SEDIMENT MONITORING SUMMARY REPORT
2009 REMEDIAL DREDGING
NEW BEDFORD HARBOR SUPERFUND SITE, OU #1

Contract No. W912WJ-09-D-0001-0010

Prepared For:
United States Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

Prepared By:
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81 Technology Park Drive
East Falmouth, MA 02536

June 2010

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EXECUTIVE SUMMARY

Sediment sampling was conducted to monitor the progress and final results of the remediation dredging operation at the New Bedford Harbor Superfund Site during the 2009 field season. Sediment push core samples were collected from seven areas at the Site to characterize the extent of the polychlorinated biphenyl (PCB) contamination in harbor sediments. Four of the seven areas were actively undergoing remediation during 2009; these "progress-" and/or "post-dredge" sample collection areas included Dredge Areas M, G, J, and L. The other three sample collection areas were characterized in anticipation for the 2010 remediation season; these "pre-dredge" sample collection areas include the cove located adjacent to Area G (North Cove), the cove adjacent to Area J (South Cove), and a location adjacent to the south boarder of Area L (Area K). Sample collection was conducted between August and December, 2009.

The objective of the progress-dredge and post-dredge sediment sampling was to: 1) assess the sediment condition during and following dredging operations, relative to the target dredge elevation set for the area of interest, and 2) confirm whether remediation dredging completed removal of contaminated sediments to concentrations at or below the 10 ppm remediation criteria. Progress- and post-dredge push cores were collected during four sampling events, and at 92 locations in Dredge Areas G, J, L, and M. With exception of one event, sediment cores were split open for internal sediment characterization and analytical sub-sample collection. The internal sediment characterization was performed to confirm the presence of the highly contaminated organic sediment layer (OL) and to determine the elevation of the transition between the OL and underlying sediment strata. The thickness of the OL layer varied by location; this was due to natural geologic features and whether that area had been dredged. The underlying sediments were generally comprised of clayey silt (ML/CL) or silty clay (CL/ML) with small amounts of fine sand. Analytical results of the NOAA-18 PCB Congeners reveal that the OL surface layer contained total PCB concentrations up to 2,148 mg/kg, with an average of 229 mg/kg. Underlying sediments were less contaminated, containing a total PCB concentration maximum of 391 mg/kg, and an average of 43 mg/kg.

The objective of the pre-dredge sediment sampling was to characterize the sediments at each location with respect to the presence and thickness of the OL layer. These data are used by the USACE and its contractors to confirm the target remediation dredge elevation estimates. Pre-dredge cores for the 2010 season were collected at 22 locations during one sampling event during 2009. These cores followed the same sample processing and characterization procedures as the progress- and post-dredge cores. At the direction of the USEPA and USACE, pre-dredge sediment samples were analyzed for PCB Aroclors rather than the NOAA-18 congeners. Results indicate physical and chemical trends similar to other cores, where surficial samples characterized as OL sediments were more highly contaminated than the underlying sediments.

The data produced as a result of the 2009 progress- and post-dredge sampling, as well as the 2010 pre-dredge sampling, will be used to assist the USACE and its contractors in developing the 2010 remediation dredge plan.

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1.0 INTRODUCTION

1.1 SITE LOCATION AND DESCRIPTION

The New Bedford Harbor Superfund Site, located in Bristol County, Massachusetts, extends from the shallow northern reaches of the Acushnet River estuary south through the commercial harbors of New Bedford and Fairhaven and into 17,000 adjacent acres of Buzzards Bay (Figure 1). The City of New Bedford, located along the western shore of the Site, is approximately 55 miles south of Boston. New Bedford is currently home port to a large offshore fishing fleet and is a densely populated manufacturing and commercial center. By comparison, the eastern shore of New Bedford Harbor is predominantly residential, light commercial or salt marsh.

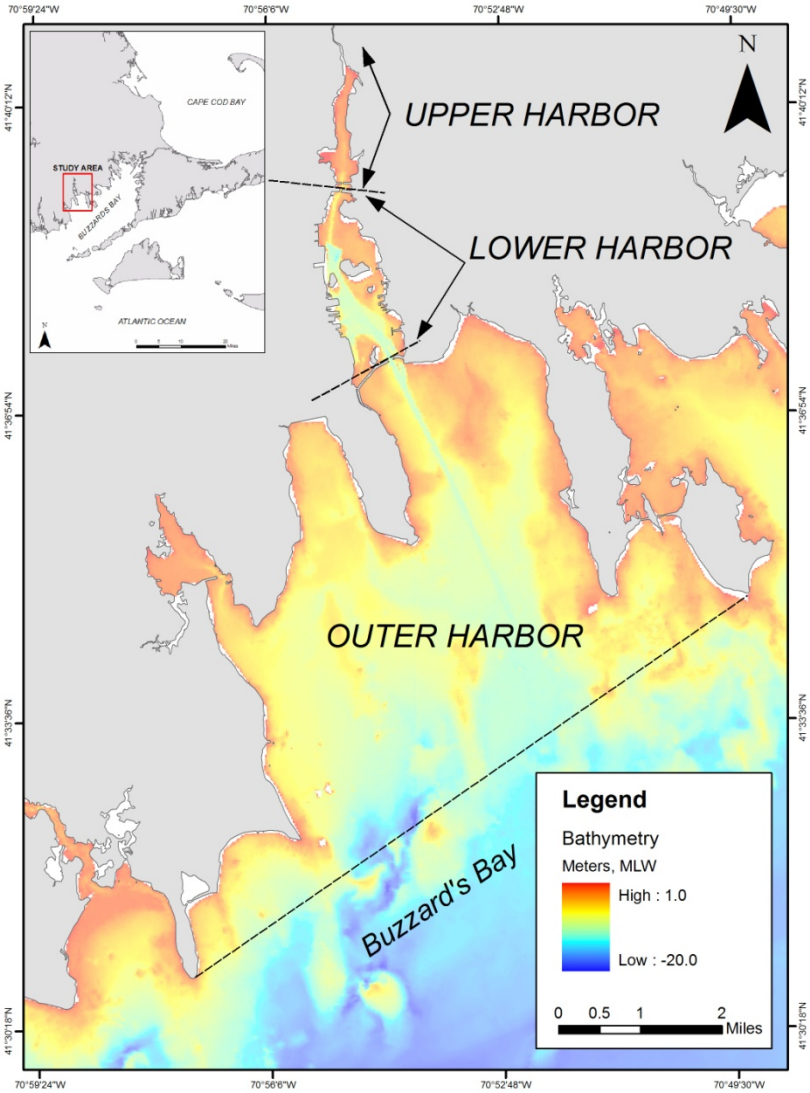

Figure 1. Basemap of New Bedford Harbor Superfund Site in Southeastern, MA

The Acushnet River's 16.5 square mile drainage basin discharges to New Bedford Harbor in the northern reaches of the Site, contributing relatively minor volumes of fresh water to the tidally influenced harbor (VHB, 1996). Numerous storm drains, combined sewer overflows (CSOs), industrial discharges, as well as smaller brooks and creeks also discharge directly to the Site. The upper and lower harbors are believed to be areas of net groundwater discharge. The estuary can be characterized as a shallow, well-mixed system.

Industrial and urban development surrounding the harbor has resulted in sediments becoming contaminated with high concentrations of many pollutants, notably polychlorinated biphenyls (PCBs) and heavy metals. Contaminant gradients within harbor sediments decrease from north to south. The source of the contamination has been attributed to two electrical capacitor manufacturing facilities that operated between the 1940s and the 1970s. One facility, Aerovox Corporation, is located near the northern boundary of the Site, and the other, Cornell-Dubilier Electronics, Inc. is located just south of the New Bedford Harbor hurricane barrier. The two facilities are known to have discharged PCB-laden wastes either directly into the harbor or indirectly via discharges to the City's sewerage system.

Based on human health concerns and ecological risk assessments, the United States Environmental Protection Agency (USEPA) added New Bedford Harbor to the National Priorities List in 1983 as a designated Superfund Site. Through an Interagency Agreement between the USEPA and the United States Army Corps of Engineers, New England District (USACE NAE), the USACE is responsible for carrying out the design and implementation of remedial measures at the Site.

The Site has been divided into three geographic areas: the upper, lower and outer harbors, consistent with geographic features, basin morphology (Figure 1) and gradients of contamination. The Site is also defined by three state-sanctioned fishing closure areas extending approximately 6.8 miles north to south and encompassing approximately 18,000 acres in total. The upper harbor comprises approximately 187 acres, with current sediment PCB levels ranging from below detection to approximately 4,000 parts per million (ppm). Prior to the removal of the most contaminated hot spot sediments in 1994 and 1995, as part of EPA's first cleanup phase, sediment PCB levels were reported higher than 100,000 ppm in the upper harbor. The boundary between the upper and lower harbor is the Coggeshall Street Bridge; at this point the harbor is constricted to a width of approximately 100 feet. The lower harbor comprises approximately 750 acres, with current sediment PCB levels ranging from below detection to over 100 ppm. The boundary between the lower and outer harbor is the 150 foot wide opening of the New Bedford hurricane barrier. The hurricane barrier was constructed in the mid-1960s. Sediment PCB levels in the outer harbor are generally low, with only localized areas of PCBs in the 50 – 100 ppm range near the Cornell-Dubilier plant and the New Bedford sewage treatment plant's outfall pipes. The southern extent of the outer harbor is a line mapped from Rock Point (the southern tip of West Island in Fairhaven), southwesterly to Negro Ledge, and then southwesterly to Mishaum Point in Dartmouth (Figure 1).

1.2 PROJECT OBJECTIVES AND SCOPE

The remediation of the Site involves the excavation and dredging of approximately 900,000 cubic yards of PCB-contaminated sediment. The majority of the contaminated material is being removed by a hydraulic dredge that pumps a spoils-slurry to the project's Sawyer Street facility where it is mechanically processed to remove all sand, gravel, and debris. The remaining silt and clay slurry is then pumped to the Area D Dewatering Facility located on Herman Melville Boulevard where it is mechanically dewatered and transported off-site for disposal.

The Site is divided into a series of Dredge Management Units (DMU) based primarily on contamination levels, contamination sources, and topography. In 2009, remediation activities at the Site included hydraulic dredging in four areas, M, G, J and L (Figure 2). Three of the four areas (Areas M, G and J) dredged during the 2009 season were in the vicinity of the Aerovox facility. These three areas comprise the majority of the estuary between the Wood Street Bridge and the Aerovox facility. The fourth area, Area L, is located south of the submerged cable crossing.

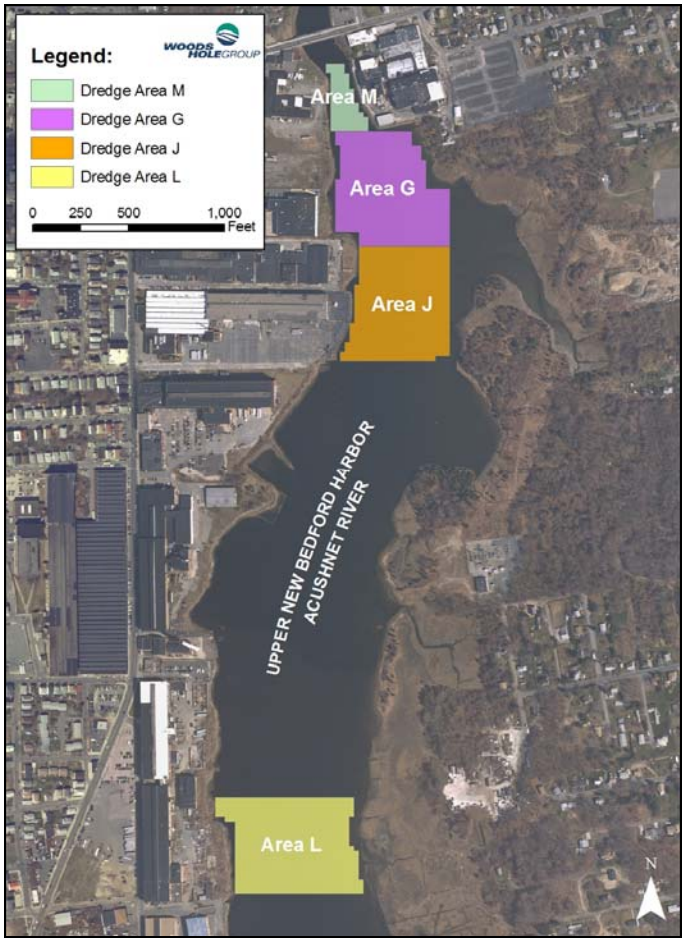

Figure 2. Basemap of 2009 Remediation Dredging Areas

The objectives of the 2009 sediment monitoring program were to collect sediment cores and perform sediment characterizations and analytical testing of PCBs to support the remedial dredging activities in Operational Unit #1 (OU1).

Sediment monitoring of the OU1 area in 2009 required the visual characterization of split sediment cores to determine the elevation of the transition between the OL layer and the underlying strata and sediment thickness of the "OL" layer. The OL layer is defined by the United Soil Classification System [USCS], as 'organic silt, organic clay.' Historical analytical data confirms that the OL layer contains the highest concentrations of PCB contaminants. Therefore, the identification of the OL layer is important in developing a dredge plan, monitoring dredging performance and assessing the overall performance of the dredging operation. Analysis of PCB contaminants in sediment core samples within the OL layer, and in others layers, further strengthens the correlation between PCB concentrations and the OL sediments, and confirms the need for further dredging. The successful completion of the sediment monitoring plan required close coordination with the USACE and the dredging contractor Jacobs Engineering (JE).

1.2.1 Pre-dredge Sediment Sampling

The entire upper harbor, including the DMUs and 2009 Dredge Areas, has been parceled into discrete 25-foot by 25 foot 'z-blocks'. During remedial design, a geostatistical model was used to predict a target elevation for dredging each z-block, termed the z* elevation. This target dredge elevation represents the elevation below which PCB concentrations are predicted to be less than the 10 mg/kg (ppm) remediation criterion. Using target dredge elevations in combination with bathymetric data, a preliminary dredge plan was developed which estimated the required depth of dredging and the thickness of the overlying sediment to be removed. In 2009, Pre-Dredge sampling was performed in preparation for remedial dredging in 2010. The Pre-Dredge sediment sampling plan was designed to confirm the target dredge elevation estimates from the z-blocks, and to adjust elevations as needed. Coring locations were placed onto the z-block map to achieve sufficient spatial coverage for the evaluation of the target dredge elevations. Visual characterization and analytical data from the pre-dredge cores will be used by the USACE and JE to prepare the final 2010 dredge plan.

1.2.2 Progress dredge and Post-dredge Sediment Sampling

Progress-dredge and Post-dredge sediment sampling was conducted to assess the sediment condition during and following dredging operations, relative to the target dredge elevation set for the area of interest. The intent of the Progress- and Post-Dredge sampling was to confirm whether remediation dredging completed removal of contaminated sediments to concentrations at or below 10 ppm. The obvious difference between Progress- and Post-Dredge cores was that Progress-Dredge cores were taken during 2009 dredging activities and post-dredge cores were taken after the completion of all 2009 dredging activities. Another less discernable difference is the degree of data validation required for the two data sets. Both Progress- and Post-Dredge cores were visually characterized to determine the elevation and thickness of "OL" material remaining. All core samples, with the exception of cores collected in August, were subsampled for analytical testing to assess PCB concentrations in the sediment. August

cores were externally examined in the field and disposed; no analytical samples were collected. If PCB concentrations exceeded 10 ppm, the location was identified for further dredging, whether in 2009 or 2010.

2.0 METHODS

Methods used to collect and analyze sediment samples are summarized below and described in detail in the project Field Sampling Plan (Woods Hole Group 2009A) and Quality Assurance Project Plan (Woods Hole Group 2009B).

2.1 CORE LOCATIONS

All locations for the collection of sediment cores were approved by the USACE and USEPA, and provided electronically to WHG by JE. Locations were provided in Massachusetts State Plane Mainland coordinates, and were converted into latitude and longitude using the program Corpscon 6. The WHG navigation system required all waypoints to be entered in geographic coordinates.

2.2 CORE COLLECTION

Sediment cores were collected with a push-core sampling device and a 2 5/8 inch inner diameter clear polycarbonate core barrel. The length of core needed for collection was determined by the target dredge elevation relative to the bottom elevation at each core location. To ensure that the target dredge elevation was sampled, a core barrel was pushed into the sediment past the target dredge elevation horizon. A piston assembly inside the core barrel was used to create suction, thereby preventing excessive compaction during penetration and loss of sediment from the bottom of the barrel during recovery.

