SAMPLING AND ANALYSIS REPORT

ALAMITOS BAY MARINA BASINS 2 AND 3 MAINTENANCE DREDGING

Prepared for

City of Long Beach

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µg/kg	microgram per kilogram
ASTM	American Society for Testing and Materials
Calscience	Calscience Environmental Laboratories, Inc.
City	City of Long Beach
cy	cubic yard
BMP	best management practice
BP	bioaccumulation potential
DDT	dichlorodiphenyltrichloroethane
DU	dredge unit
EC_{50}	median effective concentration
EET	effluent elutriate test
ERED	Environmental Residue-Effects Database
ERL	effects range low
ERM	effects range median
FDA	U.S. Food and Drug Administration
ITM	*Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual*
LC_{50}	median lethal concentration
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LPC	limiting permissible concentration
MDL	method detection limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
MLLW	mean low lower water
MS	matrix spike
MSD	matrix spike duplicate
OTM	*Evaluation for Dredged Material Proposed for Ocean Disposal – Testing Manual*
PAH	polycyclic aromatic hydrocarbon

PCB	polychlorinated biphenyl
Port	Port of Long Beach
QA/QC	quality assurance/quality control
RPD	relative percent difference
RL	reporting limit
SAP	*Sampling and Analysis Plan: Alamitos Bay Marina Basins 2 and 3 Maintenance Dredging*
SAR	Sampling and Analysis Report
SCCWRP	Southern California Coastal Water Research Project
SP	solid phase
SPP	suspended particulate phase
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency

1 INTRODUCTION

As part of the Alamitos Bay Marina rehabilitation project, the City of Long Beach (City) is conducting overall maintenance and reconstruction of Alamitos Bay Marina, located in Long Beach, California (Figure 1). The overall reconstruction of Alamitos Bay Marina is a multi-phase, multi-year effort. While the entire rehabilitation project includes dredging Basins 1 through 7, this Sampling and Analysis Report (SAR) focuses solely on Basins 2 and 3 (Figure 2). The City proposes maintenance dredging within Basins 2 and 3 to restore the original design depths. Dredging is needed to improve navigation, ensure boater safety, provide adequate access for the boating public, and allow for associated improvements in marine facilities, including changes in slip layouts and designs. Proposed dredged material was previously characterized and permitted for ocean disposal at LA-2, the U.S. Environmental Protection Agency (USEPA)-designated offshore disposal site (Weston 2007a, 2007b). Dredging permits have been renewed, and the City would now like to implement the planned program at Basins 2 and 3. Data from the previous investigation are not recent enough for the previous suitability determination to remain valid; therefore, a re-evaluation is required to confirm suitability for ocean disposal. A Tier I evaluation with confirmatory physical and chemical analyses was performed to demonstrate that sediment chemical characteristics in the proposed dredge areas are similar to the previous investigation and, therefore, are still suitable for ocean disposal. After a review of current chemical concentrations and a consultation with the USEPA, the material was determined to be different enough to require a new suitability evaluation. A full Tier III evaluation for ocean disposal was performed to determine suitability for placement at LA-2. This SAR summarizes the sediment sampling event, provides data results, and proposes recommendations for suitability determinations.

1.1 Project Summary

Maintenance dredging is planned within Basins 2 and 3 to a depth of -10 feet mean lower low water (MLLW), plus 2 feet of overdepth allowance (1 foot paid and 1 foot unpaid). The total volume of material proposed for dredging is estimated to be 148,000 cubic yards (cy), consisting of 69,900 cy above project depth and 78,100 cy of allowable overdepth. Table 1 summarizes the proposed maintenance dredging volumes for each basin. Dredged material volume estimates for Basins 2 and 3 are based on condition surveys completed by Gahagan &

Bryant Associates, Inc., in February and December 2013, respectively. Four dredge units (DUs) were identified for the purpose of sampling and analysis activities, which include two DUs for each basin (ABM-B2-DU1, ABM-B2-DU2, ABM-B3-DU1, and ABM-B3-DU2). Existing bathymetric conditions and DU boundaries for Basins 2 and 3 are presented in Figures 3 and 4, respectively.

Table 1
Proposed Maintenance Dredging Volumes

Dredge Unit	Project Depth (feet MLLW)	Estimated Volume to Project Depth (cy)	2 Feet of Allowable Overdepth Volume (cy)	Total Volume (cy)
Basin 2				
ABM-B2-DU1	-10	25,100	21,200	46,300
ABM-B2-DU2	-10	23,900	26,100	50,000
Totals for Basin 2	-	*49,000*	*47,300*	*96,300*
Basin 3				
ABM-B3-DU1	-10	9,000	12,850	21,850
ABM-B3-DU2	-10	11,900	17,950	29,850
Totals for Basin 3	-	*20,900*	*30,800*	*51,700*
Totals for Basins 2 and 3	**-**	**69,900**	**78,100**	**148,000**

Notes:
cy= cubic yard
DU = dredge unit
MLLW = mean lower low water

1.2 Total Volume Approved Under Alamitos Bay Permits

The estimated dredge volume of Basin 2 exceeds the permitted volume of 89,900 cy by 6,400 cy. This sampling program was designed to characterize the full volume of 96,300 cy; however, the volume dredged will not exceed the permitted volume of 89,900 cy. The estimated dredge volume of Basin 3 is less than the permitted volume of 55,900 cy by 4,200 cy. Table 2 includes a compilation of total project volumes, either completed or planned on the project. Data for completed basins, combined with estimated volumes for Basins 2 and 3 indicate that the City is approximately 33,197 cy below the total permitted

volume, assuming all material is removed from Basin 3 and the total permitted volume is removed from Basin 2.

Table 2
Total Project Maintenance Dredge Volumes Summary

Basin	Completion/Planned Date	Permitted Dredge Volume (cy)	Completed/Planned Dredge Volume (cy)
4	Completed Fall 2011	65,300	42,565
1	Completed Summer 2012	74,800	69,690
5	Completed Winter 2013	3,870	2,718
2	Planned Fall 2014	89,900	< 89,9001
3	Planned Fall 2014	55,900	~ 51,700
7	TBD	2,100	< 2,100
6 N/S	TBD	16,350	< 16,350
		Total Permitted Volume (cy)	308,220
		Total Completed/Planned Volume (cy)	275,023
		Net Volume Surplus	33,197

Notes:
1 Estimated volume based on 2013 bathymetry is 96,300 cy; however, actual volume dredged will not exceed permitted volume.
cy = cubic yard
TBD = to be determined

1.3 Objectives of the Sediment Investigation

The purpose of this sediment investigation was to reconfirm the suitability of the proposed dredged material for ocean disposal. Confirmatory physical and chemical analyses indicated that conditions were not similar to the previous evaluation; therefore, a full Tier III evaluation was performed to determine suitability. If suitable, dredged material will be placed at LA-2. Testing for ocean disposal included physical, chemical, and biological analyses in accordance with guidelines specified in the *Evaluation for Dredged Material Proposed for Ocean Disposal – Testing Manual* (OTM; USEPA/USACE 1991) and the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual* (ITM; USEPA/USACE 1998).

2 METHODS

This section presents a summary of methods and procedures used to characterize sediments from Basins 2 and 3.

2.1 Sampling Program for Sediment Core Collection and Handling

All sample collection, handling, and processing procedures were implemented in accordance with the *Sampling and Analysis Plan: Alamitos Bay Marina Basins 2 and 3 Maintenance Dredging* (SAP; Anchor QEA 2014). Sediment cores were collected using an electrically powered vibracore at 22 stations (Figures 3 and 4). Sampling was performed from a barge equipped with a tripod, moonpool, and winch for sample collection. The vibracore was deployed and recovered through the moonpool. The sampling program was designed to evaluate proposed dredged material to a depth of -10 feet MLLW, plus 2 feet of allowable overdepth.

Sediment cores were processed on the vessel in accordance with Table 6 of the SAP (Anchor QEA 2014). Four composite sediment samples (B2-DU1-COMP, B2-DU2-COMP, B3-DU1-COMP, and B3-DU2-COMP) were created for physical, chemical, and biological analyses. Sediments from each station to the project depth plus overdepth, as well as the z layer (-12 to -12.5 feet MLLW), were archived for potential analysis. Samples were stored in coolers with ice and picked up by Calscience Environmental Laboratories, Inc. (Calscience), located in Garden Grove, California. Proper chain-of-custody procedures were followed.

Reference material was collected by Seaventures Inc., at the LA-2 reference site using a pipe dredge. Site water was collected from Basins 2 and 3 in low-density polyethylene cubitainers.

2.2 Physical and Chemical Analyses

2.2.1 Sediment

Composite sediment samples and reference material were submitted for analysis of total solids, grain size, ammonia, sulfides, total organic carbon (TOC), metals, polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides, polychlorinated biphenyl (PCB) congeners,

organotins, and pyrethroids. Based on the presence of elevated total PCB concentrations in composite samples, individual core samples from each station were submitted for analysis of PCB congeners. PCBs included the Southern California Coastal Water Research Project (SCCWRP) list of 41 congeners used for the Bight '08 Regional Monitoring Program (Schiff et al. 2011), which is the same list used by USEPA for dredge material evaluations in Southern California. Analytical methods, target method detection limits (MDLs), and reporting limits (RLs) are presented in the SAP (Anchor QEA 2014). Results of chemical analyses were compared to effects range low (ERL) and effects range median (ERM) values developed by Long et al. (1995) to aid in data interpretation with the biological tests.

2.2.2 Tissue Residues

Chemical analysis of tissue residues was conducted to determine the bioaccumulation of sediment contaminants. Based on results of sediment chemistry, a subset of chemicals was approved for analysis by USEPA. Tissue samples were analyzed for lipids, mercury, dichlorodiphenyltrichoroethanes (DDTs), chlordane, and PCBs (Table 3). Composite samples from each replicate were analyzed separately. Analytical methods and target MDLs and RLs for tissues (reported in wet weight) are presented in the SAP (Anchor QEA 2014).

Table 3
Summary of Analysis Performed on Basins 2 and 3 Tissue Samples

Sample	Tissue Analysis
Time Zero (T_0)	Lipids, Mercury, DDTs, Chlordane, PCBs
LA2-REF	Lipids, Mercury, DDTs, Chlordane, PCBs
B2-DU1-COMP	Lipids, Mercury, DDTs, PCBs
B2-DU2-COMP	Lipids, Mercury, DDTs, PCBs
B3-DU1-COMP	Lipids, Mercury, DDTs, Chlordane, PCBs
B3-DU2-COMP	Lipids, Mercury, DDTs, Chlordane, PCBs

Notes:
DDTs = dichlorodiphenyltrichoroethanes
PCBs = polychlorinated biphenyls

Results of chemical analysis of tissue residues were initially compared against applicable Food and Drug Administration (FDA) action levels for poisonous or deleterious substances in fish and shellfish for human food, when such levels have been set. In the absence of action levels, or if tissue contaminant concentrations were less than action levels, results were statistically compared to tissue concentrations of organisms exposed to reference sediment in accordance with Appendix D of the ITM (USEPA/USACE 1998). Tissue organic chemical concentrations were normalized to lipid concentrations prior to analysis. Data were log-transformed and assessed for normality using the Shapiro-Wilk test or Kolmogorov's D test. Homogeneity of variance was assessed using Levene's test. Log-normally distributed data were evaluated using analysis of variance and Dunnett's multiple comparison tests (if applicable). Non-normally distributed data were assessed using the non-parametric Wilcoxon/Kruskal-Wallis tests and non-parametric Steel multiple comparisons test (if applicable).

No statistical analysis was performed on chemistry data if both project area data and reference data were non-detects or if the mean concentration of the project area sample was less than the mean concentration in the reference sample. For situations in which more than one replicate from the project area was non-detect, estimated data values were calculated based on a symmetrical breakdown of the data range and in such a way that the mean of the estimates centered around a value one-half of the detection limit. This statistical manipulation of data was required to generate means and variances needed to compare project area data to reference data. This data analysis procedure is one of three recommended approaches described in Appendix D of the ITM (USEPA/USACE 1998).

If tissue concentrations of organisms exposed to test sediment were statistically elevated compared to organisms exposed to reference sediment, a weight-of-evidence approach was used. This approach included a comparison to residue-effects values provided in the Environmental Residue-Effects Database (ERED; USACE/USEPA 2010) to determine whether toxic effects could be expected at concentrations measured in tissue of exposed organisms.

2.3 Biological Testing

Biological testing was conducted to determine suitability of proposed dredged material for ocean disposal at LA-2. Testing included two solid phase (SP) tests, three suspended particulate phase (SPP) tests, and two bioaccumulation potential (BP) tests, as specified in Table 4. All testing was performed by Nautilus Environmental in San Diego, California. Four composite samples and reference material were submitted for testing. Control samples were tested with each species to evaluate test acceptability. All testing was performed in accordance with OTM (USEPA/USACE 1991) and ITM (USEPA/USACE 1998) guidelines. Test methods, conditions, and acceptability criteria are presented in the SAP (Anchor QEA 2014).

Table 4
Summary of Biological Testing Performed on Alamitos Basins 2 and 3 Sediment Samples

Test Type	Organism		Reference Sediment	Control Material	Reference Toxicant Test
	Type	Taxon			
SP	Amphipod	*Ampelisca abdita*	LA-2	Native or clean sediment	Cadmium and ammonia
	Polychaete	*Neanthes arenaceodentata*	LA-2	Native or clean sediment	Cadmium
SPP	Bivalve larvae	*Mytilus galloprovincialis*	N/A	Dilution water	Ammonia
	Juvenile fish	*Menidia beryllina*	N/A	Dilution water	Copper
	Mysid shrimp	*Americamysis bahia*	N/A	Dilution water	Copper
BP	Bivalve	*Macoma nasuta*	LA-2	Native or clean sediment	N/A
	Polychaete	*Nereis virens*	LA-2	Native or clean sediment	N/A

Notes:
BP = bioaccumulation potential
N/A = not applicable
SP = solid phase
SPP = suspended particulate phase

Interstitial ammonia concentrations were measured on project sediments prior to testing. The ammonia concentration in B3-DU1-COMP (32.0 milligrams per liter [mg/L]) exceeded the recommended threshold for *Ampelisca abdita* (30 mg/L; USEPA/USACE 1998). Test sediment was purged to reduce ammonia concentrations prior to testing by performing daily seawater exchanges per ITM guidance. The test was initiated following this acclimation process when interstitial ammonia concentrations met the recommended threshold. In addition, a water-only ammonia reference toxicant test was conducted concurrently with the amphipod test to evaluate the contribution of elevated ammonia concentrations on test organism survival. An ammonia reference toxicant test was also run concurrently with the bivalve larval development bioassay due to the sensitivity of *Mytilus galloprovincialis* to elevated ammonia concentrations.

3 RESULTS

3.1 Sample Collection and Handling

Sediment cores were collected between February 3 and 6, 2014. Cores were collected from 22 stations using a vibracore (Figures 3 and 4). Two cores were required from each station to obtain sufficient volume for analysis.

Sediment cores were collected to the target core length, unless refusal was encountered. If refusal was encountered prior to the target sampling depth, the station was moved slightly, and collection was attempted again. Multiple stations were slightly moved due to limited access (e.g., docked vessels). Within Basin 2, all cores were collected to the target sampling depth. Within Basin 3, all cores were collected to the target sampling depth, except for B3-DU1-04 and B3-DU1-05. At both stations, refusal was encountered due to substantial shells. Station locations were slightly moved, and refusal was encountered again. After multiple attempts, the two longest cores from each station were retained for analysis. Z-layer depths were not achieved; therefore, the bottom 0.5 foot of each core was archived. Station coordinates, mudline elevation, estimated penetration, and retrieved core lengths for each station are summarized in Table 5. Field logs and photographs are provided in Appendix A.

3.2 Physical and Chemical Analyses of Sediment

Reference and composite sediment samples were analyzed for the physical and chemical parameters specified in in Table 7 of the SAP (Anchor QEA 2014). Based on composite results, individual core samples were submitted for analysis of PCB congeners. Results of physical and chemical analyses of sediment samples are presented below. MDLs, RLs, and raw data for the analyses are presented in the laboratory reports in Appendix B.

3.2.1 Reference and Composite Sediment

Results of physical and chemical analyses of reference and composite sediment samples from Basins 2 and 3 are presented in Table 6. All results are expressed in dry weight unless otherwise indicated.

Table 5
Station Coordinates, Mudline Elevations, Estimated Penetration, and Retrieved Core Lengths for Each Sampling Station

Station ID	Attempt	Latitude[1]	Longitude[1]	Mudline Elevation (feet MLLW)	Estimated Penetration (feet)	Retrieved Core Length (feet)	Core Length Analyzed (feet)	Core Length Archived for Z Layer (feet)	Comments
B2-DU1-01	1	33° 45.013'	118° 06.653'	-7.7	6.0	4.8	4.3	0.5	
B2-DU1-01	2	33° 45.013'	118° 06.653'	-7.7	6.0	4.3	4.3	0.0	
B2-DU1-02	1	33° 45.069'	118° 06.718'	-7.7	7.0	5.6	4.3	0.5	
B2-DU1-02	2	33° 45.069'	118° 06.718'	-7.7	6.0	4.3	4.3	0.0	
B2-DU1-03	1	33° 45.062'	118° 06.652'	-7.6	7.3	6.3	4.4	0.5	
B2-DU1-03	2	33° 45.062'	118° 06.652'	-7.6	6.1	4.7	4.4	0.0	
B2-DU1-04	1	33° 45.059'	118° 06.600'	-7.7	6.2	5.3	4.3	0.5	
B2-DU1-04	2	33° 45.059'	118° 06.600'	-7.7	6.8	5.3	4.3	0.0	
B2-DU1-05	1	33° 45.081'	118° 06.630'	-6.5	7.3	6.0	5.5	0.5	Refusal
B2-DU1-05	2	33° 45.081'	118° 06.630'	-6.5	7.2	5.5	5.5	0.0	
B2-DU2-01	1	33° 45.083'	118° 06.595'	-7.4	6.9	5.6	4.6	0.5	Refusal
B2-DU2-01	2	33° 45.083'	118° 06.595'	-7.4	6.5	4.8	4.6	0.0	
B2-DU2-02	1	33° 45.116'	118° 06.581'	-7.4	7.0	5.1	4.6	0.5	
B2-DU2-02	2	33° 45.116'	118° 06.581'	-7.4	6.7	4.6	4.6	0.0	
B2-DU2-03	1	33° 45.137'	118° 06.550'	-8.5	6.3	3.5	3.5	0.0	
B2-DU2-03	2	33° 45.137'	118° 06.550'	-8.5	4.2	2.0	0.0	0.0	Refusal
B2-DU2-03	3	33° 45.138'	118° 06.552'	-8.8	6.2	4.2	3.2	0.5	Moved due to refusal on Attempt 2.
B2-DU2-04	1	33° 45.198'	118° 06.587'	-8.1	6.5	5.0	3.9	0.5	
B2-DU2-04	2	33° 45.198'	118° 06.587'	-8.1	6.0	4.3	3.9	0.0	
B2-DU2-05	1	33° 45.137'	118° 06.470'	-5.4	2.5	[3]	0.0	0.0	Moved due to docked vessel; refusal

Station ID	Attempt	Latitude[1]	Longitude[1]	Mudline Elevation (feet MLLW)	Estimated Penetration (feet)	Retrieved Core Length (feet)	Core Length Analyzed (feet)	Core Length Archived for Z Layer (feet)	Comments
B2-DU2-05	2	33° 45.140'	118° 06.476'	-6.4	3.7	[3]	0.0	0.0	Moved due to refusal on Attempt 1; refusal
B2-DU2-05	3	33° 45.145'	118° 06.478'	-8.0	6.1	5.0	4.0	0.5	Moved due to refusal on Attempt 2; refusal
B2-DU2-05	4	33° 45.145'	118° 06.478'	-8.0	6.2	4.0	4.0	0.0	
B3-DU1-01	1	33° 45.380'	118° 06.735'	-8.8	5.4	4.7	3.2	0.5	
B3-DU1-01	2	33° 45.380'	118° 06.735'	-8.8	5.2	4.2	3.2	0.0	
B3-DU1-02	1	33° 45.358'	118° 06.710'	-8.7	5.7	4.1	3.3	0.5	Refusal
B3-DU1-02	2	33° 45.358'	118° 06.710'	-8.7	5.4	4.0	3.3	0.0	
B3-DU1-03	1	33° 45.304'	118° 06.748'	-9.4	5.2	4.3	2.6	0.5	Moved due to docked vessels
B3-DU1-03	2	33° 45.304'	118° 06.748'	-9.4	4.7	3.6	2.6	0.0	
B3-DU1-04	1	33° 45.281'	118° 06.742'	-5.8	4.9	3.3	3.3	Not Collected[2]	Moved due to docked vessels; refusal
B3-DU1-04	2	33° 45.283'	118° 06.742'	-7.8	4.2	3.0	3.0	0.0	Moved due to refusal on Attempt 1; refusal
B3-DU1-04	3	33° 45.285'	118° 06.738'	-7.7	3.7	1.5	0.0	0.0	Moved due to refusal on Attempt 2; refusal
B3-DU1-05	1	33° 45.273'	118° 06.714'	-6.9	6.3	5.0	5.0	Not Collected[2]	Moved due to docked vessels; refusal
B3-DU1-05	2	33° 45.273'	118° 06.714'	-6.9	6.2	3.6	0.0	0.0	Refusal
B3-DU1-05	3	33° 45.273'	118° 06.715'	-6.8	6.4	4.5	4.5	0.0	Moved due to refusal on Attempt 2; refusal
B3-DU1-06	1	33° 45.279'	118° 06.671'	-8.9	5.6	4.6	3.1	0.5	Moved due to docked vessels; refusal
B3-DU1-06	2	33° 45.279'	118° 06.671'	-8.9	5.1	4.0	3.1	0.0	

