can be isolated from direct deposition with a lid system and thus provide a control without recontamination flux for comparative purposes, (3) can be filled with site sediments and treated with a range of amendments and thin layer passive and active capping materials and then tested alongside untreated control materials, and (4) their performance and recontamination influences can be assessed through passive samplers and organisms placed in the microcosms as well as through the integrated sediment traps and monitoring sensors. At the end of this task, we completed the prototype design and draft methodology that forms the basis for construction of the prototype system.

The conceptual design balanced the requirements for multiple treatments, controls and replication with the constraints of size, weight, deployability and cost. An important goal of the RARA was to allow remedies to be tested *in situ* and on-site while reducing costs that would be associated with costly pilot-scale studies. We arrived at a design for the system that incorporates six treatment/control cells, thus allowing for duplicates for up to two different treatments and one control sediment. The size of the cells was discussed in detail with consideration toward keeping the system low profile and the individual cells manageable, while allowing sufficient space for sampling and exposures to occur over the course of the deployment period. Our goal was to accommodate about 6-10” of native sediment and 6” of treatment while maintaining about 2-3” of overlying water in the tub once filled. We selected the ChemTainer 17 gallon open top, flat bottom cylindrical tank measuring 17" height x 18" diameter. These polyethylene containers are rugged, can be fitted with lids, can be cleaned for multiple uses and provide adequate volume and area to accommodate a range of sampling activities. While the system design only accommodates this fixed diameter, the container is available in a range of heights that could be used to accommodate different thickness and volume requirements.

To address the recontamination flux aspect of the array, we discussed a range of options including using the tubs themselves as collection devices, as well as integrating sediment traps into the system. As the conceptual design evolved, we found that there was sufficient space to accommodate standard cylindrical sediment traps within the deployment frame within gaps created by the circular nature of the test cells. This allowed for incorporation of six 17” high x 4” diameter PVC sediment traps around the perimeter of the array that provide adequate capture area to collect incoming depositional sediments.

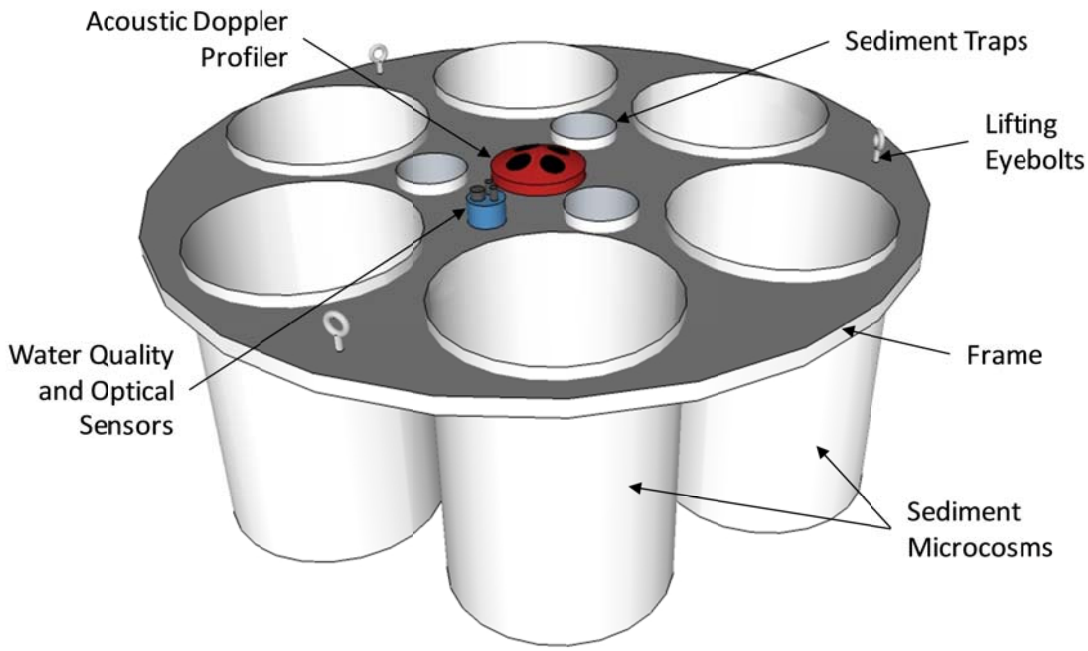

Figure 4. Preliminary concept of the RARA array showing the treatment cells, sediment traps, instrumentation, and frame components.

A number of monitoring instruments were also discussed for incorporation into the system including ADCP, OBS, conductivity, temperature, dissolved oxygen, and camera systems. The conceptual design provided a central area in the middle of the array to accommodate these instruments, and a decision was made to include at least the ADCP, OBS and temperature/dissolved oxygen sensor. The ADCP is useful in evaluating both hydrodynamics and particle plumes. The OBS provides a more direct measurement of particle concentrations in the water column near the array. The temperature and dissolved oxygen sensors provide data that is important for assessing conditions for caged organisms that were planned to be deployed within the arrays.

Based on the configuration described above, a range of measurement endpoint capabilities were discussed to provide the basis for the assessment or remedy effectiveness and recontamination. These included:

- Surface Sediment Chemistry – As an overall means of comparing treatments and assessing recontamination
- Sediment Trap Material Chemistry – To provide assessment of incoming particle contaminant loading
- Porewater Passive Sampler Chemistry – To compare potential differences in bioavailability across treatments and assess changes associated with recontamination

- Bioaccumulation - To compare direct differences in biouptake across treatments and assess changes associated with recontamination
- Toxicity - To compare direct differences in toxic response across treatments and assess changes associated with recontamination
- Benthic Infauna – To assess changes in habitat quality associated with treatments and recontamination fluxes
- Sediment Tracers – To define baseline sediment and treatment interfaces and qualitatively assess vertical mixing over time

All of these methods (and more) were expected to be accommodated by the array design. A subset of methods was selected for the proof-of-concept deployment as discussed in subsequent sections.

We also discussed the range of treatments that could be accommodated by the array. The six cells in the array will generally accommodate duplicate controls and duplicate treatments for two distinct treatment types. Cleary other arrangements are possible such as three replicates of controls and a single treatment, or duplicate controls and four replicates of a single treatment, depending on the requirements of the project. In addition, it would be relatively straightforward to add multiple arrays and thus increase the number of controls and treatments that could be accommodated in increments of six. Treatments that lend themselves well to the array include Monitored Natural Recovery (MNR), Enhanced Monitored Natural Recovery (EMNR), Sediment Amendments (e.g. activated carbon, apatite, etc.), Permeable Reactive Barriers (PBRs), Geofabrics, and other treatments that can be accommodated within the vertical scale of the array. Even dredging can potentially be assessed by collecting cores to the projected dredge horizon and using the material at this depth (with added residuals if necessary) in the array exposures. A subset of these treatments was selected for the proof-of-concept deployment.

Based on the considerations above, we completed a more detailed design for the system as a basis for construction in subsequent tasks. The component-level design is shown in Figure 5. The system consists of a light-weight aluminum frame onto which the other array components are installed. The six sediment cells are fitted into circular hoops that are part of the frame and sit on cross bars to accommodate their weight when filled with sediment. The sediment traps are installed in six triangular areas formed by the sediment cells around the perimeter of the frame. The instrumentation is all installed on brackets in the central area of the frame. The overall diameter of the frame is 5’-3” and the height is 1’-6”.

The final phase of task1 was to develop a general experimental design for the field testing, and a draft protocol for the methodology that would support the field testing. The experimental design incorporated testing of two treatments and a control. The control was defined to be untreated contaminated sediment from a site in San Diego Bay. The first treatment was a thin-layer sand cap as is traditionally used in EMNR remediation (e.g. Marine Corp Base Quantico). The second treatment was designated to be a thin-layer cap of clean natural sediment from a reference area of San Diego Bay. The second treatment type was chosen on the basis of potential transition to a proposed Navy Environmental Sustainability Development to Integration (NESDI) project that is focused on using native sediment for EMNR applications. The design called for collecting baseline samples of the site and treatment materials, followed by two subsequent sampling events (T-Mid and T-Final) over a period of about 6 months.

Based on this typical experimental design, we developed a draft protocol for the field methodology. The protocol included the following components:

- Prepare the Array
    - Site Sediment Collection
    - Sediment Treatments
    - Baseline Samples
    - Install Instruments and Sediment Traps
- Deployment
    - Install Frame to Bottom
    - Install Cells in Frame
    - Stabilize
- Sampling
    - T-Mid Install Passive Samplers and Organisms
    - T-Mid Retrieve Passive Samplers and Organisms
    - T-Final Install Passive Samplers and Organisms
    - T-Final Retrieve Passive Samplers and Organisms
    - Collect Final Samples and Instrument Data

This initial protocol was then refined and developed at additional levels of detail during the construction, testing and deployment phases of the project.

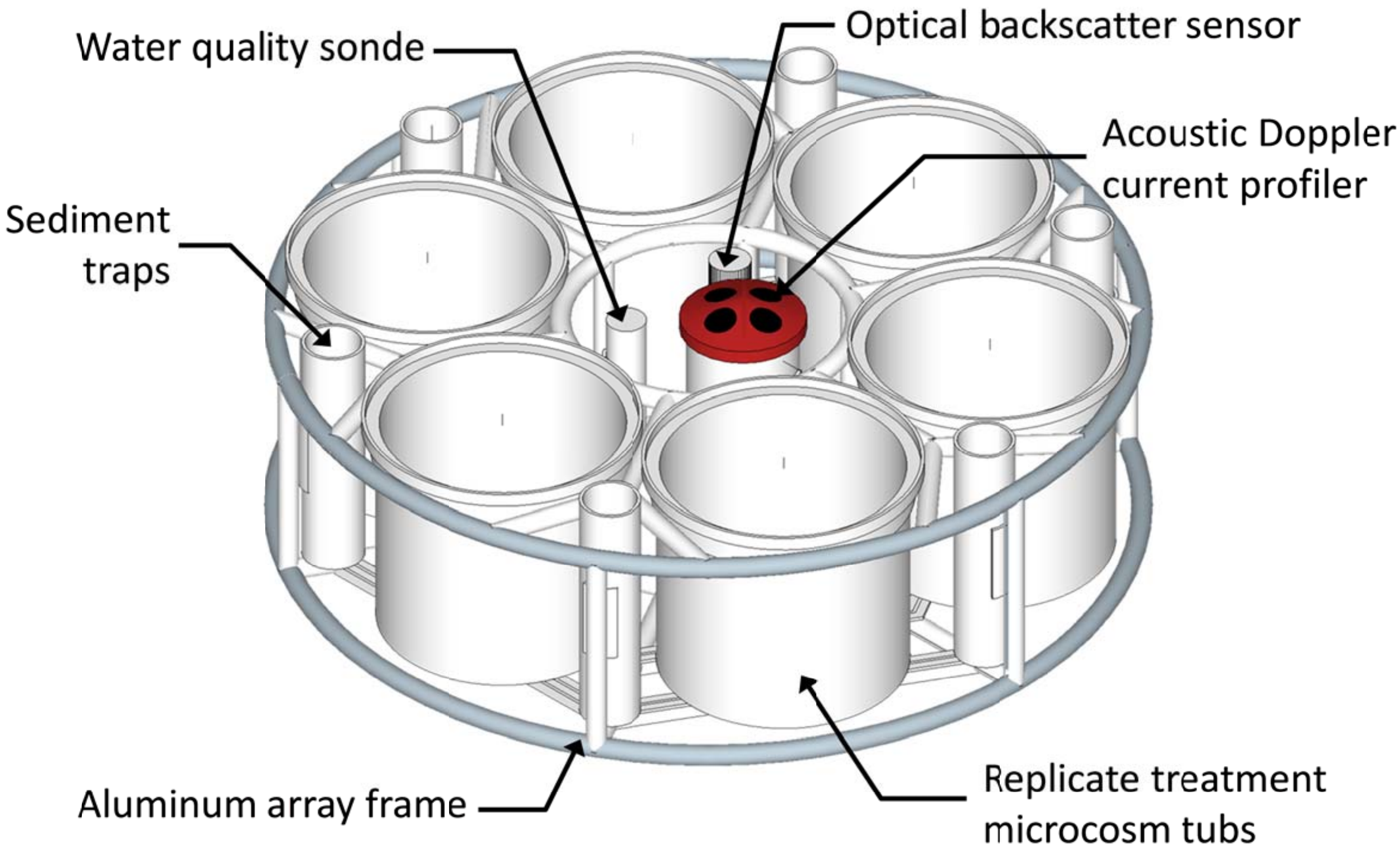

Figure 5. Final conceptual design for the RARA array.

5.2 Construction of the prototype arrays and pier-side testing of the methodology

In task 2, we completed the design and construction of the prototype array that incorporated the key design features described above. The major construction component of the RARA was the fabrication of the frame. The remaining components were largely off-the-shelf, existing equipment, or easily fabricated items. The frame construction required development of detailed engineering drawings to assure clearances and tolerances were met that would accommodate all of the desired equipment onboard the array. Drawings of the frame are shown in Figure 6. Specified frame component materials are summarized in Table 3. The drawings show the large diameter hoops that support the overall structure, the individual hoops that hold the sediment cells, the cross braces on the bottom that support the weight of the cells, the central brackets for the instruments, and the perimeter brackets that hold the sediment traps.

Design of the system was completed at the end of October 2015. A local fabricator was contracted to construct the frame. Materials for other components including the sediment cells and the sediment traps were purchased off-the-shelf from vendors. The ADCP, OBS and temperature/oxygen sensors were all available from previous projects. Other miscellaneous parts included clamps to secure the traps and instruments, small diameter line to construct lift lines for the individual sediment cells, and larger diameter line for a lifting system for the frame itself. Primary components and their costs, and the overall cost of the system not including the instruments are summarized in Table 4. From this it can be seen that the frame is about 85% of the non-instrument total cost. The total cost per unit for the RARA is only about $4500, so the system is relatively inexpensive and cost effective.

Construction of the frame was completed in mid-January 2016. The finished frame with the sediment cells inserted for test fit is shown in Figure 7. Using this prototype frame, we conducted a series of tests in the lab and at the SSC-PAC pier. These included testing the fit of the various components, testing the lifting of the individual cells, testing the lifting of the frame, and testing the deployment of the frame followed by diver-assisted installation of a sediment cell. Testing was completed in February 2016. In general, with minor adjustments, these tests were all successful and provided confidence in going forward to a proof-of-concept deployment in the field.

Table 3. RARA frame components and their construction materials.

Part	Number	Material
Outer Hoops	2	1.5" OD Aluminum tubing
Inner Hoops	2	1.5" OD Aluminum tubing
Vertical Supports	12	1.5" OD Aluminum tubing
Radial Supports - Bottom (straight)	6	1.5" OD Aluminum tubing
Radial Supports - Top (y-shape)	6	1.5" OD Aluminum tubing
Chemtainer Hoops	6	1/4" X 2" Aluminum flatbar rolled to size
Chemtainer Supports	12	1-1/2" X 1-1/2" X 1/4" Aluminum tee
ADCP Bracket	1	1/4" Aluminum plate
OBS Bracket	1	1/4" Aluminum plate
WQ Bracket	1	1/4" Aluminum plate
Sediment Trap Brackets	6	1/4" Aluminum plate

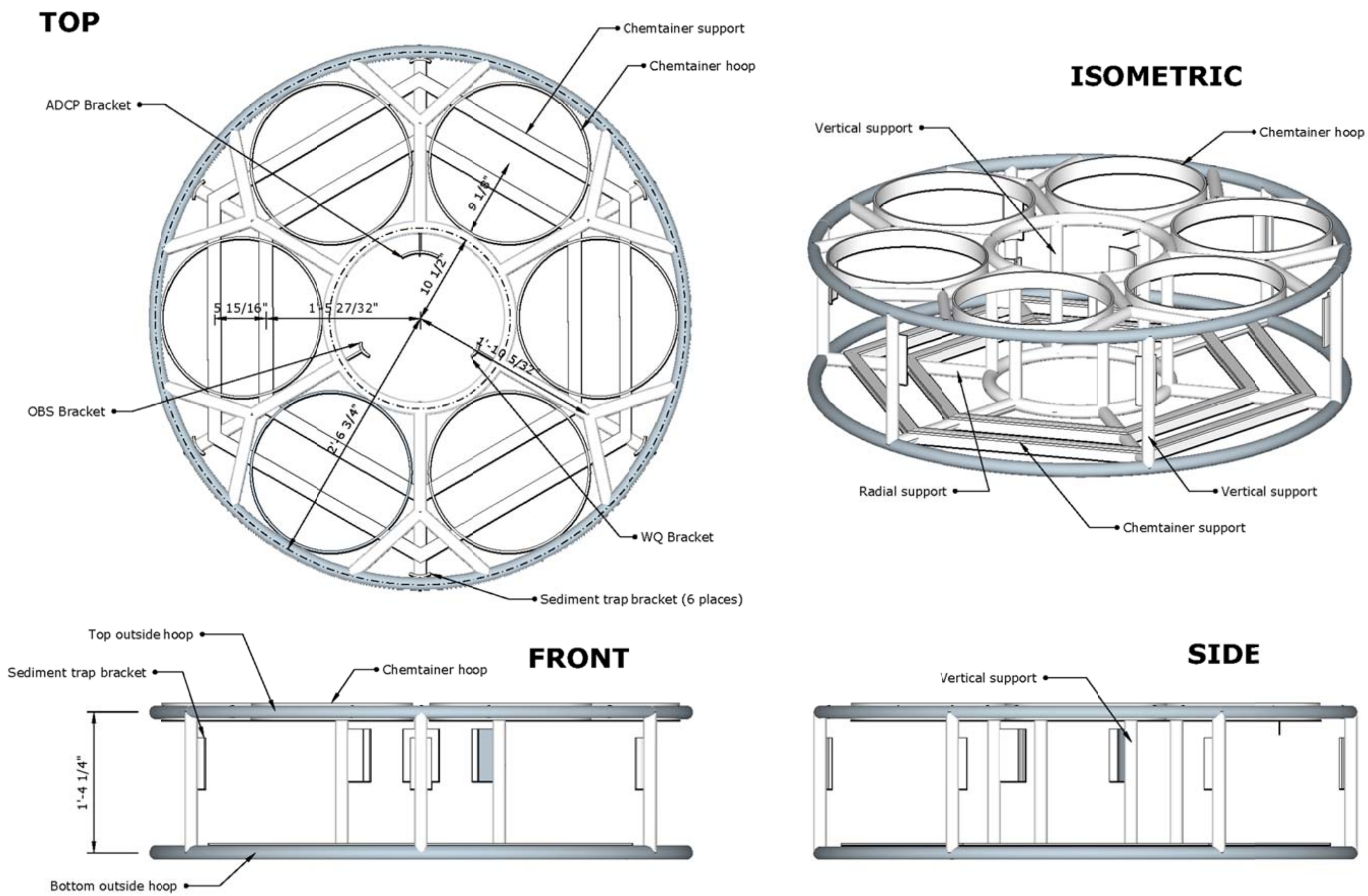

Figure 6. Construction drawings for the RARA frame.

Figure 7. Photograph of the completed RARA frame during test fit of the sediment cells.

Table 4. Overall components of the RARA system and their associated costs.

Component	Source	Description	Part Number	Unit	Unit Cost	No. of Units	Total Cost
Frame	Clint Precision Mfg., Inc.		Custom	Ea	$ 3,850.00	1	$ 3,850.00
Sediment Cells	Chemtainer	17 Gallon Open Top, Flat Bottom Cylindrical Tank	TC1815AA	Ea	$ 50.15	6	$ 300.90
Sediment Cell Lids	Chemtainer	Polyethylene Cover for 17 Gallon Cylindrical Tank	TC1815AF	Ea	$ 19.55	6	$ 117.30
Sediment Trap Body	Mcmaster-Carr	4" Diameter Schedule 40 PVC Pipe	48925K18	10 ft	$ 40.92	1	$ 40.92
Trap Bottom Cap	Mcmaster-Carr	4" PVC Pipe Cap	4880K58	Ea	$ 5.83	6	$ 34.98
Trap Removable Top Cap	Mcmaster-Carr	Flexible 4" Pipe Cap	4511K44	Ea	$ 5.31	6	$ 31.86
Sediment Cell Lift Line	West Marine	1/8" Braided Polyester Cord	179259	50 ft	$ 7.99	2	$ 15.98
Frame Lift Line	West Marine	6mm Dia. Endura Braid, 4,500 lb. Breaking Strength	3453388	ft	$ 1.93	30	$ 57.90
Trap Clamps	Mcmaster-Carr	Worm-Drive Clamp, 316 Stainless Steel	5011T37	5 Pk	$ 14.07	3	$ 42.21
Small Instrument Clamps	Mcmaster-Carr	Worm-Drive Clamp, 316 Stainless Steel	5011T41	5 Pk	$ 10.58	1	$ 10.58
Large Instrument Clamps	Mcmaster-Carr	Worm-Drive Clamp, 316 Stainless Steel	5011T38	5 Pk	$ 14.17	1	$ 14.17
						Total Cost	$ 4,516.80

5.3 Proof-of-concept field deployment of the prototype RARA array

In this task, we finalized the experimental design for the proof-of-concept deployment, refined the method protocol, and conducted the field deployment.

5.3.1 Experimental Design

The experimental design for the proof-of-concept field deployment called for evaluation of two sediment treatments to contaminated sediment collected from a site in the Chollas Creek area of San Diego Bay. The sediment treatments included duplicate cells for a thin-layer (~20 cm) clean sand treatment, a thin-layer (~20 cm) clean sediment treatment, and an untreated Chollas Creek site sediment. Sampling events were scheduled for the beginning of the deployment (T-Zero), the mid-point of the deployment (T-Mid), and the end of the deployment period (T-Final). The duration of the deployment was expected to be four months. The schedule for the deployment is shown in Table 5.

To evaluate the concept of source influence on the remedies, the experimental design called for removing the known source inputs at Chollas Creek by moving the RARA array to an area without significant ongoing sources. The SSC Pacific Pier 169 location was chosen to accommodate this design element as there are no significant sources in the area. This also allowed for easier testing and monitoring of the equipment by eliminating mobilization and access issues associated with a remote deployment. Performance relative to this removal of ongoing sources was evaluated by looking at changes in the untreated Chollas Creek sediment cells over time.

To assess the performance of the remedies in the RARA, the experimental design called for sampling events over the course of the deployment that allowed the treated cells to be compared to the untreated Chollas Creek sediment controls. Measurements of bulk sediment concentrations were made for the site and treatment sediments at the beginning of the deployment. These were compared to subsequent sediment cores that were collected from the cells at the end of the deployment. Passive samplers including SP3 and DGT samplers were deployed at the T-Mid and T-Final time periods to allow comparison of the treatments and controls based on estimated porewater concentrations. The design also incorporated bioaccumulation measurements at the T-Mid and T-Final time periods to evaluate comparative changes in bioavailability.

5.3.2 Final Protocol

Prior to the proof-of-concept field deployment, the RARA operational protocol was finalized to provide a step-by-step basis for the procedures to be used in the field. The key elements of the protocol are described below in the Preliminary Standard Operating Procedure and also included as a standalone document in Appendix C.

I. Preparation and Mobilization

- Pre-clean the sediment cells, frame, and sediment traps
- Prepare the brine solution for the sediment traps
- Ready the ADCP, OBS and water quality instruments
- Ready and clean the sampling equipment (grab, splitting tub, scoops, bottles etc.)
- Ready the treatment sand (purchase from vendor)
- Secure adequate support boat and sampling crew

II. Site Sediment Collection

- Collect site sediments - 2-3 grabs per container
- Distribute each grab to all containers
- Control cells filled 12-14”
- Treatment cells filled 8-10”
- T-Zero sampling cell filled 12-14”
- Collect sediment cores and benthic infauna samples from T-Zero cell
- Add overlying surface water to all cells
- Cover and allow site sediment to settle overnight keeping dark and cool
- Collect treatment sediment into spare cell – sufficient for 4” layer in two cells
- Homogenize and sieve treatment sediment to remove infauna
- Add treatment sand to a spare cell – sufficient for 4” layer in two cells
- Add overlying water
- Cover and keep treatment sediments cool and dark overnight

III. Apply Treatments

- Remove surface water from each cell
- Insert 10 clam chambers into control cells until ~3” is left protruding (Figure 8)
- Insert 10 clam chambers into control cells until ~7” is left protruding
- If desired, add thin layer of colored tracer at sediment/treatment interface
- Carefully add 4” layer of treatment material to each treatment cell (Figure 9 - Figure 10)
- If desired, add thin layer of colored tracer at sediment/water interface
- Collect split samples of treatment materials for T-Zero analysis
- Refresh surface water to each cell
- Cover and keep cells cool and dark until deployment

IV. RARA Deployment

- Secure boat support, crew and dive support
- Install instruments to frame and initiate data recording
- Install sediment traps to frame
- Add brine and surface water to sediment traps and cap
- Diver inspect installation location
- Install frame to bottom with diver assistance (Figure 11)
- Install cells to frame with diver assistance (Figure 12)

- Diver remove lids from cells – note time (Figure 13)
- Diver remove caps from sediment traps – note time
- Allow ~1 month for cells to stabilize

V. T-Mid Sampling Event Start

- Secure boat support, crew and dive support
- Ready the passive samplers
- Ready the clams
- Diver install caps on sediment traps – note time
- Diver retrieve OBS and HOBO loggers for cleaning and download
- Diver install covers on RARA cells – note time
- Retrieve cells one at a time (Figure 14)
- Add clams to clam chambers and install chamber covers – note time (Figure 15)
- Install passive samplers – note time (Figure 16)
- Cover and reinstall cell to frame on bottom
- Repeat for each cell
- Diver reinstalls instruments on frame
- Diver removes covers from cells – note time
- Diver removes caps from sediment traps – note time
- Allow 7 days for DGT exposures
- Allow 28 days for clam and SP3 exposures

VI. T-Mid Sampling Event DGT Retrieval

- Secure boat support, crew and dive support
- Ready sampling gear for DGTs (clean bags, DI water, labels, etc.)
- Diver retrieves DGT samplers from each cell – note time (Figure 17)
- DGT samplers cleaned and placed in clean, marked bags

VII. T-Mid Sampling Event End

- Secure boat support, crew and dive support
- Ready sampling gear for clams and SP3s (containers, bags, labels, etc.)
- Diver install caps on sediment traps – note time
- Diver retrieve OBS and HOBO loggers for cleaning and download
- Diver install covers on RARA cells – note time
- Retrieve cells one at a time
- Remove chamber covers and clams from clam chambers – note time (Figure 18)
- Rinse clams and transfer to clean containers with surface water
- Remove SP3 passive samplers – note time
- Rinse SP3 samplers and transfer to marked sample bags
- Cover and reinstall cell to frame on bottom
- Repeat for each cell
- Diver reinstalls instruments on frame

- Diver removes covers from cells – note time
- Diver removes caps from sediment traps – note time

VIII. T-Final Sampling Event Start

Same as T-Mid

IX. T-Final Sampling Event DGT Retrieval

Same as T-Mid

X. T-Final Sampling Event End

- Secure boat support, crew and dive support
- Ready sampling gear for clams, SP3s, cores, traps and benthic infauna
- Diver install caps on sediment traps – note time
- Diver retrieve OBS and HOBO loggers for cleaning and download
- Diver install covers on RARA cells – note time
- Retrieve cells one at a time
- Remove chamber covers and clams from clam chambers – note time
- Rinse clams and transfer to clean containers with surface water
- Remove SP3 passive samplers – note time
- Rinse SP3 samplers and transfer to marked sample bags
- Install partitions in each cell (Figure 19)
- Collect sediment cores from the core partition area
- Collect benthic infauna samples from the benthic partition area
- Allow sediment traps to settle and remove most of the overlying water
- Collect sediment trap samples into jars for processing

XI. Demobilization

- Process samples for shipment and/or analysis (Figure 20 and Figure 21)
- Process data from instruments
- Dispose of sediment from the cells
- Clean all equipment to remove sediment and fouling (Figure 22)
- Store equipment for future use

Table 5. Schedule of field events for the RARA array proof-of-concept field deployment.

Field Event	Date	Julian Day 2026
T-Zero Sediment Collection	4/20/2016	110
T-Zero Treatment Preparation	4/21/2016	111
T-Zero Collect Initial Sediment Samples	4/21/2016	111
T-Zero Deployment	4/22/2016	112
T-Mid Clam and Passive Sampler Installation	5/24/2016	144
T-Mid DGT Sampler Retrieval	6/1/2016	152
T-Mid Clam and PE Sampler Retrieval	6/21/2016	172
T-Final Clam and Passive Sampler Installation	7/18/2016	199
T-Final DGT Sampler Retrieval	7/25/2016	206
T-Final Clam and PE Sampler Retrieval	8/15/2016	227
T-Final Sediment Coring and Bethic Community Sampling	8/15/2016	227

Figure 8. Control sediment cell filled with site sediment and overlying water and with pre-installed clam chambers.

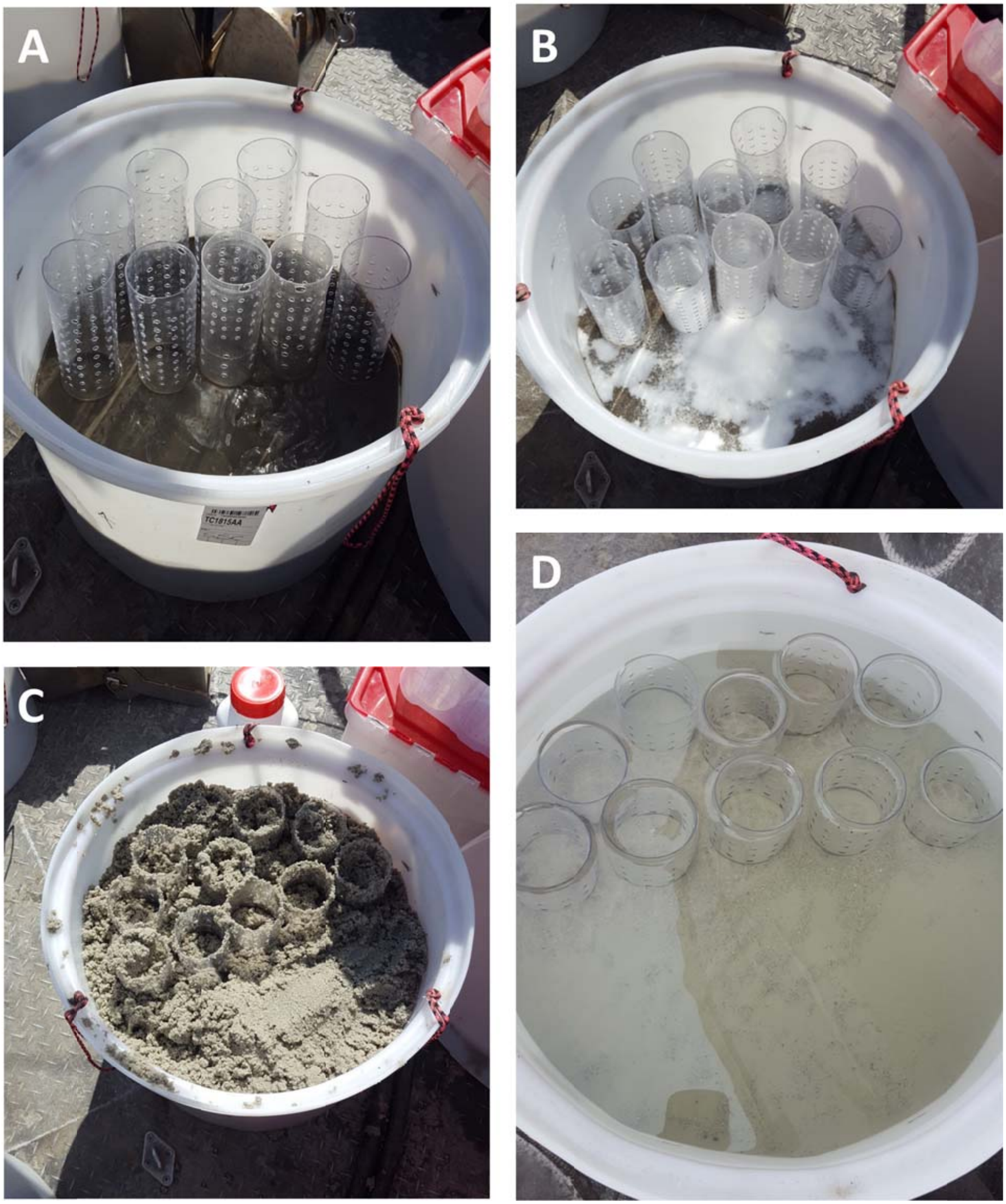

Figure 9. Sequence of the thing sand layer treatment application showing (A) site sediment prior to sand application with clam chambers installed, (B) application of silica sand visual tracer at interface, (C) addition of thin sand layer, and (D) final result with treatment and overlying water added.

Figure 10. Final result for thin clean sediment layer treatment after final installation of treatment and overlying water.

Figure 11. The RARA frame being deployed with sediment traps and instruments pre-installed from the R/V Ecos during the April 22, 2016 event.

Figure 12. Deployment sequence for a sediment cell being installed into the RARA array during the April 22, 2016 event.

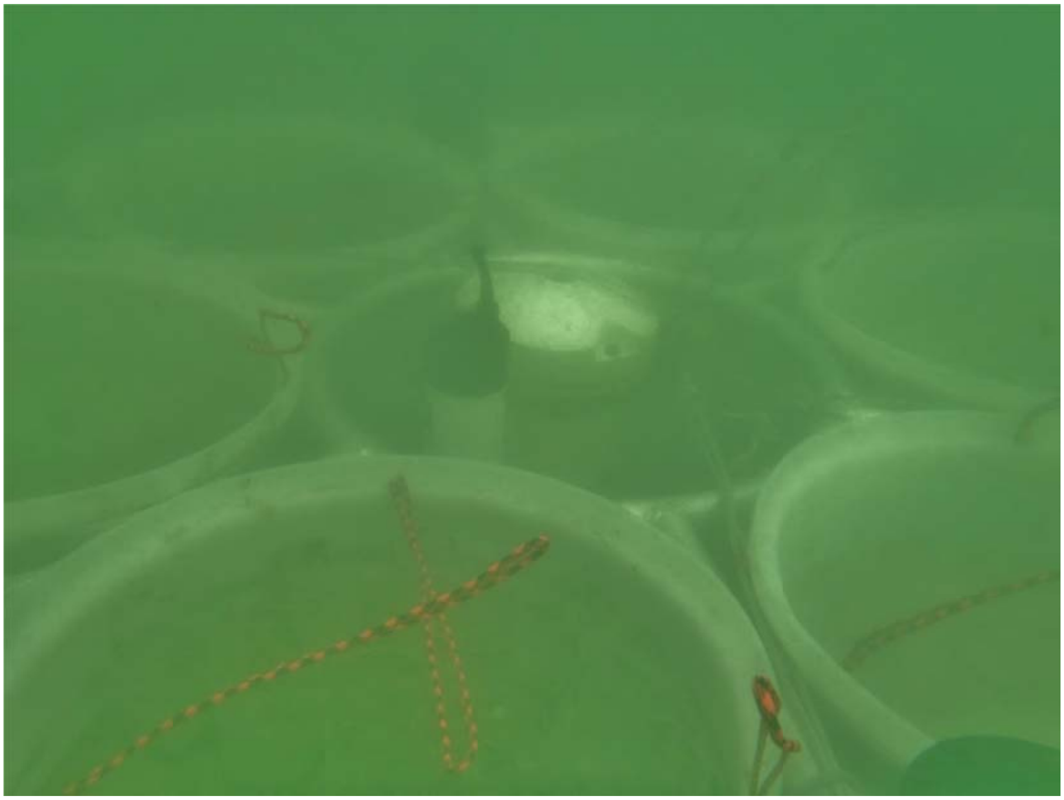

Figure 13. RARA array immediately following installation to the bottom.

Figure 14. Retrieval of individual sediment cells during the May 24, 2016 (T-Mid) event.

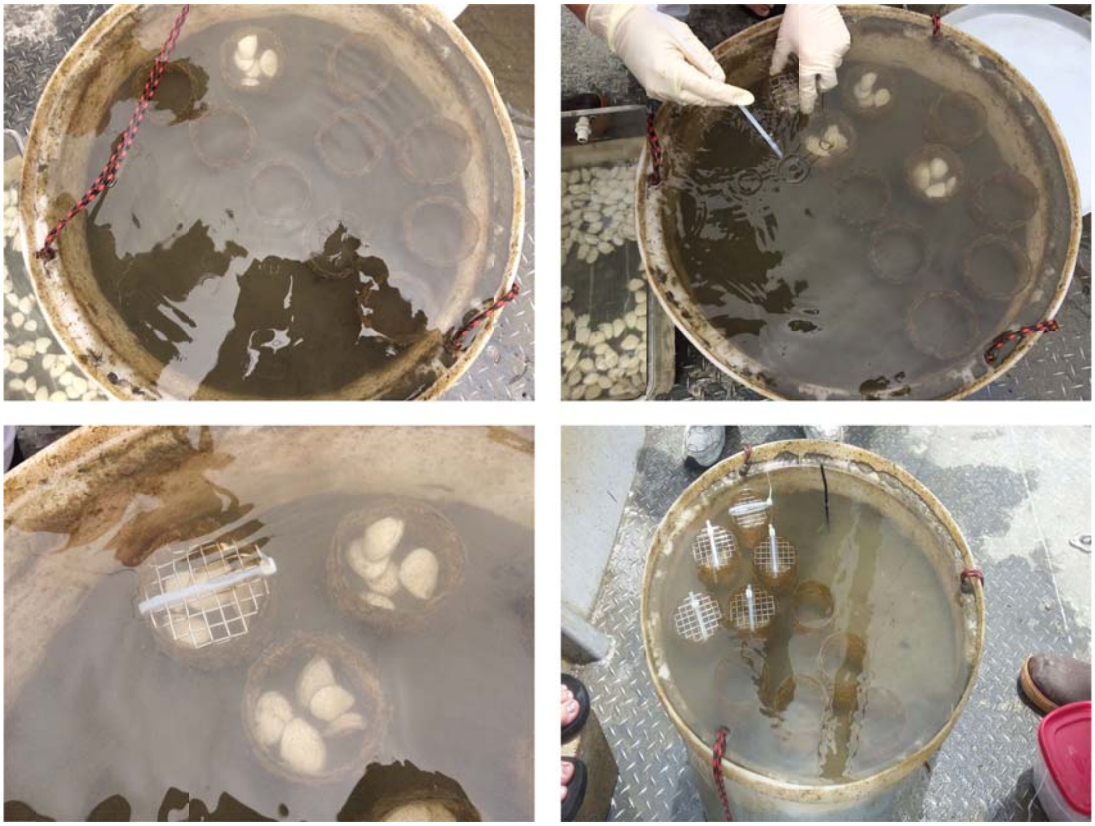

Figure 15. Sequence (clockwise from upper left) showing the installation of the clams to the pre-installed chambers during the May 24, 2016 (T-Mid) event.

Figure 16. The SP3 polyethylene passive samplers being installed during the May 24, 2016 (T-Mid) event.

Figure 17. DGT samplers retrieved from the RARA array by diver during the June 1, 2016 event.

Figure 18. Preparing to remove clams and polyethylene passive samplers from a RARA sediment cell during the June 21, 2016 event at the end of the T-Mid exposure period.

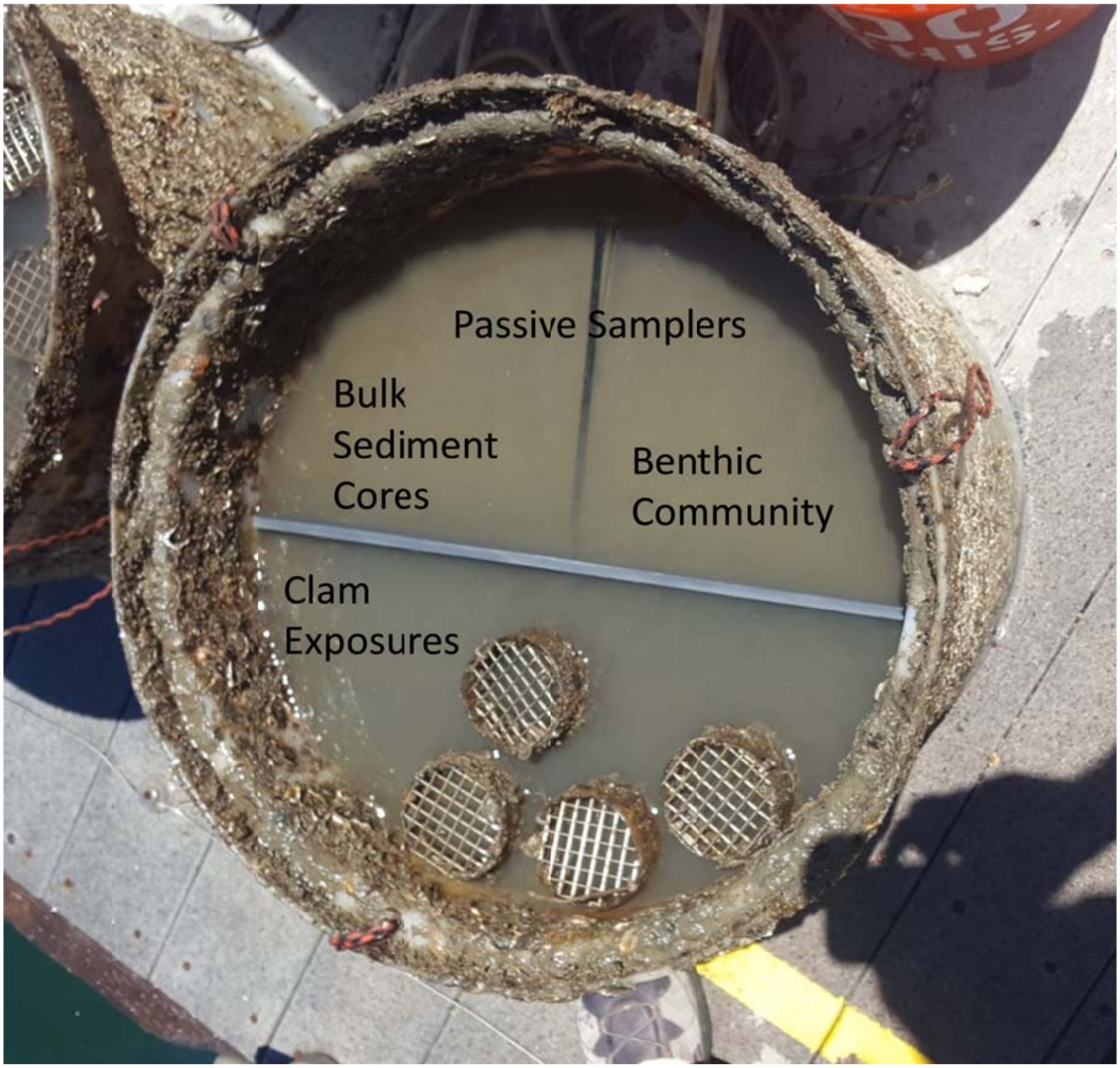

Figure 19. Photo from the August 15, 2016 event at the end of T-Final showing the segmentation of the RARA sediment cell into sampling zones for benthic community analysis, bulk sediment cores, and clam and passive sampler exposures

Figure 20. Processing benthic community samples during the August 15, 2016 event at the end of T-Final.

Figure 21. Processing clam samples during the August 15, 2016 event at the end of the T-Final exposure.

Figure 22. Removing biofouling from the ADCP and OBS instruments at the end of the RARA deployment on August 15, 2016.

5.3.3 *Proof-of-Concept Field Deployment*

The proof-of-concept field deployment for the RARA followed the protocol described above and in the methods section. Results are presented below for bulk sediment analysis, sediment traps, passive samplers, bioaccumulation and benthic community census. Supporting data from the onboard instruments and general conditions in San Diego Bay during the deployment are also presented. The results are considered in the context of the research questions originally posed for the project and restated below:

- Can microcosm experiments that are traditionally run in the laboratory be effectively replicated in the RARA field array?
- Can the experiments be sustained for time periods that are relevant to the assessment of both recontamination and remedy performance?
- Can differences be detected by the arrays as a function of sediment treatment?
- Can differences be detected by the arrays as a function of recontamination exposure?

To answer the first two questions, we evaluated our level of success in the proof-of-concept field program in all aspects of the testing ranging from preparation to deployment, sampling, retrieval and demobilization. To answer the third question, we directly compared the outcomes of the untreated site sediment controls to the sediments treated with thin-layer sand and thin-layer clean sediment for the broad range of measurement endpoints used in the study. To address the final question, the T-Zero and T-Final outcomes in the untreated Chollas Creek sediments were compared. Specific discussion of these outcomes is presented below following the description of the results for the individual measurement endpoints.

Field Conditions

Field conditions during the deployment were monitored through a combination of onboard sensors and publicly available data for San Diego Bay. Onboard sensors included acoustic backscatter and water velocities from the ADCP, water temperature and DO levels from the HOBO logger, and optical backscatter from the OBS. Publicly available data that were acquired included 6-minute water elevation (tides) from the NOAA Broadway Pier station, and daily precipitation from the NWS Lindbergh Field station.

Conditions for water elevations, acoustic backscatter, and water velocities for the entire RARA deployment period are shown in Figure 23. The results show that water elevations varied through approximately eight complete spring-neap tidal cycles with maximum tidal ranges during spring tides between 2-3 meter, and smaller tidal ranges during neap tides of about 1 meter. Acoustic backscatter, which reflects the volume of scattering material in the water column, showed significant variation (from about 160-200 dB) over both tidal and spring-neap time scales. Water velocities (averaged through the water column) were generally in the range of -5 to 15 cm/s for the north component, and about half that range for the east component, while total water speed was generally in the range of 0 – 20 cm/s. Water velocities also showed strong variability over tidal and spring-neap time scales.

Figure 24 shows a closer view of water elevations, acoustic backscatter, and water velocities for an individual spring-neap cycle between Julian Days 150-164. These data show that peak current speeds generally occur during the early phase of the larger flood tide, except during the maximum spring tides, when peak currents tend to occur during the smaller ebb tide. Figure 25 shows the same tide period with acoustic backscatter plotted directly over the water elevation.

From this it can be seen that maximum backscatter generally occurs at or just after slack low water. This is consistent with general observations for the bay that show higher particle loads further into the bay that would be advected past the RARA deployment location during low tides.

Conditions for precipitation, water temperature, DO, and optical backscatter are shown in Figure 26. In general, precipitation during the deployment period was minimal, with the only significant rainfall event occurring at about Julian Day 125 with an event total of about 9 mm. Several small events (~1 mm) occurred during the subsequent period from Julian Day 130-160. These data indicate that inputs from stormwater runoff were likely to be minimal with the exception of the single event on day 125. Water temperatures during the first half of the deployment were generally in the range of 16-18 C. Temperatures then increased during the subsequent half of the deployment ending in the range of 21-23 C.

Temperature variations associated with tidal and spring-neap time scales were also observed. Over tidal time-scales, coolest temperatures generally occurred at high water, and warmest temperatures just after low water. Over spring-neap time scales, warmest temperatures generally occurred a few days after the mid-neap time period. DO levels during the first half of the deployment were generally in the range of 7-9 mg/L. During the second half of the deployment, DO levels were generally lower in the range of 4-8 mg/L. A particularly low DO event apparently occurred during the period from Julian Day 186-204. It was not clear if this event was truly related to low DO or potentially sensor fouling. The green line in Figure 26 shows the readings corrected on the assumption of fouling by adding the offset value from the large change on day 186. Tidal and spring-neap variations in DO were also observed, but the range of variability was generally quite low (~1 mg/L).

Optical backscatter measurements were plagued by fouling problems. Between cleaning periods, backscatter was observed to increase at an accelerating rate despite little evidence of turbidity increase. These increasing trends were removed from the data by fitting a baseline curve to the low range of the readings throughout the deployment, and then removing the low-frequency trend. Data after about Julian Day 185 could not be used due to high levels of fouling. The results shown in Figure 26 are the corrected data. Even with these corrections, the data are considered to be of questionable quality and should only be viewed in a very qualitative sense. Future deployments should include OBS units with wipers to alleviate the fouling problems.

Note also that the design and presence of the RARA array creates physical variations that may not always be representative of site conditions. For example, the cells are elevated above the bottom, and the sediment within the cells is recessed below the lip of the cell. These physical variations may affect the processes that control resuspension and deposition. This is one trade-off between the more cost-effective nature of the RARA system and more costly but realistic pilot-scale approaches.

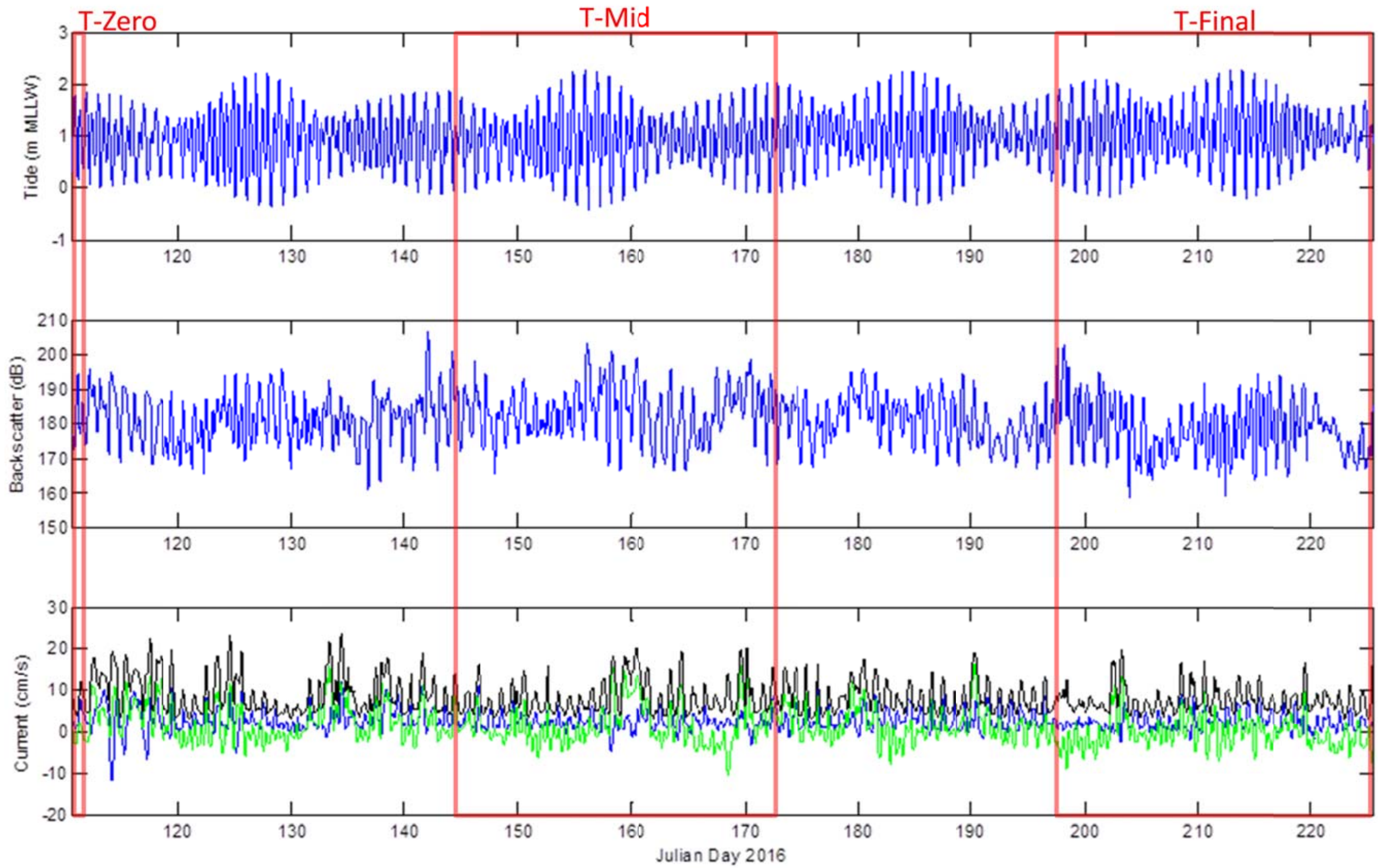

Figure 23. Hydrodynamic conditions during the complete RARA deployment period including tidal elevation (top), acoustic backscatter (mid), and current speed (bottom; north green, east blue, overall black). Red rectangles indicate the T-Zero, T-Mid and T-Final measurement periods.

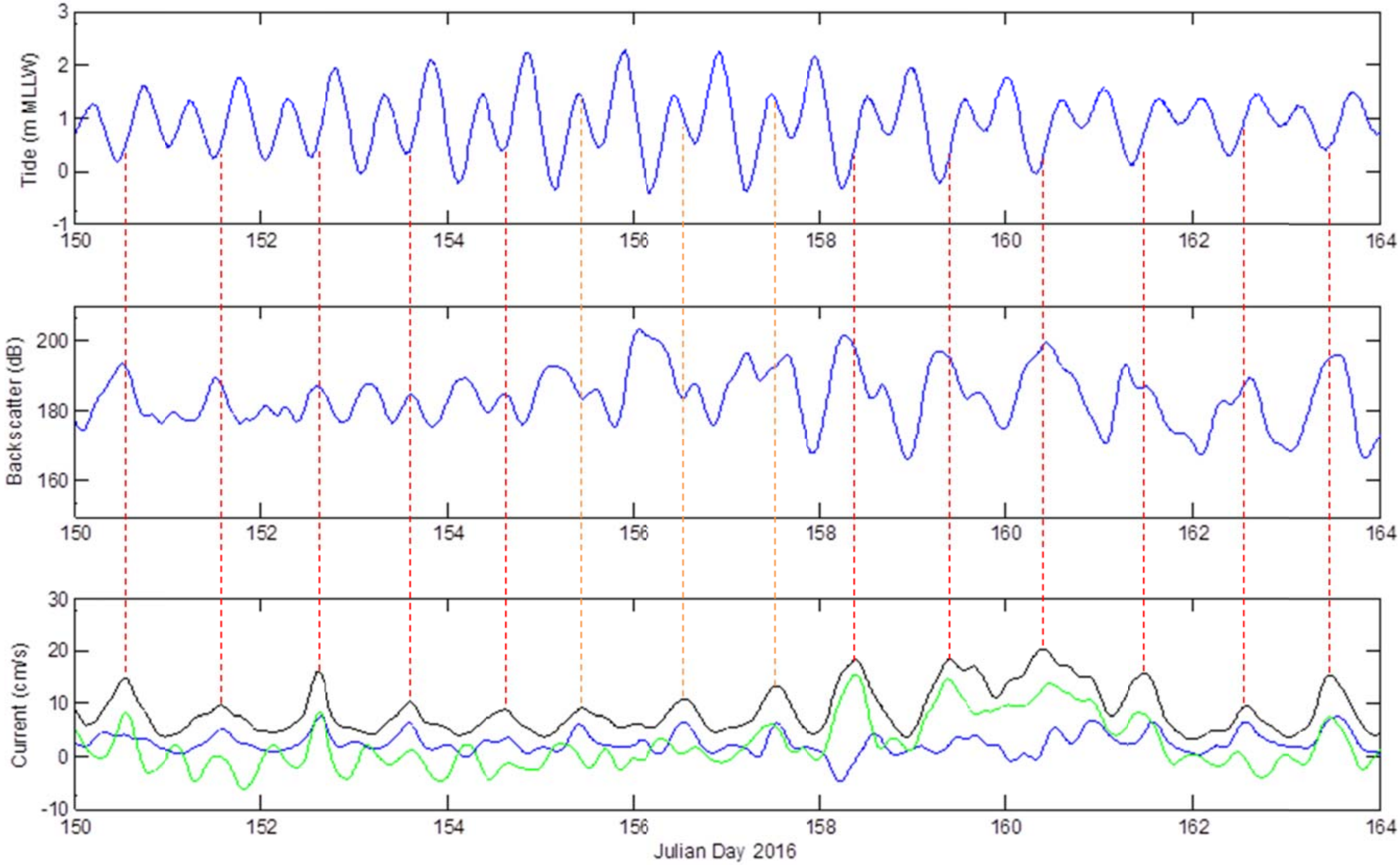

Figure 24. Hydrodynamic conditions during the spring-neap cycle from Julian Day 150-164 including tidal elevation (top), acoustic backscatter (mid), and current speed (bottom; north green, east blue, overall black). Red and orange vertical dashed lines indicate times of maximum current speed that occur during flood and ebb tide periods, respectively.

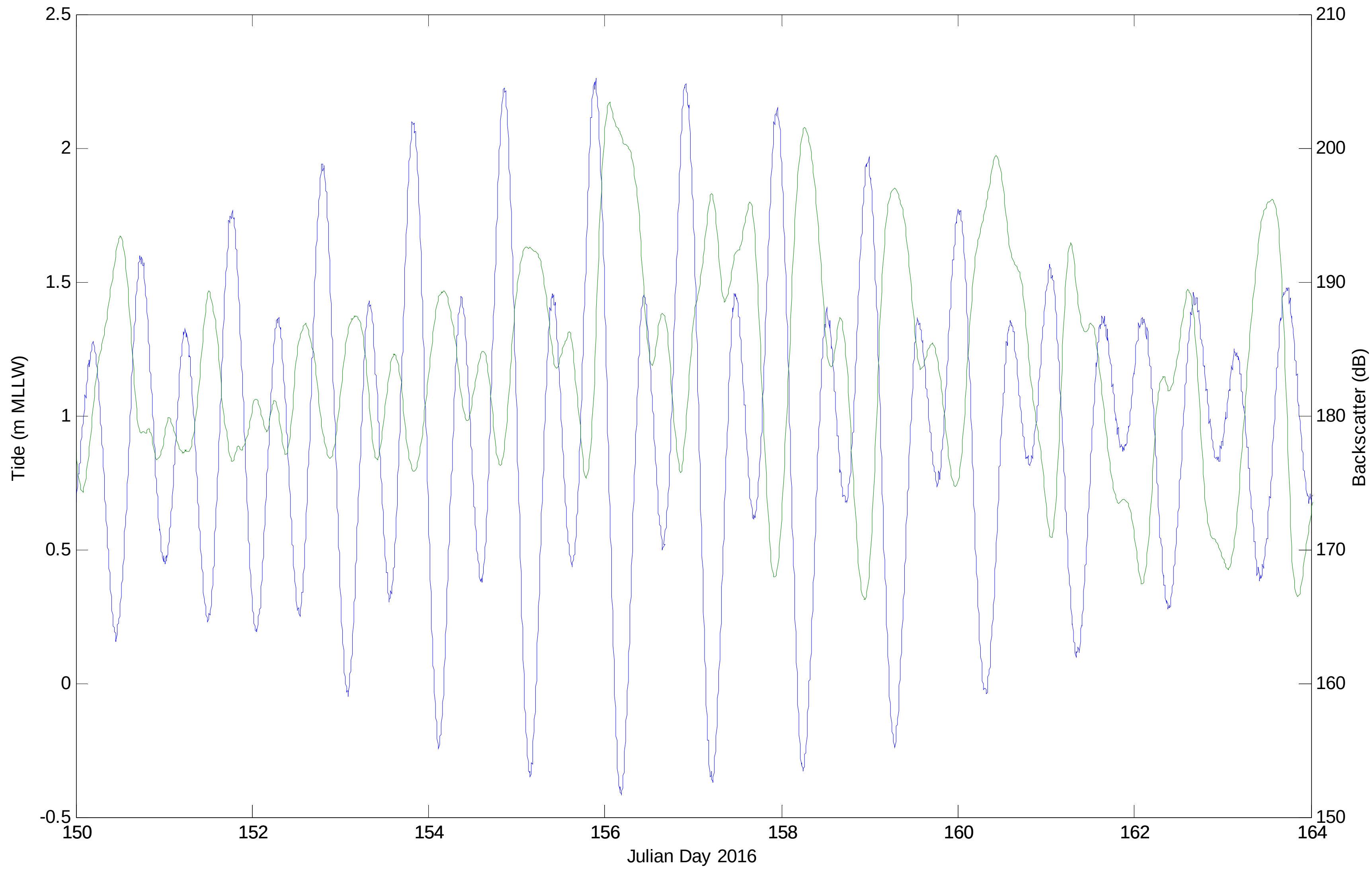

Figure 25. Tidal elevation (blue) and acoustic backscatter (green) during the spring-neap cycle from Julian Day 150-164.

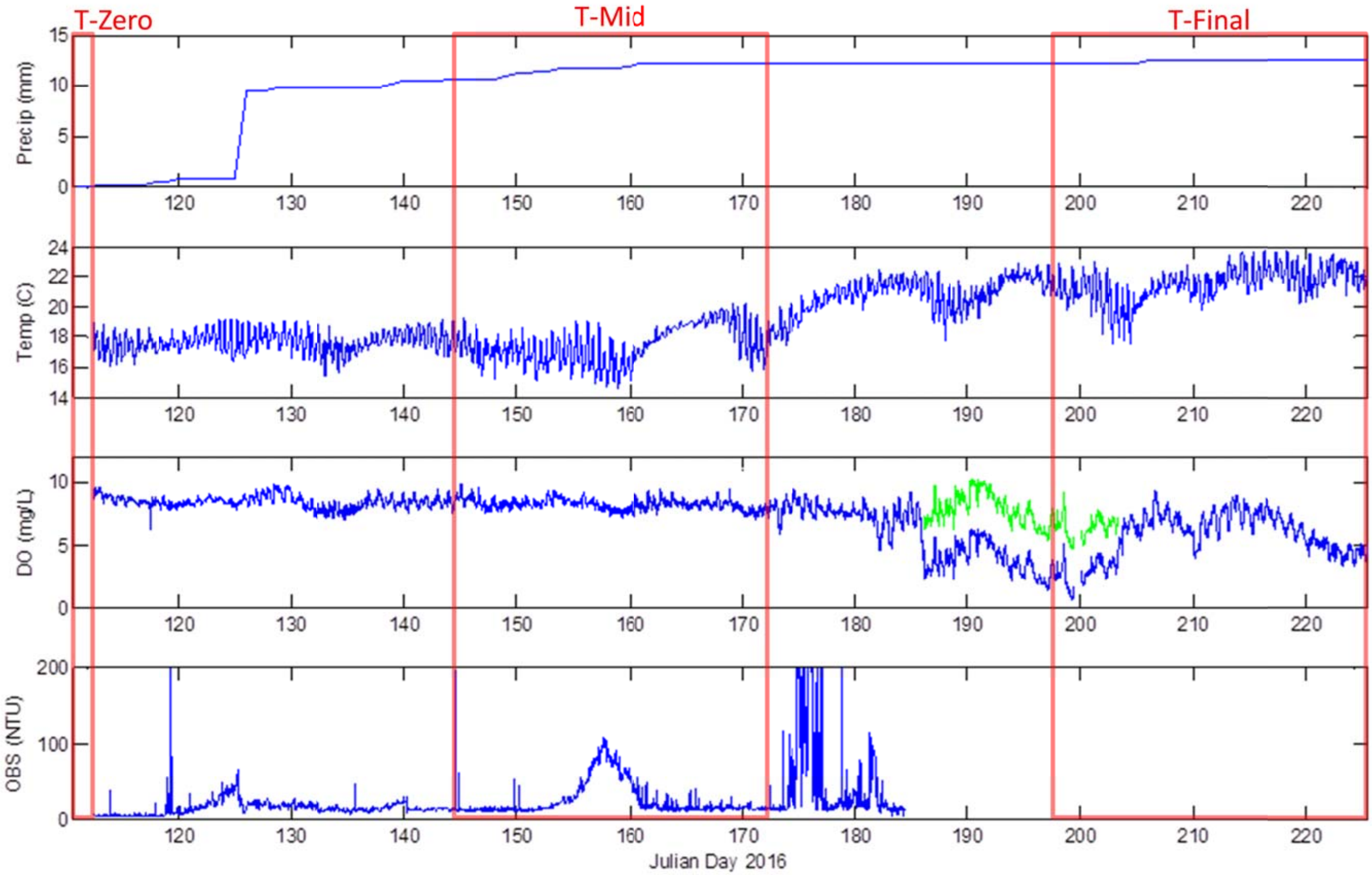

Figure 26. Cumulative precipitation (top) and water quality conditions including water temperature (second), dissolved oxygen (third), and optical backscatter (bottom) during the RARA deployment period. The red rectangles indicate the T-Zero, T-Mid and T-Final measurement periods.

Bulk Sediments

Bulk sediment concentrations were analyzed for samples collected at T-Zero from the original Chollas Creek site sediment, the two treatment materials, and for samples collected at T-Final from the untreated site sediments and the two different treatment conditions (Table 6). Results are presented below for two different comparisons. To determine the influence of removing localized sources, the T-Zero and T-Final concentrations in the untreated Chollas Creek sediments were compared. To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment at the T-Final condition.

Comparing the T-Zero and T-Final concentrations of the Chollas Creek site sediments (control), the physical properties remained relatively consistent over the 5-month period, with a slight decrease in the percent fines. Contaminant concentrations also remained relatively stable, although there were some variations (Figure 27). Cadmium increased by over 90%, although the starting concentration at T-Zero was relatively low to begin with. Total Chlordane concentration reduced by 100% such that it was below detection limits at the T-Final sampling event. Other variations in T-Zero to T-Final concentrations were in the range of ±50% or less with lead, zinc and Total PAHs increasing and copper, mercury and Total PCBs decreasing over the deployment period. With the exception of the large reduction in Total Chlordane, these results suggest that removing the site sediments from influences at the site did not have a major effect on the bulk concentrations of contaminants present in the sediments after a period of five months.

Much more dramatic differences in bulk sediment concentrations were observed in the comparisons of the untreated site sediments to the treatments (Table 6; Figure 29 - Figure 35). Comparing bulk sediment concentrations in treatments to untreated controls, we found reductions in all contaminant levels with the largest reductions in the sand treatment, followed by the clean sediment treatment. One exception to this was Total DDX which was below detection limit in all sediments at T-Zero but increased to detectable levels in the clean sediment and sand treatments at T-Final (Figure 36). Excluding DDX and Chlordane (due to non-detects), bulk sediment contaminant levels in the sediment treatment decreased by 65% while levels in the sand treatment decreased by 90% when averaged across contaminants for the T-Final condition (Figure 37). This is only a slight decrease in compared to the starting materials measured at T-Zero which showed differences between the treatment sediment and sand compared to controls of 75% and 94%, respectively.

To evaluate statistical differences between treated and untreated sediment bulk sediment concentrations, the data were evaluated using a paired (by sampling event) T-test for each contaminant with sufficient data. The results indicated that for the sediment treatment, cadmium, copper, lead, zinc, Total PCB, and Total PAH showed a statistical difference associated with treatment (all $p<0.05$). For the sand treatment, all of the same contaminants also showed statistically significant reductions with the exception of cadmium. The trends observed for other contaminants were not statistically significant.

Overall, the bulk sediment results indicate limited reductions in concentrations associated with the elimination of site specific conditions, but significant reductions in concentrations associated with the two treatments. Complete bulk sediment chemistry reports are included in Appendix D.

Trap Sediments

Sediment trap bulk sediment concentrations were analyzed for a composite sample created from sediments collected from the six sediment traps on the RARA array at T-Final (Table 6). Results are presented along with the treated and untreated RARA cell bulk sediments in Figure 29 - Figure 35. The purpose of the sediment trap samples in this case was to determine the nature of ongoing deposits on the treatment and control sediments given that the primary exposure to ongoing sources at Chollas Creek had been removed. Comparing the sediment trap concentrations to the Chollas Creek site sediments gives an indication of how the sediments might recover if the sources at the creek were controlled. Comparing sediment trap concentrations to the sediment treatment concentrations gives an indication of the level of resilience needed for the treatment given the continuing level of contamination input even after local sources have been controlled.

Deposition rates at the deployment site were estimated based on the composite total mass collected in the six sediment traps, 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 2311 g, the combined surface area of the six traps was 486 cm^2, and the deployment period was 115 days. This indicates a deposition rate of about 15.1 $g/cm^2/y$. Assuming a wet bulk density of 1.76 g/cm^3 (estimated from moisture content and assumed solids density of 2.5 g/cm^3), this indicates a deposition rate of about 8.6 cm/y or a total deposition thickness for the deployment period of about 2.7 cm. This rate is typical of many coastal harbor areas.

In general, the results for the sediment traps show that new sediments depositing at the array site had contaminant concentrations that were generally lower than the concentrations in the control sediments, with the exception of Total DDX (Table 6; Figure 38). Contaminant concentrations in trap sediments were generally <30% of the concentration in the untreated control sediments, with the exception of Total PAHs which had similar concentration in the trap at about 75% of the control sediment concentration. Total DDX was detected in the traps, but not in the control sediments, indicating that there may be a localized source of DDX at the RARA deployment site that was not previously known. These results generally support the conceptual design of the RARA deployment which was to evaluate the response of the sediments to removing the local sources of contamination from the Chollas Creek.

Comparison of trap sediment concentrations to treated sediment concentrations indicated that depositing sediments generally had contaminant concentrations that were higher than the sand treatments, but lower or comparable to the sediment treatments (Figure 39). Concentrations of copper, mercury, zinc and Total PCBs were all higher in the depositing sediments captured in the traps than in the sand treated sediments. For the sediment treatments, the depositing sediments generally had lower concentrations in the range of 36-83% of the concentration in the treatments at T-Final. These results suggest that incoming sediments would exert some upward pressure on the thin-sand treatments, but would generally have only a small downward pressure on the thin-sediment treatments. On the thin-sand treatment, with limited organic material, this might exacerbate uptake as the organisms preferentially feed on incoming organic matter with associated contaminants.

For metals, one way of examining the influence of background conditions and mixing is to normalize to iron content in the sediments. Correlation plots for metals and iron are shown in Figure 40 – Figure 43. These plot all show good correlations between metal and iron concentrations in treated and untreated Chollas Creek site sediments. They also indicate that the treatment material for both sand and clean sediment fall closely along the same relationship. In contrast, the sediments from the traps generally have much lower metal concentrations given the relatively high iron concentration, and thus fall well below the regression line. These diagrams provide conceptual insight into the relative influence of the treatment of the sediments compared to the sediment deposition. In general, the influence of treatment is to move the sediment characteristics toward the origin along the regression line, while the influence of the deposition is to move the sediment characteristics vertically downward (Figure 44). Using this analysis, we can say that the figures generally indicate trends that are dominated by treatment effects rather than deposition effects. Using the starting and ending ratios of iron to indicate the mixing of treatment and site sediments, we found that the mixing rates in the two treatments were very comparable at about 82% and 83% for the sediment treatment and sand treatment, respectively. Complete sediment trap chemistry reports are included in Appendix E.

Table 6. Results for bulk sediment analysis of RARA samples collected at T-Zero and T-Final.

Sampling Event	Treatment	Fines (%)	TOC (%)	Iron (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)	Total Detectable PCB Congeners (ug/kg)	Total Detectable DDX (ug/kg)	Total Detectable Chlordane (ug/kg)	Total Detectable PAHs (ug/kg)
T-Zero	Site Sediment Control	73%	1.8%	31000	0.489	162	75.3	3.15	271	146.1	ND	5.4	1706.4
	Treatment Sediment	32%	0.5%	14100	0.108	49.7	23.1	0.542	103	22.0	ND	0.3	397.6
	Treatment Sand	2%	ND	1060	ND	0.47	1.27	0.005	5.35	ND	ND	ND	ND
T-Final	Site Sediment Control 1	67.9%	1.60%	31600	1.06	129	107	1.37	372	113.7	ND	ND	2115.7
	Site Sediment Control 2	67.4%	1.70%	32700	0.834	165	110	1.46	252	89.7	ND	ND	2178.0
	Sediment Treatment 1	29.7%	0.5%	16900	ND	80.7	27.7	0.353	111	16.4	1.0	ND	630.1
	Sediment Treatment 2	31.2%	0.6%	17300	ND	65.5	38.8	1.46	107	17.3	1.2	ND	606.0
	Sand Treatment 1	11.0%	0.25%	6580	ND	21.6	6.45	0.055	32.1	3.3	0.3	ND	311.5
	Sand Treatment 2	8.9%	0.19%	5800	ND	18.3	5.61	0.044	34.2	1.8	0.2	ND	189.8
	Sediment Trap	NA	2.20%	33000	0.271	31.8	34.7	0.367	47.3	16.1	2.5	ND	1607.3

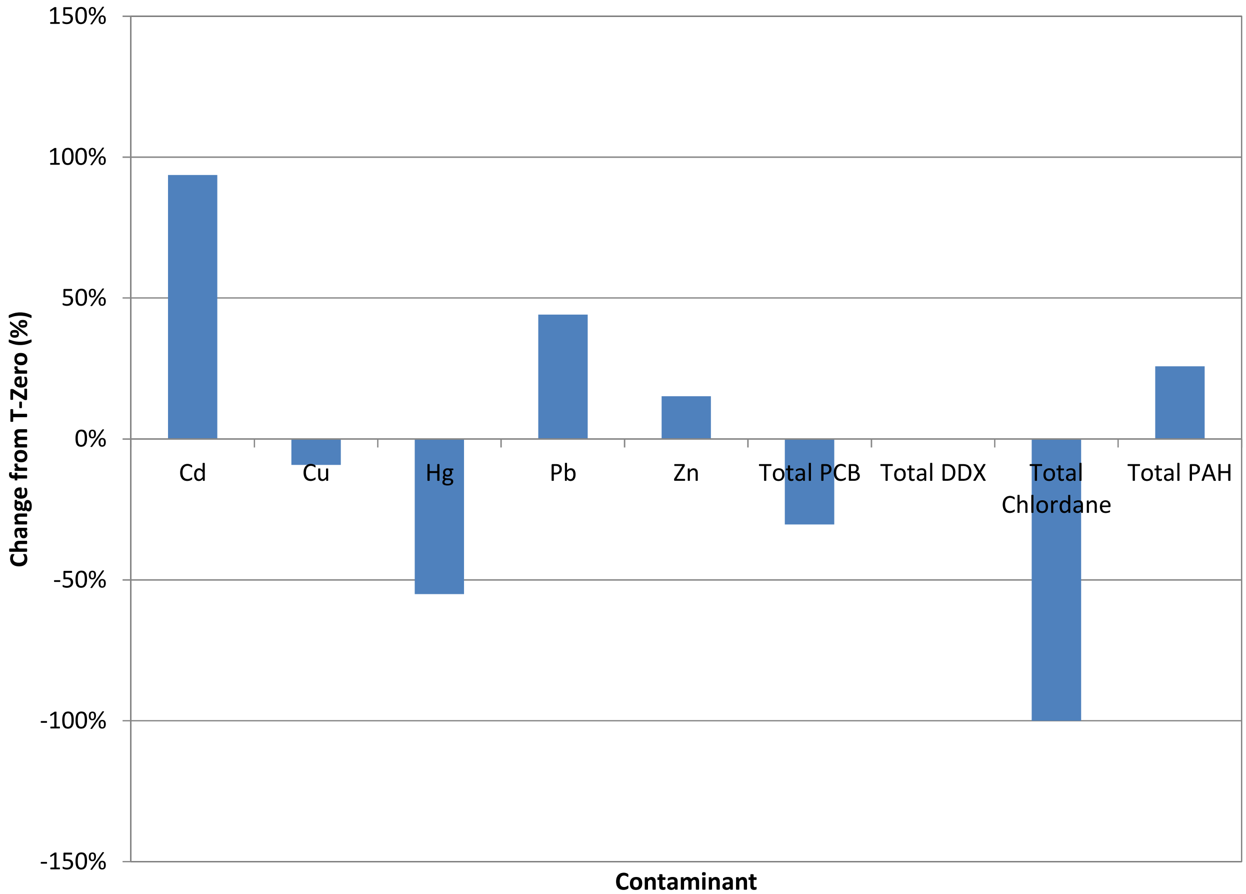

Figure 27. Change in contaminant concentrations over the 5-month RARA deployment period relative to the starting concentration at T-Zero.

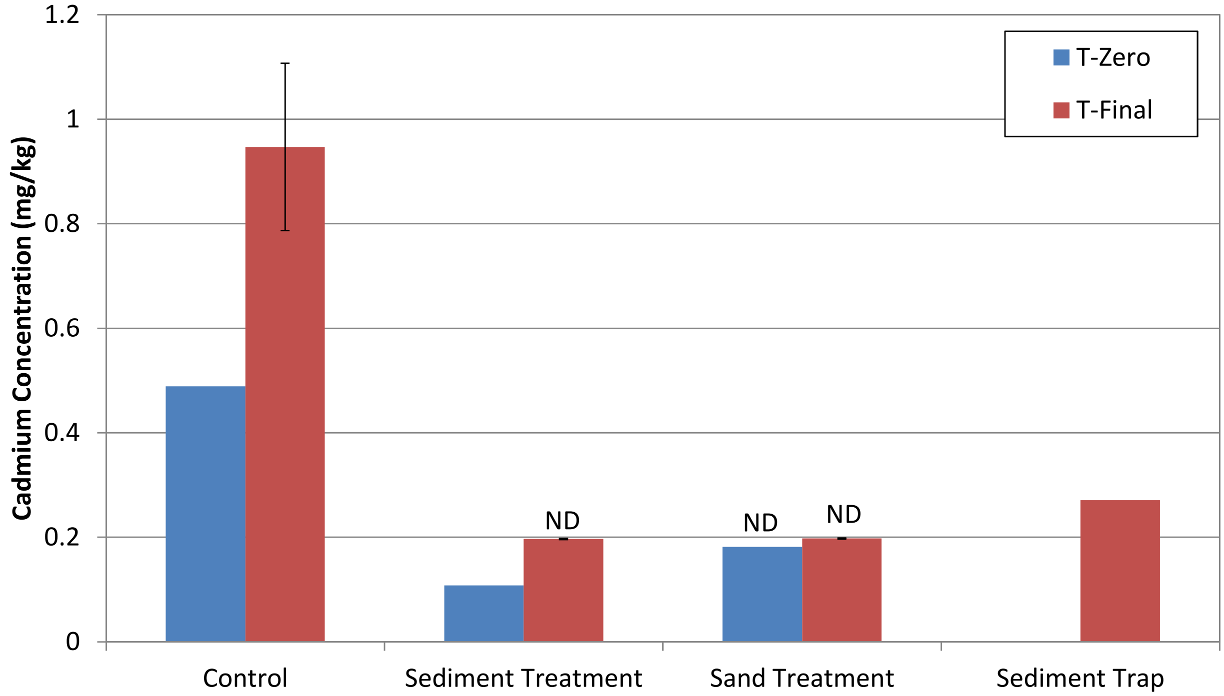

Figure 28. Comparison of bulk sediment cadmium concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

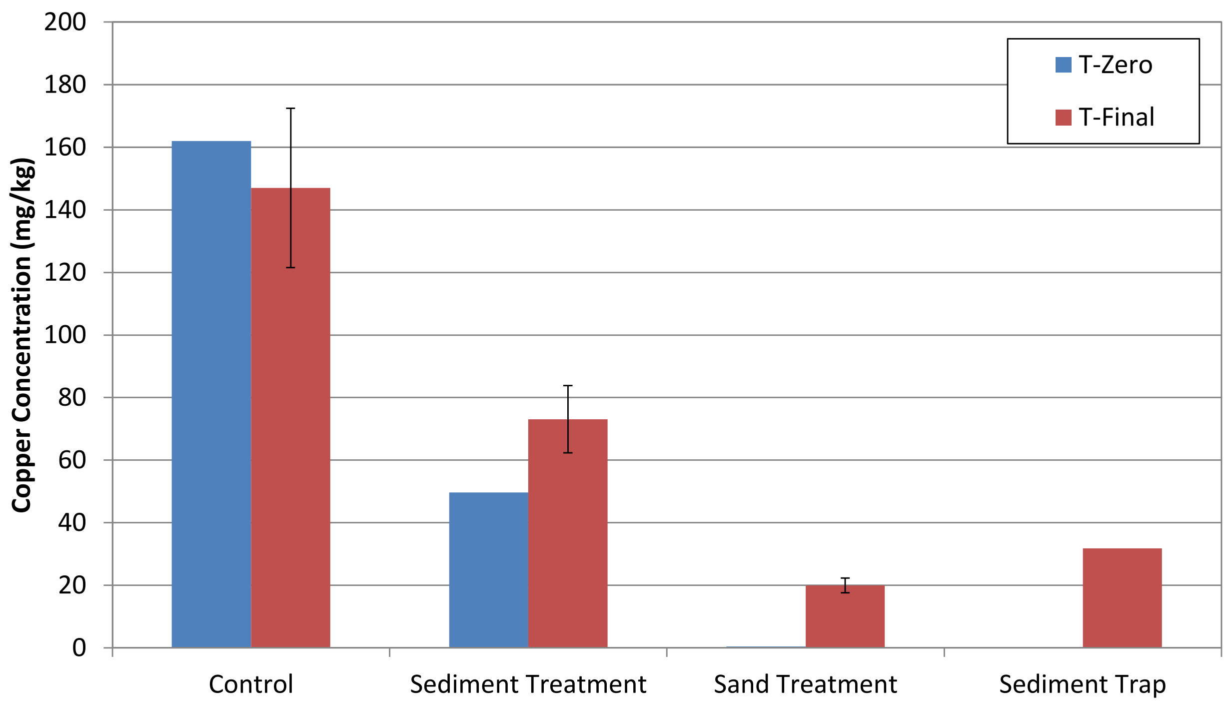

Figure 29. Comparison of bulk sediment copper concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

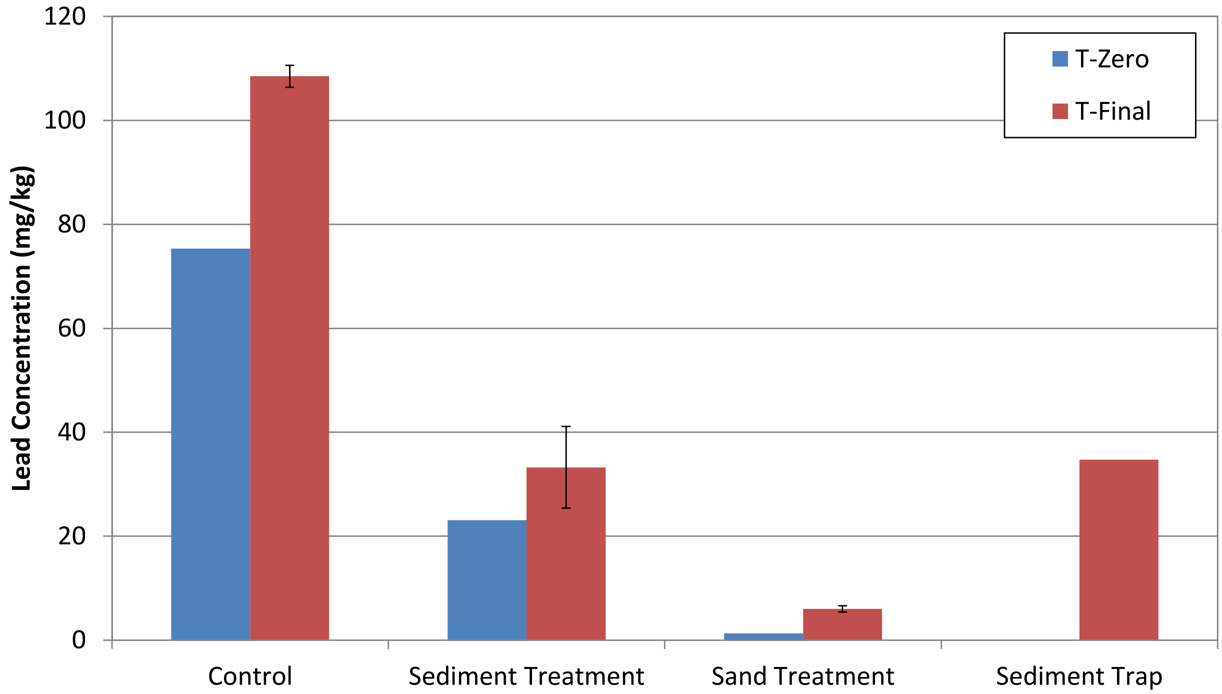

Figure 30. Comparison of bulk sediment lead concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

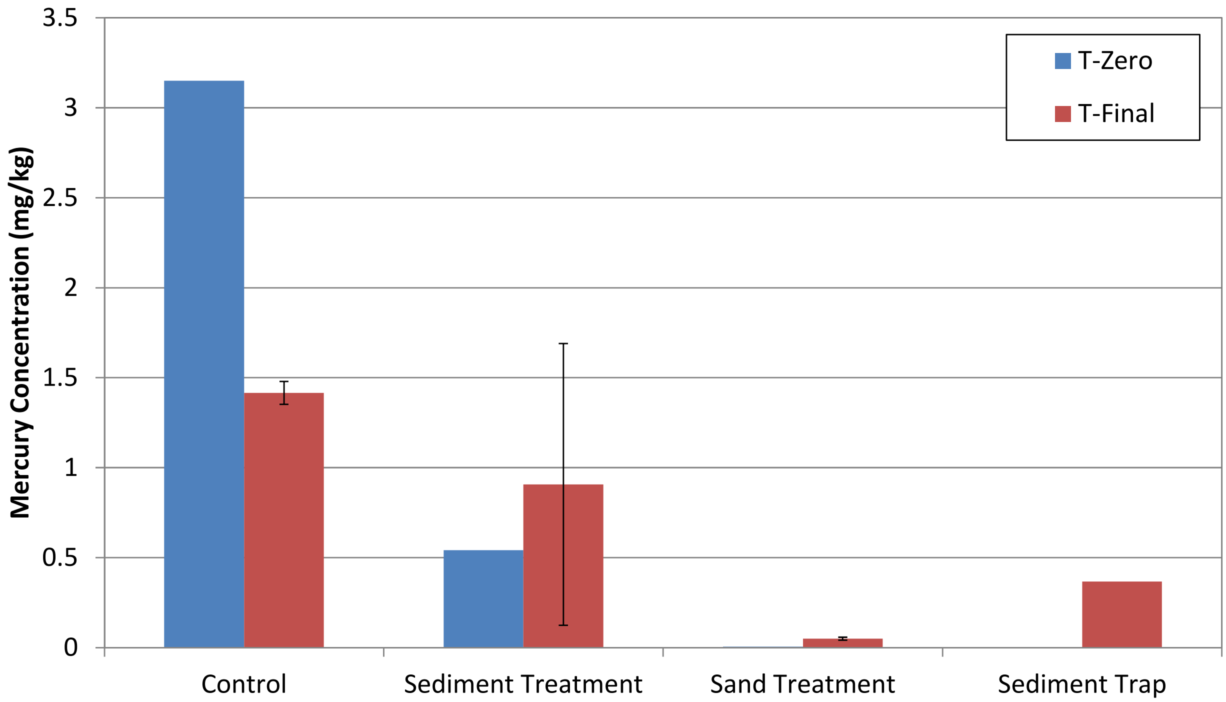

Figure 31. Comparison of bulk sediment mercury concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

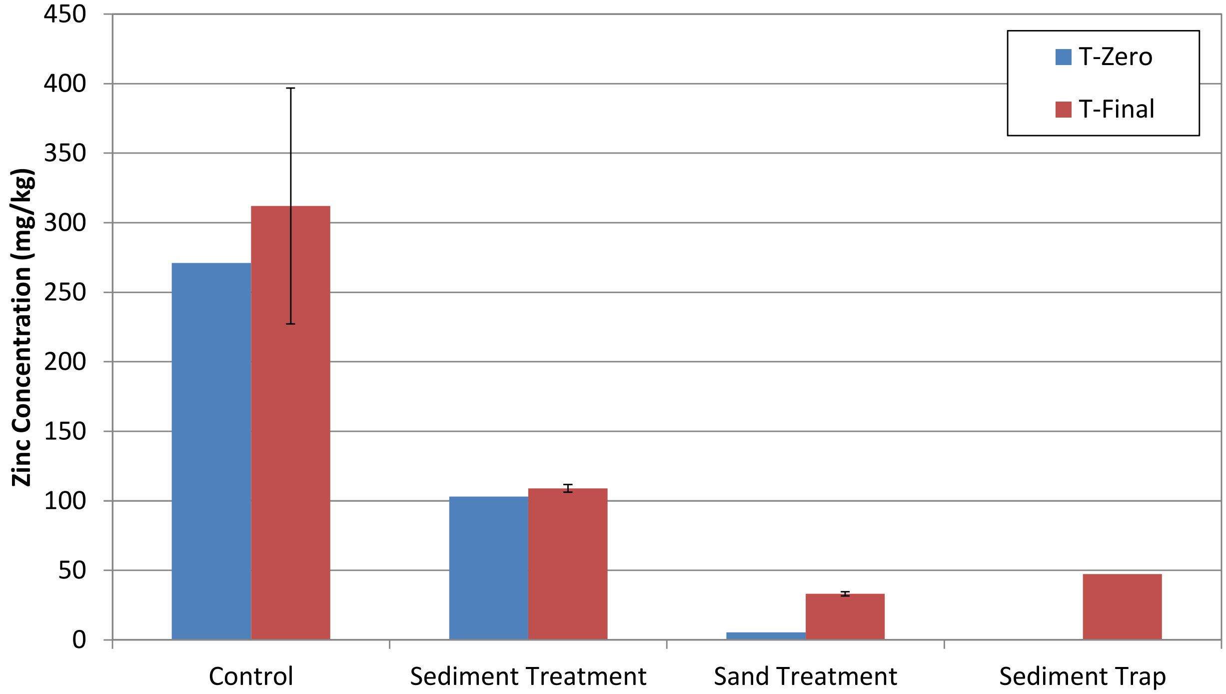

Figure 32. Comparison of bulk sediment zinc concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

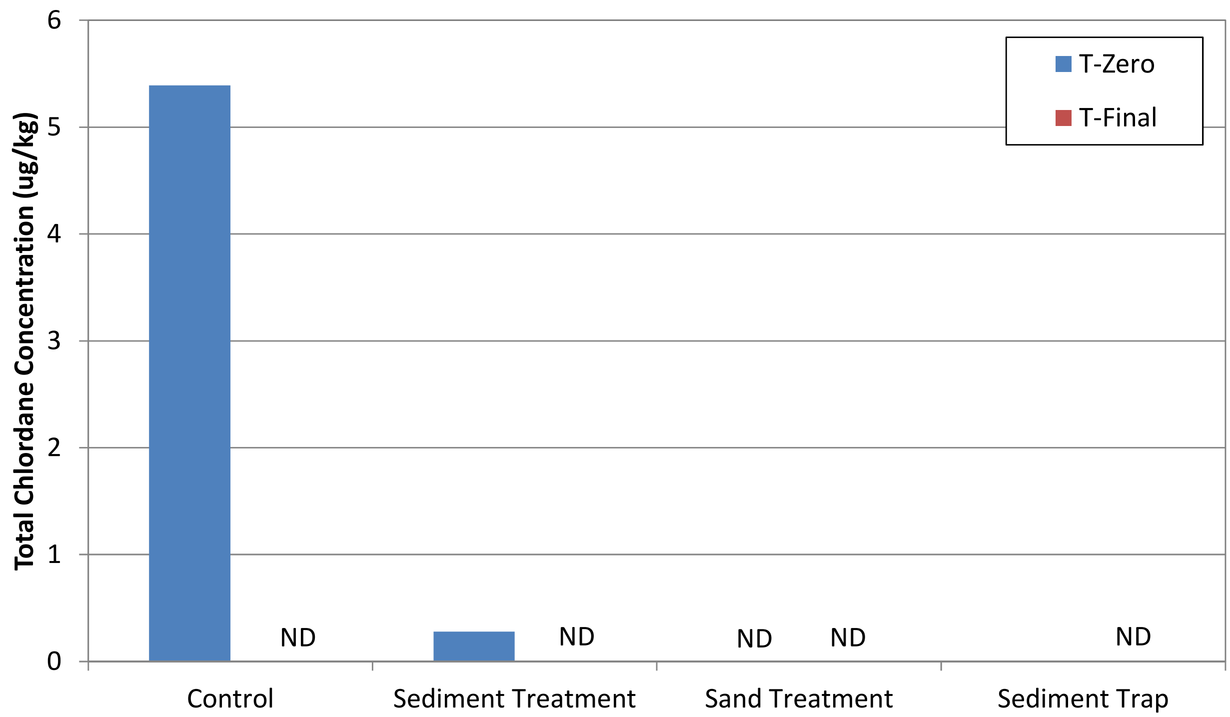

Figure 33. Comparison of bulk sediment Total Chlordane concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

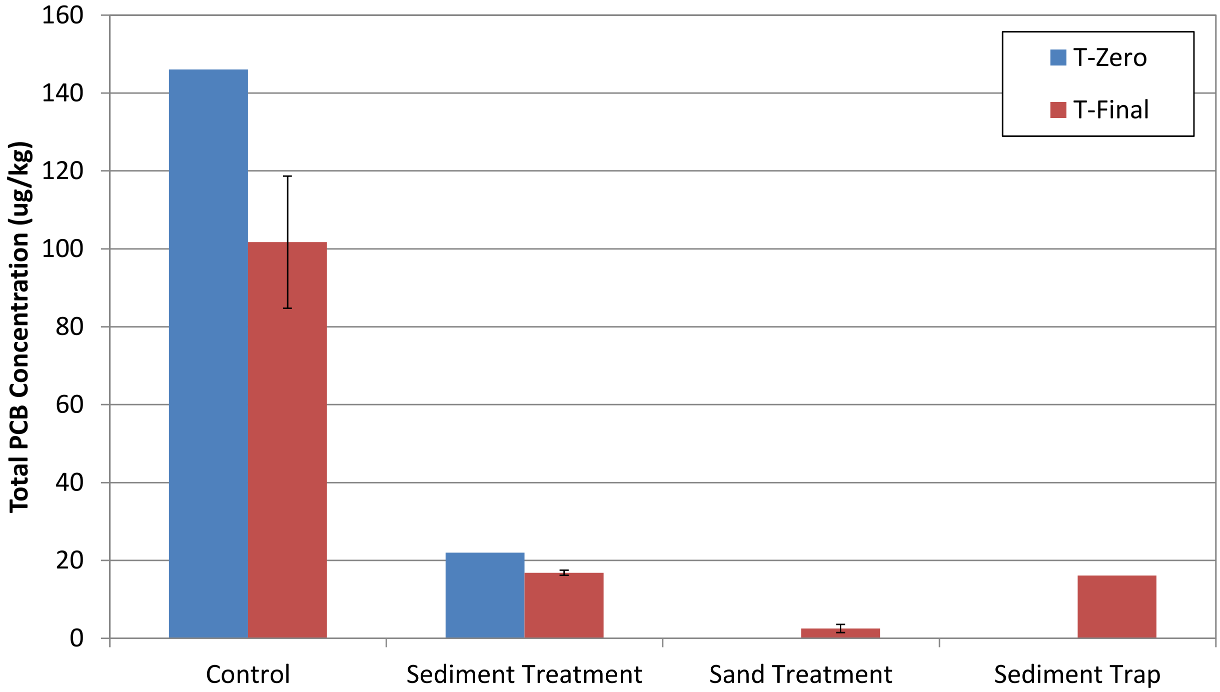

Figure 34. Comparison of bulk sediment Total PCB concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

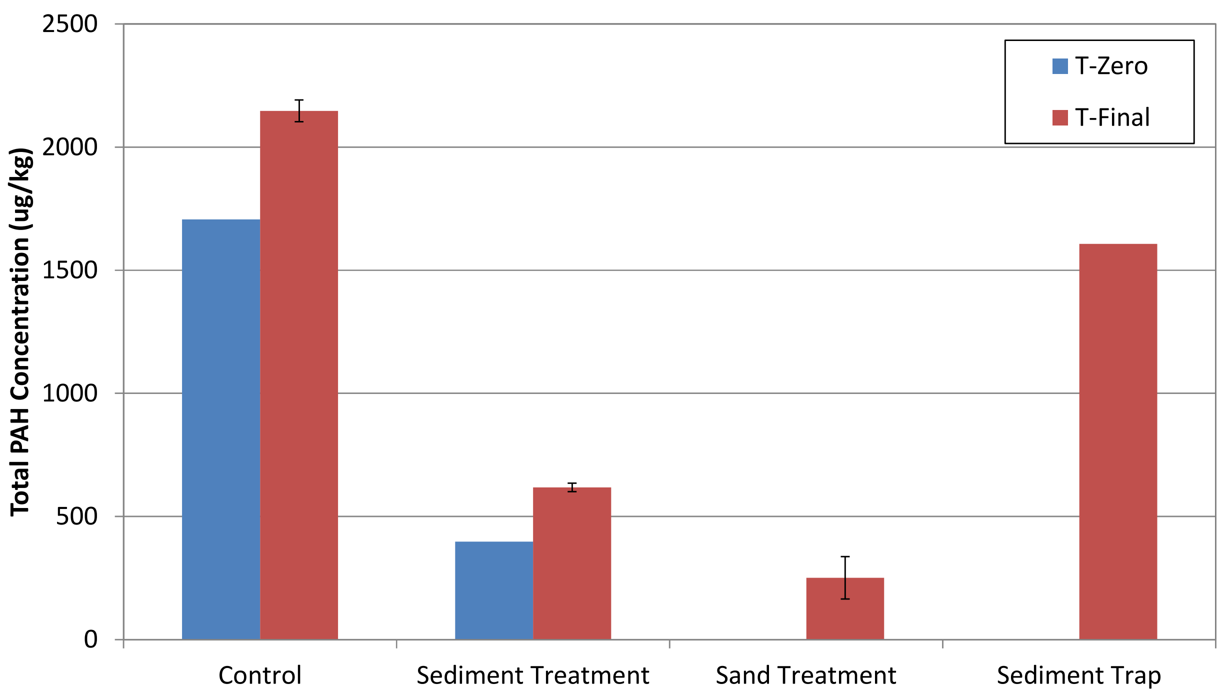

Figure 35. Comparison of bulk sediment Total PAH concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

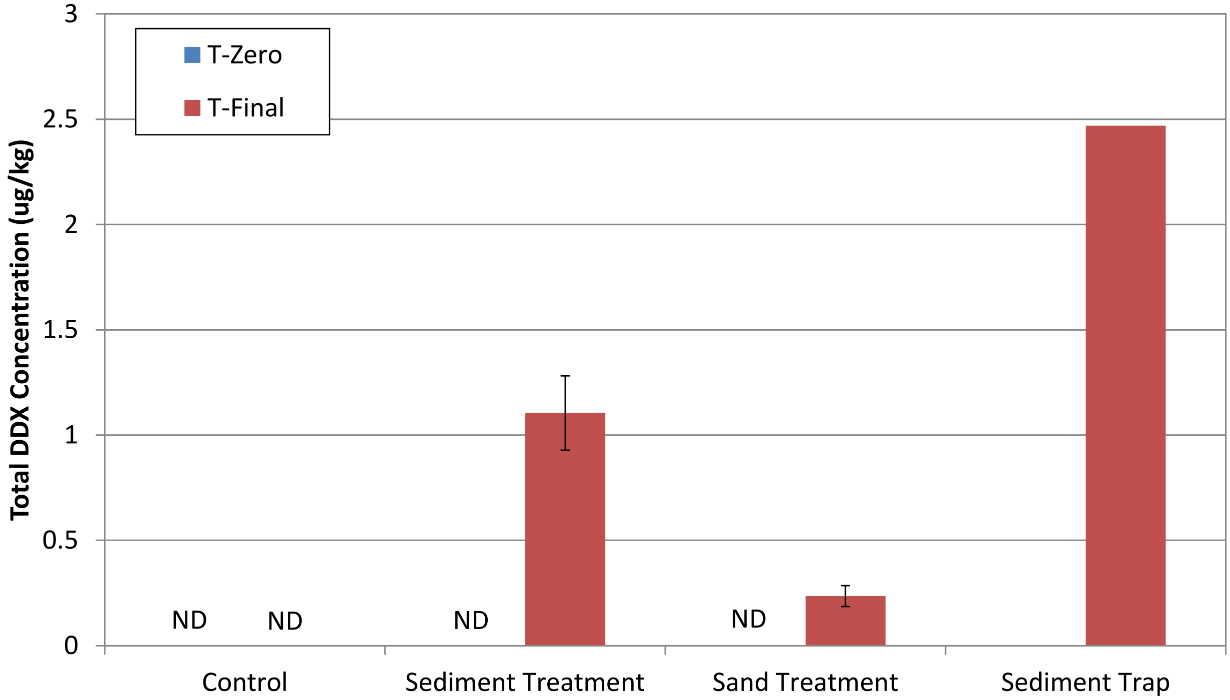

Figure 36. Comparison of bulk sediment Total DDX concentrations for controls, sediment treatments, and traps during the RARA T-Zero and T-Final measurements.

