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Dave Dickerson/R1/USEPA/US
04/05/2006 03:42 PM

To mark.j.anderson.jr@usace.army.mil
cc gary.p.morin@usace.army.mil, paul.g.l'heureux@usace.army.mil, Jim Brown/R1/USEPA/US@EPA, swolf@ensr.com
bcc
Subject comments on the 05 WQ monitoring report

Greetings - please find my comments attached.

Dave

wqensr.05.wpd

D. Dickerson's comments on the draft 2005 Water Quality Monitoring Summary Report

1. p.iv, 1st paragraph, 3rd sentence: TYPO - 15,470 cy were taken from DMU-4, not DMU-2.

2. p.iv, 4th paragraph: I agree with Gary Morin's comment (#4) re. the number of turbidity exceedences. The report is not incorrectly written, its just that it could be prone to misinterpretation by the general public and should be clarified.

Suggest a consistent usage throughout the report wherein whenever the 300' criteria is being discussed, the term "warning criteria" (as Gary recommended) or something similar be used.

3. p.v, 2nd to last sentence: the statement that the oil sheen PCB mass (18 g) represented only a small fraction of the PCB mass removed begs the question of what that removed PCB mass was. I assume we have this and can easily include it.

4. p.1, 2nd paragraph: the site was listed (as opposed to proposed for listing) on the NPL in 1983, not 1982.

5. p.2, 2nd sentence: this sentence could be misinterpreted to mean that full scale remediation will only last two years. For clarification, suggest something like: "Following completion of a sediment dewatering, ...full scale remediation dredging was **initiated in fall** 2004 (...). **The second season of full scale dredging occurred in** late summer/fall of 2005..."

6. p.3, 2nd paragraph: with comment #2 above in mind, this paragraph might be rewritten as follows, starting from the 2nd sentence:

"A project-specific turbidity **warning** criterion was set at 50 NTUs...of this report. **Exceedence of this early warning** criterion **triggers a water sampling and analysis** protocol (Figure 3). **Exceedance of this 50 NTU criterion at 600 feet downcurrent of remediation requires cessation of the turbidity causing activity, and further sampling and analysis.** The **criteria** were developed by the USEPA..."

7. p.6, last paragraph, 1st sentence: is the lower (narrow) end of the funnel plugged in order to retain the depositional sediment??

8. p.10, 2nd paragraph, 4th sentence: TYPO - "exceedence" not "exccedence"

9. p.10, 3rd paragraph, 3rd sentence: was the plume size 700 ft **north-south** by 200 ft **east-west**?

10. p.13, 3rd paragraph: "(Toxicity Summary 2005 reference)" should be edited for final form.

11. p.21, 2nd paragraph, 3rd to last sentence: the phrase "with reduced survival or cystocarp production noted for all tests." seems prone to misintrepretation since fourteen of the sixteen tests showed 100% survival (see Table 5). Recommend a slightly more detailed discussion that notes this fact as opposed to the broad approach currently in the draft.

12. Table 1: suggest that column #7 in pages 2 and 3 be labeled the same as in page 1 ("Turbidity Exceedence **and Distance from Activity"**).

13. Table 3, p.1, 1st row (14-Sep-05), last column: isn't "CM" (complete mortality) incorrect here? The 48-hour survival is listed as 100%...

14. Table 4: the background chemistry data should be presented here as well.

15. Figure 9: TYPO in Title: "Dredge" not "Derdge"

16. Last but not least, I found the sediment trap data to be informative (too bad the weights weren't taken during baseline), and recommend that they be included in future monitoring.

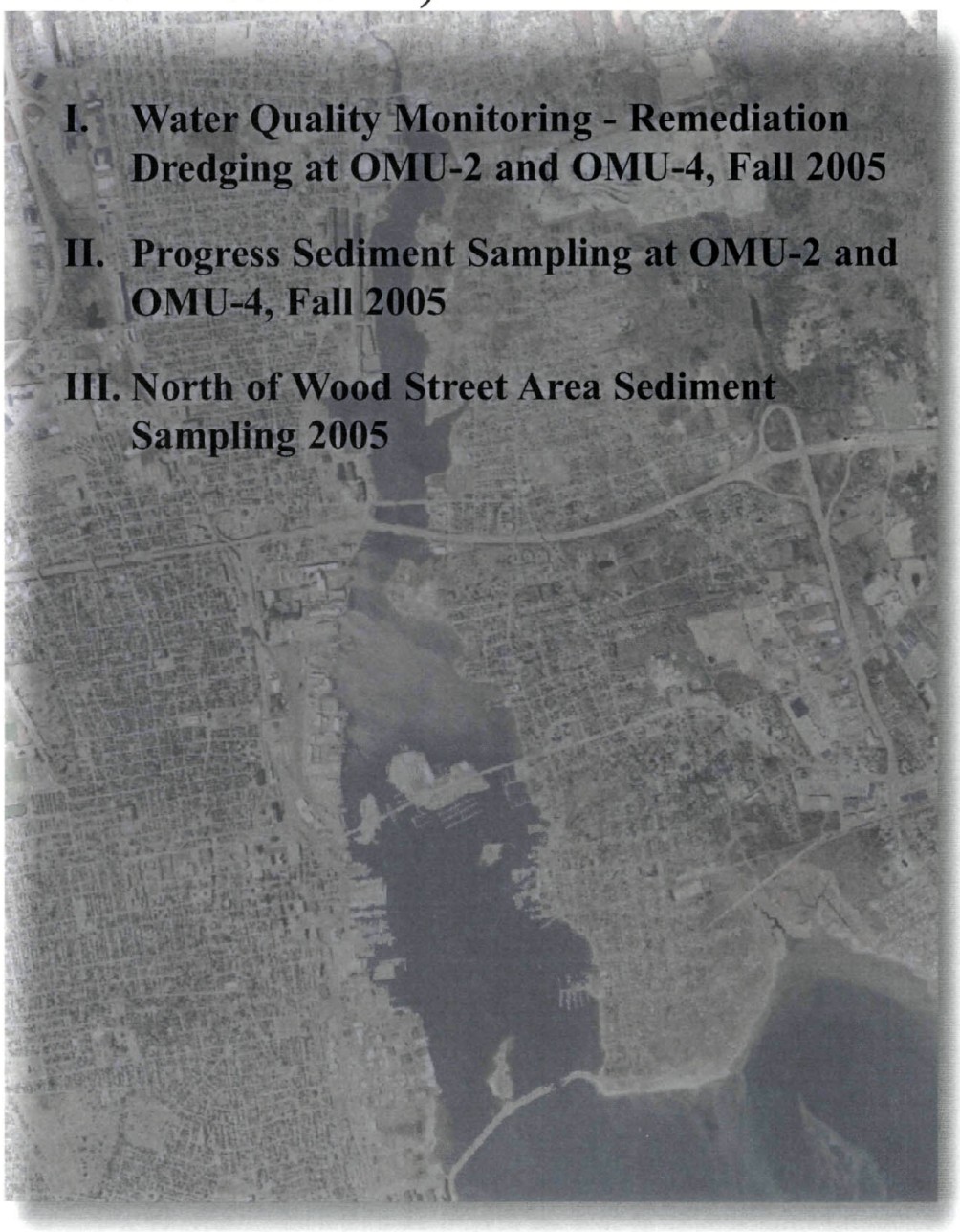
7.5
NBH

U.S. Army Corps of Engineers
New England District

U.S. Environmental Protection Agency

Water Quality Monitoring and Sediment Sampling Summary Reports 2005

New Bedford Harbor Superfund Site - New Bedford, Massachusetts



I. Water Quality Monitoring - Remediation Dredging at OMU-2 and OMU-4, Fall 2005

II. Progress Sediment Sampling at OMU-2 and OMU-4, Fall 2005

III. North of Wood Street Area Sediment Sampling 2005

Prepared by:

ENSR | AECOM

ENSR Corporation

CR ENVIRONMENTAL, INC. WBE

CR Environmental

Contract:
DACW33-00-D-0003
Task Order 0012
ENSR Document No.
09000-350-730

CV06005.indd

2005

Water Quality & Sediment

U.S. Army Corps of Engineers
New England District

U.S. Environmental Protection Agency

I. Water Quality Monitoring - Fall 2005 Remediation Dredging

II. Progress Sediment Sampling - for the Fall 2005 Remediaiton Dredging

III. 2005 Monitoring Summary Report - North of Wood Street Area Sampling

New Bedford Harbor Superfund Site

Prepared by:

ENSR | AECOM

CR ENVIRONMENTAL, INC. WBE

CR Environmental

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US Army Corps of Engineers®
New England District

U.S. Environmental Protection Agency

2005 Monitoring Summary Report

Progress Sampling for the Fall 2005 Remediation Dredging

New Bedford Harbor Superfund Site – New Bedford Massachusetts

Prepared by:

ENSR | AECOM

CR ENVIRONMENTAL, INC. WBE

Contract:
DACW33-00-D-0003-
Task Order 12
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Final August 2006

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EXECUTIVE SUMMARY

Remediation dredging was performed within Dredge Management Units (DMU) 2, 3, 4, and 5 of the New Bedford Harbor Superfund Site from September through mid-November 2005. Dredging was conducted with auger-equipped hydraulic dredges over a combined area of approximately 383,000 square feet of the Acushnet River. Approximately 24,000 cubic yards of polychlorinated biphenyl (PCB) contaminated sediments were removed from the dredged area with the depth of cut ranging from 1 to 5 feet. The 2005 dredging removed sediments to the approximate depth of the z* elevation (where PCB concentrations are predicted to be less than the 10 mg/kg remediation criteria), but the focus was on maximizing the volume of contaminated sediments removed rather than fully remediating the area (i.e., no cleanup passes were performed). Dredged material was pumped to shore-side facilities for desanding and dewatering with approximately 16,000 tons of filter cake transported for offsite disposal.

The fall 2005 dredging was performed in areas adjoining the area dredged in 2004, including the eastern portion that remained of DMU-2 (Area-A), and the entire area of DMU-4 and limited portions of DMU-3 and DMU-5 located immediately to the south (Area-B). Based on historical sampling, total PCB concentrations were reported at thousands of mg/kg for some sediments within this area with the depth of contamination ranging from 1 foot to nearly 5 feet. Ninety-five push-core sediment samples were collected prior to the start of the dredging to refine the accuracy of the predicted z* elevation over the dredge area. A limited number of these samples were submitted for analysis to determine total PCB concentrations above and below the visual transition between black surficial silt and lighter underlying sediments as a means of comparing the accuracy of the observed interface in predicting actual z* elevations. Forty-seven post-dredge cores were collected to assess the efficiency of the dredge in removing the intended depth of PCB contaminated sediment.

Pre-dredge cores were fairly consistent over both dredge areas with a distinct layer of black fluidized silt (OL layer) with a thickness up to 53 inches, transitioning to a lighter underlying layer of olive colored silt-clay. For some samples collected along the edge of the marsh on the eastern side of the harbor, an underlying layer of peat was observed beneath the black OL layer. PCB concentrations above the interface ranged up to 18,200 mg/kg (total Aroclors) and were generally non-detect or low beneath the interface. The PCB data supported the model used previously for the Upper Harbor that the visually identifiable physical characteristics of the sediment provided a good indicator of PCB concentrations and that the core measured interface elevation provided an estimate of the z* elevation. The agreement between the field measured elevation for the visual transition and the target dredge elevation in the dredge plan was determined to be within 1-foot at 67 of the 95 pre-dredge core locations with no apparent bias above or below the target dredge elevation. The limited offsets between the planned dredging elevation and the observed transition elevation were reviewed by Jacobs Engineering, and adjustments were made to the target cut depth elevation to increase overall dredging efficiency.

Visual assessment of the pre-dredge cores also allowed for comparison of the core measured thickness of the black surficial OL layer with the planned sediment removal thickness. The agreement between these two parameters was not as good as the z*/planned cut elevation comparison, particularly for Area-A with a bias toward over predicting the sediment thickness. The offset between the thickness predictions and measurements could have been due to the technical constraints of bathymetric measurements in shallow waters with fluidized surficial sediments or the constraints of collecting representative cores of the fluidized surficial sediments (historical core samples were collected by vibratory techniques). Although this potential offset could affect the predicted volume of sediment removed from a given area, it in no way affected the actual dredging, as dredging control was based on the elevation of the dredge cut rather than the thickness of the material to be removed.

Physical characterization of the post-dredge cores indicated the complete removal of the black surficial OL layer in all the samples that were collected from Area-A and approximately one-half of those collected from Area-B, with the other half retaining the distinct black surficial silt layer with an average thickness of 12 inches. For the post-dredge cores where the OL layer had been removed, it was replaced by a dark olive post-dredge surficial layer, ranging in thickness from 3 to 22 inches, and overlying the more consolidated olive colored silt.

Six sets of pre- and post-dredge core samples were selected for PCB analysis from locations in Area-B where dredging had proceeded below the sediment transition interface. The PCB concentrations in the post-dredge surficial layer were generally much lower than in surficial layer of the area prior to dredging. However, the post-dredge surficial concentrations (ranging from 4.8 to 208 mg/kg with a mean of 102 mg/kg) were well above the pre-dredge concentrations from same elevation (ranging from non-detect to 33 mg/kg with a mean of 6.1 mg/kg). The presence of a residual post-dredge surficial layer retaining some of the physical and chemical characteristics of the previously overlying pre-dredge material is not unexpected, especially given that no cleanup passes were performed in the 2005 dredging. This residual surficial layer is considered to be the result of one or more of a number of processes, including undisturbed residuals (material not fully removed), generated residuals (sloughing within and adjacent to the dredge cut, resuspension and deposition related to the dredging and support activities), and normal background resuspension and deposition in the harbor unrelated to the dredging.

1.0 INTRODUCTION

This report summarizes the sediment sampling conducted in support of the 2005 remedial dredging in Dredge Management Unit #2 (DMU-2) and DMU-4 and limited portions of DMU-3 and DMU-5 located in Upper New Bedford Harbor. Data presented herein were collected as a contribution to the production of the final dredge plans and to assess the overall effectiveness of dredging operations carried out as part of the remediation of the New Bedford Harbor Superfund Site. The report is organized into five sections. Background information is provided in Section 1. Details of the methodology of the sediment sampling are presented in Section 2. The resulting data are presented in Section 3 and discussed in Section 4. Cited references are included in Section 5.

This work was performed by ENSR and its subcontractor CR Environmental, Inc. under contract to the USACE (Contract No. DACW33-00-D-0003, Task Order 0012).

1.1 Site Background

New Bedford Harbor is located approximately 50 miles south of Boston on the waters of Buzzards Bay in Bristol County, Massachusetts. The sediments in many areas of the Harbor are contaminated with polychlorinated biphenyls (PCBs) and metals, primarily from the manufacture of electrical components which occurred in the area between 1940 and the mid-1970s. Based on human health concerns and ecological risk assessments, the U.S. Environmental Protection Agency (USEPA) added New Bedford Harbor to the National Priorities List in 1983 as a designated Superfund Site. A 1998 Record of Decision stipulated that remedial measures were required to remove PCB-contaminated sediments from the Harbor. Through an Interagency Agreement between the USEPA and the U.S. Army Corps of Engineers, New England District (USACE), the USACE is responsible for carrying out the design and implementation of the remedial measures.

The New Bedford Harbor Superfund Site extends from the shallow northern reaches of the Acushnet River estuary, south through the commercial harbor of New Bedford and out beyond the City's hurricane barrier into 17,000 adjacent acres of Buzzards Bay. The Superfund Site is divided into three areas: the Upper, Lower, and Outer Harbors defined by geographical features of the Harbor and gradients of sediment contamination (Figure 1). The industrial discharge of PCB contaminated waste, either directly into the Harbor or indirectly through the City's sewer system, was most significant in the Upper Harbor. The location of the associated PCB discharge and the hydrodynamics of the Harbor contributed to the deposition of significant levels of PCB contamination in the Upper Harbor.

The highest PCB concentrations or "hot-spots", which contained PCB concentrations in excess of 100,000 mg/kg, resided in the sediments located in the immediate area of the discharge. These "hot-spot" sediments were removed between 1994 and 1995 as part of the USEPA's first cleanup phase (USEPA 1997). The remaining sediments in the Upper Harbor, an area of approximately 190 acres, are still heavily contaminated, with PCB concentrations in the thousands of mg/kg. Following

completion of a sediment dewatering, water treatment, and material transfer facility, full-scale remediation dredging was initiated in fall 2004. The dredging completed in 2005 was the latest interval of full-scale dredging expected to occur annually in the upcoming years.

1.2 Overview of the Fall 2005 Dredging

Remediation of the Upper Harbor was divided into a series of dredge management units (DMUs) based on locations of previously defined sediment PCB concentrations. Previous dredging conducted in fall 2004 focused on DMU-2 located in the northern portion of the Upper Harbor adjacent to the Aerovox Facility, with only a portion of DMU-2 designated for dredging to allow space for the passage of the fall anadromous fish run. The fall 2005 dredging effort completed the remaining eastern portion of DMU-2 (Area-A) and all of DMU-4 and limited portions of DMU-3 and DMU-5 (Area-B) located immediately to the south (Figure 2). Based on previous investigations, total PCB concentrations were in excess of 3000 mg/kg for some sediments within this area (ENSR 2005) with the depth of contamination ranging from less than one foot to nearly five feet (USEPA data base).

Preparatory work was initiated in late August 2005 which included driving additional individual sheet piles around the perimeter of the dredge areas and the installation of the traveling cable used for dredge positioning. Advance debris removal activities were conducted in the areas to be dredged. Dredging was performed from September through mid-November using an auger equipped hydraulic dredge. Dredged material was pumped through a pipeline within the Upper Harbor waterway to a desanding unit located at the Sawyer Street Facility (Figure 1). Following desanding, the fine material was pumped through another pipeline in the waterway to the sediment dewatering, water treatment, and material transfer facility located in the Lower Harbor (Figure 1).

As part of planning and tracking of the operation, the two dredge areas were divided into a grid with numbered rows and lettered columns, defining individual 25-foot square cells (Figure 3). For each cell the planned depth of sediment to be removed and the elevation at which PCB sediment concentrations were expected to fall below the designated 10 mg/kg remediation criterion (referred to as the z^* elevation) were specified (see Figures 4, 5, and 6)(Jacobs 2005). The estimated z^* elevations were based on geo-statistical modeling performed on data from previous sediment investigations conducted in the Upper Harbor. The fall 2005 dredging removed a combined total of approximately 24,000 cubic yards of material from Area-A and Area-B with the depth of cut ranging from one to five feet (Jacobs 2006, in preparation). The demobilization effort following the completion of dredging included removal of the dredges and pipeline; the sheet piles were left in place.

The remedial operation was performed by the Jacobs Engineering Group and subcontractor Sevenson Environmental Services as part of a Total Environmental Restoration Contract with the USACE.

1.2 Progress Sampling Program

The fall 2005 dredging was performed in a region of the Upper Harbor with some of the highest PCB concentrations remaining in the Upper Harbor. The progress sampling program had two major goals:

- A pre-dredge sampling effort to collect additional core data from the two dredge areas to refine the predicted z* elevations that were previously developed using geostatistical modeling for use in setting the target dredging cut depth for the 2005 work.
- Although the 2005 dredging was performed with the goal of mass removal rather than a dredge-to-clean approach, the post-dredge core sampling effort allowed limited further assessment of the efficiency of the dredge in removing the intended depth of PCB contaminated sediments from the dredge area.

2.0 METHODS

Push coring was performed in a fashion that collected physical samples that could be referenced to the same vertical elevation system used for the Project (core and Project elevations were referenced to NGVD-29). Field efforts included the collection of push core samples in clear plastic liners that facilitated the determination of the vertical elevation for the sediment water interface and any visual transitions in sediment properties through the stratigraphy of the core. Core samples were collected prior to and immediately after the completion of dredging operations in each of the two designated dredge areas for the 2005 season.

2.1 Sediment Sampling

2.1.1 Navigation

Sediment sampling involved the collection of a series of cores from designated 25 by 25-foot grid cells. The cells selected for sampling were distributed over the two dredge areas to attain the coverage necessary to achieve the stated goals of the sampling program. The navigational procedure was designed to allow for rapid positioning within any given cell. The central position for each designated cell was set as the target location for the pre-dredge sampling. Navigation to each target station was achieved utilizing a Trimble Pro-XRS Differential GPS (DGPS) field unit. The coordinates for each station were loaded into the Trimble DGPS as individual waypoints. Once a cell was selected from the navigation menu, the data logger provided range and bearing guidance to the field team to position the sampling equipment. Once the sampling platform was secured in position over an intended sampling station, the actual coordinates for each sampling location were documented with the DGPS field unit to an accuracy of approximately 3 feet. The position for the actual pre-dredge core sample became the newly defined target location for all subsequent visits to the site during post-dredge sampling.

2.1.2 Sediment Collection

Pre-dredge core samples were collected from Area-A on three occasions in September; a total of 27 core samples were collected. Post-dredge core sampling in Area-A was conducted on two occasions; a preliminary effort in the northern half of Area-A in October, and a final sampling effort after dredging was completed in November. A total of 21 core samples were collected. Actual station locations are shown in Figure 8.

Pre-dredge core samples were collected from Area-B from late September through early October; a total of 68 core samples were collected. Post-dredge core sampling in Area-B was conducted on two occasions as the dredging completed each half of the footprint for Area-B. The eastern portion of Area-B was sampled in November, and the western portion was sampled in December after dredging was completed. A total of 26 core samples were collected. Station locations are shown in Figure 9.

Sediment collection activities were conducted from an 8 by 12-foot raft platform (Figure 10) equipped with spud poles for station keeping. The raft platform was maneuvered between stations using a Jon-boat. Sampling was performed with a piston type push core sampler (Figure 10) with the collection of samples in hard plastic liners that were cleaned prior to departure. The length of core liner for each station during pre-dredge sampling was selected based on the predicted depth to the z* elevation specified in the dredge plan and typically ranged from 3 to 6 feet in length. Post-dredge core samples were typically 2 feet in length. The core sampler was equipped with a sliding piston designed to ride inside the plastic core liner to assist in recovering an intact sediment-water interface in soft sediments. The core liner and internal piston were secured firmly inside a stainless steel socket assembly that was attached to a T-handled push bar to provide the necessary leverage to drive the core liner to the desired depth and subsequently extract the core liner from the bottom sediment after sample collection.

The general procedure for operating the piston core sampler was to lower the plastic liner, with the piston sitting just inside the leading edge of the liner, to just above the sediment-water interface. At this point, the line attached to back side of the piston was secured, thus fixing the elevation of the piston with respect to the sediment-water interface. The core liner was pushed into the sediment to the point of refusal, and with the piston held at constant elevation it effectively slides up in the core barrel as the barrel is being forced into the sediments. The relative motion of the piston thus acts as a syringe providing negative pressure on the core to aid in recovering representative samples with an intact sediment-water interface. Upon recovering the core sampler to the surface, the exterior of the core was rinsed with site water. The piston was then extracted from the top of the liner, and the core liner was securely capped at each end. The core sample was labeled, the recovery length measured, and the particulars of each sample documented in the field log book. All sampling equipment was washed and decontaminated prior to departing for the next station using a solution of Alconox and tap water. All samples were maintained on ice during field sampling activities and then transferred to a chest freezer for storage at the USACE environmental trailer at the Sawyer Street facility.

To achieve the goals of the sampling program, core samples were collected in a method that permitted the documentation of the actual vertical elevation of key aspects of each core sample including the sediment-water interface (top of core sample), visual transitions in sediment properties, and the bottom of the core sample. Documenting the particulars of each core with respect to the vertical reference plane used by the dredging contractor required three measurements during the course of coring operations as follows:

1) Recording the full length of the push core prior to deployment – Top of T-handle to the leading edge of core liner.
2) At the point of refusal, recording the height of the sampler above the water surface – Top of T-handle to the water surface.
3) After sample collection, recording the water surface elevation – Using the top elevation of the surveyed sheet piles around the perimeter of the dredge area as a reference.

The difference between the first two measurements provided the distance from the water surface down to the bottom of the core sample. Adjusting this value for the measured elevation of the water surface yielded the bottom elevation of the core sample with respect to the Project datum of MLW (NGVD-29). The bottom elevation of the core was then used as the reference plane for documenting the visual transitions within the core and the sediment water interface. The calculated elevation of the sediment-water interface was compared to an actual field measurement (water surface elevation minus a field sounding of water depth) as an integral quality check of the procedure; if the difference between the calculated and measured bottom elevation exceeded 12 inches the core sample was discarded and the sampling process repeated.

The required measurements recorded during core collection were recorded on individual log sheets depicted on Figure 11; additional notations included sediment properties, the location of any visible transitions in sediment properties, characteristic odors or the presence of visible oil sheens. Each core sample was subsequently photographed and preserved at -20°C in a chest freezer for potential future inspection and/or analysis.

2.2 Laboratory Processing and Analyses

The cores were photographed through the clear liner and were stored frozen (–20°C) on site at the USACE Sawyer Street facility. Based on a review of the core characterization and photographs, a subset of the cores was selected for analysis and delivered to Woods Hole Group Environmental Laboratories (WHGEL) in Raynham, MA. In the WHGEL lab, core samples were allowed time to thaw prior to the sub-sectioning process. For those pre-dredge samples, a 6-inch segment above and below the elevation of the visual interface was selected for analysis; this approach was selected to validate the method of using the visual transition as a field estimate of the z* elevation. For assessing the effectiveness of the dredge in reducing the original PCB contamination, companion pre- and post-dredge samples from selected stations were sectioned to remove the 6-inch segment above and below the interface from each core.

Sediment segments selected for analysis were delivered to ESS Laboratory for a rapid screening level analysis for the determination of PCB Aroclors by EPA's SW-846 method 8082 (PCBs by Gas Chromatography), by gas chromatography with an electron capture device (GC/ECD). Sample segments selected for analysis were homogenized at ESS and the samples were extracted according to EPA's SW-846 method 3541 (Automated Soxhlet Extraction) using a 1:1 solvent mixture of acetone and hexane. The hexane/acetone solvent extraction may be more effective as an extraction solvent for PCBs in some environmental samples than the methylene chloride/acetone solvent mixture. Use of hexane/acetone generally reduces the amount of co-extracted interferences and improves the signal-to-noise ratio. Diatomaceous earth was also used in the procedure which, along with acetone, desiccated the sample. Extract clean-up steps taken prior to analysis included activated copper clean-up (SW-846 method 3660B) and sulfuric acid clean-up (SW-846 method 3665A).

Positive sample results were confirmed by a secondary column confirmation analysis with the higher of the two results reported, unless analyst discretion required otherwise (e.g. the result without an interference signal was selected). The final total PCB concentration presented in the results represents the sum of all Arochlor results. Non-detected results were included in the calculation as one-half the reporting limit value.

Further details on sample handling and analytical methods can be found in the Project QAPP (Jacobs 2004). Certain analytical details specific to these samples are located in a draft revision of the QAPP which is currently under review by USACE.

3.0 RESULTS

3.1 Dredging Summary

Remobilization of the dredging effort was performed from 15 August through 12 September 2005. During this period hydraulic auger dredges and support boats were launched and tested, the infrastructure for sediment treatment and handling was readied for service, and the dredge pipeline was reinstalled with one section between the planned dredged areas in the Acushnet River and the Sawyer Street Facility and a second section connecting the Sawyer Street Facility and the Dewatering and Material Transfer Facility in the Lower Harbor. A series of individual sheet piles were also driven around the perimeter of Area-A and Area-B and numbered for reference (Figure 3). Cables were strung along the line of sheet piles along the northern and southern boundary of each site to facilitate the attachment of the transit cable for use in positioning/advancing the dredge.

Dredging was performed from September through mid-November using an auger equipped Mudcat hydraulic dredge. In addition to dredge operations, a barge mounted excavator was set out ahead of the dredge to pre-clear the intended dredge path of large debris such as rocks, wire, and timbers. Support vessels were used for crew transport, to move the barges, adjusting dredge positioning cables, and in relocating the discharge pipeline.

The objective of the 2005 dredging season was to maximize production, or the volume of sediment removed down to the predicted z* elevation, and completing remediation of the area to the final sediment criterion (10 mg/kg) was not a goal of the 2005 dredging (clean-up passes were not performed in 2005). The dredging of Area-A was completed first, running individual dredge passes in a south to north orientation and working the Area-A footprint west to east from Column A through H (Figure 4). Dredging of Area-B was completed as two individual halves with dredging beginning in Column AA and progressing to the eastern boundary of Area-B (Figure 5). Upon completing the eastern half, the dredge was returned to Column AA to begin dredging of the western half (Figure 6). Additional follow-up dredge passes were completed in each dredge area to remove isolated high spots that were indicated on the post-dredge bathymetry survey. Dredging was generally limited to a single unit, with dredged material pumped through a pipeline within the Upper Harbor waterway to a desanding unit located at the Sawyer Street facility (Figure 1). Following desanding, the fine material was pumped through another pipeline in the waterway to the sediment dewatering, water treatment, and material transfer facility located in the Lower Harbor (Figure 1). All material was disposed off site (Jacobs 2006).

Dredging within each of the two designated areas was completed with south-to-north oriented cuts, with the dredge using a series of cables for advancement and alignment along a given cut. With the width of each cut defined by the width of the dredge auger (approximately 8 feet), each 25-foot wide column therefore required a number of individual cut lanes. Within the alignment of each cut lane a series of south-to-north passes were completed to incrementally remove material down to the desired

dredge depth, with each pass removing approximately 6 to 12 inches of sediment. Upon removing the required depth of sediment, the dredge was repositioned over to an abutting cut lane. After the completion of the final south-to-north cut lane, the dredge was repositioned to work along the southern boundary to finalize the dredging effort (working west to east); this realignment facilitated the removal of sediment material that was not accessible by the configuration of a dredge working in a south-to-north orientation.

In total, an estimated 8,663 cubic yards of material was dredged from Area-A and 15,467 cubic yards of material was dredged from Area-B; a combined total of 24,130 cubic yards based on the comparison of pre-and post-dredge bathymetry surveys with the depth of cut ranging from 1 to 5 feet (Jacobs 2006).

3.2 Field Sampling and Survey Summary

Pre-dredge sediment coring in Area-A was performed on 01, 02 and 09 September, and subsequent post-dredge sampling was performed on 08 October and 14 November.

Pre-dredge sediment coring in Area-B was performed on 21-23 September, 28-29 September and 03 October, and subsequent post-dredge sampling was performed on 02 November and 08 December.

3.3 Sediment Cores

A combined total of 95 cores were collected from Area-A and Area-B prior to the start of 2005 dredging operations as shown in Figures 8 and 9, respectively. Pre-dredge cores were distributed to expand the coverage of historical data to areas not previously sampled in order to collect additional data towards the characterization of z* elevations over the entire dredge area. Based on the predicted z* elevations specified in the individual z-blocks shown in the dredge plan, Figures 4 through 6, the 2005 coring locations were selected to collect data from either an individual z-block or from the center of various sized groupings of z-blocks with similar z* elevations. For each station, the depth of each individual core sample was selected based on the predicted depth to z*; actual core depths were adjusted deeper (as required) in order to capture a visual transitional interface. Of the 95 pre-dredge cores that were collected, seven pre-dredge cores from Area-A and 10 pre-dredge cores from Area-B were submitted for a screening level analysis of PCB Aroclors to evaluate the accuracy of the visual interface elevation in estimating the approximate z* elevation.

A combined total of 47 post-dredge cores were collected to evaluate the effectiveness of the dredge in removing the desired depth of sediment as shown in Figures 8 and 9. Six post-dredge cores from Area-B were also selected for a screening level analysis of PCB Aroclors for comparison to pre-dredge sediment data.

Summaries of the field measurements recorded for each core sample are provided in Tables 1 and 2 for Area-A and Area-B, respectively. Graphical side-by-side comparisons of the photographs taken of

the pre- and post-dredge core samples are shown on Figures 12 through 24. These figures present the core samples for each station in a format which displays the relative elevations of each core, the pre- and post-dredge bathymetry data (both site specific soundings at each coring location and processed bathymetric survey data), the predicted z* elevation, the measured thickness (pre- and post-dredge) of sediment above any visual interface, and the PCB data that were obtained.

3.3.1 Physical Characteristics

Each core sample was characterized in the field based on the observations that were made through the clear plastic core liner. For the cores selected for PCB analysis, additional characterization was performed in the lab after the core samples were split and sectioned open allowing for inspection of the interior portion of the core and collection of samples for analysis. The sediments recovered from each dredge area are summarized below.

Area-A

Pre-dredge core samples ranged from 11.5 to 49.5 inches (0.96 to 4.1 feet) in length. Pre-dredge core samples were typically comprised of two distinct sediment layers. The surficial sediment consisted of a fluidized black silt (Figure 25)(referred to as the OL layer – Unified Soil Classification System) ranging in thickness from 2.5 to 27 inches (0.2 feet to 2.3 feet), the average being 16.9 inches. This material was underlain by more consolidated olive-gray clay-silt (Figure 25) with infrequent observations of shell fragments and wood fibers. As viewed through the liner the transition between the two sediment layers was sharp in a few cores, but typically a mixed transition boundary of approximately 6 inches thick separated the two layers. This mixed or apparent smeared layer was likely an artifact of drag-down along the wall of the core liner during sample collection as the mixing was not as apparent in the core samples that were sectioned and removed from the liners. A hydrogen sulfide odor was associated with many of the cores, typically those with OL layers greater than 6 inches. An oily sheen was apparent at the water surface during the recovery at approximately one-half of the stations sampled, more observations being made in the northern half of the dredge area.

Post-dredge core samples ranged from 26 to 37 inches (2.2 to 3.1 feet) in length with each core recovering a visible transition to lighter colored sediments at depth. The distinct black OL layer observed in all of the pre-dredge samples was no longer apparent in any of the post-dredge samples. However the original OL layer appeared to be replaced by a dark olive surficial layer residing above an olive colored silt-clay. This post-dredge surficial layer ranged in thickness from 6 to 22 inches (0.5 to 1.8 feet), the average being 13.5 inches. The presence of a hydrogen sulfide odor or the appearance of an oily surface sheen was not observed during the collection of any post-dredge core samples.

Area-B

Pre-dredge core samples ranged from 10 to 52.5 inches (0.83 to 4.4 feet) in length. Pre-dredge core samples exhibited a more diverse range in sediment stratigraphy. At approximately two-thirds of the

68 stations occupied, core samples were characteristically comprised of two distinct sediment layers with surficial sediments consisting of a fluidized black OL layer and underlying sediments consisting of a consolidated olive-gray clay-silt similar to the cores collected in Area-A. A number of stations along the fringes on the adjacent marsh on the eastern side of the harbor had a distinct underlying peat layer (Figure 25). A third sediment layer comprised of dark olive silt was observed directly under the OL layer in the remaining core samples that were located primarily along the approximate position of the center of the channel.

The thickness of the surficial OL layer in the pre-dredge cores ranged from 5 to 45.5 inches (0.4 to 3.8 feet), the average thickness being 23 inches. A lower OL thickness was generally observed in core samples collected along the edge of the marsh, with 13 of these stations exhibiting an underlying composite layer of either coarse sand or peat embedded into the olive clay-silt. The intermediate third layer of dark olive silt that was observed in 17 stations near the center of the channel ranged in thickness from 4 to 14 inches (0.33 to 1.2 feet). As observed with Area-A core samples, the transition between layers as viewed through the liner was typically smeared, likely an artifact of the draw-down effect in the liner during the coring process as this mixed transition was not as apparent in the central portion of the core samples that were sectioned for analysis. A hydrogen sulfide odor was associated with many of the cores, typically those with OL layers greater than 6 inches. An oily sheen bubbled to the water surface during the recovery of only a few samples; however, the presence of oil was apparent in nearly all of the samples sectioned.

Post-dredge core samples ranged from 10 to 40 inches (0.83 to 3.3 feet) in length with each core recovering a visible transition to lighter colored sediments at depth. The distinct black surficial OL layer observed in all of the pre-dredge samples was still apparent in one-half of the post-dredge cores. The percentage of cores with a dominant OL component was higher in the western portion of the dredge area, west of Column-AA (9 of 12 cores, see Figure 6) than in the eastern portion (4 of 14 cores). The thickness of the OL layer ranged from 5.5 to 21.5 inches (0.46 to 1.8 feet), the average being 12 inches, with underlying sediments generally an olive to dark olive silt-clay. The post-dredge samples with remaining OL layers found in the eastern half of the dredge area had an underlying composite layer of dark olive to black silt mixed with peat that progressively transitioned to a layer of all peat at depth.

For the other half of the post-dredge core samples, the original OL layer appeared to be a replaced by a dark olive surficial layer residing above an olive colored silt-clay. The post-dredge surficial layer ranged in thickness from 3 to 18 inches (0.25 to 1.5 feet), the average being 9.5 inches. The presence of a hydrogen sulfide odor was not detected during the collection of any post-dredge cores, and the appearance of an oily surface sheen was observed during sampling at only one station.

3.3.2 Sediment Chemistry

Seven pre-dredge cores from Area-A and 10 pre-dredge cores from Area-B were selected for analysis to evaluate the accuracy of the visual transition interface as a means of estimating the z* elevation. A

6-inch segment of sediment either immediately above and/or below the visual interface was submitted for the rapid assessment of PCB Aroclors. The analytical results are presented in Table 3. For the samples collected above the interface, all but one were above 10 mg/kg total PCB, with concentrations ranging from 3.6 to 18,200 mg/kg. For the samples collected below the interface, all but two were below 10 mg/kg, with concentrations ranging from below detection limits to 213 mg/kg.

Six post-dredge cores from Area-B were selected for analysis to compare with pre-dredge PCB concentrations for assessment of changes in concentrations related to dredging. The post-dredge surficial layer was analyzed for all six, as well as deeper layers in four of the cores. The analytical results are presented in Table 4. Concentrations in the post-dredge surficial layer were lower than the pre-dredge OL (upper layer) concentrations in four of the six cores, ranging from 4.8 to 208 mg/kg.

3.3.3 Data QC and Database Entry

Upon receipt of the PCB data from the laboratory, ENSR provided a cursory review for completeness and loaded the data into a temporary database for draft data reporting capability. ENSR also performed a quick check of the QC sample results from the temporary database to evaluate overall data quality before transmitting the data to the program database. Furthermore, electronic files of the hardcopy laboratory reports were generated and provided to Battelle Ocean Sciences for subsequent data validation efforts and uploading into the Project database.

3.4 Bathymetry

Pre-dredge bathymetry (from Jacobs 2006) for the two dredge areas is presented in Figure 26. The pre-dredge bathymetry revealed a shallow and relatively uniform harbor bottom in Area-A as compared to Area-B which gradually sloped away from marsh to progressively deeper water towards the center of the channel with the deepest area found to the southwest. Notable features of the pre-dredge bathymetry included the residual footprint of 2004 dredging completed in DMU-2 shown on the west edge of Area-A and a linear depression at the center of the northern edge of Area-B, likely the result of historical scour or dragging activity.

Post-dredge bathymetry for the two dredge areas is presented on Figure 27. Comparison of the pre- and post-dredge bathymetry clearly revealed the change imparted by the 2005 dredging effort. The fact that dredging was completed in south-to-north passes is clearly evident along with the final west-to-east cuts that were completed the southern portion of Area-B. The bathymetry indicates that a number of north-south orientated ridges and troughs were left in the two dredge areas; these two features imparted variability in depth of several feet between individual sounding measurements collected within the space of 5 to 10 feet within a number of individual dredge cells.

4.0 DISCUSSION

4.1 Use of the Physical Attributes of Sediments as a Predictor of PCB Contamination

The data collected during the 2005 progress sediment sampling program further supported the model of visually identifiable physical characteristics being a good predictor of PCB concentrations. In this area of the Upper Harbor, surface sediments typically consist of black highly fluidized organic silts. This surface layer of organic silt (classified as the OL layer – Unified Soil Classification System) is typically anoxic sediment with a characteristic odor of hydrogen sulfide (H_2S). The depth of this surface layer can range from under 1 foot along the edge of the marsh to greater than 5 feet near the center of the Acushnet River.

Beneath the OL layer are materials considered much older in the sedimentary record for the area. These underlying sediments have a reduced percentage of organic material and are characterized as a more consolidated silt layer with a clay fraction that progressively increases with depth though the layer. The color of this underlying layer transitions from an olive silt immediately under the interface to an olive-gray colored silt-clay at depth. The interface between the black surface silts and the lighter underlying layers is either a sharp distinct boundary or a mixed transition layer that is typically a few inches thick. Previous investigations (ENSR 2005, FWENC 2001, FWENC 2002) have indicated that for the Upper Harbor, the interface where the surficial black OL layer transitions to a lighter colored silt-clay provides a reasonable estimate for the point at which sediment PCB concentrations generally decline dramatically, with high concentrations (100's to 1000's mg/kg total PCBs) in the black OL layer and low concentrations (typically <10 mg/kg) in sediments beneath the transition.

Although a limited number of samples were analyzed as part of the 2005 field effort, 16 of 17 samples conformed to this model. Above the sediment transition, PCB concentrations ranged up to 18,200 mg/kg with a sharp reduction below the transition at all but one location, and with most concentrations <10 mg/kg below the transition. The model also seemed applicable to two other sediment layers that were observed during the 2005 field effort. In samples collected near the center of the channel, the transition between the black OL layer and the lighter underlying sediments was not as abrupt. At these stations the black OL layer transitioned through a dark olive OL layer that was as thick as 1.5 feet before the more prominent sediment transition was encountered. Samples analyzed from these center channel stations indicated that PCB concentrations declined somewhat with depth through the two OL layers, and in keeping with the model, PCB concentrations were markedly lower beneath the visual interface.

In some samples collected along the edge of the marsh on the eastern side of the harbor, an underlying layer of peat was observed beneath the black OL layer. The limited PCB data representing this form of sediment stratigraphy also adhered to the model, indicating that an undisturbed peat layer acted in a similar fashion as the more typical underlying silt-clay layer in forming an interface which limited the downward migration of overlying PCB contamination.

4.2 Comparison of Planned Cut-Depth Elevation and Planned Sediment Removal Thickness with 2005 Core Measurements

The 2005 dredge plan was based on geostatistical modeling that used historical PCB data from sediment cores to generate a prediction of the spatial distribution of PCB contamination in the Upper Harbor. The geostatistical modeling was used to generate a map of the predicted boundary between the contaminated surficial sediments and cleaner underlying material, with the elevation of this boundary termed z*. The 2005 dredge plans for a portion of DMU-2 (Area-A) and DMU-4 and limited portions of DMU-3 and DMU-5 (Area-B) were prepared using the z* predictions (Jacobs 2005). The two dredge areas were sectioned into individual 25 by 25-foot dredge blocks (see Figure 4 for Area-A and Figures 5 and 6 for Area-B). Based on a review of the predicted depth to z* generated by the geostatistical modeling for the area, a target depth of cut (or planned sediment removal thickness) was assigned to each block, rounded to the nearest foot. An associated target dredge elevation (or planned cut elevation) was also assigned to each block based on the rounded depth of cut. Depending on whether the target depth of cut was rounded up or down, the resulting target dredge elevation was defined slightly above or below the original z* prediction, but generally differing from z* by less than a few tenths of a foot.

As described in Section 3.3, prior to the start of dredging a combined total of 95 sediment cores were collected from Area-A and Area-B. The cores were carefully inspected through the clear liners, and the elevations for the sediment water interface and visual transitions in sediment properties along the length of the core were documented. Given the number of the pre-dredge cores in both Areas A and B (Figures 8 and 9) as compared to the historical cores collected over the area (Figure 7), the data obtained from this effort (summarized in Tables 1 and 2) allowed for a more refined mapping of sediment thicknesses and interface elevations within each of the dredge areas. These data were compared with the planned cut depth elevation (or target dredge elevation) as described below to help increase dredging efficiency.

Comparison of Planned Cut-Depth Elevation with Measured Interface Elevation

The elevation measurements determined for each pre-dredge core were used to generate a contour map of the elevation of the interface between the overlying surficial OL layer (assumed to have higher PCB concentrations) and the underlying consolidated silt layer (assumed to have no or only limited PCB contamination) as shown in Figure 28 for Area-A and in Figure 29 for Area-B. These two contour plots showed similarities to the pre-dredge bathymetry survey map presented in Figure 11, smoothly transitioning from deep water areas to the shallower water areas approaching the edge of the marsh. The contour plots also indicated the presence of isolated deep pockets, such as along the northwest corner of Area-A (Figure 28) and in the vicinity of Stations 28Q, 29S, and 30QR in Area-B (Figure 29), features that were also reflected in pre-dredge bathymetry.

The elevation of the transition interface between the OL layer and the consolidated silt was directly compared with the planned cut depth elevation for each pre-dredge core as presented in Table 5 for

Area A and Table 6 for Area-B. Positive differentials (shown in the right hand columns of the tables) represent a location where the planned cut depth was lower than the observed interface elevation (potential over-dredge scenario). Negative differentials (shown in the left hand columns of the tables) represent a location where the planned cut depth was higher than the observed interface elevation (potential under-dredge scenario). For Area-A, the planned cut depth was within ± 1.0 foot of the measured visual interface elevation at 17 of 27 core locations. For the remaining 10 stations, six were negative values (indicating potential under dredge) ranging up to -2.4 feet, and four were positive (indicating potential over dredge) ranging up to +1.6 feet (Table 5). For Area-B, the planned cut depth was within ± 1.0 foot of the measured visual interface elevation at 50 of 68 core locations. For the remaining 18 stations, 10 were negative values (indicating potential under dredge) ranging to -3.0 feet, and eight were positive (indicating potential over dredge) ranging up to +2.3 feet (Table 6).

Overall, the agreement between the measured visual interface and the planned cut depth elevations presented in Tables 5 and 6 is very good considering the somewhat limited number of historical coring locations that were included in the geostatistical modeling (Figure 7). However, the more comprehensive 2005 data set allowed for refinement of the dredge plan. The differentials between the planned cut depth and measured visual interface were contoured, using a ± 0.75 foot threshold for both Area-A (Figure 30) and Area-B (Figure 31). Blue shading within Figures 30 and 31 indicated areas where negative differentials greater than -0.75 feet were expected (potential under dredge areas), and red shading indicated areas where positive differentials greater than +0.75 feet were expected (potential over dredge). These figures were used by Jacobs Engineering to adjust the planned cut depth in some blocks to increase overall dredging efficiency.

Comparison of Planned Sediment Removal Thickness with 2005 Measurements

While attaining the correct target elevation is crucial to achieving a remediation goal, accurately assessing the overlying sediment volume is important in the budgetary planning of dredged material handling and disposal. The pre-dredge coring effort allowed for comparison of the core-measured thickness of the OL layer with the sediment removal thickness planned for each dredge block to help assess the accuracy of the volume predictions. The comparison is presented in Table 7 for Area-A and Table 8 for Area-B in a similar format as the tables for assessing the cut depth elevation. Positive differentials (shown in the right hand columns of Tables 7 and 8) represent locations where the planned sediment removal thickness was greater than the observed thickness of the OL layer within the core (potential over prediction of volume). Negative differentials (shown in the left hand columns of the tables) represent locations where the planned sediment removal thickness was less than the observed thickness of the OL layer within the core (potential under prediction of volume).

For Area-A, the planned removal thickness was within ± 1 foot of the measured OL layer thickness at 8 of the 27 core locations (Table 7). For the remaining 19 stations, only two were negative values (indicating a potential under prediction of dredge volume), and the remaining 17 stations were positive (indicating a potential over prediction of dredge volume) with differential values ranging up to +3.5 feet in thickness. For Area-B, the planned removal thickness was within ± 1 foot of the measured OL layer

thickness at 51 of the 68 core locations (Table 8). For the remaining 17 stations, five were negative values (indicating a potential under prediction of dredge volume) ranging to -1.8 feet, and 12 stations were positive (indicating a potential over prediction of dredge volume) ranging up to +2.5 feet in thickness.

Some of the offset toward more positive values for Area-A may have been related to coring technique in the very soft surficial sediments. For the initial set of cores in Area-A, this may have resulted in a bias toward under prediction of the OL layer thickness. For later cores collected in Area-A and all cores collected in Area-B, additional checks were included in the coring process to increase the confidence that the coring captured the sediment-water interface, allowing for an accurate measurement of the OL layer thickness. The continued offset toward a positive differential (over prediction of volume) in Area B indicates that other factors were involved, potentially including:

- Consolidation of core samples – The push coring used in this effort is a technique that causes little disturbance and generally provides a very representative sample. Some consolidation can occur during coring and retrieval in very soft sediments, but this factor may be more significant in the historical samples collected by vibracore sampling. However, this indicates that the cored sediments have very high water content, and correspondingly, a low percentage of solids.
- Bathymetric survey bias – The performance of bathymetric surveys in shallow water with a very soft surficial sediment surface poses a number of challenges and can sometimes lead to a consistent offset in the reported water depth. In very shallow waters, such as those found in Area-A, this offset could be more significant.

For the fall 2005 dredging, it should be noted that any offset between the predicted and actual thickness of the sediment layer targeted for removal did not affect the accuracy of the operation, as dredge control was provided by measurement of bottom elevation and direct comparison with the planned cut-depth elevation.

4.3 Evaluation of PCB Removal Efficiency

The 2005 dredging season removed approximately 24,000 cubic yards of sediment (Jacobs 2006). Although the 2005 dredge season was not designed to leave an area with PCB concentrations below the 10 mg/kg remediation criteria (i.e., no final clean-up pass was included), there were a number of stations where post-dredging sounding measurements taken during the collection of core samples indicated that the depth of sediment removed had progressed to or slightly beyond the planned cut depth elevation (based on the predicted z* elevation). This scenario provided an opportunity to compare the physical characteristics and PCB concentrations of post-dredge surface samples to representative samples from the same elevation of the corresponding pre-dredge cores and evaluate the efficiency of the rough-cut (non cleanup) dredging that was performed in 2005.

The physical characteristics of pre- and post-dredge sediments were compared using the side-by-side photos and core descriptions presented in Figures 12-24. These figures present the core photos positioned with respect to the Project datum of NGVD-29. Additional features superimposed on the core images include the thickness of the surface sediment layer, sounding measurements, bathymetry survey elevations, and the planned dredge cut depth elevation for each station. As discussed in Section 4.1, pre-dredge core samples were typically characterized as a black fluidized silt layer (OL layer) overlying a noticeably lighter olive silt-clay layer with the visual transition between the two sediment layers marking a fairly accurate estimate for the sharp decline in PCB concentrations. In theory, as the dredge cut below the interface between these two layers, the post-dredge surface left behind would resemble the characteristics of the original underlying sediments. In practice, this is challenging given the fluid characteristics of the overlying silt and the logistics of actually performing the dredging.

Although much of the 2005 dredging was performed to or slightly below the planned cut depth elevation as described above, it should again be noted that no additional cleanup passes were performed. The post-dredge cores revealed a dark colored surficial layer at many of the locations for both Area A and Area B, ranging in thickness from 3 to 22 inches. To a lesser extent a number of cores in Area B retained what appeared to be the original distinct OL surface layer. The physical characteristics of the post-dredge surficial layer were typically dissimilar to that of the sediment layer from the same elevation in the pre-dredge core. This observation is qualified by the potential uncertainty in the vertical placement of the cores (elevation was calculated from a series of field measurements) as well as the horizontal variability in sediments (pre- and post-dredge cores were not collected at exactly the same locations (estimated within 10 feet).

For six core locations in Area B, PCB concentrations were measured in both the pre-dredge and post-dredge cores (Table 4; Figures 18, 21, 22, 23). The PCB concentrations in the post-dredge surficial layer were generally much lower than in surficial layer of the area prior to dredging. However, the post-dredge surficial concentrations (ranging from 4.8 to 208 mg/kg with a mean of 102 mg/kg) were well above the pre-dredge concentrations from same elevation (ranging from non-detect to 33 mg/kg with a mean of 6.1 mg/kg).

The presence of a residual post-dredge surficial layer retaining some of the physical and chemical characteristics of the previously overlying pre-dredge material is not unexpected, especially given that no cleanup passes were performed in the 2005 dredging. Ongoing review of data from remedial dredging projects has shown that some level of residual post-dredge surficial layer is expected even if cleanup passes are performed (Resuspension, Release, Residual, and Risk (4 R's) Workshop, USACE ERDC, 25-27 April 2006). This residual layer is considered to be the result of one or more of a number of processes, including undisturbed residuals (material not fully removed), generated residuals (sloughing within and adjacent to the dredge cut, resuspension and deposition related to the dredging and support activities), and normal background resuspension and deposition in the harbor unrelated to the dredging.

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TABLES

TABLE 1 - Area-A Progress Core Samples - Measurements and Calculations

																		Planned Cut Elevation					OL Thickness						Bathymetry			Sounding							
Z-block	ID	Coring Date	Measured Total Barrel Length (in)	Measured Total Barrel Length (ft)	Measured Distance from Top of Barrel to WL at Refusal (in)	Measured Distance from Top of Barrel to WL at Refusal (ft)	Calculated Distance from WL to Bottom of Core Barrel (ft)	Elevation of Top of Pile (ft-NGVD)	Pile #	Measured Top of pile to WL (in)	Measured Top of pile to WL (ft)	Calculated Elevation of WL (ft-NGVD)	Calculated Elevation of Core Bottom (ft-NGVD)	Measured Total Recovered Core Length (in)	Total Recovered Core Length (ft)	Measured Distance from Bot. of Core to OH Interface (in)	Measured Distance from Bot. of Core to OL Interface (ft)	Calculated OL Interface Elevation (ft-NGVD)	Z* Elevation (ft-NGVD) (1)	Calculated Offset from Z* Elevation (ft)	Planned Cut Elevation (ft-NGVD)	Calculated Offset from Planned Cut Elevation (ft)	Measured thickness of silt (in)	Measured thickness of silt (ft)	Predicted Sediment Thickness (ft)	Offset from Predicted Sediment Thickness (ft)	Planned Sediment Removal Thickness (ft) (1)	Offset from Planned Thickness (ft)	Elevation of Top of Pile (ft-NGVD)	Pile #	Measured Top of pile to WL (during Sounding) (in) (2)	Measured Top of pile to WL (during Sounding) (ft)	Calculated Elevation of WL (during Sounding) (ft-NGVD)	Measured Water Depth by Sounding (in) (2)	Measured Water Depth by Sounding (ft)	Calculated Top of Core Elevation (ft -NGVD)	Calculated Bottom Elevation by Sounding (ft-NGVD)	Interpolated Bottom Elevation from Bathymetry (ft-NGVD) (3)
2	B	1-Sep-05	199.5	16.6	87.0	7.25	9.38	5.20	5	62.0	5.17	0.03	-9.34	49.5	4.13	25.5	2.13	-7.22	-4.46	-2.76	-4.8	-2.42	24.0	2.0	3.66	1.7	4.0	2.0	5.40	9	39.5	3.3	2.11	65	5.42	-5.22	-3.31	-2.0
2	D	1-Sep-05	200.0	16.7	97.0	8.08	8.58	5.20	5	62.0	5.17	0.03	-8.55	33.5	2.79	20	1.67	-6.88	-4.86	-2.02	-5.2	-1.68	13.5	1.1	3.66	2.5	4.0	2.9	5.40	9	42.0	3.5	1.90	52	4.33	-5.76	-2.43	-2.0
3	CD	1-Sep-05	201.5	16.8	107.5	8.96	7.83	5.20	5	65.0	5.42	-0.22	-8.05	39	3.25	13	1.08	-6.97	-5.98	-0.99	-6.1	-0.87	26.0	2.2	3.88	1.7	4.0	1.8	5.40	9	44.0	3.7	1.73	51	4.25	-4.80	-2.52	-2.1
4	H	1-Sep-05	176.5	14.7	120.0	10.00	4.71	5.20	5	66.0	5.50	-0.30	-5.01	30.5	2.54	13.5	1.13	-3.88	-4.72	0.84	-4.2	0.32	17.0	1.4	2.52	1.1	2.0	0.6	5.20	5	66.0	5.5	-0.30			-2.47		-1.5
10	H	1-Sep-05	189.0	15.8	112.0	9.33	6.42	5.60	11	51.5	4.29	1.31	-5.11	42	3.50	11	0.92	-4.19	-4.22	0.03	-3.7	-0.49	31.0	2.6	2.52	-0.1	2.0	-0.6	5.60	11	51.5	4.3	1.31			-1.61		-1.4
14	H	1-Sep-05	188.0	15.7	103.0	8.58	7.08	4.90	15	44.5	3.71	1.19	-5.89	42	3.50	16	1.33	-4.56	-4.00	-0.56	-3.7	-0.86	26.0	2.2	2.30	0.1	2.0	-0.2	4.90	15	44.5	3.7	1.19			-2.39		-1.3
16	G	1-Sep-05	189.0	15.8	108.0	9.00	6.75	5.30	17	48.7	4.06	1.24	-5.51	43	3.58	16	1.33	-4.18	-3.80	-0.38	-3.5	-0.68	27.0	2.3	2.30	0.0	2.0	-0.3	5.30	17	48.8	4.1	1.24			-1.93		-1.5
19	G	1-Sep-05	189.0	15.8	112.0	9.33	6.42	5.30	17	51.5	4.29	1.01	-5.41	42	3.50	15	1.25	-4.16	-3.17	-0.99	-2.6	-1.56	27.0	2.3	1.57	-0.7	1.0	-1.3	5.30	17	51.5	4.3	1.01			-1.91		-1.5
21	C	1-Sep-05	177.0	14.8	116.0	9.67	5.08	4.90	15	55.0	4.58	0.32	-4.76	23.5	1.96	5	0.42	-4.35	-3.47	-0.88	-3.1	-1.25	18.5	1.5	1.37	-0.2	1.0	-0.5	5.40	9	54.0	4.5	0.90	40	3.33	-2.81	-2.43	-2.1
21	E	1-Sep-05	177.0	14.8	110.0	9.17	5.58	5.30	17	54.7	4.56	0.74	-4.84	30.5	2.54	5.5	0.46	-4.39	-3.07	-1.32	-2.6	-1.79	25.0	2.1	1.47	-0.6	1.0	-1.1	5.30	17	54.8	4.6	0.74	37	3.08	-2.30	-2.35	-1.8
21	G	1-Sep-05	176.0	14.7	114.0	9.50	5.17	5.30	17	53.5	4.46	0.84	-4.33	31	2.58	10	0.83	-3.49	-3.17	-0.32	-2.6	-0.89	21.0	1.8	1.57	-0.2	1.0	-0.8	5.30	17	53.5	4.5	0.84	33	2.75	-1.74	-1.91	-1.5
7	H	2-Sep-05	188.0	15.7	99.5	8.29	7.38	5.40	9	38.0	3.17	2.23	-5.14	21.5	1.79	13	1.08	-4.06	-4.27	0.21	-4.2	0.14	8.5	0.7	2.07	1.4	2.0	1.3								-3.35		-1.4
8	C	2-Sep-05	201.5	16.8	86.0	7.17	9.63	5.40	9	41.5	3.46	1.94	-7.69	25.5	2.13	20	1.67	-6.02	-6.22	0.20	-6.1	0.08	5.5	0.5	4.12	3.7	4.0	3.5	5.40	9	32.0	2.7	2.73	62	5.17	-5.56	-2.43	-2.2
10	BC	2-Sep-05	189.5	15.8	89.0	7.42	8.38	5.40	9	46.0	3.83	1.57	-6.81	29	2.42	20	1.67	-5.14	-5.15	0.01	-5.4	0.26	9.0	0.8	2.75	2.0	3.0	2.3								-4.39		-2.3
13	C	2-Sep-05	188.5	15.7	115.0	9.58	6.13	5.40	9	48.0	4.00	1.40	-4.73	11.5	0.96	9	0.75	-3.98	-4.07	0.10	-4.0	0.03	2.5	0.2	2.07	1.9	2.0	1.8								-3.77		-2.0
14	F	2-Sep-05	188.5	15.7	114.0	9.50	6.21	5.00	13	50.0	4.17	0.83	-5.38	26.5	2.21	19.5	1.63	-3.75	-4.25	0.50	-4.5	0.75	7.0	0.6	2.75	2.2	3.0	2.4	5.40	9	32.0	2.7	2.73	59	4.92	-3.17	-2.18	-1.7
16	D	2-Sep-05	189.0	15.8	121.0	10.08	5.67	5.00	13	53.5	4.46	0.54	-5.13	25	2.08	13	1.08	-4.04	-4.18	0.14	-4.0	-0.04	12.0	1.0	2.18	1.2	2.0	1.0								-3.04		-1.9
18	D	2-Sep-05	189.0	15.8	114.0	9.50	6.25	5.00	13	55.0	4.58	0.42	-5.83	16.5	1.38	9.5	0.79	-5.04	-3.37	-1.67	-3.3	-1.74	7.0	0.6	2.07	1.5	2.0	1.4	5.40	9	32.0	2.7	2.73	60	5.00	-4.46	-2.27	-1.8
2	FG2	9-Sep-05	200.5	16.7	106.0	8.83	7.88	5.40	9	33.5	2.79	2.61	-5.27	37.5	3.13	12.5	1.04	-4.23	-5.13	0.90	-4.7	0.47	25.0	2.1	3.43	1.3	3.0	0.9	5.40	9	42.0	3.5	1.90	48	4.00	-2.14	-2.10	-1.9
4	FG2	9-Sep-05	201.0	16.8	116.0	9.67	7.08	5.40	9	49.5	4.13	1.28	-5.81	33	2.75	20	1.67	-4.14	-5.13	0.99	-4.7	0.56	13.0	1.1	3.43	2.3	3.0	1.9	5.40	9	44.0	3.7	1.73	46	3.83	-3.06	-2.10	-1.8
5	DE2	9-Sep-05	200.5	16.7	102.3	8.52	8.19	5.40	9	38.5	3.21	2.19	-6.00	31	2.58	15	1.25	-4.75	-6.20	1.45	-6.1	1.35	16.0	1.3	4.10	2.8	4.0	2.7	5.40	9	47.0	3.9	1.48	46	3.83	-3.41	-2.35	-2.0
5	EF	9-Sep-05	201.0	16.8	103.0	8.58	8.17	5.40	9	39.5	3.29	2.11	-6.06	32.5	2.71	15.5	1.29	-4.77	-4.90	0.13	-5.4	0.63	17.0	1.4	3.50	2.1	4.0	2.6	5.4	9	39.5	3.3	2.11			-3.35		-1.9
5	FG	9-Sep-05	200.5	16.7	132.5	11.04	5.67	5.40	9	45.0	3.75	1.65	-4.02	19	1.58	7	0.58	-3.43	-4.13	0.70	-4.7	1.27	12.0	1.0	3.43	2.4	4.0	3.0	5.4	9	45.0	3.8	1.65			-2.43		-1.8
5	CD	9-Sep-05	200.5	16.7	117.0	9.75	6.96	5.40	9	47.0	3.92	1.48	-5.48	32	2.67	12	1.00	-4.48	-6.22	1.75	-6.1	1.63	20.0	1.7	4.12	2.5	4.0	2.3	5.4	9	47.0	3.9	1.48			-2.81		-2.1
6	FG2	9-Sep-05	200.5	16.7	115.0	9.58	7.13	5.40	9	41.5	3.46	1.94	-5.18	33.5	2.79	16.5	1.38	-3.81	-5.13	1.32	-4.7	0.89	17.0	1.4	3.43	2.0	3.0	1.6	5.40	9	54.0	4.5	0.90	38	3.17	-2.39	-2.27	-1.6
12	F2	9-Sep-05	200.5	16.7	120.5	10.04	6.7	5.40	9	44.0	3.67	1.73	-4.93	29	2.42	14	1.17	-3.77	-4.68	0.91	-4.7	0.93	15.0	1.3	2.98	1.7	3.0	1.8	5.40	9	42.0	3.5	1.90	59	4.92	-2.52	-3.02	-1.6
89	F2	9-Sep-05	200.5	16.7	123.5	10.29	6.4	5.4	9	42.0	3.50	1.9	-4.5	24.5	2.04	10.5	0.88	-3.64	-4.90	1.26	-4.7	1.06	14.0	1.2	3.20	2.0	3.0	1.8	5.40	9	32.0	2.7	2.73	61	5.08	-2.48	-2.35	-1.7
POST-DREDGE CORE SAMPLING																																							
4	FG2	18-Oct-05	177.0	14.8	42.0	3.5	11.3	5.4	9	15.0	1.25	4.15	-7.1	27	2.25	8	0.67	-6.43	-5.13	-1.30	-4.7	-1.73	19	1.6	3.43		3.0		5.40	9	15	1.3	4.15	109	9.08	-4.85	-4.93	-4.9
5	CD	18-Oct-05	186.5	15.5	34.5	2.875	12.7	5.4	9	15.5	1.29	4.11	-8.6	27.5	2.29	11	0.92	-7.64	-6.22	-1.42	-6.1	-1.54	16.5	1.4	4.12		4.0		5.40	9	15.5	1.3	4.11	123	10.25	-6.27	-6.14	-6.1
5	DE2	18-Oct-05	188.0	15.7	48.0	4	11.7	5.4	9	19.0	1.58	3.82	-7.9	30	2.50	12	1.00	-6.85	-6.2	-0.65	-6.1	-0.75	18	1.5	4.10		4.0		5.40	9	19	1.6	3.82	112	9.33	-5.35	-5.52	-5.5
5	EF	18-Oct-05	188.5	15.7	46.0	3.8	11.9	5.4	9	24.0	2.00	3.40	-8.5	37	3.08	27	2.25	-6.23	-4.9	-1.33	-5.4	-0.82	10	0.8	3.50		4.0		5.40	9	24.0	2.0	3.40	105	8.75	-5.39	-5.35	-5.4
5	FG	18-Oct-05	188.5	15.7	56.5	4.7	11.0	5.4	9	27.5	2.29	3.11	-7.9	30	2.50	13	1.08	-6.81	-4.13	-2.68	-4.7	-2.11	17	1.4	3.43		4.0		5.40	9	27.5	2.3	3.11	98	8.17	-5.39	-5.06	-5.1
6	FG2	18-Oct-05	188.5	15.7	68.0	5.7	10.0	5.4	9	31.0	2.58	2.82	-7.2	32.5	2.71	24	2.00	-5.23	-5.13	-0.10	-4.7	-0.53	8.5	0.7	3.43		3.0		5.40	9	31.0	2.6	2.82	84	7.00	-4.52	-4.18	-4.2
12	F2	18-Oct-05	188.4	15.7	66.5	5.5	10.2	5.4	9	35.5	2.96	2.44	-7.7	36	3.00	23	1.92	-5.80	-4.68	-1.12	-4.7	-1.10	13	1.1	2.98		3.0		5.40	9	35.5	3.0	2.44	82	6.83	-4.72	-4.39	-4.2
1	E	14-Nov-05	180.5	15.0	78.5	6.5	8.5	5.4	9	56.5	4.71	0.69	-7.8	32	2.67	21	1.75	-6.06	-4.68	-1.38	-4.7	-1.36	11	0.9	2.98		3.0		5.40	9	56.5	4.7	0.69	67	5.60	-5.14	-4.91	-5.1
2	B	14-Nov-05	180.5	15.0	73.0	6.1	9.0	5.4	9	61.0	5.08	0.32	-8.6	27	2.25	21	1.75	-6.89	-4.46	-2.43	-4.8	-2.09	6	0.5	3.66		4.0		5.40	9	61.0	5.1	0.32	72	6.00	-6.39	-5.68	-5.8
3	CD	14-Nov-05	182.5	15.2	73.0	6.1	9.1	5.4	9	65.0	5.42	-0.02	-9.1	31	2.58	23	1.92	-7.23	-5.98	-1.25	-6.1	-1.13	8	0.7	3.88		4.0		5.40	9	65.0	5.4	-0.02	72	6.00	-6.56	-6.02	-5.4
7	H	14-Nov-05	181.0	15.1	96.0	8.0	7.1	5.4	9	67.5	5.63	-0.23	-7.3	26	2.17	17	1.42	-5.89	-4.27	-1.62	-4.2	-1.69	9	0.8	2.07		2.0		5.40	9	67.5	5.6	-0.23	55	4.60	-5.14	-4.83	-4.8
10	H	14-Nov-05	180.5	15.0	89.5	7.5	7.6	5.4	9	69.0	5.75	-0.35	-7.9	35	2.92	24	2.00	-5.93	-4.22	-1.71	-3.7	-2.23	11	0.9	2.52		2.0		5.40	9	69.0	5.8	-0.35	49	4.10	-5.02	-4.45	-4.6
14	H	14-Nov-05	180.5	15.0	102.3	8.5	6.5	5.4	9	70.0	5.83	-0.43	-7.0	32	2.67	22	1.83	-5.12	-4	-1.12	-3.7	-1.42	10	0.8	2.30		2.0		5.40	9	70.0	5.8	-0.43	46	3.80	-4.29	-4.23	-4.4
10	BC	14-Nov-05	178.5	14.9	114.0	9.5	5.4	5.4	9	72.5	6.04	-0.64	-6.0	27	2.25	10	0.83	-5.18	-5.15	-0.03	-5.4	0.22	17	1.4	2.75		3.0		5.40	9	72.5	6.0	-0.64	31	2.60	-3.77	-3.24	-3.6
10	A	14-Nov-05	180.5	15.0	81.5	6.8	8.3	5.4	9	77.5	6.46	-1.06	-9.3	34	2.83	14	1.17	-8.14	-6.92	-1.22	-6.4	-1.74	20	1.7	2.52		2.0		5.40	9	77.5	6.5	-1.06	66	5.50	-6.48	-6.56	-4.6
8	C	14-Nov-05	180.5	15.0	120.3	10.0	5.0	5.4	9	78.5	6.54	-1.14	-6.2	34	2.83	19	1.58	-4.58	-6.22	1.64	-6.1	1.52	15	1.3	4.12		4.0		5.40	9	78.5	6.5	-1.14	20	1.70	-3.33	-2.84	-5.1
19	G	14-Nov-05	180.5	15.0	121.5	10.1	4.9	5.4	9	79.0	6.58	-1.18	-6.1	30	2.50	8	0.67	-5.43	-3.17	-2.26	-2.6	-2.83	22	1.8	1.57		1.0		5.40	9	79.0	6.6	-1.18	25	2.10	-3.60	-3.28	-3.3
21	E	14-Nov-05	180.5	15.0	116.0	9.7	5.4	5.4	9	76.5	6.38	-0.98	-6.4	31	2.58	22	1.83	-4.52	-3.07	-1.45	-2.6	-1.92	9	0.8	1.47		1.0		5.40	9	76.5	6.4	-0.98	29	2.40	-3.77	-3.38	-2.4
21	C	14-Nov-05	180.5	15.0	118.3	9.9	5.2	5.4	9	76.0	6.33	-0.93	-6.1	29.5	2.46	21	1.75	-4.37	-3.47	-0.90	-3.1	-1.27	8.5	0.7	1.37		1.0		5.40	9	76.0	6.3	-0.93	31	2.60	-3.66	-3.53	-3.4
17	B	14-Nov-05	180.5	15.0	111.5	9.3	5.8	5.4	9	75.0	6.25	-0.85	-6.6	26	2.17	5	0.42	-6.18	-3.47	-2.71	-4	-2.18	21	1.8	2.07		2.0		5.40	9	75.0	6.3	-0.85	42	3.50	-4.43	-4.35	-4.4
16	D	14-Nov-05	180.5	15.0	99.5	8.3	6.8	5.4	9	73.5	6.13	-0.73	-7.5	32	2.67	18	1.50	-5.98	-4.18	-1.80	-4.0	-1.98	14	1.2	2.18		2.0		5.40	9	73.5	6.1	-0.73	50	4.20	-4.81	-4.93	-4.2

Shaded cells indicate field data entered into the spreadsheet

Notes:

(1) From Jacobs August 2005 Dredge Plan, Figure 4. z* elevation calculated by correcting planned cut elevation by the differential between predicted sediment thickness and the rounded value for the planned sediment removal thickness.
(2) Sounding measurements
(3) From Pre- and Post-Dredge Bathymetry Maps (Apex Engineering)