Station ID	Attempt	Latitude[1]	Longitude[1]	Mudline Elevation (feet MLLW)	Estimated Penetration (feet)	Retrieved Core Length (feet)	Core Length Analyzed (feet)	Core Length Archived for Z Layer (feet)	Comments
B3-DU1-07	1	33° 45.255'	118° 06.670'	-8.2	6.5	5.0	3.8	0.5	Moved due to docked vessels
B3-DU1-07	2	33° 45.255'	118° 06.670'	-8.2	5.8	4.2	3.8	0.0	
B3-DU2-01	1	33° 45.261'	118° 06.635'	-6.8	7.0	5.6	5.2	0.4	Moved due to docked vessel; refusal
B3-DU2-01	2	33° 45.261'	118° 06.635'	-6.8	6.9	5.0	5.0	0.0	Refusal
B3-DU2-02	1	33° 45.229'	118° 06.644'	-7.8	3.5	[3]	0.0	0.0	Moved due to docked vessel; refusal
B3-DU2-02	2	33° 45.231'	118° 06.645'	-9.0	5.9	4.0	3.0	0.5	Moved due to refusal on Attempt 1
B3-DU2-02	3	33° 45.231'	118° 06.645'	-9.0	5.0	3.6	3.0	0.0	
B3-DU2-03	1	33° 45.246'	118° 06.587'	-8.0	6.6	4.8	4.0	0.5	
B3-DU2-03	2	33° 45.246'	118° 06.587'	-8.0	6.1	4.6	4.0	0.0	
B3-DU2-04	1	33° 45.203'	118° 06.632'	-7.7	6.8	5.3	4.3	0.5	Refusal
B3-DU2-04	2	33° 45.203'	118° 06.632'	-7.7	6.3	4.2	4.2	0.0	
B3-DU2-05	1	33° 45.208'	118° 06.598'	-8.4	2.4	[3]	0.0	0.0	Moved due to limited access; refusal
B3-DU2-05	2	33° 45.210'	118° 06.593'	-8.3	6.3	4.8	3.7	0.5	Moved due to refusal on Attempt 1
B3-DU2-05	3	33° 45.210'	118° 06.593'	-8.3	5.7	3.7	3.7	0.0	

Notes:
1 California State Plane, Zone 7, North American Datum (NAD) 27
2 Z-layer depth not achieved. Bottom 0.5 foot of core archived.
3 Sample discarded due to insufficient length; retrieved core length not recorded.
MLLW = mean lower low water

Table 6

Sediment Physical and Chemical Results for Composite Sediment Samples from Basins 2 and 3

	ERL	ERM	B2-DU1-COMP	B2-DU2-COMP	B3-DU1-COMP	B3-DU2-COMP	LA2-REF
Conventional Parameters							
Total Sulfides (mg/kg)			**4.1**	**31**	**2.0**	**3.9**	**0.99**
Ammonia (as N) (mg/kg)			**7.0**	**6.9**	**6.6**	**4.4**	**3.6**
Total organic carbon (%)			**1.3**	**1.1**	**1.6**	**1.3**	**0.68**
Total solids (%)			**60.4**	**64.5**	**59.3**	**63.8**	**70.5**
Grain Size (%)							
Clay (less than 0.00391mm)			**17.49**	**14.95**	**16.55**	**15.42**	**4.59**
Silt (0.00391 to 0.0625mm)			**68.43**	**59.66**	**59.06**	**56.06**	**21.90**
Very Fine Sand (0.0625 to 0.125mm)			**11.10**	**17.02**	**15.89**	**14.99**	**48.20**
Fine Sand (0.125 to 0.25mm)			**2.98**	**7.98**	**7.82**	**10.19**	**25.20**
Medium Sand (0.25 to 0.5mm)			< 0.01	**0.40**	**0.68**	**3.01**	**0.10**
Coarse Sand (0.5 to 1mm)			< 0.01	< 0.01	< 0.01	**0.33**	< 0.01
Very Coarse Sand (1 to 2mm)			< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Gravel (greater than 2mm)			< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total Silt and Clay (0 to 0.0625mm)			**85.91**	**74.61**	**75.61**	**71.48**	**26.49**
Metals (mg/kg)							
Arsenic	8.2	70	**7.85**	**6.53**	**5.67**	**6.08**	**3.06 B**
Cadmium	1.2	9.6	**1.08**	**0.886**	**0.995**	**0.902**	**0.186**
Chromium	81	370	**37.0**	**31.0**	**31.4**	**34.2**	**22.1**
Copper	34	270	**82.7**	**53.4**	**81.8**	**84.2**	**9.91**
Lead	46.7	218	**64.4**	**46.4**	**53.2**	**56.5**	**5.63**
Nickel	20.9	51.6	**25.5**	**21.3**	**22.0**	**22.8**	**11.7**
Selenium			**0.468**	**0.390**	**0.430**	**0.350**	**0.275**
Silver	1	3.7	**0.387**	**0.267**	**0.434**	**0.352**	**0.0541 J**
Zinc	150	410	**186**	**136**	**185**	**168**	**48.7**
Mercury	0.15	0.71	**0.568**	**0.321**	**0.239**	**0.284**	**0.0158 J**
Organotins (µg/kg)							
Monobutyltin			< 1.1	< 1	< 1.1	< 1.0	< 0.93
Dibutyltin			**29**	**24**	**17**	**15**	< 0.93
Tributyltin			< 0.95	< 0.89	< 0.97	< 0.90	< 0.82
Tetrabutyltin			< 1.3	< 1.2	< 1.3	< 1.2	< 1.1
Total Butyltins (ND = 0)			**29**	**24**	**17**	**15**	< 1.1

Table 6

Sediment Physical and Chemical Results for Composite Sediment Samples from Basins 2 and 3

	ERL	ERM	B2-DU1-COMP	B2-DU2-COMP	B3-DU1-COMP	B3-DU2-COMP	LA2-REF
PAH (µg/kg)							
Acenaphthene	16	500	< 3.0	< 2.8	< 3.0	< 2.8	< 2.5
Acenaphthylene	44	640	**5.1 J**	**3.5 J**	**4.5 J**	**4.2 J**	< 2.1
Anthracene	85.3	1100	**9.3 J**	**7.1 J**	**8.4 J**	**7.4 J**	< 1.1
Benzo (a) Anthracene	261	1600	**31**	**27**	**32**	**26**	< 2.2
Benzo (a) Pyrene	430	1600	**49**	**41**	**49**	**41**	< 1.4
Benzo (b) Fluoranthene			**52**	**46**	**66**	**56**	< 1.4
Benzo (g,h,i) Perylene			**64**	**48**	**74**	**60**	**2.5 J**
Benzo (k) Fluoranthene			**46**	**35**	**43**	**42**	< 2
Chrysene	384	2800	**45**	**39**	**53**	**41**	**1.7 J**
Dibenz (a,h) Anthracene	63.4	260	**12 J**	**8.4 J**	**12 J**	**10 J**	< 1.5
Fluoranthene	600	5100	**50**	**51**	**52**	**44**	**1.7 J**
Fluorene	19	540	**3.3 J**	**2.5 J**	**3.9 J**	**3.2 J**	< 2.1
Indeno (1,2,3-c,d) Pyrene			**56**	**43**	**60**	**49**	< 1.5
2-Methylnaphthalene	70	670	**7.1 J**	**4.9 J**	**8.6 J**	**7.3 J**	< 2.5
1-Methylnaphthalene			< 3.3	< 3.1	**3.6 J**	< 3.2	< 2.8
Naphthalene	160	2100	**7.1 J**	**6.3 J**	**8.6 J**	**9.2 J**	< 4.2
Phenanthrene	240	1500	**34**	**27**	**23**	**22**	**1.9 J**
Pyrene	665	2600	**57**	**54**	**66**	**51**	**2.2 J**
Total HMW PAHs (ND = 0)	1700	9600	**462**	**392**	**507**	**420**	**8.1**
Total LMW PAHs (ND = 0)	552	3160	**65.9**	**51.3**	**60.6**	**53.3**	**1.9**
Total PAHs (ND = 0)	4022	44792	**527.9**	**443.7**	**567.6**	**473.3**	**10**
Pesticides (µg/kg)							
2,4'-DDD			< 0.56	< 0.53	< 0.57	< 0.53	< 0.48
2,4'-DDE			**7.2**	**8.3**	**2.2**	**6.6**	< 0.43
2,4'-DDT			< 0.5	< 0.47	< 0.51	< 0.47	< 0.43
4,4'-DDD	2	20	< 0.52	< 0.49	< 0.53	< 0.50	**0.65 J**
4,4'-DDT	1	7	< 0.55	< 0.52	< 0.56	< 0.52	< 0.47
4,4'-DDE	2.2	27	**28**	**29**	**14**	**40**	**8.3**
Total DDTs (ND = 0)	1.58	46.1	**35.2**	**37.3**	**16.2**	**46.6**	**8.95**
Alpha Chlordane			< 0.53	< 0.50	< 0.54	< 0.50	< 0.45
Gamma Chlordane			< 0.52	< 0.49	< 0.54	**0.80 J**	< 0.45

Table 6

Sediment Physical and Chemical Results for Composite Sediment Samples from Basins 2 and 3

	ERL	ERM	B2-DU1-COMP	B2-DU2-COMP	B3-DU1-COMP	B3-DU2-COMP	LA2-REF
Cis-nonachlor			< 0.49	< 0.46	**2.9**	**5.8**	< 0.42
Oxychlordane			< 0.46	< 0.44	< 0.47	< 0.44	< 0.40
Trans-nonachlor			< 0.48	< 0.45	< 0.49	< 0.45	< 0.41
Total Chlordanes (ND = 0)	0.5	6	< 0.53	< 0.50	**2.9**	**6.6**	< 0.45
Aldrin			< 0.52	< 0.49	< 0.53	< 0.49	< 0.45
alpha-BHC			< 0.54	< 0.50	< 0.55	< 0.51	< 0.46
beta-BHC			< 0.44	< 0.41	< 0.45	< 0.41	< 0.37
delta-BHC			< 0.42	< 0.4	< 0.43	< 0.40	< 0.36
gamma-BHC (Lindane)			< 0.57	< 0.54	< 0.58	< 0.54	< 0.49
Dieldrin	0.02	8	< 0.54	< 0.51	< 0.56	< 0.52	< 0.47
Endosulfan sulfate			< 0.56	< 0.52	< 0.57	< 0.53	< 0.48
Endosulfan-alpha (I)			**0.69 J**	**0.64 J**	< 0.44	< 0.41	< 0.37
Endosulfan-beta (II)			< 0.46	< 0.43	< 0.47	< 0.44	< 0.4
Endrin			< 0.59	< 0.56	< 0.60	< 0.56	< 0.51
Endrin aldehyde			< 0.40	< 0.38	< 0.41	< 0.38	< 0.35
Endrin ketone			< 0.57	< 0.54	< 0.59	< 0.54	< 0.49
Heptachlor			< 0.53	< 0.50	< 0.54	< 0.50	< 0.46
Heptachlor epoxide			< 0.59	< 0.55	< 0.60	< 0.56	< 0.50
Methoxychlor			< 0.54	< 0.50	< 0.55	< 0.51	< 0.46
Toxaphene			< 10	< 9.8	< 11	< 9.9	< 9.0
Pyrethroid Pesticide (µg/kg)							
Bifenthrin			**0.50 J**	**0.47 J**	**0.30 J**	**0.21 J**	**0.23 BJ**
Cyfluthrin			< 0.14	< 0.13	< 0.14	< 0.13	< 0.12
Cypermethrin			< 0.11	< 0.11	< 0.12	< 0.11	< 0.097
Deltamethrin/Tralomethrin			< 0.35	< 0.32	< 0.35	< 0.33	< 0.30
Fenpropathrin			< 0.06	< 0.056	< 0.061	< 0.057	< 0.051
Fenvalerate/Esfenvalerate			< 0.059	< 0.055	< 0.060	< 0.056	< 0.050
lambda-Cyhalothrin			< 0.072	< 0.067	< 0.073	< 0.068	< 0.062
Permethrin (cis/trans)			**2.4**	**2.4**	**1.2 J**	**1.3 J**	**0.45 J**
PCB Congeners (µg/kg)							
PCB018			**1.4**	**1.8**	**1.6**	**5.8**	< 0.22
PCB028			**2.7**	**2.2**	**1.6**	**5.1**	< 0.14

Table 6

Sediment Physical and Chemical Results for Composite Sediment Samples from Basins 2 and 3

	ERL	ERM	B2-DU1-COMP	B2-DU2-COMP	B3-DU1-COMP	B3-DU2-COMP	LA2-REF
PCB037			**0.68 J**	**0.79**	**0.58 J**	**1.0**	< 0.19
PCB044			**3.4**	**2.9**	**2.2**	**5.6**	< 0.19
PCB049			**3**	**4.8**	**3.7**	**10**	< 0.17
PCB052			**4.7**	**6.3**	**4.2**	**12**	< 0.14
PCB066			**5.5**	**4.3**	**4.5**	**8**	< 0.13
PCB070			**3.7**	**3.4**	**3.3**	**6.3**	< 0.12
PCB074			**2**	**1.5**	**1.4**	**2.7**	< 0.13
PCB077			**0.69 J**	**0.75 J**	**0.61 J**	**0.93**	< 0.14
PCB081			< 0.2	< 0.19	< 0.21	< 0.19	< 0.17
PCB087			**1.8**	**1.5**	**1.2**	**2.3**	< 0.14
PCB099			**4.9**	**5.9**	**5.9**	**8.6**	**0.12 J**
PCB101			**8.1**	**9.5**	**7.7**	**13**	**0.21 J**
PCB105			**2.6**	**2.2**	**2.0**	**3.2**	< 0.15
PCB110			**6.7**	**6.4**	**7.3**	**10**	**0.15 J**
PCB114			**3.4**	**1.7**	< 0.17	**0.35 J**	**0.21 J**
PCB118			**7.4**	**6.3**	**7.4**	**10**	< 0.19
PCB119			< 0.14	< 0.13	**0.67 J**	**1.0**	< 0.12
PCB123			< 0.15	< 0.13	< 0.15	< 0.14	< 0.12
PCB126			< 0.23	< 0.21	< 0.23	< 0.22	< 0.20
PCB128			**1.8**	**1.3**	**1.3**	**2.1**	< 0.15
PCB138/158			**8.6**	**8.0**	**7.5**	**11**	< 0.29
PCB149			**5.6**	**7.6**	**5.6**	**8.0**	**0.15 J**
PCB151			**1.4**	**2.0**	**1.3**	**2.0**	< 0.15
PCB153			**9.1**	**9.2**	**8.7**	**13**	**0.2 J**
PCB156			**1.1**	**0.92**	**1.0**	**1.4**	< 0.14
PCB157			**1.2**	**0.78**	< 0.16	< 0.15	< 0.14
PCB167			< 0.17	< 0.15	**0.27 J**	< 0.16	< 0.14
PCB168			< 0.14	< 0.13	< 0.14	< 0.13	< 0.12
PCB169			< 0.14	< 0.13	< 0.14	< 0.13	< 0.12
PCB170			**2.6**	**2.3**	**1.8**	**3.1**	< 0.13
PCB177			**0.88**	**1.7**	**0.69 J**	**1.1**	< 0.17
PCB180			**3.9**	**3.9**	**3.2**	**4.8**	< 0.087

Table 6
Sediment Physical and Chemical Results for Composite Sediment Samples from Basins 2 and 3

	ERL	ERM	B2-DU1-COMP	B2-DU2-COMP	B3-DU1-COMP	B3-DU2-COMP	LA2-REF
PCB183			**1.1**	**1.1**	**0.86**	**1.4**	< 0.16
PCB187			**2.6**	**5.3**	**2.2**	**3.7**	< 0.15
PCB189			< 0.14	< 0.13	< 0.14	< 0.13	< 0.12
PCB194			**1.1**	**1.3**	**1.2**	**1.8**	< 0.14
PCB201			**0.18 J**	**0.29 J**	**0.14 J**	**0.21 J**	< 0.081
PCB206			**1.0**	**1.2**	**0.61 J**	**1.5**	< 0.12
Total PCB Congeners (ND = 0)	22.7	180	**104.83**	**109.13**	**92.23**	**160.99**	**1.04**

Notes:
= detected concentration is greater than ERL
= detected concentration is greater than ERM
Bold = detected result
µg/kg = micrograms per kilogram
BHC = benzene hexachloride
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
ERL = effects range low
ERM = effects range median
HMW PAHs = high-molecular-weight polycyclic aromatic hydrocarbons
J = indicates an estimated value
LMW PAHs = low-molecular-weight polycyclic aromatic hydrocarbons
mg/kg = milligrams per kilogram
mm = millimeters
ND = not detected
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl

3.2.1.1 LA-2 Reference

Grain size of reference sediment consisted primarily of sand, totaling 73.5 percent. TOC was measured at a concentration of 0.7 percent.

Metals, PAHs, pesticides, pyrethroids, and PCBs were detected in reference sediment. All metal, PAH, and PCB concentrations were less than corresponding ERL and ERM values. DDTs were the only pesticides detected in the reference sediment with total DDT concentrations exceeding the corresponding ERL value. Two pyrethroids (bifenthrin and permethrin) were estimated at low concentrations between the MDL and RL. It should be noted that bifenthrin was detected in the method blank, and therefore, results may be biased high. Organotins were not detected in reference sediment.

3.2.1.2 Basin 2

Grain size of sediment from Basin 2 consisted primarily of fines (silt and clay), ranging from 74.6 to 85.9 percent. TOC was measured at concentrations ranging from 1.1 to 1.3 percent.

Metals, organotins, PAHs, pesticides, pyrethroids, and PCBs were detected in sediment from Basin 2. Copper, lead, mercury, nickel, and zinc concentrations exceeded corresponding ERL values in at least one composite sample. Dibutyltin was the only organotin detected. Several PAHs were detected; however, all concentrations, including total PAHs, were less than corresponding ERL and ERM values. DDTs and endosulfan-alpha were the only pesticides detected. One DDT derivative (4,4'-DDE) exceeded the corresponding ERM value, while total DDT concentrations exceeded the corresponding ERL value. Two pyrethroids (bifenthrin and permethrin) were estimated at low concentrations between the MDL and RL. Several PCB congeners were detected. Total PCB concentrations exceeded the corresponding ERL value.

3.2.1.3 Basin 3

Grain size of sediment from Basin 3 consisted primarily of fines (silt and clay), ranging from 71.5 to 75.6 percent. TOC was measured at concentrations ranging from 1.3 to 1.6 percent.

Metals, organotins, PAHs, pesticides, pyrethroids, and PCBs were detected in sediment from Basin 3. Copper, lead, mercury, nickel, and zinc concentrations exceeded corresponding ERL values. Dibutyltin was the only organotin detected. Several PAHs were detected; however, all concentrations, including total PAH, were less than corresponding ERL and ERM values. DDTs and chlordanes were the only pesticides detected. Total DDT and total chlordane concentrations exceeded corresponding ERL values in B3-DU1-COMP, and exceeded corresponding ERM values in B3-DU2-COMP. Several PCB congeners were detected. Total PCB concentrations exceeded the corresponding ERL value.

3.2.2 Additional Analysis of PCBs

Due to elevated PCBs in composite sediment samples, additional analysis of PCBs was performed. Archived samples from individual stations were analyzed for PCBs, as recommended by USEPA to further delineate the areas where elevated concentrations exist. Sediment PCB results for the individual stations within Basins 2 and 3 are presented in Table 7.

Within Basin 2, total PCB concentrations ranged from 15.28 to 118.18 micrograms per kilogram (µg/kg). All concentrations were greater than the corresponding ERL value, except for B2-DU2-04. Within Basin 3, total PCB concentrations ranged from 5.22 to 86.77 µg/kg. All concentrations were greater than the corresponding ERL value, except for B3-DU1-03, B3-DU1-04, B3-DU1-05, and B3-DU2-02. All total PCB concentrations were less than those in the composite samples, except for B2-DU2-05 (118.18 µg/kg). Additionally, a high degree of variance did occur among the cores.

Concentrations were substantially lower than composite samples; therefore, composite samples were re-analyzed for PCBs, as recommended by USEPA, to confirm the initial results. PCB re-analysis of composite samples from Basins 2 and 3 are presented in Table 8. Results of the re-analysis confirmed previous results. All total PCB concentrations were greater than ERL or ERM values.