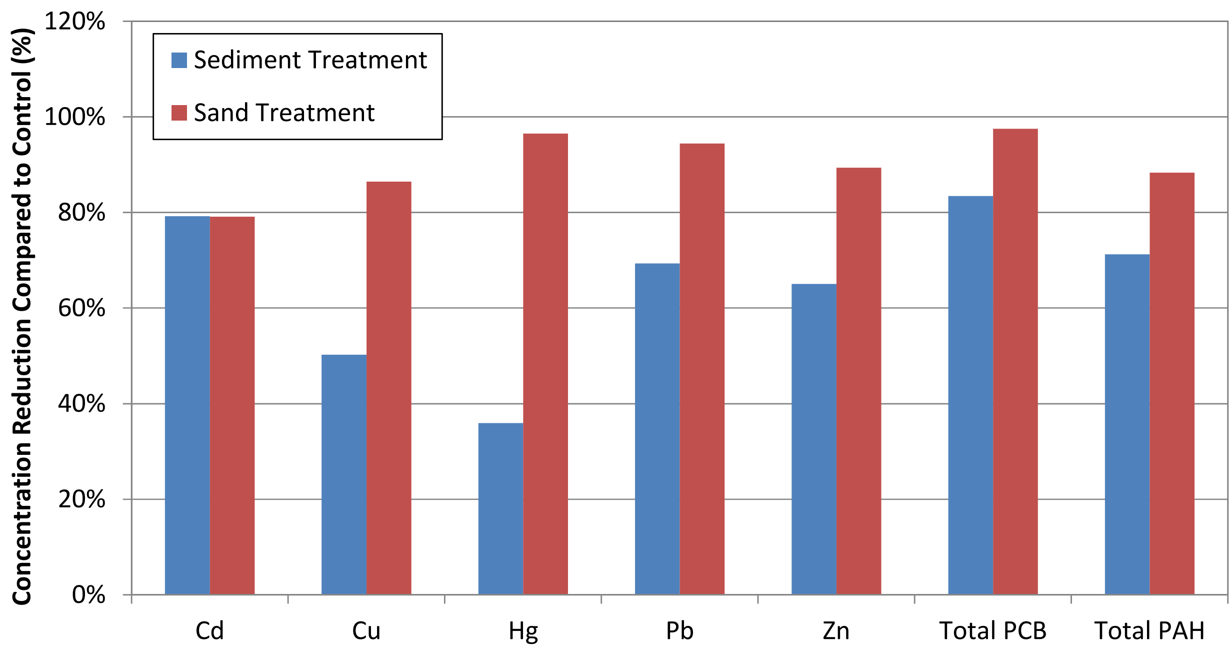

Figure 37. Bulk sediment concentration reduction compared to untreated controls for the sediment and sand thin-layer treatments.

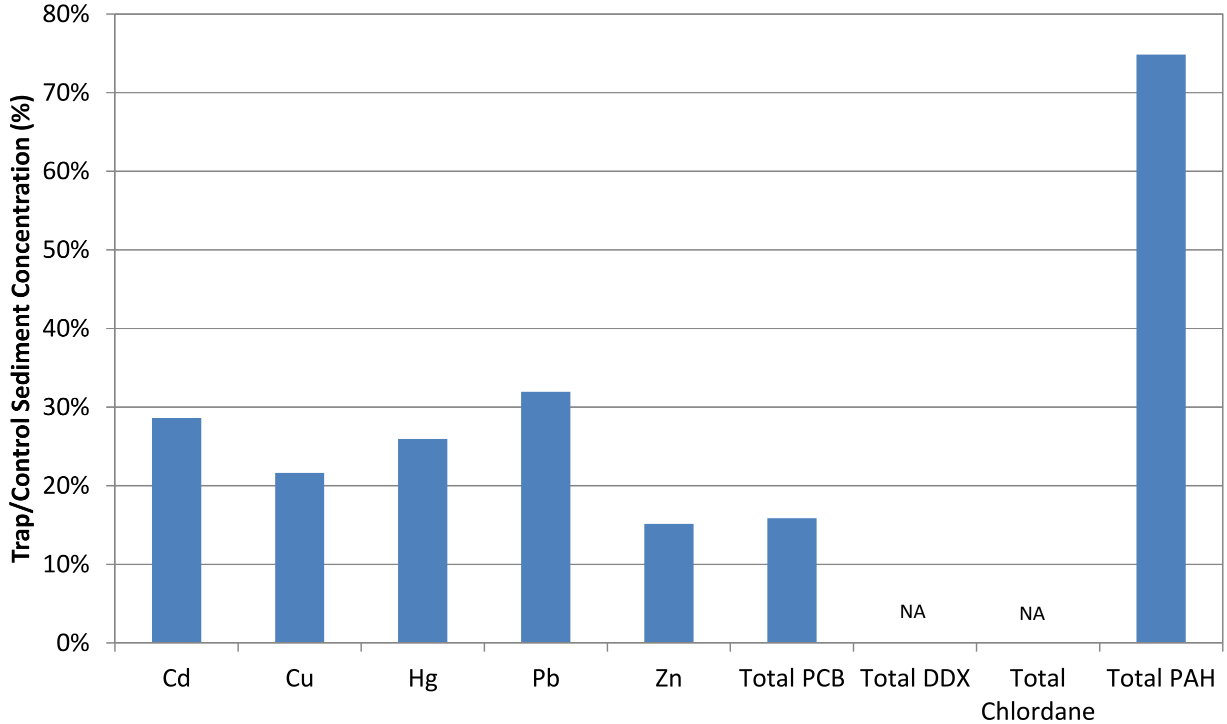

Figure 38. Ratio of the bulk sediment trap concentration to the concentration in the untreated control sediment at T-Final. Note that the ratio for Total DDX and Total Chlordane could not be calculated because DDX was not detected in the control sediments, and Chlordane was not detected in the trap sediments.

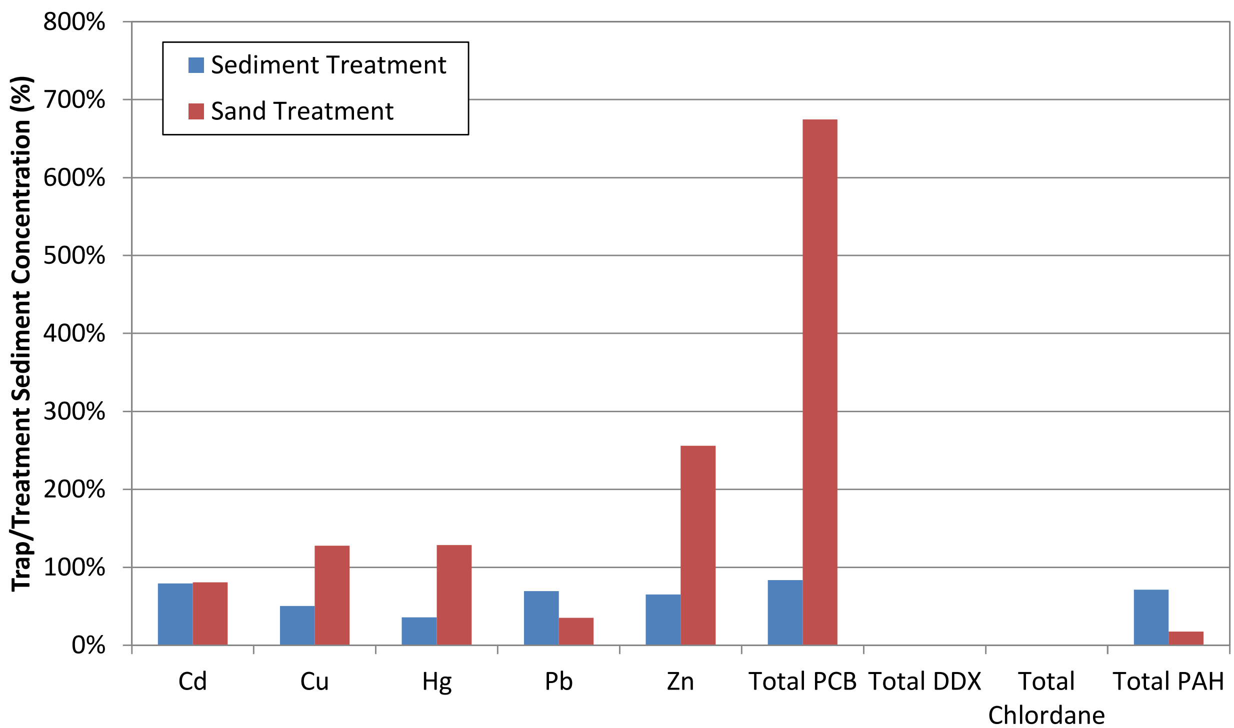

Figure 39. Ratio of the bulk sediment trap concentration to the concentration in the treated sediments at T-Final.

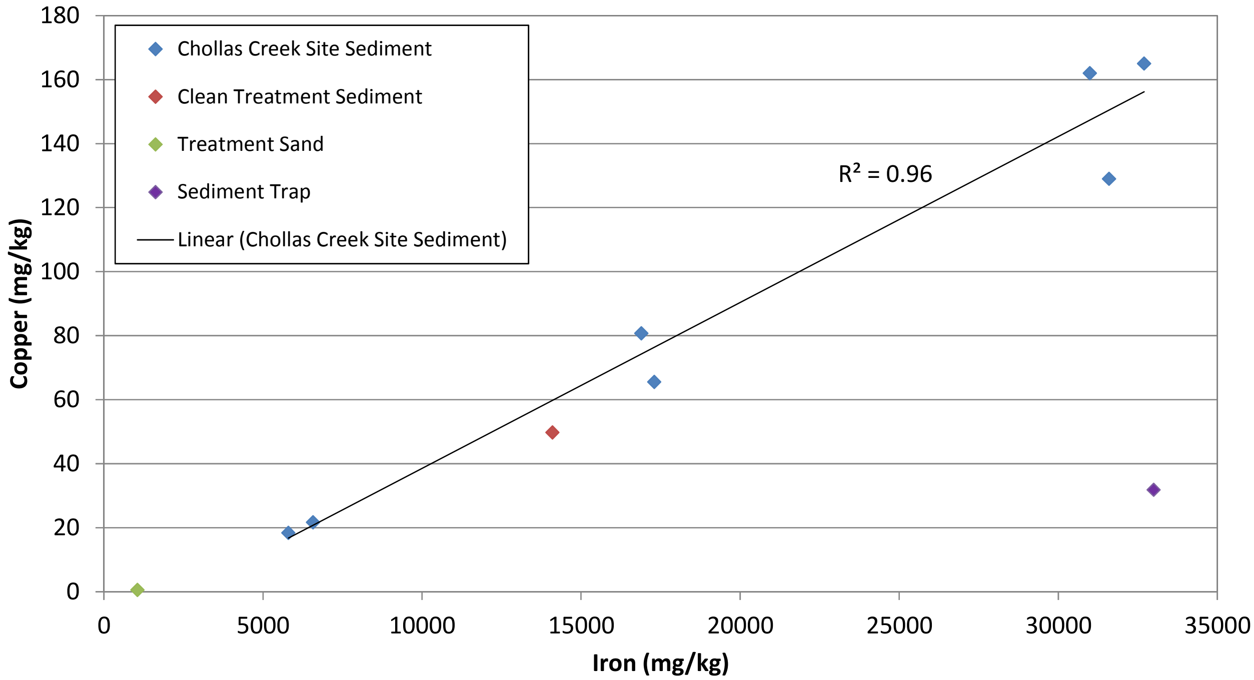

Figure 40. Regression plot for copper versus iron for the treated and untreated Chollas Creek site sediments (blue diamonds), along with the treatment sediment (red diamond), treatment sand (green diamond), and sediment trap (purple diamond).

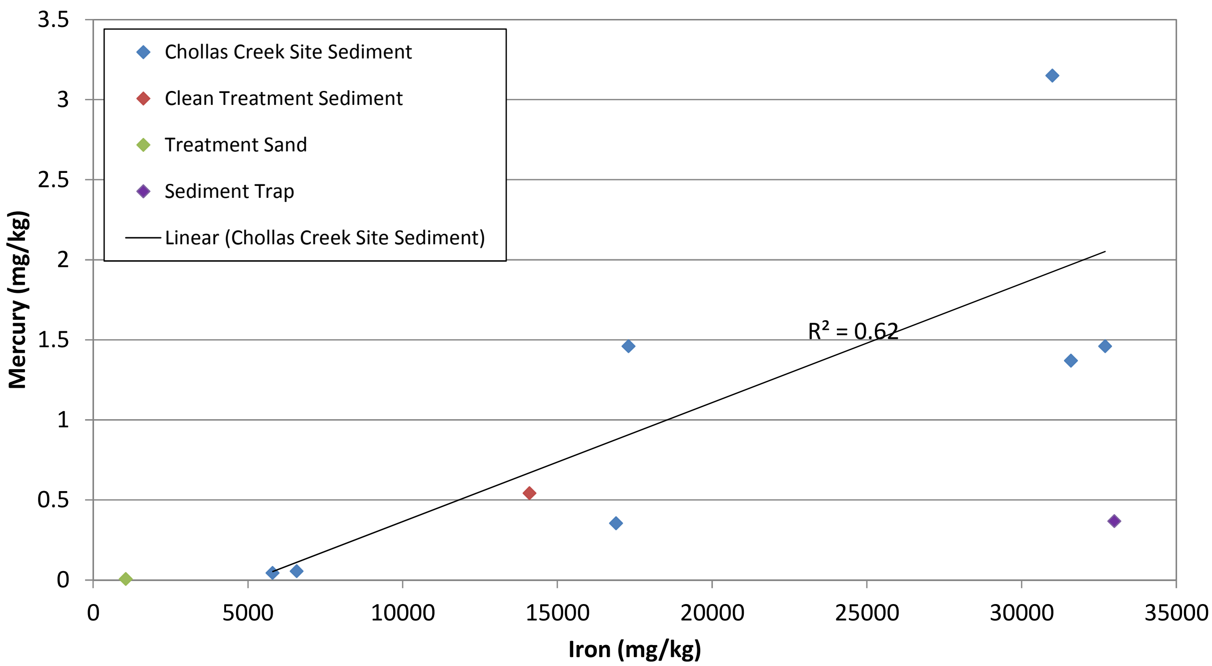

Figure 41. Regression plot for mercury versus iron for the treated and untreated Chollas Creek site sediments (blue diamonds), along with the treatment sediment (red diamond), treatment sand (green diamond), and sediment trap (purple diamond).

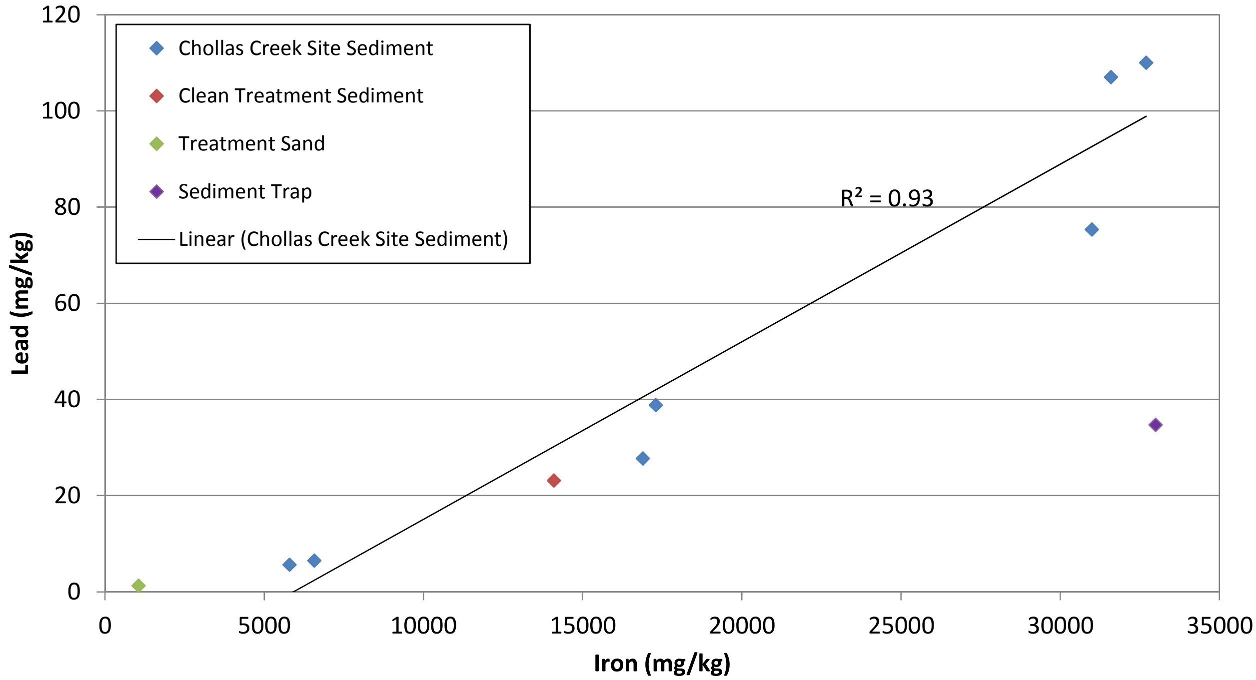

Figure 42. Regression plot for mercury versus lead for the treated and untreated Chollas Creek site sediments (blue diamonds), along with the treatment sediment (red diamond), treatment sand (green diamond), and sediment trap (purple diamond).

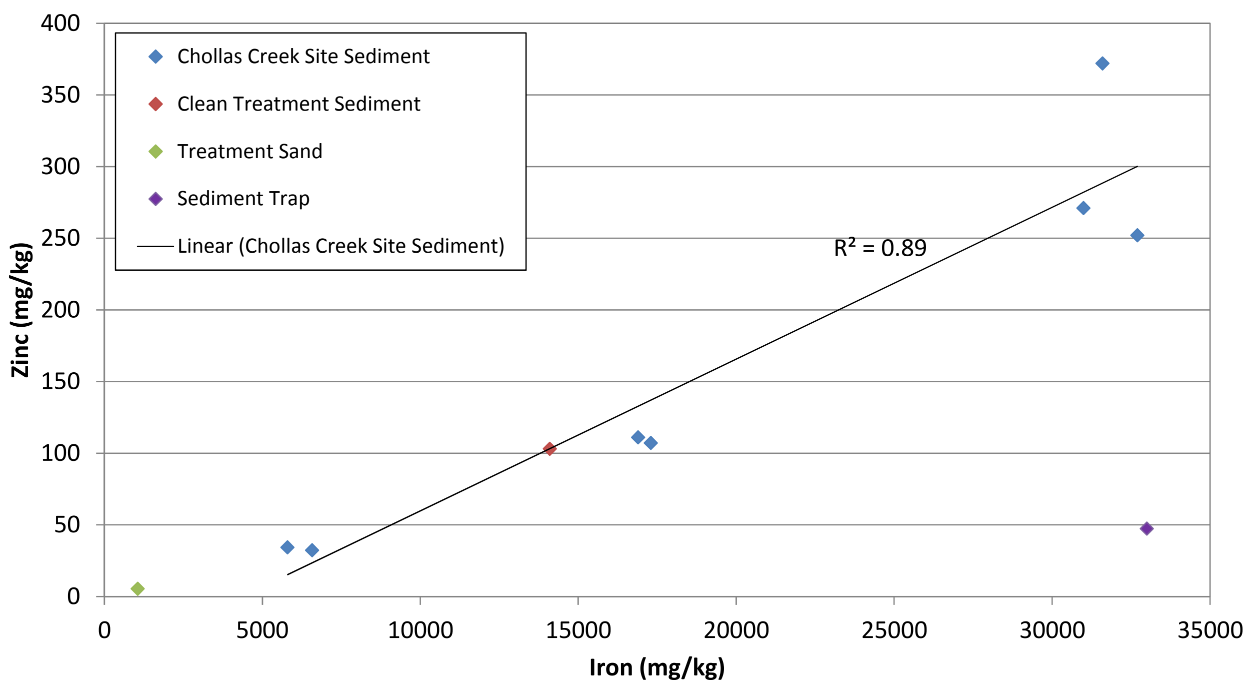

Figure 43. Regression plot for mercury versus zinc for the treated and untreated Chollas Creek site sediments (blue diamonds), along with the treatment sediment (red diamond), treatment sand (green diamond), and sediment trap (purple diamond).

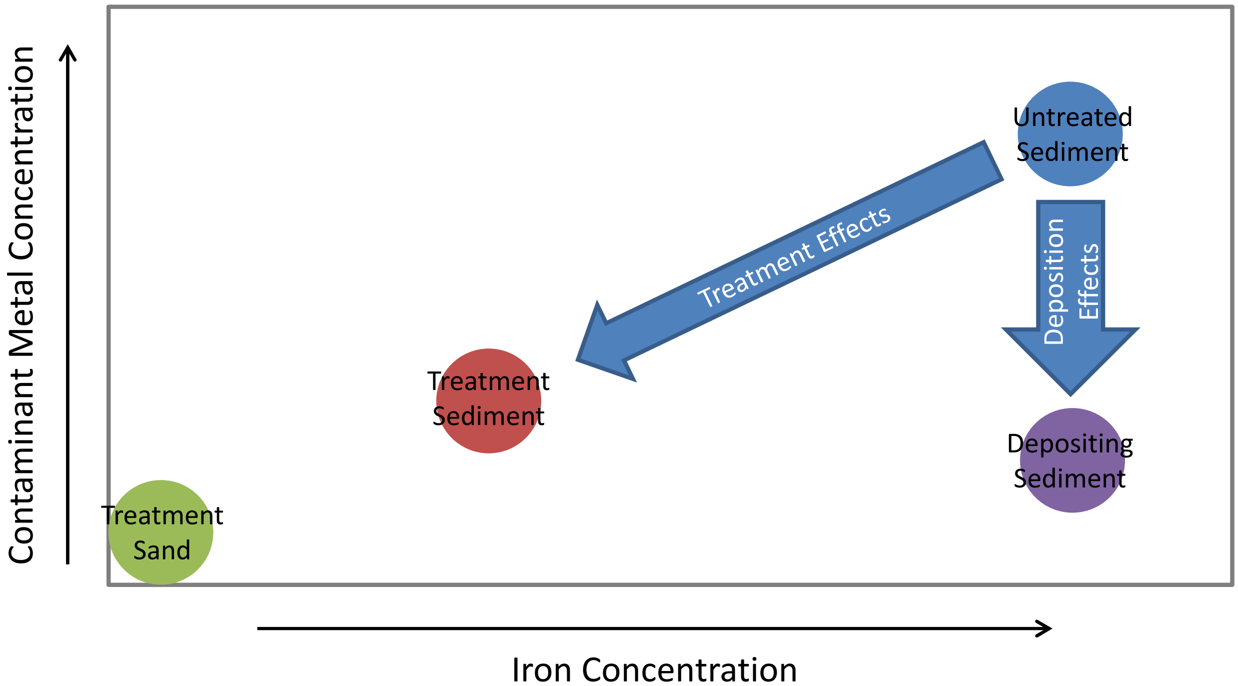

Figure 44. Conceptual diagram of the effects of treatment and deposition on the metal concentration in treated Chollas Creek sediments.

DGT Results

Sediment porewater metal concentrations measured with DGTs were analyzed for samples collected at T-Mid and T-Final from the untreated site sediments and the two different treatment conditions. To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment at these two time points during the deployment. During analysis of the DGTs, it was noted that sediment particles had found their way into some of the gels. Care was taken to remove these to the extent possible, but analytical results showed outliers that were attributed to this issue. The outliers included DGTs from one replicate each in the T-Mid exposure of RARA sand treatment cell 2, and the sediment treatment cell 1. These results were flagged and excluded from the subsequent data analysis (Table 7). General trends (non-statistical) and statistical differences are described below.

DGT results are shown in Figure 45 – Figure 48 for the metals copper, zinc, cadmium and lead. Each figure shows the comparison of blanks, untreated Chollas Creek site sediments (control), and the thin-sediment and thin-sand treatments at the T-Mid and T-Final exposure points. For all metals, at both time points, and for all treatments, concentrations in the cells were generally higher than blanks with the exception of the T-Mid time point for cadmium in the untreated control and clean sediment treatment. Averaged across the full data set (Figure 49), field exposure concentrations exceeded blank concentrations by factors of 47X, 12X, 1.4X and 11X for copper, zinc, cadmium and lead, respectively. Thus metals concentrations in DGTs exposed to field sediments were generally distinguishable compared to unexposed samplers with the exception of cadmium in some cases.

Comparing the untreated sediment to the treatments at T-Mid, we found varying results by treatment and by metal. For the clean sediment treatment, porewater metal concentrations at T-Mid were generally comparable to untreated controls for cadmium, zinc and lead, but were higher than controls for copper. For the sand treatment, metal concentrations at T-Mid were generally comparable to untreated controls for zinc, but were higher than controls for copper, cadmium and lead. Porewater metal concentrations at T-Final were generally lower than concentrations at T-Mid for most metal except lead. For the sediment treatment, metal concentrations at T-Final were generally comparable to untreated controls for cadmium and zinc, but were higher than controls for copper and lead. For the sand treatment, metal concentrations at T-Final were generally comparable to untreated controls for all metals. In general, porewater metal concentrations in all treatments and controls were low, suggesting limited metal bioavailability.

To evaluate statistical differences between treated and untreated sediment porewater concentrations, the data were evaluated using a paired (by sampling event) T-test for each contaminant with sufficient data. The results indicated that for the sediment treatment, the only metal that showed a statistical difference associated with treatment was copper ($p=0.02$), and the only metal that showed a statistical difference associated with sand treatment was zinc ($p=0.04$). The trends observed for other metals were not statistically significant, although differences in lead for the sediment and copper for the sand treatment were borderline ($p=0.07$ in each case).

Overall, the DGT results indicate limited bioavailability in all treated and untreated sediments for both time events, with the untreated sediments generally performing equally or better than the treated sediments with respect to reducing metal availability. All of the sediments also appeared to improve over time, with lower porewater metal concentrations at T-Final compared to T-Mid. Complete DGT chemistry reports are included in Appendix F.

Table 7. Porewater labile metal concentrations based on the DGT measurements at T-Mid and T-Final. Grey shaded cells indicate outlier samples that were believed to have been compromised by sediment particles and were not included in the averages.

Sample ID	Deployment T-Mid				Deployment T-Final			
	Porewater Copper (µg/L)	Porewater Zinc (µg/L)	Porewater Cadmium (µg/L)	Porewater Lead (µg/L)	Porewater Copper (µg/L)	Porewater Zinc (µg/L)	Porewater Cadmium (µg/L)	Porewater Lead (µg/L)
Blank 1	0.022	0.185	0.010	0.002	0.014	0.546	0.003	0.012
Blank 2	0.016	0.128	0.012	0.002	0.009	0.237	0.002	0.012
Control 1	0.470	4.329	0.016	0.070	0.163	1.737	0.004	0.047
Control 1 Dup	0.393	5.103	0.010	0.068	0.257	2.556	0.010	0.051
Control 2	0.337	2.635	0.009	0.041	0.242	2.162	0.007	0.079
Control 2 Dup	1.243	4.697	0.009	0.025	0.207	1.681	0.006	0.057
Sediment Treatment 1	13.466	14.383	0.011	0.388	1.110	6.871	0.009	0.084
Sediment Treatment 1 Dup	1.337	4.818	0.003	0.046	0.586	1.609	0.003	0.090
Sediment Treatment 2	1.362	9.125	0.005	0.081	0.548	2.245	0.007	0.101
Sediment Treatment 2 Dup	0.995	2.234	0.003	0.084	1.197	4.183	0.014	0.227
Sand Treatment 1	0.608	3.194	0.020	0.123	0.458	1.661	0.005	0.061
Sand Treatment 1 Dup	0.781	4.139	0.032	0.204	0.578	1.269	0.004	0.084
Sand Treatment 2	1.468	2.876	0.010	0.040	0.206	1.365	0.004	0.022
Sand Treatment 2 Dup	7.008	7.718	0.033	0.173	0.223	1.573	0.005	0.020
Average Control	0.611	4.191	0.011	0.051	0.217	2.034	0.007	0.058
Average Sediment Treatment	1.231	5.392	0.004	0.070	0.777	2.679	0.008	0.139
Average Sand Treatment	0.952	3.403	0.020	0.123	0.414	1.432	0.004	0.056

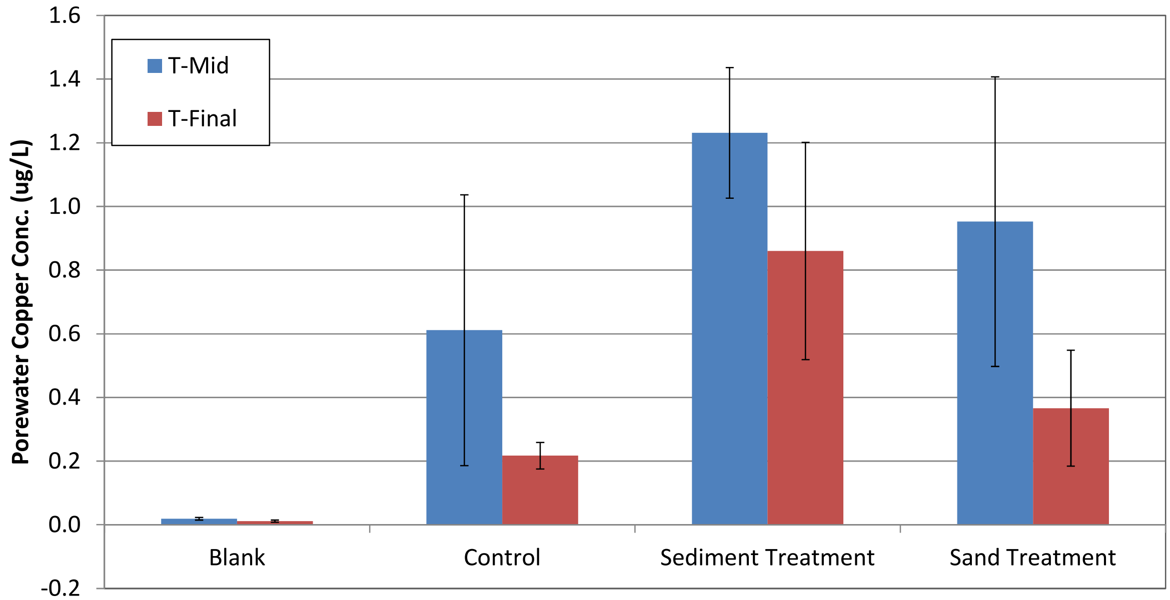

Figure 45. Copper concentrations in porewater for the T-Mid and T-Final sampling events based on results from the DGT samplers.

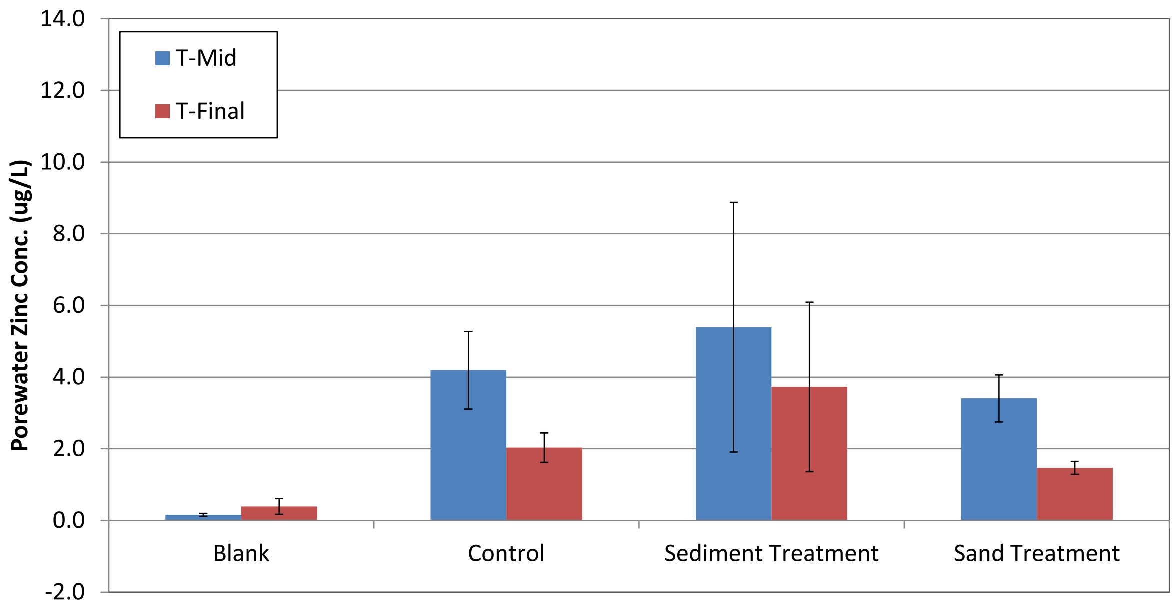

Figure 46. Zinc concentrations in porewater for the T-Mid and T-Final sampling events based on results from the DGT samplers.

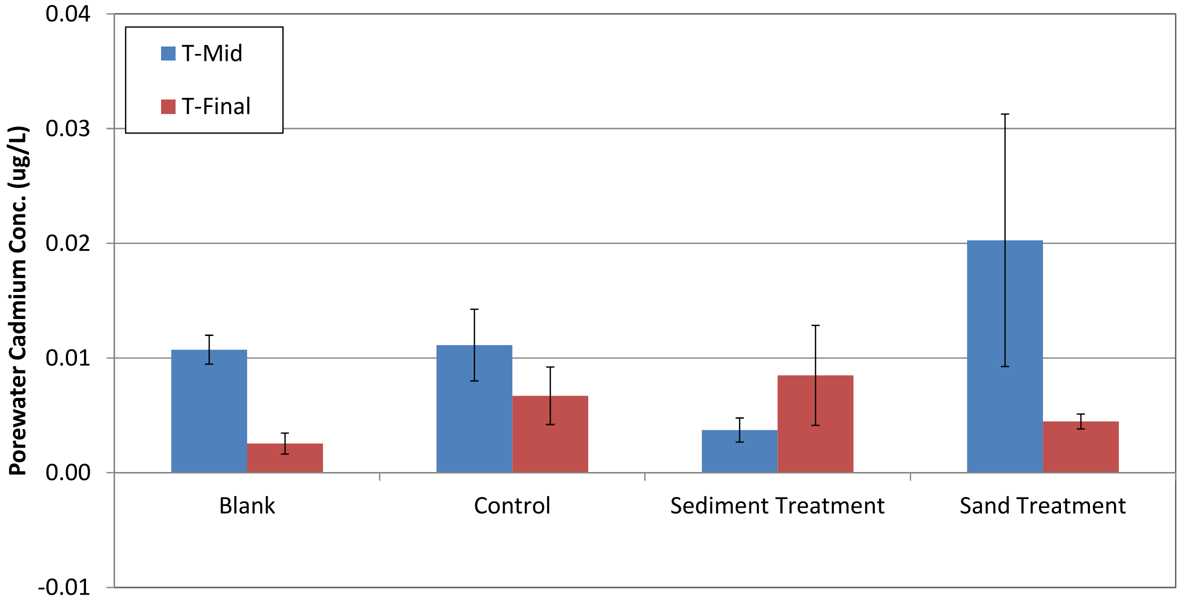

Figure 47. Cadmium concentrations in porewater for the T-Mid and T-Final sampling events based on results from the DGT samplers.

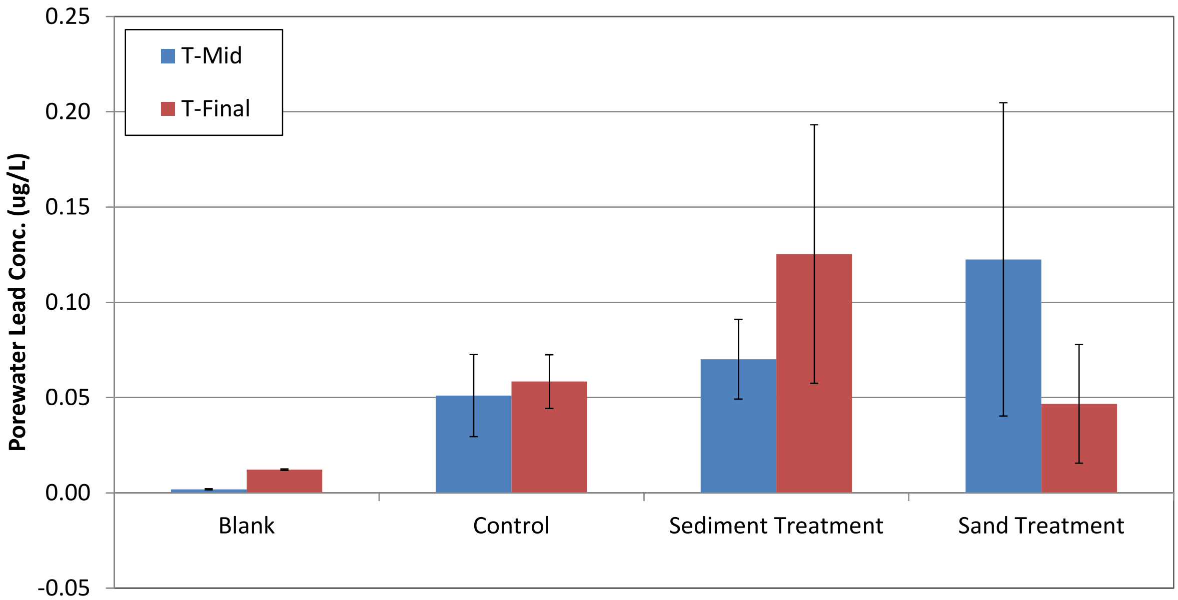

Figure 48. Lead concentrations in porewater for the T-Mid and T-Final sampling events based on results from the DGT samplers.

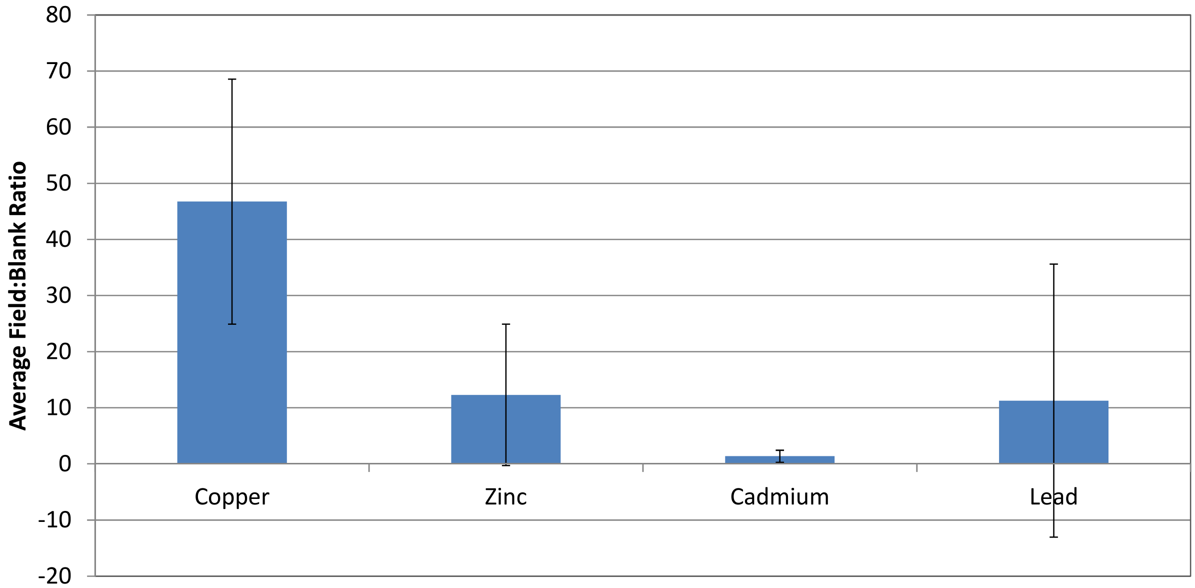

Figure 49. Ratio of field porewater DGT concentration to blank concentration averaged across all measurements.

SP3 Results

Sediment porewater HOC concentrations measured with SP3 polyethylene samplers were analyzed for samples collected at T-Mid and T-Final from the untreated site sediments and the two different treatment conditions (Table 8). To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment at these two time points during the deployment. Although the sampler deployments were reasonably long (28 days), there is some uncertainty in the calculation of porewater concentrations due to low elimination rates of PRCs (see Appendix G). However the qualitative trends are still expected to be reliable when comparing treated to untreated sediment exposures. General trends (non-statistical) and statistical differences are described below.

SP3 results are shown in Figure 50 – Figure 53 for HOCs including Total PAH, Total PCB, Total DDX, and Total Chlordane. Each figure shows the comparison of untreated Chollas Creek site sediments (control), and the thin-sediment and thin-sand treatments at the T-Mid and T-Final exposure points. At T-Mid, the thin-sediment treatment porewater concentration for Total PAH was comparable to the untreated control, while the thin-sand treatment was lower. In the T-Final porewater samples, the trend in Total PAH porewater concentrations had reversed with the control and sediment treatment still comparable, but the thin-sand treatment porewater concentration was higher. Porewater Total PCBs showed clear differences between untreated and treated sediments with both treatments showing lower concentrations and the sand treatment showing the most dramatic decrease. These differences were maintained in the T-Final exposure in which the untreated control sediment porewater Total PCB concentration increased while the two treatments both decreased.

Total DDX was not detected in the porewater of any of the treated or untreated sediments at T-Mid. However, at T-Final, detectable levels of Total DDX were found in both duplicates of the untreated controls and one duplicate of the sediment treatment, while there was still no DDX detected in the sand treatment porewater. Results for Total Chlordane in porewater showed lower concentrations in the treated sediments during T-Mid. By T-Final, Chlordane was undetectable in the porewater of all the treated and untreated sediments.

To evaluate statistical differences between treated and untreated sediment porewater concentrations, the data were evaluated using a paired (by sampling event) T-test for each contaminant with sufficient data. The results indicated that for both the sediment treatment and the sand treatment, the only HOC that showed a statistical difference associated with treatment was Total PCBs ($p=0.04$ and $p=0.01$, respectively). The trends observed for PAHs and Chlordane were not statistically significant, and the changes in DDX could not be evaluated due to non-detects.

Overall, the SP3 results indicate differing responses over time for HOC porewater concentrations. Qualitatively, PAHs in porewater showed an increasing trend in the sand treatment suggesting potential movement of PAHs from the contaminated sediment below into the sand layer. PCBs and Chlordane generally showed reductions associated with the application of the treatments. Chlordane also showed reduction with time in all sediments suggesting attenuation through degradation or some other process. Porewater DDX indicated that concentrations were increasing with time suggesting a potential local source because concentrations were increasing in the control sediments. However, the only HOC that showed a statistical decrease with treatment was Total PCBs. Complete SP3 chemistry reports are included in Appendix G.

Table 8. Porewater HOC concentrations based on the SP3 passive sampler measurements at T-Mid and T-Final

Sampling Event	T-Mid				T-Final			
Treatment	Total PAH (ng/L)	Total PCB (pg/L)	Total DDX (pg/L)	Total Chlordane (pg/L)	Total PAH (ng/L)	Total PCB (pg/L)	Total DDX (pg/L)	Total Chlordane (pg/L)
Control 1	48	620	ND	300	53	1300	210	ND
Control 2	70	1200	ND	800	27	1400	340	ND
Sediment Treatment 1	56	430	ND	190	36	250	ND	ND
Sediment Treatment 2	55	520	ND	210	78	310	60	ND
Sand Treatment 1	35	110	ND	130	73	29	ND	ND
Sand Treatment 2	26	120	ND	120	83	11	ND	ND

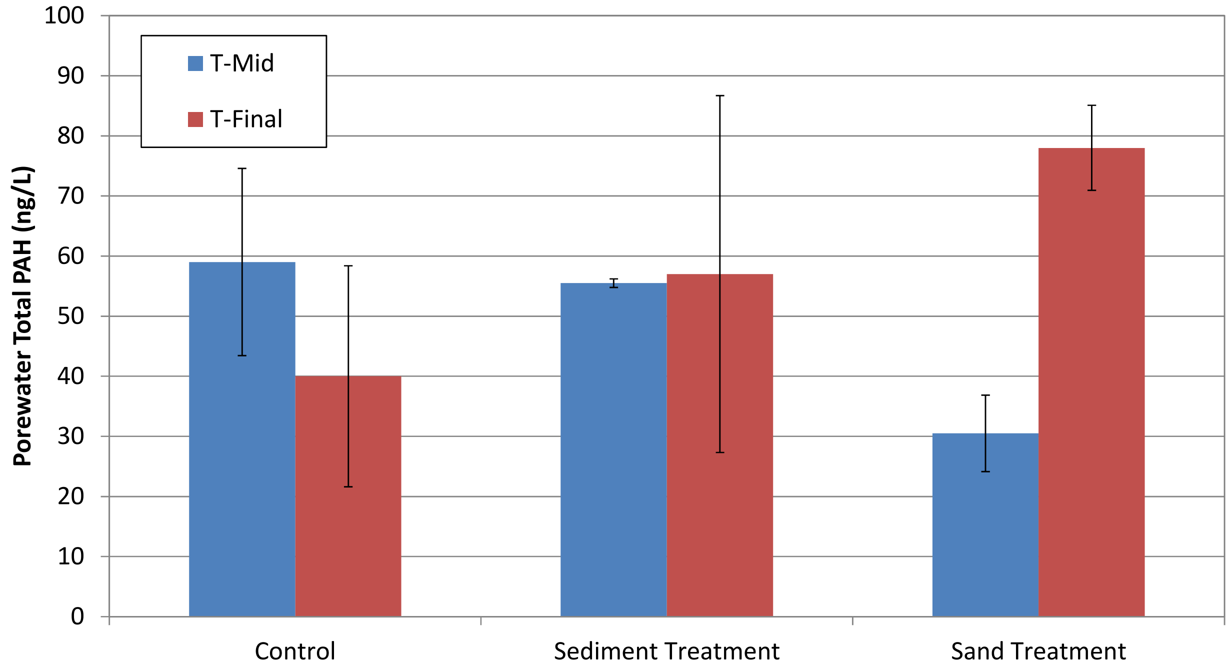

Figure 50. Total PAH concentration in porewater based on the SP3 passive samplers.

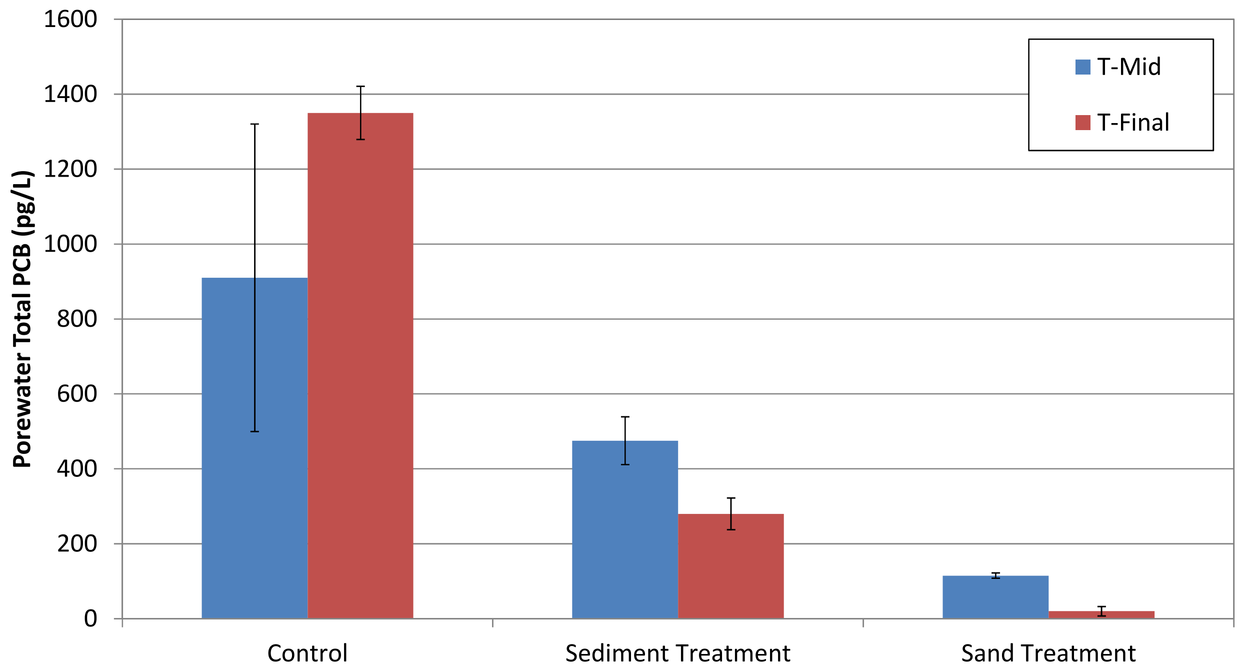

Figure 51. Total PCB concentration in porewater based on the SP3 passive samplers.

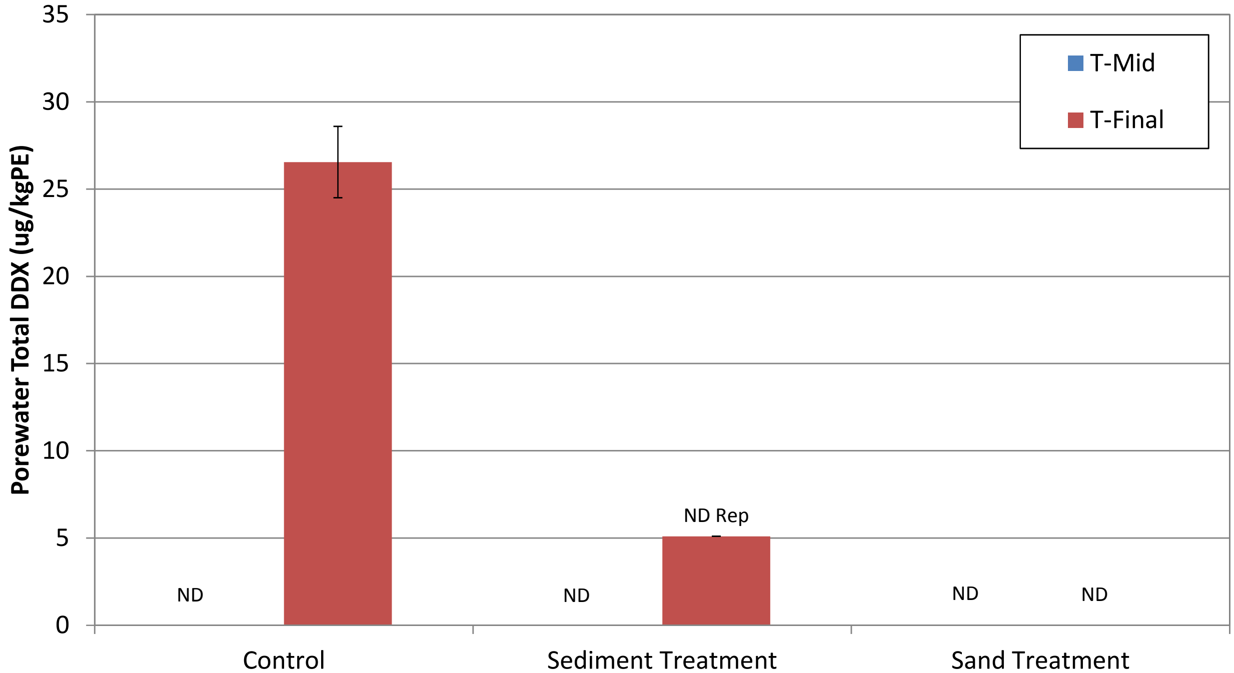

Figure 52. Total DDX concentration in porewater based on the SP3 passive samplers.

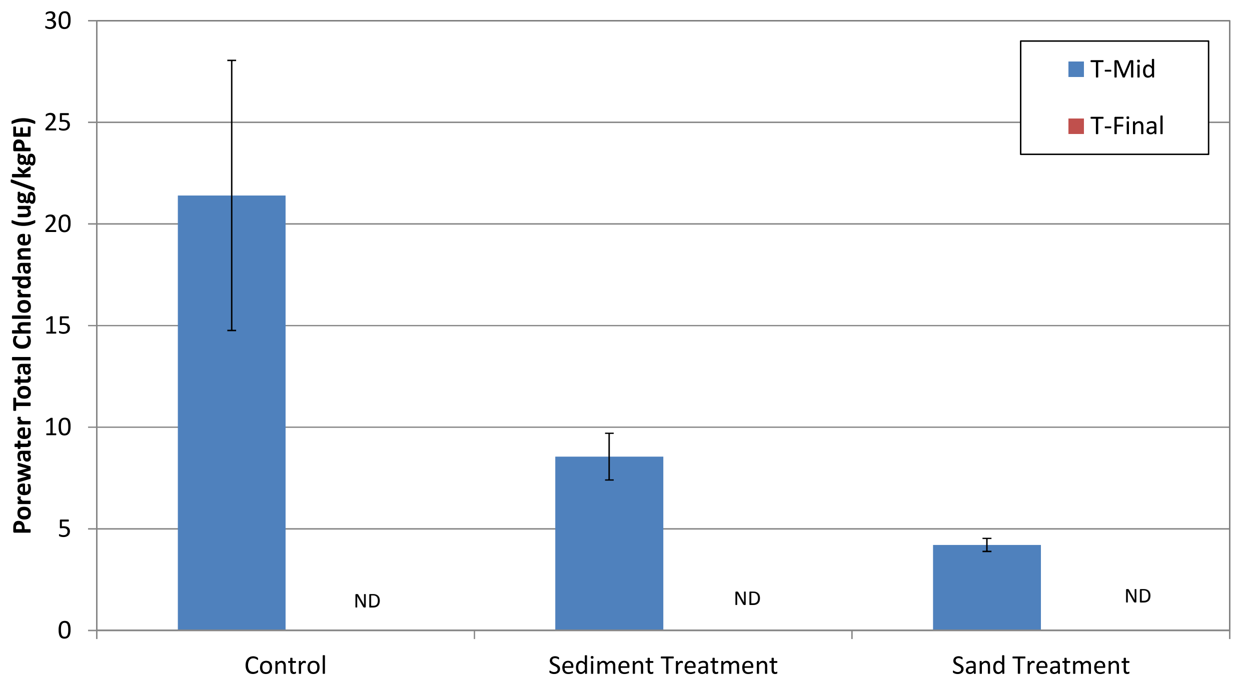

Figure 53. Total Chlordane concentration in porewater based on the SP3 passive samplers.

Bioaccumulation

Bioaccumulation in tissues of the clam *Macoma nasuta* was analyzed for samples collected at T-Mid and T-Final from the untreated site sediments and the two different treatment conditions. To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment at these two time points during the deployment. General trends (non-statistical) and statistical differences are described below.

Results for bioaccumulation of the metals copper, lead, zinc and mercury are shown in Figure 54 – Figure 57. Cadmium was below detection limits in the clam tissues. Bioaccumulation of copper was generally uniform across treated and untreated sediments at both the T-Mid and T-Final exposures. For lead, tissue concentrations were comparable for the untreated controls and the sediment treatment, but showed some decrease in the sand treatment, particularly for the T-Final exposure. As with copper, bioaccumulation of zinc was uniform across untreated and treated sediments, with slightly lower uptake in the sand treatment. Mercury bioaccumulation was generally uniform across treated and untreated sediments, but showed differences with time, with the T-Final concentrations increasing in comparison to the T-Mid exposure.

Results for bioaccumulation for Total PAHs, Total PCBs, Total DDX and Total Chlordane are shown in Figure 58 – Figure 61. Bioaccumulation of Total PAHs was fairly uniform across the untreated and treated sediments at T-Mid with slightly lower concentrations in the treatments. At T-Final, Total PAH concentrations in tissues decreased by about 50% in all sediments and showed slightly higher concentrations in the treatments compared to the controls. For Total PCBs, bioaccumulation was somewhat lower in the treatments compared to the controls at T-Mid. However, at T-Final, tissue concentrations increased across all sediments with somewhat higher levels in the treated sediments compared to the untreated controls. Total DDX concentrations were relatively low and uniform across all sediments at T-Mid, with treatment sediments each having non-detects in one of the replicate exposures. At T-Final, tissue concentrations increased in the control and sand treatment and showed higher variability between the duplicates. Total Chlordane was only detected in the bioaccumulation exposures for the controls at both T-Mid and T-final, indicating a trend toward lower (undetectable) levels in the treatments compared to the controls. Chlordane concentrations in controls appeared to decrease between T-Mid and T-Final as well.

To evaluate statistical differences between treated and untreated tissue concentrations, the data were evaluated using a paired (by sampling event) T-test for each contaminant with sufficient data. The results indicated that for the sediment treatment, no contaminants showed a statistically significant reduction (Total Chlordane had insufficient data). For the sand treatment, the only contaminant that showed a statistically significant reduction was zinc ($p=0.04$; cadmium and Total Chlordane had insufficient data). The trends observed for other contaminants were not statistically significant.

Overall, bioaccumulation results showed only limited effectiveness of the sediment treatments relative to controls. Lead and Total Chlordane showed some indication of reduced bioaccumulation in treatment sediments. Other contaminants generally did not show clear patterns that would indicate reduced bioavailability related to the treatments. Mercury, Total PCBs and Total DDX all showed increases between T-Mid and T-Final that suggest either source effects or increases in bioavailability with time. PAHs showed decreasing bioavailability with time indicating attenuation or reduction in bioavailability. Complete tissue chemistry reports are included in Appendix H.

Table 9. Tissue concentrations based on the clam exposures at T-Mid and T-Final.

Treatment	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)	Mercury (mg/kg)	Sum PAHs (µg/kg)	Sum PAHs lipid normalized (µg/kg lipid)	Sum PCBs (µg/kg)	Sum PCBs lipid normalized (µg/kg lipid)	Sum DDX (µg/kg)	Sum DDX lipid normalized (µg/kg lipid)	Sum Chlordane (µg/kg)	Sum Chlordane lipid normalized (µg/kg lipid)
	T-Mid												
Control 1	0.049	8.82	1.21	21.5	0.030	450	90840	7.38	1491	0.78	157	0.58	118
Control 2	0.044	7.09	1.01	19.6	0.026	485	99831	7.44	1530	0.82	168	1.89	388
Sediment Treatment 1	0.042	8.4	0.98	20.2	0.030	465	86785	8.20	1530	ND	ND	ND	ND
Sediment Treatment 2	0.043	7.33	0.73	21.1	0.030	412	84628	3.66	752	1.33	273	ND	ND
Sand Treatment 1	ND	7.87	0.50	19.0	0.025	407	109582	2.71	729	ND	ND	ND	ND
Sand Treatment 2	0.039	9.71	0.87	18.5	0.036	266	49822	5.12	960	0.89	166	ND	ND
	T-Final												
Control 1	ND	8.28	0.81	24.6	0.034	154	34262	10.28	2284	1.30	289	ND	ND
Control 2	ND	7.09	1.00	21.7	0.037	202	35449	15.33	2689	3.98	699	0.51	90
Sediment Treatment 1	ND	9.19	1.02	18.7	0.032	163	45139	12.77	3546	1.10	307	ND	ND
Sediment Treatment 2	ND	6.88	0.93	21.7	0.041	202	46963	11.09	2579	1.14	266	ND	ND
Sand Treatment 1	ND	8.56	0.61	18.8	0.041	227	58210	17.31	4438	5.63	1445	ND	ND
Sand Treatment 2	ND	7.63	0.58	16.9	0.035	206	47979	14.54	3381	1.04	242	ND	ND

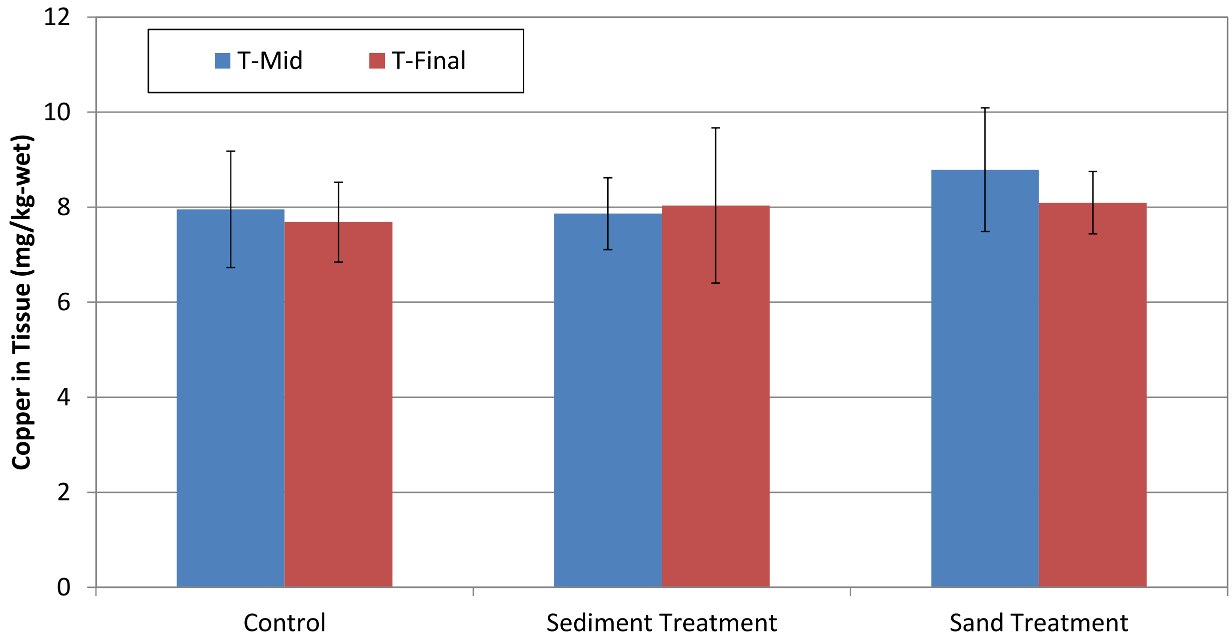

Figure 54. Copper concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

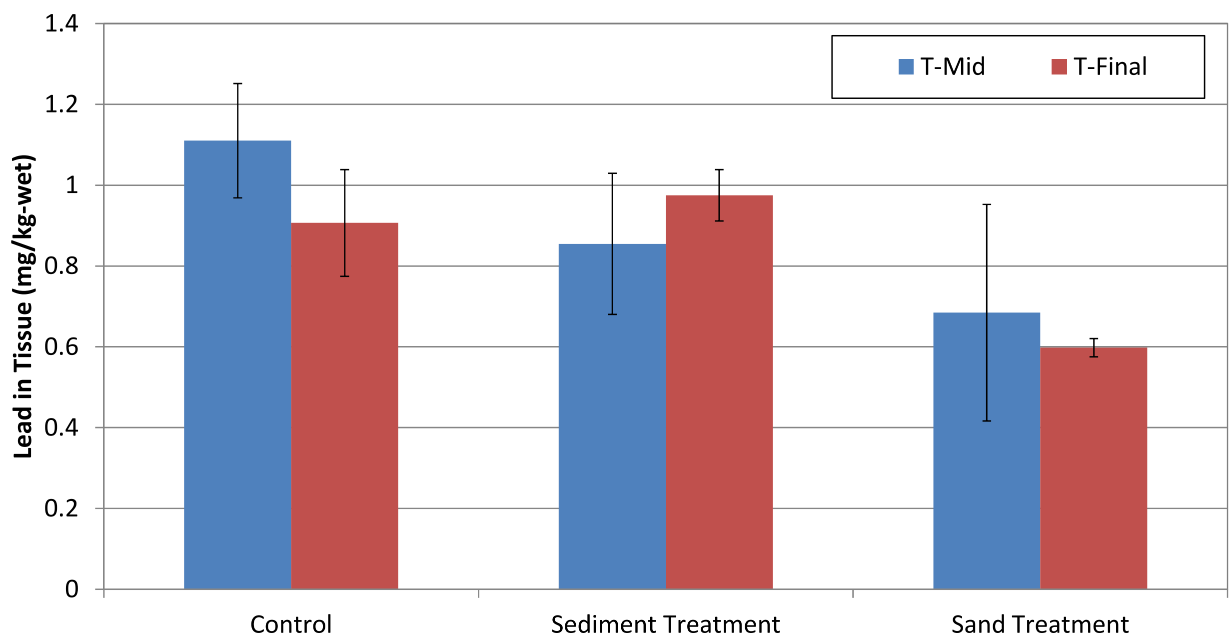

Figure 55. Lead concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

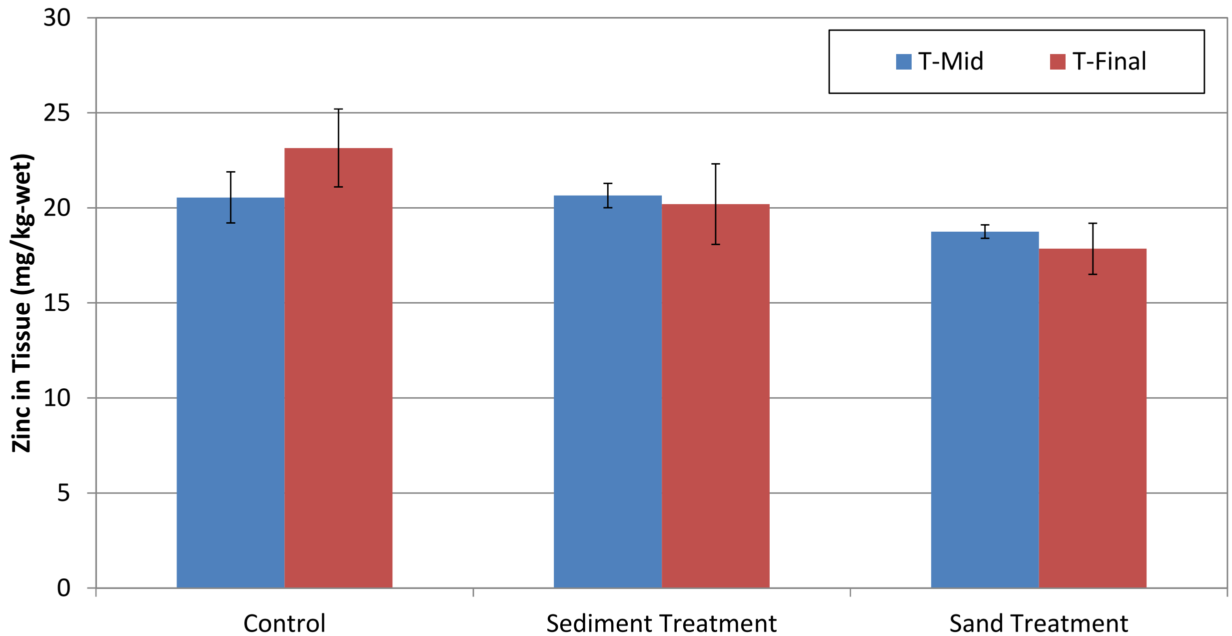

Figure 56. Zinc concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

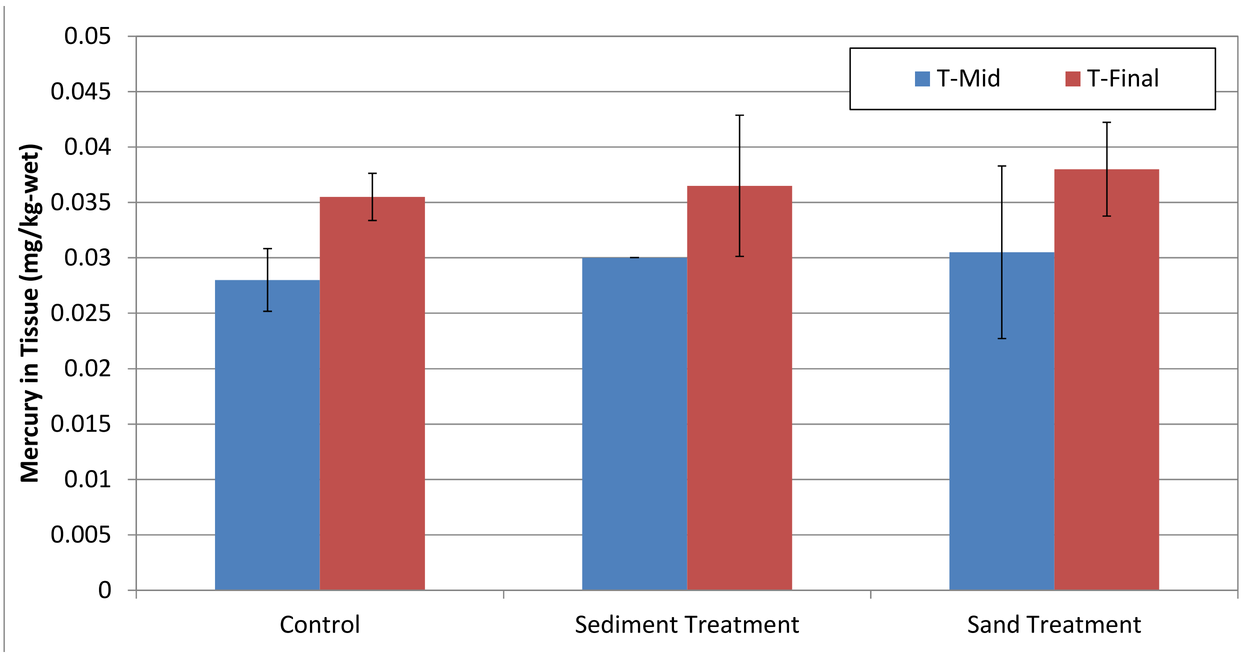

Figure 57. Mercury concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

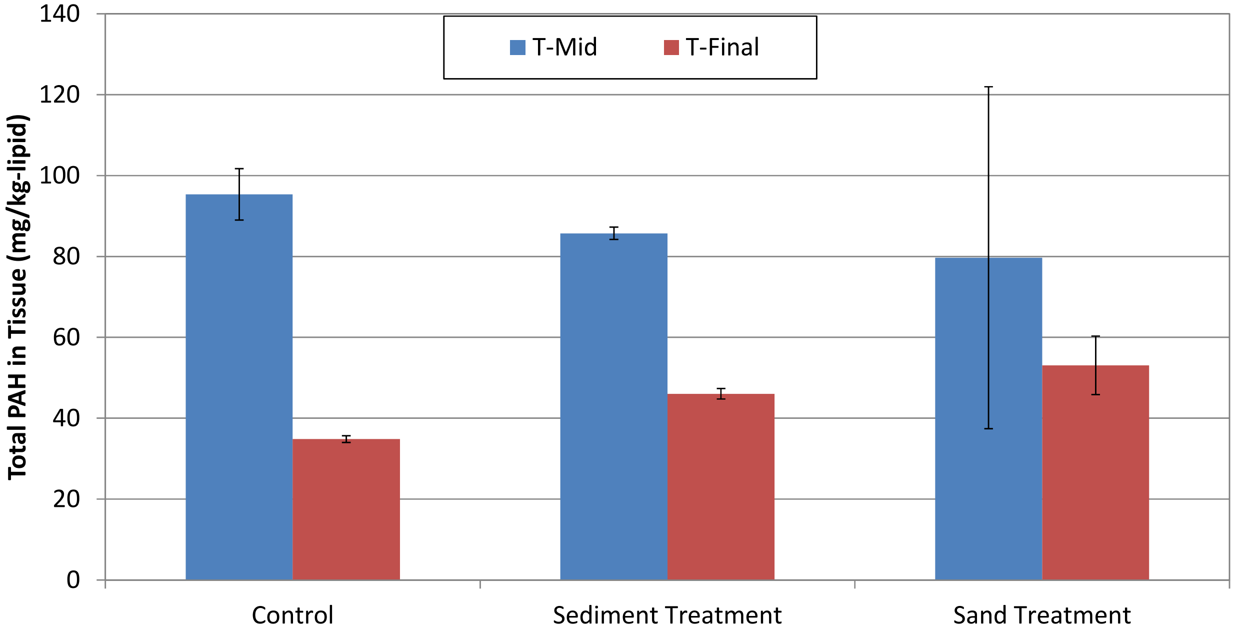

Figure 58. Lipid-normalized Total PAH concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

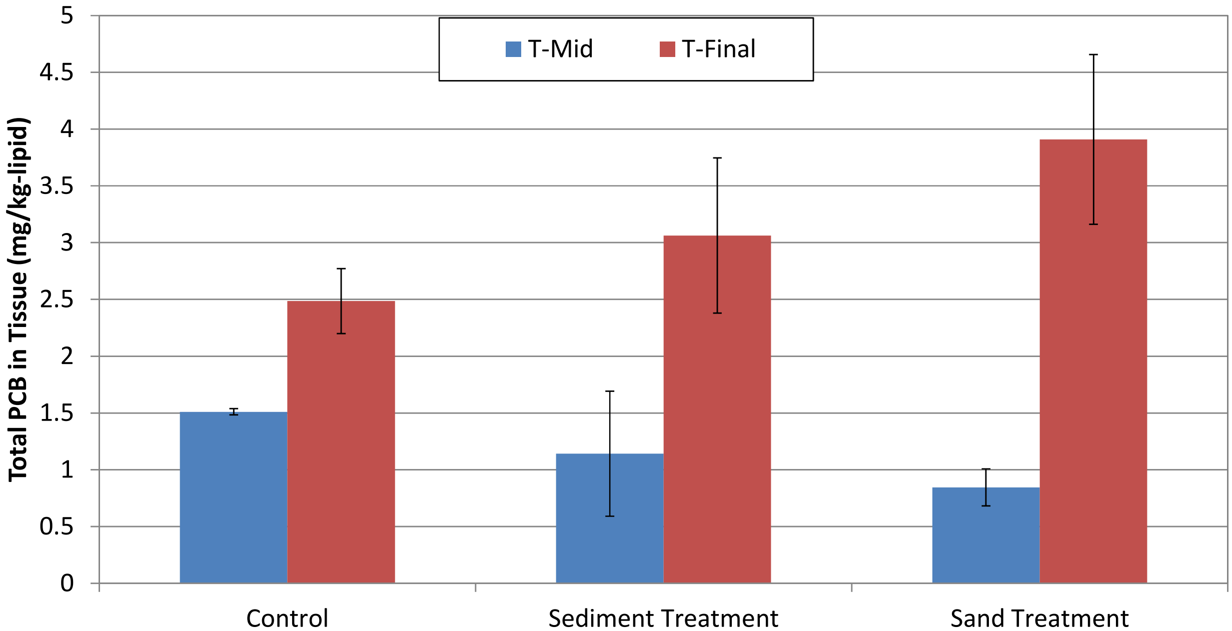

Figure 59. Lipid-normalized Total PCB concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

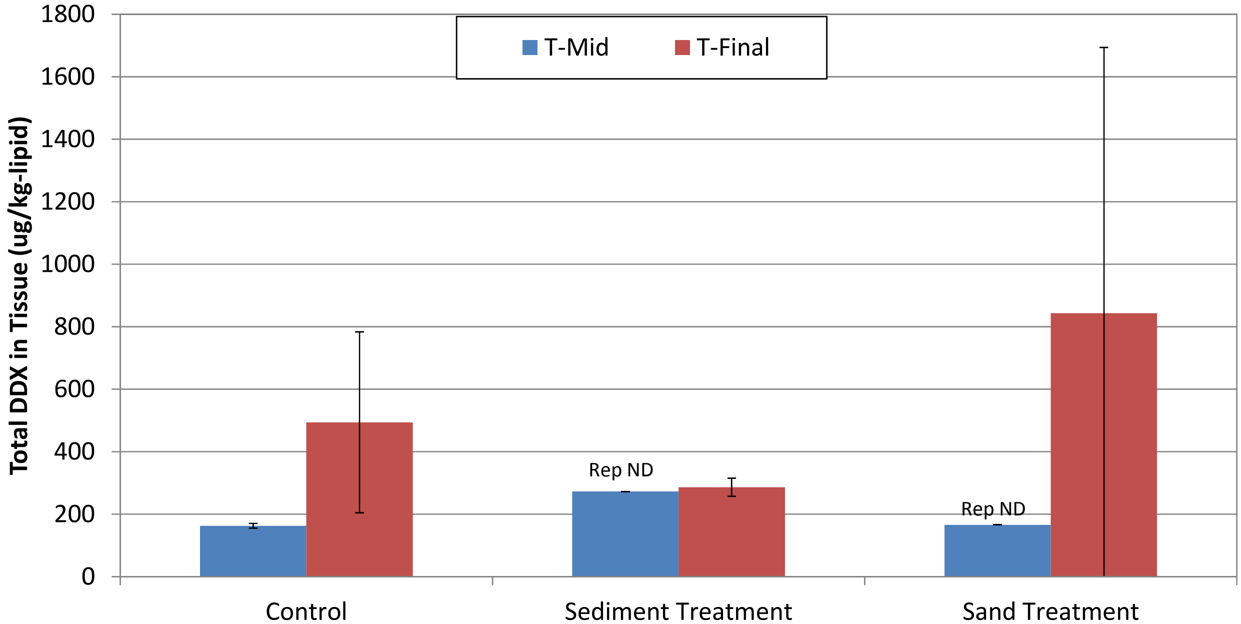

Figure 60. Lipid-normalized Total DDX concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

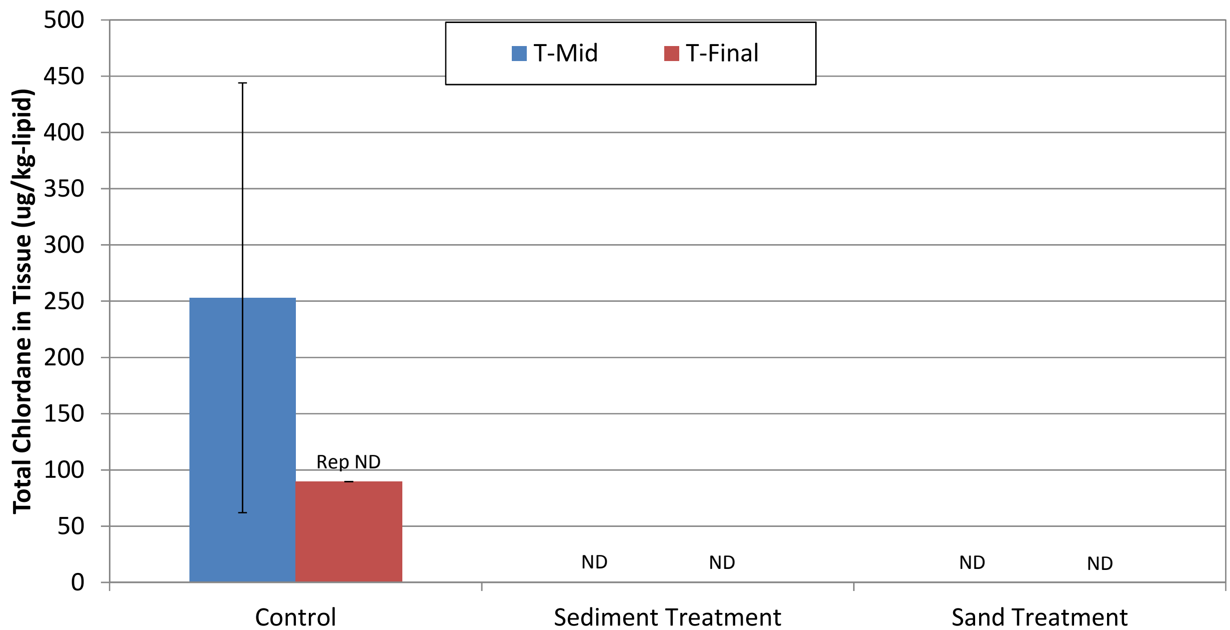

Figure 61. Lipid-normalized Total Chlordane concentrations in the clam Macoma nasuta exposed to treated and untreated RARA sediment cells from the T-Mid and T-Final exposure periods.

Benthic Community

Benthic community analyses were conducted for the original site sediments from Chollas Creek (T-Zero), and for the T-Final RARA event for the site sediment control, clean sediment treatment and sand treatment cells (Table 10). Eleven biological indices commonly used to assess benthic community health were used to evaluate the data. Results are presented below for two different comparisons. To determine the influence of removing localized sources, the T-Zero and T-Final concentrations in the untreated Chollas Creek sediments were compared. To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment. Only general trends are described as there was insufficient replication for statistical comparisons.

Results for the metrics are shown in Figure 62 – Figure 70. In these figures, the comparison between the T-Zero and T-Final untreated Chollas Creek site sediment can be seen in the first two bars of each figure. This comparison indicates the change associated with removing the sediments from the sources and physical disturbances associated with the Chollas Creek site to an area of the bay with no significant sources or disturbance for a period of 5 months. Total abundance was reduced, but virtually every other metric of benthic health (except the IBI) improved in association with moving the exposure to the undisturbed location. For example, metrics for richness, diversity, dominance, and evenness all improved. These improvements led to shifts in broader index scores including the BRI shifting from Low Disturbance to Reference, the RBI shifting from Moderate Disturbance to Reference, and the Integrated Category Score shifting from Moderate Disturbance to Low Disturbance. While there were insufficient data in the design to determine statistical differences, all of the differences are based on composited replicate samples and not single grabs. These results suggest *conditions at the Chollas Creek site, rather than conditions inherent to the sediments themselves, are contributing to the moderate levels of benthic degradation, and that by minimizing source exposure and physical disturbance, the benthic community rapidly improves.*

In Figure 62 – Figure 70, the comparison between the untreated and treated Chollas Creek site sediments can be seen by looking at the first (T-Zero untreated) and second bars (T-Final untreated) relative to the third (T-Final sediment treatment) and fourth (T-Final sand treatment) bars in each of the figures. Comparing the T-Zero untreated Chollas Creek site sediment to the T-Final treated sediments, we found broad improvements in metrics. For example, metrics for richness, diversity, dominance, and evenness all improved in both treatments compared to the untreated sediments. These improvements generally led to shifts in broader index scores. These improving trends were stronger for the sediment treatment compared to the sand treatment. For the sediment treatment, the BRI improved from Low Disturbance to Reference, the IBI improved from Low Disturbance to Reference, the RBI improved from Moderate Disturbance to Reference, and the Integrated Category Score improved from Moderate Disturbance to Reference. For the sand treatment, the BRI score improved but did not change category, the IBI was unchanged, the RBI improved from Moderate Disturbance to Reference, and the Integrated Category Score improved from Moderate Disturbance to Low Disturbance. Comparing the T-Final untreated Chollas Creek site sediment to the T-Final treated sediments, there were slight improvements in metrics for the sediment treatment, and minimal differences with the sand treatment. These results suggest that, from a benthic community health perspective, improved conditions result from treatment with thin layers of clean sediment and sand, with the largest improvement associated with the clean sediment treatment. However, because the sediment treatments were only evaluated at the remote location, it is not known how the treatments would perform under conditions of ongoing sources and physical disturbance at the site. This was only a limitation of the resources available for the study, and not a limitation of the RARA system which could clearly be used to evaluate that question as well. Complete benthic community analyses reports are included in Appendix I.

Table 10. Benthic community analysis metrics for the original Chollas Creek site sediment and the T-Final results for the untreated site sediment controls and the two treatments.