Data Entered By: J Lund
Data Checked By: R McCarthy

TABLE 2 - Area-B Progress Core Samples - Measurements and Calculations

																		Planned Cut Elevation					OL Thickness						Bathymetry – Sounding									
Z-block ID	Target ID	Coring Date	Measured Total Barrel Length (in)	Measured Total Barrel Length (ft)	Measured Distance from Top of Barrel to WL at Refusal (in)	Measured Distance from Top of Barrel to WL at Refusal (ft)	Calculated Distance from WL to Bottom of Core Barrel (ft)	Elevation of Top of Pile (ft-NGVD)	Pile #	Measured Top of pile to WL (in)	Measured Top of pile to WL (ft)	Calculated Elevation of WL (ft-NGVD)	Calculated Elevation of Core Bottom (ft-NGVD)	Measured Total Recovered Core Length (in)	Total Recovered Core Length (ft)	Measured Distance from Bot. of Core to OH Interface (in)	Measured Distance from Bot. of Core to OH Interface (ft)	Calculated OH Interface Elevation (ft-NGVD)	Z* Elevation (ft-NGVD)	Calculated Offset from Z* Elevation (ft)	Planned Cut Elevation (ft-NGVD)	Calculated Offset from Planned Cut Elevation (ft)	Measured thickness of silt (in)	Measured thickness of silt (ft)	Predicted Sediment Thickness (ft)	Offset from Predicted Sediment Thickness (ft)	Planned Sediment Removal Thickness (ft)	Offset from Planned Removal Thickness (ft)	Elevation of Top of Pile (ft-NGVD)	Pile #	Measured Top of pile to WL (during Sounding) (in)	Measured Top of pile to WL (during Sounding) (ft)	Calculated Elevation of WL (during Sounding) (ft-NGVD)	Measured Water Depth by Sounding (in)	Measured Water Depth by Sounding (ft)	Calculated Top of Core Elevation (ft -NGVD)	Calculated Bottom Elevation by Sounding (ft-NGVD)	Interpolated Bottom Elevation from Bathymetry (ft-NGVD)(3)
24 CC	23 CCDD	21-Sep-05	189.0	15.8	76.25	6.35	9.40	5.4	55	38.4	3.20	2.20	-7.20	34	2.83	12	1.00	-6.20	-6.30	0.10	-6.3	0.10	22	1.8	3.00	1.2	3.0	1.2	5.4	55	38.4	3.20	2.20	66	5.50	-4.36	-3.30	
25 EE	24 EEFF	21-Sep-05	188.5	15.7	73.75	6.15	9.56	5.4	55	32.0	2.67	2.73	-6.83	36.25	3.02	6	0.50	-6.33	-6.07	-0.26	-6.3	-0.03	30.25	2.5	2.77	0.2	3.0	0.5	5.4	55	32.0	2.67	2.73	68	5.70	-3.81	-2.97	
	27 FF	21-Sep-05	189.3	15.8	72.5	6.04	9.73	5.4	55	30.0	2.50	2.90	-6.83	38.5	3.21	14	1.17	-5.66	-4.85	-0.81	-4.8	-0.86	24.1	2.0	2.05	0.0	2.0	0.0	5.4	55	30.0	2.50	2.90	74	6.20	-3.62	-3.30	
29 CC	28 CCDD	21-Sep-05	188.0	15.7	71.5	5.96	9.71	5.4	55	26.5	2.21	3.19	-6.52	36.5	3.04	9	0.75	-5.77	-5.37	-0.40	-5.6	-0.17	27.5	2.3	2.77	0.5	3.0	0.7	5.4	55	26.5	2.21	3.19	74	6.20	-3.48	-3.01	
	31 CC	21-Sep-05	188.5	15.7	83	6.92	8.79	5.4	55	24.5	2.04	3.36	-5.43	26.5	2.21	8.5	0.71	-4.73	-4.85	0.12	-4.8	0.07	18.5	1.5	2.05	0.5	2.0	0.5	5.4	55	24.5	2.04	3.36	76	6.30	-3.23	-2.94	
	33 CC	21-Sep-05	189	15.8	83.5	6.96	8.79	5.4	55	23.5	1.96	3.44	-5.35	28	2.33	4	0.33	-5.02	-4.85	-0.17	-4.8	-0.22	24	2.0	2.05	0.0	2.0	0.0	5.4	55	23.5	1.96	3.44	77	6.40	-3.02	-2.96	
36 FF	35 FFGG	21-Sep-05	175	14.6	128	10.67	3.92	5.4	55	60.0	5.00	0.40	-3.52	13.5	1.13	5	0.42	-3.10	-3.56	0.46	-3.4	0.30	8.5	0.7	1.16	0.5	1.0	0.3	5.4	55	60.0	5.00	0.40	37	3.10	-2.39	-2.70	
36 BB	35 BBCC	21-Sep-05	189.5	15.8	88	7.33	8.46	5.4	55	23.5	1.96	3.44	-5.02	23	1.92	11	0.92	-4.10	-5.37	1.27	-5.6	1.50	12	1.0	2.77	1.8	3.0	2.0	5.4	55	23.5	1.96	3.44	77	6.45	-3.10	-3.01	
38 BB	37 BBCC	21-Sep-05	188.5	15.7	92	7.67	8.04	5.4	55	24.5	2.04	3.36	-4.68	15	1.25	4.5	0.38	-4.31	-5.49	1.18	-5.6	1.29	10.5	0.9	2.89	2.0	3.0	2.1	5.4	55	24.5	2.04	3.36	83	6.90	-3.43	-3.54	
	31 FF	21-Sep-05	189.0	15.8	103	8.58	7.17	5.4	55	50.0	4.17	1.23	-5.93	36.75	3.06	20	1.67	-4.27	-4.85	0.58	-4.8	0.53	16.75	1.4	2.05	0.7	2.0	0.6	5.4	55	50.0	4.17	1.23	46	3.80	-2.87	-2.57	
	33 FF	21-Sep-05	188.0	15.7	135	11.25	4.42	5.4	55	57.0	4.75	0.65	-3.77	10	0.83	4	0.33	-3.43	-4.85	1.42	-4.8	1.37	6	0.5	2.05	1.6	2.0	1.5	5.4	55	57.0	4.75	0.65	41	3.45	-2.93	-2.80	
	37 FFGG	21-Sep-05	189.0	15.8	141	11.75	4.00	5.4	55	64.0	5.33	0.07	-3.93	15.75	1.31	6	0.50	-3.43	-3.56	0.13	-3.4	-0.03	9.75	0.8	1.16	0.3	1.0	0.2	5.4	55	64.0	5.33	0.07	30	2.50	-2.62	-2.43	
37 DD	37 DDEE	21-Sep-05	187.0	15.6	143	11.92	3.67	5.4	55	67.0	5.58	-0.18	-3.85	11	0.92	6.5	0.54	-3.31	-5.10	1.79	-4.8	1.49	5.5	0.5	2.30	1.8	2.0	1.5	5.4	55	67.0	5.58	-0.18	30	2.50	-2.93	-2.68	
25 JJ	24 JJ	22-Sep-05	188.5	15.7	105.25	8.77	6.94	5.4	55	48.5	4.04	1.36	-5.58	36	3.00	16	1.33	-4.25	-3.72	-0.53	-4.1	-0.15	20	1.7	1.62	0.0	2.0	0.3	5.4	55	48.5	4.04	1.36	46	3.83	-2.58	-2.47	
24 OO	23 OOPP	22-Sep-05	189.0	15.8	124.5	10.38	5.38	5.4	55	44.8	3.73	1.67	-3.70	27.5	2.29	10	0.83	-2.87	-2.76	-0.11	-2.6	-0.27	17.5	1.5	1.16	-0.3	1.0	-0.5	5.4	55	44.8	3.73	1.67	41	3.38	-1.41	-1.70	
26 KK	25 KKLL	22-Sep-05	188.5	15.7	98	8.17	7.54	5.4	55	39.5	3.29	2.11	-5.43	34.75	2.90	15	1.25	-4.18	-4.15	-0.03	-4.1	-0.08	19.75	1.6	2.05	0.4	2.0	0.4	5.4	55	39.5	3.29	2.11	55	4.58	-2.54	-2.47	
27 II	26 HHII	22-Sep-05	182.5	15.2	93	7.75	7.46	5.4	55	35.8	2.98	2.42	-5.04	22	1.83	5	0.42	-4.62	-3.56	-1.06	-3.4	-1.22	17	1.4	1.16	-0.3	1.0	-0.4	5.4	55	35.8	2.98	2.42	59	4.92	-3.20	-2.50	
28 HH	28 HHII	22-Sep-05	187.5	15.6	92.25	7.69	7.94	5.4	55	31.8	2.65	2.75	-5.18	34	2.83	16	1.33	-3.85	-3.79	-0.06	-3.4	-0.45	18	1.5	1.39	-0.1	1.0	-0.5	5.4	55	31.8	2.65	2.75	62	5.17	-2.35	-2.42	
29 KK	28 JJKK	22-Sep-05	189.3	15.8	99	8.25	7.52	5.4	55	30.0	2.50	2.90	-4.62	31	2.58	9	0.75	-3.87	-4.15	0.28	-4.1	0.23	22	1.8	2.05	0.2	2.0	0.2	5.4	55	30.0	2.50	2.90	60	5.00	-2.04	-2.10	
30 MM	29 LLMM	22-Sep-05	189.0	15.8	87.5	7.29	8.46	5.4	55	28.3	2.35	3.05	-5.41	42.5	3.54	24	2.00	-3.41	-4.80	1.39	-4.8	1.39	18.5	1.5	3.00	1.5	3.0	1.5	5.4	55	28.3	2.35	3.05	56	4.67	-1.87	-1.62	
32/33 KK	32 KKLL	22-Sep-05	188.3	15.7	90.25	7.52	8.17	5.4	55	24.0	2.00	3.40	-4.77	37	3.08	12	1.00	-3.77	-3.83	0.06	-4.1	0.33	25	2.1	1.73	-0.4	2.0	-0.1	5.4	55	24.0	2.00	3.40	62	5.13	-1.68	-1.73	
38 HH	38 HHII	22-Sep-05	188.3	15.7	115	9.58	6.10	5.4	55	26.5	2.21	3.19	-2.91	12	1.00	7	0.58	-2.33	-2.76	0.43	-2.6	0.27	5	0.4	1.16	0.7	1.0	0.6	5.4	55	26.5	2.21	3.19	62	5.13	-1.91	-1.93	
31 JJ	30 JJKK	22-Sep-05	188.5	15.7	105.25	8.77	6.94	5.4	55	47.0	3.92	1.48	-5.45	40	3.33	16	1.33	-4.12	-3.72	-0.40	-4.1	-0.02	24	2.0	1.62	-0.4	2.0	0.0	5.4	55	47.0	3.92	1.48	46	3.80	-2.12	-2.32	
30 GG	30 GGHH	22-Sep-05	188.8	15.7	107.25	8.94	6.79	5.4	55	53.5	4.46	0.94	-5.85	37.5	3.13	20	1.67	-4.18	-4.64	0.46	-4.8	0.62	17.5	1.5	1.84	0.4	2.0	0.5	5.4	55	53.5	4.46	0.94	42	3.50	-2.73	-2.56	
	33 II	22-Sep-05	188.5	15.7	115	9.58	6.13	5.4	55	56.8	4.73	0.67	-5.45	35	2.92	19	1.58	-3.87	-3.56	-0.31	-3.4	-0.47	16	1.3	1.16	-0.2	1.0	-0.3	5.4	55	56.8	4.73	0.67	34	2.80	-2.54	-2.13	
	36 II	22-Sep-05	172.5	14.4	125	10.42	3.96	5.4	55	62.0	5.17	0.23	-3.73	22.5	1.88	6.5	0.54	-3.18	-2.76	-0.42	-2.6	-0.58	16	1.3	1.16	-0.2	1.0	-0.3	5.4	55	62.0	5.17	0.23	28	2.30	-1.85	-2.07	
26/27 Z	26 ZAA	23-Sep-05	184.0	15.3	97.25	8.10	7.23	5.4	55	54.0	4.50	0.9	-6.33	37	3.08	9	0.75	-5.58	-5.78	0.20	-5.95	0.37	28	2.3	2.83	0.5	3.0	0.7	5.4	55	54.0	4.50	0.90	47	3.95	-3.25	-3.05	
36 Z	35 YZ	23-Sep-05	188.5	15.7	101.25	8.44	7.27	5.4	55	52.5	4.38	1.03	-6.25	39	3.25	11	0.92	-5.33	-6.07	0.74	-6.3	0.97	28	2.3	2.77	0.4	3.0	0.7	5.4	55	52.5	4.38	1.03	49	4.10	-3.00	-3.08	
	38 Z	23-Sep-05	189.0	15.8	101	8.42	7.33	5.4	55	52.0	4.33	1.07	-6.27	35.5	2.96	12	1.00	-5.27	-6.30	1.03	-6.3	1.03	23.5	2.0	3.00	1.0	3.0	1.0	5.4	55	52.0	4.33	1.07	50	4.15	-3.31	-3.08	
	33 W	23-Sep-05	199.3	16.6	91	7.58	9.02	5.4	55	50.0	4.17	1.23	-7.79	46	3.83	4	0.33	-7.45	-6.30	-1.15	-6.3	-1.15	42	3.5	3.00	-0.5	3.0	-0.5	5.4	55	50.0	4.17	1.23	56	4.70	-3.95	-3.47	
	33 Z	23-Sep-05	201.0	16.8	91.75	7.65	9.10	5.4	55	48.0	4.00	1.40	-7.70	51.5	4.29	6	0.50	-7.20	-5.34	-1.86	-4.8	-2.40	45.5	3.8	2.54	-1.3	2.0	-1.8	5.4	55	48.0	4.00	1.40	54	4.50	-3.41	-3.10	
38 V	37 V	23-Sep-05	200.5	16.7	88.5	7.38	9.33	5.4	55	41.5	3.46	1.94	-7.39	45	3.75	14	1.17	-6.23	-6.49	0.27	-6.3	0.08	31	2.6	3.19	0.6	3.0	0.4	5.4	55	41.5	3.46	1.94	65	5.40	-3.64	-3.46	
	38 X	23-Sep-05	201.0	16.8	84.5	7.04	9.71	5.4	55	39.5	3.29	2.11	-7.60	47	3.92	11	0.92	-6.68	-6.64	-0.04	-7.0	0.32	36	3.0	3.64	0.6	4.0	1.0	5.4	55	39.5	3.29	2.11	65	5.45	-3.68	-3.34	
31 Z	31 Z	23-Sep-05	200.5	16.7	90.5	7.54	9.17	5.4	55	44.5	3.71	1.69	-7.48	49	4.08	8	0.67	-6.81	-4.85	-1.96	-4.8	-2.01	41	3.4	2.05	-1.4	2.0	-1.4	5.4	55	44.5	3.71	1.69	58	4.80	-3.39	-3.11	
39 K	38 JK	28-Sep-05	189.5	15.8	117.00	9.75	6.04	5.4	55	62.0	5.17	0.23	-5.81	34.0	2.83	12	1.00	-4.81	-3.11	-1.70	-3.4	-1.41	22	1.8	0.71	-1.1	1.0	-0.8	5.4	55	62.0	5.17	0.23	29	2.45	-2.98	-2.22	
	38 M	28-Sep-05	189.0	15.8	109.50	9.13	6.63	5.4	55	61.5	5.13	0.28	-6.35	41.0	3.42	14	1.17	-5.18	-3.11	-2.07	-3.4	-1.78	27	2.3	0.71	-1.5	1.0	-1.3	5.4	55	61.5	5.13	0.28	36	3.00	-2.93	-2.73	
33 O	32 NO	28-Sep-05	189.0	15.8	131.50	10.96	4.79	5.4	55	60.0	5.00	0.40	-4.39	20.0	1.67	11	0.92	-3.48	-3.94	0.47	-4.1	0.63	9	0.8	1.84	1.1	2.0	1.3	5.4	55	60.0	5.00	0.40	27	2.25	-2.73	-1.85	
	30 OP	28-Sep-05	188.0	15.7	122.00	10.17	5.50	5.4	55	57.0	4.75	0.65	-4.85	28.5	2.38	9	0.75	-4.10	-5.13	1.03	-4.8	0.70	19.5	1.6	3.33	1.7	3.0	1.4	5.4	55	57.0	4.75	0.65	29	2.40	-2.48	-1.75	
	26 R	28-Sep-05	189.0	15.8	108.25	9.02	6.73	5.4	55	57.0	4.75	0.65	-6.08	41.0	3.42	21	1.75	-4.33	-5.60	1.27	-5.6	1.27	20	1.7	3.00	1.3	3.0	1.3	5.4	55	57.0	4.75	0.65	36	3.00	-2.66	-2.35	
	27 S	28-Sep-05	186.5	15.5	105.50	8.79	6.75	5.4	55	54.0	4.50	0.90	-5.85	32.5	2.71	14	1.17	-4.68	-6.68	2.00	-7	2.32	18.5	1.5	3.68	2.1	4.0	2.5	5.4	55	54	4.50	0.90	46	3.85	-3.14	-2.95	
	26 U	28-Sep-05	189.0	15.8	92.00	7.67	8.08	5.4	55	52.0	4.33	1.07	-7.02	39.0	3.25	6	0.50	-6.52	-5.60	-0.92	-5.6	-0.92	33	2.8	3.00	0.3	3.0	0.3	5.4	55	52	4.33	1.07	50	4.20	-3.77	-3.13	
	24 U	28-Sep-05	188.8	15.7	96.00	8.00	7.73	5.4	55	50.5	4.21	1.19	-6.54	41.0	3.42	18	1.50	-5.04	-4.40	-0.64	-4.1	-0.94	23	1.9	2.30	0.4	2.0	0.1	5.4	55	50.5	4.21	1.19	45	3.75	-3.12	-2.56	
34 R	34 QR	28-Sep-05	189.0	15.8	96.50	8.04	7.71	5.4	55	48.5	4.04	1.36	-6.35	37.0	3.08	16	1.33	-5.02	-5.19	0.17	-4.8	-0.22	21	1.8	1.39	-0.4	1.0	-0.8	5.4	55	48.5	4.04	1.36	56	4.65	-3.27	-3.29	
33 Q	33 QR	28-Sep-05	189.0	15.8	107.75	8.98	6.77	5.4	55	47.5	3.96	1.44	-5.33	29.5	2.46	6	0.50	-4.83	-4.85	0.02	-4.8	-0.03	23.5	2.0	2.05	0.1	2.0	0.0	5.4	55	47.5	3.96	1.44	54	4.50	-2.87	-3.06	
32 Q	32 QR	28-Sep-05	188.8	15.7	101.50	8.46	7.27	5.4	55	46.5	3.88	1.53	-5.75	32.0	2.67	13	1.08	-4.66	-5.44	0.78	-5.6	0.94	19	1.6	2.84	1.3	3.0	1.4	5.4	55	46.5	3.88	1.53	53	4.45	-3.08	-2.93	
31 R	30 QR	28-Sep-05	201.5	16.8	91.75	7.65	9.15	5.4	55	43.5	3.63	1.78	-7.37	48.5	4.04	4	0.33	-7.04	-6.90	-0.14	-7	-0.04	44.5	3.7	3.90	0.2	4.0	0.3	5.4	55	43.5	3.63	1.78	56	4.70	-3.33	-2.93	
	29 S	28-Sep-05	201.3	16.8	80.50	6.71	10.06	5.4	55	40.0	3.33	2.07	-8.00	46.0	3.83	5	0.42	-7.58	-8.26	0.68	-7.7	0.12	41	3.4	4.56	1.1	4.0	0.6	5.4	55	40	3.33	2.07	74	6.15	-4.16	-4.08	
	24 Y	28-Sep-05	189.0	15.8	98.00	8.17	7.58	5.4	55	39.0	3.25	2.15	-5.43	32.0	2.67	13	1.08	-4.35	-4.64	0.29	-4.8	0.45	19	1.6	1.84	0.3	2.0	0.4	5.4	55	39	3.25	2.15	60	5.00	-2.77	-2.85	
	26 X	28-Sep-05	189.0	15.8	95.50	7.96	7.79	5.4	55	37.5	3.13	2.28	-5.52	30.5	2.54	13	1.08	-4.43	-5.34	0.91	-4.8	0.37	17.5	1.5	2.54	1.1	2.0	0.5	5.4	55	37.5	3.13	2.28	62	5.15	-2.98	-2.88	
	28 V	28-Sep-05	187.8	15.6	83.00	6.92	8.73	5.4	55	35.0	2.92	2.48	-6.25	39.0	3.25	6	0.50	-5.75	-6.30	0.55	-6.3	0.55	33	2.8	3.00	0.3	3.0	0.3	5.4	55	35	2.92	2.48	70	5.85	-3.00	-3.37	
	30 V	28-Sep-05	188.8	15.7	83.00	6.92	8.81	5.4	55	34.0	2.83	2.57	-6.25	35.5	2.96	4	0.33	-5.91	-6.07	0.16	-6.3	0.39	31.5	2.6	2.77	0.1	3.0	0.4	5.4	55	34	2.83	2.57	71	5.90	-3.29	-3.33	
	28 X	29-Sep-05	188.5	15.7	83.50	6.96	8.75	5.4	55	41.0	3.42	1.98	-6.77	32.5	2.71	5.0	0.42	-6.35	-6.30	-0.05	-6.3	-0.05	27.5	2.3	3.00	0.7	3.0	0.7	5.4	55	41.0	3.42	1.98	65	5.45	-4.06	-3.47	
	28 YZ	29-Sep-05	189.0	15.8	91.50	7.63	8.13	5.4	55	42.0	3.50	1.90	-6.23	38.0	3.17	6.0	0.50	-5.73	-5.34	-0.39	-4.8	-0.93	32.0	2.7	2.54	-0.1	2.0	-0.7	5.4	55	42.0	3.50	1.90	61	5.10	-3.06	-3.20	
	32 T	29-Sep-05	201.5	16.8	100.00	8.33	8.46	5.4	55	47.0	3.92	1.48	-6.98	37.0	3.08	10.0	0.83	-6.14	-7.23	1.09	-7.0	0.86	27.0	2.3	3.23	1.0	3.0	0.8	5.4	55	47.0	3.92	1.48	68	5.70	-3.89	-4.22	
34 U	34 UV	29-Sep-05	190.0	15.8	95.50	7.96	7.88	5.4	55	50.0	4.17	1.23	-6.64	34.0	2.83	10.0	0.83	-5.81	-6.30	0.49	-6.3	0.49	24.0	2.0	3.00	1.0	3.0	1.0	5.4	55	50.0	4.17	1.23	59	4.90	-3.81	-3.67	
36 T	36 TU	29-Sep-05	188.8	15.7	97.50	8.13	7.60	5.4	55	52.0	4.33	1.07	-6.54	32.0	2.67	10.0	0.83	-5.70	-5.90	0.20	-5.6	-0.10	22.0	1.8	2.30	0.5	2.0	0.2	5.4	55	52.0	4.33	1.07	58	4.85	-3.87	-3.78	
	38 U	29-Sep-05	189.0	15.8	96.50	8.04	7.71	5.4	55	54.0	4.50	0.90	-6.81	36.0	3.00	13.0	1.08	-5.73	-5.68	-0.05	-5.6	-0.13	23.0	1.9	2.08	0.2	2.0	0.1	5.4	55	54.0	4.50	0.90	55	4.60	-3.81	-3.70	
	39 T	29-Sep-05	185.3	15.4	114.00	9.50	5.94	5.4	55	55.0	4.58	0.82	-5.12	20.0	1.67	5.0	0.42	-4.70	-4.49	-0.21	-4.1	-0.60	15.0	1.3	1.39	0.1	1.0	-0.3	5.4	55	55.0	4.58	0.82	52	4.30	-3.45	-3.48	
	27 MM	3-Oct-05	189.0	15.8	102.50	8.54	7.21	5.4	55	37.5	3.13	2.28	-4.93	33.0	2.75	12.0	1.00	-3.93	-4.40	0.47	-4.1	0.17	21.0	1.8	2.3	0.6	2.0	0.3	5.4	55	37.5	3.13	2.28	49	4.05	-2.18	-1.78	
	28 Q	3-Oct-05	210.5	17.5	100.25	8.35	9.19	5.4	55	49.8	4.15	1.25	-7.93	48.0	4.00	2.0	0.17	-7.77	-5.17	-2.60	-4.8	-2.97	46.0	3.8	3.37	-0.5	3.0	-0.8	5.4	55	49.8	4.15	1.25	54	4.50	-3.93	-3.25	
36 X	35 WX	3-Oct-05	201.0	16.8	98.50	8.21	8.54	5.4	55	59.0	4.92	0.48	-8.06	52.5	4.38	19.0	1.58	-6.48	-6.90	0.43	-7.0	0.52	33.5	2.8	3.9	1.1	4.0	1.2	5.4	55	59.0	4.92	0.48	48	4.00	-3.68	-3.52	
	38 P	3-Oct-05	189.0	15.8	101.00	8.42	7.33	5.4	55	64.0	5.33	0.07	-7.27	41.0	3.42	15.0	1.25	-6.02	-4.26	-1.76	-4.1	-1.92	26.0	2.2	1.16	-1.0	1.0	-1.2	5.4	55	64.0	5.33	0.07	46	3.85	-3.85	-3.78	
39 R	38 RS	3-Oct-05	188.0	15.7	111.00	9.25	6.42	5.4	55	67.5	5.63	-0.23	-6.64	35.5	2.96	14.0	1.17	-5.48	-4.96	-0.51	-4.8	-0.67	21.5	1.8	1.16	-0.6	1.0	-0.8	5.4	55	67.5	5.63	-0.23	41	3.40	-3.68	-3.63	
	36 0	3-Oct-05	187.5	15.6	114.00	9.50	6.13	5.4	55	71.5	5.96	-0.56	-6.68	41.0	3.42	16.0	1.33	-5.35	-3.56	-1.79	-3.4	-1.95	25.0	2.1	1.16	-0.9	1.0	-1.1	5.4	55	71.5	5.96	-0.56	29	2.45	-3.27	-3.01	
36 S	36 RS	3-Oct-05	189.8	15.8	112.75	9.40	6.42	5.4	55	75.3	6.27	-0.87	-7.29	35.0	2.92	17.0	1.42	-5.87	-5.44	-0.43	-5.6	-0.27	18.0	1.5	1.84	0.3	2.0	0.5	5.4	55	75.3	6.27	-0.87	35	2.95	-4.37	-3.82	
35 S	34 ST	3-Oct-05	189.3	15.8	119.00	9.92	5.85	5.4	55	76.0	6.33	-0.93	-6.79	31.0	2.58	13.0	1.08	-5.70	-5.44	-0.26	-5.6	-0.10	18.0	1.5	1.84	0.3	2.0	0.5	5.4	55	76.0	6.33	-0.93	35	2.90	-4.20	-3.83	
	30 X	3-Oct-05	189.0	15.8	113.00	9.42	6.33	5.4	55	75.0	6.25	-0.85	-7.18	41.0	3.42	16.0	1.33	-5.85	-5.34	-0.51	-4.8	-1.05	25.0	2.1	2.54	0.5	2.0	-0.1	5.4	55	75.0	6.25	-0.85	28	2.30	-3.77	-3.15	
	30 AA	3-Oct-05	187.0	15.6	120.00	10.00	5.58	5.4	55	71.5	5.96	-0.56	-6.14	41.0	3.42	11.0	0.92	-5.23	-5.10	-0.13	-4.8	-0.43	30.0	2.5	2.3	-0.2	2.0	-0.5	5.4	55	71.5	5.96	-0.56	29	2.40	-2.73	-2.96	
POST-DREDGE CORE SAMPLING																																						
35 FF	35 FFGG	2-Nov-05	187.0	15.6	91.8	7.65	7.94	5.4	55	34.0	2.83	2.57	-5.37	12.0	1.00	6.0	0.50	-4.87	-3.79	-1.08	-3.4	-1.47	6.0	0.5	1.39		1.0		5.4	55	34.0	2.83	2.57	73.0	6.10	-4.37	-3.53	-3.35
	33 FF	2-Nov-05	176.5	14.7	80.0	6.67	8.04	5.4	55	39.0	3.25	2.15	-5.89	25.5	2.13	N/A	N/A	N/A	-4.85	N/A	-4.8	N/A	0.0	0.0	2.05		2.0		5.4	55	39.0	3.25	2.15	67.0	5.60	-3.77	-3.45	-3.82
	31 FF	2-Nov-05	176.5	14.71	83.0	6.92	7.79	5.4	55	43.0	3.58	1.82	-5.98	17.0	1.42	9.0	0.75	-5.23	-4.85	-0.38	-4.8	-0.43	8.0	0.67	2.05		2.0		5.4	55	43.0	3.58	1.82	70.8	5.90	-4.56	-4.08	-3.98
	27 FF	2-Nov-05	175.3	14.60	70.5	5.88	8.73	5.4	55	48.5	4.04	1.36	-7.37	20.0	1.67	10.0	0.83	-6.54	-4.85	-1.69	-4.8	-1.74	10.0	0.83	2.05		2.0		5.4	55	48.5	4.04	1.36	82.8	6.90	-5.70	-5.54	-5.19
25 EE	24 EEFF	2-Nov-05	177.0	14.75	81.5	6.79	7.96	5.4	55	52.0	4.33	1.07	-6.89	22.0	1.83	16.0	1.33	-5.56	-6.07	0.51	-6.3	0.74	6.0	0.50	2.77		3.0		5.4	55	52.0	4.33	1.07	64.8	5.40	-5.06	-4.33	-5.85

TABLE 2 - Area-B Progress Core Samples - Measurements and Calculations (continued)

																		Planned Cut Elevation					OL Thickness							Bathymetry									
																														Sounding									
Z-block ID		Target ID		Coring Date	Measured Total Barrel Length (in)	Measured Total Barrel Length (ft)	Measured Distance from Top of Barrel to WL at Refusal (in)	Measured Distance from Top of Barrel to WL at Refusal (ft)	Calculated Distance from WL to Bottom of Core Barrel (ft)	Elevation of Top of Pile (ft-NGVD)	Pile #	Measured Top of pile to WL (in)	Measured Top of pile to WL (ft)	Calculated Elevation of WL (ft-NGVD)	Calculated Elevation of Core Bottom (ft-NGVD)	Measured Total Recovered Core Length (in)	Total Recovered Core Length (ft)	Measured Distance from Bot. of Core to OH Interface (in)	Measured Distance from Bot. of Core to OH Interface (ft)	Calculated OH Interface Elevation (ft-NGVD)	Z* Elevation (ft-NGVD)	Calculated Offset from Z* Elevation (ft)	Planned Cut Elevation (ft-NGVD)	Calculated Offset from Planned Cut Elevation (ft)	Measured thickness of silt (in)	Measured thickness of silt (ft)	Predicted Sediment Thickness (ft)	Offset from Predicted Sediment Thickness (ft)	Planned Sediment Removal Thickness (ft)	Offset from Planned Removal Thickness (ft)	Elevation of Top of Pile (ft-NGVD)	Pile #	Measured Top of pile to WL (during Sounding) (in)	Measured Top of pile to WL (during Sounding) (ft)	Calculated Elevation of WL (during Sounding) (ft-NGVD)	Measured Water Depth by Sounding (in)	Measured Water Depth by Sounding (ft)	Calculated Top of Core Elevation (ft -NGVD)	Calculated Bottom Elevation by Sounding (ft-NGVD)	Interpolated Bottom Elevation from Bathymetry (ft-NGVD)(3)
23	CC	23	CCDD	2-Nov-05	176.5	14.71	70.5	5.88	8.83	5.4	55	57.5	4.79	0.61	-8.23	15.0	1.25	12.0	1.00	-7.23	-6.07	-1.16	-6.3	-0.93	3.0	0.25	2.77		3.0		5.4	55	57.5	4.79	0.61	84.0	7.00	-6.98	-6.39	-5.77
26	Z	26	ZAA	2-Nov-05	176.5	14.71	71.5	5.96	8.75	5.4	55	60.0	5.00	0.40	-8.35	24.0	2.00	6.0	0.50	-7.85	-5.60	-2.25	-5.6	-2.25	18.0	1.50	3.00		3.0		5.4	55	60.0	5.00	0.40	75.6	6.30	-6.35	-5.90	-5.26
		31	Z	2-Nov-05	176.0	14.67	89.0	7.42	7.25	5.4	55	77.0	6.42	-1.02	-8.27	27.0	2.25	11.0	0.92	-7.35	-6.85	-0.50	-6.8	-0.55	16.0	1.33	2.05		2.0		5.4	55	77.0	6.42	-1.02	56.4	4.70	-6.02	-5.72	-5.84
28	CC	28	CCDD	2-Nov-05	176.5	14.71	99.0	8.25	6.46	5.4	55	75.0	6.25	-0.85	-7.31	22.0	1.83	11.0	0.92	-6.39	-6.30	-0.09	-6.3	-0.09	11.0	0.92	3.00		3.0		5.4	55	75.0	6.25	-0.85	57.6	4.80	-5.48	-5.65	-4.98
		31	CC	2-Nov-05	176.0	14.67	109.0	9.08	5.58	5.4	55	72.0	6.00	-0.60	-6.18	19.0	1.58	6.0	0.50	-5.68	-4.85	-0.83	-4.8	-0.88	13.0	1.08	2.05		2.0		5.4	55	72.0	6.00	-0.60	46.8	3.90	-4.60	-4.50	-4.77
		33	CC	2-Nov-05	193.0	16.08	133.0	11.08	5.00	5.4	55	74.0	6.17	-0.77	-5.77	13.0	1.08	10.0	0.83	-4.93	-4.85	-0.08	-4.8	-0.13	3.0	0.25	2.05		2.0		5.4	55	74.0	6.17	-0.77	44.4	3.70	-4.68	-4.47	-4.45
36	BB	35	BBCC	2-Nov-05	177.0	14.75	121.0	10.08	4.67	5.4	55	75.0	6.25	-0.85	-5.52	10.0	0.83	3.0	0.25	-5.27	-4.37	-0.90	-4.6	-0.67	10.0	0.83	2.77		3.0		5.4	55	75.0	6.25	-0.85	44.4	3.70	-4.68	-4.55	-4.23
36	Z	35	YZ	2-Nov-05	165.0	13.75	76.5	6.38	7.38	5.4	55	73.5	6.13	-0.73	-8.10	20.0	1.67	5.0	0.42	-7.68	-5.07	-2.61	-5.3	-2.38	15.0	1.25	2.77		3.0		5.4	55	73.5	6.13	-0.73	69.6	5.80	-6.43	-6.53	-6.42
		38	Z	8-Dec-05	178.0	14.8333	57.0	4.75	10.08	5.4	55	41.5	3.46	1.94	-8.14	31.5	2.63	21.0	1.75	-6.39	-5.30	-1.09	-5.3	-1.09	10.5	0.88	3.00		3.0		5.4	55	41.5	3.46	1.94	96.0	8.00	-5.52	-6.06	-3.21
		38	U	8-Dec-05	180.5	15.0417	84.0	7.00	8.04	5.4	55	40.0	3.33	2.07	-5.98	20.0	1.67	9.0	0.75	-5.23	-5.68	0.46	-5.6	0.38	11.0	0.92	2.08		2.0		5.4	55	40.0	3.33	2.07	82.8	6.90	-4.31	-4.83	-3.82
		30	X	8-Dec-05	188.5	15.7083	81.5	6.79	8.92	5.4	55	70.0	5.83	-0.43	-9.35	37.0	3.08	28.0	2.33	-7.02	-6.34	-0.68	-5.8	-1.22	9.0	0.75	2.54		2.0		5.4	55	70.0	5.83	-0.43	73.2	6.10	-6.27	-6.53	-4.94
		26	X	8-Dec-05	189.5	15.7917	77.0	6.42	9.38	5.4	55	68.0	5.67	-0.27	-9.64	40.0	3.33	27.0	2.25	-7.39	-5.34	-2.05	-4.8	-2.59	13.0	1.08	2.54		2.0		5.4	55	68.0	5.67	-0.27	72.0	6.00	-6.31	-6.27	-4.86
28	HH	28	HHII	8-Dec-05	180.0	15	101.5	8.46	6.54	5.4	55	60.5	5.04	0.36	-6.18	30.5	2.54	17.0	1.42	-4.77	-3.79	-0.98	-3.4	-1.37	13.5	1.13	1.39		1.0		5.4	55	60.5	5.04	0.36	46.8	3.90	-3.64	-3.54	-3.83
29	KK	28	JJKK	8-Dec-05	181.5	15.125	88.0	7.33	7.79	5.4	55	57.5	4.79	0.61	-7.18	27.5	2.29	15.0	1.25	-5.93	-4.15	-1.78	-4.1	-1.83	12.5	1.04	2.05		2.0		5.4	55	57.5	4.79	0.61	58.8	4.90	-4.89	-4.29	-3.65
		33	II	8-Dec-05	180.0	15	86.0	7.17	7.83	5.4	55	52.0	4.33	1.07	-6.77	34.5	2.88	13.0	1.08	-5.68	-3.56	-2.12	-3.4	-2.28	21.5	1.79	1.16		1.0		5.4	55	52.0	4.33	1.07	56.4	4.70	-3.89	-3.63	-3.56
26	KK	25	KKLL	8-Dec-05	189.0	15.75	100.0	8.33	7.42	5.4	55	47.0	3.92	1.48	-5.93	23.5	1.96	18.0	1.50	-4.43	-4.15	-0.28	-4.1	-0.33	5.5	0.46	2.05		2.0		5.4	55	47.0	3.92	1.48	62.4	5.20	-3.98	-3.72	-4.02
35	S	34	ST	8-Dec-05	180.0	15	55.5	4.63	10.38	5.4	55	41.0	3.42	1.98	-8.39	32.5	2.71	13.0	1.08	-7.31	-5.44	-1.87	-5.6	-1.71	19.5	1.63	1.84		2.0		5.4	55	41.0	3.42	1.98	88.8	7.40	-5.68	-5.42	-5.53
33	Q	33	QR	8-Dec-05	189.0	15.75	78.0	6.50	9.25	5.4	55	36.5	3.04	2.36	-6.89	18.0	1.50	11.0	0.92	-5.98	-4.85	-1.13	-4.8	-1.18	7.0	0.58	2.05		2.0		5.4	55	36.5	3.04	2.36	90.0	7.50	-5.39	-5.14	-5.53
39	R	38	RS	8-Dec-05	189.0	15.75	77.0	6.42	9.33	5.4	55	38.0	3.17	2.23	-7.10	17.5	1.46	9.0	0.75	-6.35	-4.96	-1.39	-4.8	-1.55	8.5	0.71	1.16		1.0		5.4	55	38.0	3.17	2.23	87.6	7.30	-5.64	-5.07	-3.93
		36	O	8-Dec-05	172.0	14.3333	61.0	5.08	9.25	5.4	55	36.0	3.00	2.40	-6.85	26.0	2.17	17.0	1.42	-5.43	-4.56	-0.87	-4.4	-1.03	9.0	0.75	1.16		1.0		5.4	55	36.0	3.00	2.40	80.4	6.70	-4.68	-4.30	-3.53
		24	U	8-Dec-05	172.0	14.3333	68.0	5.67	8.67	5.4	55	35.0	2.92	2.48	-6.18	21.0	1.75	11.0	0.92	-5.27	-4.40	-0.87	-4.1	-1.17	10.0	0.83	2.30		2.0		5.4	55	35.0	2.92	2.48	78.0	6.50	-4.43	-4.02	-4.71

Shaded cells indicate field data entered into the spreadsheet

UP
DOWN
Noted Modifications to Cut-Elevations that were based on Pre-Dredge Core Results

Notes:

(1) From Jacobs August 2005 Dredge Plan, Figures 5&6. z* elevation calculated by correcting planned cut elevation by the differential between predicted sediment thickness and the rounded value for the planned sediment removal thickness.
(2) Sounding Measurements
(3) From Pre- and Post-Dredge Bathymetry Map (Apex Engineering)

Data entered by: R. McCarthy
Data checked by: D. Boye

Table 3 Total PCB Concentrations (Aroclors) for Pre-Dredge Cores

AREA-A

Station ID	Segment Interval	Location Relative to Interface	Total PCB Concentration mg/kg Aroclors
5EF	1.08 - 1.58	BELOW	0.45
5DE2	1.75 - 2.25	BELOW	0.52
5CD	1.25 - 1.75	BELOW	0.34
5FG	0.75 - 1.25	BELOW	1.5
19G	0.42 - 0.92	ABOVE	273
19G	1.17 - 1.67	BELOW	0.66
21E	0.167 - 0.67	ABOVE	1240
21E	0.92 - 1.42	BELOW	9.8
21C	0.33 - 0.83	ABOVE	445
21C	0.83 - 1.53	BELOW	7.3

AREA-B

Station ID	Segment Interval	Location Relative to Interface	Total PCB Concentration mg/kg Aroclors
26X	0.33 – 0.83	ABOVE	18200
26X	1.75 – 2.25	BELOW	33.3
27FF	0.50 – 1.0	ABOVE	155
27FF	2.0 – 2.5	BELOW	ND
28YZ	2.1 - 2.6	ABOVE	281
28YZ	2.9 - 3.6	BELOW	213
30X	1.83 – 2.33	ABOVE	367
30X	2.67 – 3.17	BELOW	0.52
31Z	2.5 - 3.2	ABOVE	27.5
31Z	3.6 - 4.1	BELOW	0.72
33II	0.50 – 1.0	ABOVE	3.62
33II	1.33 – 1.83	BELOW	0.76
33QR	1.05 – 1.50	ABOVE	26.6
33QR	2.17 – 2.5	BELOW	1.41
33Z	2.3 - 2.8	ABOVE	171
33Z	3.2 - 3.8	BELOW	1.9
35YZ	1.2 - 2.3	ABOVE	256
35YZ	2.9 - 3.4	BELOW	3.7
38RS	0.50 – 1.0	ABOVE	1240
38RS	2.0 – 2.5	BELOW	0.81

NOTES:

1 Segment interval referenced to top of core

ND A non-detect value, or less than the detection limits for the instrument

Table 4 Total PCB Concentrations (Aroclors) for Pre- and Post-Dredge Cores

AREA-B

Station ID	Segment Interval	Location Relative to Interface	Collection Timeframe	Total PCB Concentration mg/kg Aroclors
33QR	1.05 - 1.50	ABOVE	Pre-Dredge	26.6
33QR	2.17 - 2.50	BELOW	Pre-Dredge	1.41
33QR	0.0 - 0.50	ABOVE	Post-Dredge	47.4
26X	0.33 - 0.83	ABOVE	Pre-Dredge	18200
26X	1.75 - 2.25	BELOW	Pre-Dredge	33.3
26X	0.17 - 0.67	ABOVE	Post-Dredge	4.84
26X	1.0 - 1.5	BELOW	Post-Dredge	2.7
27FF	0.50 - 1.0	ABOVE	Pre-Dredge	155
27FF	2.0 - 2.5	BELOW	Pre-Dredge	ND
27FF	0.08 - 0.58	ABOVE	Post-Dredge	17.9
33II	0.5 - 1.0	ABOVE	Pre-Dredge	3.62
33II	1.33 - 1.83	BELOW	Pre-Dredge	0.756
33II	0.17 - 0.67	ABOVE	Post-Dredge	194
33II	1.0 - 1.5	ABOVE	Post-Dredge	31.3
33II	2.0 - 2.5	BELOW	Post-Dredge	1.76
30X	0.5 - 1.0	ABOVE	Pre-Dredge	113
30X	1.83 - 2.33	ABOVE	Pre-Dredge	367
30X	2.67 - 3.17	BELOW	Pre-Dredge	0.52
30X	0.0 - 0.50	ABOVE	Post-Dredge	208
30X	0.67 - 1.17	ABOVE	Post-Dredge	6.98
30X	1.5 - 2.0	BELOW	Post-Dredge	ND
38RS	0.5 - 1.0	ABOVE	Pre-Dredge	1240
38RS	2.0 - 2.5	BELOW	Pre-Dredge	0.809
38RS	0.17 - 0.58	ABOVE	Post-Dredge	138
38RS	0.92 - 1.42	BELOW	Post-Dredge	51.9

} good

OK

?

NOTES:

1 Segment interval referenced to top of core

ND A non-detect value, or less than the detection limits for the instrument

$\bar{x}$ post, surface $\cong$ 102 ppm
n = 5 (6)

Table 5 Difference between Planned Cut-Depth Elevation and Core Measured Transition Interface – Area-A

Measured Differential (feet) NEGATIVE potential under dredge			Station ID	Planned Cut-Depth Elevation (feet) NGVD-29	Measured Interface Elevation (feet) NGVD-29	Measured Differential (feet) POSITIVE potential over-dredge		
> 2.0	1.0 - 2.0	< 1.0				< 1.0	1.0 - 2.0	> 2.0
-2.42			2B	-4.8	-7.22			
	-1.68		2D	-5.2	-6.88			
		-0.87	3CD	-6.1	-6.97			
			4H	-4.2	-3.88	0.32		
		-0.49	10H	-3.7	-4.19			
		-0.86	14H	-3.7	-4.56			
		-0.68	16G	-3.5	-4.18			
	-1.56		19G	-2.6	-4.16			
	-1.25		21C	-3.1	-4.35			
	-1.79		21E	-2.6	-4.39			
		-0.89	21G	-2.6	-3.49			
			7H	-4.2	-4.06	0.14		
			8C	-6.1	-6.02	0.08		
			10BC	-5.4	-5.14	0.26		
			13C	-4.0	-3.98	0.03		
			14F	-4.5	-3.75	0.75		
		-0.04	16D	-4.0	-4.04			
	-1.74		18D	-3.3	-5.04			
			2FG2	-4.7	-4.23	0.47		
			4FG2	-4.7	-4.14	0.56		
			5DE2	-6.1	-4.75		1.35	
			5EF	-5.4	-4.77	0.63		
			5FG	-4.7	-3.43		1.27	
			5CD	-6.1	-4.48		1.63	
			6FG2	-4.7	-3.81	0.89		
			12F2	-4.7	-3.77	0.93		
			89F2	-4.7	-3.64		1.06	

Table 6 Difference between Planned Cut-Depth Elevation and Core Measured Transition Interface – Area-B

Measured Differential (feet) NEGATIVE potential under dredge			Station ID	Planned Cut-Depth Elevation (feet) NGVD-29	Measured Interface Elevation (feet) NGVD-29	Measured Differential (feet) POSITIVE potential over-dredge		
> 2.0	1.0 - 2.0	< 1.0				< 1.0	1.0 - 2.0	> 2.0
			23CCDD	-6.3	-6.20	0.10		
		-0.03	24EEFF	-6.3	-6.33			
		-0.86	27FF	-4.8	-5.66			
		-0.17	28CCDD	-5.6	-5.77			
			31CC	-4.8	-4.73	0.07		
		-0.22	33CC	-4.8	-5.02			
			35FFGG	-3.4	-3.10	0.30		
			35BBCC	-5.6	-4.10		1.50	
			37BBCC	-5.6	-4.31		1.29	
			31FF	-4.8	-4.27	0.53		
			33FF	-4.8	-3.43		1.37	
		-0.03	37FFGG	-3.4	-3.43			
			37DDEE	-4.8	-3.31		1.49	
		-0.15	24JJ	-4.1	-4.25			
		-0.27	23OOPP	-2.6	-2.87			
		-0.08	25KKLL	-4.1	-4.18			
	-1.22		26HHII	-3.4	-4.62			
		-0.45	28HHII	-3.4	-3.85			
			28JJKK	-4.1	-3.87	0.23		
			29LLMM	-4.8	-3.41		1.39	
			32KKLL	-4.1	-3.77	0.33		
			38HHII	-2.6	-2.33	0.27		
		-0.02	30JJKK	-4.1	-4.12			
			30GGHH	-4.8	-4.18	0.62		
		-0.47	33II	-3.4	-3.87			
		-0.58	36II	-2.6	-3.18			
			26ZAA	-5.95	-5.58	0.37		
			35YZ	-6.3	-5.33	0.97		
			38Z	-6.3	-5.27		1.03	
	-1.15		33W	-6.3	-7.45			
-2.40			33Z	-4.8	-7.20			
			37V	-6.3	-6.23	0.08		
			38X	-7.0	-6.68	0.32		
-2.01			31Z	-4.8	-6.81			

Table 6 Difference between Planned Cut-Depth Elevation and Core Measured Transition Interface – Area-B (continued)

Measured Differential (feet) NEGATIVE potential under dredge			Station ID	Planned Cut-Depth Elevation (feet) NGVD-29	Measured Interface Elevation (feet) NGVD-29	Measured Differential (feet) POSITIVE potential over-dredge		
> 2.0	1.0 - 2.0	< 1.0				< 1.0	1.0 - 2.0	> 2.0
	-1.41		38JK	-3.4	-4.81			
	-1.78		38M	-3.4	-5.18			
			32NO	-4.1	-3.48	0.63		
			30OP	-4.8	-4.10	0.70		
			26R	-5.6	-4.33		1.27	
			27S	-7.0	-4.68			2.32
		-0.92	26U	-5.6	-6.52			
		-0.94	24U	-4.1	-5.04			
		-0.22	34QR	-4.8	-5.02			
		-0.03	33QR	-4.8	-4.83			
			32QR	-5.6	-4.66	0.94		
		-0.04	30QR	-7.0	-7.04			
			29S	-7.7	-7.58	0.12		
			24Y	-4.8	-4.35	0.45		
			26X	-4.8	-4.43	0.37		
			28V	-6.3	-5.75	0.55		
			30V	-6.3	-5.91	0.39		
		-0.05	28X	-6.3	-6.35			
		-0.93	28YZ	-4.8	-5.73			
			32T	-7.0	-6.14	0.86		
			34UV	-6.3	-5.81	0.49		
		-0.10	36TU	-5.6	-5.70			
		-0.13	38U	-5.6	-5.73			
		-0.60	39T	-4.1	-4.70			
			27MM	-4.1	-3.93	0.17		
-2.97			28Q	-4.8	-7.77			
			35WX	-7.0	-6.48	0.52		
	-1.92		38P	-4.1	-6.02			
		-0.67	38RS	-4.8	-5.48			
	-1.95		36O	-3.4	-5.35			
		-0.27	36RS	-5.6	-5.87			
		-0.10	34ST	-5.6	-5.70			
	-1.05		30X	-4.8	-5.85			
		-0.43	30AA	-4.8	-5.23			

Table 7 Difference between Core Measured OL Thickness and Planned Removal Thickness – Area-A

Measured Differential (feet) NEGATIVE potential under-prediction of volume			Station ID	Planned Sediment Removal Thickness (feet) NGVD-29	Measured OL Thickness (feet) NGVD-29	Measured Differential (feet) POSITIVE potential over-prediction of volume		
> 2.0	1.0 - 2.0	< 1.0				< 1.0	1.0 - 2.0	> 2.0
			2B	4.0	2.0		2.0	
			2D	4.0	1.1			2.9
			3CD	4.0	2.2		1.8	
			4H	2.0	1.4	0.6		
		-0.6	10H	2.0	2.6			
		-0.2	14H	2.0	2.2			
		-0.3	16G	2.0	2.3			
	-1.3		19G	1.0	2.3			
		-0.5	21C	1.0	1.5			
	-1.1		21E	1.0	2.1			
		-0.8	21G	1.0	1.8			
			7H	2.0	0.7		1.3	
			8C	4.0	0.5			3.5
			10BC	3.0	0.8			2.3
			13C	2.0	0.2		1.8	
			14F	3.0	0.6			2.4
			16D	2.0	1.0	1.0		
			18D	2.0	0.6		1.4	
			2FG2	3.0	2.1	0.9		
			4FG2	3.0	1.1		1.9	
			5DE2	4.0	1.3			2.7
			5EF	4.0	1.4			2.6
			5FG	4.0	1.0			3.0
			5CD	4.0	1.7			2.3
			6FG2	3.0	1.4		1.6	
			12F2	3.0	1.3		1.8	
			89F2	3.0	1.2		1.8	

Table 8 Difference between Measured OL Thickness and Planned Removal Thickness – Area-B

Measured Differential (feet) NEGATIVE			Station ID	Planned Sediment Removal Thickness (feet) NGVD-29	Measured OL Thickness (feet) NGVD-29	Measured Differential (feet) POSITIVE		
Potential under-prediction of volume						Potential over-prediction of volume		
> 2.0	1.0 - 2.0	< 1.0				< 1.0	1.0 - 2.0	> 2.0
			23CCDD	3.0	1.8		1.2	
			24EEFF	3.0	2.5	0.5		
			27FF	2.0	2.0	0.0		
			28CCDD	3.0	2.3	0.7		
			31CC	2.0	1.5	0.5		
			33CC	2.0	2.0	0.0		
			35FFGG	1.0	0.7	0.3		
			35BBCC	3.0	1.0			2.0
			37BBCC	3.0	0.9			2.1
			31FF	2.0	1.4	0.6		
			33FF	2.0	0.5		1.5	
			37FFGG	1.0	0.8	0.2		
			37DDEE	2.0	0.5		1.5	
			24JJ	2.0	1.7	0.3		
		-0.5	23OOPP	1.0	1.5			
			25KKLL	2.0	1.6	0.4		
		-0.4	26HHII	1.0	1.4			
		-0.5	28HHII	1.0	1.5			
			28JJKK	2.0	1.8	0.2		
			29LLMM	3.0	1.5		1.5	
		-0.1	32KKLL	2.0	2.1			
			38HHII	1.0	0.4	0.6		
			30JJKK	2.0	2.0	0.0		
			30GGHH	2.0	1.5	0.5		
		-0.3	33II	1.0	1.3			
		-0.3	36II	1.0	1.3			
			26ZAA	3.0	2.3	0.7		
			35YZ	3.0	2.3	0.7		
			38Z	3.0	2.0	1.0		
		-0.5	33W	3.0	3.5			
	-1.8		33Z	2.0	3.8			
			37V	3.0	2.6	0.4		
			38X	4.0	3.0	1.0		

Table 8 Difference between Measured OL Thickness and Planned Removal Thickness – Area-B (continued)

Measured Differential (feet) NEGATIVE			Station ID	Planned Sediment Removal Thickness (feet) NGVD-29	Measured OL Thickness (feet) NGVD-29	Measured Differential (feet) POSITIVE		
Potential under-prediction of volume						Potential over-prediction of volume		
> 2.0	1.0 - 2.0	< 1.0				< 1.0	1.0 - 2.0	> 2.0
	-1.4		31Z	2.0	3.4			
		-0.8	38JK	1.0	1.8			
	-1.3		38M	1.0	2.3			
			32NO	2.0	0.8		1.3	
			30OP	3.0	1.6		1.4	
			26R	3.0	1.7		1.3	
			27S	4.0	1.5			2.5
			26U	3.0	2.8	0.3		
			24U	2.0	1.9	0.1		
		-0.8	34QR	1.0	1.8			
			33QR	2.0	2.0	0.0		
			32QR	3.0	1.6		1.4	
			30QR	4.0	3.7	0.3		
			29S	4.0	3.4	0.6		
			24Y	2.0	1.6	0.4		
			26X	2.0	1.5	0.5		
			28V	3.0	2.8	0.3		
			30V	3.0	2.6	0.4		
			28X	3.0	2.3	0.7		
		-0.7	28YZ	2.0	2.7			
			32T	3.0	2.3	0.8		
			34UV	3.0	2.0	1.0		
			36TU	2.0	1.8	0.2		
			38U	2.0	1.9	0.1		
		-0.3	39T	1.0	1.3			
			27MM	2.0	1.8	0.3		
		-0.8	28Q	3.0	3.8			
			35WX	4.0	2.8		1.2	
	-1.2		38P	1.0	2.2			
		-0.8	38RS	1.0	1.8			
	-1.1		36O	1.0	2.1			
			36RS	2.0	1.5	0.5		
			34ST	2.0	1.5	0.5		
		-0.1	30X	2.0	2.1			
		-0.5	30AA	2.0	2.5			

Table 9 Comparative PCB Concentrations in Pre- and Post-Dredge Cores – Area-B

Station ID	Z* Elevation (feet) NGVD-29	Pre-Dredge Bathymetry (feet) (1) NGVD-29	Planned Cut-Depth Elevation (feet) NGVD-29	Post-Dredge Bathymetry (feet) (1) NGVD-29	Post-Dredge Surface PCB Concentration mg/kg Total Aroclors	Pre-Dredge Sediment PCB Concentration at Post-Dredge Elevation mg/kg Total Aroclors
27FF	-4.9	-3.3	-4.8	-5.5	18	ND
26X	-5.3	-3.0	-4.8	-6.3	4.8	NA (33)
30X	-5.3	-3.2	-5.8	-6.5	208 (7.0) (2)	0.52
33II	-3.6	-2.2	-3.4	-3.6	194	0.76
33QR	-4.9	-3.1	-4.8	-5.1	47	1.4
38RS	-5.0	-3.6	-4.8	-5.1	138	0.81

NOTES:

1 Bathymetry measurements listed are actual soundings collected by ENSR at the point of core collection

2 Visible oily sediments (367 mg/kg PCB) were extracted from just above pre-dredge interface. The post-dredge surface sample, collected from just below the elevation of the pre-dredge sample, may have been biased high by the oil that was present. A post-dredge sample segment collected just beneath the surface (6 to 12 inch horizon) had a PCB concentration of 7.0 mg/kg.

ND Analysis resulted in a non-detect value, or less than the detection limits for the instrument

NA Pre-dredge core sample did not go to the depth of the post-dredge elevation, no sample available for direct comparison. The pre-dredge sample collected just beneath the interface and approximately 1.0 – 1.5 feet above the post-dredge surface had a concentration of 33 mg/kg.

FIGURES

US Army Corps of Engineers
New England District

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Site

Figure 1 - New Bedford Harbor Overview

ENSR | AECOM

Sources: MassGIS 2-m orthophotos
NAD 83 Mass State Plane m
Date: 26 January 2006
ME scale 1:35000

0 0.25 0.5 1 Miles

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US Army Corps of Engineers
New England District

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Site

Figure 2 - Dredge Management Units #2 and #4 - Upper New Bedford Harbor

ENSR | AECOM

Sources: MassGIS 2-m orthophotos
NAD 83 Mass State Plane m
Date: 26 January 2006
ME scale 1:7200

0 500 1,000 2,000 Feet

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US Army Corps of Engineers
New England District

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Site

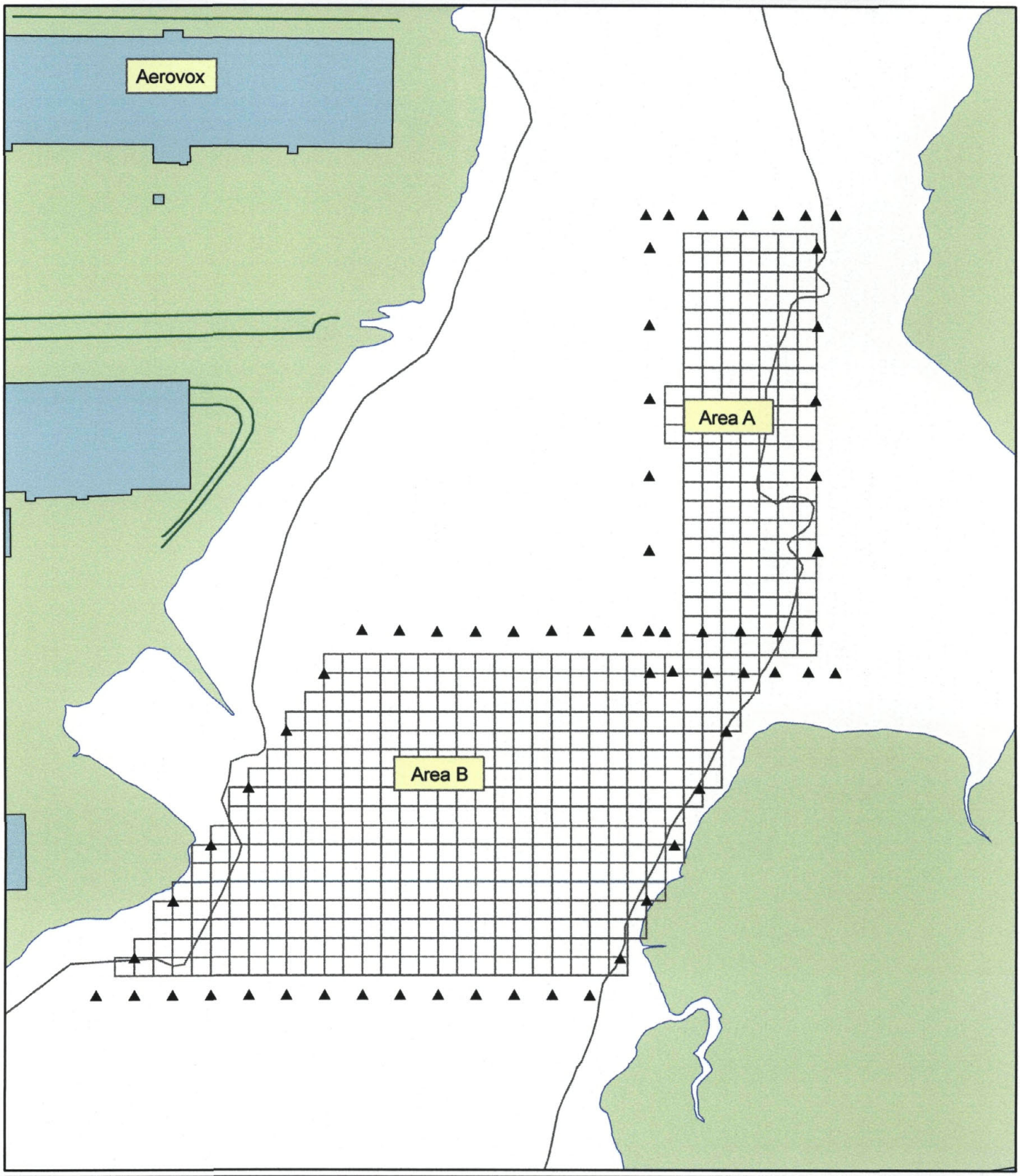

Figure 3 - Grid Layout for 2005 Dredge Area

Sources:
NAD 83 Mass State Plane ft
Date: 26 January 2006

▲ 2005 Sheetpile Locations

Mean Low Water Line

0 50 100 200 300 400 500 Feet

ENSR | AECOM

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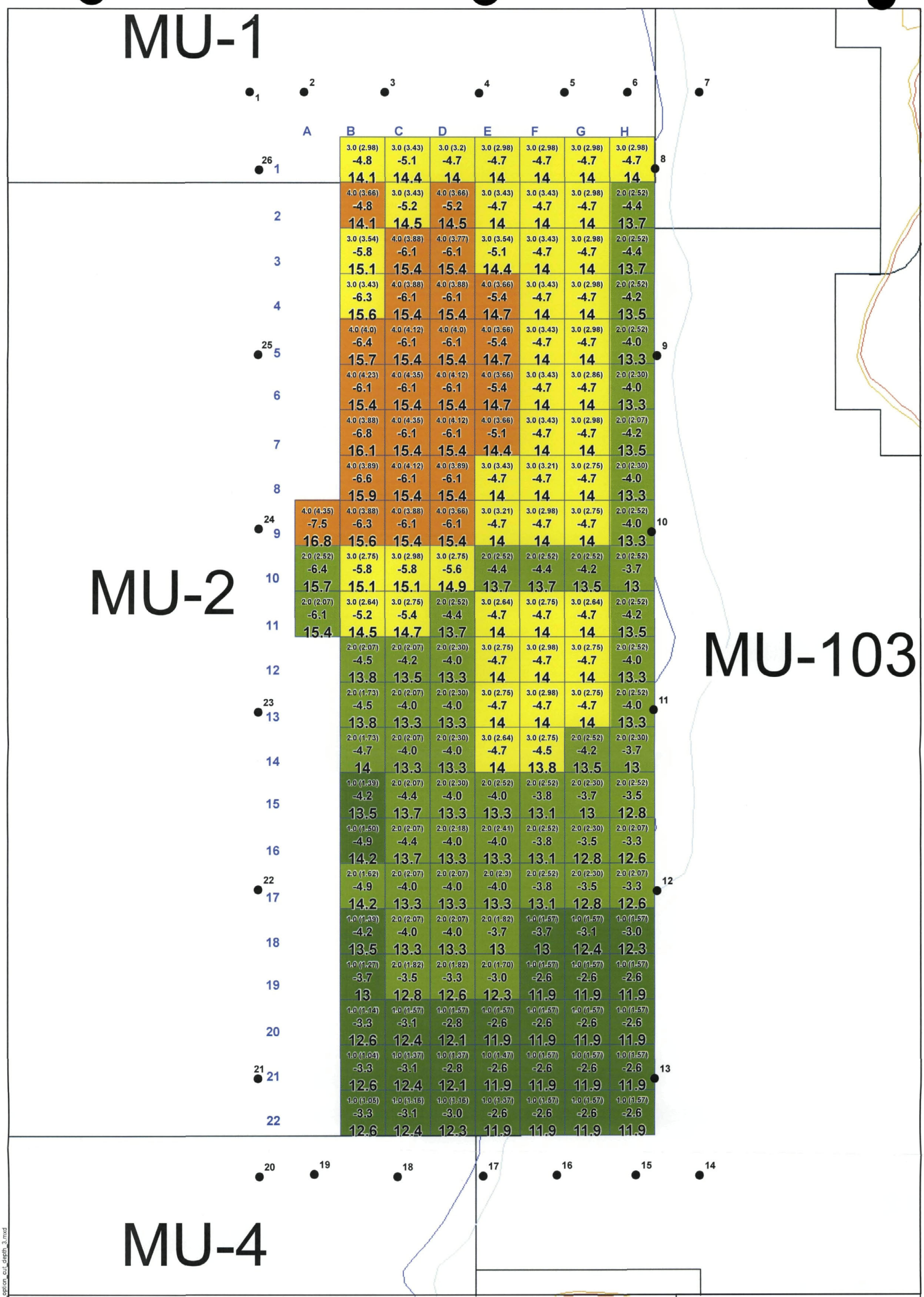
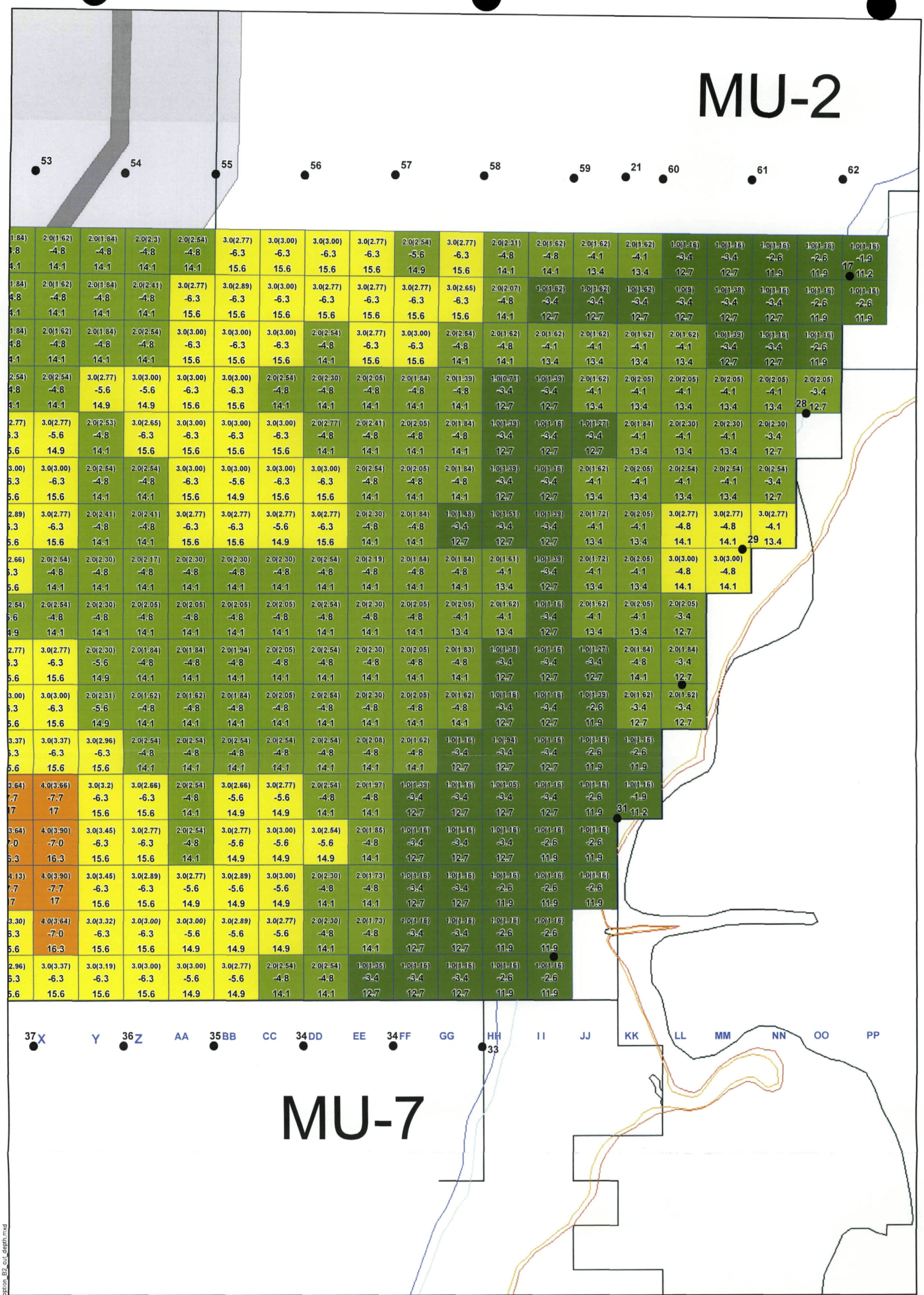

MU-1
MU-2
MU-103
MU-4
A B C D E F G H
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
3.0 (2.98) -4.8 14.1
3.0 (3.43) -5.1 14.4
3.0 (3.2) -4.7 14
3.0 (2.98) -4.7 14
3.0 (2.98) -4.7 14
3.0 (2.98) -4.7 14
3.0 (2.98) -4.7 14
4.0 (3.66) -4.8 14.1
3.0 (3.43) -5.2 14.5
4.0 (3.66) -5.2 14.5
3.0 (3.43) -4.7 14
3.0 (3.43) -4.7 14
3.0 (2.98) -4.7 14
2.0 (2.52) -4.4 13.7
3.0 (3.54) -5.8 15.1
4.0 (3.88) -6.1 15.4
4.0 (3.77) -6.1 15.4
3.0 (3.54) -5.1 14.4
3.0 (3.43) -4.7 14
3.0 (2.98) -4.7 14
2.0 (2.52) -4.4 13.7
3.0 (3.43) -6.3 15.6
4.0 (3.88) -6.1 15.4
4.0 (3.88) -6.1 15.4
4.0 (3.66) -5.4 14.7
3.0 (3.43) -4.7 14
3.0 (2.98) -4.7 14
2.0 (2.52) -4.2 13.5
4.0 (4.0) -6.4 15.7
4.0 (4.12) -6.1 15.4
4.0 (4.0) -6.1 15.4
4.0 (3.66) -5.4 14.7
3.0 (3.43) -4.7 14
3.0 (2.98) -4.7 14
2.0 (2.52) -4.0 13.3
4.0 (4.23) -6.1 15.4
4.0 (4.35) -6.1 15.4
4.0 (4.12) -6.1 15.4
4.0 (3.66) -5.4 14.7
3.0 (3.43) -4.7 14
3.0 (2.86) -4.7 14
2.0 (2.30) -4.0 13.3
4.0 (3.88) -6.8 16.1
4.0 (4.35) -6.1 15.4
4.0 (4.12) -6.1 15.4
4.0 (3.66) -5.1 14.4
3.0 (3.43) -4.7 14
3.0 (2.98) -4.7 14
2.0 (2.07) -4.2 13.5
4.0 (3.89) -6.6 15.9
4.0 (4.12) -6.1 15.4
4.0 (3.89) -6.1 15.4
3.0 (3.43) -4.7 14
3.0 (3.21) -4.7 14
3.0 (2.75) -4.7 14
2.0 (2.30) -4.0 13.3
4.0 (4.35) -7.5 16.8
4.0 (3.88) -6.3 15.6
4.0 (3.88) -6.1 15.4
4.0 (3.66) -6.1 15.4
3.0 (3.21) -4.7 14
3.0 (2.98) -4.7 14
3.0 (2.75) -4.7 14
2.0 (2.52) -4.0 13.3
2.0 (2.52) -6.4 15.7
3.0 (2.75) -5.8 15.1
3.0 (2.98) -5.8 15.1
3.0 (2.75) -5.6 14.9
2.0 (2.52) -4.4 13.7
2.0 (2.52) -4.4 13.7
2.0 (2.52) -4.2 13.5
2.0 (2.52) -3.7 13
2.0 (2.07) -6.1 15.4
3.0 (2.64) -5.2 14.5
3.0 (2.75) -5.4 14.7
2.0 (2.52) -4.4 13.7
3.0 (2.64) -4.7 14
3.0 (2.75) -4.7 14
3.0 (2.64) -4.7 14
2.0 (2.52) -4.2 13.5
2.0 (2.07) -4.5 13.8
2.0 (2.07) -4.2 13.5
2.0 (2.30) -4.0 13.3
3.0 (2.75) -4.7 14
3.0 (2.98) -4.7 14
3.0 (2.75) -4.7 14
2.0 (2.52) -4.0 13.3
2.0 (1.73) -4.5 13.8
2.0 (2.07) -4.0 13.3
2.0 (2.30) -4.0 13.3
3.0 (2.75) -4.7 14
3.0 (2.98) -4.7 14
3.0 (2.75) -4.7 14
2.0 (2.52) -4.0 13.3
2.0 (1.73) -4.7 14
2.0 (2.07) -4.0 13.3
2.0 (2.30) -4.0 13.3
3.0 (2.64) -4.7 14
3.0 (2.75) -4.5 13.8
2.0 (2.52) -4.2 13.5
2.0 (2.30) -3.7 13
1.0 (1.39) -4.2 13.5
2.0 (2.07) -4.4 13.7
2.0 (2.30) -4.0 13.3
2.0 (2.52) -4.0 13.3
2.0 (2.52) -3.8 13.1
2.0 (2.30) -3.7 13
2.0 (2.52) -3.5 12.8
1.0 (1.50) -4.9 14.2
2.0 (2.07) -4.4 13.7
2.0 (2.18) -4.0 13.3
2.0 (2.41) -4.0 13.3
2.0 (2.52) -3.8 13.1
2.0 (2.30) -3.5 12.8
2.0 (2.07) -3.3 12.6
2.0 (1.62) -4.9 14.2
2.0 (2.07) -4.0 13.3
2.0 (2.07) -4.0 13.3
2.0 (2.3) -4.0 13.3
2.0 (2.52) -3.8 13.1
2.0 (2.30) -3.5 12.8
2.0 (2.07) -3.3 12.6
1.0 (1.39) -4.2 13.5
2.0 (2.07) -4.0 13.3
2.0 (2.07) -4.0 13.3
2.0 (1.82) -3.7 13
1.0 (1.57) -3.7 13
1.0 (1.57) -3.1 12.4
1.0 (1.57) -3.0 12.3
1.0 (1.27) -3.7 13
2.0 (1.82) -3.5 12.8
2.0 (1.82) -3.3 12.6
2.0 (1.70) -3.0 12.3
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.14) -3.3 12.6
1.0 (1.57) -3.1 12.4
1.0 (1.57) -2.8 12.1
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.04) -3.3 12.6
1.0 (1.37) -3.1 12.4
1.0 (1.37) -2.8 12.1
1.0 (1.47) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.05) -3.3 12.6
1.0 (1.16) -3.1 12.4
1.0 (1.16) -3.0 12.3
1.0 (1.37) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
1.0 (1.57) -2.6 11.9
Legend
Management Units
Sheet Pile
Z Blocks (ZstarRnd) in feet
Dredged Below Z*
0
0 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
3.0 - 3.5
3.5 - 4.0
4.0 - 4.5
4.5 - 5.0
5.0 - 5.5
Aerial Photography MASSGIS 2003
Dredge Area A Grid
2.0 (1.7)
-4.0
13.3
Rounded Feet of Sediment to be Removed; Followed by actual depth to z* (relative to May 2005 bathymetric survey)
Target Elevations in feet (relative to mean sea level [MSL], NGVD 29)
Rod Reading in feet (relative to mean sea level [MSL], NGVD 29)
Note: Rod Reading based on an instrument height of 9.3', NGVD 29
MLLW
MLW
MHW
MHHW
0 25 50
Feet
1:600
N
JE JACOBS
DRAFT
2005 Targeted Sediment for Removal; Dredge Area A
New Bedford Harbor Superfund Site
August 2005
NAME: croberts
DATE: 8/11/2005
Figure 4
Y:\NBH\Projects\35BG0101\05\20050811\ArcGIS\2005_dredge_option_cut_depth_3.mxd



Legend

Management Units

Sheet Pile

Z Blocks (ZstarRnd) in feet

- Dredged Below Z*
- 0
- 0 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- 5.0 - 5.5

Aerial Photography MASSGIS 2003

Dredge Area B Grid

2.0 (1.7)
-4.0
13.3

Rounded Feet of Sediment to be Removed; Followed by actual depth to z* (Relative to May 2005 bathymetric survey)

Target Elevations in feet (relative to mean sea level [MSL], NGVD 29)

Rod Reading in feet (relative to mean sea level [MSL], NGVD 29)

Note: Rod Reading based on an instrument height of 9.3', NGVD 29

- MLLW
- MLW
- MHW
- MHHW

0 25 50 Feet

1:600

N

JACOBS

DRAFT

2005 Targeted Sediment for Removal; Eastern Dredge Area B

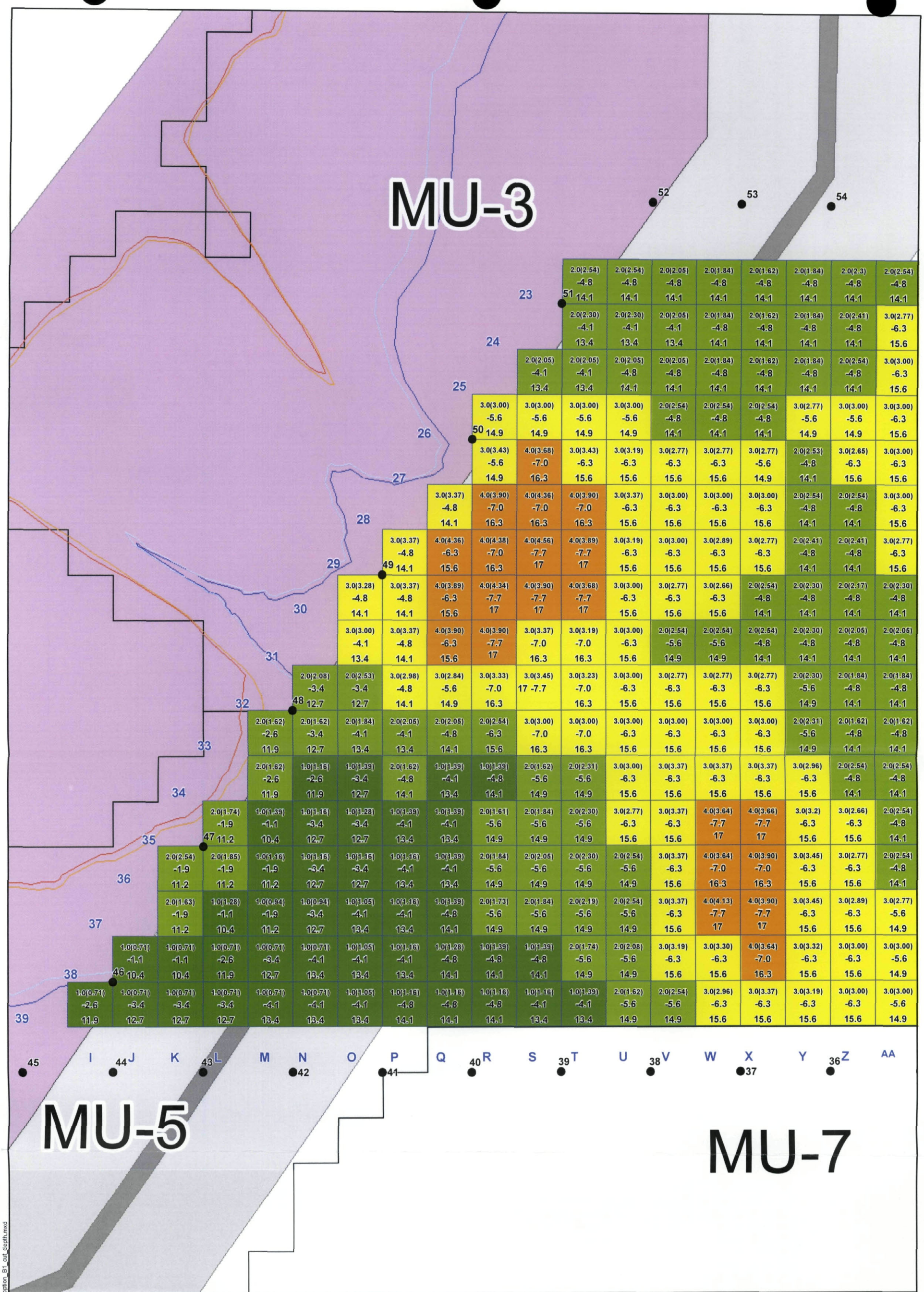
New Bedford Harbor Superfund Site

August 2005

NAME: croberts DATE: 8/11/2005

Figure 5

Y:\NBH\Projects\35BG0101\20050811\ArcGIS\2005_dredge_option_B2_cut_depth.mxd



Legend

Management Units

Sheet Pile

Z Blocks (ZstarRnd) in feet

- Dredged Below Z*
- 0
- 0 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- 5.0 - 5.5

Aerial Photography MASSGIS 2003

Dredge Area B Grid

2.0 (1.7)
-4.0
13.3

Rounded Feet of Sediment to be Removed; Followed by actual depth to z* (relative to May 2005 bathymetric survey)

Target Elevations in feet (relative to mean sea level [MSL], NGVD 29)

Rod Reading in feet (relative to mean sea level [MSL], NGVD 29)

MLLW

MLW

MHW

MHHW

Note: Rod Reading based on an instrument height of 9.3', NGVD 29

Proposed Location of footprint CDF "A". Assumed that no dredging activities will be conducted within this area during remediation activites.

Proposed Location of CDF "A" Dike. Assumed that dredging activities will be conducted in the footprint of the CDF Dike to "z star".

Proposed road on CDF "A" Dike

0 25 50 Feet

1:600

N

JACOBS

DRAFT

2005 Targeted Sediment for Removal; Western Dredge Area B

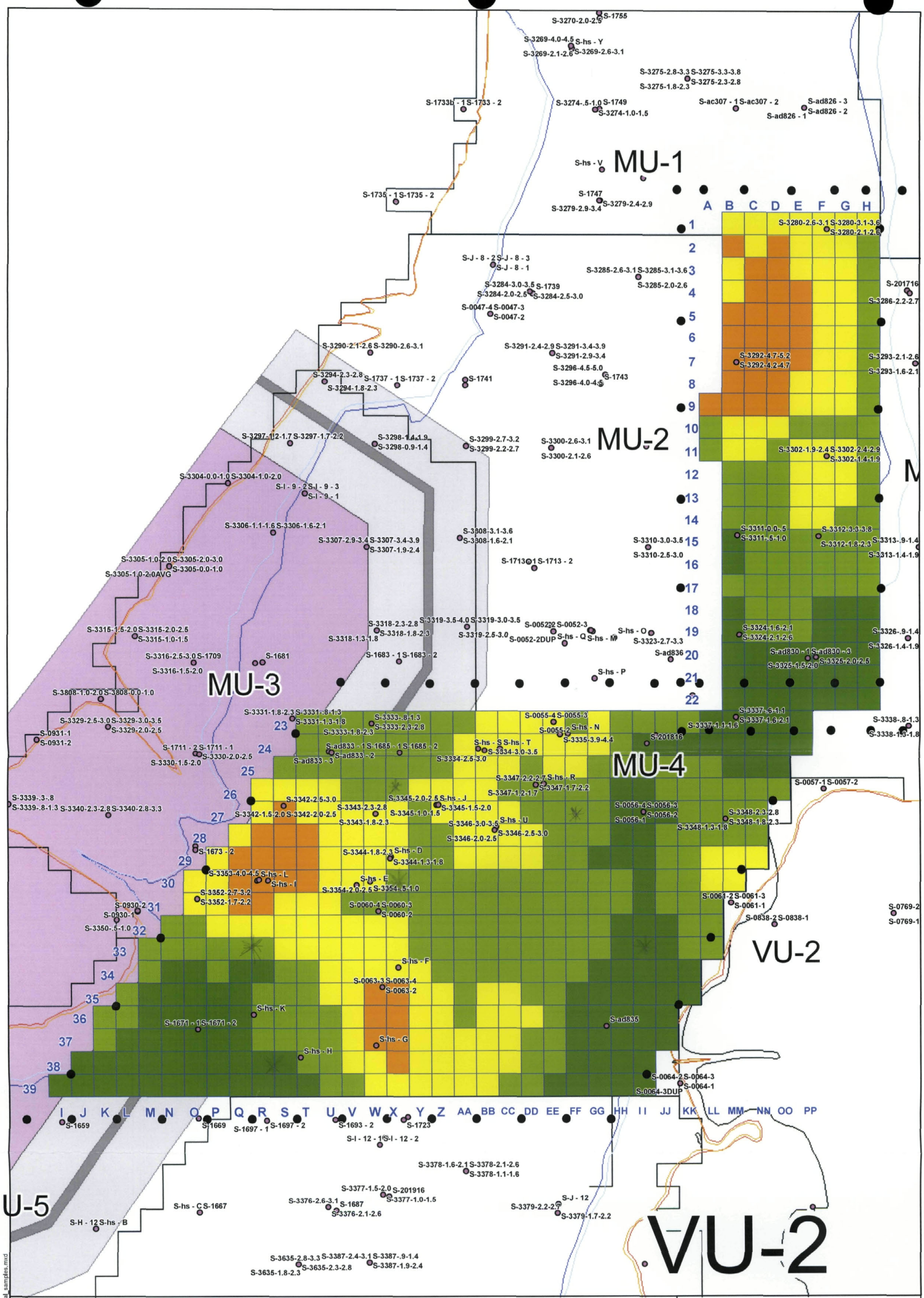
New Bedford Harbor Superfund Site

August 2005

NAME: croberts DATE: 8/11/2005

Figure 6

Y:\NBH\Projects\35BG0101\05\20050811\ArcGIS\2005_dredge_option_B1_cut_depth.mxd



Legend

- Management Units
- Sheet Pile
- Historical Analytical Sample Location
- MLLW
- MLW
- MHW
- MHHW

Cut Depths (ft)

- Dredged Below Z*
- 0
- 0 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- 5.0 - 5.5

Note: Rod Reading based on an instrument height of 9.3', NGVD 29

0 50 100 Feet

1:1,200

Aerial Photography MASSGIS 2003

Y:\NBH\Projects\35BG0101\06\20050818\ArcGIS\2005_analytical_samples.mxd

JACOBS

DRAFT

Historical Analytical Samples within 2005 Dredge Areas

New Bedford Harbor Superfund Site

August 2005

NAME: croberts DATE: 8/18/2005

Figure 7

US Army Corps of Engineers
New England District

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project

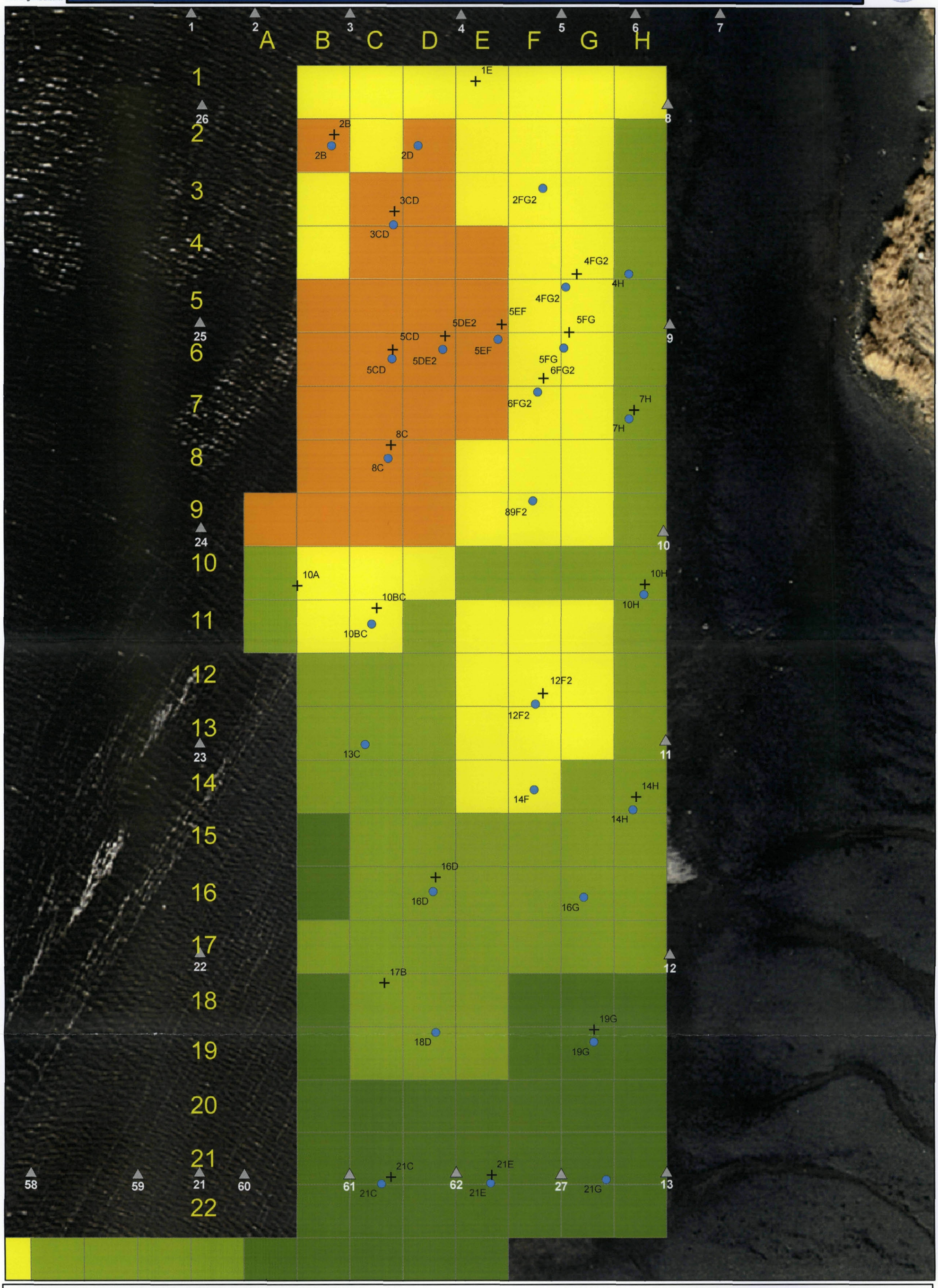


Figure 8 - 2005 Sampling Locations - Area-A

Sources:
NAD 83 Mass State Plane ft
Date: 26 January 2006

ENSR AECOM

0 50 100 Feet

Area A Pre-Dredge Sampling Locations
Area A Post-Dredge Sampling Locations
Sheet Pile Locations*
* locations subject to change

Cut Depths (ft) (from Jacobs, 2005)

0	2.0 - 2.5	4.0 - 4.5
0 - 1.0	2.5 - 3.0	4.50 - 5.0
1.0 - 1.5	3.0 - 3.5	5.00 - 5.5
1.5 - 2.0	3.5 - 4.0	

J:\Water\ProjectFiles\P90\9000NBH\Reporting\Sediment Sampling\2005 PROGRESS SEDIMENTS\FIGURES\Fig_8_2005_sampling_locations_A.mxd

US Army Corps of Engineers
New England District

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project

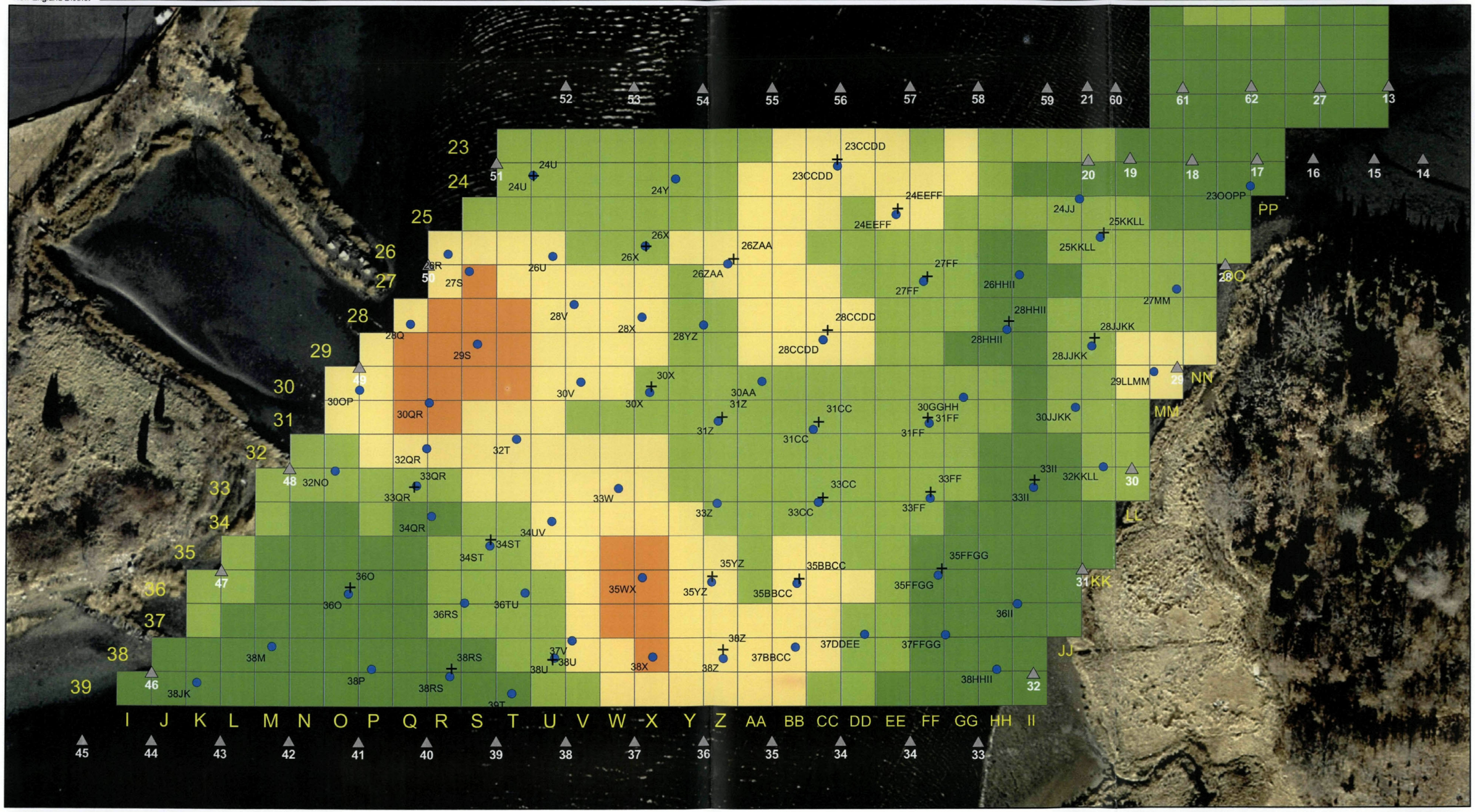


Figure 9 - 2005 Sampling Locations - Area-B

Sources:
NAD 83 Mass State Plane ft
Date: 15 August 2006

ENSR | AECOM

0 50 100 200 300 Feet

Area B Pre-Dredge Sampling Locations

Area B Post-Dredge Sampling Locations

Sheet Pile Locations*

* locations subject to change

Cut Depths (ft) (From Jacobs, 2005)

0	2.0 - 2.5	4.0 - 4.5
0 - 1.0	2.5 - 3.0	4.50 - 5.0
1.0 - 1.5	3.0 - 3.5	5.00 - 5.5
1.5 - 2.0	3.5 - 4.0	

J:\Water\ProjectFiles\P90\9000NBH\Reporting\Sediment Sampling\2005 PROGRESS SEDIMENTS\Draft\FIGURES\Fig_9_2005_sampling_locations_B.mxd