Table 7
Sediment PCB Results for Individual Stations within Basins 2 and 3

	ERL	ERM	B2-DU1-01	B2-DU1-02	B2-DU1-03	B2-DU1-04	B2-DU1-05	B2-DU2-01	B2-DU2-02	B2-DU2-03	B2-DU2-04	B2-DU2-05	B3-DU1-01	B3-DU1-02	B3-DU1-03	B3-DU1-04	B3-DU1-05	B3-DU1-06	B3-DU1-07	B3-DU2-01	B3-DU2-02	B3-DU2-03	B3-DU2-04	B3-DU2-05
Conventional Parameters																								
Total solids (%)			**52.3**	**60.5**	**65.6**	**63.5**	**65.7**	**66.8**	**67.4**	**61.4**	**66.4**	**62.3**	**58.6**	**58.5**	**54.4**	**52.4**	**47.5**	**66.7**	**59.6**	**60.0**	**60.5**	**57.2**	**52.9**	**59.4**
PCB Congeners (µg/kg)																								
PCB018			**0.34 J**	**1.3**	**0.58 J**	**0.77 J**	**0.68 J**	**0.70 J**	**0.32 J**	**0.41 J**	< 0.24	**2.7**	**0.48 J**	**0.45 J**	< 0.29	**0.34 J**	< 0.33	**6.2**	**1.3**	**1.6**	< 0.26	**2.3**	**0.33 J**	**0.36 J**
PCB028			**0.77 J**	**1.9**	**1.1**	**1.2**	**0.92**	**1.1**	**0.44 J**	**0.83**	**0.31 J**	**1.1**	**0.68 J**	**0.54 J**	< 0.18	**0.24 J**	< 0.21	**3.5**	**0.82 J**	**1.1**	**0.40 J**	**1.7**	**0.53 J**	**0.69 J**
PCB037			< 0.25	**11**	**0.27 J**	**0.31 J**	**0.22 J**	**0.20 J**	< 0.20	**0.31 J**	< 0.20	**1.0**	**0.28 J**	< 0.23	< 0.24	< 0.24	< 0.27	**0.57 J**	< 0.22	**0.22 J**	< 0.21	**0.57 J**	< 0.24	< 0.22
PCB044			**0.94 J**	**3.0**	**1.6**	**1.8**	**1.5**	**2.1**	**0.94**	**0.90**	**0.45 J**	**1.9**	**1.1**	**0.92**	< 0.24	**0.35 J**	< 0.27	**2.4**	**1.1**	**1.0**	**0.48 J**	**1.5**	**1.1**	**0.9**
PCB049			**1.0**	**2.2**	**1.6**	**1.5**	**1.5**	**2.1**	**1.0**	**1.5**	**0.45 J**	**5.9**	**1.5**	**1.2**	**0.23 J**	< 0.22	< 0.25	**5.2**	**1.4**	**1.3**	**0.55 J**	**4.1**	**1.1**	**0.92**
PCB052			**1.4**	**4.1**	**2.2**	**2.5**	**2.1**	**2.6**	**1.3**	**1.8**	**0.69 J**	**6.9**	**2.0**	**1.7**	**0.28 J**	**0.47 J**	**0.25 J**	**6.9**	**1.9**	**2.2**	**1.0**	**4.8**	**1.9**	**1.3**
PCB066			**1.5**	**3.9**	**2.3**	**2.8**	**1.9**	**2.6**	**1.2**	**1.4**	**0.65 J**	**3.8**	**2.0**	**1.5**	**0.27 J**	**0.33 J**	**0.19 J**	**4.2**	**1.4**	**1.4**	**0.78 J**	**2.6**	**1.2**	**1.4**
PCB070			**1.1**	**3.0**	**1.7**	**2.0**	**1.5**	**2.0**	**0.91**	**1.2**	**0.44 J**	**3.2**	**1.6**	**1.4**	**0.28 J**	**0.37 J**	**0.21 J**	**3.1**	**1.1**	**1.1**	**0.58 J**	**2.3**	**1.2**	**1.1**
PCB074			**0.57 J**	**1.6**	**0.86**	**1.1**	**0.69 J**	**0.98**	**0.50 J**	**0.48 J**	**0.25 J**	**1.3**	**0.67 J**	**0.59 J**	< 0.17	**0.21 J**	< 0.20	**1.7**	**0.49 J**	**0.46 J**	**0.29 J**	**0.81 J**	**0.58 J**	**0.49 J**
PCB077			**0.21 J**	< 0.16	< 0.15	**0.38 J**	**0.30 J**	< 0.14	< 0.15	< 0.16	< 0.15	**0.99**	< 0.16	< 0.17	< 0.18	< 0.18	< 0.20	**0.35 J**	< 0.16	< 0.16	< 0.16	**0.53 J**	**0.31 J**	< 0.16
PCB081			< 0.23	< 0.20	< 0.19	< 0.19	< 0.18	< 0.18	< 0.18	< 0.20	< 0.18	< 0.19	< 0.20	< 0.21	< 0.23	< 0.23	< 0.25	< 0.18	< 0.20	< 0.20	< 0.20	< 0.22	< 0.23	< 0.20
PCB087			**0.46 J**	**1.2**	**0.99**	**1.2**	**0.65 J**	**1.1**	**0.74 J**	**0.40 J**	**0.27 J**	**1.1**	**1.1**	**0.86 J**	< 0.19	**0.19 J**	< 0.21	**0.83**	**0.40 J**	**0.69 J**	**0.21 J**	**0.89 J**	**0.74 J**	**0.50 J**
PCB099			**1.5**	**3.1**	**1.9**	**2.4**	**1.7**	**2.5**	**1.4**	**1.4**	**0.56 J**	**8.1**	**2.4**	**1.9**	**0.33 J**	**0.20 J**	**0.22 J**	**2.9**	**1.1**	**1.2**	**0.87**	**4.5**	**1.4**	**1.3**
PCB101			**2.3**	**5.3**	**3.8**	**4.6**	**3.2**	**4.7**	**2.6**	**2.1**	**1.0**	**12**	**4.0**	**3.4**	**0.62 J**	**0.46 J**	**0.44 J**	**4.5**	**1.9**	**2.3**	**1.2**	**6.4**	**3.0**	**2.2**
PCB105			**0.75 J**	**1.7**	**1.5**	**1.9**	**1.2**	**1.5**	**1.1**	**0.77 J**	**0.35 J**	**1.8**	**1.5**	**1.0**	**0.26 J**	**0.37 J**	< 0.22	**1.4**	**0.58 J**	**0.89**	**0.33 J**	**1.3**	**1.0**	**0.65 J**
PCB110			**2.0**	**4.4**	**3.3**	**3.9**	**2.7**	**4.0**	**2.3**	**2.1**	**0.82**	**6.3**	**3.8**	**2.9**	**0.5 J**	< 0.19	**0.41 J**	**3.5**	**1.6**	**2.1**	**0.93**	**4.4**	**2.5**	**1.8**
PCB114			**0.73 J**	**1.8**	**1.9**	**2.4**	**1.4**	**1.7**	**1.6**	**1.1**	**0.84**	**1.1**	**1.2**	**0.55 J**	**0.43 J**	**0.34 J**	**1.2**	**1.9**	**0.81 J**	**0.88**	**0.56 J**	**1.1**	**1.3**	**1.1**
PCB118			**2.0**	**4.5**	**3.5**	**4.3**	**2.7**	**4.1**	**2.2**	**1.8**	**1.0**	**6.4**	**3.8**	**2.9**	**0.56 J**	**0.50 J**	**0.42 J**	**3.9**	**1.6**	**2.1**	**1.0**	**4.6**	**2.5**	**2.2**
PCB119			< 0.16	**0.30 J**	< 0.13	**0.28 J**	< 0.13	**0.29 J**	< 0.13	**0.24 J**	< 0.13	**0.71 J**	**0.30 J**	< 0.15	< 0.16	< 0.16	< 0.18	**0.19 J**	< 0.14	< 0.14	< 0.14	**0.51 J**	< 0.16	< 0.14
PCB123			< 0.17	< 0.14	< 0.13	< 0.14	< 0.13	< 0.13	< 0.13	< 0.14	< 0.13	< 0.14	< 0.15	< 0.15	< 0.16	< 0.16	< 0.18	< 0.13	< 0.14	< 0.14	< 0.14	< 0.14	< 0.15	< 0.16
PCB126			< 0.26	< 0.23	< 0.21	< 0.22	< 0.21	< 0.20	< 0.21	< 0.22	< 0.21	< 0.22	< 0.23	< 0.24	< 0.26	< 0.26	< 0.29	< 0.20	< 0.23	< 0.23	< 0.23	< 0.25	< 0.26	< 0.23
PCB128			**0.48 J**	**1.2**	**0.87**	**1.2**	**0.63 J**	**1.1**	**0.65 J**	**0.33 J**	**0.37 J**	**1.1**	**1.0**	**0.63 J**	< 0.19	< 0.19	< 0.21	**0.73 J**	**0.39 J**	**0.35 J**	**0.24 J**	**0.86 J**	**0.69 J**	**0.57 J**
PCB138/158			**2.3**	**4.5**	**4.2**	**5.2**	**3.4**	**5.1**	**3.0**	**2.1**	**1.4 J**	**8.6**	**5.0**	**3.4**	**0.73 J**	**0.61 J**	**0.62 J**	**3.2**	**1.7**	**2.5**	**1.0 J**	**5.6**	**3.0**	**2.4**
PCB149			**1.4**	**3.2**	**2.6**	**3.2**	**2.1**	**3.1**	**1.9**	**1.6**	**0.97**	**9.4**	**3.2**	**2.4**	**0.47 J**	**0.34 J**	**0.43 J**	**2.1**	**1.1**	**1.5**	**0.79 J**	**5.2**	**1.8**	**1.4**
PCB151			**0.33 J**	**0.77 J**	**0.65 J**	**0.87**	**0.54 J**	**0.76**	**0.50 J**	**0.48 J**	**0.27 J**	**2.9**	**0.79 J**	**0.62 J**	< 0.19	< 0.19	< 0.22	**0.51 J**	**0.27 J**	**0.42 J**	**0.23 J**	**1.3**	**0.50 J**	**0.42 J**
PCB153			**2.5**	**4.7**	**4.1**	**5.3**	**3.3**	**5.1**	**2.9**	**1.9**	**1.4**	**11**	**5.0**	**3.4**	**0.75 J**	**0.62 J**	**0.56 J**	**3.5**	**1.8**	**2.4**	**1.2**	**6.7**	**2.7**	**2.3**
PCB156			**0.22 J**	**0.60 J**	**0.55 J**	**0.75 J**	**0.44 J**	**0.78**	**0.37 J**	< 0.16	**0.23 J**	**0.73 J**	**0.57 J**	**0.47 J**	< 0.18	< 0.18	< 0.20	**0.49 J**	**0.26 J**	**0.44 J**	< 0.16	**0.64 J**	**0.35 J**	**0.49 J**
PCB157			**0.30 J**	**0.51 J**	**0.56 J**	**0.95**	**0.38 J**	**0.67 J**	**0.46 J**	**0.34 J**	< 0.14	**0.51 J**	**0.45 J**	< 0.16	< 0.18	< 0.18	< 0.20	**0.43 J**	**0.27 J**	**0.38 J**	< 0.16	**0.40 J**	**0.32 J**	**0.54 J**
PCB167			< 0.19	**0.19 J**	< 0.15	< 0.16	< 0.15	**0.18 J**	< 0.15	< 0.16	< 0.15	< 0.16	< 0.17	< 0.17	< 0.18	< 0.19	< 0.21	< 0.15	< 0.16	< 0.16	< 0.16	< 0.18	< 0.19	< 0.17
PCB168			< 0.16	< 0.14	< 0.13	< 0.14	< 0.13	< 0.13	< 0.13	< 0.14	< 0.13	< 0.14	< 0.14	< 0.15	< 0.16	< 0.16	< 0.18	< 0.13	< 0.14	< 0.14	< 0.14	< 0.15	< 0.16	< 0.14
PCB169			< 0.15	< 0.13	< 0.13	**0.51 J**	**0.18 J**	< 0.12	< 0.12	< 0.13	< 0.12	**0.34 J**	**0.24 J**	**0.20 J**	< 0.15	< 0.15	< 0.17	< 0.12	< 0.13	< 0.13	< 0.13	**0.56 J**	< 0.15	< 0.14
PCB170			**0.54 J**	**1.0**	**1.2**	**1.2**	**0.83**	**1.1**	**0.60 J**	**0.53 J**	**0.50 J**	**1.8**	**1.3**	**0.83 J**	< 0.17	**0.25 J**	< 0.19	**0.69 J**	**0.43 J**	**0.69 J**	**0.24 J**	**2.2**	**0.67 J**	**0.43 J**
PCB177			< 0.23	**0.49 J**	**0.47 J**	**0.57 J**	**0.37 J**	**0.63 J**	**0.30 J**	**0.22 J**	**0.21 J**	**1.3**	**0.58 J**	**0.35 J**	< 0.23	< 0.23	< 0.26	**0.30 J**	< 0.20	**0.21 J**	< 0.20	**1.7**	< 0.23	< 0.21
PCB180			**1.0**	**1.9**	**2.1**	**2.4**	**1.5**	**2.1**	**1.3**	**0.85**	**0.88**	**4.5**	**2.4**	**1.7**	**0.29 J**	**0.43 J**	**0.27 J**	**1.4**	**0.82 J**	**1.1**	**0.42 J**	**5.2**	**0.94**	**0.9**
PCB183			**0.26 J**	**0.45 J**	**0.52 J**	**0.62 J**	**0.40 J**	**0.51 J**	< 0.17	**0.28 J**	**0.21 J**	**1.3**	**0.61 J**	**0.47 J**	< 0.21	< 0.21	< 0.23	**0.40 J**	< 0.18	**0.30 J**	< 0.18	**0.93**	**0.24 J**	**0.32 J**
PCB187			**0.66 J**	**1.2**	**1.3**	**1.7**	**0.98**	**1.4**	**0.86**	**0.75 J**	**0.55 J**	**6.0**	**1.6**	**1.1**	**0.22 J**	**0.27 J**	< 0.22	**0.96**	**0.57 J**	**0.69 J**	**0.38 J**	**4.9**	**0.7 J**	**0.73 J**
PCB189			< 0.16	< 0.14	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.14	< 0.13	< 0.14	< 0.14	< 0.15	< 0.16	< 0.16	< 0.18	< 0.13	< 0.14	< 0.14	< 0.14	**0.19 J**	< 0.16	< 0.14
PCB194			< 0.18	**0.52 J**	**0.84**	**0.59 J**	**0.60 J**	**0.86**	**0.46 J**	< 0.16	**0.21 J**	**1.3**	**0.81 J**	**0.64 J**	< 0.18	< 0.18	< 0.20	**0.50 J**	**0.29 J**	< 0.16	< 0.16	**3.6**	< 0.18	**0.44 J**
PCB201			< 0.11	< 0.094	< 0.088	< 0.090	< 0.085	< 0.084	< 0.085	< 0.092	< 0.085	**0.32 J**	< 0.095	< 0.098	< 0.11	< 0.11	< 0.12	< 0.084	< 0.094	< 0.094	< 0.093	**0.38 J**	< 0.11	< 0.095
PCB206			**0.45 J**	**0.43 J**	**1.0**	**0.63 J**	**0.43 J**	**0.52 J**	**0.34 J**	< 0.13	< 0.12	**0.78 J**	**0.47 J**	< 0.14	< 0.15	< 0.15	< 0.17	< 0.12	< 0.14	< 0.14	< 0.14	**1.5**	< 0.15	< 0.14
Total PCB Congeners (ND = 0)	22.7	180	**28.01**	**75.96**	**50.06**	**61.03**	**40.94**	**58.18**	**32.19**	**28.12**	**15.28**	**118.18**	**52.43**	**38.02**	**6.22**	**6.89**	**5.22**	**68.45**	**25.40**	**31.52**	**13.68**	**86.77**	**32.60**	**27.85**

Notes:
= detected concentration is greater than ERL
= detected concentration is greater than ERM
Bold = detected result
µg/kg = micrograms per kilogram
ERL = effects range low
ERM = effects range median
J = indicates an estimated value
ND = not detected
PCB = polychlorinated biphenyl

Table 8

Sediment PCB Re-Analysis of Composite Samples from Basins 2 and 3

PCB Congeners (µg/kg)	ERL	ERM	B2-DU1-COMP		B2-DU2-COMP		B3-DU1-COMP		B3-DU2-COMP	
			Original Results	Re-analysis	Original Results	Re-analysis	Original Results	Re-analysis	Original Results	Re-analysis
PCB018			**1.4**	**1.2**	**1.8**	**1.1**	**1.6**	**1.8**	**5.8**	**4.4**
PCB028			**2.7**	**2.1**	**2.2**	**1.4**	**1.6**	**2.7**	**5.1**	**4.1**
PCB037			**0.68 J**	**0.53 J**	**0.79**	**0.46 J**	**0.58 J**	**0.58 J**	**1.0**	**1.0**
PCB044			**3.4**	**3.1**	**2.9**	**2.1**	**2.2**	**3.2**	**5.6**	**6.3**
PCB049			**3.0**	**3.3**	**4.8**	**2.7**	**3.7**	**4.3**	**10**	**8.9**
PCB052			**4.7**	**3.8**	**6.3**	**3.5**	**4.2**	**6.8**	**12**	**11**
PCB066			**5.5**	**4.5**	**4.3**	**2.7**	**4.5**	**5.7**	**8.0**	**7.2**
PCB070			**3.7**	**2.9**	**3.4**	**2.0**	**3.3**	**4.3**	**6.3**	**6.4**
PCB074			**2.0**	**1.5**	**1.5**	**1.0**	**1.4**	**2.2**	**2.7**	**3.1**
PCB077			**0.69 J**	**0.44 J**	**0.75 J**	**0.52 J**	**0.61 J**	**0.94**	**0.93**	**1.7**
PCB081			< 0.20	< 0.20	< 0.19	< 0.19	< 0.21	< 0.20	< 0.19	< 0.19
PCB087			**1.8**	**1.3**	**1.5**	**1.0**	**1.2**	**2.2**	**2.3**	**3.8**
PCB099			**4.9**	**4.0**	**5.9**	**3.1**	**5.9**	**6.4**	**8.6**	**11**
PCB101			**8.1**	**6.8**	**9.5**	**5.9**	**7.7**	**10**	**13**	**16**
PCB105			**2.6**	**2.2**	**2.2**	**1.5**	**2.0**	**3.5**	**3.2**	**4.8**
PCB110			**6.7**	**5.4**	**6.4**	**4.5**	**7.3**	**8.8**	**10**	**12**
PCB114			**3.4**	**3.6**	**1.7**	**1.8**	< 0.17	< 0.17	**0.35 J**	**1.7**
PCB118			**7.4**	**5.7**	**6.3**	**4.3**	**7.4**	**10**	**10**	**13**
PCB119			< 0.14	< 0.14	< 0.13	< 0.14	**0.67 J**	**0.77 J**	**1.0**	**1.3**

PCB Congeners (µg/kg)	ERL	ERM	B2-DU1-COMP		B2-DU2-COMP		B3-DU1-COMP		B3-DU2-COMP	
			Original Results	Re-analysis	Original Results	Re-analysis	Original Results	Re-analysis	Original Results	Re-analysis
PCB123			< 0.15	< 0.14	< 0.13	< 0.14	< 0.15	< 0.15	< 0.14	< 0.14
PCB126			< 0.23	< 0.23	< 0.21	< 0.22	< 0.23	< 0.23	< 0.22	< 0.22
PCB128			**1.8**	**0.98**	**1.3**	**0.7 J**	**1.3**	**2.0**	**2.1**	**2.2**
PCB138/158			**8.6**	**6.9**	**8.0**	**5.6**	**7.5**	**12**	**11**	**17**
PCB149			**5.6**	**4.2**	**7.6**	**4.2**	**5.6**	**7.3**	**8.0**	**13**
PCB151			**1.4**	**1.1**	**2.0**	**1.2**	**1.3**	**1.9**	**2.0**	**3.8**
PCB153			**9.1**	**6.8**	**9.2**	**6.7**	**8.7**	**12**	**13**	**18**
PCB156			**1.1**	**0.96**	**0.92**	**0.78**	**1.0**	**1.8**	**1.4**	**2.1**
PCB157			**1.2**	**0.93**	**0.78**	**0.95**	< 0.16	< 0.16	< 0.15	< 0.15
PCB167			< 0.17	< 0.16	< 0.15	< 0.16	**0.27 J**	**0.66 J**	< 0.16	< 0.16
PCB168			< 0.14	< 0.14	< 0.13	< 0.13	< 0.14	< 0.14	< 0.13	< 0.13
PCB169			< 0.14	< 0.13	< 0.13	< 0.13	< 0.14	< 0.14	< 0.13	< 0.13
PCB170			**2.6**	**2.1**	**2.3**	**2.8**	**1.8**	**2.0**	**3.1**	**5.5**
PCB177			**0.88**	**0.8 J**	**1.7**	**0.92**	**0.69 J**	**1.4**	**1.1**	**4.1**
PCB180			**3.9**	**2.9**	**3.9**	**4.6**	**3.2**	**4.8**	**4.8**	**9.2**
PCB183			**1.1**	**0.74 J**	**1.1**	**1.1**	**0.86**	**1.5**	**1.4**	**2.5**
PCB187			**2.6**	**2.0**	**5.3**	**2.6**	**2.2**	**3.4**	**3.7**	**8.6**
PCB189			< 0.14	< 0.14	< 0.13	< 0.13	< 0.14	< 0.14	< 0.13	< 0.13
PCB194			**1.1**	**0.95**	**1.3**	**2.2**	**1.2**	**1.9**	**1.8**	**2.3**
PCB201			**0.18 J**	**0.16 J**	**0.29 J**	**0.24 J**	**0.14 J**	**0.25 J**	**0.21 J**	**0.44 J**
PCB206			**1.0**	**0.76 J**	**1.2**	**0.96**	**0.61 J**	**0.56 J**	**1.5**	**1.2**

PCB Congeners (µg/kg)	ERL	ERM	B2-DU1-COMP		B2-DU2-COMP		B3-DU1-COMP		B3-DU2-COMP	
			Original Results	Re-analysis	Original Results	Re-analysis	Original Results	Re-analysis	Original Results	Re-analysis
Total PCB Congeners (ND = 0)	22.7	180	**104.83**	**84.65**	**109.13**	**75.13**	**92.23**	**127.66**	**160.99**	**207.64**

Notes:

= detected concentration is greater than ERL

= detected concentration is greater than ERM

Bold = detected result

*For totals, zeros were used for non-detect samples for summing. If all samples were non-detect, the highest method detection limit of all samples was used as the total result.

< = less than listed method detection limit

µg/kg = micrograms per kilogram

ERL = effects range low

ERM = effects range median

J = indicates an estimated value

ND = non-detect

PCB = polychlorinated biphenyl

3.3 Biological Testing

Biological test results for Basins 2 and 3 sediments are presented in this section. The laboratory report, including detailed results and raw data, is provided in Appendix C.

3.3.1 Solid Phase Testing

3.3.1.1 Amphipod Mortality Bioassay

Results of the 10-day amphipod SP test are summarized in Table 9. Mean survival in the control was 98 percent, which met control acceptability criterion. Mean survival in LA2-REF sediment was also 98 percent. Survival results in Basins 2 and 3 sediments were compared to survival in the reference sediment to determine suitability for ocean disposal. Survival in test sediments ranged from 95 to 98 percent, which is within 20 percent of the reference indicating sediments from Basins 2 and 3 are not acutely toxic to *A. abdita* and meet limiting permissible concentration (LPC) requirements for ocean disposal.

Table 9
Summary of Solid Phase Test Results Using *Ampelisca abdita*

Treatment	Mean Survival (%)	Standard Deviation (%)	Meets LPC for Ocean Disposal
Control	98	2.7	N/A
LA2-REF	98	4.5	N/A
B2-DU1-COMP	95	8.7	Yes
B2-DU2-COMP	96	4.2	Yes
B3-DU1-COMP	98	2.7	Yes
B3-DU2-COMP	98	4.5	Yes

Notes:
LPC = limiting permissible concentration
N/A = not applicable

3.3.1.2 Polychaete Mortality Bioassay

Results of the 10-day polychaete SP test are summarized in Table 10. Mean survival in the control was 100 percent, which met control acceptability criterion. Mean survival in LA2-REF sediment was 96 percent. Mean survival in Basins 2 and 3 samples were compared to reference survival to determine suitability for ocean disposal. Survival in test sediments

ranged from 88 to 100 percent, which is within 10 percent of the reference indicating that sediments from Basins 2 and 3 are not acutely toxic to *Neanthes arenaceodentata* and meet LPC requirements for ocean disposal.