A water depth measurement was recorded and the water surface elevation was surveyed at each sampling location. Water surface elevation was surveyed relative to the vertical datum NGVD29 using gauged tide boards previously secured to a sheet pile with elevation markings. After the push-core device was assembled, the total length of the device was measured, and the piston was positioned just inside the lower edge of the core barrel. The coring assembly was lowered in the water until the leading edge of the barrel was at the sediment–water interface. At this point the piston attachment line was secured to the boat, fixing the elevation of the piston, creating a suction point at the sediment-water interface. The push-core was then driven into the sediment to the predetermined depth, and the distance between the top of the push-core assembly and the water surface was measured. During core barrel retrieval the piston line was held tight to maintain suction in the barrel and to overcome the suction holding the penetrated core barrel in place. Upon recovery of the core onto the survey vessel, the bottom end of the barrel was capped, the barrel was removed from the push-core device, and the core was stored in a vertical position.

2.3 CORE CALCULATIONS

Quality Assurance and Quality Control (QA/QC) calculations were performed following core recovery. These calculations used the measurements recorded during the coring

process to determine whether the core was acceptable (e.g. penetrated and recovered sediment from the target elevation). The required measurements and calculations are described in detail below and illustrated in Figure 3. All measurements were recorded in units of ±0.1 feet.

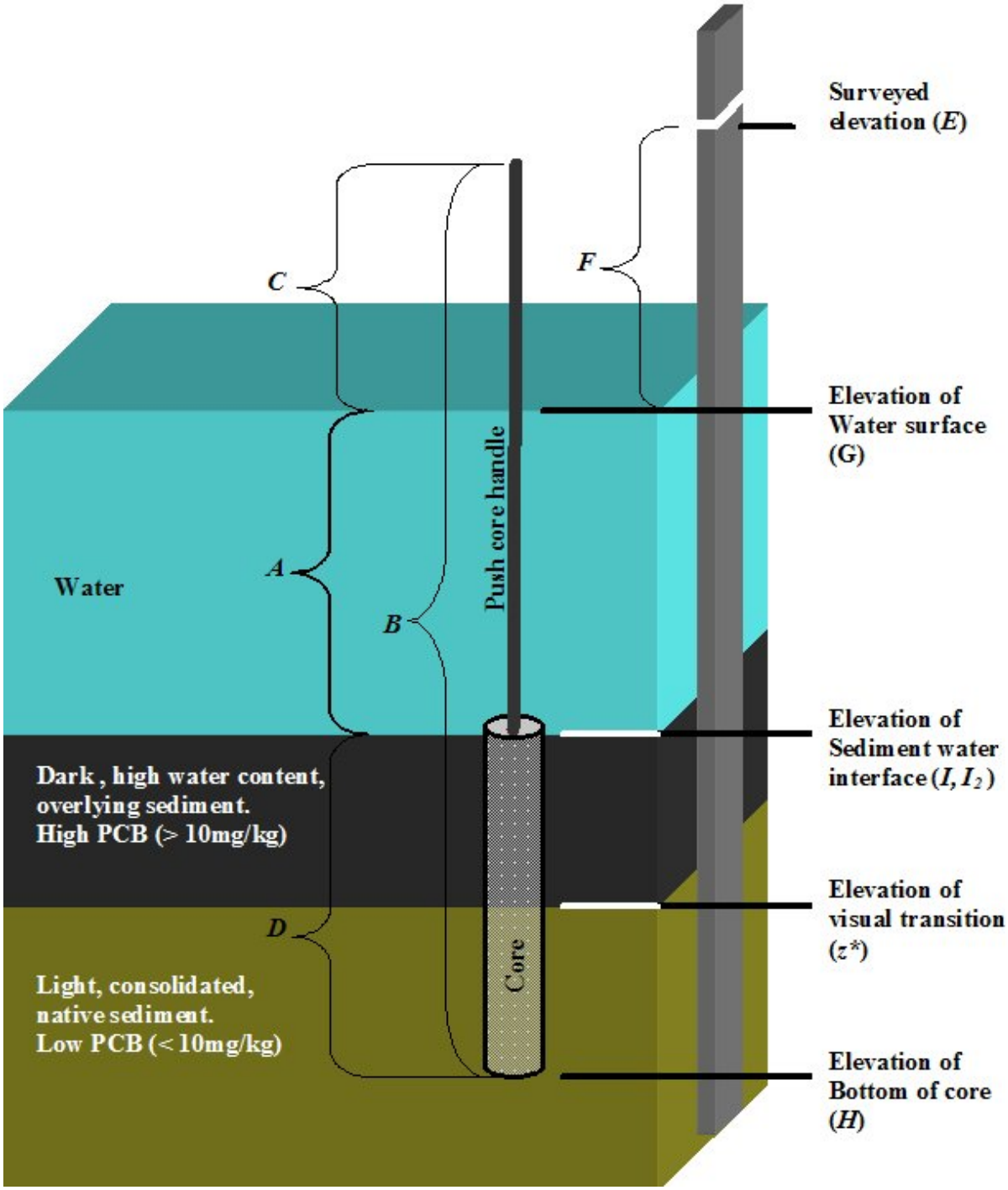

Figure 3. Graphical Representation of Sediment Core Measurements

Descriptions of coring parameters described in Figure 3:

A = **Water depth**. The water depth was recorded using a stadia rode.

B = **Length of push-core assembly**. Prior to deployment, the full length of the push-core assembly from the top of the handle to the bottom edge of the core liner was recorded.

C = **Water surface to top of core assembly handle**. Once the core assembly was fully penetrated, the length of the assembly remaining above the water surface was recorded.

D = **Core Length**. The core length retained in the core barrel, from bottom to top, was measured and recorded.

E = **Surveyed elevation**. Prior to operations, the dredge contractor installed a gauged tide board fixed to the sheet pile with markings indicating a survey elevation (NGVD 29). This elevation was recorded and served as the reference point for elevation calculations.

F = **Water surface from surveyed elevation**. After sample collection, the survey vessel navigated to the fixed gauged tide board and the distance from the water surface to the surveyed elevation was recorded.

From these measurements a number of calculations were made to determine true elevations:

E - *F* = Elevation of water surface (G).

G - *(B* - *C)* = Elevation of bottom of core (*H*).

The H elevation (bottom of core) was used to determine the elevation of all visual transitions, including apparent target dredge elevation, i.e.:

H + *(distance to visual transition)* = **Elevation of visual transition** (target dredge elevation)

H + D = Elevation of sediment-water interface (I).

The elevation of the sediment-water interface was also calculated from:

G - *A* = Elevation of sediment-water interface (I_2).

If I and I2 varied by more than 1.0 foot, the core was discarded and a new sample collected. The difference between I and I2 could have been caused by 1) too much water at the top of the core, 2) compaction of the core sediment, or 3) sediment loss from the bottom of the core. Any one, or combination, of these factors can result in an unacceptable core sample.

2.4 EXTERNAL SEDIMENT CORE EXAMINATION

Acceptable cores were brought back to the field laboratory at the Sawyer Street facility for external inspection. The external inspection process included: 1) archival photography, and 2) a geological description through the polycarbonate core barrel, where the visual transitions between each type of sediment were recorded on a log sheet.

Although it is an efficient procedure, the external examination of the sediments through the transparent core barrel has proven difficult to provide: 1) an accurate physical description, and 2) the thicknesses of in-situ sediment strata. For example, during penetration, the core barrel can push overlaying sediment downward along the sides of the core barrel, obscuring the sediments that actually comprise that section of the core. This is common in the New Bedford Harbor sediments where the upper unconsolidated black silt is dragged downward in the core barrel, and causes a "streaking" effect when observed externally. It is often difficult to determine whether the streaking is an actual stratigraphic feature (e.g., mixing), or a remnant of the coring process. After the first round of cores were collected in August and these difficulties were observed, subsequent cores were split and described internally.

2.5 INTERNAL SEDIMENT CORE EXAMINATION

Except for the initial cores taken in August, all cores were split open, described and sampled. A split core enables an accurate physical description and measurement of thickness of the in-situ sediment strata, and allows for the collection of discrete sediment subsamples for laboratory analysis.

Each core barrel was placed into a clean 4 inch gutter and split by cutting along the entire length of the polycarbonate barrel with power shears. Cuts were made on opposite sides of the core barrel, 180 degrees apart. A clean piece of stainless steel wire (18 gauge) was used to slice through the middle of the barrel, using the two cuts in the barrel as guidelines. Care was used to prevent the wire from pulling obstructions (shells, rocks) down the core barrel and potentially mixing sediment layers. After splitting, the cores were rolled 90 degrees and separated. Following separation, the core was geologically described and photographed by a trained sedimentologist (codes for types/colors). Textural descriptions were performed according to ASTM standards. Color descriptions followed the Munsell color classification.

Sediment from half-foot sections of each split core was composited and sampled into 8 ounce glass jars for PCB analysis. Typically, this subsample was collected from the top 0.5 feet of the core. However, variations in core compositions required unique sampling schemes to best characterize the sediment in a given core. If the core had a clear transition from the "OL" to another sediment layer, a one half foot (0.5 foot) interval of sediment below the transition line was also sampled and composited for PCB analysis. Additional samples were collected for laboratory-based quality control analysis. All Progress- and Post-dredge samples were sent to Alpha Analytical Laboratories for PCB congener (NOAA 18) analysis. The 2010 Pre-dredge core samples were sent to the USEPA Office of Environmental Measurement and Evaluation for PCB Aroclor analysis.

2.6 POLYCHLORINATED BIPHENYL ANALYSES

The methods used by the laboratory have been summarized below and more detail can be found in detail in Alpha Analytical Laboratories SOP O-012 and the USEPA's SOP EIA-FLDPCB2 in the Quality Assurance Project Plan (Woods Hole Group 2009B).

Upon sample preparation an aliquot of a well mixed, homogeneous sediment sample is accurately measured for sample preparation. Generally, 50 grams of sediment is extracted. The New Bedford Harbor QAPP requires 30 g of sediment for extraction by Method 3540C Soxhlet Extraction, which is air dried to a minimum of >50% solids and generally >90% solids. The sample is spiked with surrogate compounds and then extracted using methylene chloride or a methylene chloride/acetone mixture. The extract is dried and exchanged to hexane during sample concentration. After extraction, clean-up techniques are applied as necessary. The extract may be treated with Aminoprpyl, Carbon Column, Florisil (3620B) or GPC (3640A) for hydrocarbon and lipid removal, and copper (3660B) for sulfur removal. The extract is exchanged into hexane and concentrated to the appropriate volume, generally 10mL, and transferred for analysis. Prior to analysis, the extract is cleaned with sulfuric acid (3665A). Alternatively, this method can be employed for lower detection limits by decreasing the final volume to 1-5mL.

After clean-up and re-concentration, the extracts are analyzed on a gas chromatograph (GC) which is fitted with two capillary columns of differing polarities each employing separate detectors. This process follows a modified USEPA Method 8082 (WHG 2009B). The extracts of PCB Congeners are spiked with internal standards (IS) prior to analysis. The target analytes are resolved on each column and detected using an electron capture detector (ECD). Analytes are introduced into the GC/ECD by injecting a known volume of the calibration standards, quality control samples, and sample extracts into the GC which is temperature and flow programmed to separate the analytes. Identification of the target analytes is accomplished by confirming a target hit on two dissimilar columns using Retention Time (RT) and Pattern Recognition (PR). Concentrations are calculated from the ECD response using internal standard techniques. Sample results were reported in micrograms per kilogram (µg/kg) for the individual congeners.

For each batch of 20 or fewer samples, a laboratory method blank, LCS/LCSD, MS and MSD was processed and analyzed with the field samples.

3.0 RESULTS

Results from the 2009 sediment monitoring activities are described below. Complete field data collection and description logs, and digital photographs of the split and un-split sediment cores are provided in Appendix A. Digital photographs of the split Post-Dredge cores were also uploaded to the New Bedford Harbor project database. In the database the core photographs are linked to the field collection information, and to any associated analytical results.

A typical sediment core in the upper harbor consisted of a surficial OL layer with varied underlying strata. The OL layer consists of unconsolidated to loosely consolidated fine

grained black organic sediment. The underlying strata are generally composed of moderate- to well-consolidated fine grained grey sediments, which vary in texture between silt and clay or a combination of both (e.g. clayey silt - ML/CL or silty clay - CL/ML). In certain locations the underlying strata also contained low amounts of sand. Previous years of monitoring data have shown that the OL layer contains the highest concentrations of PCB contaminants. For this reason, and for the purpose of remediation, it is important to determine the thickness of the OL layer and the transition from the OL layer to the underlying strata.

3.1 PRE-DREDGE CORE SAMPLING

Pre-Dredge cores for the 2010 season were collected on October 21 and 22, 2009. Cores were located at 22 locations within 3 areas: North Cove, South Cove and Dredge Area K (Figures 4 through 6). After collection, sediment cores were split open for internal sediment characterization and analytical sample collection. The internal sediment characterization was performed to confirm the presence of the OL layer and to determine the elevation of the transition between the OL and underlying strata. Results from sediment characterization and PCB Aroclors analysis performed by the EPA's laboratory are presented in Tables 1 and 2, Figures 7 through 9, and are summarized by Dredge Area below.

3.1.1 North Cove

The OL layer in the North Cove had a light to heavy sheen present, with a thickness that ranged from 0.5–0.98 feet. Underlying strata consisted of ML/CL sediment that transitioned to CL/ML at depth. The total PCB Aroclors concentration (mg/kg) of the OL ranged from 75.0 to 1030, with a mean of 474.29. The underlying strata had total PCB Aroclors concentrations that ranged from 0.0 to 67.00, with a mean of 14.60.

3.1.2 South Cove

The South Cove OL layer had a light to heavy sheen present, with a thickness that ranged from 0.9–1.36 feet. Underlying strata consisted of ML/CL sediment that transitioned to CL/ML at depth. The total PCB Aroclor concentration (mg/kg) of the OL ranged from 38.70 to 2560.00, with a mean of 1374.78. The underlying strata had total PCB Aroclor concentrations that ranged from 20.60 to 1650.00, with a mean of 660.60

3.1.3 Dredge Area K

Dredge Area K had an OL layer with a light to heavy sheen present, and a thickness that ranged from 0.0–0.9 feet. The underlying strata followed two distinct textural patterns. The sediment was either composed of ML/CL sediment that transitioned to CL/ML at depth, or a sand/gravel mixture that transitioned into a well-sorted fine sand. The total PCB Aroclor concentration (mg/kg) of the OL ranged from 9.90 to 319.00, with a mean of 83.36. Underlying strata had total PCB Aroclor concentrations that ranged from 0.50 to 93.00, with a mean of 33.59.