FIGURE 10
Coring Approach for Fall 2005

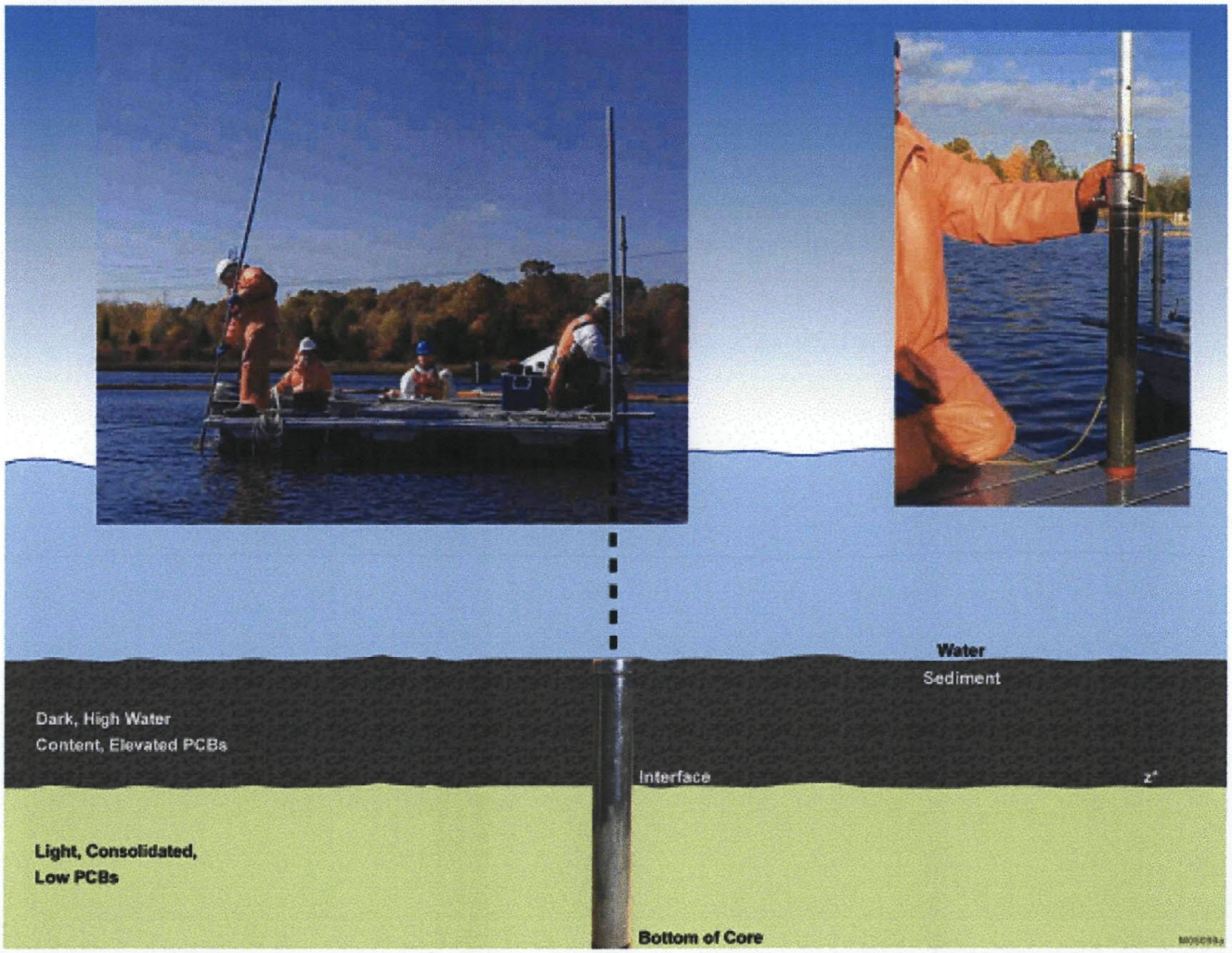


FIGURE 11
Field Log Sheet for Sediment Push Coring

ENSR.	STANDARD PROJECT LOG SHEET FOR PUSH CORING OPERATIONS				
	Client: U.S. Army Corps of Engineers New England District			STATION ID:	
	Project: Z* Evaluation Coring for 2005 New Bedford Harbor Dredging				
	Station Location: Upper New Bedford Harbor			DATE	
				TIME	
Sampling Platform				Sheet: 1 of	
Sampling Crew					
Coring Location	Northing		Easting	Datum	

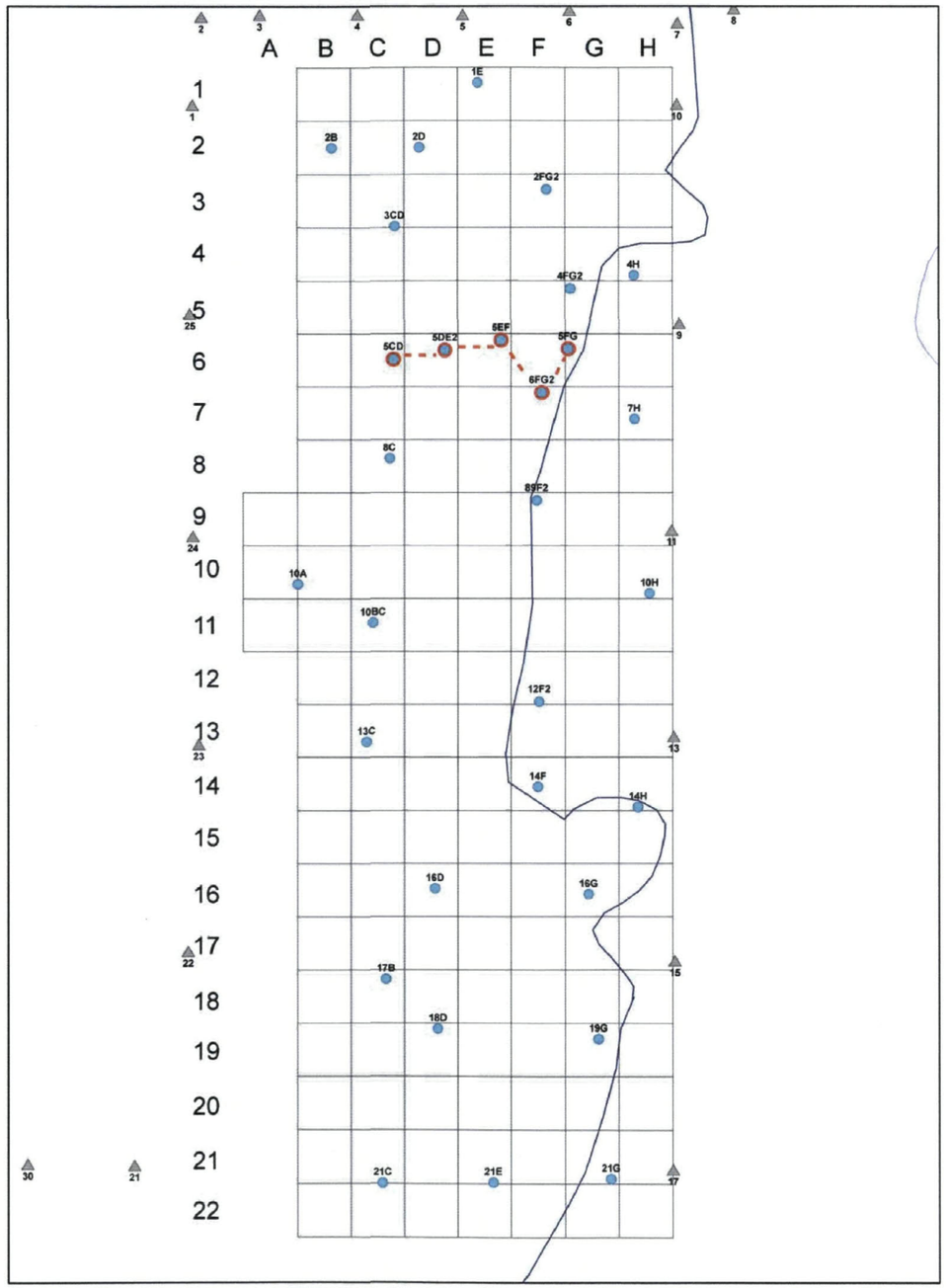
Summary of Required Field Measurements

1	Measured Water Depth at Coring Location (feet)			
2	Measured Full Length of Coring Apparatus Prior to Deployment (inches)			
3	Measured Residual Length of Coring Apparatus above Water at Full Penetration (inches)			
4	Measured Distance of Bottom of Core below Water Surface (feet) = [(2) - (3)] / 12			
5	Water Surface Elevation	Sheet pile Number	Specified Top Elevation of Sheetpile(NGVD)(feet)	
6	Measured Distance of Water Surface Elevation below Top of Sheet pile (inches)			
7	Measured Distance of Water Surface Elevation below Top of Sheet pile (feet) = (6) / 12			
8	Calculated Water Surface Elevation (NGVD)(feet) = (5) - (7)			
9	Calculated Bottom Elevation of Core Sample (NGVD)(feet) = (8) - (4)			
10	Measured Recovery Length of Core Sample - Bottom of Core to a Visual Sediment-Water Interface (inches)			
11	Measured Recovery Length of Core Sample (feet) = (10) / 12			
12	Calculated Elevation of Sediment-Water Interface for Core Sample (NGVD)(feet) = (9) + (11)			
13	Calculated Bathymetric Elevation based on Measured Water Depth (NGVD)(feet) = (8) - (1)			
14	Offset between Calculated Elevation for Sediment-Water Interface and Bathymetry (feet) = (12) - (13) (MAX=1)			

Scale (inches)	SKETCH	DESCRIPTION OF CORE SAMPLE (Define any visible transistions in sediment properties, include sediment type and color. Indicate the presence of odors or visible oil sheens)
72		A VISIBLE SEDIMENT-WATER INTERFACE MUST BE PRESENT FOR AN ACCEPTABLE CORE SAMPLE
60		
48		
36		
24		
12		
0		ALL MEASUREMENTS ARE REFERENCED TO THE BOTTOM OF THE CORE SAMPLE

Log Sheet Completed by (print name):		Initials:	

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project



Comparison of Recon and Progress Sediment Cores - Area A

Sources
NAD 83 Mass State Plane II
Date: 11.14.05

ENSR

0 50 100 Feet

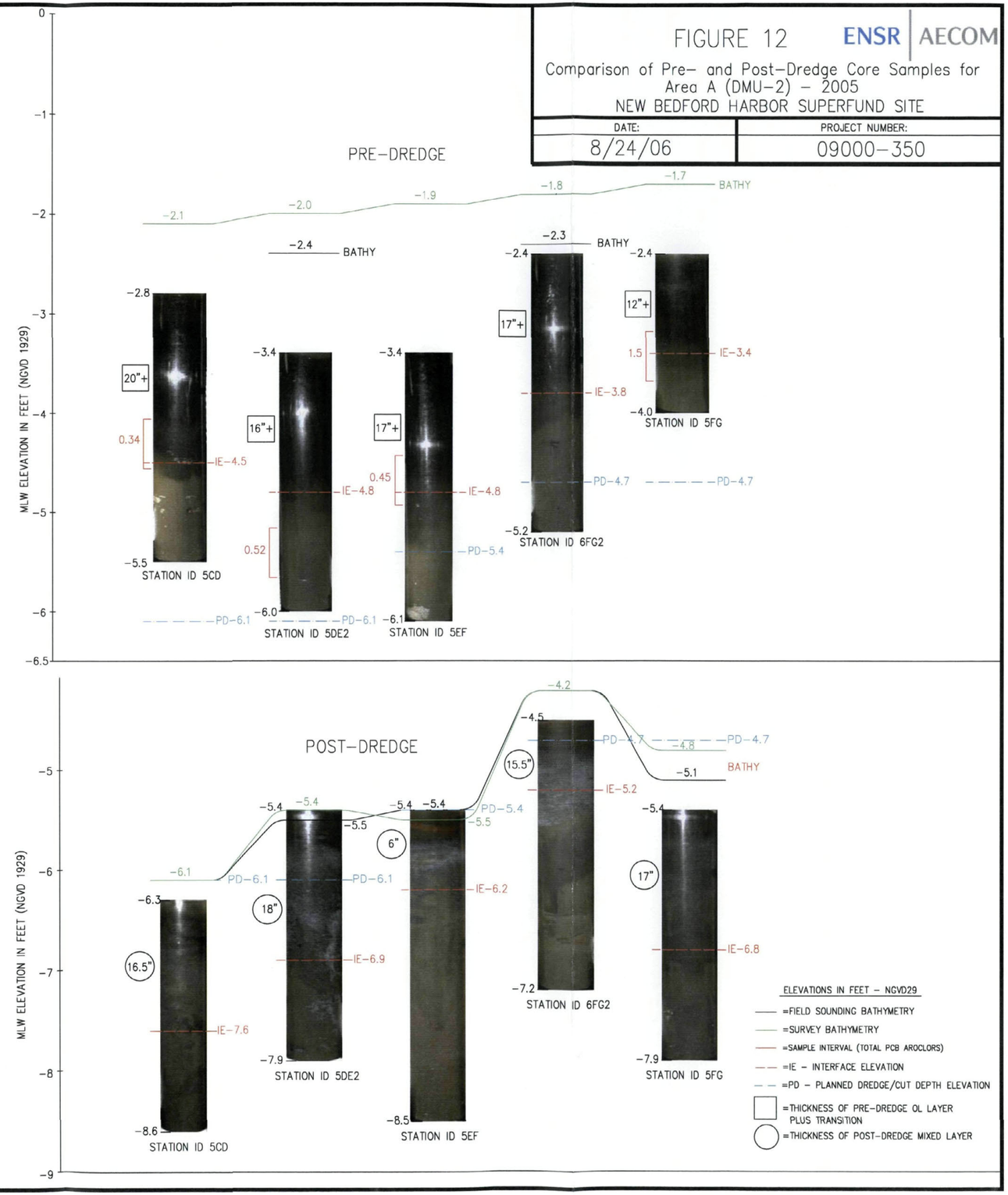
Sampled Locations 09/09/05
Sampled Locations 09/01/05 & 09/02/05
Sheet Pile Locations

FILENAME: J:\Water\ProjectFiles\P90\9000NBH\CAD\VERTICAL_CORE_PLOTS_AreaA&B.dwg

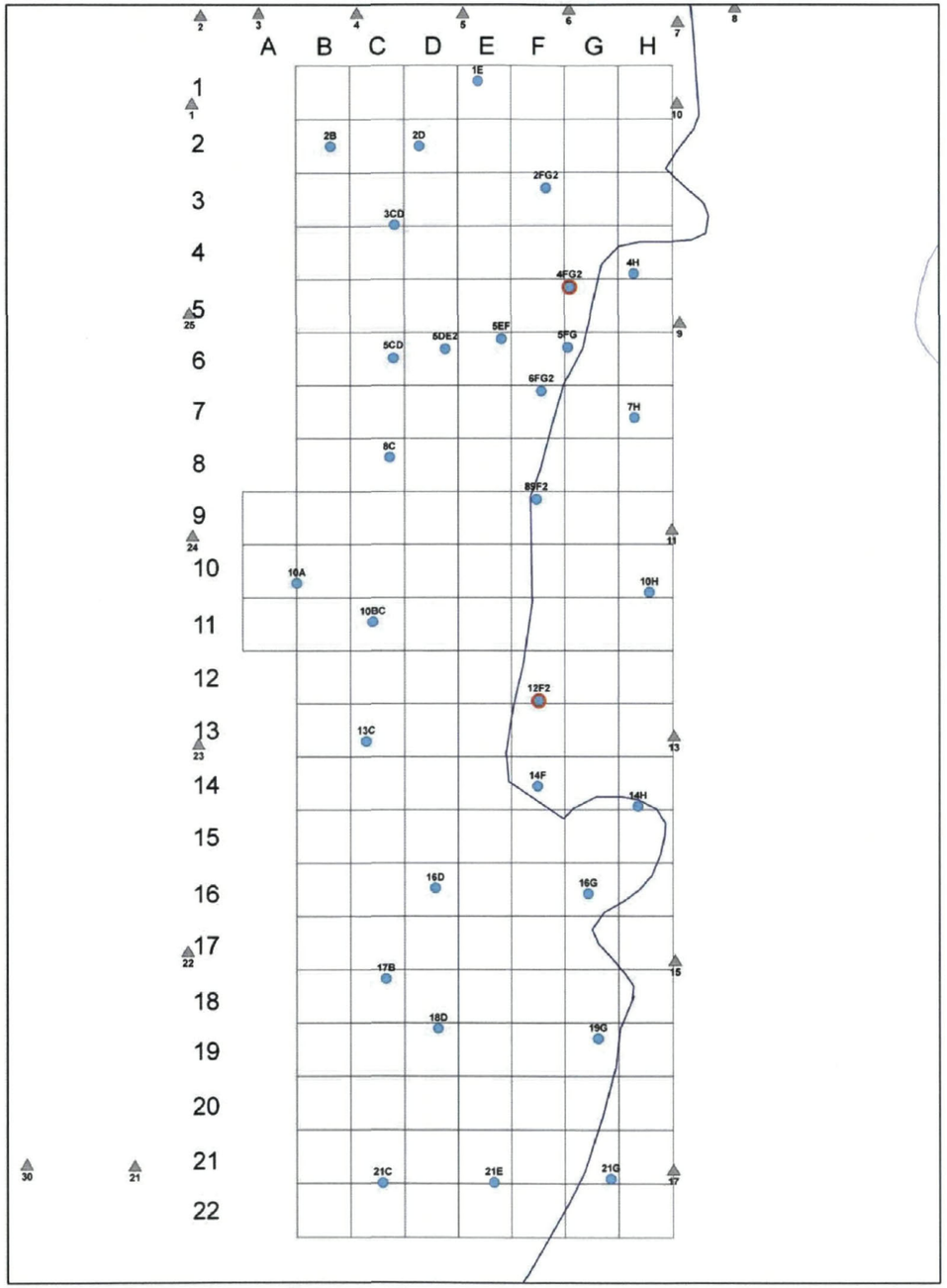
FIGURE 12 ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area A (DMU-2) - 2005
NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350



U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project



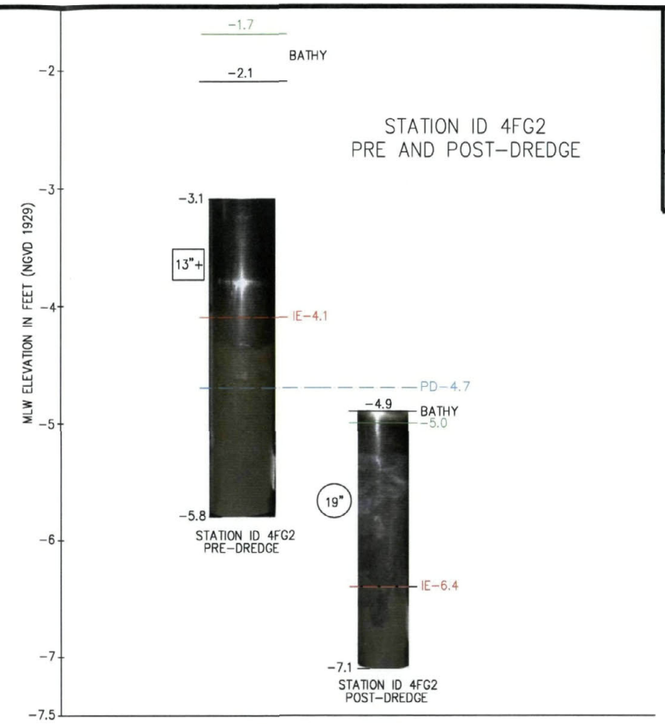
Comparison of Recon and Progress Sediment Cores - Area A

Sources:
NAD 83 Mass State Plane 8
Date: 11.14.05

ENSR

0 50 100 Feet

Sampled Locations 09/09/05
Sampled Locations 09/01/05 & 09/02/05
Sheet Pile Locations



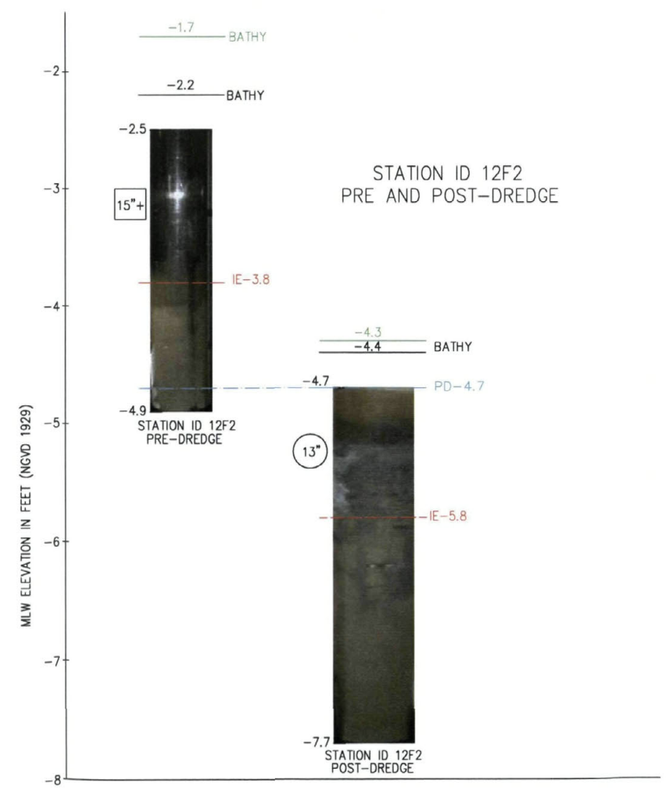


FIGURE 13

ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area A (DMU-2) - 2005
NEW BEDFORD HARBOR SUPERFUND SITE

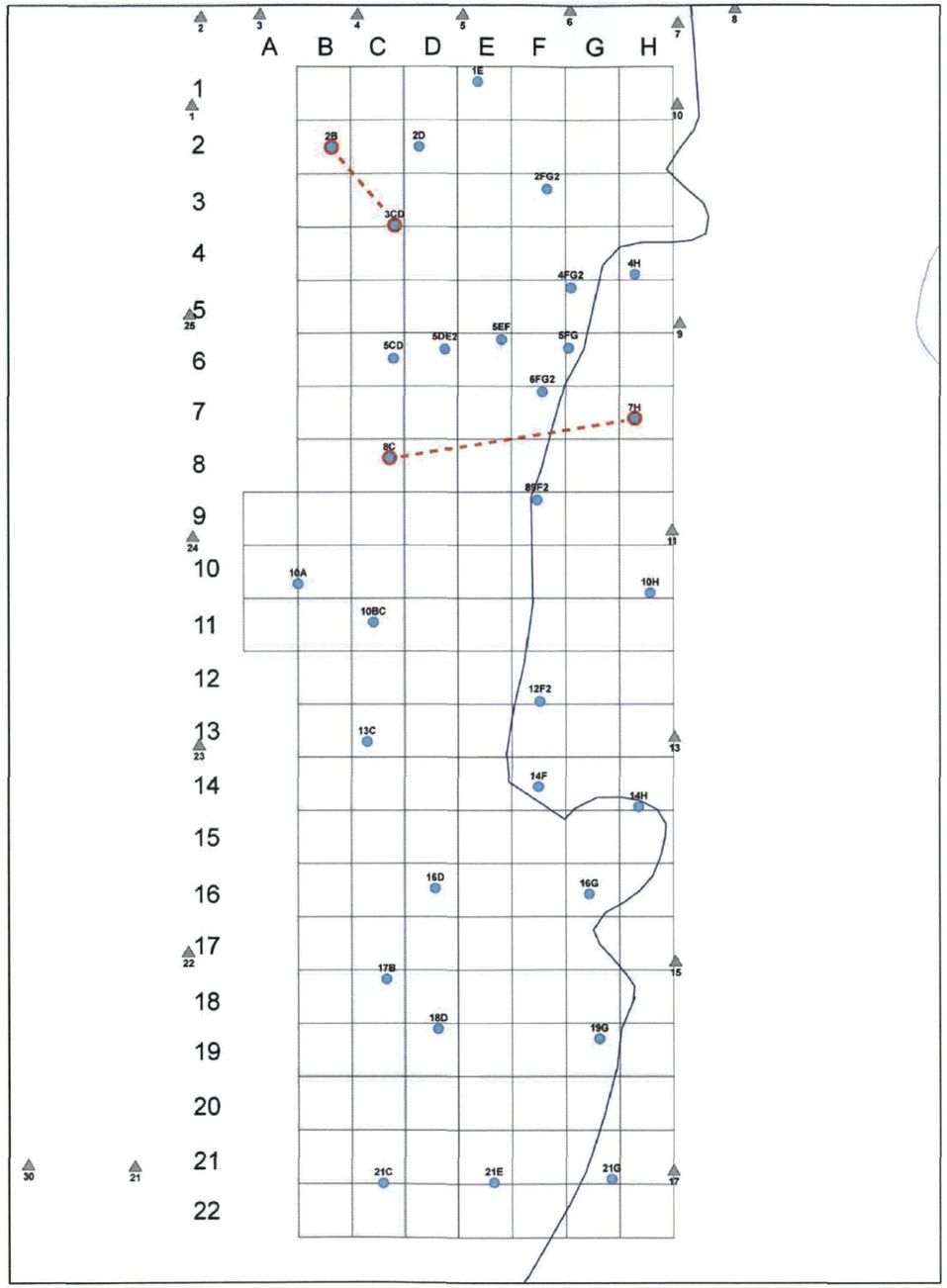
DATE:	PROJECT NUMBER:
8/24/06	09000-350

ELEVATIONS IN FEET - NGVD29

- =FIELD SOUNDING BATHYMETRY
- =SURVEY BATHYMETRY
- =IE - INTERFACE ELEVATION
- =PD - PLANNED DREDGE/CUT DEPTH ELEVATION
- =THICKNESS OF PRE-DREDGE OL LAYER PLUS TRANSITION
- =THICKNESS OF POST-DREDGE MIXED LAYER

FILENAME: J:\Water\ProjectFiles\P90\9000NBH\CAD\VERTICAL_CORE_PLOTS_AreaA&B.dwg

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project



Comparison of Recon and Progress Sediment Cores - Area A

Sources:
NAD 83 Mass State Plane 8
Date: 11.14.05

ENSR

0 50 100 Feet

Sampled Locations 09/09/05
Sampled Locations 09/01/05 & 09/02/05
Sheet Pile Locations

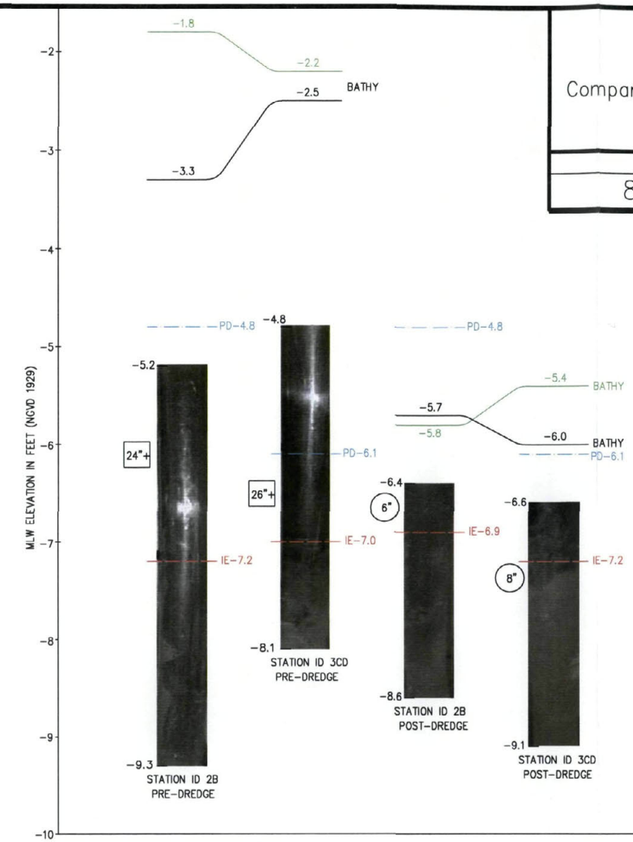
FILENAME: J:\Water\ProjectFiles\P90\9000NBH\CAD\VERTICAL_CORE_PLOTS_AreaA_Figs14-17.dwg

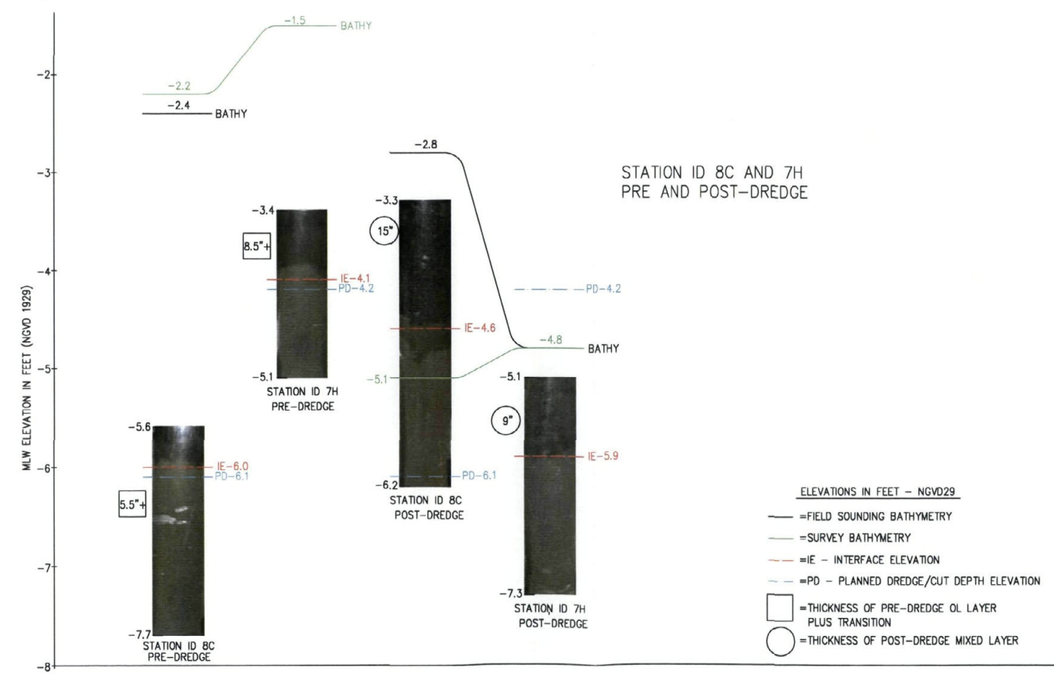
FIGURE 14

ENSR | AECOM

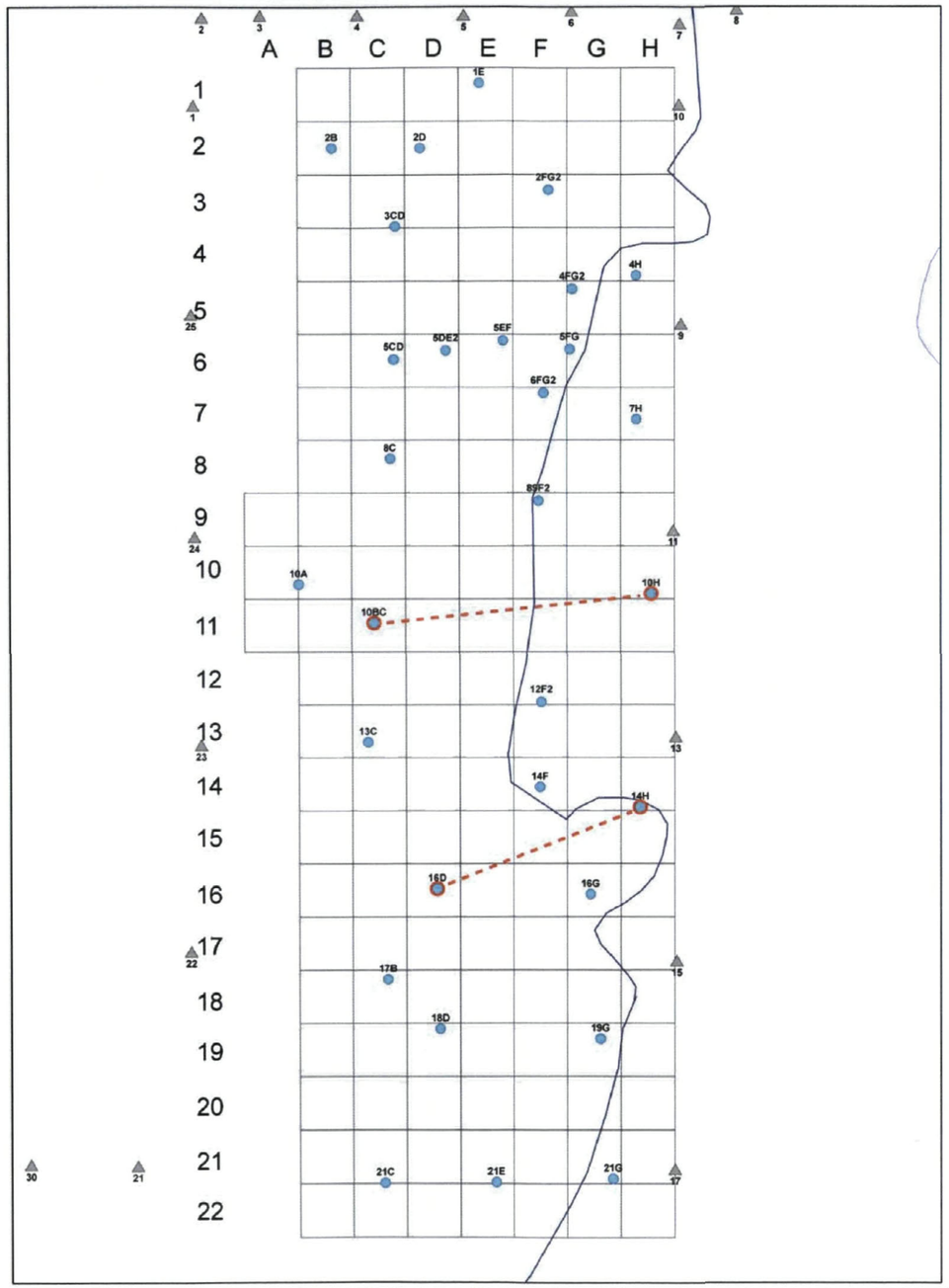
Comparison of Pre- and Post-Dredge Core Samples for Area A (DMU-2) - 2005
NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350





U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project



Comparison of Recon and Progress Sediment Cores - Area A

Sources:
NAD 83 Mass State Plane 8
Date: 11.14.05

ENSR

0 50 100 Feet

Sampled Locations 09/09/05
Sampled Locations 09/01/05 & 09/02/05
Sheet Pile Locations

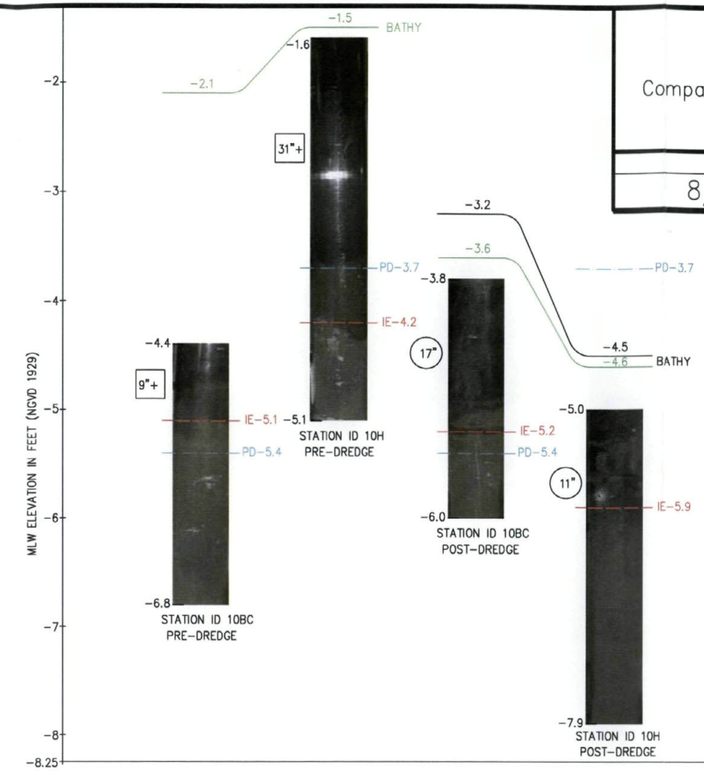
FILENAME: J:\Water\ProjectFiles\P90\9000NBH\CAD\VERTICAL_CORE_PLOTS_AreaA_Figs14-17.dwg

FIGURE 15

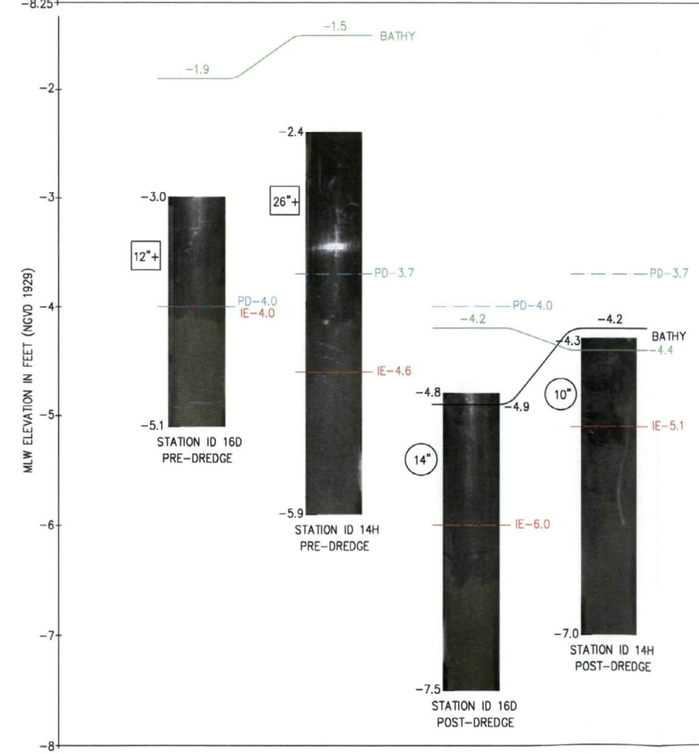
ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area A (DMU-2) - 2005
NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350



STATION ID 10BC AND 10H
PRE AND POST-DREDGE

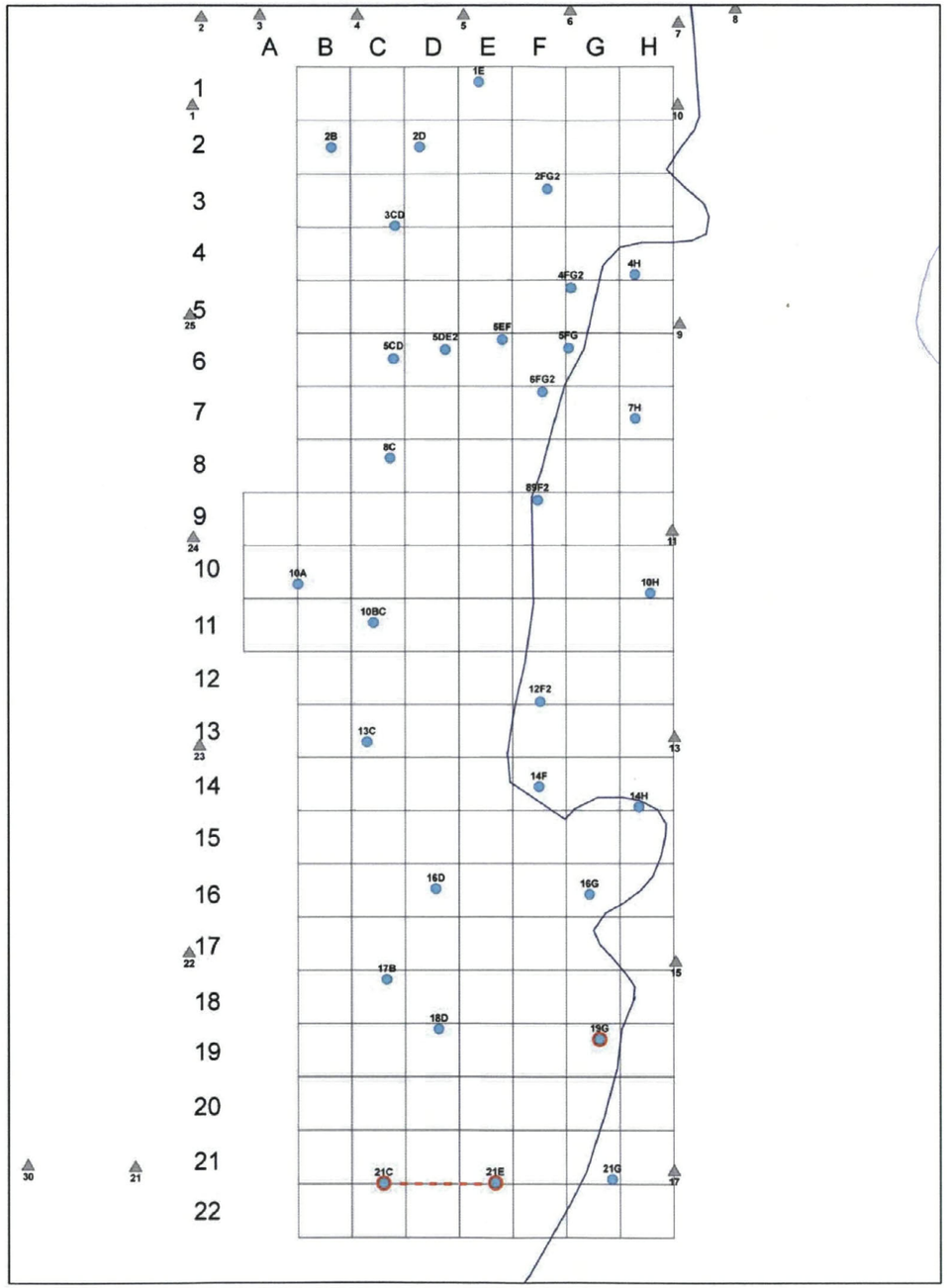


STATION ID 16D AND 14H
PRE AND POST-DREDGE

ELEVATIONS IN FEET - NGVD29

- =FIELD SOUNDING BATHYMETRY
- =SURVEY BATHYMETRY
- =IE - INTERFACE ELEVATION
- =PD - PLANNED DREDGE/CUT DEPTH ELEVATION
- =THICKNESS OF PRE-DREDGE OL LAYER PLUS TRANSITION
- =THICKNESS OF POST-DREDGE MIXED LAYER

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project



Comparison of Recon and Progress Sediment Cores - Area A

Sources:
NAD 83 Mass State Plane ft
Date: 11.14.05

ENSR

0 50 100 Feet

Sampled Locations 09/09/05
Sampled Locations 09/01/05 & 09/02/05
Sheet Pile Locations

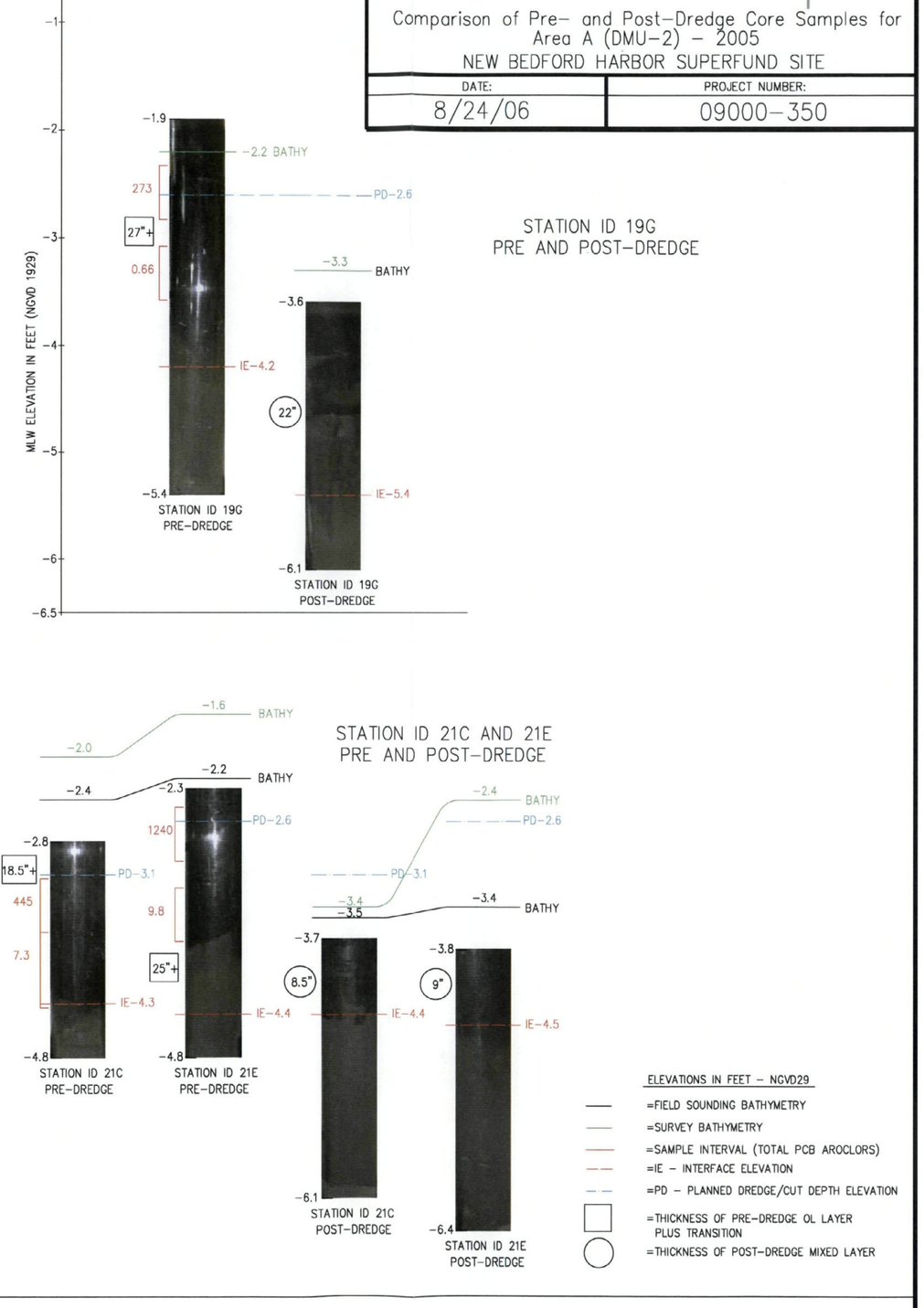
FILENAME: J:\Water\ProjectFiles\P90\9000NBH\CAD\VERTICAL_CORE_PLOTS_AreaA_Figs14-17.dwg

FIGURE 16

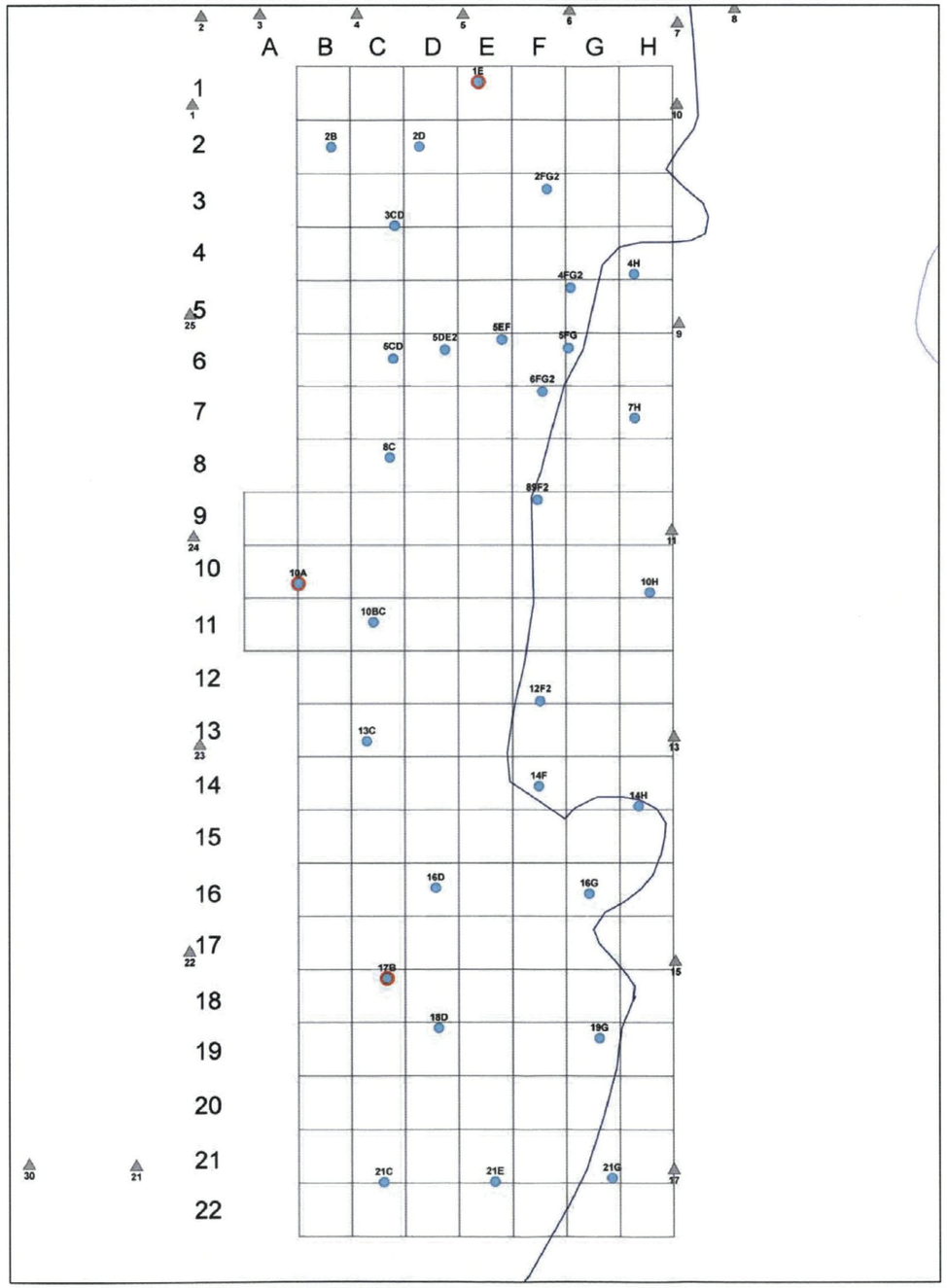
ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area A (DMU-2) – 2005
NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350



U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project



Comparison of Recon and Progress Sediment Cores - Area A

Sources:
NAD 83 Mass State Plane ft
Date: 11.14.05

ENSR

0 50 100 Feet

Sampled Locations 09/09/05
Sampled Locations 09/01/05 & 09/02/05
Sheet Pile Locations

FILENAME: J:\Water\ProjectFiles\P90\9000NBH\CAD\VERTICAL_CORE_PLOTS_AreaA_Figs14-17.dwg

FIGURE 17

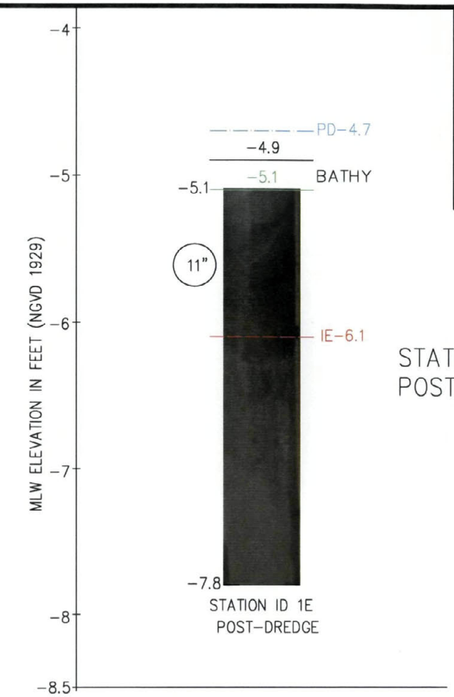
ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area A (DMU-2) - 2005
NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350

ELEVATIONS IN FEET - NGVD29

- =FIELD SOUNDING BATHYMETRY
- =SURVEY BATHYMETRY
- =SAMPLE INTERVAL (TOTAL PCB AROCLORS)
- =IE - INTERFACE ELEVATION
- =PD - PLANNED DREDGE/CUT DEPTH ELEVATION
- =THICKNESS OF PRE-DREDGE OL LAYER PLUS TRANSITION
- =THICKNESS OF POST-DREDGE MIXED LAYER



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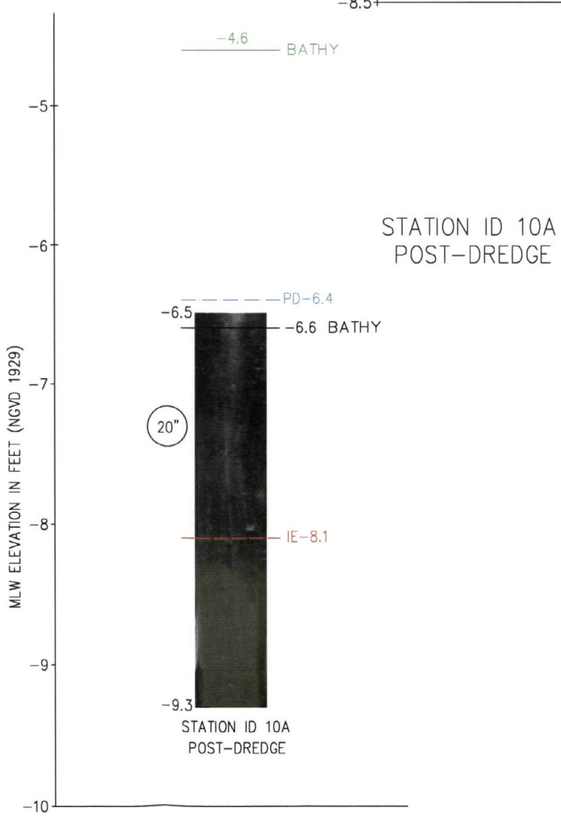

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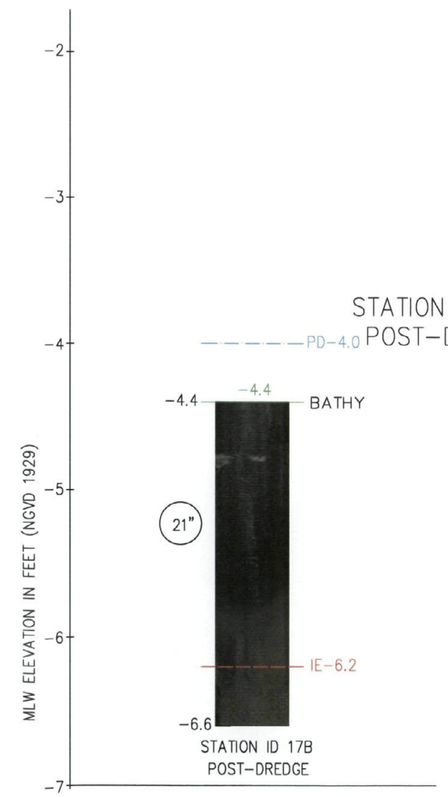


STATION ID 17B
POST-DREDGE

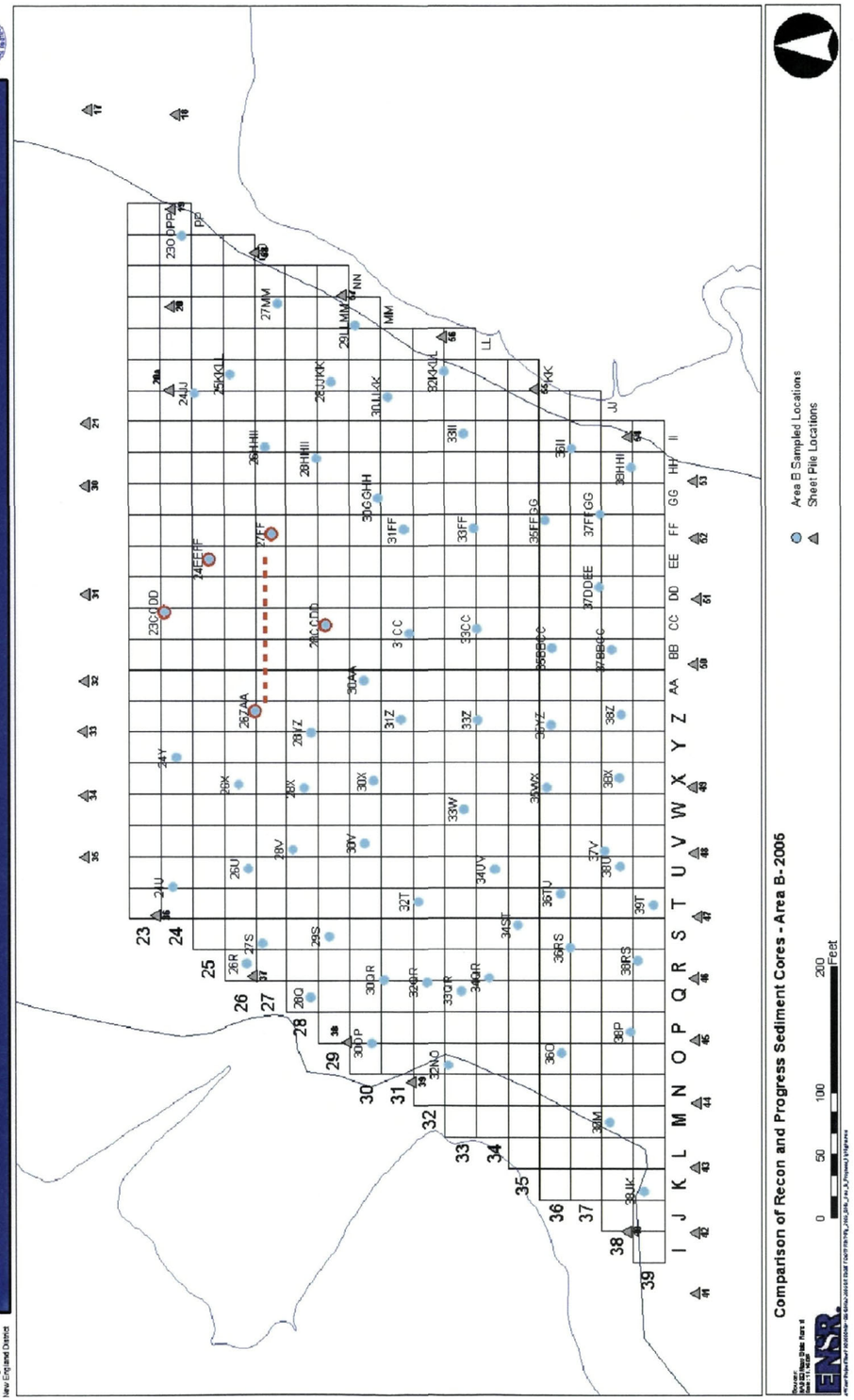
FIGURE 18

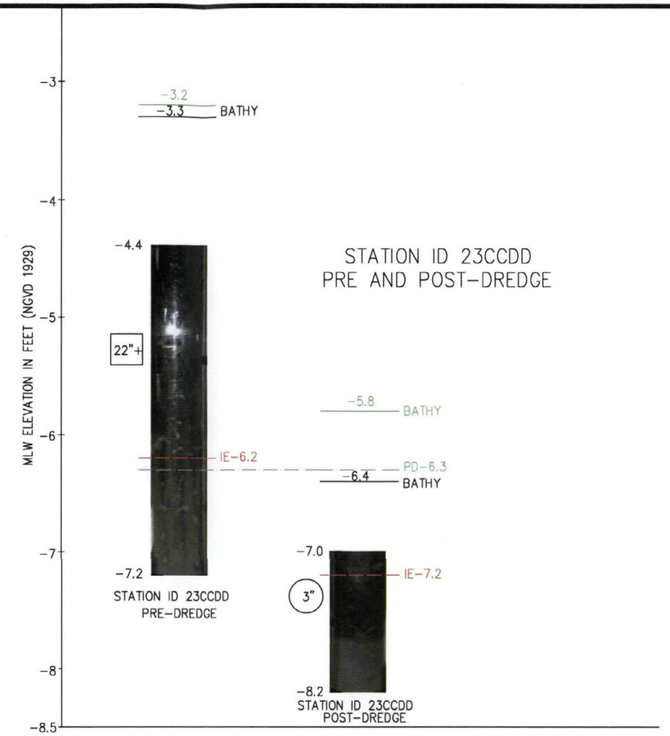
ENSR | AECOM

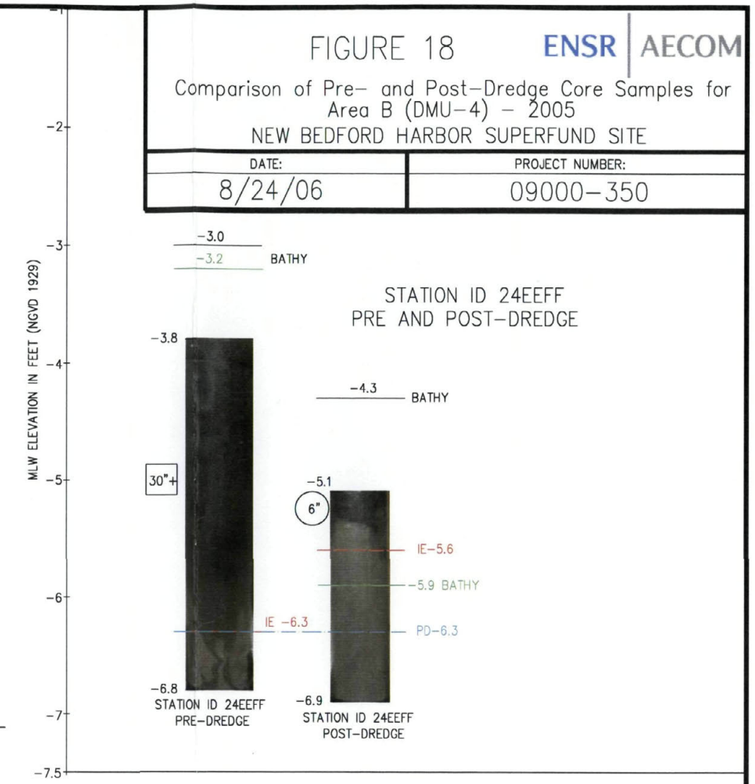
Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005

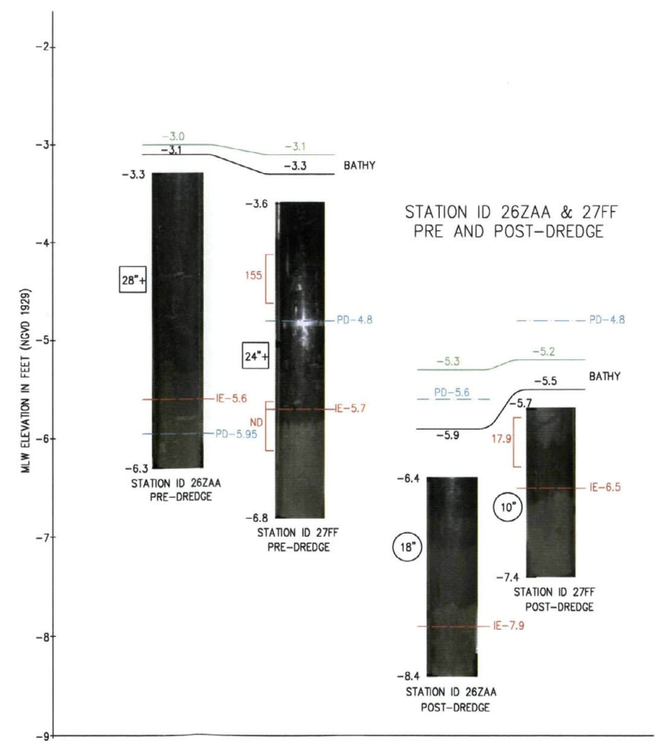
NEW BEDFORD HARBOR SUPERFUND SITE

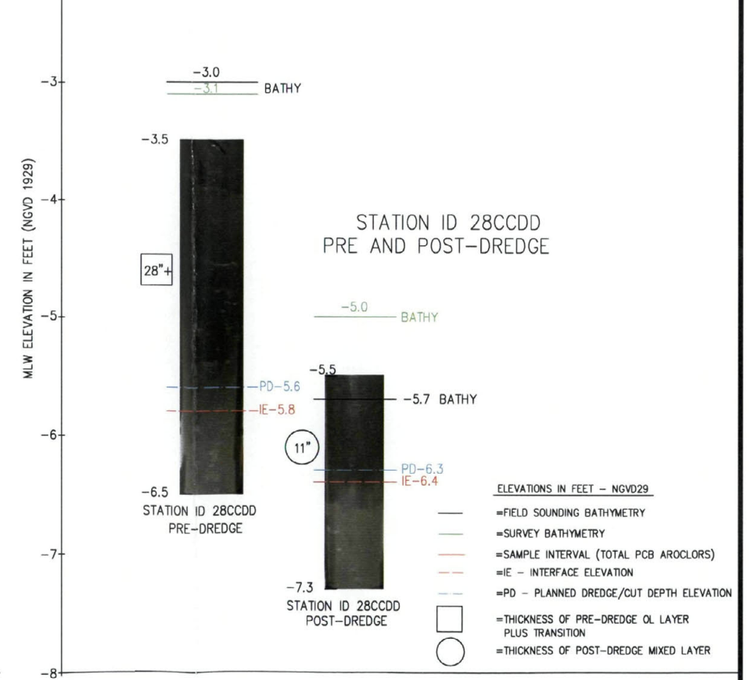
DATE:	PROJECT NUMBER:
8/24/06	09000-350











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New Bedford Harbor Superfund Project

US Army Corps of Engineers New England District

Comparison of Recon and Progress Sediment Cores - Area B-2006

ENSR

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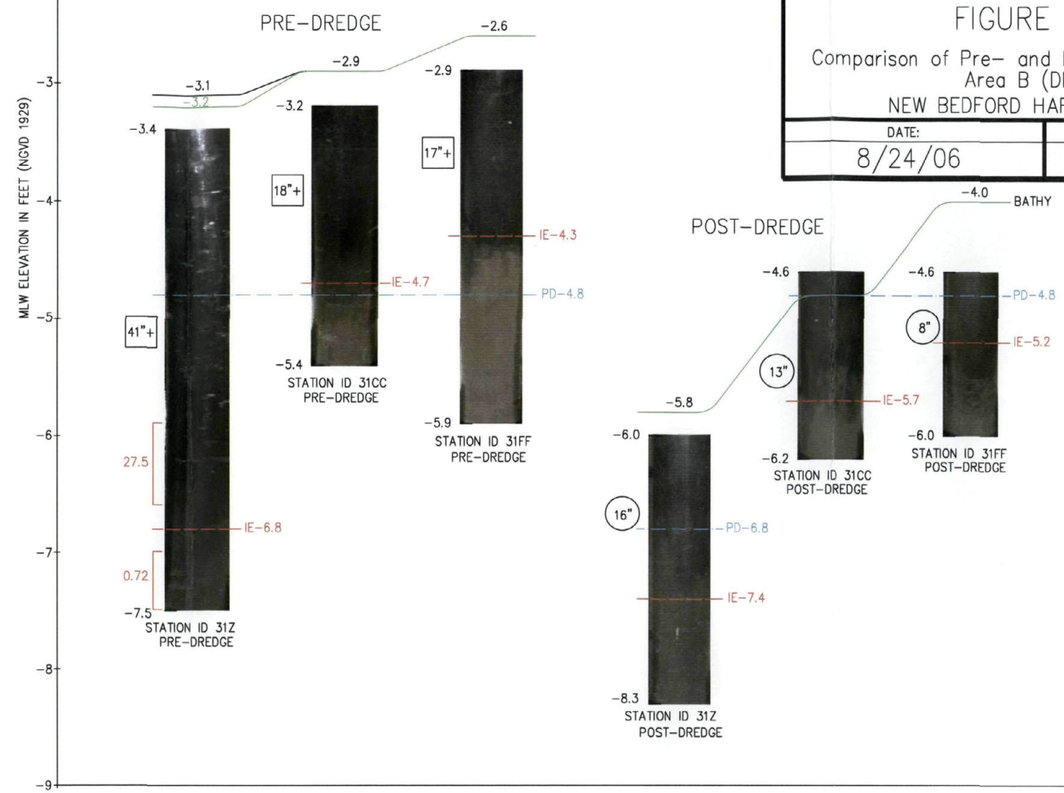
FIGURE 19

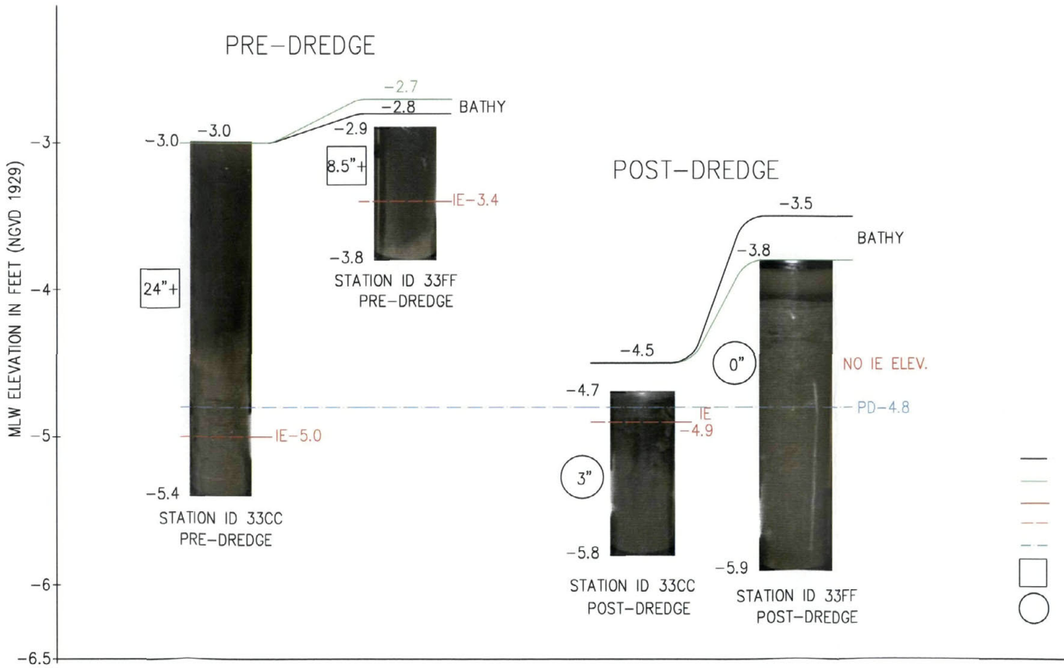
ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005

NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350





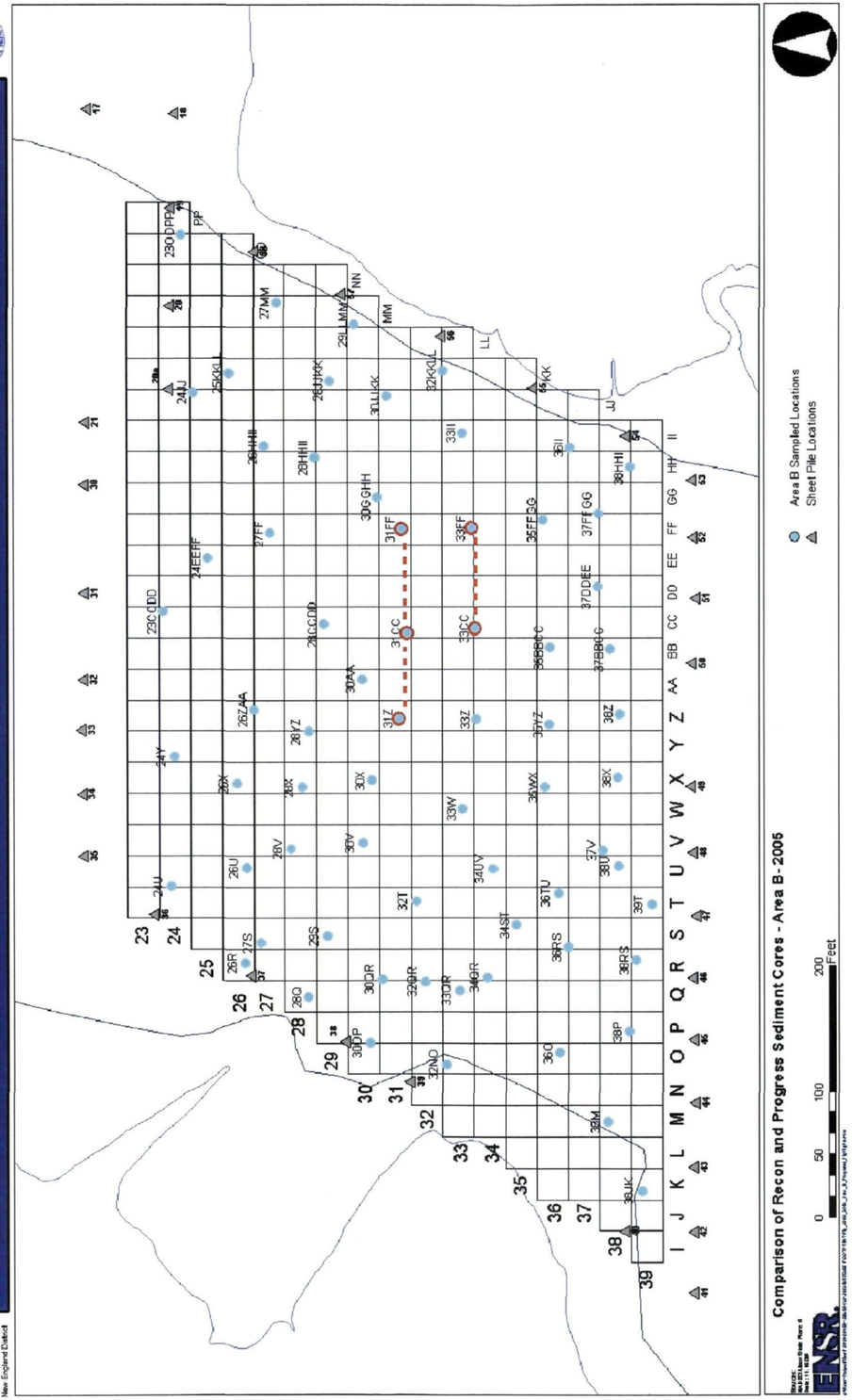


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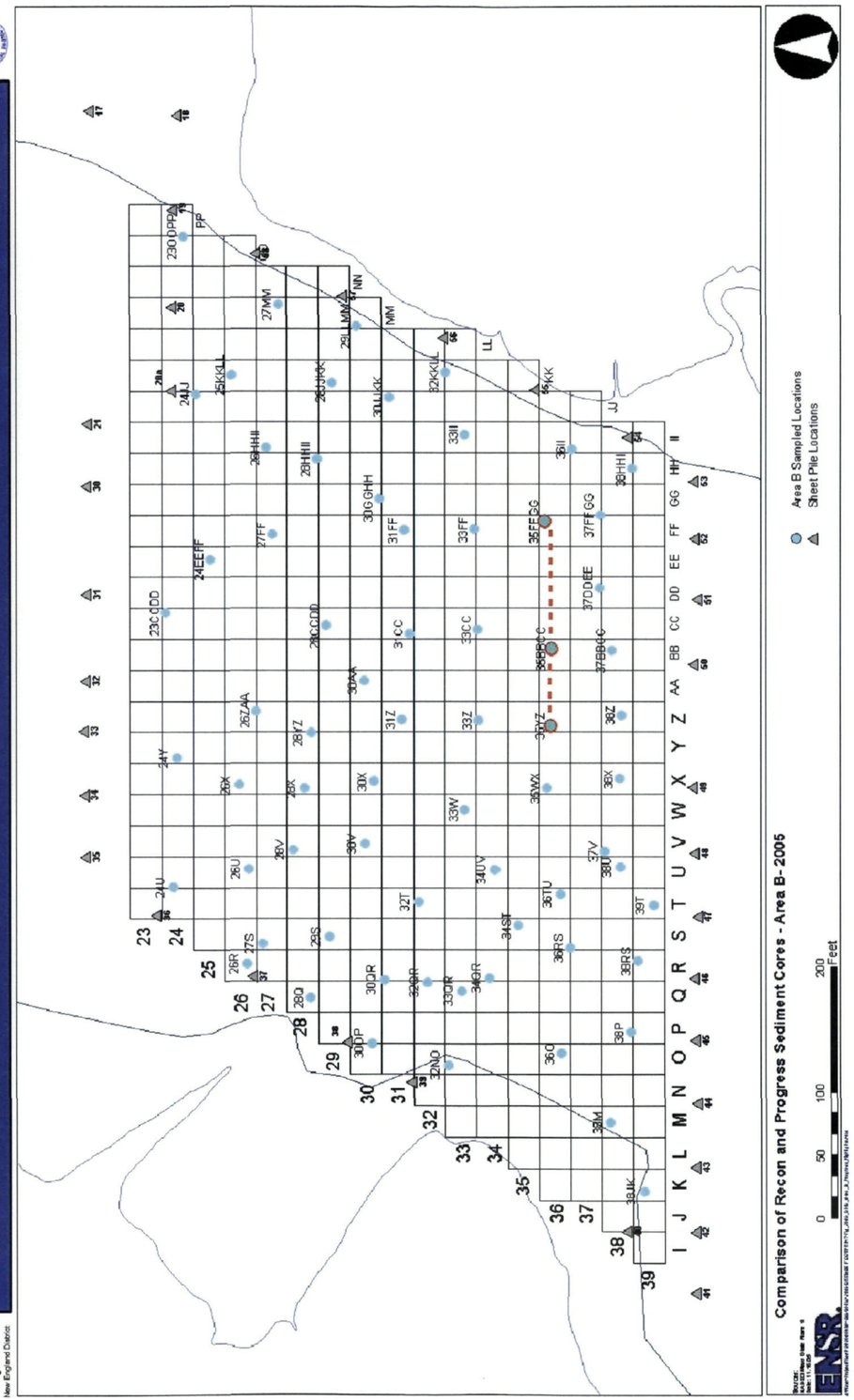
FIGURE 20

ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005

NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350



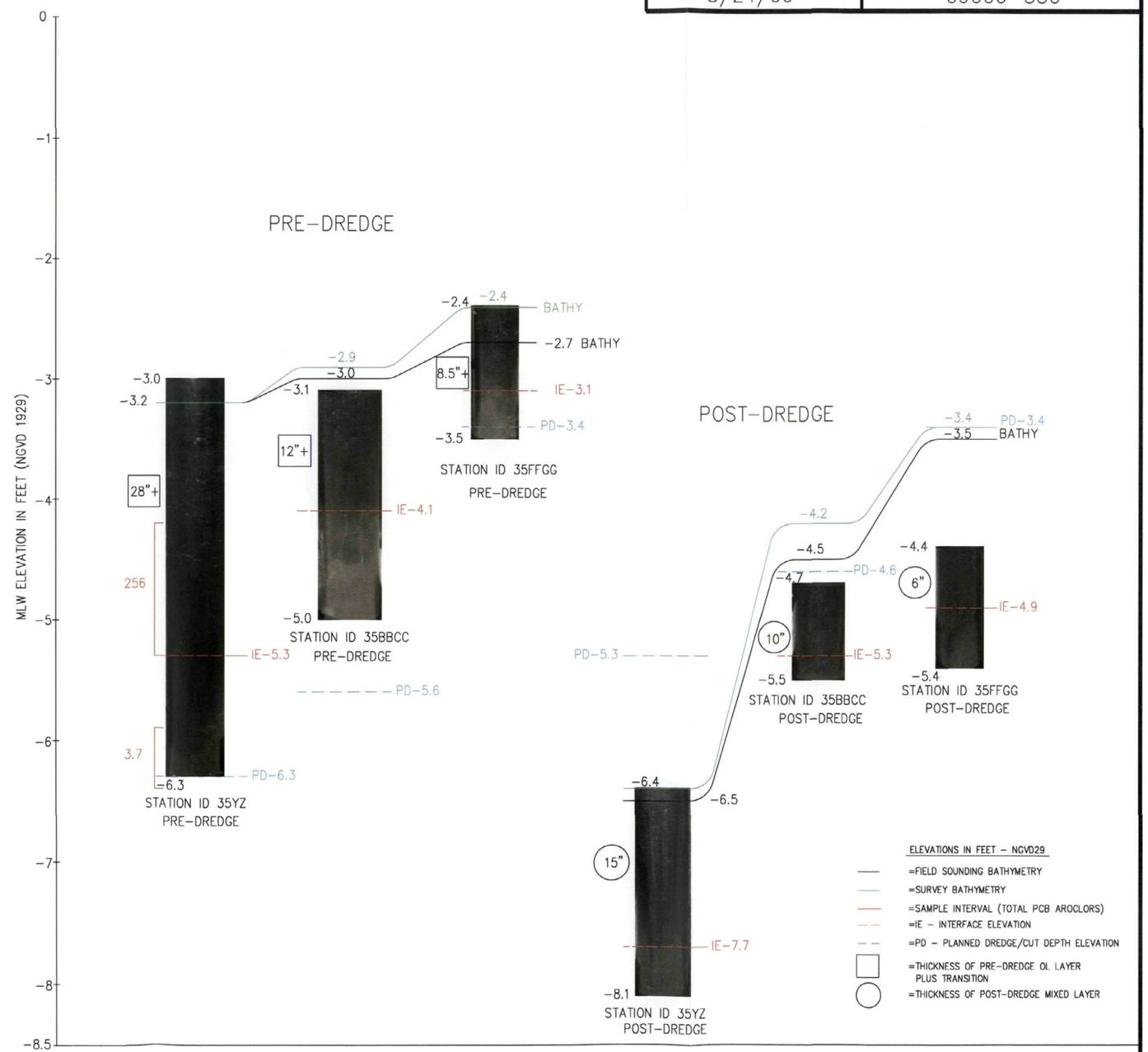


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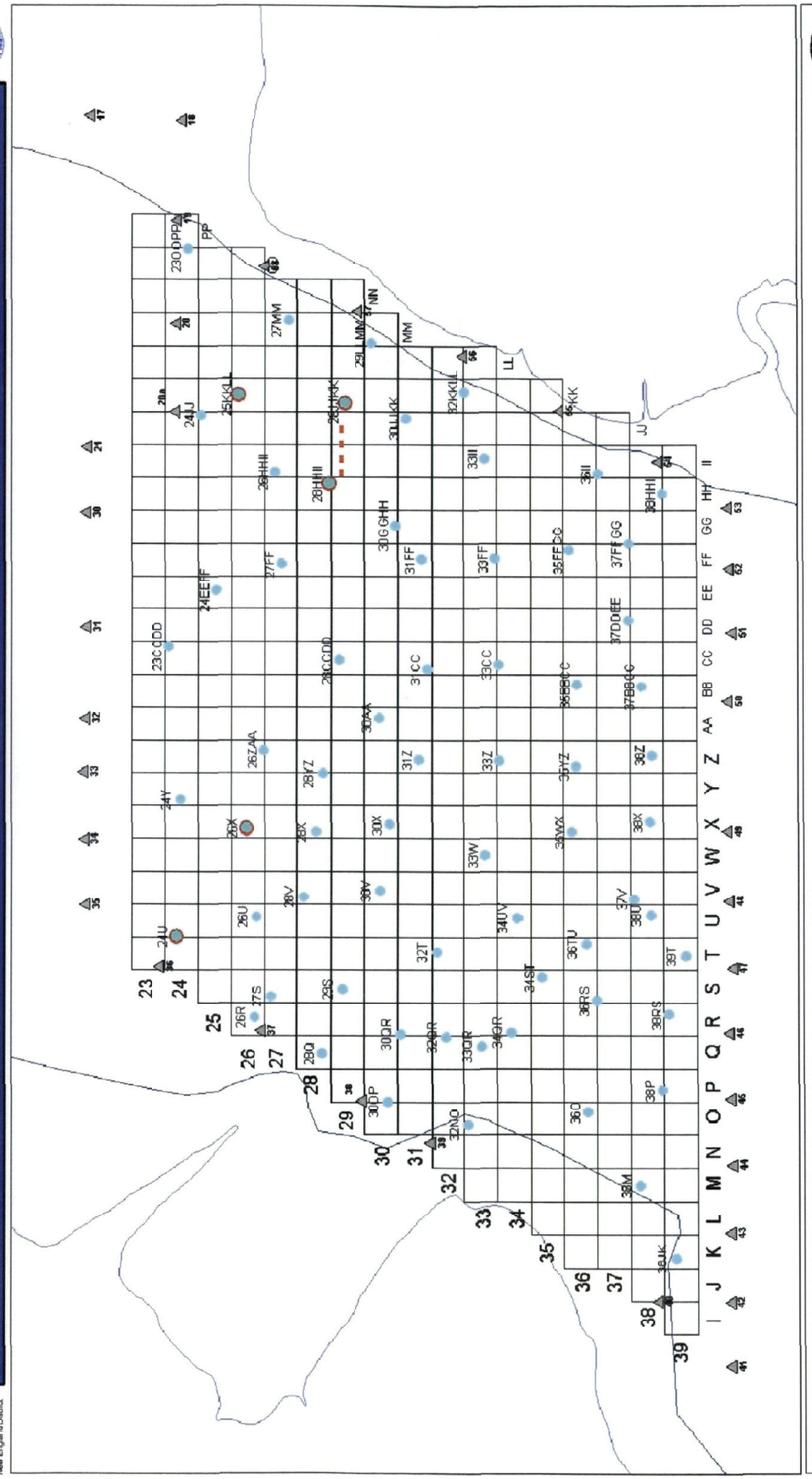
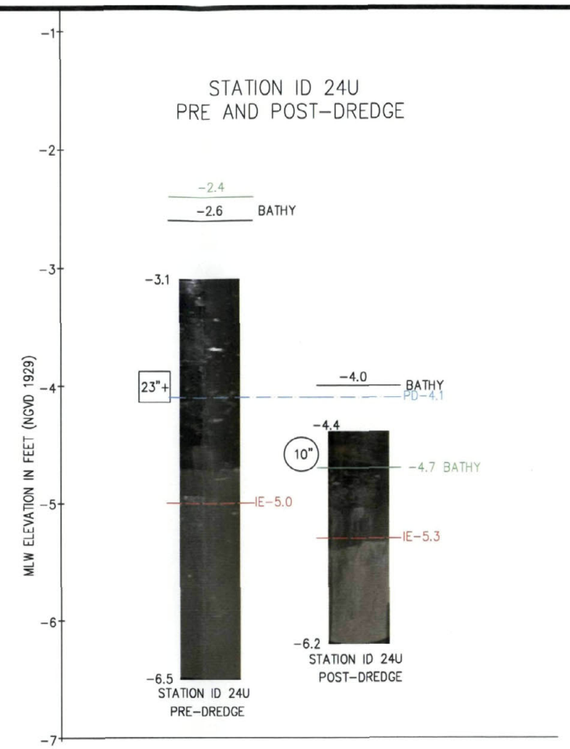
FIGURE 21