Table 10
Summary of Solid Phase Test Results Using *Neanthes arenaceodentata*

Treatment	Mean Survival (%)	Standard Deviation (%)	Meets LPC for Ocean Disposal
Control	100	0	N/A
LA2-REF	96	8.9	N/A
B2-DU1-COMP	92	11	Yes
B2-DU2-COMP	100	0	Yes
B3-DU1-COMP	96	8.9	Yes
B3-DU2-COMP	88	18	Yes

Notes:
LPC = limiting permissible concentration
N/A = not applicable

3.3.2 Suspended Particulate Phase Testing

3.3.2.1 Bivalve Larval Development Bioassay

Results for the 48-hour bivalve larval SPP test are summarized in Table 11. Mean normal development in the controls ranged from 97.6 to 97.9 percent, which met control acceptability criterion. Mean survival in the controls ranged from 92.7 to 97.0 percent, which met control acceptability criterion. Mean normal development in the site water controls ranged from 98.7 to 99.3 percent. Mean survival in the site water controls ranged from 97.1 to 98.8 percent. Mean normal development in the test elutriates ranged from 0 to 98.8 percent. Mean survival in the test elutriates ranged from 78.3 to 99.2 percent. For samples B2-DU1-COMP, B2-DU2-COMP, and B3-DU2-COMP, normal development and survival was greater than 50 percent; therefore, the median effective concentration (EC_{50}) and median lethal concentration (LC_{50}), respectively, were assumed to be greater than 100 percent. Based on these results, sediments from these DUs are not toxic to bivalve larvae and meet LPC requirements for ocean disposal. For B3-DU1-COMP, the survival was greater than 50 percent; therefore, the LC_{50} was assumed to be greater than 100 percent. The EC_{50} for development was calculated to be 22.6 percent. To determine the need for best

management practices (BMPs) during disposal operations, the EC_{50} value for B3-DU1-COMP was used in the water column toxicity mixing model (i.e., STFATE). Results of STFATE modeling are presented separately in Section 3.4.

As described in Section 2.3, an ammonia reference toxicant test was run concurrently with the bivalve larval development bioassay due to the sensitivity of *M. galloprovincialis* to elevated ammonia concentrations. The EC_{50} in the ammonia reference toxicant test was 5.8 mg/L. The ammonia concentration in the 100 percent elutriate of B3-DU1-COMP was 14.5 mg/L, indicating that ammonia likely contributed to the observed toxicity in this sample.

Table 11
Summary of Suspended Particulate Phase Test Results Using *Mytilus galloprovincialis*

Sample ID	Treatment (%)	Mean Normal Development (%)	Standard Deviation (%)	EC_{50} (%)	Mean Survival (%)	Standard Deviation (%)	LC_{50} (%)	Meets LPC for Ocean Disposal
Control	N/A	97.6	0.6	N/A	92.7	4.9	N/A	N/A
Site water control	N/A	98.7	0.5	N/A	97.1	2.8	N/A	N/A
B2-DU1-COMP	1	98.6	0.7	> 100	94.6	4.0	> 100	Yes
	10	98.7	0.7		91.2	6.4		
	50	98.5	0.4		90.1	4.8		
	100	95.7	2.3		86.3	4.2		
Control	N/A	97.6	0.6	N/A	92.7	4.9	N/A	N/A
Site water control	N/A	98.7	0.5	N/A	97.1	2.8	N/A	N/A
B2-DU2-COMP	1	98.7	1.2	> 100	96.3	8.2	> 100	Yes
	10	97.2	1.5		98.1	4.0		
	50	97.6	1.4		91.3	6.2		
	100	97.2	0.6		89.6	6.1		
Control	N/A	97.9	0.5	N/A	97.0	3.0	N/A	N/A
Site water control	N/A	99.3	0.5	N/A	98.8	1.7	N/A	N/A

Sample ID	Treatment (%)	Mean Normal Development (%)	Standard Deviation (%)	EC_{50} (%)	Mean Survival (%)	Standard Deviation (%)	LC_{50} (%)	Meets LPC for Ocean Disposal
B3-DU1-COMP	1	98.8	1.2	22.6	99.1	1.9	> 100	Requires further assessment[1]
	10	98.4	0.9		99.2	1.7		
	50	**0.7**	0.5		**89.9**	6.1		
	100	**0**	0		97.4	2.9		
Control	N/A	97.9	0.5	N/A	97.0	3.0	N/A	N/A
Site water control	N/A	99.3	0.5	N/A	98.8	1.7	N/A	N/A
B3-DU2-COMP	1	98.8	1.2	> 100	97.7	2.9	> 100	Yes
	10	98.1	1.1		99.1	1.2		
	50	97.4	1.4		95.4	5.0		
	100	**93.0**	1.3		92.6	3.3		

Notes:
1 STFATE modeling was required to estimate whether disposal of sediment at the LA-2 disposal site would negatively impact aquatic life.
Bold = Value is significantly less than the control ($P < 0.05$).
EC_{50} = median effective concentration
LC_{50} = median lethal concentration
LPC = limiting permissible concentration
N/A = not applicable

3.3.2.2 Mysid Shrimp Bioassay

Results for the 96-hour mysid shrimp SPP test are summarized in Table 12. Mean survival in the controls was 98 percent, which met control acceptability criterion. Mean survival in the site water controls ranged from 98 to 100 percent. Mean survival in the test elutriates ranged from 96 to 100 percent. For each sample, survival was greater than 50 percent; therefore, the LC_{50} was assumed to be greater than 100 percent. Based on these results, sediments from Basins 2 and 3 are not toxic to *Americamysis bahia* and meet LPC requirements for ocean disposal.

Table 12

Summary of Suspended Particulate Phase Test Results Using *Americamysis bahia*

Sample ID	Treatment (%)	Mean Survival (%)	Standard Deviation (%)	EC_{50} (%)	Meets LPC for Ocean Disposal
Control	N/A	98	4.5	N/A	N/A
Site water control	N/A	98	4.5	N/A	N/A
B2-DU1-COMP	10	96	5.5	> 100	Yes
	50	100	0		
	100	96	5.5		
Control	N/A	98	4.5	N/A	N/A
Site water control	N/A	98	4.5	N/A	N/A
B2-DU2-COMP	10	98	4.5	> 100	Yes
	50	100	0		
	100	98	4.5		
Control	N/A	98	4.5	N/A	N/A
Site water control	N/A	100	0	N/A	N/A
B3-DU1-COMP	10	96	5.5	> 100	Yes
	50	98	4.5		
	100	98	4.5		
Control	N/A	98	4.5	N/A	N/A
Site water control	N/A	100	0	N/A	N/A
B3-DU2-COMP	10	100	0	> 100	Yes
	50	98	4.5		
	100	100	0		

Notes:
EC_{50} = median effective concentration
LPC = limiting permissible concentration
N/A = not applicable

3.3.2.3 Juvenile Fish Bioassay

Test results for the 96-hour juvenile fish SPP test are presented in Table 13. Mean survival in the controls ranged from 96 to 100 percent, which met control acceptability criterion. Mean survival in the site water controls was 98 percent. Mean survival in the test elutriates ranged from 84 to 100 percent. For each sample, survival was greater than 50 percent; therefore, the LC_{50} was assumed to be greater than 100 percent. Based on these results,

sediments from Basins 2 and 3 are not toxic to *Menidia beryllina* and meet LPC requirements for ocean disposal.

Table 13

Summary of Suspended Particulate Phase Test Results Using *Menidia beryllina*

Sample ID	Treatment (%)	Mean Survival (%)	Standard Deviation (%)	EC_{50} (%)	Meets LPC for Ocean Disposal
Control	N/A	96	5.5	N/A	N/A
Site water control	N/A	98	5.0	N/A	N/A
B2-DU1-COMP	10	100	0	> 100	Yes
	50	100	0		
	100	98	4.5		
Control	N/A	96	5.5	N/A	N/A
Site water control	N/A	98	5.0	N/A	N/A
B2-DU2-COMP	10	100	0	> 100	Yes
	50	100	0		
	100	100	0		
Control	N/A	100	0	N/A	N/A
Site water control	N/A	98	5.0	N/A	N/A
B3-DU1-COMP	10	96	5.0	> 100	Yes
	50	**86**	11		
	100	**84**	15		
Control	N/A	100	0	N/A	N/A
Site water control	N/A	98	5.0	N/A	N/A
B3-DU2-COMP	10	94	5.8	> 100	Yes
	50	96	5.5		
	100	100	0		

Notes:
Bold = Value is significantly less than the control ($P < 0.05$).
EC_{50} = median effective concentration
LPC = limiting permissible concentration
N/A = not applicable

3.3.3 Bioaccumulation Potential Testing

Test results for the 28-day BP tests are presented below. Following the 28-day exposure, organisms were placed into clean seawater for 24 hours to allow organisms to depurate the test sediment. After this purging process, tissues were shipped frozen to Calscience for chemical analysis. Tissue chemistry results are presented separately in Section 3.5.

3.3.3.1 Bivalve Bioaccumulation Test

Test results for the 28-day bivalve BP test are presented in Table 14. Mean survival in the control and reference sediments were 99.3 and 95.9 percent, respectively. Mean survival in Basins 2 and 3 samples ranged from 95.2 to 97.9 percent. Sufficient tissue mass was available at test completion for chemical analysis.

Table 14
Summary of Bioaccumulation Potential Test Results Using *Macoma nasuta*

Treatment	Mean Survival (%)	Standard Deviation (%)
Control	99.3	1.5
LA2-REF	95.9	4.5
B2-DU1-COMP	97.9	4.6
B2-DU2-COMP	97.2	1.5
B3-DU1-COMP	95.2	1.9
B3-DU2-COMP	97.9	3.1

3.3.3.2 Polychaete Bioaccumulation Test

Test results for the 28-day polychaete BP test are presented in Table 15. Mean survival in the control and reference sediment was 92.7 and 96.4 percent, respectively. Mean survival in Basins 2 and 3 samples ranged from 90.9 to 98.2 percent. Sufficient tissue mass was available at test completion for chemical analysis.

Table 15

Summary of Bioaccumulation Potential Test Results Using *Nereis virens*

Treatment	Mean Survival (%)	Standard Deviation (%)
Control	92.7	4.1
LA2-REF	96.4	5.0
B2-DU1-COMP	90.9	6.4
B2-DU2-COMP	98.2	4.1
B3-DU1-COMP	92.7	7.6
B3-DU2-COMP	94.5	5.0

3.4 Prediction of Water Column Toxicity During Disposal

STFATE is a data modeling tool used to evaluate the potential need for BMPs during disposal operations to prevent exposure that may cause toxic responses to sensitive organisms. The model simulates the movement of disposed material through the water column to the ocean bottom and then as it becomes re-suspended by the current. The model uses 0.01 of the LC_{50} or EC_{50} value to determine compliance with the LPC. The EC_{50} value of B3-DU1-COMP in the bivalve test was calculated to be 22.6 percent. Therefore, the toxicity criterion, or LPC, used in the model was 0.226 percent. The guidance states that the concentration of dredged material must be less than 0.01 times the LC_{50} or EC_{50} after 4 hours within the disposal site and at all times outside the disposal site.

The input parameters for LA-2 are listed in Table 16; complete results are included in Appendix D. Physical characteristics of sediment from B3-DU1-COMP were used as inputs to the model. Site-specific input parameters used were derived from the *Draft Environmental Impact Statement: Proposed Site Designation of the LA-3 Ocean Dredged Material Disposal Site off Newport Bay, Orange County, California* (USEPA/USACE 2004).

Table 16
STFATE Model Input Parameters

Parameter	Units	LA-2 Ocean Disposal Site Value
Site Description		
Number of Grid Points (left to right + x direction)	-	36
Number of Grid Points (top to bottom + z direction)	-	36
Grid Spacing (left to right)	feet	400
Grid Spacing (top to bottom)	feet	400
Variable Water Depth within Disposal Boundary	feet	360-1,115
Roughness Height at Bottom of Disposal Site	feet	0.005[1]
Bottom Slope (x-direction)	deg.	0
Bottom Slope (z-direction)	deg.	-7
Number of Points in Density Profile	-	3
Density at Point One (depth = 0 feet)	g/cc	1.0248
Density at Point Two (depth = 350 feet)	g/cc	1.0262
Density at Point Three (depth = 740 feet)	g/cc	1.0273
Velocity		
Type of Velocity Profile	-	Single depth average velocity
X-Direction Velocity (depth = 0 feet)	feet/sec	0.500
Z-Direction Velocity (depth = 0 feet)	feet/sec	0.500
Disposal Operation		
Disposal Point Top of Grid	feet	5,000
Disposal Point Left Edge of Grid	feet	5,000
Dumping Over Depression	-	0
Solid Fraction Volume Concentration	-	Gravel = 0.0, Sand = 0.145, Silt = 0.350, Clay = 0.098
Volume of Each Layer	cy	4,800
Length of Disposal Vessel Bin	feet	200
Width of Disposal Vessel Bin	feet	50
Pre-disposal Draft	feet	15
Post-disposal Draft	feet	2
Duration	sec	14,400
Long-term Time Step for Diffusion	sec	900
Time to Empty Vessel	sec	30

Parameter	Units	LA-2 Ocean Disposal Site Value
Location of Upper Left Corner of Disposal Site (distance from top edge)	feet	2,000
Location of Upper Left Corner of Disposal Site (distance from left edge)	feet	2,000
Location of Lower Right Corner of Disposal Site (distance from top edge)	feet	8,000
Location of Lower Right Corner of Disposal Site (distance from left edge)	feet	8,000
Coefficients		
Settling Coefficient	-	0.000[1]
Apparent Mass Coefficient	-	1.000[1]
Drag Coefficient	-	0.500[1]
Form Drag for Collapsing Cloud	-	0.500[1]
Skin Friction for Collapsing Cloud	-	0.010[1]
Drag for an Ellipsoidal Wedge	-	0.100[1]
Drag for a Plate	-	1.000[1]
Friction Between Cloud and Bottom	-	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	-	0.001[1]
Unstratified Water Vertical Diffusion Coefficient	-	0.0250[1]
Cloud/Ambient Density Gradient Ratio	-	0.250[1]
Turbulent Thermal Entrainment	-	0.235[1]
Entrainment in Collapse	-	0.100[1]
Stripping Factor	-	0.003[1]

Notes:
1 Model default value.
cy = cubic yards
deg. = degree
feet/sec = feet per second
g/cc = grams per cubic centimeter
sec = seconds

3.4.1 Results of STFATE Modeling

STFATE modeling results predicted that the maximum concentration of dredged material would be less than 0.01 of the LC_{50} (i.e., less than 0.226 percent) after 4 hours within the disposal site (Table 17). After 4 hours, the maximum concentration within the disposal boundary was 0.022 percent. In addition, the model predicted that the maximum

concentration of dredged material outside the disposal site boundaries was never greater than 0.226 percent (Table 17). The maximum concentration observed outside the disposal site was 0.078 percent. Based on STFATE modeling results, sediment from B3-DU1-COMP meets the LPC requirements for ocean disposal.

Table 17
STFATE Modeling Results

Site	Time (hours)	Depth (feet)	Maximum Concentration (%)	Dilution (%)	STFATE Summary Result
Maximum Concentration After 4 Hours within Disposal Site					
LA-2	4	0	0.396E-39	2.53E+41	Toxicity criteria for the disposal site were not violated; LPC met
	4	500	0.396E-39	2.53E+41	
	4	676	0.216E-01	4.63E+03	
	4	1,000	0.396E-39	2.53E+41	
Maximum Concentration Outside Disposal Boundary					
LA-2	1	0	0.297E-38	3.37E+40	Toxicity criteria for the disposal site were not violated; LPC met
	2	500	0.297E-38	3.37E+40	
	4	676	0.780E-01	1.28E+03	
	4	1,000	0.297E-38	3.37E+40	

Note:
LPC = limiting permissible concentration

3.5 Chemical Analysis of Tissue Residues

Sediment bioaccumulation tests were conducted using *Macoma nasuta* and *Nereis virens*. Chemical analysis of tissue residues was conducted to determine the bioaccumulation potential of sediment contaminants. Based on results of sediment chemistry, a subset of chemicals was selected for analysis that included mercury, DDTs, chlordane, and PCBs (see Table 1). The data evaluation consisted of comparing tissue burdens to the following:

- FDA action levels
- Reference sediment tissue burdens
- ERED (USACE/USEPA 2010)

Results of chemical analysis of bivalve and polychaete tissue residues are presented in Tables 18 and 19, respectively. All results are expressed in wet weight. MDLs, RLs, and raw data for the analyses are provided in Appendix B.

3.5.1 Comparison of Tissue Burdens to U.S. Food and Drug Administration Action Levels

A comparison of FDA action levels for poisonous or deleterious substances in fish and shellfish for human food is presented in Tables 18 and 19. The FDA action level for mercury is 1 milligram per kilogram (mg/kg) of methyl mercury. Methyl mercury is only a fraction of the total mercury concentration. All concentrations of mercury in tissues exposed to Basins 2 and 3 sediments were less than this action level. The FDA action level for DDT and DDE (individually or in combination) is 5,000 µg/kg. All DDT concentrations in tissues exposed to Basins 2 and 3 sediments were less than this action level. The FDA action level for chlordane is 300 µg/kg. All chlordane concentrations in tissues exposed to Basins 2 and 3 sediments were less than this action level. The FDA does not have an action level for PCBs. Total PCB concentrations were compared to the FDA tolerance level of 2,000 µg/kg. All PCBs concentrations in tissues exposed to Basins 2 and 3 sediments were less than this tolerance level. FDA actions levels were not exceeded; therefore, results were also compared to tissue concentrations of organisms exposed to reference sediment.

3.5.2 Comparison of Tissue Burdens to Reference Sediment Tissue Burdens

Bioaccumulation data were analyzed by statistically comparing chemical concentrations in tissues of organisms exposed to project material to tissues of organisms exposed to reference sediment (Appendix E). Organic chemical concentrations were normalized to lipid concentrations, and all data were log-transformed prior to analysis. Results of statistical analysis are presented in Tables 20 and 21.