Treatment	Abundance	Richness	Shannon Div	Schwartz Dom	Pielou Even	BRI	IBI Cat Score	RBI	Int Cat Scores
Original Site Sediment	571	34	1.81	3.0	0.51	44.0	2	0.10	3
Site Sediment Control	407	55	2.82	9.0	0.70	39.4	2	0.42	2
Clean Sediment Treatment	415	65	2.78	10.6	0.66	38.9	1	0.51	1
Sand Treatment	417	56	2.39	9.1	0.59	41.4	2	0.50	2

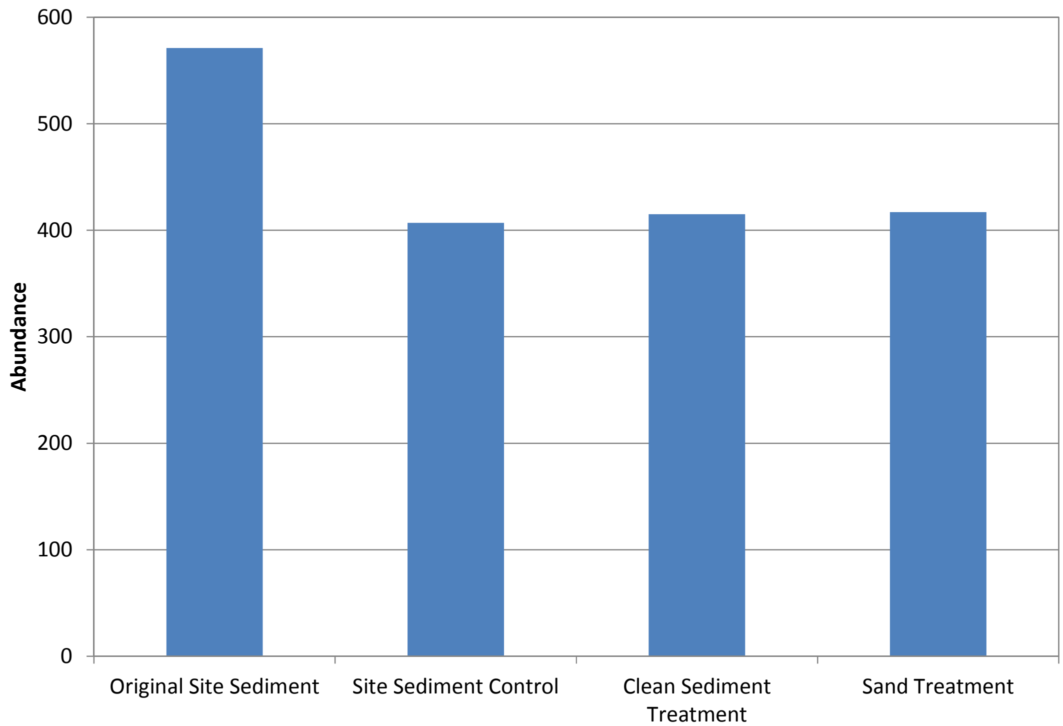

Figure 62. Total abundance for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

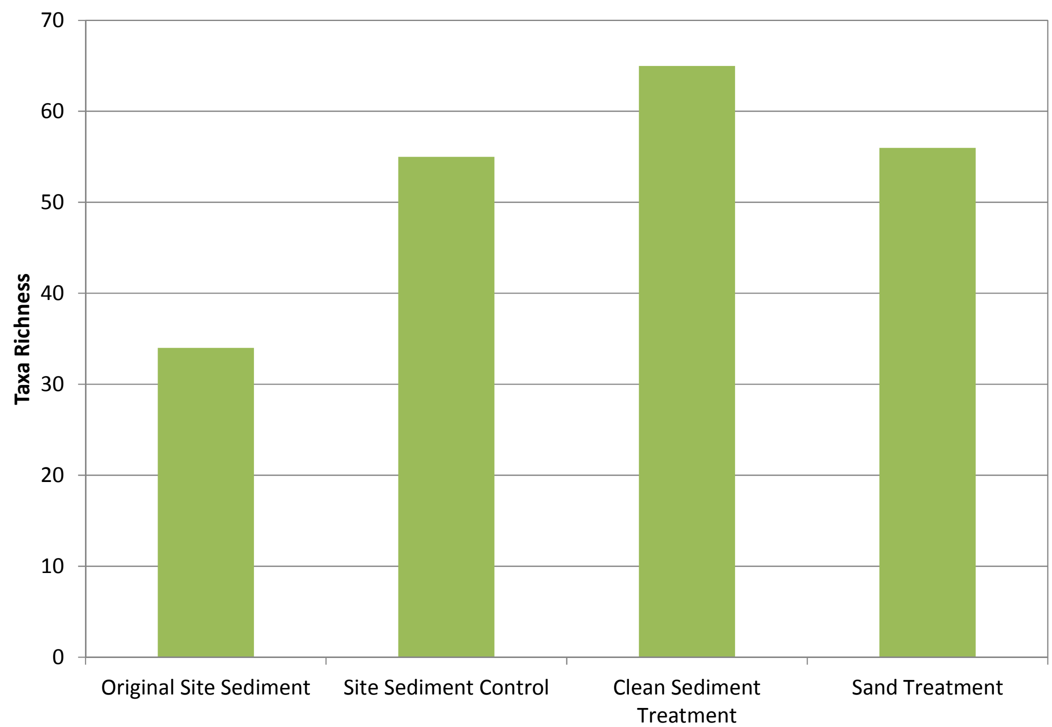

Figure 63. Taxa richness for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

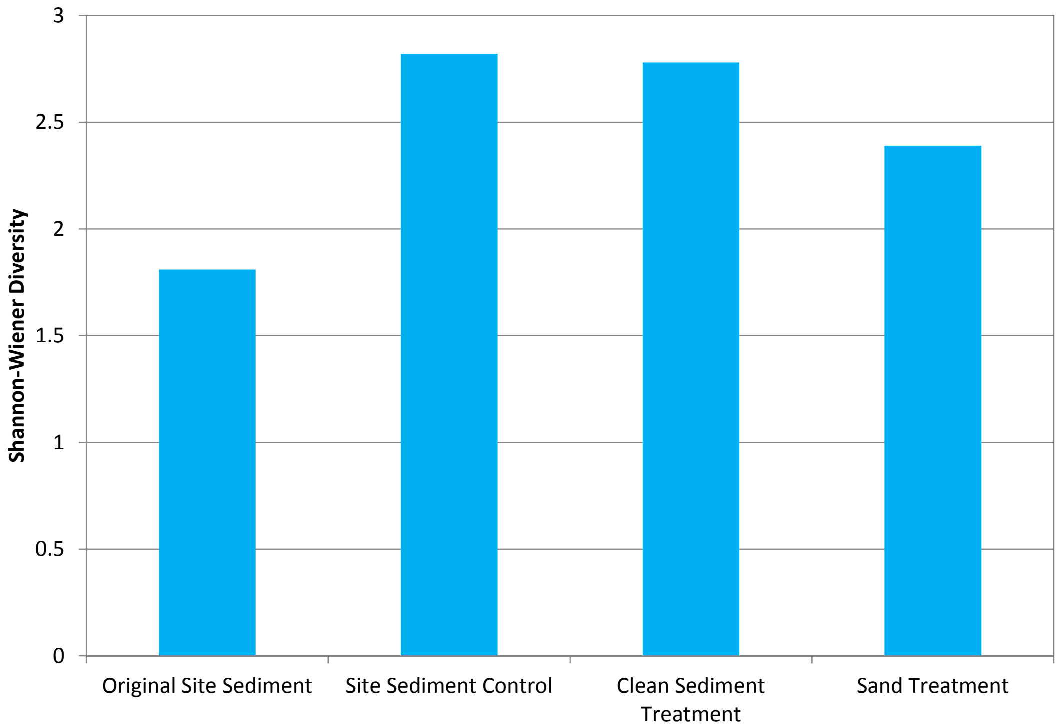

Figure 64. Shannon-Wiener Diversity Index for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

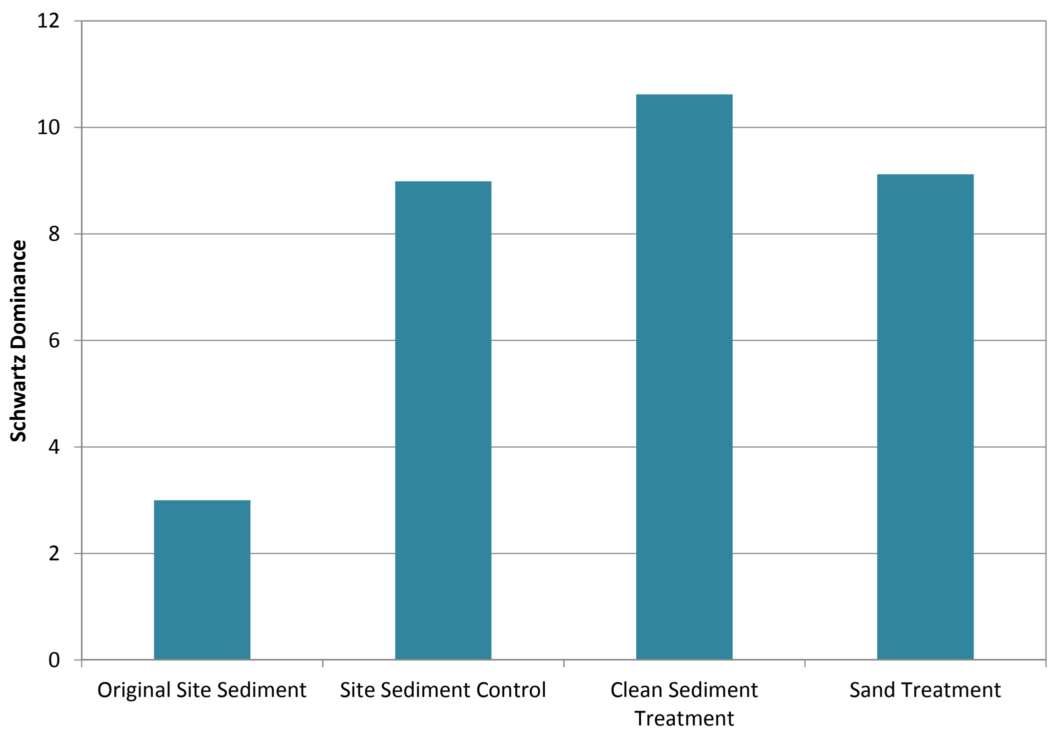

Figure 65. Schwartz Dominance Index for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

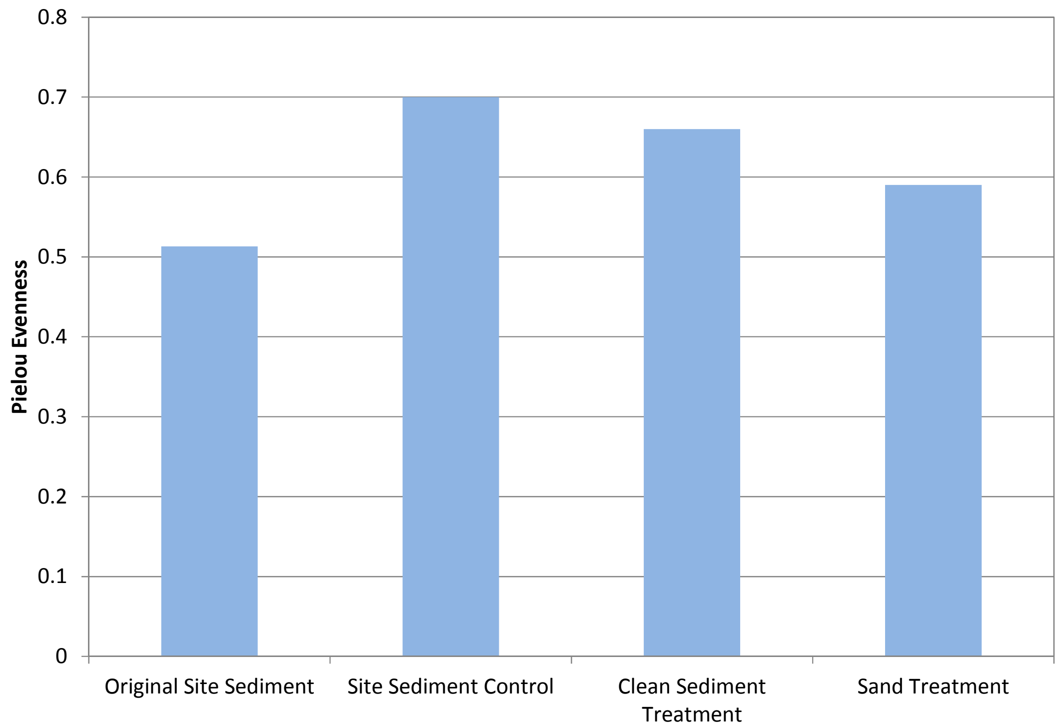

Figure 66. Pielou Evenness for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

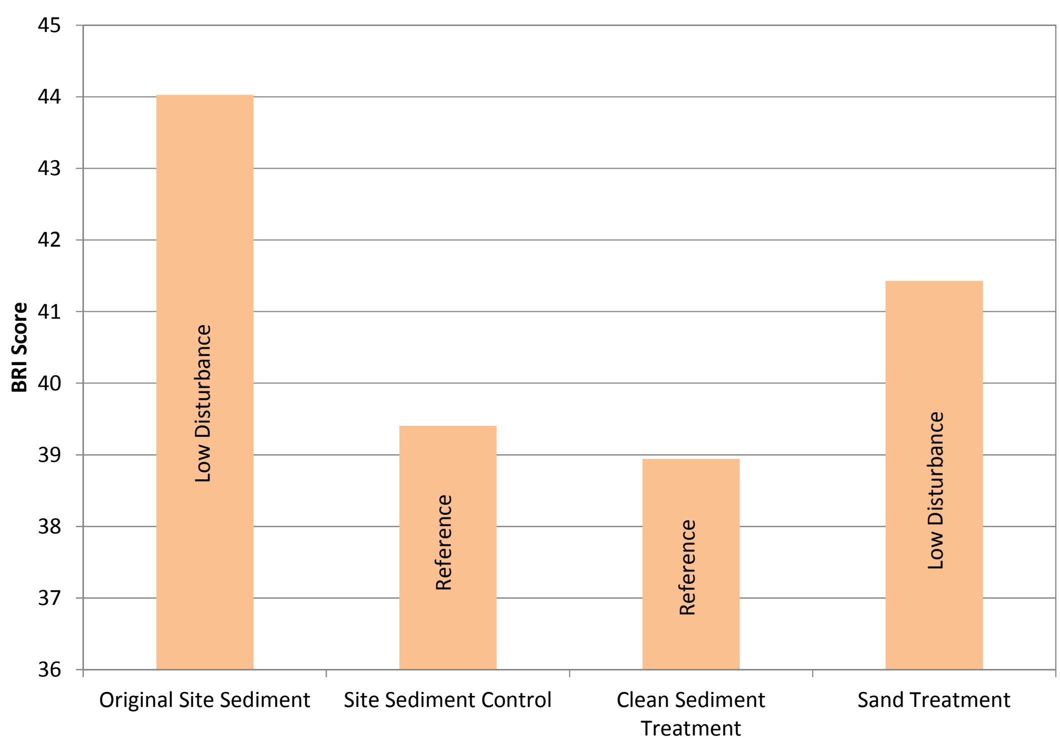

Figure 67. BRI scores for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

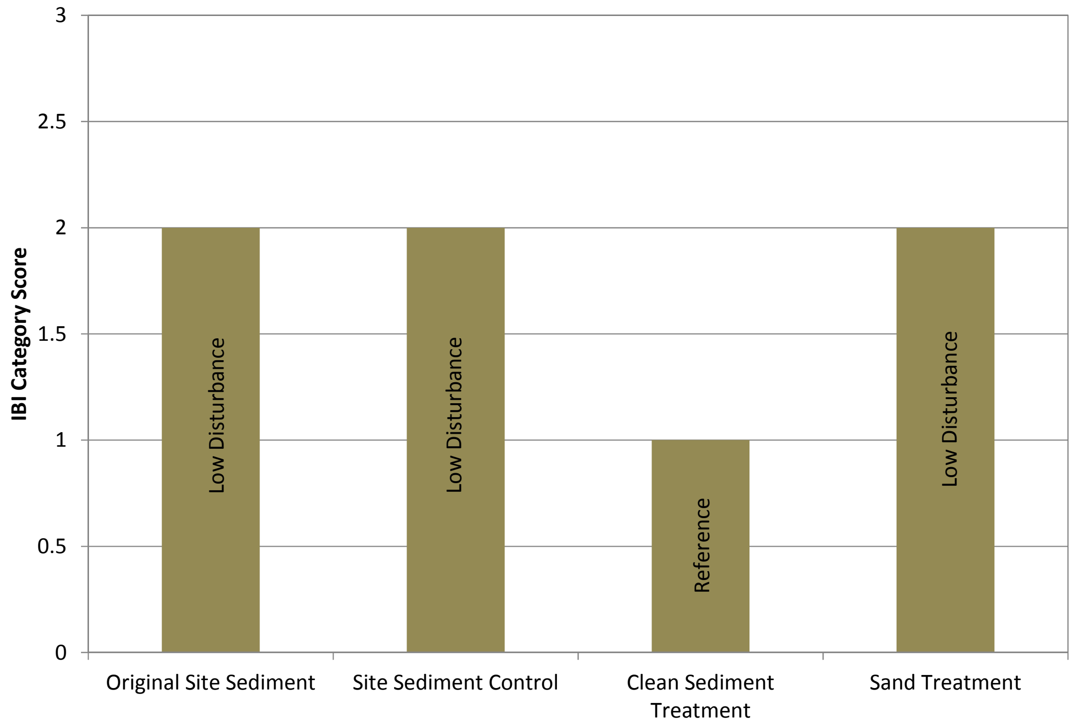

Figure 68. IBI category scores for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

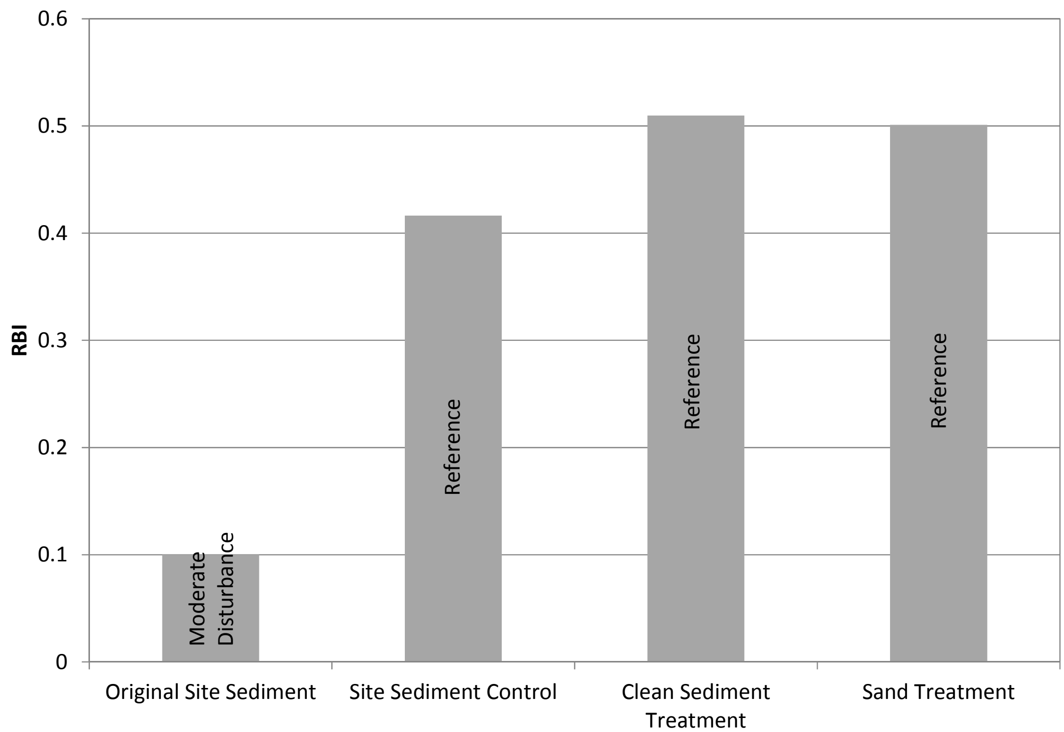

Figure 69. RBI scores for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

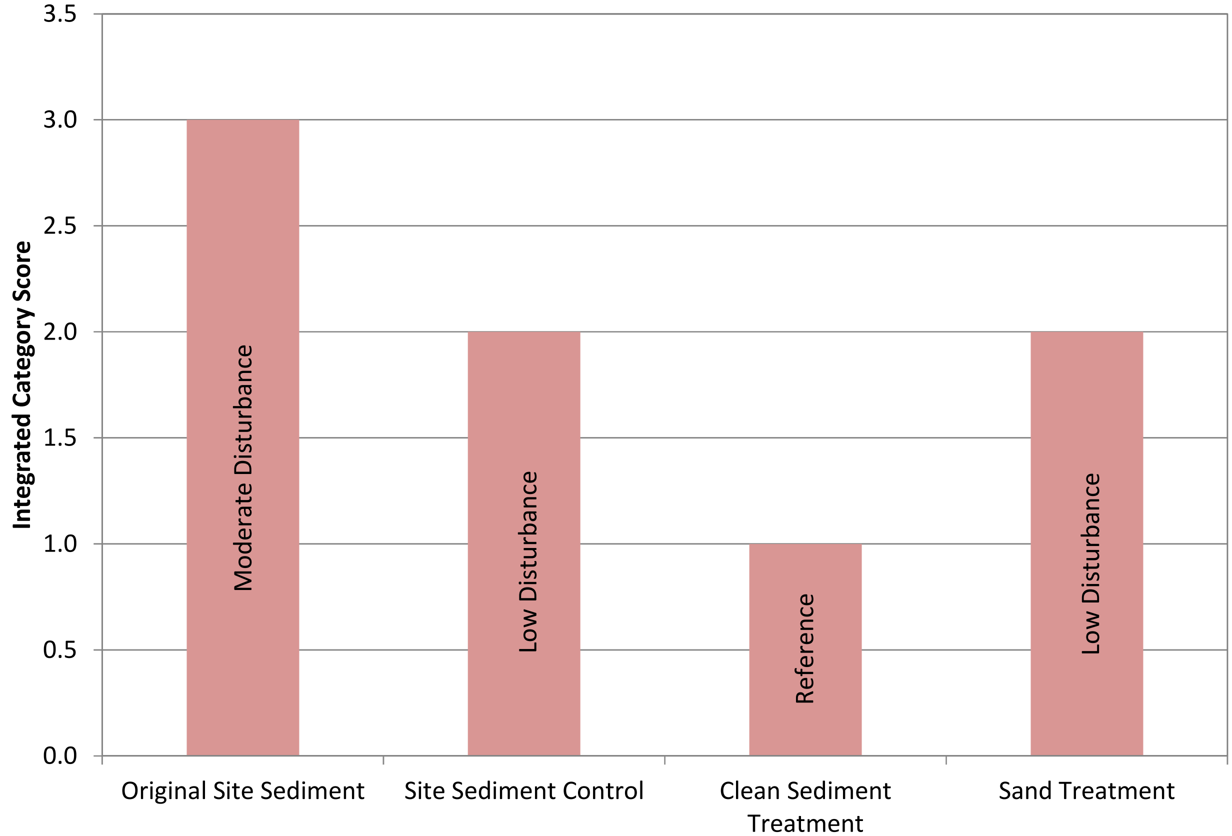

Figure 70. Integrated category scores for the original Chollas Creek site sediment, and the control and treatment sediment cells in the RARA array assessed at the end if the deployment period.

6. Conclusions and Implications for Future Research

Conclusions and implications for future research based on the proof-of-concept RARA development and testing are summarized below with respect to design and performance of the system, performance of the treatments, and potential for future development and applications.

6.1 RARA System Development and Capabilities

The RARA system was successfully designed and constructed based on the goal of providing an integrated technology for assessing the effectiveness of different sediment remedies when subjected to varying pressures from site conditions and recontamination loadings. The system design balances requirements for multiple treatments, controls and replication with the constraints of size, weight, deployability and cost. The RARA array allows remedies to be tested *in situ* and on-site while reducing costs that would be associated with costly pilot-scale studies. The system incorporates standard cylindrical sediment traps around the perimeter of the array that provide adequate capture area to collect incoming depositional sediments. The prototype system also incorporated an ADCP, OBS and temperature/dissolved oxygen sensor to monitor conditions during the deployment. The system design allows for a range of measurement endpoint capabilities to provide the basis for the assessment or remedy effectiveness and recontamination including:

- Surface Sediment Chemistry – As an overall means of comparing treatments and assessing recontamination
- Sediment Trap Material Chemistry – To provide assessment of incoming particle contaminant loading
- Porewater Passive Sampler Chemistry – To compare potential differences in bioavailability across treatments and assess changes associated with recontamination
- Bioaccumulation - To compare direct differences in biouptake across treatments and assess changes associated with recontamination
- Toxicity - To compare direct differences in toxic response across treatments and assess changes associated with recontamination
- Benthic Infauna – To assess changes in habitat quality associated with treatments and recontamination fluxes
- Sediment Tracers – To define baseline sediment and treatment interfaces and qualitatively assess vertical mixing over time

All of these methods (and more) can be accommodated by the array design. A subset of these methods were demonstrated during the proof-of-concept deployment.

Pier-side testing and the proof-of-concept deployment provided the basis for development and refinement of the RARA methodology. The RARA operational protocol provides a step-by-step basis for the procedures to be used in the field. The key elements of the protocol include: preparation and mobilization; site sediment collection; treatment application; RARA deployment;

sampling events; and demobilization. These protocols were defined in detail and successfully demonstrated during the proof-of-concept deployment.

6.2 Sediment Treatment Performance in the RARA System

As part of the proof-of-concept deployment, we used the RARA system to evaluate two aspects of remedy and recontamination performance for the untreated and treated Chollas Creek site sediments. Performance of two sediment treatments including a thin-layer clean sand treatment and a thin-layer clean sediment treatment was evaluated relative to untreated Chollas Creek site sediment. The deployment was also used to evaluate the concept of source influence on the remedies by removing the known source inputs at Chollas Creek by moving the RARA array to an area without significant ongoing sources.

6.2.1 Effects of Removing Site Associated Stressors

To determine the influence of removing localized sources, the T-Zero and T-Final concentrations in the untreated Chollas Creek sediments were compared. Comparing the T-Zero and T-Final concentrations of the untreated Chollas Creek site sediments, both the physical and chemical properties of the bulk sediment remained relatively consistent over the 5-month period. Sediment traps showed moderate deposition rates and contaminant concentrations that were generally lower than the concentrations in the untreated sediments, confirming the effective removal of recontamination from site sources. Porewater trends in the untreated sediments between T-Mid and T-Final were mixed, with most metals, Total PAHs and Total Chlordane showing downward trends, while Total PCBs and Total DDXs showed increases. Over the same time period, bioaccumulation of metals generally remained unchanged, Total PAHs and Total Chlordane showing decreasing uptake, and PCBs and DDXs showed increasing uptake. Benthic community health compared between T-Zero and T-Final in the untreated sediments showed that total abundance was reduced, but virtually every other metric of benthic health improved in association with moving the exposure to the undisturbed location. Based on these findings, we concluded that:

Overall, these results support the conclusion that removing the impacts of the creek sources and physical disturbance that are present at the Chollas Creek site resulted in some minor changes in sediment chemistry and bioavailability, but also resulted in some clear improvements in benthic community health. Because the chemical changes appear to be relatively minor, we suspect that the changes in benthic community health may results primarily from the removal of the physical disturbances that are known to occur at the Chollas Creek site primarily due to ship movements and associates propeller wash. We conclude that the deployment demonstrated the utility of the RARA system to assess changes in source pressure and site conditions on the response of site sediments with potential practical applications to impairment assessment, source control, and the performance of monitored natural recovery remedies.

6.2.2 Effects of the Applied Treatments

To determine the influence of the two treatments, the untreated site sediment controls were compared to the sediments treated with thin-layer sand and thin-layer clean sediment at the T-Zero, T-Mid and T-Final conditions (depending on the measurement endpoint). Lines of evidence are summarized in Table 11.

Comparing bulk sediment concentrations in treatments to untreated controls, we found reductions in a broad range of contaminant levels with the largest magnitude of reductions in the sand treatment, followed by the clean sediment treatment. Changes in bulk sediment concentrations appeared to be driven primarily by the treatment application as opposed to new deposition as indicated by the sediment traps. Comparison of trap sediment concentrations to treated sediment concentrations indicated that depositing sediments generally had contaminant concentrations that were higher than the sand treatments, but lower or comparable to the sediment treatments. These results suggest that incoming sediments would exert some upward pressure on the thin-sand treatments, but would generally have only a small downward pressure on the thin-sediment treatments. Sediment porewater concentrations measured in both treatments were generally comparable to untreated controls for metals and Total PAHs, while showing reductions in Total PCBs. Bioaccumulation results indicated that bioavailability in the sediment treatments was comparable to the untreated sediments for all contaminants with the exception of zinc which was slightly reduced in the sand treatment. The bioaccumulation measurements generally indicate minimal effects of the treatments with respect to reduction in bioavailability. Comparing the T-Zero untreated Chollas Creek site sediment to the T-Final treated sediments, we found broad improvements in benthic community metrics. These improving trends were stronger for the sediment treatment compared to the sand treatment.

Overall, the treatment results support the conclusion that both the clean sediment and sand treatments were effective in reducing bulk sediment concentrations when compared to untreated sediments. However, more direct measures of bioavailability including porewater and bioaccumulation indicated minimal improvement for both treatments compared to untreated controls. In contrast, direct measurements of benthic community health showed broad improvements especially in the clean sediment treatments. We conclude that the deployment demonstrated the utility of the RARA system to assess changes associated with sediment treatments using multiple lines of evidence, and that the system is effective in determining the relative performance of different sediment treatments relative to untreated controls.

6.3 Future Research and Applications

The RARA system was successfully designed and constructed based on the goal of providing an integrated technology for assessing the effectiveness of different sediment remedies when subjected to varying pressures from site conditions and recontamination loadings. The system design balances requirements for multiple treatments, controls and replication with the constraints of size, weight, deployability and cost. The RARA array allows remedies to be tested *in situ* and on-site while reducing costs that would be associated with costly pilot-scale studies. The method incorporates a broad range of measurement endpoints including surface sediment chemistry, sediment trap depositional mass and chemistry, porewater passive sampler chemistry, bioaccumulation, toxicity, benthic infauna, and sediment tracers. The system is well-suited to assess a range of remedies including thin caps, amendments, geofabrics, and natural recovery. Overall, the RARA system represents a new paradigm in cost-effective, realistic remedy performance assessment that was previously unattainable.

A key aspect for future applications of the RARA system is the potential for order-of-magnitude cost savings compared to more complex and expensive pilot scale treatability studies. Pilot scale studies at multiple DoD sites including Puget Sound Naval Shipyard, Pearl Harbor, and Hunters Point all indicate costs in excess of $1M compared to RARA costs which are much closer to $100K for a comparable assessment. Pilot studies continue to have advantages in both the degree of realism, accounting for scale effects, and incorporating aspects of installation and monitoring that may be important. However, for many sites the costs associated with pilot studies may be prohibitive, the additional information to be gained may not be critical, or the fundamental questions about the potential of the remedy may need to be addressed before undertaking a pilot study. In these scenarios, future research and applications with the RARA system have the potential to significantly reduce cost and complexity while still providing much more realistic and defensible data than can be obtained from laboratory treatability studies. To achieve this, future applications should consider optimization of the system and field design to achieve a higher degree of statistical power while balancing this against costs. We envision this could be achieved by replicating the array (so the system is still physically manageable) and deploying multiple units. Using multiple units would allow the study design to be scaled up and down based on site-specific requirements.

The RARA system has clear future applications for DoD sediments in the RI/FS process. The primary application should be in reducing uncertainties associated with remedy selection for site-specific conditions. While there is a broad range of guidance on remedy selection for sediments, understanding of how these remedies will perform under site specific conditions is still a very challenging area of research and practice. Future applications of the RARA system can provide a cost-effective means of providing site-specific and remedy-specific empirical data to reduce this uncertainty and thus improve the likelihood of remedy success. This has major implications for cost avoidance associated with overly conservative assumptions during remedy selection, and potential remedy failures due to inadequate consideration of site-specific conditions.

Another aspect of future demonstrations and applications should focus on the assessment of recontamination. The RARA system provides a methodology that could be standardized for assessment of recontamination potential at specific targeted points of interest. Because the system incorporates pre-characterized sediments that can be deployed and retrieved relatively easily, monitoring of changes associated with ongoing sources is greatly enhanced. This is also supported by the onboard instrumentation that provides documentation of conditions and potential discharge and disturbance events. One future improvement from this perspective would be to incorporate monitoring instrumentation that is better designed for long deployments and fouling conditions.

Thus, important next steps for the RARA technology include optimization of the array and associated instrumentation, development of hardware and methodologies to support the deployment of multiple systems, broader demonstration at DoD contaminated sediment sites under a range of conditions, and transition into application with standard processes including RI/FS and TMDL.

Table 11. Summary of lines of evidence from the RARA proof-of-concept deployment comparing treated sediments to untreated controls. Chemistry lines of evidence are based on statistical comparisons, while benthic community classifications are qualitative due to limited data.

Treatment	Thin Sediment Treatment				Thin Sand Treatment			
Measurement/Metric	Reduction in Bulk Sediment Concentration	Reduction in Porewater Concentration	Reduction in Bioaccumulation	Improvement in Benthic Community Health	Reduction in Bulk Sediment Concentration	Reduction in Porewater Concentration	Reduction in Bioaccumulation	Improvement in Benthic Community Health
Cadmium	+	o	o	NA	o	o	NA	NA
Copper	+	-	o	NA	+	o	o	NA
Lead	+	o	o	NA	+	o	o	NA
Mercury	o	NA	o	NA	o	NA	o	NA
Zinc	+	o	o	NA	+	+	+	NA
Total PAH	+	o	o	NA	+	o	o	NA
Total PCB	+	+	o	NA	+	+	o	NA
Total DDX	o	NA	o	NA	o	NA	o	NA
Total Chlordane	o	o	NA	NA	o	o	NA	NA
Total Abundance	NA	NA	NA	-	NA	NA	NA	-
Taxa Richness	NA	NA	NA	+	NA	NA	NA	+
Shannon-Wiener Diversity	NA	NA	NA	+	NA	NA	NA	+
Pielou’s Evenness	NA	NA	NA	+	NA	NA	NA	+
Swartz’s Dominance	NA	NA	NA	+	NA	NA	NA	+
BRI	NA	NA	NA	+	NA	NA	NA	+
IBI	NA	NA	NA	+	NA	NA	NA	o
RBI	NA	NA	NA	+	NA	NA	NA	+
Integrated Benthic Index	NA	NA	NA	+	NA	NA	NA	+

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Appendix A. Benthic Community Analyses Standard Operating Procedure

STANDARD OPERATING PROCEDURES

for

Laboratory Analysis: Marine Benthic Macroinvertebrate Indicator

Prepared by

EcoAnalysts, Inc.

LIFE IN WATER

1420 South Blaine Street, Suite 14
Moscow, Idaho 83843

February 2015

A1. TITLE AND APPROVAL SHEET

Document Title:
Quality Assurance Project Plan for Laboratory Analysis: Marine Benthic Macroinvertebrate Indicator

Preparer:
EcoAnalysts, Inc., Moscow, Idaho

Address and Telephone Number:
1420 South Blaine Street, Suite 14, Moscow, Idaho 8343/ (208) 882-2588

Day/Month/Year
18/February/2015

EcoAnalysts, Inc. President/CEO, Project Manager: ______________________________
Gary T. Lester. / 18 February 2015

A2. TABLE OF CONTENTS

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Table 1. Acronyms and Abbreviations

BMI	Benthic Macroinvertebrate
CEO	Chief Executive Officer
EPA	United States Environmental Protection Agency
DQO	Data Quality Objective
EcoAnalysts	EcoAnalysts, Inc.
LIMS	Laboratory Information Management System
MQO	Measurement Quality Objective
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
SOP	Standard Operating Procedure
US EPA	United States Environmental Protection Agency

DOCUMENT CONTROL

This document has been prepared according to the United States Environmental Protection Agency publication, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R5, March 2001). This QAPP will be reviewed annually and updated as needed. Updated versions of this QAPP will bear a new (x + 1) revision number.

GROUP A: PROJECT MANAGEMENT

A3. DISTRIBUTION LIST

Each person listed on the Approval Signature Page and each person listed in Table 2 or his/her successor will receive a copy of the final approved version of this Quality Assurance Project Plan. A copy will also be made available to other persons taking part in the project and to other interested parties.

Table 2. QAPP for Laboratory Analysis: BMI Distribution List

Name	Title/Affiliation	Address	Phone/email
Gary T. Lester	CEO, Project Manager EcoAnalysts, Inc.	1420 South Blaine Street, Suite 14 Moscow, ID 83843	208-882-2588 ext 21 glester@ecoanalysts.com
Pat Barrett	Taxonomy Coordinator EcoAnalysts, Inc.	1420 South Blaine Street, Suite 14 Moscow, ID 83843	208-882-2588 ext 27 pbarrett@ecoanalysts.com
Megan Payne	Sorting Lab Manager EcoAnalysts, Inc.	1420 South Blaine Street, Suite 14 Moscow, ID 83843	208-882-2588 ext 59 mpayne@ecoanalysts.com
Kaylani Merrill	Technical Business Development EcoAnalysts, Inc	1420 South Blaine Street, Suite 14 Moscow, ID 83843	208-882-2588 ext 81 kmerrill@ecoanalysts.com

A4. PROJECT/TASK ORGANIZATION

The primary responsibilities of the principals are as follows:

<u>EcoAnalysts Project Manager – Gary Lester, CEO</u>

- Provides overall coordination of the project and makes decisions regarding the proper functioning of all aspects of the project; and

- Makes assignments and delegates authority as needed, to other parts of the project organization.

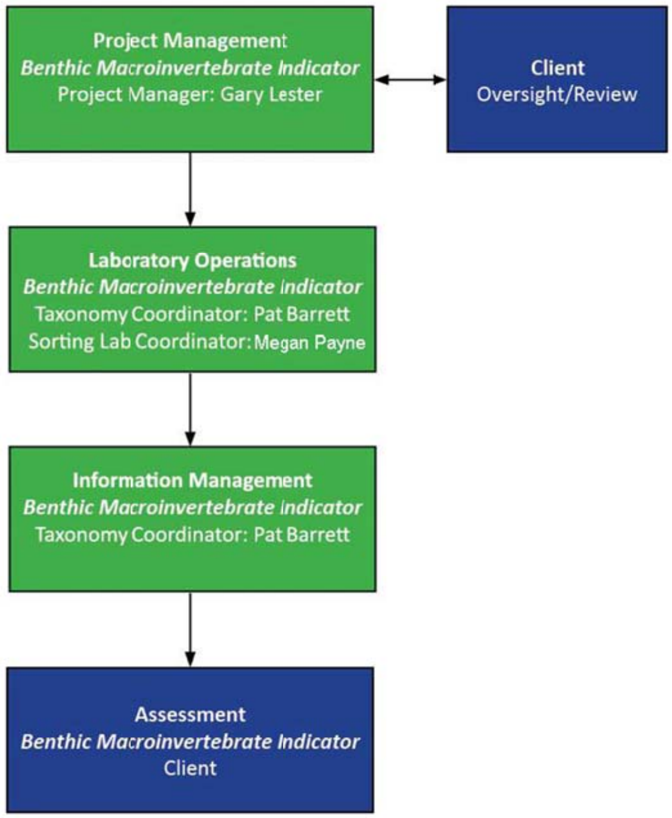
<u>EcoAnalysts Laboratory Managers – Patrick Barrett and Megan Payne</u>

- Oversee analysis of benthic macroinvertebrate samples; and
- Ensure the validity of data for the benthic macroinvertebrate indicator.

Table 3. Principal Contact List

Gary Lester CEO, Project Manager EcoAnalysts, Inc. 1420 South Blaine Street Suite 14 Moscow, ID 83843 Phone: 208-882-2588 ext. 21 Fax: 208-883-4288 glester@ecoanalysts.com	
Patrick Barrett Taxonomy Coordinator EcoAnalysts, Inc. 1420 South Blaine Street Suite 14 Moscow, ID 83843 Phone: 208-882-2588 ext. 27 Fax: 208-883-4288 pbarrett@ecoanalysts.com	Megan Payne Sorting Lab Manager EcoAnalysts, Inc. 1420 South Blaine Street Suite 14 Moscow, ID 83843 Phone: 208-882-2588 ext. 59 Fax: 208-883-4288 mpayne@ecoanalysts.com

Figure 1. Project Organization



A5. PROBLEM DEFINITION/BACKGROUND

This QAPP addresses the laboratory operations and analyses for benthic macroinvertebrate indicator samples. This plan describes elements of project management, data quality objectives, measurement and data acquisition, and information management for processing benthic macroinvertebrate samples.

A6. PROJECT/TASK DESCRIPTION

EcoAnalysts is well equipped and staffed to conduct highly specialized analyses related to the benthic macroinvertebrate indicator. EcoAnalysts complies with all methods, procedures, and QA/QC requirements as described in required laboratory methods manuals. Because EcoAnalysts has only one taxonomic expert per major group (i.e., David Drumm: Crustacea; Brendan "Chip" Barrett: Polychaeta), taxonomic identifications are externally QC'd. Prior to initiation of task orders, EcoAnalysts' laboratory operations may be evaluated by EcoAnalysts' Taxonomy Coordinator.

Benthic macroinvertebrate samples will be sorted and identified at EcoAnalysts' laboratory to the lowest practicable level or level required. The sample will first be sorted into major taxonomic groups, which then will be identified to the required taxonomic level and counted. The sorting laboratory manager and taxonomy coordinator will oversee, and periodically review, the work performed by sorting technicians.

A7. QUALITY OBJECTIVES AND CRITERIA

Performance objectives as associated primarily with measurement error, are established (following USEPA Guidance for Quality Assurance Plans EPA240/R-02/009) for analyzing benthic macroinvertebrate indicator samples. The following sections describe approaches for evaluating benthic macroinvertebrate indicator sample analyses.

A7.1 Sorting Efficacy – Aliquot Method

To ensure every sample meets a standard minimum level of sorting efficacy, EcoAnalysts, Inc. re-sorts at least 20% of the sorted material of every sample that is processed in the lab.

The resort is performed by a specially trained and designated sorting quality control technician (this will never be the technician who originally sorted the sample).

The QC technician re-sorts at least 20% of the sorted fraction of the sample to check if at least 90% (or percent established by the client) of the organisms have been removed. An estimated percent efficacy is calculated by dividing the number of organisms found in the original sort by the total number of organisms estimated to be in the sorted material, based on those found in the 20% quality control re-sort, using the following equation:

Equation 1. Sorting Efficacy

$$SortingEfficacy = \frac{OriginalCount}{OriginalCount + \left(\frac{QCCount * QCSquares}{QTSquares}\right)} * 100$$

Where:
OriginalCount = the number of organisms picked by the first sorter
QCCount = the number of organisms found in the Quality Control sort

QCSquares = the number of grids sorted during the QC process
QTSquares = the total number of grids in the QC Caton

Sorting efficacy is measured as the estimated percent of the total organisms found during the original sorting process. If the estimated percent sorting efficacy is 90% or greater, the sample passes the quality control check. If the estimate is less than 90%, the sample is re-sorted. When this happens, the sample undergoes the quality control process again until it passes the 90% efficacy requirement. In addition to calculating sorting efficacy, a specially trained and designated sorting quality control technician, who is never the technician who originally sorted the sample, also verifies label accuracy, information capture on the benchsheet, and the presence/absence of non-target organisms in the taxa vials.

A7.2 Taxonomic Precision and Accuracy

Taxonomic precision is quantified by comparing whole-sample identifications completed by independent taxonomists or laboratories. Accuracy of taxonomy is qualitatively evaluated through specification of target hierarchical levels (e.g., family, genus, or species) and the specification of appropriate technical taxonomic literature or other references (e.g., identification keys, voucher specimens). To calculate taxonomic precision for benthic macroinvertebrate samples, 10 percent of the samples are randomly selected for re-identification by an independent taxonomist or laboratory. Comparison of the results of whole sample re-identifications provides a Percent Taxonomic Disagreement (PTD) calculated as:

Equation 2. Percent Taxonomic Disagreement (PTD)

$$PTD = \left[1 - \left(\frac{comp_{pos}}{N}\right)\right] \times 100$$

where
$comp_{pos}$ = the number of agreements
N = the total number of individuals in the larger of the two counts.

The lower the PTD, the more similar taxonomic results are and the overall taxonomic precision is better. A Measurement Quality Objective (MQO) of ≤15% is recommended for taxonomic differences. Individual samples exceeding 15% are examined for taxonomic areas of substantial disagreement, the reasons for disagreement investigated, and corrective measures taken where needed.

Where re-identification by an independent, outside taxonomist or laboratory is not practical, percent similarity will be calculated between each identifying taxonomist. Percent similarity is a measure of similarity between two communities or two samples (Washington 1984). Values range from 0% for samples with no species in common, to 100% for samples that are identical. It is calculated as follows:

Equation 3. Percent Similarity

$$PSC = 1 - 0.5\sum_{i=1}^{K}|a-b|$$

where:
a and b = for a given species, the relative proportions of the total samples A and B, respectively, which that species represents.

A MQO of ≥85% is recommended for percent similarity of taxonomic identification. If the MQO is not met, the reasons for the discrepancies between analysts should be discussed. If a major discrepancy is found in how the two analysts have been identifying organisms, the last batch of samples counted by the analyst under review may have to be re-identified.

Additionally, percent similarity should be calculated for re-processed subsamples. This provides a quantifiable measure of the precision of subsampling procedures. A MQO of ≥70% is recommended for percent similarity of subsamples. If a sample does not meet this threshold, additional subsamples should be processed from that sample until the MQO is achieved.

Sample enumeration is another component of taxonomic precision. Final specimen counts for samples are dependent on the taxonomist, not the rough counts obtained during the sorting activity. Comparison of counts is quantified by calculation of percent difference in enumeration (PDE), calculated as:

Equation 4. Percent Difference in Enumeration

$$PDE = \left(\frac{|Lab1 - Lab2|}{Lab1 + Lab2}\right) \times 100$$

An MQO of ≤5% is recommended. Individual samples exceeding 5% are examined to determine reasons for the exceedance.

A7.3 MQO Evaluation

For samples exceeding these MQOs, corrective actions can include defining the taxa for which re-identification may be necessary (potentially even by a third party), for which samples (even outside of the 10% lot of QC samples) it is necessary, and where there may be issues of nomenclatural or enumeration problems.

Taxonomic accuracy is evaluated by having individual specimens representative of selected taxa identified by recognized experts. Samples will be identified using the most appropriate technical literature that is accepted by the taxonomic discipline and reflects the accepted nomenclature. Where necessary, the World Register of Marine Species (WoRMS, http://marinespecies.org/) will be used to verify nomenclatural validity and spelling. A reference collection will be compiled as the samples are identified.

A8. SPECIAL TRAINING/CERTIFICATION

Training of EcoAnalysts' project staff, when needed, is done internally through assistance from project operations staff. When appropriate, identifications are verified by taxonomists certified in the applicable area.

Table 4. Certifications By Taxonomist

Name	Degree	Discipline	Years of Relevant Experience	Professional Registrations and Certifications
Brendan "Chip" Barrett	PhD MS	Invertebrate Zoology Marine Polychaetes	22	Southern California Association of Marine Invertebrate Taxonomists (SCAMIT),International Polychaetological Association
David Drumm	PhD MS	Invertebrate Zoology Marine Crustaceans	18	Southern California Association of Marine Invertebrate Taxonomists (SCAMIT), Crustacean Society, Society of Systematic Biologists
Matt Hill	BS	Invertebrate Zoology General Invertebrates	8	Southern California Association of Marine Invertebrate Taxonomists (SCAMIT)
		Total Years Taxonomy Experience:	48	

A9. DOCUMENTATION AND RECORDS

All versions of the QAPP are retained by EcoAnalysts, Inc. EcoAnalysts retains sorting bench sheets indefinitely. Taxonomic data are entered into EcoAnalysts' custom Laboratory Information Management System (LIMS) by taxonomists during the identification process. Sample data are retained by EcoAnalysts indefinitely following completion of the project.

GROUP B: DATA GENERATION AND ACQUISITION

B1. SAMPLING DESIGN

The protocols for establishing sample and study design associated with different indicators are described in the benthic macroinvertebrate indicator-specific sections of the field QAPP or client field manual.

B2. SAMPLING METHODS

The protocols for the collection of samples associated with different indicators are described in the benthic macroinvertebrate indicator-specific sections of the field QAPP or client field manual.

B3. SAMPLE HANDLING AND CUSTODY

Immediately upon receipt of benthic macroinvertebrate samples, all containers are inspected for damage or leakage. Sample labels are checked against chain of custody forms and/or packing slips and any discrepancies are noted. Receipt records are reported to the client within one business day of sample receipt. Chain of custody logs are reported, throughout the project, according to timelines and methods requested by the client.

Samples are logged into the EcoAnalysts, Inc. custom LIMS database and assigned a unique sample tracking number.

B4. ANALYTICAL METHODS

B4.1 Sorting Benthic Macroinvertebrate Samples

A sample is checked out by a trained sorting technician via the LIMS. A sorting bench sheet is printed that contains all of the sample information and sorting protocols assigned to it. The sorter records the primary matrix type and estimates the volume of detritus in the entire sample prior to rinsing. The standard descriptors for the types of sample matrix are: Inorganic, Coarse Organic, Fine Organic, Vegetation, and Filamentous Algae.

The sample is sorted entirely (no subsampling) by emptying the matrix into a sieve of a specified mesh size to remove preservative and fine sediment. If the sample matrix is made up of a significant percentage of inorganic material, the organic material will be elutriated from the inorganic material prior to sorting.

For elutriation, the whole sample is washed into a shallow pan of water where any large pieces of organic material are rinsed and inspected thoroughly by another technician for attached invertebrates. The sample is agitated with water to separate any organic matter from inorganic sediments. After agitating the sample in water, the lighter organic material is poured back into the sieve. The inorganic portion of the sample remaining in the pan is repeatedly washed and decanted into the sieve until no more organic matter remains in the pan with the inorganic material.

The remaining inorganic sediments are inspected under a magnifying lamp (3X) to look for any invertebrates too heavy to have been elutriated (e.g. mollusks, snails, crabs, etc.). If there are significant numbers of heavy invertebrates in the inorganic material – too many to easily remove under the magnifying lamp – the inorganic and organic matrix is recombined into the sieve and entire sample matrix will be prepared for subsample. If there are not significant numbers of heavy invertebrates in the inorganic material, they are removed under the magnifying lamp and placed with the organic matrix. A second technician inspects the inorganic material for organisms until it is determined there are no more invertebrates in the inorganic fraction of the sample. Unless otherwise requested, the inorganic elutriate is discarded.

The organic material and other contents of the sieve are then evenly distributed into the bottom of a Caton-style tray. These are trays of various sizes consisting of uniform grids, each grid being 2 inches per side and the bottom is constructed of 250-micron mesh. A grid (or a standardized portion of a grid) is randomly selected and its contents transferred to a Petri dish. The material in the Petri dish is sorted under a dissecting microscope (minimum magnification = 10X). The benthic macroinvertebrates are counted as they are placed into vials containing 70% ethanol.

Sorters are trained to pick and count only benthic macroinvertebrates, with heads, that were alive during sampling and contain the attributes required for taxonomic identification. Organisms picked are placed in one of five vials corresponding either to Crustacea, Polychaeta, Mollusca, Generals (miscellaneous taxa), and Special Organisms (SPORGS: Copepods and Ostracods). Specimens rejected according to EcoAnalysts' standard include: Nematodes, Zooplankton, Exuviae, and any organism without a head. When the target count of organisms has been reached or the target percentage of the sample has been sorted but not fully sorted, a special large and rare protocol may be followed on any remaining unsorted material. Organisms deemed relatively large or rare to the sample (in comparison with the target taxa enumerated in the final count) are found by a naked eye scan in the unsorted sample remnants and are not counted but picked and placed in a separate vial.

Laser-printed labels containing the appropriate sample tracking information are placed in the vial(s). The total number of organisms removed (not including large and rare organisms), the number of grids sorted out of the total, the time spent sorting, and the final volume of the remaining sample volume are all recorded on the sorting bench sheet, as well as comments significant to the preparation, sorting, and/or condition of the sample.

To ensure every sample meets a standard minimum level of sorting efficacy, EcoAnalysts, Inc. standard sorting quality assurance is maintained by re-sorting a portion of the sorted material of every sample that is processed in the lab, and ensuring a minimum efficacy is reached (as required by the project). See Section A7.1 for sorting quality objectives.

B4.1 Taxonomic Identification of Benthic Macroinvertebrates

A taxonomist selects a sample for identification via the LIMS and empties it into a Petri dish. Under a dissecting and/or compound microscope, the invertebrates are identified to the level specified by the study design. Copepods and Ostracods are usually enumerated separately from the total count. Taxonomic references used for the taxonomic analysis of samples may be provided upon request. The taxonomist enters each taxon directly into the project database using a unique taxonomic code (this is done while at the microscope). The number of individuals of each taxon is counted and entered into the database.

As the sample is being identified, the taxonomist enters data directly into the computer using a custom built LIMS database and user interface. The data entry program has several features built into it, including steps for entering taxon names, life stage information, taxonomic notes, etc. There is a visual cue at each step which prompts for a user confirmation. A running tally of invertebrates as well as the number and type of taxa in the sample are displayed on the screen. Therefore, a taxonomist can quickly look for low or high counts as a flag for major discrepancies. Note: With this process, we have successfully eliminated the need for handwritten bench sheets, thereby doing away with a secondary step of data entry and the errors associated with it.

A synoptic reference collection can be prepared, if requested, where at least one specimen (preferably 3-5 specimens) of each taxon encountered is placed into a 1-dram vial containing 70% ethanol and is properly labeled with identity and sample number.

Depending on the requirements of the project, one or several reference collections can be made. Also, organisms can be vouchered by a specified taxonomic level, i.e. vouchered by each taxon per sample. If any synoptic reference collection is made, a second taxonomist examines the reference collection specimens to verify the accuracy of all taxa identified in the project.

If requested, a specified number of the samples are randomly selected for re-identification by a QC taxonomist. All specimens in those samples that were not set aside for the reference collection are re-identified. See Section A7.2 for taxonomic precision and accuracy measurement quality objectives. The final data is adjusted according to the recommendations of both taxonomists. If requested, reconciliation reports are written and delivered to the client as part of the overall Quality Assurance Report.

B5. QUALITY CONTROL

Each benthic macroinvertebrate sample is checked for quality control. See Sections A7.1 and A7.2 of this QAPP for quality objectives.

B6. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All microscopes and laboratory equipment are inspected regularly according to manufacturer recommendations.

B7. INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

All microscopes and laboratory equipment, including digital imaging equipment, are calibrated regularly according to manufacturer recommendations. Calibration will be checked throughout the project and equipment will be recalibrated if necessary.

B8. INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Supplies and consumables include alcohol and sample jars. Supplies and consumables are purchased only from reputable and reliable suppliers and are inspected for usability upon receipt.

B9. NON-DIRECT MEASUREMENTS

EcoAnalysts maintains a library of current taxonomic references. These are used for taxonomic identification purposes when such need arises. Taxonomists are responsible for using current references and publications.

B10. DATA MANAGEMENT

As described in section B4.1, data is directly entered into the custom built LIMS database and user interface. With several features built into it, including steps for taxonomic identification of a specimen, the number of specimens in each taxon, life stage information, taxonomic notes, etc., the data entry program successfully eliminates the need for handwritten bench sheets, the secondary step of data entry, and the errors associated with it. Additionally, a running tally of invertebrates and taxonomic groups are displayed on the screen, therefore allowing the taxonomist to quickly identify low or high counts as a flag for potential discrepancies.

Throughout the project and sample analysis, data entry is double checked for accuracy, and validated by the laboratory coordinator. Using our networked computer systems, the appropriate data are combined for each sample to obtain the sorting statistics and comprehensive taxa lists and counts.

Various metrics calculations are offered as output from the LIMS, with EcoAnalysts standard deliverables including (but not limited to) abundance, richness, and community measures. Additional metrics calculations, including more detailed Benthic Invertebrate Indices, may be provided upon request. Other supplemental reports, such as QA/QC results and data analysis and/or interpretation, can be provided dependant on project requirements.

Data are delivered in an electronic format specified by the client and emailed to the technical contact(s). Hard copies and/or copies on compact disc can be mailed to the client upon request. The delivery schedule is agreed upon by the client and EcoAnalysts, Inc. in advance, specifying the sample lots, dates, and components. EcoAnalysts, Inc. retains all raw data files used and derived in our projects.

Quality assurance data sheet checks are part of the sample validation process, and include scanning for apparent entry errors, measurement errors, omissions, and anomalies. Suspect data are flagged and/or excluded from use. Data may be presented in table, graph, and chart format. Unusual data are rechecked to verify their accuracy.

GROUP C: ASSESSMENT AND OVERSIGHT

C1. ASSESSMENT AND RESPONSE ACTIONS

The project manager, Gary Lester, is responsible for all reporting, tracking, and overall project management including field activities, reviewing the data, reporting, and forwarding all data to the client for inspection. Megan Payne and Pat Barrett are responsible for laboratory operations involving processing benthic macroinvertebrate indicator samples for projects.

C2. REPORTS TO MANAGEMENT

Draft reports of project findings will be prepared for the client on a regular basis, as requested. Problems that arise during the project are corrected and reported to client and EcoAnalysts staff via this report. The project manager will submit a final report prior to the conclusion of the task order. All data are tracked through use of EcoAnalysts' LIMS. The data compiled during this project are incorporated into spreadsheets and sent to the client and, if requested, will be uploaded to the client's database.

GROUP D: DATA VALIDATION AND USABILITY

D1. DATA REVIEW, VERIFICATION, AND VALIDATION

All raw data are transcribed into EcoAnalysts' LIMS. Any hard copies of raw data are organized and filed. Statistical analyses of replicate samples are recorded so that the degree of certainty can be estimated, when requested. All laboratory analytical results are cross-checked to ensure data are complete and error free. Data are archived using EcoAnalysts' LIMS on EcoAnalysts' servers, with multiple data backups in place.

D2. VERIFICATION AND VALIDATION METHODS

Project staff follows the EPA *Guidance on Environmental Verification and Validation* (EPA QA/G-8) whereby the data are reviewed and accepted or qualified by project staff.

D3. RECONCILIATION WITH USER REQUIREMENTS

Upon receipt of results of each sample group, calculations and determinations of precision and accuracy are made and, if needed, corrective action is implemented. If data quality does not meet project specifications, the deficient data are flagged and the cause of failure evaluated. For the data to be considered valid, data collection procedures, the handling of samples, and data analysis must be monitored for compliance with all the requirements described in this QAPP. Data are flagged and qualified if there is evidence of habitual violation of the procedures described in this QAPP. Any limitations placed on the data are reported to the data end user in narrative form. Any limitations on data use are detailed in the project reports and other documentation.

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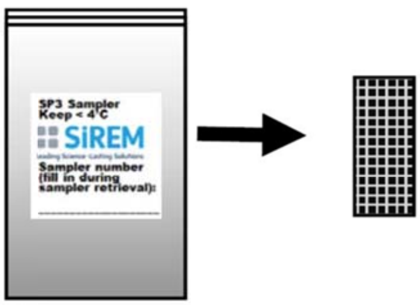
Appendix B. SP3 Standard Operating Procedure

DRAFT SOP

ANALYSIS OF *IN SITU* PE PASSIVE SAMPLERS

Bart Chadwick Project, Quantico, August 2016

1. Passive samplers will be received in cooler(s) with ice. Samples can be held for several days. Maintain cool (4°C or lower) and in the dark.
2. Each passive sampler will be contained in a labelled bag. Remove the passive sampler (steel mesh envelope) from the sample bag being sure to track the sample ID written on the outside of the bag.



3. With gloved hands, unfold the mesh envelope and remove the polyethylene (PE) sheeting.
4. Place the PE on cleaned[1] aluminum foil on the laboratory benchtop.
5. Dispose of mesh and screws/nuts in general refuse.
6. PE should only contact either gloved hands, cleaned[1] stainless steel forceps or scissors, and cleaned[1] aluminum foil. Follow clean laboratory techniques.
7. Wipe both sides of the PE with a Kimwipe moistened with ultrapure water to remove particles, mud, or biofilms[2].
8. Place the PE in 15-mL pre-cleaned amber glass vial (or other laboratory extraction container, amber glass to avoid photodegradation) without folding the PE, as possible. Telfon or foil lined vial lids should be used.
9. Spike with surrogate recovery compounds per standard laboratory procedures for analyses.
10. Add sufficient volume (e.g., 5 to 10 mL) of hexane[3], ultrapure grade or equivalent, to completely submerge the PE.
11. After 12 or more hours, transfer and retain solvent to another sample vessel (amber glass to avoid photodegradation).

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[1] Forceps, scissors, and aluminum foil should be cleaned with a hexane (or other ultrapure analytical solvent) rinse followed by triple rinse with ultrapure water.
[2] If oily coatings observed, a Kimwipe moistened with hexane should be used to wipe both sides of the sheeting for less than one minute.
[3] A 1:1 solution of methylene:dichloromethane may also be used.

1

12. Add an additional aliquot (e.g., 5 to 10 mL) of solvent (e.g., hexane). Agitate for 10 or more minutes on shaker table.

13. Combine the two extracts into a single vessel for concentration (see below).

14. Remove PE from concentration vessel, allow to air dry, and record the weight of the dried PE piece to ± 0.0001 g. Report with analytical results.

15. Concentrate combined extracts in concentration vessel using rotary evaporation or equivalent for GCMS analysis. Transfer to autosampler vial according to standard laboratory procedures.

16. Add appropriate injection standards for final total volume before analysis per standard laboratory procedures.

17. Analyze concentrated extracts for Performance References Compound (PRC) polychlorinated biphenyls (PCBs; PCB-14, 36, 142, 155, and 204; expected to range in mass from 0.4 nanogram [ng] to 80 ng per sample) and DDX (2,4'-DDT, DDD, DDE and 4,4'-DDT, DDD, DDE) by GC with ECD (EPA 8081A).

18. For each sample, report the mass of the PE and the concentration of organic analytes in PE on a dry weight basis (i.e., ng analyte per g PE [dry weight basis]).

2

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Appendix C. RARA Preliminary Standard Operating Procedure

Remedy and Recontamination Array Preliminary Standard Operating Procedure

Author: Bart Chadwick, SSC Pacific

Version: 1.0

Date: 01/01/2017

I. Introduction

This document provides a preliminary Standard Operating Procedure (SOP) for the recently developed Remedy and Recontamination Array (RARA) system. The SOP was developed on the basis of a proof-of-concept deployment that was carried out in 2016 in San Diego Bay at the culmination of the prototype RARA development process. It is expected that this SOP will continue to evolve over time as the system and method are optimized and applied under a broader range of conditions.

II. Preparation and Mobilization

Preparation and mobilization of the RARA system includes the following steps:

- Pre-clean the sediment cells, frame, and sediment traps
- Prepare the brine solution for the sediment traps
- Ready the ADCP, OBS and water quality instruments
- Ready and clean the sampling equipment (grab, splitting tub, scoops, bottles etc.)
- Ready the treatment sand (purchase from vendor)
- Secure adequate support boat and sampling crew

III. Site Sediment Collection

Site sediment collection is conducted prior to the RARA deployment. Site sediments can be for control purposes, treatment purposes, or assessment of recontamination during subsequent deployments. The following steps outline general procedures for site sediment collection:

- Collect site sediments - 2-3 grabs per container
- Distribute each grab to all containers
- Control cells filled 12-14”
- Treatment cells filled 8-10”
- T-Zero sampling cell filled 12-14”
- Collect sediment cores and benthic infauna samples from T-Zero cell
- Add overlying surface water to all cells
- Cover and allow site sediment to settle overnight keeping dark and cool
- Collect treatment sediment into spare cell – sufficient for 4” layer in two cells
- Homogenize and sieve treatment sediment to remove infauna

- Add treatment sand to a spare cell – sufficient for 4” layer in two cells
- Add overlying water
- Cover and keep treatment sediments cool and dark overnight

IV. Apply Treatments

Application of treatments to the site sediment is a project-specific endeavor. The RARA system can support a range of treatments subject to limitations on the dimensions of the individual sediment cells. General steps for application of treatments are summarized below:

- Remove surface water from each cell
- Insert 10 clam chambers into control cells until ~3” is left protruding (Figure 1)
- Insert 10 clam chambers into control cells until ~7” is left protruding
- If desired, add thin layer of colored tracer at sediment/treatment interface
- Carefully add 4” layer of treatment material to each treatment cell (Figure 2 - Figure 3)
- If desired, add thin layer of colored tracer at sediment/water interface
- Collect split samples of treatment materials for T-Zero analysis
- Refresh surface water to each cell
- Cover and keep cells cool and dark until deployment

V. RARA Deployment

Deployment of the RARA system is subject to site-specific requirements and conditions. The location for the deployment should be considered carefully both to assure that it will meet requirements for representativeness of desired site and source conditions, and also to assure that any safety and navigational issues have been considered. General steps for deployment of the RARA system are described below:

- Secure boat support, crew and dive support
- Install instruments to frame and initiate data recording
- Install sediment traps to frame
- Add brine and surface water to sediment traps and cap
- Diver inspect installation location
- Install frame to bottom with diver assistance (Figure 4)
- Install cells to frame with diver assistance (Figure 5)
- Diver remove lids from cells – note time (Figure 6)
- Diver remove caps from sediment traps – note time
- Allow ~1 month for cells to stabilize

VI. T-Mid Sampling Event Start

In some applications of the RARA, intermediate sampling events (T-Mid) may be included to help evaluate time trends in remedy performance or recontamination levels. General steps for performing a mid-deployment sampling event are outlined below:

- Secure boat support, crew and dive support
- Ready the passive samplers
- Ready the clams
- Diver install caps on sediment traps – note time
- Diver retrieve OBS and HOBO loggers for cleaning and download
- Diver install covers on RARA cells – note time
- Retrieve cells one at a time (Figure 7)
- Add clams to clam chambers and install chamber covers – note time (Figure 8)
- Install passive samplers – note time (Figure 9)
- Cover and reinstall cell to frame on bottom
- Repeat for each cell
- Diver reinstalls instruments on frame
- Diver removes covers from cells – note time
- Diver removes caps from sediment traps – note time
- Allow 7 days for DGT exposures
- Allow 28 days for clam and SP3 exposures

VII. T-Mid Sampling Event DGT Retrieval

In cases where samplers or devices such as DGTs have shorter exposure periods, a retrieval event for these devices may be required prior to the main retrieval event at the end of the typical 28-day exposure period for organisms or other passive samplers. General steps for this type of retrieval event are shown below:

- Secure boat support, crew and dive support
- Ready sampling gear for DGTs (clean bags, DI water, labels, etc.)
- Diver retrieves DGT samplers from each cell – note time (Figure 10)
- DGT samplers cleaned and placed in clean, marked bags

VIII. T-Mid Sampling Event End

At the end of the mid-deployment sampling event, samplers and organisms are retrieved and any other sampling or data downloading required by the study design are carried out. General steps for the end of a mid-deployment event are outlined below:

- Secure boat support, crew and dive support
- Ready sampling gear for clams and SP3s (containers, bags, labels, etc.)
- Diver install caps on sediment traps – note time
- Diver retrieve OBS and HOBO loggers for cleaning and download
- Diver install covers on RARA cells – note time
- Retrieve cells one at a time
- Remove chamber covers and clams from clam chambers – note time (Figure 11)
- Rinse clams and transfer to clean containers with surface water

- Remove SP3 passive samplers – note time
- Rinse SP3 samplers and transfer to marked sample bags
- Cover and reinstall cell to frame on bottom
- Repeat for each cell
- Diver reinstalls instruments on frame
- Diver removes covers from cells – note time
- Diver removes caps from sediment traps – note time

IX. T-Final Sampling Event Start

Procedures for the T-Final sampling event are general the same as the T-Mid event.

X. T-Final Sampling Event DGT Retrieval

Procedures for the T-Final DGT retrieval event are general the same as the T-Mid event.

XI. T-Final Sampling Event End

The retrieval phase of the T-Final event will generally have additional steps beyond what is carried out during the T-Mid event. This will often include destructive testing such as coring and benthic community sampling that remove significant amounts of sediment. General steps for the T-Final ending event are summarized below:

- Secure boat support, crew and dive support
- Ready sampling gear for clams, SP3s, cores, traps and benthic infauna
- Diver install caps on sediment traps – note time
- Diver retrieve OBS and HOBO loggers for cleaning and download
- Diver install covers on RARA cells – note time
- Retrieve cells one at a time
- Remove chamber covers and clams from clam chambers – note time
- Rinse clams and transfer to clean containers with surface water
- Remove SP3 passive samplers – note time
- Rinse SP3 samplers and transfer to marked sample bags
- Install partitions in each cell (Figure 12)
- Collect sediment cores from the core partition area
- Collect benthic infauna samples from the benthic partition area
- Allow sediment traps to settle and remove most of the overlying water
- Collect sediment trap samples into jars for processing

XII. Demobilization

Typical demobilization steps for the RARA system are described below:

- Process samples for shipment and/or analysis (Figure 13 and Figure 14)

- Process data from instruments
- Dispose of sediment from the cells
- Clean all equipment to remove sediment and fouling (Figure 15)
- Store equipment for future use

Figure 1. Control sediment cell filled with site sediment and overlying water and with pre-installed clam chambers.

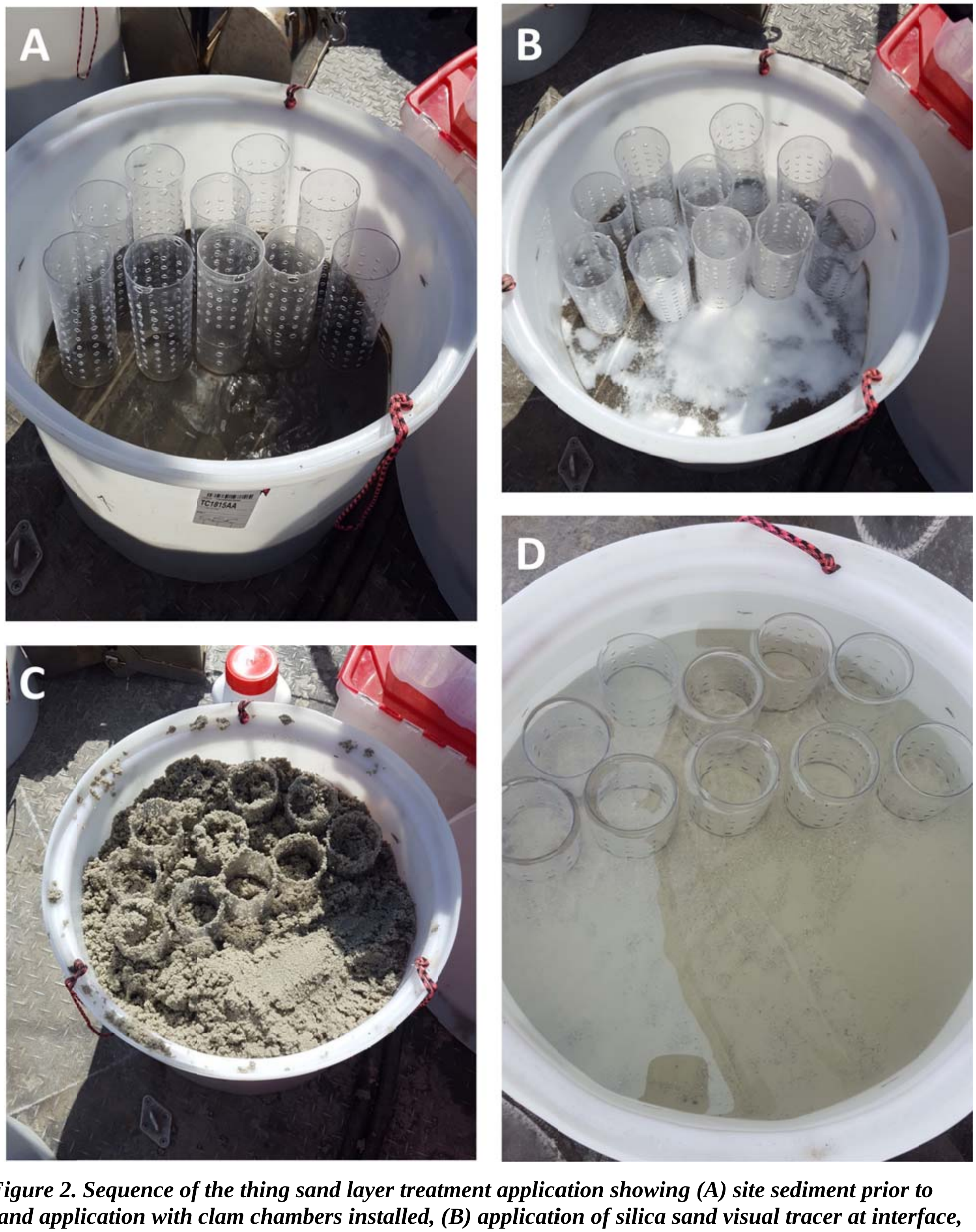

Figure 2. Sequence of the thing sand layer treatment application showing (A) site sediment prior to sand application with clam chambers installed, (B) application of silica sand visual tracer at interface, (C) addition of thin sand layer, and (D) final result with treatment and overlying water added.

Figure 3. Final result for thin clean sediment layer treatment after final installation of treatment and overlying water.

Figure 4. The RARA frame being deployed from the R/V Ecos.

Figure 5. Deployment sequence for a sediment cell being installed into the RARA array.

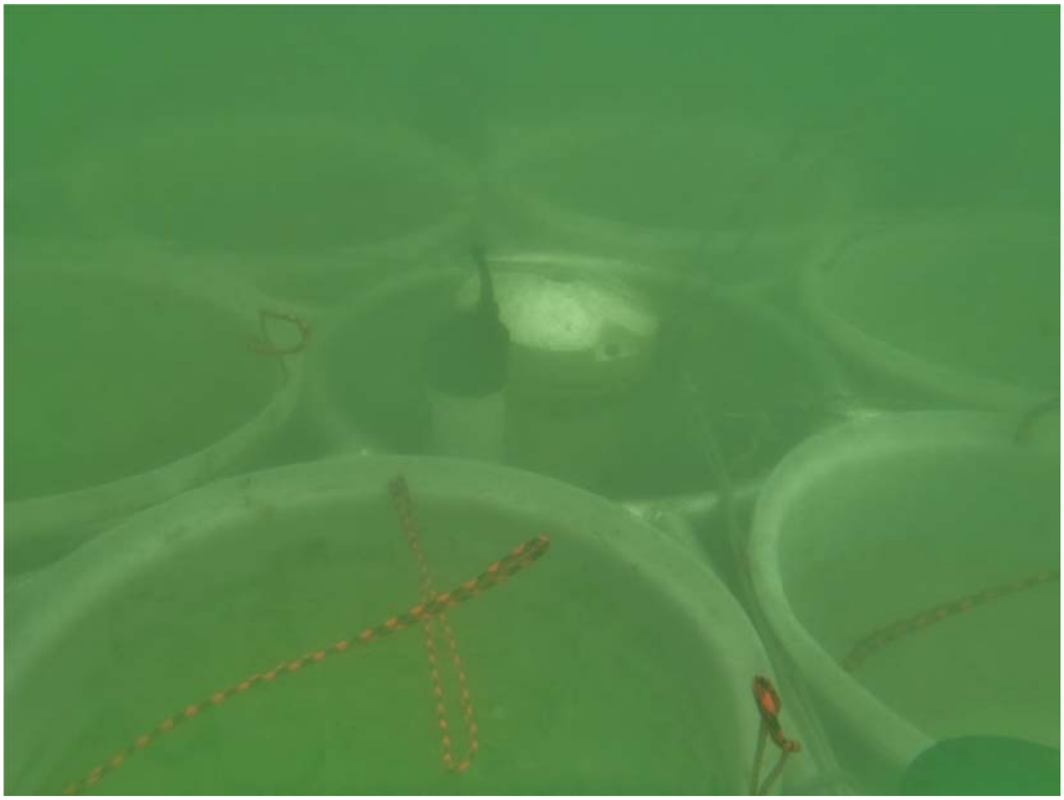

Figure 6. RARA array immediately following installation to the bottom.

Figure 7. Retrieval of individual sediment cells during a T-Mid event.

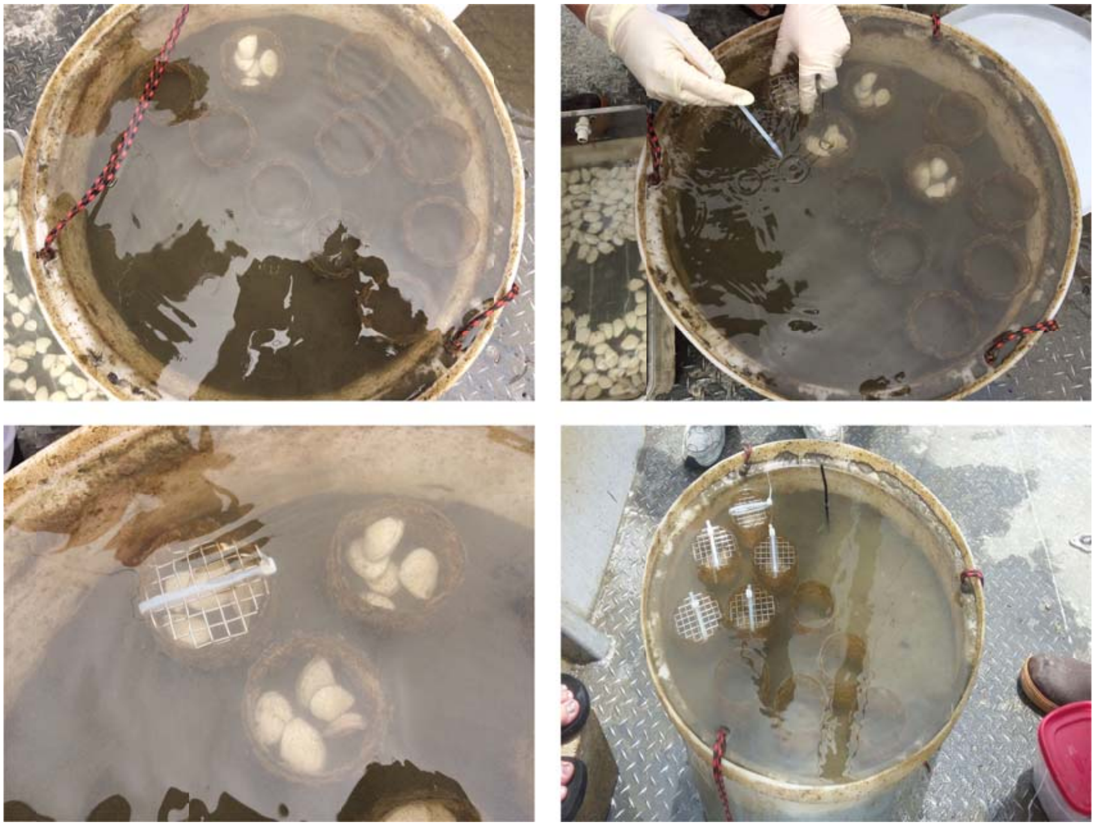

Figure 8. Sequence (clockwise from upper left) showing the installation of the clams to the pre-installed chambers during a T-Mid event.

Figure 9. The SP3 polyethylene passive samplers being installed during a T-Mid event.

Figure 10. DGT samplers retrieved from the RARA array by diver.

Figure 11. Preparing to remove clams and polyethylene passive samplers from a RARA sediment cell at the end of a T-Mid exposure period.

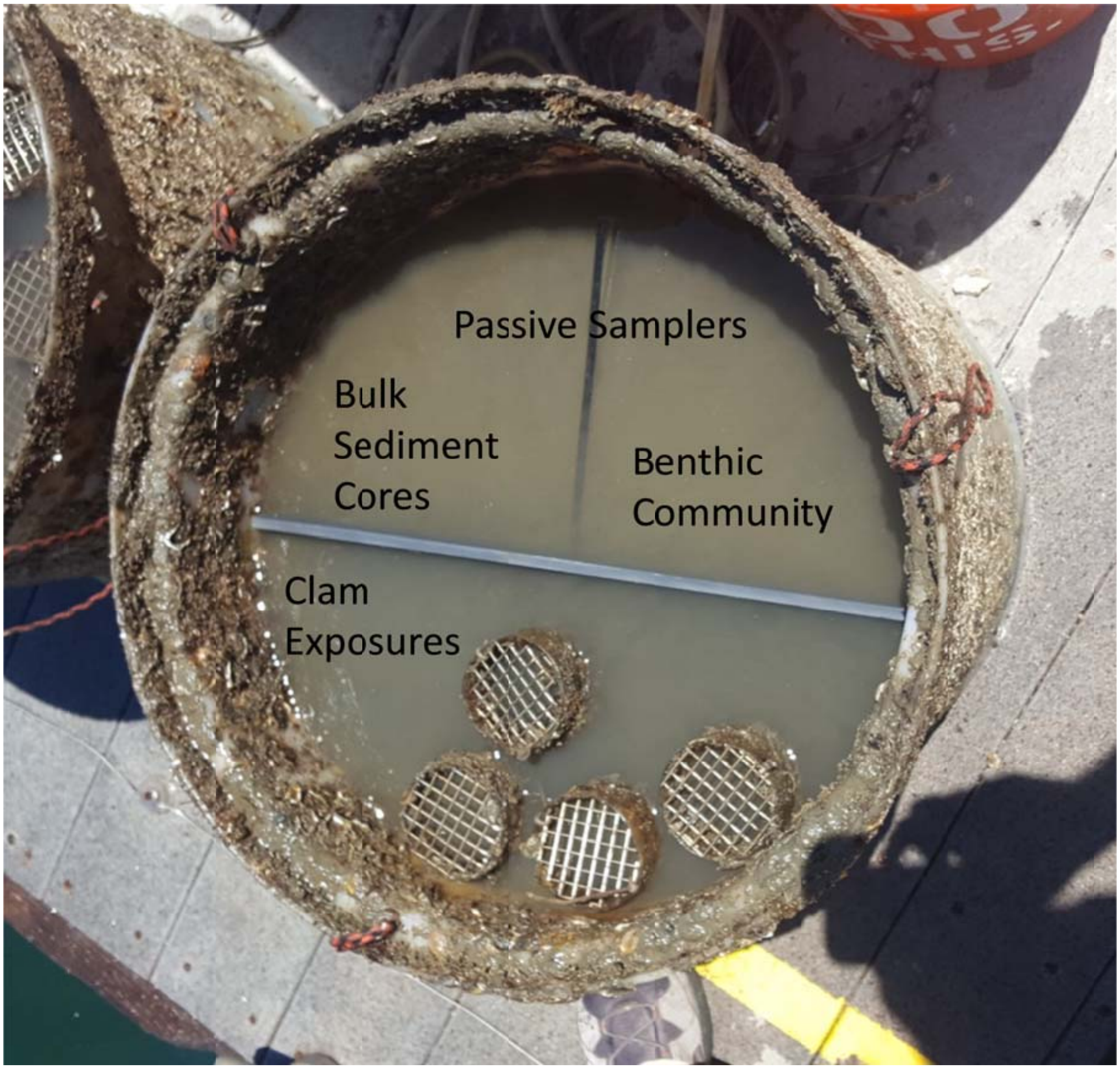

Figure 12. Photo at the end of a T-Final showing the segmentation of the RARA sediment cell into sampling zones for benthic community analysis, bulk sediment cores, and clam and passive sampler exposures.

Figure 13. Processing benthic community samples at the end of T-Final.

Figure 14. Processing clam samples during the August 15, 2016 event at the end of the T-Final exposure.

Figure 15. Removing biofouling from the ADCP and OBS instruments at the end of the RARA deployment on August 15, 2016.

Appendix D. Bulk Sediment Chemistry

T-Zero Results

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

21 October 2016

Joel Guererro
Navy – SPAWAR
Environmental Science and Applied System Branch, 536(
San Diego, CA 92152

RE: RARA

Enclosed are the results of analyses for samples received by the laboratory on 27-Apr-2016. The samples associated with this report will be held for 90 days from the date of this report. The raw data associated with this report will be held for 5 years from the date of this report. If you need us to hold onto the samples or the data longer then these specified times, you will need to notify us in writing at least 30 days before the expiration dates. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jenifer Milam
Database Manager

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

WORK ORDER SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date of Work Order
RARA-T1 &T2-042016	6042701-01	Soil/Sediment	20-Apr-2016	27-Apr-2016
RARA-S1&S2-042016	6042701-02	Soil/Sediment	20-Apr-2016	27-Apr-2016
RARA-C1 &C2-042016	6042701-03	Soil/Sediment	20-Apr-2016	27-Apr-2016

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Case Narrative

No issues were experienced during the analysis of Work Order 6042701 unless specified below.

Pesticides - samples were originally analyzed within analytical holding time but the data was not usable at that time due to a failing calibration. Samples were analyzed again well outside the 40 day analytical holding time. However, the QC was acceptable and the data was deemed valid.

PCB Congeners - Please see additional excel file for congener data.