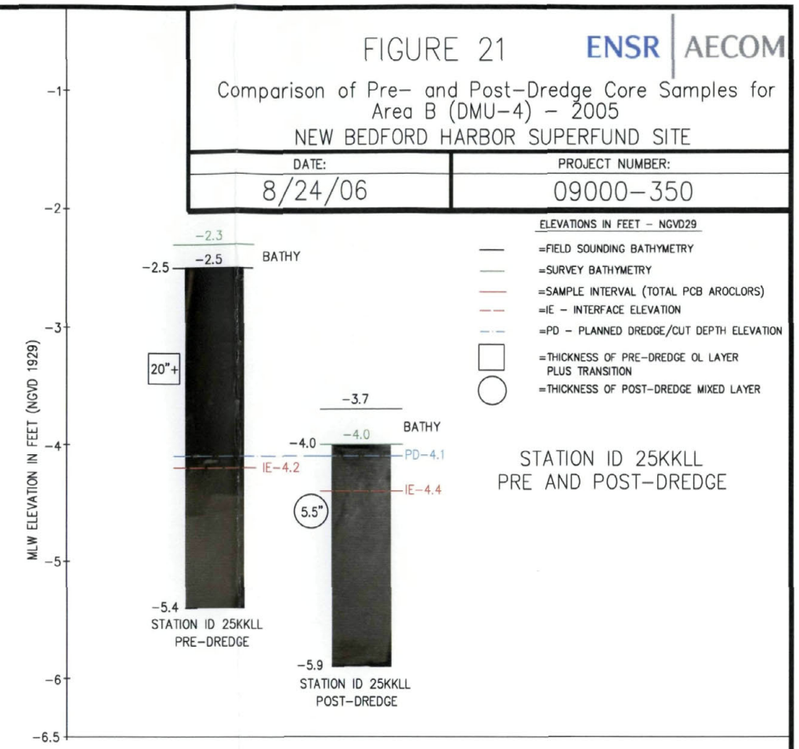
ENSR | AECOM

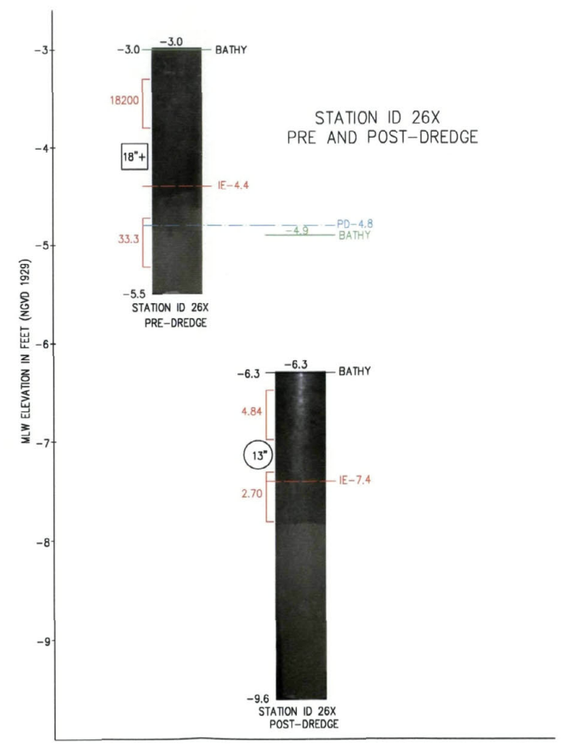
Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005
NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350









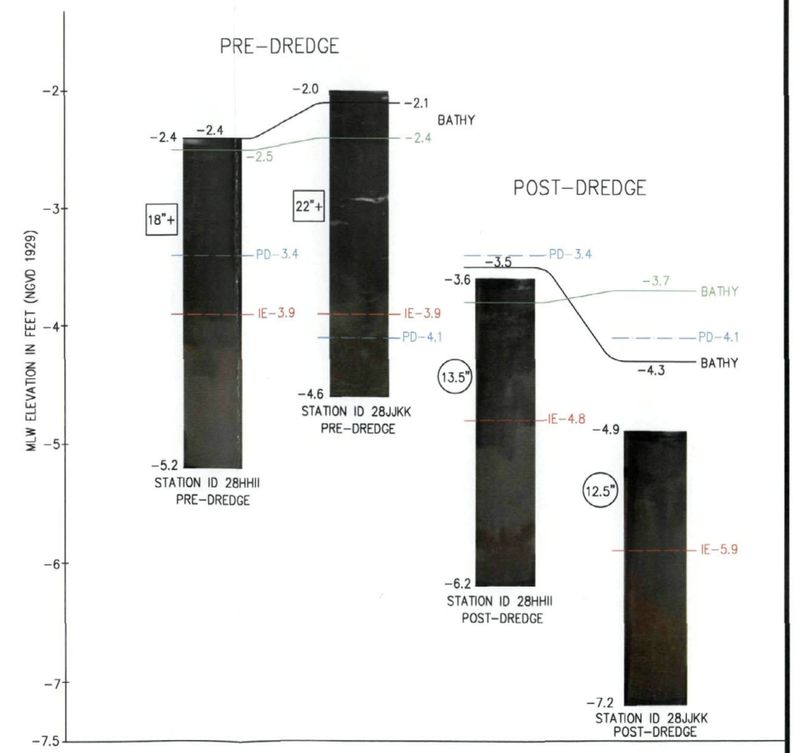


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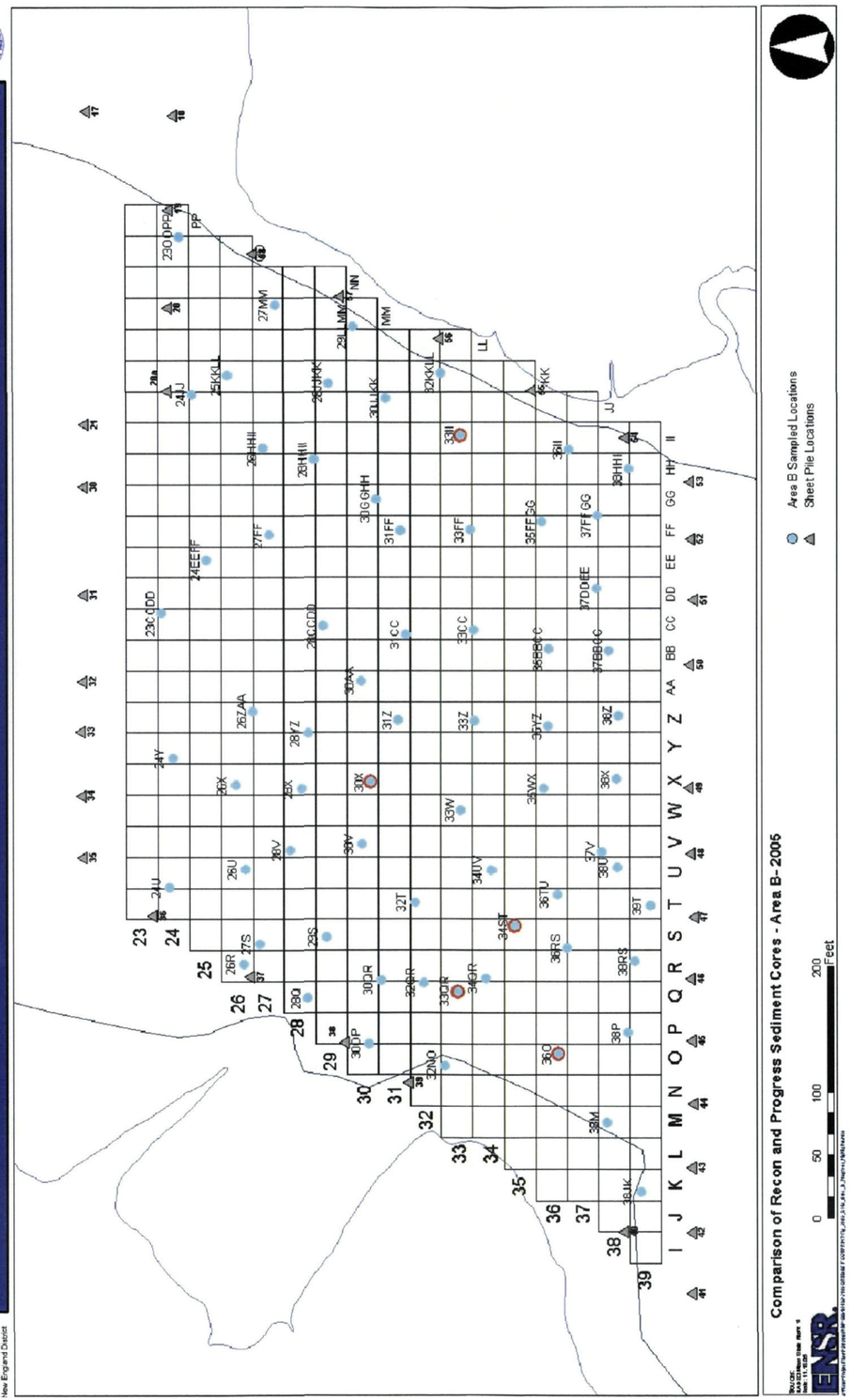
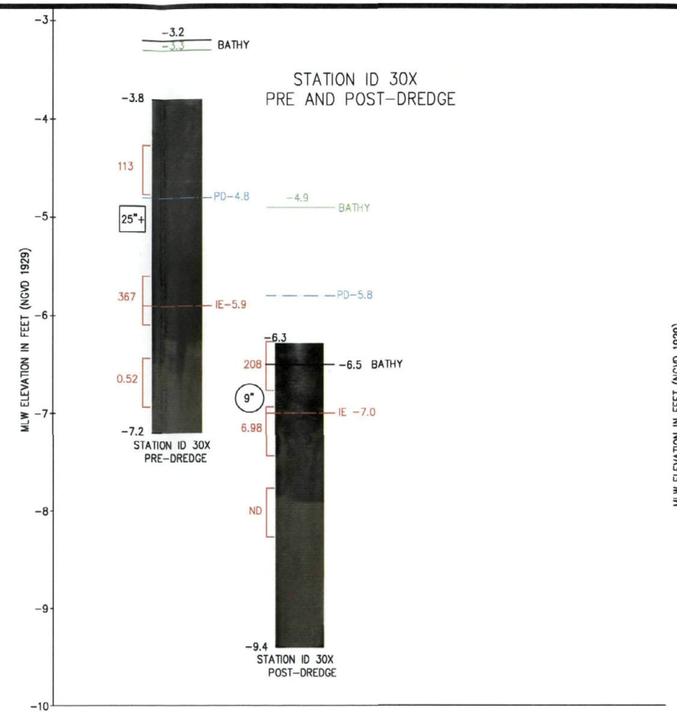
FIGURE 22

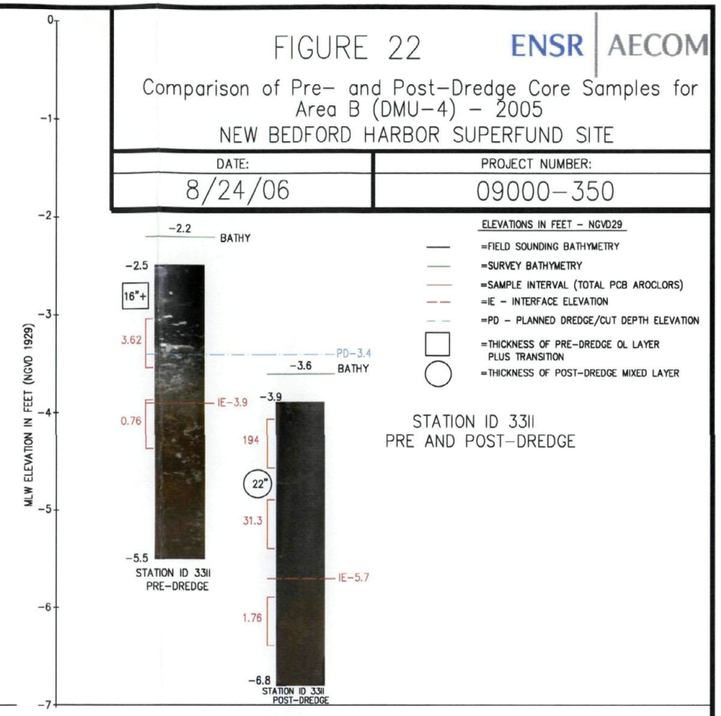
ENSR | AECOM

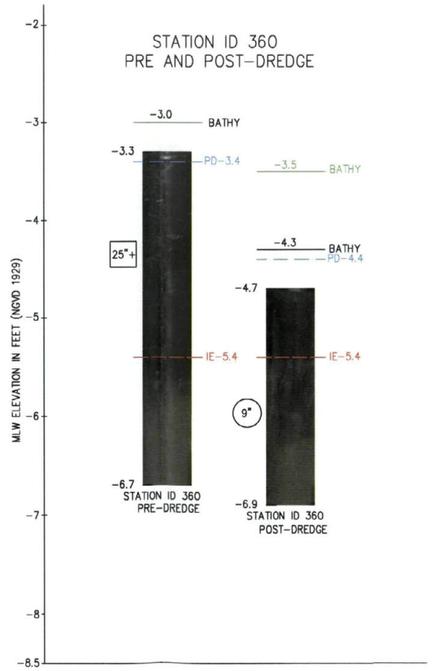
Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005
NEW BEDFORD HARBOR SUPERFUND SITE

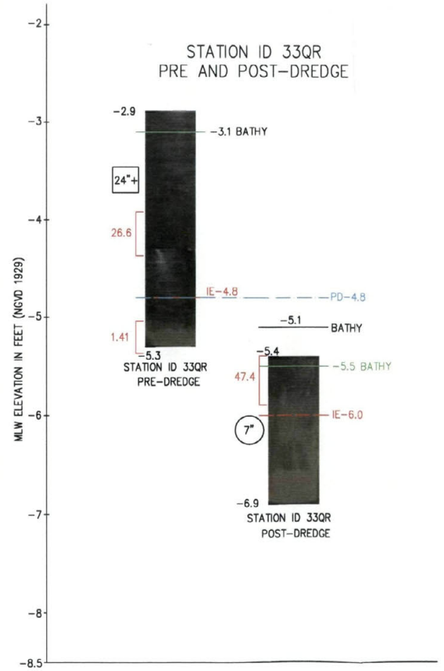
DATE:	PROJECT NUMBER:
8/24/06	09000-350











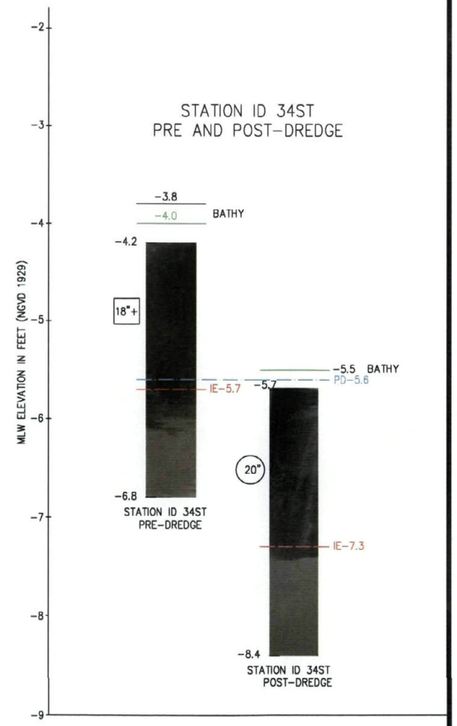


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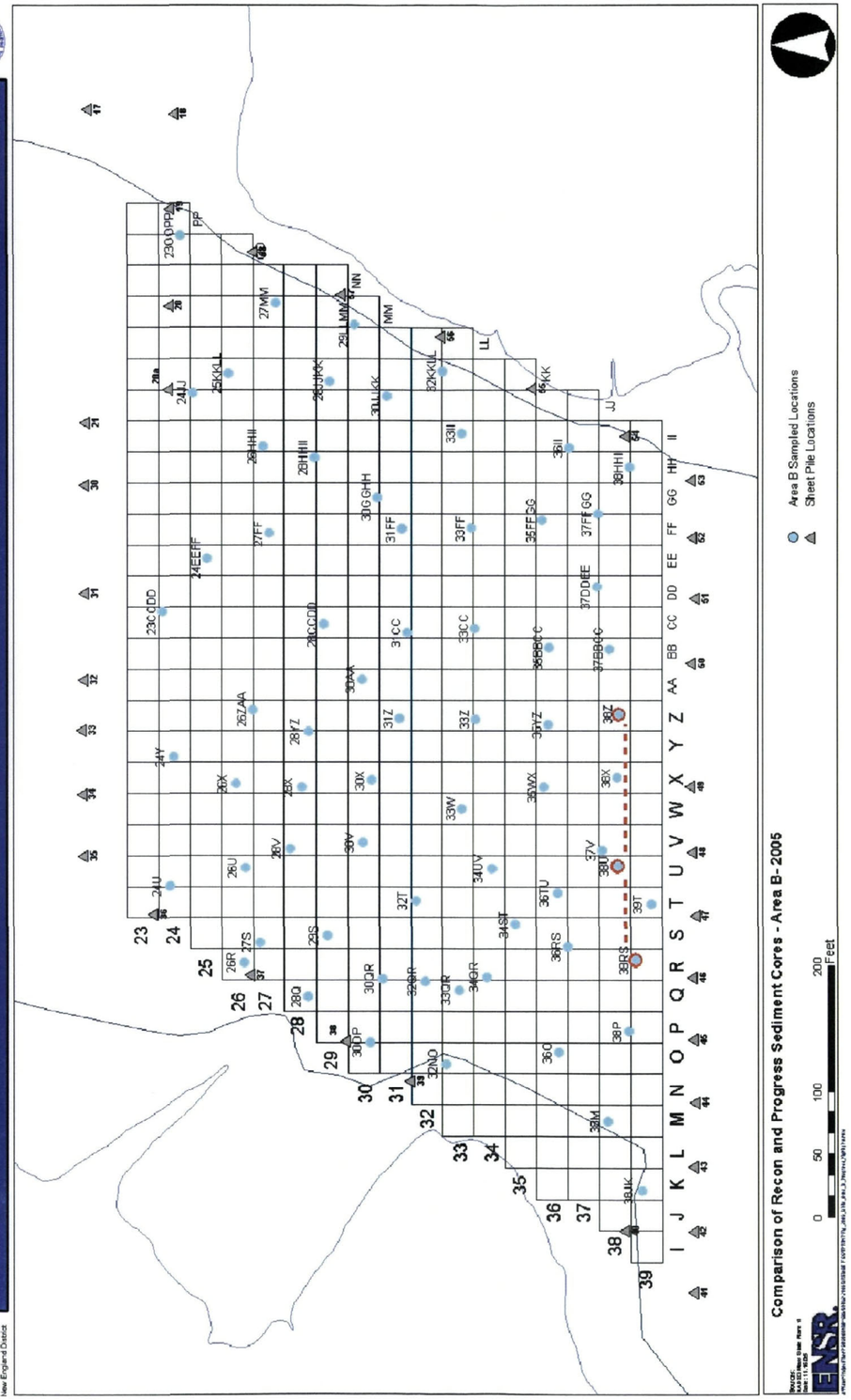
FIGURE 23

ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005

NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350



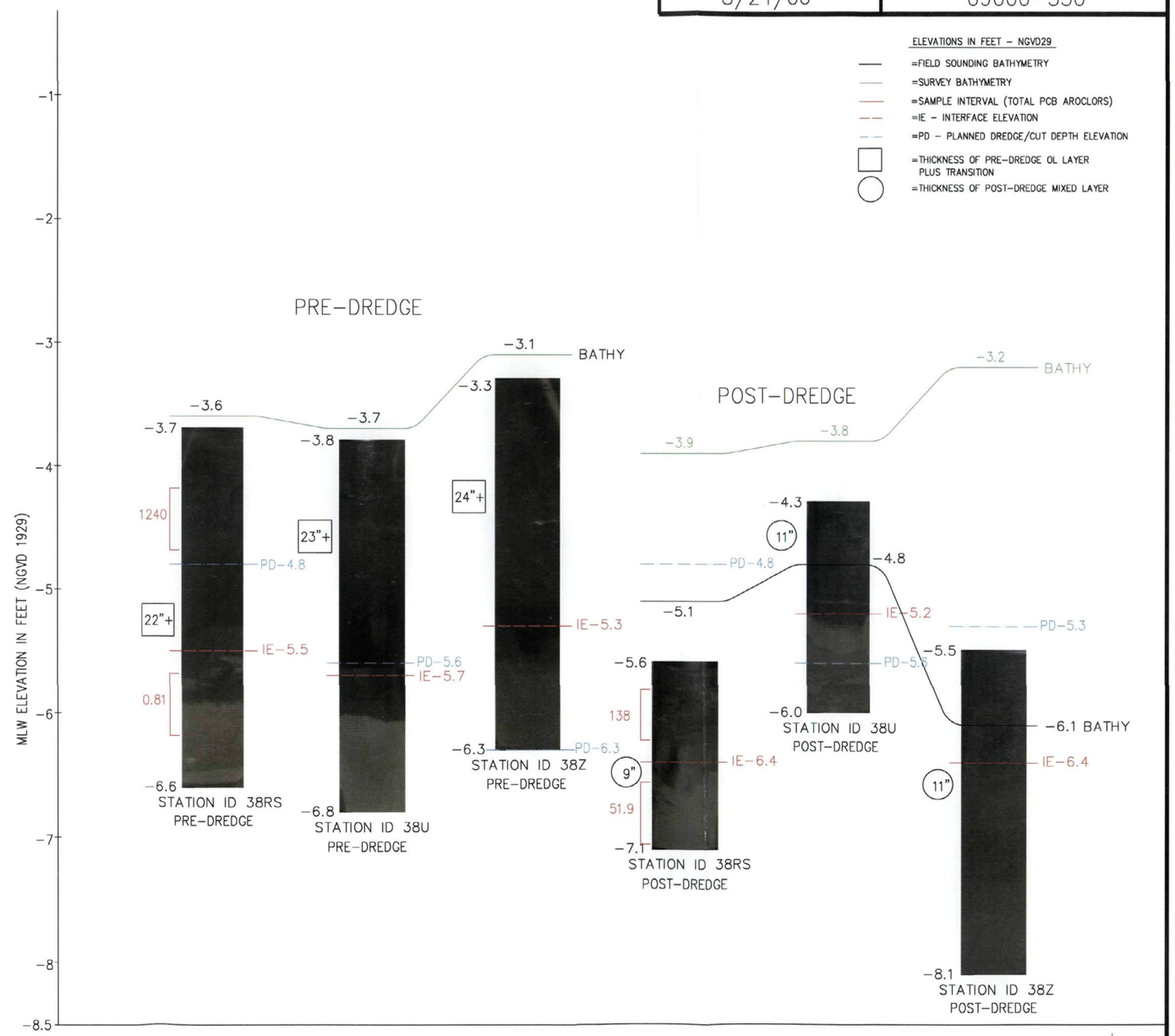


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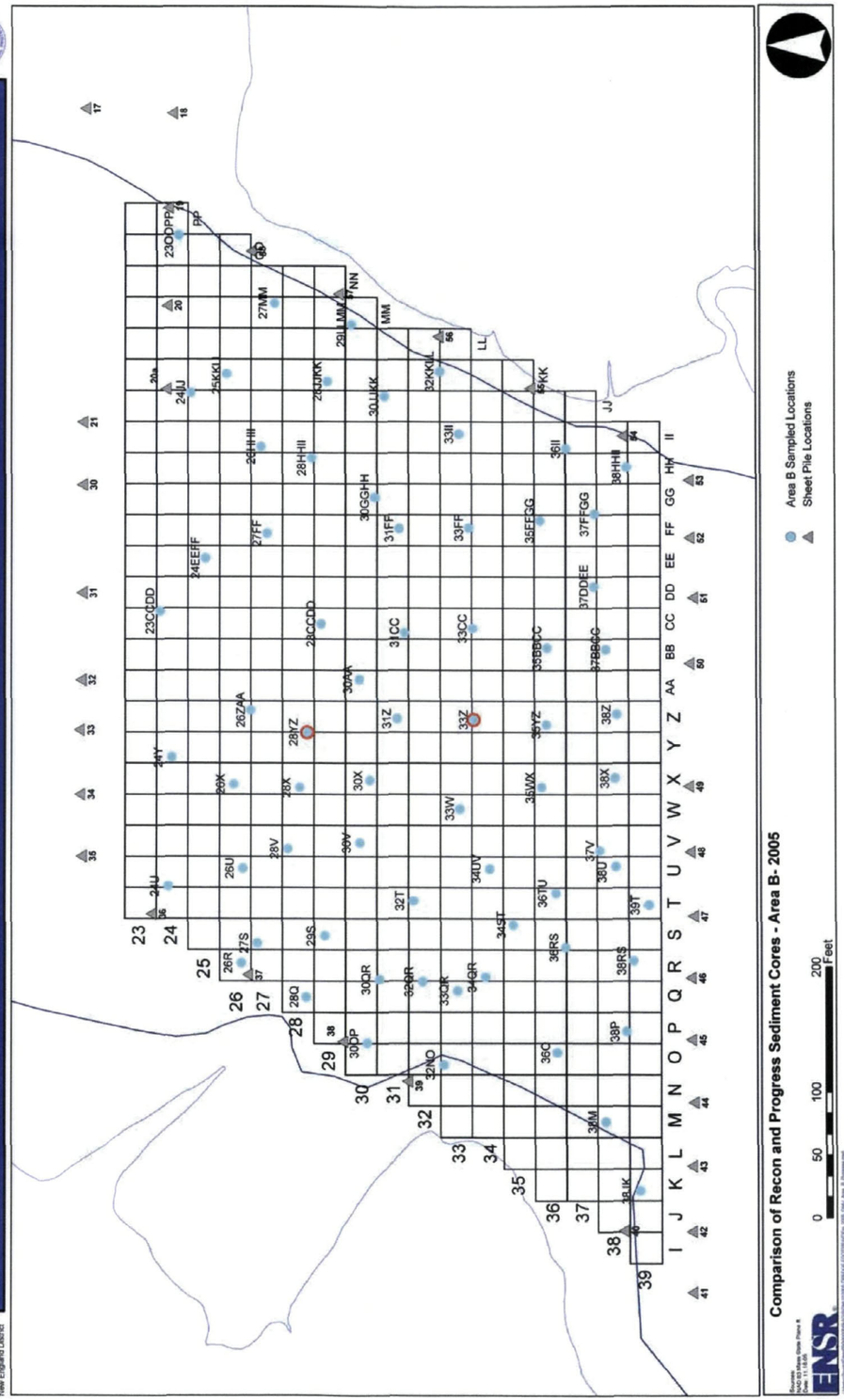
FIGURE 24

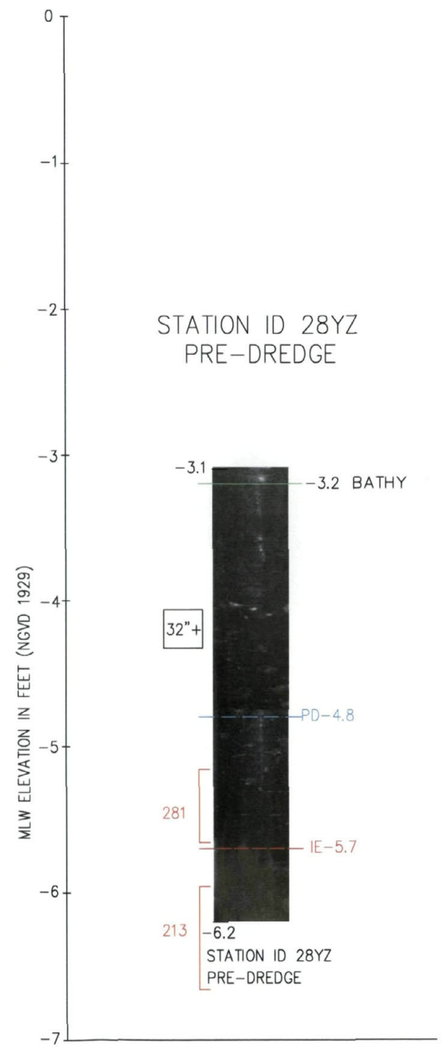
ENSR | AECOM

Comparison of Pre- and Post-Dredge Core Samples for Area B (DMU-4) – 2005

NEW BEDFORD HARBOR SUPERFUND SITE

DATE:	PROJECT NUMBER:
8/24/06	09000-350





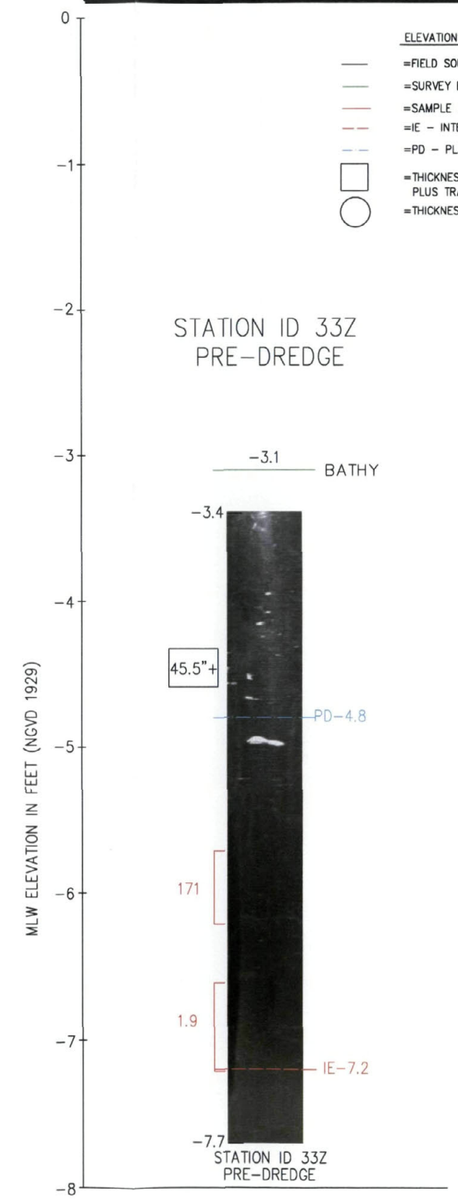


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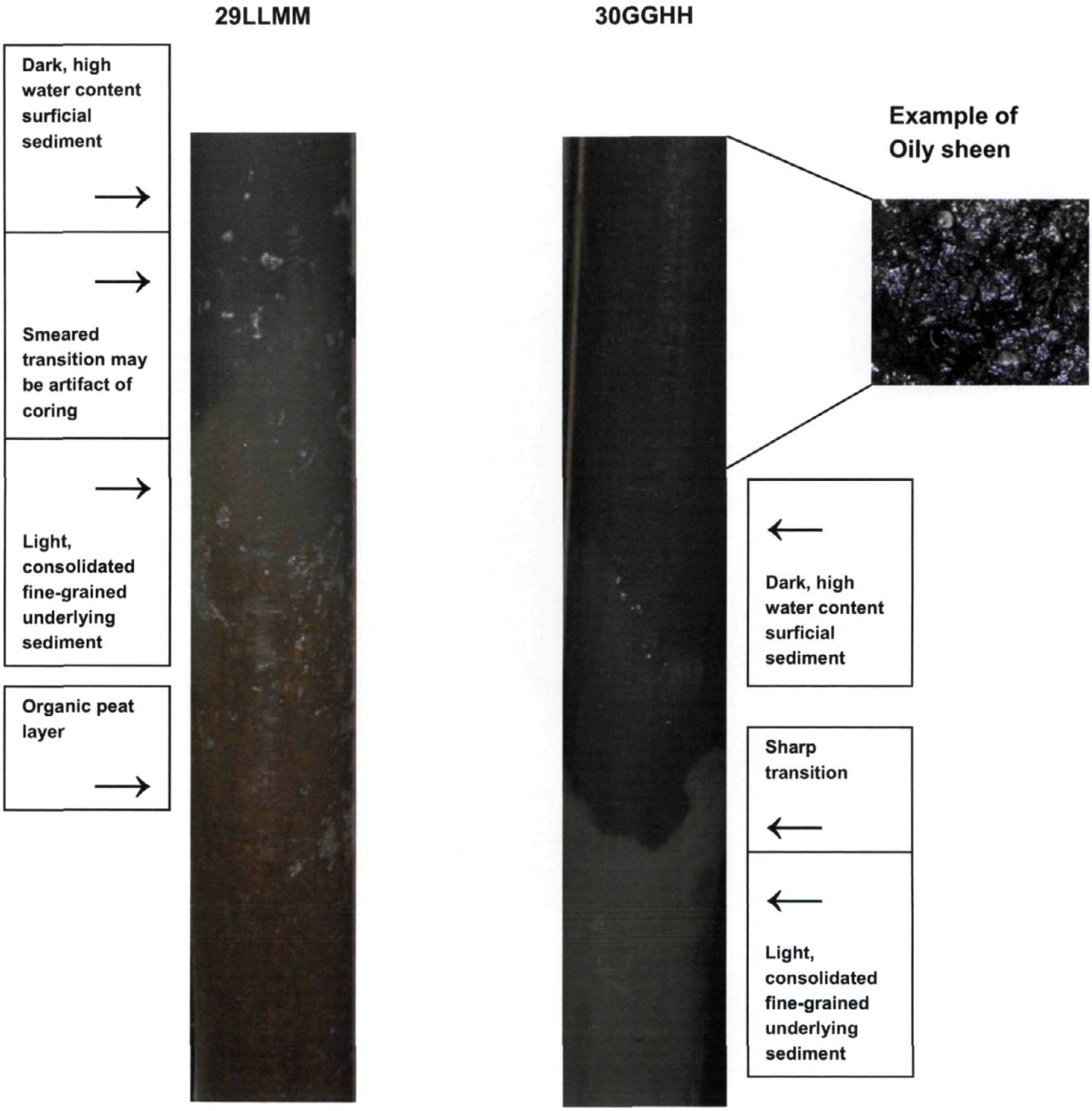
FIGURE 25
Examples of Sediment Types Observed in 2005 Core Samples



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New Bedford Harbor Superfund Site

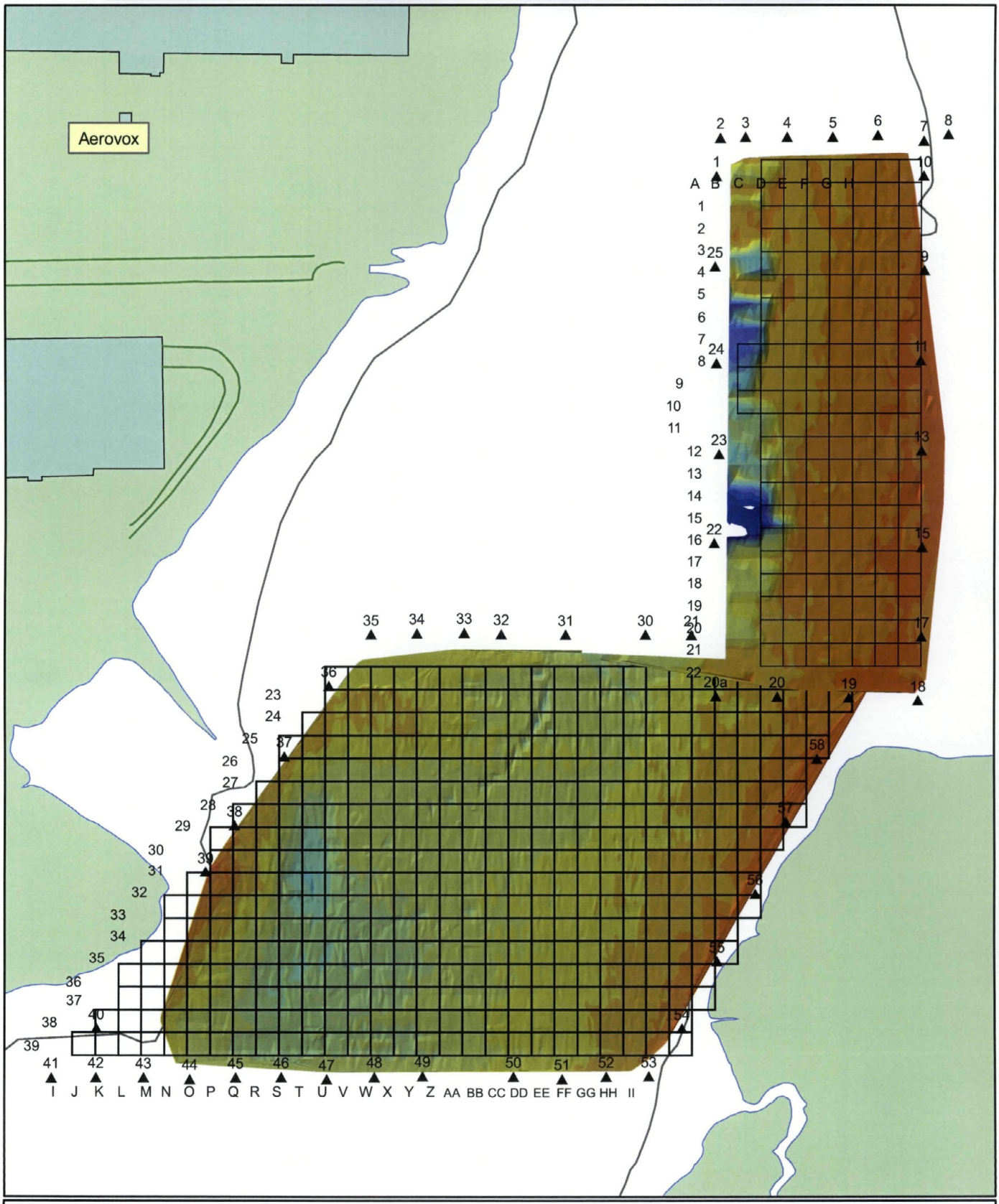

Figure 26 - Pre-Dredge Bathymetry Survey Data

Sources:
NAD 83 Mass State Plane ft
Date: 16 August 2006

-DMU-2 (Area A) bathymetry from 09/06/05
-DMU-4 (Area B) bathymetry from 09/24/05 & 10/01/05

ENSR | AECOM

0 100 200 400 Feet

Elevation (ft)

- -1.0 - -0.5
- -1.5 - -1.0
- -2.0 - -1.5
- -2.5 - -2.0
- -3.0 - -2.5
- -3.5 - -3.0
- -4.0 - -3.5
- -4.5 - -4.0
- -5.0 - -4.5
- -5.5 - -5.0
- -6.0 - -5.5
- -6.5 - -6.0
- -7.2 - -6.5
- ▲ 2005 Sheet Pile Locations

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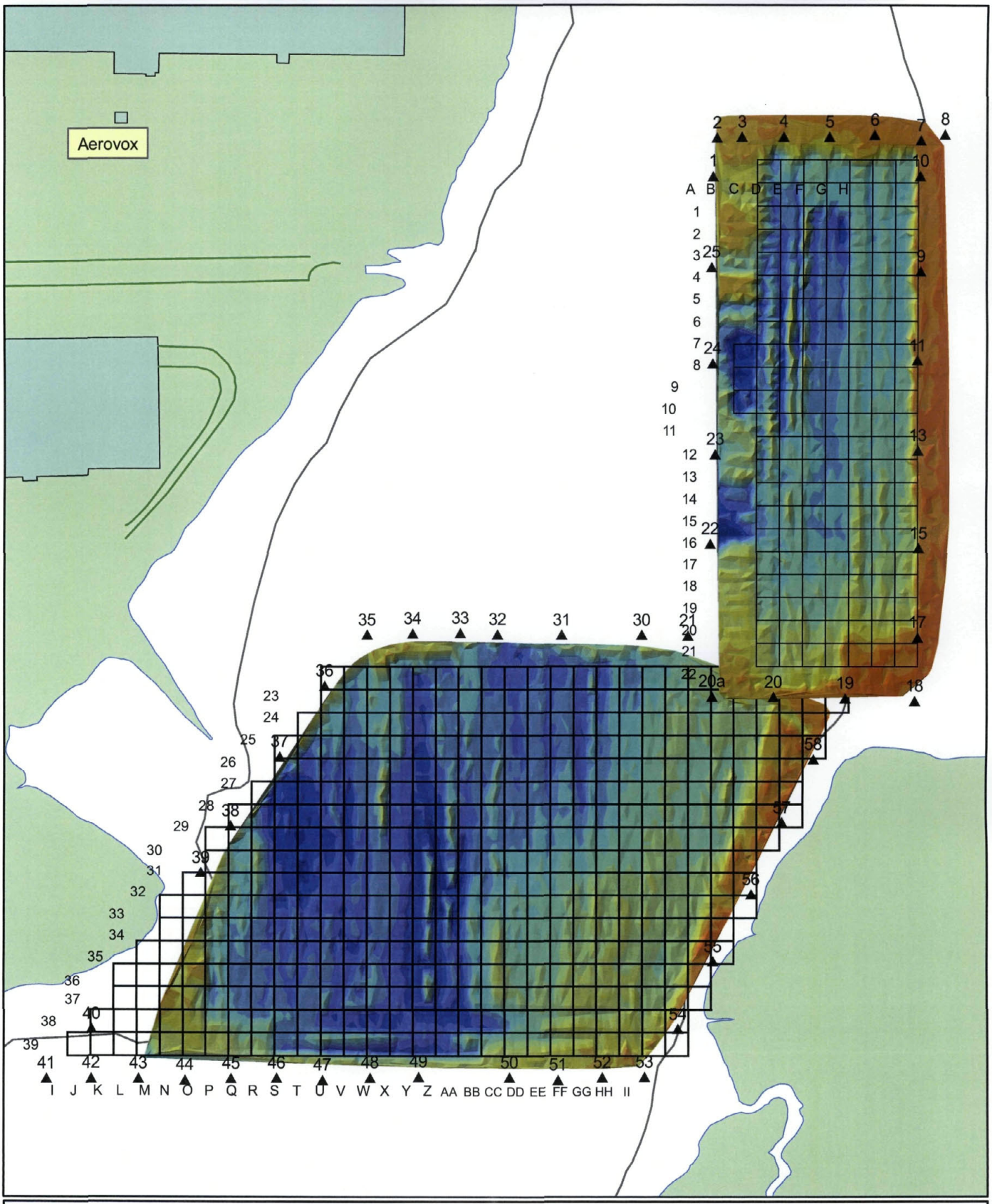

Figure 27 - Post-Dredge Bathymetry Survey Data

Sources:
NAD 83 Mass State Plane ft
Date: 16 August 2006

-DMU-2 (Area A) bathymetry from 12/08/05
-DMU-4 (Area B) bathymetry from 11/23/05

ENSR | AECOM

0 100 200 400 Feet

Elevation (ft)

- -1.0 - -0.5
- -1.5 - -1.0
- -2.0 - -1.5
- -2.5 - -2.0
- -3.0 - -2.5
- -3.5 - -3.0
- -4.0 - -3.5
- -4.5 - -4.0
- -5.0 - -4.5
- -5.5 - -5.0
- -6.0 - -5.5
- -6.5 - -6.0
- -7.2 - -6.5
- ▲ 2005 Sheet Pile Locations

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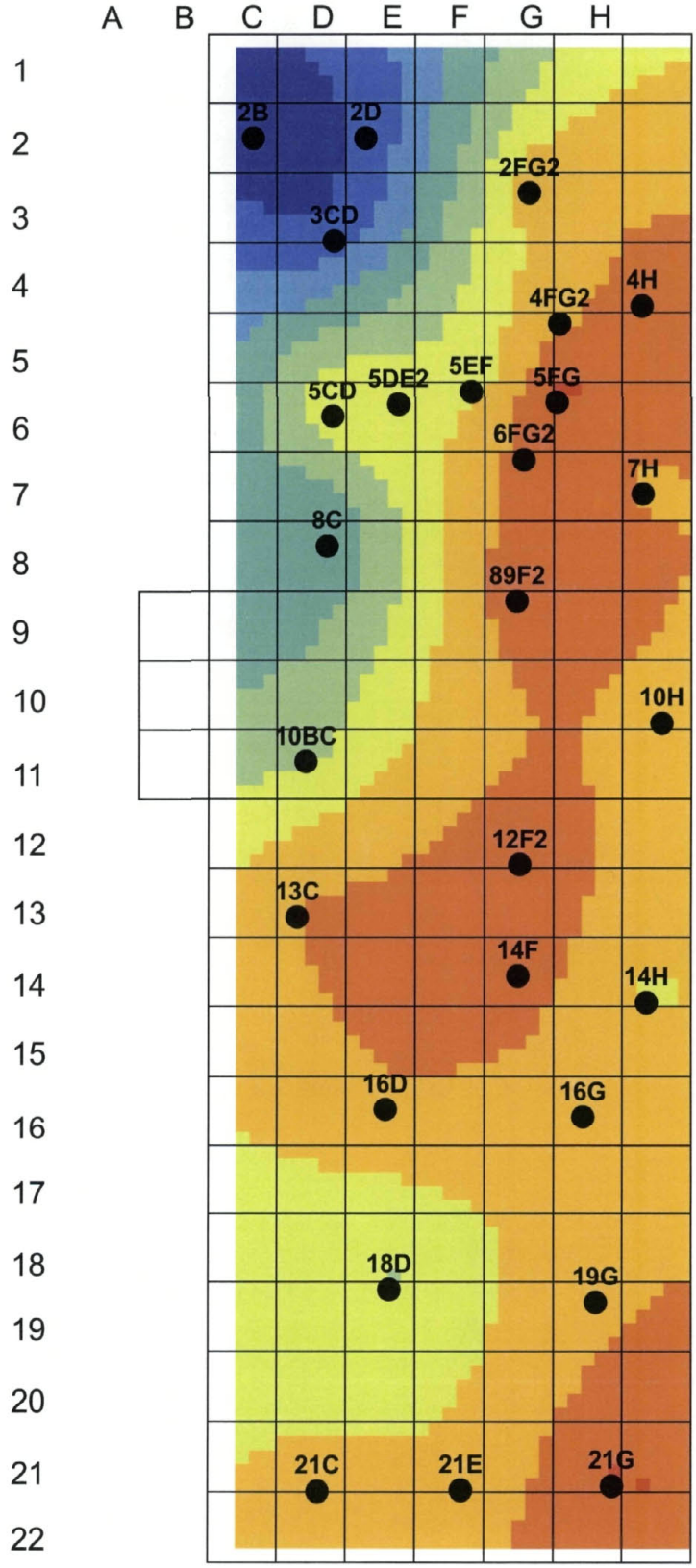

Figure 28. Measured Interface Elevation for Pre-Dredge Core Samples Collected from Area A

Sources:
NAD 83 Mass State Plane ft
Date: 16 August 2006

ENSR | AECOM

0 50 100 Feet

OH Interface Elevation(ft)

-7.5--7.0 | -6.0--5.5 | -4.5--4.0
-7.0--6.5 | -5.5--5.0 | -4.0--3.5
-6.5--6.0 | -5.0--4.5 | -3.5--3.0

Area A Sample Locations

Note - Elevations in Feet - NGVD

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U.S. Army Corps of Engineers
New Bedford Harbor Superfund Project

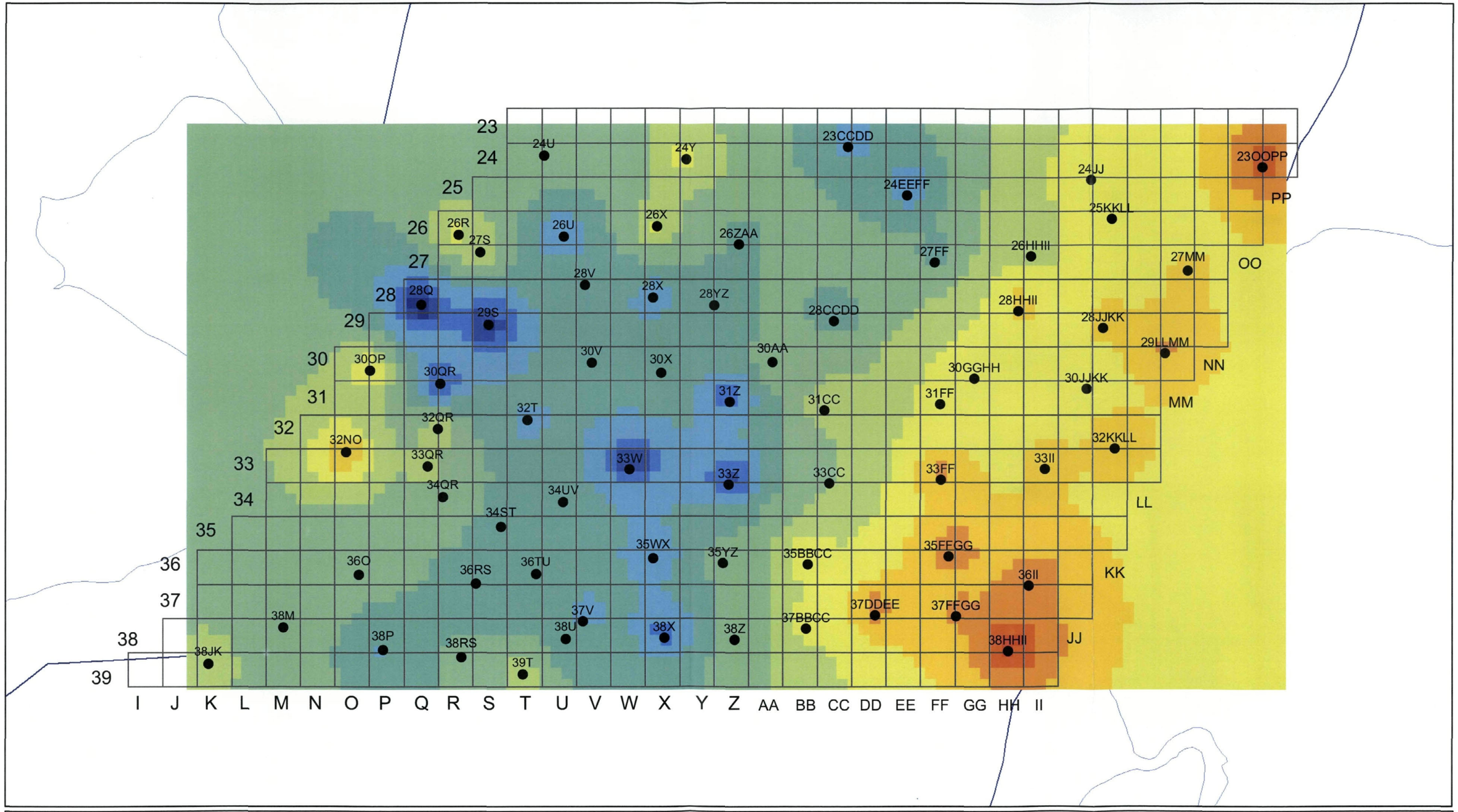

Figure 29 - Measured Interface Elevation for Pre-Dredge Core Samples Collected from Area-B

ENSR | AECOM

Sources:
NAD 83 Mass State Plane ft
Date: 15 August 2006

0 50 100 Feet

OH Interface Elevation (ft)

-8.0 - -7.5	-6.5 - -6.0	-5.0 - -4.5	-3.5 - -3.0
-7.5 - -7.0	-6.0 - -5.5	-4.5 - -4.0	-3.0 - -2.5
-7.0 - -6.5	-5.5 - -5.0	-4.0 - -3.5	-2.5 - -2.0

● Area B Sampled Locations

Notes:
Positive value indicates the measured interface is higher than the predicted elevation

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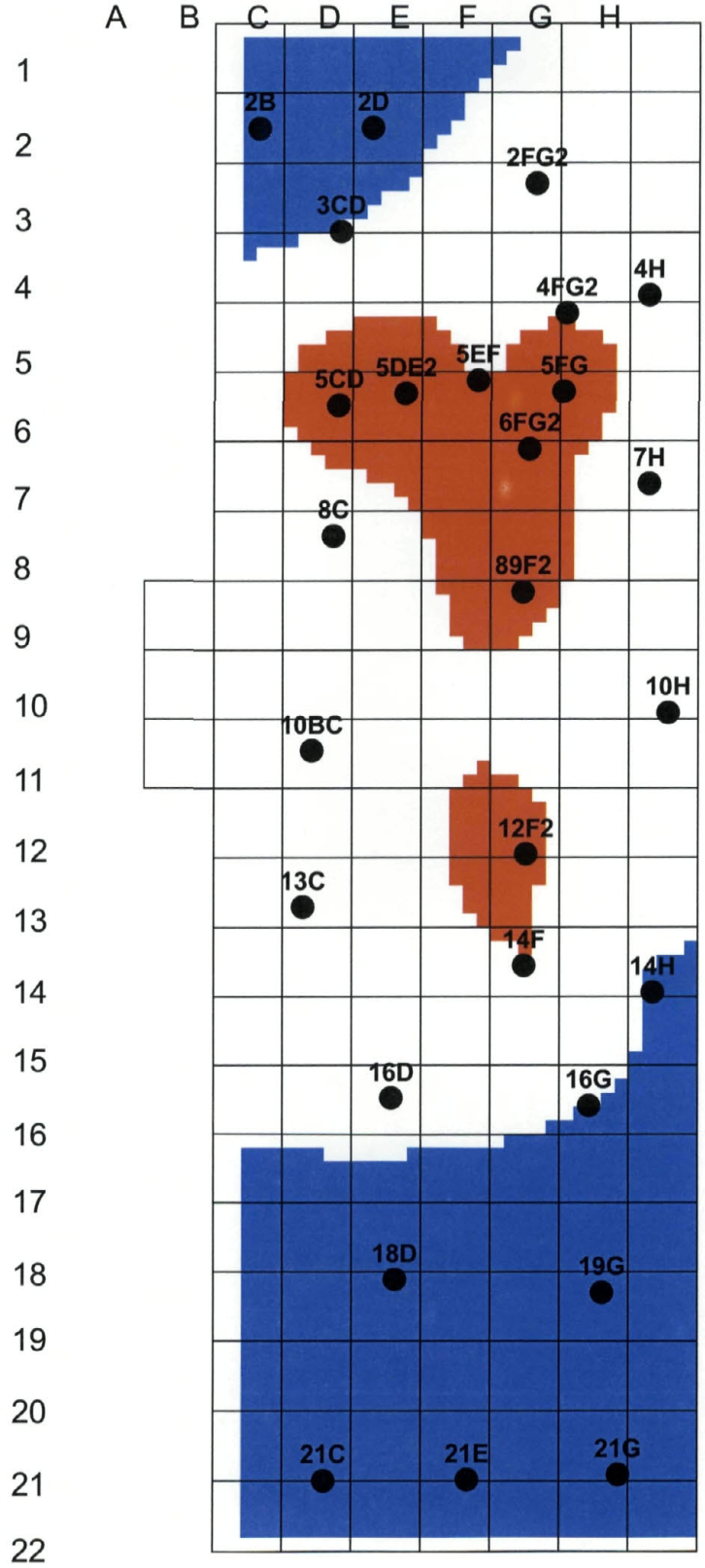

Figure 30. Differential between Measured Interface Elevation and Planned Cut Elevation for Pre-Dredge Core Samples Collected from Area A

Sources:
NAD 83 Mass State Plane ft
Date: 15 August 2006

ENSR | AECOM

0 50 100 Feet

Offset from Planned Cut Elevation (ft)
< -0.75
-0.74 - +0.74
> +0.75

Area A Sample Locations

Note - Elevations in Feet - NGVD

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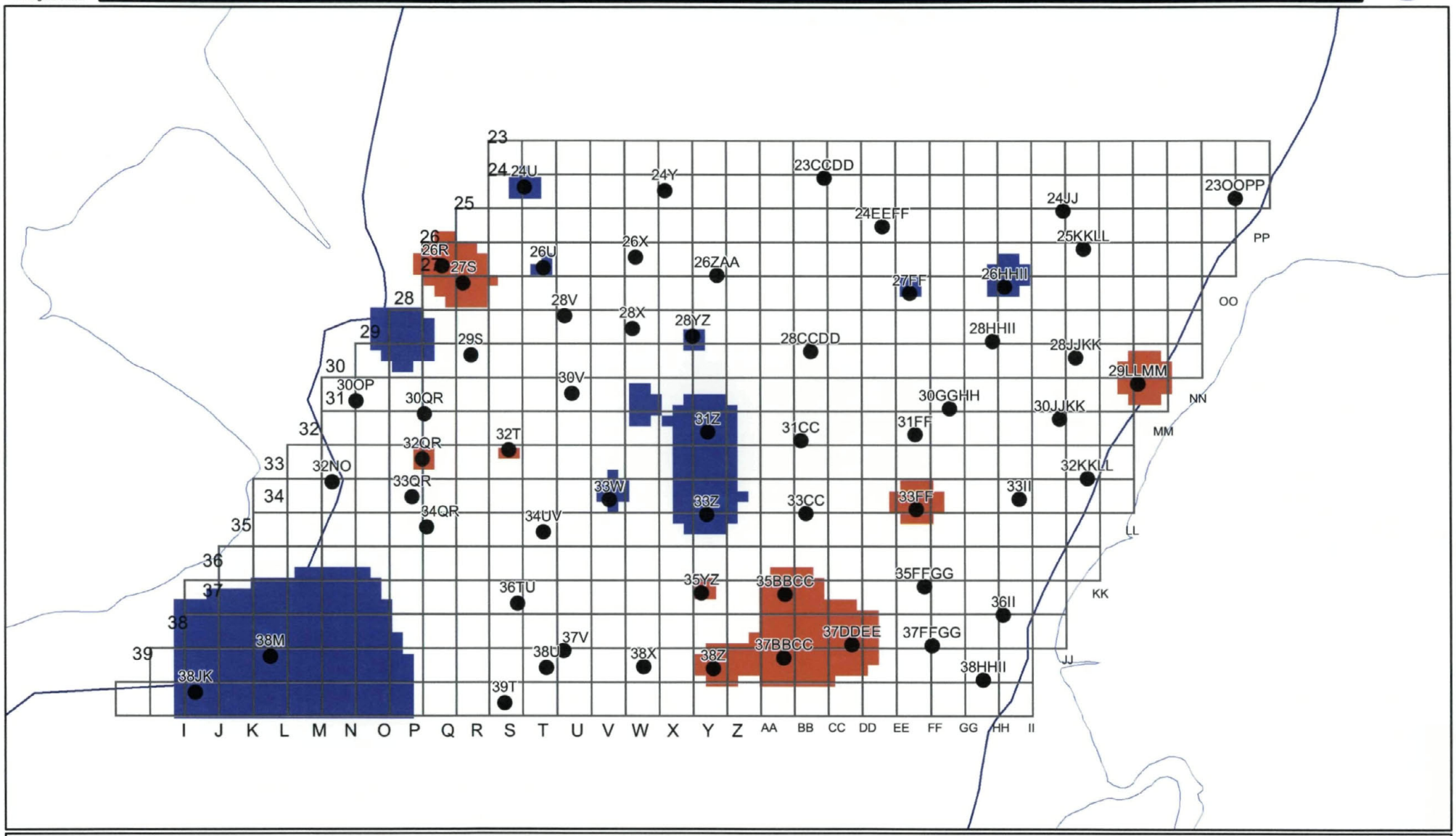

Figure 31 - Differential between Measured Interface Elevation and Planned Cut Depth Elevation for Pre-Dredge Core Samples Collected from Area-B

Sources:
NAD 83 Mass State Plane ft
Date: 16 August 2006

ENSR | AECOM

0 50 100 200 Feet

Offset of planned cut elevation (ft)

- < -0.75
- -0.74 - +0.74
- > +0.75

● Area B Sampled Locations

Notes:
Positive value indicates the measured interface is higher than the predicted elevation

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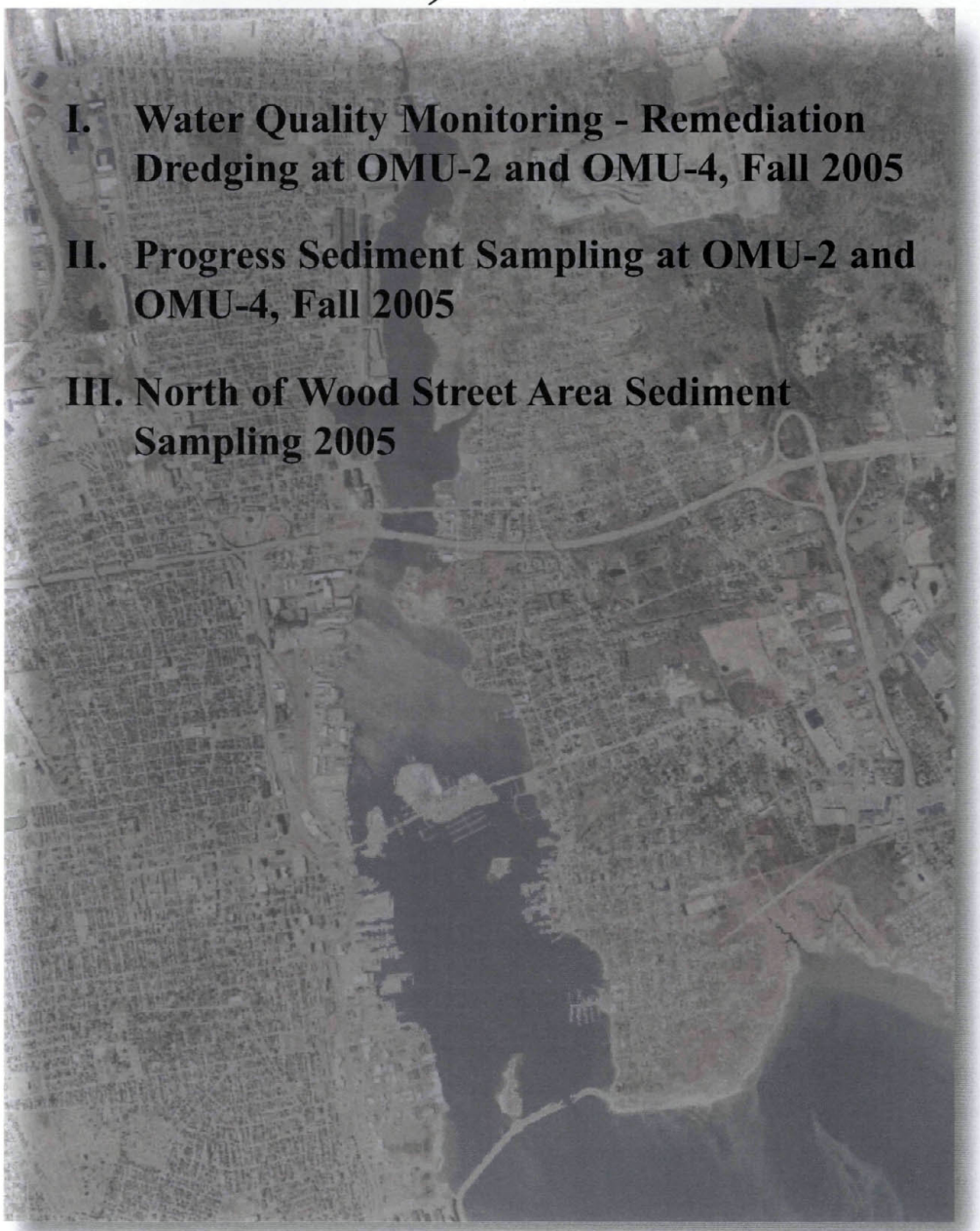
New England District

U.S. Environmental Protection Agency

Water Quality Monitoring and Sediment Sampling Summary Reports 2005

New Bedford Harbor Superfund Site - New Bedford, Massachusetts



I. Water Quality Monitoring - Remediation Dredging at OMU-2 and OMU-4, Fall 2005

II. Progress Sediment Sampling at OMU-2 and OMU-4, Fall 2005

III. North of Wood Street Area Sediment Sampling 2005

Prepared by:

ENSR | AECOM

ENSR Corporation

CR ENVIRONMENTAL, INC. WBE

CR Environmental

Contract:
DACW33-00-D-0003
Task Order 0012
ENSR Document No.
09000-350-730

CV06005.indd

Water Quality
Fall 2005

US Army Corps of Engineers®
New England District

U.S. Environmental Protection Agency

Water Quality Monitoring Summary Report

Fall 2005 Remediation Dredging

New Bedford Harbor Superfund Site – New Bedford Massachusetts

Prepared by:

ENSR | AECOM

CR ENVIRONMENTAL, INC. WBE

Contract
DACW33-00-D-0003
Task Order 12
Document No.
09000-350-1340

Final August 2006

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Figure 4. Analytical Protocol Decision Sequence

Figure 5. Dredging and Continuous Monitoring Timeline in New Bedford Harbor During the 2005 Dredge Program

Figure 6. Location of Dredge Management Unit 2 and Dredge Management Unit 4 with Environmental Compliance Boundaries

Figure 7. Continuous Recording Water Quality Meter Locations

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Figure 9. Dredge Grid System of DMU-2 and DMU-4

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Figure 11. Turbidity Monitoring at Station CM C Baseline 8/18/05 – 08/23/05

Figure 12. Turbidity Monitoring at Station CM D 11/14/05 – 11/18/05

Figure 13. Turbidity Monitoring at Station CM E 11/14/05 – 11/18/05

Figure 14. Fall 2005 Oil Sheen Sample Locations and Results

EXECUTIVE SUMMARY

Remediation dredging was performed within Dredge Management Units (DMU) 2, 3, 4, and 5 of the New Bedford Harbor Superfund Site from September through November 2005. The eastern portion of DMU-2, left open during the 2004 dredge program to allow anadromous fish passage through the Acushnet River estuary, was dredged during the early stages of the 2005 program with removal of approximately 8,660 cubic yards of contaminated sediments. Approximately 15,470 cubic yards were removed from DMU-4 and limited portions of DMU-3 and DMU-5, making for a total of approximately 24,130 cubic yards of contaminated sediments removed during the 2005 dredging. Similar to the 2004 work, the dredging was performed using auger-equipped hydraulic dredges, with the dredged material pumped to shore-side facilities for desanding, dewatering, and preparation for offsite disposal. Because of elevated PCB concentrations in the dredged sediments (>1,000 mg/kg), special material handling was required for the work as well as the performance of a water quality monitoring program.

The water quality monitoring program was developed by the USEPA and the USACE to help ensure that the dredging and support activities were carried out in a manner that did not result in: 1) acute impacts to organisms within the water column outside of the dredge area; 2) significant transport of contaminated sediments or floating sheens outside of the work zone to clean or previously remediated areas; or 3) blockage of the water way to anadromous fish passage. The monitoring included measurement of water column turbidity in real-time using meters on monitoring vessels and using deployed recording meters in and around the dredging work area and visual observation for fish passage.

Similar to previous in-water work within the New Bedford Harbor Superfund Site, an upper level turbidity criterion of 50 NTUs (Nephelometric Turbidity Unit) above background was set for the project at two down current compliance transects. A warning level was set at 300 feet down current of dredging operations (triggering sampling and evaluation of work operations if exceeded) and a project criterion was set at 600 feet down current (triggering additional sampling and operation shutdown if exceeded). Toxicity testing of water samples was the primary analytical tool for evaluating impacts to the water column. The 2005 monitoring program also featured deployment of sediment traps to support characterization of potential sediment transport and oil sheen monitoring to evaluate the potential for contaminants to be transported outside the work zone via surface sheens.

The 2005 dredging removed nearly double the amount of contaminated sediment as compared to 2004. As the work was performed without the use of partial depth silt curtains, as used in 2004, there were no apparent restrictions to fish passage. A number of large schools of baitfish (believed to be herring), along with predatory fish (believed to be bluefish and/or striped bass) were seen in

the area throughout much of the dredging period. Given the higher production rate and lack of curtains, turbidity levels were higher on average in 2005 within and immediately down current of the work zone as compared to 2004, and the sediment trap data indicated accelerated deposition within the work area. There were five exceedences of the turbidity warning level during the 2005 season (50 NTU above background at 300 feet down current of operations) and one exceedence of the project turbidity criterion (50 NTU above background at 600 feet down current of operations). The exceedences corresponded to work in shallow water depths, particularly where equipment was moved through the water column. In all cases, turbidity levels dropped quickly with cessation of the activity. Toxicity testing revealed that there were only limited sub-lethal effects associated with the elevated turbidity levels, and that the 50 NTU criterion was ecologically protective.

Oil sheens on the water surface were noted on most monitoring days, not unexpected given that the 2005 work continued in an area with extremely high PCB concentrations. In some instances, the oil surfaced and formed the sheen beyond the extent of the boom boundary around the work zone. The mass of PCBs estimated within the individual sheens was small (a maximum of approximately 18 g), representing a very small fraction of the PCBs actually being dredged (estimated at 9.5 tons PCBs removed over the 2005 dredge season, Jacobs 2006). All sheens that were noted outside of the boundaries of the boomed area were observed to move with the prevailing currents (ebb or flood tide) and disperse with distance, remaining near the axis of the channel.

1.0 INTRODUCTION

This report summarizes water quality monitoring performed in support of remediation dredging within Dredge Management Units (DMU) 2, 3, 4, and 5 that took place in fall 2005 at the New Bedford Harbor Superfund Site. The objective of the monitoring was to ensure that the remediation was carried out in a manner that minimized impacts to the surrounding waters and transport of contaminated material away from the work area. The report is organized into five sections and five appendices. Background information is provided in Section 1. Details of the methodology for field monitoring and laboratory analyses are presented in Section 2. The monitoring results are presented in Section 3 and discussed in Section 4. Cited references are included in Section 5. The appendices include the project scope of work, additional field and laboratory data records, project photographs and continuous monitoring data. The water quality monitoring was performed by ENSR and its subcontractor, CR Environmental, under USACE contract DACW33-00-D-0003.

1.1 Site Background

New Bedford Harbor is located approximately 50 miles south of Boston on the waters of Buzzards Bay in Bristol County, Massachusetts. The sediments in many areas of the harbor are contaminated with polychlorinated biphenyls (PCBs) and metals, primarily from the manufacture of electrical components which occurred in the area between 1940 and the mid-1970s. Based on human health concerns and ecological risk assessments, the U.S. Environmental Protection Agency (USEPA) added New Bedford Harbor to the National Priorities List in 1983 as a designated Superfund Site. A 1998 Record of Decision stipulated that remedial measures were required to remove PCB-contaminated sediments from the Harbor. Through an Interagency Agreement between the USEPA and the U.S. Army Corps of Engineers, New England District (USACE), the USACE is responsible for carrying out the design and implementation of the remedial measures.

The New Bedford Harbor Superfund Site extends from the shallow northern reaches of the Acushnet River estuary, south through the commercial harbor of New Bedford and out beyond the City's hurricane barrier into 17,000 adjacent acres of Buzzards Bay. The Superfund Site is divided into three areas: the Upper, Lower, and Outer Harbors defined by geographical features of the harbor and gradients of sediment contamination (Figure 1). The industrial discharge of PCB contaminated waste, either directly into the harbor or indirectly through the City's sewer system, was most significant in the Upper Harbor. The location of the associated PCB discharge and the hydrodynamics of the harbor contributed to the deposition of significant levels of PCB contamination in the Upper Harbor.

The highest PCB concentrations or "hot-spots", which contained total PCB concentrations in excess of 100,000 mg/kg, resided in the sediments located in the immediate area of the discharge in the Upper Harbor. These "hot-spot" sediments were removed between 1994 and 1995 as part of the

USEPA's first cleanup phase (USEPA, 1997). The remaining sediments in the Upper Harbor, an area of approximately 190 acres, are still heavily contaminated, with total PCB concentrations in the thousands of mg/kg. Following completion of a sediment dewatering, water treatment, and material transfer facility, full-scale remediation dredging was initiated in fall 2004 (Jacobs 2005, ENSR 2005). The second season of full-scale dredging occurred in late summer / early fall 2005 as described in this report and the 2005 After Action Report (Jacobs 2006).

1.2 Overview of the Fall 2005 Dredging

Remediation of the Upper Harbor was divided into a series of dredge management units (DMUs) based on location and previously defined sediment PCB concentrations. The fall 2005 dredging effort focused on a section of DMU-2 and on DMU-4 located in the northern portion of the Upper Harbor adjacent to the Aerovox Facility (Figure 2), with limited dredging also occurring in adjacent DMU-3 and DMU-5. Figure 2 also includes a timeline of dredging activity including timeframes of mobilization and demobilization. During the 2004 dredging season the eastern portion of DMU-2, approximately 225 feet by 600 feet along the eastern boundary, was not dredged and left open to allow space for passage of the fall anadromous fish run. The fall 2005 dredging effort focused on the remaining eastern portion of DMU-2 and on DMU-4 and portions of DMU-3 and DMU-5, located just south of DMU-2.

Preparatory work was initiated in late August 2005 and included installation of individual sheet piles, oil booms, and traveling cables and pulling the floating discharge pipelines from Sawyer Street to the dredge areas. Debris removal began in mid-September. After initial debris removal in DMU-2, dredging and debris removal was conducted simultaneously. Dredging was performed from mid-September through mid-November, using an auger equipped hydraulic dredge. Dredged material was pumped through a pipeline within the Upper Harbor waterway to a desanding unit located at the Sawyer Street Facility (Figure 1). Following desanding, the fine material was pumped through another pipeline in the waterway to the sediment dewatering, water treatment, and material transfer facility located in the Lower Harbor (Figure 1). Following dewatering, the dredged material was transported for offsite disposal (Jacobs 2006).

Over a period of approximately three months, dredging removed a total of 24,130 cubic yards of material, with the depth of cut ranging from 1 foot to nearly 5.5 feet. A total of 8,663 cubic yards was removed from DMU-2, and 15,467 cubic yards was removed from DMU-4 and portions of DMU-3 and DMU-5 (Figure 2). The remedial operation was performed by the Jacobs Engineering Group and subcontractor, Sevenson Environmental Services, as part of a Total Environmental Restoration Contract with the USACE. The demobilization effort followed completion of the dredging and included removal of dredges, pipelines, and oil booms. Sheet piles were left in place. Complete details of the dredging operation can be found in the *After Action Report – 2005 New Bedford Harbor Remedial Action* (Jacobs 2006, in preparation).

1.3 Water Quality Monitoring Program

The fall 2005 dredging was performed in areas with some of the highest PCB concentrations remaining in the Upper Harbor. The dredging approach, including placement of oil booms, was designed to minimize resuspension and transport of oil and sediments outside of the immediate dredging area. In addition, the USEPA and USACE developed a water quality monitoring program to ensure that dredging operations were carried out to meet the following overall goals for work within the Superfund Site:

- The disturbance of the contaminated sediments does not result in acute impact to organisms within the water column outside the dredging area.
- There is not significant transport and deposition of sediments and their associated contaminants outside the dredging area to uncontaminated areas or areas that have already been remediated.
- Safe and adequate passage for anadromous fish should be maintained during the dredging operation.
- There is not significant transport of oil associated contaminants outside the dredging area.

Dredge monitoring focused on continuous and real-time measurements of turbidity down current of dredging with conditional sampling for toxicity testing and chemical analyses. Similar to previous in-water work within the New Bedford Harbor Superfund Site, an upper level turbidity criterion of 50 NTUs (Nephelometric Turbidity Unit) above background was set for the project at two down current compliance transects. A warning level was set at 300 feet down current of dredging operations and project criterion was set at 600 feet down current as described in Section 2.1 of this report. The criterion was developed by the USEPA and the USACE based on a review of previous dredging and monitoring activities at the New Bedford Harbor Superfund Site (ENSR 2004), harbor sediment contamination levels, and current patterns in the vicinity of the construction and dredging area.

The real-time boat based monitoring was performed throughout dredging. Additionally, continuous monitoring was conducted throughout dredging with deployment of Yellow Springs Instruments (YSI) multi-parameter water quality meters. The YSI meters were situated in locations up and down current of planned dredging locations to optimize the potential for capturing suspended solids produced by dredging. As described in Section 2, the monitoring program contained provisions for additional sampling and analyses and for corrective action for dredging operations to ensure that project environmental goals were met.

2.0 METHODS

2.1 Program Overview

The water quality monitoring program for the 2005 dredging included field verification of water quality controls, field measurement of turbidity (boat-based and continuously monitoring meters), collection of water samples for laboratory analyses, assessment of potential dredging related deposition of suspended solids, as well as assessment and analysis of oil sheens related to dredge activity. More intensive boat-based monitoring was performed during the initial weeks of the dredging to verify the effectiveness of the dredging methodology at meeting the goals developed by the USEPA and USACE.

The monitoring focused on real-time measurement of water column turbidity and followed the protocol developed for previous water quality monitoring at New Bedford (Figure 3). During a field monitoring day, initial monitoring was performed in the immediate vicinity of the dredging operation immediately outside of the work area as well as at an up-current reference location. If turbidity was elevated immediately outside of the work area (50 to 150 feet down current of dredge activities), additional monitoring was performed along transects located further down current of the operation (300 and 600 feet).

In the event of an exceedence of the turbidity warning level of 50 NTUs above background at the 300 foot down-current transect, additional monitoring was triggered, along with collection of water samples for analysis and notification of the USACE for implementation of corrective action. In the event of an exceedence of the project turbidity criterion at the 600 foot down-current transect, additional sampling was triggered along with immediate shut down of project operations (Figure 3). A tiered set of laboratory analyses was implemented if elevated turbidity triggered collection of samples, similar to the protocol used in previous monitoring at New Bedford Harbor (Figure 4). Biological (toxicity) testing formed the initial level of tests with chemical testing (PCBs, metals) contingent on poor survivorship in the toxicity test.

The monitoring program included deployment of continuous monitoring YSI water quality meters for extended periods during dredging activities. Meters were deployed intermittently from mid-August to mid-December and included collection of data during baseline, mobilization, and demobilization activities (Figure 5). A summary of the monitoring program is presented below. Additional details can be found in the Statement of Work for the water quality monitoring (Appendix A of this report), the Quality Assurance Project Plan (Jacobs 2005), and the Field Sampling Plan (ENSR 2005).

2.2 Field Monitoring and Sampling

The monitoring program for the fall 2005 dredging consisted of four components:

1) Discrete boat-based water column monitoring and sampling;
2) Continuous water column monitoring with deployed meters;
3) Sediment transport assessment; and
4) Oil sheen assessment and oil sheen monitoring.

The boat-based monitoring and sampling operations were conducted at varying levels of intensity depending on the nature and intensity of dredge activity. The timing of this monitoring coincided with the project dredging activities deemed to have the greatest potential to affect water quality, including debris removal and dredging in areas previously identified with the highest concentrations of PCBs.

2.2.1 Discrete Boat-based Water Column Monitoring

Monitoring and sampling activities were conducted using a Jon-boat operated by CR Environmental. Geographic information, such as locations of field data collection, was obtained using a Garmin hand-held GPS, and distance between dredge activity and survey vessel was measured using a laser range finder. Real-time water quality measurements were collected using YSI multi-parameter meters. Water sampling was conducted using a 12-volt Teflon diaphragm pump and the appropriate length of C-FLEX Teflon composite tubing. Details on the use and maintenance of the YSI meter are provided in the Standard Operating Procedures attached to Field Sampling Plan (ENSR 2005).

On each monitoring day, turbidity measurements were collected periodically down current of the dredging. If elevated turbidity was recorded, additional measurements were collected 300 feet down current of the dredging operation (Figure 6). In addition to the down current monitoring locations, background (i.e., reference station) measurements were collected approximately 1,000 feet up current (based on tidal stage) outside of the influence of operations and of any localized turbidity sources such as stormwater discharges. Monitoring was conducted throughout the water column at 0.5 to 1 foot intervals at all locations.

The real-time nature of these measurements allowed for direct correlation between dredging activities and water column impacts. A field log sheet was completed during each monitoring day and included date, time, monitoring positions, sample collection identification and locations, meteorological observations, water depth, turbidity, temperature, dissolved oxygen, and other relevant observations. The daily log sheets were summarized on the Daily Field Summary and provided electronically to Corps personnel. Daily Field Summary sheets are provided in Appendix B.

2.2.2 Continuous Turbidity Monitoring

Continuous turbidity monitoring was integrated into the monitoring program to better evaluate fluctuations in turbidity levels that might not have been captured by discrete boat-based measurements. YSI meters were deployed both inside and outside oil boom areas during the dredging program. As shown in Figure 7, meters were deployed at six locations, two to the north of the dredging (one at the dredge unit boundary and one approximately 500 feet north of each dredge unit), two to the south (at the dredge unit boundary), and one at the mouth of Pierce Mill Cove just north of the Coggeshall Street Bridge. Meters situated at dredge unit boundaries, closest to dredging, were attached directly to sheet piles installed around the dredge area and secured approximately 12 inches above the bottom. Meters located further north of dredge units were attached to a weighted frame and placed into the water with sensors approximately 12 inches above the bottom. The meters were inspected every one to two weeks to confirm that sensors were operating properly and to download data.

2.2.3 Sediment Deposition Monitoring

A series of sediment traps were deployed in an effort to characterize sediment transport and deposition within the estuary associated with dredging activity. As shown on Figure 8, traps were deployed at six stations in conjunction with the continuous monitoring meter stations as follows:

- Station ST-A located approximately 500 feet north of DMU-2;
- Station ST-B located approximately 500 feet north of DMU-4;
- Station ST-C located at a sheet pile at the northern boundary of DMU-2;
- Station ST-D located at the southern boundary of DMU-2, between DMU-2 and DMU-4;
- Station ST-E located at the southern boundary of DMU-4; and
- Station ST-F located at the mouth of Pierce Mill Cove.

As shown in the Figure 8 inset, the traps consisted of a 2 liter plastic canister and attached funnel bolted to a perforated weighted 2 gallon plastic bucket outfitted with a bridle and marker. The sediment trap design was modified for the 2005 water quality monitoring program and incorporated a collection apparatus that rested approximately 12 to 18 inches above the harbor floor. The collection apparatus was elevated above the harbor floor to reduce the potential for sediment to spill into the trap during deployment and retrieval activities or through interaction of the trap with the bottom. Suspended sediments settling into the funnel were channeled into the sample container sealed to the bottom of the funnel. Once reaching the sample container, the sediments were isolated from surrounding harbor currents and effectively trapped within the container. The traps were recovered by pulling them slowly up through the water column to avoid disturbing the accumulated sediment. Once recovered, the overlying water was decanted, the canisters were weighed, and sediment slurry in the bottom of the canister was poured into 1-liter glass sample bottles for potential analysis.

2.2.4 Oil Sheen Monitoring

During water quality monitoring, bubbles of oil were observed seeping to the water surface down current of dredging, and significant oil sheens were observed forming on the water surface adjacent to dredging. Shortly after dredging began, oil sheen monitoring was added to the 2005 field monitoring plan to identify the sources of oil, estimate the amount of PCB present in the sheens, and monitor effectiveness of oil booms at containing the oil within the dredge area. Oil sheen samples were collected by gently placing a 5 inch by 5 inch V-Bond Oil-Only Sorbent Pad directly on top of the oil sheen for 2 minutes. Once the pad was removed, it was placed directly into a pre-preserved sample jar for transport to the lab. Oil sheen size was estimated and documented in the daily field log. The total PCB concentration of a sampled sheen was calculated by scaling up the total PCB concentration of the pad (25 in^2) to the total estimated area of the sheen.

2.3 Analyses

Water, sediment and oil sheen samples collected to support the monitoring program were containerized, labeled, and submitted to the designated laboratories as specified in Field Sampling Plan (ENSR 2005). Water quality samples were submitted to Enviro-Systems Incorporated (ESI) of Hampton Falls, NH for the following toxicity bioassay tests:

- Sea urchin (*Arbacia punctalata*) 1-hr sperm cell fertilization;
- Red alga (*Champia parvula*) 48-hr exposure viability and 7-day reproduction bioassay; and
- Mysid (*Americamysis bahia*) 48-hr survival and 7-day growth and survival.