Table 18
Results of Chemical Analyses of *Macoma nasuta* Tissue Residues

	FDA Action Level	Zero Time Rep A	Zero Time Rep B	Zero Time Rep C	LA2 REF Rep A	LA2 REF Rep B	LA2 REF Rep C	LA2 REF Rep D	LA2 REF Rep E	B2-DU1-COMP Rep A	B2-DU1-COMP Rep B	B2-DU1-COMP Rep C	B2-DU1-COMP Rep D	B2-DU1-COMP Rep E	B2-DU2-COMP Rep A	B2-DU2-COMP Rep B	B2-DU2-COMP Rep C	B2-DU2-COMP Rep D	B2-DU2-COMP Rep E	B3-DU1-COMP Rep A	B3-DU1-COMP Rep B	B3-DU1-COMP Rep C	B3-DU1-COMP Rep D	B3-DU1-COMP Rep E	B3-DU2-COMP Rep A	B3-DU2-COMP Rep B	B3-DU2-COMP Rep C	B3-DU2-COMP Rep D	B3-DU2-COMP Rep E
Conventional Parameters																													
% Lipids		**0.37**	**0.24**	**0.25**	**0.26**	**0.18**	**0.28**	**0.24**	**0.29**	**0.55**	**0.35**	**0.39**	**0.45**	**0.53**	**0.53**	**0.31**	**0.57**	**0.24**	**0.38**	**0.3**	**0.6**	**0.59**	**0.46**	**0.33**	**0.44**	**0.44**	**0.44**	**0.32**	**0.62**
Metals (mg/kg)																													
Mercury	1[3]	**0.00913 J**	**0.00882 J**	**0.00922**	**0.00988**	**0.00966**	**0.0111**	**0.0105**	**0.00964**	**0.0104**	**0.0143**	**0.0138**	**0.0149**	**0.0117**	**0.00919 J**	**0.00988**	**0.0101**	**0.0116**	**0.0109**	**0.0105**	**0.00907 J**	**0.011**	**0.0103**	**0.00817 J**	**0.0134**	**0.012**	**0.0129**	**0.00943**	**0.0101**
Pesticides (µg/kg)																													
2,4'-DDD		< 0.4	< 0.4	< 0.41	< 0.4	< 0.41	< 0.4	< 0.41	< 0.4	< 0.4	< 0.41	< 0.4	< 0.41	< 0.41	< 0.4	< 0.4	< 0.4	< 0.41	< 0.41	< 0.4	< 0.4	< 0.41	< 0.4	< 0.4	< 0.4	< 0.41	< 0.4	< 0.4	< 0.4
2,4'-DDE	5000[4]	< 0.18	< 0.19	< 0.19	< 0.18	< 0.19	< 0.18	< 0.19	< 0.19	< 0.18	< 0.19	< 0.19	< 0.19	< 0.19	< 0.18	< 0.18	< 0.19	< 0.19	< 0.19	< 0.18	< 0.19	< 0.19	< 0.18	< 0.19	< 0.18	< 0.19	< 0.18	< 0.18	< 0.19
2,4'-DDT	5000[4]	< 0.3	< 0.31	< 0.31	< 0.3	< 0.31	< 0.3	< 0.31	< 0.31	< 0.3	< 0.31	< 0.31	< 0.31	< 0.31	< 0.3	< 0.3	< 0.31	< 0.31	< 0.31	< 0.3	< 0.31	< 0.31	< 0.3	< 0.31	< 0.3	< 0.31	< 0.3	< 0.3	< 0.31
4,4'-DDD		< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18
4,4'-DDT	5000[4]	< 0.38	< 0.38	< 0.39	< 0.38	< 0.39	< 0.38	< 0.39	< 0.39	< 0.38	< 0.39	< 0.38	< 0.39	< 0.39	< 0.38	< 0.38	< 0.38	< 0.39	< 0.39	< 0.38	< 0.38	< 0.39	< 0.38	< 0.38	< 0.38	< 0.39	< 0.38	< 0.38	< 0.38
4,4'-DDE	5000[4]	< 0.25	< 0.25	< 0.25	**4.1**	**2.9**	**4.1**	**3.5**	**6.2**	**13**	**7.5**	**9.2**	**10**	**13**	**13**	**9.8**	**14**	**9**	**11**	**8.9**	**17**	**14**	**11**	**8.4**	**15**	**16**	**14**	**13**	**17**
Total DDTs (ND = 0)[1]	5000[4]	< 0.4	< 0.4	< 0.41	**4.1**	**2.9**	**4.1**	**3.5**	**6.2**	**13**	**7.5**	**9.2**	**10**	**13**	**13**	**9.8**	**14**	**9**	**11**	**8.9**	**17**	**14**	**11**	**8.4**	**15**	**16**	**14**	**13**	**17**
Alpha Chlordane		< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25											< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Gamma Chlordane		< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21											< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21
Cis-nonachlor		< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42											**0.6 J**	**0.99 J**	**1.1**	**0.82 J**	**0.61 J**	**1.7**	**1.4**	**1**	**1**	**1.1**
Oxychlordane		< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22											< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22
Trans-nonachlor		< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3											< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Total Chlordanes (ND = 0)[2]	300	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42											**0.6 J**	**0.99 J**	**1.1**	**0.82 J**	**0.61 J**	**1.7**	**1.4**	**1**	**1**	**1.1**
PCB Congeners (µg/kg)																													
PCB018		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.39 J**	**0.36 J**	< 0.13	< 0.13	**0.46 J**	**0.34 J**	**0.54**	**0.2 J**	< 0.13	**0.52**	**0.99**	**0.68**	**0.3 J**	**0.25 J**	**0.58**	**0.58**	**0.68**	**0.4 J**	**0.9**
PCB028		< 0.096	< 0.096	< 0.097	< 0.096	< 0.097	< 0.096	< 0.097	< 0.097	**0.78**	**0.46 J**	**0.46 J**	**0.56**	**0.77**	**0.7**	**0.58**	**0.72**	**0.44 J**	**0.48 J**	**0.78**	**1.4**	**1**	**0.78**	**0.53**	**1.4**	**1.3**	**1.4**	**1**	**1.5**
PCB037		< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	**0.2 J**	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
PCB044		< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	< 0.064	**0.32 J**	**0.2 J**	**0.25 J**	**0.27 J**	**0.35 J**	**0.29 J**	**0.24 J**	**0.28 J**	**0.71**	**0.43 J**	**0.31 J**	**0.28 J**	**0.41 J**	**0.4 J**	**0.45 J**	**0.32 J**	**0.37 J**
PCB049		< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	**0.87**	**0.45 J**	**0.43 J**	**0.66**	**0.77**	**1.5**	**1.3**	**2.1**	**0.98**	**1.6**	**0.8**	**1.7**	**1.4**	**1.1**	**0.75**	**2.3**	**2.4**	**2.2**	**1.7**	**2.4**
PCB052		< 0.057	< 0.057	< 0.058	< 0.057	< 0.058	< 0.057	< 0.058	< 0.058	**1.2**	**0.58**	**0.78**	**0.72**	**1.1**	**1.8**	**1.8**	**2.3**	**1.2**	**1.8**	**1.1**	**2.1**	**1.9**	**1.2**	**0.91**	**2.4**	**2.5**	**2.1**	**1.8**	**2.6**
PCB056		< 0.092	< 0.093	< 0.093	< 0.092	< 0.093	< 0.092	< 0.093	< 0.093	**0.58**	**0.36 J**	**0.28 J**	**0.46 J**	**0.67**	**0.36 J**	**0.35 J**	**0.43 J**	**0.24 J**	< 0.093	**0.33 J**	**1**	**0.77**	**0.35 J**	**0.24 J**	**0.7**	**0.45 J**	**0.58**	**0.26 J**	**0.64**
PCB066		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**1.4**	**0.81**	**0.81**	**1**	**1.3**	**1.2**	**1.1**	**1.4**	**0.82**	**1.1**	**0.85**	**2**	**1.3**	**0.98**	**0.76**	**1.7**	**1.7**	**1.6**	**1.3**	**1.6**
PCB070		< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	< 0.082	**0.97**	**0.51**	**0.61**	**0.73**	**0.88**	**0.97**	**0.9**	**1.1**	**0.68**	**0.8**	**0.7**	**1.5**	**1.1**	**0.9**	**0.65**	**1.3**	**1.4**	**1.2**	**1**	**1.3**
PCB074		< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	**0.65**	**0.34 J**	**0.35 J**	**0.39 J**	**0.58**	**0.52**	**0.48 J**	**0.61**	**0.32 J**	**0.43 J**	**0.38 J**	**0.88**	**0.68**	**0.48 J**	**0.38 J**	**0.72**	**0.66**	**0.6**	**0.53**	**0.66**
PCB077		< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	**0.45 J**	< 0.14	**0.28 J**	< 0.14	**0.26 J**	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14
PCB081		< 0.081	< 0.082	< 0.082	< 0.081	< 0.082	< 0.081	< 0.082	< 0.082	< 0.081	< 0.082	< 0.082	< 0.082	< 0.082	< 0.081	< 0.081	< 0.082	< 0.082	< 0.082	< 0.081	< 0.082	< 0.082	< 0.081	< 0.082	< 0.081	< 0.082	< 0.081	< 0.081	< 0.082
PCB087		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.46 J**	**0.3 J**	**0.27 J**	**0.34 J**	< 0.13	< 0.13	**0.29 J**	**0.51**	< 0.13	**0.33 J**	< 0.13	**0.53**	< 0.13	< 0.13	< 0.13	**0.47 J**	**0.47 J**	< 0.13	**0.36 J**	**0.41 J**
PCB099		< 0.073	< 0.074	< 0.074	< 0.073	< 0.074	< 0.073	< 0.074	< 0.074	**1.2**	**0.72**	**0.81**	**0.92**	**1.2**	**2**	**1.8**	**2.4**	**1.2**	**1.8**	**0.7**	**1.4**	**1.1**	**0.8**	**0.7**	**1.7**	**1.9**	**1.8**	**1.4**	**1.9**
PCB101		< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	< 0.065	**1.8**	**1.1**	**1.1**	**1.3**	**1.8**	**2.7**	**2.4**	**3.3**	**1.7**	**2.6**	**1.1**	**2.1**	**1.7**	**1.3**	**1.1**	**2.3**	**2.6**	**2.3**	**1.9**	**2.5**
PCB105		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.52**	**0.38 J**	**0.33 J**	**0.33 J**	**0.49 J**	**0.47 J**	**0.45 J**	**0.53**	**0.32 J**	**0.38 J**	**0.35 J**	**0.56**	**0.59**	**0.44 J**	**0.3 J**	**0.44 J**	**0.49 J**	**0.35 J**	**0.36 J**	**0.45 J**
PCB110		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	**1.6**	**0.86**	**1**	**1.1**	**1.6**	**1.7**	**1.7**	**1.8**	**0.98**	**1.4**	**0.86**	**1.7**	**1.6**	**1.1**	**0.89**	**1.8**	**1.9**	**1.7**	**1.4**	**1.8**
PCB114		< 0.093	< 0.094	< 0.094	< 0.093	< 0.094	< 0.093	< 0.094	< 0.094	< 0.093	< 0.094	< 0.094	< 0.094	< 0.094	< 0.093	< 0.093	< 0.094	< 0.094	< 0.094	< 0.093	< 0.094	< 0.094	< 0.093	< 0.094	< 0.093	< 0.094	< 0.093	< 0.093	< 0.094
PCB118		< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	**1.5**	**0.97**	**1.1**	**1.2**	**1.7**	**1.7**	**1.5**	**2**	**1.1**	**1.5**	**0.99**	**2**	**1.7**	**1.2**	**0.98**	**1.8**	**1.9**	**1.9**	**1.4**	**2**
PCB119		< 0.063	< 0.064	< 0.064	< 0.063	< 0.064	< 0.063	< 0.064	< 0.064	< 0.063	< 0.064	< 0.064	< 0.064	< 0.064	**0.2 J**	**0.21 J**	**0.29 J**	< 0.064	**0.21 J**	< 0.063	< 0.064	< 0.064	< 0.063	< 0.064	**0.17 J**	**0.26 J**	< 0.063	**0.18 J**	**0.22 J**
PCB123		< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
PCB126		< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23
PCB128		< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	**0.25 J**	< 0.11	**0.17 J**	**0.27 J**	**0.26 J**	**0.24 J**	**0.25 J**	**0.26 J**	< 0.11	< 0.11	< 0.11	**0.3 J**	**0.2 J**	< 0.11	< 0.11	**0.23 J**	< 0.11	< 0.11	**0.21 J**	**0.17 J**
PCB138/158		< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	**1.3**	**0.76 J**	**0.81 J**	**0.97 J**	**1.4**	**1.4**	**1.5**	**1.7**	**0.89 J**	**1.3**	**0.69 J**	**1.4**	**1.3**	**0.87 J**	**0.7 J**	**1.2**	**1.3**	**1.2**	**1.1**	**1.3**
PCB149		< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	**0.88**	**0.54**	**0.55**	**0.67**	**0.99**	**1.4**	**1.4**	**1.9**	**0.9**	**1.4**	**0.47 J**	**0.92**	**0.85**	**0.63**	**0.47 J**	**1.1**	**1.2**	**1.1**	**0.9**	**1.2**
PCB151		< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	**0.22 J**	< 0.15	**0.22 J**	**0.19 J**	**0.3 J**	**0.41 J**	**0.47 J**	**0.57**	**0.3 J**	**0.47 J**	< 0.15	**0.36 J**	**0.41 J**	**0.2 J**	< 0.15	**0.3 J**	**0.36 J**	**0.35 J**	**0.27 J**	**0.35 J**
PCB153		< 0.072	< 0.072	< 0.073	< 0.072	< 0.073	< 0.072	< 0.073	< 0.073	**1.5**	**0.9**	**0.95**	**1.1**	**1.4**	**1.9**	**2**	**2.4**	**1.2**	**1.8**	**0.76**	**1.5**	**1.3**	**1**	**0.77**	**1.5**	**1.7**	**1.6**	**1.4**	**1.7**
PCB156		< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23
PCB157		< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14
PCB167		< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12
PCB168		< 0.095	< 0.096	< 0.096	< 0.095	< 0.096	< 0.095	< 0.096	< 0.096	< 0.095	< 0.096	< 0.096	< 0.096	< 0.096	< 0.095	< 0.095	< 0.096	< 0.096	< 0.096	< 0.095	< 0.096	< 0.096	< 0.095	< 0.096	< 0.095	< 0.096	< 0.095	< 0.095	< 0.096
PCB169		< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18
PCB170		< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23
PCB177		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
PCB180		< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	**0.3 J**	**0.26 J**	< 0.16	**0.21 J**	**0.31 J**	**0.36 J**	**0.41 J**	**0.44 J**	**0.27 J**	**0.39 J**	< 0.16	**0.33 J**	**0.35 J**	< 0.16	< 0.16	**0.32 J**	**0.32 J**	**0.35 J**	**0.26 J**	**0.32 J**
PCB183		< 0.099	< 0.099	< 0.1	< 0.099	< 0.1	< 0.099	< 0.1	< 0.1	< 0.099	< 0.1	< 0.099	< 0.1	< 0.1	< 0.099	**0.15 J**	**0.16 J**	< 0.1	< 0.1	< 0.099	< 0.099	< 0.1	< 0.099	< 0.099	< 0.099	< 0.1	< 0.099	< 0.099	< 0.099
PCB187		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.27 J**	**0.17 J**	**0.16 J**	**0.19 J**	**0.28 J**	**0.39 J**	**0.42 J**	**0.58**	**0.25 J**	**0.47 J**	< 0.13	**0.34 J**	**0.25 J**	< 0.13	< 0.13	**0.23 J**	**0.29 J**	**0.41 J**	**0.29 J**	**0.39 J**

Table 18
Results of Chemical Analyses of *Macoma nasuta* Tissue Residues

	FDA Action Level	Zero Time Rep A	Zero Time Rep B	Zero Time Rep C	LA2 REF Rep A	LA2 REF Rep B	LA2 REF Rep C	LA2 REF Rep D	LA2 REF Rep E	B2-DU1-COMP Rep A	B2-DU1-COMP Rep B	B2-DU1-COMP Rep C	B2-DU1-COMP Rep D	B2-DU1-COMP Rep E	B2-DU2-COMP Rep A	B2-DU2-COMP Rep B	B2-DU2-COMP Rep C	B2-DU2-COMP Rep D	B2-DU2-COMP Rep E	B3-DU1-COMP Rep A	B3-DU1-COMP Rep B	B3-DU1-COMP Rep C	B3-DU1-COMP Rep D	B3-DU1-COMP Rep E	B3-DU2-COMP Rep A	B3-DU2-COMP Rep B	B3-DU2-COMP Rep C	B3-DU2-COMP Rep D	B3-DU2-COMP Rep E
PCB189		< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
PCB194		< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
PCB201		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
PCB206		< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23
Total PCB Congeners (ND = 0)	2000[5]	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	< 0.29	**18.25**	**10.86**	**11.55**	**13.63**	**18**	**22.63**	**22.07**	**28.84**	**14.28**	**20.78**	**11.66**	**26.18**	**20.61**	**13.94**	**10.66**	**25.07**	**26.08**	**23.87**	**19.74**	**26.68**

Notes:

For totals, zeroes were used for non-detect samples for summing. If all samples were non-detect, the highest method detection limit of all samples was used as the total result.