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Notes and Definitions

U	Analyte included in the analysis, but not detected
RPD-01	Analyses are not controlled on RPD values from sample concentrations less than the reporting limit.
QM-08	Spike or surrogate was inadvertently left out of this sample.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
Q	Value is outside of acceptance limits.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-T1 &T2-042016

6042701-01 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
ERDC-EL-EP-C								
Classical Chemistry Parameters								
% Solids	**68.1**	0.500	0.500	% Solids	21-Oct-2016	21-Oct-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.542**	0.00384	0.00384	mg/kg	18-May-2016	18-May-2016	EPA 7474	
Iron	**14100**	1.58	7.89	mg/kg	09-May-2016	28-May-2016	SW 846/6010	
Aluminum-27 [1]	**9560**	0.0972	0.486	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Cadmium-111 [1]	**0.108**	0.0972	0.486	mg/kg	09-May-2016	12-May-2016	SW 846/6020	J
Copper-63 [2]	**49.7**	0.0972	0.486	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Lead-206 [1]	**23.1**	0.0972	0.486	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Zinc-66 [1]	**103**	4.86	9.72	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Aldrin	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	**0.28**	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	
Heptachlor	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.08	0.24	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	2.85	9.50	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**3.10**		*40.7 %*	*40-125*	*02-May-2016*	*21-Aug-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**5.03**		*66.2 %*	*40-130*	*02-May-2016*	*21-Aug-2016*	*EPA 8081A*	

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Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-T1 &T2-042016

6042701-01 (Soil/Sediment)

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Acenaphthene	ND	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Acenaphthylene	**1.92**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	J
Anthracene	**4.99**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (a) anthracene	**29.2**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (a) pyrene	**50.2**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (b) fluoranthene	**50.3**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (g,h,i) perylene	**48.8**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (k) fluoranthene	**47.5**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Chrysene	**34.4**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Dibenz (a,h) anthracene	**6.52**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Fluoranthene	**24.9**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Fluorene	ND	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**47.3**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Naphthalene	**1.38**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	J
Phenanthrene	**8.82**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Pyrene	**41.4**	1.14	3.70	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**53**		*46.7 %*	*40-105*	*02-May-2016*	*13-May-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**68**		*59.5 %*	*30-125*	*02-May-2016*	*13-May-2016*	*EPA 8270C*	
D422 Grain Size								
Clay	**14.2**			%		03-May-2016	D422	
Coarse Sand	0.0			%		03-May-2016	D422	
Fine Sand	**68.1**			%		03-May-2016	D422	
Gravel	0.0			%		03-May-2016	D422	
Hydrometer Reading 1 - Percent Finer	**19.6**			%		03-May-2016	D422	
Hydrometer Reading 2 - Percent Finer	**18.9**			%		03-May-2016	D422	
Hydrometer Reading 3 - Percent Finer	**17.6**			%		03-May-2016	D422	
Hydrometer Reading 4 - Percent Finer	**15.6**			%		03-May-2016	D422	
Hydrometer Reading 5 - Percent Finer	**14.2**			%		03-May-2016	D422	
Hydrometer Reading 6 - Percent Finer	**12.2**			%		03-May-2016	D422	

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Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-T1 &T2-042016

6042701-01 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
TestAmerica Burlington								
D422 Grain Size								
Hydrometer Reading 7 - Percent Finer	10.2			%		03-May-2016	D422	
Medium Sand	0.2			%		03-May-2016	D422	
Sand	68.3			%		03-May-2016	D422	
Sieve Size #10 - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size #100 - Percent Finer	88.1			%		03-May-2016	D422	
Sieve Size #20 - Percent Finer	99.9			%		03-May-2016	D422	
Sieve Size #200 - Percent Finer	31.7			%		03-May-2016	D422	
Sieve Size #4 - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size #40 - Percent Finer	99.8			%		03-May-2016	D422	
Sieve Size #60 - Percent Finer	98.9			%		03-May-2016	D422	
Sieve Size #80 - Percent Finer	94.5			%		03-May-2016	D422	
Sieve Size 0.375 inch - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size 0.75 inch - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size 1 inch - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size 1.5 inch - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size 2 inch - Percent Finer	100.0			%		03-May-2016	D422	
Sieve Size 3 inch - Percent Finer	100.0			%		03-May-2016	D422	
Silt	17.5			%		03-May-2016	D422	
Moisture SM 2540G								
Percent Moisture	30.7	0.1	0.1	%		05-May-2016	2540G	
Percent Solids	69.3	0.1	0.1	%		05-May-2016	2540G	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	5200	97	360	mg/Kg dry		09-May-2016	WALKLEY BLACK	

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Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-S1&S2-042016

6042701-02 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes

ERDC-EL-EP-C

Classical Chemistry Parameters

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
% Solids	**84.6**	0.500	0.500	% Solids	21-Oct-2016	21-Oct-2016	% Calculation	

Metals by EPA 6000/7000 Series Methods

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Mercury	**0.00515**	0.00345	0.00345	mg/kg	18-May-2016	18-May-2016	EPA 7474	
Iron	**1060**	1.60	8.01	mg/kg	09-May-2016	28-May-2016	SW 846/6010	
Aluminum-27 [1]	**797**	0.0726	0.363	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Cadmium-111 [1]	ND	0.0726	0.363	mg/kg	09-May-2016	12-May-2016	SW 846/6020	U
Copper-63 [2]	**0.467**	0.0726	0.363	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Lead-206 [1]	**1.27**	0.0726	0.363	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Zinc-66 [1]	**5.35**	3.63	7.26	mg/kg	09-May-2016	12-May-2016	SW 846/6020	J

Organochlorine Pesticides by EPA Method 8081A

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
4,4´-DDD	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Aldrin	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.06	0.19	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	2.33	7.76	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**3.42**		*55.0 %*	*40-125*	*02-May-2016*	*21-Aug-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**4.86**		*78.2 %*	*40-130*	*02-May-2016*	*21-Aug-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-S1&S2-042016

6042701-02 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
2-Methylnaphthalene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Acenaphthene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Acenaphthylene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Anthracene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Benzo (a) anthracene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Benzo (a) pyrene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Benzo (b) fluoranthene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Benzo (g,h,i) perylene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Chrysene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Dibenz (a,h) anthracene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Fluoranthene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Fluorene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Naphthalene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Phenanthrene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Pyrene	ND	0.932	3.03	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
Surrogate: 2-Fluorobiphenyl	67		*71.5 %*	*40-105*	*02-May-2016*	*13-May-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	77		*83.0 %*	*30-125*	*02-May-2016*	*13-May-2016*	*EPA 8270C*	
D422 Grain Size								
Clay	**1.1**			%		03-May-2016	D422	
Coarse Sand	**0.4**			%		03-May-2016	D422	
Fine Sand	**39.4**			%		03-May-2016	D422	
Gravel	0.0			%		03-May-2016	D422	
Hydrometer Reading 1 - Percent Finer	**1.6**			%		03-May-2016	D422	
Hydrometer Reading 2 - Percent Finer	**1.6**			%		03-May-2016	D422	
Hydrometer Reading 3 - Percent Finer	**1.2**			%		03-May-2016	D422	
Hydrometer Reading 4 - Percent Finer	**1.2**			%		03-May-2016	D422	
Hydrometer Reading 5 - Percent Finer	**1.1**			%		03-May-2016	D422	
Hydrometer Reading 6 - Percent Finer	**1.1**			%		03-May-2016	D422	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-S1&S2-042016

6042701-02 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
TestAmerica Burlington								
D422 Grain Size								
Hydrometer Reading 7 - Percent Finer	**1.1**			%		03-May-2016	D422	
Medium Sand	**58.8**			%		03-May-2016	D422	
Sand	**98.6**			%		03-May-2016	D422	
Sieve Size #10 - Percent Finer	**99.6**			%		03-May-2016	D422	
Sieve Size #100 - Percent Finer	**4.1**			%		03-May-2016	D422	
Sieve Size #20 - Percent Finer	**80.6**			%		03-May-2016	D422	
Sieve Size #200 - Percent Finer	**1.5**			%		03-May-2016	D422	
Sieve Size #4 - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size #40 - Percent Finer	**40.8**			%		03-May-2016	D422	
Sieve Size #60 - Percent Finer	**10.6**			%		03-May-2016	D422	
Sieve Size #80 - Percent Finer	**5.5**			%		03-May-2016	D422	
Sieve Size 0.375 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 0.75 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 1 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 1.5 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 2 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 3 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Silt	**0.4**			%		03-May-2016	D422	
Moisture SM 2540G								
Percent Moisture	**25.1**	0.1	0.1	%		05-May-2016	2540G	
Percent Solids	**74.9**	0.1	0.1	%		05-May-2016	2540G	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	ND	89	330	mg/Kg dry		09-May-2016	WALKLEY BLACK	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-C1 &C2-042016

6042701-03 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**44.3**	0.500	0.500	% Solids	21-Oct-2016	21-Oct-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**3.15**	0.00381	0.00381	mg/kg	18-May-2016	18-May-2016	EPA 7474	
Iron	**31000**	1.58	7.90	mg/kg	09-May-2016	28-May-2016	SW 846/6010	
Aluminum-27 [1]	**1740**	0.0099	0.0497	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Cadmium-111 [1]	**0.489**	0.0993	0.497	mg/kg	09-May-2016	12-May-2016	SW 846/6020	J
Copper-63 [2]	**162**	0.0993	0.497	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Lead-206 [1]	**75.3**	0.0993	0.497	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Zinc-66 [1]	**271**	4.97	9.93	mg/kg	09-May-2016	12-May-2016	SW 846/6020	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Aldrin	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	**1.52**	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	
beta-BHC	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	**3.87**	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	
Heptachlor	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.12	0.37	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	4.43	14.8	ug/kg dry	02-May-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**ND**		*%*	*40-125*	*02-May-2016*	*21-Aug-2016*	*EPA 8081A*	*QM-08, U*
Surrogate: Decachlorobiphenyl	**ND**		*%*	*40-130*	*02-May-2016*	*21-Aug-2016*	*EPA 8081A*	*QM-08, U*

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-C1 &C2-042016

6042701-03 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	U
2-Methylnaphthalene	**3.90**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	J
Acenaphthene	**1.78**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	J
Acenaphthylene	**8.59**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Anthracene	**15.0**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (a) anthracene	**72.7**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (a) pyrene	**272**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (b) fluoranthene	**297**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (g,h,i) perylene	**224**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Benzo (k) fluoranthene	**239**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Chrysene	**118**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Dibenz (a,h) anthracene	**38.5**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Fluoranthene	**48.8**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Fluorene	**2.77**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	J
Indeno (1,2,3-cd) pyrene	**243**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Naphthalene	**7.01**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Phenanthrene	**33.6**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Pyrene	**80.7**	1.77	5.76	ug/kg dry	02-May-2016	13-May-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	ND		%	*40-105*	*02-May-2016*	*13-May-2016*	*EPA 8270C*	*QM-08, U*
Surrogate: Terphenyl-d14	ND		%	*30-125*	*02-May-2016*	*13-May-2016*	*EPA 8270C*	*QM-08, U*
D422 Grain Size								
Clay	**33.6**			%		03-May-2016	D422	
Coarse Sand	**0.1**			%		03-May-2016	D422	
Fine Sand	**21.1**			%		03-May-2016	D422	
Gravel	**1.6**			%		03-May-2016	D422	
Hydrometer Reading 1 - Percent Finer	**52.1**			%		03-May-2016	D422	
Hydrometer Reading 2 - Percent Finer	**48.7**			%		03-May-2016	D422	
Hydrometer Reading 3 - Percent Finer	**44.1**			%		03-May-2016	D422	
Hydrometer Reading 4 - Percent Finer	**38.4**			%		03-May-2016	D422	
Hydrometer Reading 5 - Percent Finer	**33.6**			%		03-May-2016	D422	
Hydrometer Reading 6 - Percent Finer	**29.0**			%		03-May-2016	D422	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

RARA-C1 &C2-042016

6042701-03 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
TestAmerica Burlington								
D422 Grain Size								
Hydrometer Reading 7 - Percent Finer	**22.2**			%		03-May-2016	D422	
Medium Sand	**3.8**			%		03-May-2016	D422	
Sand	**25.0**			%		03-May-2016	D422	
Sieve Size #10 - Percent Finer	**98.3**			%		03-May-2016	D422	
Sieve Size #100 - Percent Finer	**84.4**			%		03-May-2016	D422	
Sieve Size #20 - Percent Finer	**97.4**			%		03-May-2016	D422	
Sieve Size #200 - Percent Finer	**73.4**			%		03-May-2016	D422	
Sieve Size #4 - Percent Finer	**98.4**			%		03-May-2016	D422	
Sieve Size #40 - Percent Finer	**94.5**			%		03-May-2016	D422	
Sieve Size #60 - Percent Finer	**90.5**			%		03-May-2016	D422	
Sieve Size #80 - Percent Finer	**87.0**			%		03-May-2016	D422	
Sieve Size 0.375 inch - Percent Finer	**99.4**			%		03-May-2016	D422	
Sieve Size 0.75 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 1 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 1.5 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 2 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Sieve Size 3 inch - Percent Finer	**100.0**			%		03-May-2016	D422	
Silt	**39.8**			%		03-May-2016	D422	
Moisture SM 2540G								
Percent Moisture	**53.3**	0.1	0.1	%		05-May-2016	2540G	
Percent Solids	**46.7**	0.1	0.1	%		05-May-2016	2540G	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**18000**	140	540	mg/Kg dry		09-May-2016	WALKLEY BLACK	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605078 - Default Prep Metals											
Blank (B605078-BLK1)					Prepared: 09-May-2016 Analyzed: 12-May-2016						
Aluminum-27 [1]	ND	0.100	0.500	mg/kg							U
Cadmium-111 [1]	ND	0.100	0.500	mg/kg							U
Copper-63 [2]	ND	0.100	0.500	mg/kg							U
Lead-206 [1]	ND	0.100	0.500	mg/kg							U
Zinc-66 [1]	7.08	5.00	10.0	mg/kg							J
LCS (B605078-BS1)					Prepared: 09-May-2016 Analyzed: 12-May-2016						
Aluminum-27 [1]	6350	0.100	0.500	mg/kg	5000		127	80-120			Q
Cadmium-111 [1]	53.6	0.100	0.500	mg/kg	50.00		107	80-120			
Copper-63 [2]	92.0	0.100	0.500	mg/kg	100.0		92.0	80-120			
Lead-206 [1]	106	0.100	0.500	mg/kg	100.0		106	80-120			
Zinc-66 [1]	193	5.00	10.0	mg/kg	200.0		96.5	80-120			
Calibration Check (B605078-CCV1)					Prepared: 09-May-2016 Analyzed: 12-May-2016						
Aluminum-27 [1]	0.0533	0.0001	0.0005	mg/kg	0.05000		107	90-110			
Calibration Check (B605078-CCV2)					Prepared: 09-May-2016 Analyzed: 12-May-2016						
Aluminum-27 [1]	0.0548	0.0001	0.0005	mg/kg	0.05000		110	90-110			
Duplicate (B605078-DUP1)		Source: 6042701-01			Prepared: 09-May-2016 Analyzed: 12-May-2016						
Aluminum-27 [1]	9090	0.0965	0.482	mg/kg		9560			5.07	20	
Cadmium-111 [1]	0.169	0.0965	0.482	mg/kg		0.108			44.2	20	RPD-01, J
Copper-63 [2]	48.6	0.0965	0.482	mg/kg		49.7			2.24	20	
Lead-206 [1]	22.0	0.0965	0.482	mg/kg		23.1			4.87	20	
Zinc-66 [1]	97.4	4.82	9.65	mg/kg		103			5.66	20	
Matrix Spike (B605078-MS1)		Source: 6042701-01			Prepared: 09-May-2016 Analyzed: 12-May-2016						
Aluminum-27 [1]	18500	0.0977	0.488	mg/kg	4883	9560	183	80-120			Q
Cadmium-111 [1]	50.0	0.0977	0.488	mg/kg	48.83	0.108	102	80-120			
Copper-63 [2]	128	0.0977	0.488	mg/kg	97.66	49.7	80.1	80-120			
Lead-206 [1]	131	0.0977	0.488	mg/kg	97.66	23.1	110	80-120			
Zinc-66 [1]	271	4.88	9.77	mg/kg	195.3	103	86.0	80-120			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605144 - Default Prep Metals											
Blank (B605144-BLK1)					Prepared & Analyzed: 18-May-2016						
Mercury	ND	0.00400	0.00400	mg/kg							U
LCS (B605144-BS1)					Prepared & Analyzed: 18-May-2016						
Mercury	0.107	0.00400	0.00400	mg/kg	0.1000		107	75-125			
Calibration Blank (B605144-CCB1)					Prepared & Analyzed: 18-May-2016						
Mercury	0.0001	0.004	0.004	mg/kg							
Calibration Check (B605144-CCV1)					Prepared & Analyzed: 18-May-2016						
Mercury	0.107	0.00400	0.00400	mg/kg	0.1000		107	90-110			
Calibration Check (B605144-CCV2)					Prepared & Analyzed: 18-May-2016						
Mercury	0.105	0.00400	0.00400	mg/kg	0.1000		105	90-110			
Duplicate (B605144-DUP1)		**Source: 6042701-01**			Prepared & Analyzed: 18-May-2016						
Mercury	0.448	0.00320	0.00320	mg/kg		0.542			18.8	25	
Matrix Spike (B605144-MS1)		**Source: 6042701-01**			Prepared & Analyzed: 18-May-2016						
Mercury	0.708	0.00308	0.00308	mg/kg	0.1542	0.542	108	75-125			
Batch B605158 - Default Prep Metals											
Blank (B605158-BLK1)					Prepared: 09-May-2016 Analyzed: 28-May-2016						
Iron	ND	1.60	8.00	mg/kg							U
LCS (B605158-BS1)					Prepared: 09-May-2016 Analyzed: 28-May-2016						
Iron	5120	1.60	8.00	mg/kg	5000		102	80-120			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605158 - Default Prep Metals											
Duplicate (B605158-DUP1)	**Source: 6042701-01**				Prepared: 09-May-2016 Analyzed: 28-May-2016						
Iron	14100	1.59	7.96	mg/kg		14100			0.164	20	
Matrix Spike (B605158-MS1)	**Source: 6042701-01**				Prepared: 09-May-2016 Analyzed: 28-May-2016						
Iron	18800	1.59	7.96	mg/kg	4972	14100	93.5	80-120			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
Blank (B605001-BLK1)					Prepared: 02-May-2016 Analyzed: 21-Aug-2016						
4,4'-DDD	ND	0.05	0.17	ug/kg wet							U
4,4'-DDE	ND	0.05	0.17	ug/kg wet							U
4,4'-DDT	ND	0.05	0.17	ug/kg wet							U
Aldrin	ND	0.05	0.17	ug/kg wet							U
alpha-BHC	ND	0.05	0.17	ug/kg wet							U
alpha-Chlordane	ND	0.05	0.17	ug/kg wet							U
beta-BHC	ND	0.05	0.17	ug/kg wet							U
delta-BHC	ND	0.05	0.17	ug/kg wet							U
Dieldrin	ND	0.05	0.17	ug/kg wet							U
Endosulfan I	ND	0.05	0.17	ug/kg wet							U
Endosulfan II	ND	0.05	0.17	ug/kg wet							U
Endosulfan sulfate	ND	0.05	0.17	ug/kg wet							U
Endrin	ND	0.05	0.17	ug/kg wet							U
Endrin aldehyde	ND	0.05	0.17	ug/kg wet							U
Endrin ketone	ND	0.05	0.17	ug/kg wet							U
gamma-BHC (Lindane)	ND	0.05	0.17	ug/kg wet							U
gamma-Chlordane	ND	0.05	0.17	ug/kg wet							U
Heptachlor	ND	0.05	0.17	ug/kg wet							U
Heptachlor epoxide	ND	0.05	0.17	ug/kg wet							U
Methoxychlor	ND	0.05	0.17	ug/kg wet							U
Toxaphene	ND	2.00	6.67	ug/kg wet							U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.67*			*ug/kg wet*	*5.333*		*50.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.68*			*ug/kg wet*	*5.333*		*50.2*	*40-130*			
LCS (B605001-BS1)					Prepared: 02-May-2016 Analyzed: 21-Aug-2016						
4,4'-DDD	3.5	0.05	0.17	ug/kg wet	4.000		88.0	40-125			
4,4'-DDE	2.8	0.05	0.17	ug/kg wet	4.000		69.0	40-125			
4,4'-DDT	3.7	0.05	0.17	ug/kg wet	4.000		92.3	45-125			
Aldrin	2.6	0.05	0.17	ug/kg wet	4.000		65.3	45-125			
alpha-BHC	2.6	0.05	0.17	ug/kg wet	4.000		65.1	45-125			
alpha-Chlordane	2.5	0.05	0.17	ug/kg wet	4.000		63.7	45-120			
beta-BHC	3.1	0.05	0.17	ug/kg wet	4.000		78.0	40-100			
delta-BHC	1.2	0.05	0.17	ug/kg wet	1.600		71.9	45-130			
Dieldrin	3.0	0.05	0.17	ug/kg wet	4.000		75.7	50-125			
Endosulfan I	2.8	0.05	0.17	ug/kg wet	4.000		70.3	30-130			
Endosulfan II	2.8	0.05	0.17	ug/kg wet	4.000		69.7	30-140			
Endosulfan sulfate	2.3	0.05	0.17	ug/kg wet	4.000		58.0	50-145			
Endrin	3.1	0.05	0.17	ug/kg wet	4.000		77.0	50-125			
Endrin aldehyde	1.8	0.05	0.17	ug/kg wet	4.000		45.3	30-145			
Endrin ketone	3.1	0.05	0.17	ug/kg wet	4.000		78.0	55-135			
gamma-BHC (Lindane)	2.7	0.05	0.17	ug/kg wet	4.000		67.3	45-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
LCS (B605001-BS1)					Prepared: 02-May-2016 Analyzed: 21-Aug-2016						
gamma-Chlordane	2.9	0.05	0.17	ug/kg wet	4.000		72.7	50-125			
Heptachlor	3.7	0.05	0.17	ug/kg wet	4.000		93.7	50-125			
Heptachlor epoxide	2.9	0.05	0.17	ug/kg wet	4.000		72.0	50-125			
Methoxychlor	3.6	0.05	0.17	ug/kg wet	4.000		90.0	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.25*			*ug/kg wet*	*5.333*		*61.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*5.81*			*ug/kg wet*	*5.333*		*109*	*40-130*			
Duplicate (B605001-DUP1)	**Source: 6042701-01**				Prepared: 02-May-2016 Analyzed: 21-Aug-2016						
4,4'-DDD	ND	0.08	0.24	ug/kg dry		ND				30	U
4,4'-DDE	ND	0.08	0.24	ug/kg dry		ND				30	U
4,4'-DDT	ND	0.08	0.24	ug/kg dry		ND				30	U
Aldrin	ND	0.08	0.24	ug/kg dry		ND				30	U
alpha-BHC	ND	0.08	0.24	ug/kg dry		ND				30	U
alpha-Chlordane	ND	0.08	0.24	ug/kg dry		ND				30	U
beta-BHC	ND	0.08	0.24	ug/kg dry		ND				30	U
delta-BHC	ND	0.08	0.24	ug/kg dry		ND				30	U
Dieldrin	ND	0.08	0.24	ug/kg dry		ND				30	U
Endosulfan I	ND	0.08	0.24	ug/kg dry		ND				30	U
Endosulfan II	ND	0.08	0.24	ug/kg dry		ND				30	U
Endosulfan sulfate	ND	0.08	0.24	ug/kg dry		ND				30	U
Endrin	ND	0.08	0.24	ug/kg dry		ND				30	U
Endrin aldehyde	ND	0.08	0.24	ug/kg dry		ND				30	U
Endrin ketone	ND	0.08	0.24	ug/kg dry		ND				30	U
gamma-BHC (Lindane)	ND	0.08	0.24	ug/kg dry		ND				30	U
gamma-Chlordane	0.24	0.08	0.24	ug/kg dry		0.28			14.8	30	
Heptachlor	ND	0.08	0.24	ug/kg dry		ND				30	U
Heptachlor epoxide	ND	0.08	0.24	ug/kg dry		ND				30	U
Methoxychlor	ND	0.08	0.24	ug/kg dry		ND				30	U
Toxaphene	ND	2.87	9.57	ug/kg dry		ND				30	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.31*			*ug/kg dry*	*7.658*		*43.2*	*40-125*			
Surrogate: Decachlorobiphenyl	*4.59*			*ug/kg dry*	*7.658*		*60.0*	*40-130*			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
Matrix Spike (B605001-MS1)		**Source: 6042701-03**			**Prepared: 02-May-2016 Analyzed: 21-Aug-2016**						
4,4'-DDD	8.8	0.12	0.36	ug/kg dry	8.725	ND	101	40-125			
4,4'-DDE	5.4	0.12	0.36	ug/kg dry	8.725	ND	61.7	40-125			
4,4'-DDT	9.0	0.12	0.36	ug/kg dry	8.725	ND	104	45-125			
Aldrin	4.5	0.12	0.36	ug/kg dry	8.725	ND	51.7	45-110			
alpha-BHC	4.1	0.12	0.36	ug/kg dry	8.725	ND	47.0	45-125			
alpha-Chlordane	8.8	0.12	0.36	ug/kg dry	8.725	1.5	83.6	45-120			
beta-BHC	5.4	0.12	0.36	ug/kg dry	8.725	ND	61.7	40-100			
delta-BHC	1.8	0.12	0.36	ug/kg dry	3.490	ND	52.2	45-125			
Dieldrin	6.0	0.12	0.36	ug/kg dry	8.725	ND	69.3	50-125			
Endosulfan I	7.5	0.12	0.36	ug/kg dry	8.725	ND	85.7	30-135			
Endosulfan II	6.5	0.12	0.36	ug/kg dry	8.725	ND	74.7	30-140			
Endosulfan sulfate	6.2	0.12	0.36	ug/kg dry	8.725	ND	70.7	50-135			
Endrin	5.7	0.12	0.36	ug/kg dry	8.725	ND	65.0	50-125			
Endrin aldehyde	ND	0.12	0.36	ug/kg dry	8.725	ND		30-145			QM-07, U
Endrin ketone	6.9	0.12	0.36	ug/kg dry	8.725	ND	78.7	55-135			
gamma-BHC (Lindane)	4.4	0.12	0.36	ug/kg dry	8.725	ND	50.3	45-125			
gamma-Chlordane	9.7	0.12	0.36	ug/kg dry	8.725	3.9	66.3	50-125			
Heptachlor	6.4	0.12	0.36	ug/kg dry	8.725	ND	73.0	50-125			
Heptachlor epoxide	5.0	0.12	0.36	ug/kg dry	8.725	ND	57.3	40-125			
Methoxychlor	7.4	0.12	0.36	ug/kg dry	8.725	ND	85.0	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*6.11*			*ug/kg dry*	*11.63*		*52.5*	*40-125*			
Surrogate: Decachlorobiphenyl	*11.2*			*ug/kg dry*	*11.63*		*96.2*	*40-130*			
Matrix Spike Dup (B605001-MSD1)		**Source: 6042701-03**			**Prepared: 02-May-2016 Analyzed: 21-Aug-2016**						
4,4'-DDD	7.0	0.12	0.36	ug/kg dry	8.691	ND	80.3	40-125	23.2	30	
4,4'-DDE	4.5	0.12	0.36	ug/kg dry	8.691	ND	52.3	40-125	16.8	30	
4,4'-DDT	7.9	0.12	0.36	ug/kg dry	8.691	ND	91.3	45-125	13.0	30	
Aldrin	4.3	0.12	0.36	ug/kg dry	8.691	ND	49.0	45-110	5.68	30	
alpha-BHC	3.6	0.12	0.36	ug/kg dry	8.691	ND	41.3	45-125	13.2	30	Q
alpha-Chlordane	7.2	0.12	0.36	ug/kg dry	8.691	1.5	65.9	45-120	19.6	30	
beta-BHC	4.6	0.12	0.36	ug/kg dry	8.691	ND	53.0	40-100	15.5	30	
delta-BHC	1.6	0.12	0.36	ug/kg dry	3.476	ND	45.3	45-125	14.6	30	
Dieldrin	5.0	0.12	0.36	ug/kg dry	8.691	ND	57.3	50-125	19.3	30	
Endosulfan I	6.2	0.12	0.36	ug/kg dry	8.691	ND	71.7	30-135	18.2	30	
Endosulfan II	5.4	0.12	0.36	ug/kg dry	8.691	ND	61.7	30-140	19.5	30	
Endosulfan sulfate	5.7	0.12	0.36	ug/kg dry	8.691	ND	65.3	50-135	8.23	30	
Endrin	4.8	0.12	0.36	ug/kg dry	8.691	ND	55.0	50-125	17.1	30	
Endrin aldehyde	ND	0.12	0.36	ug/kg dry	8.691	ND		30-145		30	QM-07, U
Endrin ketone	5.8	0.12	0.36	ug/kg dry	8.691	ND	66.7	55-135	16.9	30	
gamma-BHC (Lindane)	4.0	0.12	0.36	ug/kg dry	8.691	ND	45.7	45-125	10.1	30	
gamma-Chlordane	8.8	0.12	0.36	ug/kg dry	8.691	3.9	57.1	50-125	8.86	30	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
Matrix Spike Dup (B605001-MSD1)		**Source: 6042701-03**			Prepared: 02-May-2016 Analyzed: 21-Aug-2016						
Heptachlor	5.7	0.12	0.36	ug/kg dry	8.691	ND	65.3	50-125	11.5	30	
Heptachlor epoxide	4.2	0.12	0.36	ug/kg dry	8.691	ND	48.7	40-125	16.7	30	
Methoxychlor	6.0	0.12	0.36	ug/kg dry	8.691	ND	68.7	55-145	21.6	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*5.45*			*ug/kg dry*	*11.59*		*47.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*9.15*			*ug/kg dry*	*11.59*		*79.0*	*40-130*			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
Blank (B605001-BLK1)					Prepared: 02-May-2016 Analyzed: 13-May-2016						
1-Methylnaphthalene	ND	0.800	2.60	ug/kg wet							U
2-Methylnaphthalene	ND	0.800	2.60	ug/kg wet							U
Acenaphthene	ND	0.800	2.60	ug/kg wet							U
Acenaphthylene	ND	0.800	2.60	ug/kg wet							U
Anthracene	ND	0.800	2.60	ug/kg wet							U
Benzo (a) anthracene	ND	0.800	2.60	ug/kg wet							U
Benzo (a) pyrene	ND	0.800	2.60	ug/kg wet							U
Benzo (b) fluoranthene	ND	0.800	2.60	ug/kg wet							U
Benzo (g,h,i) perylene	ND	0.800	2.60	ug/kg wet							U
Benzo (k) fluoranthene	ND	0.800	2.60	ug/kg wet							U
Chrysene	ND	0.800	2.60	ug/kg wet							U
Dibenz (a,h) anthracene	ND	0.800	2.60	ug/kg wet							U
Fluoranthene	ND	0.800	2.60	ug/kg wet							U
Fluorene	ND	0.800	2.60	ug/kg wet							U
Indeno (1,2,3-cd) pyrene	ND	0.800	2.60	ug/kg wet							U
Naphthalene	ND	0.800	2.60	ug/kg wet							U
Phenanthrene	ND	0.800	2.60	ug/kg wet							U
Pyrene	ND	0.800	2.60	ug/kg wet							U
Surrogate: 2-Fluorobiphenyl	*51*			*ug/kg wet*	*80.00*		*63.5*	*40-105*			
Surrogate: Terphenyl-d14	*51*			*ug/kg wet*	*80.00*		*64.3*	*30-125*			
LCS (B605001-BS2)					Prepared: 02-May-2016 Analyzed: 13-May-2016						
1-Methylnaphthalene	96.8	0.800	2.60	ug/kg wet	133.3		72.6	40-105			
2-Methylnaphthalene	98.9	0.800	2.60	ug/kg wet	133.3		74.2	40-105			
Acenaphthene	83.3	0.800	2.60	ug/kg wet	133.3		62.5	45-110			
Acenaphthylene	84.9	0.800	2.60	ug/kg wet	133.3		63.7	45-110			
Anthracene	76.8	0.800	2.60	ug/kg wet	133.3		57.6	50-115			
Benzo (a) anthracene	96.8	0.800	2.60	ug/kg wet	133.3		72.6	50-125			
Benzo (a) pyrene	101	0.800	2.60	ug/kg wet	133.3		76.0	50-130			
Benzo (b) fluoranthene	107	0.800	2.60	ug/kg wet	133.3		80.0	45-130			
Benzo (g,h,i) perylene	103	0.800	2.60	ug/kg wet	133.3		77.3	40-125			
Benzo (k) fluoranthene	112	0.800	2.60	ug/kg wet	133.3		84.2	45-130			
Chrysene	116	0.800	2.60	ug/kg wet	133.3		87.3	50-125			
Dibenz (a,h) anthracene	94.9	0.800	2.60	ug/kg wet	133.3		71.2	40-125			
Fluoranthene	107	0.800	2.60	ug/kg wet	133.3		80.6	50-120			
Fluorene	97.6	0.800	2.60	ug/kg wet	133.3		73.2	50-110			
Indeno (1,2,3-cd) pyrene	91.1	0.800	2.60	ug/kg wet	133.3		68.3	40-125			
Naphthalene	83.3	0.800	2.60	ug/kg wet	133.3		62.5	40-105			
Phenanthrene	110	0.800	2.60	ug/kg wet	133.3		82.4	50-130			
Pyrene	76.8	0.800	2.60	ug/kg wet	133.3		57.6	45-125			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
LCS (B605001-BS2)					Prepared: 02-May-2016 Analyzed: 13-May-2016						
Surrogate: 2-Fluorobiphenyl	*58*			*ug/kg wet*	*80.00*		*72.3*	*40-105*			
Surrogate: Terphenyl-dl4	*54*			*ug/kg wet*	*80.00*		*67.8*	*30-125*			
Duplicate (B605001-DUP1)		**Source: 6042701-01**			Prepared: 02-May-2016 Analyzed: 13-May-2016						
1-Methylnaphthalene	ND	1.15	3.73	ug/kg dry		ND				30	U
2-Methylnaphthalene	1.37	1.15	3.73	ug/kg dry		ND				30	J
Acenaphthene	ND	1.15	3.73	ug/kg dry		ND				30	U
Acenaphthylene	ND	1.15	3.73	ug/kg dry		1.92				30	U
Anthracene	4.22	1.15	3.73	ug/kg dry		4.99			16.6	30	
Benzo (a) anthracene	22.8	1.15	3.73	ug/kg dry		29.2			24.8	30	
Benzo (a) pyrene	38.5	1.15	3.73	ug/kg dry		50.2			26.3	30	
Benzo (b) fluoranthene	38.0	1.15	3.73	ug/kg dry		50.3			27.7	30	
Benzo (g,h,i) perylene	36.9	1.15	3.73	ug/kg dry		48.8			27.8	30	
Benzo (k) fluoranthene	38.4	1.15	3.73	ug/kg dry		47.5			21.1	30	
Chrysene	26.0	1.15	3.73	ug/kg dry		34.4			27.7	30	
Dibenz (a,h) anthracene	5.37	1.15	3.73	ug/kg dry		6.52			19.2	30	
Fluoranthene	19.5	1.15	3.73	ug/kg dry		24.9			24.3	30	
Fluorene	ND	1.15	3.73	ug/kg dry		ND				30	U
Indeno (1,2,3-cd) pyrene	40.4	1.15	3.73	ug/kg dry		47.3			15.7	30	
Naphthalene	2.44	1.15	3.73	ug/kg dry		1.38			55.2	30	J
Phenanthrene	8.10	1.15	3.73	ug/kg dry		8.82			8.51	30	
Pyrene	60.3	1.15	3.73	ug/kg dry		41.4			37.2	30	Q
Surrogate: 2-Fluorobiphenyl	*71*			*ug/kg dry*	*114.9*		*61.5*	*40-105*			
Surrogate: Terphenyl-dl4	*91*			*ug/kg dry*	*114.9*		*79.0*	*30-125*			
Matrix Spike (B605001-MS2)		**Source: 6042701-03**			Prepared: 02-May-2016 Analyzed: 13-May-2016						
1-Methylnaphthalene	162	1.78	5.78	ug/kg dry	296.4	ND	54.7	40-105			
2-Methylnaphthalene	164	1.78	5.78	ug/kg dry	296.4	3.90	54.0	40-105			
Acenaphthene	169	1.78	5.78	ug/kg dry	296.4	1.78	56.3	45-110			
Acenaphthylene	178	1.78	5.78	ug/kg dry	296.4	8.59	57.3	45-110			
Anthracene	228	1.78	5.78	ug/kg dry	296.4	15.0	72.0	50-115			
Benzo (a) anthracene	317	1.78	5.78	ug/kg dry	296.4	72.7	82.5	50-125			
Benzo (a) pyrene	550	1.78	5.78	ug/kg dry	296.4	272	94.0	50-130			
Benzo (b) fluoranthene	455	1.78	5.78	ug/kg dry	296.4	297	53.1	45-130			
Benzo (g,h,i) perylene	512	1.78	5.78	ug/kg dry	296.4	224	97.0	40-125			
Benzo (k) fluoranthene	394	1.78	5.78	ug/kg dry	296.4	239	52.4	45-130			
Chrysene	375	1.78	5.78	ug/kg dry	296.4	118	86.6	50-125			
Dibenz (a,h) anthracene	279	1.78	5.78	ug/kg dry	296.4	38.5	81.0	40-125			
Fluoranthene	238	1.78	5.78	ug/kg dry	296.4	48.8	63.7	50-120			
Fluorene	192	1.78	5.78	ug/kg dry	296.4	2.77	63.9	50-110			
Indeno (1,2,3-cd) pyrene	569	1.78	5.78	ug/kg dry	296.4	243	110	40-125			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B605001 - EPA 3545											
Matrix Spike (B605001-MS2)		**Source: 6042701-03**			Prepared: 02-May-2016 Analyzed: 13-May-2016						
Naphthalene	142	1.78	5.78	ug/kg dry	296.4	7.01	45.7	40-105			
Phenanthrene	303	1.78	5.78	ug/kg dry	296.4	33.6	91.1	50-130			
Pyrene	252	1.78	5.78	ug/kg dry	296.4	80.7	58.0	45-125			
Surrogate: 2-Fluorobiphenyl	*110*			*ug/kg dry*	*177.8*		*59.8*	*40-105*			
Surrogate: Terphenyl-dl4	*150*			*ug/kg dry*	*177.8*		*83.8*	*30-125*			

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USACE ERDC-EP-C
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Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

Moisture SM 2540G - Quality Control

TestAmerica Pittsburgh

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 175409 -											
DU (200-33325-1DU)		**Source: 6042701-01**			Prepared: Analyzed: 05-May-2016						
Percent Moisture	30.6	0.1	0.1	%		30.7		-	0.6	20	
Percent Solids	69.4	0.1	0.1	%		69.3		-	0.3	20	
DU (200-33325-3DU)		**Source: 6042701-03**			Prepared: Analyzed: 05-May-2016						
Percent Moisture	54.1	0.1	0.1	%		53.3		-	1	20	
Percent Solids	45.9	0.1	0.1	%		46.7		-	2	20	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	21-Oct-2016

WALKLEY_BLACK Organic Carbon, Total (TOC) - Quality Control

TestAmerica Pittsburgh

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 175638 -											
LCS (180-1756381)					Prepared: Analyzed: 09-May-2016						
Total Organic Carbon	489000	67	250	mg/Kg	471000		104	80-120			
MB (180-1756382)					Prepared: Analyzed: 09-May-2016						
Total Organic Carbon	ND	67	250	mg/Kg				-			
DU (200-33325-1DU)		**Source: 6042701-01**			Prepared: Analyzed: 09-May-2016						
Total Organic Carbon	5210	97	360	mg/Kg dry		5200		-	0	20	

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SPAWAR Systems Center PACIFIC

SPAWAR SYSTEMS CENTER PACIFIC
ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY
BRANCH, CODE 7176
53475 STROTHE ROAD
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 21-Apr-2016
Page: 1 of 1

Project Title/Project Number:	ESTCP Drifting Exposure (DrEx) System DemVal	**Project PI:**	Dr. D. Bart Chadwick
Remarks		**Contact:**	Joel Guerrero
Sampler(s): (Signature)	Bart Chadwick (Code 7176)	**Contact Tel:**	(619) 850-2109
Tel: 619-553-5333	**Fax:** 619-553-6305 **Email:** joel.guerrero@navy.mil		

Special Instructions/Comments:
Water samples; kept dark & cold (4 °C)

Field Sample Identification	Start Date Collection	Start Time (local)	Matrix	Type	Pres. ** samples acidified, pH<2	PCB congeners [8082A / 3510]	PAHs [8270D / 3510]	Pesticides [8081B / 3535]	TOC [9060]	Grain Size [ASTM D422-63]	Al,Cd,Cu,Fe,Pb,Zn [6020A] Hg [7471B]
RARA-T1-042016	04-20-2016	1305	Sediment	Grab	none	x	x	x	x	x	x
RARA-T2-042016	04-20-2016	1305	Sediment	Grab	none	x	x	x	x	x	x
RARA-S1-042016	04-20-2016	1200	Sediment	Grab	none	x	x	x	x	x	x
RARA-S2-042016	04-20-2016	1200	Sediment	Grab	none	x	x	x	x	x	x
RARA-C1-042016	04-20-2016	1300	Sediment	Grab	none	x	x	x	x	x	x
RARA-C2-042016	04-20-2016	1300	Sediment	Grab	none	x	x	x	x	x	x
					TOTAL	6					

Relinquished by: Lewis Hsu	(Signature) [signature]	**Date:** 4/21/2016	**Time:** 1030
Received by:	(Signature) [signature]	**Date:** 4/22/16	**Time:** 15:00

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception
			Data included from: W:\TransferIn\6042701 TRANSFER 29 Jun 2016 1111.mdb
			Data included from: W:\TransferIn\6042701 TRANSFER 29 Jun 2016 1117.mdb

UNITS - ug/kg dry wt

peak can not be resolved due to co

				SURROGATE							
				%Rec	%Rec						
SAMPLE ID	LAB ID	DL	RL	TMX	209	1	3	4	5	6	7
RARA-T1&T2-042016	6042701-01	0.06	0.19	46.2	84.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-S1&S2-042016	-2	0.05	0.16	60.5	138	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-C1&C2-042016	-3	0.10	0.3	surr not added		N.D.	N.D.	N.D.		N.D.	N.D.
						N.D.	N.D.	N.D.	0.281	N.D.	N.D.
	B			50.1	102	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	BS %Rec			77.3	136				67.5		
	MS %Rec			71	78.3				79.8		
	MSD %Rec			75.5	91.8				74.2		

ɔelutions on both columns

8	9	10	12	13	14	15	16	17	18	19	20/33	22	24
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.	N.D.	N.D.	N.D.	0.388	0.521	N.D.	N.D.	N.D.	0.443	N.D.	N.D.
0.194	N.D.	N.D.	N.D.	N.D.	N.D.			N.D.	N.D.	N.D.		N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
									58.5				
									66.7				
									64.1				

25	26	27	28/31	29	32	34	35	37	40	41	42	44	45
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.098	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	0.885	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.		1.116	N.D.
N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	1.467	N.D.	N.D.	0.438		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
			64.8									84.5	
			58.7									82.6	
			62.1									88.4	

46	47	48	49	51	52	53	54	56	59	60	63	64	66
N.D.		N.D.	0.171	N.D.	0.207	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.	0.154	N.D.		N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.467
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
0.463			1.594	0.494	2.225	0.871	N.D.	0.794		N.D.	N.D.		
	1.216	0.308					N.D.		0.419	N.D.	N.D.	0.641	2.039
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
					62.3								70.0
					63.7								79.8
					66.4								81.6

67/100	69	70	71	73	74	75	77	81/117	82	83	84	85	87/115
N.D.	N.D.	0.524	N.D.	N.D.		N.D.	N.D.	0.133	N.D.	N.D.	0.128	N.D.	0.101
N.D.	N.D.		N.D.	N.D.	0.168	N.D.	N.D.		N.D.	N.D.		N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
0.182	0.234	2.112		N.D.				0.37	0.462	N.D.	N.D.	N.D.	1.354
			1.332	N.D.	0.616	0.355	0.275			N.D.	N.D.	N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
													86.5
													87.3
													88.4

90/101	91	92	93	95	97	99	103	104	105	107	110	114	118
	N.D.	N.D.		0.411	0.234	0.554	N.D.	1.388	0.414	N.D.	0.461	N.D.	1.377
0.943	N.D.	N.D.					N.D.			N.D.		N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	1.278	1.902		4.417	1.792	3.394	N.D.	3.362	2.791	0.57	3.902	N.D.	8.214
7.452							N.D.					N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
73.0											81.3		
70.4											85.8		
70.0											87.6		

119	122	123	124	126/129	128	130	131	132/153	134	135	136	137	138
N.D.	N.D.	N.D.	N.D.	N.D.	0.439	0.096	N.D.	2.37	N.D.		N.D.	N.D.	3.089
N.D.	N.D.	N.D.	N.D.	N.D.			N.D.		N.D.	0.203	N.D.	N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
0.342	N.D.	N.D.		0.485	1.816	0.558	0.455	12.539	0.513		N.D.	0.429	16.577
	N.D.	N.D.	0.157							0.998	N.D.		
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								81.0					95.5
								75.2					77.4
								74.9					78.4

141	144	146	147	149	151	154	156/157	158	165	167	169	170	171
N.D.	N.D.	0.374	0.061	1.042	0.322	N.D.		N.D.	N.D.	0.161	N.D.		
N.D.	N.D.					N.D.	0.233	N.D.	N.D.		N.D.	0.379	0.192
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		1.808	0.357	6.732	2.125	N.D.		N.D.	N.D.	N.D.	N.D.		
1.401	0.379					N.D.	1.048	N.D.	N.D.	N.D.	N.D.	5.287	0.835
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
93.3					80.0							113.0	
78.3					80.5							74.5	
79.4					82.4							68.9	

172	173	174	175	176	177	178	179	180	183	184	185	187	189
0.103	N.D.	0.452	N.D.	N.D.	0.388	0.146		0.889	0.333	N.D.	0.071	0.961	N.D.
	N.D.		N.D.	N.D.			0.244			N.D.			N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
0.621	N.D.	2.19	0.174	N.D.	2.047	0.857		5.068	1.6	N.D.	0.496	4.051	N.D.
	N.D.			N.D.			1.075			N.D.			N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								107.0	102.5			101.8	
								91.0	82.8			84.3	
								96.6	83.9			80.9	

190	191	193	194	195	196	197	199	200	201	202	203	205	206
N.D.	N.D.	0.081	0.328	N.D.		N.D.	0.335	N.D.	N.D.			N.D.	N.D.
N.D.	N.D.			N.D.	0.151	N.D.		N.D.	N.D.	0.116	0.233	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	0.378	1.551			N.D.	1.439		N.D.			N.D.	1.569
0.248	N.D.			0.384	0.679	N.D.		1.137	N.D.	0.449	1.12	N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
													118.8
													90.3
													82.4

207	208
0.092	
	0.191
N.D.	N.D.
N.D.	N.D.
0.341	
	0.576
N.D.	N.D.

T-Final Results

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

25 January 2017

Joel Guererro
Navy – SPAWAR
Environmental Science and Applied System Branch, 536(
San Diego, CA 92152

RE: RARA

Enclosed are the results of analyses for samples received by the laboratory on 18-Aug-2016. The samples associated with this report will be held for 90 days from the date of this report. The raw data associated with this report will be held for 5 years from the date of this report. If you need us to hold onto the samples or the data longer then these specified times, you will need to notify us in writing at least 30 days before the expiration dates. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jenifer Milam
Database Manager

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

WORK ORDER SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date of Work Order
RARA-T1-081516	6081808-01	Soil/Sediment	15-Aug-2016	18-Aug-2016
RARA-T2-081516	6081808-02	Soil/Sediment	15-Aug-2016	18-Aug-2016
RARA-S1-081516	6081808-03	Soil/Sediment	15-Aug-2016	18-Aug-2016
RARA-S2-081516	6081808-04	Soil/Sediment	15-Aug-2016	18-Aug-2016
RARA-C1-081516	6081808-05	Soil/Sediment	15-Aug-2016	18-Aug-2016
RARA-C2-081516	6081808-06	Soil/Sediment	15-Aug-2016	18-Aug-2016

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Case Narrative

No issues were experienced during the analysis of Work Order 6081808 unless specified below.

Pesticides - Analysis of the spiking standard used for the BS, MS, and MSD showed that dBHC, endrin aldehyde, and endosulfan had degraded resulting in low or no % recoveries. However, all analytical QC for these analytes (calibration, CCV, ICV) were within acceptable ranges indicating that they would have been detected by the analysis if they had been present.

PAH - MS has low recoveries for most analytes likely due to either incorrect spiking or incomplete extraction. These low recoveries caused the RPD between MS and MSD to exceed the acceptance range. All BS and MSD recoveries had passing recoveries and the data was deemed valid.

PCB Congener data will be provided in a separate excel file.

We have reported TOC by both Walkey Black and 9060.

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USACE ERDC-EP-C
3909 Halls Ferry Road
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Notes and Definitions

Z-03	See case narrative.
U	Analyte included in the analysis, but not detected
S-GC	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate/s.
RPD-04	RPD between primary and confirmation column values >40%. Per SW846 8000C, the lower result has been reported.
QM-11	The spike recovery was outside of QC acceptance limits for the MS and/or MSD due to inherent analyte concentration greater than the spike concentration. The QC batch was accepted based on LCS and/or LCSD recoveries within the acceptance limits.
Q	Value is outside of acceptance limits.
P	Duplicate analysis does not meet the acceptance criteria for precision
MB-01	The method blank contains analyte at a concentration above the MRL; however, concentration is less than 10% of the sample result, which is negligible according to method criteria.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
HD	Original sample run within holding time. Subsequent re-analyses/dilutions analyzed outside of holding time.
H	Sample was prepped or analyzed beyond the specified holding time
B	Analyte is found in the associated blank as well as in the sample.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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USACE ERDC-EP-C
3909 Halls Ferry Road
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-T1-081516

6081808-01 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**63.9**	0.500	0.500	% Solids	07-Sep-2016	26-Sep-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.353**	0.00992	0.0198	mg/kg	22-Aug-2016	31-Aug-2016	EPA 7474	
Aluminum	**16000**	3.92	19.6	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Iron	**16900**	3.92	19.6	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Cadmium-111 [1]	ND	0.196	0.392	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-63 [2]	**80.7**	0.196	0.392	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**27.7**	0.196	0.392	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-68 [2]	**111**	0.196	0.392	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.47**	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	RPD-04
4,4´-DDE	**0.51**	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	
4,4´-DDT	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Aldrin	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-BHC	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-Chlordane	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
beta-BHC	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
delta-BHC	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Dieldrin	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan I	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan II	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin aldehyde	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin ketone	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-Chlordane	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Methoxychlor	ND	0.08	0.26	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Toxaphene	ND	3.06	10.2	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.84**		*69.5 %*	*40-125*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.65**		*65.0 %*	*40-130*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-T1-081516

6081808-01 (Soil/Sediment)

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthene	ND	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Anthracene	**9.39**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) anthracene	**32.2**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) pyrene	**71.6**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**107**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	**59.6**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (k) fluoranthene	**55.3**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Chrysene	**58.1**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Dibenz (a,h) anthracene	**11.4**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluoranthene	**74.1**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluorene	ND	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**60.0**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Naphthalene	**5.71**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Phenanthrene	**12.2**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Pyrene	**73.5**	1.22	3.98	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	14		*49.6 %*	*40-105*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	22		*75.2 %*	*30-125*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Wet Chemistry Analysis								
TOC	**1050**	80.0	100	mg/kg	12-Sep-2016	12-Sep-2016	SW9060A	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**4900**	100	380	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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Navy -- SPAWAR	Project: RARA	
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San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-T2-081516

6081808-02 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**64.6**	0.500	0.500	% Solids	07-Sep-2016	26-Sep-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**1.46**	0.0250	0.0499	mg/kg	22-Aug-2016	31-Aug-2016	EPA 7474	
Aluminum	**15800**	3.95	19.7	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Iron	**17300**	3.95	19.7	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Cadmium-111 [1]	ND	0.197	0.395	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-63 [2]	**65.5**	0.197	0.395	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**38.8**	0.197	0.395	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-68 [2]	**107**	0.197	0.395	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
4,4´-DDE	**0.73**	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	
4,4´-DDT	**0.50**	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	RPD-04
Aldrin	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-BHC	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-Chlordane	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
beta-BHC	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
delta-BHC	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Dieldrin	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan I	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan II	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin aldehyde	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin ketone	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-Chlordane	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Methoxychlor	ND	0.08	0.25	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Toxaphene	ND	3.04	10.1	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.37**		*58.5 %*	*40-125*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.66**		*65.5 %*	*40-130*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	

USACE ERDC-EP-C
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-T2-081516

6081808-02 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthene	ND	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Anthracene	**11.2**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) anthracene	**33.0**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) pyrene	**58.0**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**103**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	**45.6**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (k) fluoranthene	**47.8**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Chrysene	**63.9**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Dibenz (a,h) anthracene	**8.52**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluoranthene	**81.5**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluorene	ND	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**46.8**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Naphthalene	**2.84**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	J
Phenanthrene	**14.6**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Pyrene	**89.2**	1.22	3.95	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	11		*38.5 %*	*40-105*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	*S-GC*
Surrogate: Terphenyl-d14	19		*65.5 %*	*30-125*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Wet Chemistry Analysis								
TOC	**1140**	80.0	100	mg/kg	12-Sep-2016	12-Sep-2016	SW9060A	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**5600**	99	370	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-S1-081516

6081808-03 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**75.6**	0.500	0.500	% Solids	07-Sep-2016	26-Sep-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.0552**	0.00946	0.0189	mg/kg	22-Aug-2016	31-Aug-2016	EPA 7474	
Aluminum	**5680**	3.97	19.8	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Iron	**6580**	3.97	19.8	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Cadmium-111 [1]	ND	0.198	0.397	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-63 [2]	**21.6**	0.198	0.397	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**6.45**	0.198	0.397	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-68 [2]	**32.1**	0.198	0.397	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
4,4´-DDE	**0.17**	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	J
4,4´-DDT	**0.10**	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	RPD-04, J
Aldrin	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-BHC	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-Chlordane	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
beta-BHC	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
delta-BHC	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Dieldrin	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan I	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan II	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin aldehyde	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin ketone	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-Chlordane	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Methoxychlor	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Toxaphene	ND	2.53	8.43	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.46**		*73.0 %*	*40-125*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.12**		*63.0 %*	*40-130*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-S1-081516

6081808-03 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthene	ND	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Anthracene	**9.61**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) anthracene	**19.1**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) pyrene	**40.0**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**53.3**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	**19.9**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (k) fluoranthene	**31.7**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Chrysene	**48.0**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Dibenz (a,h) anthracene	**5.73**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluoranthene	**24.1**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluorene	ND	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**23.6**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Naphthalene	**6.07**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Phenanthrene	**4.55**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Pyrene	**25.8**	1.01	3.29	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	11		*49.6 %*	*40-105*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	18		*71.7 %*	*30-125*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Wet Chemistry Analysis								
TOC	**896**	80.0	100	mg/kg	12-Sep-2016	12-Sep-2016	SW9060A	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**2500**	91	340	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-S2-081516

6081808-04 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**76.3**	0.500	0.500	% Solids	07-Sep-2016	26-Sep-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.0438**	0.00909	0.0182	mg/kg	22-Aug-2016	31-Aug-2016	EPA 7474	
Aluminum	**4900**	3.94	19.7	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Iron	**5800**	3.94	19.7	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Cadmium-111 [1]	ND	0.197	0.394	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-63 [2]	**18.3**	0.197	0.394	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**5.61**	0.197	0.394	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-68 [2]	**34.2**	0.197	0.394	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.08**	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	J
4,4´-DDE	**0.12**	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	J
4,4´-DDT	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Aldrin	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-BHC	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-Chlordane	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
beta-BHC	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
delta-BHC	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Dieldrin	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan I	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan II	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin aldehyde	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin ketone	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-Chlordane	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Methoxychlor	ND	0.07	0.21	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Toxaphene	ND	2.55	8.51	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.11**		*62.0 %*	*40-125*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**1.74**		*51.0 %*	*40-130*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-S2-081516

6081808-04 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthene	ND	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Anthracene	**4.93**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) anthracene	**10.6**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) pyrene	**21.8**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**32.2**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	**14.3**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (k) fluoranthene	**20.2**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Chrysene	**24.3**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Dibenz (a,h) anthracene	**3.40**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluoranthene	**16.7**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluorene	ND	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**15.0**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Naphthalene	**3.40**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Phenanthrene	**5.96**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Pyrene	**17.0**	1.02	3.32	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**12**		*51.9 %*	*40-105*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	**19**		*77.2 %*	*30-125*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Wet Chemistry Analysis								
TOC	**826**	80.0	100	mg/kg	12-Sep-2016	12-Sep-2016	SW9060A	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**1900**	90	340	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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USACE ERDC-EP-C
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-C1-081516

6081808-05 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**50.2**	0.500	0.500	% Solids	07-Sep-2016	26-Sep-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**1.37**	0.0237	0.0474	mg/kg	22-Aug-2016	31-Aug-2016	EPA 7474	
Aluminum	**31600**	3.93	19.6	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Iron	**31600**	3.93	19.6	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Cadmium-111 [1]	**1.06**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Copper-63 [2]	**129**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**107**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-68 [2]	**372**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
4,4´-DDE	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
4,4´-DDT	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Aldrin	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-BHC	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-Chlordane	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
beta-BHC	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
delta-BHC	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Dieldrin	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan I	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan II	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin aldehyde	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin ketone	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-Chlordane	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Methoxychlor	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Toxaphene	ND	3.86	12.9	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.73**		*53.0 %*	*40-125*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**5.51**		*107 %*	*40-130*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-C1-081516

6081808-05 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthene	ND	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Anthracene	**33.5**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) anthracene	**71.1**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) pyrene	**289**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**499**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	**167**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (k) fluoranthene	**218**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Chrysene	**150**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Dibenz (a,h) anthracene	**28.6**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluoranthene	**184**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluorene	ND	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**161**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Naphthalene	**9.79**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Phenanthrene	**41.7**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Pyrene	**263**	1.55	5.02	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	18		*50.4 %*	*40-105*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	27		*72.4 %*	*30-125*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**16000**	130	500	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-C1-081516

6081808-05RE1 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes

Air Water and Soil Laboratories, Inc.

Wet Chemistry Analysis

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
TOC	**2450**	800	1000	mg/kg	13-Sep-2016	13-Sep-2016	SW9060A	HD

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Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-C2-081516

6081808-06 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**49.9**	0.500	0.500	% Solids	07-Sep-2016	26-Sep-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**1.46**	0.0245	0.0490	mg/kg	22-Aug-2016	31-Aug-2016	EPA 7474	
Aluminum	**36200**	3.93	19.6	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Iron	**32700**	3.93	19.6	mg/kg	22-Aug-2016	05-Dec-2016	SW 846/6010	
Cadmium-111 [1]	**0.834**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Copper-63 [2]	**165**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**110**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-68 [2]	**252**	0.196	0.393	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
4,4´-DDE	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
4,4´-DDT	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Aldrin	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-BHC	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
alpha-Chlordane	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
beta-BHC	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
delta-BHC	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Dieldrin	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan I	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan II	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin aldehyde	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Endrin ketone	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
gamma-Chlordane	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Methoxychlor	ND	0.10	0.32	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Toxaphene	ND	3.82	12.7	ug/kg dry	07-Sep-2016	21-Nov-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.70**		*53.0 %*	*40-125*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**3.28**		*64.5 %*	*40-130*	*07-Sep-2016*	*21-Nov-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-C2-081516

6081808-06 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthene	ND	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Anthracene	**21.4**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) anthracene	**66.7**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (a) pyrene	**325**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**533**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	**204**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Benzo (k) fluoranthene	**269**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Chrysene	**145**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Dibenz (a,h) anthracene	**36.4**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluoranthene	**142**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Fluorene	ND	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**191**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Naphthalene	**9.17**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Phenanthrene	**41.3**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Pyrene	**194**	1.53	4.97	ug/kg dry	07-Sep-2016	11-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	17		*50.4 %*	*40-105*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	25		*66.9 %*	*30-125*	*07-Sep-2016*	*11-Oct-2016*	*EPA 8270C*	
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**17000**	140	530	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-C2-081516

6081808-06RE1 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			Air Water and Soil Laboratories, Inc.					
Wet Chemistry Analysis								
TOC	**1980**	800	1000	mg/kg	13-Sep-2016	13-Sep-2016	SW9060A	HD

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609034 - Default Prep Metals											
Blank (B609034-BLK1)					Prepared: 22-Aug-2016 Analyzed: 31-Aug-2016						
Mercury	ND	0.0100	0.0200	mg/kg							U
LCS (B609034-BS1)					Prepared: 22-Aug-2016 Analyzed: 31-Aug-2016						
Mercury	0.0928	0.0100	0.0200	mg/kg	0.1000		92.8	75-125			
Duplicate (B609034-DUP1)		**Source: 6081808-01**			Prepared: 22-Aug-2016 Analyzed: 31-Aug-2016						
Mercury	0.346	0.00965	0.0193	mg/kg		0.353			2.27	25	
Matrix Spike (B609034-MS1)		**Source: 6081808-01**			Prepared: 22-Aug-2016 Analyzed: 31-Aug-2016						
Mercury	0.488	0.00995	0.0199	mg/kg	0.09950	0.353	135	75-125			QM-11
Matrix Spike Dup (B609034-MSD1)		**Source: 6081808-01**			Prepared: 22-Aug-2016 Analyzed: 31-Aug-2016						
Mercury	0.487	0.00975	0.0195	mg/kg	0.09750	0.353	137	75-125	1.19	25	QM-11
Batch B611138 - Default Prep Metals											
Blank (B611138-BLK1)					Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	ND	0.200	0.400	mg/kg							U
Copper-63 [2]	ND	0.200	0.400	mg/kg							U
Lead-206 [1]	ND	0.200	0.400	mg/kg							U
Zinc-68 [2]	1.31	0.200	0.400	mg/kg							MB-01
LCS (B611138-BS1)					Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	51.4	0.500	1.00	mg/kg	50.00		103	80-120			
Copper-63 [2]	113	0.500	1.00	mg/kg	100.0		113	80-120			
Lead-206 [1]	111	0.500	1.00	mg/kg	100.0		111	80-120			
Zinc-68 [2]	207	0.500	1.00	mg/kg	200.0		104	80-120			MB-01, B

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611138 - Default Prep Metals											
Duplicate (B611138-DUP1)		**Source: 6081808-01**			Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	ND	0.199	0.397	mg/kg		ND				20	U
Copper-63 [2]	74.0	0.199	0.397	mg/kg		80.7			8.63	20	
Lead-206 [1]	26.8	0.199	0.397	mg/kg		27.7			3.26	20	
Zinc-68 [2]	109	0.199	0.397	mg/kg		111			1.91	20	MB-01, B
Matrix Spike (B611138-MS1)		**Source: 6081808-01**			Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	48.2	0.497	0.993	mg/kg	49.67	ND	97.1	80-120			
Copper-63 [2]	165	0.497	0.993	mg/kg	99.34	80.7	85.2	80-120			
Lead-206 [1]	138	0.497	0.993	mg/kg	99.34	27.7	111	80-120			
Zinc-68 [2]	303	0.497	0.993	mg/kg	198.7	111	96.8	80-120			MB-01, B
Batch B612019 - Default Prep Metals											
Blank (B612019-BLK1)					Prepared: 22-Aug-2016 Analyzed: 05-Dec-2016						
Aluminum	5.83	4.00	20.0	mg/kg							J
Iron	ND	4.00	20.0	mg/kg							U
LCS (B612019-BS1)					Prepared: 22-Aug-2016 Analyzed: 05-Dec-2016						
Aluminum	5140	4.00	20.0	mg/kg	5000		103	80-120			
Iron	5090	4.00	20.0	mg/kg	5000		102	80-120			
Duplicate (B612019-DUP1)		**Source: 6081808-01**			Prepared: 22-Aug-2016 Analyzed: 05-Dec-2016						
Aluminum	16100	3.97	19.9	mg/kg		16000			0.222	20	
Iron	16200	3.97	19.9	mg/kg		16900			3.90	20	
Matrix Spike (B612019-MS1)		**Source: 6081808-01**			Prepared: 22-Aug-2016 Analyzed: 05-Dec-2016						
Aluminum	22100	3.97	19.9	mg/kg	4967	16000	121	80-120			QM-11
Iron	21500	3.97	19.9	mg/kg	4967	16900	94.0	80-120			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609375 - EPA 3545											
Blank (B609375-BLK1)					Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016						
4,4'-DDD	ND	0.08	0.25	ug/kg wet							U
4,4'-DDE	ND	0.08	0.25	ug/kg wet							U
4,4'-DDT	ND	0.08	0.25	ug/kg wet							U
Aldrin	ND	0.08	0.25	ug/kg wet							U
alpha-BHC	ND	0.08	0.25	ug/kg wet							U
alpha-Chlordane	ND	0.08	0.25	ug/kg wet							U
beta-BHC	ND	0.08	0.25	ug/kg wet							U
delta-BHC	ND	0.08	0.25	ug/kg wet							U
Dieldrin	ND	0.08	0.25	ug/kg wet							U
Endosulfan I	ND	0.08	0.25	ug/kg wet							U
Endosulfan II	ND	0.08	0.25	ug/kg wet							U
Endosulfan sulfate	ND	0.08	0.25	ug/kg wet							U
Endrin	ND	0.08	0.25	ug/kg wet							U
Endrin aldehyde	ND	0.08	0.25	ug/kg wet							U
Endrin ketone	ND	0.08	0.25	ug/kg wet							U
gamma-BHC (Lindane)	ND	0.08	0.25	ug/kg wet							U
gamma-Chlordane	ND	0.08	0.25	ug/kg wet							U
Heptachlor	ND	0.08	0.25	ug/kg wet							U
Heptachlor epoxide	ND	0.08	0.25	ug/kg wet							U
Methoxychlor	ND	0.08	0.25	ug/kg wet							U
Toxaphene	ND	3.00	10.0	ug/kg wet							U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.90*			*ug/kg wet*	*4.000*		*97.5*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.78*			*ug/kg wet*	*4.000*		*69.5*	*40-130*			
LCS (B609375-BS1)					Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016						
4,4'-DDD	1.9	0.08	0.25	ug/kg wet	3.000		63.5	40-125			
4,4'-DDE	3.9	0.08	0.25	ug/kg wet	3.000		131	40-125			Q
4,4'-DDT	1.6	0.08	0.25	ug/kg wet	3.000		51.7	45-125			
Aldrin	2.3	0.08	0.25	ug/kg wet	3.000		76.7	45-125			
alpha-BHC	1.2	0.08	0.25	ug/kg wet	1.400		86.7	45-125			
alpha-Chlordane	2.6	0.08	0.25	ug/kg wet	3.000		87.3	45-120			
beta-BHC	2.0	0.08	0.25	ug/kg wet	2.600		76.9	40-100			
delta-BHC	ND	0.08	0.25	ug/kg wet	3.000			45-130			Z-03, U
Dieldrin	2.3	0.08	0.25	ug/kg wet	3.000		76.7	50-125			
Endosulfan I	2.3	0.08	0.25	ug/kg wet	3.000		77.3	30-130			
Endosulfan II	1.2	0.08	0.25	ug/kg wet	3.000		39.6	30-140			
Endosulfan sulfate	ND	0.08	0.25	ug/kg wet	1.400			50-145			Z-03, U
Endrin	2.3	0.08	0.25	ug/kg wet	3.000		75.3	50-125			
Endrin aldehyde	ND	0.08	0.25	ug/kg wet	3.000			30-145			Z-03, U
Endrin ketone	1.1	0.08	0.25	ug/kg wet	1.600		65.9	55-135			
gamma-BHC (Lindane)	1.2	0.08	0.25	ug/kg wet	2.000		60.0	45-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609375 - EPA 3545											
LCS (B609375-BS1)					Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016						
gamma-Chlordane	2.4	0.08	0.25	ug/kg wet	3.000		80.7	50-125			
Heptachlor	2.1	0.08	0.25	ug/kg wet	3.000		70.7	50-125			
Heptachlor epoxide	2.4	0.08	0.25	ug/kg wet	3.000		78.7	50-125			
Methoxychlor	2.2	0.08	0.25	ug/kg wet	3.000		72.7	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.46*			*ug/kg wet*	*4.000*		*86.5*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.56*			*ug/kg wet*	*4.000*		*64.0*	*40-130*			
LCS (B609375-BS3)					Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016						
Toxaphene	58.8	3.00	10.0	ug/kg wet	80.00		73.5	50-125			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.44*			*ug/kg wet*	*4.000*		*86.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.56*			*ug/kg wet*	*4.000*		*64.0*	*40-130*			
LCS Dup (B609375-BSD3)					Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016						
Toxaphene	71.2	3.00	10.0	ug/kg wet	80.00		89.0	50-125	19.1	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.68*			*ug/kg wet*	*4.000*		*92.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.44*			*ug/kg wet*	*4.000*		*61.0*	*40-130*			
Matrix Spike (B609375-MS1)		**Source: 6081808-04**			Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016						
4,4'-DDD	2.4	0.10	0.31	ug/kg dry	3.691	0.08	65.5	40-125			
4,4'-DDE	4.2	0.10	0.31	ug/kg dry	3.691	0.1	110	40-125			
4,4'-DDT	2.3	0.10	0.31	ug/kg dry	3.691	ND	62.3	45-125			
Aldrin	2.3	0.10	0.31	ug/kg dry	3.691	ND	63.5	45-110			
alpha-BHC	1.5	0.10	0.31	ug/kg dry	1.722	ND	87.0	45-125			
alpha-Chlordane	2.6	0.10	0.31	ug/kg dry	3.691	ND	70.7	45-120			
beta-BHC	2.5	0.10	0.31	ug/kg dry	3.199	ND	79.2	40-100			
delta-BHC	ND	0.10	0.31	ug/kg dry	3.691	ND		45-125			Z-03, U
Dieldrin	2.6	0.10	0.31	ug/kg dry	3.691	ND	70.7	50-125			
Endosulfan I	2.5	0.10	0.31	ug/kg dry	3.691	ND	68.0	30-135			
Endosulfan II	2.3	0.10	0.31	ug/kg dry	3.691	ND	62.7	30-140			
Endosulfan sulfate	0.7	0.10	0.31	ug/kg dry	1.722	ND	40.0	50-135			Z-03
Endrin	2.6	0.10	0.31	ug/kg dry	3.691	ND	69.3	50-125			
Endrin aldehyde	ND	0.10	0.31	ug/kg dry	3.691	ND		30-145			Z-03, U
Endrin ketone	2.3	0.10	0.31	ug/kg dry	1.968	ND	118	55-135			
gamma-BHC (Lindane)	1.6	0.10	0.31	ug/kg dry	2.461	ND	64.2	45-125			
gamma-Chlordane	2.7	0.10	0.31	ug/kg dry	3.691	ND	74.0	50-125			
Heptachlor	2.6	0.10	0.31	ug/kg dry	3.691	ND	70.0	50-125			
Heptachlor epoxide	2.6	0.10	0.31	ug/kg dry	3.691	ND	70.0	40-125			
Methoxychlor	2.8	0.10	0.31	ug/kg dry	3.691	ND	74.7	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.84*			*ug/kg dry*	*4.921*		*78.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.78*			*ug/kg dry*	*4.921*		*56.5*	*40-130*			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Batch B609375 - EPA 3545

Matrix Spike Dup (B609375-MSD1) **Source: 6081808-04** Prepared: 07-Sep-2016 Analyzed: 21-Nov-2016

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
4,4′-DDD	2.3	0.10	0.31	ug/kg dry	3.687	0.08	61.1	40-125	6.94	30	
4,4′-DDE	3.2	0.10	0.31	ug/kg dry	3.687	0.1	82.8	40-125	27.5	30	
4,4′-DDT	2.1	0.10	0.31	ug/kg dry	3.687	ND	55.9	45-125	10.9	30	
Aldrin	1.9	0.10	0.31	ug/kg dry	3.687	ND	52.1	45-110	19.7	30	
alpha-BHC	1.1	0.10	0.31	ug/kg dry	1.721	ND	66.4	45-125	26.9	30	
alpha-Chlordane	2.3	0.10	0.31	ug/kg dry	3.687	ND	62.3	45-120	12.7	30	
beta-BHC	2.2	0.10	0.31	ug/kg dry	3.196	ND	67.3	40-100	16.4	30	
delta-BHC	ND	0.10	0.31	ug/kg dry	3.687	ND		45-125		30	Z-03, U
Dieldrin	2.3	0.10	0.31	ug/kg dry	3.687	ND	63.4	50-125	10.9	30	
Endosulfan I	2.3	0.10	0.31	ug/kg dry	3.687	ND	61.6	30-135	9.97	30	
Endosulfan II	1.9	0.10	0.31	ug/kg dry	3.687	ND	51.9	30-140	19.0	30	
Endosulfan sulfate	0.5	0.10	0.31	ug/kg dry	1.721	ND	28.7	50-135	32.9	30	Z-03
Endrin	2.3	0.10	0.31	ug/kg dry	3.687	ND	62.2	50-125	10.9	30	
Endrin aldehyde	ND	0.10	0.31	ug/kg dry	3.687	ND		30-145		30	Z-03, U
Endrin ketone	2.2	0.10	0.31	ug/kg dry	1.967	ND	112	55-135	5.54	30	
gamma-BHC (Lindane)	1.2	0.10	0.31	ug/kg dry	2.458	ND	50.0	45-125	25.0	30	
gamma-Chlordane	2.5	0.10	0.31	ug/kg dry	3.687	ND	66.7	50-125	10.5	30	
Heptachlor	2.0	0.10	0.31	ug/kg dry	3.687	ND	54.7	50-125	24.6	30	
Heptachlor epoxide	2.2	0.10	0.31	ug/kg dry	3.687	ND	59.7	40-125	15.9	30	
Methoxychlor	2.4	0.10	0.31	ug/kg dry	3.687	ND	65.9	55-145	12.5	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.12*			*ug/kg dry*	*4.917*		*63.5*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.78*			*ug/kg dry*	*4.917*		*56.5*	*40-130*			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609375 - EPA 3545											
Blank (B609375-BLK1)					Prepared: 07-Sep-2016 Analyzed: 11-Oct-2016						
1-Methylnaphthalene	ND	1.20	3.90	ug/kg wet							U
2-Methylnaphthalene	ND	1.20	3.90	ug/kg wet							U
Acenaphthene	ND	1.20	3.90	ug/kg wet							U
Acenaphthylene	ND	1.20	3.90	ug/kg wet							U
Anthracene	ND	1.20	3.90	ug/kg wet							U
Benzo (a) anthracene	ND	1.20	3.90	ug/kg wet							U
Benzo (a) pyrene	ND	1.20	3.90	ug/kg wet							U
Benzo (b) fluoranthene	ND	1.20	3.90	ug/kg wet							U
Benzo (g,h,i) perylene	ND	1.20	3.90	ug/kg wet							U
Benzo (k) fluoranthene	ND	1.20	3.90	ug/kg wet							U
Chrysene	ND	1.20	3.90	ug/kg wet							U
Dibenz (a,h) anthracene	ND	1.20	3.90	ug/kg wet							U
Fluoranthene	ND	1.20	3.90	ug/kg wet							U
Fluorene	ND	1.20	3.90	ug/kg wet							U
Indeno (1,2,3-cd) pyrene	ND	1.20	3.90	ug/kg wet							U
Naphthalene	ND	1.20	3.90	ug/kg wet							U
Phenanthrene	ND	1.20	3.90	ug/kg wet							U
Pyrene	ND	1.20	3.90	ug/kg wet							U
Surrogate: 2-Fluorobiphenyl	*21*			*ug/kg wet*	*27.00*		*76.3*	*40-105*			
Surrogate: Terphenyl-dl4	*23*			*ug/kg wet*	*29.00*		*78.6*	*30-125*			
LCS (B609375-BS1)					Prepared: 07-Sep-2016 Analyzed: 11-Oct-2016						
1-Methylnaphthalene	78.0	1.20	3.90	ug/kg wet	120.0		65.0	40-105			
2-Methylnaphthalene	68.6	1.20	3.90	ug/kg wet	120.0		57.2	40-105			
Acenaphthene	94.4	1.20	3.90	ug/kg wet	120.0		78.7	45-110			
Acenaphthylene	95.6	1.20	3.90	ug/kg wet	120.0		79.7	45-110			
Anthracene	137	1.20	3.90	ug/kg wet	120.0		114	50-115			
Benzo (a) anthracene	87.8	1.20	3.90	ug/kg wet	120.0		73.2	50-125			
Benzo (a) pyrene	96.2	1.20	3.90	ug/kg wet	120.0		80.2	50-130			
Benzo (b) fluoranthene	78.6	1.20	3.90	ug/kg wet	120.0		65.5	45-130			
Benzo (g,h,i) perylene	103	1.20	3.90	ug/kg wet	120.0		86.2	40-125			
Benzo (k) fluoranthene	111	1.20	3.90	ug/kg wet	120.0		92.7	45-130			
Chrysene	139	1.20	3.90	ug/kg wet	120.0		116	50-125			
Dibenz (a,h) anthracene	88.2	1.20	3.90	ug/kg wet	120.0		73.5	40-125			
Fluoranthene	100	1.20	3.90	ug/kg wet	120.0		83.5	50-120			
Fluorene	67.0	1.20	3.90	ug/kg wet	120.0		55.8	50-110			
Indeno (1,2,3-cd) pyrene	124	1.20	3.90	ug/kg wet	120.0		104	40-125			
Naphthalene	82.0	1.20	3.90	ug/kg wet	120.0		68.3	40-105			
Phenanthrene	91.0	1.20	3.90	ug/kg wet	120.0		75.8	50-130			
Pyrene	102	1.20	3.90	ug/kg wet	120.0		84.8	45-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609375 - EPA 3545											
LCS (B609375-BS1)					Prepared: 07-Sep-2016 Analyzed: 11-Oct-2016						
Surrogate: 2-Fluorobiphenyl	*18*			*ug/kg wet*	*27.00*		*67.4*	*40-105*			
Surrogate: Terphenyl-dl4	*22*			*ug/kg wet*	*29.00*		*75.2*	*30-125*			
Matrix Spike (B609375-MS1)		**Source: 6081808-04**			Prepared: 07-Sep-2016 Analyzed: 11-Oct-2016						
1-Methylnaphthalene	49.2	1.48	4.80	ug/kg dry	147.6	ND	33.3	40-105			Z-03
2-Methylnaphthalene	46.3	1.48	4.80	ug/kg dry	147.6	ND	31.3	40-105			Z-03
Acenaphthene	58.3	1.48	4.80	ug/kg dry	147.6	ND	39.5	45-110			Z-03
Acenaphthylene	55.9	1.48	4.80	ug/kg dry	147.6	ND	37.8	45-110			Z-03
Anthracene	79.7	1.48	4.80	ug/kg dry	147.6	4.93	50.7	50-115			
Benzo (a) anthracene	65.7	1.48	4.80	ug/kg dry	147.6	10.6	37.4	50-125			Z-03
Benzo (a) pyrene	79.2	1.48	4.80	ug/kg dry	147.6	21.8	38.9	50-130			Z-03
Benzo (b) fluoranthene	98.4	1.48	4.80	ug/kg dry	147.6	32.2	44.9	45-130			Z-03
Benzo (g,h,i) perylene	84.4	1.48	4.80	ug/kg dry	147.6	14.3	47.5	40-125			
Benzo (k) fluoranthene	96.7	1.48	4.80	ug/kg dry	147.6	20.2	51.8	45-130			
Chrysene	90.6	1.48	4.80	ug/kg dry	147.6	24.3	44.9	50-125			Z-03
Dibenz (a,h) anthracene	73.6	1.48	4.80	ug/kg dry	147.6	3.40	47.5	40-125			
Fluoranthene	93.5	1.48	4.80	ug/kg dry	147.6	16.7	52.0	50-120			
Fluorene	59.1	1.48	4.80	ug/kg dry	147.6	ND	40.0	50-110			Z-03
Indeno (1,2,3-cd) pyrene	81.4	1.48	4.80	ug/kg dry	147.6	15.0	45.0	40-125			
Naphthalene	49.7	1.48	4.80	ug/kg dry	147.6	3.40	31.4	40-105			Z-03
Phenanthrene	53.6	1.48	4.80	ug/kg dry	147.6	5.96	32.3	50-130			Z-03
Pyrene	82.9	1.48	4.80	ug/kg dry	147.6	17.0	44.6	45-125			Z-03
Surrogate: 2-Fluorobiphenyl	*12*			*ug/kg dry*	*33.22*		*36.7*	*40-105*			*S-GC*
Surrogate: Terphenyl-dl4	*16*			*ug/kg dry*	*35.68*		*44.3*	*30-125*			
Matrix Spike Dup (B609375-MSD1)		**Source: 6081808-04**			Prepared: 07-Sep-2016 Analyzed: 11-Oct-2016						
1-Methylnaphthalene	82.1	1.47	4.79	ug/kg dry	147.5	ND	55.7	40-105	50.1	30	Z-03
2-Methylnaphthalene	78.2	1.47	4.79	ug/kg dry	147.5	ND	53.0	40-105	51.3	30	Z-03
Acenaphthene	102	1.47	4.79	ug/kg dry	147.5	ND	69.0	45-110	54.3	30	Z-03
Acenaphthylene	92.7	1.47	4.79	ug/kg dry	147.5	ND	62.8	45-110	49.6	30	Z-03
Anthracene	117	1.47	4.79	ug/kg dry	147.5	4.93	75.7	50-115	37.5	30	Z-03
Benzo (a) anthracene	113	1.47	4.79	ug/kg dry	147.5	10.6	69.5	50-125	53.0	30	Z-03
Benzo (a) pyrene	133	1.47	4.79	ug/kg dry	147.5	21.8	75.1	50-130	50.3	30	Z-03
Benzo (b) fluoranthene	137	1.47	4.79	ug/kg dry	147.5	32.2	71.2	45-130	32.9	30	Z-03
Benzo (g,h,i) perylene	133	1.47	4.79	ug/kg dry	147.5	14.3	80.5	40-125	44.7	30	Z-03
Benzo (k) fluoranthene	154	1.47	4.79	ug/kg dry	147.5	20.2	90.8	45-130	45.8	30	Z-03
Chrysene	153	1.47	4.79	ug/kg dry	147.5	24.3	87.5	50-125	51.5	30	Z-03
Dibenz (a,h) anthracene	117	1.47	4.79	ug/kg dry	147.5	3.40	76.9	40-125	45.4	30	Z-03
Fluoranthene	148	1.47	4.79	ug/kg dry	147.5	16.7	89.4	50-120	45.4	30	Z-03
Fluorene	111	1.47	4.79	ug/kg dry	147.5	ND	75.5	50-110	61.4	30	Z-03
Indeno (1,2,3-cd) pyrene	126	1.47	4.79	ug/kg dry	147.5	15.0	75.3	40-125	43.0	30	Z-03

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609375 - EPA 3545											
Matrix Spike Dup (B609375-MSD1)	**Source: 6081808-04**				Prepared: 07-Sep-2016 Analyzed: 11-Oct-2016						
Naphthalene	80.9	1.47	4.79	ug/kg dry	147.5	3.40	52.5	40-105	47.7	30	Z-03
Phenanthrene	88.0	1.47	4.79	ug/kg dry	147.5	5.96	55.6	50-130	48.5	30	Z-03
Pyrene	162	1.47	4.79	ug/kg dry	147.5	17.0	98.3	45-125	64.6	30	Z-03
Surrogate: 2-Fluorobiphenyl	*19*			*ug/kg dry*	*33.19*		*58.5*	*40-105*			
Surrogate: Terphenyl-dl4	*27*			*ug/kg dry*	*35.65*		*75.2*	*30-125*			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Wet Chemistry Analysis - Quality Control

Air Water and Soil Laboratories, Inc.

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BZI0243 - No Prep Halides											
Blank (BZI0243-BLK1)					Prepared & Analyzed: 12-Sep-2016						
TOC	ND	80.0	100	mg/kg				-			
LCS (BZI0243-BS1)					Prepared & Analyzed: 12-Sep-2016						
TOC	864	80.0	100	mg/kg	862		100	80-120			
LCS Dup (BZI0243-BSD1)					Prepared & Analyzed: 12-Sep-2016						
TOC	883	80.0	100	mg/kg	877		101	80-120	2.16	20	
Matrix Spike (BZI0243-MS1)		**Source: 16I0085-02**			Prepared & Analyzed: 12-Sep-2016						
TOC	743	80.0	100	mg/kg	658	136	92.2	75-125			
Matrix Spike Dup (BZI0243-MSD1)		**Source: 16I0085-02**			Prepared & Analyzed: 12-Sep-2016						
TOC	924	80.0	100	mg/kg	820	136	96.2	75-125	21.8	20	P

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

WALKLEY_BLACK Organic Carbon, Total (TOC) - Quality Control

TestAmerica Pittsburgh

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 198708 -											
LCS (180-1987081)					Prepared: Analyzed: 30-Dec-2016						
Total Organic Carbon	490000	67	250	mg/Kg	471000		104	80-120			
MB (180-1987082)					Prepared: Analyzed: 30-Dec-2016						
Total Organic Carbon	ND	67	250	mg/Kg				-			

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WORK ORDER | **Printed: 8/19/2016 8:20:29AM**

6081808

ERDC-EL-EP-C

Client: Navy -- SPAWAR
Project: RARA
Project Manager: Jenifer Milam
Project Number: [none]

Report To:
Navy -- SPAWAR
Joel Guererro
Environmental Science and Applied System Branch, 53605 Hull :
San Diego, CA 92152
Phone: (619) 553-0886
Fax: -

Invoice To:
Navy -- SPAWAR
Gunther Rosen
Environmental Science and Applied System Branch, 53605 Hull :
San Diego, CA 92152
Phone :(619) 553-0886
Fax: -

Date Due: 16-Sep-2016 00:00 (21 day TAT)
Received By: Madeline Tarasar | Date Received: 18-Aug-2016 15:55
Logged In By: Madeline Tarasar | Date Logged In: 18-Aug-2016 15:55

Samples Received at: 3°C
Custody Seals: No | Proper Temperature: No
Containers Intact: No
COC/Labels Agree: No | Hardcopy Folder G: No
Proper Preservation: No | Login Reviewed: No

Analysis	Due	TAT	Expires	Comments
6081808-01 RARA-T1 [Soil/Sediment] Sampled 15-Aug-2016 09:00 (GMT-12:00) International Date				
Mercury	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
OC Pests	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
PAH SIM2	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
Particle Size - Hydrometer	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
Particle Size - Sieve	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
PCB Congeners	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
TAL Metals-6020	16-Sep-2016 00:00	21	11-Feb-2017 15:00	AVS/SEM
TOC	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
6081808-02 RARA-T2 [Soil/Sediment] Sampled 15-Aug-2016 09:00 (GMT-12:00) International Date				
Mercury	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
OC Pests	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
PAH SIM2	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
Particle Size - Hydrometer	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
Particle Size - Sieve	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
PCB Congeners	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
TAL Metals-6020	16-Sep-2016 00:00	21	11-Feb-2017 15:00	AVS/SEM
TOC	16-Sep-2016 00:00	21	12-Sep-2016 16:00	

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WORK ORDER

6081808

ERDC-EL-EP-C

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Client: Navy -- SPAWAR
Project: RARA
Project Manager: Jenifer Milam
Project Number: [none]

Analysis	Due	TAT	Expires	Comments
6081808-03 RARA-S1 [Soil/Sediment] Sampled 15-Aug-2016 09:00 (GMT-12:00) International Date				
Mercury	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
OC Pests	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
PAH SIM2	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
Particle Size - Hydrometer	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
Particle Size - Sieve	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
PCB Congeners	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
TAL Metals-6020	16-Sep-2016 00:00	21	11-Feb-2017 15:00	AVS/SEM
TOC	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
6081808-04 RARA-S2 [Soil/Sediment] Sampled 15-Aug-2016 09:00 (GMT-12:00) International Date				
Mercury	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
OC Pests	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
PAH SIM2	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
Particle Size - Hydrometer	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
Particle Size - Sieve	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
PCB Congeners	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
TAL Metals-6020	16-Sep-2016 00:00	21	11-Feb-2017 15:00	AVS/SEM
TOC	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
6081808-05 RARA-C1 [Soil/Sediment] Sampled 15-Aug-2016 09:00 (GMT-12:00) International Date				
Mercury	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
OC Pests	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
PAH SIM2	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
Particle Size - Hydrometer	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
Particle Size - Sieve	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
PCB Congeners	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
TAL Metals-6020	16-Sep-2016 00:00	21	11-Feb-2017 15:00	AVS/SEM
TOC	16-Sep-2016 00:00	21	12-Sep-2016 16:00	

WORK ORDER

6081808

ERDC-EL-EP-C

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Client: Navy -- SPAWAR
Project: RARA
Project Manager: Jenifer Milam
Project Number: [none]

Analysis	Due	TAT	Expires	Comments
6081808-06 RARA-C2 [Soil/Sediment] Sampled 15-Aug-2016 09:00 (GMT-12:00) International Date				
Mercury	16-Sep-2016 00:00	21	12-Sep-2016 16:00	
OC Pests	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
PAH SIM2	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
Particle Size - Hydrometer	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
Particle Size - Sieve	19-Aug-2016 00:00	0	14-Sep-2016 16:00	
PCB Congeners	16-Sep-2016 00:00	21	29-Aug-2016 16:00	
TAL Metals-6020	16-Sep-2016 00:00	21	11-Feb-2017 15:00	AVS/SEM
TOC	16-Sep-2016 00:00	21	12-Sep-2016 16:00	

Reviewed By

Date

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PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.		Boring	16H0699
Client Project	16H0699		Depth	9-1-2016
Project No.	37820		Sample	01
			Lab Sample	37820001

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2010	3"	75	0	0.0%	100.0%	
Tare + WS., gm	840.11	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	618.57	2"	50	0	0.0%	100.0%	
Tare, gm	155.33	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**47.8%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	463	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	437	3/8"	9.5	0	0.0%	100.0%	
Tare + WS., gm	20.99	No. 4	4.75	0	0.0%	100.0%	
Tare + DS., gm	20.96	No. 10	2	0.37	0.1%	99.9%	
Tare, gm	10.62	No. 20	0.85	0.1	0.2%	99.7%	
Hygroscopic WC	0.29%	No. 40	0.425	0.15	0.3%	99.4%	
		No. 60	0.25	0.56	1.1%	98.3%	
-#10 Hydro/Sieve air dry wt.	50.20	No. 140	0.106	17.1	34.0%	64.3%	
Wt. of +#200 Sample, gm	31.83	No. 200	0.075	13.92	27.7%	36.6%	

HYDROMETER (-#10)

Split Air Dry Wt	50.35						Specific Gravity	2.7
Hygroscopic WC	0.29%							Assumed
Corrected Dry wt	50.2		*-#10 Dispersed 1min in Hamilton Beach Mixer*				*a Factor*	*0.9889*

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	17.5	21.3	5.7	11.8	0.0133	23.2	0.0343	23.2%
5	17.5	21.2	5.7	11.8	0.0133	23.2	0.0217	23.2%
15	17	21.2	5.7	11.3	0.0133	22.3	0.0126	22.2%
30	16	21.1	5.7	10.3	0.0133	20.3	0.0090	20.3%
60	15.5	21.1	5.7	9.8	0.0133	19.3	0.0063	19.3%
250	13.5	21	5.7	7.8	0.0133	15.4	0.0032	15.4%
1440	12	20	6.0	6.0	0.0135	11.8	0.0013	11.8%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.0**	Silt=18.4% Clay=17.9%	
Coarse=0; Fine=0		D60, mm	NA
% Sand (-#4 & +#200)	**63.4**	D30, mm	NA
Coarse=0.1; Medium=0.5; Fine=62.9		D10, mm	NA
% Fines (-#200)	**36.6**	Cc	NA
% Plus #200 (-3")	**63.4**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.9
0.05	29.7
0.002	13.5

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.1	0
Sand	70.3	70.3
Silt	16.2	16.2
Clay	13.5	13.5

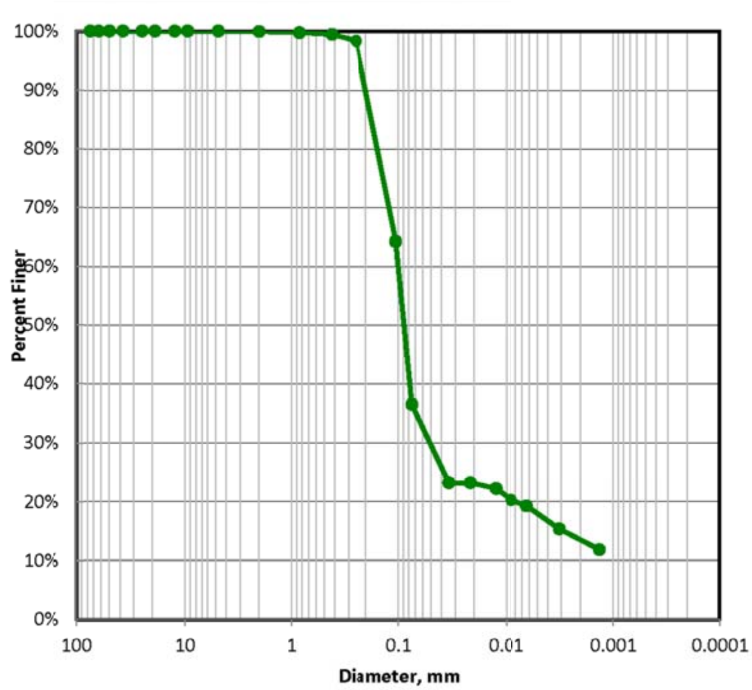
USDA Classification
SANDY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	01
		Lab Sample	37820001

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	100.0%
No. 4	4.75	100.0%
No. 10	2	99.9%
No. 20	0.85	99.7%
No. 40	0.425	99.4%
No. 60	0.25	98.3%
No. 140	0.106	64.3%
No. 200	0.075	36.6%
NA	0.0343	23.2%
NA	0.0217	23.2%
NA	0.0126	22.2%
NA	0.0090	20.3%
NA	0.0063	19.3%
NA	0.0032	15.4%
NA	0.0013	11.8%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.0**	Silt=18.4% Clay=17.9%	
Coarse=0; Fine=0		D60, mm	NA
% Sand (-#4 & +#200)	**63.4**	D30, mm	NA
Coarse=0.1; Medium=0.5; Fine=62.9		D10, mm	NA
% Fines (-#200)	**36.6**	Cc	NA
% Plus #200 (-3")	**63.4**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.1	0
2	99.9			
		Sand	70.3	70.3
0.05	29.7			
		Silt	16.2	16.2
0.002	13.5			
		Clay	13.5	13.5

USDA Classification
SANDY LOAM

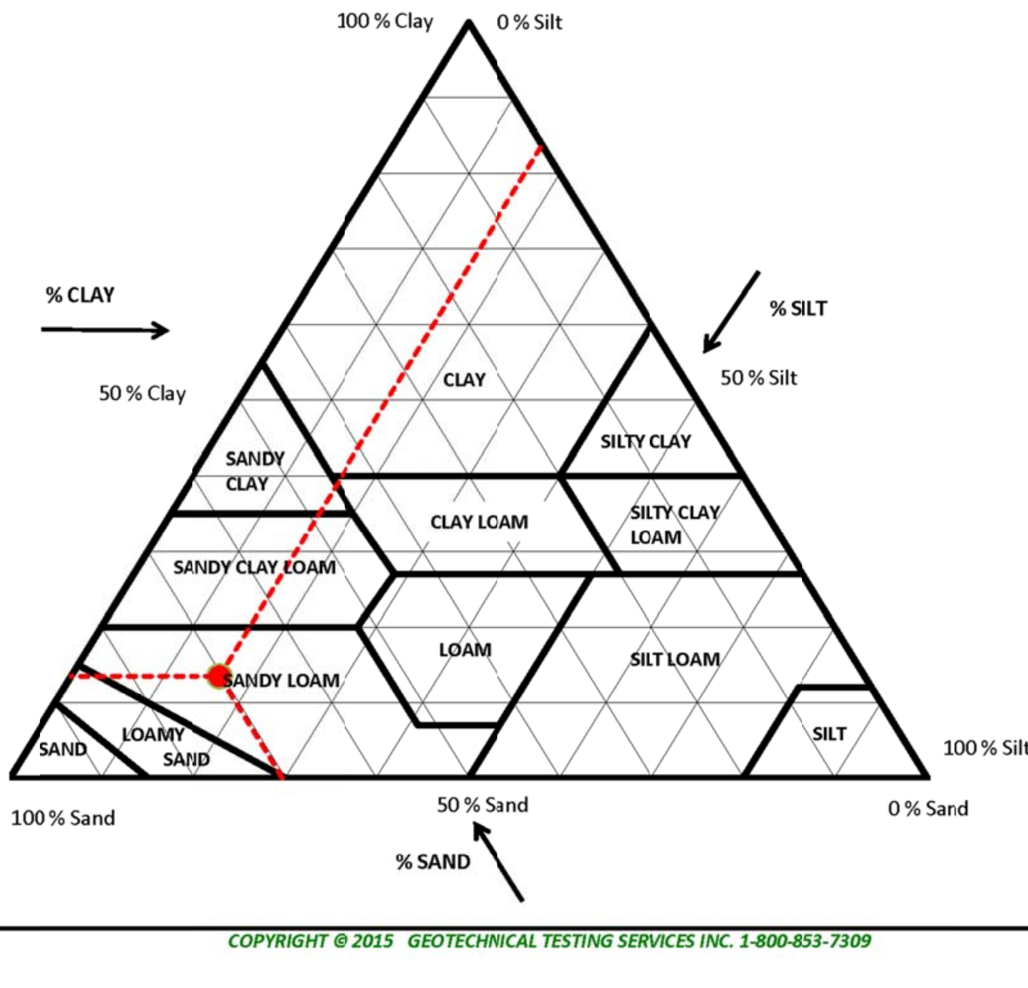
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	01
		Lab Sample	37820001

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	70.3
Percent Silt, %	16.2
Percent Clay, %	13.5

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.2
Coarse Sand; 1-0.5	0.3
Medium Sand; 0.5-0.25	1.2
Fine Sand; 0.25-0.1	38.7
Very Fine Sand; 0.1-0.05	30.0
Total	**70.3**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	02
		Lab Sample	37820002

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2059	3"	75	0	0.0%	100.0%	
Tare + WS., gm	750.74	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	539.22	2"	50	0	0.0%	100.0%	
Tare, gm	151.27	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**54.5%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	388	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	467	3/8"	9.5	0.44	0.1%	99.9%	
Tare + WS., gm	22.33	No. 4	4.75	0.27	0.1%	99.8%	
Tare + DS., gm	22.33	No. 10	2	0.81	0.2%	99.6%	
Tare, gm	10.74	No. 20	0.85	0.16	0.3%	99.3%	
Hygroscopic WC	0.00%	No. 40	0.425	0.43	0.9%	98.4%	
		No. 60	0.25	0.84	1.7%	96.8%	
-#10 Hydro/Sieve air dry wt.	50.18	No. 140	0.106	13.02	25.8%	70.9%	
Wt. of +#200 Sample, gm	31.16	No. 200	0.075	16.71	33.2%	37.8%	

HYDROMETER (-#10)

Split Air Dry Wt	50.18		Specific Gravity	2.7
Hygroscopic WC	0.00%			Assumed
Corrected Dry wt	50.2	*-#10 Dispersed 1min in Hamilton Beach Mixer*	*a Factor*	*0.9889*

Elapsed Time (min.)	R Measured	Temp °C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	18.5	21.2	5.7	12.8	0.0133	25.2	0.0341	25.1%
5	17.5	21.2	5.7	11.8	0.0133	23.3	0.0217	23.2%
15	17.5	21	5.7	11.8	0.0133	23.3	0.0126	23.2%
30	17	21	5.7	11.3	0.0133	22.3	0.0089	22.2%
60	16.5	21.1	5.7	10.8	0.0133	21.3	0.0063	21.2%
250	14.5	20.9	5.8	8.7	0.0133	17.1	0.0031	17.1%
1440	13	20	6.0	7.0	0.0135	13.8	0.0013	13.7%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=17.7% Clay=19.8%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**62.1**	D30, mm	NA
Coarse=0.2; Medium=1.2; Fine=60.7		D10, mm	NA
% Fines (-#200)	**37.8**	Cc	NA
% Plus #200 (-3")	**62.2**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol		
sm	ml - Silt (assumed)		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	Percent of Each Component (%)	Corrected Percent of -2.0 mm Material for USDA
100	100	Gravel	0.4	0
2	99.6	Sand	68.3	68.6
0.05	31.3	Silt	15.9	16.0
0.002	15.3	Clay	15.3	15.4

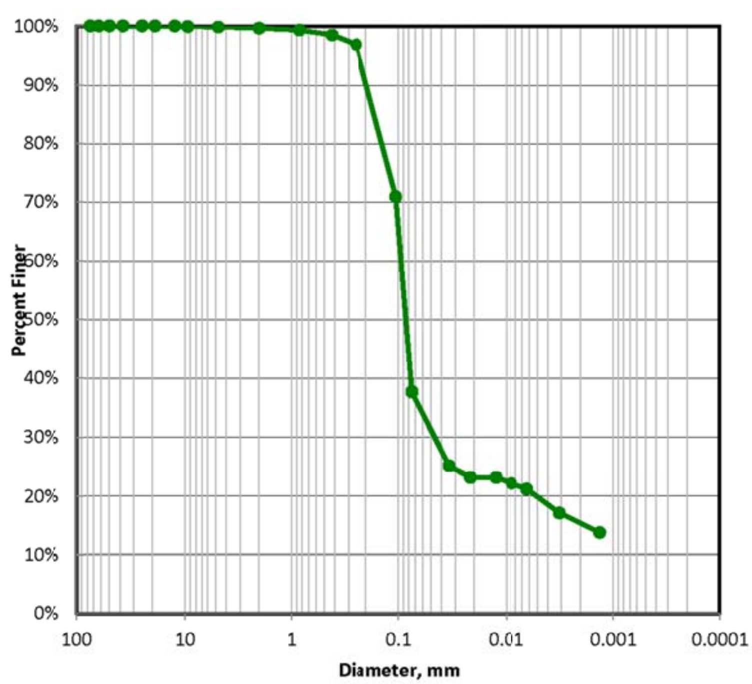
USDA Classification
SANDY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	02
		Lab Sample	37820002

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	99.9%
No. 4	4.75	99.8%
No. 10	2	99.6%
No. 20	0.85	99.3%
No. 40	0.425	98.4%
No. 60	0.25	96.8%
No. 140	0.106	70.9%
No. 200	0.075	37.8%
NA	0.0341	25.1%
NA	0.0217	23.2%
NA	0.0126	23.2%
NA	0.0089	22.2%
NA	0.0063	21.2%
NA	0.0031	17.1%
NA	0.0013	13.7%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=17.7% Clay=19.8%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**62.1**	D30, mm	NA
Coarse=0.2; Medium=1.2; Fine=60.7		D10, mm	NA
% Fines (-#200)	**37.8**	Cc	NA
% Plus #200 (-3")	**62.2**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.4	0
2	99.6			
		Sand	68.3	68.6
0.05	31.3			
		Silt	15.9	16.0
0.002	15.3			
		Clay	15.3	15.4

USDA Classification
SANDY LOAM

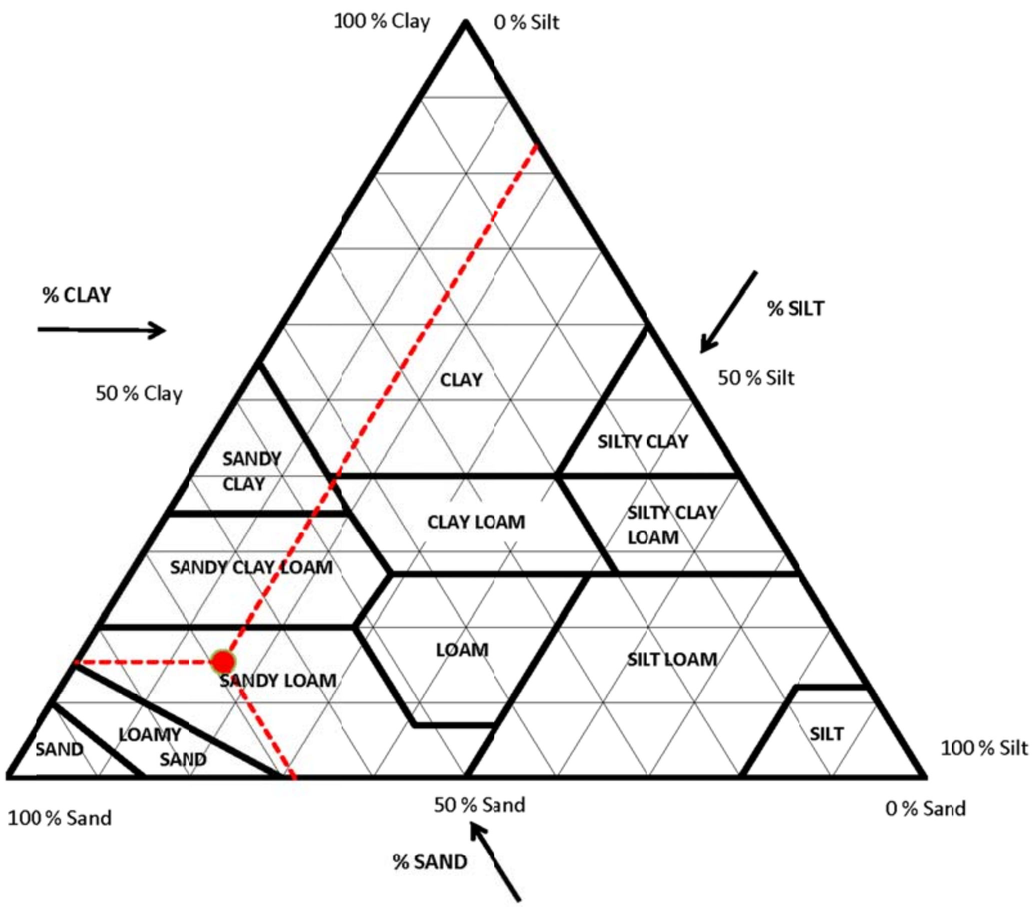
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	02
		Lab Sample	37820002

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	68.6
Percent Silt, %	16.0
Percent Clay, %	15.4

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.3
Coarse Sand; 1-0.5	0.7
Medium Sand; 0.5-0.25	1.9
Fine Sand; 0.25-0.1	31.6
Very Fine Sand; 0.1-0.05	34.2
Total	**68.6**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	03
		Lab Sample	37820003

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SAND**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2008	3"	75	0	0.0%	100.0%	
Tare + WS., gm	853.94	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	696.73	2"	50	0	0.0%	100.0%	
Tare, gm	153.01	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**28.9%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	544	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0.96	0.2%	99.8%	
Tare No.	480	3/8"	9.5	0	0.0%	99.8%	
Tare + WS., gm	22.38	No. 4	4.75	0	0.0%	99.8%	
Tare + DS., gm	22.38	No. 10	2	0.8	0.1%	99.7%	
Tare, gm	10.61	No. 20	0.85	14.12	14.0%	85.7%	
Hygroscopic WC	0.00%	No. 40	0.425	37.23	36.9%	48.8%	
		No. 60	0.25	26.64	26.4%	22.4%	
-#10 Hydro/Sieve air dry wt.	100.62	No. 140	0.106	7.9	7.8%	14.6%	
Wt. of +#200 Sample, gm	87.59	No. 200	0.075	1.7	1.7%	12.9%	

HYDROMETER (-#10)

Split Air Dry Wt	100.62	Specific Gravity	2.7
Hygroscopic WC	0.00%		Assumed
Corrected Dry wt	100.6	*-#10 Dispersed 1min in Hamilton Beach Mixer* *a Factor*	*0.9889*