Toxicity test controls were prepared using surface water from the Hampton Estuary of Hampton, NH. Toxicity tests were conducted in accordance with relevant U.S. EPA Environmental Research Laboratory, Atlantic Ecology Division Narragansett, RI protocols and the project Quality Assurance Project Plan (QAPP, Jacobs 2005). Water quality, sediment, and oil sheen samples collected for chemical analysis were submitted to Alpha Woods Hole Group (AWHG) of Raynham, MA. Water samples were analyzed for total suspended solids and dissolved and particulate PCBs (18 NOAA congeners). Sediment samples were submitted to AWHG for analysis of PCBs (18 NOAA congeners). Oil sheen samples were also submitted to AWHG for analysis of PCBs (18 NOAA congeners). Gravimetric Total Suspended Solids (TSS) measurements were made using membrane filters, with careful rinsing of any retained salt to avoid bias. Whole water samples collected for PCB analysis were filtered at the laboratory to obtain dissolved and particulate sample fractions. Standard EPA methods (SW-846) were used to analyze the water sediment and oil sheen samples for PCBs. Specific analytical methods and procedures are presented in the project QAPP (Jacobs 2005).

3.0 RESULTS

3.1 Dredging Summary

Dredging and debris removal at DMU-2 were conducted from September through mid-October, and dredging and debris removal of DMU-4 and portions of DMU-3 and DMU-5 were conducted from October through November. Dredging was performed using an auger equipped Mudcat hydraulic dredge. Dredged material was pumped through a pipeline within the Upper Harbor waterway to a desanding unit located at the Sawyer Street Facility (Figure 1). Following desanding, the fine material was pumped through another pipeline in the waterway to the sediment dewatering, water treatment, and material transfer facility located in the Lower Harbor (Figure 1). Debris removal was accomplished by scooping debris from the harbor bottom using a barge-mounted excavator. Large containers were used for collecting debris. Support boats repositioned the barge after debris was cleared from dredging areas.

Similar to the 2004 dredge plan, a grid system was laid out over the areas of DMU-2, DMU-3, DMU-4, and DMU-5 designated for dredging in 2005 (Figure 9). The grid system was used to support planning and tracking of dredging activities. A target depth of cut and final post-dredge elevations were assigned to each grid cell based on previous sediment investigations. Dredging was performed in south-to-north oriented cuts, with the dredge using a series of cables for advancement and alignment along a given cut. The depth of cut was approximately 1 foot for each production pass. At times, debris (e.g. bricks, rope, and pipe) were encountered and had to be periodically cleared from the cutterhead and pipeline. Floating oil and gas bubbles were often observed in the water above the cutterhead. As in 2004, the 2005 dredging was performed within a surrounding oil boom. However, the 2005 dredging was performed without a partial depth silt curtain, as was attached to the floating boom in 2004. In total, the dredging removed 24,130 cubic yards of material, with the depth of cut ranging from 1 foot to nearly 5.5 feet (Jacobs 2006). The post-dredge bathymetry clearly showed the overall area dredged as well as the portion with deeper total cut depth (Figure 10).

A number of barges and support vessels supported the dredging operation. Barges were used as excavator platforms, for storage and transport of large debris, and for staging operations within the boomed areas. Support vessels were used for transporting crew, moving barges, adjusting oil booms and dredge positioning cable systems, and relocating the discharge pipeline. Representative photos of the various dredging and support operations are provided in Appendix D. Figure 2 provides an aerial view of the site and a timeline for dredging activities. A chronology of the dredging operations performed in fall 2005 and additional details are provided below:

> <u>25 August – 12 September</u> – In-water mobilization work was performed. Approximately 25 sheet piles were removed from the 2004 dredge configuration of DMU-2, and new sheet

piles were driven around the eastern portion of DMU-2 (Area A) and around the perimeter of DMU-4 and portions of DMU-3 and DMU-5 (Area B). The piles were numbered for reference (Figure 9). The pipeline was assembled and moved northward toward the dredge area. Cables were run around the sheet piles of both DMUs for dredge control. The perimeter of the dredge areas was enclosed with floating oil booms.

13 September – Debris removal and dredging were initiated within DMU-2 (Area A).

4 October – Debris and dredging operations were initiated within DMU-4 (Area B).

20 October – Debris removal and dredging were completed within Area A.

17 November – Dredging and debris removal were completed within Area B.

18 November - 28 November – In-water demobilization was performed.

The 2005 remedial operations were performed by the Jacobs Engineering Group and subcontractor Sevenson Environmental Services as part of a Total Environmental Restoration Contract with the USACE. Complete details of the dredging operation can be found in the *After Action Report – 2005 New Bedford Harbor Remedial Action* (Jacobs 2006, in preparation).

3.2 Field Monitoring Summary

Water quality monitoring was performed on a total of 22 days during 2005 dredging activities. A chronology of the water quality monitoring effort is provided in Table 1. Monitoring included general observations of remedial operations and environmental controls. Discrete boat-based water quality measurements and sampling, the deployment and maintenance of continuous recording turbidity meters and sediment traps, and the performance of oil sheen monitoring and sampling were also conducted. The monitoring program began in mid-August with baseline monitoring. Baseline continuous monitoring was conducted in the Upper Harbor adjacent to dredge areas as well as adjacent to Pierce Mill Cove (Figure 7 and 8).

More focused water quality monitoring was initiated in mid-September during debris removal and remedial dredging of DMU-2. Based on the results of the 2004 monitoring, the 2005 Field Sampling Plan was modified to focus more on deployed meter monitoring rather than the more intensive boat-based monitoring of 2004. However, the 2005 monitoring revealed higher turbidity levels than in 2004, attributed to the lack of the silt curtain and more aggressive debris removal. As a result, the monitoring continued to rely on more intensive boat-based measurements throughout the 2005 dredging season. The continuous recording turbidity meters and sediment traps deployed throughout the program supported evaluation of cumulative water column impacts. A summary of each component of the 2005 monitoring program is provided below.

3.3 Boat-Based Water Column Monitoring and Sampling

3.3.1 Turbidity Measurements

Each monitoring day, turbidity was measured periodically at several locations down current of dredging, including adjacent to oil booms and further down current at the edge of the 300 foot mixing zone, and at an up current reference location. During the duration of the project, reference turbidity values generally ranged from 3 to 7 NTU. Turbidity down current of the dredging was variable, and ranged from 4 to 20 NTUs during standard dredging activities. During additional activity, such as clearing the dredge cutterhead or removal of debris in shallow water, turbidity ranged from 25 to 50 NTUs 300 feet down current of the activity. On five occasions the +50 NTU turbidity warning level was exceeded at the 300 foot down current location with turbidity ranging from 60 to 100 NTUs above background. On one of those occasions, the +50 NTU project turbidity criterion was exceeded at the 600 foot down current location (19 October - 61 NTU above background). High turbidity events were generally linked to specific dredging operations or support operations occurring during low tide periods. These activities included aggressive debris removal, support vessel maneuvering in shallow waters, or lifting the dredge cutterhead through the water column. A summary of the high turbidity events is provided below:

17 October – Dredging and debris removal activities were conducted simultaneously in the eastern portion of DMU-4 during an exceptionally low tide. A suspended solids plume was visible moving down current of debris removal on the ebb tide with turbidity levels elevated to 146 NTUs above background at 200 feet down current. Further down current, at 300 feet and beyond the confines of the oil booms, turbidity levels were measured at 91 NTUs above background. At 600 feet down current, turbidity dropped to 38 NTUs above background. The exceedence occurred during very low water conditions, just prior to low water slack tide. The USACE resident engineer was notified, and activity was stopped until later that day. Grab samples were collected at 200 feet and 600 feet down current as well as at a reference location as described in Section 3.2.2.

19 October – Debris removal and dredging activities were conducted at the eastern portion of DMU-4. As the tide was nearing low water conditions, a suspended solids plume was observed moving down current of debris removal activity on the ebb tide. Since the water conditions were calm and visibility was exceptionally clear, the plume was easily tracked and was observed to be approximately 700 feet by 200 feet in extent (orientated north-to-south). Turbidity levels within the plume were measured at 71 NTUs above background at 300 feet down current and 61 NTUs above background at 600 feet down current of the activity. Elevations of turbidity were measured as far as 900 feet down current of the activity. The highest turbidity levels occurred when debris removal was operating continuously without

breaks between each scoop. The USACE resident engineer was notified, and activity was stopped for the remainder of the day. Grab samples were collected at 300 and 600 feet down current of debris removal as well as at a reference location as described in Section 3.2.2.

11 November – Dredging occurred in the southwestern portion of DMU-4 just prior to field monitoring. At the start of monitoring, elevated turbidity was measured down current of DMU-4 during low water slack tide. Water conditions were very shallow, and a turbidity of 58 NTUs above background was measured at 300 feet down current of the dredge position. Turbidity levels were significantly lower further down current (6 NTUs at 600 feet down current) of the dredge location. The USACE resident engineer was notified, and dredging had already been stopped earlier that the day. Grab samples were collected at the 300 foot location as well as at a reference location as described in Section 3.2.2.

14 November – Dredging occurred along the western boundary of DMU-4 and eastern portions of DMU-3 and DMU-5. Elevated turbidity was measured down current of dredge activity at the onset of flood tide. Water conditions were shallow as flood waters moved a suspended solids plume north. A turbidity of 103 NTUs above background occurred at 300 feet down current of dredging within the confines of the oil booms. Turbidity dropped significantly further down current, 15 NTUs at 500 feet. The USACE resident engineer was notified, and the dredging operation was slowed down. Grab samples were collected at the 300 foot location as well as at the reference location as described in Section 3.2.2.

17 November – Dredging was conducted at the southern boundary of DMU-4 along a west to east transect. When the dredge intake became clogged with debris, the clearing process involved repeated lifting of the cutterhead out of the water. During this activity, a suspended solids plume was observed moving south on the ebb tide. Turbidity at 300 feet down current was elevated to 85 NTUs above background. Turbidity had dropped to 35 NTUs at 600 feet down current, and elevations of turbidity were measured as far as 1,000 feet down current. The USCAE resident engineer was notified, and grab samples were collected at the 300 foot location and at the reference location as described in Section 3.2.2.

As noted above, each of the exceedences of the turbidity warning level and the single project turbidity criterion exceedence occurred during a low tide period, and turbidity levels dropped below the criterion soon after dredging or debris removal activities stopped or slowed.

3.3.2 Sample Collection and Analyses

Water samples were collected for toxicity testing on seven occasions throughout the dredge program. Two sampling events were performed early in the dredge program to verify the

protectiveness of the +50 NTU criteria. These initial samples were not collected in response to an exceedence of the +50 NTU turbidity criteria and are described below:

14 September – Grab samples were collected approximately 225 feet down current (to the south on ebb tide) of dredging operations performed in DMU-2. Turbidity was measured at approximately 72 NTUs above background at this location, but dropped significantly further down current, and an exceedence was not observed at 300 feet.

22 September – Grab samples were collected approximately 150 feet down current (to the south on ebb tide) of the dredge during operations in DMU-2. Turbidity was measured up to approximately 60 NTUs above background at this location.

During the later part of the dredge program, five exceedences of the turbidity warning level (+50 NTU at 300 feet down current) occurred triggering the compliance sampling protocol (Figure 3). On one of these occasions, 19 October 2005, the project turbidity criterion (+50 NTU at 600 feet down current) was exceeded triggering additional sampling and analyses. The site conditions (e.g., dredging activity and tidal stages) associated with these events has been described above in Section 3.3.1. During each exceedence, grab samples were collected as described below:

17 October – Turbidity was measured at 95 NTUs (91 NTUs above background) at 300 feet down current of debris removal, and grab samples were collected at approximately 200 feet and 600 feet down current (to the south on ebb tide) of debris removal as well as at a reference location, 1,000 feet up current of activities.

19 October – Turbidity was measured at 75 NTUs (71 NTUs above background) at 300 feet down current of debris removal (to the south on ebb tide). Turbidity was measured at 65 NTUs (61 NTUs above background) 600 feet down current. Samples were collected at each of the 300 and 600 foot down current locations including at a reference location.

11 November – Turbidity was measured at 65 NTUs (58 NTUs above background) at 300 feet down current (to the south on ebb tide) of dredging. Grab samples were collected at this location as well as at a reference location.

14 November – Turbidity was measured at 105 NTUs (103 NTUs above background) at 300 feet down current (to the north on flood tide) of dredge activity. Grab samples were collected at this location as well as at a reference location.

17 November – Turbidity was measured at 90 NTUs (85 NTUs above background) at 300 feet down current (to the south on ebb tide) of dredging. Samples were collected at this location as well as at a reference location.

Total Suspended Solids

A total of 16 grab samples were submitted to AWHG for analysis of TSS. Results of the TSS and field turbidity measurements are presented in Table 2. Laboratory measured TSS values ranged from 4 to 250 mg/L with a mean of 76 mg/L. The maximum TSS value (250 mg/l) was associated with debris removal activity conducted in shallow water. The field turbidity measurement at this location was 150 NTUs. This sample was collected approximately 200 feet down current of the activity and within the confines of the oil boom surrounding DMU-4. The maximum value associated with the dredging was 140 mg/L for a sample collected from within the suspended solids plume approximately 75 feet down current of dredging. The field turbidity measurement at this location was 75 NTUs.

Biological Testing

Toxicity samples were collected on six of the dates noted above, and 13 samples were submitted for biological testing. Of the 13 samples, three were investigative samples (not compliance samples resulting from a turbidity exceedence); five were reference samples, and five samples were triggered by elevated turbidity. Results of the biological testing are presented in Table 3 and summarized below. Additional test data are presented in Appendix C.

Sea urchin (*Arbacia punctalata*) 1-hr sperm cell fertilization – *Arbacia* fertilization analyses were not performed on 10 samples because during the months of October and November 2005, as the laboratory (ESI) was unable to obtain viable gametes from the adult sea urchins for fertilization (Appendix C1). Of the 3 samples analyzed, 2 samples, collected on 22 September, found Arbacia mean fertilization similar to the laboratory control (range of 86.5 to 87.8%). Fertilization, of the sample collected on 14 September, was statistically less (82.0%) than the laboratory control (92.2%). However, the level of fertilization (82%) in the 14 September sample was relatively high and was indicative of minimal impacts.

Mysid (*Americamysis bahia*) 48-hr survival – All 13 samples tested for mysid 48-hr survival were within 5% of the laboratory controls, and the overall survival rate was excellent.

Mysid (*Americamysis bahia*) 7-day survival – Survival in the samples at 7 days averaged 94% for the 13 samples. Test results of 11 samples were within 7% of the laboratory controls, and survival was excellent. Test results of two samples indicated low level chronic impacts. Survival in the sample collected on 22 September was 20% less than the associated laboratory control and the reference sample, a significant difference indicating a low level chronic impact. This sample was collected 150 feet down current of dredge activity within a suspended solids plume measured at 58 NTUs above background. Survival in the sample collected on 14 November was 10% less than the associated laboratory control and also considered a low level chronic impact. This sample was collected 300 feet down current of dredge activity within a suspended solids plume measured at 103 NTUs above background.

Mysid (*Americamysis bahia*) 7-day growth – Growth rates for the test samples at 7 days ranged from 0.2 to 0.54 mg/mysid, based on the number of test organisms at test initiation. Growth rates in seven samples were within 0.07 mg/mysid of laboratory controls. In the remaining 6 samples, growth rates were significantly different from associated laboratory control samples and associated reference samples. In two of the remaining six samples, collected on 19 October, growth rates were greater than laboratory controls, but were 0.16 mg/mysid to 0.17 mg/mysid less than associated reference samples. In four of the remaining six samples, growth rates ranged from 0.179 mg/mysid to 0.422 mg/mysid and were 0.03 to 0.15 less than associated laboratory controls. All sample weights were similar to or greater than the general test acceptability criteria of 0.20 mg/surviving mysid, indicating that although statistically significant, these weights may not indicate a negative ecological impact.

Red alga (*Champia parvula*) 48-hour exposure viability – In 10 of the 13 samples, 100% survival of *champia* was observed. In three of the 13 samples, 0% survival was observed corresponding to total mortality in the 48 hour test. All three of these samples were collected within suspended solids plumes created by dredge activity during shallow water conditions. Sample, WQE2091405, collected on 14 September, was located 225 feet down current of dredge activity and within the confines of oil booms. Sample, WQE2111405, collected on 14 November, was located 300 feet down current of dredge activity and was also within oil booms. Sample WQE2111705, collected on 17 November, was located 300 feet down current of activity that included cleaning the dredge cutterhead.

Red alga (*Champia parvula*) 7-day reproduction – The U.S. EPA acceptance criteria for the Champia 7-day reproduction test is 10 cystocarps per branch tip. Statistically reduced cystocarp production was observed in five down current samples and three reference samples: WQE1092205, WQE1101705, WQE2101705, WQE1101905, WQE2101905, WQR1092205, WQR1101705, and WQR1111705. Two of the reference locations (WQR1101705, and WQR1111705) had more than the U.S. EPA acceptance criteria of 10 cystocarps per branch tip and did not indicate a negative ecological impact. For the remaining samples, cystocarp production was below the acceptance criteria indicating the potential for impacts on *Champia* reproduction.

Chemical Analyses

Two water samples collected 19 October 2005 were analyzed for dissolved and particulate PCBs. These samples were collected during exceedence of the project turbidity criterion 600 feet down current of debris removal operations during exceptionally low water conditions. Dissolved PCB concentrations were 1.7 ug/L and 2.3 ug/L, and particulate PCB concentrations were 2.0 ug/L and 6.7 ug/L for the 300 foot and 600 foot locations, respectively. A summary of results is presented in Table 4, and individual congener data are presented in Appendix C.

Results for the total metals analysis are also presented in Table 4. As in previous monitoring for New Bedford Harbor, metals concentrations (particularly for copper, lead, and zinc) were elevated. As the values reported in Table 4 represent total concentration (dissolved + particulate), they should not be directly compared with water quality criteria.

3.3.3 Additional Observations

Visual inspections of the dredge areas were conducted during boat-based water quality monitoring surveys. Condition of oil booms and oil boom maintenance were observed and noted. Booms were in place around the perimeter of the dredging areas for the duration of the fall 2005 season. The booms were periodically reinforced or replaced to help ensure that oil and debris were contained within the dredge areas. Booms were also added around debris removal activity and dredging for additional reinforcement and oil absorption.

The water quality monitoring field teams also observed anadromous fish activity. Large schools of fish were observed in and around dredge areas from September through mid-November (photo 10 in Appendix D). No abnormal fish schooling behaviors were observed during this period. During the early stages of the dredge program dead bluefish (*Pomatomus saltatrix)* were observed within the Harbor and Upper Acushnet River Estuary. Approximately 20 to 40 dead fish were observed on Monday, 12 September. The peak turbidity measured at the time was 43 NTUs (37 NTUs above background) 200-feet north of the dredge on the flood tide; no exceedence was recorded. The cause of the fish deaths was not determined. However, schools of bluefish were prevalent in the area, and fishing along the estuary shore was observed during this time (and likely more prevalent over the prior weekend). As the dead fish were generally small (< 1 foot in length), the deaths may have been the result of catch and release fishing over the weekend. Dissolved oxygen measured as part of the monitoring was low (3–5 mg/L) during the morning hours, but the levels were typical of those observed during previous monitoring of the Upper Harbor (ENSR 2004). Small fish as well as comb jellies, periwinkles, small shrimp, and crabs were also observed in the harbor and near dredge areas during the dredge program, and there were no other observations of distressed or dead organisms.

3.4 Recording Turbidity Meter Measurements

Recording turbidity meters were deployed at six locations during the 2005 dredge program (Figure 7). A timeline of turbidity deployments is provided in Figure 5. Turbidity meters were deployed throughout the dredge season, including prior to the start of activities (baseline), during mobilization, dredging, and demobilization; and following completion of work in the harbor. Turbidity measurements were recorded at five-minute intervals during the deployment periods. The data retrieved from the meters were plotted along with tidal water level and other information.

Figures 11-13 represent time series plots of turbidity measurements during selected periods of the fall 2005 dredging season. These turbidity time series plots were selected because they are representative of baseline conditions (Figure 11) and dredging activity conditions (Figures 12 and 13). Each of the figures also provides a sampling location inset, tidal water levels, dredging operation periods, and the 50 NTU turbidity criterion value for reference. Turbidity values above the 50 NTU value are not necessarily indicative of exceedences of the turbidity warning level (>50 NTU above background at 300 feet down current) or project turbidity criterion (>50 NTU above background at 600 feet down current) because the measurements were often collected at distances closer than the 300 foot threshold and/or interference with the turbidity sensor (debris or fouling) could bias the measurements. Time series turbidity plots for all recorded data are provided in Appendix E. Brief descriptions of the representative turbidity figures are provided below.

3.4.1 Turbidity Measurement During Baseline Conditions

Figure 11 provides baseline turbidity measurements recorded over a 5 day period from 18 to 23 August, 2005. Turbidity values typically ranged from 5 and 15 NTU, but excursions of over 50 NTU were frequent. High turbidity excursions occurred most often, but not always, during low water level periods, and a maximum value of 140 NTU was recorded. These high turbidity values were recorded in the absence of dredging and associated activities.

High turbidity measurements may have been due to actual events driven by wind, tide, or other forces that resulted in disruption of bottom sediments in shallow water. It appears likely, however, that the high turbidity measurements were at least partially due to interference at the turbidity sensor. Turbidity meters depend on the backscatter of an emitted light signal to measure turbidity. False high turbidity measurements are recorded by the meter if the light sensor is blocked. The turbidity meter may be blocked by a variety of items such as large particles, objects, biota (e.g., crabs, shrimp, drifting algae or debris). Figure 11 and several other turbidity data records (Appendix E) contain events of high turbidity that are likely due to blockage of the turbidity sensor.

3.4.2 Turbidity Measured During Dredging Conditions

Figures 12 and 13 provide a record of turbidity measured during dredging activities over a 4 day period from 14 to 18 November, 2005. Turbidity values typically ranged from 5 to 25 NTU, but excursions over 50 NTU occurred approximately once per day. Periods of dredging activity are indicated by green lines in the figures. During this time period, dredging was conducted within DMU-4. Station CM D (Figure 12) is situated north of DMU-4, and Station CM E (Figure 13) is situated south of DMU-4. Station CM D was between 150 and 700 feet away from dredging activity (range due to dredge movement), and Station CM E was between 50 and 400 feet away from dredge activity during this dredging period. High turbidity events were generally closely correlated with periods when dredging activities were conducted at low tide.

3.5 Sediment Deposition Monitoring

Sediment traps were deployed at six locations (Figure 8) to support assessment of suspended solids transport and re-deposition. Sediment trap stations were located adjacent to continuous monitoring stations. Sampling locations were situated around DMU-2 and DMU-4 (ST-B through ST-E) with reference stations to the north (ST-A) and south (ST-F).

The sediment trap design was modified for the 2005 water quality monitoring program and is shown in the inset of Figure 8. The new 2005 trap design incorporated a collection apparatus that rested approximately 12 to 15 inches above the harbor floor. The collection apparatus was elevated above the harbor floor to reduce the potential for sediment to spill into the trap during deployment and retrieval activities or by the trap's motion potentially suspending sediments during wind/wave events.

Sediment traps were deployed for periods of 10 to 20 days during six deployment periods from May to November 2005 (Table 5). A total of 23 sediment trap samples were collected with deployments prior to dredging (four samples), during dredging (16 samples), and post-dredging (three samples). Table 5 provides a summary of sediment trap sampling including periods of deployment, dredging activity, sediment weight and total sediment concentrations. Table 5 also provides estimates of total sediment loading rate and total PCB loading rate.

Traps were deployed at four locations prior to the start of mobilization for dredging. Total PCB concentrations (reported as the (sum of the 18 NOAA congeners) x (the project-specific 2.6 multiplier)) ranged from 66 mg/kg at station ST-F near the mouth of Pierce Mill Cove to 659 mg/kg at station ST-D located between DMU-2 and DMU-4 (Table 5). As sample weights were not measured, an estimate of the sediment and PCB deposition rates could not be made for this period.

There were four deployment periods during dredging, with traps deployed at three to five locations during each period. PCB analysis was conducted on trap samples from two of the deployment periods, late October and November. Total PCB concentrations ranged from 82 mg/kg at station ST-F near the mouth of Pierce Mill Cove to 2,190 mg/kg at station ST-D located between DMU-2 and DMU-4. All deployment periods samples were weighed, and sediment deposition rates reported in Table 5 ranged from 46 g/m^2/day both at station ST-A north of the dredge area and station ST-F near the mouth of Pierce Mill Cove to 163 g/m^2/day at Station ST-B to the west of DMU-2. The calculated PCB deposition rates ranged from 4 mg/m^2/day at station ST-F to 231 mg/m^2/day at station ST-D.

Traps were deployed at three locations after dredging and demobilization. PCB analysis was conducted on all trap samples for this period, and total PCB concentrations ranged from 86 mg/kg at station ST-F to 755 mg/kg from station ST-E located at the southern boundary of DMU-4. Sediment deposition rates from 39 g/m^2/day at station ST-B to 54 g/m^2/day at Station ST-F. The calculated PCB deposition rates ranged from 5 mg/m^2/day at station ST-F to 39 mg/m^2/day at station ST-E.

3.6 Oil Sheen Monitoring

Oil sheen monitoring was performed as part of visual inspections conducted by field teams on a daily basis. Oil sheen monitoring included noting oil sheen sizes and characteristics in daily field logs and collecting samples for chemical analysis if deemed appropriate. Sampling for chemical analysis of oil sheens was conducted if the sheen was observed to be large in size, appeared thick with oil, and/or had strong petroleum odors. Sheen samples were collected using a 5 inch by 5 inch sorbent pad as described in Section 2.2.4.

During a total of 22 field monitoring days, 19 oil sheens were observed during 16 of the monitoring days. Sheen size, location, and origin were noted in the field logs. Seven of these sheens remained within the boundary of the oil absorbent booms surrounding the dredge area. Twelve sheens moved beyond the booms, transported by the tide and winds. Seven of the 19 oil sheens were sampled and are described below. For each of the seven sampling events, total PCB mass in each oil sheen was estimated by scaling up the total PCB mass in the sheen pad sample (in mass/area) to the sheen's estimated aerial extent (based on field observations). Figure 14 provides a map with locations of sheens, dates of sampling, estimated sheen sizes, total PCB mass (mg) per sample pad, and estimated total PCB mass (grams) in the observed sheen. Total PCB mass in sample pads ranged from 0.07 to 1.1 mg. Sheen sizes ranged from 800 to 30,000 square feet (approximately two-thirds of an acre). Estimated total mass of PCBs in each sheen ranged from 0.5 to 18.3 grams.

Oil sheen observations and concurrent dredging activities for each of the seven sampling events are provided below.

5 October – Two oil sheens were observed and sampled down current of DMU-4 dredging activity. One sample was collected adjacent to the southern boundary of DMU-4, between an inner oil boom and outer oil boom. Total PCB mass of this sheen was estimated to be 0.5 grams. A second sample was collected from a larger sheen moving south of DMU-4 with the ebb tide. When the sample was collected, this sheen was breaking apart. The total PCB mass of this sheen was estimated to be 5 grams.

17 October – An oil sheen was observed moving down current of dredging activity. The sheen moved south on an ebb tide but remained within the boomed boundary of DMU-4. A sheen sample was collected approximately 100 feet down current of dredging. The total PCB mass of this sheen was estimated to be 9 grams.

3 November – An oil sheen was observed moving down current of dredging activity. Strong winds from the south moved the sheen north of the dredge and approximately 50 feet beyond the oil booms located at the northern boundary of DMU-4. An oil sheen sample was collected approximately 75 feet north of the dredge and inside the DMU-4 boundary. The sheen

appeared thick with a metallic blue gloss and had a strong petroleum odor. The total PCB mass of the sheen was estimated to be 14 grams.

11 November – Two oil sheens were observed and sampled within DMU-4. One sheen was observed within DMU-4 and appeared to have been in existence for some time; the sheen was thin and broke apart easily when agitated. The total PCB mass of this sheen was estimated to be 18 grams. A second sheen was observed moving north on the flood tide later that day. This sheen appeared thick with a metallic blue gloss and had a strong petroleum odor. The total PCB mass of this sheen was estimated to be 9 grams.

14 November – An oil sheen was observed moving south from active dredging on the ebb tide and beyond the confines of DMU-4. The sample was collected approximately 250 feet south of the dredge activity and approximately 200 south of DMU-4. The total PCB mass was estimated to be 12 grams.

All sheens were reported to the USACE resident engineer along with any observations on the potential cause of release for sheens that were observed outside of the boomed area. Response actions included adjusting the boom coverage as well as adding additional secondary and tertiary booms.

3.7 Data QC and Database Entry

Upon receipt of analytical data from the laboratory, ENSR provided a cursory review for completeness and loaded the data into a temporary database for use in draft data reporting. ENSR also performed a quick check of the QC sample results from the temporary database to evaluate overall data quality before transmitting the data to the program database. Electronic files of the hardcopy laboratory reports were generated and provided to Battelle Ocean Sciences for subsequent data validation efforts and uploading into the Project database.

4.0 DISCUSSION

The fall 2005 dredging with DMU-2 and DMU-4 and portions of DMU-3 and DMU-5 was performed in areas with some of the highest sediment PCB concentrations remaining in the Upper Harbor. The hydraulic dredging approach was employed to limit the resuspension and transport of sediments outside of the immediate dredging area. Oil booms surrounding the dredging operation were used to help contain floating oil sheens and debris within the work area. The water quality monitoring program developed by the USEPA and USACE was designed to evaluate potential water column impacts around the work zone and potential transport of suspended solids and surface sheens as well as to ensure that an adequate unobstructed zone was maintained for anadromous fish passage.

Fish Passage

A surrounding partial depth silt curtain was not used during the 2005 dredging season (as was used in 2004). As a result, the overall operation in 2005 presented only very limited blockage of portions of the waterway. Dredging equipment included the debris removal and dredge barges as well as several support vessels. The south-to-north orientation of the dredging for much of 2005 (as opposed to east-to-west in 2004) resulted in the dredge discharge pipeline leading in less of a direct cross-harbor path. Large schools of fish were observed in the area on a number of occasions during the monitoring from September through mid-November, and the overall dredging operation did not appear to hinder their movement.

Evaluation of Impacts to the Water Column

As in previous phases of New Bedford Harbor Superfund Site work, a project-specific warning level of 50 NTUs above background 300 feet down current of dredging operations was set as a threshold for sample collection and assessment of operating methods, and a project criterion of 50 NTUs above background 600 feet down current of operations was set as a threshold for immediate cessation of turbidity producing activities and additional sampling.

The monitoring revealed higher overall levels of turbidity in 2005 as compared to 2004, attributed to dredging without the use of silt curtains and higher production rates and more aggressive debris removal. There were five exceedences of the turbidity warning level during the 2005 season (50 NTU above background at 300 feet down current of operations) and one exceedence of the project turbidity criterion (50 NTU above background at 600 feet down current of operations). Dredging, debris removal, and support vessels working in shallow water all had the capacity to re-suspend sediments. However, the most significant cause of re-suspended sediment appeared to be the passage of equipment (covered heavily with sediment) vertically through the water column. Most of the exceedences occurred when debris removal activity was occurring with a short cycle time or

when the dredge cutterhead was lifted to the water surface for clearing. Turbidity levels within the water column dropped quickly soon after the specific operations were terminated.

Data from deployed recording turbidity meters generally supported the boat-based measurements; the dredging, debris removal, and support operations generated plumes of suspended solids that were variable over time and location, and the plumes diminished in intensity quickly as they moved down current. The recording meters identified instances of turbidity levels over 50 NTU, but the recorded elevations were short in duration (minutes) and may have been due to biota (shrimp and crabs) interfering with the sensor's measurements or support vessel or dredging operations closer to the deployed meters.

Water samples were collected for toxicity testing on seven occasions during periods of boat-based measurements of elevated turbidity, with values ranging from 38 to 103 NTU. For testing with Mysids (*Americanmysis bahia*), the 48 hour survival results revealed no impacts related to the dredging, while the 7 day survival and growth results revealed statistically significant, but low level impacts for the higher turbidity levels. The testing with sea urchin (*Arbacia punctalata*) was limited to early in the monitoring program because viable specimens were not available to the lab later in the season, and the results for the two sets of tests performed did not reveal any significant impacts. Similar to previous New Bedford Harbor monitoring, the red alga *Champia parvula* was the most sensitive test organism, with reduced survival for samples from three of the six dates sampled and reduced cystocarp production noted for all tests. Taken together, the biological testing results indicate that the 2005 dredging was performed with measurable, but limited water column impacts. The additional data further confirmed that the +50 NTU criterion was ecologically protective, while still allowing remediation efforts to progress at an efficient pace.

Transport of Suspended Sediments

The boat-based and recording turbidity meters provided a clear record that the dredging operations resulted in short-term elevations of suspended solids down current. The sediment trap data provided a cumulative record of sediments suspended by the dredging and/or by normal harbor processes. Although considered a screening-level evaluation tool, the trap data did indicate that deposition of sediment with associated PCBs increased in the vicinity of the dredging both in overall rate and in PCB concentration during dredging operations. The limited data set for stations outside of the immediate dredging area did not allow for a direct comparison of dredging vs. non-dredging periods, but the data further confirmed that sediments with associated PCB contamination are in a continual state of flux throughout the Upper Harbor even during non-dredging periods.

Transport of Surface Oil Sheens

The frequency of oil sheens generated by the dredging operations was not unexpected given that the 2005 work continued in an area with high PCB concentrations (% level concentrations with

pockets of separate phase oil). The oil booms were effective at containing and absorbing the sheens in some instances. In other instances, the oil surfaced and formed the sheen beyond the extent of the boom boundary (more likely if the dredging was being performed close to the boundary), the sheens passed through temporary gaps in the boom system (opened for vessel passage), or the wind and/or current pushed the floating sheen beneath the boom at the down-current boundary.

The mass of PCBs estimated within the individual plumes was small, ranging from less than 1 g to approximately 18 g, representing a very small fraction of the PCBs actually being dredged (estimated at 9.5 tons PCBs removed over the 2005 dredge season, Jacobs 2006). All sheens that were noted outside of the boundaries of the oil boom were observed to move with the prevailing currents (ebb or flood tide) and remained near the axis of the channel. The sheens dispersed gradually as they moved down current, likely the combined effect of volatilization of the lighter PCB components, dissolution into the underlying waters, or general spreading out over the surface, and no sheens were observed to contact the shoreline.

In summary, the 2005 dredging removed nearly double the amount of contaminated sediment as compared to 2004. As the work was performed without the use of partial depth silt curtains, there were no apparent restrictions to fish movement with numerous schools noted in the area throughout much of the dredge period. Given the higher production rate and lack of curtains, turbidity levels were higher on average in 2005 as compared to 2004, and the sediment trap data indicated accelerated deposition within the work area. There were five exceedences of the turbidity warning level during the 2005 season (50 NTU above background at 300 feet down current of operations) and one exceedence of the project turbidity criterion (50 NTU above background at 600 feet down current of operations). The exceedences corresponded to work in shallow water depths, particularly where equipment was moved through the water column. In all cases, turbidity levels dropped quickly with cessation of the activity. Toxicity testing revealed that there were only sub-lethal limited effects associated with the elevated turbidity levels, and that the 50 NTU criterion was ecologically protective.

5.0 REFERENCES

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TABLES

Table 1. Water Quality Monitoring Summary during Fall 2005 Dredging at DMU-2 and DMU-4

Date	Day	Dredging Activity	Tidal Stage(s)	Background Turbidity (NTU)	Turbidity Range near Dredging Activities (NTU)	Turbidity Exceedance and Distance from Activity	Sampling for Laboratory Analysis										Notes:
							Toxicity		TSS/Turb.		PCBs		Metals		Oil Sheen		
							Analyze	Archive	Analyze	Archive	Analyze	Archive	Analyze	Archive	Analyze	Observed	
18-Aug-05	Thu	None															Deployed 3 YSI meters, made environmental observations.
23-Aug-05	Tue	None															Downloaded meter, pre-dredging observations.
1-Sep-05	Thu	None															New piles installed; removed meters for maintenance and re-deploy.
12-Sep-05	Mon	1 Dredge & Debris Removal	Flood	6	10-43	No										2	Oil sheen within booms, 15-20 dead fish in DMU-2. Small bait fish in DMU-2.
13-Sep-05	Tue	I Dredge	Flood	5	8-47	No										1	Oil sheen down current of dredge beyond oil boom. 15-20 dead fish near DMU-2.
14-Sep-05	Wed	1 Dredge	Ebb	4	4-75	No	1		1			1		1		1	Oil sheen down current of dredge and oil boom, sample collected.
16-Sep-05	Fri	1 Dredge	Ebb	3	9	No										1	Oil sheen flowing through open gate in boom of DMU-2
21-Sep-05	Wed	1 Dredge	Ebb	2	7-28	No			1								4 YSI meters deployed, large school of fish observed west of DMU-2
22-Sep-05	Thu	1 Dredge	Flood /Ebb	3	3-80	No	2		2			2		2		1	Large school of fish observed north of DMU-2
23-Sep-05	Fri	1 Dredge	Flood	4	6-35	No			1								Large schools of fish in and around DMU-2.
30-Sep-05	Fri	1 Dredge DMU2, Debris removal DMU4	Ebb	3	12-46	No										1	Small schools of bait fish observed near DMU-2 and at Sawyer street dock.

Table 1. Continued

Date	Day	Dredging Activity	Tidal Stage(s)	Background Turbidity (NTU)	Turbidity Range near Dredging Activities (NTU)	Turbidity Exceedance and Distance from Activity	Sampling for Laboratory Analysis										Notes:
							Toxicity		TSS/Turb.		PCBs		Metals		Oil Sheen		
							Analyze	Archive	Analyze	Archive	Analyze	Archive	Analyze	Archive	Analyze	Observed	
4-Oct-05	Tue	1 Test Dredge DMU4	Ebb	3	5-15	No										1	Oil sheen 150 feet down current of dredge activity to 600 ft down current of DMU-4.
5-Oct-05	Wed	None	Ebb												2	2	2 heavy oil sheen observed south of DMU-4.
14-Oct-05	Fri	1 Dredge DMU-4	Ebb	3	30-95	No										1	Observed oil sheen south of DMU-4.
17-Oct-05	Mon	1 Dredge DMU4	Ebb	4	42-95	300 ft (91 NTU)	3		3		1	3		3	1	1	Dredge and debris removal were active. No fish were observed. 1 exceedence at 300 ft down current of dredge.
19-Oct-05	Wed	1 Dredge DMU-4	Ebb	4	65-75	300 ft (71NTU) 600 ft (61NTU)	3		3		2	1	2	1			Dredge and debris removal were active. Exceedences at 300 ft and 600 ft down current of debris removal.
27-Oct-05	Thu	1 Dredge	Ebb	2	15-33	No											Fish observed in and around DMU-2 and 4. Collected all meters.
28-Oct-05	Fri	1 Dredge	Flood	6	4-23	No										1	Deployed 5 sediment traps.
31-Oct-05	Mon	1 Dredge	Ebb/Flood	2	8-20	No											Observed fish in DMU-4.
4-Nov-05	Fri	1 Dredge	Ebb	2	4-5	No									1	1	Infrequent debris removal, oil sheen observed north of dredge.
8-Nov-05	Tue	1 Dredge	Flood	6	7-35	No											Observed a few fish.
11-Nov-05	Fri	1 Dredge	LWS	7	7-65	300 ft (58 NTU)	2					2			2	2	Exceedence at 300 ft down current of dredgd, YSIs collected, observed fish in and around DMU-4.

Table 1. Continued

Date	Day	Dredging Activity	Tidal Stage(s)	Background Turbidity (NTU)	Turbidity Range near Dredging Activities (NTU)	Turbidity Exceedance and Distance from Activity	Sampling for Laboratory Analysis										Notes:
							Toxicity		TSS/Turb.		PCBs		Metals		Oil Sheen		
							Analyze	Archive	Analyze	Archive	Analyze	Archive	Analyze	Archive	Analyze	Observed	
14-Nov-05	Mon	1 Dredge	Flood	2	3-105	300 ft (103 NTU)	2		2			2			1	1	Exceedence at 300 ft. Turbidity plume observed down-current in shallow conditions.
17-Nov-05	Thu	1 Dredge	Ebb	5	10-90	300 ft (85 NTU)	2		2			4		2		1	Exceedence at 300 ft. related to raising of dredge cutterhead. Comb jellies observed south of DMU-4.
18-Nov-05	Fri	1 Dredge	Ebb	2	3-49	No										1	Turbidity plume evident down-current of dredge, but >50 NTUs.
21-Nov-05	Mon	None	Ebb														Uploaded YSIs, collected sediment traps.
7-Dec-05	Wed	None	Ebb														Deployed 3 meters, 3 sediment traps, to collect baseline data.
17-Ded-05	Sat	None	Flood														Collected 3 meters and 3 sediment Traps.
19-Dec-05	Mon	None															Downloaded meters and prepared sediment trap samples for Lab.

Table 2. Results of TSS Analyses and Turbidity Measurements of Water Samples Collected during Fall 2005 Dredging at DMU-2 and DMU-4

Sample Date	Tide	Sample ID	Estimated Distance from Dredge Activity	Total Suspended Solids (TSS) (mg/L)	Turbidity Field Measured (NTU)
14 September	Ebb	WQE2091405ARC	300' down current of dredging	72	75
21 September	Ebb	WQTSS001092105	300' down current of dredging	140	75
22 September	Ebb	WQR1092205	1,000' up current of dredging	4	4
	Ebb	WQE1092205	150' down current of dredge	190	62
23 September	Flood	WQ-TSS-001-092305	125' down durrent of dredging	32	35
17 October	Ebb	WQR1101705	1,000 up current of dredging	14	4
	Ebb	WQE1101705	200' down current of debris removal	250	150
	Ebb	WQE2101705	600' down current of debris removal	71	42
19 October	Ebb	WQR1101905	1,000' up current of activity	20	5
	Ebb	WQE1101905	300' down current of debris removal	120	75
	Ebb	WQE2101905	600' down current of debris removal	94	65
11 November	LWS	WQ-E1-111105	300' down current of dredge	77	60
	LWS	WQ-R1-111105	1,000' up current of dredging	4.3	3
14 November	LWS-Flood	WQE2111405	300' Down-Current of Dredging	120	105
	LWS-Flood	WQR1111405	Reference	7.7	3
17 November	Ebb	WQE21111705	300' down current of dredging	120	90
	Ebb	WQR1111705	1,000' up current of dredging	6.2	3

Table 3. Results of Biological Testing for Water Samples Collected during Fall 2005 Dredging at DMU-2 and DMU-4

Sample Date	Sample Location	Field Measured Turbidity	Sea urchin (*Arbacia punctalata*)	Mysid (*Americamysis bahia*)			Red alga (*Champia parvula*)	
			mean fertilization (%)	48 hour mean survival (%)	7 day mean survival (%)	7 day mean growth (mg/mysid)	48 hour mean survival (%)	7-day mean reproduction (cystocarp/tip)
14-Sep-05	Lab Control	NA	92.3	100	100	0.449	100	NA
	230 feet down-current of dredging	71	**82.0** [1]	100	100	0.450	**0** [1]	NA
22-Sep-05	Lab Control	NA	86.5	100	97.5	0.330	100	9.65
	1,000 feet up current of dredging	3	87.8	100	97.5	0.333	100	**0.0** [1]
	150 feet down current of dredging	75	87.5	100	**77.5**[1,2]	**0.179** [1,2]	100	**0.0** [1]
17-Oct-05	Lab Control	NA	NT	100	95	0.537	100	62.85
	1,000 feet up current of activity	4	NT	100	97.5	0.469	100	**14.85** [1]
	220 feet down current of debris removal	91	NT	95	92.5	**0.226** [1,2]	100	**0.0** [1,2]
	600 feet down current of debris removal	38	NT	100	100	**0.422** [1,2]	100	**0.45** [1,2]
19-Oct-05	Lab Control	NA	NT	100	97.5	0.324	100	58.1
	1,000 feet up current of debris removal	4	NT	100	97.5	0.571	100	53.6
	300 feet down current of debris removal	71	NT	97.5	95	**0.410** [2]	100	**0.9** [1,2]
	600 feet down current of debris removal	61	NT	100	95	**0.402** [2]	100	**0.5** [1,2]
14-Nov-05	Lab Control	NA	NT	100	95	0.309	100	0.0
	1,000 feet up current of dredging	2	NT	100	97.5	0.315	100	0.0
	300 feet down current of dredging	103	NT	100	**85** [2]	0.362	**0** [1,2]	NA

Table 3. Continued

Sample Date	Sample Location	Field Measured Turbidity	Sea urchin (*Arbacia punctalata*)	Mysid (*Americamysis bahia*)			Red alga (*Champia parvula*)	
			mean fertilization (%)	48 hour mean survival (%)	7 day mean survival (%)	7 day mean growth (mg/mysid)	48 hour mean survival (%)	day mean reproduction (cystocarp/tip)
17-Nov-05	Lab Control	NA	NT	100	97.5	0.268	100	46.1
	1,000 feet up current of dredging	5	NT	95	90	0.272	100	**31.9** [1]
	300 feet down current of cutterhead cleaning	85	NT	100	100	**0.230** [1]	**0** [1,2]	NA

NT – No Testing because viable specimens were not available for the test
NA – Not Applicable
CM - Complete Mortality in tested sample, no reproductive endpoint necessary.
[1] – Significantly different from associated laboratory control sample
[2] – Significantly different from associated reference sample

Table 4. Results of Chemical Analyses for Water Samples Collected during Fall 2005 Dredging

Sample Date	Tide	Estimated Distance from Activity	Sample ID	Sample Results							
				PCB (ug/L) Fraction		Total Metals (ug/L)					
				Dissolved	Particulate	Cadmium	Zinc	Nickel	Lead	Copper	Chromium
10/19/2005	Ebb	300' down-current of Debris Removal	WQE1101905	1.7	2.0	0.8	92	3.3	26	40	18
		600' down-current of Debris Removal	WQE2101905	2.3	6.7	1.1	76	2.4	21	33	17

present background results too
(per Fig. 3)

Table 5. Total PCB Concentrations for Sediment Trap Samples Collected during Fall 2005

Station ID	Date Deployed	Date Collected	Number of Days Deployed	Number of Dredge Days	Estimated Sediment Weight (grams)	Estimated Total Deposition Rate (grams/m²/day)	Total PCB* mg/Kg	Estimated PCB Deposition Rate (mg/m²/day)
Prior to Dredging and Mobilization								
ST-A	5/12/2005	6/1/2005	19	0	N/A	N/A	345	N/A
ST-A	5/12/2005	6/1/2005	19	0	N/A	N/A	283	N/A
ST-D	5/12/2005	6/1/2005	19	0	N/A	N/A	659	N/A
ST-F	5/12/2005	6/1/2005	19	0	N/A	N/A	66	N/A
During Dredging								
ST-A	9/30/2005	10/14/2005	15	6	35	46	N/A	N/A
ST-C	9/30/2005	10/14/2005	15	6	65	86	N/A	N/A
ST-E	9/30/2005	10/14/2005	15	6	65	86	N/A	N/A
ST-F	9/30/2005	10/14/2005	15	6	35	46	N/A	N/A
ST-B	10/17/2005	10/27/2005	11	6	20	36	N/A	N/A
ST-C	10/17/2005	10/27/2005	11	6	63	113	N/A	N/A
ST-E	10/17/2005	10/27/2005	11	6	54	97	N/A	N/A
ST-F	10/17/2005	10/27/2005	11	6	38	68	N/A	N/A
ST-A	10/28/2005	11/8/2005	12	8	35	57	567	33
ST-B	10/28/2005	11/8/2005	12	8	99	163	745	121
ST-D	10/28/2005	11/8/2005	12	8	64	105	2190	231
ST-E	10/28/2005	11/8/2005	12	8	72	118	878	104
ST-F	10/28/2005	11/8/2005	12	8	51	84	110	9
ST-B	11/8/2005	11/21/2005	14	7	74	104	510	53
ST-D	11/8/2005	11/21/2005	14	7	70	99	1820	180
ST-F	11/8/2005	11/21/2005	14	7	38	54	82	4
After Dredging and Demobilization								
ST-B	12/7/2005	12/17/2005	11	0	22	40	549**	22
ST-E	12/7/2005	12/17/2005	11	0	29	52	755**	39
ST-F	12/7/2005	12/17/2005	11	0	30	54	86	5

Notes:
* (18 NOAA Congeners) x (Site specific 2.6 multiplier)
** Sample volume too small to perform final % moisture test, sample results based on assumed 100% solids and results may be biased low.
N/A = No data available

FIGURES

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Figure 1. New Bedford Harbor Overview

Sources:MassGIS 2-m orthophotos
NAD 83 Mass State Plane m
ME scale 1:35000

Figure Date: 01.23.06 (JAS)

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0 0.25 0.5 1 Miles

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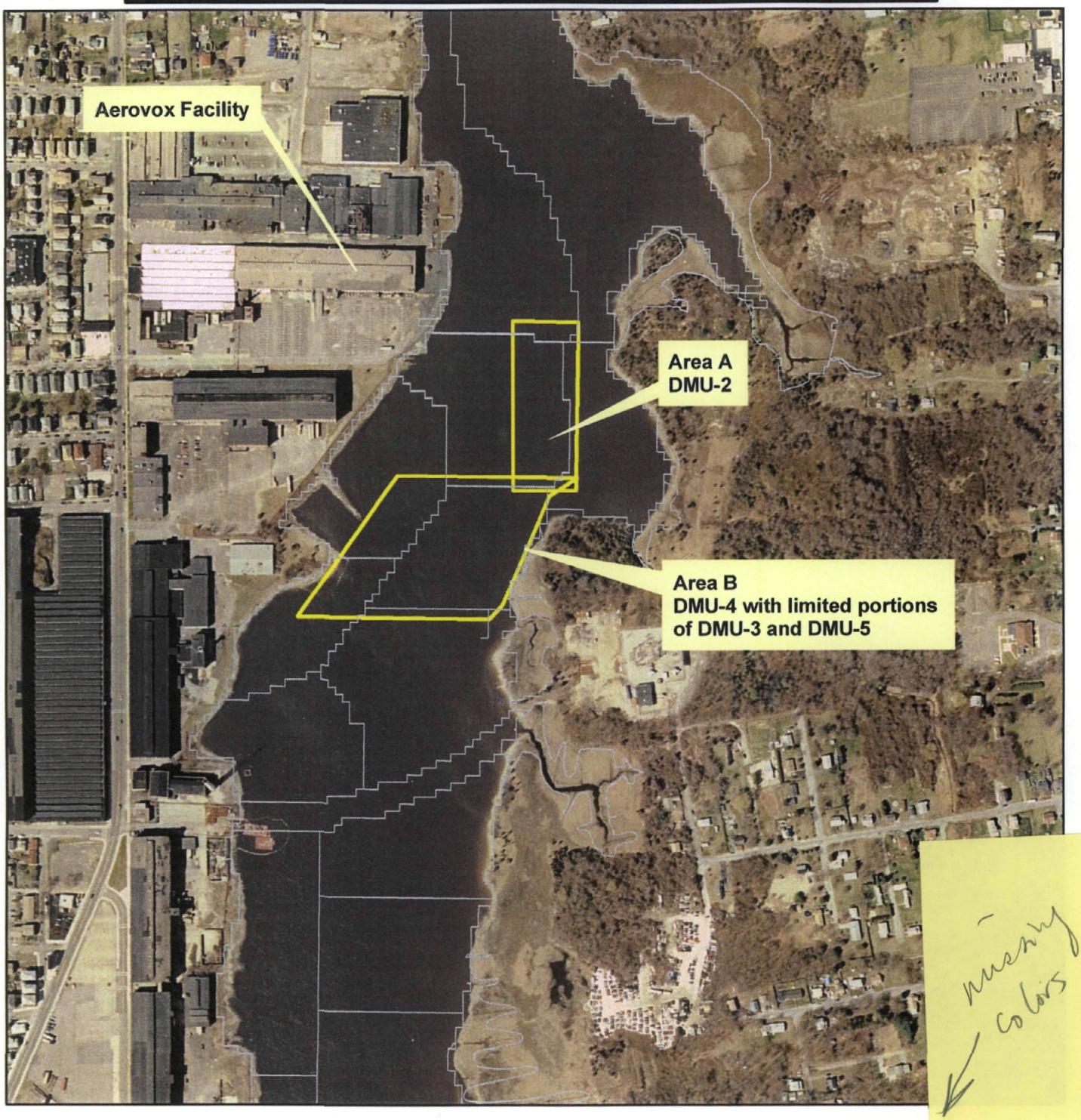

messy colors

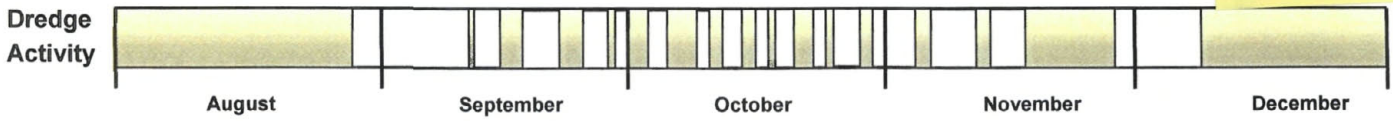

Figure 2. 2005 Location of Dredge Management Units in Upper New Bedford Harbor and Dredge Timeline

Sources:MassGIS 2-m orthophotos
NAD 83 Mass State Plane m
ME scale 1:7200

igure Date: 16 August 2006

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Dredge Activity

Mobilizaton and Demobilization

0 250 500 1,000 Feet

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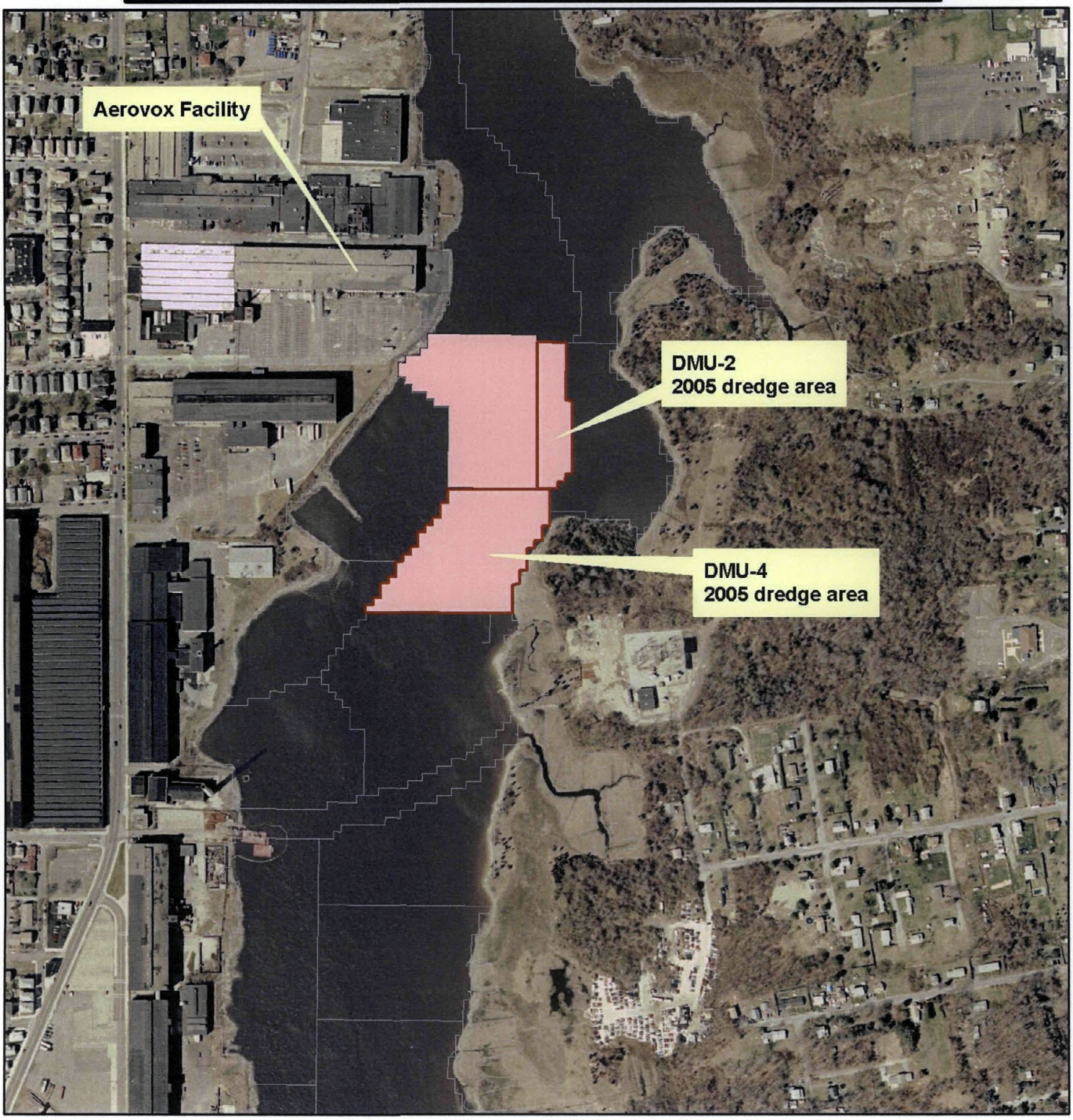

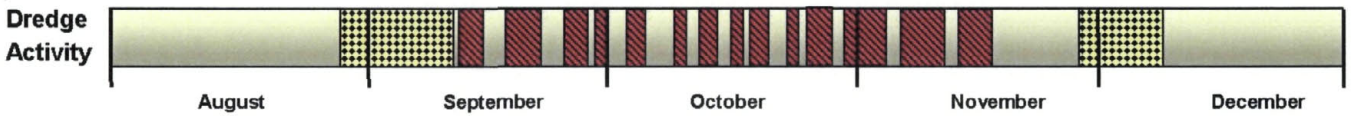

Figure 2. 2005 Location of Dredge Management Units in Upper New Bedford Harbor and Dredge Timeline

Sources:MassGIS 2-m orthophotos
NAD 83 Mass State Plane m
ME scale 1:7200

Figure Date: 01/23/06 (JAS)

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Dredge Activity

Mobilizaton and Demobilization

0 200 400 800 Feet

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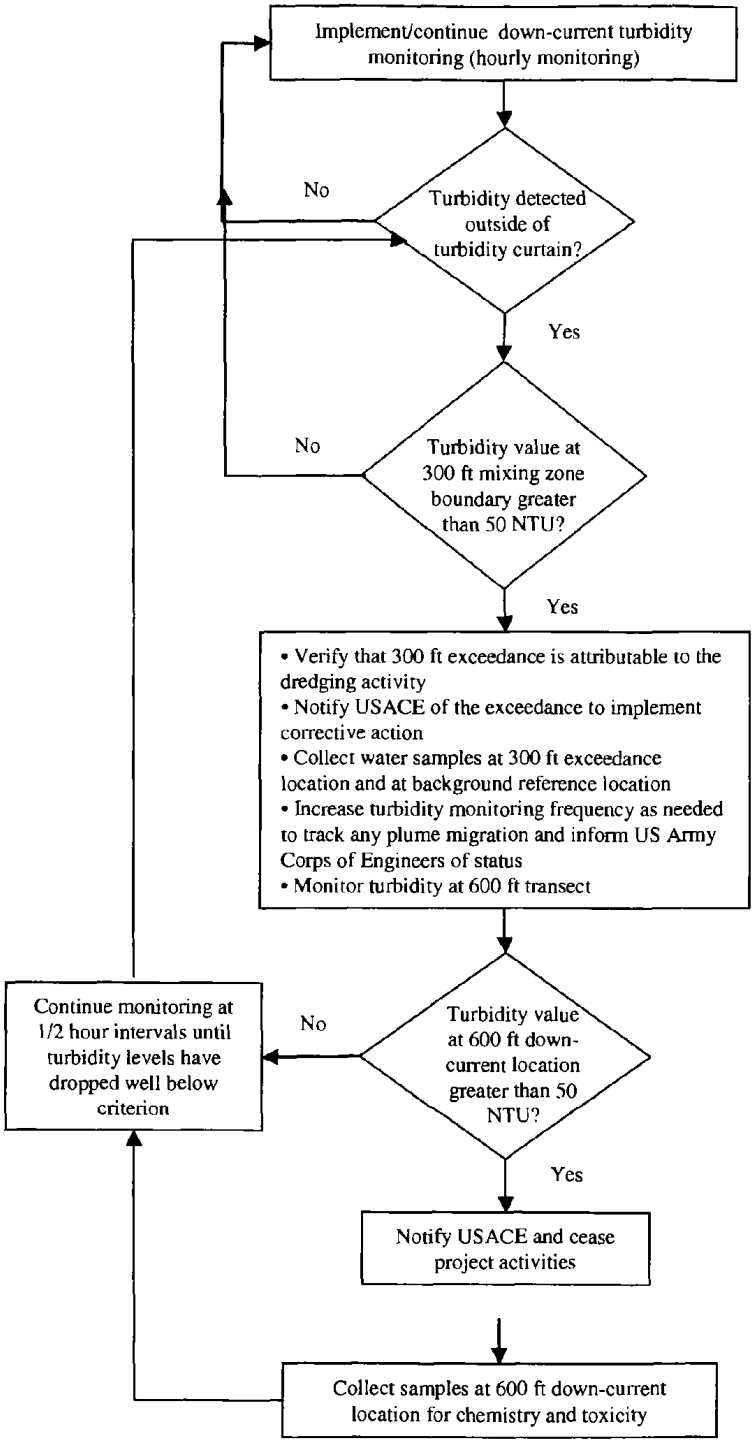
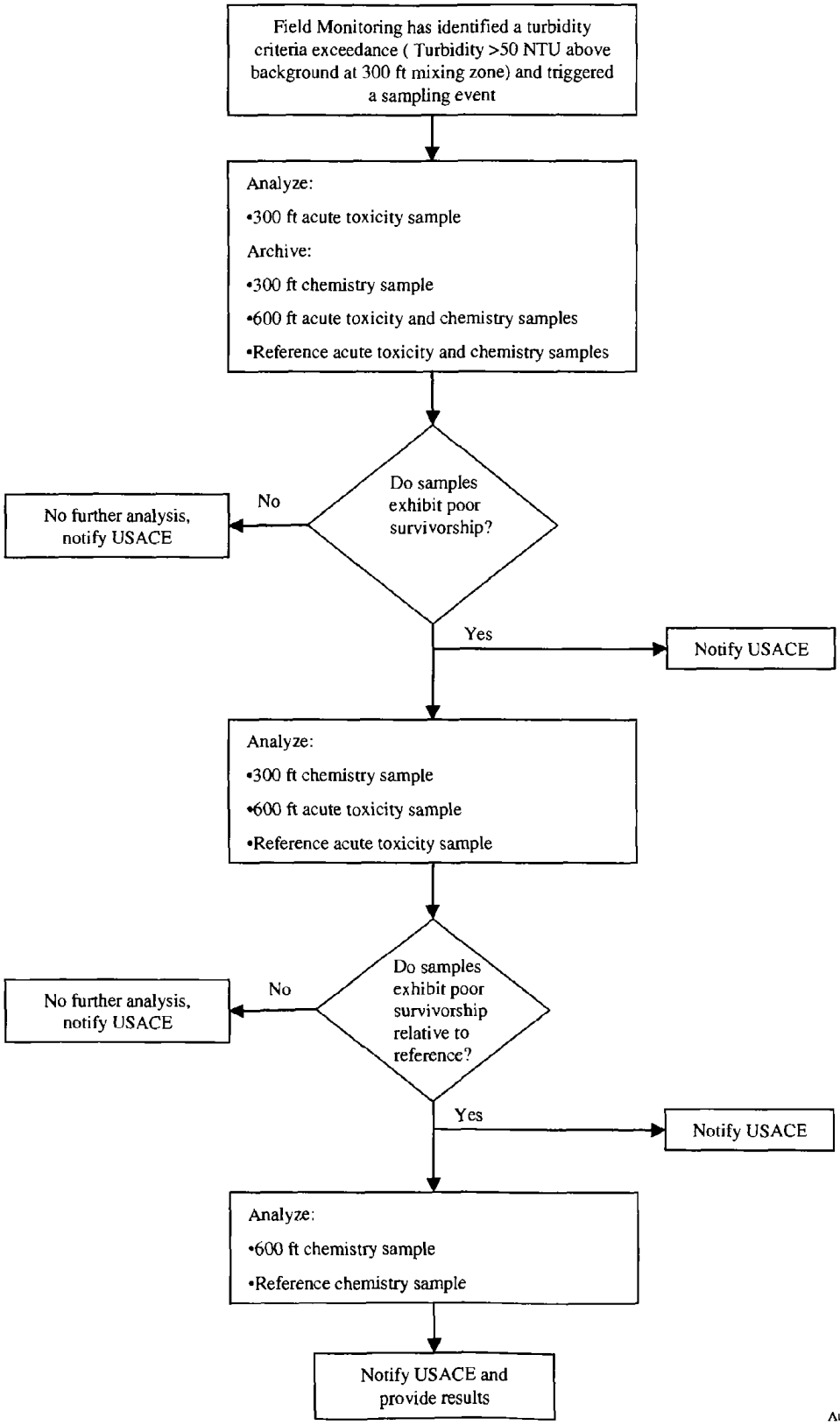
Figure 3. Water Quality Monitoring Decision Sequence



Notes

1: 50 NTU value was defined as 50 NTU above background turbidity level

Figure 4. Analytical Protocol Decision Sequence



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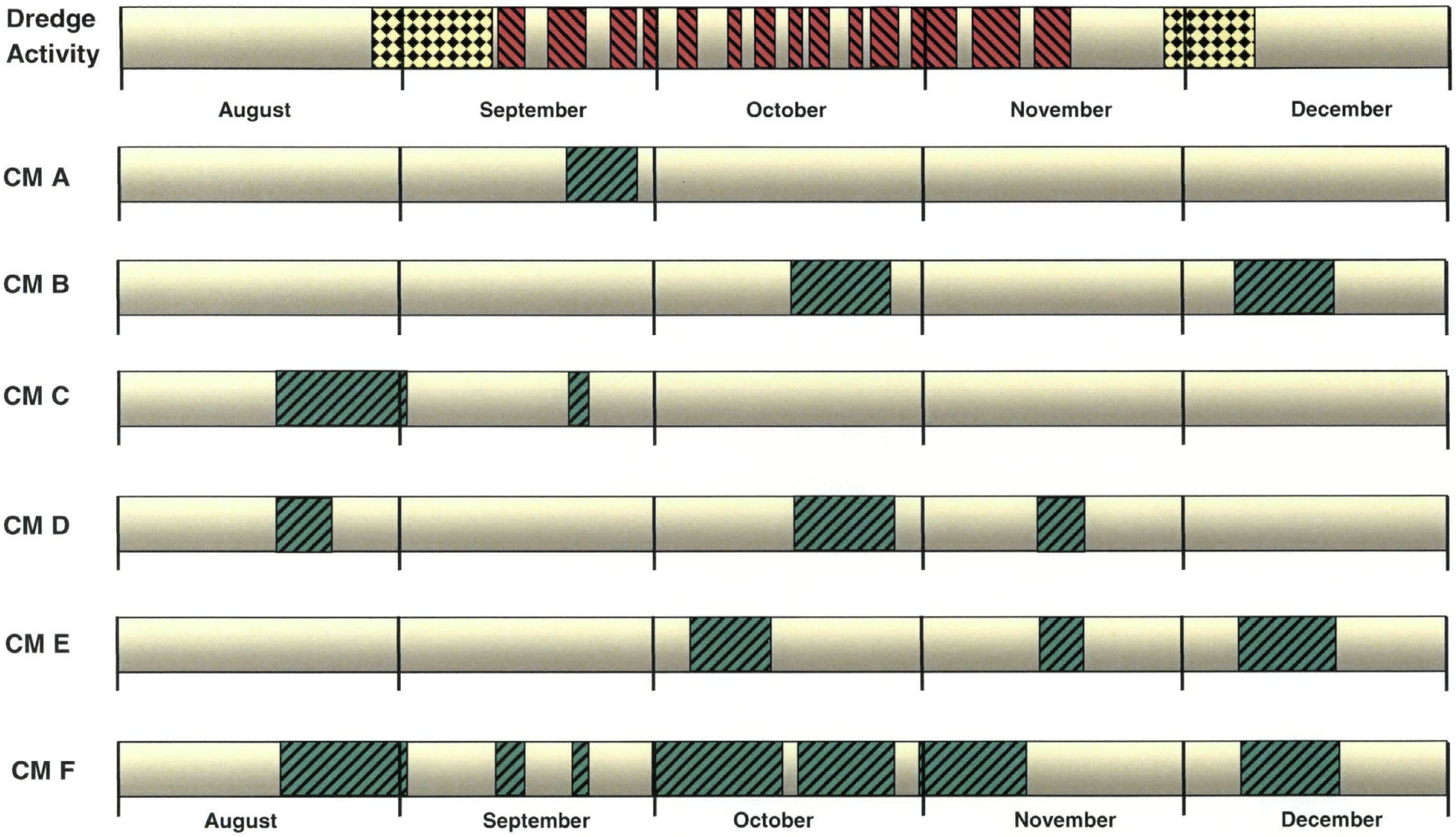

Figure 5. Dredging and Continuous Monitoring Timeline in New Bedford Harbor During the 2005 Dredge Program

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Dredging

Mobilization and Demobilization

Meter Deployment

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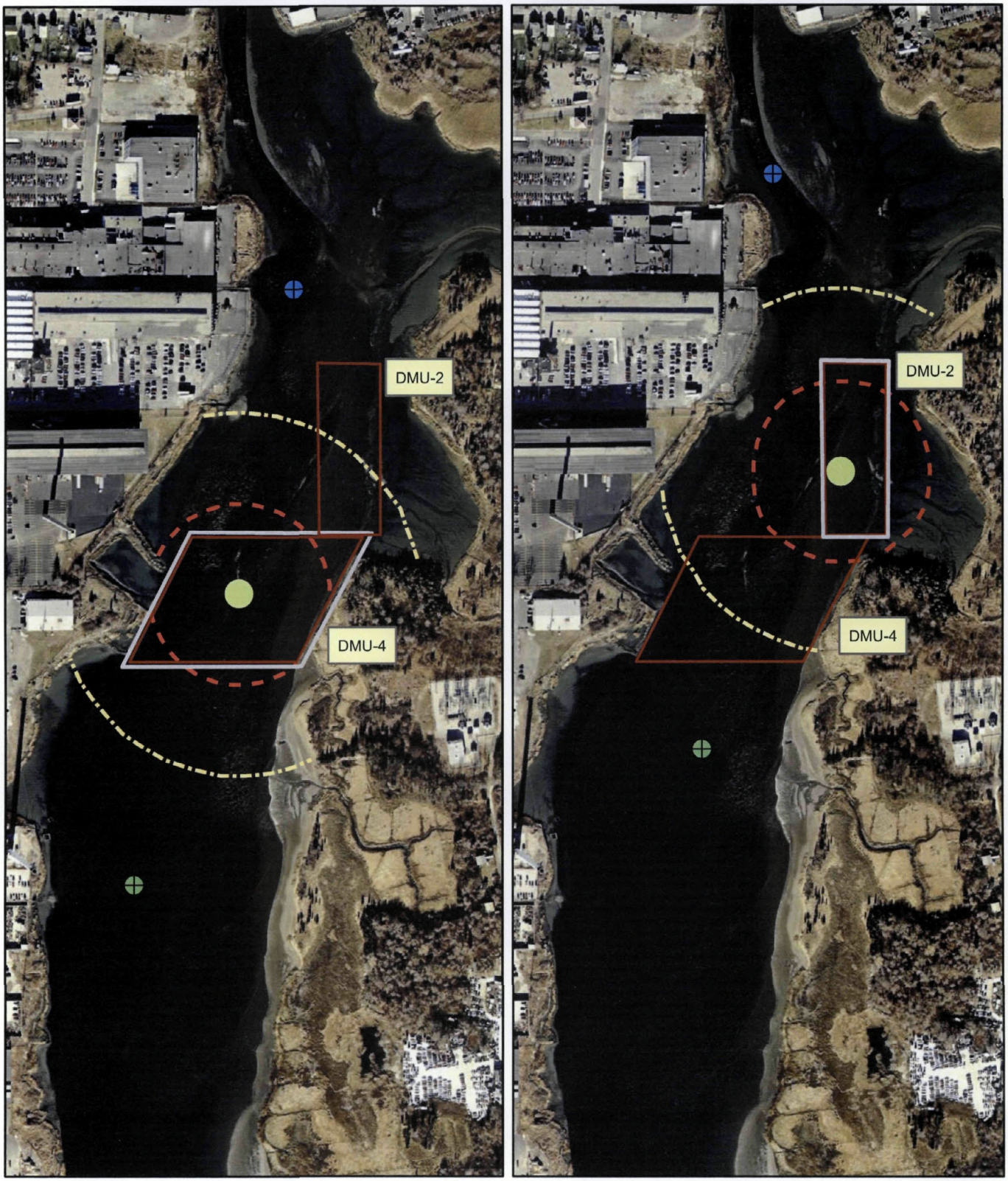

Figure 6. Location of Dredge Management Units with Environmental Compliance Boundaries

Sources:MassGIS 2-m orthophotos
NAD 83 Mass State Plane ft

Figure Date: 01.23.06 (JAS)

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Oil boom
Dredged Area
300 ft Boundary
600 ft Boundary
Ebb Reference
Flood Reference
Dredge Location

0 250 500 1,000 Feet

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Figure 7. Continuous Recording Water Quality Meter Locations

Sources: MassGIS 2-m orthophoto
NAD 83 Mass State Plane ft

Figure Date: 01.23.06 (JAS)

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Continuous Monitoring Station
2005 Dredge Area
Oil boom

0 500 1,000 Feet

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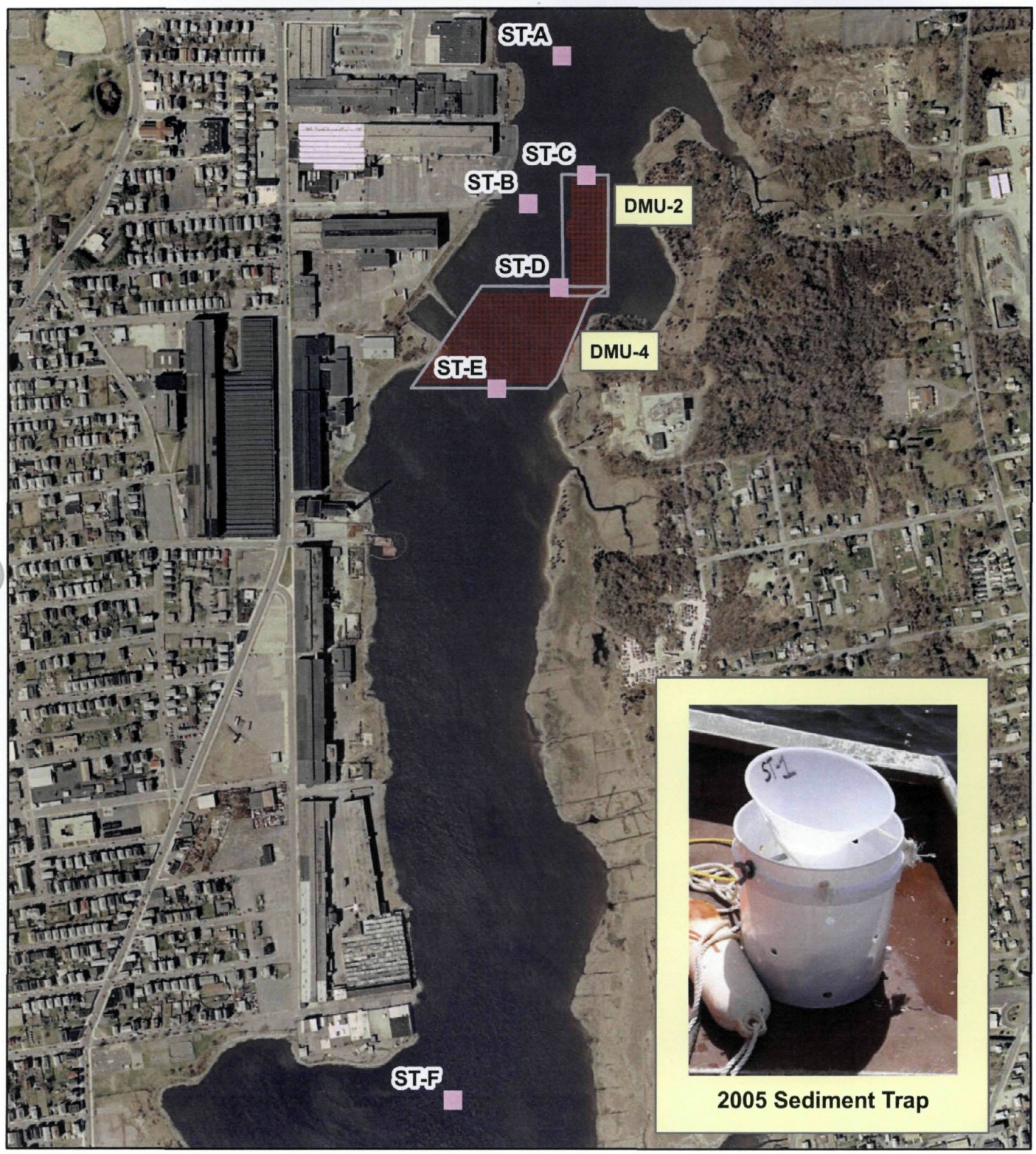

Figure 8. Sediment Trap Station Locations

Sources: MassGis 2-m orthophoto
NAD 83 Mass State Plane ft

Figure Date: 01.23.06 (JAS)

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Sediment Trap Station
2005 Dredge Area
Oil boom

0 500 1,000 Feet

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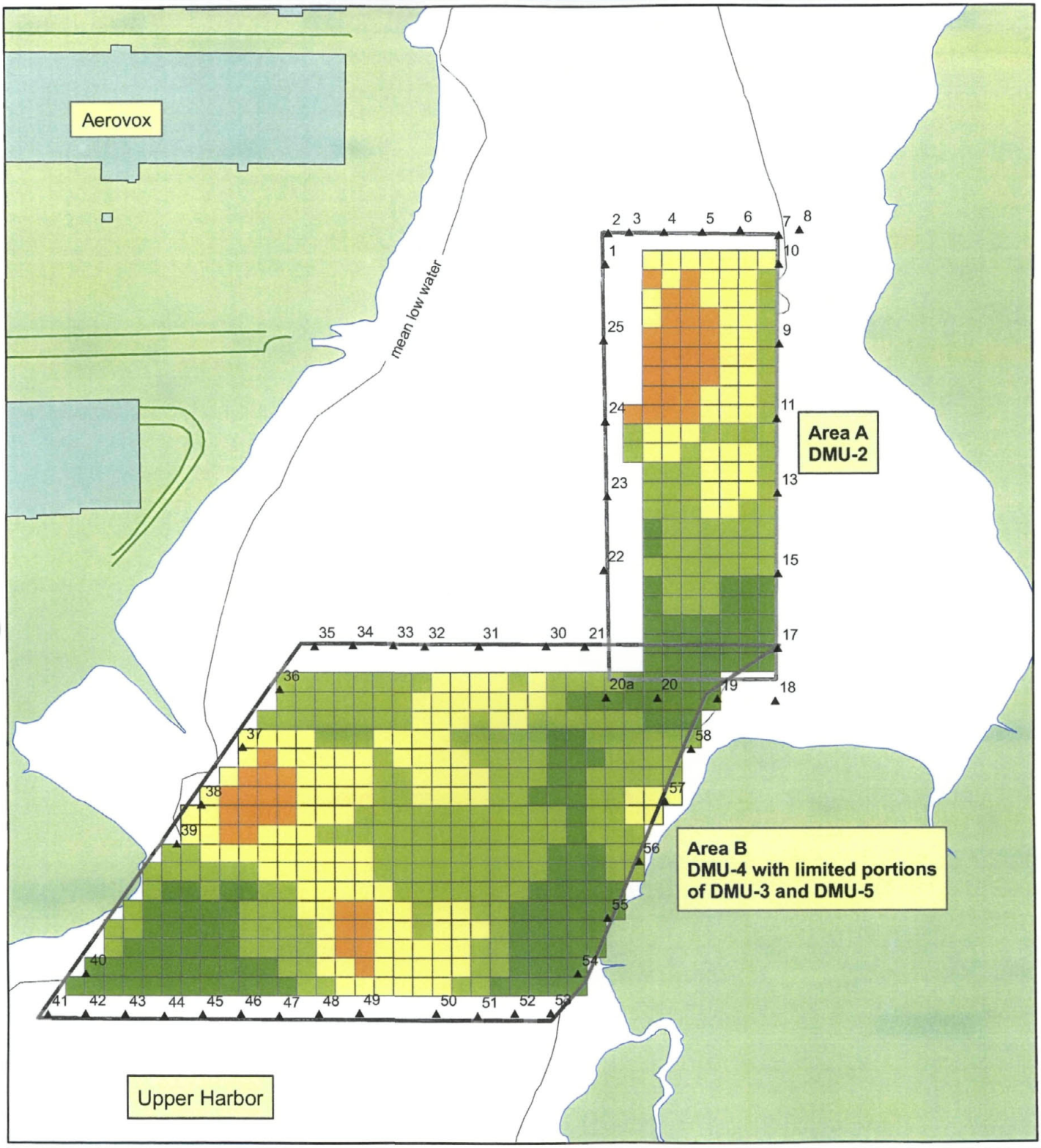

Figure 9. Dredge Grid System of DMU-2 and DMU-4

Sources:
NAD 83 Mass State Plane ft

Figure Date: 16 August 2006

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Cut Depths (Jacobs 2005)

0
0 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
3.0 - 3.5
3.5 - 4.0
4.0 - 4.5
4.5 - 5.0
5.0 - 5.5

2005 Sheet Piles
Oil boom

0 75 150 300 Feet

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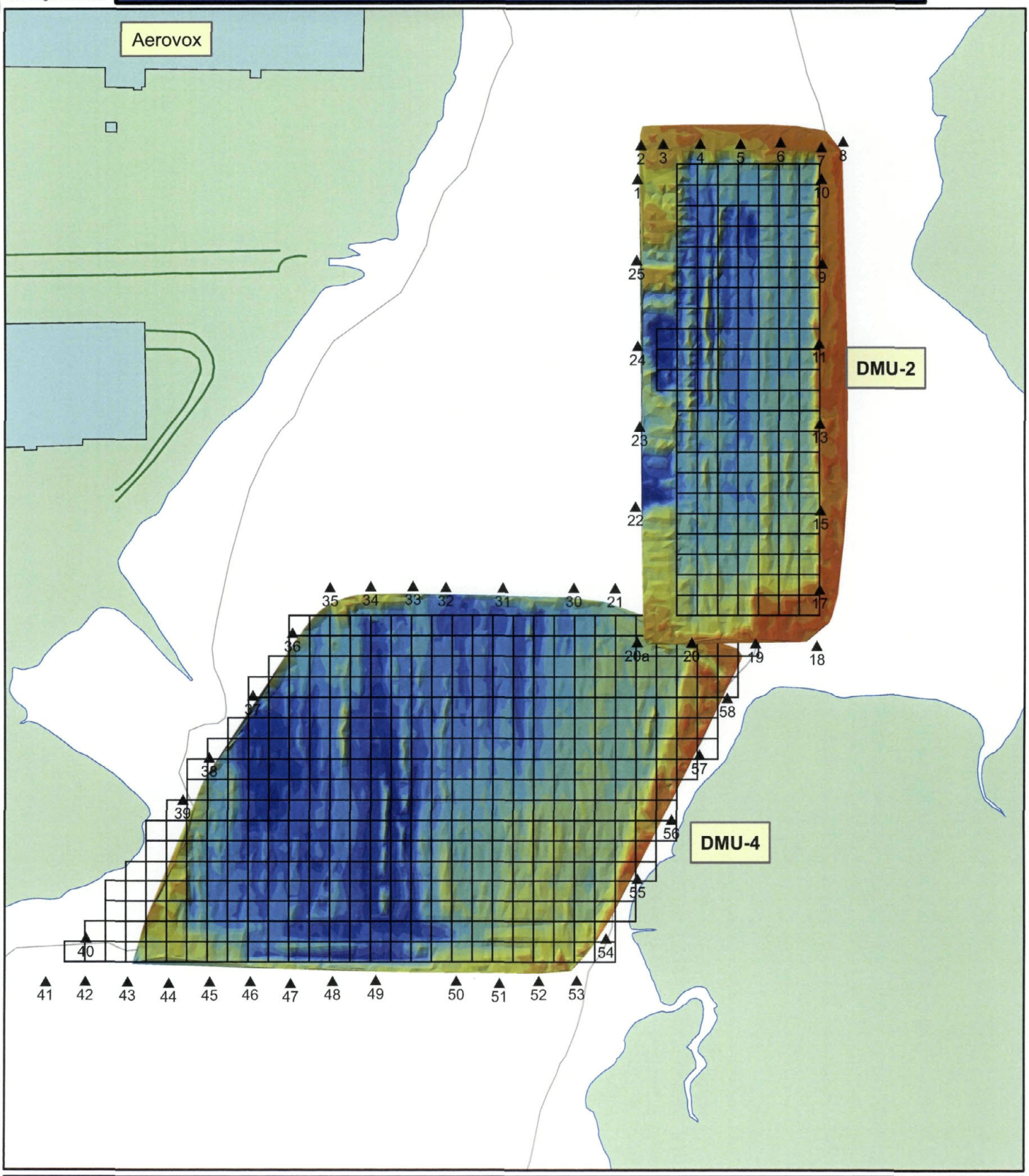