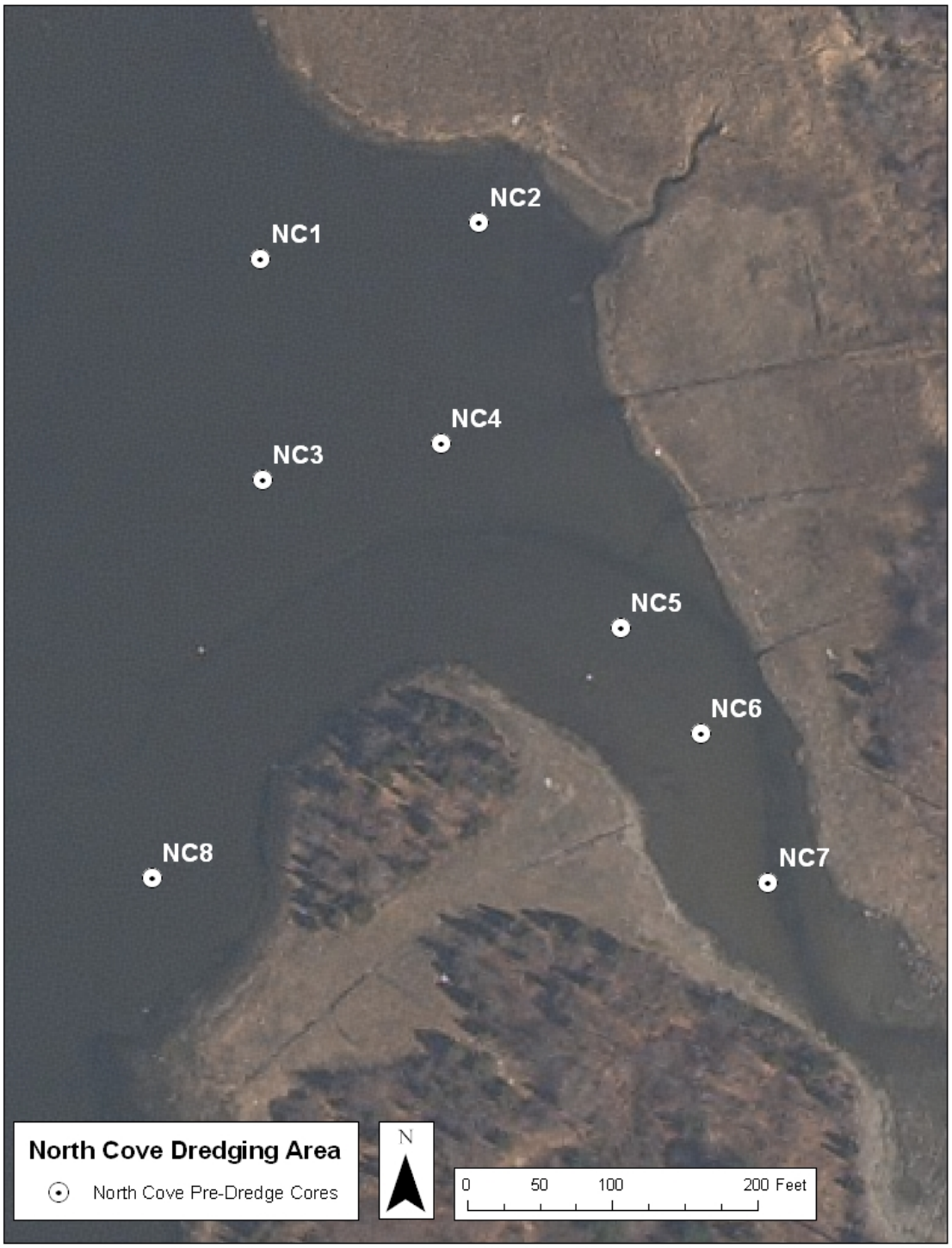

Figure 4. Basemap of North Cove Core Locations Collected in 2009

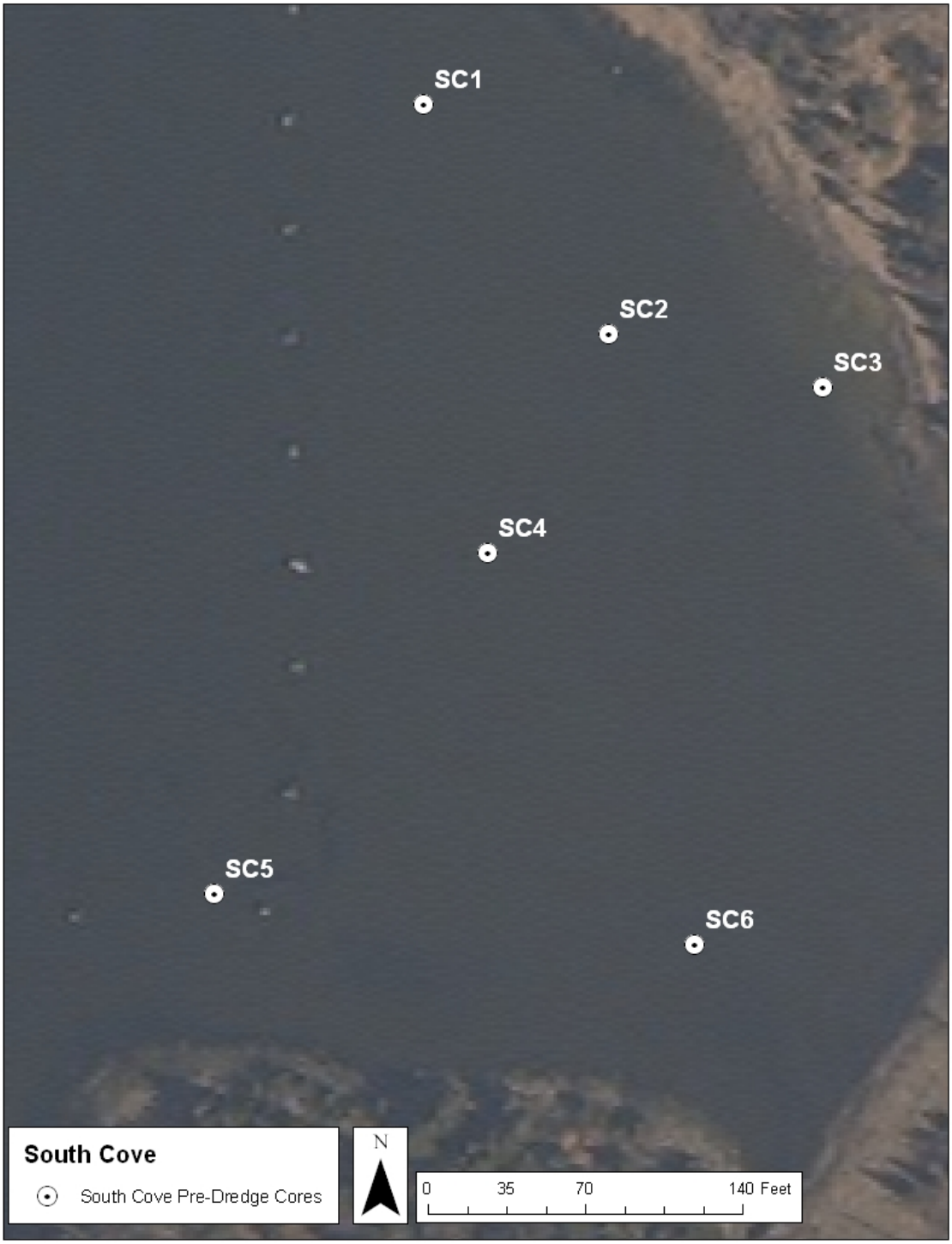

Figure 5. Basemap of South Cove Core Locations Collected in 2009

Figure 6. Basemap of Area K Core Locations Collected in 2009

Table 1. Elevation Data from 2010 Pre-dredge Sampling Event, October 21–22, 2009

Station ID	Northing NAD 83 MA, ft	Easting NAD 83 MA, ft	Elevation Measurements (NGVD 29ft)		Measured Sediment Thickness of 'OL' Layer Remaining (ft)
			Measured Elevation of Sediment Surface	Measured Elevation of Transition ('OL' to Underlying Strata)	
K1	2703647.78	815442.13	-6.96	-7.86	0.90
K2	2703825.49	815673.18	-2.1	-2.10	0.00
K3	2703722.59	815723.98	-2.9	-2.90	0.00
K4	2703649.55	815701.71	-3.65	-4.03	0.38
K5	2703528.25	815725.31	-4.28	-4.68	0.40
K6	2703497.20	815625.33	-4.9	-5.40	0.50
K7	2703450.14	815848.80	-3.5	-4.06	0.56
K8	2703426.53	815949.16	-1.46	-1.46	0.00
NC1	2707400.59	816249.76	-1.9	-2.43	0.53
NC2	2707425.91	816399.84	-1.3	-1.94	0.64
NC3	2707248.76	816250.80	-1.97	-2.95	0.98
NC4	2707273.90	816373.57	-1.61	-2.21	0.60
NC5	2707147.21	816497.38	-1.05	-1.95	0.90
NC6	2707074.71	816552.52	-1.05	-1.85	0.80
NC7	2706971.78	816598.77	-1.9	-2.40	0.50
NC8	2706974.94	816175.27	-2.2	-2.95	0.75
SC1	2706549.45	816123.55	-2.25	-3.61	1.36
SC2	2706446.77	816206.22	-2.22	-3.12	0.90
SC3	2706423.13	816302.01	-1.05	-2.05	1.00
SC4	2706349.22	816152.25	-1.85	-2.99	1.14
SC5	2706196.55	816030.35	-1.95	-2.91	0.96
SC6	2706173.73	816244.52	-1.65	-2.55	0.90

Table 2. Total PCB Concentrations of 2010 Pre-Dredge Cores, collected October 21–22, 2009.

Station ID	Core ID	Sample Interval (ft)	PCB Aroclors (mg/kg)
K1	S-09O-C041	0.0-0.5	319.00
		0.5-1.0	93.00
K2	S-09O-C034	0.0-0.5	21.40
		0.5-1.0	0.99
K3	S-09O-C035	0.0-0.5	21.60
		0.5-1.0	8.70
K4	S-09O-C036	0.0-0.5	32.00
		0.5-1.0	5.40
K5	S-09O-C037	0.0-0.5	34.00
		0.5-1.0	0.60
K6	S-09O-C040	0.0-0.5	189.00
		0.5-1.0	154.00
K7	S-09O-C038	0.0-0.5	40.00
		0.5-1.0	0.90
K8	S-09O-C039	0.0-0.5	9.90
		0.5-1.0	0.50
NC1	S-09O-C023	0.0-0.5	115.00
		0.5-1.0	2.50
NC2	S-09O-C022	0.0-0.5	280.00
		0.5-1.0	67.00
NC3	S-09O-C024	0.0-0.5	75.00
		0.5-1.0	6.60
NC4	S-09O-C021	0.0-0.6	1030.00
		0.6-1.1	9.50
NC5	S-09O-C020	0.5-1.0	470.00
		1.0-1.5	0.00
NC6	S-09O-C019	0.3-0.8	590.00
		0.8-1.3	2.50
NC7	S-09O-C018	0.0-0.5	760.00
		0.5-1.0	13.40
NC8	S-09O-C025	0.3-0.8	137.00
		0.8-1.3	15.30
SC1	S-09O-C026	0.0-0.5	1230.00
		0.5-1.0	20.60
SC2	S-09O-C027	0.0-0.5	1150.00
		0.5-1.0	43.00
SC3	S-09O-C028	0.0-0.5	2560.00
		0.5-1.0	1200.00
SC4	S-09O-C031	0.0-0.5	2560.00
		0.5-1.0	430.00
SC5	S-09O-C032	0.0-0.5	710.00
		0.5-1.0	620.00
SC6	S-09O-C033	0.0-0.5	38.70
		0.5-1.0	1650.00

* Note: These samples were analyzed for PCB aroclors by the EPA's laboratory.