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	15	21.9	5.5	9.5	0.0132	9.3	0.0345	9.3%
5	13.5	21.8	5.5	8.0	0.0132	7.9	0.0221	7.8%
15	13	21.7	5.6	7.4	0.0132	7.3	0.0128	7.2%
30	13	21.6	5.6	7.4	0.0132	7.3	0.0091	7.2%
60	12.5	21.5	5.6	6.9	0.0132	6.8	0.0064	6.8%
250	11.5	21	5.7	5.8	0.0133	5.7	0.0032	5.7%
1440	10.5	20.4	5.9	4.6	0.0134	4.5	0.0013	4.5%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=6.5% Clay=6.4%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**86.9**	D30, mm	NA
Coarse=0.1; Medium=50.9; Fine=35.9		D10, mm	NA
% Fines (-#200)	**12.9**	Cc	NA
% Plus #200 (-3")	**87.1**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol		
sm	np - Non-Plastic (assumed)		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.3	0
2	99.7			
		Sand	88.7	88.9
0.05	11.0			
		Silt	6.0	6.0
0.002	5.0			
		Clay	5.0	5.1

USDA Classification
SAND

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

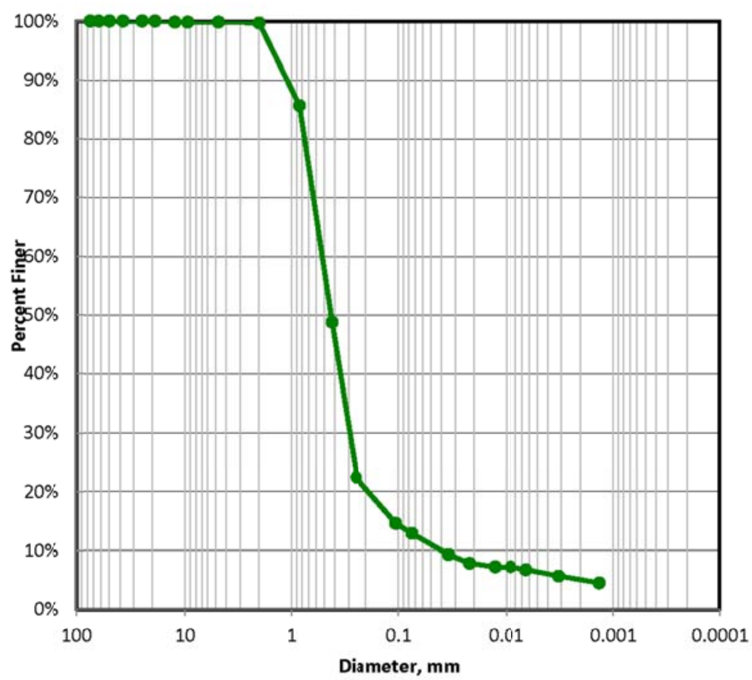
PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	03
		Lab Sample	37820003

Sample Color: **GRAY**

USCS Group Name: **SILTY SAND**

USCS Group Symbol: **sm** USDA: **SAND**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	99.8%
3/8"	9.5	99.8%
No. 4	4.75	99.8%
No. 10	2	99.7%
No. 20	0.85	85.7%
No. 40	0.425	48.8%
No. 60	0.25	22.4%
No. 140	0.106	14.6%
No. 200	0.075	12.9%
NA	0.0345	9.3%
NA	0.0221	7.8%
NA	0.0128	7.2%
NA	0.0091	7.2%
NA	0.0064	6.8%
NA	0.0032	5.7%
NA	0.0013	4.5%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	0.2	Silt=6.5% Clay=6.4%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	86.9	D30, mm	NA
Coarse=0.1; Medium=50.9; Fine=35.9		D10, mm	NA
% Fines (-#200)	12.9	Cc	NA
% Plus #200 (-3")	87.1	Cu	NA

USCS Description

SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	np - Non-Plastic (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.3	0
2	99.7			
		Sand	88.7	88.9
0.05	11.0			
		Silt	6.0	6.0
0.002	5.0			
		Clay	5.0	5.1

USDA Classification

SAND

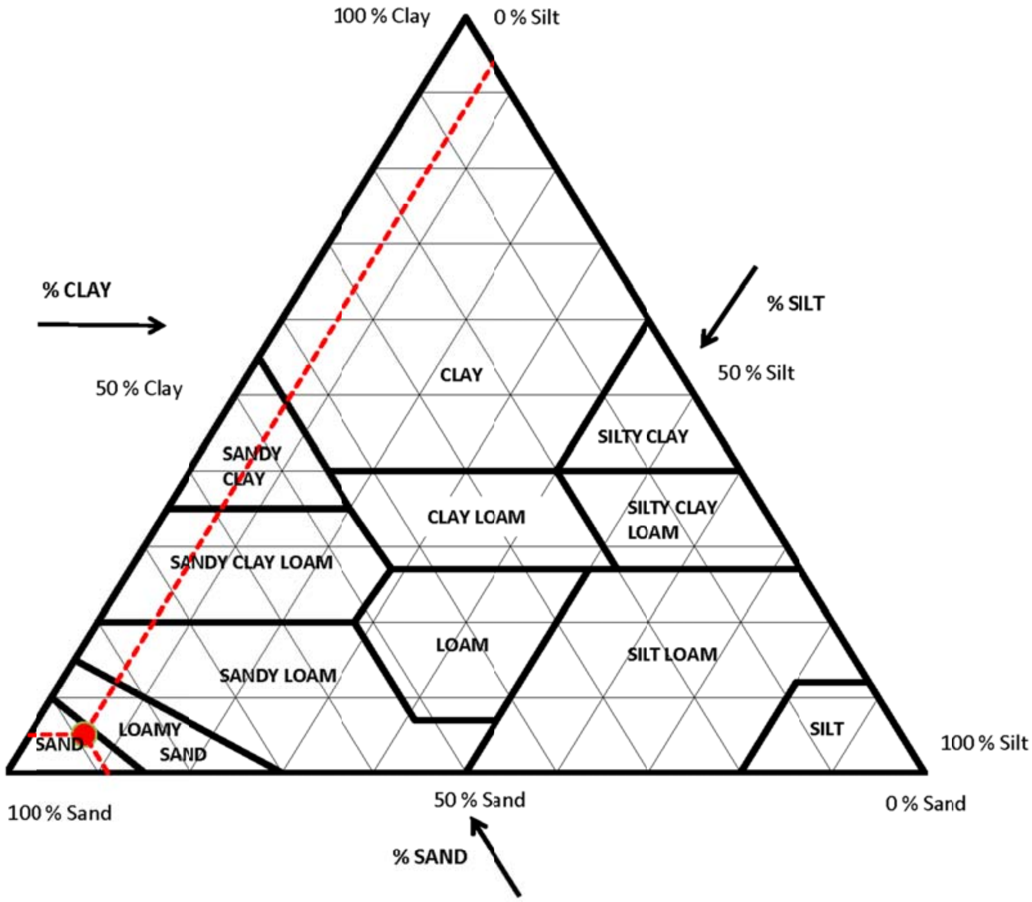
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	03
		Lab Sample	37820003

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SAND**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	88.9
Percent Silt, %	6.0
Percent Clay, %	5.1

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	11.4
Coarse Sand; 1-0.5	31.0
Medium Sand; 0.5-0.25	35.2
Fine Sand; 0.25-0.1	8.1
Very Fine Sand; 0.1-0.05	3.3
Total	**88.9**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	04
		Lab Sample	37820004

Sample Color: **GRAY**
USCS Group Name: **WELL-GRADED SAND WITH SILT**
USCS Group Symbol: **sw-sm** USDA: **SAND**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2076	3"	75	0	0.0%	100.0%	
Tare + WS., gm	850.81	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	708.44	2"	50	0	0.0%	100.0%	
Tare, gm	151.56	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**25.6%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	557	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	405	3/8"	9.5	0.3	0.1%	99.9%	
Tare + WS., gm	23.24	No. 4	4.75	0.61	0.1%	99.8%	
Tare + DS., gm	23.24	No. 10	2	1.2	0.2%	99.6%	
Tare, gm	10.54	No. 20	0.85	15.52	15.3%	84.3%	
Hygroscopic WC	0.00%	No. 40	0.425	38.46	38.0%	46.2%	
		No. 60	0.25	27.19	26.9%	19.3%	
-#10 Hydro/Sieve air dry wt.	100.73	No. 140	0.106	7.16	7.1%	12.3%	
Wt. of +#200 Sample, gm	90.40	No. 200	0.075	2.07	2.0%	10.2%	

HYDROMETER (-#10)

Split Air Dry Wt	100.73	Specific Gravity	2.7
Hygroscopic WC	0.00%		Assumed
Corrected Dry wt	100.7	*a Factor*	*0.9889*

-#10 Dispersed 1min in Hamilton Beach Mixer

Elapsed Time (min.)	R Measured	Temp °C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	13.5	21.9	5.5	8.0	0.0132	7.9	0.0348	7.8%
5	12.5	21.8	5.5	7.0	0.0132	6.9	0.0222	6.8%
15	12	21.7	5.6	6.4	0.0132	6.3	0.0129	6.3%
30	12	21.5	5.6	6.4	0.0132	6.3	0.0091	6.3%
60	11.5	21.4	5.6	5.9	0.0133	5.8	0.0065	5.8%
250	11	21	5.7	5.3	0.0133	5.2	0.0032	5.2%
1440	10	20.3	5.9	4.1	0.0134	4.0	0.0014	4.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=4.6% Clay=5.6%	
Coarse=0; Fine=0.2		D60, mm	0.55
% Sand (-#4 & +#200)	**89.6**	D30, mm	0.31
Coarse=0.2; Medium=53.4; Fine=36		D10, mm	0.07
% Fines (-#200)	**10.2**	Cc	2.49
% Plus #200 (-3")	**89.8**	Cu	7.80

USCS Description
WELL-GRADED SAND WITH SILT

USCS Group Symbol	Atterberg Limits Group Symbol		
sw-sm	np - Non-Plastic (assumed)		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.6
0.05	9.0
0.002	4.5

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.4	0
Sand	90.7	91.0
Silt	4.4	4.4
Clay	4.5	4.6

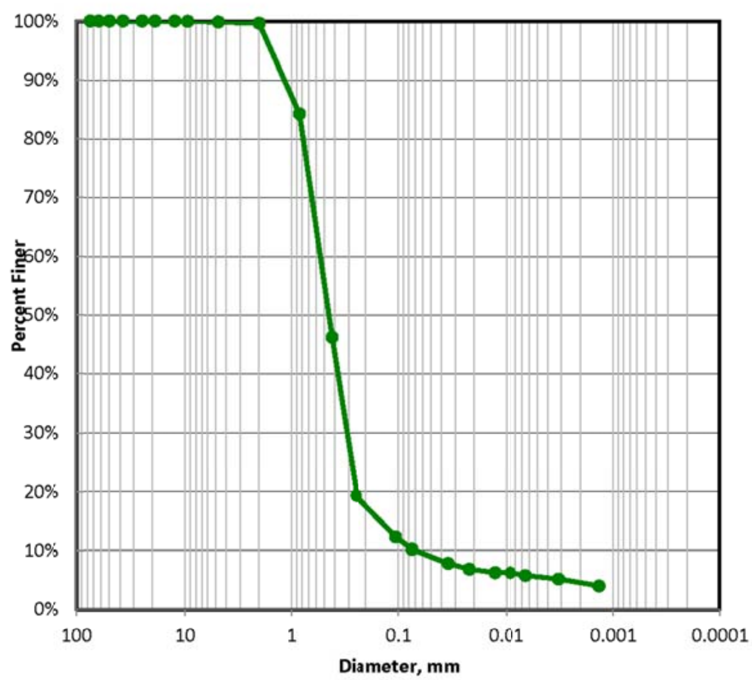
USDA Classification
SAND

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	04
		Lab Sample	37820004

Sample Color: **GRAY**
USCS Group Name: **WELL-GRADED SAND WITH SILT**
USCS Group Symbol: **sw-sm** USDA: **SAND**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	99.9%
No. 4	4.75	99.8%
No. 10	2	99.6%
No. 20	0.85	84.3%
No. 40	0.425	46.2%
No. 60	0.25	19.3%
No. 140	0.106	12.3%
No. 200	0.075	10.2%
NA	0.0348	7.8%
NA	0.0222	6.8%
NA	0.0129	6.3%
NA	0.0091	6.3%
NA	0.0065	5.8%
NA	0.0032	5.2%
NA	0.0014	4.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=4.6% Clay=5.6%	
Coarse=0; Fine=0.2		D60, mm	0.546
% Sand (-#4 & +#200)	**89.6**	D30, mm	0.308
Coarse=0.2; Medium=53.4; Fine=36		D10, mm	0.070
% Fines (-#200)	**10.2**	Cc	2.490
% Plus #200 (-3")	**89.8**	Cu	7.800

USCS Description
WELL-GRADED SAND WITH SILT

USCS Group Symbol	Atterberg Limits Group Symbol
sw-sm	np - Non-Plastic (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.4	0
2	99.6			
		Sand	90.7	91.0
0.05	9.0			
		Silt	4.4	4.4
0.002	4.5			
		Clay	4.5	4.6

USDA Classification
SAND

USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	04
		Lab Sample	37820004

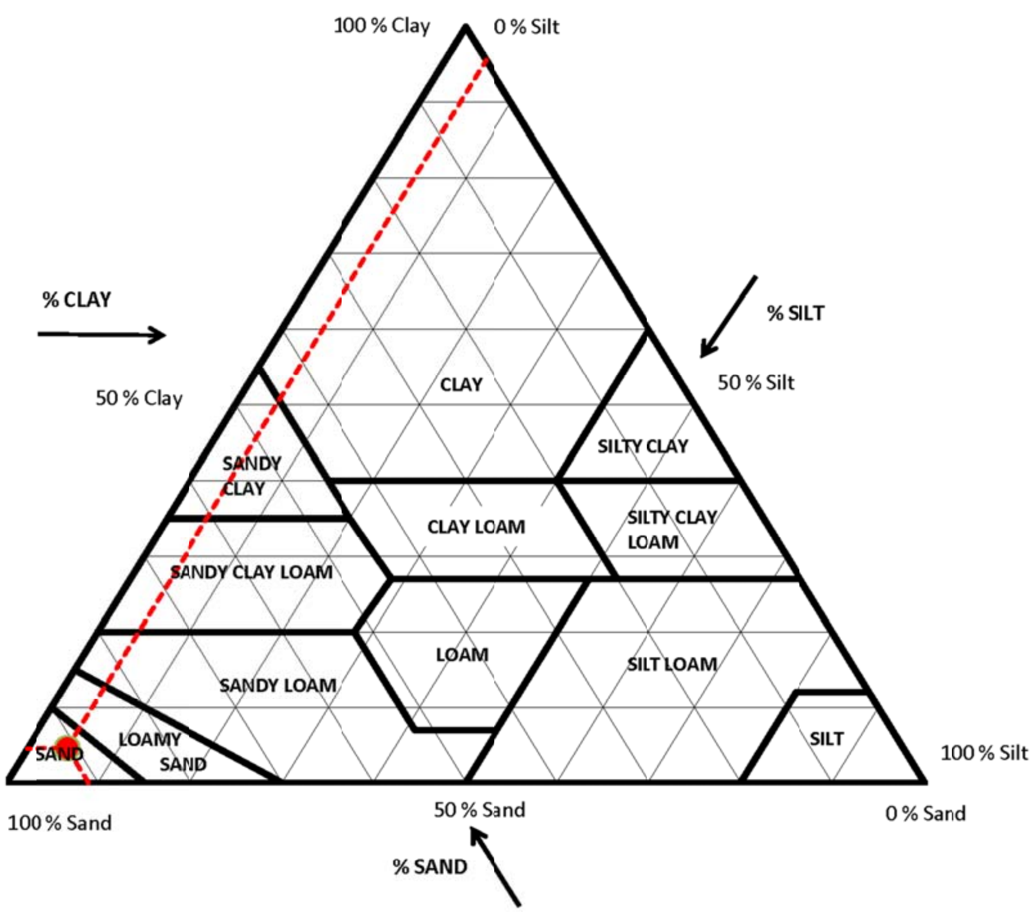
Sample Color: **GRAY**

USCS Group Name: **WELL-GRADED SAND WITH SILT**

USCS Group Symbol: **sw-sm** USDA: **SAND**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	91.0
Percent Silt, %	4.4
Percent Clay, %	4.6

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	12.5
Coarse Sand; 1-0.5	32.2
Medium Sand; 0.5-0.25	35.9
Fine Sand; 0.25-0.1	7.5
Very Fine Sand; 0.1-0.05	3.0
Total	**91.0**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	05
		Lab Sample	37820005

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**

MECHANICAL SIEVE

Total Sample		**Sieve Size**	**Nominal Opening, mm**	**Dry Wt, gm**	**Split Normalized % Retained**	**Split Normalized % Finer**	**Project Specifications**
Tare No.	2016	3"	75	0	0.0%	100.0%	
Tare + WS., gm	488.46	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	320.87	2"	50	0	0.0%	100.0%	
Tare, gm	151.37	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**98.9%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	170	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	420	3/8"	9.5	0	0.0%	100.0%	
Tare + WS., gm	21.48	No. 4	4.75	0.22	0.1%	99.9%	
Tare + DS., gm	21.36	No. 10	2	0.29	0.2%	99.7%	
Tare, gm	10.74	No. 20	0.85	0.53	1.1%	98.6%	
Hygroscopic WC	1.13%	No. 40	0.425	1.43	2.9%	95.8%	
		No. 60	0.25	1.93	3.9%	91.9%	
-#10 Hydro/Sieve air dry wt.	49.81	No. 140	0.106	5.64	11.3%	80.6%	
Wt. of +#200 Sample, gm	12.93	No. 200	0.075	3.4	6.8%	73.8%	

HYDROMETER (-#10)

Split Air Dry Wt	50.37	Specific Gravity	2.7
Hygroscopic WC	1.13%		Assumed
Corrected Dry wt	49.8	*a Factor*	*0.9889*

-#10 Dispersed 1min in Hamilton Beach Mixer

Elapsed Time (min.)	**R Measured**	**Temp *C**	**Composite Correction**	**R Corrected**	**K Factor**	**Percent Finer (%)**	**Particle Diameter (mm)**	**Adjusted % Finer (%)**
2	36	21.9	5.5	30.5	0.0132	60.6	0.0299	60.4%
5	32.5	21.9	5.5	27.0	0.0132	53.6	0.0194	53.4%
15	29.5	21.8	5.5	24.0	0.0132	47.7	0.0115	47.5%
30	27.5	21.8	5.5	22.0	0.0132	43.7	0.0082	43.5%
60	25	21.7	5.6	19.4	0.0132	38.5	0.0059	38.4%
250	21.5	21.2	5.7	15.8	0.0133	31.4	0.0030	31.3%
1440	18.5	20.4	5.9	12.6	0.0134	25.0	0.0013	24.9%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.1**	Silt=37% Clay=36.6%	
Coarse=0; Fine=0.1		D60, mm	NA
% Sand (-#4 & +#200)	**26.1**	D30, mm	NA
Coarse=0.2; Medium=3.9; Fine=22		D10, mm	NA
% Fines (-#200)	**73.8**	Cc	NA
% Plus #200 (-3")	**26.2**	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	**Atterberg Limits Group Symbol**		
ml	**ml - Silt (assumed)**		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.7
0.05	67.9
0.002	28.3

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.3	0
Sand	31.8	31.9
Silt	39.6	39.7
Clay	28.3	28.3

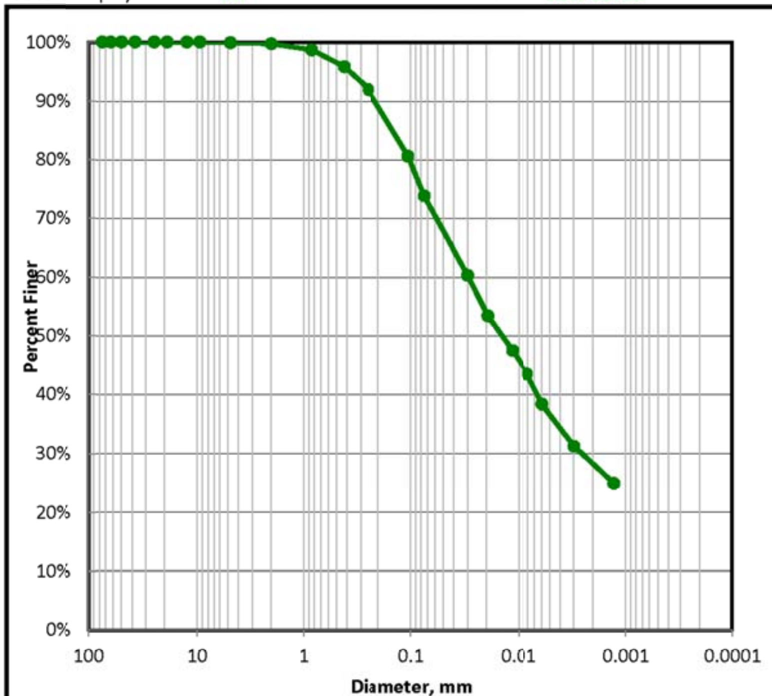
USDA Classification
CLAY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	05
		Lab Sample	37820005

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	100.0%
No. 4	4.75	99.9%
No. 10	2	99.7%
No. 20	0.85	98.6%
No. 40	0.425	95.8%
No. 60	0.25	91.9%
No. 140	0.106	80.6%
No. 200	0.075	73.8%
NA	0.0299	60.4%
NA	0.0194	53.4%
NA	0.0115	47.5%
NA	0.0082	43.5%
NA	0.0059	38.4%
NA	0.0030	31.3%
NA	0.0013	24.9%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.1**	Silt=37% Clay=36.6%	
Coarse=0; Fine=0.1		D60, mm	NA
% Sand (-#4 & +#200)	**26.1**	D30, mm	NA
Coarse=0.2; Medium=3.9; Fine=22		D10, mm	NA
% Fines (-#200)	**73.8**	Cc	NA
% Plus #200 (-3")	**26.2**	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	Atterberg Limits Group Symbol
ml	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.3	0
2	99.7			
		Sand	31.8	31.9
0.05	67.9			
		Silt	39.6	39.7
0.002	28.3			
		Clay	28.3	28.3

USDA Classification
CLAY LOAM

USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	05
		Lab Sample	37820005

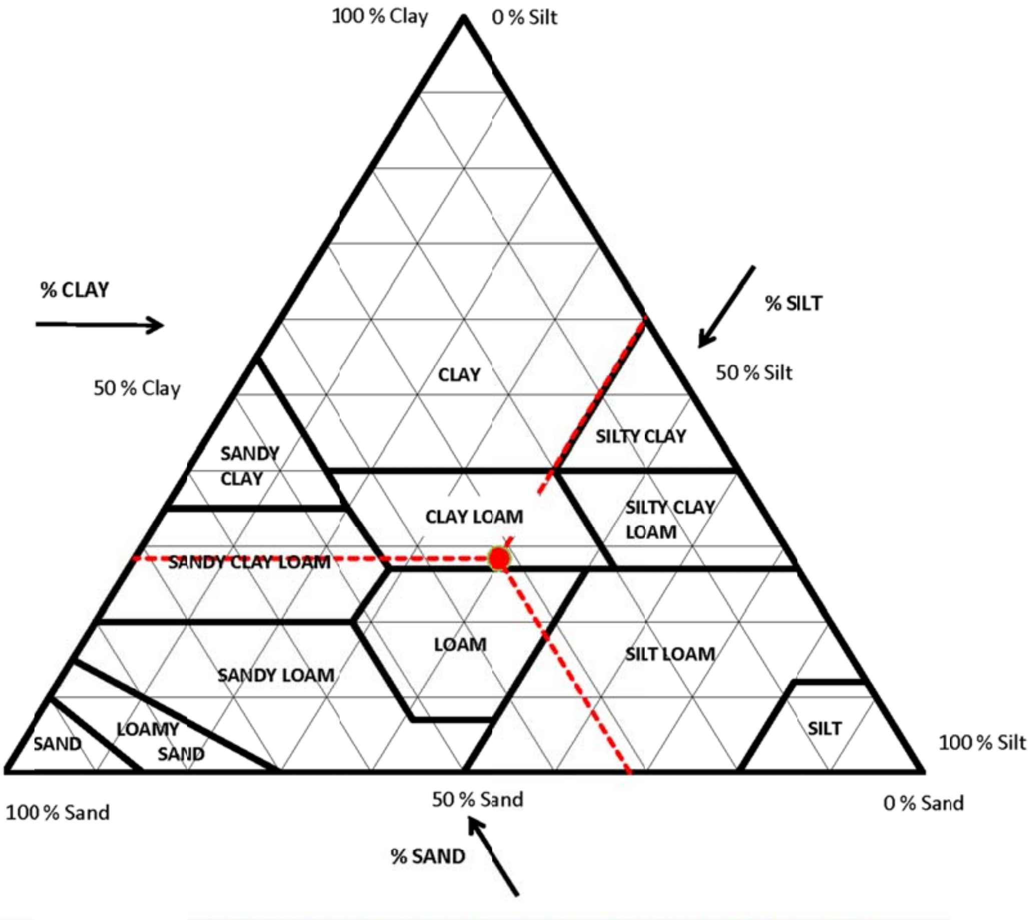
Sample Color: **GRAY**

USCS Group Name: **SILT WITH SAND**

USCS Group Symbol: **ml** USDA: **CLAY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	31.9
Percent Silt, %	39.7
Percent Clay, %	28.3

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.9
Coarse Sand; 1-0.5	2.4
Medium Sand; 0.5-0.25	4.5
Fine Sand; 0.25-0.1	12.5
Very Fine Sand; 0.1-0.05	11.6
Total	**31.9**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	06
		Lab Sample	37820006

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2057	3"	75	0	0.0%	100.0%	
Tare + WS., gm	671.31	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	413.3	2"	50	0	0.0%	100.0%	
Tare, gm	152.1	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**98.8%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	261	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	485	3/8"	9.5	0	0.0%	100.0%	
Tare + WS., gm	21.11	No. 4	4.75	0.82	0.3%	99.7%	
Tare + DS., gm	21.02	No. 10	2	0.93	0.4%	99.3%	
Tare, gm	10.83	No. 20	0.85	0.55	1.1%	98.3%	
Hygroscopic WC	0.88%	No. 40	0.425	1.74	3.4%	94.9%	
		No. 60	0.25	1.95	3.8%	91.2%	
-#10 Hydro/Sieve air dry wt.	51.53	No. 140	0.106	3.86	7.4%	83.7%	
Wt. of +#200 Sample, gm	13.71	No. 200	0.075	5.61	10.8%	72.9%	

HYDROMETER (-#10)

Split Air Dry Wt	51.99	Specific Gravity	2.7
Hygroscopic WC	0.88%		Assumed
Corrected Dry wt	51.5	*a Factor*	*0.9889*

-#10 Dispersed 1min in Hamilton Beach Mixer

Elapsed Time (min.)	R Measured	Temp °C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	37	22.1	5.4	31.6	0.0131	60.6	0.0296	60.2%
5	33	22	5.5	27.5	0.0132	52.8	0.0193	52.4%
15	30.5	21.9	5.5	25.0	0.0132	48.0	0.0114	47.7%
30	28	21.8	5.5	22.5	0.0132	43.2	0.0082	42.9%
60	25.5	21.7	5.6	19.9	0.0132	38.2	0.0059	37.9%
250	21.5	21.2	5.7	15.8	0.0133	30.3	0.0030	30.1%
1440	18.5	20.4	5.9	12.6	0.0134	24.2	0.0013	24.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.3**	Silt=36.7% Clay=36%	
Coarse=0; Fine=0.3		D60, mm	NA
% Sand (-#4 & +#200)	**26.8**	D30, mm	NA
Coarse=0.4; Medium=4.4; Fine=22		D10, mm	NA
% Fines (-#200)	**72.9**	Cc	NA
% Plus #200 (-3")	**27.1**	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	Atterberg Limits Group Symbol		
ml	ml - Silt (assumed)		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100	Gravel	0.7	0
2	99.3	Sand	32.0	32.2
0.05	67.4	Silt	40.2	40.4
0.002	27.2	Clay	27.2	27.4

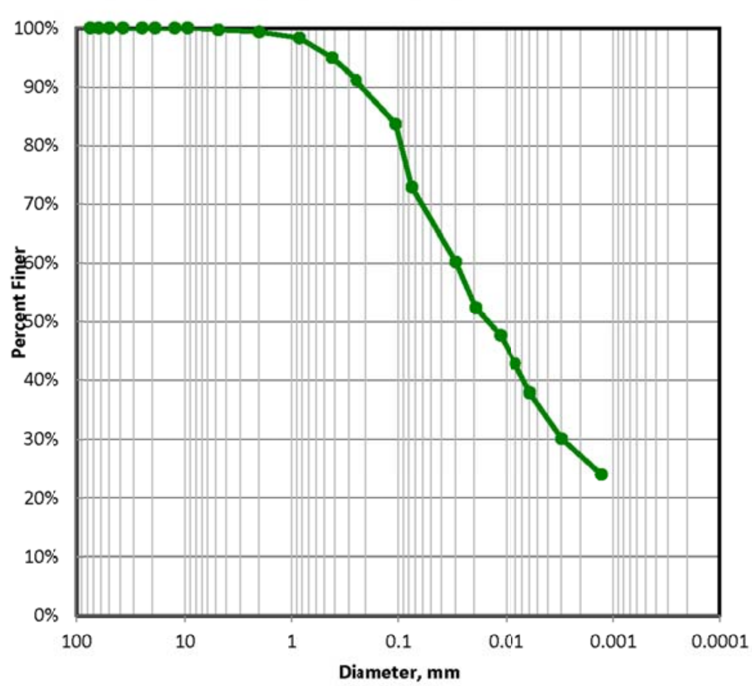
USDA Classification
CLAY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	06
		Lab Sample	37820006

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	100.0%
No. 4	4.75	99.7%
No. 10	2	99.3%
No. 20	0.85	98.3%
No. 40	0.425	94.9%
No. 60	0.25	91.2%
No. 140	0.106	83.7%
No. 200	0.075	72.9%
NA	0.0296	60.2%
NA	0.0193	52.4%
NA	0.0114	47.7%
NA	0.0082	42.9%
NA	0.0059	37.9%
NA	0.0030	30.1%
NA	0.0013	24.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	0.3	Silt=36.7% Clay=36%	
Coarse=0; Fine=0.3		D60, mm	NA
% Sand (-#4 & +#200)	26.8	D30, mm	NA
Coarse=0.4; Medium=4.4; Fine=22		D10, mm	NA
% Fines (-#200)	72.9	Cc	NA
% Plus #200 (-3")	27.1	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	Atterberg Limits Group Symbol
ml	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.7	0
2	99.3			
		Sand	32.0	32.2
0.05	67.4			
		Silt	40.2	40.4
0.002	27.2			
		Clay	27.2	27.4

USDA Classification
CLAY LOAM

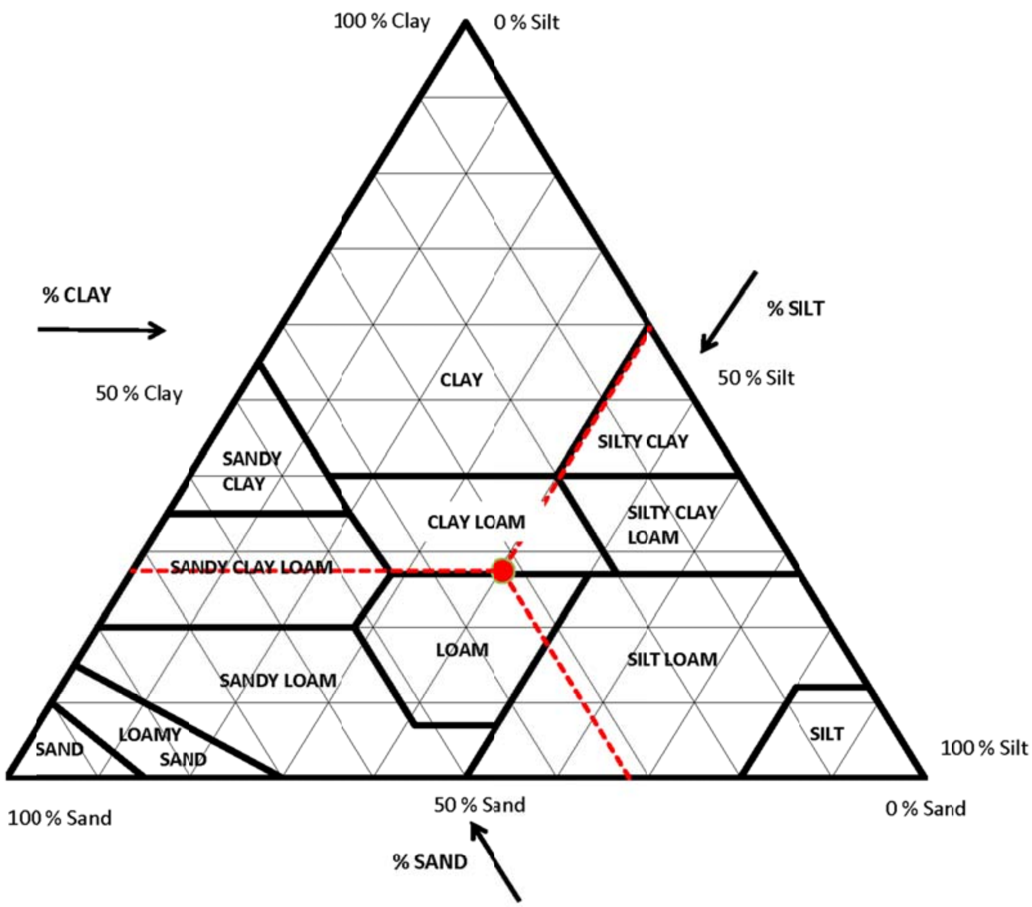
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	06
		Lab Sample	37820006

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	32.2
Percent Silt, %	40.4
Percent Clay, %	27.4

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.9
Coarse Sand; 1-0.5	2.8
Medium Sand; 0.5-0.25	4.6
Fine Sand; 0.25-0.1	9.3
Very Fine Sand; 0.1-0.05	14.6
Total	**32.2**



Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception
			Data included from: W:\TransferIn\6081808 TRANSFER 25 Jan 2017 1546.mdb
			Data included from: W:\TransferIn\6081808 TRANSFER 31 Oct 2016 1126.mdb

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	01
		Lab Sample	37820001

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	% Finer	Project Specifications
Tare No.	2010	3"	75	0	0.0%	100.0%	
Tare + WS., gm	840.11	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	618.57	2"	50	0	0.0%	100.0%	
Tare, gm	155.33	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**47.8%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	463	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	437	3/8"	9.5	0	0.0%	100.0%	
Tare + WS., gm	20.99	No. 4	4.75	0	0.0%	100.0%	
Tare + DS., gm	20.96	No. 10	2	0.37	0.1%	99.9%	
Tare, gm	10.62	No. 20	0.85	0.1	0.2%	99.7%	
Hygroscopic WC	0.29%	No. 40	0.425	0.15	0.3%	99.4%	
		No. 60	0.25	0.56	1.1%	98.3%	
-#10 Hydro/Sieve air dry wt.	50.20	No. 140	0.106	17.1	34.0%	64.3%	
Wt. of +#200 Sample, gm	31.83	No. 200	0.075	13.92	27.7%	36.6%	

HYDROMETER (-#10)

Split Air Dry Wt	50.35		Specific Gravity	2.7
Hygroscopic WC	0.29%			Assumed
Corrected Dry wt	50.2	*-#10 Dispersed 1min in Hamilton Beach Mixer*	*a Factor*	*0.9889*

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	17.5	21.3	5.7	11.8	0.0133	23.2	0.0343	23.2%
5	17.5	21.2	5.7	11.8	0.0133	23.2	0.0217	23.2%
15	17	21.2	5.7	11.3	0.0133	22.3	0.0126	22.2%
30	16	21.1	5.7	10.3	0.0133	20.3	0.0090	20.3%
60	15.5	21.1	5.7	9.8	0.0133	19.3	0.0063	19.3%
250	13.5	21	5.7	7.8	0.0133	15.4	0.0032	15.4%
1440	12	20	6.0	6.0	0.0135	11.8	0.0013	11.8%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.0**	Silt=18.4% Clay=17.9%	
Coarse=0; Fine=0		D60, mm	NA
% Sand (-#4 & +#200)	**63.4**	D30, mm	NA
Coarse=0.1; Medium=0.5; Fine=62.9		D10, mm	NA
% Fines (-#200)	**36.6**	Cc	NA
% Plus #200 (-3")	**63.4**	Cu	NA

USCS Description: **SILTY SAND**

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.1	0
2	99.9			
		Sand	70.3	70.3
0.05	29.7			
		Silt	16.2	16.2
0.002	13.5			
		Clay	13.5	13.5

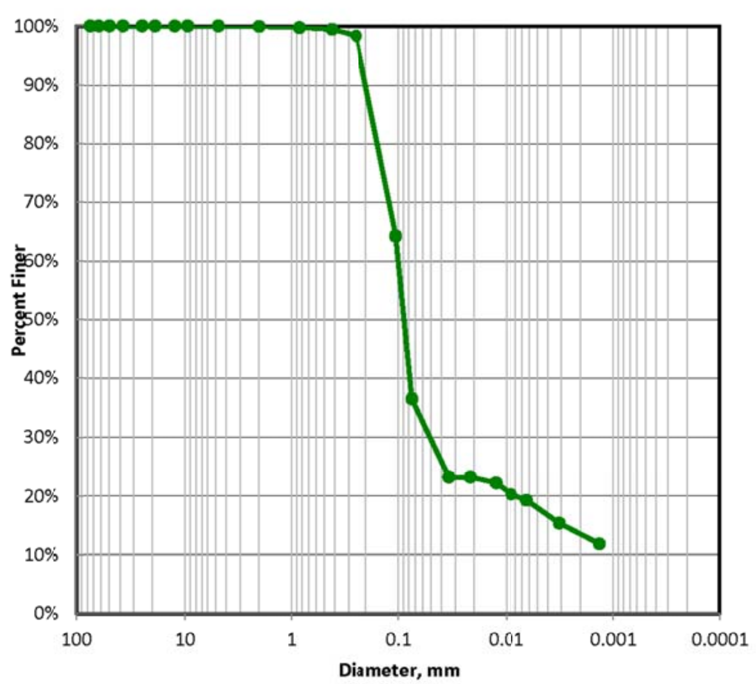
USDA Classification: **SANDY LOAM**

Input Validation	tmp	Reviewed By: tmp		Date Tested	9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	01
		Lab Sample	37820001

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	100.0%
No. 4	4.75	100.0%
No. 10	2	99.9%
No. 20	0.85	99.7%
No. 40	0.425	99.4%
No. 60	0.25	98.3%
No. 140	0.106	64.3%
No. 200	0.075	36.6%
NA	0.0343	23.2%
NA	0.0217	23.2%
NA	0.0126	22.2%
NA	0.0090	20.3%
NA	0.0063	19.3%
NA	0.0032	15.4%
NA	0.0013	11.8%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	0.0	Silt=18.4% Clay=17.9%	
Coarse=0; Fine=0		D60, mm	NA
% Sand (-#4 & +#200)	63.4	D30, mm	NA
Coarse=0.1; Medium=0.5; Fine=62.9		D10, mm	NA
% Fines (-#200)	36.6	Cc	NA
% Plus #200 (-3")	63.4	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.9
0.05	29.7
0.002	13.5

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.1	0
Sand	70.3	70.3
Silt	16.2	16.2
Clay	13.5	13.5

USDA Classification
SANDY LOAM

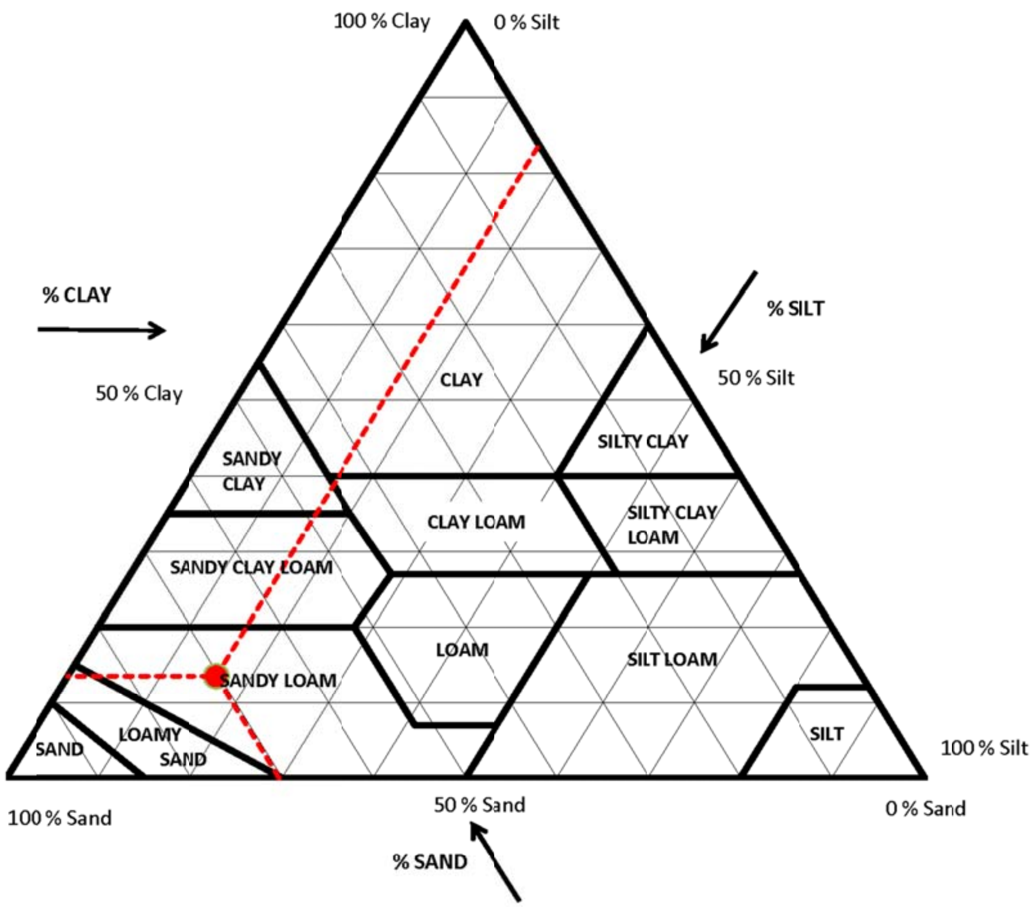
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	01
		Lab Sample	37820001

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	70.3
Percent Silt, %	16.2
Percent Clay, %	13.5

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.2
Coarse Sand; 1-0.5	0.3
Medium Sand; 0.5-0.25	1.2
Fine Sand; 0.25-0.1	38.7
Very Fine Sand; 0.1-0.05	30.0
Total	**70.3**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	02
		Lab Sample	37820002

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2059	3"	75	0	0.0%	100.0%	
Tare + WS., gm	750.74	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	539.22	2"	50	0	0.0%	100.0%	
Tare, gm	151.27	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**54.5%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	388	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	467	3/8"	9.5	0.44	0.1%	99.9%	
Tare + WS., gm	22.33	No. 4	4.75	0.27	0.1%	99.8%	
Tare + DS., gm	22.33	No. 10	2	0.81	0.2%	99.6%	
Tare, gm	10.74	No. 20	0.85	0.16	0.3%	99.3%	
Hygroscopic WC	0.00%	No. 40	0.425	0.43	0.9%	98.4%	
		No. 60	0.25	0.84	1.7%	96.8%	
-#10 Hydro/Sieve air dry wt.	50.18	No. 140	0.106	13.02	25.8%	70.9%	
Wt. of +#200 Sample, gm	31.16	No. 200	0.075	16.71	33.2%	37.8%	

HYDROMETER (-#10)

Split Air Dry Wt	50.18	Specific Gravity	2.7
Hygroscopic WC	0.00%		Assumed
Corrected Dry wt	50.2	*a Factor*	*0.9889*

-#10 Dispersed 1min in Hamilton Beach Mixer

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	18.5	21.2	5.7	12.8	0.0133	25.2	0.0341	25.1%
5	17.5	21.2	5.7	11.8	0.0133	23.3	0.0217	23.2%
15	17.5	21	5.7	11.8	0.0133	23.3	0.0126	23.2%
30	17	21	5.7	11.3	0.0133	22.3	0.0089	22.2%
60	16.5	21.1	5.7	10.8	0.0133	21.3	0.0063	21.2%
250	14.5	20.9	5.8	8.7	0.0133	17.1	0.0031	17.1%
1440	13	20	6.0	7.0	0.0135	13.8	0.0013	13.7%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=17.7% Clay=19.8%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**62.1**	D30, mm	NA
Coarse=0.2; Medium=1.2; Fine=60.7		D10, mm	NA
% Fines (-#200)	**37.8**	Cc	NA
% Plus #200 (-3")	**62.2**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100	Gravel	0.4	0
2	99.6	Sand	68.3	68.6
0.05	31.3	Silt	15.9	16.0
0.002	15.3	Clay	15.3	15.4

USDA Classification
SANDY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

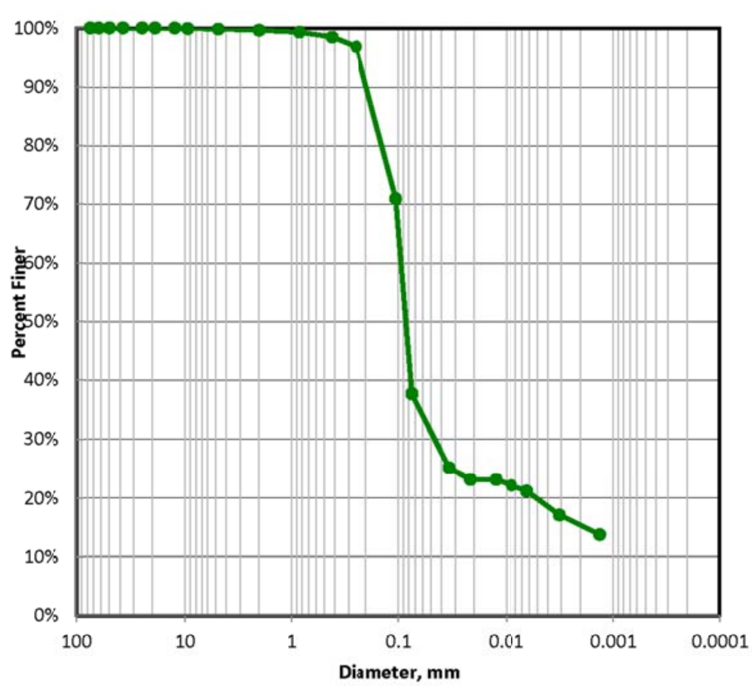
PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	02
		Lab Sample	37820002

Sample Color: **GRAY**

USCS Group Name: **SILTY SAND**

USCS Group Symbol: **sm** USDA: **SANDY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	99.9%
No. 4	4.75	99.8%
No. 10	2	99.6%
No. 20	0.85	99.3%
No. 40	0.425	98.4%
No. 60	0.25	96.8%
No. 140	0.106	70.9%
No. 200	0.075	37.8%
NA	0.0341	25.1%
NA	0.0217	23.2%
NA	0.0126	23.2%
NA	0.0089	22.2%
NA	0.0063	21.2%
NA	0.0031	17.1%
NA	0.0013	13.7%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=17.7% Clay=19.8%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**62.1**	D30, mm	NA
Coarse=0.2; Medium=1.2; Fine=60.7		D10, mm	NA
% Fines (-#200)	**37.8**	Cc	NA
% Plus #200 (-3")	**62.2**	Cu	NA

USCS Description

SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.4	0
2	99.6			
		Sand	68.3	68.6
0.05	31.3			
		Silt	15.9	16.0
0.002	15.3			
		Clay	15.3	15.4

USDA Classification

SANDY LOAM

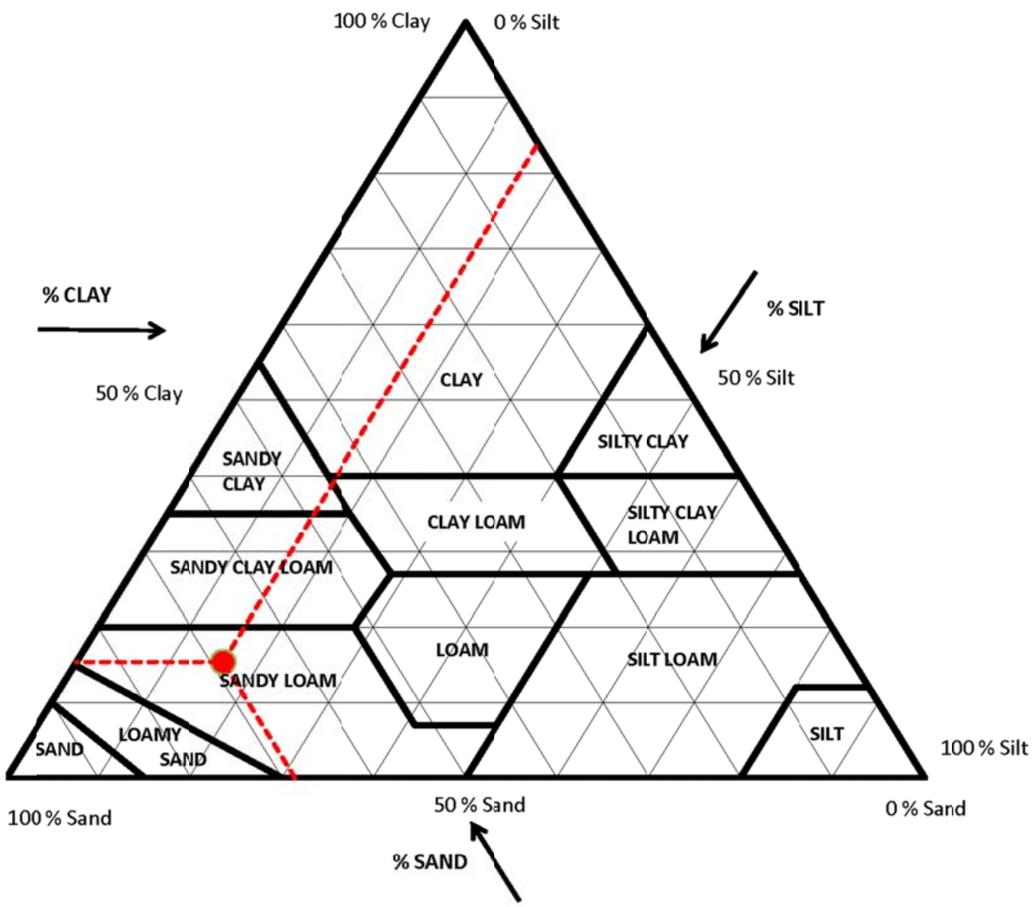
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	02
		Lab Sample	37820002

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SANDY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	68.6
Percent Silt, %	16.0
Percent Clay, %	15.4

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.3
Coarse Sand; 1-0.5	0.7
Medium Sand; 0.5-0.25	1.9
Fine Sand; 0.25-0.1	31.6
Very Fine Sand; 0.1-0.05	34.2
Total	**68.6**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.		Boring	16H0699
Client Project	16H0699		Depth	9-1-2016
Project No.	37820		Sample	03
			Lab Sample	37820003

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SAND**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2008	3"	75	0	0.0%	100.0%	
Tare + WS., gm	853.94	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	696.73	2"	50	0	0.0%	100.0%	
Tare, gm	153.01	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**28.9%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	544	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0.96	0.2%	99.8%	
Tare No.	480	3/8"	9.5	0	0.0%	99.8%	
Tare + WS., gm	22.38	No. 4	4.75	0	0.0%	99.8%	
Tare + DS., gm	22.38	No. 10	2	0.8	0.1%	99.7%	
Tare, gm	10.61	No. 20	0.85	14.12	14.0%	85.7%	
Hygroscopic WC	0.00%	No. 40	0.425	37.23	36.9%	48.8%	
		No. 60	0.25	26.64	26.4%	22.4%	
-#10 Hydro/Sieve air dry wt.	100.62	No. 140	0.106	7.9	7.8%	14.6%	
Wt. of +#200 Sample, gm	87.59	No. 200	0.075	1.7	1.7%	12.9%	

HYDROMETER (-#10)

Split Air Dry Wt	100.62	Specific Gravity	2.7
Hygroscopic WC	0.00%		Assumed
Corrected Dry wt	100.6	*a Factor*	*0.9889*

-#10 Dispersed 1min in Hamilton Beach Mixer

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	15	21.9	5.5	9.5	0.0132	9.3	0.0345	9.3%
5	13.5	21.8	5.5	8.0	0.0132	7.9	0.0221	7.8%
15	13	21.7	5.6	7.4	0.0132	7.3	0.0128	7.2%
30	13	21.6	5.6	7.4	0.0132	7.3	0.0091	7.2%
60	12.5	21.5	5.6	6.9	0.0132	6.8	0.0064	6.8%
250	11.5	21	5.7	5.8	0.0133	5.7	0.0032	5.7%
1440	10.5	20.4	5.9	4.6	0.0134	4.5	0.0013	4.5%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=6.5% Clay=6.4%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**86.9**	D30, mm	NA
Coarse=0.1; Medium=50.9; Fine=35.9		D10, mm	NA
% Fines (-#200)	**12.9**	Cc	NA
% Plus #200 (-3")	**87.1**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol		
sm	np - Non-Plastic (assumed)		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.7
0.05	11.0
0.002	5.0

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.3	0
Sand	88.7	88.9
Silt	6.0	6.0
Clay	5.0	5.1

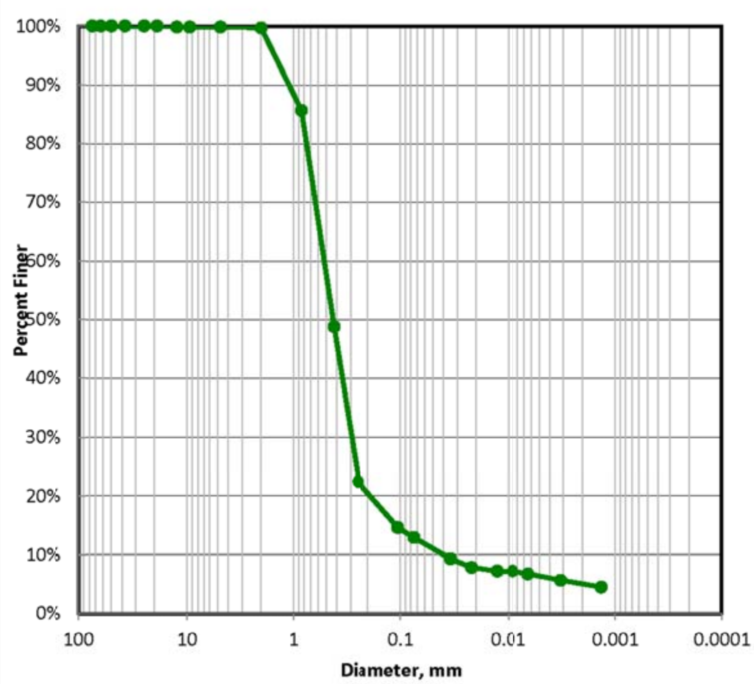
USDA Classification
SAND

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	03
		Lab Sample	37820003

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SAND**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	99.8%
3/8"	9.5	99.8%
No. 4	4.75	99.8%
No. 10	2	99.7%
No. 20	0.85	85.7%
No. 40	0.425	48.8%
No. 60	0.25	22.4%
No. 140	0.106	14.6%
No. 200	0.075	12.9%
NA	0.0345	9.3%
NA	0.0221	7.8%
NA	0.0128	7.2%
NA	0.0091	7.2%
NA	0.0064	6.8%
NA	0.0032	5.7%
NA	0.0013	4.5%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.2**	Silt=6.5% Clay=6.4%	
Coarse=0; Fine=0.2		D60, mm	NA
% Sand (-#4 & +#200)	**86.9**	D30, mm	NA
Coarse=0.1; Medium=50.9; Fine=35.9		D10, mm	NA
% Fines (-#200)	**12.9**	Cc	NA
% Plus #200 (-3")	**87.1**	Cu	NA

USCS Description
SILTY SAND

USCS Group Symbol	Atterberg Limits Group Symbol
sm	np - Non-Plastic (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.7
0.05	11.0
0.002	5.0

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.3	0
Sand	88.7	88.9
Silt	6.0	6.0
Clay	5.0	5.1

USDA Classification
SAND

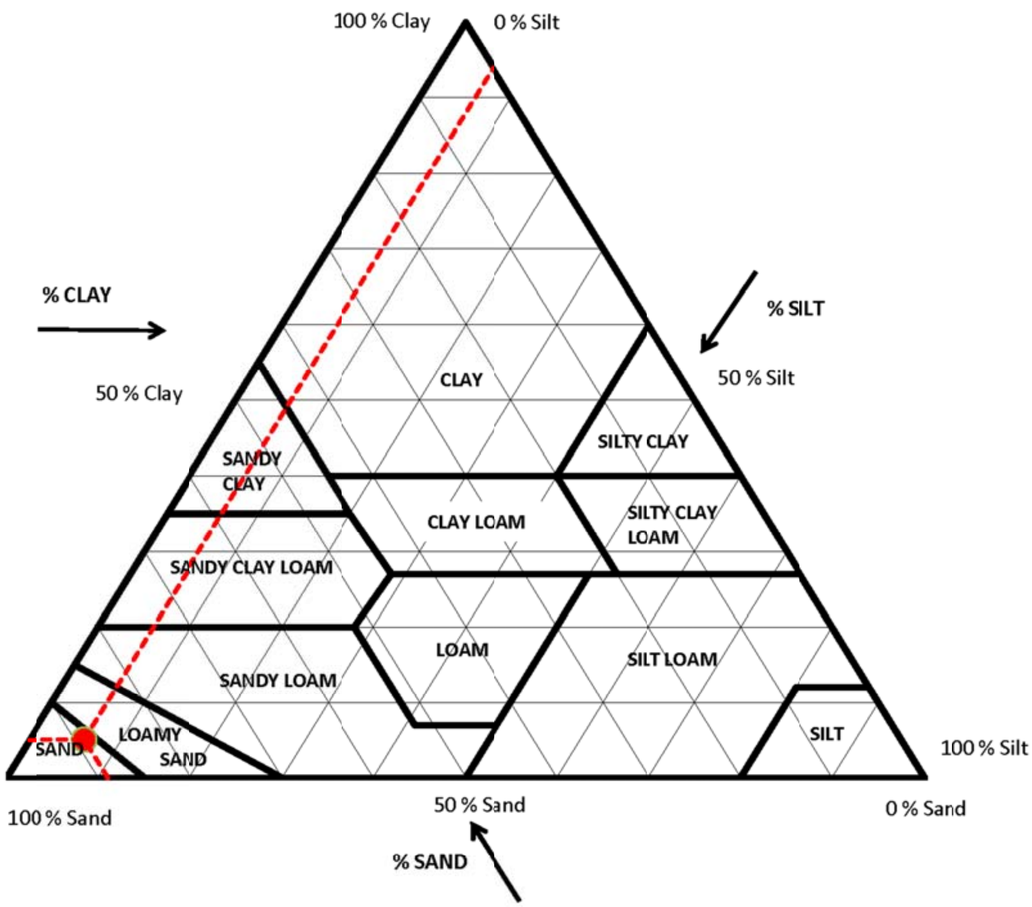
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	03
		Lab Sample	37820003

Sample Color: **GRAY**
USCS Group Name: **SILTY SAND**
USCS Group Symbol: **sm** USDA: **SAND**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	88.9
Percent Silt, %	6.0
Percent Clay, %	5.1

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	11.4
Coarse Sand; 1-0.5	31.0
Medium Sand; 0.5-0.25	35.2
Fine Sand; 0.25-0.1	8.1
Very Fine Sand; 0.1-0.05	3.3
Total	**88.9**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	04
		Lab Sample	37820004

Sample Color: GRAY
USCS Group Name: WELL-GRADED SAND WITH SILT
USCS Group Symbol: sw-sm   USDA: SAND

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2076	3"	75	0	0.0%	100.0%	
Tare + WS., gm	850.81	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	708.44	2"	50	0	0.0%	100.0%	
Tare, gm	151.56	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**25.6%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	557	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	405	3/8"	9.5	0.3	0.1%	99.9%	
Tare + WS., gm	23.24	No. 4	4.75	0.61	0.1%	99.8%	
Tare + DS., gm	23.24	No. 10	2	1.2	0.2%	99.6%	
Tare, gm	10.54	No. 20	0.85	15.52	15.3%	84.3%	
Hygroscopic WC	0.00%	No. 40	0.425	38.46	38.0%	46.2%	
		No. 60	0.25	27.19	26.9%	19.3%	
-#10 Hydro/Sieve air dry wt.	100.73	No. 140	0.106	7.16	7.1%	12.3%	
Wt. of +#200 Sample, gm	90.40	No. 200	0.075	2.07	2.0%	10.2%	

HYDROMETER (-#10)

Split Air Dry Wt	100.73	Specific Gravity	2.7
Hygroscopic WC	0.00%		Assumed
Corrected Dry wt	100.7	*-#10 Dispersed 1min in Hamilton Beach Mixer*	
		a Factor	*0.9889*

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	13.5	21.9	5.5	8.0	0.0132	7.9	0.0348	7.8%
5	12.5	21.8	5.5	7.0	0.0132	6.9	0.0222	6.8%
15	12	21.7	5.6	6.4	0.0132	6.3	0.0129	6.3%
30	12	21.5	5.6	6.4	0.0132	6.3	0.0091	6.3%
60	11.5	21.4	5.6	5.9	0.0133	5.8	0.0065	5.8%
250	11	21	5.7	5.3	0.0133	5.2	0.0032	5.2%
1440	10	20.3	5.9	4.1	0.0134	4.0	0.0014	4.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	0.2	Silt=4.6% Clay=5.6%	
Coarse=0; Fine=0.2		D60, mm	0.55
% Sand (-#4 & +#200)	89.6	D30, mm	0.31
Coarse=0.2; Medium=53.4; Fine=36		D10, mm	0.07
% Fines (-#200)	10.2	Cc	2.49
% Plus #200 (-3")	89.8	Cu	7.80

USCS Description
WELL-GRADED SAND WITH SILT

USCS Group Symbol	Atterberg Limits Group Symbol		
sw-sm	np - Non-Plastic (assumed)		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100	Gravel	0.4	0
2	99.6	Sand	90.7	91.0
0.05	9.0	Silt	4.4	4.4
0.002	4.5	Clay	4.5	4.6

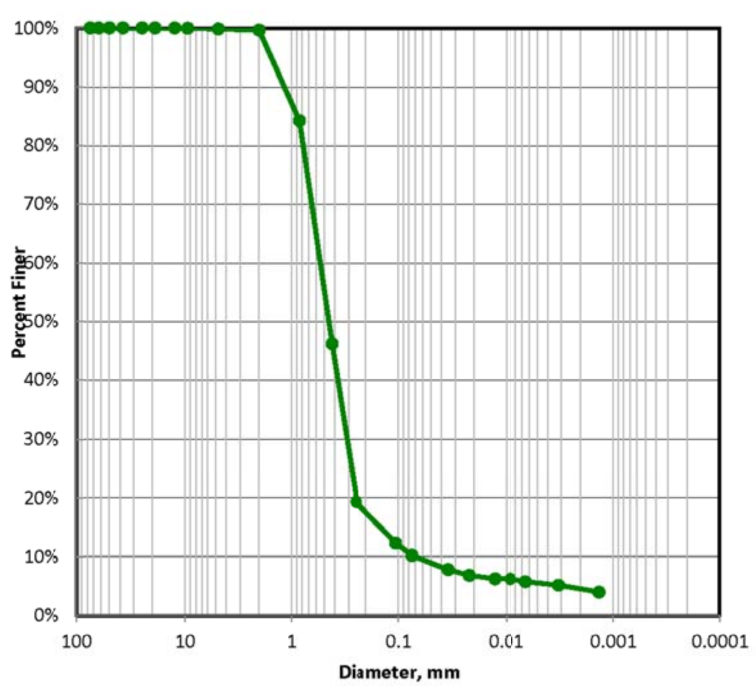
USDA Classification
SAND

Input Validation tmp   Reviewed By: tmp   Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	04
		Lab Sample	37820004

Sample Color: **GRAY**
USCS Group Name: **WELL-GRADED SAND WITH SILT**
USCS Group Symbol: **sw-sm** USDA: **SAND**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	99.9%
No. 4	4.75	99.8%
No. 10	2	99.6%
No. 20	0.85	84.3%
No. 40	0.425	46.2%
No. 60	0.25	19.3%
No. 140	0.106	12.3%
No. 200	0.075	10.2%
NA	0.0348	7.8%
NA	0.0222	6.8%
NA	0.0129	6.3%
NA	0.0091	6.3%
NA	0.0065	5.8%
NA	0.0032	5.2%
NA	0.0014	4.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	0.2	Silt=4.6% Clay=5.6%	
Coarse=0; Fine=0.2		D60, mm	0.546
% Sand (-#4 & +#200)	89.6	D30, mm	0.308
Coarse=0.2; Medium=53.4; Fine=36		D10, mm	0.070
% Fines (-#200)	10.2	Cc	2.490
% Plus #200 (-3")	89.8	Cu	7.800

USCS Description
WELL-GRADED SAND WITH SILT

USCS Group Symbol	Atterberg Limits Group Symbol
sw-sm	np - Non-Plastic (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.4	0
2	99.6			
		Sand	90.7	91.0
0.05	9.0			
		Silt	4.4	4.4
0.002	4.5			
		Clay	4.5	4.6

USDA Classification
SAND

USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	04
		Lab Sample	37820004

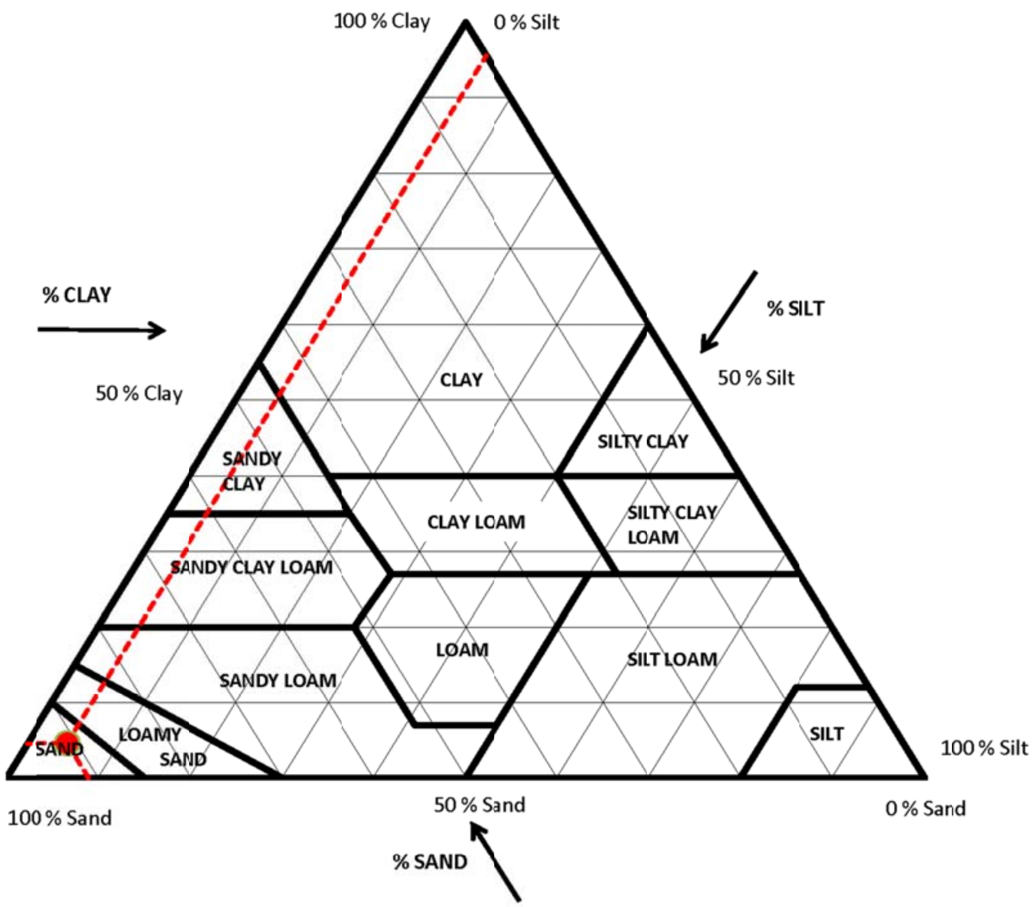
Sample Color: **GRAY**

USCS Group Name: **WELL-GRADED SAND WITH SILT**

USCS Group Symbol: **sw-sm** USDA: **SAND**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	91.0
Percent Silt, %	4.4
Percent Clay, %	4.6

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	12.5
Coarse Sand; 1-0.5	32.2
Medium Sand; 0.5-0.25	35.9
Fine Sand; 0.25-0.1	7.5
Very Fine Sand; 0.1-0.05	3.0
Total	**91.0**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	05
		Lab Sample	37820005

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2016	3"	75	0	0.0%	100.0%	
Tare + WS., gm	488.46	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	320.87	2"	50	0	0.0%	100.0%	
Tare, gm	151.37	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**98.9%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	170	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	420	3/8"	9.5	0	0.0%	100.0%	
Tare + WS., gm	21.48	No. 4	4.75	0.22	0.1%	99.9%	
Tare + DS., gm	21.36	No. 10	2	0.29	0.2%	99.7%	
Tare, gm	10.74	No. 20	0.85	0.53	1.1%	98.6%	
Hygroscopic WC	1.13%	No. 40	0.425	1.43	2.9%	95.8%	
		No. 60	0.25	1.93	3.9%	91.9%	
-#10 Hydro/Sieve air dry wt.	49.81	No. 140	0.106	5.64	11.3%	80.6%	
Wt. of +#200 Sample, gm	12.93	No. 200	0.075	3.4	6.8%	73.8%	

HYDROMETER (-#10)

Split Air Dry Wt	50.37	Specific Gravity	2.7
Hygroscopic WC	1.13%		Assumed
Corrected Dry wt	49.8	*a Factor*	*0.9889*

-#10 Dispersed 1min in Hamilton Beach Mixer

Elapsed Time (min.)	R Measured	Temp °C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	36	21.9	5.5	30.5	0.0132	60.6	0.0299	60.4%
5	32.5	21.9	5.5	27.0	0.0132	53.6	0.0194	53.4%
15	29.5	21.8	5.5	24.0	0.0132	47.7	0.0115	47.5%
30	27.5	21.8	5.5	22.0	0.0132	43.7	0.0082	43.5%
60	25	21.7	5.6	19.4	0.0132	38.5	0.0059	38.4%
250	21.5	21.2	5.7	15.8	0.0133	31.4	0.0030	31.3%
1440	18.5	20.4	5.9	12.6	0.0134	25.0	0.0013	24.9%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.1**	Silt=37% Clay=36.6%	
Coarse=0; Fine=0.1		D60, mm	NA
% Sand (-#4 & +#200)	**26.1**	D30, mm	NA
Coarse=0.2; Medium=3.9; Fine=22		D10, mm	NA
% Fines (-#200)	**73.8**	Cc	NA
% Plus #200 (-3")	**26.2**	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	Atterberg Limits Group Symbol
ml	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.7
0.05	67.9
0.002	28.3

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.3	0
Sand	31.8	31.9
Silt	39.6	39.7
Clay	28.3	28.3

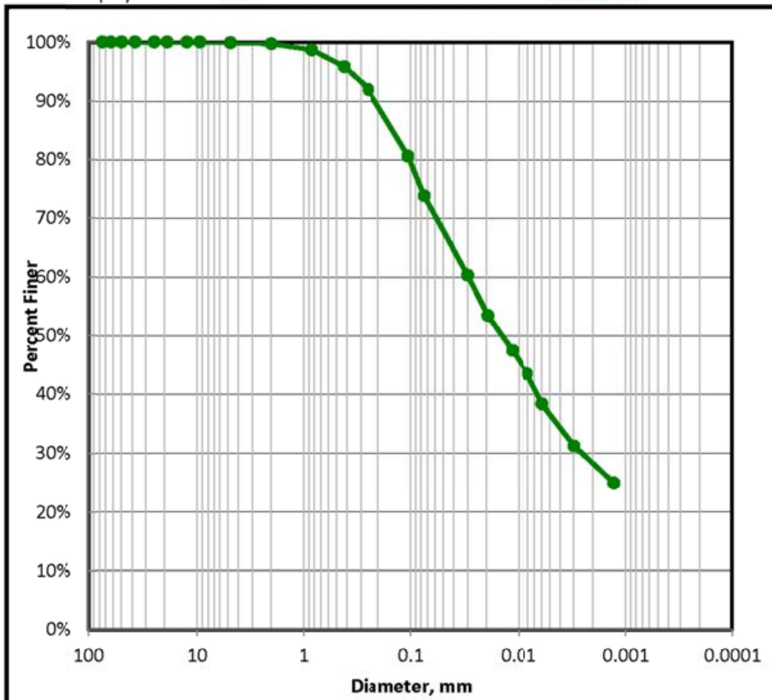
USDA Classification
CLAY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	05
		Lab Sample	37820005

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	100.0%
No. 4	4.75	99.9%
No. 10	2	99.7%
No. 20	0.85	98.6%
No. 40	0.425	95.8%
No. 60	0.25	91.9%
No. 140	0.106	80.6%
No. 200	0.075	73.8%
NA	0.0299	60.4%
NA	0.0194	53.4%
NA	0.0115	47.5%
NA	0.0082	43.5%
NA	0.0059	38.4%
NA	0.0030	31.3%
NA	0.0013	24.9%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.1**	Silt=37% Clay=36.6%	
Coarse=0; Fine=0.1		D60, mm	NA
% Sand (-#4 & +#200)	**26.1**	D30, mm	NA
Coarse=0.2; Medium=3.9; Fine=22		D10, mm	NA
% Fines (-#200)	**73.8**	Cc	NA
% Plus #200 (-3")	**26.2**	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	Atterberg Limits Group Symbol
ml	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.3	0
2	99.7			
		Sand	31.8	31.9
0.05	67.9			
		Silt	39.6	39.7
0.002	28.3			
		Clay	28.3	28.3

USDA Classification
CLAY LOAM

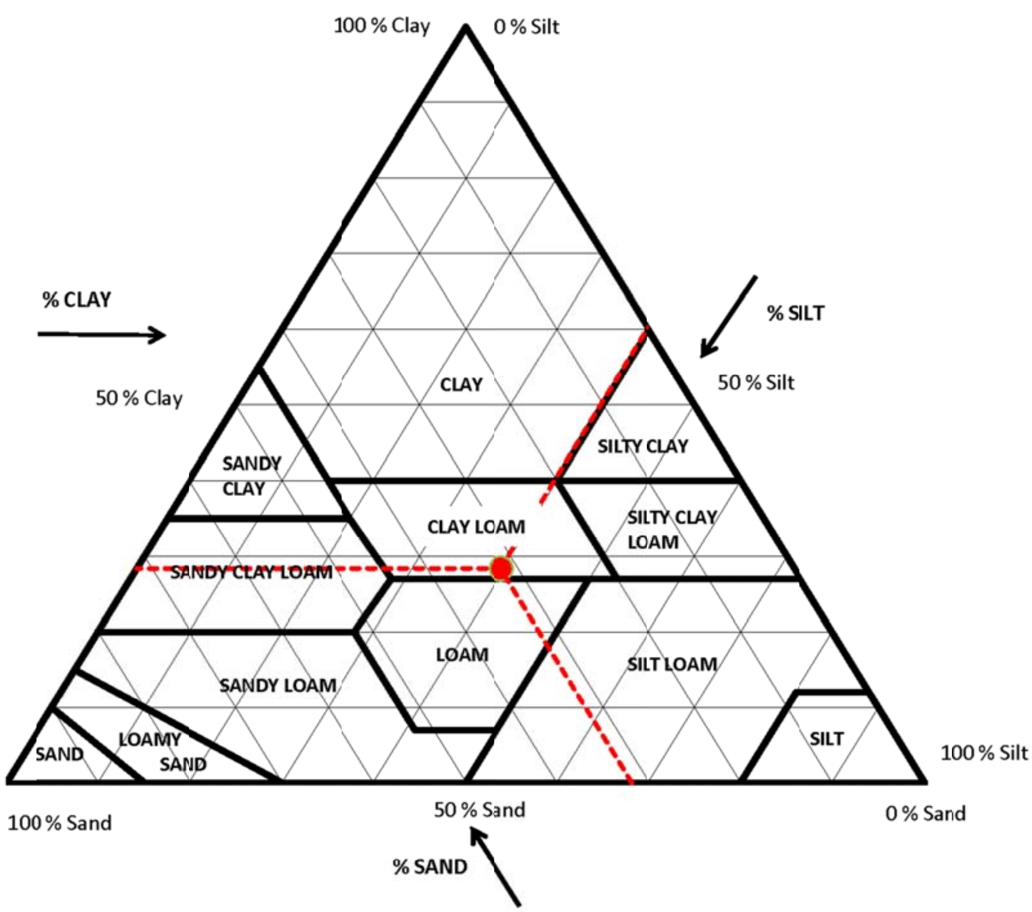
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	05
		Lab Sample	37820005

Sample Color: GRAY
USCS Group Name: SILT WITH SAND
USCS Group Symbol: ml USDA: CLAY LOAM

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	31.9
Percent Silt, %	39.7
Percent Clay, %	28.3

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.9
Coarse Sand; 1-0.5	2.4
Medium Sand; 0.5-0.25	4.5
Fine Sand; 0.25-0.1	12.5
Very Fine Sand; 0.1-0.05	11.6
Total	**31.9**



PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	06
		Lab Sample	37820006

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**

MECHANICAL SIEVE

Total Sample		Sieve Size	Nominal Opening, mm	Dry Wt, gm	Split Normalized % Retained	Split Normalized % Finer	Project Specifications
Tare No.	2057	3"	75	0	0.0%	100.0%	
Tare + WS., gm	671.31	2-1/2"	63	0	0.0%	100.0%	
Tare + DS., gm	413.3	2"	50	0	0.0%	100.0%	
Tare, gm	152.1	1-1/2"	37.5	0	0.0%	100.0%	
Total sample WC	**98.8%**	1"	25	0	0.0%	100.0%	
Total Sample Dry Wt, gm (-3")	261	3/4"	19	0	0.0%	100.0%	
Hygroscopic WC (-#10)		1/2"	12.5	0	0.0%	100.0%	
Tare No.	485	3/8"	9.5	0	0.0%	100.0%	
Tare + WS., gm	21.11	No. 4	4.75	0.82	0.3%	99.7%	
Tare + DS., gm	21.02	No. 10	2	0.93	0.4%	99.3%	
Tare, gm	10.83	No. 20	0.85	0.55	1.1%	98.3%	
Hygroscopic WC	0.88%	No. 40	0.425	1.74	3.4%	94.9%	
		No. 60	0.25	1.95	3.8%	91.2%	
-#10 Hydro/Sieve air dry wt.	51.53	No. 140	0.106	3.86	7.4%	83.7%	
Wt. of +#200 Sample, gm	13.71	No. 200	0.075	5.61	10.8%	72.9%	

HYDROMETER (-#10)

Split Air Dry Wt	51.99	Specific Gravity	2.7
Hygroscopic WC	0.88%		Assumed
Corrected Dry wt	51.5	*-#10 Dispersed 1min in Hamilton Beach Mixer* / *a Factor*	*0.9889*

Elapsed Time (min.)	R Measured	Temp *C	Composite Correction	R Corrected	K Factor	Percent Finer (%)	Particle Diameter (mm)	Adjusted % Finer (%)
2	37	22.1	5.4	31.6	0.0131	60.6	0.0296	60.2%
5	33	22	5.5	27.5	0.0132	52.8	0.0193	52.4%
15	30.5	21.9	5.5	25.0	0.0132	48.0	0.0114	47.7%
30	28	21.8	5.5	22.5	0.0132	43.2	0.0082	42.9%
60	25.5	21.7	5.6	19.9	0.0132	38.2	0.0059	37.9%
250	21.5	21.2	5.7	15.8	0.0133	30.3	0.0030	30.1%
1440	18.5	20.4	5.9	12.6	0.0134	24.2	0.0013	24.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	**0.3**	Silt=36.7% Clay=36%	
Coarse=0; Fine=0.3		D60, mm	NA
% Sand (-#4 & +#200)	**26.8**	D30, mm	NA
Coarse=0.4; Medium=4.4; Fine=22		D10, mm	NA
% Fines (-#200)	**72.9**	Cc	NA
% Plus #200 (-3")	**27.1**	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	**Atterberg Limits Group Symbol**		
ml	**ml - Silt (assumed)**		
Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)
100	100
2	99.3
0.05	67.4
0.002	27.2

Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
Gravel	0.7	0
Sand	32.0	32.2
Silt	40.2	40.4
Clay	27.2	27.4

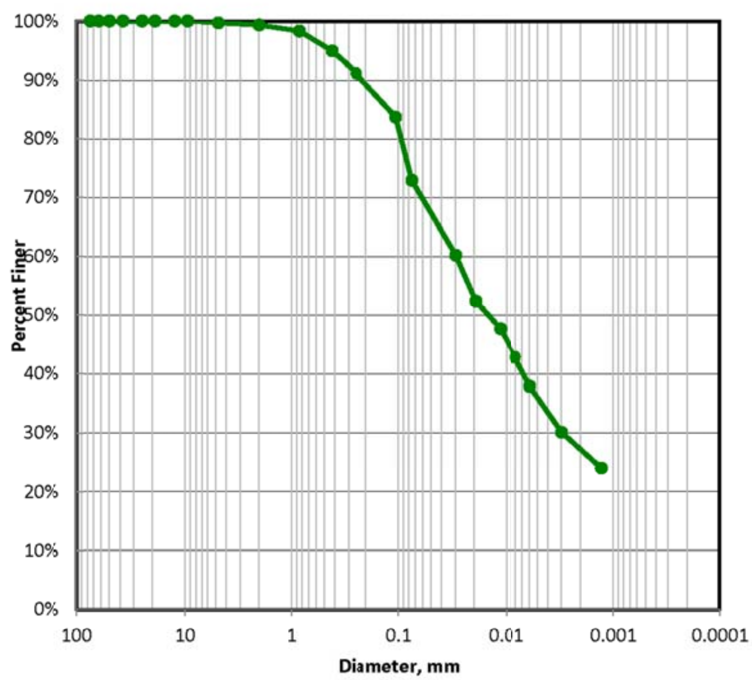
USDA Classification
CLAY LOAM

Input Validation tmp Reviewed By: tmp Date Tested 9/1/2016

PARTICLE-SIZE ANALYSIS OF SOILS - AASHTO T88

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	06
		Lab Sample	37820006

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**



US Std. Sieve Size	Particle Diameter (mm)	Percent Finer
3"	75	100.0%
2-1/2"	63	100.0%
2"	50	100.0%
1-1/2"	37.5	100.0%
1"	25	100.0%
3/4"	19	100.0%
1/2"	12.5	100.0%
3/8"	9.5	100.0%
No. 4	4.75	99.7%
No. 10	2	99.3%
No. 20	0.85	98.3%
No. 40	0.425	94.9%
No. 60	0.25	91.2%
No. 140	0.106	83.7%
No. 200	0.075	72.9%
NA	0.0296	60.2%
NA	0.0193	52.4%
NA	0.0114	47.7%
NA	0.0082	42.9%
NA	0.0059	37.9%
NA	0.0030	30.1%
NA	0.0013	24.0%

USCS SOIL CLASSIFICATION

Corrected For 100% Passing a 3" Sieve

% Gravel (-3" & +#4)	0.3	Silt=36.7% Clay=36%	
Coarse=0; Fine=0.3		D60, mm	NA
% Sand (-#4 & +#200)	26.8	D30, mm	NA
Coarse=0.4; Medium=4.4; Fine=22		D10, mm	NA
% Fines (-#200)	72.9	Cc	NA
% Plus #200 (-3")	27.1	Cu	NA

USCS Description
SILT WITH SAND

USCS Group Symbol	Atterberg Limits Group Symbol
ml	ml - Silt (assumed)

Auxiliary Information	Wt Ret, gm	% Retained	% Finer
12" Sieve - 300 mm	0	0.0	100.0
6" Sieve - 150 mm	0	0.0	100.0
3" Sieve - 75 mm	0	0.0	100.0

USDA CLASSIFICATION

Particle Size (mm)	Percent Finer (%)	Percent of Each Component (Material)	(%)	Corrected Percent of -2.0 mm Material for USDA
100	100			
		Gravel	0.7	0
2	99.3			
		Sand	32.0	32.2
0.05	67.4			
		Silt	40.2	40.4
0.002	27.2			
		Clay	27.2	27.4

USDA Classification
CLAY LOAM

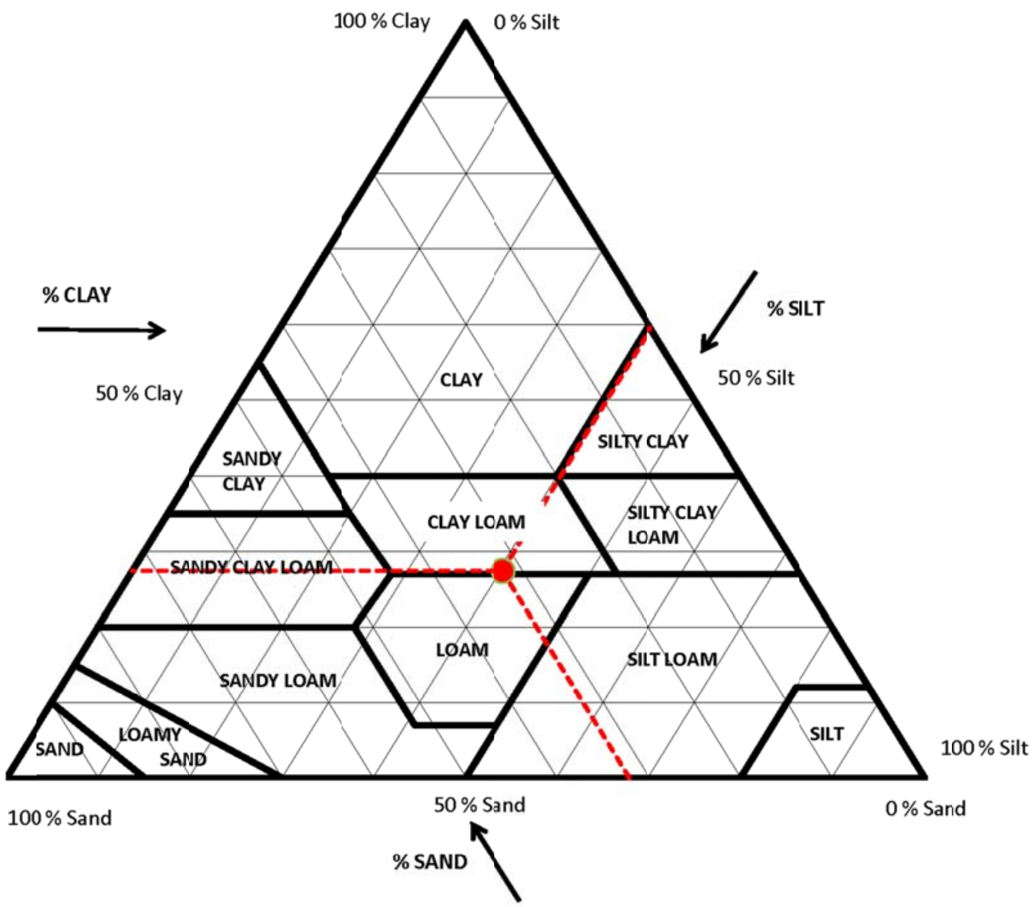
USDA CLASSIFICATION CHART

Client	Air Water & Soil Laboratories, Inc.	Boring	16H0699
Client Project	16H0699	Depth	9-1-2016
Project No.	37820	Sample	06
		Lab Sample	37820006

Sample Color: **GRAY**
USCS Group Name: **SILT WITH SAND**
USCS Group Symbol: **ml** USDA: **CLAY LOAM**

Corrected for 0% gravel	
Percent Gravel, %	0.0
Percent Sand, %	32.2
Percent Silt, %	40.4
Percent Clay, %	27.4

Sand Subsizes Corrected Percentages	
Very Coarse Sand; 2-1	0.9
Coarse Sand; 1-0.5	2.8
Medium Sand; 0.5-0.25	4.6
Fine Sand; 0.25-0.1	9.3
Very Fine Sand; 0.1-0.05	14.6
Total	**32.2**



Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception
			Data included from: W:\TransferIn\6081808 TRANSFER 31 Oct 2016 1126.mdb

can't be resolved due to coelutions on both columns

Units = ug/kg

		Detect Limit	Report Limit	%REC TMX	%REC 209	1	3	4	5	6	7	8
RARA-T1	6081808-1	0.07	0.2	76.8	46.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-T2	-2	0.07	0.2	66.9	55.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-S1	-3	0.06	0.17	65.2	57.9	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-S2	-4	0.06	0.17	61.4	49.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-C1	-5	0.09	0.26	63.0	40.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-C2	-6	0.09	0.26	59.7	51.4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	B	0.07	0.2	82.0	64.7	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	BS %rec			90.0	54.3				117			
	MS %rec			70.5	52.6				78.3			
	MSD %rec			69.0	57.6				74.0			

9	10	12	13	14	15/16	17	18	19	20	22	24	25	26
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.492	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	3.178	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
							103						
							72.0						
							71.0						

27	28	29	32	34	35	37	40	41	42	44	45	46	47
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.096	N.D.	N.D.	0.073	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	0.277	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.105	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	2.087	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.		2.082	N.D.	N.D.	
N.D.		N.D.	0.339	N.D.	N.D.	N.D.	N.D.	N.D.	0.718		N.D.	N.D.	0.941
N.D.	1.904	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		1.613	N.D.	N.D.	
N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.577		N.D.	N.D.	1.123
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	126									127			
	87.0									96.3			
	85.7									96.0			

48	49	51	52	53	54	56	59	60	63	64	66	67	69
N.D.	0.399	N.D.		N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	0.2
N.D.		N.D.	0.344	N.D.	N.D.	N.D.	0.385	N.D.	N.D.	N.D.	0.588	N.D.	
N.D.	0.361	N.D.		N.D.	N.D.				N.D.			N.D.	0.177
N.D.		N.D.	0.655	N.D.	N.D.	0.133	0.25	0.101	N.D.	0.212	0.606	N.D.	
N.D.	N.D.	0.489	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	N.D.
N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	0.124	N.D.	N.D.	N.D.	0.134	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	2.53	N.D.		0.702	N.D.				N.D.			N.D.	N.D.
0.362		N.D.	3.168		N.D.	0.776	0.836	0.255	N.D.	0.757	2.043	N.D.	N.D.
	2.402	N.D.		0.731	N.D.				N.D.			N.D.	N.D.
0.395		N.D.	2.64		N.D.	0.662	0.86	0.2	N.D.	0.685	1.995	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
			96.0								98.7		
			85.3								79.0		
			84.0								78.3		

70	71	73	74	75	77	81/117	82	83	84	85	87/115	90/101	91
0.527	N.D.	N.D.		N.D.		0.131	N.D.	N.D.	0.179	N.D.	0.1		0.703
	N.D.	N.D.	0.19	N.D.	0.131		N.D.	N.D.		N.D.		1.33	
0.513	N.D.	N.D.		N.D.		0.325	N.D.	N.D.	0.395	0.141	0.179		0.255
	N.D.	N.D.	0.144	N.D.	0.13		N.D.	N.D.				1.447	
0.306	N.D.	N.D.	N.D.	N.D.	N.D.	0.12	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	0.231	N.D.
0.195	N.D.	N.D.	N.D.	N.D.	N.D.	0.107	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	0.154	N.D.
3.225		N.D.		N.D.	N.D.	0.304	N.D.	0.418	1.106	0.781	1.866		2.041
	1.164	N.D.	0.702	N.D.	N.D.		N.D.					7.064	
2.64		N.D.		N.D.	N.D.	0.342	N.D.	0.251	1.084	0.712	1.241		1.855
	1.319	N.D.	0.668	N.D.	N.D.		N.D.					6.62	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
											78.0	100.3	
											84.7	83.3	
											81.0	81.7	

92	93	95	97	99	100	103	104	105	107	110	114	118	119
0.241		0.63	N.D.	0.643	N.D.	N.D.	N.D.	0.391	0.116	0.429	N.D.	0.773	N.D.
			N.D.		N.D.	N.D.	N.D.				N.D.		N.D.
0.161		0.918	N.D.	0.603	N.D.	N.D.	N.D.	0.273	N.D.	0.584	N.D.	0.786	N.D.
			N.D.		N.D.	N.D.	N.D.		N.D.		N.D.		N.D.
N.D.		N.D.	N.D.	0.111	N.D.	N.D.	N.D.	N.D.	N.D.	0.121	N.D.	0.183	N.D.
N.D.		N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.		N.D.		N.D.
N.D.		N.D.	N.D.	0.091	N.D.	N.D.	N.D.	N.D.	N.D.	0.088	N.D.	0.165	N.D.
N.D.		N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.		N.D.		N.D.
1.748		5.955	2.85	3.39	N.D.	N.D.	N.D.	3.576	0.516	5.277	N.D.	6.538	0.374
					N.D.	N.D.	N.D.				N.D.		
1.868		4.849	2.334	3.939	N.D.	N.D.	N.D.	2.317	0.417	4.114	N.D.	5.246	0.345
					N.D.	N.D.	N.D.				N.D.		
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
										93.3			
										76.3			
										75.0			

122	123	124	126	128	129	130	131	132/153	134	135	136	137	138/163/164
N.D.		N.D.	N.D.	0.269	N.D.	N.D.	N.D.	1.651	N.D.		0.115	N.D.	1.896
N.D.	0.216	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	0.199		N.D.	
N.D.		N.D.	N.D.	0.281	N.D.	N.D.	N.D.	1.618	0.087		0.114	N.D.	1.883
N.D.	0.165	N.D.	N.D.		N.D.	N.D.	N.D.			0.17		N.D.	
N.D.		N.D.	N.D.	0.132	N.D.	N.D.	N.D.	0.281	N.D.	N.D.	N.D.	N.D.	0.542
N.D.	0.109	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	
N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.226	N.D.	N.D.	N.D.	N.D.	0.345
N.D.	0.088	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	
N.D.	N.D.	N.D.	N.D.	8.251	N.D.	N.D.	N.D.	7.416	N.D.	1.4	0.902	N.D.	6.103
N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.			N.D.	
N.D.	N.D.	N.D.	N.D.	3.99	N.D.	N.D.	N.D.	7.11	N.D.		0.74	N.D.	6.4
N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	0.612		N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								77.3					81.3
								83.3					88.7
								81.3					81.7

141	144	146	147	149	151	154	156/157	158	165	167	169	170	171
N.D.	N.D.	0.223	0.089	1.102	0.199	N.D.		N.D.	N.D.	0.193	N.D.	N.D.	N.D.
N.D.	N.D.					N.D.	0.114	N.D.	N.D.		N.D.	N.D.	N.D.
N.D.		0.204	0.087	1.091	0.187	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.	0.131					N.D.	0.117	N.D.	N.D.	N.D.	N.D.	N.D.	0.144
N.D.	N.D.	N.D.	N.D.	0.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	0.14	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	8.151	1.835	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.			N.D.	0.922	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	5.721	1.28	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.			N.D.	0.554	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
93.0					83.3							65.0	
89.3					84.0							59.3	
83.7					82.3							61.7	

172	173	174	175	176	177	178	179	180	183	184	185	187	189
N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.		0.183	N.D.	N.D.		N.D.
N.D.	N.D.	0.18	N.D.	N.D.	N.D.	N.D.	N.D.	0.352		N.D.	N.D.	0.505	N.D.
N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.		0.161	N.D.	N.D.		N.D.
N.D.	N.D.	0.149	N.D.	N.D.	N.D.	N.D.	N.D.	0.35		N.D.	N.D.	0.411	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.087	N.D.	N.D.	N.D.	0.107	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.077	N.D.	N.D.	N.D.	0.082	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.8	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	6.298	N.D.
N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	1.14	N.D.	N.D.	N.D.	N.D.	N.D.	1.495	N.D.	N.D.	N.D.	2.699	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
								80.7	84.7			82.0	
								75.3	87.3			68.3	
								77.0	76.3			64.3	

190	191	193	194	195	196	197	199	200	201	202	203	205	206
N.D.	N.D.	N.D.	0.125	N.D.	N.D.	N.D.	0.146	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	0.097	N.D.	N.D.	N.D.	0.108	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.		N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.467	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
													46.7
													43.3
													43.0

207	208
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.