Figure 10. Post-Dredge Bathymetry of DMU-2 and DMU-4

Sources:
NAD 83 Mass State Plane ft

Figure Date: 01.23.06 (JAS)

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DMU-2 bathymetry from 12/08/05
DMU-4 bathymetry from 11/23/05

0 100 200 400 Feet

Elevation

-1.0 - -0.5
-1.5 - -1.0
-2.0 - -1.5
-2.5 - -2.0
-3.0 - -2.5
-3.5 - -3.0
-4.0 - -3.5
-4.5 - -4.0
-5.0 - -4.5
-5.5 - -5.0
-6.0 - -5.5
-6.5 - -6.0
-7.2 - -6.5

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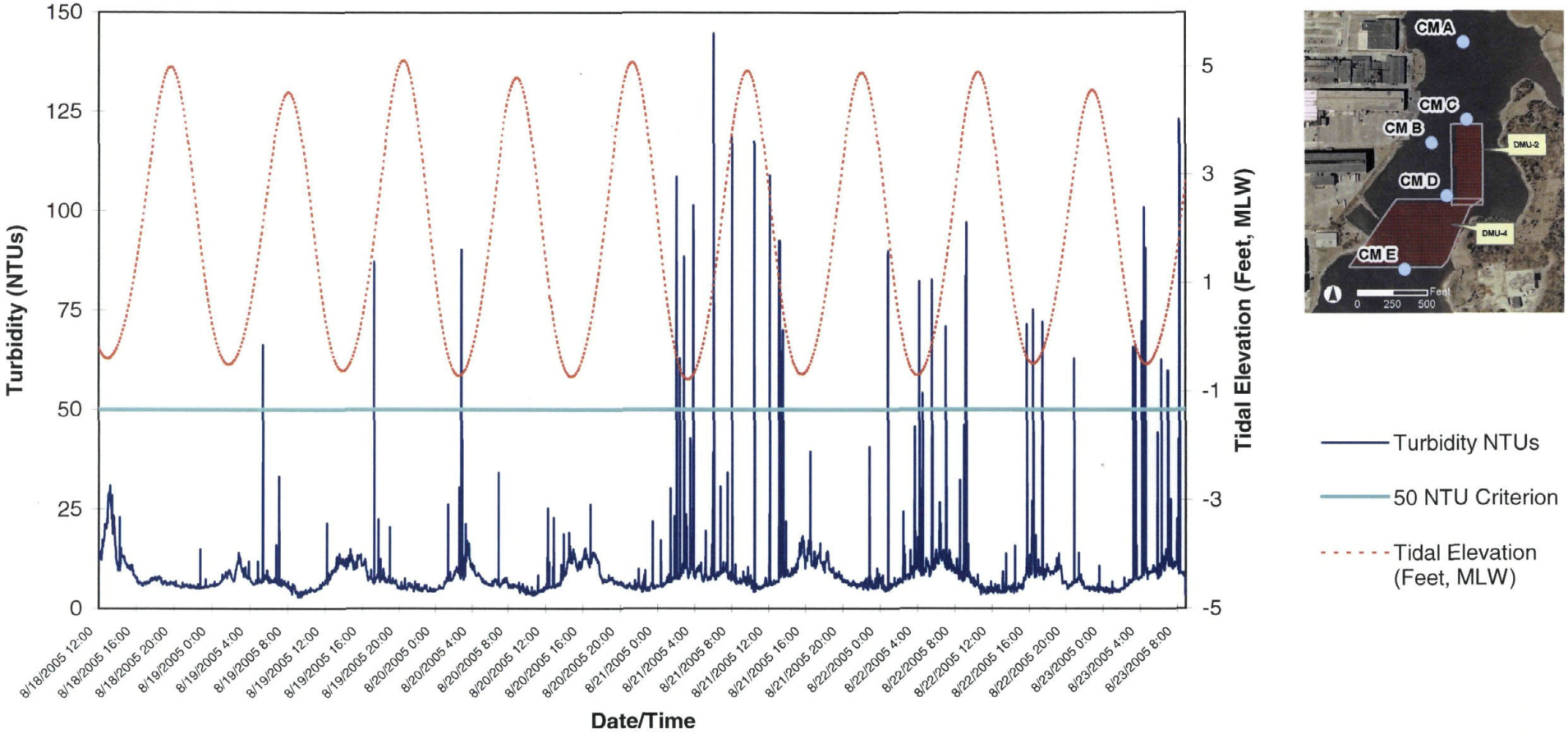

Figure 11. Turbidity Monitoring at Station CM C Baseline 8/18/05 - 08/23/05

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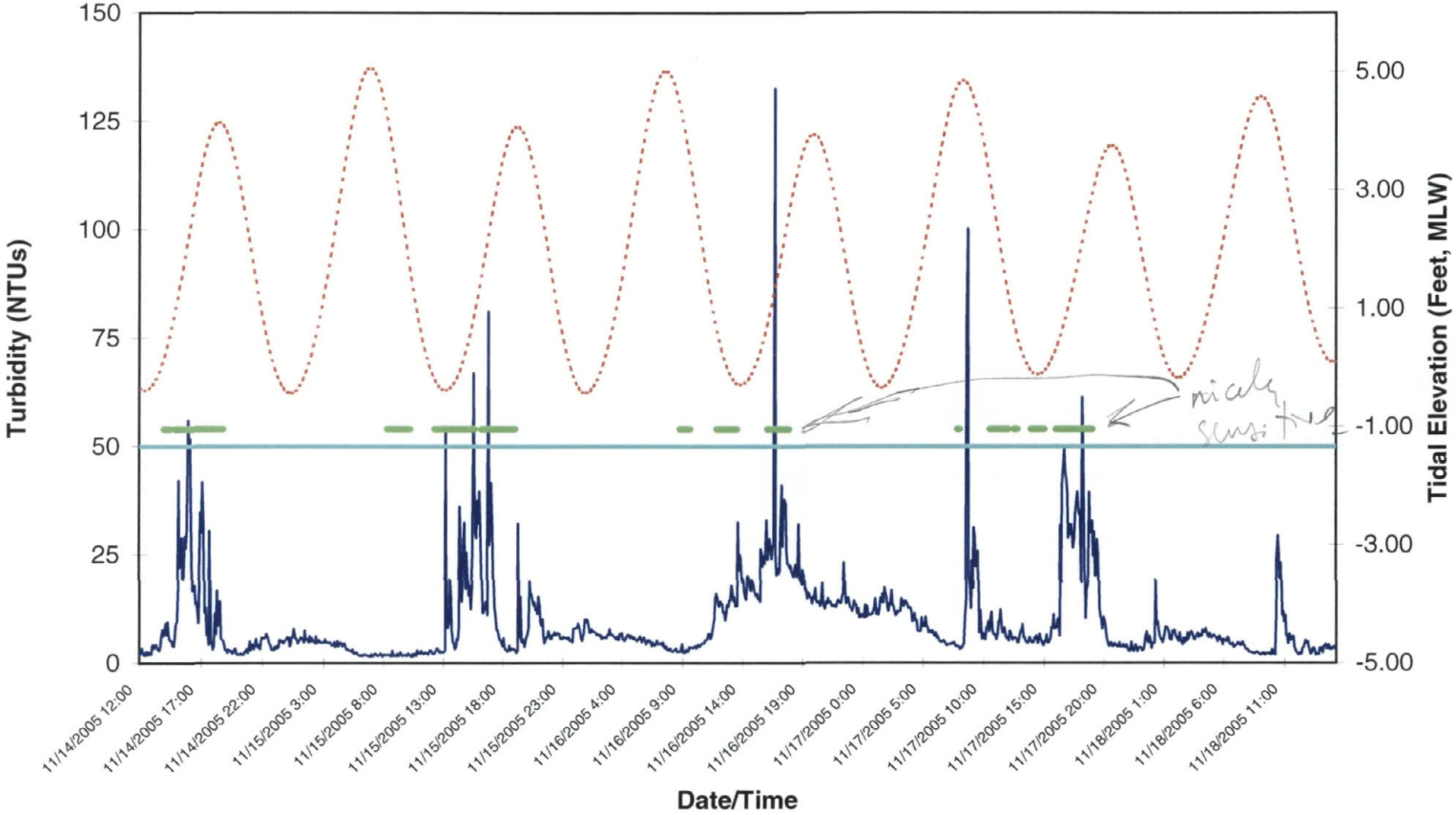

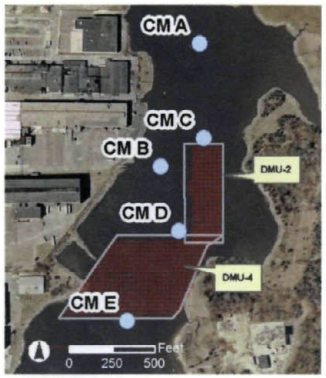

Turbidity NTU
50 NTU Criterion
DMU 4 Dredge Period
Tidal Elevation (Feet, MLW)

Figure 12. Turbidity Monitoring at Station CM D during Dredging of DMU-4 11/14/05-11/18/05

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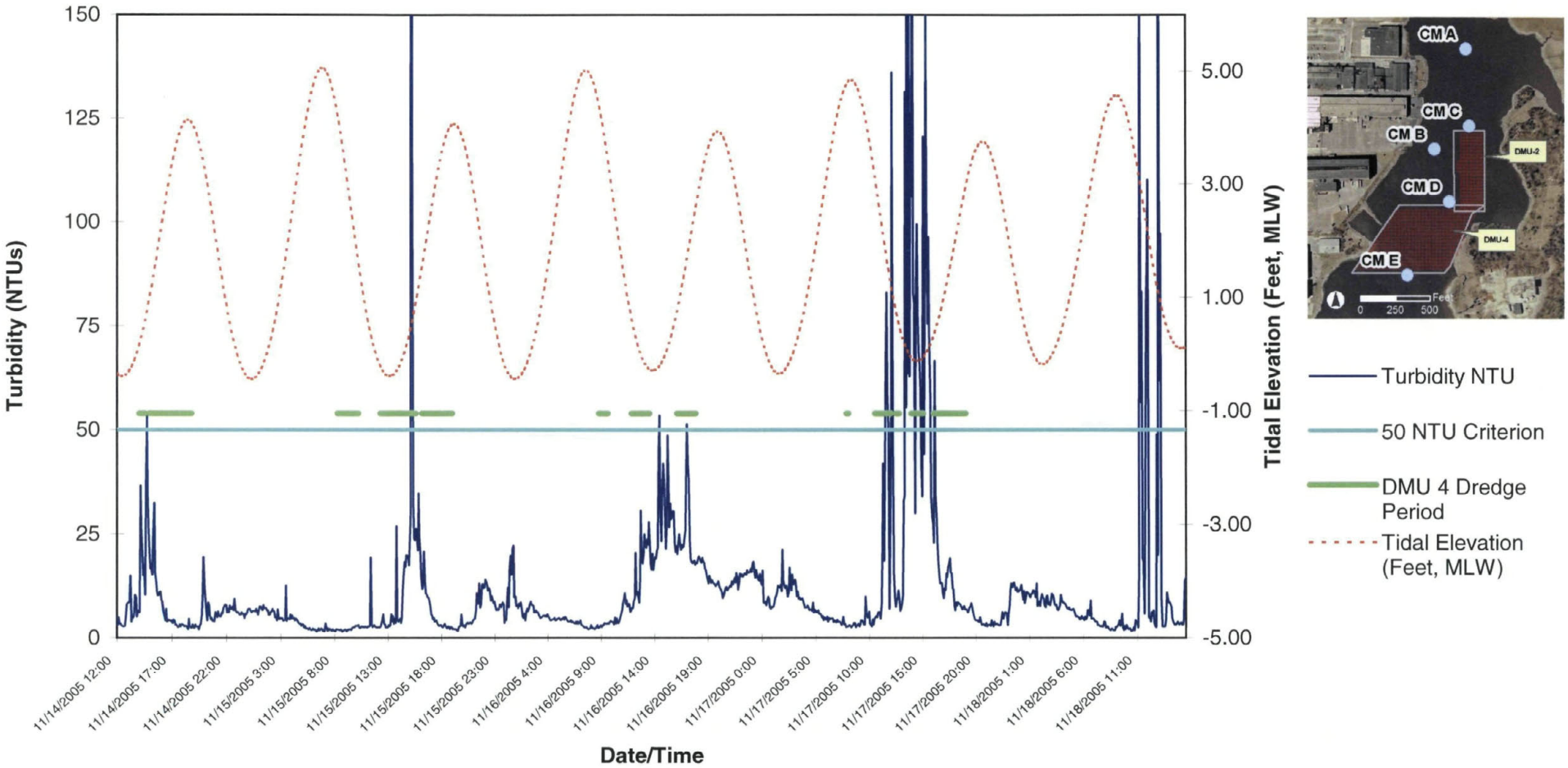

Figure 13. Turbidity Monitoring at Station CM E during Dredging of DMU-4 11/14/05-11/18/05

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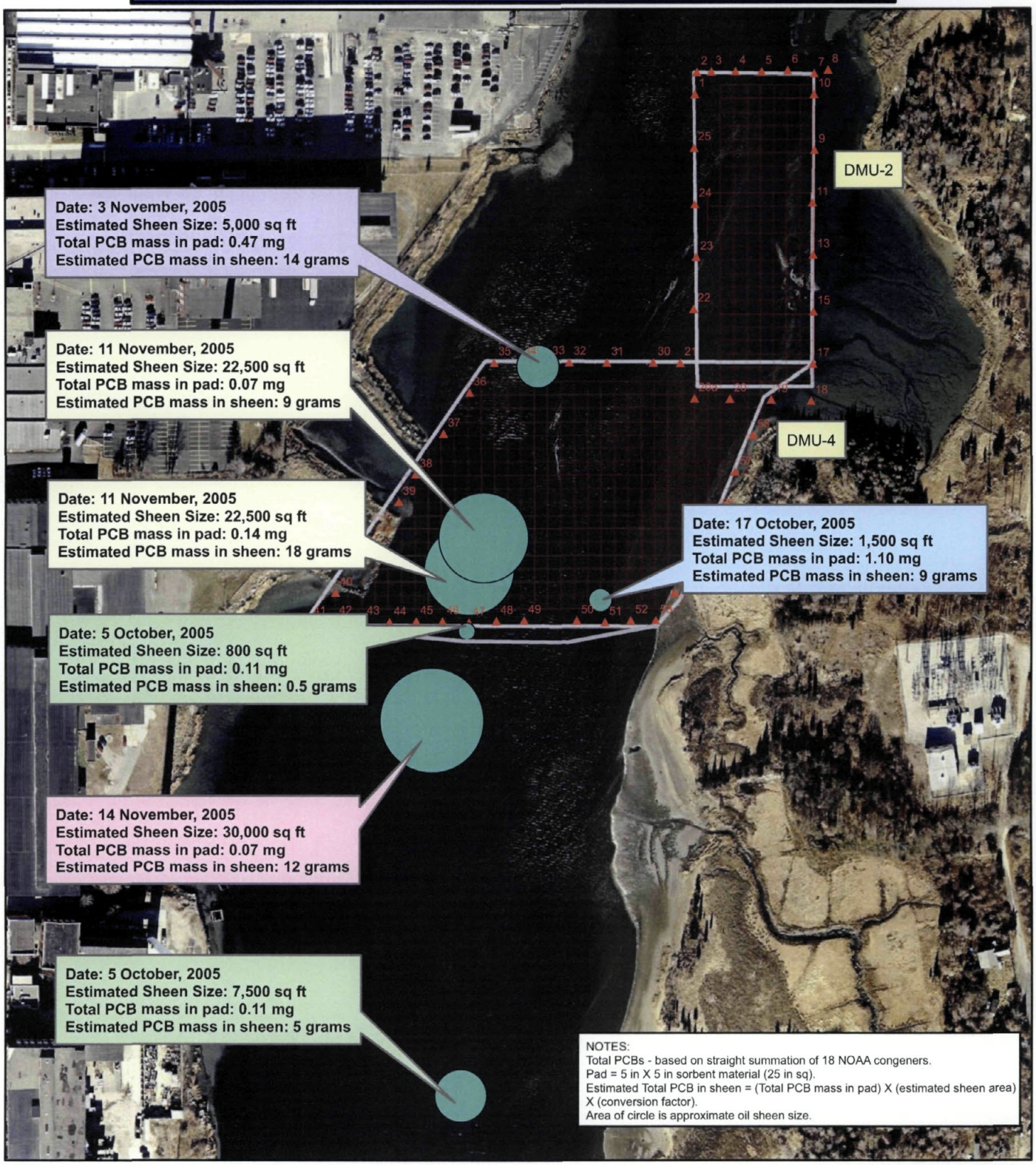

Figure 14. Fall 2005 Oil Sheen Sample Locations and Results

Sources: MassGiss .5-m orthophoto
NAD 83 Mass State Plane ft

Figure Date: 01.30.06 (JAS)

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Sample Dates

- 5 October, 2005
- 17 October, 2005
- 3 November, 2005
- 11 November, 2005
- 14 November, 2005

- Oil Sheen Sample
- Sheet Piles
- Dredge Area Grid
- Oil boom

0 100 200 400 Feet

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APPENDIX

APPENDIX A

STATEMENT OF WORK FOR WATER QUALITY MONITORING

I. General

The purpose of this scope of work (SOW) is to present a general monitoring approach to assess ecological impact to the water column.

Water quality monitoring will be conducted during the 2005dredging season scheduled to begin in early June 2005. During this timeframe dredging is anticipated in several dredge management units (DMUs) in the Upper Harbor. The dredging will be performed using a hydraulic dredge system and pumped via pipeline to a sand separation facility and then ultimately to the dewatering facility at Area D. As with all previous construction and dredging related operations conducted as part of this Superfund remedy, a water quality monitoring program will be implemented designed to limit environmental impacts to the water column and to assess transport and settlement of contaminated material away from the dredging operation.

Similar to the monitoring performed during the dredging of DMU2 in 2004, there will be a shift in the emphasis of the monitoring away from a total flux measurement approach (as performed during the "hot spot" dredging) to one that focuses on near-field water column impacts (environmental) as well as identifying the extent of recontamination of previously dredged areas (operational) as a result of the dredging process. The data collected as part of this effort will continue to be used to guide project operations as necessary in order to minimize environmental impacts and limit recontamination of previously dredged areas for this and future DMU' s. For the purpose of this SOW the Tasks will be addressed as two distinct efforts referred to as the environmental component (water quality monitoring) and the operational component (recontamination assessment). Although these are separate efforts, the Contractor shall identify opportunities for efficiencies in carrying out both field programs.

A Water Quality Monitoring:

As with previous monitoring efforts, a tiered approach will be employed using varying levels of monitoring intensity to assess and gauge project related water quality impacts. More intensive monitoring will occur during the initial weeks of dredging to establish and verify the protectiveness of project specific monitoring criteria and track plume dispersion, suspended sediment and contaminant transport downfield of the dredge. The monitoring effort will incorporate plume tracking, transect monitoring, water column sampling/analysis and toxicity testing to gauge impacts. During the course of the 2005 dredging operation, it is anticipated that environmental conditions within the water column will stabilize and a protective criteria will have been established. At this point, monitoring intensity and duration will be scaled back with a reliance on acoustic profiling and real-time turbidity monitoring as the primary methods to gauge impact. Flexibility in the monitoring program will be necessary throughout the dredging process to respond to changing field conditions and data flow. The Contractor shall review the elements of this SOW and consult with the USEPA Region I, USEPA Atlantic Ecology Division and the USACE to finalize the goals, methods and approaches of the program.

II. Monitoring Approach

A. Water Quality Monitoring

Boat-based monitoring shall be performed during in-water operations that have the potential to disturb significant quantities of sediment. The purpose of this monitoring is to ensure that acute impacts to the water column do not extend beyond the designated mixing zone established for the project and that contaminants are not transported away from the operations area at unacceptable levels to other portions of the harbor or to adjacent areas that have been previously dredged.

A tiered monitoring approach will be implemented incorporating field measurements of acoustic backscatter, turbidity, and water quality parameters as well as sampling for toxicity testing and laboratory analysis. The overall approach of the water quality monitoring program will consist of boat-based measurements of water column turbidity along transects within the vicinity of the project site. Measurement of acoustic backscatter using ADCP may be implemented at locations with adequate water depths. Monitoring along transects will take place immediately adjacent of the dredging operation, and at 300 and 600 feet distance(s) down-current, with additional tracking of any identified suspended solids plumes. Monitoring shall also be performed at an appropriate up current reference location. Three general levels of the intensity of the monitoring are defined as follows:

- Level I – Includes sampling/testing at all stations over multiple tidal cycles
- Level II – Includes sampling/testing at the station immediately adjacent to the dredging operation
- Level III – Boat-based monitoring using acoustic backscatter and OBS sensor with water sample collection and analysis contingent upon on any exceedance of the project-based criterion or as may be determined based on detection of sheens or plumes emanating from the project area.

During project initiation, Level I monitoring will be implemented to ensure that project environmental goals are being met and to verify the protectiveness of the project-based turbidity criterion. It is expected that the level of monitoring will be scaled back as the project progresses, but is assumed to return to Level I at various points throughout the project as different dredging conditions are encountered. An assumed monitoring schedule is presented in Attachment 1.

A(1) Equipment – The Contractor shall incorporate the following equipment for use in the implementation of the monitoring program:

- Optical back-scatter (OBS) nephelometer with an underwater sensor and direct surface readout or capable of submerged deployment. Up to three units may be required over the course of the project with the potential for evaluation of the effectiveness of a deployed meter array.

- Acoustic Doppler Current Profiler (ADCP) capable of performing in the relatively shallow waters of the Upper Harbor.
- Water quality instrumentation capable of providing in-situ measurements of temperature, salinity, and dissolved oxygen.
- Sampling equipment (pumps, tubing etc.) suitable for the collection of water samples requiring low detection limit analyses.

A(2) Location – The boat-based monitoring shall focus on the following areas:

- Station 1 – defined as immediately adjacent to an down current of the dredging operation (as close as practice and safety allows)
- Station 2 – defined as along the down-current edge of pre-determined mixing zone set 300 feet from the dredging operation
- Station 3 – defined as along a second zone set 600 feet down-current of the dredging operation
- Reference Station – background (i.e., reference) measurements shall be collected approximately 1000 feet up current of the dredging operations prior to each day of dredging for each monitoring day. This location shall be outside the influence of any localized turbidity sources (ex. CSO discharges or storm water drains), but still representative of the water flowing through the deeper channel areas up current of the dredge area.
- Additional sampling locations may be defined as the monitoring is performed

A(3). Frequency – For the purposes of this SOW, the Contractor shall assume the frequency of environmental monitoring activities as presented in Table 1 attached.

A(4). Sample Collection and Analyses – Sample collection shall be assumed as follows over the course of each monitoring day:

- Level I – 4 stations x 2 tidal stages = 8 sample sets/day
- Level II – 1 station (#1) x 1 tidal stage = 1 sample set/day (with 2 additional sets archived)
- Level III – sampling conditional on results of turbidity monitoring

Total number of samples assumed during the effort and specific testing and analytical requirements are found in the attached table.

A(5). Lab Schedule – For a Level I, II and III activities, a laboratory turn-around time of two weeks shall be required for the chemical analysis unless otherwise specified. Toxicity test analysis shall report results verbally as soon as practical with full reports due within 1 week of test completion.

A(6). Project Specific Criterion - The upper level turbidity criterion, defined as a "reportable event" will be initially set at 50 Nephelometric Turbidity Units (NTUs) above

background as measured at the edge of the 300-foot mixing zone. This criterion may be adjusted based on the results of the monitoring during the program.

III. Reporting

A. Daily Reporting - The Contractor shall develop a daily field report sheet for each monitoring event. This daily submittal shall provide the following information:

(1) Date, time, location, and type of construction activity as well as the names of sampling team members and team leader.
(2) A plan-view of the harbor and construction site that allows for the recording of visual events such as plumes or oil sheens. This map will be included with the daily field-reporting sheet and will graphically present turbidity values recorded during each monitoring event.
(4) A summary of weather conditions, and the timing of the tides.
(5) A comments section to allow field personnel to record visual observations or relevant field activities that may assist in data interpretation.

Data sheets shall be delivered either electronically or in hard copy to the USACE or their representative at the end of each day of monitoring. A hard copy shall be hand delivered to the on-site office of the USACE Resident Engineer. If the established turbidity criterion is exceeded, the USACE shall be immediately notified and "conditional" monitoring/sampling activities initiated.

B. Weekly Update – A weekly update report shall be prepared summarizing the monitoring performed during the week and the results of testing and analyses. This report shall be distributed via email.

IV. Deliverables

A. Summary Report - The Contractor shall provide the USACE a summary report of the monitoring results within 2 months of completion of the 2005 dredging and all associated analyses. The report shall include monitoring methods, field observations during construction, photos of the monitoring process and toxicity and analytical data. The report shall also contain a "Summary" and "Conclusions" section based on all monitoring data with discussion relative to overall impact of the dredging process on water quality. The discussion shall also address dredging impacts relative to recontamination and present recommendations to minimize these effects if warranted. The deliverable shall include 10 hard copies as well as 10 CDs.

APPENDIX B

FIELD DATA LOGS

Appendix B contains copies of Daily Field Summary Logs from 12 September to 18 November 2005. Field monitoring was performed during 22 days of the dredge program. Summary logs were completed at the end of each monitoring day and submitted electronically to Corps personnel within 24 hours. Each log contains date, time, monitoring positions, sample collection, meteorological observations, water depth, turbidity and other relevant observations.

ENSR INTERNATIONAL

Daily Field Summary for Water Quality Monitoring DMU #2 Area A

Date: 12 September 2005

Weather: Sunny 85°F

Tides:

LWS @ 0744
Flood @ 1144
HWS @ 1530

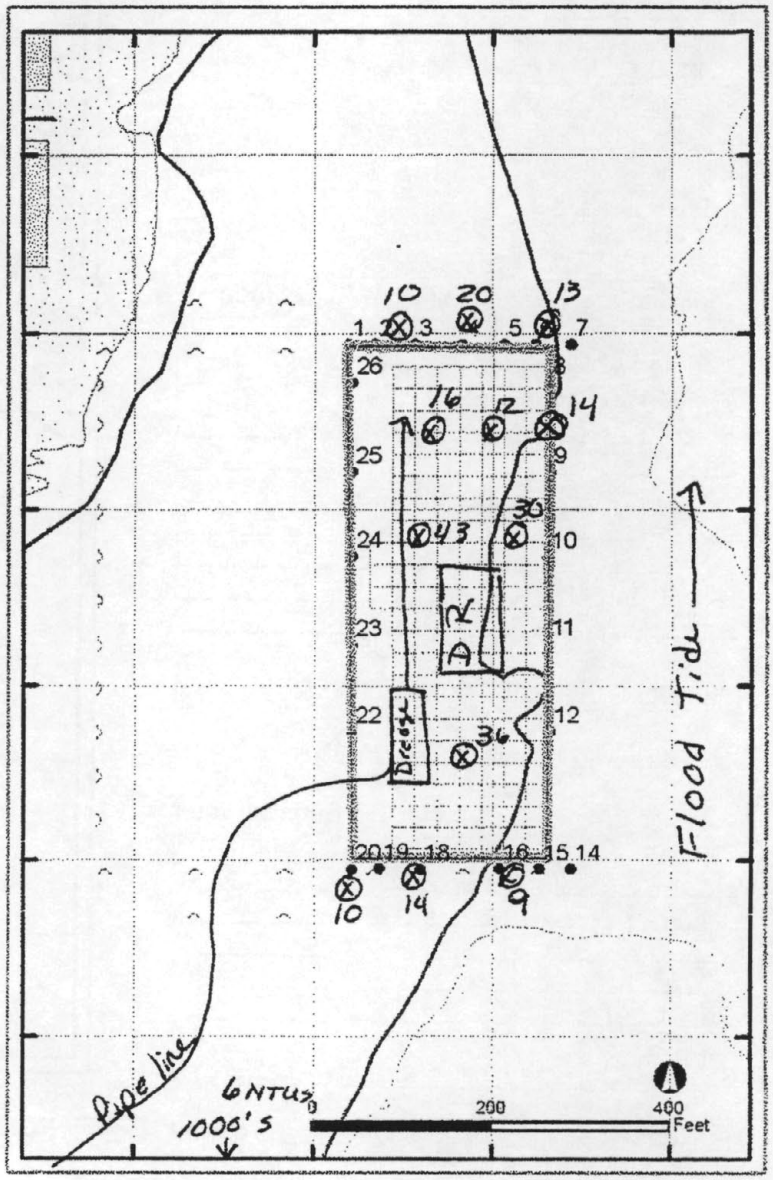
Monitoring Period:

From: 0744 To: 1600
Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity *(number of dredges, locations, and time period)*:

1 Dredge operating from south west corner of Area A north.

Debris removal active and centerally located



Monitoring Measurement Summary:

Range of Turbidity Down Current:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
1000' South	6	2
200' N of Dredge	43	2
300-500' N of Dredge	16-20	2-3
200-500' S of Dredge	9-14	2-3

Samples Collected for Laboratory Analysis

☑ None ☐ TSS & turbidity ☐ Toxicity ☐ PCBs & Metals

Grid spacing: 200 feet

Observations

Dredging and debris removal activities
Observed oil sheen 20 feet south of oil boom's southern boundary during morning activity, oil sheen also observed within boom boundary. Observed 10-15 8" dead Blue fish in and around Area A. Many gulls and turkey vultures feeding on dead fish and small ~~bait~~ bait fish in the area.

Scientific Crew: Julie Stearns, Heather Davidson, Terry Delaney.

Completed By: Julie Stearns

ENSR INTERNATIONAL

Daily Field Summary for Water Quality Monitoring DMU #2 Area A

Date: 13 September 2005

Weather: Sunny 85°F

Tides:

LWS @ 0920
Flood @ 1330
HWS @ 1630

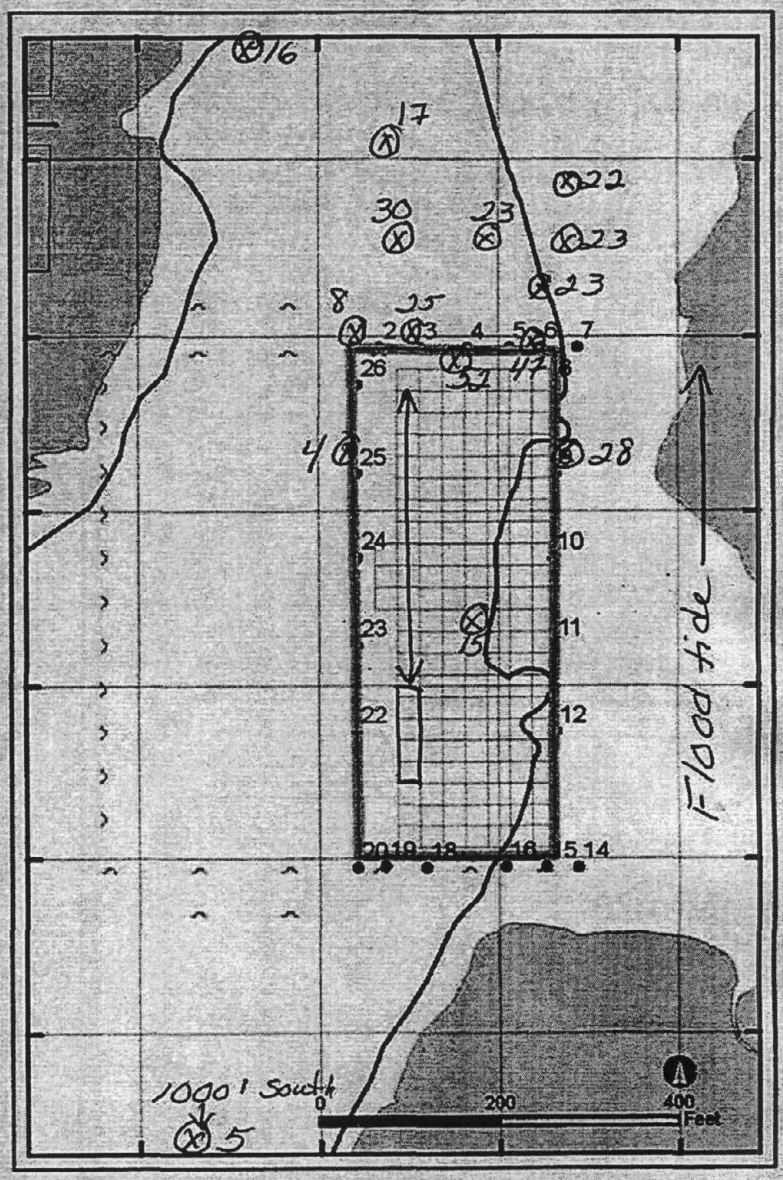
Monitoring Period:

From: 1130 To: 1630

Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity (number of dredges, locations, and time period):

1 Dredge in operation



Monitoring Measurement Summary:

Range of Turbidity Down Current:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
50-100 ft Down current	17-52	2-3
100-300 ft Down current	52	2-3

Samples Collected for Laboratory Analysis

☑ None ☐ TSS & turbidity ☐ Toxicity ☐ PCBs & Metals

Grid spacing: 200 feet

Observations

Observed thin oil sheen down current of Dredge operation beyond oil booms. Only some oil is held back by oil booms. Turbidity elevated to 47 NTUs above back ground but no exceedences occurred during monitoring. Observed more dead bluefish north of Wood Street.

Scientific Crew: Julie Stearns, Heather Davidson, Jerry Delaney

Completed By: Julie Stearns

ENSR INTERNATIONAL

Daily Field Summary for Water Quality Monitoring DMU #2 Area A

D 14 September 2005

Weather: Partly Sunny 75°F

Tides:

Ebb	@	0745
LWS	@	1041
Flood	@	1500

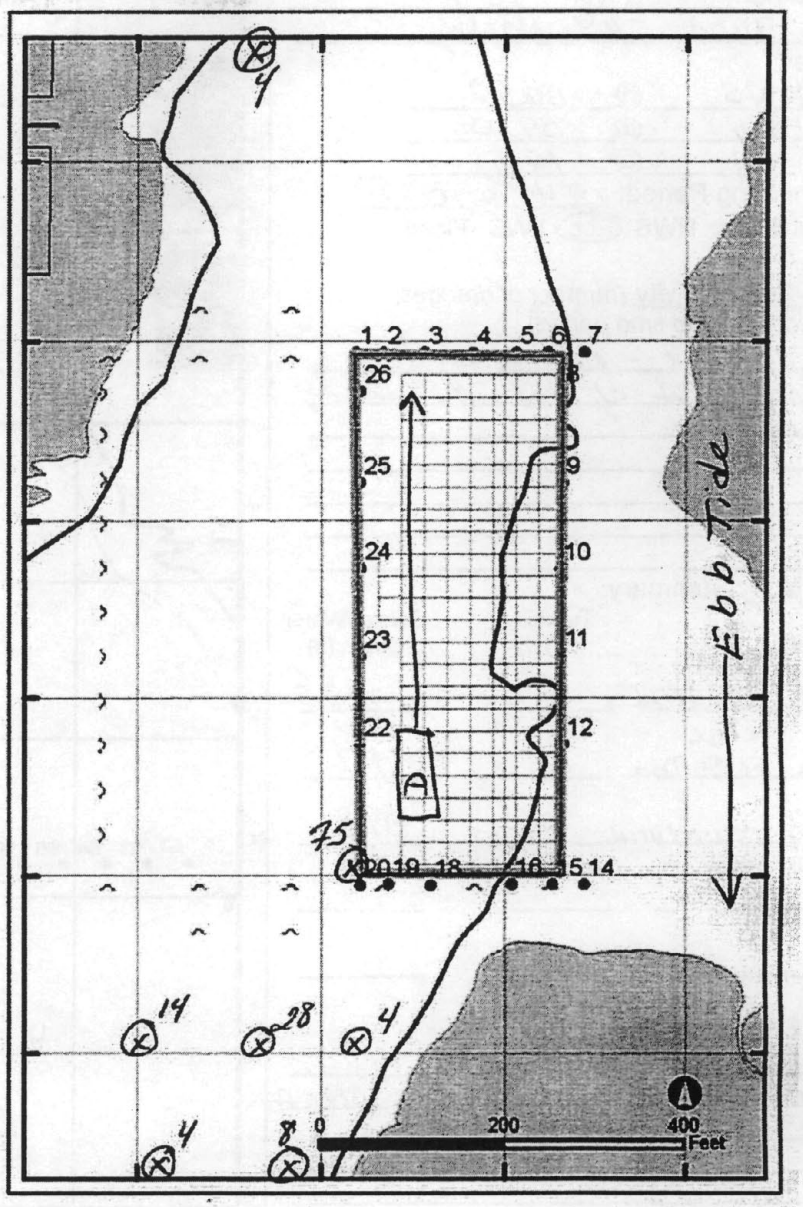
Monitoring Period:

From: 0745 To: 1045

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, locations, and time period)* :

1 Dredge operating



Monitoring Measurement Summary:

Range of Turbidity Down Current:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
228ft down Current of Dredge	75	1-2
400ft down Current of Dred	28	1-2
600-700' down Current of Dredge	8	1-2
Reference	3	2

Samples Collected for Laboratory Analysis

☐ None ☑ TSS & turbidity ☑ Toxicity ☑ PCBs & Metals

Grid spacing: 200 feet

Observations

Observed small spots of oil at water surface during dredge activity. Oil sheen was not observed beyond oil boom during monitoring. Turbidity elevated to 75 NTUs 228 feet down current of dredge activity, sample was collected.

Scientific Crew: Julie Stearns, Heather Davidson, Terry Delaney

pleted By: Julie Stearns

ENSR

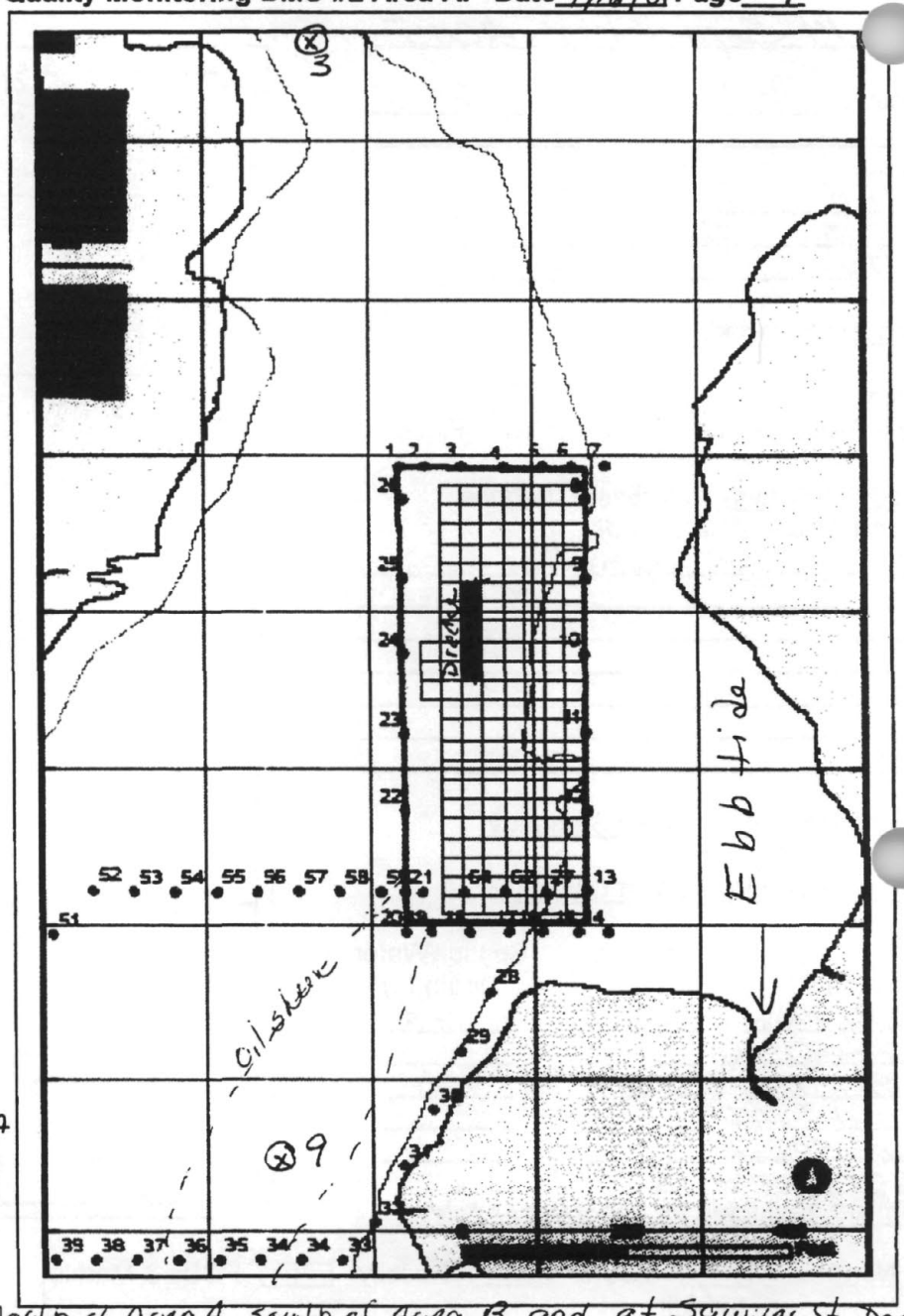
Daily Field Summary for Water Quality Monitoring DMU #2 Area A. *Date* 9/16/01 *Page* 1

Weather: Cloudy 70°F
Wind 5K North

Tides:
HWS @ 0652
Ebb @ 0930
LWS @ 1251

Monitoring Period: 0815 To: 1025
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
1 Dredge - not operating for most of the monitoring period.



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
1000' up current of Dredge	3	2/3.5
Sawyer St. Dock	6	4/6
1000' down current of Dredge	9	1/3

Oil Sheen/Debris:
Oil sheen observed at 1020, flowing south from Area A to 100ft south of Area B.

Fish Passage:
Observed small bait fish 1000' north of Area A, south of Area B and at Sawyer St. Dock

Samples Collected for Laboratory Analysis
☑ None ☐ TSS & turbidity ☐ Toxicity ☐ PCBs/Metals

Recording Meters: None

Observations:
Oil Sheen appeared to be flowing through open boom gate at the south western corner of Area A. Dredge was having problems and was not operating for most of the operating period, but was started just prior to observing oil sheen.

Monitoring Crew: Julie Stearns, Heather Davidson, Terry Delaney
Completed By: Julie Stearns

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Daily Field Summary for Water Quality Monitoring DMU #2 Area A. **Date** 9/21/05 **Page** 1

Weather: Sunny 80°F
Winds <5K, Calm Seas

Tides:
SWH @ 1049
Ebb @ 1300
SWL @ 1642

Monitoring Period: 1100 To: 1545

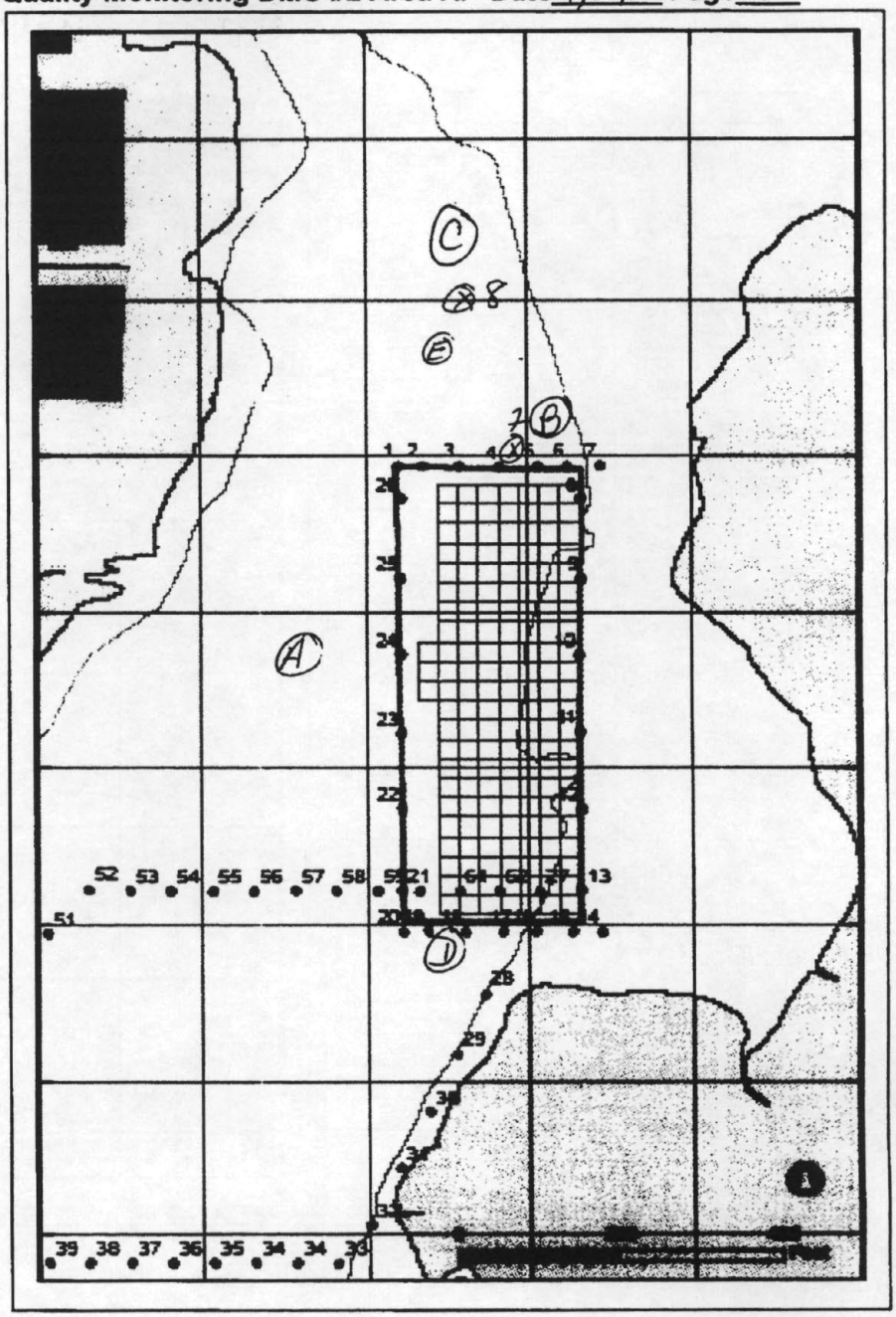
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
1 Dredge Operating
1100 - 1300 No dredging
1300 - 1352 Dredging
1352 - 1405 No dredging
1405 - 1430 Dredging
1430 - 1530 No dredging
1530 - 1545 Dredging

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
1000' Downcurrent	2	5/6
200' Not Dred	10	2/3
300' Down Current of D	18 - 28	2/3
75' Downcurrent ~~Dredge~~	75	1/2

Oil Sheen/Debris:
No observable oil sheen beyond oil booms



Fish Passage:
Large school of menhadden

Samples Collected for Laboratory Analysis
☐ None ☑ TSS & turbidity ☐ Toxicity ☐ PCBs/Metals

Recording Meters: 4 meters Deployed

Observations:
A - location of school of fish
B, C and D - location of YSIs, 3rd YSI deployed adjacent to Piera Mill Cove.
E - Sediment trap location

Monitoring Crew: Jule Stearns, Ken Heim, Chip Ryther

Completed By: Jule Stearns

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #2 Area A.** Date 9/22/05 Page 1 of 1

Weather: Clear, 80°F, 75 kts

Tides:
Flood @ 0800
HWS @ 1138
Ebb @ 1500

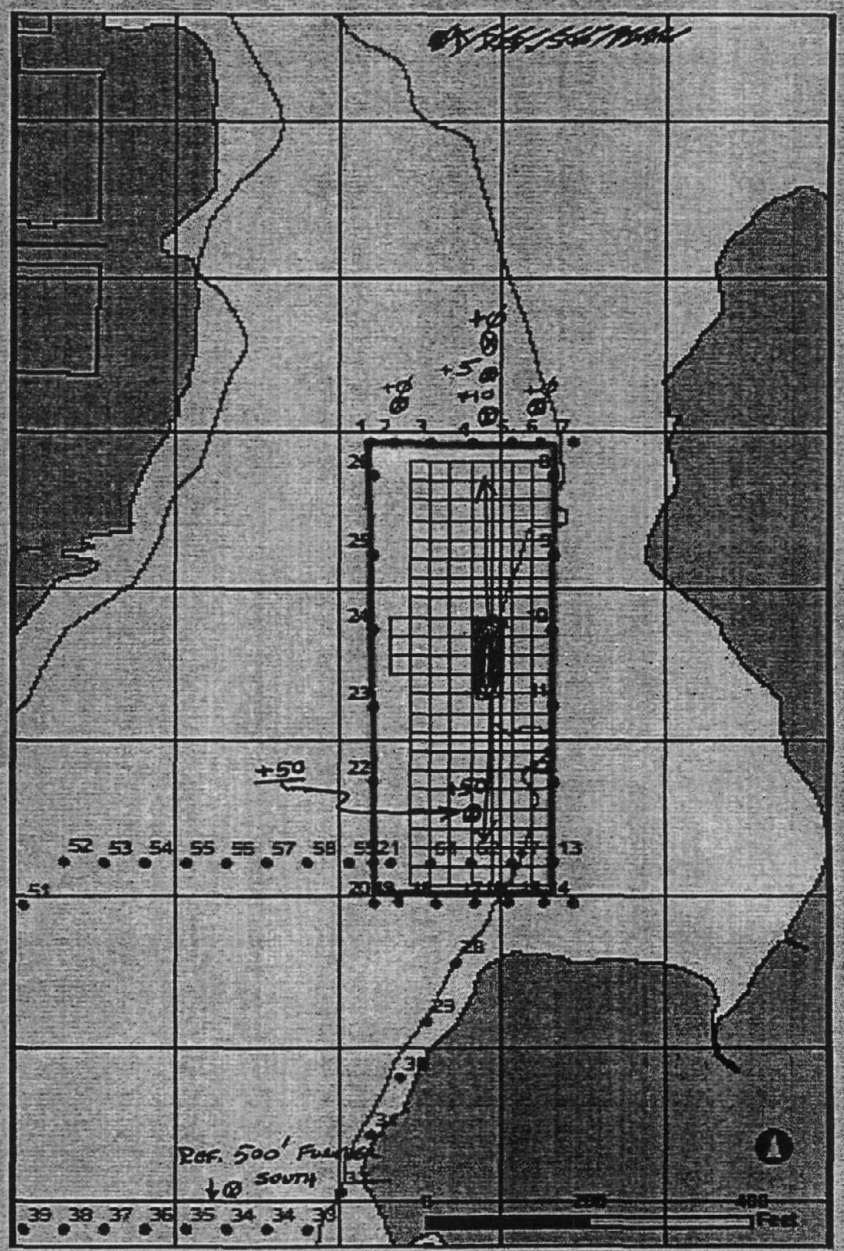
Monitoring Period: 0830 To: 15:30
Tidal Stage: HWS Ebb LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)*:
One Dredge
North To South Dredging
Between Plugs 4 & 5.

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
41° 40.469 70° 54.905	2.6	2'/6'
41° 40.450 70° 54.893	17	3'/6'
A. Plug #6	12	3'/5'
41° 40.452 70° 54.924	3.8	3'/5'

Oil Sheen/Debris:
Slight Oil Sheen Outside of Plugs with Minor Amounts of Misc. Debris.



Fish Passage:
1000's Bluefish North of Dredge Area in Am.

Samples Collected for Laboratory Analysis
☐ None ☒ 2 TSS & turbidity ☒ 2 Toxicity ☒ 2 PCBs/Metals

Recording Meters: YSI 6920 Multi Meter

Observations:
Dredging Activity During Late Morning Just Before, At, And After HWS. Minor Turbidity Increase Outside of Dredge Area And Greater Than 300' From Dredge. Dredge Activity Ceased Midday And Began Again At About 1430. High Turbidity (28 NTU) Measured 150' Downcurrent of Dredge At Peak Ebb. Sample Collected For Toxicity Testing.

Monitoring Crew: K. Heim / H. Davidson / J. Stearns.

Completed By: Kenneth Heim / [signature]

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #2 Area A.** **Date** 9/21/05 **Page** ____

Weather: Sunny 90°F
45 knots calm seas

Tides:
LWS @ 0514
Flood @ 0915
HWS @ 1230

Monitoring Period: 0830 To 1200

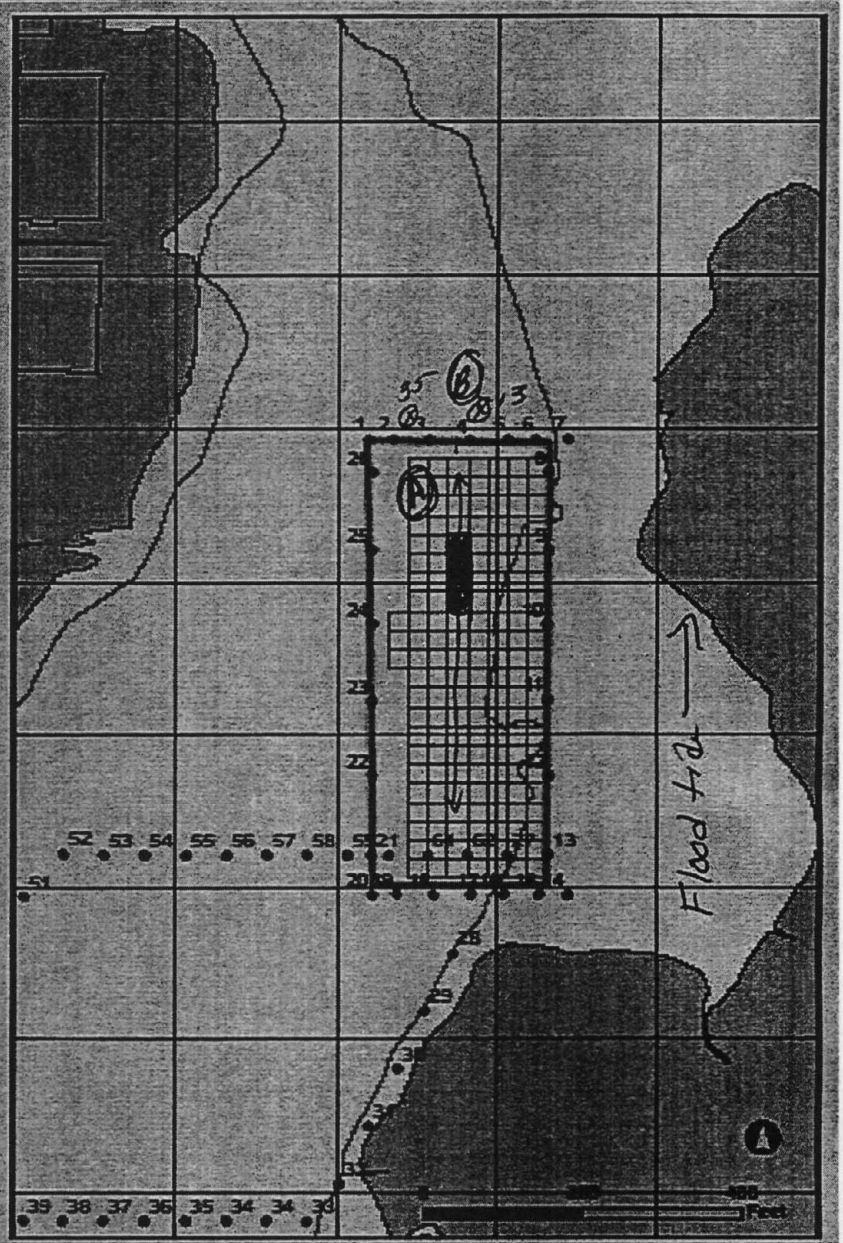
Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity (number of dredges, Locations, and time period)
1 Active dredge lanes D + E
None active 0830-830
Anchor 0930 - 1130

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
1000' up current	4	2/3
270' DC of Dredge	6	2/3
100' DC of Dred	13	1/3
120' DC of Dred	35	2/3

Oil Sheen/Debris:
no observable sheen.



Fish Passage:
large schools of fish in and around Area A.

Samples Collected for Laboratory Analysis
☐ None ☑ TSS & turbidity ☐ Toxicity ☐ PCBs/Metals

Recording Meters: deployed 9/21/05

Observations:
A + B - schools of fish.

Monitoring Crew: Julie Stearns, Ken Thomson, Ken Hein

Completed By: Julie Stearns

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #2 Area A.** *Date*_____ *Page*____

Weather: Sunny 70°F
15 knots Calm seas

Tides:
Ebb @ 0845
LWS @ 1246
Flood @ 1615

Monitoring Period: 1000 To: 1230

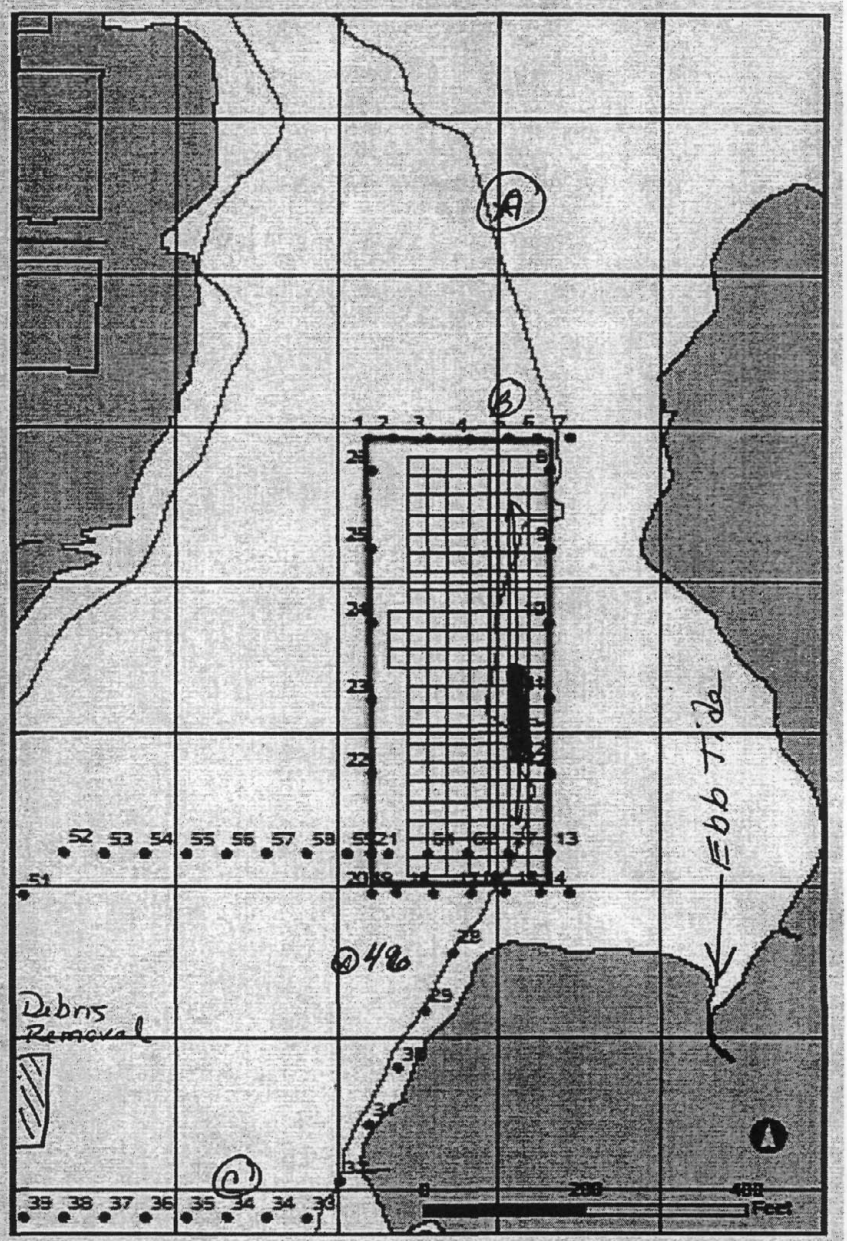
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity (number of dredges, Locations, and time period):
1 Dredge operating in Area A
Debris removal in Area B.

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
285' S of Dredg	49	1/2
900' S of Dredg	14	1/3
945' S of Dre	12	1/3
132' S of Debris Removal	12	1/2.5
Background Sawyer St. Dock.	3	1/5

Oil Sheen/Debris:
Small oil sheen observed south of Debris Removal



Fish Passage:
Small amount of fish observed near area A and at Sawyer St. Dock.

Samples Collected for Laboratory Analysis
☒ None ☐ TSS & turbidity ☐ Toxicity ☐ PCBs/Metals

Recording Meters: A, B, C and D is located near Pierce Mill Cove.

Observations:
Debris removal underway in South West portion of Area B, Dredging is western portion of Area A. Turbidity was elevated south of dredging operations, recorded at 46 above background. Monitoring was conducted during the end of the Ebb tide.

Monitoring Crew: J. Stearns, J. Lund, S. Dunsmore

Completed By: Julie Stearns

ENSR

Daily Field Summary for Water Quality Monitoring DMU #2 Area A. ***Date*** 10/4/05 **Page** 1 **of** 1

File Name: WQ-Log 04 OCT 05

Weather: Partly Sunny 70°F <5 kt

Monitoring Period: 0930 **To:** 1200

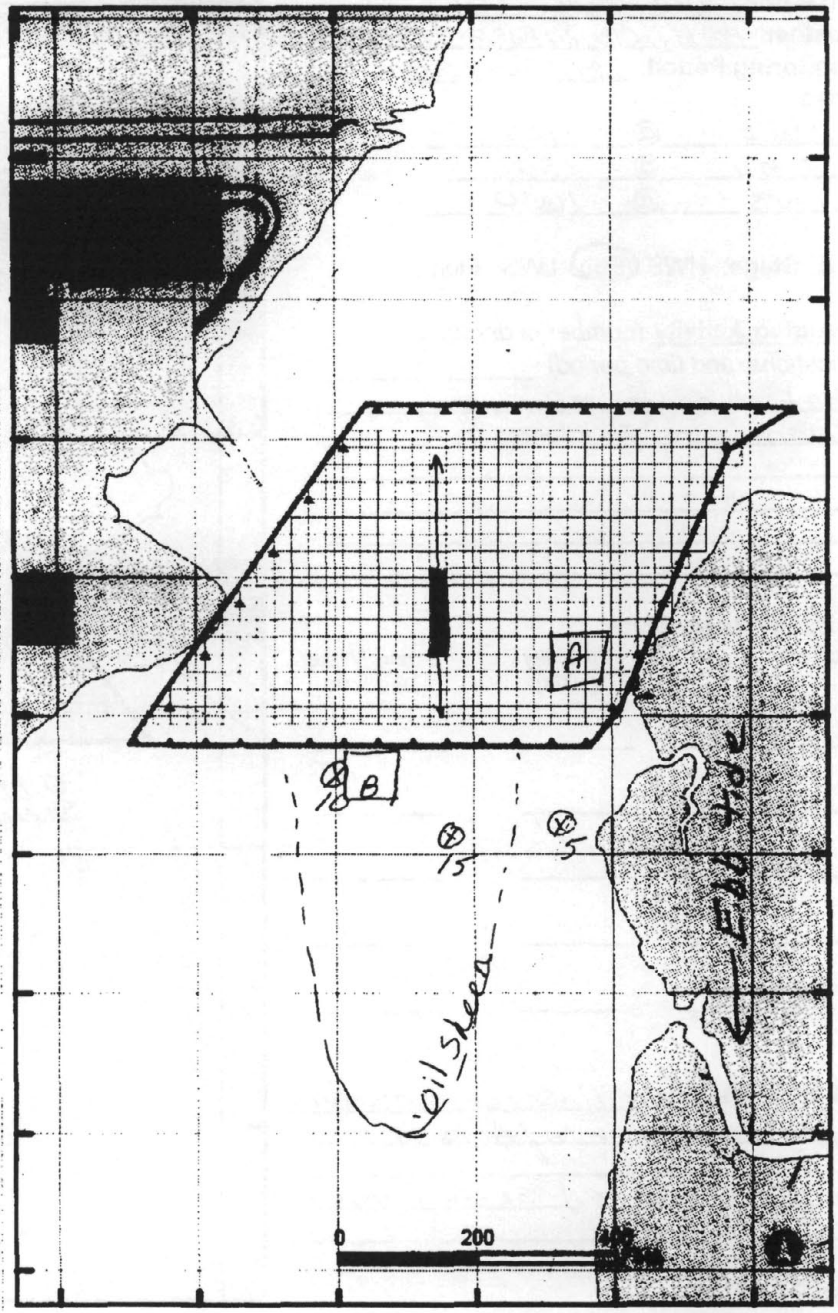
Tides:

HWS	@	0903
Ebb	@	1145
LWS	@	1434

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)*: One test dredge operating in Area B. Dredging starts and stops through morning.

Debris removal 1110 - 1120 in southeast corner.



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	3	2/7
Pile 46 (150 ft South of Dredge)	10	1/6
230 ft S. of Dredge	15	1/5
150 ft S of Debris Removal	5	3/5

Oil Sheen/Debris: Oil sheen observed flowing south with ebb tide. Measurable sheen 550 ft south of Pile 49.

Fish Passage:

Small bait fish observed at Sawyer St. dock, and N. and S. of Area B.

Samples Collected for Laboratory Analysis

☑ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals

Recording Meters: Pile 50

Observations:

A - Debris Removal and Barge. B staging barge

Health & Safety: Briefing: AM - Ken Gaynor mentions oil sheen and odors.

Debriefing: - Heavy oil (petroleum) odor ≈ 150 ft South of dredge activity (felt on tongue)

Monitoring Crew: Julia Stearns, Terry Delaney

Completed By: Julia Stearns

ENSR Daily Field Summary for Water Quality Monitoring DMU #2 Area A. *Date* 10/5/05 *Page* 1 of 1

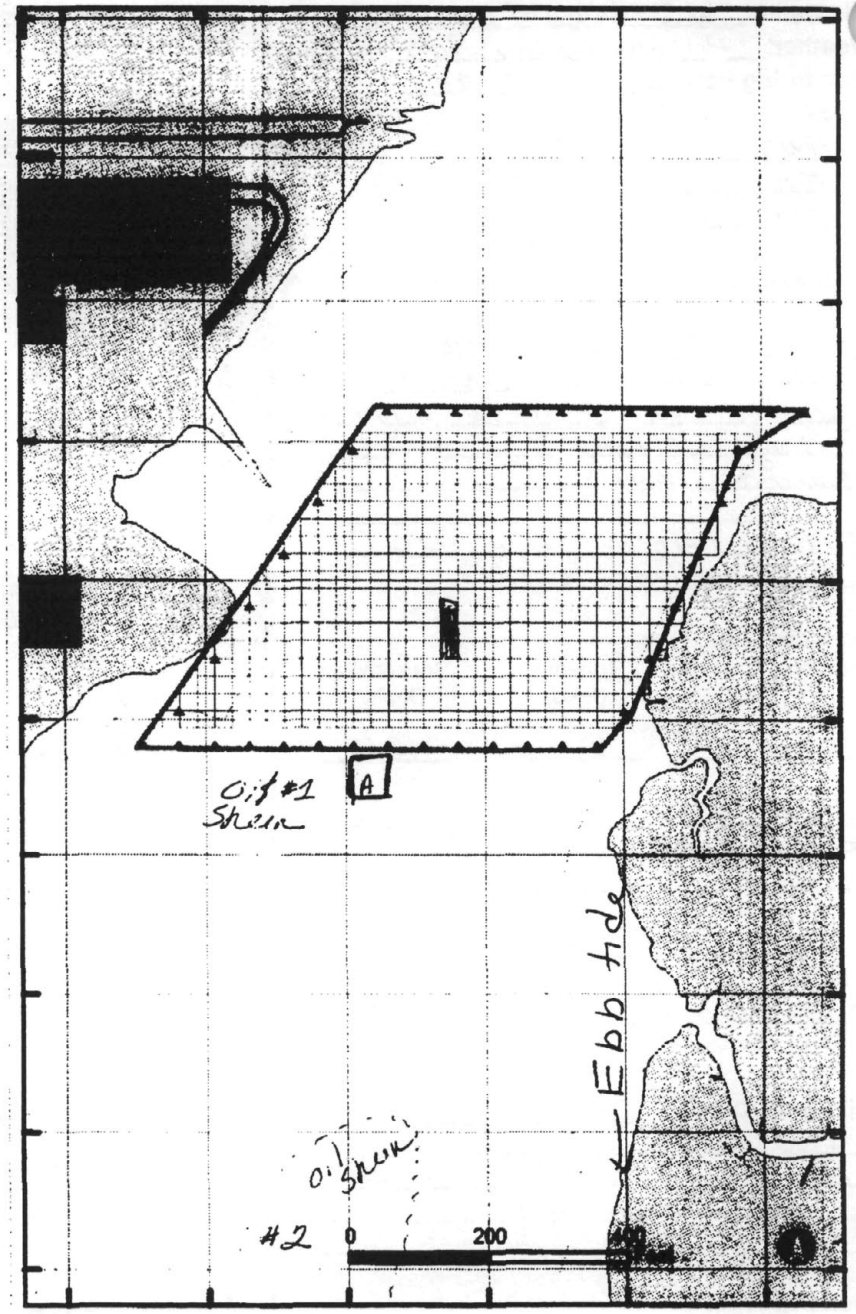
File Name: WQ-Log 05 OCT 05
Weather: Partly Cloudy 80°F <5 Knots
Monitoring Period: 1303 To: 1530
Tides:
HWS @ 1106
Ebb @ 1330
LWS @ 1630

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Not dredging during monitoring period.

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)



Oil Sheen/Debris: Oil sheen observed flowing south of Area B.
Collected 2 oil sheen samples.

Fish Passage:
Observed small bait fish at Sawyer St. dock

Samples Collected for Laboratory Analysis
☐ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals

Recording Meters: Placed YSI at Pile 49, YSI at Pierce Mill Cove and Northeb Area A.
Observations: Dredge not operating in Area B, however oil sheen was observed to the south from ≈ 1500 ft south of Area B to ≈ 2000 ft. NO Turbidity data collected.
A-staging barge, #1, #2 Oil Sheen Collection
Health & Safety: Briefing: moving YSIs, replacing batteries.
Debriefing: Collected oil sheen samples with special care for preservative ($MnCl_2$)
Monitoring Crew: Julia Stearns, Terry Delaney
Completed By: Julia Stearns

ENSR INTERNATIONAL

Daily Field Summary for Water Quality Monitoring DMU #2 Area A. *Date* 10/14/05 *Page* 1 of 1

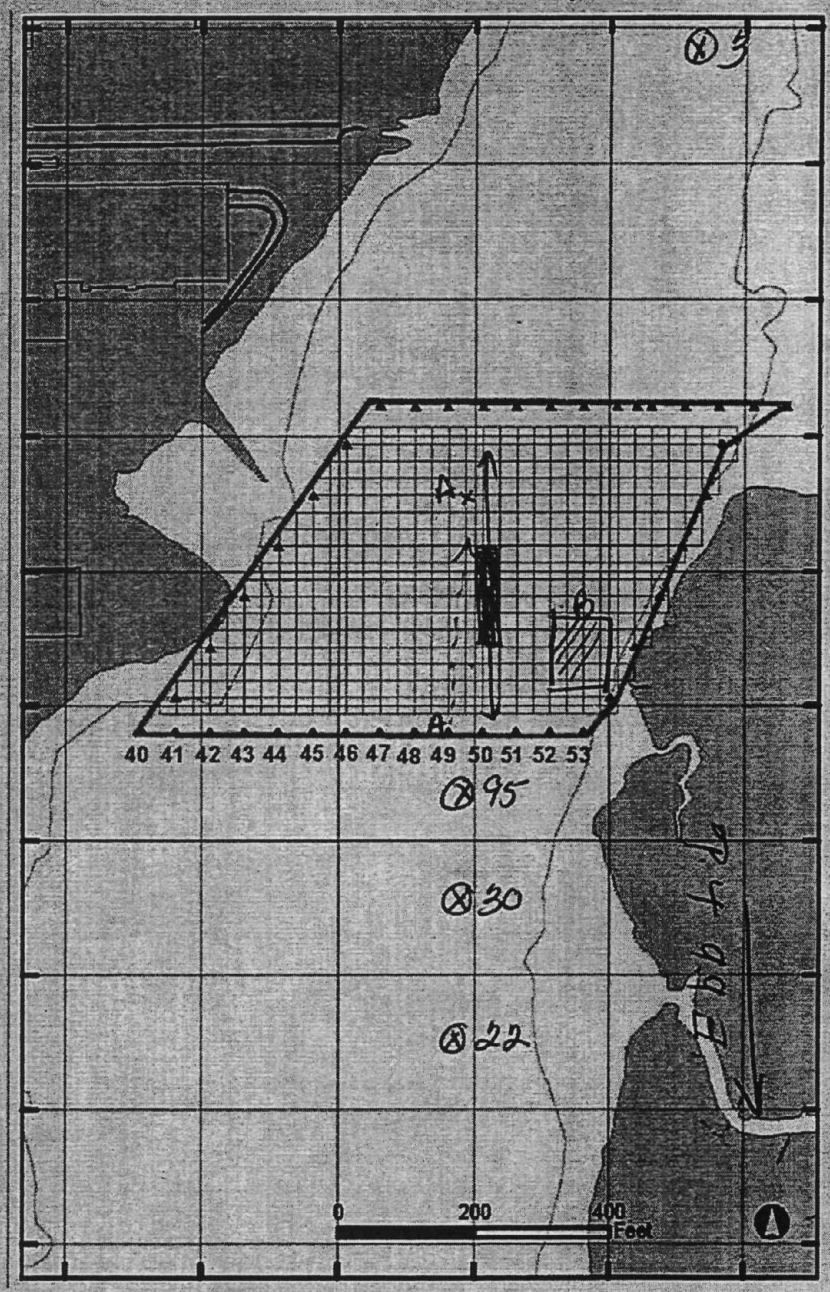
File Name: WQ-log 14OCT05
Weather: Rain
Monitoring Period: 0800 To: 1030
Tides:
HWS @ 0544
Ebb @ 0815
LWS @ 1150

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)*: 1 Dredge active in Area B. Debris Removal Barge moved to Area B and positioned inside oil booms

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	3	1/3
20's of Dredge	95	2/4
150's of Dredge	45	1/4
300's of Dredge	24-30	1/3
600's of Dredge	22	1/3



Oil Sheen/Debris: observed oil sheen at surface while Barge was moved into Area B. observed small oil sheens breaking at surface during dredging.

Fish Passage:
observed small fish just south of Area B.

Samples Collected for Laboratory Analysis
[X] None [ ] TSS/turbidity [ ] Toxicity [ ] PCBs/Metals

Recording Meters: Removed all unattended YSIs for maintance and download.
Observations: Oil booms were opened for barge. oil sheen moved south of Area B. Turbidity was elevated during dredging (95 NTUs) however no exceedance occurred.
A-YSI left at Pile 49 was dragged approximately 300' North of Pile 49, B- D.R. Barge
Health & Safety: Briefing: Discussed focus of day and oil sheen & odor.
Debriefing:
Monitoring Crew: J. Stearns, R. McCarthy, S. Delamore
Completed By:

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #2 Area A.** **Date** 10/17/05 **Page** 1 **of** 1

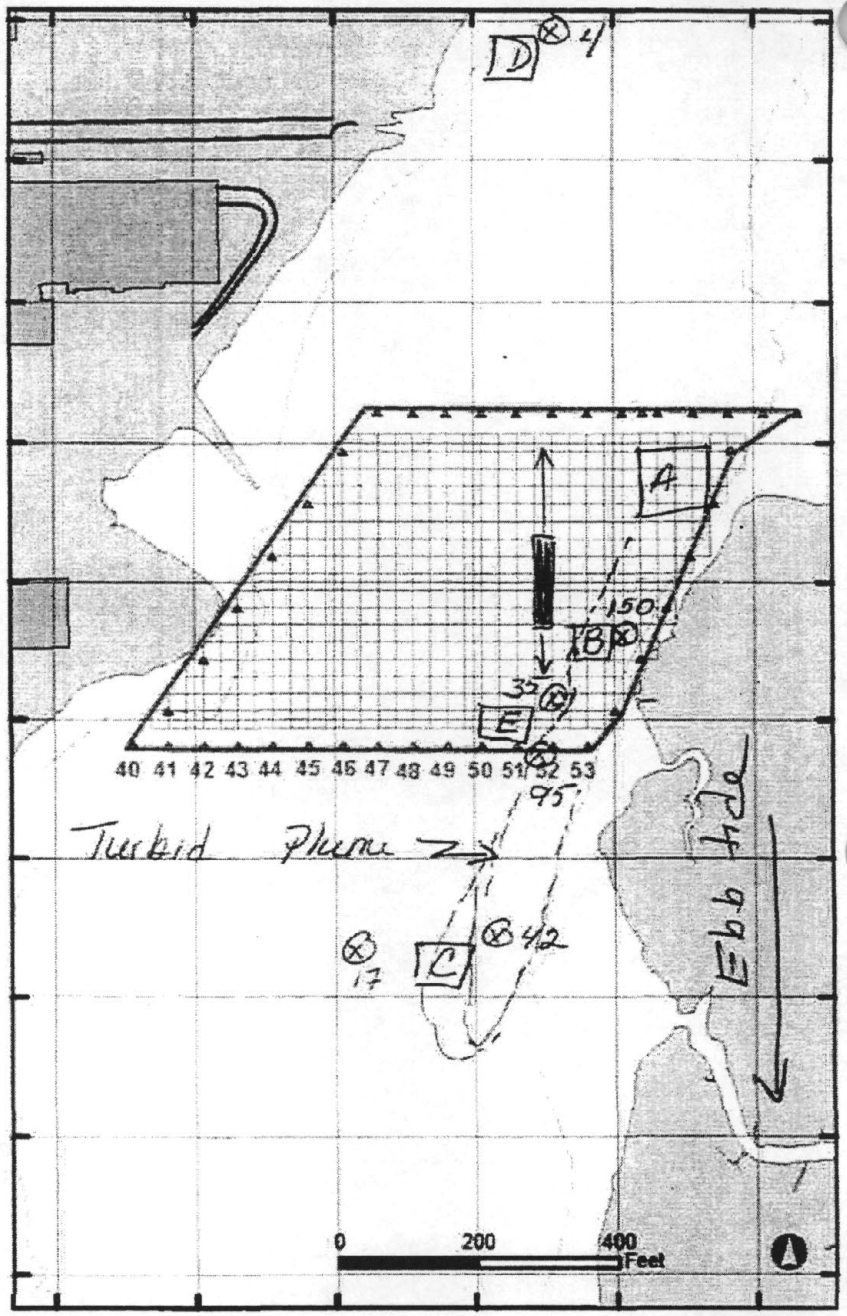
File Name: WQ-Log 17OCT05
Weather: 60°F Windy 15-20 Knots
Monitoring Period: 1000 To: 1300
Tides:

HWS	@	0800
Ebb	@	1015
LWS	@	1421

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
1 Dredge operating between piles 51 & 31.

Debris Removal in North East Corner of Area B



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	4	2/4
200' South of Debris Removal	150	1/2
300' S of DR	95	1/2
150' S of Dredge	35	2/3
600' S of DR	42	1/2
220' S of Pile 47	17	1/2

Oil Sheen/Debris: oil sheen observed from dredging activity, collected oil sheen sample at E

Fish Passage:
Did not observe fish - no bait fish with in monitoring Area B.

Samples Collected for Laboratory Analysis
☐ None ☑ TSS/turbidity ☑ Toxicity ☑ PCBs/Metals oil/sheen E

Recording Meters:
Observations: A - Debris removal, B - collected sample E1, C - collected sample E2, D - collected Reference sample

Health & Safety: Briefing: Reinforced issues - oil odors, wire - cables, metal from oil sheen sa
Debriefing: at end of monitoring period.
Monitoring Crew: Julie Stearns, Ryan McCarthy, Skip Densmore
Completed By: Julie Stearns.

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #2 Area A.** **Date** 10/19/05 **Page** 1 **of** 1

File Name: WQ-Log 19OCT05
Weather: 65°F winds <5K Calm seas
Monitoring Period: 0930 **To:** 1915
Tides:

HWS	@	0940
Ebb	@	1200
LWS	@	1546

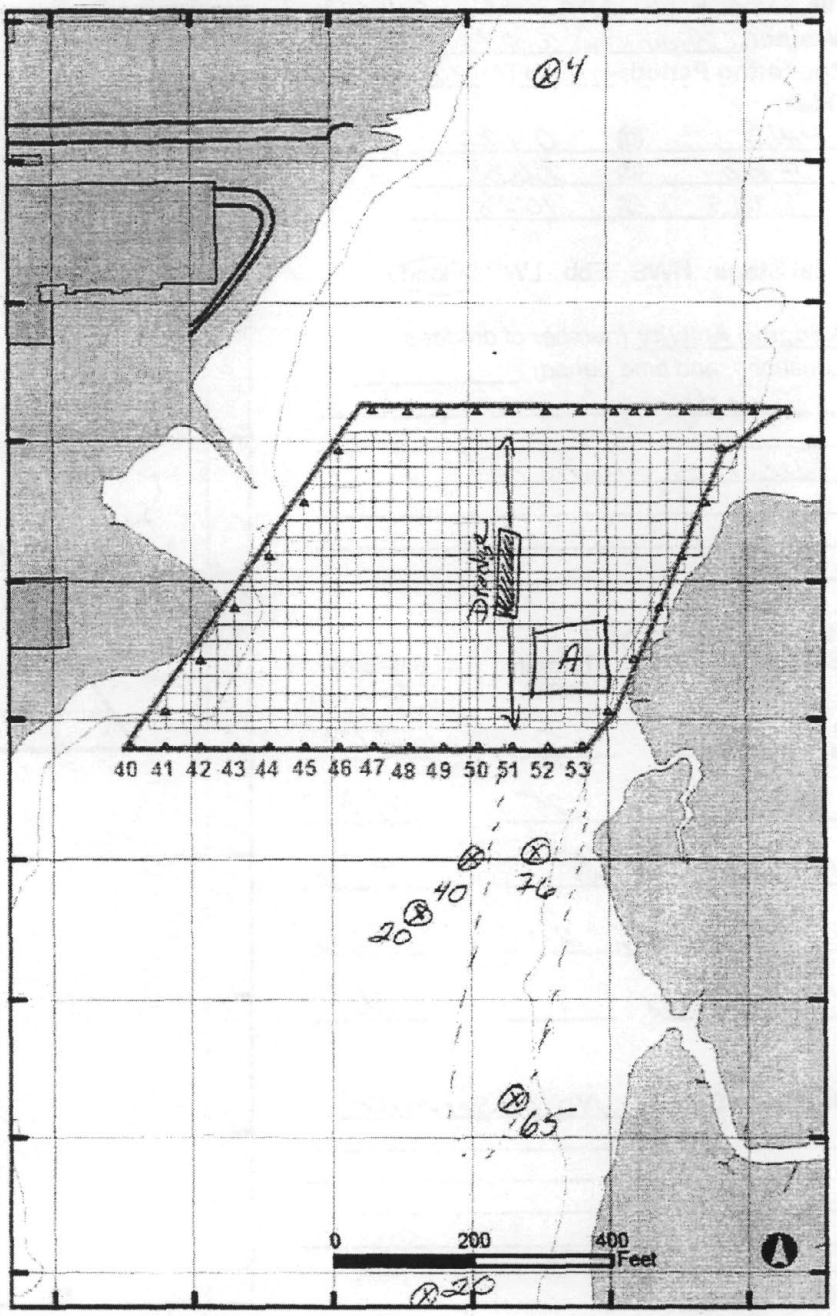
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
1 Dredge operating between piles 52 and 30

Debris Removal in south east Corner of Area B

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
800'-1000' N of Dredge	4	4/7
300' S of DR	75	3/4
240' S of Pile 48 (300' S Dredge)	20	4/5
600' S of DR	65	3/4
900' S of DR	20	2/3



Oil Sheen/Debris: No significant oil sheens observed

Fish Passage:
No fish observed with in monitoring Area.