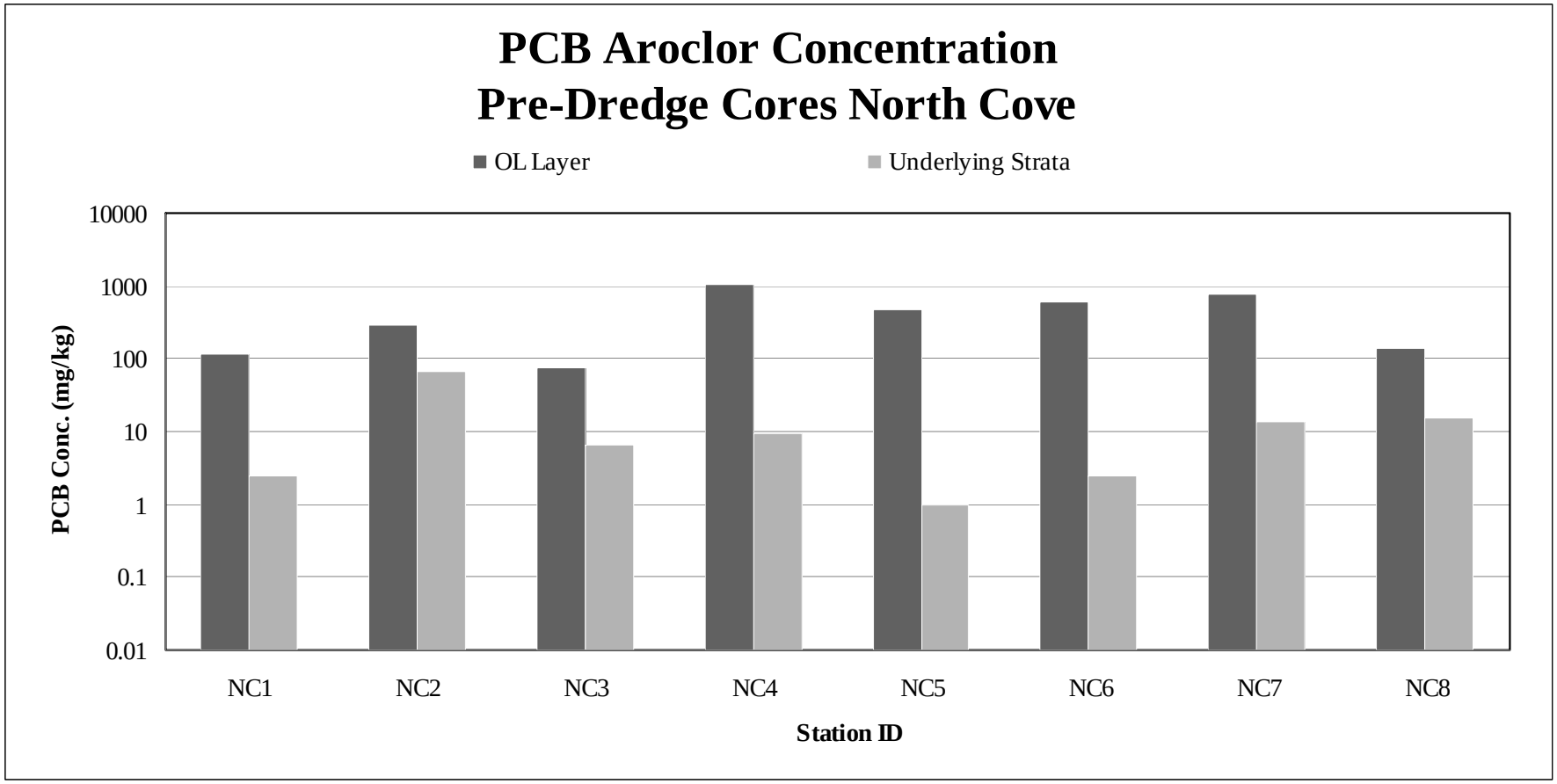

Figure 7. PCB Aroclor Concentration in North Cove Pre-dredge Cores

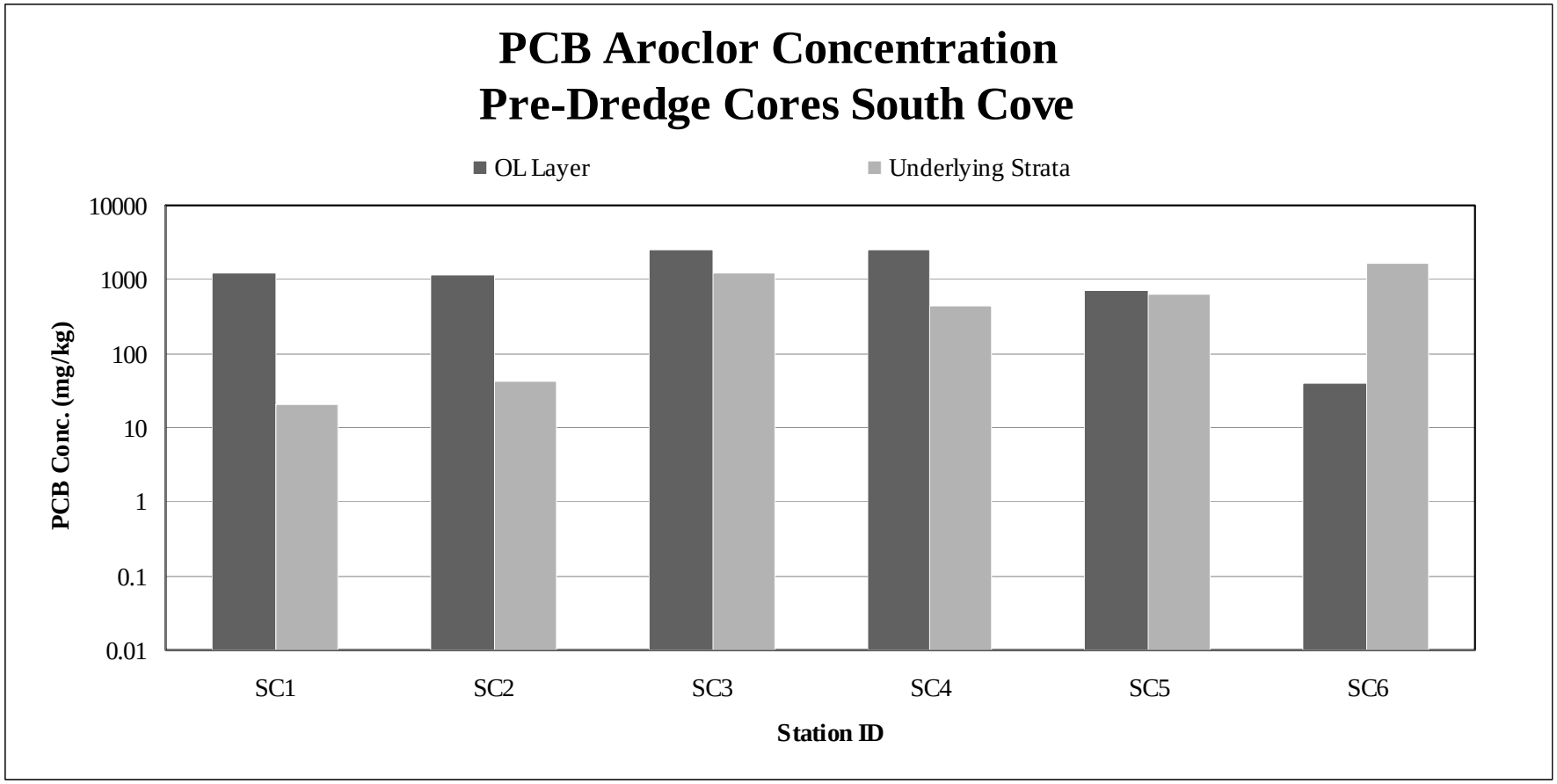

Figure 8. PCB Aroclor Concentration in South Cove Pre-dredge Cores

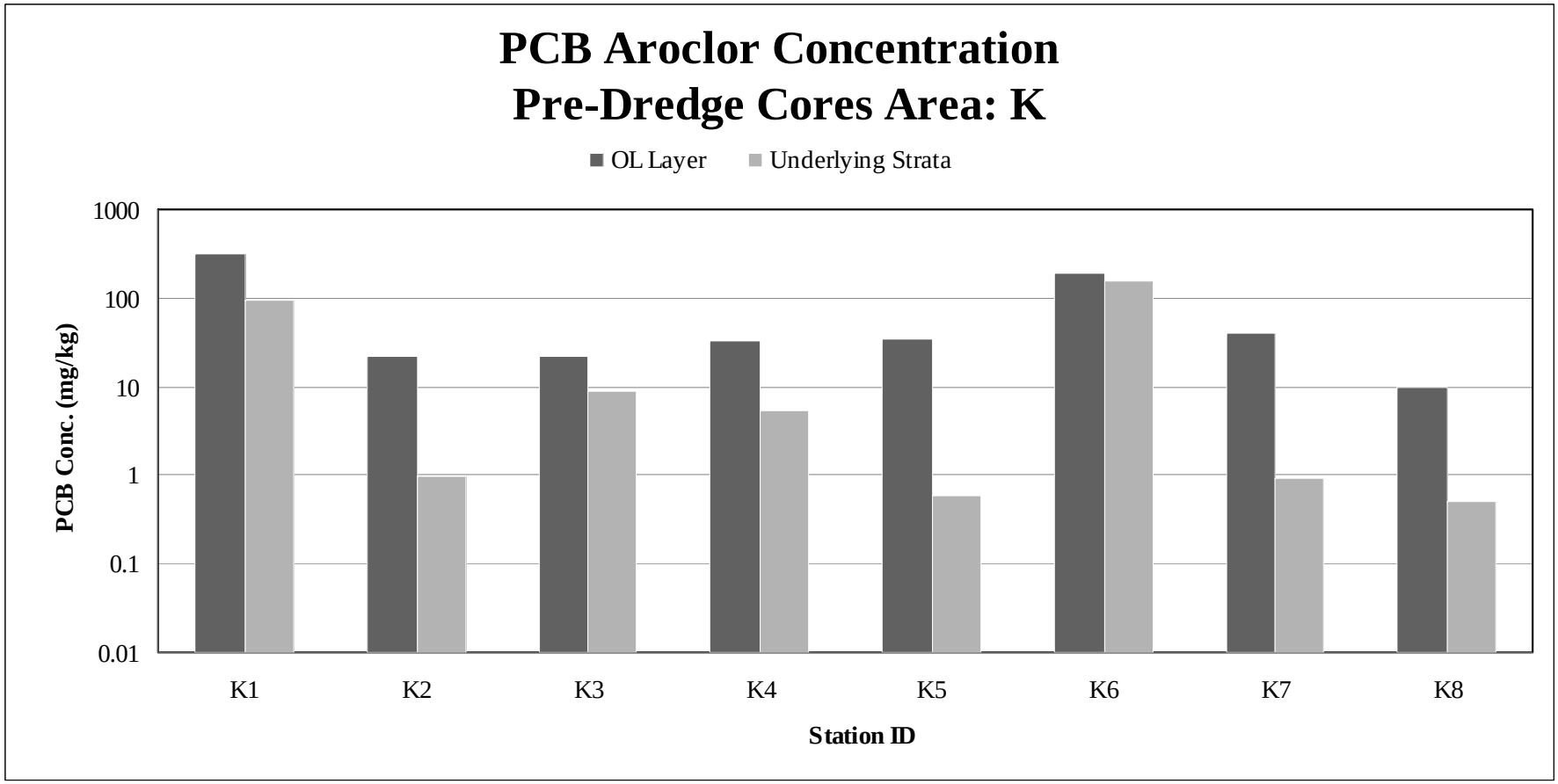

Figure 9. PCB Aroclor Concentration in Area K Pre-dredge Cores

3.2 PROGRESS-DREDGE AND POST-DREDGE CORE SAMPLING

Progress-Dredge and Post-Dredge cores were collected in August, September, November and December 2009. Cores were collected at 92 locations in Dredge Areas G, J, L, and M (Figures 10 through 13). During the September, November, and December collection events sediment cores were split open for internal sediment characterization and analytical sample collection. The internal sediment characterization was performed to confirm the presence of the OL layer and to determine the elevation of the transition between the OL and underlying strata. During the August collection event cores were externally examined in the field and disposed; no analytical samples were collected. Results from sediment characterizations and PCB congener analysis are presented in Tables 3 through 10, Figures 14 through 23 and summarized by Dredge Area below.

3.2.1 Area G

The thickness of the OL layer in Dredge Area G ranged from 0.0–1.3 feet. The underlying strata generally consisted of ML/CL or CL/ML sediment with small amounts of fine sand. The total PCB concentration (mg/kg) of the OL layer ranged from 3.81 to 371.00, with a mean of 134.01. The underlying strata had total PCB concentrations that ranged from 0.29 to 32.12, with a mean of 7.95.

3.2.2 Area J

The OL layer in Dredge Area J had a light to heavy sheen present and ranged in thickness from 0.0–1.33 feet. The underlying strata consisted of ML/CL sediment that transitioned to CL/ML at depth. The total PCB concentration (mg/kg) of the OL layer ranged from 9.94 to 1399.20, with a mean of 261.08. The underlying strata had total PCB concentrations that ranged from 0.03 to 391.32, with a mean of 50.20.

3.2.3 Area L

Dredge Area L had an OL layer with a light to heavy sheen and a strong petroleum odor present, and a thickness that ranged from 0.03–3.90 feet. The underlying strata consisted of ML/CL sediment that transitioned to CL/ML at depth. The total PCB concentration (mg/kg) of the OL layer ranged from 1.56 to 2148.19, with a mean of 321.59. Underlying strata had total PCB concentrations that ranged from 0.04 to 294.69, with a mean of 60.51.

3.2.4 Area M

The thickness of the OL layer in Dredge Area M ranged from 0.0–0.6 feet and had a slight petroleum odor. The underlying strata generally consisted of ML/CL or CL/ML sediment. The total PCB concentration (mg/kg) of the OL layer ranged from 1.12 to 55.49, with a mean of 16.59. Only two samples were collected from the underlying strata in Area M cores. These two samples resulted in total PCB concentrations 0.07 and 2.55 mg/kg.