1 Total DDTs are the sum of: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT.

2 Total Chlordanes are the sum of Alpha Chlordane and Gamma Chlordane.

3 Action level for methyl mercury.

4 Action level for DDT and DDE (individually or in combination).

5 Tolerance level for PCBs. No action level.

Bold = detected result

< = less than listed method detection limit

- = results not reported or not applicable

µg/kg = microgram per kilogram

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

FDA = U.S. Food and Drug Administration

J = indicates an estimated value

mg/kg = milligrams per kilogram

ND = not detected

PCB = polychlorinated biphenyl

Table 19
Results of Chemical Analyses of *Nereis virens* Tissue Residues

	FDA Action Level	Zero Time Rep A	Zero Time Rep B	Zero Time Rep C	LA2 REF Rep A	LA2 REF Rep B	LA2 REF Rep C	LA2 REF Rep D	LA2 REF Rep E	B2-DU1-COMP Rep A	B2-DU1-COMP Rep B	B2-DU1-COMP Rep C	B2-DU1-COMP Rep D	B2-DU1-COMP Rep E	B2-DU2-COMP Rep A	B2-DU2-COMP Rep B	B2-DU2-COMP Rep C	B2-DU2-COMP Rep D	B2-DU2-COMP Rep E	B3-DU1-COMP Rep A	B3-DU1-COMP Rep B	B3-DU1-COMP Rep C	B3-DU1-COMP Rep D	B3-DU1-COMP Rep E	B3-DU2-COMP Rep A	B3-DU2-COMP Rep B	B3-DU2-COMP Rep C	B3-DU2-COMP Rep D	B3-DU2-COMP Rep E
Conventional Parameters																													
% Lipids		**0.59**	**0.51**	**1.2**	**0.99**	**0.98**	**1**	**0.73**	**0.64**	**0.53**	**0.81**	**0.87**	**0.86**	**0.74**	**0.67**	**0.8**	**0.93**	**0.8**	**0.95**	**0.94**	**0.85**	**0.92**	**0.76**	**0.87**	**0.81**	**0.73**	**0.73**	**0.72**	**0.87**
Metals (mg/kg)																													
Mercury	1[3]	**0.0426**	**0.0442**	**0.028**	**0.0247**	**0.0209**	**0.0202**	**0.025**	**0.0237**	**0.0374**	**0.039**	**0.036**	**0.0387**	**0.0389**	**0.0339**	**0.0339**	**0.0293**	**0.0244**	**0.0171**	**0.0311**	**0.0401**	**0.0331**	**0.0209**	**0.0184**	**0.024**	**0.0217**	**0.0178**	**0.0169**	**0.0209**
Pesticides (µg/kg)																													
2,4'-DDD		< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.41	< 0.4	< 0.4	< 0.4	< 0.41	< 0.4	< 0.4	< 0.41	< 0.41	< 0.4	< 0.4	< 0.4	< 0.41	< 0.41	< 0.4	< 0.4	< 0.41	< 0.4	< 0.41
2,4'-DDE	5000[4]	< 0.19	< 0.18	< 0.18	< 0.18	< 0.18	< 0.19	< 0.18	< 0.19	< 0.18	< 0.19	< 0.19	< 0.18	< 0.18	< 0.19	< 0.18	< 0.18	< 0.19	< 0.19	< 0.19	< 0.18	< 0.18	< 0.19	< 0.19	< 0.18	< 0.18	< 0.19	< 0.18	< 0.19
2,4'-DDT	5000[4]	< 0.31	< 0.3	< 0.3	< 0.3	< 0.3	< 0.31	< 0.3	< 0.31	< 0.3	< 0.31	< 0.31	< 0.3	< 0.3	< 0.31	< 0.3	< 0.3	< 0.31	< 0.31	< 0.31	< 0.3	< 0.3	< 0.31	< 0.31	< 0.3	< 0.3	< 0.31	< 0.3	< 0.31
4,4'-DDD		< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18
4,4'-DDT	5000[4]	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39	< 0.38	< 0.38	< 0.38	< 0.39	< 0.38	< 0.38	< 0.39	< 0.39	< 0.38	< 0.38	< 0.38	< 0.39	< 0.39	< 0.38	< 0.38	< 0.39	< 0.38	< 0.39
4,4'-DDE	5000[4]	< 0.25	< 0.25	< 0.25	**1.1**	**0.63 J**	**0.87 J**	**1**	**0.57 J**	**0.86 J**	**1.3**	**1.6**	**1.6**	**1.5**	**0.76 J**	**1.9**	**1.8**	**1**		**2.3**	**2.2**	**0.89 J**	**1.2**	**1.9**	**2.1**	**2.4**	**2.3**	**1.7**	**1.2**
Total DDTs (ND = 0)[1]	5000[4]	< 0.4	< 0.4	< 0.4	**1.1**	**0.63 J**	**0.87 J**	**1**	**0.57 J**	**0.86 J**	**1.3**	**1.6**	**1.6**	**1.5**	**0.76 J**	**1.9**	**1.8**	**1**	< 0.41	**2.3**	**2.2**	**0.89 J**	**1.2**	**1.9**	**2.1**	**2.4**	**2.3**	**1.7**	**1.2**
Alpha Chlordane		< 0.25	< 0.24	< 0.24	< 0.24	< 0.24	< 0.25	< 0.25	< 0.25											< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Gamma Chlordane		< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21											< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21
Cis-nonachlor		< 0.42	< 0.41	**1.8**	**1.8**	**1.7**	**1.3**	**0.77 J**	**0.79 J**											< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42
Oxychlordane		**0.26 J**	**0.27 J**	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22											< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22	< 0.22
Trans-nonachlor		< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3											< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Total Chlordanes (ND = 0)[2]	300	**0.26 J**	**0.27 J**	**1.8**	**1.8**	**1.7**	**1.3**	**0.77 J**	**0.79 J**											< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42	< 0.42
PCB Congeners (µg/kg)																													
PCB018		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.28 J**	**0.4 J**	**0.46 J**	**0.33 J**	**0.41 J**	**0.46 J**	**0.47 J**	**0.66**	**0.56**	**1.4**	**1.5**	**0.94**	**0.64**	**0.84**	**0.75**	**1**	**1.1**	**1.5**	**0.7**	**1**
PCB028		< 0.096	< 0.095	< 0.095	< 0.095	< 0.095	< 0.096	< 0.096	< 0.096	**0.29 J**	**0.37 J**	**0.4 J**	**0.26 J**	**0.46 J**	**0.32 J**	**0.36 J**	**0.45 J**	**0.43 J**	**0.94**	**0.85**	**0.61**	**0.42 J**	**0.61**	**0.5**	**0.81**	**0.93**	**1.7**	**0.67**	**0.86**
PCB037		< 0.11	< 0.1	< 0.1	< 0.1	< 0.1	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	**0.52**	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
PCB044		< 0.064	< 0.063	< 0.063	< 0.063	< 0.063	< 0.064	< 0.064	< 0.064	**0.28 J**	**0.3 J**	**0.56**	**0.4 J**	**0.33 J**	**0.25 J**	**0.26 J**	**0.44 J**	**0.34 J**	**0.95**	**0.62**	**0.53**	**0.31 J**	**0.41 J**	**0.42 J**	**0.48 J**	**0.49 J**	**0.5 J**	**0.37 J**	**0.36 J**
PCB049		< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	**0.23 J**	**0.39 J**	**0.43 J**	**0.34 J**	**0.5 J**	**0.58**	**0.75**	**1.1**	**0.75**	**1.6**	**0.76**	**0.63**	**0.52**	**0.55**	**0.59**	**1.1**	**1.4**	**1.9**	**0.96**	**1.2**
PCB052		< 0.057	< 0.057	< 0.057	< 0.057	< 0.057	< 0.057	< 0.057	< 0.057	**0.71**	**1.2**	**1.1**	**1**	**1.1**	**1.2**	**1.8**	**2.8**	**1.9**	**3.1**	**2.1**	**1.6**	**1.4**	**1.4**	**1.6**	**2.6**	**2.8**	**4.3**	**2.1**	**2.8**
PCB056		< 0.093	< 0.092	< 0.092	< 0.092	< 0.092	< 0.093	< 0.092	< 0.093	< 0.092	< 0.093	**0.25 J**	< 0.092	< 0.092	< 0.093	< 0.092	< 0.092	< 0.093	**1.1**	**0.27 J**	**0.28 J**	**0.22 J**	< 0.093	< 0.093	< 0.092	< 0.092	**0.17 J**	< 0.092	< 0.093
PCB066		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.48 J**	**0.67**	**0.74**	**0.47 J**	**0.71**	**0.52**	**0.53**	**0.82**	**0.63**	**1.6**	**0.89**	**0.71**	**0.61**	**0.62**	**0.67**	**0.91**	**0.98**	**1.3**	**0.76**	**1.1**
PCB070		< 0.082	< 0.081	< 0.081	< 0.081	< 0.081	< 0.082	< 0.082	< 0.082	**0.21 J**	**0.19 J**	**0.3 J**	**0.16 J**	**0.18 J**	**0.23 J**	**0.19 J**	**0.28 J**	**0.28 J**	**1**	**0.36 J**	**0.32 J**	**0.2 J**	**0.16 J**	**0.3 J**	**0.27 J**	**0.37 J**	**0.37 J**	**0.26 J**	**0.27 J**
PCB074		< 0.15	< 0.14	< 0.14	< 0.14	< 0.14	< 0.15	< 0.15	< 0.15	**0.16 J**	**0.15 J**	**0.23 J**	< 0.15	**0.26 J**	**0.17 J**	**0.17 J**	**0.26 J**	**0.24 J**	**0.65**	**0.29 J**	**0.27 J**	**0.2 J**	**0.23 J**	< 0.15	**0.23 J**	**0.31 J**	**0.38 J**	**0.22 J**	**0.28 J**
PCB077		< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14
PCB081		< 0.082	< 0.081	< 0.081	< 0.081	< 0.081	< 0.082	< 0.081	< 0.082	< 0.081	< 0.082	< 0.082	< 0.081	< 0.081	< 0.082	< 0.081	< 0.081	< 0.082	< 0.082	< 0.082	< 0.081	< 0.081	< 0.082	< 0.082	< 0.081	< 0.081	< 0.082	< 0.081	< 0.082
PCB087		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
PCB099		< 0.074	< 0.073	**0.29 J**	**0.28 J**	**0.32 J**	**0.26 J**	**0.19 J**	**0.22 J**	**0.59**	**0.8**	**0.69**	**0.63**	**0.82**	**0.77**	**1.1**	**1.6**	**1.2**	**1.9**	**0.94**	**0.75**	**0.71**	**0.73**	**0.85**	**1.3**	**1.4**	**1.8**	**1.1**	**1.3**
PCB101		< 0.065	< 0.064	**0.61**	**0.57**	**0.49 J**	**0.48 J**	**0.31 J**	**0.43 J**	**0.98**	**1.4**	**1.3**	**1.3**	**1.5**	**1.5**	**1.9**	**2.8**	**2**	**3**	**1.6**	**1.3**	**1.2**	**1.2**	**1.5**	**2.2**	**2.2**	**2.6**	**1.8**	**2**
PCB105		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	**0.25 J**	**0.38 J**	**0.46 J**	**0.36 J**	**0.41 J**	**0.5**	**0.33 J**	**0.35 J**	**0.43 J**	**0.38 J**	**0.52**	**0.48 J**	**0.44 J**	**0.38 J**	**0.49 J**	**0.4 J**	**0.43 J**	**0.55**	**0.5 J**	**0.45 J**	**0.39 J**
PCB110		< 0.2	< 0.2	**0.32 J**	**0.31 J**	< 0.2	< 0.2	**0.22 J**	< 0.2	**0.56**	**0.85**	**0.92**	**0.82**	**1**	**0.73**	**0.82**	**1.3**	**0.99**	**1.4**	**1.1**	**0.92**	**0.84**	**0.97**	**0.94**	**1.1**	**1.2**	**1.1**	**1.1**	**1.2**
PCB114		< 0.094	< 0.093	< 0.093	< 0.093	< 0.093	< 0.094	< 0.093	< 0.094	< 0.093	< 0.094	< 0.094	< 0.093	< 0.093	< 0.094	< 0.093	< 0.093	< 0.094	< 0.094	< 0.094	< 0.093	< 0.093	< 0.094	< 0.094	< 0.093	< 0.093	< 0.094	< 0.093	< 0.094
PCB118		< 0.15	< 0.15	**0.47 J**	**0.5 J**	**0.43 J**	**0.39 J**	**0.22 J**	**0.33 J**	**0.56**	**0.9**	**0.85**	**0.62**	**0.92**	**0.68**	**0.69**	**1.1**	**0.91**	**1.3**	**1.1**	**0.94**	**0.8**	**0.73**	**1**	**1.1**	**1.2**	**1.3**	**1.1**	**1.1**
PCB119		< 0.064	< 0.063	< 0.063	< 0.063	< 0.063	< 0.064	< 0.063	< 0.064	< 0.063	< 0.064	< 0.064	< 0.063	< 0.063	< 0.064	< 0.063	< 0.063	< 0.064	< 0.064	< 0.064	< 0.063	< 0.063	< 0.064	< 0.064	< 0.063	< 0.063	< 0.064	< 0.063	< 0.064
PCB123		< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
PCB126		< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23
PCB128		< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	**0.23 J**	< 0.11	< 0.11	< 0.11	< 0.11	**0.22 J**	**0.26 J**	< 0.11	< 0.11	< 0.11	< 0.11	**0.27 J**	< 0.11	**0.18 J**	< 0.11	< 0.11
PCB138/158		**0.3 J**	< 0.29	**1.1**	**1.3**	**1.2**	**1.2**	**0.66 J**	**0.95 J**	**0.87 J**	**1.4**	**1.2**	**1.3**	**1.5**	**1.2**	**1.2**	**1.8**	**1.7**	**2.1**	**1.6**	**1.4**	**1.3**	**1.4**	**1.7**	**1.8**	**1.8**	**1.6**	**1.5**	**1.7**
PCB149		< 0.22	< 0.22	**0.66**	**0.83**	**0.89**	**0.71**	**0.48 J**	**0.61**	**0.58**	**0.88**	**0.94**	**0.87**	**1**	**0.91**	**1.2**	**1.7**	**1.5**	**2.1**	**1.1**	**0.91**	**0.96**	**0.99**	**1.1**	**1.4**	**1.5**	**1.3**	**1.3**	**1.3**
PCB151		< 0.15	< 0.15	**0.2 J**	**0.27 J**	**0.27 J**	**0.21 J**	**0.16 J**	**0.24 J**	**0.15 J**	**0.33 J**	**0.25 J**	**0.26 J**	**0.68**	**0.3 J**	**0.39 J**	**0.62**	**0.5 J**	**0.71**	**0.35 J**	**0.38 J**	**0.32 J**	**0.29 J**	**0.39 J**	**0.48 J**	**0.44 J**	**0.51**	**0.39 J**	**0.35 J**
PCB153		**0.44 J**	**0.38 J**	**1.3**	**1.8**	**1.9**	**1.6**	**0.96**	**1.4**	**1**	**1.7**	**1.6**	**1.7**	**1.7**	**1.4**	**1.7**	**2.4**	**2.4**	**3.2**	**2**	**1.7**	**1.8**	**1.9**	**2.3**	**2.5**	**2.5**	**2.4**	**2.2**	**2.4**
PCB156		< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23	< 0.23
PCB157		< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14	< 0.14
PCB167		< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12
PCB168		< 0.096	< 0.095	< 0.095	< 0.095	< 0.095	< 0.096	< 0.095	< 0.096	< 0.095	< 0.096	< 0.096	< 0.095	< 0.095	< 0.096	< 0.095	< 0.095	< 0.096	< 0.096	< 0.096	< 0.095	< 0.095	< 0.096	< 0.096	< 0.095	< 0.095	< 0.096	< 0.095	< 0.096
PCB169		< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18	< 0.18
PCB170		< 0.23	< 0.23	**0.28 J**	**0.35 J**	**0.31 J**	**0.31 J**	< 0.23	**0.26 J**	< 0.23	**0.26 J**	**0.32 J**	**0.24 J**	**0.31 J**	< 0.23	**0.24 J**	**0.35 J**	**0.51**	**0.52**	**0.31 J**	**0.25 J**	**0.28 J**	**0.3 J**	**0.45 J**	**0.39 J**	**0.34 J**	**0.31 J**	**0.32 J**	**0.37 J**
PCB177		< 0.2	< 0.19	< 0.19	**0.22 J**	**0.25 J**	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	**0.2 J**	< 0.2	< 0.2	< 0.2	**0.31 J**	**0.27 J**	< 0.2	< 0.2	< 0.2	< 0.2	**0.22 J**	**0.2 J**	**0.21 J**	**0.21 J**	< 0.2	**0.21 J**

Table 19
Results of Chemical Analyses of *Nereis virens* Tissue Residues

	FDA Action Level	Zero Time Rep A	Zero Time Rep B	Zero Time Rep C	LA2 REF Rep A	LA2 REF Rep B	LA2 REF Rep C	LA2 REF Rep D	LA2 REF Rep E	B2-DU1-COMP Rep A	B2-DU1-COMP Rep B	B2-DU1-COMP Rep C	B2-DU1-COMP Rep D	B2-DU1-COMP Rep E	B2-DU2-COMP Rep A	B2-DU2-COMP Rep B	B2-DU2-COMP Rep C	B2-DU2-COMP Rep D	B2-DU2-COMP Rep E	B3-DU1-COMP Rep A	B3-DU1-COMP Rep B	B3-DU1-COMP Rep C	B3-DU1-COMP Rep D	B3-DU1-COMP Rep E	B3-DU2-COMP Rep A	B3-DU2-COMP Rep B	B3-DU2-COMP Rep C	B3-DU2-COMP Rep D	B3-DU2-COMP Rep E
PCB180		**0.21 J**	< 0.16	**0.67**	**0.99**	**0.91**	**0.83**	**0.5**	**0.63**	**0.36 J**	**0.56**	**0.62**	**0.61**	**0.61**	**0.47 J**	**0.54**	**0.86**	**1.1**	**1.1**	**0.62**	**0.55**	**0.67**	**0.71**	**0.87**	**0.91**	**0.87**	**0.7**	**0.73**	**0.85**
PCB183		< 0.099	< 0.098	**0.19 J**	**0.25 J**	**0.28 J**	**0.22 J**	**0.16 J**	**0.18 J**	< 0.099	**0.22 J**	**0.22 J**	**0.19 J**	**0.25 J**	**0.18 J**	**0.2 J**	**0.28 J**	**0.33 J**	**0.38 J**	**0.24 J**	**0.22 J**	**0.27 J**	**0.21 J**	**0.31 J**	**0.24 J**	**0.3 J**	**0.27 J**	**0.26 J**	**0.27 J**
PCB187		**0.21 J**	< 0.13	**0.54**	**0.74**	**0.74**	**0.69**	**0.46 J**	**0.6**	**0.3 J**	**0.52**	**0.53**	**0.53**	**0.55**	**0.48 J**	**0.59**	**0.93**	**1.3**	**1.2**	**0.6**	**0.56**	**0.72**	**0.64**	**0.78**	**0.76**	**0.85**	**0.68**	**0.67**	**0.74**
PCB189		< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
PCB194		< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	**0.25 J**	**0.32 J**	**0.26 J**	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
PCB201		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13
PCB206		< 0.23	< 0.23	**0.29 J**	**0.42 J**	**0.36 J**	**0.37 J**	**0.28 J**	**0.29 J**	< 0.23	**0.25 J**	**0.25 J**	**0.26 J**	**0.26 J**	< 0.23	< 0.23	**0.28 J**	**0.35 J**	**0.37 J**	**0.23 J**	< 0.23	**0.37 J**	**0.34 J**	**0.29 J**	**0.31 J**	**0.33 J**	**0.31 J**	**0.29 J**	**0.31 J**
Total PCB Congeners (ND = 0)	2000[5]	**1.16**	**0.38 J**	**6.92**	**8.83**	**8.35**	**7.27**	**4.6**	**6.39**	**8.97**	**14.2**	**14.52**	**12.7**	**15.98**	**12.68**	**15.45**	**23.51**	**20.93**	**33.41**	**20.17**	**16.21**	**15.14**	**15.72**	**17.93**	**22.79**	**24.07**	**27.89**	**19.25**	**22.36**

Notes:

For totals, zeroes were used for non-detect samples for summing. If all samples were non-detect, the highest method detection limit of all samples was used as the total result.

1 Total DDTs are the sum of: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT.

2 Total Chlordanes are the sum of Alpha Chlordane and Gamma Chlordane.

3 Action level for methyl mercury.

4 Action level for DDT and DDE (individually or in combination).

5 Tolerance level for PCBs. No action level.

Bold = detected result

< = less than listed method detection limit

- = results not reported or not applicable

µg/kg = micrograms per kilogram

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

FDA = U.S. Food and Drug Administration

J = indicates an estimated value

mg/kg = milligrams per kilogram

ND = not detected

PCB = polychlorinated biphenyl

Table 20
Summary of Statistically Elevated Macoma nasuta Tissue Residues

Project Area	Analyte	Units	MDL[1]	Day 0 Mean Tissue Concentration	Reference Mean Tissue Concentration	Project Area Mean Tissue Concentration	p value	Project Area Mean: Reference Mean Ratio	Comparison to Relevant Environmental Residue-Effects Database Values
B2-DU1-COMP	Mercury	mg/kg	0.0037	0.0091	0.0102	0.0130	0.0163	1.28	NOED: 8.4 mg/kg for mortality of the mussel *Mytilus edulis.*
	4,4'-DDE	µg/kg	0.51	0.125 U	4.16	10.5	0.0024	2.53	LC_{50}: 110,400 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	Total DDTs (ND = 0)	µg/kg	0.41	0.202 U	4.16	10.5	0.0024	2.53	No data in the ERED for total DDTs. The lowest relevant NOED for DDT derivatives was 510 µg/kg for reproduction of Chinook salmon (*Oncorhynchus tshawytscha*).
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.606	0.0421	12.5	No relevant effects in the ERED.
	PCB052	µg/kg	0.058	0.029 U	0.029 U	0.876	0.0421	30.4	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB056	µg/kg	0.093	0.046 U	0.046 U	0.47	0.0421	10.2	-
	PCB066	µg/kg	0.13	0.065 U	0.065 U	1.06	0.0421	16.4	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.74	0.0421	18.0	-
	PCB074	µg/kg	0.15	0.075 U	0.075 U	0.462	0.0421	6.16	-
	PCB099	µg/kg	0.074	0.037 U	0.037 U	0.97	0.0421	26.4	-
	PCB101	µg/kg	0.065	0.033 U	0.033 U	1.42	0.0421	43.7	No relevant effects in the ERED for this species. NOED 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (Pimephales promelas).
	PCB105	µg/kg	0.13	0.065 U	0.065 U	0.41	0.0421	6.31	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.1 U	0.1 U	1.23	0.0421	12.3	-
	PCB118	µg/kg	0.15	0.075 U	0.075 U	1.29	0.0421	17.3	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB138/158	µg/kg	0.29	0.145 U	0.145 U	1.05	0.0421	7.23	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.11 U	0.11 U	0.726	0.0421	6.60	-
	PCB153	µg/kg	0.073	0.036 U	0.036 U	1.17	0.0421	32.2	LOED: 126,310 µg/kg for mortality of the oligochaete (*Lumbriculus variegatu* s).
	PCB187	µg/kg	0.13	0.065 U	0.065 U	0.214	0.0421	3.29	-
	Total PCB Congeners (ND = 0)	µg/kg	0.13	0.145 U	0.145 U	14.5	0.0421	99.7	NOED: 1,700 µg/kg for mortality and growth of the clam *Macoma nasuta.*
B2-DU2-COMP	4,4'-DDE	µg/kg	0.51	0.125 U	4.16	11.4	<0.0001	2.73	LC_{50}: 110,400 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	Total DDTs (ND = 0)	µg/kg	0.41	0.202 U	4.16	11.4	<0.0001	2.73	No data in the ERED for total DDTs. The lowest relevant NOED for DDT derivatives was 510 µg/kg for reproduction of Chinook salmon (*Oncorhynchus tshawytscha*).
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.584	0.0413	12.1	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.28	0.0421	8.75	-
	PCB052	µg/kg	0.058	0.029 U	0.029 U	1.78	0.0421	61.8	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB066	µg/kg	0.13	0.065 U	0.065 U	1.12	0.0421	17.3	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.89	0.0421	21.7	-
	PCB074	µg/kg	0.15	0.075 U	0.075 U	0.472	0.0421	6.29	-
	PCB099	µg/kg	0.074	0.037 U	0.037 U	1.84	0.0421	50.0	-
	PCB101	µg/kg	0.065	0.033 U	0.033 U	2.54	0.0421	78.2	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.065 U	0.43	0.0421	6.62	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.1 U	0.1 U	1.52	0.0421	15.2	-
	PCB118	µg/kg	0.15	0.075 U	0.075 U	1.56	0.0421	20.8	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB119	µg/kg	0.064	0.031 U	0.031 U	0.188	0.0143	5.92	-
	PCB138/158	µg/kg	0.29	0.145 U	0.145 U	1.36	0.0421	9.37	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.11 U	0.11 U	1.4	0.0421	12.7	-
	PCB151	µg/kg	0.15	0.075 U	0.075 U	0.444	<0.0001	5.92	-
	PCB153	µg/kg	0.073	0.036 U	0.036 U	1.86	0.0421	51.2	LOED: 126,310 µg/kg for mortality of the oligochaete (*Lumbriculus variegatu* s).

Table 20
Summary of Statistically Elevated Macoma nasuta Tissue Residues

Project Area	Analyte	Units	MDL[1]	Day 0 Mean Tissue Concentration	Reference Mean Tissue Concentration	Project Area Mean Tissue Concentration	p value	Project Area Mean: Reference Mean Ratio	Comparison to Relevant Environmental Residue-Effects Database Values
B2-DU2-COMP	PCB180	µg/kg	0.16	0.08 U	0.08 U	0.374	0.0005	4.68	No relevant effects in the ERED for this species. NOED: 1,210,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB187	µg/kg	0.13	0.065 U	0.065 U	0.422	0.0421	6.49	-
	Total PCB Congeners (ND = 0)	µg/kg	0.13	0.145 U	0.145 U	21.7	0.0421	150	NOED: 1,700 µg/kg for mortality and growth of the clam *Macoma nasuta.*
B3-DU1-COMP	4,4'-DDE	µg/kg	1.3	0.125 U	4.16	11.9	<0.0001	2.85	LC_{50}: 110,400 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	Total DDTs (ND = 0)	µg/kg	0.41	0.202 U	4.16	11.9	<0.0001	2.85	No data in the ERED for total DDTs. The lowest relevant NOED for DDT derivatives was 510 µg/kg for reproduction of Chinook salmon (*Oncorhynchus tshawytscha*).
	Cis-nonachlor	µg/kg	0.42	0.21 U	0.21 U	0.824	0.0002	3.92	-
	Total Chlordanes (ND = 0)	µg/kg	0.25	0.21 U	0.21 U	0.824	0.0002	3.92	NOED: 22 µg/kg for growth of the eastern oyster (*Crassostrea virginica*).
	PCB018	µg/kg	0.13	0.065 U	0.065 U	0.548	0.0421	8.43	-
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.898	0.0421	18.6	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.402	0.0421	12.6	-
	PCB052	µg/kg	0.058	0.029 U	0.029 U	1.442	0.0421	50.1	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB056	µg/kg	0.093	0.046 U	0.046 U	0.538	0.0421	11.6	-
	PCB066	µg/kg	0.13	0.065 U	0.065 U	1.18	0.0421	18.1	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.97	0.0421	23.7	-
	PCB074	µg/kg	0.15	0.075 U	0.075 U	0.56	0.0421	7.47	-
	PCB099	µg/kg	0.074	0.037 U	0.037 U	0.94	0.0413	25.5	-
	PCB101	µg/kg	0.065	0.033 U	0.033 U	1.46	0.0421	44.9	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.065 U	0.448	0.0421	6.89	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.1 U	0.1 U	1.23	0.0421	12.3	-
	PCB118	µg/kg	0.15	0.075 U	0.075 U	1.37	0.0421	18.3	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB138/158	µg/kg	0.29	0.145 U	0.145 U	0.992	0.0421	6.84	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.11 U	0.11 U	0.668	0.0421	6.07	-
	PCB153	µg/kg	0.073	0.036 U	0.036 U	1.07	0.0421	29.4	LOED: 126,310 µg/kg for mortality of the oligochaete (*Lumbriculus variegatu* s).
	Total PCB Congeners (ND = 0)	µg/kg	0.13	0.145 U	0.145 U	16.6	0.0421	115	NOED: 1,700 µg/kg for mortality and growth of the clam *Macoma nasuta.*
B3-DU2-COMP	4,4'-DDE	µg/kg	1.3	0.125 U	4.16	15	<0.0001	3.61	LC_{50}: 110,400 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	Total DDTs (ND = 0)	µg/kg	0.41	0.202 U	4.16	15	<0.0001	3.61	No data in the ERED for total DDTs. The lowest relevamt NOED for DDT derivatives was 510 µg/kg for reproduction of Chinook salmon (*Oncorhynchus tshawytscha*).
	Cis-nonachlor	µg/kg	0.42	0.21 U	0.21 U	1.24	<0.0001	5.90	-
	Total Chlordanes (ND = 0)	µg/kg	0.25	0.21 U	0.21 U	1.24	<0.0001	5.90	NOED: 22 µg/kg for growth of the eastern oyster (*Crassostrea virginica*).
	PCB018	µg/kg	0.13	0.065 U	0.065 U	0.628	0.0413	9.66	-
	PCB028	µg/kg	0.097	0.048 U	0.048 U	1.32	0.0413	27.3	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.39	0.0421	12.2	-
	PCB052	µg/kg	0.058	0.029 U	0.029 U	2.28	0.0421	79.2	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB056	µg/kg	0.093	0.046 U	0.046 U	0.526	0.0421	11.4	-
	PCB066	µg/kg	0.13	0.065 U	0.065 U	1.58	0.0413	24.3	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	1.24	0.0421	30.2	-
	PCB074	µg/kg	0.15	0.075 U	0.075 U	0.634	0.0421	8.45	-
	PCB099	µg/kg	0.074	0.037 U	0.037 U	1.74	0.0421	47.3	-