Samples Collected for Laboratory Analysis
☐ None ☑ TSS/turbidity ☑ Toxicity ☑ PCBs/Metals

Recording Meters: Deployed on 10/17/05
Observations: A - Debris Removal
observed elevated levels of turbidity when ~~[illegible]~~ debris removal was constant and without breaks. Turbid plume observed at 2-3 feet below water surface

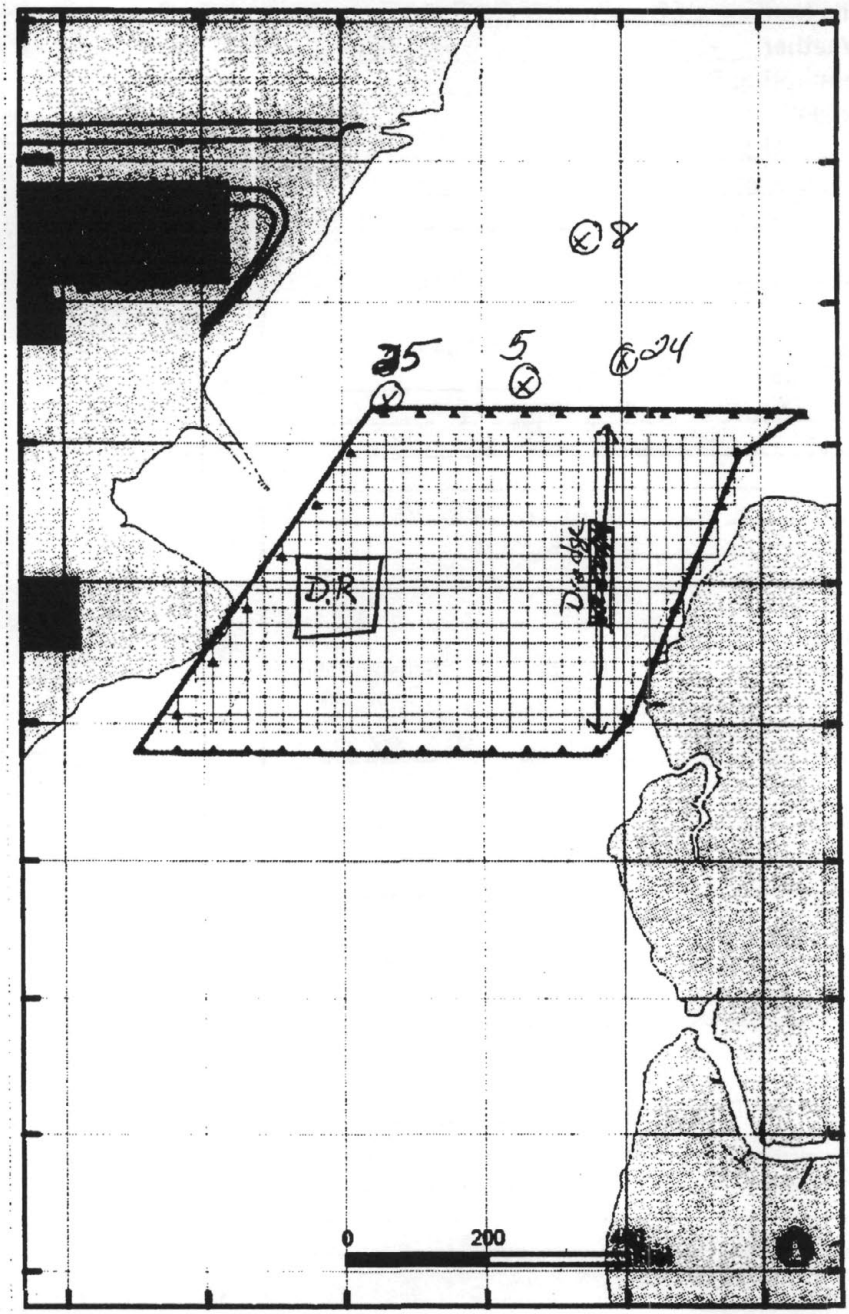
Health & Safety: Briefing: prior to monitoring - New employee briefing
Debriefing: 1330.
Monitoring Crew: J. Stearns, K. Dunlap, S. Densmore
Completed By: Julie Stearns

ENSR Daily Field Summary for Water Quality Monitoring DMU #2 Area A. Date 10/27/05 Page 1 of 1

File Name: WQ - Log 27 OCT 05 - Flood
Weather: Cloudy, No winds
Monitoring Period: 1330 To: 1600
Tides:
HWS @ 0425
Ebb @ 0630
LWS @ 1028

Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity (number of dredges, Locations, and time period) :
Dredging
Debris Removal



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference 1000' upcurrent	1.5	3/8+
300' N of DR	25	2/3.5
Pile 31	5	3/6
240' N of Dredge	24	3/6
600' N of Dred	8	3/5

Oil Sheen/Debris: No observable oil sheen

Fish Passage:
Observed fish in and around Area B and Area A

Samples Collected for Laboratory Analysis
[0] None [ ] TSS/turbidity [ ] Toxicity [ ] PCBs/Metals

Recording Meters: Removed all
Observations: No observable oil sheens, Debris removal conducted slowly, and appeared to have minimal impacts during this flood tide. Debris removal started and stopped approximately every 20 minutes.
Health & Safety: Briefing: early in day - a review of all safety issues.
Debriefing: at Sawyer St. Trailer at end of day.
Monitoring Crew: Julie Stearns, Tamie Lund, Bob Lane
Completed By: Julie Stearns

ENSR

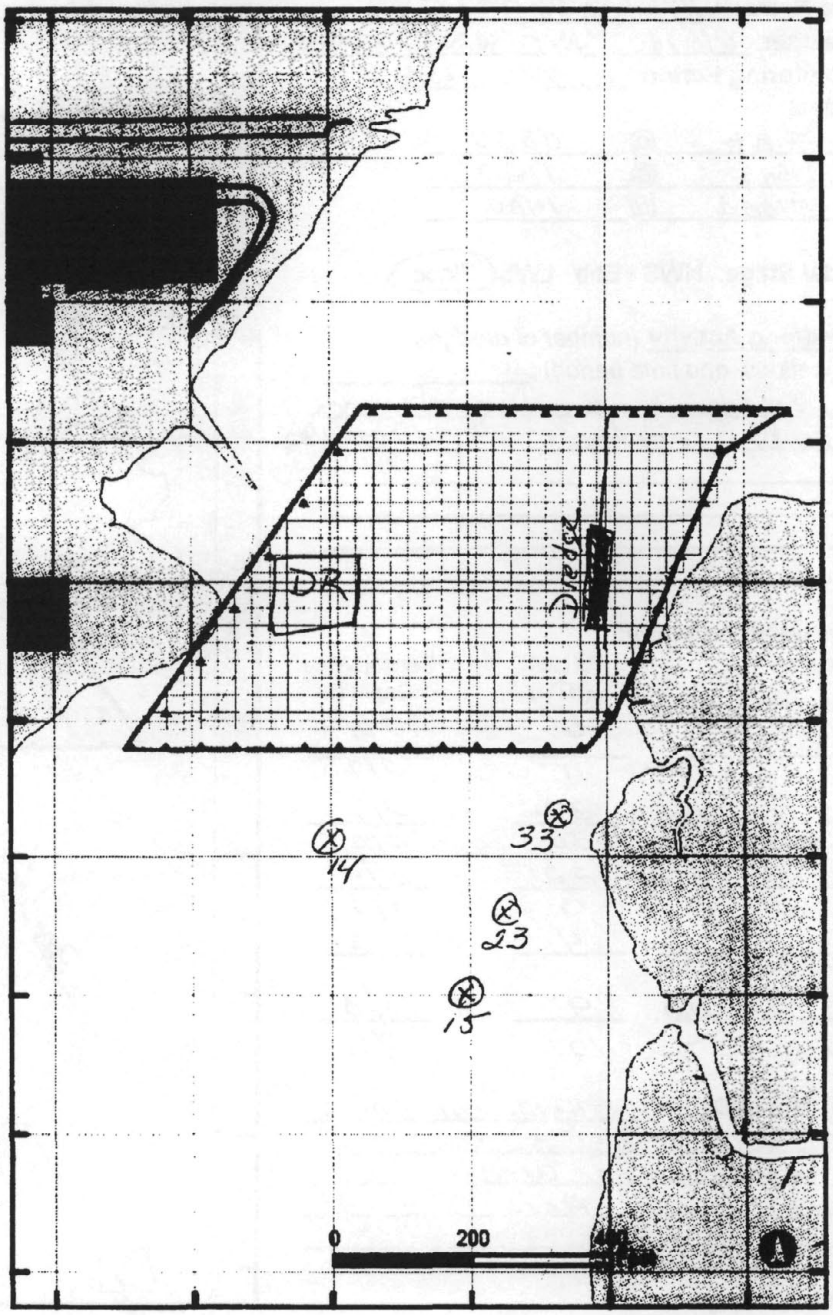
Daily Field Summary for Water Quality Monitoring DMU #2 Area A. ***Date*** 10/27/05 ***Page*** 1 ***of*** ___

File Name: WQ-Log27OCT05-Ebb
Weather: Sunny, North winds, 10 Knots
Monitoring Period: 1010 **To:** 1145
Tides:

HWS	@	0425
Ebb	@	0630
LWS	@	1028

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredging



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference 100' upcurrent	1.5	3/8+
1120 300' S of Dred	33	1/2.5
330' S of D	23	1/2.5
100' S of Pile #4 300' S of D.R.	14	0/3
400' S of Pile #0	15	1/2.5

Oil Sheen/Debris: No observable oil sheen from Dredge

Fish Passage:
Observed fish in and around Area B and Area A

Samples Collected for Laboratory Analysis
[0] None [ ] TSS/turbidity [ ] Toxicity [ ] PCBs/Metals

Recording Meters: Collect all meters,
Observations:

Health & Safety: Briefing: Overview of site and Health issues for new boat captain
Debriefing: at end of Day.
Monitoring Crew: J. Stearns, Jamie Lund, Bob Lane
Completed By: Julie Stearns

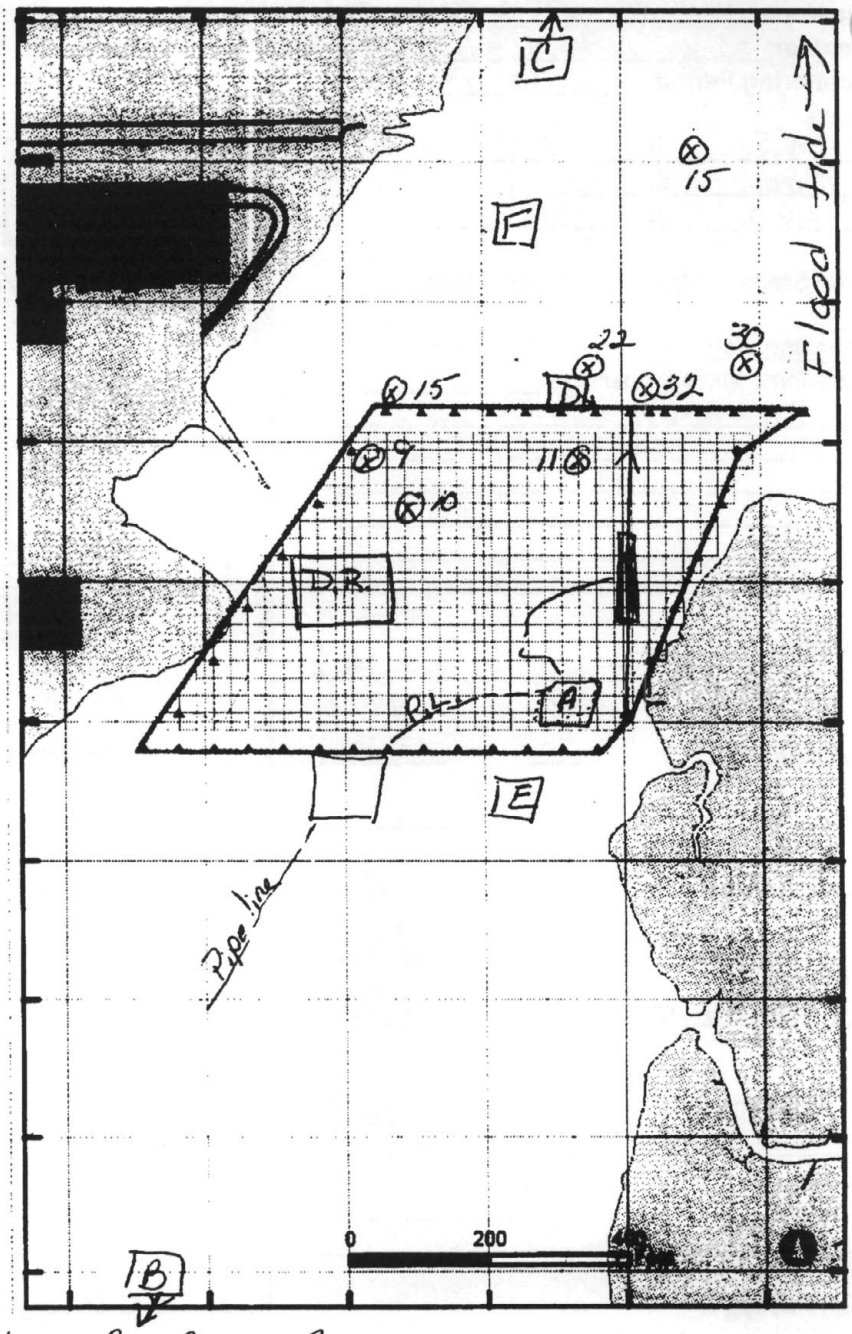
ENSR Daily Field Summary for Water Quality Monitoring DMU #2 Area A. Date 10/28/05 Page 2 of 1

File Name: WQ-Log28OCT05
Weather: Cloudy, N.E. Winds, 10-15 K
Monitoring Period: 0930 To: 1500
Tides:

Ebb	@	0830
LWS	@	1120
Flood	@	1400

Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity (number of dredges, Locations, and time period):
1 Dredging operating afternoon
Debris removal at 1400-1430



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference 1000's of Area B	6	2/4
240' N.W. of Dredge	11	2/7
160' N. of Dredge	32	2/7
100' N.E. of Dredge	30	2/3.5
100' N.W. of Dredge	22	2/4
600' N. of Dredge	15	1/7
300' N. of D.R.	4	1/3
250 N. of D.R.	9	1/3
90' N. of D.R.	10	3/4

Oil Sheen/Debris: Slight oil sheen observed as support boat repositioned dredge pipe line inside Area B = [A]

Fish Passage:
observed fish north of Area B.

Samples Collected for Laboratory Analysis
[a] None [ ] TSS/turbidity [ ] Toxicity [ ] PCBs/Metals

Recording Meters: None
Observations: Turbidity elevated as dredge cutter head is brought to water surface between 1300 - 1500. Debris removal working very slow resulting in low turbidity readings.
Deployed 5 Sediment Traps [B] at Piera mill Cove, [C] 1000' North of Area B, [D] pile 21
~~Health & Safety Briefing~~: [F] - 50' South of Pile 51, [E] 400' North of Area B.
Debriefing: Briefing in Am, debriefing Pm.
Monitoring Crew: Julie Stearns, Kate Dunlap, Bob Lane.
Completed By: Julie Stearns

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Daily Field Summary for Water Quality Monitoring DMU #4 Area B. **Date** 10/31/00 **Page** 1 **of** 2

File Name: WQ-Log 31OCT05- Ebb
Weather: Sunny 65°F
Wind direction: West wind < 5 Knots
Monitoring Period: 1030 **To:** 1220
Tides:
HWS @ 0618
Ebb @ 1000
LWS @ 1210

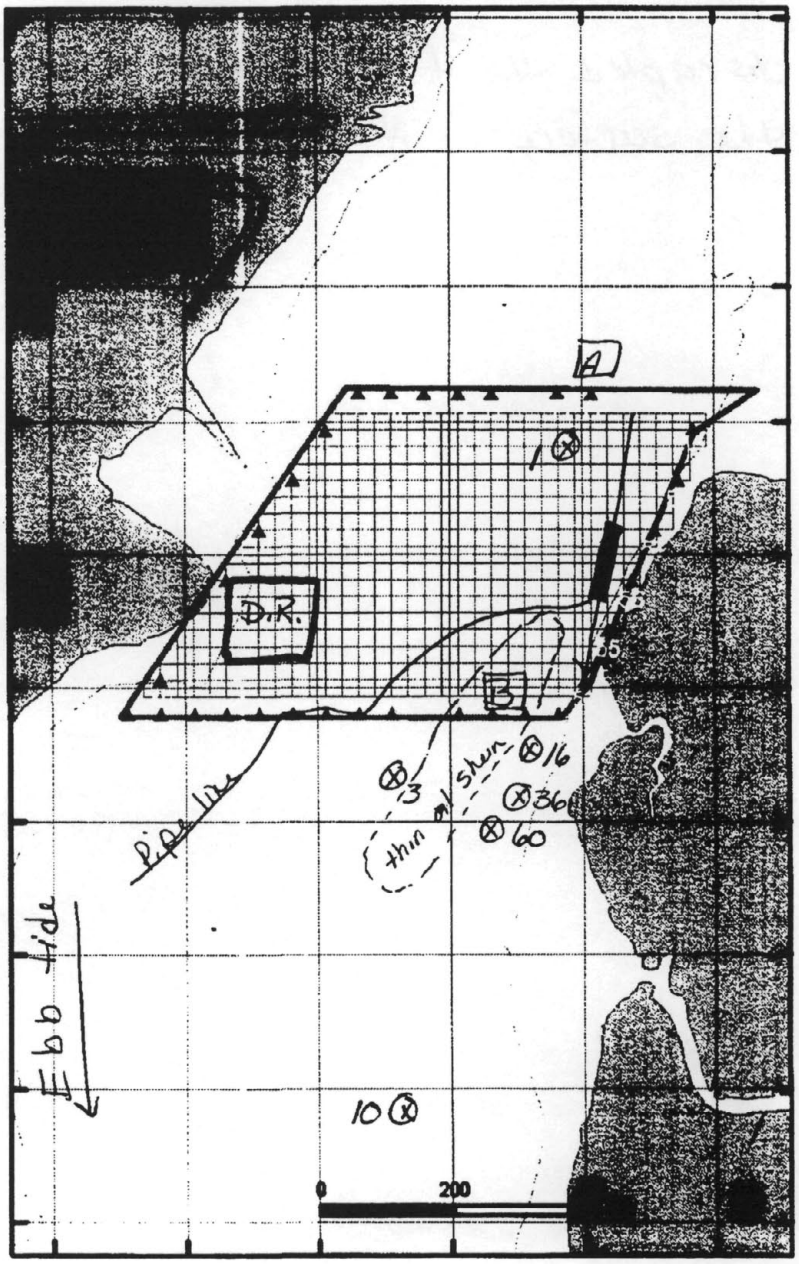
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredge operating from 1105 to 1200 with few stops. between piles 30 and 58.

No debris removal during monitoring

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	2	4/8
150' NW of Dredge	1	1/3
300' S. of Dredge	36	2/2.5
90' S of Dredge	16	2/2.5
100' S.W. of Dredge	3	2/2.5
120' S. of Boat	60	2/2.5
600' S. of Dredge	10	1/1.5



Oil Sheen/Debris: thin oil sheen observed down current of dredge and oil boom.

Fish Passage:
observed 3-5 8-12 inch fish South of Area B.

Samples Collected for Laboratory Analysis
☑ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ Oil Sheen

Recording Meters: Deployed 3 meters at Pierce Mill Cove, A Pile 30 and B Pile 51.
Observations: High turbidity levels (60 NTUs) due to support boat maneuvering in shallow water down current of dredge. Elevated turbidity levels were observed at 6 inches from bottom. A turbid plume was observed in the Surface or on the down current side of monitoring boat. The plume was created - Page 2
Health & Safety: Briefing: Review for new WQ boat Captain
Debriefing: end of day
Monitoring Crew: Julie Stearns, Ken Heim, Jarrett Drake
Completed By: Julie Stearns

when the water volume was constricted as it flowed under the boat, the increased volume of water disrupted the turbid water and pushed it toward the surface as it flowed out from under the boat.

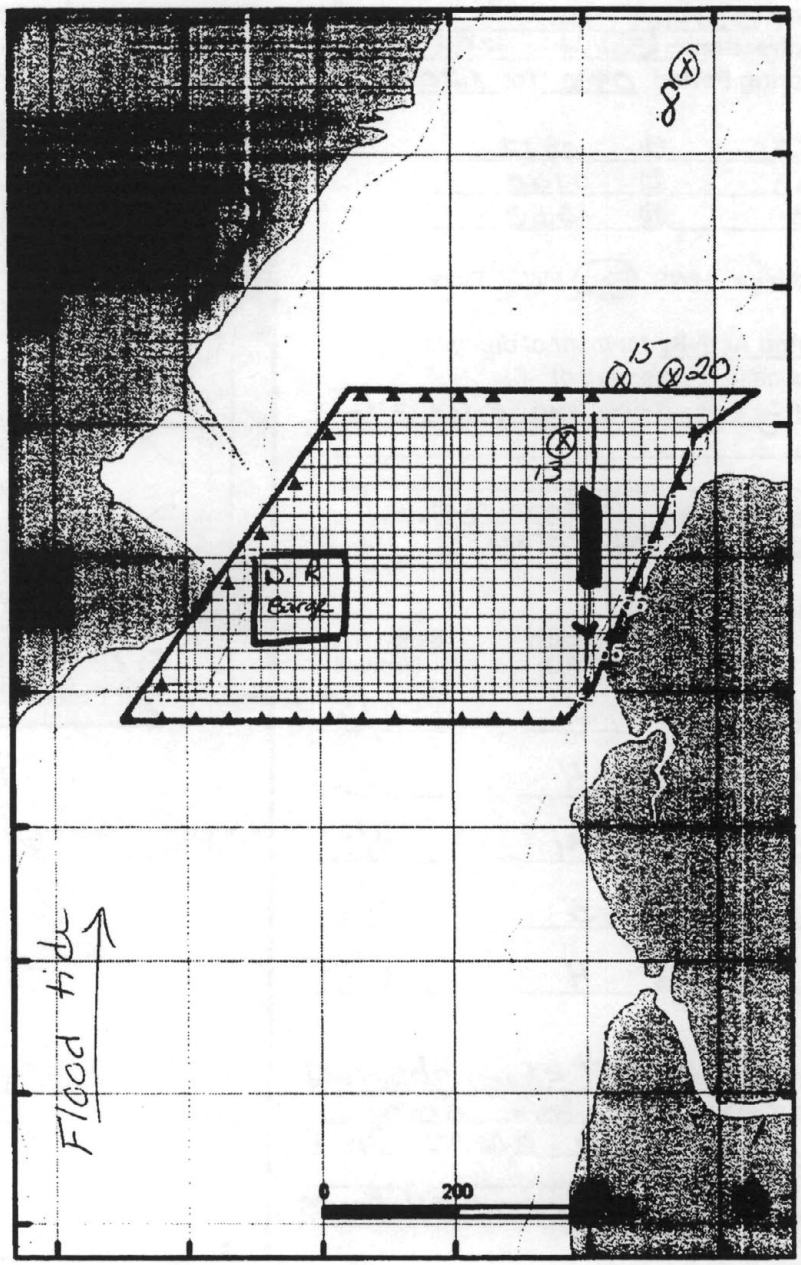
ENSR Daily Field Summary for Water Quality Monitoring DMU #2 Area A. *Date* 10/3/05 *Page* 1 of 1

File Name: WQ-Log 31 OCT05 - Flood
Weather: Sunny 60°F
Wind direction: South
Monitoring Period: 1300 To: 1515
Tides:
LWS @ 1212
Flood @ 1500
HWS @ 1530

Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredge operating 1300 - 1500 between piles 54 and 20, in the southern portion of Area B

No debris removal activity



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	2	2/2.5
190' N. of Dredge	13	2/3
600' N. of Dredge	8	2/5
400' N. of Dredge	15	1/3
300' N of Dredge	20	2/3

Oil Sheen/Debris: No observable oil sheens.

Fish Passage:
observed fish south of Area B approx. 4-5

Samples Collected for Laboratory Analysis
☑ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ Oil Sheen

Recording Meters: Deployed during morning monitoring
Observations: Turbidity levels remained within criteria of 50 NTUs above background down current of Dredge. Turbidity elevated to 20 NTUs when dredge cutter head was brought to the water surface for clearing.
Health & Safety: Briefing: AM
Debriefing: at end of Day
Monitoring Crew: Julie Stearns, Ken Heim, Jarrett Drake
Completed By: Julie Stearns

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Daily Field Summary for Water Quality Monitoring DMU #4 Area B. *Date* 11/4/05 *Page* 1 *of* 1

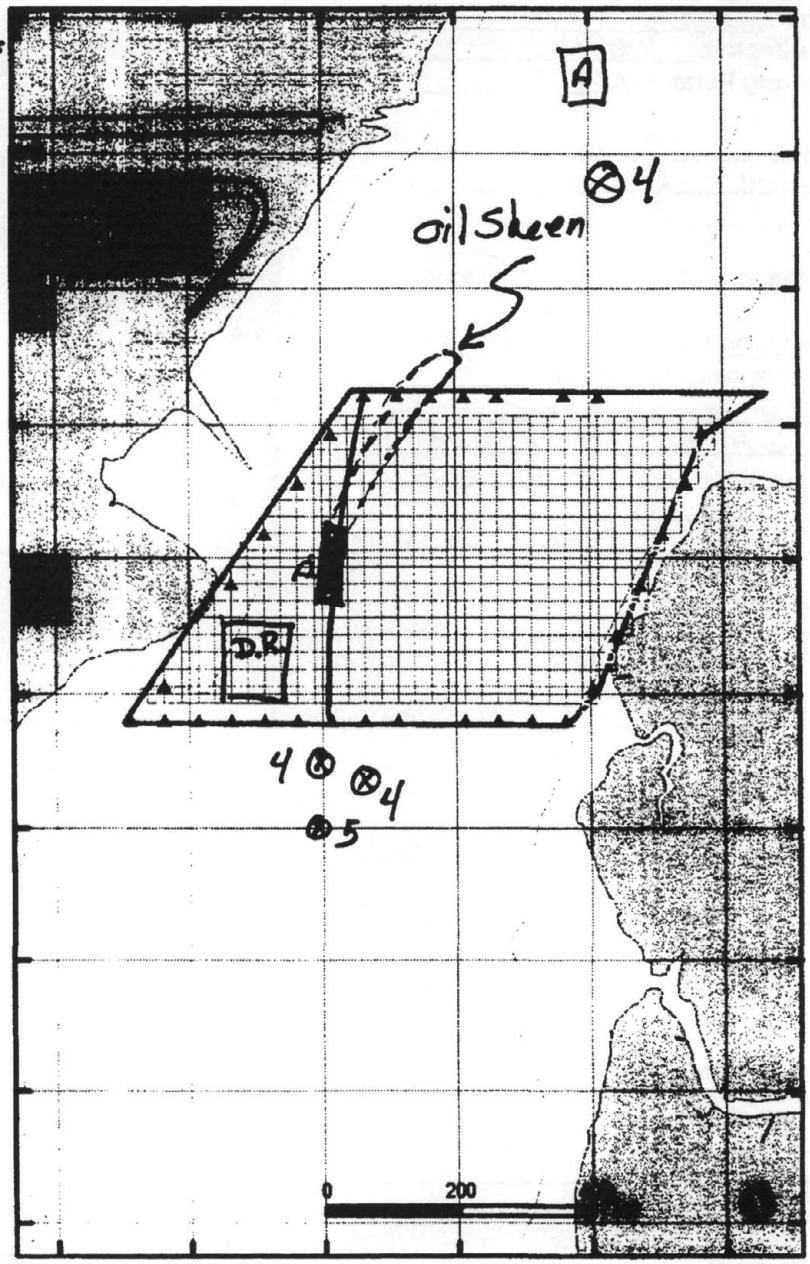
File Name: WQ-Log 03 NOV05
Weather: Sunny 60°F
Wind direction: South 20-30 knots
Monitoring Period: 0900 To: 1200
Tides:

HWS	@	0817
Ebb	@	1100
LWS	@	1353

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredging between Piles 34-46.

Infrequent Debris removal in South West corner



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	2	2/6+
450' S of Dredge	4	4/6.5
300' S of Dredge	4	4/5
300' S of D.R	5	4/5
400' N of Area B	4	3/4.5

Oil Sheen/Debris: Oil sheen observed flowing north from dredge. Oil sheen size approx. 20'X 250'. Sheen flowing beyond oil booms (North of Dredge)

Fish Passage:
No fish observed, very windy difficult to observe.

Samples Collected for Laboratory Analysis
☐ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ 1 Oil Sheen

Recording Meters: Moved 2 meters from E. of Area B to North and South of Dredge. and deployed new meter [4] north of Area B.
~~**Observations:**~~ Observations: Dredge operating intermittently, turbidity remaind below 5 NTUs south of Dredge and north of Dredge. Winds kept ebb tide in upper harbor.
Health & Safety: Briefing: Wind briefing in am.
Debriefing: Left site due to wind at 1200.
Monitoring Crew: Julie Stearns, Ken Heim, Bob Lane
Completed By: Julie Stearns

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #4 Area B.** *Date* 11/8/05 *Page* 1 *of* 1

File Name: WQ-Log08Nov05-Ebb
Weather: Sunny
Wind direction: South West Winds <5k
Monitoring Period: 1400 **To:** 1545
Tides:
HWS @ 1250
Ebb @ 1500
LWS @ 1830

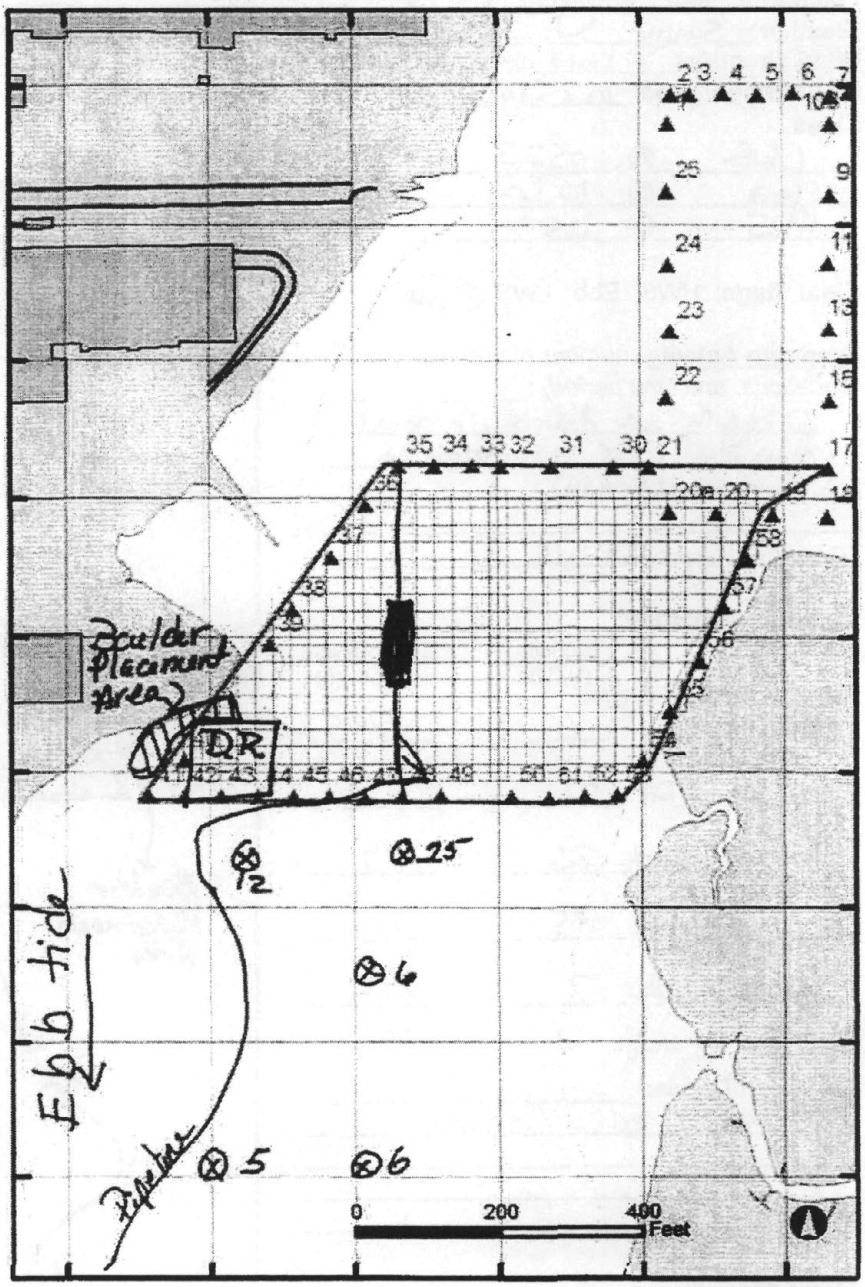
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredge operating intermittently
Debris Removal not operating but stone (boulders) are being placed in South West Corner of Area B.

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	15	3/5
240' S of Dredge	25	2/4
480' S of Dredge	6	1/4
600' S of Dredge	6	1/4
100' S of Boulder Placement	12	3/4.5
600' S of Boulder Placement	5	1/4

Oil Sheen/Debris:
No oil sheens observed during Ebb tide monitoring.



Fish Passage:
observed fish breaking water surface in and south of Area B.

Samples Collected for Laboratory Analysis
[X] None [ ] TSS/turbidity [ ] Toxicity [ ] PCBs/Metals [ ] Oil Sheen

Recording Meters: Checked placement and condition
Observations: Observed turbidity values north of Wood Street bridge to range from 9 to 12 NTUs.

Health & Safety: Briefing: in am
Debriefing: at lunch
Monitoring Crew: Julie Stearns, Kate Dunlap, Jarrett Drake
Completed By: Julie Stearns

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Daily Field Summary for Water Quality Monitoring DMU #4 Area B. *Date* 11-8-05 *Page* 1 *of* 1

File Name: WQ-Log08Nov05-Flood
Weather: Sunny
Wind direction: 5 knots south westerly
Monitoring Period: 1025 To: 12:30
Tides:
LWS @ 0523
Flood @ 1030
HWS @ 1250

Tidal Stage: HWS Ebb LWS (Flood)

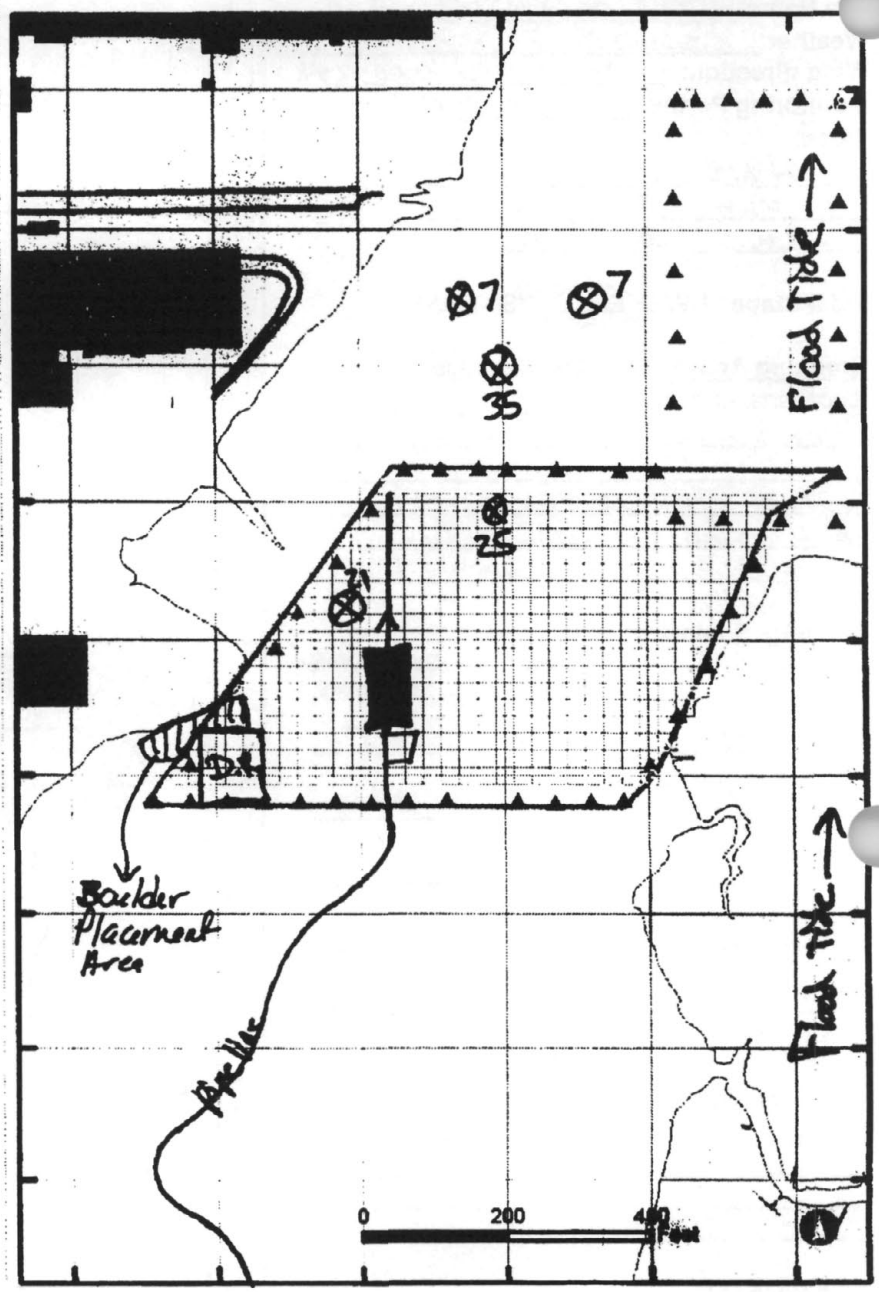
Dredging Activity *(number of dredges, Locations, and time period)* :
Dredging and debris removal conducted prior to monitoring (before 1030AM)

Dredging began @ 1115

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
1000's South of dredge Reference	6	4/4.5
300' N. of DR.	21	3/5.5
240' N. of Dredge	25	3/4
250' N. of dredge	35	3/4
450' N. of dredge	7	2/3
450' NE of dredge	7	2/4

Oil Sheen/Debris:
No observed oil sheen



Fish Passage:
observed a few fish breaking water surface within Area B

Samples Collected for Laboratory Analysis
☒ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ Oil Sheen

Recording Meters: Remain at previous locations, collected and redeployed sediment traps
Observations: Dredging and debris removal occurred prior to monitoring and turbidity remained low, especially beyond 300 ft. down current.

Health & Safety: Briefing: Received potential strong petroleum odor, and cables during high tide
Debriefing: at lunch
Monitoring Crew: Julia Stearns, Kate Dunlap, Jerrett Drake
Completed By: Kate R. Dunlap

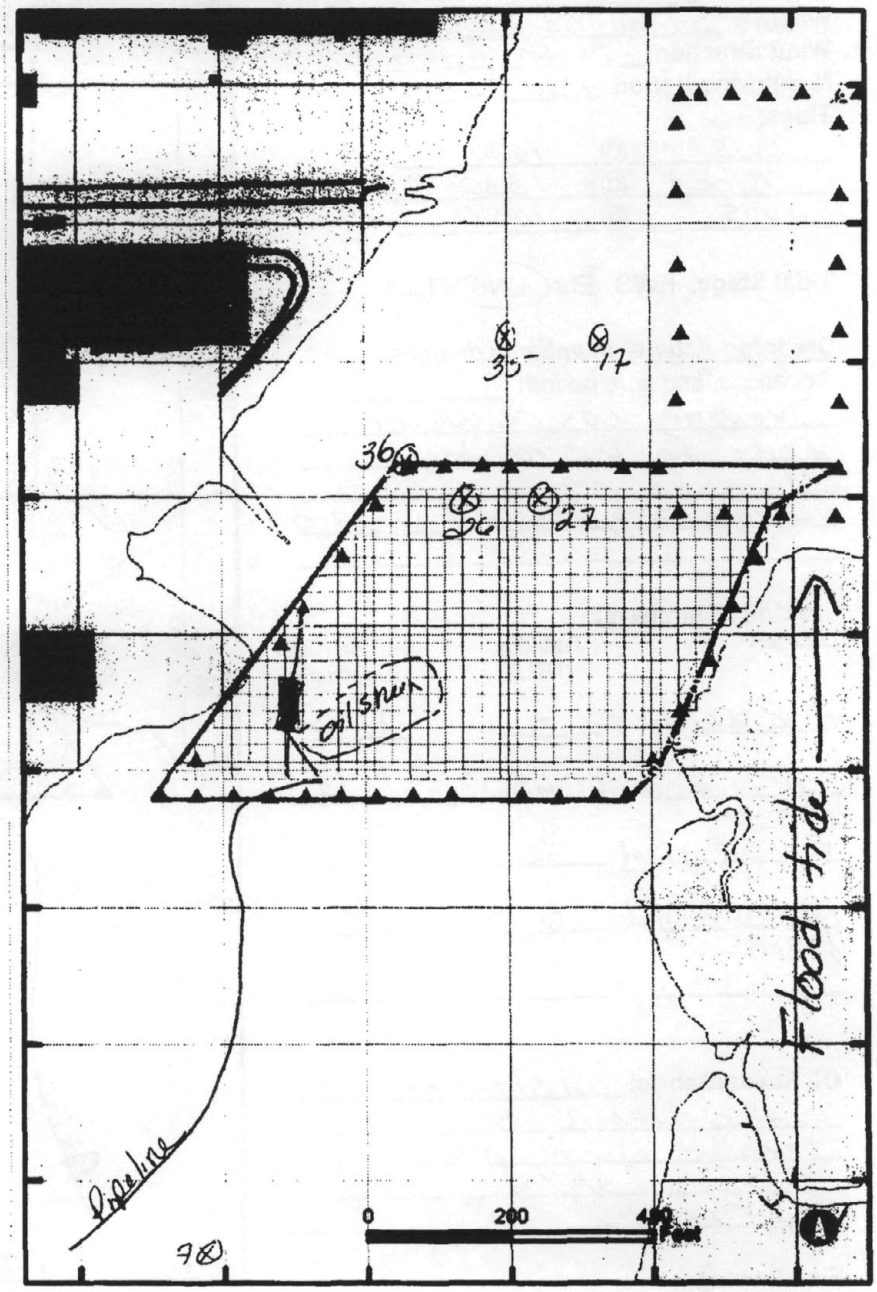
ENSR Daily Field Summary for Water Quality Monitoring DMU #4 Area B. *Date* 11/11/05 *Page* 2 of 2

File Name: WQ - Log 11 Nov 05 - Flood
Weather: Sunny 65°F
Wind direction: Northwest 5 Knots
Monitoring Period: 1145 **To:** 1400
Tides:

LWS	@	1030
Flood	@	1380
HWS	@	1550

Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredge operating intermittently from 1200 - 1400



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference 1000' upcurrent	7	1/2.5
250' downcurrent of Dredge	36	2/3
450' downcurrent of Dredge	35	3/5
450' NE of Dredge (Downcurrent)	17	2/4

Oil Sheen/Debris: oil sheen observed during dredging within Area B, size was ≈ 150' X 50' located east of dredge sample was collected.
2 oil sheen samples total.

Fish Passage:
observed fish in and around Area B.

Samples Collected for Laboratory Analysis
☐ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ 1 Oil Sheen

Recording Meters: YSIs collected earlier in day
Observations: No exceedance occurred during Flood tide water quality monitoring.

Health & Safety: Briefing: In morning
Debriefing: End of day - reminder to avoid contact with oil sample preservative ($MnCl_2$)
Monitoring Crew: Julie Stearns, Kate Dunlop, Jarrett Drake
Completed By: Julie Stearns

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Daily Field Summary for Water Quality Monitoring DMU #4 Area B. *Date* 11/11/05 *Page* 1 *of* 2

File Name: WQ-Log 11NOV05-LWS
Weather: Sunny 65°F
Wind direction: North Northwest 15-20k
Monitoring Period: 1030 To: 1145
Tides:

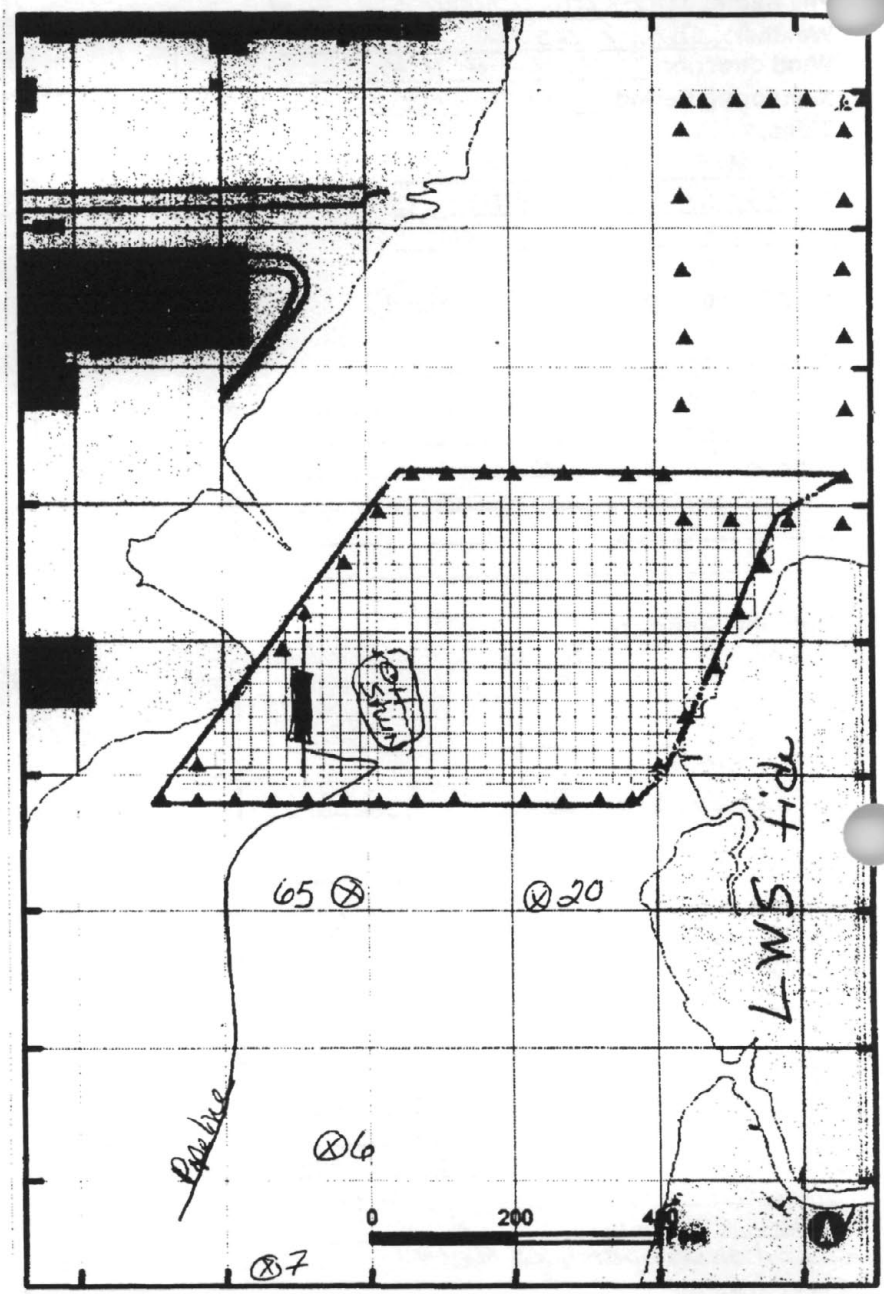
LWS	@	1030
Flood	@	1330
HWS	@	1550

Tidal Stage: HWS Ebb (LWS) Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredging was conducted prior to LWS monitoring
Dredge began again at 1800

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
1000' Upcurrent	7	1/2
300' Downcurrent of Dredge	65	1/2
400' SE of Dredge	20	1/2
600' Downcurrent of Dredge	6	1/2



Oil Sheen/Debris: Oil sheen observed within Area B. Sheen was created during previous dredging. Size of sheen ≈ 150' x 150'.

Fish Passage:
Observed fish in and around Area B.

Samples Collected for Laboratory Analysis
☐ None [2] TSS/turbidity ☐ Toxicity [2] PCBs/Metals [1] Oil Sheen

Recording Meters: Collected 4 YSIs for maintance, 1 YSI appeared damaged.
Observations: Observed high turbidity values (65 NTUs) during low slack tide 300ft down current of dredge. Dredge was not operating ~~but~~ however turbidity above exceedence of 57 NTUs, sample was collected. Turbidity decreased to normal values 600 ft down current of Dredge.
Health & Safety: Briefing: In morning
Debriefing: At end of day - reminder to avoid contact with oil sample preservative.
Monitoring Crew: Julie Stearns, Kate Dunlap, Jarrett Drake
Completed By: Julie Stearns

ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #4 Area B.** *Date* 11/14/05 *Page* 1 *of* 2

File Name: WQ-Log 14NOV05-Ebb
Weather: Sunny 60°F
Wind direction: Southwest 5-10K
Monitoring Period: 1000 To: 1200
Tides:

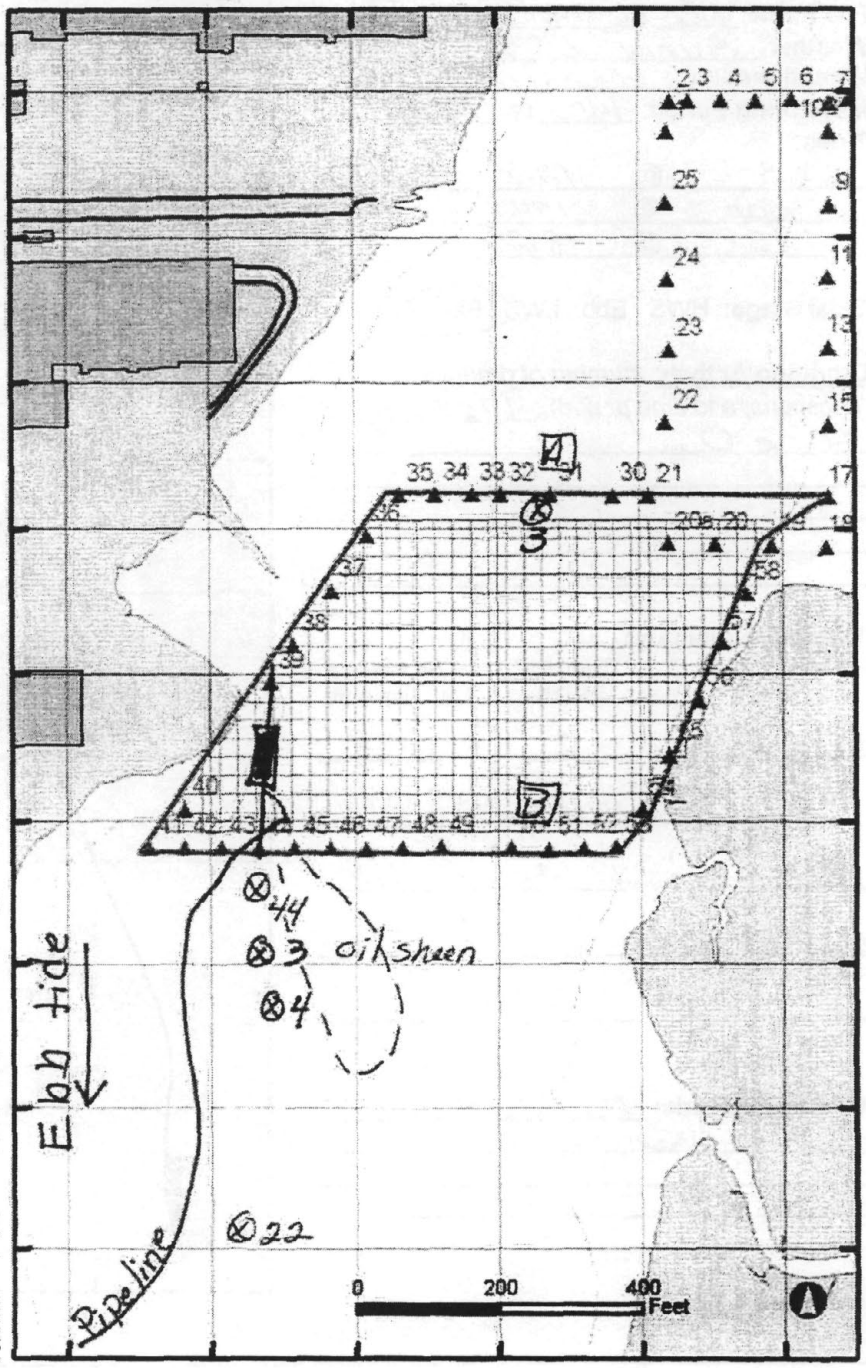
Ebb	@	0850
LWS	@	1218
Flood	@	1545

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredge started at 1100 and operated intermittently in Lane O.

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	2	1/4
Prior to Dredge		
200' upcurrent	3	.5/2
200' Downcurrent	3	.5/2
125' Downcurrent	4	1/2
Dredge began		
150' downcurrent	44	1/2
600' downcurrent	22	1/2



Oil Sheen/Debris: Oil sheen appeared South (downcurrent) of dredge and Area B after dredge began operating. Sheen was approx. 200' x 150' in and sample was collected

Fish Passage:
No fish were observed

Samples Collected for Laboratory Analysis
☐ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ 1 Oil Sheen

Recording Meters: 2 YSI meters were deployed at locations A and B
Observations: Turbidity remained low prior to dredging but shortly after dredging began a clear turbid plume was observed moving downcurrent. No exceedances were detected and turbidity dropped at 600 feet downcurrent. Water conditions were very shallow.
Health & Safety: Briefing: in morning.
Debriefing: end of Day -
Monitoring Crew: Julie Stearns, Kate Dunlop, Terry Delaney
Completed By: Julie Stearns

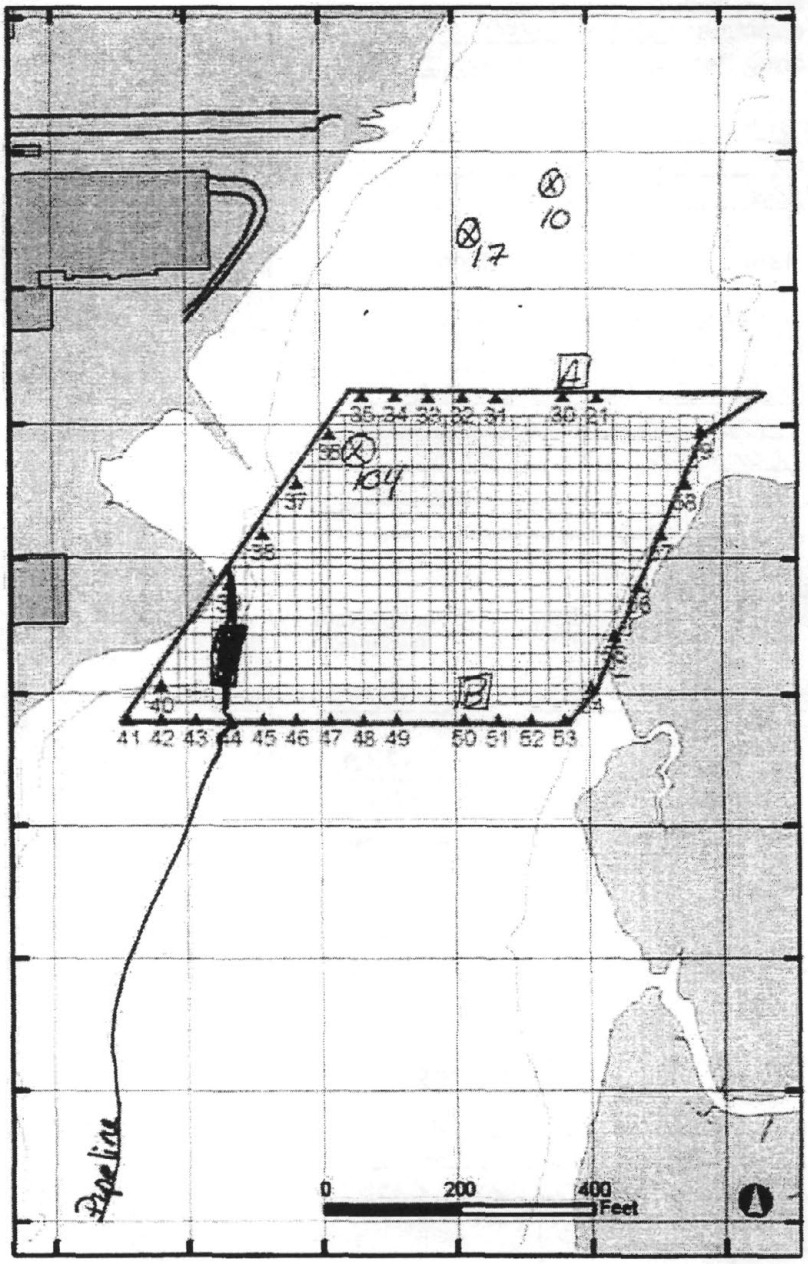
ENSR INTERNATIONAL **Daily Field Summary for Water Quality Monitoring DMU #4 Area B.** ***Date*** 11/14/05 ***Page*** 2 of 2

File Name: WQ-Log14NOV05- Flood
Weather: Sunny 65°F
Wind direction: North northwest
Monitoring Period: 1400 To: 1600
Tides:

LWS	@	1218
Flood	@	1545
HWS	@	1817

Tidal Stage: HWS Ebb LWS (Flood)

Dredging Activity *(number of dredges, Locations, and time period)* : Dredging Lane O.



Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference	2	1/4
300' downcurrent of Dredge	105	2/3
600' downcurrent	17	1/2
620' NE (upcurrent) of Dredge	10	2/3

Oil Sheen/Debris: No oil sheens were observed

Fish Passage:

Samples Collected for Laboratory Analysis
☐ None ☒ TSS/turbidity ☒ Toxicity ☒ PCBs/Metals ☐ Oil Sheen

Recording Meters: meters deployed at Areas A and B locations
Observations: Turbidity values exceeded the +50 NTU criteria at the 300 foot down current location and sample was collected. Turbidity values decreased further down current at 600 feet and an exceedance did not occur. Reference sample was also collected.
Health & Safety: Briefing: discussion about extreme low water conditions
Debriefing: at end of Day
Monitoring Crew: Julie Stearns, Kate Dunlop, Terry Delaney
Completed By: Julie Stearns

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Daily Field Summary for Water Quality Monitoring DMU #4 Area B. **Date** 11/17/05 **Page** 1 **of** 1

File Name: WQ-log17Nov05

Weather: Sunny 55°F

Wind direction: north northwest 5 Knot

Monitoring Period: 0900 **To:** 1400

Tides:

HWS	@	810
Ebb	@	1000
LWS	@	1413

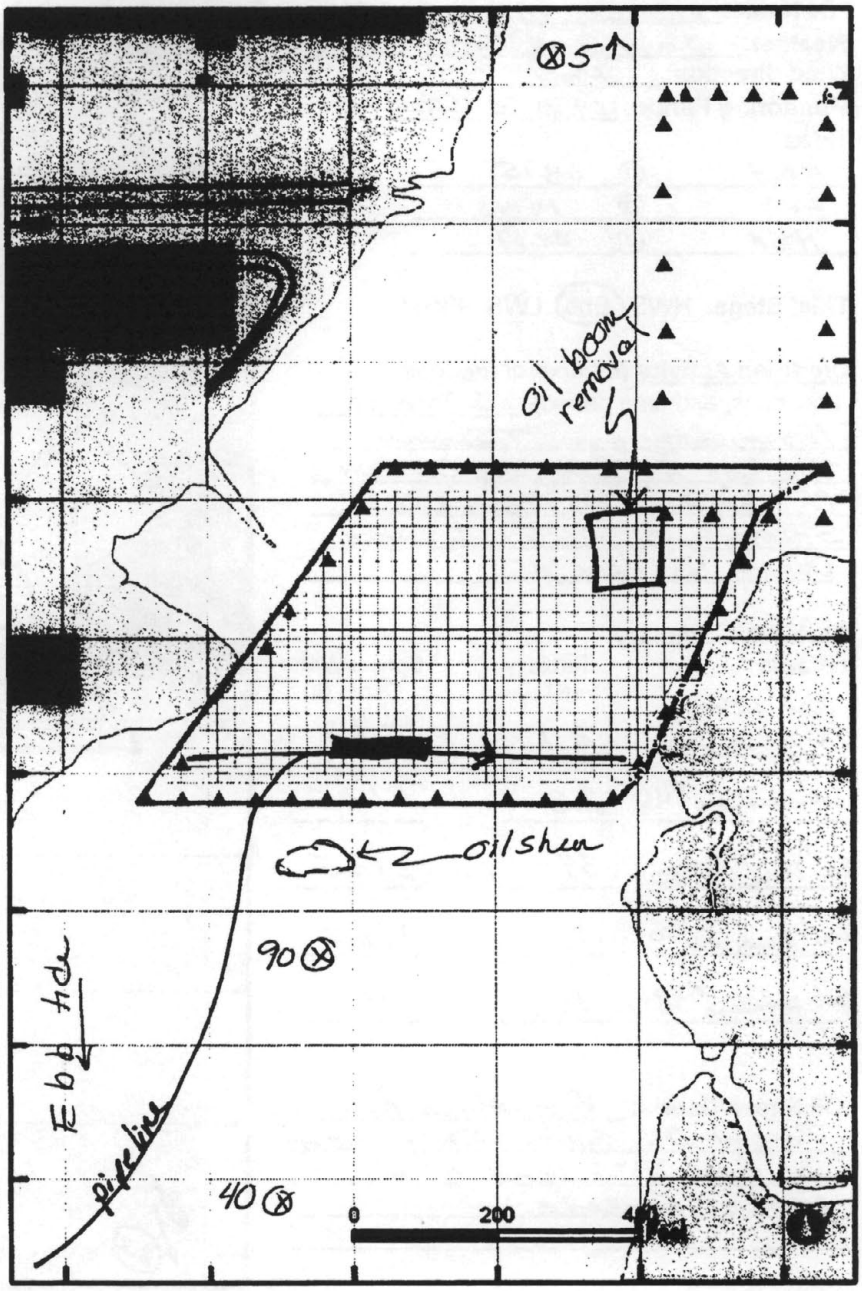
Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* :
Dredge started operating at 9035. between piles 40 and 54 west to east

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
Reference 1000' upcurrent of Dredge	5	2/4
300' downcurrent of Dredge	90	1/4
600' Downcurrent	40	1/4
1000' Downcurrent	27	1/4
1600' Downcurrent	10	1/4

Oil Sheen/Debris: Thin oil sheen (20'x20') observed south of Area B, sample was not collected.



Fish Passage:
No fish were observed during monitoring however comb jellies were observed south of Area B.

Samples Collected for Laboratory Analysis

☐ None [2] TSS/turbidity [2] Toxicity [2] PCBs/Metals ☐ Oil Sheen

Recording Meters: 2 meters are currently deployed at piles 30 and 50.

Observations: Turbidity elevated to 85 NTUs above background when the dredge cutter head was raised to the water surface for cleaning. The cleaning process included dunking the head in and out of the water. Turbidity values dropped further down current but the water column was effected 1600' down current of activity.

Health & Safety: Briefing: Reviewed water safety, cables around Area B, oil sheens.

Debriefing: End of Day.

Monitoring Crew: Julie Stearns, Kate Dunlop, Jarrett Drake.

Completed By: Julie Stearns

ENSR

Daily Field Summary for Water Quality Monitoring DMU #4 Area B. *Date* 11/18/05 *Page* 1 *of* 1

File Name: WA-LOG 1BNW05-EBB
Weather: SUNNY, CLEAR, COLD 40°F's
Wind direction: NORTH 10 KTS
Monitoring Period: 0930 To: 1500
Tides:

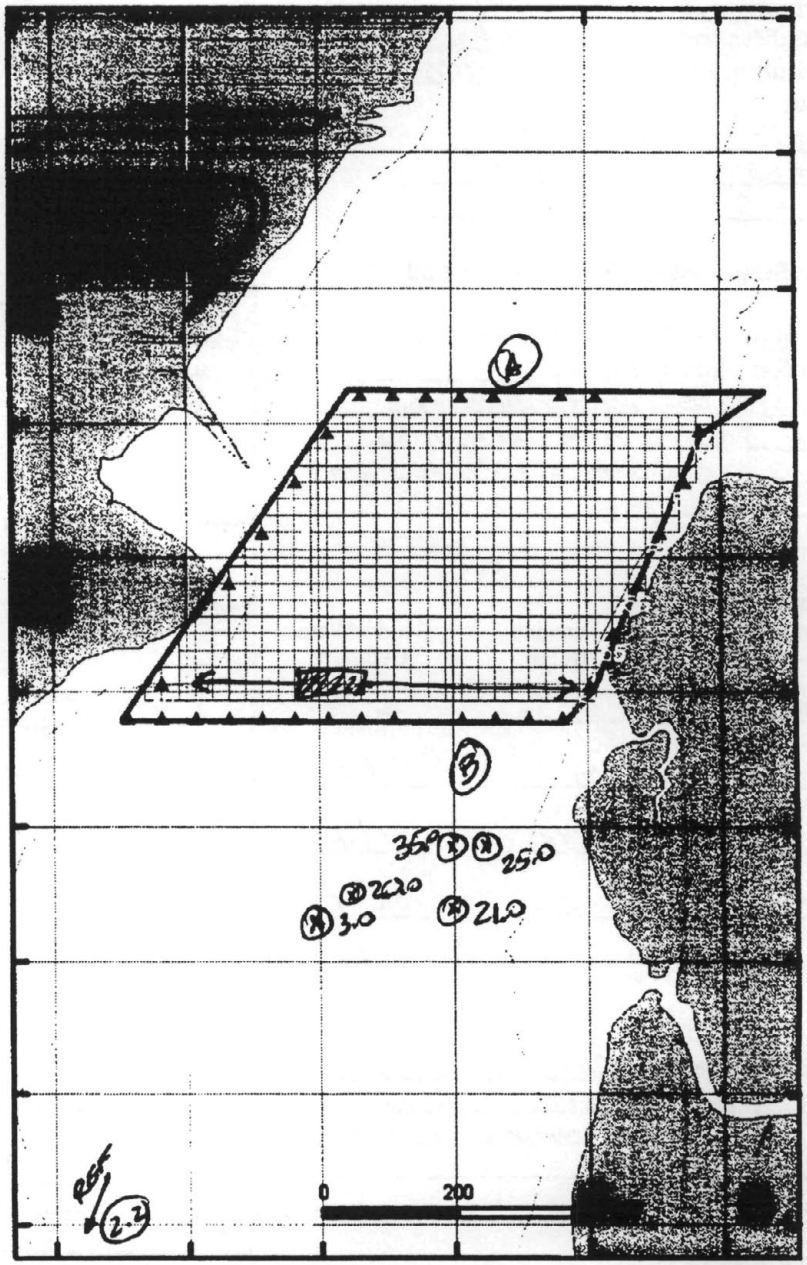
HIGH	@	08:55
LOW	@	14:48
HIGH	@	21:17

Tidal Stage: HWS (Ebb) LWS Flood

Dredging Activity *(number of dredges, Locations, and time period)* : 1 DREDGE INTERMITTENTLY ACTIVE THROUGHOUT THE DAY ALONG SOUTH SIDE OF AREA "B" HEADING E-W BETWEEN SHEET PILINGS 40 & 54. 1 WATCHING DREDGE IN AREA "A".

Turbidity Summary:

Location	Turbidity (NTU)	Sensor/Water Depth (ft)
REF. NEAR SAWYER ST. DOCK	2.1	3/7
300' DOWNCURR #46	2.8	2/3.5
200' DOWNCURR #50	35	2/3.5
200' DOWNCURR #50	49	1/2.5
300' DOWNCURR #48	19	1/2



Oil Sheen/Debris: VERY MINOR AND PATCHY OIL SHEEN DOWNCURRENT OF AREA "B". SOME MINOR DEBRIS NOTICABLE.

Fish Passage:
NO FISH OBSERVED

Samples Collected for Laboratory Analysis
☑ None ☐ TSS/turbidity ☐ Toxicity ☐ PCBs/Metals ☐ Oil Sheen

Recording Meters: 2 YSI MULTIMETERS WERE DEPLOYED AT "A" & "B".
Observations: DREDGING CONTINUED THROUGHOUT THE DAY ALONG A EAST-WEST LINE BETWEEN PILINGS 40 & 54. TURBIDITY PLUME WAS EVIDENT DOWNCURRENT OF THE DREDGE DURING DREDGING BUT NOT TO LEVELS 750 NTU AT 300'. ONLY VERY PATCHY OIL SHEENS WERE VISIBLE DOWN CURRENT OF DREDGE.
Health & Safety: Briefing: A.M. BRIEFLY BEFORE LEAVING DOCK
Debriefing: END OF DAY
Monitoring Crew: K. HELM, K. DUNLAP, B. LANE
Completed By: Ken Helm / Kent H

APPENDIX C

BIOLOGICAL AND ANALYTICAL LABORATORY ANALYSIS

Appendix C1 contains the Biomonitoring of Surface Water Samples New Bedford Harbor, New Bedford, Massachusetts Fall 2005. This report summaries data generated from a series of acute and chronic exposure screening assays evaluating surface water samples collected from New Bedford Harbor.

Appendix C2 contains analytical laboratory data for water samples collected during the spring and fall 2005 dredging program.

APPENDIX C1

BIOLOGICAL LABORATORY ANALYSIS

Biomonitoring of Surface Water Samples
New Bedford Harbor
New Bedford, Massachusetts

Fall 2005

Prepared for

ENSR International
2 Technology Park Drive
Westford, Massachusetts 01886-3140

Prepared by

EnviroSystems, Incorporated
1 Lafayette Road
Hampton, New Hampshire 03843

September-November 2005
Rev 1.01
Reference Number:ENSR13738,13769,13855,13867,13978,13990

Biomonitoring of Surface Water Samples
New Bedford Harbor, New Bedford, Massachusetts

Fall 2005

1.0 INTRODUCTION

This report provides a summarization of data generated from a series of acute and chronic exposure screening assays evaluating surface water samples collected from New Bedford Harbor. Toxicity tests were conducted on grab surface water samples collected from the specified areas in the harbor. Assay design included a laboratory control treatment and one or more surface water samples. Samples were evaluated "As Received" without dilutions. Assays were conducted based on water quality levels in the vicinity of dredging operations. Samples were collected by ENSR personnel from the Westford, Massachusetts office. Testing was based on programs and protocols developed by the US EPA (2002) and included the following assays; modified 2 day acute and 7 day chronic assays conducted with the mysid shrimp, *Americamysis bahia*, and the red macro alga, *Champia parvula*, and 60 minute chronic fertilization assays conducted with the purple sea urchin, *Arbacia punctulata*. All mysid, urchin fertilization assays and a portion of the algal assays were conducted by ESI at its Hampton, New Hampshire facility. Additionally, a portion of the algal assays were conducted by the Saskatchewan Research Council, SRC, Saskatoon, Saskatchewan, Canada.

2.0 MATERIALS AND METHODS

2.1 General Methods

Toxicological and analytical protocols used in this program followed procedures primarily designed by the EPA to provide standard approaches for the evaluation of toxicological effects of discharges on aquatic organisms, and for the analysis of water samples.

2.2 Test Species

A. bahia, ≤5 days, were obtained from cultures maintained by Aquatic Research Organisms (ARO), Hampton, New Hampshire. Juvenile shrimp were collected daily, isolated, and placed in a rearing tank for up to 6 days. Holding tanks were maintained in a flow-through culture mode at a temperature of 25±2°C. At the start of the assays the mysids were 7 days old. Juveniles were fed ≤24 hour old brine shrimp on a daily basis. Water temperature, salinity, and pH were monitored on a daily basis. Prior to testing organisms were siphoned from the rearing tanks to a holding vessel, and then transferred to test chambers using a large bore pipet, minimizing the amount of water added to test solutions.

A. punctulata adults were from cultures maintained by ESI. Original stock was obtained from commercial supply. Male and female urchins are maintained in separate chambers as recommended by protocol (EPA 2002) and ESI. Adult urchins were induced to spawn by the injection of a potassium chloride solution. The viability of gametes obtained was determined prior to their addition to the test solutions. Eggs and/or sperm that would not result in a fertilized egg were rejected from the pool of gametes used in the assay.

C. parvula biomass was obtained from stock cultures maintained by ESI and the Saskatchewan Research Council. Original stocks were obtained from the University of Texas algal collection. The male and female plants are maintained in separate culture vessels under sterile conditions. Algal cultures were maintained on an orbital shaker (100 rpm) at 23±2°C under 16 hour light : 8 hours dark at 40 to 75 foot candles light intensity. Cultures are "cropped" and transferred to fresh nutrient solutions on a weekly basis.

2.3 Surface Water Samples and Laboratory Control Water

Grab surface water samples were collected by ENSR staff on six occasions in the Harbor, Table 1. Samples were placed in polyethylene cubitainers for shipment to the laboratory. Two, 2.5 gallon cubitainers were collected for each of the chronic assays. Prior to testing, samples were evaluated to document salinity, conductivity, and total residual chlorine. Total residual chlorine was measured by amperometric titration (MDL 0.05 mg/L). Prior to use in the assays the salinity of the samples was adjusted, if necessary, to predetermined levels using artificial sea salts for *A. bahia* and *A. punctulata* assays, and GP-2 salts (EPA 2002) for the *C. parvula* assays. The salinity of samples for the *A. bahia* acute and chronic exposure assays were adjusted to 25±2‰ while samples used for the *A. punctulata* and *C. parvula* assays were adjusted to 30±2‰. Samples with as received salinity above these levels were not adjusted.

Laboratory control water used for mysid and sea urchin assays was collected from the Hampton/Seabrook Estuary. This water is classified as SA-1 and has been used to culture marine test organisms since 1981. The laboratory control water used in the algal assay, collected from Rye, New Hampshire, is the same water used in culture maintenance. Prior to use, seawater used in the algal assays was filtered through glass fiber filters and sterilized. Dilution water used in the algal assays conducted by SRC was natural seawater collected from the West Coast of Canada. Salinity of the surface water samples was adjusted using commercial sea salts.

2.4 Bioassays

2.4.1 *Americamysis bahia* Modified Acute and Chronic Exposure Bioassays

Modified acute and chronic exposure screening assays were conducted in a static renewal test mode with renewals made at 24-hour intervals. The 7 day assays were conducted at a temperature of 26±1°C with a photoperiod of 16:8 hours light:dark. Mysids were maintained in 250 mL beakers containing 150 mL of test solution. Approximately 100 mL of the test solution were replaced each day. The assay incorporated 8 replicates with 5 organisms/replicate. Survival and dissolved oxygen were measured daily in each replicate prior to test solution renewal. Salinity, temperature and pH were recorded in a composite sample of the "old" test solution and in the "new" test solution prior to being added to the test chamber. Incubator temperatures were also recorded on a daily basis.

During the test, mysids were fed ≤24 hour old *Artemia* nauplii. On Day 7 of the assay, surviving mysids were removed from test solutions, rinsed to remove any surface detritus and salts, and transferred to tared foils and dried for 24 hours at 103°C. Foils were weighed to the nearest 0.01 mg. Mean dry weights per individual were obtained by dividing the net dry weight of all surviving organisms by the number of organisms added at the start of the assay.

2.4.2 *Arbacia punctulata* Chronic Exposure Fertilization Assays

Gametes were obtained by potassium chloride injection to induce spawning. Sperm were collected dry, diluted to achieve a concentration of approximately 5.0×10^7 sperm/mL in the surface water treatments. Actual sperm concentrations are provided on laboratory bench sheets in Appendix A. Sperm solutions were added to 5 mL aliquots of each sample being evaluated and allowed to remain in the test solutions for 60 minutes before the addition of unfertilized eggs. Each treatment incorporated a total of four (4) replicates. After 20 minutes exposure the assay was terminated by the addition of 0.2 mL of preservative. Aliquots of preserved solution were counted to determine numbers of fertilized and unfertilized eggs. Fertilization was accepted based on the presence or absence of a fertilization membrane around the egg.

2.4.3 *Champia parvula* Modified Acute and Chronic Exposure Assays

The 7 day red algae assay was conducted with a 2 day exposure period to the surface waters and laboratory control treatments. Each treatment used four replicates with five female branches and one male branch per replicate. Temperature was maintained at 23±1°C. The light source was cool white and fluorescent bulbs set on a 16:8 hours light:dark cycle, with a light intensity of 40 to 75 foot candles. Light intensity was checked at the start of each assay. Temperatures were monitored on a daily basis. Test chambers were 200 mL borosilicate glass fleakers. After 2 days exposure, female branch tips were transferred to approximately 100 mL of recovery medium with added nutrients and allowed to recover and mature for 5 days. During transfer, plants were examined to determine the physical condition of the individual branches. Branches showing signs of degeneration were noted and used to establish an acute endpoint. After the recovery period, the number of cystocarps (reproductive bodies) on each female branch were counted.

2.5 Data Analysis

Statistical analysis of acute and chronic exposure data was completed using CETIS, Comprehensive Environmental Toxicity Testing System, software. The program computes acute and chronic exposure endpoints based on EPA decision tree guidelines specified in individual test methods. For chronic exposure endpoints statistical significance was accepted at $\alpha < 0.05$.

2.6 Quality Control

As part of the laboratory quality control program, standard reference toxicant assays are conducted on a regular basis for each test species. These results, summarized in Table 10, provide relative health and response data while allowing for comparison with historic data sets. Review of reference toxicant data associated with the September 27, 2005 Arbacia punctulata test documents that the fertilization C-NOEC, 5.0 mg/L copper, was outside the acceptable range of 20 to 80 mg/L copper. The acceptable NOEC range for this assay is defined as ±1 concentration of the central tendency. A single value outside the acceptable range is anticipated to occur approximately once every 20 assays based on normal statistical distributions. As such, this excursion outside the acceptable range is considered as acceptable, especially as the fertilization IC-25 was within the acceptable range.

2.7 Protocol Deviations and Unacceptable Assays

Review of data collected from the six sets of assays conducted during the monitoring period documented one protocol deviation. Minimum acceptability criteria for the *C. parvula* assay requires a mean production of 10 cystocarp per female branch tip. During the assay conducted on samples collected on September 22, mean cystocarp production was 9.65. As the value could be rounded to 10, the assay was considered to be acceptable, and the data valid for evaluation of potential impacts.

Several assays failed to meet acceptability criteria. No cystocarps were produced during the assay conducted with samples collected on November 14, 2005. In this case all plants, in both treatment and laboratory control failed to produce any cystocarps and the plants showed signs of extreme stress; loss of color and loss or rigidity. The failure was attributed to an error in the preparation of the nutrient stocks used for the recovery portion of the assay.

Four chronic exposure *A. punctulata* sperm viability assays, conducted using samples collected on October 17 and 19 and November 14 and 17, could not be completed due to a lack of viable gametes. Regularly scheduled renewal / replenishment of ESI's in-house urchin population was interrupted by adverse weather conditions along the Carolina coast during October. Tropical storms forced suppliers to cancel field collection efforts. After the storms urchin populations were unavailable due to storm related sea conditions. Attempts to obtain urchins capable of producing viable gametes from suppliers in Florida were unsuccessful. Above normal ocean water temperature had postponed normal seasonal migrations and gamete maturation. These events resulted in the laboratory being unable to obtain viable gametes for the assays.

3.0 RESULTS SUMMARY

Table 2 provides a summary of test acceptability for the six rounds of assays conducted during this monitoring period. Tables 3-8 provide summaries of survival, growth, development and reproduction endpoints and associated statistical analyses. Table 9 provides a summary of basic water quality data associated with the assays. Support data, including laboratory bench sheets, are provided in Appendix A.

4.0 REFERENCES

APHA. 1998. *Standard Methods for the Examination of Water and Wastewater*, 20th edition. Washington D.C.

US EPA. 2002. *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*. Fourth Edition. EPA-821-R-02-012.

US EPA. 2002. *Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. Fourth Edition. EPA-821-R-02-013.

Table 1. Summary of Sample Collection Data. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Collected		Received		Lab Code	Temperature °C
WQE2091405	09/14/05	0844	09/15/05	1340	13738-001	6
WQE1092205	09/22/05	1525	09/23/05	0935	13769-001	4
WQR1092205	09/22/05	0853	09/23/05	0935	13769-002	4
WQE1101705	10/17/05	1145	10/18/05	1030	13855-001	-
WQE2101705	10/17/05	1230	10/18/05	1030	13855-002	-
WQR1101705	10/17/05	1050	10/18/05	1030	13855-003	-
WQE1101905	10/19/05	1210	10/20/05	1200	13867-001	4
WQE2101905	10/19/05	1225	10/20/05	1200	13867-002	4
WQR1101905	10/19/05	1250	10/20/05	1200	13867-003	4
WQR1111405	11/14/05	1340	11/15/05	1215	13978-001	2
WQE2111405	11/14/05	1510	11/15/05	1215	13978-002	2
WQR2111705	11/17/05	1150	11/17/05	1040	13990-001	1
WQE2111705	11/17/05	1105	11/18/05	1040	13990-002	1

Table 2. Summary of Assay Acceptability. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

	Americamysis bahia		*Champia parvula*		*Arbacia punctulata*
Lab Code	Acute Exposure	Chronic Exposure	Acute Exposure	Chronic Exposure	Chronic Exposure
13738	Acceptable	Acceptable	Acceptable	-*	Acceptable
13769	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
13855	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable**
13867	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable**
13978	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable**
13990	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable**

Notes:

* Chronic exposure algal assay not conducted, surface water treatments showed signs of extreme stress, assay limited to 48-hour acute exposure evaluation.