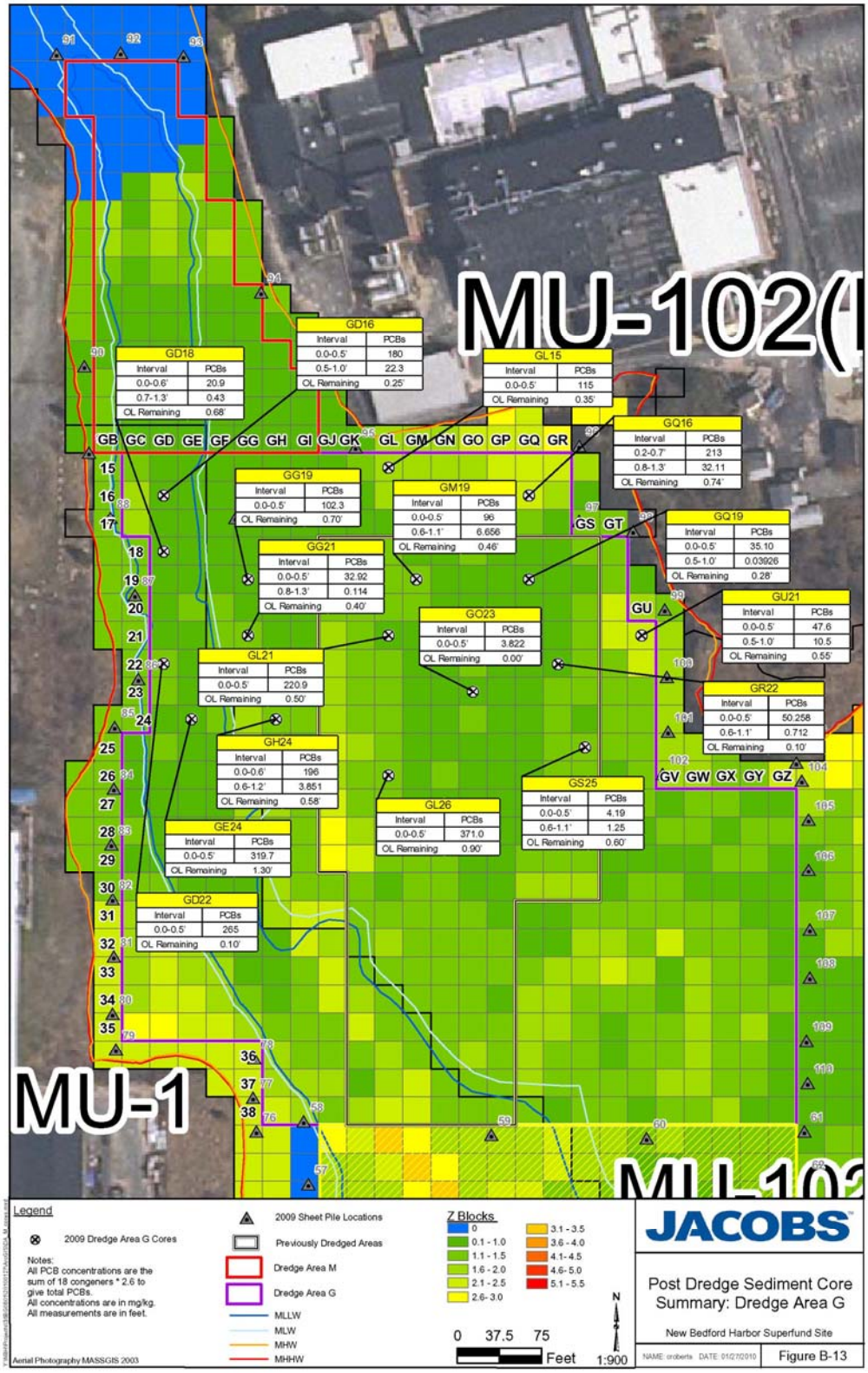

Figure 10. Area G Total PCB Concentrations and OL Thickness for 2009

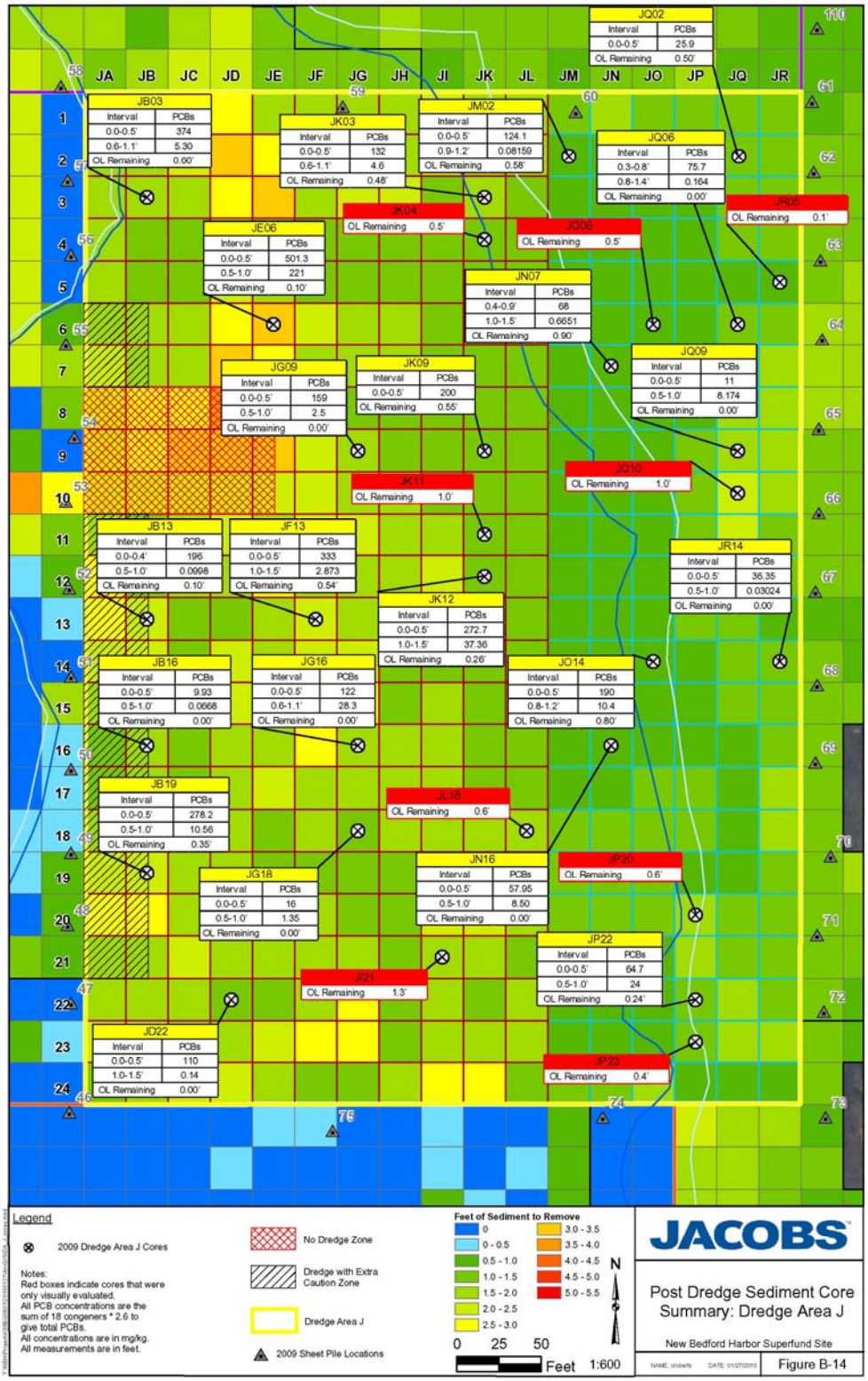

Figure 11. Area J Total PCB Concentrations and OL Thickness for 2009

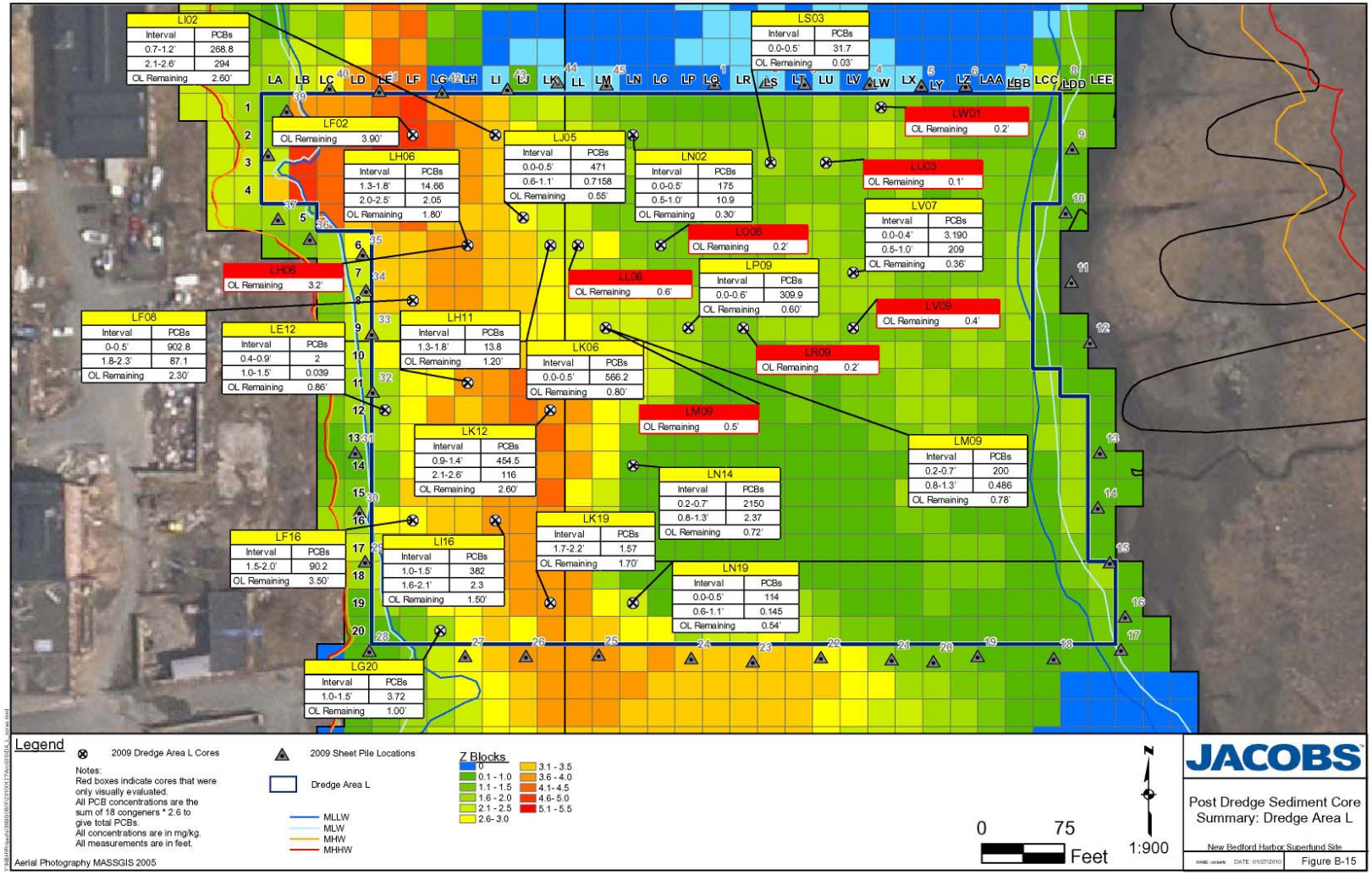

Figure 12. Area L Total PCB Concentrations and OL Thickness for 2009

Figure 13. Area M Total PCB Concentrations and OL Thickness for 2009

Table 3. Elevation Data from August 2009 Progress Dredge Sampling Event, August 12, 2009

Station ID	Northing NAD 83 MA, ft	Easting NAD 83 MA, ft	Elevation Measurements (NGVD 29 ft)			Measured Sediment Thickness of 'OL' Layer Remaining (ft)	Actual vs. Predicted Transition Elevation (ft)[b]
			Measured Elevation of Sediment Surface	Measured Elevation of Transition ('OL' to Underlying Strata)	Target Dredge Elevation[a]		
JR05	2706543.47	816137.25	-4.00	-4.10	NA	0.10	NA
JK04	2707173.89	815959.89	-4.90	-5.40	-4.80	0.50	-0.60
JO06	2707131.94	816042.14	-4.60	-5.10	-4.20	0.50	-0.90
JQ10	2707017.05	816115.79	-5.50	-6.50	-4.50	1.00	-2.00
JK11	2707003.74	815947.40	-5.90	-6.90	-4.90	1.00	-2.00
JL18	2707019.66	818251.35	-6.00	-6.60	NA	0.60	NA
JL18 (REP)	2707019.66	818251.35	-6.20	-6.90	NA	0.70	NA
JP20	2706773.78	816067.37	-5.90	-6.50	-4.70	0.60	-1.80
JP23	2706707.04	816076.93	-5.00	-5.40	-4.20	0.40	-1.20
JI21	2706754.59	815926.34	-6.10	-7.40	-6.80	1.30	-0.60
LH06	2704252.79	815101.00	-7.90	-11.10	-8.58	3.20	-2.52
LL04	2704295.95	815196.34	-7.10	-7.70	-6.88	0.60	-0.82
LM09	2704174.68	815224.49	-7.80	-8.30	-7.94	0.50	-0.36
LO06	2704253.94	815269.49	-7.40	-7.60	-6.37	0.20	-1.23
LR09	2704181.59	815347.40	-6.50	-6.70	-6.30	0.20	-0.40
LV09	2704182.24	815443.03	-5.80	-6.20	-5.68	0.40	-0.52
LU03	2704321.80	815423.86	-6.10	-6.20	-5.63	0.10	-0.57
LU03 (REP)	2704321.80	815423.86	-5.80	-5.90	-5.63	0.10	-0.27
LW01	2704376.77	815469.03	-5.70	-5.90	-5.20	0.20	-0.70

[a] Source: Jacobs (2009)
[b] Actual vs. Predicted = Measured Elevation of Visual Transition (ft) – Target Dredge Elevation (ft).

* Note: These samples were not analyzed.

Table 4. Elevation Data from September 2009 Progress Dredge Sampling Event, September 15–16, 2009

Station ID	Northing NAD 83 MA, ft	Easting NAD 83 MA, ft	Elevation Measurements (NGVD 29 ft)			Measured Sediment Thickness of 'OL' Layer Remaining (ft)	Actual vs. Predicted Transition Elevation (ft)[b]
			Measured Elevation of Sediment Surface	Measured Elevation of Visual Transition ('OL' to Underlying Strata)	Target Dredge Elevation[a]		
GD18	2707778.58	815573.27	-4.30	-4.98	-4.20	0.68	-0.78
GD22	2707675.36	815578.53	-5.20	-5.30	-4.70	0.10	-0.60
GE24	2707626.90	815597.07	-4.50	-5.80	-4.30	1.30	-1.50
GL21	2707701.03	815778.70	-3.76	-4.26	-2.50	0.50	-1.76
GG19	2707748.71	815646.33	-3.18	-3.88	-2.10	0.70	-1.78
GL26	2707573.46	815775.02	-2.50	-3.40	-3.00	0.90	-0.40
GH24	2707627.43	815674.48	-3.95	-4.53	-2.40	0.58	-2.13
JK24	2706675.83	815954.20	-5.90	-6.70	-7.60	0.80	0.90
JN21	2706749.24	816031.11	-5.80	-6.40	-5.40	0.60	-1.00
JK19	2706797.26	815948.82	-5.80	-5.80	-5.90	0.00	0.10
JQ18	2706822.58	816098.91	-4.60	-4.80	-4.00	0.20	-0.80
JP11	2706998.55	816074.93	-6.00	-6.00	-4.40	0.00	-1.60
JK09	2707052.61	815988.05	-6.25	-6.80	-4.50	0.55	-2.30
JN07	2707095.37	816024.18	-4.70	-5.60	-4.00	0.90	-1.60
JQ06	2707126.27	816101.38	-5.10	-5.10	-4.10	0.00	-1.00
JQ02	2707223.44	816100.71	-5.80	-6.30	-3.70	0.50	-2.60
JM02	2707228.82	816000.50	-5.80	-6.38	-4.10	0.58	-2.28
JK03	2707204.19	815950.58	-5.70	-6.18	-4.80	0.48	-1.38
LV07	2704224.78	815447.30	-5.90	-6.26	-5.62	0.36	-0.64
LS03	2704327.53	815373.73	-6.96	-7.50	-5.91	0.03	-1.59
LP09	2704175.17	815297.35	-7.35	-8.00	-6.98	0.60	-1.02
LF02	2704349.62	815050.25	-8.92	-12.83	-8.97	3.90	-3.86
LF08	2704197.79	815051.28	-8.28	-10.60	-7.50	2.30	-3.10
LK06	2704253.32	815178.42	-8.31	-9.10	-7.13	0.80	-1.97
LN02	2704350.98	815250.61	-6.60	-7.17	-6.20	0.30	-0.97

[a] Source: Jacobs (2009)
[b] Actual vs. Predicted = Measured Elevation of Visual Transition (ft) – Target Dredge Elevation (ft).

Table 5. Total PCB Concentrations of September Progress Dredge Cores

Station ID	Core ID	Sample Interval (ft)	Sum of 18 NOAA Congeners (mg/kg)	Total PCB[a] (mg/kg)
JK24	S-09S-C001	0.0-0.5	339.723	883.28
		1.2-1.7	7.554	19.64
JN21	S-09S-C002	0.0-0.5	191.787	498.65
		0.5-1.0	82.197	213.71
JK19	S-09S-C003	0.0-0.6	230.423	599.10
		0.6-1.2	34.793	90.46
JQ18	S-09S-C004	0.0-0.2	40.468	105.22
JP11	S-09S-C005	0.0-0.5	82.714	215.06
		1.0-1.2	0.108	0.28
JK09	S-09S-C006	0.0-0.5	77.100	200.46
JN07	S-09S-C007	0.0-0.5	26.025	67.67
		0.5-1.1	0.256	0.66
JQ06	S-09S-C008	0.3-0.8	29.110	75.69
		0.8-1.4	0.086	0.22
JQ02	S-09S-C009	0.0-0.5	9.961	25.90
JM02	S-09S-C010	0.0-0.5	47.715	124.06
		0.9-1.2	0.0314	0.08
JK03	S-09S-C011	0.0-0.5	50.778	132.02
		0.6-1.1	1.779	4.63
GD18	S-09S-C012	0.0-0.6	8.015	20.84
		0.7-1.3	0.166	0.43
GD22	S-09S-C013	0.0-0.5	102.368	266.16
GE24	S-09S-C014	0-0.5	122.946	319.66
GL21	S-09S-C015	0-0.5	84.974	220.93
GG19	S-09S-C016	0-0.5	39.356	102.33
GL26	S-09S-C017	0-0.5	142.695	371.01
GH24	S-09S-C018	0.0-0.6	75.323	195.84
		0.6-1.2	1.494	3.88
LV07	S-09S-C019	0.0-0.4	1.227	3.19
		0.5-1.0	80.288	208.75
LS03	S-09S-C020	0.0-0.5	12.178	31.70
LP09	S-09S-C021	0.0-0.5	119.186	309.90
LF08	S-09S-C023	0.0-0.5	347.240	902.80
		1.8-2.3	33.501	87.10
LK06	S-09S-C024	0.0-0.5	217.779	566.20
LN02	S-09S-C025	0.0-0.5	67.430	175.32
		0.5-1.0	4.360	11.33

[a] Total PCB = Sum NOAA 18 congeners * 2.6

Table 6. Elevation Data from October 2009 Progress Dredge Sampling Event, October 21–22, 2009

Station ID	Northing NAD 83 MA, ft	Easting NAD 83 MA, ft	Elevation Measurements (NGVD 29ft)			Measured Sediment Thickness of 'OL' Layer Remaining (ft)	Actual vs. Predicted Transition Elevation (ft)[b]
			Measured Elevation of Sediment Surface	Measured Elevation of Visual Transition ('OL' to Underlying Strata)	Target Dredge Elevation[a]		
GQ16	2707823.33	815900.80	-3.20	-3.94	-2.60	0.74	-1.34
GL15	2707846.69	815764.04	-2.60	-2.95	-2.20	0.35	-0.75
GD16	2707821.06	815568.42	-3.90	-4.15	-4.00	0.25	-0.15
GQ19	2707750.45	815901.30	-3.21	-3.49	-2.50	0.28	-0.99
GU21	2707696.48	816001.84	-3.70	-4.25	-2.20	0.55	-2.05
GS25	2707598.94	815947.87	-4.42	-5.02	-3.10	0.60	-1.92
JB03	2707202.94	815768.45	-6.92	-7.52	-6.10	0.60	-1.42
JE06	2707124.33	815819.08	-6.80	-6.90	-6.40	0.10	-0.50
JG09	2707063.94	815869.58	-5.86	-5.86	-4.60	0.00	-1.26
JO13	2706943.76	816057.09	-3.78	-4.03	-4.30	0.25	0.27
JQ15	2706901.44	816084.71	-3.10	-3.60	-4.00	0.50	0.40
JB13	2706953.76	815742.84	-7.90	-8.00	-6.80	0.10	-1.20
JG16	2706875.68	815870.87	-6.52	-6.52	-5.30	0.00	-1.22
LH11	2704125.25	815101.87	-8.25	-9.45	-8.62	1.20	-0.83
LI16	2703991.77	815121.00	-9.29	-10.79	-8.71	1.50	-2.08
LK19	2703919.20	815167.03	-9.92	-11.62	-9.75	1.70	-1.87
LG20	2703888.15	815067.06	-4.65	-5.65	-4.60	1.00	-1.05
LE12	2704100.43	815024.62	-6.77	-7.63	-5.34	0.86	-2.29
LF16	2703997.34	815048.10	-7.17	-10.67	-6.37	3.50	-4.30

[a] Source: Jacobs (2009)
[b] Actual vs. Predicted = Measured Elevation of Visual Transition (ft) – Target Dredge Elevation (ft).

Table 7. Total PCB Concentrations of October Progress Cores

Station ID	Core ID	Sample Interval (ft)	Sum of 18 NOAA Congeners (mg/kg)	Total PCB[a] (mg/kg)
JB03	S-09O-C004	0.0-0.5	143.966	374.31
		0.6-1.1	2.042	5.31
JE06	S-09O-C005	0.0-0.5	192.837	501.38
		0.5-1.0	84.871	220.66
JG09	S-09O-C006	0.0-0.5	61.200	159.12
		0.5-1.0	0.955	2.48
JO13	S-09O-C007	0.0-0.5	189.829	493.56
		0.5-1.1	150.506	391.32
JQ15	S-09O-C008	0.0-0.5	538.155	1399.20
		0.9-1.4	101.522	263.96
JB13	S-09O-C009	0.0-0.4	75.450	196.17
		0.5-1.0	0.0384	0.10
JG16	S-09O-C010	0.0-0.5	52.482	136.45
		0.6-1.1	10.921	28.39
GQ16	S09O-C001	0.2-0.7	81.796	212.67
		0.8-1.3	12.355	32.12
GL15	S-09O-C002	0.0-0.5	45.995	119.59
GD16	S-09O-C003	0.0-0.5	69.375	180.38
		0.5-1.0	8.559	22.25
GQ19	S-09O-C015	0.0-0.5	13.503	35.11
		0.5-1.0	0.113	0.29
GU21	S-09O-C016	0.0-0.5	18.268	47.50
		0.5-1.0	4.037	10.50
GS25	S-09O-C017	0.0-0.5	1.611	4.19
		0.6-1.1	0.480	1.25
LH11	S-09O-C011	1.3-1.8	5.349	13.91
LI16	S-09O-C012	1.0-1.5	146.55	381.04
		1.6-2.1	0.865	2.25
LK19	S-09O-C013	1.7-2.2	0.602	1.56
LG20	S-09O-C014	1.0-1.5	1.435	3.73
LE12	S-09O-C029	0.4-0.9	0.788	2.05
		1.0-1.5	0.015	0.04
LF16	S-09O-C030	1.5-2.0	34.726	90.29