Table 20
Summary of Statistically Elevated Macoma nasuta Tissue Residues

Project Area	Analyte	Units	MDL[1]	Day 0 Mean Tissue Concentration	Reference Mean Tissue Concentration	Project Area Mean Tissue Concentration	p value	Project Area Mean: Reference Mean Ratio	Comparison to Relevant Environmental Residue-Effects Database Values
B3-DU2-COMP	PCB101	µg/kg	0.065	0.033 U	0.033 U	2.32	0.0413	71.4	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.065 U	0.418	0.0421	6.43	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.1 U	0.1 U	1.72	0.0421	17.2	-
	PCB118	µg/kg	0.15	0.075 U	0.075 U	1.8	0.0413	24.0	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB119	µg/kg	0.064	0.032 U	0.032 U	0.172	0.0486	5.42	-
	PCB138/158	µg/kg	0.29	0.145 U	0.145 U	1.22	0.0413	8.41	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.11 U	0.11 U	1.1	0.0413	10.0	-
	PCB151	µg/kg	0.15	0.075 U	0.075 U	0.326	0.0014	4.35	-
	PCB153	µg/kg	0.073	0.036 U	0.036 U	1.58	0.0421	43.5	LOED: 126,310 µg/kg for mortality of the oligochaete (*Lumbriculus variegatu* s).
	PCB180	µg/kg	0.16	0.08 U	0.08 U	0.314	0.0101	3.93	No relevant effects in the ERED for this species. NOED: 1,210,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB187	µg/kg	0.13	0.065 U	0.065 U	0.322	0.0421	4.95	-
	Total PCB Congeners (ND = 0)	µg/kg	0.13	0.145 U	0.145 U	24.3	0.0421	168	NOED: 1,700 µg/kg for mortality and growth of the clam *Macoma nasuta.*

Notes:
1 If MDL differed between samples, maximum MDL presented.
2 Organics were normalized to percent lipids prior to statistical analysis.
3 All data were log-transformed prior to statistical analysis.
µg/kg = micrograms per kilogram
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
ERED = Environmental Residue Effects Database
LC_{50} = median lethal concentration
LOED = lowest observed effect dose
mg/kg = milligrams per kilogram
MDL = method detection limit
ND = not detected
NOED = no observed effect dose
PCB = polychlorinated biphenyl
U = non-detect; half the detection limit shown

Table 21
Summary of Statistically Elevated Nereis virens Tissue Residues

Project Area	Analyte	Units	MDL[1]	Day 0 Mean Tissue Concentration	Reference Mean Tissue Concentration	Project Area Mean Tissue Concentration	p value	Project Area Mean: Reference Mean Ratio	Comparison to Relevant Environmental Residue-Effects Database Values
B2-DU1-COMP	Mercury	mg/kg	0.0037	0.0383	0.0229	0.0380	0.0330	1.66	NOED: 8.4 mg/kg for mortality of the mussel *Mytilus edulis.*
	4,4'-DDE	µg/kg	0.25	0.125 U	0.834	1.37	0.0167	1.65	LOED: 178,400 µg/kg for growth of the oligochaete *Lumbriculus variegatus.*
	PCB018	µg/kg	0.13	0.065 U	0.065 U	0.376	0.0421	5.78	-
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.356	0.0421	7.45	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.374	0.0421	11.8	-
	PCB049	µg/kg	0.11	0.055 U	0.055 U	0.378	0.0421	6.87	-
	PCB052	µg/kg	0.058	0.029 U	0.029 U	1.02	0.0421	35.9	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB066	µg/kg	0.13	0.065 U	0.065 U	0.614	0.0421	9.45	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.208	0.0421	5.10	-
	PCB099	µg/kg	0.074	0.121	0.254	0.706	<0.0001	2.78	-
	PCB101	µg/kg	0.065	0.225	0.456	1.30	0.0421	2.84	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.102	0.422	0.0421	4.14	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.173	0.166	0.83	0.0421	5.00	-
	PCB118	µg/kg	0.15	0.207	0.374	0.77	<0.0001	2.06	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB138/158	µg/kg	0.29	0.515	1.06	1.25	0.0096	1.18	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.293	0.704	0.854	0.0047	1.21	-
	Total PCB Congeners (ND = 0)	µg/kg	0.13	2.82	7.09	13.3	<0.0001	1.87	NOED: 127 µg/kg for growth of the white sea urchin (*Lytochinus pictus*).
B2-DU2-COMP	PCB018	µg/kg	0.13	0.065 U	0.065 U	0.71	0.0421	10.9	-
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.5	0.0421	10.5	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.448	0.0421	14.1	-
	PCB049	µg/kg	0.11	0.055 U	0.055 U	0.956	0.0413	17.4	-
	PCB052	µg/kg	0.058	0.029 U	0.029 U	2.16	0.0421	75.8	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB066	µg/kg	0.13	0.065 U	0.065 U	0.82	0.0421	12.6	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.396	0.0421	9.71	-
	PCB099	µg/kg	0.074	0.121	0.254	1.31	<0.0001	5.17	-
	PCB101	µg/kg	0.065	0.225	0.456	2.24	0.0421	4.91	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.102	0.402	0.0421	3.94	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.173	0.166	1.05	0.0421	6.31	-
	PCB118	µg/kg	0.15	0.207	0.374	0.936	<0.0001	2.50	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB138/158	µg/kg	0.29	0.515	1.06	1.6	0.0003	1.51	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.293	0.704	1.48	<0.0001	2.11	-
	PCB151	µg/kg	0.15	0.117	0.23	0.504	0.001	2.19	-
	PCB153	µg/kg	0.073	0.707	1.53	2.22	0.002	1.45	LOED: 126,310 µg/kg for mortality of the oligochaete *Lumbriculus variegatus.*
	PCB194	µg/kg	0.17	0.085 U	0.085 U	0.2	0.0357	2.35	
	Total PCB Congeners (ND = 0)	µg/kg	0.13	2.82	7.088	21.2	<0.0001	2.99	NOED: 127 µg/kg for growth of the white sea urchin (*Lytochinus pictus*).
B3-DU1-COMP	4,4'-DDE	µg/kg	0.25	0.125 U	0.834	1.70	0.0119	2.04	LOED: 178,400 µg/kg for growth of the oligochaete *Lumbriculus variegatus.*
	PCB018	µg/kg	0.13	0.065 U	0.065 U	0.934	0.0421	14.4	-
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.598	0.0421	12.5	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.458	0.0421	14.4	-
	PCB049	µg/kg	0.11	0.055 U	0.055 U	0.61	0.0421	11.1	-

Table 21
Summary of Statistically Elevated Nereis virens Tissue Residues

Project Area	Analyte	Units	MDL[1]	Day 0 Mean Tissue Concentration	Reference Mean Tissue Concentration	Project Area Mean Tissue Concentration	p value	Project Area Mean: Reference Mean Ratio	Comparison to Relevant Environmental Residue-Effects Database Values
B3-DU1-COMP	PCB052	µg/kg	0.058	0.029 U	0.029 U	1.62	0.0421	56.8	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB066	µg/kg	0.13	0.065 U	0.065 U	0.7	0.0421	10.8	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.268	0.0421	6.57	-
	PCB099	µg/kg	0.074	0.121	0.254	0.796	<0.0001	3.13	-
	PCB101	µg/kg	0.065	0.225	0.456	1.36	0.0421	2.98	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.102	0.438	0.0421	4.29	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.173	0.166	0.954	0.0421	5.75	-
	PCB118	µg/kg	0.15	0.207	0.374	0.914	<0.0001	2.44	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB138/158	µg/kg	0.29	0.515	1.06	1.48	0.004	1.39	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.2933	0.704	1.01	0.0016	1.44	-
	Total PCB Congeners (ND = 0)	µg/kg	0.13	2.82	7.09	17.0	<0.0001	2.40	NOED: 127 µg/kg for growth of the white sea urchin (*Lytochinus pictus*).
B3-DU2-COMP	4,4'-DDE	µg/kg	0.25	0.125 U	0.834	1.94	0.0005	2.33	LOED: 178,400 µg/kg for growth of the oligochaete *Lumbriculus variegatus.*
	Total DDTs (ND = 0)	µg/kg	0.41	0.2 U	0.834	1.94	0.0251	2.33	No data in the ERED for total DDTs. The lowest relevant NOED for DDT derivatives was 510 µg/kg for reproduction of Chinook salmon (*Oncorhynchus tshawytscha*).
	PCB018	µg/kg	0.13	0.065 U	0.065 U	1.06	0.0421	16.3	-
	PCB028	µg/kg	0.097	0.048 U	0.048 U	0.994	0.0421	20.8	No relevant effects in the ERED.
	PCB044	µg/kg	0.064	0.032 U	0.032 U	0.44	0.0421	13.8	-
	PCB049	µg/kg	0.11	0.055 U	0.055 U	1.31	0.0421	23.9	-
	PCB052	µg/kg	0.058	0.029 U	0.029 U	2.92	0.0421	102	NOED: 54,000 µg/kg for mortality of the freshwater amphipod *Hyalella azteca.*
	PCB066	µg/kg	0.13	0.065 U	0.065 U	1.01	0.0421	15.5	-
	PCB070	µg/kg	0.082	0.041 U	0.041 U	0.308	0.0413	7.55	-
	PCB099	µg/kg	0.074	0.121	0.254	1.38	<0.0001	5.43	-
	PCB101	µg/kg	0.065	0.225	0.456	2.16	0.0421	4.74	No relevant effects in the ERED for this species. NOED: 1,115,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB105	µg/kg	0.13	0.065 U	0.102	0.464	0.0421	4.55	No relevant species in the ERED.
	PCB110	µg/kg	0.2	0.173	0.166	1.14	0.0421	6.87	-
	PCB118	µg/kg	0.15	0.207	0.374	1.16	<0.0001	3.10	NOED: 3,260 µg/kg for mortality of the starfish (*Asterias rubens*).
	PCB138/158	µg/kg	0.29	0.515	1.06	1.68	<0.0001	1.58	No relevant effects in the ERED for this species. NOED for PCB 138: 946,000 µg/kg for mortality, growth, and reproduction of the fathead minnow (*Pimephales promelas*).
	PCB149	µg/kg	0.22	0.293	0.704	1.36	<0.0001	1.93	-
	PCB151	µg/kg	0.15	0.117	0.23	0.434	0.0018	1.89	-
	PCB153	µg/kg	0.073	0.707	1.53	2.4	<0.0001	1.57	LOED: 126,310 µg/kg for mortality of the oligochaete *Lumbriculus variegatus.*
	PCB183	µg/kg	0.1	0.096	0.218	0.268	0.0147	1.23	-
	Total PCB Congeners (ND = 0)	µg/kg	0.13	2.82	7.09	23.3	<0.0001	3.28	NOED: 127 µg/kg for growth of the white sea urchin (*Lytochinus pictus*).

Notes:

1 If MDL differed between samples, maximum MDL presented.

2 Organics were normalized to percent lipids prior to statistical analysis.

3 All data was log-transformed prior to statistical analysis.

µg/kg = micrograms per kilogram

DDD = dichlorodiphenyldichloroethane

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorodiphenyltrichloroethane

ERED = Environmental Residue Effects Database

LC_{50} = median lethal dose

LOED = lowest observed effect dose

mg/kg = milligrams per kilogram

MDL = method detection limit

ND = not detected

NOED = no observed effect dose

PCB = polychlorinated biphenyl

U = non-detect; half the detection limit shown

3.5.2.1 Macoma nasuta

Mercury, one DDT derivative (4,4'-DDE), total DDT, several PCB congeners, and total PCB were statistically elevated in *M. nasuta* tissue samples exposed to B2-DU1-COMP sediment (Table 20). The magnitudes of exceedances were low for mercury and DDTs, with mean concentrations ranging from 1.28 to 2.53 times greater than the reference. For PCB congeners, all reference samples were non-detect; therefore, the magnitudes of exceedances were slightly higher. Mean concentrations of PCB congeners ranged from 3.29 to 43.7 times greater than the reference, while the mean concentration of total PCB was 99.7 times greater than the reference.

One DDT derivative (4,4'-DDE), total DDT, several PCB congeners, and total PCB were statistically elevated in M. nasuta tissue samples exposed to B2-DU2-COMP sediment (Table 20). The magnitudes of exceedances were low for DDTs, with mean concentrations 2.73 times greater than the reference. For PCB congeners, all reference samples were non-detect; therefore, the magnitudes of exceedances were slightly higher. Mean concentrations of PCB congeners ranged from 4.68 to 78.2 times greater than the reference, while the mean concentration of total PCB was 150 times greater than the reference.

One DDT derivative (4,4'-DDE), total DDTs, cis-nonachlor, total chlordanes, several PCB congeners, and total PCBs were statistically elevated in *M. nasuta* tissue samples exposed to B3-DU1-COMP sediment (Table 20). The magnitudes of exceedances were low for DDTs and chlordanes, with mean concentrations ranging from 2.85 to 3.92 times greater than the reference. For PCB congeners, all reference samples were non-detect; therefore, the magnitudes of exceedances were slightly higher. Mean concentrations of PCB congeners ranged from 6.07 to 50.1 times greater than the reference, while the mean concentration of total PCBs was 115 times greater than the reference.

One DDT derivative (4,4'-DDE), total DDT, cis-nonachlor, total chlordanes, several PCB congeners, and total PCB were statistically elevated in *M. nasuta* tissue samples exposed to B3-DU2-COMP sediment (Table 20). The magnitudes of exceedances were low for DDTs and chlordanes, with mean concentrations ranging from 3.61 to 5.90 times greater than the reference. For PCB congeners, all reference samples were non-detect; therefore, the magnitudes of exceedances were slightly higher. Mean concentrations of PCB congeners

ranged from 3.93 to 79.2 times greater than the reference, while the mean concentration of total PCB was 168 times greater than the reference.

3.5.2.2 Nereis virens

Mercury, one DDT derivative (4,4'-DDE), several PCB congeners, and total PCBs were statistically elevated in *N. virens* tissue samples exposed to B2-DU1-COMP sediment (Table 21). The magnitudes of exceedances were low for mercury and 4,4'-DDE, with mean concentrations 1.66 and 1.65 times greater than the reference, respectively. Mean concentrations of PCB congeners were slightly higher, ranging from 1.18 to 35.9 times greater than the reference; however, the mean concentration of total PCB was only 1.89 times greater than the reference.

Several PCB congeners and total PCBs were statistically elevated in *N. virens* tissue samples exposed to B2-DU2-COMP sediment (Table 21). Mean concentrations of PCB congeners ranged from 1.45 to 75.8 times greater than the reference. The mean concentration of total PCBs was only 2.99 times greater than the reference.

One DDT derivative (4,4'-DDE), several PCB congeners, and total PCB were statistically elevated in *N. virens* tissue samples exposed to B3-DU1-COMP sediment (Table 21). The magnitude of exceedance was low for 4,4'-DDE, with a mean concentration 2.04 times greater than the reference. Mean concentrations of PCB congeners were slightly higher, ranging from 1.39 to 56.8 times greater than the reference; however, the mean concentration of total PCB was only 2.40 times greater than the reference.

One DDT derivative (4,4'-DDE), total DDTs, several PCB congeners, and total PCBs were statistically elevated in *N. virens* tissue samples exposed to B3-DU2-COMP sediment (Table 21). The magnitudes of exceedances were low for DDTs, with mean concentrations 2.33 times greater than the reference. Mean concentrations of PCB congeners were slightly higher, ranging from 1.23 to 102 times greater than the reference; however, the mean concentration of total PCBs was only 3.28 times greater than the reference.

3.5.3 Comparison of Tissue Burdens to Environmental Residue Effects Database

Statistically elevated tissue concentrations were compared to residue-effects values provided in the ERED (USACE/USEPA 2010). The cited ERED values were based on the lowest effect level of relevant species and endpoints. The comparison to tissue residue effects data is presented in Tables 20 and 21. All concentrations were less than ERED values.

3.6 Quality Assurance/Quality Control

A review of analytical results was conducted to evaluate the laboratory's performance in meeting quality assurance/quality control (QA/QC) guidelines outlined in the SAP (Anchor QEA 2014).

3.6.1 Physical and Chemical Analyses of Sediment

The data validation report prepared by Anchor QEA for physical and chemical analyses of sediment is presented in Appendix F. All samples were analyzed within the appropriate holding times. Generally, QA/QC sample results were within the project-specified and laboratory control limits, with the following exceptions:

- The method blank for LA2-REF contained bifenthrin and arsenic. The sample concentration of bifenthrin was less than 5 times the concentration in the blank, and therefore, the associated result may be biased high. The sample concentration of arsenic was greater than 5 times the method blank concentration, and therefore, data are not expected to be affected.
- Surrogate recoveries for the pesticide surrogate 2,4,5,6-tetrachloro-m-xylene in B3-DU1-COMP and the PCB surrogate 2-fluorobiphenyl in B2-DU1-03 and B2-DU2-01 were outside the laboratory control limits. Detected results may be biased high.
- The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery values associated with B2-DU1-COMP and B2-DU2-COMP for fenvalerate/esfenvalerate exceeded the project control. This compound was not detected in associated samples so data are not expected to be affected. The LCS/LCSD relative percent difference (RPD) values associated with analysis of individual stations exceeded the control limits for PCB066, PCB077, PCB101, PCB105, PCB118, and

PCB153. Detected results may be estimated.

- The matrix spike/matrix spike duplicate (MS/MSD) percent recovery values in B2-DU1-COMP exceeded the control limit for deltamethrin/tralomethrin and fenvalerate/esfenvalerate. These compounds were not detected in the parent sample, and therefore, data are not expected to be affected.
- Zinc recoveries were not reported in the MS/MSD or post-digestion spike in B2-DU1-COMP because the sample concentration was significantly (4 times) higher than the concentration of the spike. Data are not expected to be affected.
- The MSD percent recovery value in B2-DU1-COMP exceeded the control limit for 4,4'-DDD. The parent sample result was below detection, and therefore, data are not expected to be affected.
- The MS and/or MSD percent recovery values in LA2-REF exceeded the control limit for of cyfluthrin, cypermethrin, deltamethrin/tralomethrin, and fenvalerate/esfenvalerate. These compounds were not detected in the parent sample, and therefore, data are not expected to be affected.
- The MS/MSD RPD value in LA2-REF exceeded the control limit for methoxychlor. Sample results may be estimated.
- The MS percent recovery value in LA2-REF was less than the control limit and the MSD percent recovery value was less than 10 percent for tetrabutyltin. In addition, the RPD value exceeded the control limit. Sample results may be biased low.
- The MS/MSD percent recovery values in LA2-REF exceeded the control limit for tributyltin. Parent sample results were below detection, and therefore, data are not expected to be affected.

Results of this assessment concluded that data were acceptable as reported.

3.6.2 Chemical Analysis of Tissue Residues

The data validation report prepared by Anchor QEA for chemical analysis of tissue residues is presented in Appendix F. All samples were analyzed within the appropriate holding times. Generally, QA/QC sample results were within the project-specified and laboratory control limits, with the following exceptions:

- Surrogate recoveries for the pesticide surrogate dibutylchlorendate in *N. virens* tissue

samples Zero Time Rep A and Zero Time Rep B were outside the laboratory control limits. Detected results may be biased low.

- The MS/MSD percent recovery values in *N. virens* tissue sample B2-DU2-COMP Rep D exceeded the control limit for alpha-chlordane. This compound was not detected in the parent sample, and therefore, data are not expected to be affected.
- The MS percent recovery value in *M. nasuta* tissue sample LA2-REF Rep E was below 10 percent, and the MSD percent recovery value was less than the control limit for 4,4'-DDE. Sample results may be biased low.
- The MSD percent recovery value and MS/MSD RPD value in *M. nasuta* tissue sample B2-DU1-COMP Rep A exceeded the control limit for 4,4'-DDD. Sample results may be biased low.
- The MS did not recover, the MSD percent recovery value was below 10 percent, and the MS/MSD RPD value exceeded the control limit value in *M. nasuta* tissue sample B2-DU1-COMP Rep A for 4'4-DDE. Sample results may be biased low.

Results of this assessment concluded that data were acceptable as reported.

3.6.3 Biological Testing

Biological testing of Basins 2 and 3 sediments incorporated standard QA/QC procedures, consistent with OTM (USEPA/USACE 1991) and ITM (USEPA/USACE 1998) guidelines.

Sediments were stored at 4 degrees Celsius (°C) plus or minus 2°C and used within the 8-week holding period. All test organism responses within the negative (laboratory) controls met acceptability criterion.

Water quality was measured prior to and during testing. All water quality conditions were within the appropriate limits, with minor exceptions. On Days 7 and 8, temperatures in the *N. arenaceodentata* test slightly exceeded the recommended range of 20°C plus or minus 1°C. Corrective actions were taken and temperatures returned within the desired range. On Day 2, dissolved oxygen concentrations in the *M. beryllina* test approached 4 mg/L; therefore, test chambers were aerated to prevent further decline. In the *M. beryllina* and *A. bahia* tests, salinity concentrations were slightly outside the recommended range. In the *M.*

galloprovincialis test, temperatures were slightly below the recommended range of 16°C plus or minus 1°C; however, concentrations were within the recommended range for SPP tests provided in the OTM (USEPA/USACE 1991). These minor water quality deviations are not believed to affect the overall test results. Raw water quality data are provided in Appendix C.

As discussed in Section 2.3, interstitial ammonia concentrations were measured on project sediments prior to testing. The ammonia concentration in B3-DU1-COMP was above the recommended threshold for *A. abdita* in the ITM (USEPA/USACE 1998). Test sediment was purged to reduce ammonia concentrations prior to testing. In addition, ammonia reference toxicant tests were run for *A. abdita* and *M. galloprovincialis* to evaluate the contribution of ammonia to toxicity.

Reference toxicant test data are provided in Appendix C. All reference toxicant tests LC_{50} and/or EC_{50} for each test species were within two standard deviations of the laboratory mean, indicating that sensitivity of test organisms was normal, with one exception. The LC_{50} of the ammonia reference toxicant test performed on *A. abdita* was outside this range. It should be noted that this test was performed to evaluate the effect of ammonia on test organisms. These results indicate that this batch of test organisms may be less sensitive to ammonia than those previously tested by the laboratory. The standard reference toxicant test using cadmium indicated that sensitivity of this test organism was normal.

As described in Section 3.2.1, the EC_{50} in the ammonia reference toxicant test for *M. galloprovincialis* was 5.8 mg/L. The ammonia concentration in the 100 percent elutriate of B3-DU1-COMP was 14.5 mg/L, indicating ammonia likely contributed to the abnormal development of *M. galloprovincialis* in this sample.