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Appendix E. Sediment Trap Chemistry

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

25 January 2017

Joel Guererro
Navy – SPAWAR
Environmental Science and Applied System Branch, 536(
San Diego, CA 92152

RE: RARA

Enclosed are the results of analyses for samples received by the laboratory on 16-Sep-2016. The samples associated with this report will be held for 90 days from the date of this report. The raw data associated with this report will be held for 5 years from the date of this report. If you need us to hold onto the samples or the data longer then these specified times, you will need to notify us in writing at least 30 days before the expiration dates. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jenifer Milam
Database Manager

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

WORK ORDER SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date of Work Order
RARA-Sediment Trap-081516	6091606-01	Soil/Sediment	01-Sep-2016	16-Sep-2016

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Case Narrative

No issues were experienced during the analysis of Work Order 6091606 unless specified below.

Pesticides - dBHC and endrin aldehyde had degraded in the spiking solution resulting in low or no recoveries. However, all the analytical QC, calibration and CCVs, were within acceptable ranges indicating that these analytes would have been detected had they been present in the samples.

We have reported TOC by both Walkey Black and 9060.

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Notes and Definitions

U	Analyte included in the analysis, but not detected
RPD-04	RPD between primary and confirmation column values >40%. Per SW846 8000C, the lower result has been reported.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
Q	Value is outside of acceptance limits.
MB-01	The method blank contains analyte at a concentration above the MRL; however, concentration is less than 10% of the sample result, which is negligible according to method criteria.
M2	Sample was diluted due to matrix interference.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
Ha	This sample was extracted and/or analyzed outside of the EPA recommended holding time.
H	Sample was prepped or analyzed beyond the specified holding time
B	Analyte is found in the associated blank as well as in the sample.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-Sediment Trap-081516

6091606-01 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Solids	**51.6**	0.500	0.500	% Solids	09-Nov-2016	09-Nov-2016	% Calculation	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.367**	0.00200	0.00500	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7474	
Aluminum	**25400**	1.91	9.56	mg/kg	14-Dec-2016	14-Dec-2016	SW 846/6010	MB-01, B
Iron	**33000**	1.91	9.56	mg/kg	14-Dec-2016	14-Dec-2016	SW 846/6010	
Cadmium-111 [1]	**0.271**	0.0956	0.191	mg/kg	14-Nov-2016	15-Nov-2016	SW 846/6020	
Copper-63 [1]	**31.8**	0.0956	0.191	mg/kg	14-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-206 [1]	**34.7**	0.0956	0.191	mg/kg	14-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**47.3**	0.0956	0.191	mg/kg	14-Nov-2016	15-Nov-2016	SW 846/6020	MB-01, B
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.34**	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha
4,4´-DDE	**1.64**	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha
4,4´-DDT	**0.49**	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, RPD-04
Aldrin	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
alpha-BHC	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
alpha-Chlordane	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
beta-BHC	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
delta-BHC	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Dieldrin	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Endosulfan I	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Endosulfan II	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Endosulfan sulfate	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Endrin	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Endrin aldehyde	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Endrin ketone	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
gamma-BHC (Lindane)	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
gamma-Chlordane	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Heptachlor	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Heptachlor epoxide	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Methoxychlor	ND	0.10	0.32	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Toxaphene	ND	3.78	12.6	ug/kg dry	08-Nov-2016	21-Nov-2016	EPA 8081A	Ha, U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**4.10**		*95.5 %*	*40-125*	*08-Nov-2016*	*21-Nov-2016*	*EPA 8081A*	*Ha*
Surrogate: Decachlorobiphenyl	**3.19**		*126 %*	*40-130*	*08-Nov-2016*	*21-Nov-2016*	*EPA 8081A*	*Ha*

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-Sediment Trap-081516

6091606-01 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha, U
2-Methylnaphthalene	ND	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha, U
Acenaphthene	**3.70**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha, J
Acenaphthylene	ND	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha, U
Anthracene	**27.9**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Benzo (a) anthracene	**101**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Benzo (a) pyrene	**161**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Benzo (b) fluoranthene	**329**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Benzo (g,h,i) perylene	**102**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Benzo (k) fluoranthene	**122**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Chrysene	**186**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Dibenz (a,h) anthracene	**17.4**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Fluoranthene	**173**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Fluorene	**12.1**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Indeno (1,2,3-cd) pyrene	**117**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Naphthalene	**2.91**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha, J
Phenanthrene	**34.3**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Pyrene	**218**	1.51	4.92	ug/kg dry	08-Nov-2016	23-Nov-2016	EPA 8270C	Ha
Surrogate: 2-Fluorobiphenyl	**11**		*45.1 %*	*40-105*	*08-Nov-2016*	*23-Nov-2016*	*EPA 8270C*	*Ha*
Surrogate: Terphenyl-dl4	**20**		*65.0 %*	*30-125*	*08-Nov-2016*	*23-Nov-2016*	*EPA 8270C*	*Ha*
Wet Chemistry Analysis								
TOC (Max)	**3580**	538	673	mg/kg	28-Sep-2016	28-Sep-2016	SW9060A	
TOC (Mean)	**3510**	538	673	mg/kg	28-Sep-2016	28-Sep-2016	SW9060A	
TOC (Min)	**3370**	538	673	mg/kg	28-Sep-2016	28-Sep-2016	SW9060A	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

RARA-Sediment Trap-081516

6091606-01 (Soil/Sediment)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
TestAmerica Pittsburgh								
WALKLEY BLACK Organic Carbon, Total (TOC)								
Total Organic Carbon	**22000**	130	500	mg/Kg dry		30-Dec-2016	WALKLEY BLACK	H

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610235 - Default Prep Metals											
Blank (B610235-BLK1)					Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	ND	0.00200	0.00500	mg/kg							U
LCS (B610235-BS1)					Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	0.101	0.00200	0.00500	mg/kg	0.1000		101	75-125			
Duplicate (B610235-DUP1)		Source: 6091606-01			Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	0.334	0.00199	0.00498	mg/kg		0.367			9.45	25	
Matrix Spike (B610235-MS1)		Source: 6091606-01			Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	0.449	0.00200	0.00499	mg/kg	0.09984	0.367	81.6	75-125			
Batch B611139 - Default Prep Metals											
Blank (B611139-BLK1)					Prepared: 14-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	ND	0.100	0.200	mg/kg							U
Copper-63 [1]	ND	0.100	0.200	mg/kg							U
Lead-206 [1]	ND	0.100	0.200	mg/kg							U
Zinc-66 [1]	0.348	0.100	0.200	mg/kg							MB-01
LCS (B611139-BS1)					Prepared: 14-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	26.0	0.250	0.500	mg/kg	25.00		104	80-120			
Copper-63 [1]	51.7	0.250	0.500	mg/kg	50.00		103	80-120			
Lead-206 [1]	60.2	0.250	0.500	mg/kg	50.00		120	80-120			
Zinc-66 [1]	92.3	0.250	0.500	mg/kg	100.0		92.3	80-120			MB-01, B
Duplicate (B611139-DUP1)		Source: 6091606-01			Prepared: 14-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	0.271	0.0961	0.192	mg/kg		0.271			0.0549	20	
Copper-63 [1]	31.0	0.0961	0.192	mg/kg		31.8			2.45	20	
Lead-206 [1]	34.5	0.0961	0.192	mg/kg		34.7			0.406	20	
Zinc-66 [1]	45.9	0.0961	0.192	mg/kg		47.3			3.06	20	MB-01, B

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611139 - Default Prep Metals											
Matrix Spike (B611139-MS1)		**Source: 6091606-01**			Prepared: 14-Nov-2016 Analyzed: 15-Nov-2016						
Cadmium-111 [1]	24.8	0.246	0.493	mg/kg	24.65	0.271	99.3	80-120			
Copper-63 [1]	73.2	0.246	0.493	mg/kg	49.30	31.8	84.0	80-120			
Lead-206 [1]	91.1	0.246	0.493	mg/kg	49.30	34.7	114	80-120			
Zinc-66 [1]	126	0.246	0.493	mg/kg	98.60	47.3	80.3	80-120			MB-01, B
Batch B612050 - Default Prep Metals											
Blank (B612050-BLK1)					Prepared & Analyzed: 14-Dec-2016						
Aluminum	14.9	0.400	2.00	mg/kg							MB-01
Iron	0.749	0.400	2.00	mg/kg							J
LCS (B612050-BS1)					Prepared & Analyzed: 14-Dec-2016						
Aluminum	2490	0.400	2.00	mg/kg	2500		99.5	80-120			MB-01, B
Iron	2750	0.400	2.00	mg/kg	2500		110	80-120			
Duplicate (B612050-DUP1)		**Source: 6091606-01**			Prepared & Analyzed: 14-Dec-2016						
Aluminum	25300	1.92	9.61	mg/kg		25400			0.411	20	MB-01, B
Iron	32600	1.92	9.61	mg/kg		33000			1.18	20	
Matrix Spike (B612050-MS1)		**Source: 6091606-01**			Prepared & Analyzed: 14-Dec-2016						
Aluminum	31400	1.97	9.86	mg/kg	2465	25400	243	80-120			MB-01, QM-07, B
Iron	36000	1.97	9.86	mg/kg	2465	33000	123	80-120			QM-07

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Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611085 - EPA 3545											
Blank (B611085-BLK1)					Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
4,4'-DDD	ND	0.05	0.17	ug/kg wet							U
4,4'-DDE	ND	0.05	0.17	ug/kg wet							U
4,4'-DDT	ND	0.05	0.17	ug/kg wet							U
Aldrin	ND	0.05	0.17	ug/kg wet							U
alpha-BHC	ND	0.05	0.17	ug/kg wet							U
alpha-Chlordane	ND	0.05	0.17	ug/kg wet							U
beta-BHC	ND	0.05	0.17	ug/kg wet							U
delta-BHC	ND	0.05	0.17	ug/kg wet							U
Dieldrin	ND	0.05	0.17	ug/kg wet							U
Endosulfan I	ND	0.05	0.17	ug/kg wet							U
Endosulfan II	ND	0.05	0.17	ug/kg wet							U
Endosulfan sulfate	ND	0.05	0.17	ug/kg wet							U
Endrin	ND	0.05	0.17	ug/kg wet							U
Endrin aldehyde	ND	0.05	0.17	ug/kg wet							U
Endrin ketone	ND	0.05	0.17	ug/kg wet							U
gamma-BHC (Lindane)	ND	0.05	0.17	ug/kg wet							U
gamma-Chlordane	ND	0.05	0.17	ug/kg wet							U
Heptachlor	ND	0.05	0.17	ug/kg wet							U
Heptachlor epoxide	ND	0.05	0.17	ug/kg wet							U
Methoxychlor	ND	0.05	0.17	ug/kg wet							U
Toxaphene	ND	2.00	6.67	ug/kg wet							U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.04*			*ug/kg wet*	*2.267*		*90.0*	*40-125*			
Surrogate: Decachlorobiphenyl	*1.37*			*ug/kg wet*	*1.333*		*103*	*40-130*			
LCS (B611085-BS1)					Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
4,4'-DDD	2.1	0.05	0.17	ug/kg wet	2.667		78.0	40-125			
4,4'-DDE	2.0	0.05	0.17	ug/kg wet	2.667		76.7	40-125			
4,4'-DDT	1.7	0.05	0.17	ug/kg wet	2.667		65.2	45-125			
Aldrin	1.6	0.05	0.17	ug/kg wet	2.667		58.9	45-125			
alpha-BHC	1.6	0.05	0.17	ug/kg wet	2.667		60.4	45-125			
alpha-Chlordane	1.7	0.05	0.17	ug/kg wet	2.667		63.1	45-120			
beta-BHC	1.5	0.05	0.17	ug/kg wet	2.667		58.0	40-100			
delta-BHC	0.8	0.05	0.17	ug/kg wet	2.000		40.1	45-130			
Dieldrin	1.7	0.05	0.17	ug/kg wet	2.667		64.3	50-125			
Endosulfan I	1.7	0.05	0.17	ug/kg wet	2.667		63.5	30-130			
Endosulfan II	1.6	0.05	0.17	ug/kg wet	2.667		59.5	30-140			
Endosulfan sulfate	1.3	0.05	0.17	ug/kg wet	2.667		50.1	50-145			
Endrin	1.8	0.05	0.17	ug/kg wet	2.667		67.3	50-125			
Endrin aldehyde	0.08	0.05	0.17	ug/kg wet	2.667		2.82	30-145			J
Endrin ketone	1.8	0.05	0.17	ug/kg wet	2.667		66.3	55-135			
gamma-BHC (Lindane)	1.6	0.05	0.17	ug/kg wet	2.667		61.2	45-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611085 - EPA 3545											
LCS (B611085-BS1)					Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
gamma-Chlordane	1.6	0.05	0.17	ug/kg wet	2.667		60.0	50-125			
Heptachlor	1.6	0.05	0.17	ug/kg wet	2.667		60.3	50-125			
Heptachlor epoxide	1.7	0.05	0.17	ug/kg wet	2.667		65.0	50-125			
Methoxychlor	1.7	0.05	0.17	ug/kg wet	2.667		62.2	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*1.81*			*ug/kg wet*	*2.267*		*79.9*	*40-125*			
Surrogate: Decachlorobiphenyl	*1.36*			*ug/kg wet*	*1.333*		*102*	*40-130*			
LCS (B611085-BS3)					Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
Toxaphene	43.7	2.00	6.67	ug/kg wet	53.33		82.0	50-125			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.03*			*ug/kg wet*	*2.267*		*89.4*	*40-125*			
Surrogate: Decachlorobiphenyl	*1.41*			*ug/kg wet*	*1.333*		*106*	*40-130*			
LCS Dup (B611085-BSD3)					Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
Toxaphene	47.5	2.00	6.67	ug/kg wet	53.33		89.0	50-125	8.19	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.13*			*ug/kg wet*	*2.267*		*94.1*	*40-125*			
Surrogate: Decachlorobiphenyl	*1.57*			*ug/kg wet*	*1.333*		*118*	*40-130*			
Matrix Spike (B611085-MS1)	**Source: 6091606-01**				Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
4,4´-DDD	3.6	0.10	0.32	ug/kg dry	5.131	0.3	62.7	40-125			
4,4´-DDE	4.7	0.10	0.32	ug/kg dry	5.131	1.6	59.4	40-125			
4,4´-DDT	5.0	0.10	0.32	ug/kg dry	5.131	0.5	87.0	45-125			
Aldrin	2.5	0.10	0.32	ug/kg dry	5.131	ND	49.4	45-110			
alpha-BHC	2.5	0.10	0.32	ug/kg dry	5.131	ND	48.6	45-125			
alpha-Chlordane	2.6	0.10	0.32	ug/kg dry	5.131	ND	50.3	45-120			
beta-BHC	2.5	0.10	0.32	ug/kg dry	5.131	ND	49.2	40-100			
delta-BHC	1.1	0.10	0.32	ug/kg dry	3.848	ND	29.4	45-125			
Dieldrin	3.5	0.10	0.32	ug/kg dry	5.131	ND	67.8	50-125			
Endosulfan I	2.6	0.10	0.32	ug/kg dry	5.131	ND	50.4	30-135			
Endosulfan II	2.5	0.10	0.32	ug/kg dry	5.131	ND	48.1	30-140			
Endosulfan sulfate	2.7	0.10	0.32	ug/kg dry	5.131	ND	53.5	50-135			
Endrin	2.7	0.10	0.32	ug/kg dry	5.131	ND	52.9	50-125			
Endrin aldehyde	0.8	0.10	0.32	ug/kg dry	5.131	ND	16.5	30-145			
Endrin ketone	2.8	0.10	0.32	ug/kg dry	5.131	ND	55.5	55-135			
gamma-BHC (Lindane)	2.5	0.10	0.32	ug/kg dry	5.131	ND	48.3	45-125			
gamma-Chlordane	2.8	0.10	0.32	ug/kg dry	5.131	ND	55.5	50-125			
Heptachlor	2.8	0.10	0.32	ug/kg dry	5.131	ND	55.0	50-125			
Heptachlor epoxide	3.5	0.10	0.32	ug/kg dry	5.131	ND	68.3	40-125			
Methoxychlor	3.1	0.10	0.32	ug/kg dry	5.131	ND	60.5	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.80*			*ug/kg dry*	*4.361*		*64.2*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.40*			*ug/kg dry*	*2.565*		*93.4*	*40-130*			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611085 - EPA 3545											
Matrix Spike Dup (B611085-MSD1)		**Source: 6091606-01**			Prepared: 08-Nov-2016 Analyzed: 21-Nov-2016						
4,4'-DDD	3.7	0.10	0.32	ug/kg dry	5.131	0.3	65.5	40-125	4.06	30	
4,4'-DDE	4.5	0.10	0.32	ug/kg dry	5.131	1.6	55.5	40-125	4.36	30	
4,4'-DDT	4.8	0.10	0.32	ug/kg dry	5.131	0.5	84.5	45-125	2.62	30	
Aldrin	2.6	0.10	0.32	ug/kg dry	5.131	ND	50.5	45-110	2.31	30	
alpha-BHC	2.6	0.10	0.32	ug/kg dry	5.131	ND	50.9	45-125	4.76	30	
alpha-Chlordane	2.6	0.10	0.32	ug/kg dry	5.131	ND	51.4	45-120	2.25	30	
beta-BHC	2.7	0.10	0.32	ug/kg dry	5.131	ND	51.7	40-100	5.00	30	
delta-BHC	1.4	0.10	0.32	ug/kg dry	3.848	ND	36.0	45-125	20.2	30	
Dieldrin	3.3	0.10	0.32	ug/kg dry	5.131	ND	65.1	50-125	3.95	30	
Endosulfan I	2.6	0.10	0.32	ug/kg dry	5.131	ND	51.5	30-135	2.16	30	
Endosulfan II	2.6	0.10	0.32	ug/kg dry	5.131	ND	51.1	30-140	6.05	30	
Endosulfan sulfate	3.4	0.10	0.32	ug/kg dry	5.131	ND	65.6	50-135	20.3	30	
Endrin	2.8	0.10	0.32	ug/kg dry	5.131	ND	55.5	50-125	4.87	30	
Endrin aldehyde	1.5	0.10	0.32	ug/kg dry	5.131	ND	29.6	30-145	57.1	30	
Endrin ketone	3.2	0.10	0.32	ug/kg dry	5.131	ND	61.5	55-135	10.3	30	
gamma-BHC (Lindane)	2.6	0.10	0.32	ug/kg dry	5.131	ND	50.3	45-125	4.12	30	
gamma-Chlordane	2.8	0.10	0.32	ug/kg dry	5.131	ND	54.9	50-125	1.16	30	
Heptachlor	2.6	0.10	0.32	ug/kg dry	5.131	ND	50.7	50-125	8.21	30	
Heptachlor epoxide	2.7	0.10	0.32	ug/kg dry	5.131	ND	53.0	40-125	25.2	30	
Methoxychlor	2.9	0.10	0.32	ug/kg dry	5.131	ND	56.5	55-145	6.87	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.89*			*ug/kg dry*	*4.361*		*66.3*	*40-125*			
Surrogate: Decachlorobiphenyl	*2.55*			*ug/kg dry*	*2.565*		*99.3*	*40-130*			

USACE ERDC-EP-C
3909 Halls Ferry Road
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611085 - EPA 3545											
Blank (B611085-BLK1)					Prepared: 08-Nov-2016 Analyzed: 23-Nov-2016						
1-Methylnaphthalene	ND	0.800	2.60	ug/kg wet							U
2-Methylnaphthalene	ND	0.800	2.60	ug/kg wet							U
Acenaphthene	ND	0.800	2.60	ug/kg wet							U
Acenaphthylene	ND	0.800	2.60	ug/kg wet							U
Anthracene	ND	0.800	2.60	ug/kg wet							U
Benzo (a) anthracene	ND	0.800	2.60	ug/kg wet							U
Benzo (a) pyrene	ND	0.800	2.60	ug/kg wet							U
Benzo (b) fluoranthene	ND	0.800	2.60	ug/kg wet							U
Benzo (g,h,i) perylene	ND	0.800	2.60	ug/kg wet							U
Benzo (k) fluoranthene	ND	0.800	2.60	ug/kg wet							U
Chrysene	ND	0.800	2.60	ug/kg wet							U
Dibenz (a,h) anthracene	ND	0.800	2.60	ug/kg wet							U
Fluoranthene	ND	0.800	2.60	ug/kg wet							U
Fluorene	ND	0.800	2.60	ug/kg wet							U
Indeno (1,2,3-cd) pyrene	ND	0.800	2.60	ug/kg wet							U
Naphthalene	ND	0.800	2.60	ug/kg wet							U
Phenanthrene	ND	0.800	2.60	ug/kg wet							U
Pyrene	ND	0.800	2.60	ug/kg wet							U
Surrogate: 2-Fluorobiphenyl	*11*			*ug/kg wet*	*13.33*		*80.6*	*40-105*			
Surrogate: Terphenyl-dl4	*11*			*ug/kg wet*	*16.00*		*69.7*	*30-125*			
LCS (B611085-BS1)					Prepared: 08-Nov-2016 Analyzed: 23-Nov-2016						
1-Methylnaphthalene	48.8	0.800	2.60	ug/kg wet	80.00		61.0	40-105			
2-Methylnaphthalene	48.6	0.800	2.60	ug/kg wet	80.00		60.7	40-105			
Acenaphthene	56.1	0.800	2.60	ug/kg wet	80.00		70.2	45-110			
Acenaphthylene	53.8	0.800	2.60	ug/kg wet	80.00		67.2	45-110			
Anthracene	57.1	0.800	2.60	ug/kg wet	80.00		71.3	50-115			
Benzo (a) anthracene	65.4	0.800	2.60	ug/kg wet	80.00		81.7	50-125			
Benzo (a) pyrene	62.8	0.800	2.60	ug/kg wet	80.00		78.6	50-130			
Benzo (b) fluoranthene	73.0	0.800	2.60	ug/kg wet	80.00		91.3	45-130			
Benzo (g,h,i) perylene	68.3	0.800	2.60	ug/kg wet	80.00		85.3	40-125			
Benzo (k) fluoranthene	64.6	0.800	2.60	ug/kg wet	80.00		80.8	45-130			
Chrysene	68.4	0.800	2.60	ug/kg wet	80.00		85.5	50-125			
Dibenz (a,h) anthracene	70.4	0.800	2.60	ug/kg wet	80.00		88.0	40-125			
Fluoranthene	52.1	0.800	2.60	ug/kg wet	80.00		65.1	50-120			
Fluorene	61.3	0.800	2.60	ug/kg wet	80.00		76.6	50-110			
Indeno (1,2,3-cd) pyrene	71.7	0.800	2.60	ug/kg wet	80.00		89.6	40-125			
Naphthalene	50.6	0.800	2.60	ug/kg wet	80.00		63.3	40-105			
Phenanthrene	57.4	0.800	2.60	ug/kg wet	80.00		71.7	50-130			
Pyrene	61.5	0.800	2.60	ug/kg wet	80.00		76.9	45-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611085 - EPA 3545											
LCS (B611085-BS1)					Prepared: 08-Nov-2016 Analyzed: 23-Nov-2016						
Surrogate: 2-Fluorobiphenyl	*10*			*ug/kg wet*	*13.33*		*77.5*	*40-105*			
Surrogate: Terphenyl-dl4	*12*			*ug/kg wet*	*16.00*		*73.6*	*30-125*			
Matrix Spike (B611085-MS1)		**Source: 6091606-01**			Prepared: 08-Nov-2016 Analyzed: 23-Nov-2016						
1-Methylnaphthalene	63.1	1.54	5.00	ug/kg dry	153.9	ND	41.0	40-105			
2-Methylnaphthalene	63.4	1.54	5.00	ug/kg dry	153.9	ND	41.2	40-105			
Acenaphthene	85.2	1.54	5.00	ug/kg dry	153.9	3.70	52.9	45-110			
Acenaphthylene	72.6	1.54	5.00	ug/kg dry	153.9	ND	47.2	45-110			
Anthracene	90.6	1.54	5.00	ug/kg dry	153.9	27.9	40.7	50-115			QM-07
Benzo (a) anthracene	179	1.54	5.00	ug/kg dry	153.9	101	51.1	50-125			
Benzo (a) pyrene	253	1.54	5.00	ug/kg dry	153.9	161	59.8	50-130			
Benzo (b) fluoranthene	438	1.54	5.00	ug/kg dry	153.9	329	70.9	45-130			
Benzo (g,h,i) perylene	180	1.54	5.00	ug/kg dry	153.9	102	50.2	40-125			
Benzo (k) fluoranthene	246	1.54	5.00	ug/kg dry	153.9	122	80.9	45-130			
Chrysene	299	1.54	5.00	ug/kg dry	153.9	186	73.4	50-125			
Dibenz (a,h) anthracene	110	1.54	5.00	ug/kg dry	153.9	17.4	60.0	40-125			
Fluoranthene	339	1.54	5.00	ug/kg dry	153.9	173	108	50-120			
Fluorene	123	1.54	5.00	ug/kg dry	153.9	12.1	72.1	50-110			
Indeno (1,2,3-cd) pyrene	220	1.54	5.00	ug/kg dry	153.9	117	66.9	40-125			
Naphthalene	59.8	1.54	5.00	ug/kg dry	153.9	2.91	36.9	40-105			QM-07
Phenanthrene	146	1.54	5.00	ug/kg dry	153.9	34.3	72.4	50-130			
Pyrene	323	1.54	5.00	ug/kg dry	153.9	218	67.9	45-125			
Surrogate: 2-Fluorobiphenyl	*12*			*ug/kg dry*	*25.65*		*48.3*	*40-105*			
Surrogate: Terphenyl-dl4	*19*			*ug/kg dry*	*30.79*		*62.2*	*30-125*			
Matrix Spike Dup (B611085-MSD1)		**Source: 6091606-01**			Prepared: 08-Nov-2016 Analyzed: 23-Nov-2016						
1-Methylnaphthalene	75.4	1.54	5.00	ug/kg dry	153.9	ND	49.0	40-105	17.8	30	
2-Methylnaphthalene	77.0	1.54	5.00	ug/kg dry	153.9	ND	50.0	40-105	19.4	30	
Acenaphthene	90.8	1.54	5.00	ug/kg dry	153.9	3.70	56.6	45-110	6.41	30	
Acenaphthylene	76.2	1.54	5.00	ug/kg dry	153.9	ND	49.5	45-110	4.83	30	
Anthracene	101	1.54	5.00	ug/kg dry	153.9	27.9	47.7	50-115	11.2	30	QM-07
Benzo (a) anthracene	201	1.54	5.00	ug/kg dry	153.9	101	65.2	50-125	11.5	30	
Benzo (a) pyrene	263	1.54	5.00	ug/kg dry	153.9	161	65.8	50-130	3.60	30	
Benzo (b) fluoranthene	464	1.54	5.00	ug/kg dry	153.9	329	88.0	45-130	5.84	30	
Benzo (g,h,i) perylene	182	1.54	5.00	ug/kg dry	153.9	102	51.5	40-125	1.13	30	
Benzo (k) fluoranthene	259	1.54	5.00	ug/kg dry	153.9	122	89.2	45-130	5.10	30	
Chrysene	313	1.54	5.00	ug/kg dry	153.9	186	83.0	50-125	4.84	30	
Dibenz (a,h) anthracene	109	1.54	5.00	ug/kg dry	153.9	17.4	59.8	40-125	0.323	30	
Fluoranthene	393	1.54	5.00	ug/kg dry	153.9	173	142	50-120	14.5	30	Q
Fluorene	115	1.54	5.00	ug/kg dry	153.9	12.1	67.1	50-110	6.45	30	
Indeno (1,2,3-cd) pyrene	219	1.54	5.00	ug/kg dry	153.9	117	65.9	40-125	0.706	30	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611085 - EPA 3545											
Matrix Spike Dup (B611085-MSD1)		**Source: 6091606-01**			Prepared: 08-Nov-2016 Analyzed: 23-Nov-2016						
Naphthalene	68.0	1.54	5.00	ug/kg dry	153.9	2.91	42.3	40-105	12.9	30	
Phenanthrene	150	1.54	5.00	ug/kg dry	153.9	34.3	75.0	50-130	2.69	30	
Pyrene	414	1.54	5.00	ug/kg dry	153.9	218	127	45-125	24.8	30	Q
Surrogate: 2-Fluorobiphenyl	*14*			*ug/kg dry*	*25.65*		*54.0*	*40-105*			
Surrogate: Terphenyl-d14	*22*			*ug/kg dry*	*30.79*		*71.5*	*30-125*			

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

Wet Chemistry Analysis - Quality Control

Air Water and Soil Laboratories, Inc.

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BZI0754 - No Prep											
Blank (BZI0754-BLK1)					Prepared & Analyzed: 28-Sep-2016						
TOC (Max)	ND	77.5	100	mg/kg				-			
TOC (Mean)	ND	77.5	100	mg/kg				-			
TOC (Min)	ND	77.5	100	mg/kg				-			
LCS (BZI0754-BS1)					Prepared & Analyzed: 28-Sep-2016						
TOC (Max)	832	65.3	100	mg/kg	816		102	80-120			
TOC (Mean)	832	65.3	100	mg/kg	816		102	80-120			
TOC (Min)	832	65.3	100	mg/kg	816		102	80-120			
LCS Dup (BZI0754-BSD1)					Prepared & Analyzed: 28-Sep-2016						
TOC (Max)	995	79.1	100	mg/kg	988		101	80-120	17.9	20	
TOC (Mean)	995	79.1	100	mg/kg	988		101	80-120	17.9	20	
TOC (Min)	995	79.1	100	mg/kg	988		101	80-120	17.9	20	
Matrix Spike (BZI0754-MS1)		**Source: 16I0611-01**			Prepared & Analyzed: 28-Sep-2016						
TOC (Max)	4910	549	586	mg/kg	6860	3580	19.4	80-120			M2
TOC (Mean)	4900	549	586	mg/kg	6860	3510	20.3	80-120			M2
TOC (Min)	4890	549	586	mg/kg	6860	3370	22.1	80-120			M2
Matrix Spike Dup (BZI0754-MSD1)		**Source: 16I0611-01**			Prepared & Analyzed: 28-Sep-2016						
TOC (Max)	5270	568	710	mg/kg	7100	3580	23.7	80-120	7.04	20	M2
TOC (Mean)	5250	568	710	mg/kg	7100	3510	24.5	80-120	6.89	20	M2
TOC (Min)	5230	568	710	mg/kg	7100	3370	26.2	80-120	6.74	20	M2

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	25-Jan-2017

WALKLEY_BLACK Organic Carbon, Total (TOC) - Quality Control

TestAmerica Pittsburgh

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 198708 -											
LCS (180-1987081)					Prepared: Analyzed: 30-Dec-2016						
Total Organic Carbon	490000	67	250	mg/Kg	471000		104	80-120			
MB (180-1987082)					Prepared: Analyzed: 30-Dec-2016						
Total Organic Carbon	ND	67	250	mg/Kg				-			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

SPAWAR SYSTEMS CENTER PACIFIC
ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY
BRANCH, CODE 7176
53475 STROTHE ROAD
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 16-Sep-2016
Page: of

Project Title: ESTCP Remedy and Recontamination Assessment (RARA) Array DemVal						**Project PI:** Dr. D. Bart Chadwick					
Remarks						**Contact:** Ernie Arias					
Sampler(s): (Signature)	Ernie Arias Code 71750					**Contact Tel:** (619) 553-3579					
Tel: 619-553-3579	**Fax:** 619-553-6305		**Email:** ernie.arias@navy.mil			**Analyses**					
Special Instructions/Comments: Kept dark & cold (4 °C)	2 jars, 1 sample										
Field Sample Identification	**Start Date/Time Deployment**	**End Date/Time Separation**	**Matrix**	**Type**	**Pres.**	PCB congeners [8082A / 3510]	PAHs [8270D / 3510]	Pesticides [8081B / 3535]	TOC [9060]	Al,Cd,Cu,Fe,Pb,Zn [6020A]	Hg [7471B}
RARA-Sediment Trap - 081516	07-18-2016	09-01-2016	sediment	Comp	none	X	X	X	X	X	X
					TOTAL	7					

Relinquished by: *Ernie Arias*	**(Signature)** Ernest Arias	**Date:** 09/15/2016	**Time:** 0830
Received by:	**(Signature)**	**Date:**	**Time:**

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception
			Data included from: W:\TransferIn\6091606 TRANSFER 25 Jan 2017 1545.mdb
			Data included from: W:\TransferIn\6091606 TRANSFER 28 Nov 2016 1018.mdb

Sediment

Units - ug/kg		Det Limit	Report Limit	%Rec TMX	%Rec 209	1	3	4	5	6
RARA sediment trap 081516	6091606-01	0.08	0.25	54.8	57.6	ND	ND	ND	ND	ND
	BLK	0.08	0.25	65.3	68.5	ND	ND	ND	ND	ND
	BS %Rec			59.4	64.7				63	
	MS %Rec			58.8	50.8				61.59	
	MSD %Rec			60.6	56.4				62.67	

7	8	9	10	12	13	15	16	17	18	19	20	22	24
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
									57.7				
									66.28				
									65.33				

25	26	27	28/31	29	31	32	33	34	35	37	40	41	42
ND	ND	ND	**0.28**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
			73										
			66.15										
			68.00										

44	45	46	47	48	49	51	52	53	54	56	59	60	63
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
78							61						
79.95							61.46						
84.67							70.27						

64	66	67	69	70	71	73	74	75	77	81	82	83	84
ND	**1.75**	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
	69.7												
	51.95												
	55.07												

85	87	90/101	91	92	93	95	97	99	100	103	105	107	110
ND	ND	**1.72**	ND	ND		**0.647**	ND	**0.785**	ND	ND	**0.423**	ND	**1.31**
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	72.3	72.3											70.3
	62.63	61.85											56.77
	69.47	66.00											62.13

114	115	117	118	119	122	123	124	126	128	129	130	131	132/153
ND	ND	ND	**0.835**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.93**
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
													61.7
													46.48
													50.13

134	135	136	137	138	141	144	146	147	149	151	154	156	157
ND	ND	ND	ND	**2.95**	ND	ND	ND	ND	**1.35**	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
				70.7	70.3					68.3			
					59.11					65.36			
					61.87					68.27			

158	163	164	165	167	169	170	171	172	173	174	175	176	177
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
						77.3							
						75.00							
						76.53							

178	179	180	183	184	185	187	189	190	191	193	194	195	196
ND	ND	**0.963**	**0.332**	ND	ND	**0.855**	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		62.3	67.7			62.3							
		56.90	59.38			58.85							
		60.53	58.00			62.00							

197	199	200	201	202	203	205	206	207	208
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
							64		
							59.77		
							57.87		

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Appendix F. DGT Chemistry

T-Mid Results

FIRST RARA DEPLOYMENT

Sample ID	Copper (µg/L)	Copper Std Dev (µg/L)	Zinc (µg/L)	Zinc Std Dev (µg/L)	Cadmium (µg/L)	Cadmium Std Dev (µg/L)	Lead (µg/L)	Lead Std Dev (µg/L)
RARA BKA	2.21		18		0.99		0.27	
RARA BKB	1.63		12		1.16		0.21	
RARA 1A	48		422		1.57		9.12	
RARA 1B DUP	40	11	497	169	1.04	0.0016	8.81	0.49
RARA 2A	34		257		0.90		5.40	
RARA 2B	126		458		0.95		3.29	
RARA 3A	62		312		1.97		16.08	
RARA 3B	79		405		3.17		26.72	
RARA 4A	149		281		0.96		5.23	
RARA 4B	712		753		3.35		22.53	
RARA 5A	1372		1407		1.15		50.78	
RARA 5B	136		471		0.34		6.03	
RARA 6A	139		892		0.49		10.53	
RARA 6B	101		218		0.29		10.96	
QA/QC								
Mean Blanks	0.030		0.21		0.029		0.008	
Stdev Blanks	0.035		0.264		0.025		0.012	
LOD (3*SD)	0.10		0.79		0.074		0.035	
LOR (10*SD)	0.35		2.64		0.247		0.12	
Mean Recovery SRM 1643e (%)	90		104		107		94	
StdDev SRM1643e (%)	12		17		4		3	
Number of SRMs	4		3		5		5	
Run duplicate recovery (%)	67		61		100		92	
Spike recovery (%)	117		59		98		91	

Negative values highlighted in pale yellow are not different than Zero concentration. Meaning that the ICP MS is not able to detect the concentration.

Porewater Copper (µg/L)	Porewater Zinc (µg/L)	Porewater Cadmium (µg/L)	Porewater Lead (µg/L)
0.022	0.18	0.010	0.0021
0.016	0.13	0.012	0.0016
0.47	4.33	0.016	0.070
0.39	5.10	0.010	0.068
0.34	2.63	0.0089	0.041
1.24	4.70	0.009	0.025
0.61	3.19	0.020	0.12
0.78	4.14	0.032	0.20
1.47	2.88	0.010	0.040
7.01	7.72	0.033	0.17
13.47	14.38	0.011	0.39
1.34	4.82	0.0034	0.046
1.36	9.13	0.0049	0.081
0.99	2.23	0.0029	0.084

T-Final Results

SECOND RARA DEPLOYMENT

Sample ID	Copper (µg/L)	Copper Std Dev (µg/L)	Zinc (µg/L)	Zinc Std Dev (µg/L)	Cadmium (µg/L)	Cadmium Std Dev (µg/L)	Lead (µg/L)	Lead Std Dev (µg/L)
RARA BKA	1.29		50		0.30		1.51	
RARA BKB	0.85		22		0.18		1.45	
RARA 1A	15		158		0.38		5.69	
RARA 1B DUP	24	1.65	232	21	0.93	0.028	6.26	0.29
RARA 2A	23		197		0.66		9.58	
RARA 2B	20		153		0.53		6.90	
RARA 3A	43		151		0.49		7.36	
RARA 3B	54		115		0.36		10.19	
RARA 4A	19		124		0.37		2.71	
RARA 4B	21		142		0.44		2.38	
RARA 5A	105		624		0.88		10.17	
RARA 5B	55		146		0.32		10.98	
RARA 6A	52		204		0.67		12.20	
RARA 6B	113		380		1.29		27.48	
QA/QC								
Mean Blanks	-0.0028		0.57		0.0047		0.036	
Stdev Blanks	0.0029		0.053		0.0010		0.026	
LOD (3*SD)	0.0088		0.16		0.0030		0.078	
LOR (10*SD)	0.029		0.53		0.010		0.26	
Mean Recovery SRM 1643e (%)	106		87		100		94	
StdDev SRM1643e (%)	5		4		6		2	
Number of SRMs	5		5		5		5	
Run duplicate recovery (%)	110		113		104		107	
Spike recovery (%)	188		151		109		110	

Porewater Copper (µg/L)	Porewater Zinc (µg/L)	Porewater Cadmium (µg/L)	Porewater Lead (µg/L)
0.014	0.55	0.0032	0.012
0.0090	0.24	0.0019	0.012
0.16	1.74	0.0041	0.047
0.26	2.56	0.010	0.051
0.24	2.16	0.0070	0.079
0.21	1.68	0.0057	0.057
0.46	1.66	0.0052	0.061
0.58	1.27	0.0039	0.084
0.21	1.37	0.0040	0.022
0.22	1.57	0.0048	0.020
1.11	6.87	0.0095	0.084
0.59	1.61	0.0034	0.090
0.55	2.24	0.0072	0.10
1.20	4.18	0.014	0.23

Deployment temperature set to 20
Average termperature 20.4

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Appendix G. SP3 Chemistry

T-Mid Results

130 Research Lane, Ste 2
Guelph ON N1G 5G3
(519) 822-2265

Certificate of Analysis
Concentrations of Freely-Dissolved Analytes
Measured via SP3™ Passive Samplers

Customer: SSC Pacific

SiREM Reference: WSN-4801

Project: RARA Round 1

Final Report Issued: December 16, 2016

Customer Project: HE1551 Phase 04

Site Sampling Date: May 24 to June 21, 2016

Introduction

This report supercedes the report dated December 13, 2016. This report presents the results for 7 SP3™ passive samples associated with sampler deployment at 6 locations for the Remedy and Recontamination Assessment Array (RARA) project in San Diego Bay, San Diego, California. The samplers were deployed on May 24, 2016 and retrieved on June 21, 2016 to measure freely-dissolved concentrations (C_{free}) of organochlorine pesticides (OCP), polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) in sediments. The data analysis steps are provided in Attachment A and the Engineer Research and Development Center (ERDC) Environmental Laboratory report is provided in Attachment B.

Sample Summary

Client Sample ID	Sampler Deployment Date	Sampler Collection Date	Analysis
RARA-SPME 1-062116	May 24, 2016	June 21, 2016	PCB, PAH, OCP
RARA-SPME 2-062116	May 24, 2016	June 21, 2016	PCB, PAH, OCP
RARA-SPME 3-062116	May 24, 2016	June 21, 2016	PCB, PAH, OCP
RARA-SPME 4-062116	May 24, 2016	June 21, 2016	PCB, PAH, OCP
RARA-SPME 5-062116	May 24, 2016	June 21, 2016	PCB, PAH, OCP
RARA-SPME 6-062116	May 24, 2016	June 21, 2016	PCB, PAH, OCP
RARA-SPME TB-062116	Not Deployed	June 21, 2016	PCB, PAH, OCP

siremlab.com

Sampler Design, Deployment, and Chemical Analysis

The SP3™ custom sampler design for this project consisted of a 4 × 10 centimeter (cm) sheet of 17 micrometer (µm) thick low density polyethylene (PE) housed in a stainless steel mesh envelope attached to a galvanized steel support plate. The PE was spiked with the Performance Reference Compounds (PRCs) consisting of rare PCBs congeners assumed to: 1) not be present in the media in which the samplers were deployed, or 2) present at concentrations so low as to be inconsequential, not affect calculations involving PRCs, and insignificant compared to the concentration of other freely-dissolved PCBs in the media sampled. The PRCs used for this project were: PCB-14, PCB-36, PCB-78, PCB-104, PCB-121, PCB-142, PCB-155, PCB-192, and PCB-204[1].

Six samplers (labeled on chain of custody as RARA-SPME 1-062116 to RARA-SPME 6-062116) were deployed in the surficial sediment by SSC Pacific on May 24, 2016 and retrieved on June 21, 2016. The Sample IDs were incorrectly labeled as "SPME" in the field which seems to indicate solid phase microextraction was used, however the samplers were polyethylene. The deployment time for each sampler was 28 days, within the minimum recommended period. The samplers were placed in an opaque resealable bag, then placed in a resealable plastic bag, and packaged in a cooler with ice or ice packs for overnight shipment to ERDC Environmental Laboratory by the field personnel. One trip blank (sample ID RARA-SPME TB-062116) was not deployed in sediment, but remained in original packaging under cold storage (approximately 4 degrees Celsius [°C]). The trip blank was removed from the packaging by field personnel, exposed to ambient field conditions for approximately 5 minutes, and packaged for shipment in the same manner as the deployed samplers.

Processing of the samplers by ERDC Environmental Laboratory included removal the PE from the stainless steel mesh envelope, wiping any visible sediment from the PE using a moist tissue, and determination of the concentrations in PE of PCB congeners by EPA method 8082A, PAHs by EPA method 8270C, and pesticides by EPA method 8081A. The analytical report provided by ERDC Environmental Laboratory is attached to this report (Attachment B).

Results

C_{free} values are reported in Table 1. As noted in the ERDC Environmental Laboratory report (Attachment B), the samples arrived to the laboratory at 10.5°C, above the recommended temperature of 4°C. It is also noted the OCP and PAH analyses were reran.

It should be noted that the concentrations of several PRCs (PCB-14, PCB-104, and PCB-121) in the samplers exposed to field sediments appeared to be elevated relative

[1] PCB shorthand nomenclature used in this report follows the Chemical Abstract Service (CAS) nomenclature used by USEPA (2003): United States Environmental Protection Agency (USEPA). 2003. Table of PCB Species by Congener Number.

to the trip blank. These results are unexpected based on experience with these PRCs, as analyzed in samplers by multiple laboratories in multiple sites, including San Diego Bay.

PRC data associated with sample 6 was extremely unusual and indicated sampling conditions were insufficient to reach levels of steady state normally observed in the SP3 samplers. The PRC data with this sampler was not considered reliable; therefore, the average k_e values (where calculated) from samples 1 to 5 has been applied to sample 6 to correct concentrations for non-equilibrium conditions. This assumes that the conditions for samplers 1 through 5 apply to sample 6.

It should also be noted the sample IDs in the PCB congener results from ERDC ('6062402 Navy SPAWAR RARA FINAL Congeners.xlsx') are not identical to the chain of custody or PAH and OCP results from ERDC ('6062402 Navy SPAWAR RARA FINAL.xls'). ERDC has not yet confirmed the assumptions on the sample IDs in the table below are correct; therefore, this report may be revised if the assumptions in the table below are not correct.

Assumptions on Sample IDs from PCB Congener Results

Sample ID in the PCB Congener Results	Sample ID in the PAH/Pesticide Results
SPME 1 062116	RARA-SPME 1 -062116
SPME 2 062116	RARA-SPME 2-062116
SPME 3 062116	RARA-SPME 3-062116
SPME 4 062116	RARA-SPME 4-062116
SPME 5 062116	RARA-SPME 5-062116
SPME 6 062116	RARA-SPME 6-062116
SPME 7 062116	RARA-SPME TB-062116

3

TABLE 1

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 1 -062116			RARA-SPME 2-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
1-Methylnaphthalene	PAH			U	65000		U	140000
2-Methylnaphthalene	PAH			U	61000		U	130000
Acenaphthene	PAH			U	34000		U	71000
Acenaphthylene	PAH			U	42000		U	87000
Anthracene	PAH			U	10000		U	20000
Benzo(a)anthracene	PAH		1400	J	730	1600	J	980
Benzo(a)pyrene	PAH		610	J	240	970		270
Benzo(b)fluoranthene	PAH		1200		240	2200		270
Benzo(ghi)perylene	PAH			U	35		U	28
Benzo(k)fluoranthene	PAH		1100		240	1800		270
Chrysene	PAH		1700	J	730	2100	J	980
Dibenz(a,h)anthracene	PAH			U	200		U	220
Fluoranthene	PAH		16000		2700	30000		4400
Fluorene	PAH			U	19000		U	37000
Indeno(1,2,3-cd)pyrene	PAH			U	140		U	140
Naphthalene	PAH			U	140000		U	320000
Phenanthrene	PAH			U	10000		U	20000
Pyrene	PAH		26000		2700	31000		4400
PCB-1	PCB			U	1300		U	2500
PCB-3	PCB			U	220		U	360
PCB-4	PCB			U	490		U	890
PCB-5	PCB			U	210		U	340
PCB-6	PCB			U	210		U	340
PCB-7	PCB			U	210		U	340
PCB-8	PCB			U	210		U	340
PCB-9	PCB			U	210		U	340
PCB-10	PCB			U	490		U	890
PCB-12	PCB			U	87		U	130
PCB-13	PCB			U	87		U	130
PCB-14	PCB	PRC						
PCB-15	PCB			U	87		U	130
PCB-16	PCB			U	110		U	160
PCB-17	PCB			U	110		U	160
PCB-18	PCB			U	110		U	160
PCB-19	PCB			U	190		U	310
PCB-20	PCB			U	61		U	87
PCB-22	PCB			U	61		U	87
PCB-24	PCB			U	110		U	160
PCB-25	PCB			U	61		U	87
PCB-26	PCB			U	61		U	87
PCB-27	PCB			U	110		U	160
PCB-28	PCB			U	61		U	87
PCB-29	PCB			U	61		U	87

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 1 -062116			RARA-SPME 2-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-31	PCB			U	61		U	87
PCB-32	PCB			U	110		U	160
PCB-33	PCB			U	61		U	87
PCB-34	PCB			U	61		U	87
PCB-35	PCB			U	35		U	46
PCB-36	PCB	PRC						
PCB-37	PCB			U	35		U	46
PCB-40	PCB			U	32		U	42
PCB-41	PCB			U	32		U	42
PCB-42	PCB			U	32		U	42
PCB-44	PCB			U	32		U	42
PCB-45	PCB			U	50		U	69
PCB-46	PCB			U	50		U	69
PCB-47	PCB			U	32		U	42
PCB-48	PCB			U	32		U	42
PCB-49	PCB		96	J	32		U	42
PCB-51	PCB			U	50		U	69
PCB-52	PCB		100		32	330		42
PCB-53	PCB			U	50		U	69
PCB-54	PCB			U	51		U	70
PCB-56	PCB			U	22		U	26
PCB-59	PCB			U	32		U	42
PCB-60	PCB			U	22		U	26
PCB-63	PCB			U	22		U	26
PCB-64	PCB			U	32		U	42
PCB-66	PCB		44	J	22	140		26
PCB-67	PCB			U	22		U	26
PCB-69	PCB			U	32		U	42
PCB-70	PCB			U	22		U	26
PCB-71	PCB			U	32		U	42
PCB-73	PCB			U	32		U	42
PCB-74	PCB			U	22		U	26
PCB-75	PCB			U	32		U	42
PCB-77	PCB			U	14		U	16
PCB-78	PCB	PRC						
PCB-81	PCB			U	14		U	16
PCB-82	PCB			U	11		U	12
PCB-83	PCB			U	11		U	12
PCB-84	PCB			U	16		U	18
PCB-85	PCB			U	11		U	12
PCB-87	PCB			U	11		U	12
PCB-90/101	PCB		71		11	200		12
PCB-91	PCB			U	16		U	18

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 1 -062116			RARA-SPME 2-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-92	PCB			U	11		U	12
PCB-93	PCB			U	16		U	18
PCB-95	PCB		66		16	170		18
PCB-97	PCB		21	J	11	47		12
PCB-99	PCB		38		11	75		12
PCB-100	PCB			U	16		U	18
PCB-103	PCB			U	16		U	18
PCB-104	PCB	PRC						
PCB-105	PCB			U	8.2	17	J	8.5
PCB-107	PCB			U	8.2		U	8.5
PCB-110	PCB		60		11		U	12
PCB-114	PCB			U	8.2		U	8.5
PCB-115	PCB			U	11		U	12
PCB-117	PCB			U	11		U	12
PCB-118	PCB		54		8.2	120		8.5
PCB-119	PCB			U	11		U	12
PCB-121	PCB	PRC						
PCB-122	PCB			U	8.2		U	8.5
PCB-123	PCB			U	8.2		U	8.5
PCB-124	PCB			U	8.2		U	8.5
PCB-126	PCB			U	5.9		U	5.8
PCB-128	PCB			U	4.2	8.1	J	3.9
PCB-129	PCB			U	4.2		U	3.9
PCB-130	PCB			U	4.2		U	3.9
PCB-131	PCB			U	5.5		U	5.3
PCB-132	PCB			U	5.5		U	5.3
PCB-134	PCB			U	5.5		U	5.3
PCB-135	PCB			U	5.5		U	5.3
PCB-136	PCB			U	4.9		U	4.7
PCB-137	PCB			U	4.2		U	3.9
PCB-138	PCB		21		4.2	37		3.9
PCB-141	PCB			U	4.2		U	3.9
PCB-142	PCB	PRC						
PCB-144	PCB			U	5.5		U	5.3
PCB-146	PCB			U	4.2		U	3.9
PCB-147	PCB			U	5.5		U	5.3
PCB-149	PCB		23		5.5	36		5.3
PCB-151	PCB			U	5.5	12	J	5.3
PCB-153	PCB		19		4.2	28		3.9
PCB-154	PCB			U	5.5		U	5.3
PCB-155	PCB	PRC						
PCB-156	PCB			U	3.2		U	2.8
PCB-157	PCB			U	3.2		U	2.8

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 1 -062116			RARA-SPME 2-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-158	PCB			U	4.2		U	3.9
PCB-163	PCB			U	4.2		U	3.9
PCB-164	PCB			U	4.2		U	3.9
PCB-165	PCB			U	4.2		U	3.9
PCB-167	PCB			U	3.2		U	2.8
PCB-169	PCB			U	2.4		U	2
PCB-170	PCB			U	1.6		U	1.2
PCB-171	PCB			U	2		U	1.6
PCB-172	PCB			U	1.6		U	1.2
PCB-173	PCB			U	2		U	1.6
PCB-174	PCB			U	2		U	1.6
PCB-175	PCB			U	2		U	1.6
PCB-176	PCB			U	1.8		U	1.4
PCB-177	PCB			U	2		U	1.6
PCB-178	PCB			U	2		U	1.6
PCB-179	PCB			U	1.8		U	1.4
PCB-180	PCB		2.4	J	1.6	3.2	J	1.2
PCB-183	PCB			U	2		U	1.6
PCB-184	PCB			U	1.8		U	1.4
PCB-185	PCB			U	2		U	1.6
PCB-187	PCB		2.5	J	2	3.8	J	1.6
PCB-189	PCB			U	1.3		U	0.95
PCB-190	PCB			U	1.6		U	1.2
PCB-191	PCB			U	1.6		U	1.2
PCB-192	PCB	PRC						
PCB-193	PCB			U	1.6		U	1.2
PCB-194	PCB			U	0.63		U	0.41
PCB-195	PCB			U	0.77		U	0.52
PCB-196	PCB			U	0.77		U	0.52
PCB-197	PCB			U	0.66		U	0.43
PCB-199	PCB			U	0.66		U	0.43
PCB-200	PCB			U	0.66		U	0.43
PCB-201	PCB			U	0.77		U	0.52
PCB-202	PCB			U	0.66		U	0.43
PCB-203	PCB			U	0.77		U	0.52
PCB-204	PCB	PRC						
PCB-205	PCB			U	0.63		U	0.41
PCB-206	PCB			UL	0.31		U	0.17
PCB-207	PCB			UL	0.25		U	0.14
PCB-208	PCB			UL	0.25		U	0.14
4,4'-DDD	Pesticide			U	9.9		U	19
4,4'-DDT	Pesticide			U	2.4		U	3.7
4,4'-DDE	Pesticide			U	1.4		U	2

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 1 -062116			RARA-SPME 2-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
Aldrin	Pesticide			U	0.74		U	0.94
alpha-BHC	Pesticide			U	200		U	480
alpha-Chlordane	Pesticide			U	5.5		U	9.6
beta-BHC	Pesticide			U	200		U	480
delta-BHC	Pesticide			U	170		U	420
Dieldrin	Pesticide			U	25		U	52
Endosulfan I	Pesticide			U	160		U	380
Endosulfan II	Pesticide			U	37		U	79
Endosulfan sulfate	Pesticide			U	220		U	550
Endrin	Pesticide			U	12		U	24
Endrin aldehyde	Pesticide			U	18		U	36
Endrin ketone	Pesticide			U	2000		U	5100
gamma-BHC (Lindane)	Pesticide			U	190		U	470
gamma-Chlordane	Pesticide		300		5.3	800		9.2
Heptachlor	Pesticide			U	1.6		U	2.3
Heptachlor epoxide	Pesticide			U	15		U	28
Methoxychlor	Pesticide			U	12		U	23
Toxaphene	Pesticide			U	270		U	470
Total PCBs			**620**			**1200**		
Total PAH			**48000**			**70000**		

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
1-Methylnaphthalene	PAH			U	44000		U	42000		U	55000
2-Methylnaphthalene	PAH			U	41000		U	40000		U	52000
Acenaphthene	PAH			U	22000		U	21000		U	29000
Acenaphthylene	PAH			U	27000		U	26000		U	35000
Anthracene	PAH			U	8000		U	6600		U	9500
Benzo(a)anthracene	PAH		2200	J	1800		U	1500	1200	J	1100
Benzo(a)pyrene	PAH			UL	1100		UL	940	540	J	510
Benzo(b)fluoranthene	PAH			UL	1100		UL	940	1100	J	510
Benzo(ghi)perylene	PAH			UL	480		UL	450		UL	130
Benzo(k)fluoranthene	PAH			UL	1100		UL	940	1000	J	510
Chrysene	PAH		2200	J	1800		U	1500	1200	J	1100
Dibenz(a,h)anthracene	PAH			UL	1000		UL	880		U	450
Fluoranthene	PAH		18000		3400	16000		2700	30000		3100
Fluorene	PAH			U	13000		U	11000		U	16000
Indeno(1,2,3-cd)pyrene	PAH			UL	860		UL	760		UL	340
Naphthalene	PAH			U	100000		U	100000		U	130000
Phenanthrene	PAH			U	8000		U	6600		U	9500
Pyrene	PAH		13000		3400	9900		2700	21000		3100
PCB-1	PCB			U	860		U	730		U	1100
PCB-3	PCB			U	230		U	170		U	220
PCB-4	PCB			U	390		U	300		U	440
PCB-5	PCB			U	220		U	160		U	210
PCB-6	PCB			U	220		U	160		U	210
PCB-7	PCB			U	220		U	160		U	210
PCB-8	PCB			U	220		U	160		U	210
PCB-9	PCB			U	220		U	160		U	210
PCB-10	PCB			U	390		U	300		U	440
PCB-12	PCB			U	140		U	100		U	110
PCB-13	PCB			U	140		U	100		U	110
PCB-14	PCB	PRC									
PCB-15	PCB			U	140		U	100		U	110
PCB-16	PCB			U	150		U	110		U	130
PCB-17	PCB			U	150		U	110		U	130
PCB-18	PCB			U	150		U	110		U	130
PCB-19	PCB			U	210		U	160		U	200
PCB-20	PCB			U	110		U	87		U	82
PCB-22	PCB			U	110		U	87		U	82
PCB-24	PCB			U	150		U	110		U	130
PCB-25	PCB			U	110		U	87		U	82
PCB-26	PCB			U	110		U	87		U	82
PCB-27	PCB			U	150		U	110		U	130
PCB-28	PCB			U	110		U	87		U	82
PCB-29	PCB			U	110		U	87		U	82

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-31	PCB			U	110		U	87		U	82
PCB-32	PCB			U	150		U	110		U	130
PCB-33	PCB			U	110		U	87		U	82
PCB-34	PCB			U	110		U	87		U	82
PCB-35	PCB			U	88		U	68		U	54
PCB-36	PCB	PRC									
PCB-37	PCB			U	88		U	68		U	54
PCB-40	PCB			U	85		U	66		U	51
PCB-41	PCB			U	85		U	66		U	51
PCB-42	PCB			U	85		U	66		U	51
PCB-44	PCB			U	85		U	66		U	51
PCB-45	PCB			U	100		U	79		U	70
PCB-46	PCB			U	100		U	79		U	70
PCB-47	PCB			U	85		U	66		U	51
PCB-48	PCB			U	85		U	66		U	51
PCB-49	PCB			U	85		U	66		U	51
PCB-51	PCB			U	100		U	79		U	70
PCB-52	PCB			U	85		U	66		U	51
PCB-53	PCB			U	100		U	79		U	70
PCB-54	PCB			U	100		U	80		U	71
PCB-56	PCB			UL	70		UL	55		U	38
PCB-59	PCB			U	85		U	66		U	51
PCB-60	PCB			UL	70		UL	55		U	38
PCB-63	PCB			UL	70		UL	55		U	38
PCB-64	PCB			U	85		U	66		U	51
PCB-66	PCB			UL	70		UL	55	54	J	38
PCB-67	PCB			UL	70		UL	55		U	38
PCB-69	PCB			U	85		U	66		U	51
PCB-70	PCB			UL	70		UL	55		U	38
PCB-71	PCB			U	85		U	66		U	51
PCB-73	PCB			U	85		U	66		U	51
PCB-74	PCB			UL	70		UL	55		U	38
PCB-75	PCB			U	85		U	66		U	51
PCB-77	PCB			UL	58		UL	47		U	28
PCB-78	PCB	PRC									
PCB-81	PCB			UL	58		UL	47		U	28
PCB-82	PCB			UL	53		UL	43		U	24
PCB-83	PCB			UL	53		UL	43		U	24
PCB-84	PCB			UL	61		UL	49		U	30
PCB-85	PCB			UL	53		UL	43		U	24
PCB-87	PCB			UL	53		UL	43		U	24
PCB-90/101	PCB			UL	53		UL	43	62	J	24
PCB-91	PCB			UL	61		UL	49		U	30

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-92	PCB			UL	53		UL	43		U	24
PCB-93	PCB			UL	61	54	JL	49		U	30
PCB-95	PCB			UL	61		UL	49	61	J	30
PCB-97	PCB			UL	53		UL	43	50	J	24
PCB-99	PCB			UL	53		UL	43		U	24
PCB-100	PCB			UL	61		UL	49		U	30
PCB-103	PCB			UL	61		UL	49		U	30
PCB-104	PCB	PRC									
PCB-105	PCB			UL	46		UL	38		U	19
PCB-107	PCB			UL	46		UL	38		U	19
PCB-110	PCB			UL	53		UL	43		U	24
PCB-114	PCB			UL	46		UL	38		U	19
PCB-115	PCB			UL	53		UL	43		U	24
PCB-117	PCB			UL	53		UL	43		U	24
PCB-118	PCB			UL	46	63	JL	38	72		19
PCB-119	PCB			UL	53		UL	43		U	24
PCB-121	PCB	PRC									
PCB-122	PCB			UL	46		UL	38		U	19
PCB-123	PCB			UL	46		UL	38		U	19
PCB-124	PCB			UL	46		UL	38		U	19
PCB-126	PCB			UL	40		UL	33		UL	15
PCB-128	PCB			UL	34		UL	29		UL	12
PCB-129	PCB			UL	34		UL	29		UL	12
PCB-130	PCB			UL	34		UL	29		UL	12
PCB-131	PCB			UL	39		UL	32		UL	14
PCB-132	PCB			UL	39		UL	32		UL	14
PCB-134	PCB			UL	39		UL	32		UL	14
PCB-135	PCB			UL	39		UL	32		UL	14
PCB-136	PCB			UL	37		UL	31		UL	13
PCB-137	PCB			UL	34		UL	29		UL	12
PCB-138	PCB		69	JL	34		UL	29	47	L	12
PCB-141	PCB			UL	34		UL	29		UL	12
PCB-142	PCB	PRC									
PCB-144	PCB			UL	39		UL	32		UL	14
PCB-146	PCB			UL	34		UL	29		UL	12
PCB-147	PCB			UL	39		UL	32		UL	14
PCB-149	PCB			UL	39		UL	32	33	JL	14
PCB-151	PCB			UL	39		UL	32		UL	14
PCB-153	PCB		41	JL	34		UL	29	39	L	12
PCB-154	PCB			UL	39		UL	32		UL	14
PCB-155	PCB	PRC									
PCB-156	PCB			UL	31		UL	26		UL	9.6
PCB-157	PCB			UL	31		UL	26		UL	9.6

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-158	PCB			UL	34		UL	29		UL	12
PCB-163	PCB			UL	34		UL	29		UL	12
PCB-164	PCB			UL	34		UL	29		UL	12
PCB-165	PCB			UL	34		UL	29		UL	12
PCB-167	PCB			UL	31		UL	26		UL	9.6
PCB-169	PCB			UL	27		UL	24		UL	7.9
PCB-170	PCB			UL	23		UL	20		UL	5.9
PCB-171	PCB			UL	25		UL	22		UL	7
PCB-172	PCB			UL	23		UL	20		UL	5.9
PCB-173	PCB			UL	25		UL	22		UL	7
PCB-174	PCB			UL	25		UL	22		UL	7
PCB-175	PCB			UL	25		UL	22		UL	7
PCB-176	PCB			UL	24		UL	21		UL	6.3
PCB-177	PCB			UL	25		UL	22		UL	7
PCB-178	PCB			UL	25		UL	22		UL	7
PCB-179	PCB			UL	24		UL	21		UL	6.3
PCB-180	PCB			UL	23		UL	20		UL	5.9
PCB-183	PCB			UL	25		UL	22		UL	7
PCB-184	PCB			UL	24		UL	21		UL	6.3
PCB-185	PCB			UL	25		UL	22		UL	7
PCB-187	PCB			UL	25		UL	22	9.9	JL	7
PCB-189	PCB			UL	21		UL	19		UL	5
PCB-190	PCB			UL	23		UL	20		UL	5.9
PCB-191	PCB			UL	23		UL	20		UL	5.9
PCB-192	PCB	PRC									
PCB-193	PCB			UL	23		UL	20		UL	5.9
PCB-194	PCB			UL	15		UL	14		UL	3.1
PCB-195	PCB			UL	17		UL	15		UL	3.5
PCB-196	PCB			UL	17		UL	15		UL	3.5
PCB-197	PCB			UL	16		UL	14		UL	3.2
PCB-199	PCB			UL	16		UL	14		UL	3.2
PCB-200	PCB			UL	16		UL	14		UL	3.2
PCB-201	PCB			UL	17		UL	15		UL	3.5
PCB-202	PCB			UL	16		UL	14		UL	3.2
PCB-203	PCB			UL	17		UL	15		UL	3.5
PCB-204	PCB	PRC									
PCB-205	PCB			UL	15		UL	14		UL	3.1
PCB-206	PCB			UL	11		UL	11		UL	1.8
PCB-207	PCB			UL	10		UL	10		UL	1.6
PCB-208	PCB			UL	10		UL	10		UL	1.6
4,4'-DDD	Pesticide			U	13		U	11		U	10
4,4'-DDT	Pesticide			U	6.5		U	5.5		U	3.4
4,4'-DDE	Pesticide			UL	5.2		UL	4.4		U	2.3

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
Aldrin	Pesticide			UL	3.9		UL	3.4		U	1.5
alpha-BHC	Pesticide			U	150		U	150		U	150
alpha-Chlordane	Pesticide			U	9.8		U	8		U	6.4
beta-BHC	Pesticide			U	150		U	150		U	150
delta-BHC	Pesticide			U	130		U	130		U	130
Dieldrin	Pesticide			U	23		U	19		U	22
Endosulfan I	Pesticide			U	120		U	110		U	120
Endosulfan II	Pesticide			U	31		U	26		U	30
Endosulfan sulfate	Pesticide			U	170		U	170		U	180
Endrin	Pesticide			U	15		U	12		U	12
Endrin aldehyde	Pesticide			U	19		U	15		U	16
Endrin ketone	Pesticide			U	1800		U	1800		U	1800
gamma-BHC (Lindane)	Pesticide			U	140		U	140		U	150
gamma-Chlordane	Pesticide		130		9.6	120		7.9	190		6.2
Heptachlor	Pesticide			UL	5.4		UL	4.7		U	2.5
Heptachlor epoxide	Pesticide			U	17		U	14		U	14
Methoxychlor	Pesticide			U	15		U	12		U	12
Toxaphene	Pesticide			U	500		U	410		U	320
Total PCBs			**110**			**120**			**430**		
Total PAH			**35000**			**26000**			**56000**		

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 6-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
1-Methylnaphthalene	PAH			U	74000
2-Methylnaphthalene	PAH			U	70000
Acenaphthene	PAH			U	40000
Acenaphthylene	PAH			U	49000
Anthracene	PAH			U	13000
Benzo(a)anthracene	PAH		1500	J	1100
Benzo(a)pyrene	PAH			U	370
Benzo(b)fluoranthene	PAH		640	J	370
Benzo(ghi)perylene	PAH			UL	58
Benzo(k)fluoranthene	PAH		1000	J	370
Chrysene	PAH		1500	J	1100
Dibenz(a,h)anthracene	PAH			U	310
Fluoranthene	PAH		17000		3700
Fluorene	PAH			U	23000
Indeno(1,2,3-cd)pyrene	PAH			U	220
Naphthalene	PAH			U	160000
Phenanthrene	PAH			U	13000
Pyrene	PAH		34000		3700
PCB-1	PCB			U	1600
PCB-3	PCB			U	300
PCB-4	PCB			U	640
PCB-5	PCB			U	280
PCB-6	PCB			U	280
PCB-7	PCB			U	280
PCB-8	PCB			U	280
PCB-9	PCB			U	280
PCB-10	PCB			U	640
PCB-12	PCB			U	130
PCB-13	PCB			U	130
PCB-14	PCB	PRC			
PCB-15	PCB			U	130
PCB-16	PCB			U	150
PCB-17	PCB			U	150
PCB-18	PCB			U	150
PCB-19	PCB			U	260
PCB-20	PCB			U	90
PCB-22	PCB			U	90
PCB-24	PCB			U	150
PCB-25	PCB			U	90
PCB-26	PCB			U	90
PCB-27	PCB			U	150
PCB-28	PCB			U	90
PCB-29	PCB			U	90

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 6-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-31	PCB			U	90
PCB-32	PCB			U	150
PCB-33	PCB			U	90
PCB-34	PCB			U	90
PCB-35	PCB			U	53
PCB-36	PCB	PRC			
PCB-37	PCB			U	53
PCB-40	PCB			U	49
PCB-41	PCB			U	49
PCB-42	PCB			U	49
PCB-44	PCB			U	49
PCB-45	PCB			U	74
PCB-46	PCB			U	74
PCB-47	PCB			U	49
PCB-48	PCB			U	49
PCB-49	PCB			U	49
PCB-51	PCB			U	74
PCB-52	PCB			U	49
PCB-53	PCB			U	74
PCB-54	PCB			U	75
PCB-56	PCB			U	33
PCB-59	PCB			U	49
PCB-60	PCB			U	33
PCB-63	PCB			U	33
PCB-64	PCB			U	49
PCB-66	PCB		94	J	33
PCB-67	PCB			U	33
PCB-69	PCB			U	49
PCB-70	PCB			U	33
PCB-71	PCB			U	49
PCB-73	PCB			U	49
PCB-74	PCB			U	33
PCB-75	PCB			U	49
PCB-77	PCB			U	22
PCB-78	PCB	PRC			
PCB-81	PCB			U	22
PCB-82	PCB			U	18
PCB-83	PCB			U	18
PCB-84	PCB			U	25
PCB-85	PCB			U	18
PCB-87	PCB			U	18
PCB-90/101	PCB		33	J	18
PCB-91	PCB			U	25

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 6-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-92	PCB			U	18
PCB-93	PCB		180		25
PCB-95	PCB		46	J	25
PCB-97	PCB			U	18
PCB-99	PCB		33	J	18
PCB-100	PCB			U	25
PCB-103	PCB			U	25
PCB-104	PCB	PRC			
PCB-105	PCB			U	13
PCB-107	PCB			U	13
PCB-110	PCB			U	18
PCB-114	PCB			U	13
PCB-115	PCB			U	18
PCB-117	PCB			U	18
PCB-118	PCB		46		13
PCB-119	PCB			U	18
PCB-121	PCB	PRC			
PCB-122	PCB			U	13
PCB-123	PCB			U	13
PCB-124	PCB			U	13
PCB-126	PCB			U	9.7
PCB-128	PCB			U	6.9
PCB-129	PCB			U	6.9
PCB-130	PCB			U	6.9
PCB-131	PCB			U	9
PCB-132	PCB			U	9
PCB-134	PCB			U	9
PCB-135	PCB			U	9
PCB-136	PCB			U	8.1
PCB-137	PCB			U	6.9
PCB-138	PCB		25		6.9
PCB-141	PCB			U	6.9
PCB-142	PCB	PRC			
PCB-144	PCB			U	9
PCB-146	PCB			U	6.9
PCB-147	PCB			U	9
PCB-149	PCB		19	J	9
PCB-151	PCB			U	9
PCB-153	PCB		29		6.9
PCB-154	PCB			U	9
PCB-155	PCB	PRC			
PCB-156	PCB			UL	5.4
PCB-157	PCB			UL	5.4

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 6-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-158	PCB			U	6.9
PCB-163	PCB			U	6.9
PCB-164	PCB			U	6.9
PCB-165	PCB			U	6.9
PCB-167	PCB			UL	5.4
PCB-169	PCB			UL	4.1
PCB-170	PCB			UL	2.8
PCB-171	PCB			UL	3.5
PCB-172	PCB			UL	2.8
PCB-173	PCB			UL	3.5
PCB-174	PCB			UL	3.5
PCB-175	PCB			UL	3.5
PCB-176	PCB			UL	3
PCB-177	PCB			UL	3.5
PCB-178	PCB			UL	3.5
PCB-179	PCB			UL	3
PCB-180	PCB			UL	2.8
PCB-183	PCB			UL	3.5
PCB-184	PCB			UL	3
PCB-185	PCB			UL	3.5
PCB-187	PCB		3.8	JL	3.5
PCB-189	PCB			UL	2.2
PCB-190	PCB			UL	2.8
PCB-191	PCB			UL	2.8
PCB-192	PCB	PRC			
PCB-193	PCB			UL	2.8
PCB-194	PCB			UL	1.1
PCB-195	PCB			UL	1.4
PCB-196	PCB			UL	1.4
PCB-197	PCB			UL	1.2
PCB-199	PCB			UL	1.2
PCB-200	PCB			UL	1.2
PCB-201	PCB			UL	1.4
PCB-202	PCB			UL	1.2
PCB-203	PCB			UL	1.4
PCB-204	PCB	PRC			
PCB-205	PCB			UL	1.1
PCB-206	PCB			UL	0.56
PCB-207	PCB			UL	0.47
PCB-208	PCB			UL	0.47
4,4'-DDD	Pesticide			U	15
4,4'-DDT	Pesticide			U	3.9
4,4'-DDE	Pesticide			U	2.4

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME 6-062116		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
Aldrin	Pesticide			U	1.3
alpha-BHC	Pesticide			U	250
alpha-Chlordane	Pesticide			U	8.6
beta-BHC	Pesticide			U	250
delta-BHC	Pesticide			U	220
Dieldrin	Pesticide			U	36
Endosulfan I	Pesticide			U	200
Endosulfan II	Pesticide			U	52
Endosulfan sulfate	Pesticide			U	280
Endrin	Pesticide			U	19
Endrin aldehyde	Pesticide			U	26
Endrin ketone	Pesticide			U	2200
gamma-BHC (Lindane)	Pesticide			U	250
gamma-Chlordane	Pesticide		210		8.3
Heptachlor	Pesticide			U	2.7
Heptachlor epoxide	Pesticide			U	22
Methoxychlor	Pesticide			U	18
Toxaphene	Pesticide			U	430
Total PCBs			520		
Total PAH			55000		

Notes
1. Interval: depth below sediment-water interface in centimeters
2. U: Not detected at the MDL shown in the second column for each sample.
3. NC: Cfree was not calculated for Sample QT25-5-0205-PE. See report text.
4. J: Analyte concentration is below calibration range
5. L: Percent to steady state less than 10%
6. Abbreviations:
DDD: dichlorodiphenyldichloroethane DDT: dichlorodiphenyltrichloroethane pg/L: picogram per liter
DDE: dichlorodiphenyldichloroethylene MDL: method detection limit

ATTACHMENT A: DATA ANALYSIS METHODS

Attachment A: Data Analysis Methods
Concentrations of Freely-Dissolved DDX
Measured via SP3™ Passive Samplers

The concentration of analytes in PE (Table A1) obtained from the information provided in the ERDC Environmental Laboratory report (Attachment B) are used in a multi-step data process to calculate C_{free} analytes as described below.

Step 1:

The concentrations of the PRCs in PE [PE_t] were used to calculate the elimination rate (k_e) values for the PRCs in each deployed sampler using the following equation (Lohmann, 2012):

$$PRC\ k_e = \ln\left(\frac{[PE_{t=0}]}{[PE_{t=final}]}\right) \div t_{final}$$

where:

$PE_{t=0}$	= the average concentration of the PRC present in the PE at the beginning of the deployment (obtained from an average measurement of the trip blanks);
$PE_{t=final}$	= the concentration of the PRC in the PE after the deployment (obtained from each deployed PE sampler); and
t_{final}	= the deployment time (in days).
k_e	= the elimination rate (in days^{-1})

PRC k_e values for the PRCs in each sampler are shown in Table A2. The values are also expressed as a percentage of steady state (concentration at equilibrium). Several PRC k_e values were not calculated and were treated as outliers because $PE_{t=final}$ values were equal to or greater than $PE_{t=0}$ values.

Step 2:

The second step was to estimate k_e values for the non-PRC primary analytes (OCP, PAH, and non-PRC PCB) in each of the deployed samplers. This was accomplished by developing a linear regression model using PRC k_e values (dependent variable, from Table A2) and PE-water partition coefficients (K_{PE}) for each PRC PCB (independent variable, Smedes et al., 2009). Note that regression models were specific to each sampler (i.e. not global to the whole deployment) as local geologic and hydrodynamic conditions can vary greatly within a site.

1

Values were $\log_{10}$-transformed per Tomaszewski and Luthy (2008). By entering the analyte-specific K_{PE} into the linear regression model developed for each sampler, k_e values for each of the primary analytes for each sampler were calculated.

Step 3:

This step describes the calculation of sampling rate correction factors (*CF*s) for each primary analyte in each sampler. The following equation is used, as adapted from Lohmann (2012):

$$CF = \frac{1}{1 - e^{-k_e \times t_{final}}}$$

where:

k_e = the elimination rate value predicted by the sampler-specific regression model (in days^{-1}); and

t_{final} = the deployment time (in days).

Step 4:

The concentration of primary analyte in the PE of each sampler (obtained from Table A1) were multiplied by the *CF* values to calculate the steady-state concentration of primary analytes. Note, no impurities were observed in the trip blank (e.g., non-PRC PCBs).

Step 5:

In the final step, the steady-state concentrations are divided by K_{PE} values (Choi et al., 2013; Lohmann and Muir, 2010, Thompson et al., 2015; U.S. EPA, 2012) to obtain the concentrations of C_{free} primary analytes. These are reported in Table 1. C_{free} Method Detection Limits (MDLs) were calculated in the approach described above using the estimated MDL concentration in PE, as reported by EDRC Environmental Laboratory and shown in Table A1. For samples in which the percentage of steady state was indicated to be less than 10% for a primary analyte, C_{free} was calculated and given an "L" qualifier in Table 1.

2

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United States Environmental Protection Agency (USEPA). 2003. Table of PCB Species by Congener Number.

U.S. EPA (United States Environmental Protection Agency). 2012. Guidelines for Using Passive Samplers to Monitor Organic Contaminants at Superfund Sediment Sites. OSWER Directive 9200.1-110 FS. December.

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TABLE A1

Table A1. Concentration of Analytes in Polyethylene

Client ID		RARA-SPME 1-062116			RARA-SPME 2-062116			RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116			RARA-SPME 6-062116			RARA-SPME TB-062116		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
1-Methylnaphthalene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
2-Methylnaphthalene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Acenaphthene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Acenaphthylene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Anthracene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Benzo(a)anthracene		173	J	92.10	128	J	80.40	99.8	J	82.80		U	80.50	107	J	100.00	117	J	82.40		U	93.00
Benzo(a)pyrene		234	J	92.10	285		80.40		U	82.80		U	80.50	107	J	100.00		U	82.40		U	93.00
Benzo(b)fluoranthene		459		92.10	661		80.40		U	82.80		U	80.50	221	J	100.00	141	J	82.40		U	93.00
Benzo(ghi)perylene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Benzo(k)fluoranthene		425		92.10	519		80.40		U	82.80		U	80.50	203	J	100.00	225	J	82.40		U	93.00
Chrysene		211	J	92.10	173	J	80.40	101	J	82.80		U	80.50	103	J	100.00	119	J	82.40		U	93.00
Dibenz(a,h)anthracene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Fluoranthene		538		92.10	557		80.40	427		82.80	470		80.50	957		100.00	379		82.40		U	93.00
Fluorene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Indeno(1,2,3-cd)pyrene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Naphthalene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Phenanthrene			U	92.10		U	80.40		U	82.80		U	80.50		U	100.00		U	82.40		U	93.00
Pyrene		891		92.10	566		80.40	322		82.80	290		80.50	679		100.00	750		82.40		U	93.00
PCB-1			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-3			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-4			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-5			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-6			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-7			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-8			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-9			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-10			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-12			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-13			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-14	PRC	15.7		4.33	24.7		3.67	37.3		4.00	41.5		3.67	18.2		4.67	32.8		4.00	28.6		4.33
PCB-15			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-16			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-17			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-18			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-19			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-20			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-22			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-24			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-25			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-26			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-27			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-28			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-29			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-31			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-32			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-33			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-34			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-35			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-36	PRC	162		4.33	172		3.67	264		4.00	274		3.67	201		4.67	336		4.00	351		4.33
PCB-37			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-40			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-41			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-42			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-44			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-45			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-46			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-47			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-48			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-49		12.8	J	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-51			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-52		13.78		4.33	28.8		3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33

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Table A1. Concentration of Analytes in Polyethylene

Client ID		RARA-SPME 1-062116			RARA-SPME 2-062116			RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116			RARA-SPME 6-062116			RARA-SPME TB-062116		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
PCB-53			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-54			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-56			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-59			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-60			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-63			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-64			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-66		8.85	J	4.33	19.5		3.67		U	4.00		U	3.67	6.68	J	4.67	11.34	J	4.00		U	4.33
PCB-67			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-69			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-70			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-71			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-73			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-74			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-75			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-77			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-78	PRC	525		4.33	489		3.67	702		4.00	697		3.67	623		4.67	701		4.00	715		4.33
PCB-81			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-82			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-83			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-84			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-85			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-87			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-90/101		26.91		4.33	59.1		3.67		U	4.00		U	3.67	12.2	J	4.67	7.38	J	4.00		U	4.33
PCB-91			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-92			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-93			U	4.33		U	3.67		U	4.00	4.37	J	3.67		U	4.67	29.9		4.00		U	4.33
PCB-95		18.1		4.33	33.9		3.67		U	4.00		U	3.67	9.52	J	4.67	7.48	J	4.00		U	4.33
PCB-97		8.02	J	4.33	13.9		3.67		U	4.00		U	3.67	9.88	J	4.67		U	4.00		U	4.33
PCB-99		14.4		4.33	22.2		3.67		U	4.00		U	3.67		U	4.67	7.22	J	4.00		U	4.33
PCB-100			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-103			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-104	PRC	54.08		4.33	61.1		3.67	67.7		4.00	72.2		3.67	57		4.67	65.8		4.00	66.4		4.33
PCB-105			U	4.33	7.51	J	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-107			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-110		22.9		4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-114			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-115			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-117			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-118		28.5		4.33	50.9		3.67		U	4.00	6.38	J	3.67	17.8		4.67	14		4.00		U	4.33
PCB-119			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-121	PRC	514		4.33	472		3.67	597		4.00	596		3.67	529		4.67	577		4.00	551		4.33
PCB-122			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-123			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-124			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-126			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-128			U	4.33	7.71	J	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-129			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-130			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-131			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-132			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-134			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-135			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-136			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-137			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-138		22.1		4.33	35.5		3.67	7.99	J	4.00		U	3.67	19		4.67	14.64		4.00		U	4.33
PCB-141			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-142	PRC	286		4.33	337		3.67	522		4.00	422		3.67	355		4.67	310		4.00	442		4.33
PCB-144			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-146			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-147			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33

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Table A1. Concentration of Analytes in Polyethylene

Client ID		RARA-SPME 1-062116			RARA-SPME 2-062116			RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116			RARA-SPME 6-062116			RARA-SPME TB-062116		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
PCB-149		18.5		4.33	24.6		3.67		U	4.00		U	3.67	11.05	J	4.67	8.33	J	4.00		U	4.33
PCB-151			U	4.33	8.5	J	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-153		19.8		4.33	26.6		3.67	4.78	J	4.00		U	3.67	15.8		4.67	16.9		4.00		U	4.33
PCB-154			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-155	PRC	472		4.33	502		3.67	600		4.00	597		3.67	555		4.67	564		4.00	573		4.33
PCB-156			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-157			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-158			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-163			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-164			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-165			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-167			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-169			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-170			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-171			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-172			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-173			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-174			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-175			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-176			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-177			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-178			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-179			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-180		6.57	J	4.33	9.29	J	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-183			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-184			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-185			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-187		5.4	J	4.33	8.51	J	3.67		U	4.00		U	3.67	6.58	J	4.67	4.38	J	4.00		U	4.33
PCB-189			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-190			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-191			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-192	PRC	796		4.33	777		3.67	920		4.00	947		3.67	887		4.67	991		4.00	932		4.33
PCB-193			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-194			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-195			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-196			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-197			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-199			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-200			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-201			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-202			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-203			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-204	PRC	924		4.33	918		3.67	1147		4.00	1136		3.67	1030		4.67	1177		4.00	1064		4.33
PCB-205			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-206			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-207			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
PCB-208			U	4.33		U	3.67		U	4.00		U	3.67		U	4.67		U	4.00		U	4.33
4,4'-DDD			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
4,4'-DDT			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
4,4'-DDE			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Aldrin			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
alpha-BHC			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
alpha-Chlordane			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
beta-BHC			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
delta-BHC			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Dieldrin			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Endosulfan I			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Endosulfan II			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Endosulfan sulfate			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Endrin			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Endrin aldehyde			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30

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Table A1. Concentration of Analytes in Polyethylene

Client ID		RARA-SPME 1-062116			RARA-SPME 2-062116			RARA-SPME 3-062116			RARA-SPME 4-062116			RARA-SPME 5-062116			RARA-SPME 6-062116			RARA-SPME TB-062116		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
Endrin ketone			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
gamma-BHC (Lindane)			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
gamma-Chlordane		16.7		0.30	26.1		0.30	3.98		0.30	4.43		0.30	9.36		0.30	7.74		0.30		U	0.30
Heptachlor			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Heptachlor epoxide			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Methoxychlor			U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30		U	0.30
Toxaphene			U	16.00		U	16.00		U	16.00		U	16.00		U	16.00		U	16.00		U	16.00

Notes
1. U: Not detected at the MDL shown in the second column for each sample.
2. J: Analyte concentration is below calibration range
3. Abbreviations:
   DDD: dichlorodiphenyldichloroethane
   DDE: dichlorodiphenyldichloroethylene
   DDT: dichlorodiphenyltrichloroethane
   MDL: method detection limit
   ng/g: nanogram per gram
   PCB: Polychlorinated biphenyl
   PRC: Performance Reference Compound

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TABLE A2

Table A2. Elimination Rates (ke) and Percentage to Steady State Reached by Performance Reference Compounds (PRCs) During Deployment.

Client ID		RARA-SPME 1 - 062116		RARA-SPME 2-062116		RARA-SPME 3-062116		RARA-SPME 4-062116		RARA-SPME 5-062116		RARA-SPME 6-062116	
PRC	Homolog Group	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %
PCB-14	Di	0.021420	45%	0.005236	14%	OUTLIER		OUTLIER		0.016142	36%	0.014266	32%
PCB-36	Tri	0.027614	54%	0.025475	51%	0.010173	25%	0.008845	22%	0.019910	43%	0.018403	39%
PCB-78	Tetra	0.011032	27%	0.013569	32%	0.000655	2%	0.000911	3%	0.004919	13%	0.006217	15%
PCB-104	Penta	0.007330	19%	0.002971	8%	OUTLIER		OUTLIER		0.005452	14%	0.005251	14%
PCB-121	Penta	0.002483	7%	0.005527	14%	OUTLIER		OUTLIER		0.001455	4%	0.003155	8%
PCB-142	Hexa	0.015547	35%	0.009687	24%	OUTLIER		0.001654	5%	0.007828	20%	0.008679	21%
PCB-155	Hexa	0.006925	18%	0.004724	12%	OUTLIER		OUTLIER		0.001140	3%	0.004263	11%
PCB-192	Hepta	0.005633	15%	0.006496	17%	0.000463	1%	OUTLIER		0.001767	5%	0.003590	9%
PCB-204	Octa	0.005039	13%	0.005271	14%	OUTLIER		OUTLIER		0.001160	3%	0.003823	10%

Notes

1. The PRCs noted "OUTLIER" were removed from the calculations. See report text.
2. For RARA-SPME-6-062116, the PRC results were not considered reliable; therefore, the average k_e values (where calculated) from samples 1 to 5 were applied to sample 6 to correct concentrations for non-equilibrium conditions. See report text.
3. Abbreviations:
   d: day %: percent PCB: Polychlorinated biphenyl

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ATTACHMENT B: ERDC ENVIRONMENTAL LABORATORY REPORT

T-Final Results

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Certificate of Analysis
Concentrations of Freely-Dissolved Analytes
Measured via SP3™ Passive Samplers

Customer: SSC Pacific

SiREM Reference: WSN-4801

Project: RARA Round 2

Final Report Issued: December 18, 2016

Customer Project: HE1551 Phase 04

Site Sampling Date: July 18 to August 15, 2016

Introduction

This report presents the results for 7 SP3™ passive samples associated with sampler deployment at 6 locations for the Remedy and Recontamination Assessment Array (RARA) project in San Diego Bay, San Diego, California. The samplers were deployed on July 18, 2016 and retrieved on August 15, 2016 to measure freely-dissolved concentrations (C_{free}) of organochlorine pesticides (OCP), polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) in sediments. The data analysis steps are provided in Attachment A and the Engineer Research and Development Center (ERDC) Environmental Laboratory report is provided in Attachment B.

Sample Summary

Client Sample ID	Sampler Deployment Date	Sampler Collection Date	Analysis
RARA-SPME 1-081516	July 18, 2016	August 15, 2016	PCB, PAH, OCP
RARA-SPME 2-081516	July 18, 2016	August 15, 2016	PCB, PAH, OCP
RARA-SPME 3-081516	July 18, 2016	August 15, 2016	PCB, PAH, OCP
RARA-SPME 4-081516	July 18, 2016	August 15, 2016	PCB, PAH, OCP
RARA-SPME 5-081516	July 18, 2016	August 15, 2016	PCB, PAH, OCP
RARA-SPME 6-081516	July 18, 2016	August 15, 2016	PCB, PAH, OCP
RARA-SPME TB-081516	Not Deployed	August 15, 2016	PCB, PAH, OCP

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Sampler Design, Deployment, and Chemical Analysis

The SP3™ custom sampler design for this project consisted of a 4 × 10 centimeter (cm) sheet of 17 micrometer (µm) thick low density polyethylene (PE) housed in a stainless steel mesh envelope attached to a galvanized steel support plate. The PE was spiked with the Performance Reference Compounds (PRCs) consisting of rare PCBs congeners assumed to: 1) not be present in the media in which the samplers were deployed, or 2) present at concentrations so low as to be inconsequential, not affect calculations involving PRCs, and insignificant compared to the concentration of other freely-dissolved PCBs in the media sampled. The PRCs used for this project were: PCB-14, PCB-36, PCB-78, PCB-104, PCB-121, PCB-142, PCB-155, PCB-192, and PCB-204[1].

Six samplers (labeled on chain of custody as RARA-SPME 1-081516 to RARA-SPME 6-081516) were deployed in the surficial sediment by SSC Pacific on July 18, 2016 and retrieved on August 15, 2016. The Sample IDs were incorrectly labeled as "SPME" in the field which seems to indicate solid phase microextraction was used, however the samplers were polyethylene. The deployment time for each sampler was 28 days, within the minimum recommended period. The samplers were placed in an opaque resealable bag, then placed in a resealable plastic bag, and packaged in a cooler with ice or ice packs for overnight shipment to ERDC Environmental Laboratory by the field personnel. One trip blank (sample ID RARA-SPME TB-081516) was not deployed in sediment, but remained in original packaging under cold storage (approximately 4 degrees Celsius [°C]). The trip blank was removed from the packaging by field personnel, exposed to ambient field conditions for approximately 5 minutes, and packaged for shipment in the same manner as the deployed samplers.

Processing of the samplers by ERDC Environmental Laboratory included removal the PE from the stainless steel mesh envelope, wiping any visible sediment from the PE using a moist tissue, and determination of the concentrations in PE of PCB congeners by EPA method 8082A, PAHs by EPA method 8270C, and pesticides by EPA method 8081A. The analytical report provided by ERDC Environmental Laboratory is attached to this report (Attachment B).

Results

C_{free} values are reported in Table 1. ERDC did not report issues during the analysis of Work Order 6081807 for PAH and OCP, and all surrogate recovery percentages were within the acceptable range. The surrogate recovery for PCBs were also within the acceptable range. The blank spike recovery (BS %Rec) and blank spike duplicate recovery(BSD %Rec) are reported as 224.3% and 241.1%, respectively for PCB-141, which is outside the acceptable range.