[a] Total PCB = Sum NOAA 18 congeners * 2.6

Table 8. Elevation Data from Post-Dredge Sampling Event, December 14–15, 2009

Station ID	Northing NAD 83 MA, ft	Easting NAD 83 MA, ft	Elevation Measurements (NGVD 29 ft)			Measured Sediment Thickness of 'OL' Layer Remaining (ft)	Actual vs. Predicted Transition Elevation (ft)[b]
			Measured Elevation of Sediment Surface	Measured Elevation of Visual Transition ('OL' to Underlying Strata)	Target Dredge Elevation[a]		
GM19	2707749.77	815801.13	-3.55	-4.01	-2.70	0.46	-1.31
GR22	2707671.66	815924.61	-3.20	-3.30	-3.40	0.10	0.10
GO23	2707646.84	815847.37	-3.70	-3.70	-2.50	0.00	-1.20
GG21	2707700.15	815651.21	-3.00	-3.40	-2.50	0.40	-0.90
JQ09	2707053.39	816101.88	-5.05	-5.05	-4.10	0.00	-0.95
JR14	2706926.01	816125.52	-4.35	-4.35	-3.60	0.00	-0.75
JO14	2706925.48	816048.11	-5.80	-6.60	-4.10	0.80	-2.50
JN16	2706876.74	816025.68	-6.55	-6.55	-4.40	0.00	-2.15
JP22	2706725.23	816072.25	-5.00	-5.24	-4.60	0.24	-0.64
JD22	2706723.38	815803.61	-7.10	-7.10	-6.80	0.00	-0.30
JB19	2706801.96	815748.43	-6.90	-7.25	-6.80	0.35	-0.45
JB16	2706874.84	815747.93	-6.75	-6.75	-5.90	0.00	-0.85
JF13	2706948.40	815847.60	-6.00	-6.54	-5.50	0.54	-1.04
JK12	2706973.35	815943.05	-5.40	-5.66	-5.00	0.26	-0.66
JG18	2706827.13	815875.75	-6.35	-6.35	-5.10	0.00	-1.25
LN19	2703925.83	815248.96	-10.90	-11.44	-9.45	0.54	-1.99
LN14	2704053.37	815248.09	-9.00	-9.72	-8.20	0.72	-1.52
LK12	2704101.46	815174.90	-9.15	-11.75	-9.85	2.60	-1.90
LM09	2704174.68	815224.49	-9.25	-10.03	-7.94	0.78	-2.09
LH06	2704252.79	815101.00	-7.50	-9.30	-8.58	1.80	-0.72
LJ05	2704277.42	815150.93	-9.75	-10.30	-7.50	0.55	-2.80
LI02	2704350.11	815123.11	-7.80	-10.40	-7.83	2.60	-2.57
ME07	2708052.05	815598.72	-4.28	-4.88	-3.60	0.60	-1.28
MD10	2707972.91	815571.94	-4.05	-4.05	-4.36	0.00	0.31
MF12	2707924.67	815622.36	-4.50	-4.50	-3.46	0.00	-1.04
MI13	2707900.91	815699.92	-3.00	-3.10	-1.80	0.10	-1.30
MD14	2707875.75	815572.60	-4.20	-4.20	-3.71	0.00	-0.49

[a] Source: Jacobs (2009)
[b] Actual vs. Predicted = Measured Elevation of Visual Transition (ft) – Target Dredge Elevation (ft).

Table 9. Total PCB Concentration of Post-Dredge Cores

Station ID	Core ID	Sample Interval (ft)	Sum of 18 NOAA Congeners (mg/kg)	Total PCB[a] (mg/kg)
JQ09	S-09D-C017	0.0-0.5	4.154	10.80
		0.5-1.0	3.144	8.17
JR14	S-09D-C018	0.0-0.5	13.980	36.35
		0.5-1.0	0.012	0.03
JO14	S-09D-C019	0.0-0.5	74.340	193.28
		0.8-1.2	3.996	10.39
JN16	S-09D-C020	0.0-0.5	22.294	57.96
		0.5-1.0	3.273	8.51
JP22	S-09D-C021	0.0-0.5	24.901	64.74
		0.5-1.0	9.321	24.23
JD22	S-09D-C022	0.0-0.5	43.139	112.16
		1.0-1.5	0.052	0.13
JB19	S-09D-C023	0.0-0.5	107.010	278.23
		0.5-1.0	4.059	10.55
JB16	S-09D-C024	0.0-0.5	3.824	9.94
		0.5-1.0	0.026	0.07
JF13	S-09D-C025	0.0-0.5	127.650	331.89
		1.0-1.5	1.105	2.87
JK12	S-09D-C026	0.0-0.5	104.850	272.61
		1.0-1.5	14.366	37.35
JG18	S-09D-C027	0.0-0.5	6.207	16.14
		0.5-1.0	0.518	1.35
GM19	S-09D-C013	0.0-0.5	36.570	95.08
		0.6-1.1	2.560	6.66
GR22	S-09D-C014	0.0-0.5	19.327	50.25
		0.6-1.1	0.274	0.71
GO23	S-09D-C015	0.0-0.5	1.466	3.81
GG21	S-09D-C016	0.0-0.5	12.663	32.92
		0.8-1.3	0.557	1.45
LN19	S-09D-C001	0.0-0.5	44.302	115.19
		0.6-1.1	0.056	0.15
LN14	S-09D-C002	0.2-0.7	826.225	2148.19
		0.8-1.3	0.912	2.37
LK12	S-09D-C003	0.9-1.4	174.754	454.36
		2.1-2.6	44.701	116.22
LM09	S-09D-C004	0.2-0.7	91.335	237.47
		0.8-1.3	0.189	0.49

Station ID	Core ID	Sample Interval (ft)	Sum of 18 NOAA Congeners (mg/kg)	Total PCB[a] (mg/kg)
LH06	S-09D-C005	1.3-1.8	38.139	99.16
		2.0-2.5	0.789	2.05
LJ05	S-09D-C006	0.0-0.5	180.553	469.44
		0.6-1.1	0.275	0.72
LI02	S-09D-C007	0.7-1.2	103.368	268.76
		2.1-2.6	113.343	294.69
ME07	S-09D-C008	0.0-0.5	21.344	55.49
		0.6-1.1	0.982	2.55
MD10	S-09D-C009	0.0-0.5	0.431	1.12
MF12	S-09D-C010	0.0-0.5	2.061	5.36
MI13	S-09D-C011	0.0-0.5	1.602	4.17
MD14	S-09D-C012	0.0-0.5	6.372	16.57
		0.5-1.0	0.026	0.07

[a] Total PCB = Sum NOAA 18 congeners * 2.6

Table 10. Results from Analysis of Variance (ANOVA) test between sediment layers in each area

Area	Sediment Layer	Average PCB Concentration (mg/kg)	P –value[a]
Area J	OL Layer	261.082	0.001
	Underlying Strata	50.201	
Area L	OL Layer	321.592	0.090
	Underlying Strata	60.513	
Area G	OL Layer	134.015	0.002
	Underlying Strata	7.955	
Area M	OL Layer	16.541	0.408
	Underlying Strata	1.311	
North Cove	OL Layer	432.125	0.004
	Underlying Strata	14.600	
South Cove	OL Layer	1374.783	0.176
	Underlying Strata	660.600	
Area K	OL Layer	83.363	0.276
	Underlying Strata	33.011	