4 DISCUSSION

A Tier I evaluation with confirmatory chemistry was initially performed on sediment from Basins 2 and 3 to demonstrate that the results of the 2007 sediment characterization study for ocean disposal suitability were still relevant to the sites' current condition. Chemical analysis of sediment indicated that conditions at the sites have changed, and PCB concentrations in composite samples were at levels that required further evaluation (92.23 to 160.99 µg/kg). Following discussion with USEPA, it was determined that individual cores would be chemically analyzed to further refine the contamination boundary, and full Tier III testing for ocean disposal would be performed. SP testing indicated that sediments were not acutely toxic to benthic organisms. SPP testing and STFATE modeling indicated that sediments do not pose a toxicity risk to water column organisms. BP testing and tissue chemistry indicated low bioaccumulation potential, with concentrations less than FDA action levels and those that have been shown to cause toxicity. These results indicate that sediments within Basins 2 and 3, except for areas with elevated PCBs, meet LPC requirements for ocean disposal.

PCB results for individual stations within Basins 2 and 3 are shown in Figures 5 and 6, respectively. PCB concentrations at the individual stations were substantially lower than composite samples and showed a high degree of variability. Total PCB concentrations ranged from 5.22 to 118.18 µg/kg, with average concentrations for each DU ranging from 28.95 to 52.36 µg/kg. Based on recent Dredged Material Management Team suitability determinations (e.g., Los Angeles River Estuary project on April 23, 2014), areas with total PCB concentrations greater than 100 µg/kg were determined to be unsuitable for ocean disposal at LA-2 for large dredge volumes. The total PCB concentration from one station (B2-DU2-05) within Basin 2 was above this threshold. The area represented by this station is limited to the shoal along the eastern wharf face of Basin 2, extending north approximately half way to B2-DU2-04 (Figure 5). The total volume of this area, including 2 feet of allowable overdepth, is 1,776 cy.

5 CONCLUSIONS

Physical, chemical, and biological analyses were conducted to evaluate the suitability of proposed dredge material from Basins 2 and 3 for placement at LA-2. This assessment finds the following:

- All concentrations of contaminants were less than values of concern, with the possible exception of PCBs in a portion of the project.
- Further chemical characterization showed one area of potential concern with elevated PCB concentrations greater than 100 µg/kg.
- Biological testing in conjunction with STFATE modeling indicated no effects to aquatic organisms.
- Tissue chemistry showed low bioaccumulation potential with concentrations less than FDA action levels and those that have been shown to cause toxicity.

Based on these results, it is recommended that the proposed dredge material from Basins 2 and 3 be considered suitable for placement at LA-2. One area has the potential of not being dredged if found unsuitable for ocean disposal (1,776 cy of material within Basin 2 shown in Figure 5).

6 REFERENCES

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FIGURES

L:\AutoCAD Project Files_Projects\0548-City of LB\Alamitos Bay Basins 2 and 3\0548-RP-001 BASIN 2_3 VMAP.dwg FIG 1

Jan 06, 2014 11:40am mpratschner

SOURCE: Aerial from Google Earth Pro, 2012.
HORIZONTAL DATUM: California State Plane, Zone 7, NAD27, U.S. Feet.

0 1.5
Scale in Miles

ANCHOR QEA

Figure 1
Vicinity Map
Alamitos Bay Marina Basins 2 and 3

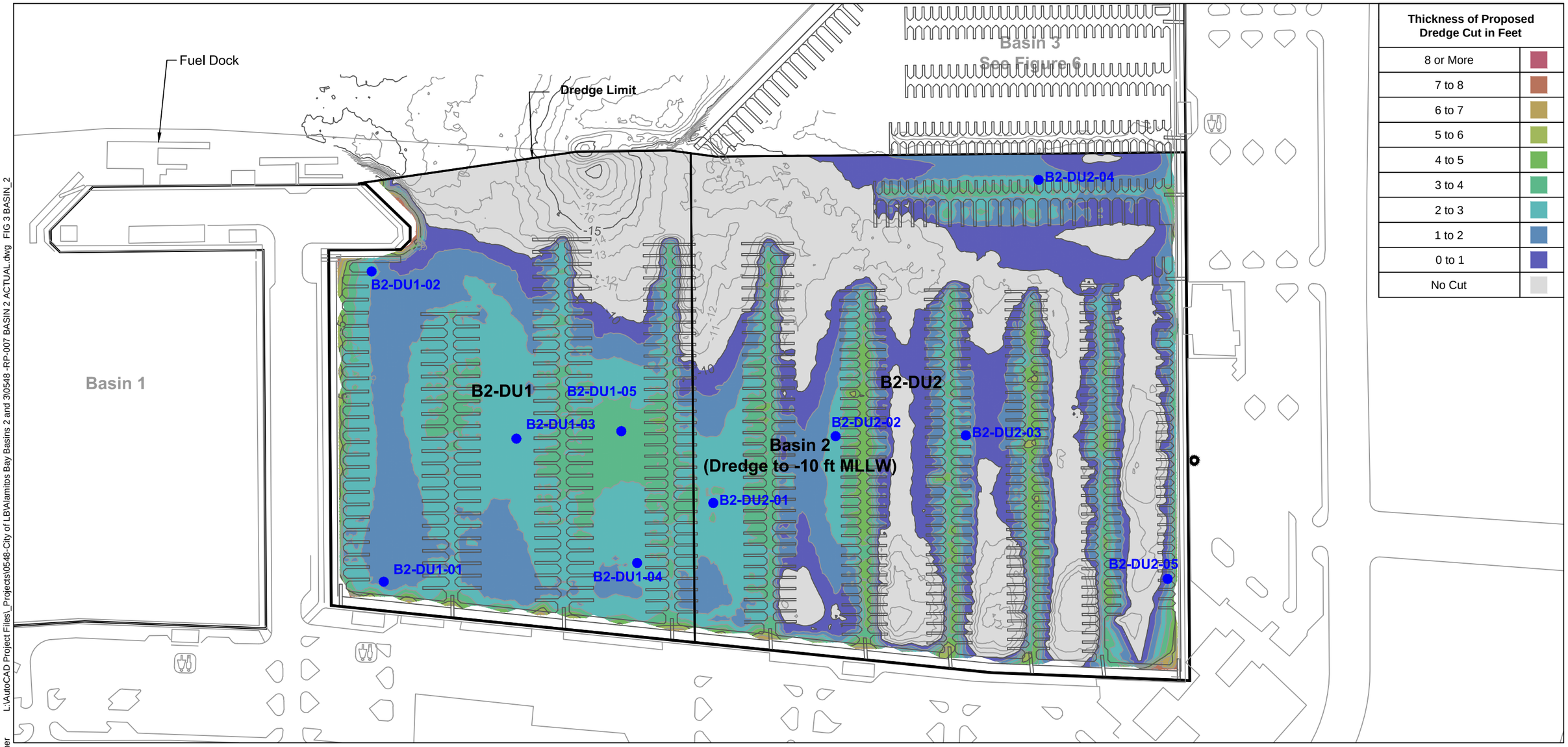
SOURCE: Aerial from Google Earth Pro, 2012.
HORIZONTAL DATUM: California State Plane, Zone 7, NAD27, U.S. Feet.

0 1000
Scale in Feet

L:\AutoCAD Project Files_Projects\0548-City of LB\Alamitos Bay Basins 2 and 3\0548-RP-002 BASINS 2_3.dwg FIG 2
Jan 06, 2014 11:41am mpratschner

ANCHOR QEA

Figure 2
Overview of Work at Alamitos Bay Marina
Alamitos Bay Marina Basins 2 and 3



Thickness of Proposed Dredge Cut in Feet	
8 or More	
7 to 8	
6 to 7	
5 to 6	
4 to 5	
3 to 4	
2 to 3	
1 to 2	
0 to 1	
No Cut	

SOURCE: Basemaps and bathymetric data from Gahagan & Bryant Associates, Inc. survey performed February 13, 2013. Additional bathymetric data from TranSystems, Long Beach.
HORIZONTAL DATUM: California State Plane, Zone 7, NAD27.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

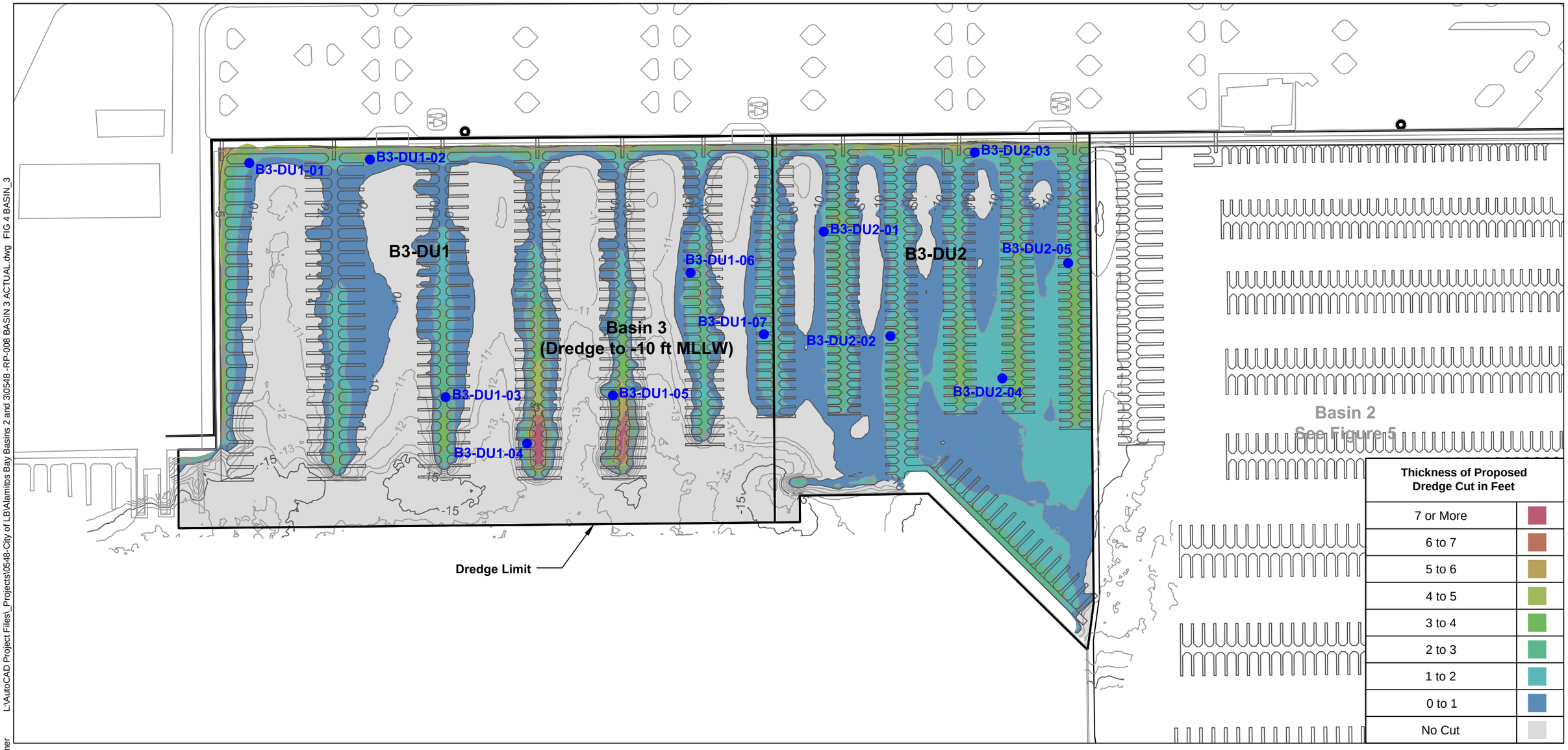
- B#-# — Actual Core Sampling Location
- MS4 Discharge Location

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0548-City of LB\Alamitos Bay Basins 2 and 3\0548 -RP-007 BASIN 2 ACTUAL.dwg FIG 3 BASIN_2
May 08, 2014 10:51am mpratschner

ANCHOR QEA

Figure 3
Basin 2 Dredge Units and Core Sampling Locations
Alamitos Bay Marina Basins 2 and 3



SOURCE: Basemaps and bathymetric data from Gahagan & Bryant Associates, Inc. survey performed December 22 - 26, 2013. Additional bathymetric data from TranSystems, Long Beach, survey performed August 1, 2007.
HORIZONTAL DATUM: California State Plane, Zone 7, NAD27.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

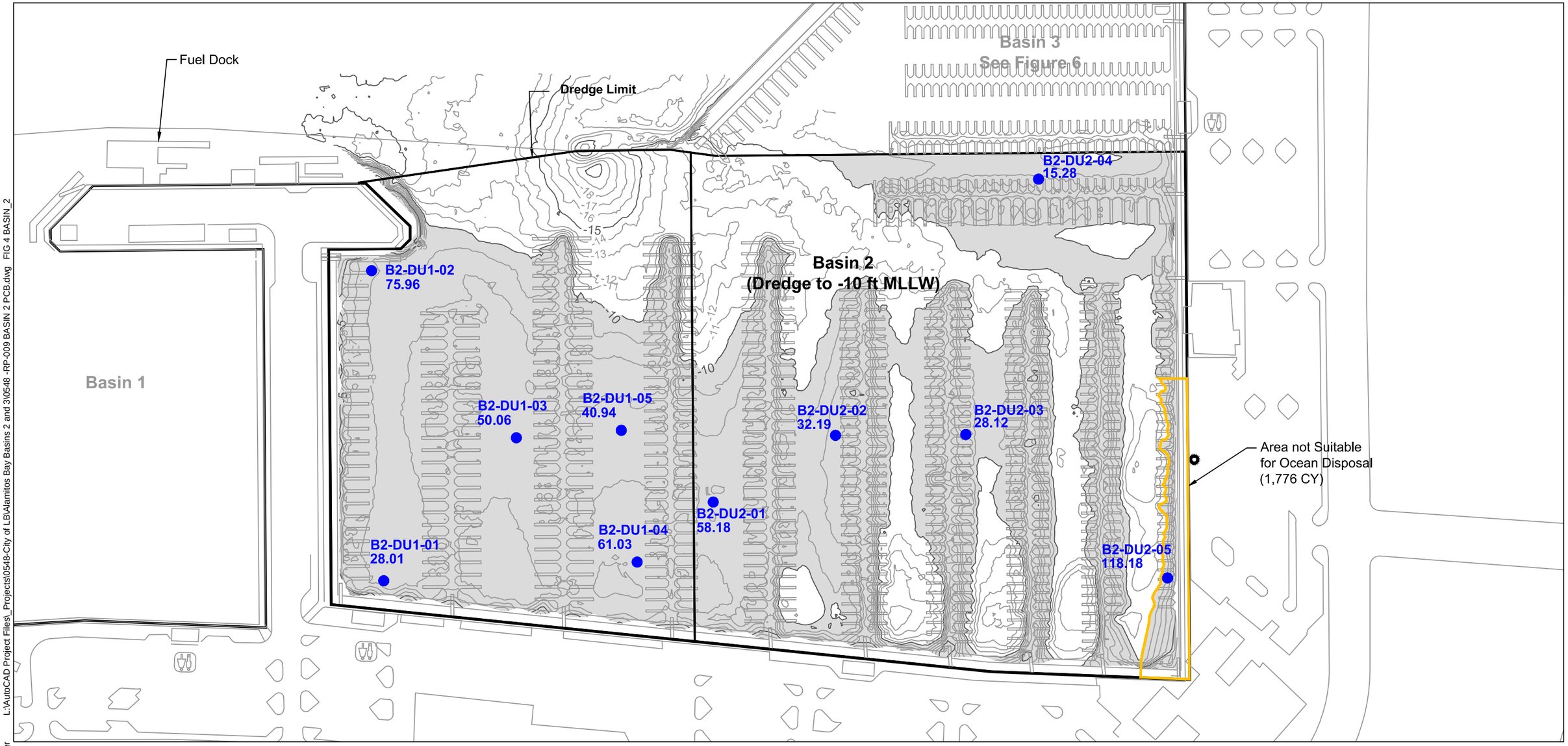
- B#-# — Actual Core Sampling Location
- MS4 Discharge Location

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0548-City of LB\Alamitos Bay Basins 2 and 3\0548 -RP-008 BASIN 3 ACTUAL.dwg FIG 4 BASIN_3
May 08, 2014 10:53am mpratschner

ANCHOR QEA

Figure 4
Basin 3 Dredge Units and Core Sampling Locations
Alamitos Bay Marina Basins 2 and 3



SOURCE: Basemaps and bathymetric data from Gahagan & Bryant Associates, Inc. survey performed February 13, 2013. Additional bathymetric data from TranSystems, Long Beach.
HORIZONTAL DATUM: California State Plane, Zone 7, NAD27.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

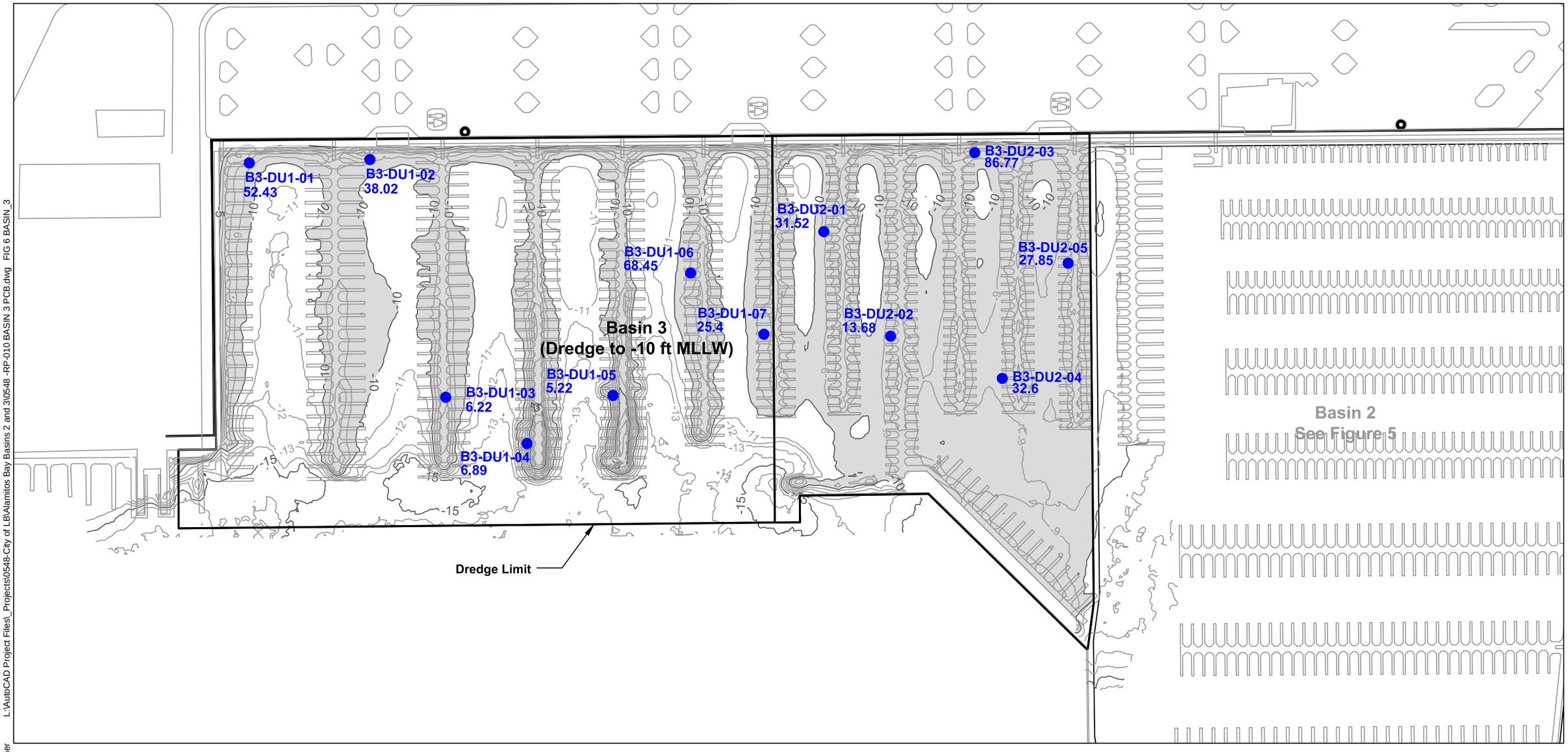
- B#-## — Actual Core Sampling Location, Total PCB Concentrations (µg/kg)
- MS4 Discharge Location
- Areas Higher than -10 (MLLW)

0 150
Scale in Feet

L:\AutoCAD Project Files_Projects\0548-City of LB\Alamitos Bay Basins 2 and 3\0548 -RP-009 BASIN 2 PCB.dwg FIG 4 BASIN_2
May 07, 2014 3:22pm mpratschner

ANCHOR QEA

Figure 5
Total PCB Concentrations within Basin 2
Alamitos Bay Marina Basins 2 and 3



L:\AutoCAD Project Files_Projects\0548-City of LBA\Alamitos Bay Basins 2 and 3\0548 -RP-010 BASIN 3 PCB.dwg FIG 6 BASIN_3

May 07, 2014 5:10pm mpratschner

SOURCE: Basemaps and bathymetric data from Gahagan & Bryant Associates, Inc. survey performed December 22 - 26, 2013. Additional bathymetric data from TranSystems, Long Beach, survey performed August 1, 2007.
HORIZONTAL DATUM: California State Plane, Zone 7, NAD27.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

LEGEND:

- B#-# ## — Actual Core Sampling Location, Total PCB Concentrations (µg/kg)
- MS4 Discharge Location
- Areas Higher than -10 (MLLW)

0 150
Scale in Feet

ANCHOR QEA

Figure 6
Total PCB Concentrations within Basin 3
Alamitos Bay Marina Basins 2 and 3

APPENDIX A
FIELD LOGS AND CORE PHOTOGRAPHS

APPENDIX B
CHEMISTRY LABORATORY REPORTS

APPENDIX C
BIOLOGICAL LABORATORY REPORT

APPENDIX D
STFATE MODELING

APPENDIX E
STATISTICAL ANALYSES OF TISSUE CONCENTRATIONS

APPENDIX F
DATA VALIDATION REPORTS