---

[1] PCB shorthand nomenclature used in this report follows the Chemical Abstract Service (CAS) nomenclature used by USEPA (2003): United States Environmental Protection Agency (USEPA). 2003. Table of PCB Species by Congener Number.

It should be noted that the concentrations of two PRCs (PCB-104 and PCB-155) in the samplers exposed to field sediments appeared to be elevated relative to the trip blank. These results are unexpected based on experience with these PRCs, as analyzed in samplers by multiple laboratories in multiple sites, including San Diego Bay. This observation could be due to analytical error, sample contamination, or presence of PRCs in the field sediment. PCB-104 was not detected in sediment samples associated with this project above detection limits of 0.06 micrograms per kilogram (µg/kg) to 0.09 µg/kg (PCB-155 was not reported). Therefore, PCB-104 and PCB-155 were not included in the PRC model calculations.

PRC data associated with samples 3, 4, and 5 were extremely unusual and indicated sampling conditions were insufficient to reach levels of steady state normally observed in the SP3 samplers. The PRC data with these samplers were not considered reliable; therefore, the average k_e values (where calculated) from samples 1, 2, and 6 have been applied to samples 3, 4, and 5 to correct concentrations for non-equilibrium conditions. This assumes that the conditions for samplers 1, 2, and 6 apply to samples 3, 4, and 5.

It should also be noted the sample IDs in the PCB congener results from ERDC ('6081807 SPAWAR RARA Congeners.xlsx') are not identical to the chain of custody or PAH and OCP results from ERDC ('6081807 SPAWAR RARA FINAL.xls'). ERDC has not yet confirmed the assumptions on the sample IDs in the table below are correct; therefore, this report may be revised if the assumptions in the table below are not correct.

Assumptions on Sample IDs from PCB Congener Results

Sample ID in the PCB Congener Results	Sample ID in the PAH/Pesticide Results
SPME 1 081516	RARA-SPME 1-081516
SPME 2 081516	RARA-SPME 2-081516
SPME 3 081516	RARA-SPME 3-081516
SPME 4 081516	RARA-SPME 4-081516
SPME 5 081516	RARA-SPME 5-081516
SPME 6 081516	RARA-SPME 6-081516
SPME 7 081516	RARA-SPME TB-081516

TABLE 1

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
1-Methylnaphthalene	PAH			U	80000		U	53000
2-Methylnaphthalene	PAH			U	75000		U	50000
Acenaphthene	PAH			U	44000		U	27000
Acenaphthylene	PAH			U	53000		U	33000
Anthracene	PAH			U	14000		U	8600
Benzo(a)anthracene	PAH			U	1200	6400		960
Benzo(a)pyrene	PAH		2100		440		U	420
Benzo(b)fluoranthene	PAH		4200		440	5600		420
Benzo(ghi)perylene	PAH			UL	71		UL	100
Benzo(k)fluoranthene	PAH		1600		440	2000		420
Chrysene	PAH			U	1200	1900	J	960
Dibenz(a,h)anthracene	PAH			U	370		U	370
Fluoranthene	PAH		18000		4200		U	2700
Fluorene	PAH			U	25000		U	15000
Indeno(1,2,3-cd)pyrene	PAH			U	260		U	280
Naphthalene	PAH			U	170000		U	120000
Phenanthrene	PAH			U	14000		U	8600
Pyrene	PAH		27000		4200	11000		2700
PCB-1	PCB			U	1700		U	1000
PCB-3	PCB			U	320		U	200
PCB-4	PCB			U	690		U	410
PCB-5	PCB			U	310		U	190
PCB-6	PCB			U	310		U	190
PCB-7	PCB			U	310		U	190
PCB-8	PCB			U	310		U	190
PCB-9	PCB			U	310		U	190
PCB-10	PCB			U	690		U	410
PCB-12	PCB			U	140		U	94
PCB-13	PCB			U	140		U	94
PCB-14	PCB	PRC						
PCB-15	PCB			U	140		U	94
PCB-16	PCB			U	170		U	110
PCB-17	PCB			U	170		U	110
PCB-18	PCB			U	170		U	110
PCB-19	PCB			U	290		U	180
PCB-20	PCB			U	100		U	71
PCB-22	PCB			U	100		U	71
PCB-24	PCB			U	170		U	110
PCB-25	PCB			U	100		U	71
PCB-26	PCB			U	100		U	71
PCB-27	PCB			U	170		U	110
PCB-28	PCB			U	100		U	71
PCB-29	PCB			U	100		U	71

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-31	PCB			U	100		U	71
PCB-32	PCB			U	170		U	110
PCB-33	PCB			U	100		U	71
PCB-34	PCB			U	100		U	71
PCB-35	PCB			U	59		U	46
PCB-36	PCB	PRC						
PCB-37	PCB			U	59		U	46
PCB-40	PCB			U	55		U	44
PCB-41	PCB			U	55		U	44
PCB-42	PCB			U	55		U	44
PCB-44	PCB			U	55		U	44
PCB-45	PCB			U	82		U	61
PCB-46	PCB			U	82		U	61
PCB-47	PCB			U	55		U	44
PCB-48	PCB			U	55		U	44
PCB-49	PCB			U	55		U	44
PCB-51	PCB			U	82		U	61
PCB-52	PCB		260		55	250		44
PCB-53	PCB			U	82		U	61
PCB-54	PCB			U	84		U	62
PCB-56	PCB			U	38		U	32
PCB-59	PCB			U	55		U	44
PCB-60	PCB			U	38		U	32
PCB-63	PCB			U	38		U	32
PCB-64	PCB			U	55		U	44
PCB-66	PCB		98	J	38	140		32
PCB-67	PCB			U	38		U	32
PCB-69	PCB			U	55		U	44
PCB-70	PCB		96	J	38	85	J	32
PCB-71	PCB			U	55		U	44
PCB-73	PCB			U	55		U	44
PCB-74	PCB		71	J	38	47	J	32
PCB-75	PCB			U	55		U	44
PCB-77	PCB			U	25		U	24
PCB-78	PCB	PRC						
PCB-81	PCB			U	25		U	24
PCB-82	PCB			U	21		U	20
PCB-83	PCB			U	21		U	20
PCB-84	PCB			U	28		U	26
PCB-85	PCB			U	21		U	20
PCB-87	PCB			U	21		U	20
PCB-90	PCB		170		21	190		20
PCB-91	PCB			U	28		U	26

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-92	PCB			U	21		U	20
PCB-93	PCB			U	28		U	26
PCB-95	PCB		170		28	190		26
PCB-97	PCB		35	J	21	39	J	20
PCB-99	PCB		86		21	73		20
PCB-100	PCB			U	28		U	26
PCB-101	PCB			U	21		U	20
PCB-103	PCB			U	28		U	26
PCB-104	PCB	PRC						
PCB-105	PCB		24	J	15	29	J	16
PCB-107	PCB			U	15		U	16
PCB-110	PCB		63		21	70		20
PCB-114	PCB			U	15		U	16
PCB-115	PCB			U	21		U	20
PCB-117	PCB			U	21		U	20
PCB-118	PCB		83		15	87		16
PCB-119	PCB			U	21		U	20
PCB-121	PCB	PRC						
PCB-122	PCB			U	15		U	16
PCB-123	PCB			U	15		U	16
PCB-124	PCB			U	15		U	16
PCB-126	PCB			U	11		U	12
PCB-128	PCB			UL	8.1		UL	9.6
PCB-129	PCB			UL	8.1		UL	9.6
PCB-130	PCB			UL	8.1		UL	9.6
PCB-131	PCB			U	11		UL	12
PCB-132	PCB			U	11		UL	12
PCB-134	PCB			U	11		UL	12
PCB-135	PCB			U	11		UL	12
PCB-136	PCB			UL	9.5		UL	11
PCB-137	PCB			UL	8.1		UL	9.6
PCB-138	PCB		56	L	8.1	75	L	9.6
PCB-141	PCB			UL	8.1		UL	9.6
PCB-142	PCB	PRC						
PCB-144	PCB			U	11		UL	12
PCB-146	PCB			UL	8.1		UL	9.6
PCB-147	PCB			U	11		UL	12
PCB-149	PCB		66		11	86	L	12
PCB-151	PCB		11	J	11	15	JL	12
PCB-153	PCB		43	L	8.1	47	L	9.6
PCB-154	PCB			U	11		UL	12
PCB-155	PCB	PRC						
PCB-156	PCB			UL	6.3		UL	7.9

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-157	PCB			UL	6.3		UL	7.9
PCB-158	PCB			UL	8.1		UL	9.6
PCB-163	PCB			UL	8.1		UL	9.6
PCB-164	PCB			UL	8.1		UL	9.6
PCB-165	PCB			UL	8.1		UL	9.6
PCB-167	PCB			UL	6.3		UL	7.9
PCB-169	PCB			UL	4.9		UL	6.5
PCB-170	PCB			UL	3.3		UL	4.8
PCB-171	PCB			UL	4.1		UL	5.7
PCB-172	PCB			UL	3.3		UL	4.8
PCB-173	PCB			UL	4.1		UL	5.7
PCB-174	PCB			UL	4.1		UL	5.7
PCB-175	PCB			UL	4.1		UL	5.7
PCB-176	PCB			UL	3.6		UL	5.1
PCB-177	PCB			UL	4.1		UL	5.7
PCB-178	PCB			UL	4.1		UL	5.7
PCB-179	PCB			UL	3.6		UL	5.1
PCB-180	PCB		4.6	JL	3.3	8.4	JL	4.8
PCB-183	PCB			UL	4.1		UL	5.7
PCB-184	PCB			UL	3.6		UL	5.1
PCB-185	PCB			UL	4.1		UL	5.7
PCB-187	PCB		6.6	JL	4.1	13	JL	5.7
PCB-189	PCB			UL	2.7		UL	4.1
PCB-190	PCB			UL	3.3		UL	4.8
PCB-191	PCB			UL	3.3		UL	4.8
PCB-192	PCB	PRC						
PCB-193	PCB			UL	3.3		UL	4.8
PCB-194	PCB			UL	1.4		UL	2.5
PCB-195	PCB			UL	1.7		UL	2.8
PCB-196	PCB			UL	1.7		UL	2.8
PCB-197	PCB			UL	1.4		UL	2.5
PCB-199	PCB			UL	1.4		UL	2.5
PCB-200	PCB			UL	1.4		UL	2.5
PCB-201	PCB			UL	1.7		UL	2.8
PCB-202	PCB			UL	1.4		UL	2.5
PCB-203	PCB			UL	1.7		UL	2.8
PCB-204	PCB	PRC						
PCB-205	PCB			UL	1.4		UL	2.5
PCB-206	PCB			UL	0.7		UL	1.5
PCB-207	PCB			UL	0.58		UL	1.3
PCB-208	PCB			UL	0.58		UL	1.3
4,4'-DDD	Pesticide			U	210	190	J	120
4,4'-DDT	Pesticide			U	55		U	40

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
4,4'-DDE	Pesticide		210		34	150		27
Aldrin	Pesticide			U	18		U	17
alpha-BHC	Pesticide			U	3300		U	2000
alpha-Chlordane	Pesticide			U	120		U	76
beta-BHC	Pesticide			U	3300		U	2000
delta-BHC	Pesticide			U	2900		U	1800
Dieldrin	Pesticide			U	480		U	270
Endosulfan I	Pesticide			U	2700		U	1600
Endosulfan II	Pesticide			U	690		U	380
Endosulfan sulfate	Pesticide			U	3700		U	2300
Endrin	Pesticide			U	250		U	150
Endrin aldehyde	Pesticide			U	350		U	200
Endrin ketone	Pesticide			U	29000		U	24000
gamma-BHC (Lindane)	Pesticide			U	3200		U	2000
gamma-Chlordane	Pesticide			U	120		U	74
Heptachlor	Pesticide			U	38		U	29
Heptachlor epoxide	Pesticide			U	290		U	170
Methoxychlor	Pesticide			U	240		U	140
Toxaphene	Pesticide			U	5600		U	3600
Total PCBs			**1300**			**1400**		
Total PAH			**53000**			**27000**		

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
1-Methylnaphthalene	PAH			U	75000		U	67000		U	62000
2-Methylnaphthalene	PAH			U	71000		U	63000		U	58000
Acenaphthene	PAH			U	41000		U	37000		U	34000
Acenaphthylene	PAH			U	50000		U	44000		U	41000
Anthracene	PAH			U	14000	16000	J	13000		U	12000
Benzo(a)anthracene	PAH		1900	J	1300	1700	J	1200	1700	J	1100
Benzo(a)pyrene	PAH			U	510		U	450		U	420
Benzo(b)fluoranthene	PAH			U	510		U	450	1500		420
Benzo(ghi)perylene	PAH			UL	92		UL	82		UL	76
Benzo(k)fluoranthene	PAH			U	510		U	450	710	J	420
Chrysene	PAH		1700	J	1300	1500	J	1200	1600	J	1100
Dibenz(a,h)anthracene	PAH			U	430		U	390		U	350
Fluoranthene	PAH		23000		4300	22000		3800	15000		3500
Fluorene	PAH			U	24000		U	21000		U	20000
Indeno(1,2,3-cd)pyrene	PAH			UL	310		UL	280		UL	260
Naphthalene	PAH			U	160000		U	140000		U	130000
Phenanthrene	PAH		26000	J	14000	18000	J	13000		U	12000
Pyrene	PAH		20000		4300	23000		3800	16000		3500
PCB-1	PCB			U	1600		U	1400		U	1300
PCB-3	PCB			U	330		U	290		U	270
PCB-4	PCB			U	670		U	600		U	550
PCB-5	PCB			U	310		U	280		U	250
PCB-6	PCB			U	310		U	280		U	250
PCB-7	PCB			U	310		U	280		U	250
PCB-8	PCB			U	310		U	280		U	250
PCB-9	PCB			U	310		U	280		U	250
PCB-10	PCB			U	670		U	600		U	550
PCB-12	PCB			U	150		U	130		U	120
PCB-13	PCB			U	150		U	130		U	120
PCB-14	PCB	PRC									
PCB-15	PCB			U	150		U	130		U	120
PCB-16	PCB			U	180		U	160		U	140
PCB-17	PCB			U	180		U	160		U	140
PCB-18	PCB			U	180		U	160		U	140
PCB-19	PCB			U	290		U	260		U	240
PCB-20	PCB			U	110		U	95		U	87
PCB-22	PCB			U	110		U	95		U	87
PCB-24	PCB			U	180		U	160		U	140
PCB-25	PCB			U	110		U	95		U	87
PCB-26	PCB			U	110		U	95		U	87
PCB-27	PCB			U	180		U	160		U	140
PCB-28	PCB			U	110		U	95		U	87
PCB-29	PCB			U	110		U	95		U	87

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-31	PCB			U	110		U	95		U	87
PCB-32	PCB			U	180		U	160		U	140
PCB-33	PCB			U	110		U	95		U	87
PCB-34	PCB			U	110		U	95		U	87
PCB-35	PCB			U	65		U	58		U	53
PCB-36	PCB	PRC									
PCB-37	PCB			U	65		U	58		U	53
PCB-40	PCB			U	61		U	54		U	50
PCB-41	PCB			U	61		U	54		U	50
PCB-42	PCB			U	61		U	54		U	50
PCB-44	PCB			U	61		U	54		U	50
PCB-45	PCB			U	89		U	79		U	72
PCB-46	PCB			U	89		U	79		U	72
PCB-47	PCB			U	61		U	54		U	50
PCB-48	PCB			U	61		U	54		U	50
PCB-49	PCB			U	61		U	54		U	50
PCB-51	PCB			U	89		U	79		U	72
PCB-52	PCB			U	61		U	54		U	50
PCB-53	PCB			U	89		U	79		U	72
PCB-54	PCB			U	90		U	80		U	74
PCB-56	PCB			U	43		U	38		U	35
PCB-59	PCB			U	61		U	54		U	50
PCB-60	PCB			U	43		U	38		U	35
PCB-63	PCB			U	43		U	38		U	35
PCB-64	PCB			U	61		U	54		U	50
PCB-66	PCB			U	43		U	38		U	35
PCB-67	PCB			U	43		U	38		U	35
PCB-69	PCB			U	61		U	54		U	50
PCB-70	PCB			U	43		U	38		U	35
PCB-71	PCB			U	61		U	54		U	50
PCB-73	PCB			U	61		U	54		U	50
PCB-74	PCB			U	43		U	38		U	35
PCB-75	PCB			U	61		U	54		U	50
PCB-77	PCB			U	29		U	26		U	24
PCB-78	PCB	PRC									
PCB-81	PCB			U	29		U	26		U	24
PCB-82	PCB			U	24		U	22		U	20
PCB-83	PCB			U	24		U	22		U	20
PCB-84	PCB			U	32		U	29		U	26
PCB-85	PCB			U	24		U	22		U	20
PCB-87	PCB			U	24		U	22		U	20
PCB-90	PCB			U	24		U	22	59		20
PCB-91	PCB			U	32		U	29		U	26

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-92	PCB			U	24		U	22		U	20
PCB-93	PCB			U	32		U	29		U	26
PCB-95	PCB			U	32		U	29	38	J	26
PCB-97	PCB			U	24		U	22		U	20
PCB-99	PCB			U	24		U	22	36	J	20
PCB-100	PCB			U	32		U	29		U	26
PCB-101	PCB			U	24		U	22		U	20
PCB-103	PCB			U	32		U	29		U	26
PCB-104	PCB	PRC									
PCB-105	PCB			U	18		U	16		U	15
PCB-107	PCB			U	18		U	16		U	15
PCB-110	PCB			U	24		U	22		U	20
PCB-114	PCB			U	18		U	16		U	15
PCB-115	PCB			U	24		U	22		U	20
PCB-117	PCB			U	24		U	22		U	20
PCB-118	PCB			U	18		U	16	32	J	15
PCB-119	PCB			U	24		U	22		U	20
PCB-121	PCB	PRC									
PCB-122	PCB			U	18		U	16		U	15
PCB-123	PCB			U	18		U	16		U	15
PCB-124	PCB			U	18		U	16		U	15
PCB-126	PCB			UL	14		UL	12		UL	11
PCB-128	PCB			UL	10		UL	8.9		UL	8.2
PCB-129	PCB			UL	10		UL	8.9		UL	8.2
PCB-130	PCB			UL	10		UL	8.9		UL	8.2
PCB-131	PCB			UL	13		UL	11		UL	10
PCB-132	PCB			UL	13		UL	11		UL	10
PCB-134	PCB			UL	13		UL	11		UL	10
PCB-135	PCB			UL	13		UL	11		UL	10
PCB-136	PCB			UL	12		UL	10		UL	9.5
PCB-137	PCB			UL	10		UL	8.9		UL	8.2
PCB-138	PCB			UL	10		UL	8.9	37	L	8.2
PCB-141	PCB			UL	10		UL	8.9		UL	8.2
PCB-142	PCB	PRC									
PCB-144	PCB			UL	13		UL	11		UL	10
PCB-146	PCB			UL	10		UL	8.9		UL	8.2
PCB-147	PCB			UL	13		UL	11		UL	10
PCB-149	PCB		18	JL	13		UL	11	44	L	10
PCB-151	PCB			UL	13		UL	11		UL	10
PCB-153	PCB		11	JL	10	11	JL	8.9		UL	8.2
PCB-154	PCB			UL	13		UL	11		UL	10
PCB-155	PCB	PRC									
PCB-156	PCB			UL	7.9		UL	7		UL	6.5

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-157	PCB			UL	7.9		UL	7		UL	6.5
PCB-158	PCB			UL	10		UL	8.9		UL	8.2
PCB-163	PCB			UL	10		UL	8.9		UL	8.2
PCB-164	PCB			UL	10		UL	8.9		UL	8.2
PCB-165	PCB			UL	10		UL	8.9		UL	8.2
PCB-167	PCB			UL	7.9		UL	7		UL	6.5
PCB-169	PCB			UL	6.2		UL	5.5		UL	5.1
PCB-170	PCB			UL	4.3		UL	3.9		UL	3.5
PCB-171	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-172	PCB			UL	4.3		UL	3.9		UL	3.5
PCB-173	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-174	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-175	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-176	PCB			UL	4.7		UL	4.2		UL	3.8
PCB-177	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-178	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-179	PCB			UL	4.7		UL	4.2		UL	3.8
PCB-180	PCB			UL	4.3		UL	3.9		UL	3.5
PCB-183	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-184	PCB			UL	4.7		UL	4.2		UL	3.8
PCB-185	PCB			UL	5.3		UL	4.7		UL	4.3
PCB-187	PCB			UL	5.3		UL	4.7	5.6	JL	4.3
PCB-189	PCB			UL	3.5		UL	3.1		UL	2.9
PCB-190	PCB			UL	4.3		UL	3.9		UL	3.5
PCB-191	PCB			UL	4.3		UL	3.9		UL	3.5
PCB-192	PCB	PRC									
PCB-193	PCB			UL	4.3		UL	3.9		UL	3.5
PCB-194	PCB			UL	1.9		UL	1.7		UL	1.6
PCB-195	PCB			UL	2.3		UL	2		UL	1.8
PCB-196	PCB			UL	2.3		UL	2		UL	1.8
PCB-197	PCB			UL	2		UL	1.7		UL	1.6
PCB-199	PCB			UL	2		UL	1.7		UL	1.6
PCB-200	PCB			UL	2		UL	1.7		UL	1.6
PCB-201	PCB			UL	2.3		UL	2		UL	1.8
PCB-202	PCB			UL	2		UL	1.7		UL	1.6
PCB-203	PCB			UL	2.3		UL	2		UL	1.8
PCB-204	PCB	PRC									
PCB-205	PCB			UL	1.9		UL	1.7		UL	1.6
PCB-206	PCB			UL	1		UL	0.89		UL	0.82
PCB-207	PCB			UL	0.84		UL	0.75		UL	0.69
PCB-208	PCB			UL	0.84		UL	0.75		UL	0.69
4,4'-DDD	Pesticide			U	200		U	200		U	200
4,4'-DDT	Pesticide			U	56		U	56		U	56

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)	Result (pg/L)	Qualifier	MDL (pg/L)
4,4'-DDE	Pesticide			U	36		U	36		U	36
Aldrin	Pesticide			U	20		U	20		U	20
alpha-BHC	Pesticide			U	3000		U	3000		U	3000
alpha-Chlordane	Pesticide			U	120		U	120		U	120
beta-BHC	Pesticide			U	3000		U	3000		U	3000
delta-BHC	Pesticide			U	2600		U	2600		U	2600
Dieldrin	Pesticide			U	450		U	450		U	450
Endosulfan I	Pesticide			U	2400		U	2400		U	2400
Endosulfan II	Pesticide			U	640		U	640		U	640
Endosulfan sulfate	Pesticide			U	3300		U	3300		U	3300
Endrin	Pesticide			U	240		U	240		U	240
Endrin aldehyde	Pesticide			U	330		U	330		U	330
Endrin ketone	Pesticide			U	26000		U	26000		U	26000
gamma-BHC (Lindane)	Pesticide			U	2900		U	2900		U	2900
gamma-Chlordane	Pesticide			U	110		U	110		U	110
Heptachlor	Pesticide			U	40		U	40		U	40
Heptachlor epoxide	Pesticide			U	280		U	280		U	280
Methoxychlor	Pesticide			U	240		U	240		U	240
Toxaphene	Pesticide			U	5500		U	5500		U	5500
Total PCBs			**29**			**11**			**250**		
Total PAH			**73000**			**83000**			**36000**		

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-6-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
1-Methylnaphthalene	PAH			U	85000
2-Methylnaphthalene	PAH			U	81000
Acenaphthene	PAH			U	48000
Acenaphthylene	PAH			U	57000
Anthracene	PAH			U	16000
Benzo(a)anthracene	PAH		3100	J	1400
Benzo(a)pyrene	PAH			UL	510
Benzo(b)fluoranthene	PAH		2800	L	510
Benzo(ghi)perylene	PAH			UL	84
Benzo(k)fluoranthene	PAH			UL	510
Chrysene	PAH		3500	J	1400
Dibenz(a,h)anthracene	PAH			UL	430
Fluoranthene	PAH		33000		4800
Fluorene	PAH			U	28000
Indeno(1,2,3-cd)pyrene	PAH			UL	310
Naphthalene	PAH			U	170000
Phenanthrene	PAH			U	16000
Pyrene	PAH		35000		4800
PCB-1	PCB			U	1800
PCB-3	PCB			U	370
PCB-4	PCB			U	770
PCB-5	PCB			U	350
PCB-6	PCB			U	350
PCB-7	PCB			U	350
PCB-8	PCB			U	350
PCB-9	PCB			U	350
PCB-10	PCB			U	770
PCB-12	PCB			U	160
PCB-13	PCB			U	160
PCB-14	PCB	PRC			
PCB-15	PCB			U	160
PCB-16	PCB			U	190
PCB-17	PCB			U	190
PCB-18	PCB			U	190
PCB-19	PCB			U	330
PCB-20	PCB			U	120
PCB-22	PCB			U	120
PCB-24	PCB			U	190
PCB-25	PCB			U	120
PCB-26	PCB			U	120
PCB-27	PCB			U	190
PCB-28	PCB			U	120
PCB-29	PCB			U	120

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-6-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-31	PCB			U	120
PCB-32	PCB			U	190
PCB-33	PCB			U	120
PCB-34	PCB			U	120
PCB-35	PCB			U	69
PCB-36	PCB	PRC			
PCB-37	PCB			U	69
PCB-40	PCB			U	64
PCB-41	PCB			U	64
PCB-42	PCB			U	64
PCB-44	PCB			U	64
PCB-45	PCB			U	95
PCB-46	PCB			U	95
PCB-47	PCB			U	64
PCB-48	PCB			U	64
PCB-49	PCB			U	64
PCB-51	PCB			U	95
PCB-52	PCB			U	64
PCB-53	PCB			U	95
PCB-54	PCB			U	97
PCB-56	PCB			U	44
PCB-59	PCB			U	64
PCB-60	PCB			U	44
PCB-63	PCB			U	44
PCB-64	PCB			U	64
PCB-66	PCB			U	44
PCB-67	PCB			U	44
PCB-69	PCB			U	64
PCB-70	PCB			U	44
PCB-71	PCB			U	64
PCB-73	PCB			U	64
PCB-74	PCB			U	44
PCB-75	PCB			U	64
PCB-77	PCB			UL	30
PCB-78	PCB	PRC			
PCB-81	PCB			UL	30
PCB-82	PCB			UL	24
PCB-83	PCB			UL	24
PCB-84	PCB			U	33
PCB-85	PCB			UL	24
PCB-87	PCB			UL	24
PCB-90	PCB		81	L	24
PCB-91	PCB			U	33

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-6-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-92	PCB			UL	24
PCB-93	PCB			U	33
PCB-95	PCB		56	J	33
PCB-97	PCB			UL	24
PCB-99	PCB		45	JL	24
PCB-100	PCB			U	33
PCB-101	PCB			UL	24
PCB-103	PCB			U	33
PCB-104	PCB	PRC			
PCB-105	PCB			UL	18
PCB-107	PCB			UL	18
PCB-110	PCB			UL	24
PCB-114	PCB			UL	18
PCB-115	PCB			UL	24
PCB-117	PCB			UL	24
PCB-118	PCB		39	JL	18
PCB-119	PCB			UL	24
PCB-121	PCB	PRC			
PCB-122	PCB			UL	18
PCB-123	PCB			UL	18
PCB-124	PCB			UL	18
PCB-126	PCB			UL	13
PCB-128	PCB			UL	9.6
PCB-129	PCB			UL	9.6
PCB-130	PCB			UL	9.6
PCB-131	PCB			UL	12
PCB-132	PCB			UL	12
PCB-134	PCB			UL	12
PCB-135	PCB			UL	12
PCB-136	PCB			UL	11
PCB-137	PCB			UL	9.6
PCB-138	PCB		40	L	9.6
PCB-141	PCB			UL	9.6
PCB-142	PCB	PRC			
PCB-144	PCB			UL	12
PCB-146	PCB			UL	9.6
PCB-147	PCB			UL	12
PCB-149	PCB		46	L	12
PCB-151	PCB			UL	12
PCB-153	PCB			UL	9.6
PCB-154	PCB			UL	12
PCB-155	PCB	PRC			
PCB-156	PCB			UL	7.4

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Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-6-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
PCB-157	PCB			UL	7.4
PCB-158	PCB			UL	9.6
PCB-163	PCB			UL	9.6
PCB-164	PCB			UL	9.6
PCB-165	PCB			UL	9.6
PCB-167	PCB			UL	7.4
PCB-169	PCB			UL	5.8
PCB-170	PCB			UL	3.9
PCB-171	PCB			UL	4.9
PCB-172	PCB			UL	3.9
PCB-173	PCB			UL	4.9
PCB-174	PCB			UL	4.9
PCB-175	PCB			UL	4.9
PCB-176	PCB			UL	4.3
PCB-177	PCB			UL	4.9
PCB-178	PCB			UL	4.9
PCB-179	PCB			UL	4.3
PCB-180	PCB			UL	3.9
PCB-183	PCB			UL	4.9
PCB-184	PCB			UL	4.3
PCB-185	PCB			UL	4.9
PCB-187	PCB		5.6	JL	4.9
PCB-189	PCB			UL	3.1
PCB-190	PCB			UL	3.9
PCB-191	PCB			UL	3.9
PCB-192	PCB	PRC			
PCB-193	PCB			UL	3.9
PCB-194	PCB			UL	1.6
PCB-195	PCB			UL	2
PCB-196	PCB			UL	2
PCB-197	PCB			UL	1.7
PCB-199	PCB			UL	1.7
PCB-200	PCB			UL	1.7
PCB-201	PCB			UL	2
PCB-202	PCB			UL	1.7
PCB-203	PCB			UL	2
PCB-204	PCB	PRC			
PCB-205	PCB			UL	1.6
PCB-206	PCB			UL	0.82
PCB-207	PCB			UL	0.68
PCB-208	PCB			UL	0.68
4,4'-DDD	Pesticide			U	280
4,4'-DDT	Pesticide			U	76

Table 1. Concentration of Freely-Dissolved (Cfree) Analyte

		Client ID	RARA-SPME-6-081516		
Analyte	Analyte Group	PRC	Result (pg/L)	Qualifier	MDL (pg/L)
4,4'-DDE	Pesticide		60	J	47
Aldrin	Pesticide			UL	26
alpha-BHC	Pesticide			U	4300
alpha-Chlordane	Pesticide			U	160
beta-BHC	Pesticide			U	4300
delta-BHC	Pesticide			U	3800
Dieldrin	Pesticide			U	650
Endosulfan I	Pesticide			U	3500
Endosulfan II	Pesticide			U	930
Endosulfan sulfate	Pesticide			U	4800
Endrin	Pesticide			U	350
Endrin aldehyde	Pesticide			U	480
Endrin ketone	Pesticide			U	34000
gamma-BHC (Lindane)	Pesticide			U	4100
gamma-Chlordane	Pesticide			U	160
Heptachlor	Pesticide			U	53
Heptachlor epoxide	Pesticide			U	400
Methoxychlor	Pesticide			U	330
Toxaphene	Pesticide			U	7700
Total PCBs			**310**		
Total PAH			**78000**		

Notes
1. Interval: depth below sediment-water interface in centimeters
2. U: Not detected at the MDL shown in the second column for each sample.
3. J: Analyte concentration is below calibration range
4. L: Percent to steady state less than 10%
5. Abbreviations:
   DDD: dichlorodiphenyldichloroethane DDT: dichlorodiphenyltrichloroethane pg/L: picogram per liter
   DDE: dichlorodiphenyldichloroethylene MDL: method detection limit

ATTACHMENT A: DATA ANALYSIS METHODS

Attachment A: Data Analysis Methods
Concentrations of Freely-Dissolved DDX
Measured via SP3^{TM} Passive Samplers

The concentration of analytes in PE (Table A1) obtained from the information provided in the ERDC Environmental Laboratory report (Attachment B) are used in a multi-step data process to calculate C_{free} analytes as described below.

Step 1:

The concentrations of the PRCs in PE [PE_t] were used to calculate the elimination rate (k_e) values for the PRCs in each deployed sampler using the following equation (Lohmann, 2012):

$$PRC\ \ k_e = \ln\left(\frac{[PE_{t=0}]}{[PE_{t=final}]}\right) \div t_{final}$$

where:

$PE_{t=0}$	= the average concentration of the PRC present in the PE at the beginning of the deployment (obtained from an average measurement of the trip blanks);
$PE_{t=final}$	= the concentration of the PRC in the PE after the deployment (obtained from each deployed PE sampler); and
t_{final}	= the deployment time (in days).
k_e	= the elimination rate (in days^{-1})

PRC k_e values for the PRCs in each sampler are shown in Table A2. The values are also expressed as a percentage of steady state (concentration at equilibrium). Several PRC k_e values were not calculated and were treated as outliers because $PE_{t=final}$ values were equal to or greater than $PE_{t=0}$ values.

Step 2:

The second step was to estimate k_e values for the non-PRC primary analytes (OCP, PAH, and non-PRC PCB) in each of the deployed samplers. This was accomplished by developing a linear regression model using PRC k_e values (dependent variable, from Table A2) and PE-water partition coefficients (K_{PE}) for each PRC PCB (independent variable, Smedes et al., 2009). Note that regression models were specific to each sampler (i.e. not global to the whole deployment) as local geologic and hydrodynamic conditions can vary greatly within a site.

Values were $\log_{10}$-transformed per Tomaszewski and Luthy (2008). By entering the analyte-specific K_{PE} into the linear regression model developed for each sampler, k_e values for each of the primary analytes for each sampler were calculated.

Step 3:

This step describes the calculation of sampling rate correction factors (*CF*s) for each primary analyte in each sampler. The following equation is used, as adapted from Lohmann (2012):

$$CF = \frac{1}{1 - e^{-k_e \times t_{final}}}$$

where:

k_e	= the elimination rate value predicted by the sampler-specific regression model (in days^{-1}); and
t_{final}	= the deployment time (in days).

Step 4:

The concentration of primary analyte in the PE of each sampler (obtained from Table A1) were multiplied by the *CF* values to calculate the steady-state concentration of primary analytes. Note, no impurities were observed in the trip blank (e.g., non-PRC PCBs).

Step 5:

In the final step, the steady-state concentrations are divided by K_{PE} values (Choi et al., 2013; Lohmann and Muir, 2010, Thompson et al., 2015; U.S. EPA, 2012) to obtain the concentrations of C_{free} primary analytes. These are reported in Table 1. C_{free} Method Detection Limits (MDLs) were calculated in the approach described above using the estimated MDL concentration in PE, as reported by EDRC Environmental Laboratory and shown in Table A1. For samples in which the percentage of steady state was indicated to be less than 10% for a primary analyte, C_{free} was calculated and given an "L" qualifier in Table 1.

2

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TABLE A1

Table A1. Concentration of Analytes in Polyethylene

	Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516			RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516			RARA-SPME-6-081516			RARA-SPME-TB-081516		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
1-Methylnaphthalene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
2-Methylnaphthalene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Acenaphthene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Acenaphthylene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Anthracene			U	89.90		U	96.60		U	9510	109	J	84.70		U	77.90		U	75.10		U	82.90
Benzo(a)anthracene			U	89.90	648		96.60	136	J	9510	121	J	84.70	122	J	77.90	161	J	75.10		U	82.90
Benzo(a)pyrene		424		89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Benzo(b)fluoranthene		873		89.90	1280		96.60		U	9510		U	84.70	289		77.90	418		75.10		U	82.90
Benzo(ghi)perylene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Benzo(k)fluoranthene		334		89.90	455		96.60		U	9510		U	84.70	133	J	77.90		U	75.10		U	82.90
Chrysene			U	89.90	193	J	96.60	122	J	9510	109	J	84.70	111	J	77.90	182	J	75.10		U	82.90
Dibenz(a,h)anthracene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Fluoranthene		385		89.90		U	96.60	516		9510	484		84.70	323		77.90	526		75.10		U	82.90
Fluorene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Indeno(1,2,3-cd)pyrene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Naphthalene			U	89.90		U	96.60		U	9510		U	84.70		U	77.90		U	75.10		U	82.90
Phenanthrene			U	89.90		U	96.60	177	J	9510	121	J	84.70		U	77.90		U	75.10		U	82.90
Pyrene		591		89.90	386		96.60	448		9510	521		84.70	356		77.90	558		75.10		U	82.90
PCB-1			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-3			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-4			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-5			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-6			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-7			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-8			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-9			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-10			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-12			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-13			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-14	PRC	25.7		4.27	19.9		4.60	26.4		453	23.8		4.03	29.1		3.70	28.1		3.57	27.3		3.93
PCB-15			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-16			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-17			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-18			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-19			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-20			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-22			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-24			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-25			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-26			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-27			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-28			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-29			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-31			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-32			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-33			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-34			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-35			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-36	PRC	86.8		4.27	86		4.60	126		453	127		4.03	120		3.70	113		3.57	132		3.93
PCB-37			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-40			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-41			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-42			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-44			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-45			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-46			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-47			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-48			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-49			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-51			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93

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Table A1. Concentration of Analytes in Polyethylene

	Client ID	RARA-SPME-1-081516			RARA-SPME-2-081516			RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516			RARA-SPME-6-081516			RARA-SPME-TB-081516		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
PCB-52		20.3		4.27	25.8		4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-53			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-54			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-56			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-59			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-60			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-63			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-64			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-66		11	J	4.27	20.1		4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-67			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-69			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-70		10.8	J	4.27	12.2	J	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-71			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-73			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-74		7.98	J	4.27	6.67	J	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-75			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-77			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-78	PRC	205		4.27	228		4.60	307		453	294		4.03	299		3.70	284		3.57	322		3.93
PCB-81			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-82			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-83			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-84			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-85			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-87			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-90		35.6		4.27	42.7		4.60		U	453		U	4.03	11.1		3.70	11.9		3.57		U	3.93
PCB-91			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-92			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-93			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-95		25.7		4.27	33.5		4.60		U	453		U	4.03	5.29	J	3.70	6.03	J	3.57		U	3.93
PCB-97		7.25	J	4.27	8.87	J	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-99		17.6		4.27	16.9		4.60		U	453		U	4.03	6.82	J	3.70	6.66	J	3.57		U	3.93
PCB-100			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-101			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-103			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-104	PRC	54.9		4.27	61.3		4.60	51.7		453	51.3		4.03	55.2		3.70	52.4		3.57	53.9		3.93
PCB-105		6.69	J	4.27	8.41	J	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-107			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-110		12.9		4.27	16.1		4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-114			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-115			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-117			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-118		23.3		4.27	25.6		4.60		U	453		U	4.03	7.88	J	3.70	7.76	J	3.57		U	3.93
PCB-119			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-121	PRC	289		4.27	309		4.60	352		453	334		4.03	339		3.70	322		3.57	345		3.93
PCB-122			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-123			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-124			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-126			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-128			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-129			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-130			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-131			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-132			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-134			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-135			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-136			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-137			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-138		29.2		4.27	36		4.60		U	453		U	4.03	16.5		3.70	15		3.57		U	3.93
PCB-141			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-142	PRC	254		4.27	266		4.60	290		453	323		4.03	283		3.70	268		3.57	289		3.93

Page 2 of 4

Table A1. Concentration of Analytes in Polyethylene

Client ID		RARA-SPME-1-081516			RARA-SPME-2-081516			RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516			RARA-SPME-6-081516			RARA-SPME-TB-081516		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
PCB-144			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-146			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-147			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-149		26.6		4.27	33.7		4.60	6.52	J	453		U	4.03	15.7		3.70	13.3		3.57		U	3.93
PCB-151		4.62	J	4.27	6.07	J	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-153		22.5		4.27	22.7		4.60	4.93	J	453	5.1	J	4.03		U	3.70		U	3.57		U	3.93
PCB-154			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-155	PRC	352		4.27	359		4.60	375		453	357		4.03	368		3.70	350		3.57	355		3.93
PCB-156			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-157			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-158			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-163			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-164			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-165			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-167			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-169			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-170			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-171			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-172			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-173			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-174			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-175			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-176			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-177			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-178			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-179			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-180		5.89	J	4.27	8.02	J	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-183			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-184			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-185			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-187		6.75	J	4.27	10.2	J	4.60		U	453		U	4.03	4.79	J	3.70	4.06	J	3.57		U	3.93
PCB-189			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-190			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-191			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-192	PRC	491		4.27	503		4.60	532		453	516		4.03	537		3.70	504		3.57	532		3.93
PCB-193			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-194			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-195			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-196			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-197			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-199			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-200			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-201			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-202			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-203			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-204	PRC	686		4.27	682		4.60	710		453	682		4.03	724		3.70	677		3.57	701		3.93
PCB-205			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-206			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-207			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
PCB-208			U	4.27		U	4.60		U	453		U	4.03		U	3.70		U	3.57		U	3.93
4,4'-DDD			U	4.00	6.29	J	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
4,4'-DDT			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
4,4'-DDE		25.1		4.00	21.7		4.00		U	400		U	4.00		U	4.00	5.09	J	4.00		U	4.00
Aldrin			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
alpha-BHC			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
alpha-Chlordane			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
beta-BHC			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
delta-BHC			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Dieldrin			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Endosulfan I			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00

Table A1. Concentration of Analytes in Polyethylene

Client ID		RARA-SPME-1-081516			RARA-SPME-2-081516			RARA-SPME-3-081516			RARA-SPME-4-081516			RARA-SPME-5-081516			RARA-SPME-6-081516			RARA-SPME-TB-081516		
Analyte	PRC	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)	Result (ng/g)	Qualifier	MDL (ng/g)
Endosulfan II			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Endosulfan sulfate			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Endrin			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Endrin aldehyde			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Endrin ketone			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
gamma-BHC (Lindane)			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
gamma-Chlordane			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Heptachlor			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Heptachlor epoxide			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Methoxychlor			U	4.00		U	4.00		U	400		U	4.00		U	4.00		U	4.00		U	4.00
Toxaphene			U	200.00		U	200.00		U	20000		U	200.00		U	200.00		U	200.00		U	200.00

Notes
1. U: Not detected at the MDL shown in the second column for each sample.
2. J: Analyte concentration is below calibration range
3. Abbreviations:
   DDD: dichlorodiphenyldichloroethane
   DDE: dichlorodiphenyldichloroethylene
   DDT: dichlorodiphenyltrichloroethane
   MDL: method detection limit
   ng/g: nanogram per gram
   PCB: Polychlorinated biphenyl
   PRC: Performance Reference Compound

TABLE A2

Table A2. Elimination Rates (ke) and Percentage to Steady State Reached by Performance Reference Compounds (PRCs) During Deployment.

Client ID		RARA-SPME-1-081516		RARA-SPME-2-081516		RARA-SPME-3-081516		RARA-SPME-4-081516		RARA-SPME-5-081516		RARA-SPME-6-081516	
PRC	Homolog Group	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %	k_e (d^{-1})	Steady State %
PCB-14	Di	0.002157	6%	0.011292	27%	0.006724	16%	0.006724	16%	0.006724	16%	OUTLIER	
PCB-36	Tri	0.014971	34%	0.015302	35%	0.011941	28%	0.011941	28%	0.011941	28%	0.005551	14%
PCB-78	Tetra	0.016126	36%	0.012329	29%	0.010980	26%	0.010980	26%	0.010980	26%	0.004485	12%
PCB-104	Penta	OUTLIER		OUTLIER		OUTLIER		OUTLIER		OUTLIER		OUTLIER	
PCB-121	Penta	0.006326	16%	0.003936	10%	0.004242	11%	0.004242	11%	0.004242	11%	0.002464	7%
PCB-142	Hexa	0.004610	12%	0.002962	8%	0.003422	9%	0.003422	9%	0.003422	9%	0.002694	7%
PCB-155	Hexa	OUTLIER		OUTLIER		OUTLIER		OUTLIER		OUTLIER		OUTLIER	
PCB-192	Hepta	0.002864	8%	0.002002	5%	0.002266	6%	0.002266	6%	0.002266	6%	0.001931	5%
PCB-204	Octa	0.000773	2%	0.000981	3%	0.000999	3%	0.000999	3%	0.000999	3%	0.001244	3%

Notes

1. The PRCs noted "OUTLIER" were removed from the calculations. See report text.
2. For RARA-SPME-3-081516, RARA-SPME-4-081516, and RARA-SPME-5-081516, the PRC results were not considered reliable; therefore, the average k_e values (where calculated) from samples 1, 2, and 6 were applied to samples 3, 4, and 5 to correct concentrations for non-equilibrium conditions. See report text.
3. Abbreviations:
   d: day %: percent PCB: Polychlorinated biphenyl

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ATTACHMENT B: ERDC ENVIRONMENTAL LABORATORY REPORT

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

13 December 2016

Joel Guererro
Navy – SPAWAR
Environmental Science and Applied System Branch, 536(
San Diego, CA 92152

RE: RARA

Enclosed are the results of analyses for samples received by the laboratory on 18-Aug-2016. The samples associated with this report will be held for 90 days from the date of this report. The raw data associated with this report will be held for 5 years from the date of this report. If you need us to hold onto the samples or the data longer then these specified times, you will need to notify us in writing at least 30 days before the expiration dates. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jenifer Milam
Database Manager

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

WORK ORDER SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date of Work Order
RARA-SPME-1-081516	6081807-01	passive sampler (calculated)	15-Aug-2016	18-Aug-2016
RARA-SPME-2-081516	6081807-02	passive sampler (calculated)	15-Aug-2016	18-Aug-2016
RARA-SPME-3-081516	6081807-03	passive sampler (calculated)	15-Aug-2016	18-Aug-2016
RARA-SPME-4-081516	6081807-04	passive sampler (calculated)	15-Aug-2016	18-Aug-2016
RARA-SPME-5-081516	6081807-05	passive sampler (calculated)	15-Aug-2016	18-Aug-2016
RARA-SPME-6-081516	6081807-06	passive sampler (calculated)	15-Aug-2016	18-Aug-2016
RARA-SPME-TB-081516	6081807-07	passive sampler (calculated)	15-Aug-2016	18-Aug-2016

USACE ERDC-EP-C
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Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Case Narrative

No issues were experienced during the analysis of Work Order 6081807 unless specified below.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Notes and Definitions

Z-03	See case narrative.
U	Analyte included in the analysis, but not detected
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-1-081516

6081807-01 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDE	**25.1**	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	309		*120 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	205		*79.8 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) anthracene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) pyrene	**424**	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Benzo (b) fluoranthene	**873**	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	**334**	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Chrysene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-1-081516

6081807-01 (passive sampler (calculated))

ERDC-EL-EP-C

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Dibenz (a,h) anthracene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Fluoranthene	**385**	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Fluorene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	ND	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Pyrene	**591**	89.9	257	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**1300**		*51.0 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**1400**		*56.0 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-2-081516

6081807-02 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**6.29**	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	J
4,4´-DDE	**21.7**	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**281**		*102 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**195**		*70.6 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) anthracene	**648**	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Benzo (a) pyrene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (b) fluoranthene	**1280**	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	**455**	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Chrysene	**193**	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Dibenz (a,h) anthracene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-2-081516

6081807-02 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
ERDC-EL-EP-C								
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Fluorene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	ND	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Pyrene	**386**	96.6	276	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**1600**		*56.5 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**1500**		*53.0 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-3-081516

6081807-03 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDE	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**286**		*105 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**186**		*68.4 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) anthracene	**136**	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Benzo (a) pyrene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (b) fluoranthene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (g,h,i) perylene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Chrysene	**122**	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Dibenz (a,h) anthracene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

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6081807-03 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**516**	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Fluorene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	**177**	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Pyrene	**448**	95.1	272	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**1400**		*52.5 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**1600**		*57.5 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-4-081516

6081807-04 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDE	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	324		*134 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	214		*88.5 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	**109**	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Benzo (a) anthracene	**121**	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Benzo (a) pyrene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (b) fluoranthene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (g,h,i) perylene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Chrysene	**109**	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Dibenz (a,h) anthracene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

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6081807-04 (passive sampler (calculated))

ERDC-EL-EP-C

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Fluoranthene	**484**	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Fluorene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	**121**	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Pyrene	**521**	84.7	242	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**1500**		*61.0 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	**1400**		*59.0 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-5-081516

6081807-05 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDE	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**215**		*96.5 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**150**		*67.4 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) anthracene	**122**	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Benzo (a) pyrene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (b) fluoranthene	**289**	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	**133**	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Chrysene	**111**	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Dibenz (a,h) anthracene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-5-081516

6081807-05 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**323**	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Fluorene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	ND	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Pyrene	**356**	77.9	222	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**1300**		*57.5 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**1200**		*54.0 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-6-081516

6081807-06 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDE	**5.09**	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	J
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**196**		*91.3 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**132**		*61.4 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) anthracene	**161**	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Benzo (a) pyrene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (b) fluoranthene	**418**	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Benzo (g,h,i) perylene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Chrysene	**182**	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	J
Dibenz (a,h) anthracene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-6-081516

6081807-06 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**526**	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Fluorene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	ND	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Pyrene	**558**	75.1	215	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**1100**		*50.0 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**1300**		*62.5 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-TB-081516

6081807-07 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDE	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
4,4´-DDT	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Aldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
alpha-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
beta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
delta-BHC	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Dieldrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan I	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan II	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endosulfan sulfate	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin aldehyde	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Endrin ketone	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
gamma-Chlordane	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Heptachlor epoxide	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Methoxychlor	ND	4.00	12.5	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Toxaphene	ND	200	625	ug/kg	11-Oct-2016	07-Dec-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**249**		*105 %*	*25-140*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**177**		*74.8 %*	*30-135*	*11-Oct-2016*	*07-Dec-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
2-Methylnaphthalene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Acenaphthylene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Anthracene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) anthracene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (a) pyrene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (b) fluoranthene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (g,h,i) perylene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Chrysene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Dibenz (a,h) anthracene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U

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Navy -- SPAWAR	Project: RARA	
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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

RARA-SPME-TB-081516

6081807-07 (passive sampler (calculated))

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Fluorene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Naphthalene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Phenanthrene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Pyrene	ND	82.9	237	ug/kg	11-Oct-2016	12-Oct-2016	EPA 8270C	U
Surrogate: 2-Fluorobiphenyl	**1300**		*55.5 %*	*45-110*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	**1400**		*59.0 %*	*40-125*	*11-Oct-2016*	*12-Oct-2016*	*EPA 8270C*	

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Navy -- SPAWAR	Project: RARA	
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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610102 - * DEFAULT PREP *****											
Blank (B610102-BLK1)					Prepared: 11-Oct-2016 Analyzed: 07-Dec-2016						
4,4'-DDD	ND	4.00	12.5	ug/kg							U
4,4'-DDE	ND	4.00	12.5	ug/kg							U
4,4'-DDT	ND	4.00	12.5	ug/kg							U
Aldrin	ND	4.00	12.5	ug/kg							U
alpha-BHC	ND	4.00	12.5	ug/kg							U
alpha-Chlordane	ND	4.00	12.5	ug/kg							U
beta-BHC	ND	4.00	12.5	ug/kg							U
delta-BHC	ND	4.00	12.5	ug/kg							U
Dieldrin	ND	4.00	12.5	ug/kg							U
Endosulfan I	ND	4.00	12.5	ug/kg							U
Endosulfan II	ND	4.00	12.5	ug/kg							U
Endosulfan sulfate	ND	4.00	12.5	ug/kg							U
Endrin	ND	4.00	12.5	ug/kg							U
Endrin aldehyde	ND	4.00	12.5	ug/kg							U
Endrin ketone	ND	4.00	12.5	ug/kg							U
gamma-BHC (Lindane)	ND	4.00	12.5	ug/kg							U
gamma-Chlordane	ND	4.00	12.5	ug/kg							U
Heptachlor	ND	4.00	12.5	ug/kg							U
Heptachlor epoxide	ND	4.00	12.5	ug/kg							U
Methoxychlor	ND	4.00	12.5	ug/kg							U
Toxaphene	ND	200	525	ug/kg							U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*283*			*ug/kg*	*250.0*		*113*	*25-140*			
Surrogate: Decachlorobiphenyl	*187*			*ug/kg*	*250.0*		*74.8*	*30-135*			
LCS (B610102-BS1)					Prepared: 11-Oct-2016 Analyzed: 07-Dec-2016						
4,4'-DDD	225	4.00	12.5	ug/kg	250.0		90.2	25-150			
4,4'-DDE	246	4.00	12.5	ug/kg	250.0		98.4	35-140			
4,4'-DDT	231	4.00	12.5	ug/kg	250.0		92.3	45-140			
Aldrin	190	4.00	12.5	ug/kg	250.0		76.2	25-140			
alpha-BHC	169	4.00	12.5	ug/kg	250.0		67.4	60-130			
alpha-Chlordane	209	4.00	12.5	ug/kg	250.0		83.6	65-125			
beta-BHC	221	4.00	12.5	ug/kg	250.0		88.2	65-125			
delta-BHC	8.10	4.00	12.5	ug/kg	250.0		3.24	45-135			Z-03, J
Dieldrin	225	4.00	12.5	ug/kg	250.0		89.9	60-130			
Endosulfan I	216	4.00	12.5	ug/kg	250.0		86.3	50-110			
Endosulfan II	238	4.00	12.5	ug/kg	250.0		95.2	30-130			
Endosulfan sulfate	203	4.00	12.5	ug/kg	250.0		81.2	55-135			
Endrin	221	4.00	12.5	ug/kg	250.0		88.5	55-135			
Endrin aldehyde	ND	4.00	12.5	ug/kg	250.0			55-135			Z-03, U
Endrin ketone	224	4.00	12.5	ug/kg	250.0		89.6	75-125			
gamma-BHC (Lindane)	200	4.00	12.5	ug/kg	250.0		80.1	25-125			

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San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610102 - * DEFAULT PREP *****											
LCS (B610102-BS1)					Prepared: 11-Oct-2016 Analyzed: 07-Dec-2016						
gamma-Chlordane	218	4.00	12.5	ug/kg	250.0		87.3	60-125			
Heptachlor	236	4.00	12.5	ug/kg	250.0		94.4	40-130			
Heptachlor epoxide	220	4.00	12.5	ug/kg	250.0		88.0	60-130			
Methoxychlor	230	4.00	12.5	ug/kg	250.0		92.0	55-150			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*286*			*ug/kg*	*250.0*		*114*	*25-140*			
Surrogate: Decachlorobiphenyl	*192*			*ug/kg*	*250.0*		*76.9*	*30-135*			
LCS (B610102-BS3)					Prepared: 11-Oct-2016 Analyzed: 13-Dec-2016						
Toxaphene	4340	200	525	ug/kg	5000		86.8	75-125			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*242*			*ug/kg*	*250.0*		*97.0*	*25-140*			
Surrogate: Decachlorobiphenyl	*195*			*ug/kg*	*250.0*		*78.0*	*30-135*			
LCS Dup (B610102-BSD1)					Prepared: 11-Oct-2016 Analyzed: 07-Dec-2016						
4,4'-DDD	225	4.00	12.5	ug/kg	250.0		90.0	25-150	0.150	30	
4,4'-DDE	239	4.00	12.5	ug/kg	250.0		95.6	35-140	2.92	30	
4,4'-DDT	236	4.00	12.5	ug/kg	250.0		94.4	45-140	2.24	30	
Aldrin	214	4.00	12.5	ug/kg	250.0		85.5	25-140	11.5	30	
alpha-BHC	183	4.00	12.5	ug/kg	250.0		73.3	60-130	8.38	30	
alpha-Chlordane	227	4.00	12.5	ug/kg	250.0		90.7	65-125	8.18	30	
beta-BHC	232	4.00	12.5	ug/kg	250.0		92.6	65-125	4.87	30	
delta-BHC	8.71	4.00	12.5	ug/kg	250.0		3.48	45-135	7.29	30	Z-03, J
Dieldrin	225	4.00	12.5	ug/kg	250.0		90.2	60-130	0.350	30	
Endosulfan I	225	4.00	12.5	ug/kg	250.0		90.0	50-110	4.20	30	
Endosulfan II	236	4.00	12.5	ug/kg	250.0		94.4	30-130	0.833	30	
Endosulfan sulfate	212	4.00	12.5	ug/kg	250.0		84.8	55-135	4.43	30	
Endrin	234	4.00	12.5	ug/kg	250.0		93.7	55-135	5.66	30	
Endrin aldehyde	ND	4.00	12.5	ug/kg	250.0			55-135		30	Z-03, U
Endrin ketone	243	4.00	12.5	ug/kg	250.0		97.3	75-125	8.33	30	
gamma-BHC (Lindane)	215	4.00	12.5	ug/kg	250.0		86.1	25-125	7.27	30	
gamma-Chlordane	242	4.00	12.5	ug/kg	250.0		96.7	60-125	10.2	30	
Heptachlor	232	4.00	12.5	ug/kg	250.0		92.8	40-130	1.74	30	
Heptachlor epoxide	234	4.00	12.5	ug/kg	250.0		93.6	60-130	6.22	30	
Methoxychlor	234	4.00	12.5	ug/kg	250.0		93.4	55-150	1.50	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*283*			*ug/kg*	*250.0*		*113*	*25-140*			
Surrogate: Decachlorobiphenyl	*185*			*ug/kg*	*250.0*		*74.0*	*30-135*			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610102 - * DEFAULT PREP *****											
LCS Dup (B610102-BSD3)					Prepared: 11-Oct-2016 Analyzed: 13-Dec-2016						
Toxaphene	3980	200	525	ug/kg	5000		79.5	75-125	8.72	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*242*			*ug/kg*	*250.0*		*97.0*	*25-140*			
Surrogate: Decachlorobiphenyl	*158*			*ug/kg*	*250.0*		*63.0*	*30-135*			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610102 - * DEFAULT PREP *****											
Blank (B610102-BLK1)					Prepared: 11-Oct-2016 Analyzed: 12-Oct-2016						
1-Methylnaphthalene	ND	87.5	250	ug/kg							U
2-Methylnaphthalene	ND	87.5	250	ug/kg							U
Acenaphthene	ND	87.5	250	ug/kg							U
Acenaphthylene	ND	87.5	250	ug/kg							U
Anthracene	ND	87.5	250	ug/kg							U
Benzo (a) anthracene	ND	87.5	250	ug/kg							U
Benzo (a) pyrene	ND	87.5	250	ug/kg							U
Benzo (b) fluoranthene	ND	87.5	250	ug/kg							U
Benzo (g,h,i) perylene	ND	87.5	250	ug/kg							U
Benzo (k) fluoranthene	ND	87.5	250	ug/kg							U
Chrysene	ND	87.5	250	ug/kg							U
Dibenz (a,h) anthracene	ND	87.5	250	ug/kg							U
Fluoranthene	ND	87.5	250	ug/kg							U
Fluorene	ND	87.5	250	ug/kg							U
Indeno (1,2,3-cd) pyrene	ND	87.5	250	ug/kg							U
Naphthalene	ND	87.5	250	ug/kg							U
Phenanthrene	ND	87.5	250	ug/kg							U
Pyrene	ND	87.5	250	ug/kg							U
Surrogate: 2-Fluorobiphenyl	*1400*			*ug/kg*	*2500*		*54.0*	*45-110*			
Surrogate: Terphenyl-dl4	*1400*			*ug/kg*	*2500*		*56.5*	*40-125*			
LCS (B610102-BS1)					Prepared: 11-Oct-2016 Analyzed: 12-Oct-2016						
1-Methylnaphthalene	7440	87.5	250	ug/kg	7500		99.1	40-105			
2-Methylnaphthalene	7160	87.5	250	ug/kg	7500		95.4	40-105			
Acenaphthene	6930	87.5	250	ug/kg	7500		92.4	40-110			
Acenaphthylene	6490	87.5	250	ug/kg	7500		86.5	40-105			
Anthracene	7420	87.5	250	ug/kg	7500		99.0	50-110			
Benzo (a) anthracene	7320	87.5	250	ug/kg	7500		97.7	50-110			
Benzo (a) pyrene	7150	87.5	250	ug/kg	7500		95.3	50-120			
Benzo (b) fluoranthene	7220	87.5	250	ug/kg	7500		96.3	45-120			
Benzo (g,h,i) perylene	7220	87.5	250	ug/kg	7500		96.3	40-125			
Benzo (k) fluoranthene	7250	87.5	250	ug/kg	7500		96.7	45-125			
Chrysene	7650	87.5	250	ug/kg	7500		102	50-110			
Dibenz (a,h) anthracene	7420	87.5	250	ug/kg	7500		99.0	40-125			
Fluoranthene	7740	87.5	250	ug/kg	7500		103	50-125			
Fluorene	7410	87.5	250	ug/kg	7500		98.8	50-110			
Indeno (1,2,3-cd) pyrene	7150	87.5	250	ug/kg	7500		95.3	45-125			
Naphthalene	6960	87.5	250	ug/kg	7500		92.8	40-105			
Phenanthrene	7350	87.5	250	ug/kg	7500		98.0	50-125			
Pyrene	7850	87.5	250	ug/kg	7500		105	45-130			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	13-Dec-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610102 - * DEFAULT PREP *****											
LCS (B610102-BS1)					Prepared: 11-Oct-2016 Analyzed: 12-Oct-2016						
Surrogate: 2-Fluorobiphenyl	*1600*			*ug/kg*	*2500*		*64.5*	*45-110*			
Surrogate: Terphenyl-dl4	*1400*			*ug/kg*	*2500*		*57.0*	*40-125*			
LCS Dup (B610102-BSD1)					Prepared: 11-Oct-2016 Analyzed: 12-Oct-2016						
1-Methylnaphthalene	6360	87.5	250	ug/kg	7500		84.8	40-105	15.6	30	
2-Methylnaphthalene	5780	87.5	250	ug/kg	7500		77.0	40-105	21.4	30	
Acenaphthene	6660	87.5	250	ug/kg	7500		88.8	40-110	3.97	30	
Acenaphthylene	6400	87.5	250	ug/kg	7500		85.3	40-105	1.36	30	
Anthracene	6740	87.5	250	ug/kg	7500		89.8	50-110	9.71	30	
Benzo (a) anthracene	6810	87.5	250	ug/kg	7500		90.8	50-110	7.25	30	
Benzo (a) pyrene	6640	87.5	250	ug/kg	7500		88.5	50-120	7.43	30	
Benzo (b) fluoranthene	7040	87.5	250	ug/kg	7500		93.8	45-120	2.63	30	
Benzo (g,h,i) perylene	6550	87.5	250	ug/kg	7500		87.3	40-125	9.80	30	
Benzo (k) fluoranthene	6950	87.5	250	ug/kg	7500		92.7	45-125	4.23	30	
Chrysene	7200	87.5	250	ug/kg	7500		96.0	50-110	6.06	30	
Dibenz (a,h) anthracene	6450	87.5	250	ug/kg	7500		86.0	40-125	14.1	30	
Fluoranthene	5920	87.5	250	ug/kg	7500		79.0	50-125	26.5	30	
Fluorene	7220	87.5	250	ug/kg	7500		96.3	50-110	2.56	30	
Indeno (1,2,3-cd) pyrene	6460	87.5	250	ug/kg	7500		86.2	45-125	10.1	30	
Naphthalene	6660	87.5	250	ug/kg	7500		88.8	40-105	4.35	30	
Phenanthrene	6340	87.5	250	ug/kg	7500		84.5	50-125	14.7	30	
Pyrene	7840	87.5	250	ug/kg	7500		104	45-130	0.159	30	
Surrogate: 2-Fluorobiphenyl	*1600*			*ug/kg*	*2500*		*62.5*	*45-110*			
Surrogate: Terphenyl-dl4	*1400*			*ug/kg*	*2500*		*57.0*	*40-125*			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Page 22 of 24

ERDC SAMPLE RECEIPT CHECKLIST

Client: SPaRWaR	Work Order: 6081805
Project: RARA	Date/Time Received
Shipping Company:	

Suspected Hazard Information	Yes	No	NA	Comments:
Shipped as DOT Hazardous?		✓		
Samples identified as Foreign Material?		✓		

Sample Receipt Criteria	Yes	No	NA	Comments:
1. Shipping containers received intact and sealed?	✓			
2. Chain of Custody documents included with shipment?	✓			
3. COC form is properly signed in relinquished/received sections?	✓			
4. Samples requiring chemical preservation at proper pH?	✓			
5. Samples requiring cold preservation within 0-5°C?	✓			[illegible] 3.6
6. Samples IDs on COC match IDs on containers?	✓			
7. Date and time of COC match date and time on containers?	✓			
8. Number of containers received match number indicated on COC?	✓			
9. Samples received within holding time?	✓			
10. Aqueous samples found to have visible solids?			✓	

Additional Comments:

Checklist preformed by: NP

Time/Date: 8/18/16

SPAWAR
Systems Center San Diego

ENVIRONMENTAL SCIENCES AND APPLIED SYSTEMS, Code 71760
53605 Hull Street
San Diego, CA 92152-5000

6081805

Chain of Custody Record

Date 8/16/16

Page 1 of 1

Project Title/Project Number: RARA

Project Leader: Bart Chadwick

Remarks/Air Bill:

Contact: Bart Chadwick

Sampler(s): (Signature)

Contact Tel: 619-553-5333

Tel: 619-553-2788 | Fax: | Email: mcolvin@spawar.navy.mil

Special Instructions/Comments:
Keep dark + cold (4°c) Contact Bart Chadwick prior to analysis Wet wt. (g)

Sample Identification	Date	Time	Matrix	Container Type	Collection Temp (°C)	Arrival Temp (°C)	PCB congeners [8082A/3570]	PAHs [8270D/3510]	Pesticides [8081B/3535]
Container #1	8/16/2016	0900	Tissue	2 oz glass jar	18.5		X	X	X
Container #2	8/16/2016		Tissue	2 oz glass jar	17.2		X	X	X
Container #3	8/16/2016		Tissue	2 oz glass jar	19.9		X	X	X
Container #4	8/16/2016		Tissue	2 oz glass jar	16.7		X	X	X
Container #5	8/16/2016		Tissue	2 oz glass jar	21.3		X	X	X
Container #6	8/16/2016		Tissue	2 oz glass jar	20.1		X	X	X
Time 4	8/16/2016		Tissue	" "	24.3		X	X	X

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Molly Colvin - SSC PAC	MEP 8/18/16	8/16/2016	1030
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

SPAWAR Systems Center PACIFIC

SPAWAR SYSTEMS CENTER PACIFIC
ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY BRANCH, CODE 7176
53475 STROTHE ROAD

Chain of Custody Record

6081808

AWS
TOC 9060

GTS → AWS

Project Title: ESTCP Remedy and Recontamination Assessment (RARA) Array DemVal						Project PI:	Dr. D adw				
Remarks						Contact:	Joel				
Sampler(s): (Signature) Bart Chadwick (Code 7176)						Contact Tel:	(619) 9				
Tel: 619-553-5333	Fax: 619-553-6305		Email: joel.guerrero@navy.mil			Analy					
Special Instructions/Comments: Water samples; kept dark & cold (4 °C)											
Field Sample Identification	Start Date/Time Deployment	End Date/Time Retrieval	Matrix	No. of containers	Pres.	PCB congeners [8082A / 3510]	PAHs [8270D / 3510]	Pesticides [8081B / 3535]	TOC [9060]	Grain Size [ASTM D422-6	Al,Cd,Cu,Fe,Pb,Zn [6020A] Hg [7471B]
RARA-T1-081516	20-Apr-16	15-Aug-16	Sediment	2 - bottle/ziplock	none	x	x	x	x	x	x
RARA-T2-081516	20-Apr-16	15-Aug-16	Sediment	2 - bottle/ziplock	none	x	x	x	x	x	x
RARA-S1-081516	20-Apr-16	15-Aug-16	Sediment	2 - bottle/ziplock	none	x	x	x	x	x	x
RARA-S2-081516	20-Apr-16	15-Aug-16	Sediment	2 - bottle/ziplock	none	x	x	x	x	x	x
RARA-C1-081516	20-Apr-16	15-Aug-16	Sediment	2 - bottle/ziplock	none	x	x	x	x	x	x
RARA-C2-081516	20-Apr-16	15-Aug-16	Sediment	2 - bottle/ziplock	none	x	x	x	x	x	x
					TOTAL	6					

Relinquished by:	(Signature)	Date:	Time:
Joel Guerrero		8/17/2016	1030
Received by:	(Signature)	Date:	Time:

SPAWAR
Systems Center PACIFIC

SPAWAR SYSTEMS CENTER PACIFIC
ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY
BRANCH, CODE 7176
53475 STROTHE ROAD
SAN DIEGO, CA 92152-5000

Chain of Custody Record

6081807

Date: 17-Aug-2016
Page: of

Project Title: ESTCP Remedy and Recontamination Assessment (RARA) Array DemVal		**Project PI:**	Dr. D. Bart Chadwick
Remarks		**Contact:**	Joel Guerrero
Sampler(s): (Signature)	Bart Chadwick (Code 71705) / M.Colvin (Code 71760)	**Contact Tel:**	(619) 850-2109
Tel: 619-553-5333	**Fax:** 619-553-6305 **Email:** joel.guerrero@navy.mil	**Analyses**	

Special Instructions/Comments:
Kept dark & cold (4 °C)

Field Sample Identification	Start Date/Time Deployment	End Date/Time Retrieval	Matrix	Type	Pres.	PCB congeners [8082A / 3510]	PAHs [8270D / 3510]	Pesticides [8081B / 3535]			
RARA-SPME-1-081516	07-18-2016	08-15-2016	SPME	Comp	none	x	x	x			
RARA-SPME-2-081516	07-18-2016	08-15-2016	SPME	Comp	none	x	x	x			
RARA-SPME-3-081516	07-18-2016	08-15-2016	SPME	Comp	none	x	x	x			
RARA-SPME-4-081516	07-18-2016	08-15-2016	SPME	Comp	none	x	x	x			
RARA-SPME-5-081516	07-18-2016	08-15-2016	SPME	Comp	none	x	x	x			
RARA-SPME-6-081516	07-18-2016	08-15-2016	SPME	Comp	none	x	x	x			
RARA-SPME-TB-081516	n/a		SPME	Comp	none	x	x	x			
					TOTAL	7					

Relinquished by: Joel Guerrero	(Signature)	**Date:** 8/17/2016	**Time:** 1030
Received by:	(Signature)	**Date:**	**Time:**

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception

File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler Units - ug/kg		Det Limit	Report Limit	%Rec TMX	%Rec 209	14	36	78	PRC Congeners 104	121
RARA-SPEME-1	6081807-1	4.3	12.8	75.5	58.5	25.7	86.8	205.0	54.9	289.0
RARA-SPEME-2	-2	4.6	13.8	77.5	47.2	19.9	86.0	228.0	61.3	309.0
RARA-SPEME-3	-3	4.5	13.6	81.0	51.5	26.4	126.0	307.0	51.7	352.0
RARA-SPEME-4	-4	4.0	12.1	82.0	47.3	23.8	127.0	294.0	51.3	334.0
RARA-SPEME-5	-5	3.7	11.1	85.5	56.5	29.1	120.0	299.0	55.2	339.0
RARA-SPEME-6	-6	3.6	10.7	75.0	41.5	28.1	113.0	284.0	52.4	322.0
RARA-SPME-TB-081516	-7	3.9	11.8	79.0	44.6	27.3	132.0	322.0	53.9	345.0
	BLK	0.13	0.4	77.0	49.6	ND	ND	ND	ND	ND
	BS %rec	0.13	0.4	77.0	48.0					
	BSD %Rec	0.13	0.4	73.0	43.5					

1 of 15

File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	142	155	192	204	1	3	4	5	6	7	8
RARA-SPEME-1	254.0	352.0	491.0	686.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	266.0	359.0	503.0	682.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	290.0	375.0	532.0	710.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	323.0	357.0	516.0	682.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	283.0	368.0	537.0	724.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	268.0	350.0	504.0	677.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	289.0	355.0	532.0	701.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
								71.0			
								74.3			

File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	9	10	12	13	15	16	17	18	19	20	22
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
								67.3			
								70.0			

3 of 15

File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	24	25	26	27	28	29	31	32	33	34	35
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
							71.7				
							75.0				

File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	37	40	41	42	44	45	46	47	48	49	51
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
					78.0						
					80.3						

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	52	53	54	56	59	60	63	64	66	67	69
RARA-SPEME-1	**20.3**	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**11**	N.D.	N.D.
RARA-SPEME-2	**25.8**	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**20.1**	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	75.3								67.7		
	80.0								69.3		

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	70	71	73	74	75	77	81	82	83	84	85
RARA-SPEME-1	**10.8**	N.D.	N.D.	**7.98**	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	**12.2**	N.D.	N.D.	**6.67**	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	87	90	91	92	93	95	97	99	100	101	103
RARA-SPEME-1	N.D.	**35.6**	N.D.	N.D.	N.D.	**25.7**	**7.25**	**17.6**	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	**42.7**	N.D.	N.D.	N.D.	**33.5**	**8.87**	**16.9**	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	**11.1**	N.D.	N.D.	N.D.	**5.29**	N.D.	**6.82**	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	**11.9**	N.D.	N.D.	N.D.	**6.03**	N.D.	**6.66**	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	82.3	88.7									
	84.0	90.7									

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	105	107	110	114	115	117	118	119	122	123	124
RARA-SPEME-1	**6.69**	N.D.	**12.9**	N.D.	N.D.	N.D.	**23.3**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	**8.41**	N.D.	**16.1**	N.D.	N.D.	N.D.	**25.6**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**7.88**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**7.76**	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
			57.3								
			56.7								

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	126	128	129	130	131	132	134	135	136	137	138
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**29.2**
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**36**
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**16.5**
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**15**
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
											87.0
											91.0

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	141	144	146	147	149	151	153	154	156	157	158
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	**26.6**	**4.62**	**22.5**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	**33.7**	**6.07**	**22.7**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	**6.52**	N.D.	**4.93**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**5.1**	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	**15.7**	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	**13.3**	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	224.3					73.7	92.3				
	241.1					77.7	94.0				

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	163	164	165	167	169	170	171	172	173	174	175
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
						82.0					
						79.7					

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	176	177	178	179	180	183	184	185	187	189	190
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	**5.89**	N.D.	N.D.	N.D.	**6.75**	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	**8.02**	N.D.	N.D.	N.D.	**10.2**	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**4.79**	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	**4.06**	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	N.D.	ND	ND
					86.3	96.3			68.7		
					86.0	96.7			69.3		

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	191	193	194	195	196	197	199	200	201	202	203
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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File name:
6081807 SPAWAR RARA congeners
Second version
Sent on 12/16/16 from Allyson.H.Wooley@erdc.dren.mil

Passive Sampler
Units - ug/kg

	205	206	207	208
RARA-SPEME-1	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-2	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-3	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-4	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-5	N.D.	N.D.	N.D.	N.D.
RARA-SPEME-6	N.D.	N.D.	N.D.	N.D.
RARA-SPME-TB-081516	N.D.	N.D.	N.D.	N.D.
	ND	ND	ND	ND
		56.3		
		56.7		

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Appendix H. Tissue Chemistry

T-Mid Results

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

29 November 2016

Joel Guererro
Navy – SPAWAR
Environmental Science and Applied System Branch, 536(
San Diego, CA 92152

RE: RARA

Enclosed are the results of analyses for samples received by the laboratory on 24-Jun-2016. The samples associated with this report will be held for 90 days from the date of this report. The raw data associated with this report will be held for 5 years from the date of this report. If you need us to hold onto the samples or the data longer then these specified times, you will need to notify us in writing at least 30 days before the expiration dates. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jenifer Milam
Database Manager

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

WORK ORDER SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date of Work Order
RARA-Tissue 1 -062116	6062401-01	Tissue	21-Jun-2016	24-Jun-2016
RARA-Tissue 2 -062116	6062401-02	Tissue	21-Jun-2016	24-Jun-2016
RARA-Tissue 3-062116	6062401-03	Tissue	21-Jun-2016	24-Jun-2016
RARA-Tissue 4-062116	6062401-04	Tissue	21-Jun-2016	24-Jun-2016
RARA-Tissue 5-062116	6062401-05	Tissue	21-Jun-2016	24-Jun-2016
RARA-Tissue 6-062116	6062401-06	Tissue	21-Jun-2016	24-Jun-2016
RARA-Time 0-062116	6062401-07	Tissue	21-Jun-2016	24-Jun-2016

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Case Narrative

No issues were experienced during the analysis of Work Order 6062401 unless specified below.

Pesticides - The MSD sample was dropped and spilled.

Congeners will be sent as a separate excel file.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Notes and Definitions

Z-02	Analyte could not be quantitated due to interfering peak/s.
U	Analyte included in the analysis, but not detected
S-GC	Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate/s.
Q	Value is outside of acceptance limits.
MB-01	The method blank contains analyte at a concentration above the MRL; however, concentration is less than 10% of the sample result, which is negligible according to method criteria.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
H	This sample was extracted and/or analyzed outside of the EPA recommended holding time.
B	Analyte is found in the associated blank as well as in the sample.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 1 -062116

6062401-01 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Classical Chemistry Parameters								
% Lipids	**0.495**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.030**	0.005	0.010	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	**0.0494**	0.0340	0.170	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Copper-63 [1]	**8.82**	0.0340	0.170	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**1.21**	0.0340	0.170	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Zinc-66 [1]	**21.5**	0.0340	0.170	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**80.5**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	**0.779**	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	J
Aldrin	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	**0.584**	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	J
beta-BHC	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.278	0.795	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 1 -062116

6062401-01 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**9.30**		*58.5 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**14.8**		*93.0 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	**8.89**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) anthracene	**15.8**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) pyrene	**18.5**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (b) fluoranthene	**30.3**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (g,h,i) perylene	**5.13**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (k) fluoranthene	**31.3**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Chrysene	**20.0**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**70.5**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Fluorene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**6.96**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Naphthalene	ND	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	**6.48**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Pyrene	**20.8**	3.18	7.95	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**130**		*56.4 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**85**		*41.0 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

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3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 2 -062116

6062401-02 (Tissue)

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Classical Chemistry Parameters								
% Lipids	**0.486**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.026**	0.005	0.010	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	**0.0439**	0.0382	0.191	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Copper-63 [1]	**7.09**	0.0382	0.191	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**1.01**	0.0382	0.191	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Zinc-66 [1]	**19.6**	0.0382	0.191	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**81.5**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	**0.817**	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	
Aldrin	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	**0.516**	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	J
beta-BHC	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	**1.37**	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	
Heptachlor	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**9.17**		*57.7 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 2 -062116

6062401-02 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
ERDC-EL-EP-C								
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: Decachlorobiphenyl	**14.2**		*89.5 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	**5.20**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (a) anthracene	**11.3**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) pyrene	**17.2**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (b) fluoranthene	**27.1**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (g,h,i) perylene	**5.97**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (k) fluoranthene	**32.3**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Chrysene	**16.0**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**28.1**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Fluorene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**6.73**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Naphthalene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	**9.98**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Pyrene	**35.3**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**110**		*49.8 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	**180**		*86.0 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 3-062116

6062401-03 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.371**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.025**	0.005	0.009	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	ND	0.0397	0.199	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	U
Copper-63 [1]	**7.87**	0.0397	0.199	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**0.495**	0.0397	0.199	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Zinc-66 [1]	**19.0**	0.0397	0.199	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**84.8**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Aldrin	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.280	0.800	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**8.96**		*56.0 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 3-062116

6062401-03 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: Decachlorobiphenyl	**13.6**		*84.8 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	**4.54**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (a) anthracene	**10.6**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) pyrene	**7.41**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (b) fluoranthene	**10.6**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (g,h,i) perylene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (k) fluoranthene	**15.1**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Chrysene	**14.4**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**56.2**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Fluorene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Naphthalene	ND	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	**4.30**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Pyrene	**23.4**	3.20	8.00	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**130**		*56.1 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	
Surrogate: Terphenyl-d14	**130**		*60.8 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

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Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 4-062116

6062401-04 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.533**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.036**	0.005	0.010	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	**0.0388**	0.0352	0.176	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Copper-63 [1]	**9.71**	0.0352	0.176	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**0.874**	0.0352	0.176	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Zinc-66 [1]	**18.5**	0.0352	0.176	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**80.5**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	**0.886**	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	
Aldrin	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.275	0.784	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**8.98**		*57.2 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 4-062116

6062401-04 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: Decachlorobiphenyl	**13.4**		*85.2 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	**3.84**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (a) anthracene	**8.15**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) pyrene	**6.04**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (b) fluoranthene	**9.53**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (g,h,i) perylene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (k) fluoranthene	**12.1**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Chrysene	**9.80**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**30.0**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Fluorene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Naphthalene	ND	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	**3.79**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Pyrene	**26.3**	3.14	7.84	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**56**		*25.5 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	*S-GC*
Surrogate: Terphenyl-dl4	**100**		*49.2 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	**29-Nov-2016**

RARA-Tissue 5-062116

6062401-05 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.536**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.030**	0.005	0.010	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	**0.0424**	0.0344	0.172	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Copper-63 [1]	**8.40**	0.0344	0.172	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**0.978**	0.0344	0.172	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Zinc-66 [1]	**20.2**	0.0344	0.172	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**80.2**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Aldrin	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.278	0.794	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**10.6**		*66.7 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 5-062116

6062401-05 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: Decachlorobiphenyl	**15.4**		*96.7 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	**9.70**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) anthracene	**13.4**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) pyrene	**13.9**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (b) fluoranthene	**31.3**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (g,h,i) perylene	**4.94**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (k) fluoranthene	**28.9**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Chrysene	**20.2**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**53.9**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Fluorene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**4.73**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Naphthalene	ND	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	**17.7**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Pyrene	**36.5**	3.17	7.94	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**110**		*48.4 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**120**		*56.2 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 6-062116

6062401-06 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.487**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.030**	0.005	0.010	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	**0.0431**	0.0363	0.182	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Copper-63 [1]	**7.33**	0.0363	0.182	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**0.731**	0.0363	0.182	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Zinc-66 [1]	**21.1**	0.0363	0.182	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**81.2**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	**1.33**	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	
Aldrin	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.268	0.766	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**8.97**		*58.5 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Tissue 6-062116

6062401-06 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: Decachlorobiphenyl	**12.8**		*83.5 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	**8.12**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) anthracene	**13.4**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (a) pyrene	**13.7**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (b) fluoranthene	**30.5**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Benzo (g,h,i) perylene	**4.62**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Benzo (k) fluoranthene	**29.8**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Chrysene	**19.1**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**55.9**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Fluorene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**5.59**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Naphthalene	ND	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	**5.01**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Pyrene	**19.4**	3.07	7.66	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**120**		*53.9 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**87**		*43.8 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Time 0-062116

6062401-07 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.440**			% by Weight	26-Jul-2016	01-Aug-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.016**	0.005	0.010	mg/kg	27-Jul-2016	29-Jul-2016	EPA 7471A	H
Cadmium-111 [1]	**0.0392**	0.0375	0.187	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Copper-63 [1]	**4.09**	0.0375	0.187	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	
Lead-206 [1]	**0.150**	0.0375	0.187	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	J
Zinc-66 [1]	**16.2**	0.0375	0.187	mg/kg	08-Aug-2016	27-Sep-2016	SW 846/6020	MB-01, B
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**84.7**			% by Volume	29-Jul-2016	21-Nov-2016	-	
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDE	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
4,4´-DDT	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Aldrin	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-BHC	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
alpha-Chlordane	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
beta-BHC	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
delta-BHC	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Dieldrin	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan I	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan II	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin aldehyde	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Endrin ketone	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
gamma-Chlordane	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Methoxychlor	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Toxaphene	ND	0.270	0.771	ug/kg	08-Jul-2016	21-Aug-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**10.9**		*70.5 %*	*35-125*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

RARA-Time 0-062116

6062401-07 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
Surrogate: Decachlorobiphenyl	**13.3**		*86.2 %*	*40-130*	*08-Jul-2016*	*21-Aug-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Acenaphthylene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Anthracene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (a) anthracene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (a) pyrene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (b) fluoranthene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (g,h,i) perylene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Chrysene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Dibenz (a,h) anthracene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Fluoranthene	**4.63**	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Fluorene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Naphthalene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Phenanthrene	ND	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	U
Pyrene	**6.92**	3.08	7.71	ug/kg	08-Jul-2016	18-Aug-2016	EPA 8270C	J
Surrogate: 2-Fluorobiphenyl	**110**		*50.8 %*	*45-105*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**120**		*61.5 %*	*30-125*	*08-Jul-2016*	*18-Aug-2016*	*EPA 8270C*	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B609032 - Default Prep Metals											
Blank (B609032-BLK1)					**Prepared: 27-Jul-2016 Analyzed: 29-Jul-2016**						
Mercury	ND	0.005	0.010	mg/kg							U
LCS (B609032-BS1)					**Prepared: 27-Jul-2016 Analyzed: 29-Jul-2016**						
Mercury	0.107	0.005	0.010	mg/kg	0.1000		107	75-125			
Duplicate (B609032-DUP1)		**Source: 6062401-07**			**Prepared: 27-Jul-2016 Analyzed: 29-Jul-2016**						
Mercury	0.0155	0.005	0.009	mg/kg		0.0156			0.879	25	
Matrix Spike (B609032-MS1)		**Source: 6062401-07**			**Prepared: 27-Jul-2016 Analyzed: 29-Jul-2016**						
Mercury	0.0951	0.005	0.009	mg/kg	0.09058	0.0156	87.7	75-125			
Batch B611106 - Default Prep Metals											
Blank (B611106-BLK1)					**Prepared: 08-Aug-2016 Analyzed: 27-Sep-2016**						
Cadmium-111 [1]	ND	0.0400	0.200	mg/kg							U
Copper-63 [1]	0.0469	0.0400	0.200	mg/kg							J
Lead-206 [1]	ND	0.0400	0.200	mg/kg							U
Zinc-66 [1]	0.653	0.0400	0.200	mg/kg							MB-01
LCS (B611106-BS1)					**Prepared: 08-Aug-2016 Analyzed: 27-Sep-2016**						
Cadmium-111 [1]	50.1	0.100	0.500	mg/kg	50.00		100	80-120			
Copper-63 [1]	97.4	0.100	0.500	mg/kg	100.0		97.4	80-120			
Lead-206 [1]	104	0.100	0.500	mg/kg	100.0		104	80-120			
Zinc-66 [1]	215	0.100	0.500	mg/kg	200.0		108	80-120			MB-01, B
Duplicate (B611106-DUP1)		**Source: 6062401-01**			**Prepared: 08-Aug-2016 Analyzed: 27-Sep-2016**						
Cadmium-111 [1]	ND	0.0372	0.186	mg/kg		0.0494				20	U
Copper-63 [1]	8.54	0.0372	0.186	mg/kg		8.82			3.29	20	
Lead-206 [1]	1.09	0.0372	0.186	mg/kg		1.21			10.4	20	
Zinc-66 [1]	21.4	0.0372	0.186	mg/kg		21.5			0.553	20	MB-01, B

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611106 - Default Prep Metals											
Matrix Spike (B611106-MS1)		**Source: 6062401-01**			Prepared: 08-Aug-2016 Analyzed: 27-Sep-2016						
Cadmium-111 [1]	44.3	0.0875	0.437	mg/kg	43.74	0.0494	101	80-120			
Copper-63 [1]	88.5	0.0875	0.437	mg/kg	87.49	8.82	91.1	80-120			
Lead-206 [1]	93.1	0.0875	0.437	mg/kg	87.49	1.21	105	80-120			
Zinc-66 [1]	176	0.0875	0.437	mg/kg	175.0	21.5	88.3	80-120			MB-01, B