[a] P-value significant if less than or equal to 0.05

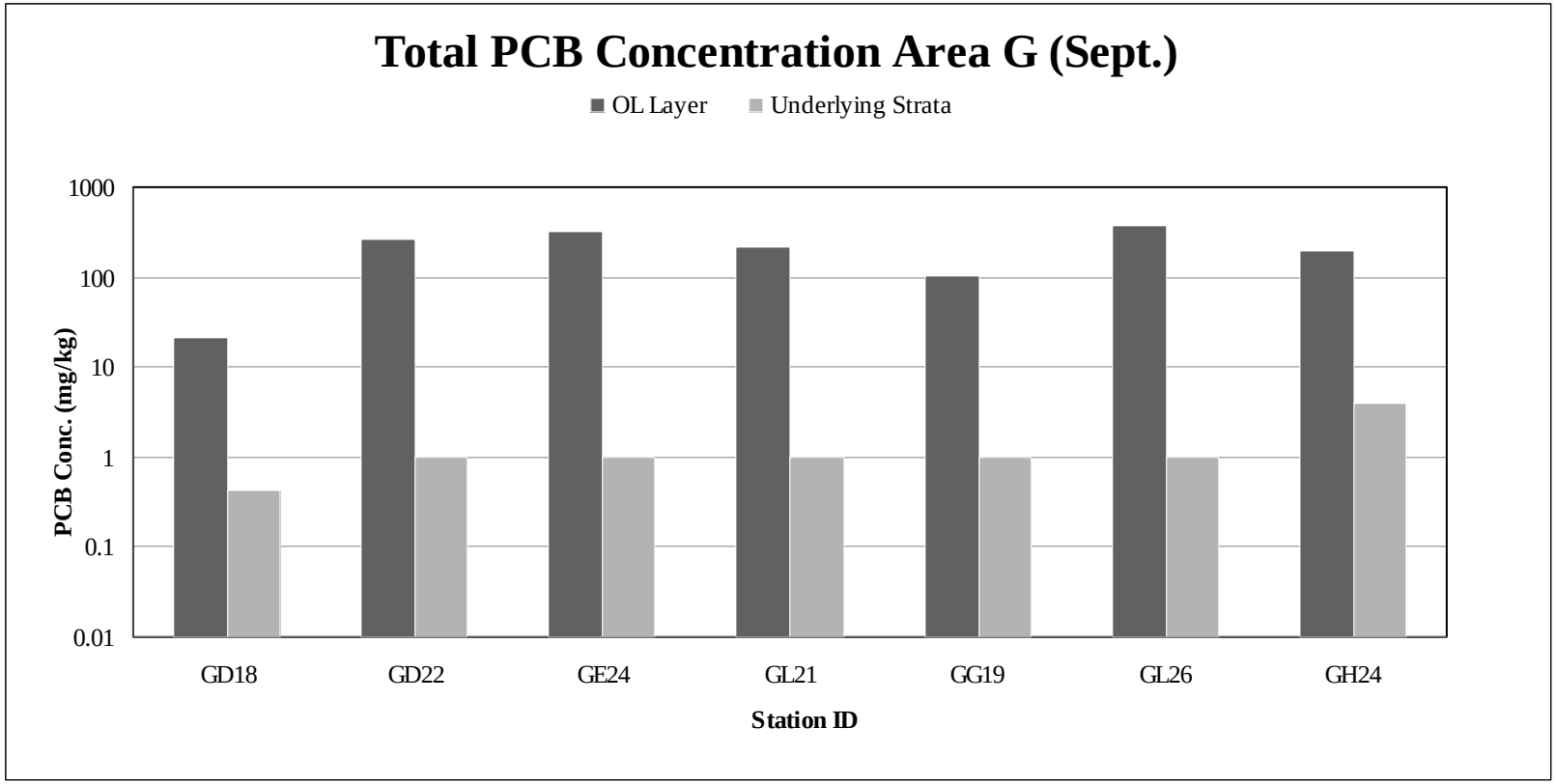

Figure 14. Total PCB Concentration in Area G for September Progress Cores

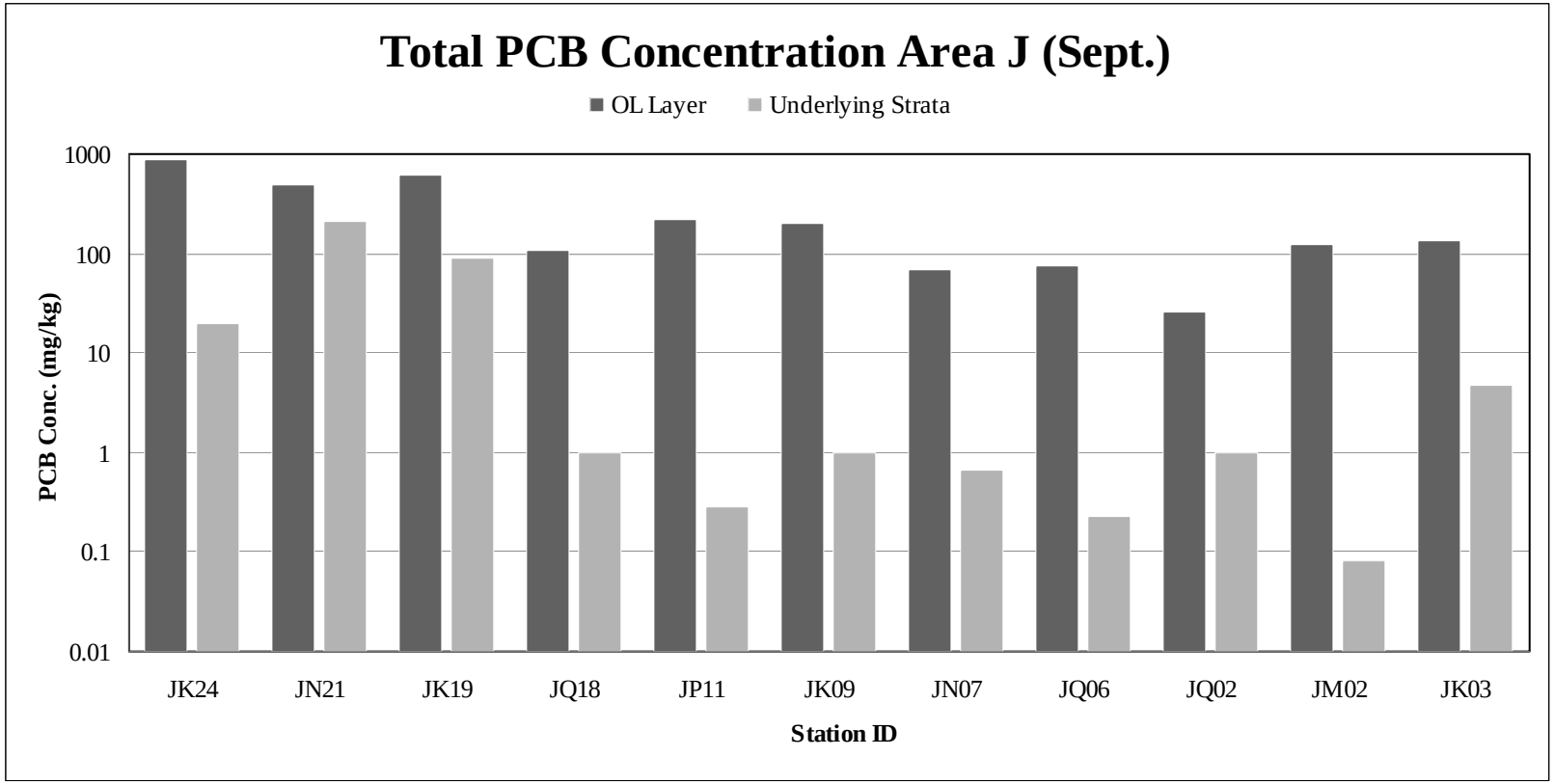

Figure 15. Total PCB Concentration in Area J during September Progress Cores

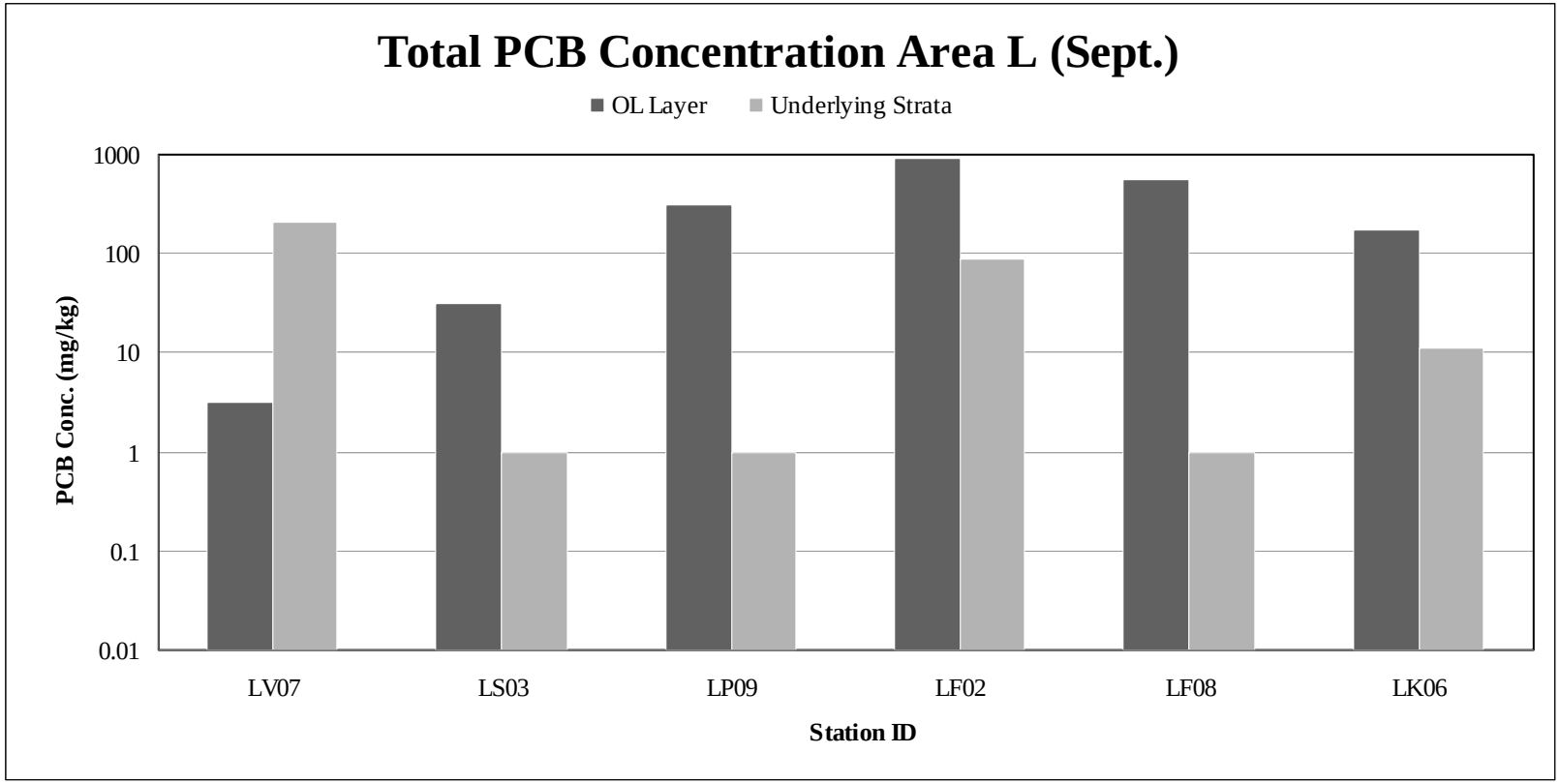

Figure 16. Total PCB Concentration in Area L for September Progress Cores

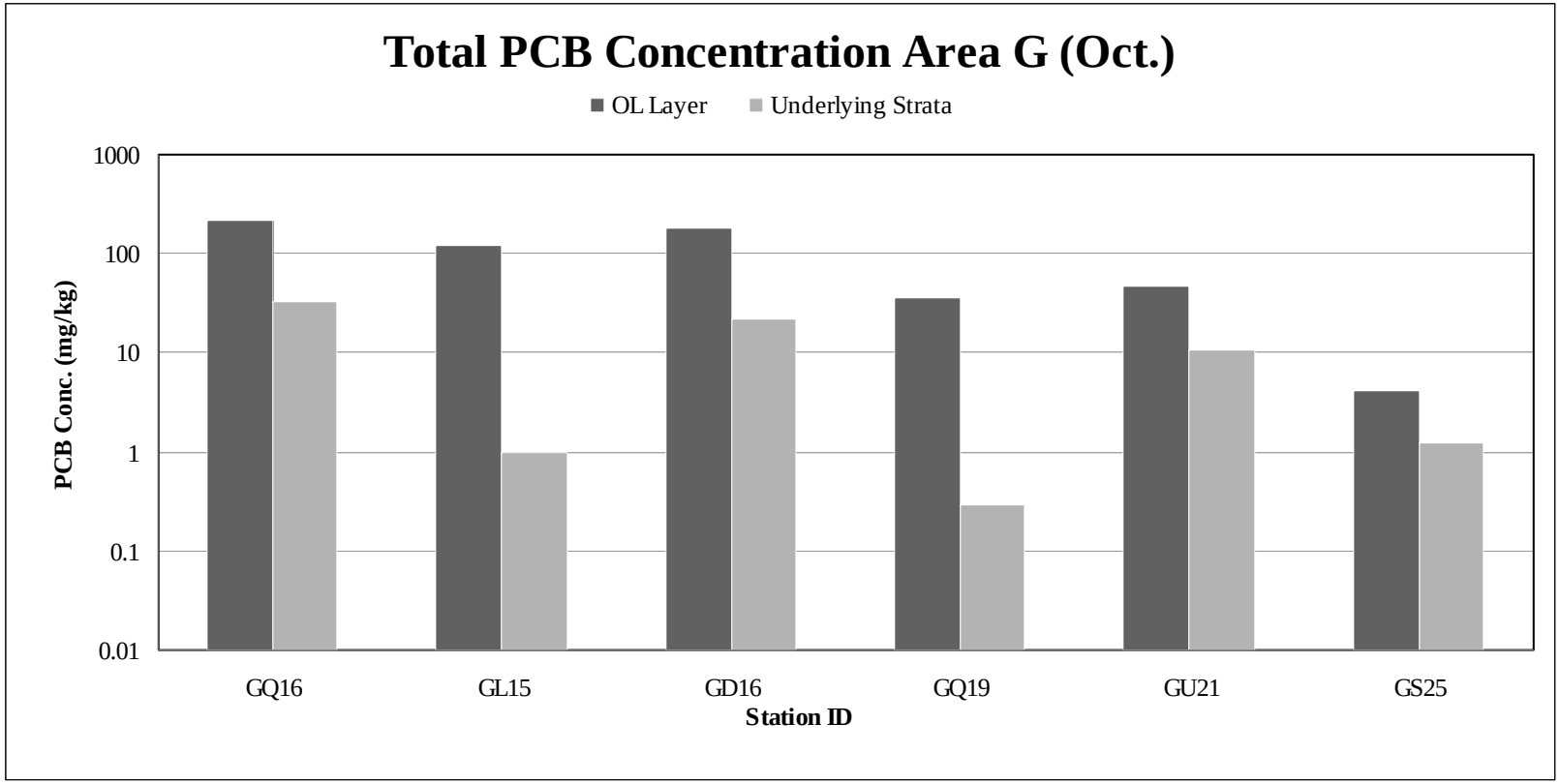

Figure 17. Total PCB Concentration in Area G for October Progress Cores

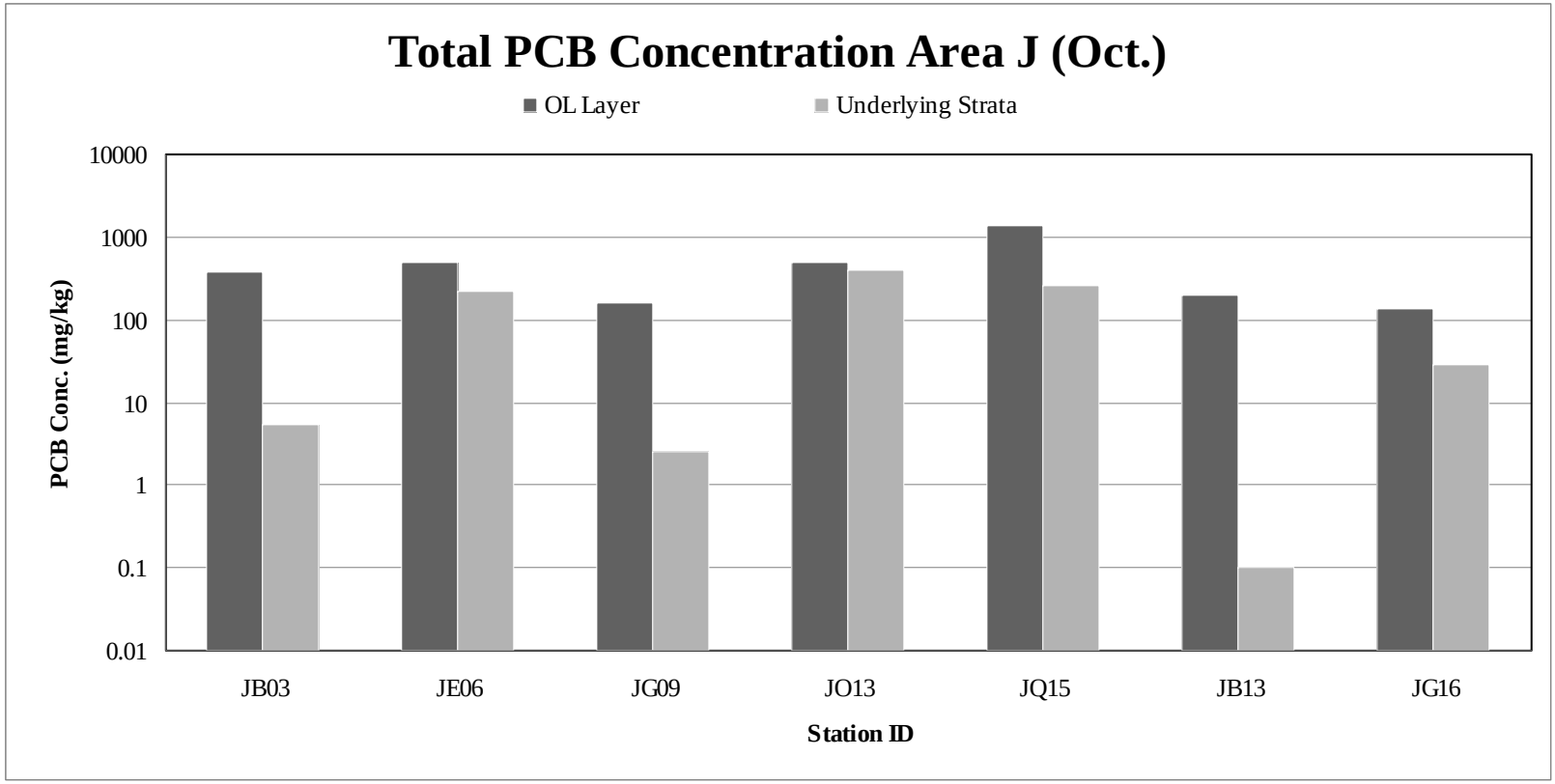

Figure 18. Total PCB Concentration in Area J for October Progress Cores

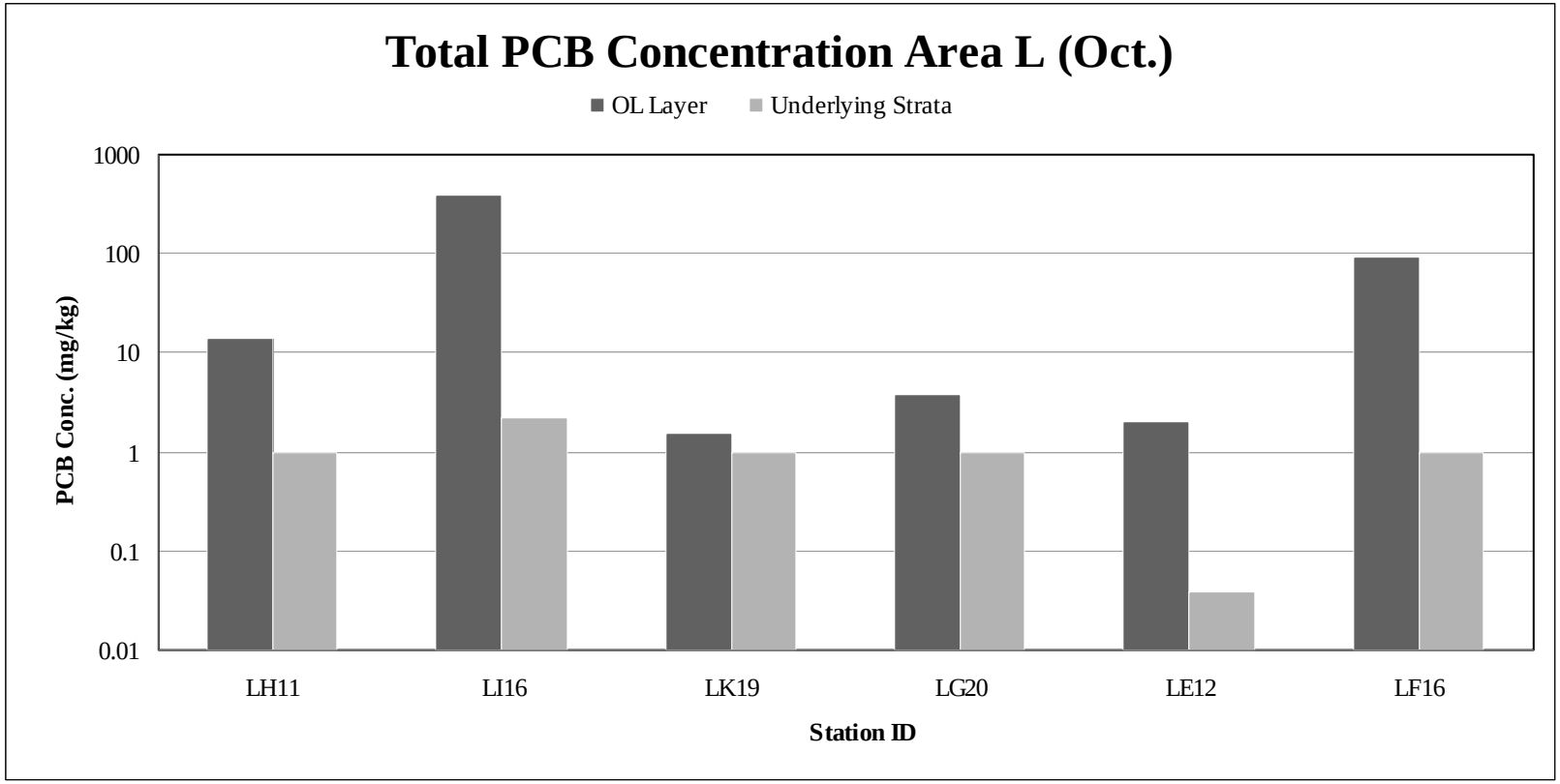

Figure 19. Total PCB Concentration in Area L for October Progress Cores

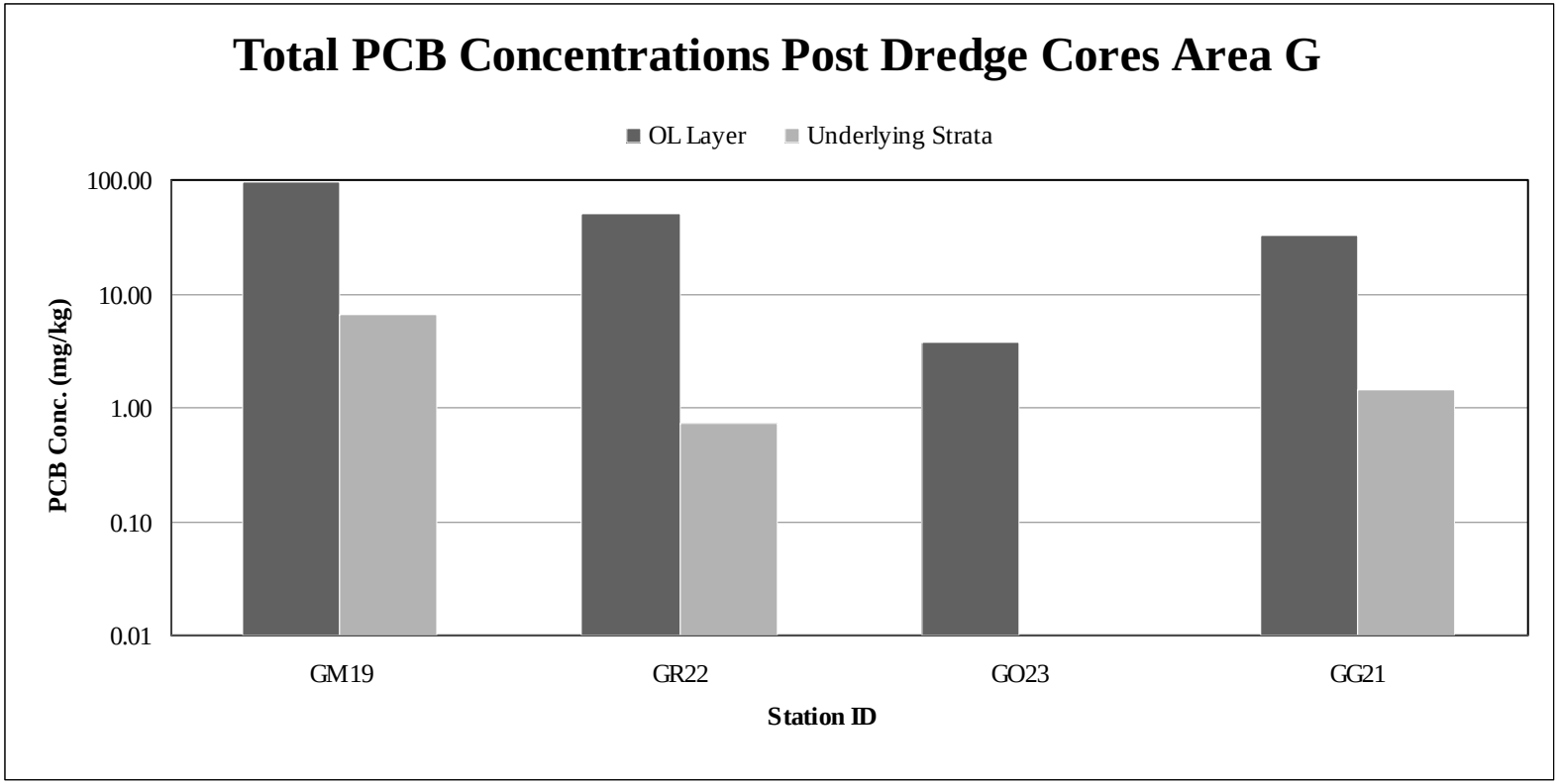

Figure 20. Total PCB Concentration in Post-Dredge Cores in Area G

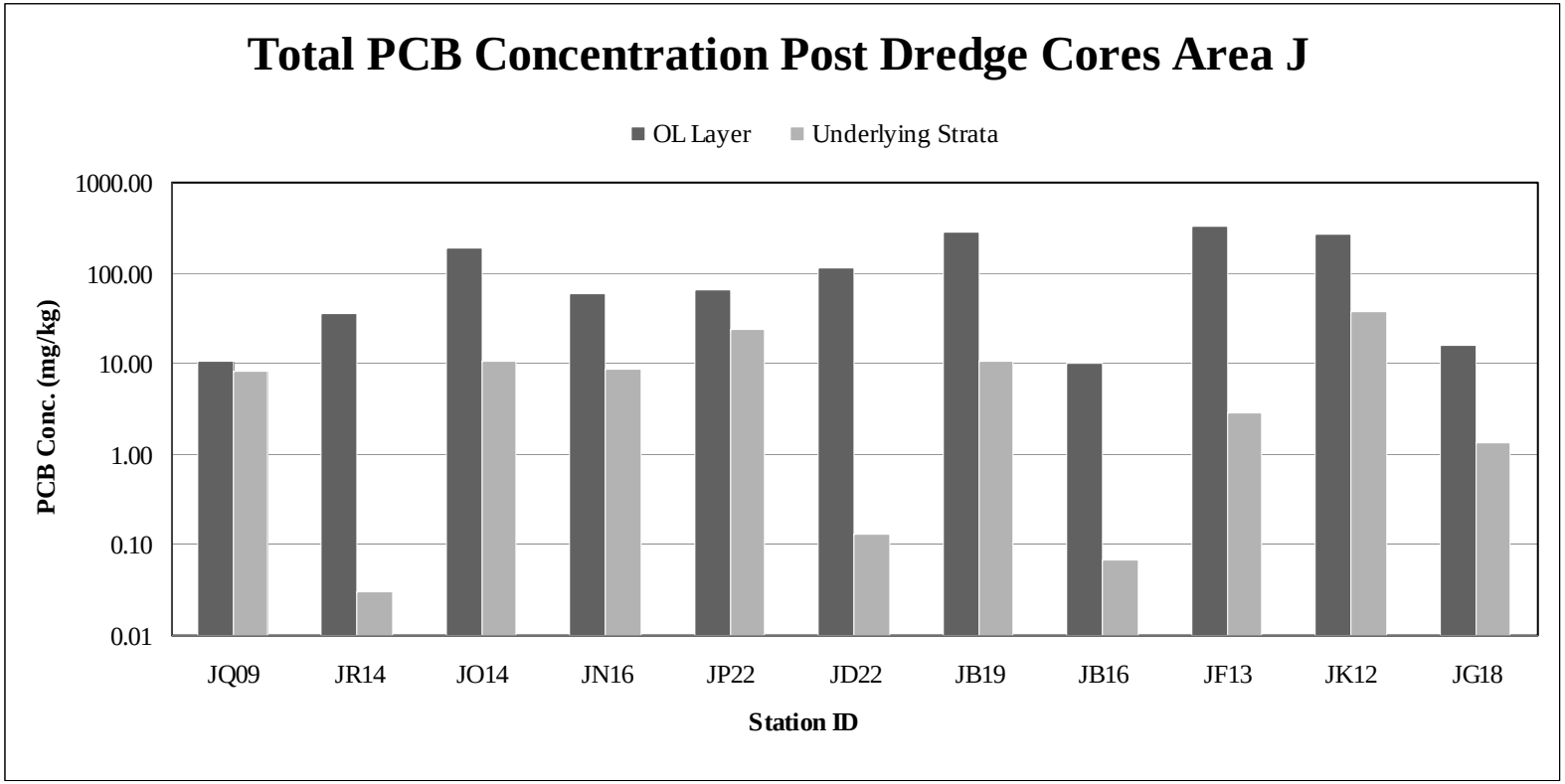

Figure 21. Total PCB Concentration in Area J of Post-Dredge Cores

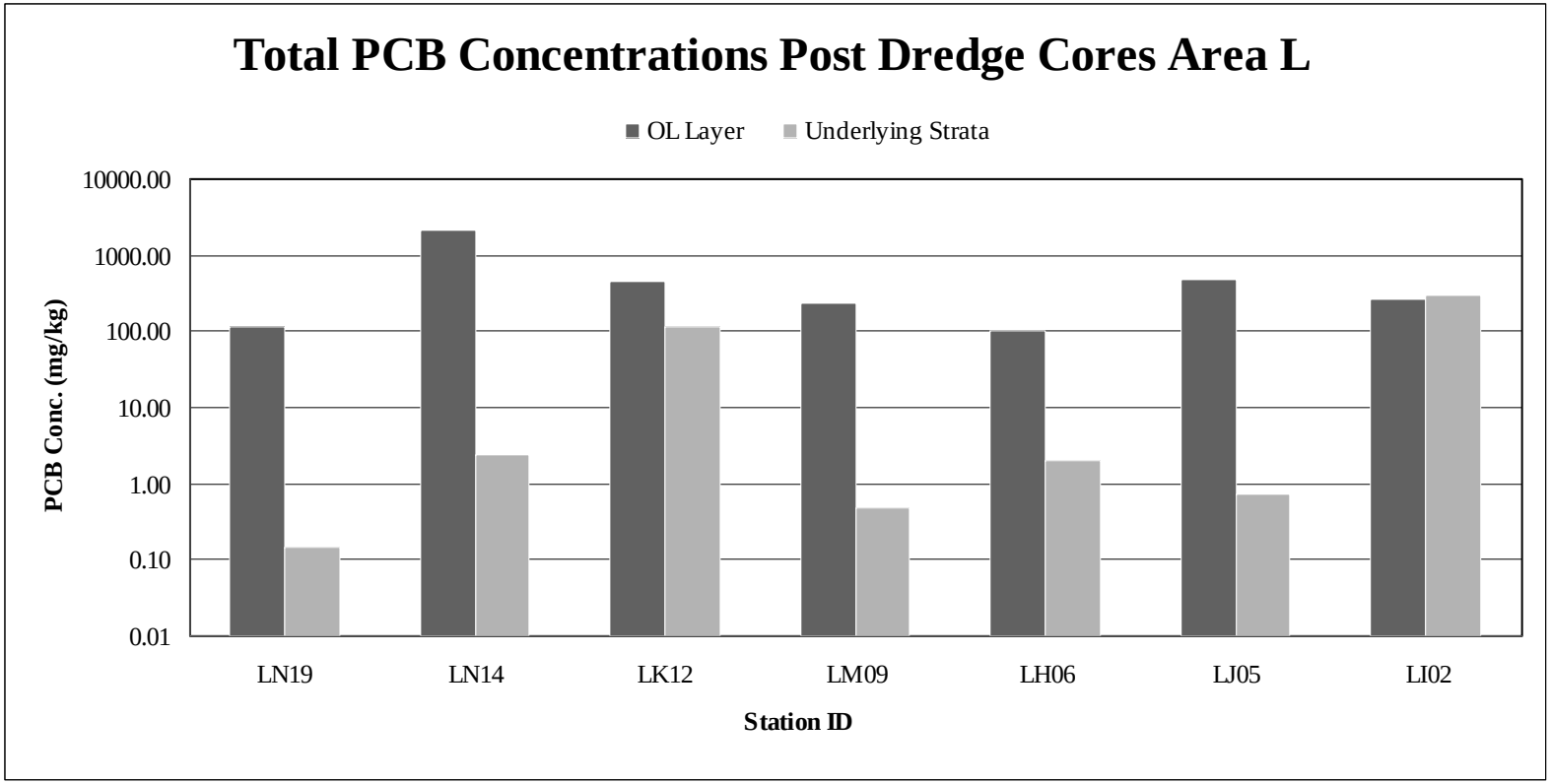

Figure 22. Total PCB Concentration in Post-Dredge Cores in Area L

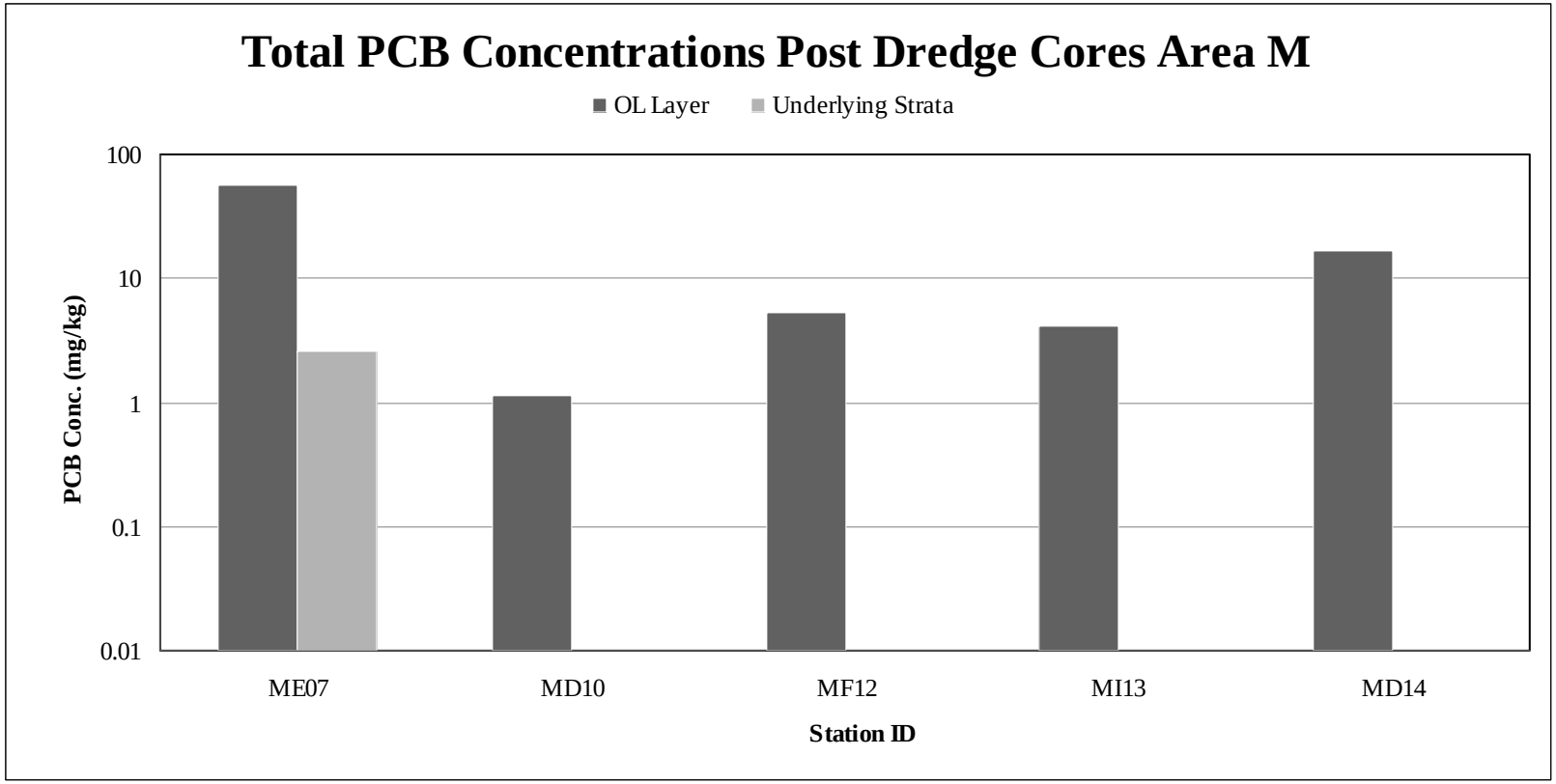

Figure 23. Total PCB Concentration in Area M from Post-Dredge Cores

4.0 DISCUSSION

This section discusses results of the sediment cores analyses and addresses trends in PCB concentrations to examine remediation efficiency, establish target dredge elevations, and plan for upcoming remediation events. It is important to note that the PCB concentration of the Pre-Dredge cores cannot be compared directly to the results from other coring events in 2009 since the total PCB concentrations of Pre-Dredge core sediments were reported from Aroclors rather than congeners (NOAA 18). However, the site-specific regression factor of 2.6, used in converting the NOAA 18 PCB congeners to total PCBs, was developed through comparisons of several hundred samples analyzed by Aroclors, homologues and congeners. Although the samples were analyzed by two different methods, the total PCB concentrations should be comparable.

Spatially, the PCB concentrations throughout active dredge Areas G, J, L and M exhibited no clear pattern. Portions of these areas were previously dredged, some multiple times, which may have had an impact of spatial distribution of the "OL" layers and PCB contaminants. Concentrations were evenly distributed throughout each area (Figures 10 through 13). The spatially homogenous distribution differs from previous years when concentrations were found to be more localized (i.e. "Hotspots") within the dredge areas.

Results from PCB analyses of the Pre-Dredge core samples, which were collected in non-active dredge areas, did show a localized pattern. Area K exhibited the highest PCB concentrations towards the middle of the channel. In the South Cove the highest PCB concentrations were found on the northern half of the cove, closest to the Aerovox facility. The North Cove exhibited the highest concentrations within or adjacent to the natural channel; concentrations were generally lower on the flats.

In all 2009 sediment cores, with the exception of 3 cores, total PCB concentrations were higher in the samples collected from the OL layer than in the underlying strata. There was a significant statistical difference between the total PCB concentrations of the OL layer and underlying strata in Dredge Areas G and J and in the North Cove (Table 10). Statistical significance was determined by running an analysis of variance (ANOVA); results were deemed significant if p values were equal to or less than 0.05. Though there wasn't a significant difference between the layers in the other sampling areas, a clear trend in PCB concentration was still observed. The lack of significance can most likely be attributed to the smaller number of samples taken from the underlying strata (e.g. Area M). Despite the lack of statistically significant differences in all sampling areas, the relationship described in Table 10 supports the use of the visual transition between the OL and underlying strata as an adequate method to preliminarily distinguish highly contaminated surface sediment from less contaminated native sediments.

At all but a few core locations the target dredge elevation, known as "z*", was within the OL layer and above the elevation of the visual transition. In some locations, the visual transition was observed to be up to 4.3 feet lower than z*. It is clear from these types of discrepancies that sediment core observations of the OL visual transition should supplement the use of z* as the target dredge elevation. The visual transition, as mapped

from sediment coring, can serve as a "benchmark" for confidently estimating: 1) the presence of PCB contamination, 2) the target dredge elevation required for successful removal of the highest PCB concentrations, and 3) volumes of contaminated sediment that require removal.

5.0 REFERENCES

Woods Hole Group. 2009A. Environmental Monitoring, Sampling and Analysis Water Quality Monitoring Field Sampling Plan. New Bedford Harbor Superfund Site, New Bedford, MA. Prepared under Contract W912WJ-09-D-0001 Task Order No 0010 for the U.S. Army Corps of Engineers New England District, Concord, MA.

Woods Hole Group. 2009B. Environmental Monitoring, Sampling and Analysis Quality Assurance Project Plan Addendum. New Bedford Harbor Superfund Site, New Bedford, Massachusetts. Prepared under Contract W912WJ-09-D-0001 Task Order No 0010 for the U.S. Army Corps of Engineers New England District, Concord, MA.

APPENDIX A. 2009 CORING PHOTOGRAPHS AND FIELD LOGS

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APPENDIX B. ALPHA ANALYTICAL LABORATORIES REPORTS AND ANALYTICAL DATA

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APPENDIX C. USEPA LABORATORY REPORT AND ANALYTICAL DATA

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