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B607014 - * DEFAULT PREP *****											
Blank (B607014-BLK1)					Prepared: 08-Jul-2016 Analyzed: 21-Aug-2016						
4,4'-DDD	ND	0.280	0.300	ug/kg							U
4,4'-DDE	ND	0.280	0.300	ug/kg							U
4,4'-DDT	ND	0.280	0.300	ug/kg							U
Aldrin	ND	0.280	0.300	ug/kg							U
alpha-BHC	ND	0.280	0.300	ug/kg							U
alpha-Chlordane	ND	0.280	0.300	ug/kg							U
beta-BHC	ND	0.280	0.300	ug/kg							U
delta-BHC	ND	0.280	0.300	ug/kg							U
Dieldrin	ND	0.280	0.300	ug/kg							U
Endosulfan I	ND	0.280	0.300	ug/kg							U
Endosulfan II	ND	0.280	0.300	ug/kg							U
Endosulfan sulfate	ND	0.280	0.300	ug/kg							U
Endrin	ND	0.280	0.300	ug/kg							U
Endrin aldehyde	ND	0.280	0.300	ug/kg							U
Endrin ketone	ND	0.280	0.300	ug/kg							U
gamma-BHC (Lindane)	ND	0.280	0.300	ug/kg							U
gamma-Chlordane	ND	0.280	0.300	ug/kg							U
Heptachlor	ND	0.280	0.300	ug/kg							U
Heptachlor epoxide	ND	0.280	0.300	ug/kg							U
Methoxychlor	ND	0.280	0.300	ug/kg							U
Toxaphene	ND	0.280	0.300	ug/kg							U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*10.4*			*ug/kg*	*16.00*		*65.2*	*35-125*			
Surrogate: Decachlorobiphenyl	*14.9*			*ug/kg*	*16.00*		*93.0*	*40-130*			
LCS (B607014-BS2)					Prepared: 08-Jul-2016 Analyzed: 21-Aug-2016						
4,4'-DDD	7.08	0.280	0.300	ug/kg	8.000		88.5	30-135			
4,4'-DDE	6.88	0.280	0.300	ug/kg	8.000		86.0	50-125			
4,4'-DDT	7.76	0.280	0.300	ug/kg	8.000		97.0	40-140			
Aldrin	7.40	0.280	0.300	ug/kg	8.000		92.5	45-140			
alpha-BHC	7.28	0.280	0.300	ug/kg	5.000		146	50-125			
alpha-Chlordane	6.96	0.280	0.300	ug/kg	8.000		87.0	50-120			
beta-BHC	4.12	0.280	0.300	ug/kg	8.000		51.5	50-125			
delta-BHC	0.920	0.280	0.300	ug/kg	2.400		38.3	55-130			Q
Dieldrin	6.84	0.280	0.300	ug/kg	8.000		85.5	50-125			
Endosulfan I	6.32	0.280	0.300	ug/kg	8.000		79.0	15-135			
Endosulfan II	5.16	0.280	0.300	ug/kg	8.000		64.5	35-140			
Endosulfan sulfate	4.28	0.280	0.300	ug/kg	6.000		71.3	50-135			
Endrin	7.20	0.280	0.300	ug/kg	8.000		90.0	50-135			
Endrin aldehyde	3.52	0.280	0.300	ug/kg	8.000		44.0	35-145			
Endrin ketone	ND	0.280	0.300	ug/kg	8.000			50-135			Z-02, U
gamma-BHC (Lindane)	5.40	0.280	0.300	ug/kg	7.000		77.1	50-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B607014 - * DEFAULT PREP *****											
LCS (B607014-BS2)					**Prepared: 08-Jul-2016 Analyzed: 21-Aug-2016**						
gamma-Chlordane	5.00	0.280	0.300	ug/kg	8.000		62.5	50-125			
Heptachlor	9.08	0.280	0.300	ug/kg	8.000		114	50-140			
Heptachlor epoxide	5.40	0.280	0.300	ug/kg	8.000		67.5	50-130			
Methoxychlor	5.80	0.280	0.300	ug/kg	8.000		72.5	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*9.92*			*ug/kg*	*16.00*		*62.0*	*35-125*			
Surrogate: Decachlorobiphenyl	*10.4*			*ug/kg*	*16.00*		*65.0*	*40-130*			
Matrix Spike (B607014-MS2)	**Source: 6062401-04**				**Prepared: 08-Jul-2016 Analyzed: 21-Aug-2016**						
4,4′-DDD	13.3	0.553	1.58	ug/kg	15.81	ND	84.0	30-135			
4,4′-DDE	10.8	0.553	1.58	ug/kg	15.81	ND	68.0	50-125			
4,4′-DDT	14.9	0.553	1.58	ug/kg	15.81	0.886	88.9	40-140			
Aldrin	10.8	0.553	1.58	ug/kg	15.81	ND	68.0	45-140			
alpha-BHC	9.88	0.553	1.58	ug/kg	9.881	ND	100	50-125			
alpha-Chlordane	9.80	0.553	1.58	ug/kg	15.81	ND	62.0	50-120			
beta-BHC	12.9	0.553	1.58	ug/kg	15.81	ND	81.5	50-125			
delta-BHC	2.69	0.553	1.58	ug/kg	4.743	ND	56.7	55-130			
Dieldrin	9.72	0.553	1.58	ug/kg	15.81	ND	61.5	50-125			
Endosulfan I	10.0	0.553	1.58	ug/kg	15.81	ND	63.5	15-135			
Endosulfan II	11.9	0.553	1.58	ug/kg	15.81	ND	75.5	35-140			
Endosulfan sulfate	8.70	0.553	1.58	ug/kg	11.86	ND	73.3	50-135			
Endrin	11.3	0.553	1.58	ug/kg	15.81	ND	71.5	50-135			
Endrin aldehyde	5.54	0.553	1.58	ug/kg	15.81	ND	35.0	35-145			
Endrin ketone	10.3	0.553	1.58	ug/kg	15.81	ND	65.0	50-135			
gamma-BHC (Lindane)	13.2	0.553	1.58	ug/kg	13.83	ND	95.4	50-125			
gamma-Chlordane	10.3	0.553	1.58	ug/kg	15.81	ND	65.0	50-125			
Heptachlor	11.0	0.553	1.58	ug/kg	15.81	ND	69.5	50-140			
Heptachlor epoxide	11.7	0.553	1.58	ug/kg	15.81	ND	74.0	50-130			
Methoxychlor	13.5	0.553	1.58	ug/kg	15.81	ND	85.5	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*11.1*			*ug/kg*	*31.62*		*35.3*	*35-125*			
Surrogate: Decachlorobiphenyl	*13.6*			*ug/kg*	*31.62*		*43.0*	*40-130*			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B607014 - * DEFAULT PREP *****											
Blank (B607014-BLK1)					Prepared: 08-Jul-2016 Analyzed: 18-Aug-2016						
1-Methylnaphthalene	ND	3.20	8.00	ug/kg							U
2-Methylnaphthalene	ND	3.20	8.00	ug/kg							U
Acenaphthene	ND	3.20	8.00	ug/kg							U
Acenaphthylene	ND	3.20	8.00	ug/kg							U
Anthracene	ND	3.20	8.00	ug/kg							U
Benzo (a) anthracene	ND	3.20	8.00	ug/kg							U
Benzo (a) pyrene	ND	3.20	8.00	ug/kg							U
Benzo (b) fluoranthene	ND	3.20	8.00	ug/kg							U
Benzo (g,h,i) perylene	ND	3.20	8.00	ug/kg							U
Benzo (k) fluoranthene	ND	3.20	8.00	ug/kg							U
Chrysene	ND	3.20	8.00	ug/kg							U
Dibenz (a,h) anthracene	ND	3.20	8.00	ug/kg							U
Fluoranthene	ND	3.20	8.00	ug/kg							U
Fluorene	ND	3.20	8.00	ug/kg							U
Indeno (1,2,3-cd) pyrene	ND	3.20	8.00	ug/kg							U
Naphthalene	ND	3.20	8.00	ug/kg							U
Phenanthrene	ND	3.20	8.00	ug/kg							U
Pyrene	ND	3.20	8.00	ug/kg							U
Surrogate: 2-Fluorobiphenyl	*110*			*ug/kg*	*224.0*		*48.0*	*45-105*			
Surrogate: Terphenyl-d14	*140*			*ug/kg*	*208.0*		*68.2*	*30-125*			
LCS (B607014-BS1)					Prepared: 08-Jul-2016 Analyzed: 18-Aug-2016						
1-Methylnaphthalene	95.0	3.20	8.00	ug/kg	120.0		79.1	40-105			
2-Methylnaphthalene	95.6	3.20	8.00	ug/kg	120.0		79.7	40-105			
Acenaphthene	92.4	3.20	8.00	ug/kg	120.0		77.0	45-110			
Acenaphthylene	93.2	3.20	8.00	ug/kg	120.0		77.7	45-105			
Anthracene	125	3.20	8.00	ug/kg	120.0		104	55-105			
Benzo (a) anthracene	98.9	3.20	8.00	ug/kg	120.0		82.5	50-120			
Benzo (a) pyrene	104	3.20	8.00	ug/kg	120.0		86.6	50-110			
Benzo (b) fluoranthene	97.3	3.20	8.00	ug/kg	120.0		81.0	45-115			
Benzo (g,h,i) perylene	98.8	3.20	8.00	ug/kg	120.0		82.4	40-125			
Benzo (k) fluoranthene	119	3.20	8.00	ug/kg	120.0		98.8	45-125			
Chrysene	105	3.20	8.00	ug/kg	120.0		87.4	55-120			
Dibenz (a,h) anthracene	113	3.20	8.00	ug/kg	120.0		94.1	40-125			
Fluoranthene	127	3.20	8.00	ug/kg	120.0		106	55-120			
Fluorene	104	3.20	8.00	ug/kg	120.0		86.5	50-110			
Indeno (1,2,3-cd) pyrene	79.0	3.20	8.00	ug/kg	120.0		65.8	40-120			
Naphthalene	90.4	3.20	8.00	ug/kg	120.0		75.4	40-105			
Phenanthrene	84.5	3.20	8.00	ug/kg	120.0		70.5	50-110			
Pyrene	96.4	3.20	8.00	ug/kg	120.0		80.3	45-125			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B607014 - * DEFAULT PREP *****											
LCS (B607014-BS1)					Prepared: 08-Jul-2016 Analyzed: 18-Aug-2016						
Surrogate: 2-Fluorobiphenyl	*120*			*ug/kg*	*224.0*		*55.4*	*45-105*			
Surrogate: Terphenyl-dl4	*180*			*ug/kg*	*208.0*		*87.9*	*30-125*			
Matrix Spike (B607014-MS1)		**Source: 6062401-04**			Prepared: 08-Jul-2016 Analyzed: 18-Aug-2016						
1-Methylnaphthalene	175	6.08	15.2	ug/kg	228.1	ND	76.5	40-105			
2-Methylnaphthalene	164	6.08	15.2	ug/kg	228.1	ND	71.7	40-105			
Acenaphthene	172	6.08	15.2	ug/kg	228.1	ND	75.3	45-110			
Acenaphthylene	172	6.08	15.2	ug/kg	228.1	ND	75.2	45-105			
Anthracene	166	6.08	15.2	ug/kg	228.1	3.84	72.6	55-105			
Benzo (a) anthracene	219	6.08	15.2	ug/kg	228.1	8.15	92.5	50-120			
Benzo (a) pyrene	207	6.08	15.2	ug/kg	228.1	6.04	90.8	50-110			
Benzo (b) fluoranthene	207	6.08	15.2	ug/kg	228.1	9.53	86.7	45-115			
Benzo (g,h,i) perylene	181	6.08	15.2	ug/kg	228.1	ND	79.3	40-125			
Benzo (k) fluoranthene	288	6.08	15.2	ug/kg	228.1	12.1	121	45-125			
Chrysene	236	6.08	15.2	ug/kg	228.1	9.80	99.3	55-120			
Dibenz (a,h) anthracene	186	6.08	15.2	ug/kg	228.1	ND	81.6	40-125			
Fluoranthene	231	6.08	15.2	ug/kg	228.1	30.0	88.1	55-120			
Fluorene	199	6.08	15.2	ug/kg	228.1	ND	87.4	50-110			
Indeno (1,2,3-cd) pyrene	158	6.08	15.2	ug/kg	228.1	ND	69.3	40-120			
Naphthalene	157	6.08	15.2	ug/kg	228.1	ND	68.7	40-105			
Phenanthrene	218	6.08	15.2	ug/kg	228.1	3.79	95.4	50-110			
Pyrene	259	6.08	15.2	ug/kg	228.1	26.3	102	45-125			
Surrogate: 2-Fluorobiphenyl	*220*			*ug/kg*	*425.9*		*51.5*	*45-105*			
Surrogate: Terphenyl-dl4	*220*			*ug/kg*	*395.4*		*56.1*	*30-125*			
Matrix Spike Dup (B607014-MSD1)		**Source: 6062401-04**			Prepared: 08-Jul-2016 Analyzed: 18-Aug-2016						
1-Methylnaphthalene	176	6.40	16.0	ug/kg	240.0	ND	73.5	40-105	1.05	30	
2-Methylnaphthalene	168	6.40	16.0	ug/kg	240.0	ND	70.2	40-105	2.87	30	
Acenaphthene	178	6.40	16.0	ug/kg	240.0	ND	74.1	45-110	3.54	30	
Acenaphthylene	169	6.40	16.0	ug/kg	240.0	ND	70.5	45-105	1.46	30	
Anthracene	154	6.40	16.0	ug/kg	240.0	3.84	64.3	55-105	7.07	30	
Benzo (a) anthracene	223	6.40	16.0	ug/kg	240.0	8.15	89.6	50-120	1.74	30	
Benzo (a) pyrene	228	6.40	16.0	ug/kg	240.0	6.04	95.1	50-110	9.63	30	
Benzo (b) fluoranthene	221	6.40	16.0	ug/kg	240.0	9.53	88.1	45-115	6.39	30	
Benzo (g,h,i) perylene	203	6.40	16.0	ug/kg	240.0	ND	84.7	40-125	11.6	30	
Benzo (k) fluoranthene	301	6.40	16.0	ug/kg	240.0	12.1	120	45-125	4.57	30	
Chrysene	251	6.40	16.0	ug/kg	240.0	9.80	101	55-120	6.07	30	
Dibenz (a,h) anthracene	224	6.40	16.0	ug/kg	240.0	ND	93.5	40-125	18.6	30	
Fluoranthene	234	6.40	16.0	ug/kg	240.0	30.0	85.2	55-120	1.45	30	
Fluorene	206	6.40	16.0	ug/kg	240.0	ND	85.6	50-110	3.02	30	
Indeno (1,2,3-cd) pyrene	169	6.40	16.0	ug/kg	240.0	ND	70.3	40-120	6.59	30	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	29-Nov-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B607014 - * DEFAULT PREP *****											
Matrix Spike Dup (B607014-MSD1)	**Source: 6062401-04**				Prepared: 08-Jul-2016 Analyzed: 18-Aug-2016						
Naphthalene	153	6.40	16.0	ug/kg	240.0	ND	63.8	40-105	2.36	30	
Phenanthrene	195	6.40	16.0	ug/kg	240.0	3.79	81.3	50-110	11.0	30	
Pyrene	301	6.40	16.0	ug/kg	240.0	26.3	114	45-125	15.0	30	
Surrogate: 2-Fluorobiphenyl	*220*			*ug/kg*	*448.0*		*49.0*	*45-105*			
Surrogate: Terphenyl-d14	*440*			*ug/kg*	*416.0*		*105*	*30-125*			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Page 24 of 26

ERDC SAMPLE RECEIPT CHECKLIST

Client: Sparwar	**Work Order:** 6062401 6062402
Project: RARA	**Date/Time Received** 6/24/16 1430
Shipping Company: Fedex	

Suspected Hazard Information	Yes	No	NA	Comments:
Shipped as DOT Hazardous?		\		
Samples identified as Foreign Material?		\		

Sample Receipt Criteria	Yes	No	NA	Comments:
1. Shipping containers received intact and sealed?	\			
2. Chain of Custody documents included with shipment?	\			
3. COC form is properly signed in relinquished/received sections?	\			
4. Samples requiring chemical preservation at proper pH?	\			
5. Samples requiring cold preservation within 0-5°C?		\		10.5°C / warmer on top than bottom
6. Samples IDs on COC match IDs on containers?	\			
7. Date and time of COC match date and time on containers?	\			
8. Date and time of COC match date and [redacted]				
9. Number of containers received match number indicated on COC?	\			
10. Samples received within holding time?	\			
11. Aqueous samples found to have visible solids?			\	

Additional Comments:

* samples above 4°C

Checklist preformed by: Madeline J

Time/Date: 6/24/16 14:30

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Systems Center
PACIFIC

SPAWAR SYSTEMS CENTER PACIFIC
ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY
BRANCH, CODE 7176
53475 STROTHE ROAD
SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 23-Jun-2016
Page: 2 of 82

Project Title: **ESTCP Remedy and Recontamination Assessment (RARA) Array DemVal**							***Project PI:***		Dr. D. Bart Chadwick			
Remarks							***Contact:***		Joel Guerrero			
Sampler(s): (Signature)		Bart Chadwick (Code 71705) / M.Colvin (Code 71760)					***Contact Tel:***		(619) 850-2109			
Tel: 619-553-5333		***Fax:*** 619-553-6305		***Email:*** joel.guerrero@navy.mil			***Analyses***					
Special Instructions/Comments: Kept dark & cold (4 °C)												
Field Sample Identification	Client ID	***Start Date Collection***	***Start Time (local)***	***Matrix***	***Type***	***Pres.***	**PCB congeners [8082A / 3510]**	**PAHs [8270D / 3510]**	**Pesticides [8081B / 3535]**			
RARA-SPME-1-062116	RARA-1	06-21-2016	11:57	SPME	Comp	none	x	x	x			
RARA-SPME-2-062116	RARA-2	06-21-2016	12:04	SPME	Comp	none	x	x	x			
RARA-SPME-3-062116	RARA-3	06-21-2016	11:30	SPME	Comp	none	x	x	x			
RARA-SPME-4-062116	RARA-4	06-21-2016	12:10	SPME	Comp	none	x	x	x			
RARA-SPME-5-062116	RARA-5	06-21-2016	11:47	SPME	Comp	none	x	x	x			
RARA-SPME-6-062116	RARA-6	06-21-2016	11:37	SPME	Comp	none	x	x	x			
RARA-SPME-TB-062116	RARA-TB	06-21-2016	—	SPME	Comp	none	x	x	x			
						TOTAL	7					
Relinquished by: Marienne Colvin			***(Signature)*** [signature]				***Date:*** 6/23/2016			***Time:*** 1030		
Received by: MKT			***(Signature)*** [signature]				***Date:*** 6/24/16			***Time:*** 1430		

SPAWAR Systems Center PACIFIC

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ADVANCED SYSTEMS & APPLIED SCIENCES DIVISION
ENERGY AND ENVIRONMENTAL SUSTAINABILITY
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SAN DIEGO, CA 92152-5000

Chain of Custody Record

Date: 23-Jun-2016
Page: 1 of 2

Project Title: ESTCP Remedy and Recontamination Assessment (RARA) Array DemVal		**Project PI:**	Dr. D. Bart Chadwick
Remarks		**Contact:**	Joel Guerrero
Sampler(s): (Signature)	Bart Chadwick (Code 71705) / M.Colvin (Code 71760)	**Contact Tel:**	(619) 850-2109
Tel: 619-553-5333	**Fax:** 619-553-6305 **Email:** joel.guerrero@navy.mil		

Special Instructions/Comments:
Kept dark & cold (4 °C)

Field Sample Identification	Wet weight (g)	Start Date Collection	Start Time (local)	Matrix	Type	Pres.	PCB congeners [8082A / 3510]	PAHs [8270D / 3510]	Pesticides [8081B / 3535]	Cd,Cu,Pb,Zn [6020A] Hg [7471B]	Lipids	Percent (%) Moisture
RARA- Tissue1 -062116	18.7	06-21-2016	0924	Tissue	Comp	none	x	x	x	x	x	x
RARA- Tissue2 -062116	21.6	06-21-2016	0939	Tissue	Comp	none	x	x	x	x	x	x
RARA- Tissue3 -062116	23.0	06-21-2016	1005	Tissue	Comp	none	x	x	x	x	x	x
RARA- Tissue4 -062116	24.6	06-21-2016	1030	Tissue	Comp	none	x	x	x	x	x	x
RARA- Tissue5 -062116	23.2	06-21-2016	1057	Tissue	Comp	none	x	x	x	x	x	x
RARA- Tissue6 -062116	23.4	06-21-2016	1110	Tissue	Comp	none	x	x	x	x	x	x
RARA- Time 0 -062116	21.3	06-21-2017	1128	Tissue	Comp	none	x	x	x	x	x	x
						TOTAL	7					

Relinquished by: Marienne Colvin	(Signature)	**Date:** 6/23/2016	**Time:** 1030
Received by: MKT	(Signature)	**Date:** 6/24/16	**Time:** 1430

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception

Units - ug/kg		Det Limit	Report Limit	%Rec TMX	%Rec 209	1	3	4	5	6	7	8
Tissue 1 062116	6062401-1	0.13	0.4	56.0	68.5	ND	ND	ND	ND	ND	ND	ND
Tissue 2 062116	-2	0.13	0.4	54.0	44.0	ND	ND	ND	ND	ND	ND	ND
Tissue 3 062116	-3	0.13	0.4	50.3	42.5	ND	ND	ND	ND	ND	ND	ND
Tissue 4 062116	-4	0.13	0.4	51.5	52.0	ND	ND	ND	ND	ND	ND	ND
Tissue 5 062116	-5	0.13	0.4	55.8	58.8	ND	ND	ND	ND	ND	ND	ND
Tissue 6 062116	-6	0.13	0.4	57.0	43.8	ND	ND	ND	ND	ND	ND	ND
Time 0 062116	-7	0.13	0.4	54.3	47.0	ND	ND	ND	ND	ND	ND	ND
	BLK	0.13	0.4	49.3	52.3	ND	ND	ND	ND	ND	ND	ND
	BS %rec	0.13	0.4						86.7			
	MS %Rec	0.13	0.4						85.3			
	MSD %Rec	0.13	0.4						79.0			

9	10	12	13	14	15	16	17	18	19	20	22	24	25
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	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	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	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
								68.3					
								88.0					
								85.3					

26	27	28	29	31	32	33	34	35	37	40	41	42	44
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	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	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	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
				86.0									90.3
				68.3									102.0
				65.7									106.0

45	46	47	48	49	51	52	53	54	56	59	60	63	64
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	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	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	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
						71.3							
						79.7							
						82.3							

66	67	69	70	71	73	74	75	77	81	82	83	84	85
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	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	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	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
74.0													
66.3													
62.0													

87	90	91	92	93	95	97	99	100	101	103	104	105	107
ND	2.68	ND	ND	ND	0.945	ND	ND	ND	ND	ND	ND	ND	ND
ND	2.62	ND	ND	ND	0.762	ND	ND	ND	ND	ND	ND	ND	ND
ND	1.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND	2.26	ND	ND	ND	0.647	ND	ND	ND	ND	ND	ND	ND	ND
ND	3.84	ND	ND	ND	0.906	ND	ND	ND	ND	ND	ND	ND	ND
ND	2.04	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	ND	ND	ND	ND	ND	ND	ND	ND
77.0	80.7												
85.3	95.0												
89.3	97.7												

110	114	115	117	118	119	122	123	124	126	128	129	130	131
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	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	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	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
76.0													
71.3													
71.0													

132	134	135	136	137	138	141	144	146	147	149	151	153	154
ND	ND	ND	ND	ND	1.63	ND	ND	ND	ND	ND	ND	1.72	ND
ND	ND	ND	ND	ND	2.03	ND	ND	ND	ND	ND	ND	1.62	ND
ND	ND	ND	ND	ND	0.576	ND	ND	ND	ND	ND	ND	0.576	ND
ND	ND	ND	ND	ND	1.17	ND	ND	ND	ND	ND	ND	0.789	ND
ND	ND	ND	ND	ND	1.77	ND	ND	ND	ND	ND	ND	1.33	ND
ND	ND	ND	ND	ND	0.992	ND	ND	ND	ND	ND	ND	0.357	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.823	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
					71.7	67.3					76.0	67.0	
					78.0	72.3					79.0	70.0	
					84.3	73.0					82.0	76.0	

156	157	158	163	164	165	167	169	170	171	172	173	174	175
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	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	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	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
								79.3					
								75.3					
								82.3					

176	177	178	179	180	183	184	185	187	189	190	191	193	194
ND	ND	ND	ND	ND	ND	ND	ND	0.403	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	0.405	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	0.224	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	0.249	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	0.357	ND	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	0.275	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
				67.0	70.0			66.3					
				62.3	67.7			63.3					
				66.3	73.0			66.7					

195	196	197	199	200	201	202	203	205	206	207	208
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	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	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
									70.3		
									61.3		
									52.3		

T-Final Results

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

12 December 2016

Joel Guererro
Navy – SPAWAR
Environmental Science and Applied System Branch, 536(
San Diego, CA 92152

RE: RARA

Enclosed are the results of analyses for samples received by the laboratory on 18-Aug-2016. The samples associated with this report will be held for 90 days from the date of this report. The raw data associated with this report will be held for 5 years from the date of this report. If you need us to hold onto the samples or the data longer then these specified times, you will need to notify us in writing at least 30 days before the expiration dates. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jenifer Milam
Database Manager

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

WORK ORDER SUMMARY

Sample ID	Laboratory ID	Matrix	Date Sampled	Date of Work Order
#1	6081805-01	Tissue	16-Aug-2016	18-Aug-2016
#2	6081805-02	Tissue	16-Aug-2016	18-Aug-2016
#3	6081805-03	Tissue	16-Aug-2016	18-Aug-2016
#4	6081805-04	Tissue	16-Aug-2016	18-Aug-2016
#5	6081805-05	Tissue	16-Aug-2016	18-Aug-2016
#6	6081805-06	Tissue	16-Aug-2016	18-Aug-2016
Time 0	6081805-07	Tissue	16-Aug-2016	18-Aug-2016

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Case Narrative

No issues were experienced during the analysis of Work Order 6081805 unless specified below.

This report does include iron since it is not part of our 6020 metals list.

We will have to run in by 6010.

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Notes and Definitions

U	Analyte included in the analysis, but not detected
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
Q	Value is outside of acceptance limits.
MB-01	The method blank contains analyte at a concentration above the MRL; however, concentration is less than 10% of the sample result, which is negligible according to method criteria.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration.
H	This sample was extracted and/or analyzed outside of the EPA recommended holding time.
B	Analyte is found in the associated blank as well as in the sample.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#1

6081805-01 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.450**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.034**	0.002	0.004	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**292**	0.358	0.717	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.179	0.358	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**8.28**	0.179	0.358	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	**0.813**	0.179	0.358	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**24.6**	0.179	0.358	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**84.2**			% by Volume	27-Sep-2016	21-Nov-2016	-	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#1

6081805-01RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes

ERDC-EL-EP-C

Organochlorine Pesticides by EPA Method 8081A

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
4,4´-DDD	**0.221**	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	J
4,4´-DDE	**1.08**	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
4,4´-DDT	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Aldrin	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
beta-BHC	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin aldehyde	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin ketone	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	2.46		*47.8 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	2.57		*49.9 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
1-Methylnaphthalene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) anthracene	**9.14**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (a) pyrene	**15.8**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (b) fluoranthene	**31.3**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (g,h,i) perylene	**6.73**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (k) fluoranthene	**13.9**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Chrysene	**11.3**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#1

6081805-01RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**12.2**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Fluorene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Naphthalene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	**5.51**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Pyrene	**18.3**	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	13		*36.1 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	17		*46.3 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#2

6081805-02 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Classical Chemistry Parameters								
% Lipids	**0.570**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.037**	0.002	0.005	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**330**	0.366	0.732	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.183	0.366	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**7.09**	0.183	0.366	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	**1.00**	0.183	0.366	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**21.7**	0.183	0.366	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**81.8**			% by Volume	27-Sep-2016	21-Nov-2016	-	

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3909 Halls Ferry Road
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#2

6081805-02RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.293**	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	J
4,4´-DDE	**1.31**	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
4,4´-DDT	**2.38**	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
Aldrin	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	**0.511**	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
beta-BHC	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin aldehyde	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin ketone	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.121	0.402	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.38**		*44.4 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.71**		*50.6 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) anthracene	**10.6**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (a) pyrene	**22.4**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (b) fluoranthene	**39.5**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (g,h,i) perylene	**7.27**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (k) fluoranthene	**19.1**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Chrysene	**13.5**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#2

6081805-02RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**18.8**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Fluorene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**7.51**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Naphthalene	ND	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	**3.78**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Pyrene	**15.6**	3.22	8.04	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**16**		*44.7 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**28**		*70.9 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#3

6081805-03 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Classical Chemistry Parameters								
% Lipids	**0.390**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.041**	0.002	0.004	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**256**	0.390	0.781	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.195	0.390	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**8.56**	0.195	0.390	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	**0.614**	0.195	0.390	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**18.8**	0.195	0.390	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**82.2**			% by Volume	27-Sep-2016	21-Nov-2016	-	

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USACE ERDC-EP-C
3909 Halls Ferry Road
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#3

6081805-03RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.294**	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	J
4,4´-DDE	**2.89**	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
4,4´-DDT	**2.45**	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
Aldrin	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
beta-BHC	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	**0.275**	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	J
Endrin aldehyde	**0.717**	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
Endrin ketone	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.121	0.403	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.77**		*51.6 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**4.88**		*90.8 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) anthracene	**12.6**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (a) pyrene	**17.0**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (b) fluoranthene	**37.6**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (g,h,i) perylene	**6.23**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (k) fluoranthene	**16.1**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Chrysene	**15.9**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#3

6081805-03RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**33.9**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Fluorene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**6.62**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Naphthalene	ND	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	**6.17**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Pyrene	**29.9**	3.23	8.06	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**16**		*43.1 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**29**		*73.9 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

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USACE ERDC-EP-C
3909 Halls Ferry Road
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#4

6081805-04 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Classical Chemistry Parameters								
% Lipids	**0.430**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.035**	0.002	0.005	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**224**	0.345	0.690	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.173	0.345	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**7.63**	0.173	0.345	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	**0.582**	0.173	0.345	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**16.9**	0.173	0.345	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**82.3**			% by Volume	27-Sep-2016	21-Nov-2016	-	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#4

6081805-04RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
4,4´-DDE	**1.04**	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
4,4´-DDT	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Aldrin	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
beta-BHC	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin aldehyde	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin ketone	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.120	0.401	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**3.01**		*56.4 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.96**		*55.4 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	**3.44**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (a) anthracene	**13.8**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (a) pyrene	**18.4**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (b) fluoranthene	**40.5**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (g,h,i) perylene	**6.08**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (k) fluoranthene	**17.5**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Chrysene	**17.1**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#4

6081805-04RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	**17.7**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Fluorene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**6.98**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Naphthalene	ND	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	**4.21**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Pyrene	**22.6**	3.21	8.02	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**15**		*40.6 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**23**		*58.7 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

#5

6081805-05 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Classical Chemistry Parameters								
% Lipids	**0.360**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.032**	0.002	0.004	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**351**	0.374	0.748	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.187	0.374	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**9.19**	0.187	0.374	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	**1.02**	0.187	0.374	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**18.7**	0.187	0.374	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**82.2**			% by Volume	27-Sep-2016	21-Nov-2016	-	

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San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

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6081805-05RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.179**	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	J
4,4´-DDE	**0.925**	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
4,4´-DDT	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Aldrin	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
beta-BHC	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin aldehyde	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin ketone	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.119	0.397	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.25**		*42.6 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.49**		*47.0 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) anthracene	**9.88**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (a) pyrene	**14.3**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (b) fluoranthene	**32.0**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (g,h,i) perylene	**5.63**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (k) fluoranthene	**13.4**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Chrysene	**11.9**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

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6081805-05RE1 (Tissue)

ERDC-EL-EP-C

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Fluoranthene	**13.5**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Fluorene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**6.08**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Naphthalene	ND	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	**3.61**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Pyrene	**13.2**	3.17	7.94	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**15**		*42.2 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**24**		*61.8 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

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6081805-06 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Classical Chemistry Parameters								
% Lipids	**0.430**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.041**	0.002	0.005	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**387**	0.353	0.706	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.177	0.353	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**6.88**	0.177	0.353	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	**0.930**	0.177	0.353	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Zinc-66 [1]	**21.7**	0.177	0.353	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**81.2**			% by Volume	27-Sep-2016	21-Nov-2016	-	

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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6081805-06RE1 (Tissue)

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	**0.133**	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	J
4,4´-DDE	**1.01**	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	
4,4´-DDT	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Aldrin	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
beta-BHC	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin aldehyde	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin ketone	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.121	0.404	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	**2.41**		*44.7 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	**2.55**		*47.2 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) anthracene	**12.9**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (a) pyrene	**18.4**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (b) fluoranthene	**39.2**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Benzo (g,h,i) perylene	**6.54**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Benzo (k) fluoranthene	**15.5**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Chrysene	**15.4**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Dibenz (a,h) anthracene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

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6081805-06RE1 (Tissue)

ERDC-EL-EP-C

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
Fluoranthene	**18.7**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Fluorene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	**6.56**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Naphthalene	ND	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	**4.14**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	J
Pyrene	**18.6**	3.23	8.09	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	
Surrogate: 2-Fluorobiphenyl	**17**		*45.5 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	**29**		*72.9 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Time 0

6081805-07 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
				ERDC-EL-EP-C				
Classical Chemistry Parameters								
% Lipids	**0.340**			% by Weight	28-Sep-2016	21-Nov-2016	Lipid Content by Gravimetric Determination	
Metals by EPA 6000/7000 Series Methods								
Mercury	**0.016**	0.002	0.005	mg/kg	16-Sep-2016	20-Oct-2016	EPA 7471A	H
Aluminum-27 [1]	**16.5**	0.359	0.717	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	B
Cadmium-111 [1]	ND	0.179	0.359	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Copper-65 [1]	**1.97**	0.179	0.359	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	
Lead-208 [1]	ND	0.179	0.359	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	U
Zinc-66 [1]	**13.3**	0.179	0.359	mg/kg	03-Nov-2016	15-Nov-2016	SW 846/6020	MB-01
Miscellaneous Physical/Conventional Chemistry Parameters								
% Moisture	**86.8**			% by Volume	27-Sep-2016	21-Nov-2016	-	

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Time 0

6081805-07RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Organochlorine Pesticides by EPA Method 8081A								
4,4´-DDD	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
4,4´-DDE	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
4,4´-DDT	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Aldrin	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-BHC	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
alpha-Chlordane	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
beta-BHC	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
delta-BHC	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Dieldrin	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan I	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan II	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endosulfan sulfate	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin aldehyde	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Endrin ketone	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-BHC (Lindane)	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
gamma-Chlordane	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Heptachlor epoxide	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Methoxychlor	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Toxaphene	ND	0.116	0.387	ug/kg	25-Oct-2016	27-Oct-2016	EPA 8081A	U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	1.77		*34.4 %*	*35-125*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Surrogate: Decachlorobiphenyl	2.43		*47.1 %*	*40-130*	*25-Oct-2016*	*27-Oct-2016*	*EPA 8081A*	
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
1-Methylnaphthalene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
2-Methylnaphthalene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Acenaphthylene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Anthracene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) anthracene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (a) pyrene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (b) fluoranthene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (g,h,i) perylene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Benzo (k) fluoranthene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Chrysene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Dibenz (a,h) anthracene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Time 0

6081805-07RE1 (Tissue)

Analyte	Result	Detection Limit	Reporting Limit	Units	Prepared	Analyzed	Method	Notes
			ERDC-EL-EP-C					
Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring								
Fluoranthene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Fluorene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Indeno (1,2,3-cd) pyrene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Naphthalene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Phenanthrene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Pyrene	ND	3.09	7.73	ug/kg	20-Oct-2016	21-Nov-2016	EPA 8270C	U
Surrogate: 2-Fluorobiphenyl	14		*39.7 %*	*45-105*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	
Surrogate: Terphenyl-dl4	24		*63.7 %*	*30-125*	*20-Oct-2016*	*21-Nov-2016*	*EPA 8270C*	

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610233 - Default Prep Metals											
Blank (B610233-BLK1)					Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	ND	0.002	0.005	mg/kg							U
LCS (B610233-BS1)					Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	0.101	0.002	0.005	mg/kg	0.1000		101	75-125			
Duplicate (B610233-DUP1)		**Source: 6081805-01**			Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	0.0332	0.002	0.005	mg/kg		0.0343			3.34	25	
Matrix Spike (B610233-MS1)		**Source: 6081805-01**			Prepared: 16-Sep-2016 Analyzed: 20-Oct-2016						
Mercury	0.106	0.002	0.004	mg/kg	0.08452	0.0343	85.3	75-125			
Batch B611135 - Default Prep Metals											
Blank (B611135-BLK1)					Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Aluminum-27 [1]	11.6	0.200	0.400	mg/kg							
Cadmium-111 [1]	ND	0.400	0.800	mg/kg							U
Copper-65 [1]	ND	0.400	0.800	mg/kg							U
Lead-208 [1]	ND	0.400	0.800	mg/kg							U
Zinc-66 [1]	0.696	0.400	0.800	mg/kg							MB-01, J
LCS (B611135-BS1)					Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Aluminum-27 [1]	5380	1.00	2.00	mg/kg	5000		108	80-120			B
Cadmium-111 [1]	52.1	1.00	2.00	mg/kg	50.00		104	80-120			
Copper-65 [1]	96.7	1.00	2.00	mg/kg	100.0		96.7	80-120			
Lead-208 [1]	114	1.00	2.00	mg/kg	100.0		114	80-120			
Zinc-66 [1]	185	1.00	2.00	mg/kg	200.0		92.3	80-120			MB-01

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Navy -- SPAWAR	Project: RARA	
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San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Metals by EPA 6000/7000 Series Methods - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B611135 - Default Prep Metals											
Duplicate (B611135-DUP1)		**Source: 6081805-07**			Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Aluminum-27 [1]	16.0	0.358	0.717	mg/kg		16.5			3.31	20	B
Cadmium-111 [1]	ND	0.179	0.358	mg/kg		ND				20	U
Copper-65 [1]	2.37	0.179	0.358	mg/kg		1.97			18.5	20	
Lead-208 [1]	ND	0.179	0.358	mg/kg		ND				20	U
Zinc-66 [1]	10.9	0.179	0.358	mg/kg		13.3			19.8	20	MB-01
Matrix Spike (B611135-MS1)		**Source: 6081805-07**			Prepared: 03-Nov-2016 Analyzed: 15-Nov-2016						
Aluminum-27 [1]	4670	0.905	1.81	mg/kg	4524	16.5	103	80-120			B
Cadmium-111 [1]	52.6	0.452	0.905	mg/kg	45.24	ND	116	80-120			
Copper-65 [1]	94.3	0.452	0.905	mg/kg	90.48	1.97	102	80-120			
Lead-208 [1]	115	0.452	0.905	mg/kg	90.48	ND	127	80-120			QM-07
Zinc-66 [1]	198	0.452	0.905	mg/kg	181.0	13.3	102	80-120			MB-01

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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610279 - * DEFAULT PREP *****											
Blank (B610279-BLK1)					Prepared: 20-Oct-2016 Analyzed: 27-Oct-2016						
4,4'-DDD	ND	0.122	0.405	ug/kg							U
4,4'-DDE	ND	0.122	0.405	ug/kg							U
4,4'-DDT	ND	0.122	0.405	ug/kg							U
Aldrin	ND	0.122	0.405	ug/kg							U
alpha-BHC	ND	0.122	0.405	ug/kg							U
alpha-Chlordane	ND	0.122	0.405	ug/kg							U
beta-BHC	ND	0.122	0.405	ug/kg							U
delta-BHC	ND	0.122	0.405	ug/kg							U
Dieldrin	ND	0.122	0.405	ug/kg							U
Endosulfan I	ND	0.122	0.405	ug/kg							U
Endosulfan II	ND	0.122	0.405	ug/kg							U
Endosulfan sulfate	ND	0.122	0.405	ug/kg							U
Endrin	ND	0.122	0.405	ug/kg							U
Endrin aldehyde	ND	0.122	0.405	ug/kg							U
Endrin ketone	ND	0.122	0.405	ug/kg							U
gamma-BHC (Lindane)	ND	0.122	0.405	ug/kg							U
gamma-Chlordane	ND	0.122	0.405	ug/kg							U
Heptachlor	ND	0.122	0.405	ug/kg							U
Heptachlor epoxide	ND	0.122	0.405	ug/kg							U
Methoxychlor	ND	0.122	0.405	ug/kg							U
Toxaphene	ND	0.122	0.405	ug/kg							U
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.04*			*ug/kg*	*5.405*		*37.8*	*35-125*			
Surrogate: Decachlorobiphenyl	*3.33*			*ug/kg*	*5.405*		*61.6*	*40-130*			
LCS (B610279-BS1)					Prepared: 20-Oct-2016 Analyzed: 27-Oct-2016						
4,4'-DDD	5.23	0.122	0.405	ug/kg	5.405		96.8	30-135			
4,4'-DDE	4.46	0.122	0.405	ug/kg	5.405		82.5	50-125			
4,4'-DDT	5.51	0.122	0.405	ug/kg	5.405		102	40-140			
Aldrin	3.13	0.122	0.405	ug/kg	5.405		57.9	45-140			
alpha-BHC	3.06	0.122	0.405	ug/kg	5.405		56.6	50-125			
alpha-Chlordane	4.34	0.122	0.405	ug/kg	5.405		80.3	50-120			
beta-BHC	3.50	0.122	0.405	ug/kg	5.405		64.7	50-125			
delta-BHC	3.32	0.122	0.405	ug/kg	5.405		61.4	55-130			
Dieldrin	4.78	0.122	0.405	ug/kg	5.405		88.5	50-125			
Endosulfan I	4.14	0.122	0.405	ug/kg	5.405		76.5	15-135			
Endosulfan II	5.72	0.122	0.405	ug/kg	5.405		106	35-140			
Endosulfan sulfate	5.39	0.122	0.405	ug/kg	5.405		99.8	50-135			
Endrin	4.82	0.122	0.405	ug/kg	5.405		89.2	50-135			
Endrin aldehyde	5.39	0.122	0.405	ug/kg	5.405		99.8	35-145			
Endrin ketone	6.41	0.122	0.405	ug/kg	5.405		118	50-135			
gamma-BHC (Lindane)	3.54	0.122	0.405	ug/kg	5.405		65.6	50-125			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610279 - * DEFAULT PREP *****											
LCS (B610279-BS1)					Prepared: 20-Oct-2016 Analyzed: 27-Oct-2016						
gamma-Chlordane	4.50	0.122	0.405	ug/kg	5.405		83.3	50-125			
Heptachlor	3.69	0.122	0.405	ug/kg	5.405		68.3	50-140			
Heptachlor epoxide	4.14	0.122	0.405	ug/kg	5.405		76.5	50-130			
Methoxychlor	6.28	0.122	0.405	ug/kg	5.405		116	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*2.35*			*ug/kg*	*5.405*		*43.5*	*35-125*			
Surrogate: Decachlorobiphenyl	*5.11*			*ug/kg*	*5.405*		*94.5*	*40-130*			
Matrix Spike (B610279-MS1)		**Source: 6081805-06RE1**			Prepared: 20-Oct-2016 Analyzed: 27-Oct-2016						
4,4'-DDD	5.72	0.198	0.561	ug/kg	8.811	0.133	65.0	30-135			
4,4'-DDE	6.67	0.198	0.561	ug/kg	8.811	1.01	64.3	50-125			
4,4'-DDT	7.27	0.198	0.561	ug/kg	8.811	ND	82.5	40-140			
Aldrin	4.70	0.198	0.561	ug/kg	8.811	ND	53.3	45-140			
alpha-BHC	4.66	0.198	0.561	ug/kg	8.811	ND	52.9	50-125			
alpha-Chlordane	5.97	0.198	0.561	ug/kg	8.811	ND	67.8	65-120			
beta-BHC	6.05	0.198	0.561	ug/kg	8.811	ND	68.6	50-125			
delta-BHC	5.20	0.198	0.561	ug/kg	8.811	ND	59.0	55-130			
Dieldrin	5.75	0.198	0.561	ug/kg	8.811	ND	65.2	50-125			
Endosulfan I	12.8	0.198	0.561	ug/kg	8.811	ND	146	15-135			Q
Endosulfan II	5.47	0.198	0.561	ug/kg	8.811	ND	62.1	35-140			
Endosulfan sulfate	5.82	0.198	0.561	ug/kg	8.811	ND	66.1	50-135			
Endrin	5.95	0.198	0.561	ug/kg	8.811	ND	67.5	50-135			
Endrin aldehyde	3.39	0.198	0.561	ug/kg	8.811	ND	38.5	35-145			
Endrin ketone	5.62	0.198	0.561	ug/kg	8.811	ND	63.8	50-135			
gamma-BHC (Lindane)	5.21	0.198	0.561	ug/kg	8.811	ND	59.2	50-125			
gamma-Chlordane	5.70	0.198	0.561	ug/kg	8.811	ND	64.6	50-125			
Heptachlor	4.92	0.198	0.561	ug/kg	8.811	ND	55.8	50-140			
Heptachlor epoxide	7.86	0.198	0.561	ug/kg	8.811	ND	89.2	50-130			
Methoxychlor	5.72	0.198	0.561	ug/kg	8.811	ND	64.9	55-145			
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*5.60*			*ug/kg*	*8.811*		*63.6*	*35-125*			
Surrogate: Decachlorobiphenyl	*3.86*			*ug/kg*	*8.811*		*43.8*	*40-130*			

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USACE ERDC-EP-C
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Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Organochlorine Pesticides by EPA Method 8081A - Quality Control

ERDC-EL-EP-C

Batch B610279 - * DEFAULT PREP *****

Matrix Spike Dup (B610279-MSD1) **Source: 6081805-06RE1** Prepared: 20-Oct-2016 Analyzed: 27-Oct-2016

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
4,4'-DDD	5.56	0.188	0.525	ug/kg	8.333	0.133	66.8	30-135	2.84	30	
4,4'-DDE	5.96	0.188	0.525	ug/kg	8.333	1.01	59.4	50-125	11.3	30	
4,4'-DDT	5.18	0.188	0.525	ug/kg	8.333	ND	62.2	40-140	33.5	30	QM-07
Aldrin	3.39	0.188	0.525	ug/kg	8.333	ND	40.6	45-140	32.4	30	QM-07
alpha-BHC	3.61	0.188	0.525	ug/kg	8.333	ND	43.4	50-125	25.3	30	QM-07
alpha-Chlordane	4.80	0.188	0.525	ug/kg	8.333	ND	57.6	65-120	21.8	30	QM-07
beta-BHC	5.14	0.188	0.525	ug/kg	8.333	ND	61.7	50-125	16.1	30	
delta-BHC	4.69	0.188	0.525	ug/kg	8.333	ND	56.3	55-130	10.2	30	
Dieldrin	4.50	0.188	0.525	ug/kg	8.333	ND	54.0	50-125	24.4	30	
Endosulfan I	4.75	0.188	0.525	ug/kg	8.333	ND	57.0	15-135	91.9	30	QM-07
Endosulfan II	4.79	0.188	0.525	ug/kg	8.333	ND	57.5	35-140	13.2	30	
Endosulfan sulfate	5.02	0.188	0.525	ug/kg	8.333	ND	60.2	50-135	14.8	30	
Endrin	4.68	0.188	0.525	ug/kg	8.333	ND	56.1	50-135	24.0	30	
Endrin aldehyde	2.14	0.188	0.525	ug/kg	8.333	ND	25.6	35-145	45.3	30	QM-07
Endrin ketone	5.56	0.188	0.525	ug/kg	8.333	ND	66.8	50-135	0.970	30	
gamma-BHC (Lindane)	4.24	0.188	0.525	ug/kg	8.333	ND	50.9	50-125	20.5	30	
gamma-Chlordane	4.76	0.188	0.525	ug/kg	8.333	ND	57.2	50-125	17.9	30	
Heptachlor	4.25	0.188	0.525	ug/kg	8.333	ND	51.0	50-140	14.5	30	
Heptachlor epoxide	6.25	0.188	0.525	ug/kg	8.333	ND	75.0	50-130	22.9	30	
Methoxychlor	5.50	0.188	0.525	ug/kg	8.333	ND	66.0	55-145	3.85	30	
Surrogate: 2,4,5,6 Tetrachloro-m-xylene	*3.33*			*ug/kg*	*8.333*		*40.0*	*35-125*			
Surrogate: Decachlorobiphenyl	*4.14*			*ug/kg*	*8.333*		*49.6*	*40-130*			

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610279 - * DEFAULT PREP *****											
Blank (B610279-BLK1)					Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
1-Methylnaphthalene	ND	3.24	8.11	ug/kg							U
2-Methylnaphthalene	ND	3.24	8.11	ug/kg							U
Acenaphthene	ND	3.24	8.11	ug/kg							U
Acenaphthylene	ND	3.24	8.11	ug/kg							U
Anthracene	ND	3.24	8.11	ug/kg							U
Benzo (a) anthracene	ND	3.24	8.11	ug/kg							U
Benzo (a) pyrene	ND	3.24	8.11	ug/kg							U
Benzo (b) fluoranthene	ND	3.24	8.11	ug/kg							U
Benzo (g,h,i) perylene	ND	3.24	8.11	ug/kg							U
Benzo (k) fluoranthene	ND	3.24	8.11	ug/kg							U
Chrysene	ND	3.24	8.11	ug/kg							U
Dibenz (a,h) anthracene	ND	3.24	8.11	ug/kg							U
Fluoranthene	ND	3.24	8.11	ug/kg							U
Fluorene	ND	3.24	8.11	ug/kg							U
Indeno (1,2,3-cd) pyrene	ND	3.24	8.11	ug/kg							U
Naphthalene	ND	3.24	8.11	ug/kg							U
Phenanthrene	ND	3.24	8.11	ug/kg							U
Pyrene	ND	3.24	8.11	ug/kg							U
Surrogate: 2-Fluorobiphenyl	*14*			*ug/kg*	*36.49*		*38.3*	*45-105*			
Surrogate: Terphenyl-dl4	*21*			*ug/kg*	*39.19*		*54.6*	*30-125*			
LCS (B610279-BS1)					Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
1-Methylnaphthalene	41.8	3.24	8.11	ug/kg	81.08		51.5	40-105			
2-Methylnaphthalene	44.2	3.24	8.11	ug/kg	81.08		54.5	40-105			
Acenaphthene	45.8	3.24	8.11	ug/kg	81.08		56.5	45-110			
Acenaphthylene	43.8	3.24	8.11	ug/kg	81.08		54.0	45-105			
Anthracene	51.5	3.24	8.11	ug/kg	81.08		63.5	55-105			
Benzo (a) anthracene	59.6	3.24	8.11	ug/kg	81.08		73.5	50-120			
Benzo (a) pyrene	55.5	3.24	8.11	ug/kg	81.08		68.5	50-110			
Benzo (b) fluoranthene	57.2	3.24	8.11	ug/kg	81.08		70.5	45-115			
Benzo (g,h,i) perylene	57.6	3.24	8.11	ug/kg	81.08		71.0	40-125			
Benzo (k) fluoranthene	60.4	3.24	8.11	ug/kg	81.08		74.5	45-125			
Chrysene	62.0	3.24	8.11	ug/kg	81.08		76.5	55-120			
Dibenz (a,h) anthracene	62.0	3.24	8.11	ug/kg	81.08		76.5	40-125			
Fluoranthene	45.4	3.24	8.11	ug/kg	81.08		56.0	55-120			
Fluorene	61.2	3.24	8.11	ug/kg	81.08		75.5	50-110			
Indeno (1,2,3-cd) pyrene	61.6	3.24	8.11	ug/kg	81.08		76.0	40-120			
Naphthalene	43.4	3.24	8.11	ug/kg	81.08		53.5	40-105			
Phenanthrene	51.5	3.24	8.11	ug/kg	81.08		63.5	50-110			
Pyrene	58.8	3.24	8.11	ug/kg	81.08		72.5	45-125			

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		**Reported:**
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610279 - * DEFAULT PREP *****											
LCS (B610279-BS1)					Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
Surrogate: 2-Fluorobiphenyl	*16*			*ug/kg*	*36.49*		*43.2*	*45-105*			
Surrogate: Terphenyl-dl4	*19*			*ug/kg*	*39.19*		*47.5*	*30-125*			
LCS Dup (B610279-BSD1)					Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
1-Methylnaphthalene	37.2	3.24	8.11	ug/kg	81.08		45.9	40-105	11.6	30	
2-Methylnaphthalene	37.2	3.24	8.11	ug/kg	81.08		45.8	40-105	17.2	30	
Acenaphthene	39.6	3.24	8.11	ug/kg	81.08		48.8	45-110	14.5	30	
Acenaphthylene	37.2	3.24	8.11	ug/kg	81.08		45.9	45-105	16.3	30	
Anthracene	41.4	3.24	8.11	ug/kg	81.08		51.0	55-105	21.8	30	
Benzo (a) anthracene	53.5	3.24	8.11	ug/kg	81.08		66.0	50-120	10.8	30	
Benzo (a) pyrene	50.7	3.24	8.11	ug/kg	81.08		62.5	50-110	9.16	30	
Benzo (b) fluoranthene	53.9	3.24	8.11	ug/kg	81.08		66.5	45-115	5.84	30	
Benzo (g,h,i) perylene	53.9	3.24	8.11	ug/kg	81.08		66.5	40-125	6.55	30	
Benzo (k) fluoranthene	52.7	3.24	8.11	ug/kg	81.08		65.0	45-125	13.6	30	
Chrysene	55.1	3.24	8.11	ug/kg	81.08		68.0	55-120	11.8	30	
Dibenz (a,h) anthracene	56.8	3.24	8.11	ug/kg	81.08		70.0	40-125	8.87	30	
Fluoranthene	53.9	3.24	8.11	ug/kg	81.08		66.5	55-120	17.1	30	
Fluorene	45.8	3.24	8.11	ug/kg	81.08		56.5	50-110	28.8	30	
Indeno (1,2,3-cd) pyrene	55.5	3.24	8.11	ug/kg	81.08		68.5	40-120	10.4	30	
Naphthalene	34.7	3.24	8.11	ug/kg	81.08		42.8	40-105	22.2	30	
Phenanthrene	44.6	3.24	8.11	ug/kg	81.08		55.0	50-110	14.3	30	
Pyrene	47.8	3.24	8.11	ug/kg	81.08		59.0	45-125	20.5	30	
Surrogate: 2-Fluorobiphenyl	*14*			*ug/kg*	*36.49*		*37.0*	*45-105*			
Surrogate: Terphenyl-dl4	*20*			*ug/kg*	*39.19*		*51.6*	*30-125*			
Matrix Spike (B610279-MS1)		Source: 6081805-06RE1			Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
1-Methylnaphthalene	63.1	5.29	13.2	ug/kg	132.2	ND	47.8	40-105			
2-Methylnaphthalene	64.0	5.29	13.2	ug/kg	132.2	ND	48.4	40-105			
Acenaphthene	64.2	5.29	13.2	ug/kg	132.2	ND	48.6	45-110			
Acenaphthylene	61.7	5.29	13.2	ug/kg	132.2	ND	46.7	45-105			
Anthracene	74.7	5.29	13.2	ug/kg	132.2	ND	56.5	55-105			
Benzo (a) anthracene	97.1	5.29	13.2	ug/kg	132.2	12.9	63.7	50-120			
Benzo (a) pyrene	96.5	5.29	13.2	ug/kg	132.2	18.4	59.0	50-110			
Benzo (b) fluoranthene	116	5.29	13.2	ug/kg	132.2	39.2	58.3	45-115			
Benzo (g,h,i) perylene	98.5	5.29	13.2	ug/kg	132.2	6.54	69.6	40-125			
Benzo (k) fluoranthene	106	5.29	13.2	ug/kg	132.2	15.5	68.3	45-125			
Chrysene	103	5.29	13.2	ug/kg	132.2	15.4	66.4	55-120			
Dibenz (a,h) anthracene	91.9	5.29	13.2	ug/kg	132.2	ND	69.5	40-125			
Fluoranthene	122	5.29	13.2	ug/kg	132.2	18.7	77.8	55-120			
Fluorene	80.6	5.29	13.2	ug/kg	132.2	ND	61.0	50-110			
Indeno (1,2,3-cd) pyrene	104	5.29	13.2	ug/kg	132.2	6.56	74.0	40-120			

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USACE ERDC-EP-C
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Navy -- SPAWAR	Project: RARA	
Environmental Science and Applied System Branch, 5360:		Reported:
San Diego CA, 92152	Project Manager: Joel Guererro	12-Dec-2016

Polynuclear Aromatic Compounds by GC/MS with Selected Ion Monitoring - Quality Control

ERDC-EL-EP-C

Analyte	Result	Detection Limit	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B610279 - * DEFAULT PREP *****											
Matrix Spike (B610279-MS1)	**Source: 6081805-06RE1**				Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
Naphthalene	58.6	5.29	13.2	ug/kg	132.2	ND	44.3	40-105			
Phenanthrene	79.3	5.29	13.2	ug/kg	132.2	4.14	60.0	50-110			
Pyrene	104	5.29	13.2	ug/kg	132.2	18.6	64.4	45-125			
Surrogate: 2-Fluorobiphenyl	*23*			*ug/kg*	*59.47*		*39.0*	*45-105*			
Surrogate: Terphenyl-dl4	*35*			*ug/kg*	*63.88*		*54.1*	*30-125*			
Matrix Spike Dup (B610279-MSD1)	**Source: 6081805-06RE1**				Prepared: 20-Oct-2016 Analyzed: 21-Nov-2016						
1-Methylnaphthalene	57.8	5.00	12.5	ug/kg	125.0	ND	46.2	40-105	8.76	30	
2-Methylnaphthalene	59.1	5.00	12.5	ug/kg	125.0	ND	47.2	40-105	8.07	30	
Acenaphthene	63.1	5.00	12.5	ug/kg	125.0	ND	50.5	45-110	1.73	30	
Acenaphthylene	62.5	5.00	12.5	ug/kg	125.0	ND	50.0	45-105	1.26	30	
Anthracene	81.9	5.00	12.5	ug/kg	125.0	ND	65.5	55-105	9.21	30	
Benzo (a) anthracene	111	5.00	12.5	ug/kg	125.0	12.9	78.2	50-120	13.0	30	
Benzo (a) pyrene	107	5.00	12.5	ug/kg	125.0	18.4	70.7	50-110	10.2	30	
Benzo (b) fluoranthene	132	5.00	12.5	ug/kg	125.0	39.2	74.6	45-115	13.0	30	
Benzo (g,h,i) perylene	109	5.00	12.5	ug/kg	125.0	6.54	82.3	40-125	10.5	30	
Benzo (k) fluoranthene	114	5.00	12.5	ug/kg	125.0	15.5	78.6	45-125	7.31	30	
Chrysene	117	5.00	12.5	ug/kg	125.0	15.4	81.2	55-120	12.5	30	
Dibenz (a,h) anthracene	106	5.00	12.5	ug/kg	125.0	ND	85.0	40-125	14.5	30	
Fluoranthene	134	5.00	12.5	ug/kg	125.0	18.7	92.0	55-120	9.53	30	Q
Fluorene	88.1	5.00	12.5	ug/kg	125.0	ND	70.5	50-110	8.90	30	
Indeno (1,2,3-cd) pyrene	117	5.00	12.5	ug/kg	125.0	6.56	88.3	40-120	11.3	30	
Naphthalene	54.0	5.00	12.5	ug/kg	125.0	ND	43.2	40-105	8.19	30	
Phenanthrene	92.5	5.00	12.5	ug/kg	125.0	4.14	74.0	50-110	15.4	30	
Pyrene	107	5.00	12.5	ug/kg	125.0	18.6	70.6	45-125	2.97	30	
Surrogate: 2-Fluorobiphenyl	*22*			*ug/kg*	*56.25*		*40.0*	*45-105*			
Surrogate: Terphenyl-dl4	*43*			*ug/kg*	*60.42*		*70.8*	*30-125*			

SPAWAR
Systems Center San Diego

ENVIRONMENTAL SCIENCES AND APPLIED SYSTEMS, Code 71760
53605 Hull Street
San Diego, CA 92152-5000

Chain of Custody Record

6081805

Date 8/16/16

Page 1 of 1

Project Title/Project Number: RARA

Remarks/Air Bill:

Sampler(s): (Signature) [signature]

Tel: 619-553-2788 | Fax: | Email: mcolvin@spawar.navy.mil

Project Leader: Bart Chadwick

Contact: Bart Chadwick

Contact Tel: 619-553-5333

Special Instructions/Comments:
Keep dark + cold (4°c) Contact Bart Chadwick prior to analysis Wet wt. (g)

Sample Identification	Date	Time	Matrix	Container Type	Collection Temp (°C)	Arrival Temp (°C)	PCB congeners [8082A/3570]	PAHs [8270D/3510]	Pesticides [8081B/3535]							
Container #1	8/16/2016	0900	Tissue	2 oz glass jar	18.5	ME	X	X	X							
Container #2	8/16/2016	↓	Tissue	2 oz glass jar	17.2		X	X	X							
Container #3	8/16/2016	↓	Tissue	2 oz glass jar	19.9		X	X	X							
Container #4	8/16/2016	↓	Tissue	2 oz glass jar	16.7		X	X	X							
Container #5	8/16/2016	↓	Tissue	2 oz glass jar	21.3		X	X	X							
Container #6	8/16/2016	↓	Tissue	2 oz glass jar	20.1		X	X	X							
Time 0	8/16/2016	↓	Tissue	" "	24.3		X	X	X							

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
[signature] - Molly Colvin SSC PAC	MEP 8/18/16	8/16/2016	1030
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

Items for Project Manager Review

LabNumber	Analysis	Analyte	Exception

can not be resolved due to coelutions on oth columns

Units - ug/kg tissue

		Detect Limit	Report Limit	%Rec TMX	%Rec 209	1	3	4	5	6	7	8
#1	6081805-1	0.17	0.52	54.9	61.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
#2	-2	0.18	0.54	49.3	53	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
#3	-3	0.18	0.54	68.4	66.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
#4	-4	0.18	0.54	90.2	82.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
#5	-5	0.18	0.53	51.7	60.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
#6	-6	0.18	0.54	53.3	56.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
T0	-7	0.17	0.52	40.6	76	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
						N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
BLK		0.18	0.54	38	77.2	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
BS				67.9	86				76.0			
MS				75.1	79				75.3			
MSD				70.6	75.4				75.3			

9	10	12	13	14	15/16	17	18	19	20	22	24	25	26
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
							79.3						
							80.0						
							79.3						

27	28/31	29	32	33	34	35	37	40	41	42	44	45	46
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	93.3										95.3		
	89.3										89.3		
	74.0										86.7		

47	48	49	51	52	53	54	56	59	60	63	64	66	67
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.534	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.762	N.D.
N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	2.594	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.761	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.758	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.		N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.266	N.D.	0.223	N.D.	N.D.	0.883	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.567	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
				77.3								84.7	
				82.7								74.0	
				78.0								70.7	

69	70	71	73	74	75	77	81/117	82	83	84	85	87/115	90/101
N.D.	0.39	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.		N.D.	N.D.	0.33	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.697
N.D.	0.629	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.193	
N.D.		N.D.	N.D.	0.351	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		2.086
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.11
N.D.	0.479	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.		N.D.	N.D.	0.52	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.57
N.D.	0.888	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.		N.D.	N.D.	0.678	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.678
N.D.	0.442	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
N.D.		N.D.	N.D.	N.D.	N.D.	0.846	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.54
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
												88.7	88.0
												84.0	81.3
												79.3	80.7

91	92	93	95	97	99	100	103	104	105	107	110	114	118
N.D.	N.D.			0.383	0.813	N.D.	N.D.	N.D.	0.288	N.D.	0.415	N.D.	1.419
N.D.	N.D.		0.721			N.D.	N.D.	N.D.		N.D.		N.D.	
N.D.	N.D.			0.437	1.129	N.D.	N.D.	N.D.	0.429	N.D.	0.741	N.D.	1.641
N.D.	N.D.		1.213			N.D.	N.D.	N.D.		N.D.		N.D.	
N.D.	N.D.			N.D.	1.216	N.D.	N.D.	N.D.	0.6	N.D.	1.445	N.D.	4.398
N.D.	N.D.		1.54	N.D.		N.D.	N.D.	N.D.		N.D.		N.D.	
N.D.	N.D.			0.379	1.11	N.D.	N.D.	N.D.	0.497	N.D.	0.588	N.D.	2.08
N.D.	N.D.		0.797			N.D.	N.D.	N.D.		N.D.		N.D.	
N.D.	N.D.			0.394	0.952	N.D.	N.D.	N.D.	0.476	N.D.	0.438	N.D.	1.23
N.D.	N.D.		0.64			N.D.	N.D.	N.D.		N.D.		N.D.	
N.D.	N.D.		N.D.	0.394	0.797	N.D.	N.D.	N.D.	0.273	0.497	0.359	N.D.	0.707
N.D.	N.D.		N.D.			N.D.	N.D.	N.D.				N.D.	
N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
											83.3		
											66.0		
											63.1		

119	122	123	124	126	128	129	130	131	132/153	134	135	136	137
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.45	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.10	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.65	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	2.69	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.64	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
0.647	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	1.69	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
									72.7				
									70.7				
									68.7				

138/163/164	141	144	146	147	149	151	154	156/157	158	165	167	169	170
0.702	N.D.	N.D.	0.117	N.D.	0.762	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.		N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1.09	N.D.	N.D.	0.269	N.D.	1.32	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.		N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1.42	N.D.	N.D.	N.D.	N.D.	1.16	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
0.896	N.D.	N.D.	0.22	N.D.	0.85	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.		N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
0.755	N.D.	N.D.	N.D.	N.D.	0.829	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
	N.D.	N.D.	N.D.	N.D.		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
80.7	86.7					72.7							58.2
75.3	76.7					67.3							40.3
73.3	73.3					65.0							38.2

171	172	173	174	175	176	177	178	179	180	183	185	187	189
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.258	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.935	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.49	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.409	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0.748	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
									71.3	83.3		72.7	
									62.1	86.0		58.2	
									55.4	68.7		55.0	

190	191	193	194	195	196	197	199	200	201	202	203	205	206
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
													76.0
													49.5
													39.1

207	208
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.
N.D.	N.D.

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Appendix I. Benthic Community Analyses

T-Zero Results

SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON	TAXON_NAME
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number	Unique Taxon Name
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	11736	Baseodiscus punnetti
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	10533	Edwardsia californica
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	6522	Lyonsia californica
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	7236	Myidae
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	11632	Ostrea conchaphila
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	9572	Theora lubrica
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	8093	Tagelus subteres
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	11167	Solen rostriformis
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	4	Oligochaeta
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	6514	Trochidae
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	M. Hill	8303	Philine sp.
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	D. Drumm	11731	Phtisica marina
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	D. Drumm	8126	Amphideutopus oculatus
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	D. Drumm	9800	Mayerella acanthopoda
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	D. Drumm	10191	Heterophoxus conlanae
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	D. Drumm	6911	Panopeidae
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	D. Drumm	11733	Schmittius politus
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	4385	Mediomastus sp.
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	9620	Cossura sp. A sensu Phillips 1987
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	8109	Petaloclymene pacifica
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	6105	Glycera americana
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	8440	Scoletoma tetraura Complex
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	9682	Eumida tubiformis
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	8061	Harmothoe hirsuta
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	11754	Branchiosyllis exilis Complex
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	7522	Exogone lourei
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	8405	Odontosyllis phosphorea
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	8469	Brada pilosa
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	10712	Euchone limnicola
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	11652	Fabricinuda limnicola
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	6339	Prionospio (Prionospio) heterobranchia
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	7624	Pseudopolydora paucibranchiata
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	8102	Spiophanes duplex
RARA-2136371B	4/20/2016	Benthic	EcoAnalysts	7572.02-1	C. Barrett	7623	Leitoscoloplos pugettensis

TOTAL	%_SUB	IMMATURE	\DETERMINAT	CONDITION	DISTINCT	AGGREGATED	LAB_COM	KINGDOM
Number of Individuals	Percent Subsampled	Specimens Immature (Y/N)	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments	Taxonomic Kingdom
1	100.00	N	N	N	Y	0		Animalia
1	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
1	100.00	Y	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
7	100.00	N	N	N	Y	0		Animalia
1	100.00	N	N	N	Y	0		Animalia
5	100.00	N	N	N	Y	3		Animalia
2	100.00	N	N	N	Y	0		Animalia
1	100.00	Y	N	N	Y	0		Animalia
1	100.00	N	Y	N	Y	0		Animalia
1	100.00	N	N	N	Y	0		Animalia
3	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0	Pereopod 6 with singly inse	Animalia
1	100.00	N	N	N	Y	0		Animalia
1	100.00	N	N	N	Y	0		Animalia
77	100.00	N	N	N	Y	2		Animalia
16	100.00	N	N	N	Y	0		Animalia
30	100.00	N	N	N	Y	14		Animalia
2	100.00	N	N	N	Y	0		Animalia
5	100.00	N	N	N	Y	4		Animalia
1	100.00	N	N	N	Y	0		Animalia
1	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
1	100.00	N	N	N	Y	0		Animalia
307	100.00	N	N	N	Y	13		Animalia
4	100.00	N	N	N	Y	0		Animalia
13	100.00	N	N	N	Y	2		Animalia
53	100.00	N	N	N	Y	0		Animalia
2	100.00	N	N	N	Y	0		Animalia
19	100.00	N	N	N	Y	0		Animalia

PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS	SUPERORDER	ORDER	SUBORDER	INFRAORDER
Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic
Phylum	Subphylum	Class	Subclass	Infraclass	Superorder	Order	Suborder	Infraorder
Nemertea		Anopla				Heteronemertea		
Cnidaria		Anthozoa				Actiniaria		
Mollusca		Bivalvia				Anomalodesmata		
Mollusca		Bivalvia	Heterodonta			Myoida		
Mollusca		Bivalvia	Pteriomorphia			Ostreoida		
Mollusca		Bivalvia	Heterodonta			Veneroida		
Mollusca		Bivalvia	Heterodonta			Veneroida		
Mollusca		Bivalvia	Heterodonta			Veneroida		
Annelida		Clitellata	Oligochaeta					
Mollusca		Gastropoda	Prosobranchia			Archaeogastropoda		
Mollusca		Gastropoda				Cephalaspidea		
Arthropoda	Crustacea	Malacostraca	Eumalacostraca		Peracarida	Amphipoda	Caprellidea	
Arthropoda	Crustacea	Malacostraca	Eumalacostraca		Peracarida	Amphipoda	Gammaridea	
Arthropoda	Crustacea	Malacostraca	Eumalacostraca		Peracarida	Amphipoda	Caprellidea	
Arthropoda	Crustacea	Malacostraca	Eumalacostraca		Peracarida	Amphipoda		
Arthropoda	Crustacea	Malacostraca	Eumalacostraca		Eucarida	Decapoda	Pleocyemata	Brachyura
Arthropoda	Crustacea	Malacostraca				Stomatopoda		
Annelida	Aclitellata	Polychaeta	Scolecida					
Annelida	Aclitellata	Polychaeta	Scolecida					
Annelida	Aclitellata	Polychaeta	Scolecida					
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Phyllodocida	
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Eunicida	
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Phyllodocida	
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Phyllodocida	
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Phyllodocida	
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Phyllodocida	
Annelida	Aclitellata	Polychaeta	Palpata			Aciculata	Phyllodocida	
Annelida	Aclitellata	Polychaeta	Palpata			Canalipalpata	Terebellida	
Annelida	Aclitellata	Polychaeta	Palpata			Canalipalpata	Sabellida	
Annelida	Aclitellata	Polychaeta	Palpata			Canalipalpata	Sabellida	
Annelida	Aclitellata	Polychaeta	Palpata			Canalipalpata	Spionida	
Annelida	Aclitellata	Polychaeta	Palpata			Canalipalpata	Spionida	
Annelida	Aclitellata	Polychaeta	Palpata			Canalipalpata	Spionida	
Annelida	Aclitellata	Polychaeta	Scolecida			Orbiniida		

SUPERFAMILY	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS	SUBGENUS
Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic	Taxonomic
Superfamily	Family	Subfamily	Tribe	Subtribe	Genus	Subgenus
	Valenciniidae				Baseodiscus	
	Edwardsiidae				Edwardsia	
	Lyonsiidae				Lyonsia	
Myoidea	Myidae					
	Ostreidae				Ostrea	
Tellinoidea	Semelidae				Theora	
Tellinoidea	Solecurtidae				Tagelus	
Solenoidea	Solenidae				Solen	
	Trochidae					
	Philinidae				Philine	
		Phtisicinae			Phtisica	
	Aoridae				Amphideutopus	
	Caprellidae	Caprellinae			Mayerella	
	Phoxocephalidae				Heterophoxus	
Xanthoidea	Panopeidae					
	Squillidae				Schmittius	
	Capitellidae				Mediomastus	
	Cossuridae				Cossura	
	Maldanidae				Petaloclymene	
	Glyceridae				Glycera	
	Lumbrineridae				Scoletoma	
	Phyllodocidae				Eumida	
	Polynoidae				Harmothoe	
	Syllidae				Branchiosyllis	
	Syllidae				Exogone	
	Syllidae				Odontosyllis	
	Flabelligeridae				Brada	
	Sabellidae				Euchone	
	Sabellidae				Fabricinuda	
	Spionidae				Prionospio	
	Spionidae				Pseudopolydora	
	Spionidae				Spiophanes	
	Orbiniidae				Leitoscoloplos	

SPECIES	SUBSPECIES	ADDITIONS	SERIAL
Taxonomic	Taxonomic	Other	ITIS (or uBio.com)
Species	Subspecies	Descriptor	Serial Number
Baseodiscus punnetti			57442
Edwardsia californica			52494
Lyonsia californica			81920
			81688
Ostrea conchaphila			568041
Theora lubrica			81322
Tagelus subteres			81276
Solen rostriformis			568295
			68422
			69794
sp.			76176
Phtisica marina			101864
Amphideutopus oculatus			93501
Mayerella acanthopoda			
Heterophoxus conlanae			
			621504
Schmittius politus			409338
sp.			
Cossura sp. A sensu Phillips 1987			
Petaloclymene pacifica			
Glycera americana			66106
Scoletoma tetraura Complex			
Eumida tubiformis			
Harmothoe hirsuta			
Branchiosyllis exilis Complex			
Exogone lourei			
Odontosyllis phosphorea			
Brada pilosa			
Euchone limnicola			
Fabricinuda limnicola			
Prionospio (Prionospio) heterobranchia			
Pseudopolydora paucibranchiata			
Spiophanes duplex			
Leitoscoloplos pugettensis			

T-Final Results

SPAWAR San Diego Bay Mesocosm Benthos 2016
Taxonomy Data

ECOANALYSTS, INC.
LIFE IN WATER

SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6187
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	10649
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6522
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	8159
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	7016
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	4182
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	9975
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	11632
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	9997
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	9789
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	8342
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	9804
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	9572
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	8093
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	11167
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	4021
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6465
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	4
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	11234
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	9699
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6657
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6032
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	11639
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6666
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	11642
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	M. Hill	6328
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	10928

SPAWAR San Diego Bay Mesocosm Benthos 2016
Taxonomy Data

ECO ANALYSTS, INC.
LIFE IN WATER

SAMPLE_ID	DATE_COL	SAMPTYPE	TAXON_NAME	TOTAL	%_SUB	IMMATURE
Field Sample ID	Sample Collection Date	Benthic Sample Type	Unique Taxon Name	Number of Individuals	Percent Sorted	Specimens Immature (Y/N)
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Phoronis sp.	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Styela sp.	1	100	Y
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Lyonsia californica	9	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Asthenothaerus diegensis	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Hiatella arctica	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Mytilidae	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Musculista senhousia	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Ostrea conchaphila	70	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Argopecten ventricosus	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Laevicardium substriatum	8	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Cooperella subdiaphana	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Cumingia californica	4	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Theora lubrica	46	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Tagelus subteres	74	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Solen rostriformis	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Tellina sp.	1	100	Y
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Venerupis philippinarum	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Oligochaeta	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Melanochlamys diomedea	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Acteocina harpa	3	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Alia sp.	9	100	Y
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Crepidula sp.	2	100	Y
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Crepipatella lingulata	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Alvania compacta	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Aegires albopunctatus	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Leptosynapta sp.	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Corophiida	3	100	N

SPAWAR San Diego Bay Mesocosm Benthos 2016
Taxonomy Data

ECOANALYSTS, INC.
LIFE IN WATER

SAMPLE_ID	DATE_COL	SAMPTYPE	NDETERMINATI	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Phoronida				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Chordata	Tunicata	Ascidiacea		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Pteriomorphia	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Pteriomorphia	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida		Clitellata	Oligochaeta	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Echinodermata		Holothuroidea		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Stolidobranchia			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Anomalodesmata			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Anomalodesmata			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Myoida			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Mytiloida			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Mytiloida			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Ostreoida			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Ostreoida			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Cardioidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Veneroidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Solenoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Veneroida			Veneroidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Cephalaspidea			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Cephalaspidea			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Neogastropoda			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Nudibranchia		Doridacea	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Apodida			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda		Corophiida	

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					Phoronis
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Styelidae				Styela
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Lyonsiidae				Lyonsia
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Thraciidae				Asthenothaerus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Hiatellidae				Hiatella
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Mytilidae				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Mytilidae				Musculista
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Ostreidae				Ostrea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Pectinidae				Argopecten
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Cardiidae				Laevicardium
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Petricolidae				Cooperella
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Semelidae				Cumingia
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Semelidae				Theora
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Solecurtidae				Tagelus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Solenidae				Solen
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Tellinidae				Tellina
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Veneridae				Venerupis
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Aglajidae				Melanochlamys
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Cylichnidae				Acteocina
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Columbellidae				Alia
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepidula
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepipatella
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Rissoidae				Alvania
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Aegiridae				Aegires
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Synaptidae				Leptosynapta
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Lyonsia californica		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Asthenothaerus diegensis		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Hiatella arctica		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Musculista senhousia		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Ostrea conchaphila		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Argopecten ventricosus		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Laevicardium substriatum		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Cooperella subdiaphana		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Cumingia californica		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Theora lubrica		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Tagelus subteres		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Solen rostriformis		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Venerupis philippinarum		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Melanochlamys diomedea		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Acteocina harpa		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Crepipatella lingulata		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Alvania compacta		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Aegires albopunctatus		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm				

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	155462
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	81920
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	567250
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	79451
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	79577
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	568041
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	394270
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	381805
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	81647
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	507256
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	81322
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	81276
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	568295
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	81074
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	81477
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	68422
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	76212
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	76114
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	72619
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	72649
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	78307
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	158429
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	719474

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SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	10255
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	11596
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	6967
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	7013
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	10132
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	5091
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	6047
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	10655
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	11593
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	9663
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	9870
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	10129
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	D. Drumm	10214
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	4385
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	7602
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	8117
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	10584
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	10384
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	8204
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	7726
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	11652
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	11650
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	11651
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	3967
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	6338
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	7624
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	8102

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SAMPLE_ID	DATE_COL	SAMPTYPE	TAXON_NAME	TOTAL	%_SUB	IMMATURE
Field Sample ID	Sample Collection Date	Benthic Sample Type	Unique Taxon Name	Number of Individuals	Percent Sorted	Specimens Immature (Y/N)
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Caprella simia	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Quadrimaera carla	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Gammaropsis sp.	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Heterophoxus sp.	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Podocerus cristatus	14	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Xanthoidea	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Majoidea	3	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Alpheus californiensis	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Neotrypaea biffari	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Glebocarcinus amphioetus	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Heptacarpus sp.	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Paracerceis sculpta	7	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Zeuxo normani	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Mediomastus sp.	49	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Praxillella pacifica	36	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Scoletoma sp. C sensu Harris 1985	8	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Harmothoe imbricata Complex	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Megasyllis nipponica	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Monticellina siblina	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Bispira sp.	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Fabricinuda limnicola	2	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Crucigera zygophora	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Serpula columbiana	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Spionidae	1	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Prionospio sp.	4	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Pseudopolydora paucibranchiata	3	100	N
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Spiophanes duplex	2	100	N

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SAMPLE_ID	DATE_COL	SAMPTYPE	NDETERMINAT	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	Head only
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	15	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	Y	Y	7	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	As Megasyllis nipponica
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Y	Y	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Y	Y	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Caprellidea		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda			Hadzioidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Corophiidea		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda			
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	Xanthoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	Majoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Alpheoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Callianassoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	Cancroidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Alpheoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Isopoda	Flabellifera		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Peracarida	Tanaidacea	Tanaidomorpha		Tanaoidea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Aciculata	Eunicida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Caprellidae				Caprella
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Maeridae				Quadrimaera
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Photidae				Gammaropsis
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Phoxocephalidae				Heterophoxus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Podoceridae				Podocerus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm					
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Alpheidae				Alpheus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Callianassidae				Neotrypaea
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Cancridae				Glebocarcinus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Hippolytidae				Heptacarpus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Sphaeromatidae				Paracerceis
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Tanaidae				Zeuxo
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Capitellidae				Mediomastus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Maldanidae				Praxillella
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Lumbrineridae				Scoletoma
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Polynoidae				Harmothoe
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Syllidae				Syllis
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Cirratulidae				Monticellina
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Sabellidae				Bispira
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Sabellidae				Fabricinuda
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Serpulidae				Crucigera
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Serpulidae				Serpula
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Spionidae				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Spionidae				Prionospio
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Spionidae				Pseudopolydora
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Spionidae				Spiophanes

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Caprella simia		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Quadrimaera carla		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Podocerus cristatus		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Alpheus californiensis		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Neotrypaea biffari		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Glebocarcinus amphioetus		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Paracerceis sculpta		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Zeuxo normani		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Praxillella pacifica		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Scoletoma sp. C sensu Harris 1985		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Harmothoe imbricata Complex		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Megasyllis nipponica		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Monticellina siblina		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Fabricinuda limnicola		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Crucigera zygophora		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Serpula columbiana		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm				
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Pseudopolydora paucibranchiata		
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Spiophanes duplex		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	430911
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	534864
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	103053
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	206960
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	206956
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	465342
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	261827
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	247722
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	68150
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	66781
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	

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SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-1	C. Barrett	7623
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6283
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6187
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	10649
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6522
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	8159
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	7016
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	4182
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	9975
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11644
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11632
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	9789
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	9650
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	8342
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11207
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	9804
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	9572
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	8093
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11167
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6457
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	4021
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6465
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	9699
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6014
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	7532
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6032
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11648

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SAMPLE_ID	DATE_COL	SAMPTYPE	TAXON_NAME	TOTAL	%_SUB	IMMATURE
Field Sample ID	Sample Collection Date	Benthic Sample Type	Unique Taxon Name	Number of Individuals	Percent Sorted	Specimens Immature (Y/N)
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Leitoscoloplos pugettensis	10	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Sipuncula	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Phoronis sp.	3	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Styela sp.	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Lyonsia californica	7	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Asthenothaerus diegensis	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Hiatella arctica	3	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Mytilidae	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Musculista senhousia	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Anomia peruviana	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Ostrea conchaphila	124	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Laevicardium substriatum	7	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Mactrotoma californica	3	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Cooperella subdiaphana	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Gari californica	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Cumingia californica	4	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Theora lubrica	10	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Tagelus subteres	65	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Solen rostriformis	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Macoma nasuta	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Tellina sp.	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Venerupis philippinarum	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Acteocina harpa	9	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Neogastropoda	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Alia gausapata	8	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Crepidula sp.	2	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Crepidula perforans	1	100	N

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SAMPLE_ID	DATE_COL	SAMPTYPE	NDETERMINAT	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	1	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	2	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Sipuncula				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Phoronida				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Chordata	Tunicata	Ascidiacea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Pteriomorphia	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Pteriomorphia	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Orbiniida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Stolidobranchia			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Anomalodesmata			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Anomalodesmata			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Myoida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Mytiloida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Mytiloida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Ostreoida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Ostreoida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Cardioidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Mactroidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Veneroidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Solenoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Veneroida			Veneroidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Cephalaspidea			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Neogastropoda			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Neogastropoda			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Neotaenioglossa			

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	Orbiniidae				Leitoscoloplos
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					Phoronis
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Styelidae				Styela
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Lyonsiidae				Lyonsia
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Thraciidae				Asthenothaerus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Hiatellidae				Hiatella
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Mytilidae				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Mytilidae				Musculista
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Anomiidae				Anomia
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Ostreidae				Ostrea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Cardiidae				Laevicardium
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Mactridae				Mactrotoma
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Petricolidae				Cooperella
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Psammobiidae				Gari
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Semelidae				Cumingia
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Semelidae				Theora
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Solecurtidae				Tagelus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Solenidae				Solen
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Tellinidae				Macoma
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Tellinidae				Tellina
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Veneridae				Venerupis
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Cylichnidae				Acteocina
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Columbellidae				Alia
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepidula
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepidula

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm		Leitoscoloplos pugettensis		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Lyonsia californica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Asthenothaerus diegensis		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Hiatella arctica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Musculista senhousia		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Anomia peruviana		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Ostrea conchaphila		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Laevicardium substriatum		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Mactrotoma californica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Cooperella subdiaphana		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Gari californica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Cumingia californica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Theora lubrica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Tagelus subteres		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Solen rostriformis		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Macoma nasuta		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Venerupis philippinarum		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Acteocina harpa		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Alia gausapata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Crepidula perforans		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-C1/C2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	154520
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	155462
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81920
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	567250
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	79451
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	79577
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	79801
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	568041
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	381805
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81647
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81261
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	507256
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81322
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81276
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	568295
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81050
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81074
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	81477
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	76114
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	73228
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	72619
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	72631

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SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11639
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	11642
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6328
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	10928
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	8126
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	11200
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	11006
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	10132
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	5091
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	3885
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	10655
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	11593
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	9870
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	10129
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	7075
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	10214
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	6733
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	3930
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	M. Hill	6141
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	4385
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	6349
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	7522
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	11659
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	8078
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	8204
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	7726
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	10712

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SAMPLE_ID	DATE_COL	SAMPTYPE	TAXON_NAME	TOTAL	%_SUB	IMMATURE
Field Sample ID	Sample Collection Date	Benthic Sample Type	Unique Taxon Name	Number of Individuals	Percent Sorted	Specimens Immature (Y/N)
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Crepipatella lingulata	3	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Aegires albopunctatus	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Leptosynapta sp.	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Corophiida	5	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Amphideutopus oculatus	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Bemlos macromanus	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Paradexamine sp.	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Podocerus cristatus	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Xanthoidea	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Brachyura	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Alpheus californiensis	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Neotrypaea biffari	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Heptacarpus sp.	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Paracerceis sculpta	5	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Leptochelia dubia Cmplx	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Zeuxo normani	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Balanus trigonus	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Ophiuroidea	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Amphiuridae	1	100	Y
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Mediomastus sp.	32	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Scoletoma sp.	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Exogone lourei	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Haplosyllis spongicola Complex	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Amphicteis scaphobranchiata	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Monticellina siblina	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Bispira sp.	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Euchone limnicola	1	100	N

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SAMPLE_ID	DATE_COL	SAMPTYPE	INDETERMINATE	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Y	Y	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Echinodermata		Holothuroidea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Maxillopoda		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Echinodermata	Asterozoa	Ophiuroidea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Echinodermata	Asterozoa	Ophiuroidea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Nudibranchia		Doridacea	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Apodida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda		Corophiida	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	Xanthoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Alpheoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Callianassoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Alpheoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Isopoda	Flabellifera		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Tanaidacea	Tanaidomorpha		Paratanaoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Peracarida	Tanaidacea	Tanaidomorpha		Tanaoidea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Sessilia			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Ophiurida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Aciculata	Eunicida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepipatella
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Aegiridae				Aegires
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Synaptidae				Leptosynapta
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Aoridae				Amphideutopus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Aoridae				Bemlos
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Dexaminidae				Paradexamine
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Podoceridae				Podocerus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Alpheidae				Alpheus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Callianassidae				Neotrypaea
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Hippolytidae				Heptacarpus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Sphaeromatidae				Paracerceis
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Leptocheliidae				Leptochelia
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Tanaidae				Zeuxo
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Balanidae				Balanus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm					
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Amphiuridae				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Capitellidae				Mediomastus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Lumbrineridae				Scoletoma
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Syllidae				Exogone
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Syllidae				Haplosyllis
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Ampharetidae				Amphicteis
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Cirratulidae				Monticellina
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Sabellidae				Bispira
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Sabellidae				Euchone

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Crepipatella lingulata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Aegires albopunctatus		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Amphideutopus oculatus		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Bemlos macromanus		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Podocerus cristatus		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Alpheus californiensis		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Neotrypaea biffari		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Paracerceis sculpta		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Leptochelia dubia Cmplx		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Zeuxo normani		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Balanus trigonus		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm				
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Exogone lourei		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Haplosyllis spongicola Complex		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Amphicteis scaphobranchiata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Monticellina siblina		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Euchone limnicola		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	72649
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	78307
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	158429
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	719474
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	93501
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	488743
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	206577
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	103053
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	206960
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	98276
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	465342
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	261827
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	247722
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	157325
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	157646
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	68150
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	

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SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	11652
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	11651
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	6375
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	6339
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	7624
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	6292
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	8102
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	11658
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	10003
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	8443
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	C. Barrett	7623
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-2	D. Drumm	8305
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	6187
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	7451
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	6522
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	8159
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	7016
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9975
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	11632
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9997
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9789
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	10041
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	11207
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9804
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9572
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	8093
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	11167

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SAMPLE_ID	DATE_COL	SAMPTYPE	TAXON_NAME	TOTAL	%_SUB	IMMATURE
Field Sample ID	Sample Collection Date	Benthic Sample Type	Unique Taxon Name	Number of Individuals	Percent Sorted	Specimens Immature (Y/N)
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Fabricinuda limnicola	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Serpula columbiana	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Boccardiella hamata	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Prionospio (Prionospio) heterobranchia	12	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Pseudopolydora paucibranchiata	49	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Scolelepis (Scolelepis) squamata	3	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Spiophanes duplex	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Loimia sp. A sensu SCAMIT 2001	2	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Pista brevibranchiata	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Pista estevanica	1	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Leitoscoloplos pugettensis	5	100	N
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Anoplodactylus erectus	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Phoronis sp.	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Tubulanidae	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Lyonsia californica	4	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Asthenothaerus diegensis	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Hiatella arctica	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Musculista senhousia	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Ostrea conchaphila	181	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Argopecten ventricosus	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Laevicardium substriatum	3	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Trachycardium quadragenarium	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Gari californica	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Cumingia californica	5	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Theora lubrica	5	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Tagelus subteres	42	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Solen rostriformis	2	100	N

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SAMPLE_ID	DATE_COL	SAMPTYPE	\DETERMINATI	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	10	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	1	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	1	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Chelicerata	Pycnogonida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Phoronida				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Nemertea		Anopla	Palaeonemertea	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Pteriomorphia	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Pteriomorphia	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Orbiniida			
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Pantopoda			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Anomalodesmata			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Anomalodesmata			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Myoida			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Mytiloida			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Ostreoida			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Ostreoida			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Cardioidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Cardioidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Tellinoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Solenoidea

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Sabellidae				Fabricinuda
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Serpulidae				Serpula
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Spionidae				Boccardiella
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Spionidae				Prionospio
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Spionidae				Pseudopolydora
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Spionidae				Scolelepis
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Spionidae				Spiophanes
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Terebellidae				Loimia
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Terebellidae				Pista
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Terebellidae				Pista
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Orbiniidae				Leitoscoloplos
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	Phoxichilidiidae				Anoplodactylus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					Phoronis
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Tubulanidae				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Lyonsiidae				Lyonsia
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Thraciidae				Asthenothaerus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Hiatellidae				Hiatella
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Mytilidae				Musculista
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Ostreidae				Ostrea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Pectinidae				Argopecten
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Cardiidae				Laevicardium
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Cardiidae				Trachycardium
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Psammobiidae				Gari
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Semelidae				Cumingia
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Semelidae				Theora
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Solecurtidae				Tagelus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Solenidae				Solen

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Fabricinuda limnicola		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Serpula columbiana		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Boccardiella hamata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Prionospio (Prionospio) heterobranchia		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Pseudopolydora paucibranchiata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Scolelepis (Scolelepis) squamata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Spiophanes duplex		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Loimia sp. A sensu SCAMIT 2001		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Pista brevibranchiata		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Pista estevanica		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Leitoscoloplos pugettensis		
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm		Anoplodactylus erectus		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Lyonsia californica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Asthenothaerus diegensis		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Hiatella arctica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Musculista senhousia		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Ostrea conchaphila		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Argopecten ventricosus		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Laevicardium substriatum		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Trachycardium quadragenarium		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Gari californica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Cumingia californica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Theora lubrica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Tagelus subteres		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Solen rostriformis		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	
RARA-BCA-T1/T2-081516	8/15/2016	Mesocosm	83641
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	155462
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	81920
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	567250
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	79577
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	568041
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	394270
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	381805
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	80910
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	81261
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	507256
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	81322
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	81276
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	568295

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SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9977
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	9699
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	7532
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	6031
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	11656
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	10429
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	11639
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	M. Hill	11655
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10928
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	8126
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	5555
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	6492
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	11605
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	11595
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10089
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10132
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	9810
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	6047
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10655
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	11593
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10639
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10129
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	10214
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	D. Drumm	6733
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	9762
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	4385
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8221

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SAMPLE_ID Field Sample ID	DATE_COL Sample Collection Date	SAMPTYPE Benthic Sample Type	TAXON_NAME Unique Taxon Name	TOTAL Number of Individuals	%_SUB Percent Sorted	IMMATURE Specimens Immature (Y/N)
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Saxidomus nuttalli	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Acteocina harpa	4	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Alia gausapata	7	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Calyptraeidae	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Crepidula adunca	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Crepidula onyx	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Crepipatella lingulata	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Doriopsilla albopunctata	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Corophiida	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Amphideutopus oculatus	3	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Grandidierella japonica	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Caprella sp.	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Colomastix sp.	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Quadrimaera sp.	3	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Hartmanodes hartmanae	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Podocerus cristatus	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Rudilemboides stenopropodus	4	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Majoidea	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Alpheus californiensis	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Neotrypaea biffari	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Lophopanopeus frontalis	3	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Paracerceis sculpta	4	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Zeuxo normani	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Balanus trigonus	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Capitella capitata Complex	16	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Mediomastus sp.	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Dorvillea (Schistomeringos) annulata	1	100	N

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SAMPLE_ID	DATE_COL	SAMPTYPE	NDETERMINAT	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	Y	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	Head only
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	Heads only
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	2	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Bivalvia	Heterodonta	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Mollusca		Gastropoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Arthropoda	Crustacea	Maxillopoda		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Veneroida			Veneroidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Cephalaspidea			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neogastropoda			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neotaenioglossa			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Nudibranchia		Doridacea	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda		Corophiida	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Caprellidea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda			Hadzioidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Gammaridea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Amphipoda	Corophiidea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	Majoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Alpheoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata		Callianassoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Eucarida	Decapoda	Pleocyemata	Brachyura	Xanthoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Isopoda	Flabellifera		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Peracarida	Tanaidacea	Tanaidomorpha		Tanaoidea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Sessilia			
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Aciculata	Eunicida		

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Veneridae				Saxidomus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Cylichnidae				Acteocina
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Columbellidae				Alia
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Calyptraeidae				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepidula
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepidula
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Calyptraeidae				Crepipatella
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Dendrodorididae				Doriopsilla
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Aoridae				Amphideutopus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Aoridae				Grandidierella
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Caprellidae				Caprella
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Colomastigidae				Colomastix
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Maeridae				Quadrimaera
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Oedicerotidae				Hartmanodes
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Podoceridae				Podocerus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Unciolidae	Acuminodeutopinae			Rudilemboides
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm					
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Alpheidae				Alpheus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Callianassidae				Neotrypaea
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Panopeidae				Lophopanopeus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Sphaeromatidae				Paracerceis
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Tanaidae				Zeuxo
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Balanidae				Balanus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Capitellidae				Capitella
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Capitellidae				Mediomastus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Dorvilleidae				Schistomeringos

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Saxidomus nuttalli		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Acteocina harpa		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Alia gausapata		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Crepidula adunca		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Crepidula onyx		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Crepipatella lingulata		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Doriopsilla albopunctata		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Amphideutopus oculatus		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Grandidierella japonica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Hartmanodes hartmanae		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Podocerus cristatus		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Rudilemboides stenopropodus		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm				
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Alpheus californiensis		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neotrypaea biffari		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Lophopanopeus frontalis		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Paracerceis sculpta		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Zeuxo normani		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Balanus trigonus		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Capitella capitata Complex		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		sp.		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Dorvillea (Schistomeringos) annulata		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	81448
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	76114
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	72611
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	72622
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	397063
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	72649
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	78454
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	719474
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	93501
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	95392
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	101484
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	236533
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	657138
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	103053
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	93498
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	206956
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	465342
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	261827
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	247722
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	

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SAMPLE_ID	DATE_COL	SAMPTYPE	LAB_NAME	LAB_ID	TAXONOMIST	LAB_TAXON
Field Sample ID	Sample Collection Date	Benthic Sample Type	Name of Lab Processing Sample	Lab Sample ID Number	Name of Taxonomist	Lab Taxa ID Number
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	6105
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	7522
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	11659
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8405
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8204
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8065
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	10712
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8201
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	11651
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	6339
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	7624
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8102
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	8443
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	EcoAnalysts	7572.01-3	C. Barrett	7623

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SAMPLE_ID	DATE_COL	SAMPTYPE	TAXON_NAME	TOTAL	%_SUB	IMMATURE
Field Sample ID	Sample Collection Date	Benthic Sample Type	Unique Taxon Name	Number of Individuals	Percent Sorted	Specimens Immature (Y/N)
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Glycera americana	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Exogone lourei	4	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Haplosyllis spongicola Complex	2	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Odontosyllis phosphorea	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Monticellina siblina	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Neosabellaria cementarium	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Euchone limnicola	3	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Megalomma pigmentum	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Serpula columbiana	7	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Prionospio (Prionospio) heterobranchia	4	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Pseudopolydora paucibranchiata	62	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Spiophanes duplex	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Pista estevanica	1	100	N
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Leitoscoloplos pugettensis	6	100	N

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SAMPLE_ID	DATE_COL	SAMPTYPE	NDETERMINAT	CONDITION	DISTINCT	AGGREGATED	LAB_COM
Field Sample ID	Sample Collection Date	Benthic Sample Type	Specimens Indeterminate (Y/N)	Specimens in Poor Condition or Fragments (Y/N)	Distinct Taxa Within Sample (Y/N)	Number of Taxa Aggregated	Lab Personnel Comments
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	3	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	3	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	0	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	N	N	Y	1	

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SAMPLE_ID	DATE_COL	SAMPTYPE	KINGDOM	PHYLUM	SUBPHYLUM	CLASS	SUBCLASS	INFRACLASS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Kingdom	Taxonomic Phylum	Taxonomic Subphylum	Taxonomic Class	Taxonomic Subclass	Taxonomic Infraclass
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Palpata	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Animalia	Annelida	Aclitellata	Polychaeta	Scolecida	

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUPERORDER	ORDER	SUBORDER	INFRAORDER	SUPERFAMILY
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Superorder	Taxonomic Order	Taxonomic Suborder	Taxonomic Infraorder	Taxonomic Superfamily
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Aciculata	Phyllodocida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Sabellida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Spionida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Canalipalpata	Terebellida		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Orbiniida			

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SAMPLE_ID	DATE_COL	SAMPTYPE	FAMILY	SUBFAMILY	TRIBE	SUBTRIBE	GENUS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Family	Taxonomic Subfamily	Taxonomic Tribe	Taxonomic Subtribe	Taxonomic Genus
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Glyceridae				Glycera
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Syllidae				Exogone
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Syllidae				Haplosyllis
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Syllidae				Odontosyllis
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Cirratulidae				Monticellina
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Sabellariidae				Neosabellaria
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Sabellidae				Euchone
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Sabellidae				Megalomma
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Serpulidae				Serpula
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Spionidae				Prionospio
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Spionidae				Pseudopolydora
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Spionidae				Spiophanes
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Terebellidae				Pista
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	Orbiniidae				Leitoscoloplos

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SAMPLE_ID	DATE_COL	SAMPTYPE	SUBGENUS	SPECIES	SUBSPECIES	ADDITIONS
Field Sample ID	Sample Collection Date	Benthic Sample Type	Taxonomic Subgenus	Taxonomic Species	Taxonomic Subspecies	Other Descriptor
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Glycera americana		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Exogone lourei		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Haplosyllis spongicola Complex		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Odontosyllis phosphorea		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Monticellina siblina		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Neosabellaria cementarium		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Euchone limnicola		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Megalomma pigmentum		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Serpula columbiana		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Prionospio (Prionospio) heterobranchia		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Pseudopolydora paucibranchiata		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Spiophanes duplex		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Pista estevanica		
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm		Leitoscoloplos pugettensis		

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SAMPLE_ID	DATE_COL	SAMPTYPE	SERIAL
Field Sample ID	Sample Collection Date	Benthic Sample Type	ITIS (or uBio.com) Serial Number
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	66106
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	
RARA-BCA-S1/S2-081516	8/15/2016	Mesocosm	