** *A. punctulata* assay attempted but not able to obtain viable gametes.

Table 3. Endpoint Summary Table - New Bedford Harbor Water Quality Monitoring September 14, 2005 Sampling Event. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Reps	Mean	Min	Max	CV	Significant Difference vs p Value	Significant Difference vs Lab
Arbacia punctulata							
		Proportion Fertilized					
Lab Control	4	92.25%	90.27%	95.24%	2.41%		
WQE2091405		82.02%	75.76%	85.47%	5.39%	0.0023	YES
Americamysis bahia							
		Day 2 Survival					
Lab Control		100.00%	100.00%	100.00%	0.00%	-	-
WQE2091405		100.00%	100.00%	100.00%	0.00%	0.4796	NO
		Day 7 Survival					
Lab Control	8	100.00%	100.00%	100.00%	0.00%	-	-
WQE2091405		100.00%	100.00%	100.00%	0.00%	0.4796	NO
		Day 7 Dry Weight Biomass - mg					
Lab Control	8	0.449	0.394	0.490	7.12%		
WQE2091405		0.450	0.420	0.490	5.56%	0.5068	NO
Champia parvula							
		Day 2 Survival					
Lab Control	4	100.00%	100.00%	100.00%	0.00%		
WQE2091405		0.00%*	0.00%*	0.00%*	0.00%	0.0000	YES
		Day 7 Mean # Cystocarps					
Lab Control	4	Plants Dead @ 48 Hours				-	-
WQE2091405						-	-

* Branch tips pale and limp; no color except at very tip; branches showing signs of degradation

Table 4. Endpoint Summary Table - New Bedford Harbor Water Quality Monitoring September 22, 2005 Sampling Event. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Reps	Mean	Min	Max	CV	Significant Difference vs			
						p Value	Lab	p Value	Ref
Arbacia punctulata									
		Proportion Fertilized							
Lab Control		86.47%	83.48%	91.82%	4.25%	-	-	-	-
WQR1092205	4	87.80%	84.75%	90.27%	3.10%	0.6919	NO	-	-
WQE1092205		87.54%	85.95%	90.99%	2.68%	0.6551	NO	0.5601	NO
Americamysis bahia									
		Day 2 Survival							
Lab Control		100.00%	100.00%	100.00%	0.00%	-	-	-	-
WQR1092205		100.00%	100.00%	100.00%	0.00%	0.4796	NO	-	-
WQE1092205		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Survival							
Lab Control		97.50%	80.00%	100.00%	7.25%	-	-	-	-
WQR1092205	8	97.50%	80.00%	100.00%	7.25%	0.4796	NO	-	-
WQE1092205		77.50%	40.00%	100.00%	25.57%	0.0141	YES	0.0141	YES
		Day 7 Dry Weight Biomass - mg							
Lab Control		0.330	0.230	0.394	14.50%	-	-	-	-
WQR1092205	8	0.333	0.256	0.476	19.77%	0.5407	NO	-	-
WQE1092205		0.179	0.128	0.256	25.83%	0.0000	YES	0.0000	YES
Champia parvula									
		Day 2 Survival							
Lab Control		100.00%	100.00%	100.00%	0.00%				
WQR1092205*	4	100.00%	100.00%	100.00%	0.00%	0.4796	NO		
WQE1092205*		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Mean # Cystocarps							
Lab Control		9.65	8.40	10.20	8.69%	-	-	-	-
WQR1092205	4	0.00	0.00	0.00	0.00%	0.0000	YES	-	-
WQE1092205		0.00	0.00	0.00	0.00%	0.0000	YES	0.0000	YES

* Branch tips color paler than control

Table 5. Endpoint Summary Table - New Bedford Harbor Water Quality Monitoring October 17, 2005 Sampling Event. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Reps	Mean	Min	Max	CV	Significant Difference vs p Value	Lab	p Value	Ref
Arbacia punctulata									
		Proportion Fertilized							
Lab Control									
WQR1101705	4	Fertilization Unsuccessful							
WQE1101705									
WQE2101705									
Americamysis bahia									
		Day 2 Survival							
Lab Control		100.00%	100.00%	100.00%	0.00%	-	-	-	-
WQR1101705		100.00%	100.00%	100.00%	0.00%	0.4796	NO	-	-
WQE1101705		95.00%	80.00%	100.00%	9.75%	0.3604	NO	0.3604	NO
WQE2101705		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Survival							
Lab Control		95.00%	80.00%	100.00%	9.75%	-	-	-	-
WQR1101705	8	97.50%	80.00%	100.00%	7.25%	0.6395	NO	-	-
WQE1101705		92.50%	80.00%	100.00%	11.19%	0.3605	NO	.2209	NO
WQE2101705		100.00%	100.00%	100.00%	0.00%	0.7791	NO	.6395	NO
		Day 7 Dry Weight Biomass - mg							
Lab Control		0.537	0.294	1.318	67.19%	-	-	-	-
WQR1101705	8	0.469	0.402	0.576	11.84%	0.8828	NO	-	-
WQE1101705		0.226	0.150	0.286	21.53%	0.0001	YES	0.0000	YES
WQE2101705		0.422	0.360	0.472	9.71%	0.7473	NO	0.0372	YES
Champia parvula									
		Day 2 Survival							
Lab Control		100.00%	100.00%	100.00%	0.00%	-	-	-	-
WQR1101705	4	100.00%	100.00%	100.00%	0.00%	0.4796	NO	-	-
WQE1101705		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
WQE2101705		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Mean # Cystocarps							
Lab Control		62.85	53.60	72.40	15.45%	-	-	-	-
WQR1101705	4	14.85	9.20	19.60	30.28%	0.0005	YES	-	-
WQE1101705		0.00	0.00	0.00	0.00%	0.0005	YES	0.0003	YES
WQE2101705		0.45	0.00	1.20	116.89%	0.0001	YES	0.0039	YES

Table 6. Endpoint Summary Table - New Bedford Harbor Water Quality Monitoring October 19, 2005 Sampling Event. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Reps	Mean	Min	Max	CV	Significant Difference vs			
						p Value	Lab	p Value	Ref
Arbacia punctulata									
		Proportion Fertilized							
Lab Control									
WQR1101905	4	Fertilization Unsuccessful							
WQE1101905									
WQE2101905									
Americamysis bahia									
		Day 2 Survival							
Lab Control		100.00%	100.00%	100.00%	0.00%	-	-	-	-
WQR1101905	8	100.00%	100.00%	100.00%	0.00%	0.4796	NO	-	-
WQE1101905		97.50%	80.00%	100.00%	7.25%	0.2209	NO	0.2209	NO
WQE2101905		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Survival							
Lab Control		97.50%	80.00%	100.00%	7.25%	-	-	-	-
WQR1101905	8	97.50%	80.00%	100.00%	7.25%	0.4796	NO	-	-
WQE1101905		95.00%	80.00%	100.00%	9.75%	0.3605	NO	0.3605	NO
WQE2101905		95.00%	80.00%	100.00%	9.75%	0.3605	NO	0.3605	NO
		Day 7 Dry Weight Biomass - mg							
Lab Control		0.324	0.260	0.404	16.38%	-	-	-	-
WQR1101905	8	0.571	0.306	0.796	33.56%	0.9960	NO	-	-
WQE1101905		0.410	0.294	0.484	18.14%	0.9906	NO	0.0218	YES
WQE2101905		0.402	0.316	0.522	15.65%	0.9912	NO	0.0228	YES
Champia parvula									
		Day 2 Survival							
Lab Control		100.00%	100.00%	100.00%	0.00%	-	-	-	-
WQR1101905	4	100.00%	100.00%	100.00%	0.00%	0.4796	NO	-	-
WQE1101905		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
WQE2101905		100.00%	100.00%	100.00%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Mean # Cystocarps							
Lab Control		58.1	51.0	65.0	11.41%	-	-	-	-
WQR1101905	4	53.6	45.8	59.4	11.84%	0.1821	NO	-	-
WQE1101905		0.9	0.2	2.2	98.55%	0.0002	YES	0.0002	YES
WQE2101905		0.5	0.0	1.4	142.29%	0.0002	YES	0.0002	YES

Table 7. Endpoint Summary Table - New Bedford Harbor Water Quality Monitoring November 14, 2005 Sampling Event. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Reps	Mean	Min	Max	CV	Significant Difference vs p Value	Lab	p Value	Ref
Arbacia punctulata									
		Proportion Fertilized							
Lab Control									
WQR1111405	4	Fertilization Unsuccessful							
WQE2111405									
Americamysis bahia									
		Day 2 Survival							
Lab Control		100.0%	100.0%	100.0%	0.00%	-	-	-	-
WQR1111405	8	100.0%	100.0%	100.0%	0.00%	0.4796	NO	-	-
WQE2111405		100.0%	100.0%	100.0%	0.00%	0.4796	NO	0.4796	NO
		Day 7 Survival							
Lab Control		95.0%	80.0%	100.0%	9.75%	-	-	-	-
WQR1111405	8	97.5%	80.0%	100.0%	7.25%	0.6395	NO	-	-
WQE2111405		85.0%	60.0%	100.0%	20.86%	0.4796	NO	0.0427	YES
		Day 7 Dry Weight Biomass - mg							
Lab Control		0.30925	0.26000	0.49400	24.76%	-	-	-	-
WQR1111405	8	0.31525	0.25400	0.38200	11.66%	0.8828	NO	-	-
WQE2111405		0.36225	0.14400	0.88600	65.65%	0.0918	NO	0.4796	NO
Champia parvula									
		Day 2 Survival							
Lab Control		100.0%	100.0%	100.0%	0.0%	-	-	-	-
WQR1111405	4	100.0%	100.0%	100.0%	0.0%	-	NO	-	-
WQE2111405*		0.0%	0.0%	0.0%	0.0%	0.0000	YES	0.0000	YES
		Day 7 Mean # Cystocarps							
Lab Control						-	-	-	-
WQR1111405	4	No Cystocarp Development in any Treatment**				-	-	-	-
WQE2111405						-	-	-	-

* Branch tips pale and limp; no color except at very tip; branches showing signs of degradation

** Assay failed to meet acceptability criteria, review of assay suggests that recovery nutrient solution was at fault.

Table 8. Endpoint Summary Table - New Bedford Harbor Water Quality Monitoring November 17, 2005 Sampling Event. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Reps	Mean	Min	Max	CV	Significant Difference vs			
						p Value	Lab	p Value	Ref
Arbacia punctulata									
		Proportion Fertilized							
Lab Control									
WQR1111705	4	Fertilization Unsuccessful							
WQE2111705									
Americamysis bahia									
		Day 2 Survival							
Lab Control		100.0%	100.0%	100.0%	0.00%	-	-	-	-
WQR1111705	8	95.0%	80.0%	100.0%	9.75%	0.2209	NO	-	-
WQE2111705		100.0%	100.0%	100.0%	0.00%	0.4796	NO	0.7791	NO
		Day 7 Survival							
Lab Control		97.5%	80.0%	100.0%	7.25%	-	-	-	-
WQR1111705	8	90.0%	60.0%	100.0%	16.80%	0.1911	NO	-	-
WQE2111705		100.0%	100.0%	100.0%	0.00%	0.6395	NO	0.8828	NO
		Day 7 Dry Weight Biomass - mg							
Lab Control		0.26825	0.24600	0.33400	10.40%	-	-	-	-
WQR1111705	8	0.27175	0.22000	0.40000	20.68%	0.3992	NO	-	-
WQE2111705		0.23050	0.14800	0.31600	21.65%	0.0414	YES	0.0714	NO
Champia parvula									
		Day 2 Survival							
Lab Control		100.0%	100.0%	100.0%	0.0%	-	-	-	-
WQR1111705	4	100.0%	100.0%	100.0%	0.0%	-	NO	-	-
WQE2111705*		0.0%	0.0%	0.0%	0.0%	0.0000	YES	0.0000	YES
		Day 7 Mean # Cystocarps							
Lab Control		46.1	36.4	53.8	16.93%	-	-	-	-
WQR1111705	4	31.9	26.6	40.4	18.88%	0.0140	YES	-	-
WQE2111705*		0.0	0.0	0.0	0.00%	0.0007	YES	0.0000	YES

* Branch tips limp, pale green with red tips

Table 9. Summary of "As Received" Sample Physical and Chemical Characteristics. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Sample ID	Lab Code	Ammonia (mg/L)	pH (SU)	Salinity (‰)	Specific Conductance (µmhos/cm)	Total Residual Chlorine (mg/L)
LAB WATER	13738-000	<0.1	7.47	29	45100	<0.05
WQE2091405	13738-001	<0.1	7.71	29	15000	<0.05
LAB WATER	13769-000	<0.1	7.89	25	-	<0.05
WQE1092205	13769-001	0.27	7.35	22	30980	<0.05
WQR1092205	13769-002	0.24	7.25	25	37880	<0.05
LAB WATER	13855-000	<0.1	7.78	25	-	<0.05
WQE1101705	13855-001	<0.1	6.73	2	3622	<0.05
WQE2101705	13855-002	<0.1	6.77	5	8090	<0.05
WQR1101705	13855-003	<0.1	6.70	5	7890	<0.05
LAB WATER	13867-000	<0.10	7.44	25	35980	<0.05
WQE1101905	13867-001	0.23	7.48	23	35980	<0.05
WQE2101905	13867-002	0.29	7.43	24	36820	<0.05
WQR1101905	13867-003	<0.1	7.19	6	9790	<0.05
LAB WATER	13978-000	<0.1	7.82	24	37420	<0.05
WQR1111405	13978-001	<0.1	7.26	10	16860	<0.05
WQE2111405	13978-002	0.31	7.18	14	22800	<0.05
LAB WATER	13990-000	<0.1	7.88	24	36480	<0.05
WQR2111705	13990-001	0.11	7.06	17	25860	<0.05
WQE2111705	13990-002	0.23	7.40	19	30160	<0.05

Table 10. Reference Toxicant Summary. New Bedford Harbor Surface Water Monitoring Program. Fall 2005.

Date	Endpoint		Value	Historic Mean/ Central Tendency	Acceptable Range	Reference Toxicant
*A. bahia**						
09/27/05	Survival	LC-50	24.1	20.6	14.8 - 26.4	SDS (mg/L)
011/04/05	Survival	LC-50	20.8	20.3	15.1 - 25.5	SDS (mg/L)
10/26/05	Survival	C-NOEC	15.0	-	-	SDS (mg/L)
10/26/05	Growth	C-NOEC	15.0	-	-	SDS (mg/L)
011/04/05	Survival	LC-50	20.8	20.3	15.1 - 25.5	SDS (mg/L)
10/26/05	Survival	C-NOEC	15.0	-	-	SDS (mg/L)
10/26/05	Growth	C-NOEC	15.0	-	-	SDS (mg/L)
*A. Punctulata**						
09/27/05	Fertilization	C-NOEC	5.0	40.0	20.0 - 80.0	Copper (µg/L)
09/27/05	Fertilization	IC-25	6.7	74.1	0.0 - 156.2	Copper (µg/L)
*C. parvula***						
09/14/05	# Cystocarps	IC-50	1.45	1.39	1.13 - 1.71	SDS (mg/L)
10/20/05	# Cystocarps	IC-50	1.38	1.39	1.13 - 1.71	SDS (mg/L)
11/22/05	# Cystocarps	IC-50	1.31	1.39	1.13 - 1.71	SDS (mg/L)

* Mean and Acceptable Ranges based on most recent 20 reference toxicant assays (NELAP standard)

** Mean and Acceptable Range based on 29 reference toxicant assays.

APPENDIX C2

ANALYTICAL LABORATORY ANALYSIS

Analytical Laboratory Analysis Table for Water Samples Collected during Spring and Fall 2005 for Dredging Program at DMU-2 and DMU-4

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
ST-2-05	SA	TOTAL	1	NBH012	Solids, Percent	82	d	PCT_SOL
ST-3-05	SA	TOTAL	1	NBH012	Solids, Percent	86	d	PCT_SOL
ST-4-05	SA	TOTAL	1	NBH012	Solids, Percent	73	d	PCT_SOL
ST-5-05	SA	TOTAL	1	NBH012	Solids, Percent	85	d	PCT_SOL
ST-6-05	SA	TOTAL	1	NBH012	Solids, Percent	78	d	PCT_SOL
ST-1-05	SA	TOTAL	1	NBH012	Solids, Percent	94	d	PCT_SOL
ST-2-05	SA	TOTAL	400	34883-43-7	BZ 8	4450	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	37680-65-2	BZ 18	14300	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	7012-37-5	BZ 28	23500	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	41464-39-5	BZ 44	10800	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	35693-99-3	BZ 52	26200	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	32598-10-0	BZ 66	13100	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	37680-73-2	BZ 101	13600	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	32598-14-4	BZ 105	1260	dpD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	31508-00-6	BZ 118	6860	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	38380-07-3	BZ 128	1040	dpD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	35065-28-2	BZ 138	5100	dpD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	35065-27-1	BZ 153	8220	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	35065-30-6	BZ 170	929	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	35065-29-3	BZ 180	1230	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	52663-68-0	BZ 187	1810	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	52663-78-2	BZ 195	194	dUD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	40186-72-9	BZ 206	212	dD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	C-2051-24-3	BZ 209	194	dUD	UG/KG_DRYWT
ST-2-05	SA	TOTAL	400	CS-10386-84-2	DBOB		dD	PCT_REC
ST-2-05	SA	TOTAL	400	CS-68194-17-2	BZ 198		dD	PCT_REC
ST-3-05	SA	TOTAL	200	34883-43-7	BZ 8	3430	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	37680-65-2	BZ 18	11000	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	7012-37-5	BZ 28	19100	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	41464-39-5	BZ 44	8790	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	35693-99-3	BZ 52	20900	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	32598-10-0	BZ 66	10900	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	37680-73-2	BZ 101	11300	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	32598-14-4	BZ 105	1120	dpD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	31508-00-6	BZ 118	5900	dD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
ST-3-05	SA	TOTAL	200	38380-07-3	BZ 128	904	dpD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	35065-28-2	BZ 138	4510	dpD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	35065-27-1	BZ 153	7060	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	35065-30-6	BZ 170	981	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	35065-29-3	BZ 180	1170	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	52663-68-0	BZ 187	1560	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	52663-78-2	BZ 195	134	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	40186-72-9	BZ 206	187	dD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	C-2051-24-3	BZ 209	121	dUD	UG/KG_DRYWT
ST-3-05	SA	TOTAL	200	CS-10386-84-2	DBOB		dD	PCT_REC
ST-3-05	SA	TOTAL	200	CS-68194-17-2	BZ 198		dD	PCT_REC
ST-4-05	SA	TOTAL	500	34883-43-7	BZ 8	15600	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	37680-65-2	BZ 18	33300	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	7012-37-5	BZ 28	46700	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	41464-39-5	BZ 44	20400	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	35693-99-3	BZ 52	39100	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	32598-10-0	BZ 66	27100	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	37680-73-2	BZ 101	25900	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	32598-14-4	BZ 105	1850	dpD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	31508-00-6	BZ 118	15200	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	38380-07-3	BZ 128	1510	dpD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	35065-28-2	BZ 138	7680	dpD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	35065-27-1	BZ 153	12800	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	35065-30-6	BZ 170	1390	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	35065-29-3	BZ 180	1870	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	52663-68-0	BZ 187	2380	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	52663-78-2	BZ 195	262	dUD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	40186-72-9	BZ 206	293	dD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	C-2051-24-3	BZ 209	262	dUD	UG/KG_DRYWT
ST-4-05	SA	TOTAL	500	CS-10386-84-2	DBOB		dD	PCT_REC
ST-4-05	SA	TOTAL	500	CS-68194-17-2	BZ 198		dD	PCT_REC
ST-5-05	SA	TOTAL	250	34883-43-7	BZ 8	7080	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	37680-65-2	BZ 18	15700	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	7012-37-5	BZ 28	23200	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	41464-39-5	BZ 44	8800	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	35693-99-3	BZ 52	20400	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	32598-10-0	BZ 66	10100	dD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
ST-5-05	SA	TOTAL	250	37680-73-2	BZ 101	11000	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	32598-14-4	BZ 105	1070	dpD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	31508-00-6	BZ 118	5500	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	38380-07-3	BZ 128	889	dpD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	35065-28-2	BZ 138	4120	dpD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	35065-27-1	BZ 153	6120	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	35065-30-6	BZ 170	773	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	35065-29-3	BZ 180	1010	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	52663-68-0	BZ 187	1300	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	52663-78-2	BZ 195	136	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	40186-72-9	BZ 206	160	dD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	C-2051-24-3	BZ 209	120	dUD	UG/KG_DRYWT
ST-5-05	SA	TOTAL	250	CS-10386-84-2	DBOB		dD	PCT_REC
ST-5-05	SA	TOTAL	250	CS-68194-17-2	BZ 198		dD	PCT_REC
ST-6-05	SA	TOTAL	50	34883-43-7	BZ 8	665	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	37680-65-2	BZ 18	1760	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	7012-37-5	BZ 28	4180	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	41464-39-5	BZ 44	1820	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	35693-99-3	BZ 52	3630	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	32598-10-0	BZ 66	2860	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	37680-73-2	BZ 101	2980	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	32598-14-4	BZ 105	504	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	31508-00-6	BZ 118	2080	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	38380-07-3	BZ 128	368	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	35065-28-2	BZ 138	1530	dpD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	35065-27-1	BZ 153	1710	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	35065-30-6	BZ 170	281	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	35065-30-6	BZ 170	829	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	35065-29-3	BZ 180	916	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	52663-68-0	BZ 187	1290	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	52663-78-2	BZ 195	109	dUD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	40186-72-9	BZ 206	161	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	C-2051-24-3	BZ 209	109	dUD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	CS-10386-84-2	DBOB		dD	PCT_REC
ST-1-05	SA	TOTAL	100	CS-68194-17-2	BZ 198		dD	PCT_REC
ST-1-05	SA	TOTAL	100	34883-43-7	BZ 8	2670	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	37680-65-2	BZ 18	8510	dD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
ST-1-05	SA	TOTAL	100	7012-37-5	BZ 28	15100	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	41464-39-5	BZ 44	7130	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	35693-99-3	BZ 52	16400	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	32598-10-0	BZ 66	9210	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	37680-73-2	BZ 101	9700	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	32598-14-4	BZ 105	931	dpD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	31508-00-6	BZ 118	5040	dD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	38380-07-3	BZ 128	828	dpD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	35065-28-2	BZ 138	3920	dpD	UG/KG_DRYWT
ST-1-05	SA	TOTAL	100	35065-27-1	BZ 153	5840	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	35065-29-3	BZ 180	372	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	52663-68-0	BZ 187	378	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	52663-78-2	BZ 195	40	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	40186-72-9	BZ 206	112	dD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	C-2051-24-3	BZ 209	77	dpD	UG/KG_DRYWT
ST-6-05	SA	TOTAL	50	CS-10386-84-2	DBOB		dD	PCT_REC
ST-6-05	SA	TOTAL	50	CS-68194-17-2	BZ 198		dD	PCT_REC
WQE2091405 ARC	SA	TOTAL	1	TSS	TSS - Membrane	72		MG/L
WQE2091405 ARC	SA	TOTAL	1	TURB	Turbidity - 180.1	15		NTU
WQE2091405 ARCDUP	DUP	TOTAL	1	TSS	TSS - Membrane	71		MG/L
WQE2091405 ARCDUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	15		NTU
WQTSS00109 2105	SA	TOTAL	1	TSS	TSS - Membrane	140		MG/L
WQTSS00109 2105	SA	TOTAL	1	TURB	Turbidity - 180.1	22		NTU
WQTSS00109 2105DUP	DUP	TOTAL	1	TSS	TSS - Membrane	140		MG/L
WQTSS00109 2105DUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	22		NTU
WQ-TSS-001-092305	SA	TOTAL	1	TSS	TSS - Membrane	32		MG/L
WQ-TSS-001-092305	SA	TOTAL	1	TURB	Turbidity - 180.1	6.3		NTU
WQ-TSS-001-092305DUP	DUP	TOTAL	1	TSS	TSS - Membrane	29		MG/L
WQ-TSS-001-092305DUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	6		NTU
WQR1101705	SA	TOTAL	1	TSS	TSS - Membrane	14		MG/L
WQR1101705	SA	TOTAL	1	TURB	Turbidity - 180.1	1.5		NTU
WQR1101705 DUP	DUP	TOTAL	1	TSS	TSS - Membrane	12		MG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQR1101705 DUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	1.7		NTU
WQE1101705	SA	TOTAL	1	TSS	TSS - Membrane	250		MG/L
WQE1101705	SA	TOTAL	1	TURB	Turbidity - 180.1	15		NTU
WQE2101705	SA	TOTAL	1	TSS	TSS - Membrane	71		MG/L
WQE2101705	SA	TOTAL	1	TURB	Turbidity - 180.1	27		NTU
WQ-E1-111105	SA	TOTAL	1	TSS	TSS - Membrane	77		MG/L
WQ-E1-111105	SA	TOTAL	1	TURB	Turbidity - 180.1	17		NTU
WQ-R1-111105	SA	TOTAL	1	TSS	TSS - Membrane	4.3		MG/L
WQ-R1-111105	SA	TOTAL	1	TURB	Turbidity - 180.1	1.4		NTU
WQE2111705	SA	TOTAL	1	TSS	TSS - Membrane	120		MG/L
WQE2111705	SA	TOTAL	1	TURB	Turbidity - 180.1	22		NTU
WQE2111705 DUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	23		NTU
WQR1111705	SA	TOTAL	1	TSS	TSS - Membrane	6.2		MG/L
WQR1111705	SA	TOTAL	1	TURB	Turbidity - 180.1	1.4		NTU
WQF2111405	SA	TOTAL	1	TSS	TSS - Membrane	120		MG/L
WQF2111405	SA	TOTAL	1	TURB	Turbidity - 180.1	23		NTU
WQR1111405	SA	TOTAL	1	TSS	TSS - Membrane	7.7		MG/L
WQR1111405	SA	TOTAL	1	TURB	Turbidity - 180.1	2		NTU
WQR1111405 DUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	2		NTU
WQR1092205	SA	TOTAL	1	TSS	TSS - Membrane	4		MG/L
WQR1092205	SA	TOTAL	1	TURB	Turbidity - 180.1	2.8		NTU
WQE1092205	SA	TOTAL	1	TSS	TSS - Membrane	190		MG/L
WQE1092205	SA	TOTAL	1	TURB	Turbidity - 180.1	16		NTU
WQ-PCB-004-102805-ST	SA	TOTAL	1	NBH012	Solids, Percent	73.81	d	PCT_SOL
WQ-PCB-005-102805-ST	SA	TOTAL	1	NBH012	Solids, Percent	52.13	d	PCT_SOL
WQ-PCB-001-102805-ST	SA	TOTAL	2000	34883-43-7	BZ 8	21600	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	37680-65-2	BZ 18	35000	dD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	7012-37-5	BZ 28	62600	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	41464-39-5	BZ 44	21300	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	35693-99-3	BZ 52	46100	dID	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	32598-10-0	BZ 66	29400	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	37680-73-2	BZ 101	24900	dPD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	32598-14-4	BZ 105	1800	dPD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	31508-00-6	BZ 118	14900	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	38380-07-3	BZ 128	1420	dPD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	35065-28-2	BZ 138	7860	dPD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	35065-27-1	BZ 153	12100	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	35065-30-6	BZ 170	1320	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	35065-29-3	BZ 180	2700	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	52663-68-0	BZ 187	2620	dD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	52663-78-2	BZ 195	498	dUD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	40186-72-9	BZ 206	498	dUD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	C-2051-24-3	BZ 209	498	dUD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	2000	CS-10386-84-2	DBOB		dD	PCT_REC
WQ-PCB-001-102805-ST	SA	TOTAL	2000	CS-68194-17-2	BZ 198		dD	PCT_REC
WQ-PCB-002-102805-ST	SA	TOTAL	8000	34883-43-7	BZ 8	71500	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	37680-65-2	BZ 18	103000	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	7012-37-5	BZ 28	191000	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	41464-39-5	BZ 44	68800	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	35693-99-3	BZ 52	112000	dID	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	32598-10-0	BZ 66	98900	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	37680-73-2	BZ 101	72500	dPD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	32598-14-4	BZ 105	5110	dPD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	31508-00-6	BZ 118	46200	dD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	38380-07-3	BZ 128	3650	dPD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	35065-28-2	BZ 138	20200	dPD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	35065-27-1	BZ 153	29600	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	35065-30-6	BZ 170	3270	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	35065-29-3	BZ 180	7290	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	52663-68-0	BZ 187	5830	dD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	52663-78-2	BZ 195	1740	dUD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	40186-72-9	BZ 206	1740	dUD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	C-2051-24-3	BZ 209	1740	dUD	UG/KG_DRYWT
WQ-PCB-002-102805-ST	SA	TOTAL	8000	CS-10386-84-2	DBOB		dD	PCT_REC
WQ-PCB-002-102805-ST	SA	TOTAL	8000	CS-68194-17-2	BZ 198		dD	PCT_REC
WQ-PCB-003-102805-ST	SA	TOTAL	500	34883-43-7	BZ 8	6590	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	37680-65-2	BZ 18	21600	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	7012-37-5	BZ 28	43600	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	41464-39-5	BZ 44	18000	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	35693-99-3	BZ 52	36500	dID	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	32598-10-0	BZ 66	25200	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	37680-73-2	BZ 101	23500	dPD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	32598-14-4	BZ 105	1620	dPD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	31508-00-6	BZ 118	14400	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	38380-07-3	BZ 128	1360	dPD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	35065-28-2	BZ 138	7290	dPD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	35065-27-1	BZ 153	11400	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	35065-30-6	BZ 170	1260	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	35065-29-3	BZ 180	2520	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	52663-68-0	BZ 187	2440	dD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	52663-78-2	BZ 195	492	dUD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQ-PCB-003-102805-ST	SA	TOTAL	500	40186-72-9	BZ 206	492	dUD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	C-2051-24-3	BZ 209	492	dUD	UG/KG_DRYWT
WQ-PCB-003-102805-ST	SA	TOTAL	500	CS-10386-84-2	DBOB		dD	PCT_REC
WQ-PCB-003-102805-ST	SA	TOTAL	500	CS-68194-17-2	BZ 198		dD	PCT_REC
WQ-PCB-004-102805-ST	SA	TOTAL	200	34883-43-7	BZ 8	1700	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	37680-65-2	BZ 18	3390	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	7012-37-5	BZ 28	8020	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	41464-39-5	BZ 44	2850	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	35693-99-3	BZ 52	5770	dID	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	32598-10-0	BZ 66	4650	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	37680-73-2	BZ 101	4380	dPD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	32598-14-4	BZ 105	657	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	31508-00-6	BZ 118	3470	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	38380-07-3	BZ 128	455	dPD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	35065-28-2	BZ 138	2000	dPD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	35065-27-1	BZ 153	2290	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	35065-30-6	BZ 170	330	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	35065-29-3	BZ 180	530	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	52663-68-0	BZ 187	503	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	52663-78-2	BZ 195	52	dUD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	40186-72-9	BZ 206	65	dD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	C-2051-24-3	BZ 209	52	dUD	UG/KG_DRYWT
WQ-PCB-004-102805-ST	SA	TOTAL	200	CS-10386-84-2	DBOB		dD	PCT_REC
WQ-PCB-004-102805-ST	SA	TOTAL	200	CS-68194-17-2	BZ 198		dD	PCT_REC
WQ-PCB-005-102805-ST	SA	TOTAL	1000	34883-43-7	BZ 8	31400	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	37680-65-2	BZ 18	41600	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	7012-37-5	BZ 28	69700	dD	UG/KG_DRYWT

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	41464-39-5	BZ 44	26800	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	35693-99-3	BZ 52	47400	dID	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	32598-10-0	BZ 66	37700	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	37680-73-2	BZ 101	30500	dPD	UG/KG_DRYWT
WQ-PCB-001-102805-ST	SA	TOTAL	1	NBH012	Solids, Percent	77.7	d	PCT_SOL
WQ-PCB-001-102805-STDUP	DUP	TOTAL	1	NBH012	Solids, Percent	76.8	d	PCT_SOL
WQ-PCB-002-102805-ST	SA	TOTAL	1	NBH012	Solids, Percent	89.23	d	PCT_SOL
WQ-PCB-003-102805-ST	SA	TOTAL	1	NBH012	Solids, Percent	91.11	d	PCT_SOL
WQ-PCB-005-102805-ST	SA	TOTAL	1000	32598-14-4	BZ 105	2270	dPD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	31508-00-6	BZ 118	20000	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	38380-07-3	BZ 128	1620	dPD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	35065-28-2	BZ 138	8690	dPD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	35065-27-1	BZ 153	12800	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	35065-30-6	BZ 170	1760	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	35065-29-3	BZ 180	2610	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	52663-68-0	BZ 187	2600	dD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	52663-78-2	BZ 195	372	dUD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	40186-72-9	BZ 206	372	dUD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	C-2051-24-3	BZ 209	372	dUD	UG/KG_DRYWT
WQ-PCB-005-102805-ST	SA	TOTAL	1000	CS-10386-84-2	DBOB		dD	PCT_REC
WQ-PCB-005-102805-ST	SA	TOTAL	1000	CS-68194-17-2	BZ 198		dD	PCT_REC
WQE1101905	SA	TOTAL	5	7440-43-9	Cadmium	0.8	D	UG/L
WQE2101905	SA	TOTAL	5	7440-50-8	Copper	33	D	UG/L
WQE2101905	SA	TOTAL	5	7439-92-1	Lead	21	D	UG/L
WQE2101905	SA	TOTAL	5	7440-02-0	Nickel	2.4	D	UG/L
WQE2101905	SA	TOTAL	5	7440-66-6	Zinc	76	D	UG/L
WQE2101905	SADL1	PART	10	37680-65-2	BZ 18	1.31	D	UG/L
WQE2101905	SA	TOTAL	20	7440-47-3	Chromium	17	D	UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE2101905	SADL1	TOTAL	4	37680-65-2	BZ 18	0.771	D	UG/L
WQE2101905	SADL1	TOTAL	4	35065-27-1	BZ 153	0.00928	D	UG/L
WQE2101905	SADL1	PART	10	35065-28-2	BZ 138	0.266	PD	UG/L
WQE2101905	SADL1	PART	10	35065-27-1	BZ 153	0.395	D	UG/L
WQE2101905	SADL1	PART	10	35065-30-6	BZ 170	0.05	D	UG/L
WQE2101905	SADL1	PART	10	35065-29-3	BZ 180	0.0619	D	UG/L
WQE2101905	SADL1	PART	10	52663-78-2	BZ 195	0.0103	UD	UG/L
WQE2101905	SADL1	PART	10	C-2051-24-3	BZ 209	0.0103	UD	UG/L
WQE2101905	SADL1	PART	10	CS-10386-84-2	DBOB	86	ID	PCT_REC
WQE2101905	SADL1	PART	10	CS-68194-17-2	BZ 198	113	D	PCT_REC
WQE2101905	SADL1	PART	10	31508-00-6	BZ 118	0.368	D	UG/L
WQE2101905	SADL1	TOTAL	4	34883-43-7	BZ 8	0.639	D	UG/L
WQE2101905	SADL1	PART	10	32598-14-4	BZ 105	0.0377	PD	UG/L
WQE2101905	SADL1	TOTAL	4	7012-37-5	BZ 28	0.407	D	UG/L
WQE2101905	SADL1	TOTAL	4	41464-39-5	BZ 44	0.104	D	UG/L
WQE2101905	SADL1	TOTAL	4	35693-99-3	BZ 52	0.335	D	UG/L
WQE2101905	SADL1	TOTAL	4	32598-10-0	BZ 66	0.0557	D	UG/L
WQE2101905	SADL1	TOTAL	4	37680-73-2	BZ 101	0.0245	D	UG/L
WQE2101905	SADL1	TOTAL	4	32598-14-4	BZ 105	0.00412	UD	UG/L
WQE2101905	SADL1	TOTAL	4	31508-00-6	BZ 118	0.00854	D	UG/L
WQE2101905	SADL1	TOTAL	4	38380-07-3	BZ 128	0.00412	UD	UG/L
WQE2101905	SA	PART	1	35693-99-3	BZ 52	1.66	E	UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE2101905	SA	TOTAL	1	CS-68194-17-2	BZ 198	84		PCT_REC
WQE2101905	SA	PART	1	40186-72-9	BZ 206	0.00737		UG/L
WQE2101905	SA	PART	1	32598-10-0	BZ 66	0.496	E	UG/L
WQE2101905	SA	PART	1	37680-73-2	BZ 101	0.527	PE	UG/L
WQE2101905	SA	PART	1	32598-14-4	BZ 105	0.0243	P	UG/L
WQE2101905	SA	PART	1	31508-00-6	BZ 118	0.236	E	UG/L
WQE2101905	SA	PART	1	38380-07-3	BZ 128	0.0311	P	UG/L
WQE2101905	SA	PART	1	35065-28-2	BZ 138	0.176	P	UG/L
WQE2101905	SA	PART	1	35065-27-1	BZ 153	0.251	E	UG/L
WQE2101905	SA	PART	1	35065-30-6	BZ 170	0.0345		UG/L
WQE2101905	SA	PART	1	35065-29-3	BZ 180	0.0398		UG/L
WQE2101905	SADL1	PART	10	38380-07-3	BZ 128	0.053	PD	UG/L
WQE2101905	SA	PART	1	52663-78-2	BZ 195	0.00574		UG/L
WQE2101905	SADL1	TOTAL	4	35065-30-6	BZ 170	0.00412	UD	UG/L
WQE2101905	SA	PART	1	C-2051-24-3	BZ 209	0.00203	P	UG/L
WQE2101905	SA	PART	1	CS-10386-84-2	DBOB	87		PCT_REC
WQE2101905	SADL1	PART	10	34883-43-7	BZ 8	0.63	D	UG/L
WQE2101905	SA	TOTAL	5	7440-43-9	Cadmium	1.1	D	UG/L
WQE2101905	SADL1	PART	10	7012-37-5	BZ 28	1.78	D	UG/L
WQE2101905	SADL1	PART	10	41464-39-5	BZ 44	0.694	D	UG/L
WQE2101905	SADL1	PART	10	35693-99-3	BZ 52	2.05	ID	UG/L
WQE2101905	SADL1	PART	10	32598-10-0	BZ 66	0.728	D	UG/L
WQE2101905	SADL1	PART	10	37680-73-2	BZ 101	0.464	ID	UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE2101905	SA	PART	1	52663-68-0	BZ 187	0.053		UG/L
WQE1101905 DUP	DUP	TOTAL	5	7439-92-1	Lead	25	D	UG/L
WQE2101905	SADL1	TOTAL	4	35065-28-2	BZ 138	0.00412	UD	UG/L
WQE1101905	SA	PART	1	C-2051-24-3	BZ 209	0.00104	U	UG/L
WQE1101905 MS	MS	TOTAL	5	7440-66-6	Zinc	85	D	PCT_REC
WQE1101905 MS	MS	TOTAL	5	7440-02-0	Nickel	97	D	PCT_REC
WQE1101905 MS	MS	TOTAL	5	7439-92-1	Lead	86	D	PCT_REC
WQE1101905 MS	MS	TOTAL	5	7440-50-8	Copper	93	D	PCT_REC
WQE1101905 MS	MS	TOTAL	20	7440-47-3	Chromium	105	D	PCT_REC
WQE1101905 MS	MS	TOTAL	5	7440-43-9	Cadmium	93	D	PCT_REC
WQE1101905 DUP	DUP	TOTAL	5	7440-66-6	Zinc	88	D	UG/L
WQE1101905	SA	PART	1	52663-78-2	BZ 195	0.00194		UG/L
WQE2101905	SA	PART	1	CS-68194-17-2	BZ 198	77		PCT_REC
WQE1101905	SA	PART	1	52663-68-0	BZ 187	0.018		UG/L
WQR1101905	SA	TOTAL	1	TSS	TSS - Membrane	20		MG/L
WQE1101905 DUP	DUP	TOTAL	5	7440-50-8	Copper	38	D	UG/L
WQE1101905 DUP	DUP	TOTAL	20	7440-47-3	Chromium	19	D	UG/L
WQE1101905 DUP	DUP	TOTAL	5	7440-43-9	Cadmium	0.78	D	UG/L
WQE1101905	SA	TOTAL	5	7440-66-6	Zinc	92	D	UG/L
WQE1101905	SA	TOTAL	5	7440-02-0	Nickel	3.3	D	UG/L
WQE1101905	SA	TOTAL	5	7439-92-1	Lead	26	D	UG/L
WQE1101905	SA	TOTAL	5	7440-50-8	Copper	40	D	UG/L
WQE1101905	SA	TOTAL	20	7440-47-3	Chromium	18	D	UG/L
WQE1101905 DUP	DUP	TOTAL	5	7440-02-0	Nickel	3	D	UG/L
WQE1101905	SA	PART	1	35693-99-3	BZ 52	0.523	E	UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE2101905	SADL1	TOTAL	4	35065-29-3	BZ 180	0.00412	UD	UG/L
WQE2101905	SADL1	TOTAL	4	52663-68-0	BZ 187	0.00412	UD	UG/L
WQE2101905	SADL1	TOTAL	4	52663-78-2	BZ 195	0.00412	UD	UG/L
WQE2101905	SADL1	TOTAL	4	40186-72-9	BZ 206	0.00412	UD	UG/L
WQE2101905	SADL1	TOTAL	4	C-2051-24-3	BZ 209	0.00412	UD	UG/L
WQE2101905	SADL1	TOTAL	4	CS-10386-84-2	DBOB	80	D	PCT_REC
WQE2101905	SADL1	TOTAL	4	CS-68194-17-2	BZ 198	90	D	PCT_REC
WQE1101905	SA	PART	1	34883-43-7	BZ 8	0.127		UG/L
WQE1101905	SA	PART	1	37680-65-2	BZ 18	0.315	E	UG/L
WQE1101905	SA	PART	1	40186-72-9	BZ 206	0.00246		UG/L
WQE1101905	SA	PART	1	41464-39-5	BZ 44	0.131		UG/L
WQE2101905	SADL1	PART	10	52663-68-0	BZ 187	0.0968	D	UG/L
WQE1101905	SA	PART	1	32598-10-0	BZ 66	0.126		UG/L
WQE1101905	SA	PART	1	37680-73-2	BZ 101	0.134	P	UG/L
WQE1101905	SA	PART	1	32598-14-4	BZ 105	0.00882	P	UG/L
WQE1101905	SA	PART	1	31508-00-6	BZ 118	0.0642		UG/L
WQE1101905	SA	PART	1	38380-07-3	BZ 128	0.0117	P	UG/L
WQE1101905	SA	PART	1	35065-28-2	BZ 138	0.0524	P	UG/L
WQE1101905	SA	PART	1	35065-27-1	BZ 153	0.0805		UG/L
WQE1101905	SA	PART	1	35065-30-6	BZ 170	0.0107		UG/L
WQE1101905	SA	PART	1	35065-29-3	BZ 180	0.0131		UG/L
WQE1101905	SA	PART	1	7012-37-5	BZ 28	0.411	E	UG/L
WQE1101905	SADL1	TOTAL	4	38380-07-3	BZ 128	0.00417	UD	UG/L
WQE1101905	SA	TOTAL	1	CS-10386-84-2	DBOB	85		PCT_REC
WQE1101905	SA	TOTAL	1	CS-68194-17-2	BZ 198	86		PCT_REC
WQE1101905	SADL1	TOTAL	4	34883-43-7	BZ 8	0.51	D	UG/L
WQE1101905	SADL1	TOTAL	4	37680-65-2	BZ 18	0.688	D	UG/L
WQE1101905	SADL1	TOTAL	4	7012-37-5	BZ 28	0.343	D	UG/L
WQE1101905	SADL1	TOTAL	4	41464-39-5	BZ 44	0.081	D	UG/L
WQE1101905	SADL1	TOTAL	4	35693-99-3	BZ 52	0.302	D	UG/L
WQE1101905	SADL1	TOTAL	4	32598-10-0	BZ 66	0.0432	D	UG/L
WQE1101905	SADL1	TOTAL	4	37680-73-2	BZ 101	0.0155	D	UG/L
WQE1101905	SADL1	TOTAL	4	CS-68194-17-2	BZ 198	108	D	PCT_REC
WQE1101905	SADL1	TOTAL	4	31508-00-6	BZ 118	0.00679	D	UG/L
WQE1101905	SA	TOTAL	1	52663-78-2	BZ 195	0.00104	U	UG/L
WQE1101905	SADL1	TOTAL	4	35065-28-2	BZ 138	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	35065-27-1	BZ 153	0.00646	D	UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE1101905	SADL1	TOTAL	4	35065-30-6	BZ 170	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	35065-29-3	BZ 180	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	35693-99-3	BZ 52	0.302	D	UG/L
WQE1101905	SADL1	TOTAL	4	52663-68-0	BZ 187	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	52663-78-2	BZ 195	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	40186-72-9	BZ 206	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	C-2051-24-3	BZ 209	0.00417	UD	UG/L
WQE1101905	SADL1	TOTAL	4	CS-10386-84-2	DBOB	101	D	PCT_REC
WQE1101905	SADL1	TOTAL	4	32598-14-4	BZ 105	0.00417	UD	UG/L
WQE1101905	SA	TOTAL	1	32598-10-0	BZ 66	0.0395		UG/L
WQR1101905	SA	TOTAL	1	TURB	Turbidity - 180.1	1.5		NTU
WQE1101905	SA	TOTAL	1	TSS	TSS - Membrane	120		MG/L
WQE1101905	SA	TOTAL	1	TURB	Turbidity - 180.1	25		NTU
WQE1101905 DUP	DUP	TOTAL	1	TURB	Turbidity - 180.1	25		NTU
WQE2101905	SA	TOTAL	1	TSS	TSS - Membrane	94		MG/L
WQE2101905	SA	TOTAL	1	TURB	Turbidity - 180.1	20		NTU
WQE1101905	SA	TOTAL	1	34883-43-7	BZ 8	0.386	E	UG/L
WQE1101905	SA	TOTAL	1	37680-65-2	BZ 18	0.683	E	UG/L
WQE1101905	SA	TOTAL	1	7012-37-5	BZ 28	0.265	E	UG/L
WQE1101905	SA	TOTAL	1	C-2051-24-3	BZ 209	0.00104	U	UG/L
WQE1101905	SA	TOTAL	1	35693-99-3	BZ 52	0.236	E	UG/L
WQE1101905	SA	TOTAL	1	40186-72-9	BZ 206	0.00104	U	UG/L
WQE1101905	SA	TOTAL	1	37680-73-2	BZ 101	0.0132		UG/L
WQE1101905	SA	TOTAL	1	32598-14-4	BZ 105	0.00104	U	UG/L
WQE1101905	SA	TOTAL	1	31508-00-6	BZ 118	0.00534		UG/L
WQE2101905	SADL1	PART	10	40186-72-9	BZ 206	0.0103	UD	UG/L
WQE1101905	SA	TOTAL	1	35065-28-2	BZ 138	0.00379	P	UG/L
WQE2101905	SA	PART	1	41464-39-5	BZ 44	0.456	E	UG/L
WQE1101905	SA	TOTAL	1	35065-30-6	BZ 170	0.00104	U	UG/L
WQE1101905	SA	TOTAL	1	35065-29-3	BZ 180	0.00104	U	UG/L
WQE1101905	SA	TOTAL	1	52663-68-0	BZ 187	0.00115		UG/L
WQE1101905	SA	TOTAL	1	35065-27-1	BZ 153	0.00496		UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE1101905	SA	TOTAL	1	41464-39-5	BZ 44	0.0631		UG/L
WQE1101905	SADL1	PART	10	52663-68-0	BZ 187	0.0302	D	UG/L
WQE1101905	SADL1	PART	10	7012-37-5	BZ 28	0.619	D	UG/L
WQE1101905	SADL1	PART	10	41464-39-5	BZ 44	0.209	D	UG/L
WQE1101905	SADL1	PART	10	35693-99-3	BZ 52	0.809	D	UG/L
WQE1101905	SADL1	PART	10	32598-10-0	BZ 66	0.198	D	UG/L
WQE1101905	SADL1	PART	10	37680-73-2	BZ 101	0.217	PD	UG/L
WQE1101905	SADL1	PART	10	32598-14-4	BZ 105	0.0104	UD	UG/L
WQE1101905	SADL1	PART	10	31508-00-6	BZ 118	0.0962	D	UG/L
WQE1101905	SADL1	PART	10	38380-07-3	BZ 128	0.0104	UD	UG/L
WQE1101905	SADL1	PART	10	35065-28-2	BZ 138	0.0819	PD	UG/L
WQE1101905	SADL1	PART	10	37680-65-2	BZ 18	0.526	D	UG/L
WQE1101905	SADL1	PART	10	35065-30-6	BZ 170	0.0162	D	UG/L
WQE1101905	SADL1	PART	10	35065-29-3	BZ 180	0.0196	D	UG/L
WQE1101905	SADL1	PART	10	40186-72-9	BZ 206	0.0104	UD	UG/L
WQE1101905	SADL1	PART	10	C-2051-24-3	BZ 209	0.0104	UD	UG/L
WQE1101905	SADL1	PART	10	CS-10386-84-2	DBOB	111	D	PCT_REC
WQE1101905	SADL1	PART	10	CS-68194-17-2	BZ 198	121	D	PCT_REC
WQE2101905	SA	PART	1	34883-43-7	BZ 8	0.42	E	UG/L
WQE2101905	SA	PART	1	37680-65-2	BZ 18	0.933	E	UG/L
WQE2101905	SA	PART	1	7012-37-5	BZ 28	1.36	E	UG/L
WQE2101905	SA	TOTAL	1	34883-43-7	BZ 8	0.597	E	UG/L
WQE1101905	SA	TOTAL	1	38380-07-3	BZ 128	0.00104	U	UG/L
WQE1101905	SADL1	PART	10	35065-27-1	BZ 153	0.134	D	UG/L
WQE2101905	SA	TOTAL	1	31508-00-6	BZ 118	0.0101		UG/L
WQE2101905	SA	TOTAL	1	37680-65-2	BZ 18	0.708	E	UG/L
WQE2101905	SA	TOTAL	1	7012-37-5	BZ 28	0.409	E	UG/L
WQE1101905	SADL1	PART	10	52663-78-2	BZ 195	0.0104	UD	UG/L
WQE1101905	SADL1	PART	10	34883-43-7	BZ 8	0.218	D	UG/L
WQE2101905	SA	TOTAL	1	41464-39-5	BZ 44	0.102		UG/L
WQE2101905	SA	TOTAL	1	35693-99-3	BZ 52	0.322	E	UG/L
WQE2101905	SA	TOTAL	1	32598-10-0	BZ 66	0.0589		UG/L
WQE2101905	SA	TOTAL	1	32598-14-4	BZ 105	0.00103	U	UG/L
WQE2101905	SA	TOTAL	1	38380-07-3	BZ 128	0.00103	U	UG/L
WQE2101905	SA	TOTAL	1	35065-28-2	BZ 138	0.00613	P	UG/L
WQE2101905	SA	TOTAL	1	35065-27-1	BZ 153	0.00956		UG/L

Analytical Laboratory Analysis Table Continued

SAMP_ID	LAB_QC _CODE	FRACTION	DILUTION	CAS	ANALYTE	VALUE	LAB_ QUAL	UNIT
WQE2101905	SA	TOTAL	1	52663-78-2	BZ 195	0.00103	U	UG/L
WQE1101905	SA	PART	1	CS-10386-84-2	DBOB	77		PCT_REC
WQE2101905	SA	TOTAL	1	37680-73-2	BZ 101	0.0268		UG/L
WQE2101905	SA	TOTAL	1	35065-30-6	BZ 170	0.00103	U	UG/L
WQE2101905	SA	TOTAL	1	40186-72-9	BZ 206	0.00103	U	UG/L
WQE2101905	SA	TOTAL	1	CS-10386-84-2	DBOB	80		PCT_REC
WQE1101905	SA	PART	1	CS-68194-17-2	BZ 198	79		PCT_REC
WQE2101905	SA	TOTAL	1	C-2051-24-3	BZ 209	0.00103	U	UG/L
WQE2101905	SA	TOTAL	1	52663-68-0	BZ 187	0.00203		UG/L
WQE2101905	SA	TOTAL	1	35065-29-3	BZ 180	0.00137		UG/L

*D - Result is reported at a secondary dilution factor. Spike and surrogate recoveries may have been diluted below quantifiable levels.

d – Sample air dried before analysis until the percent solids met or exceeded the standard.

E - Concentration exceeds the range of the calibration curve for that particular analyte or compound.

I – Labeled standards used to quantitate this analyte have been interfered with on the GC column by do-eluting, interfering peaks.

L - More than 25 % diff. for detected target analyte conc. between the two columns. WHG only. Lower of two reported

P – Greater than 25 Percent difference for detected GC method target analyte concentrations between the two columns. Lower value reported.

p - Greater than 40 percent difference for detected GC method target analyte concentrations between the two columns. Higher value reported. 05/10/05

U - Indicates the compound was analyzed for, but not detected above the reporting limit.

APPENDIX D

PROJECT PHOTOGRAPHS

Appendix D provides copies of project photos. The photos were collected during water quality monitoring over the course of the dredging program.

List of APPENDIX D

Photo 1. Dredging at DMU-2, September 2005

Photo 2. Oil Boom and Support Boat at DMU-2, September 2005

Photo 3. Debris Removal Barge at CMU-4, October 2005

Photo 4. Debris Removal Barge and Oil Booms, October 2005

Photo 5. Oil Seeping away from Oil Boom, September 2005

Photo 6. Oil Sheen Sampling with 5" x 5" Sorbent Pad, October 2005

Photo 7. Sediment Trap Deployment, October 2005

Photo 8. Sediment Trap Sample Collection, June 2005

Photo 9. Debris Collecting within Oil Boomed Area of DMU-4, September 2005

Photo 10. Large School of Fish North of Dredge Areas, September 2005

Photo 1. Dredging at DMU-2, September 2005

Photo 2. Oil Boom and Support Boat at DMU-2, September 2005

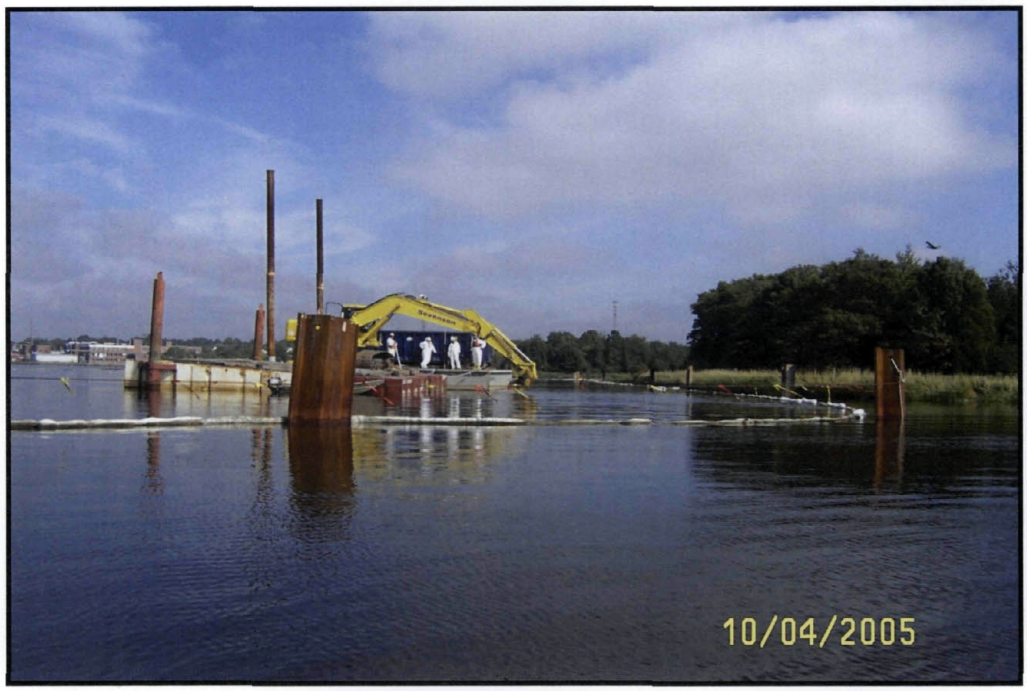


Photo 3. Debris Removal Barge at DMU-4, October 2005

Photo 4. Debris Removal Barge and Oil Booms, October 2005

Photo 5. Oil Seeping away from Oil Boom, September 2005

Photo 6. Oil Sheen Sampling with 5" x 5" Sorbent Pad, October 2005

Photo 7. Sediment Trap Deployment, October 2005

Photo 8. Sediment Trap Sample Collection, June 2005

Photo 9. Debris Collecting within Oil Boomed Area of DMU-4, September 2005

Photo 10. Large School of Fish North of Dredge Areas, September 2004

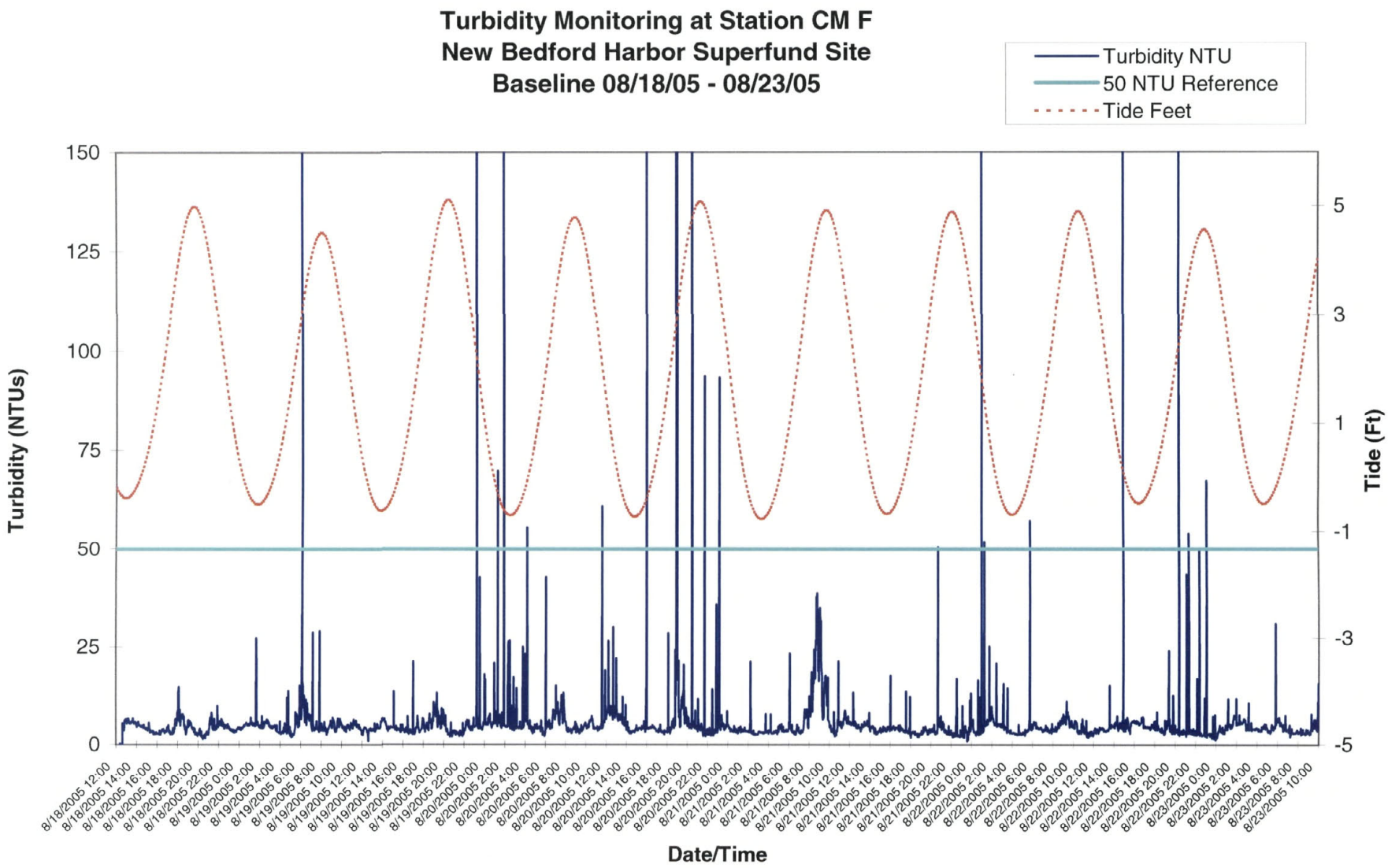
APPENDIX E

CONTINUOUS RECORDING MONITORING METER DATA

Appendix E provides graphic record of turbidity data collected from the continuous recording monitoring meters deployed throughout the dredge site during the dredge program. The meters were deployed at five locations, near dredge units (DMU-2 and DMU-4) and at the mouth of Pierce Mill Cove. Each graph represents a period of time in which data was collected as well as meter location (Stations CM A, CM B, CM C, CM D, CM E, and CM F). The graphs are assembled in chronological order and in 2 to 5 five day increments. Each graph is listed below.

List of Appendix E

E1. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site Baseline 08/18/05 – 08/23/05
E2. Turbidity Monitoring at Station CM C New Bedford Harbor Superfund Site Baseline 08/18/05 – 08/23/05
E3. Turbidity Monitoring at Station CM D New Bedford Harbor Superfund Site Baseline 08/18/05 – 08/23/05
E4. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site Mobilization 08/23/05 – 08/27/05
E5. Turbidity Monitoring at Station CM C New Bedford Harbor Superfund Site Mobilization 08/23/05 - 08/28/05
E6. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site Mobilization 08/27/05 - 09/01/05
E7. Turbidity Monitoring at Station CM C New Bedford Harbor Superfund Site Mobilization 08/27/05 – 09/01/05
E8. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 09/12/05 – 09/14/05
E9. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 09/21/05 – 09/22/05
E10. Turbidity Monitoring at Station CM C New Bedford Harbor Superfund Site 09/21/05 – 09/22/05
E11. Turbidity Monitoring at Station CM A New Bedford Harbor Superfund Site 09/21/05 – 09/24/05
E12. Turbidity Monitoring at Station CM A New Bedford Harbor Superfund Site 09/24/05 – 09/28/05
E13. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 09/30/05 – 10/05/05
E14. Turbidity Monitoring at Station CM A New Bedford Harbor Superfund Site 09/30/05 – 10/05/05
E15. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 10/05/05 – 10/09/05
E16. Turbidity Monitoring at Station CM E New Bedford Harbor Superfund Site 10/05/05 – 10/09/05
E17. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 10/10/05 – 10/14/05
E18. Turbidity Monitoring at Station CM E New Bedford Harbor Superfund Site 10/10/05 – 10/14/05
E19. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 10/17/05 – 10/22/05
E20. Turbidity Monitoring at Station CM D New Bedford Harbor Superfund Site 10/17/05 - 10/22/05
E21. Turbidity Monitoring at Station CM B New Bedford Harbor Superfund Site 10/17/05 – 10/22/05
E22. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 10/23/05 – 10/27/05
E23. Turbidity Monitoring at Station CM D New Bedford Harbor Superfund Site 10/23/05 – 10/27/05
E24. Turbidity Monitoring at Station CM B New Bedford Harbor Superfund Site 10/23/05 – 10/27/05
E25. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 10/31/05 – 11/05/05
E26. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site 11/05/05 – 11/11/05
E27. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site Demobilization 12/07/05 – 12/11/05
E28. Turbidity Monitoring at Station CM E New Bedford Harbor Superfund Site Demobilization 12/07/05 – 12/11/05
E29. Turbidity Monitoring at Station CM B New Bedford Harbor Superfund Site Demobilization 12/07/05 – 12/11/05
E30. Turbidity Monitoring at Station CM F New Bedford Harbor Superfund Site Baseline 12/12/05 – 12/17/05
E31. Turbidity Monitoring at Station CM E New Bedford Harbor Superfund Site Baseline 12/12/05 – 12/17/05
E32. Turbidity Monitoring at Station CM B New Bedford Harbor Superfund Site Baseline 12/12/05 – 12/17/05



E1

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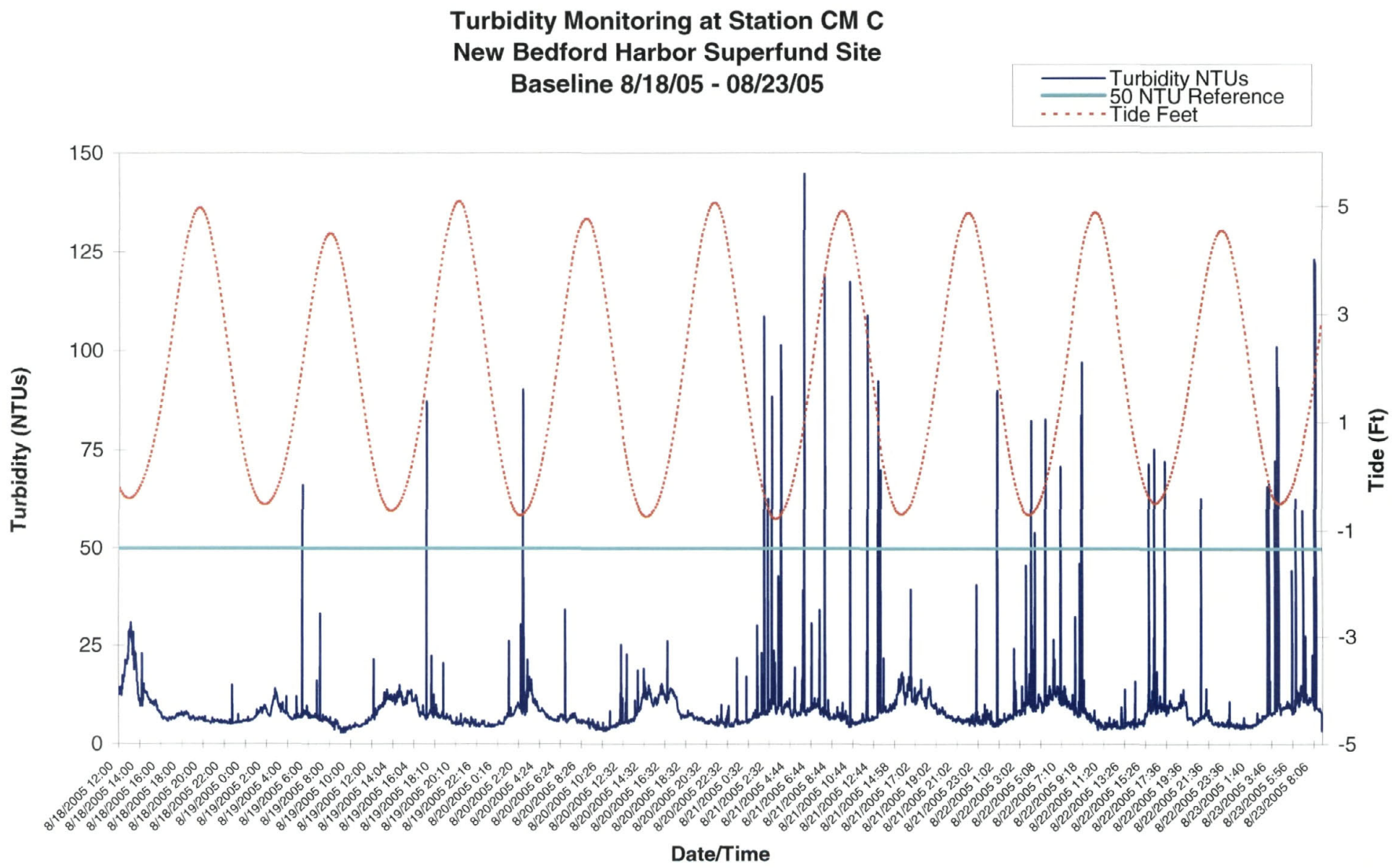

E2

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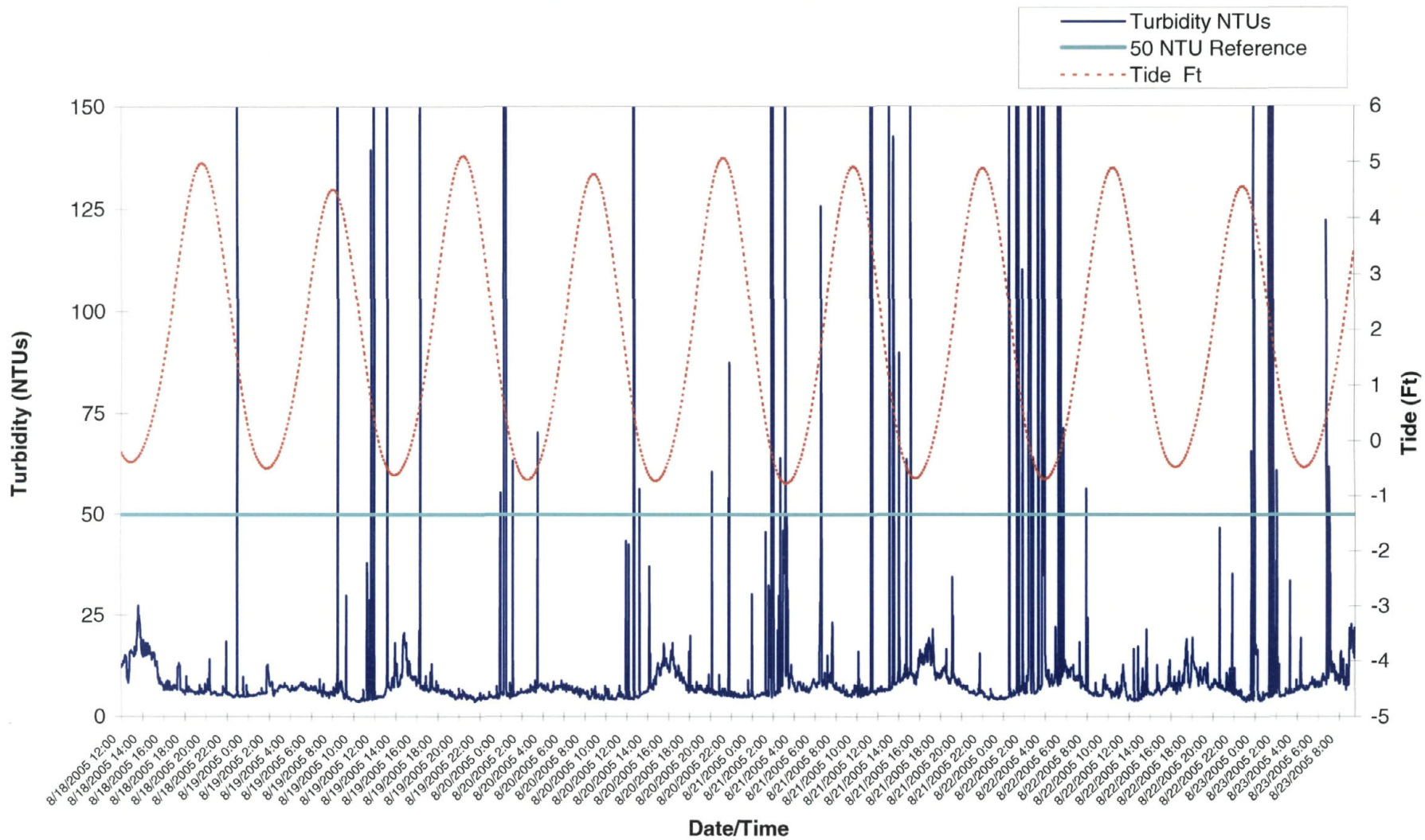
Turbidity Monitoring at Station CM D
New Bedford Harbor Superfund Site
Baseline 8/18/05 - 08/23/05



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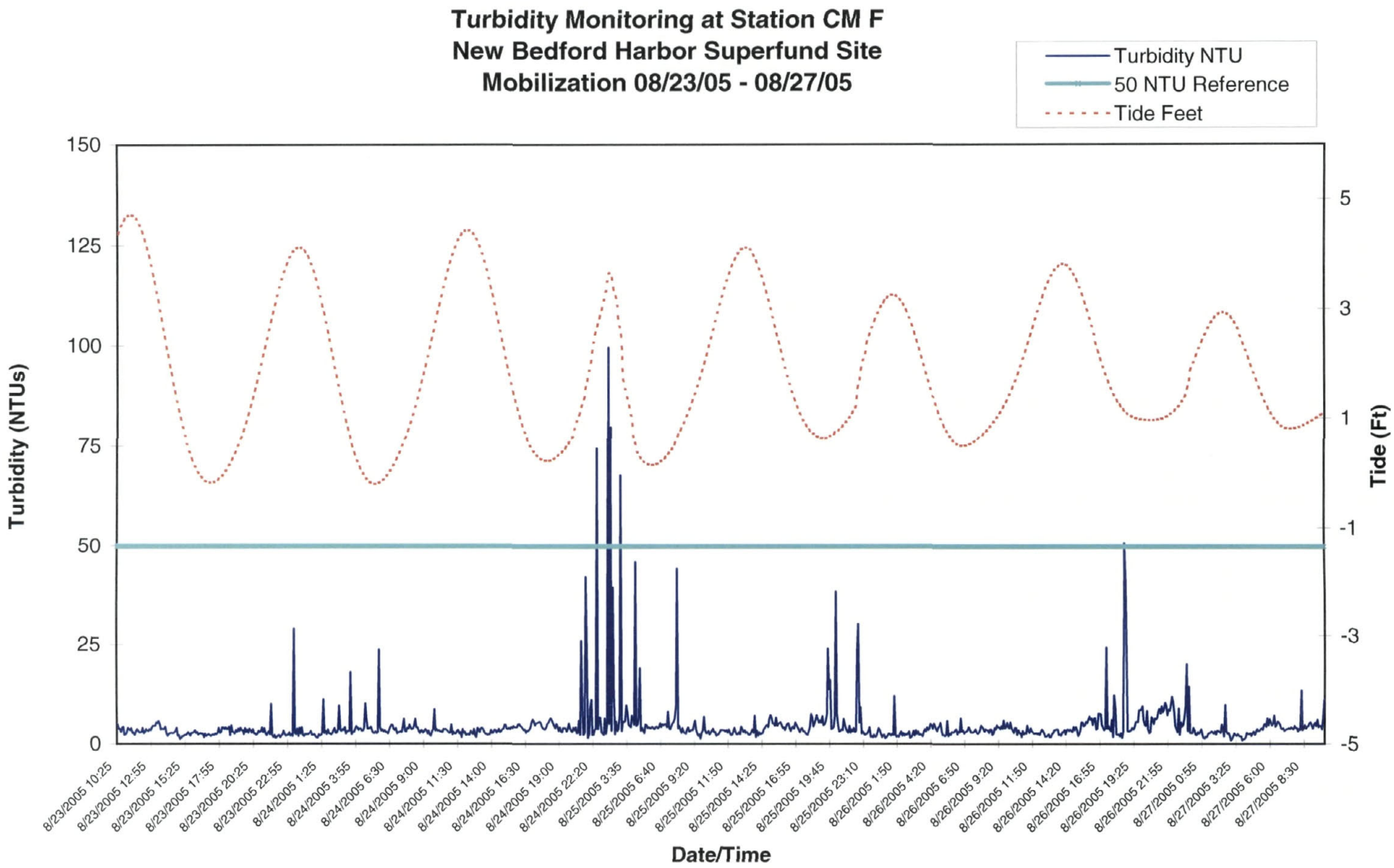
Turbidity Monitoring at Station CM F
New Bedford Harbor Superfund Site
Mobilization 08/23/05 - 08/27/05
Turbidity NTU
50 NTU Reference
Tide Feet
Turbidity (NTUs)
Tide (Ft)
Date/Time
150
125
100
75
50
25
0
5
3
1
-1
-3
-5
8/23/2005 10:25
8/23/2005 12:55
8/23/2005 15:25
8/23/2005 17:55
8/23/2005 20:25
8/23/2005 22:55
8/24/2005 1:25
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8/24/2005 6:30
8/24/2005 9:00
8/24/2005 11:30
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8/24/2005 16:30
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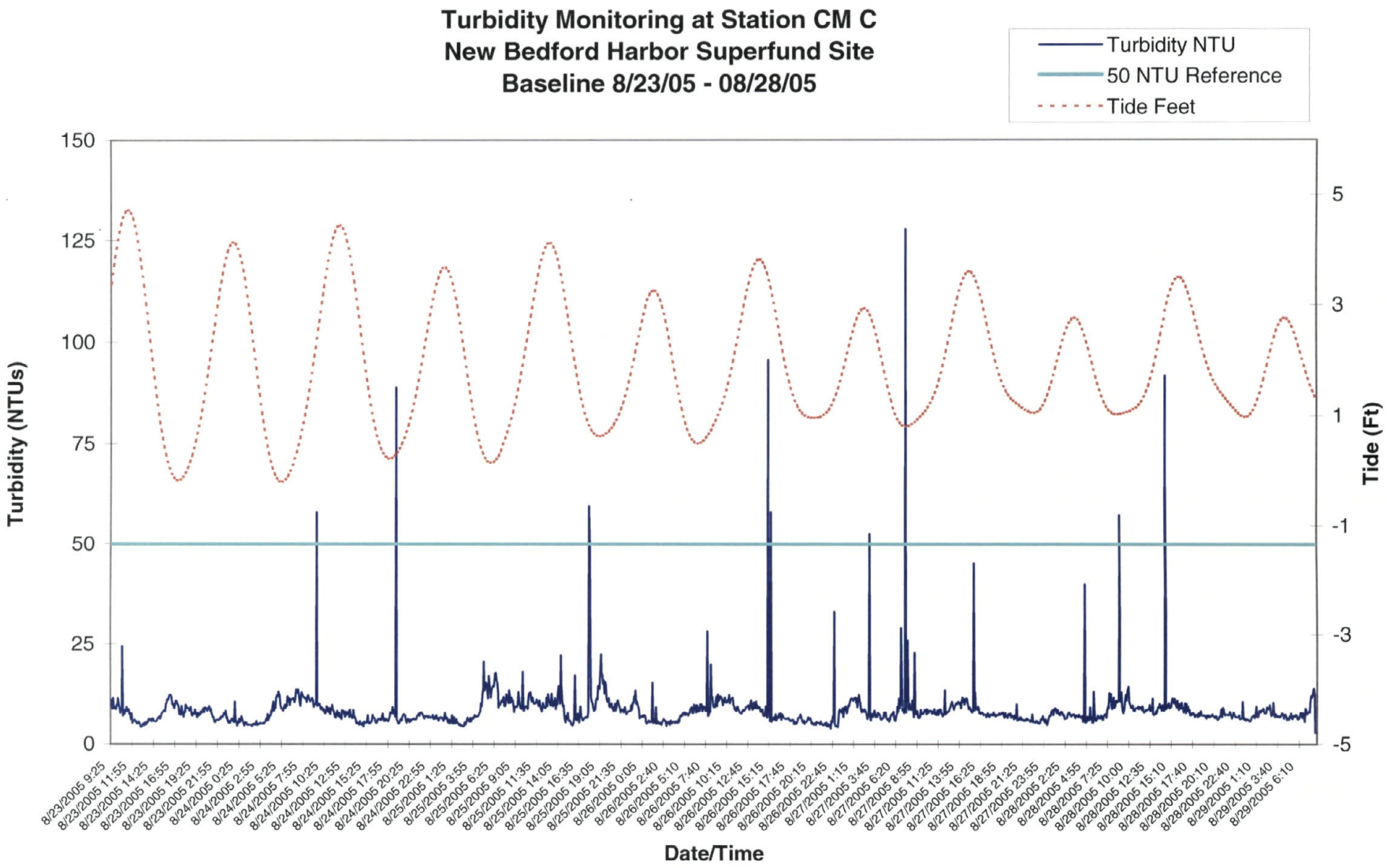

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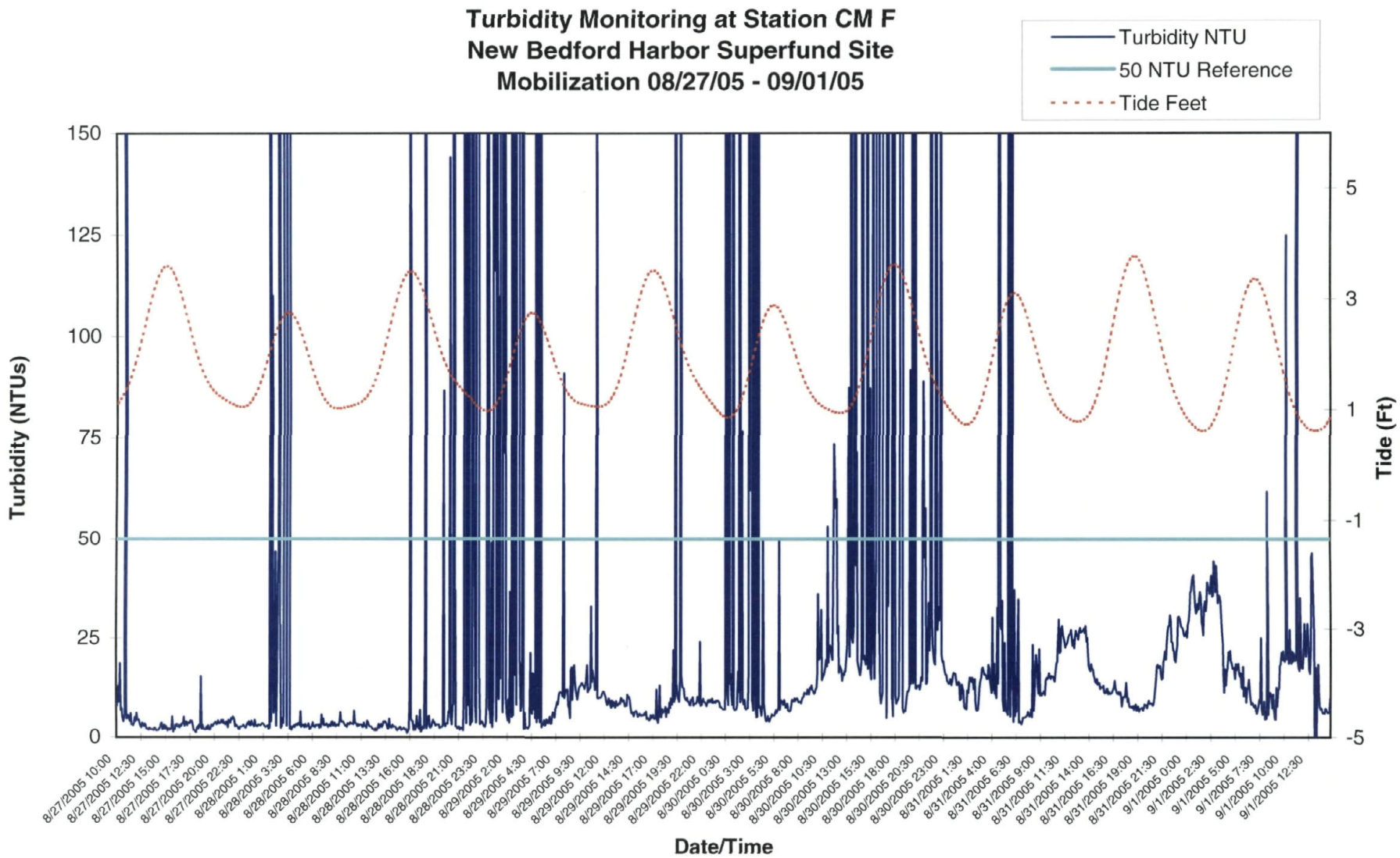

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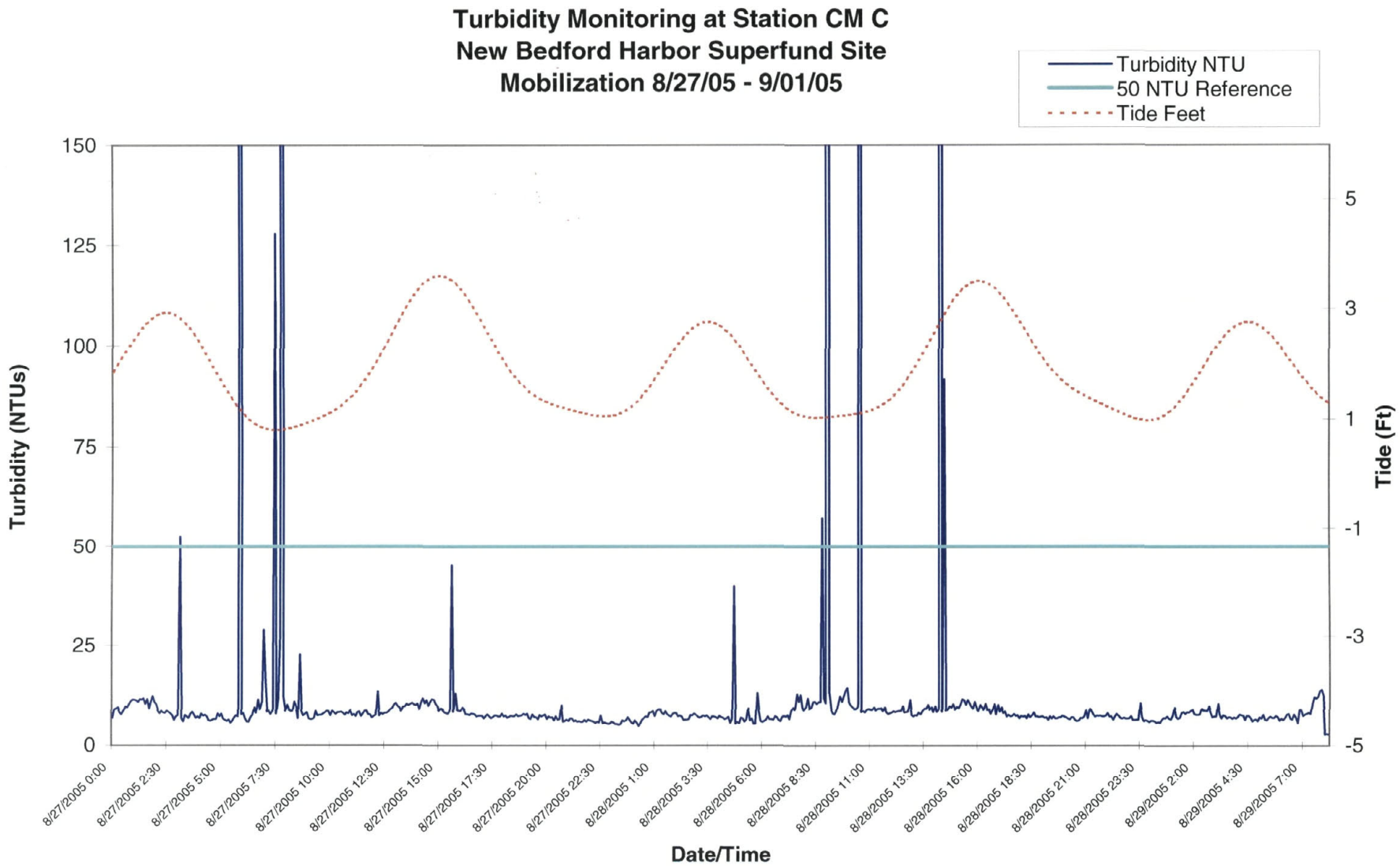

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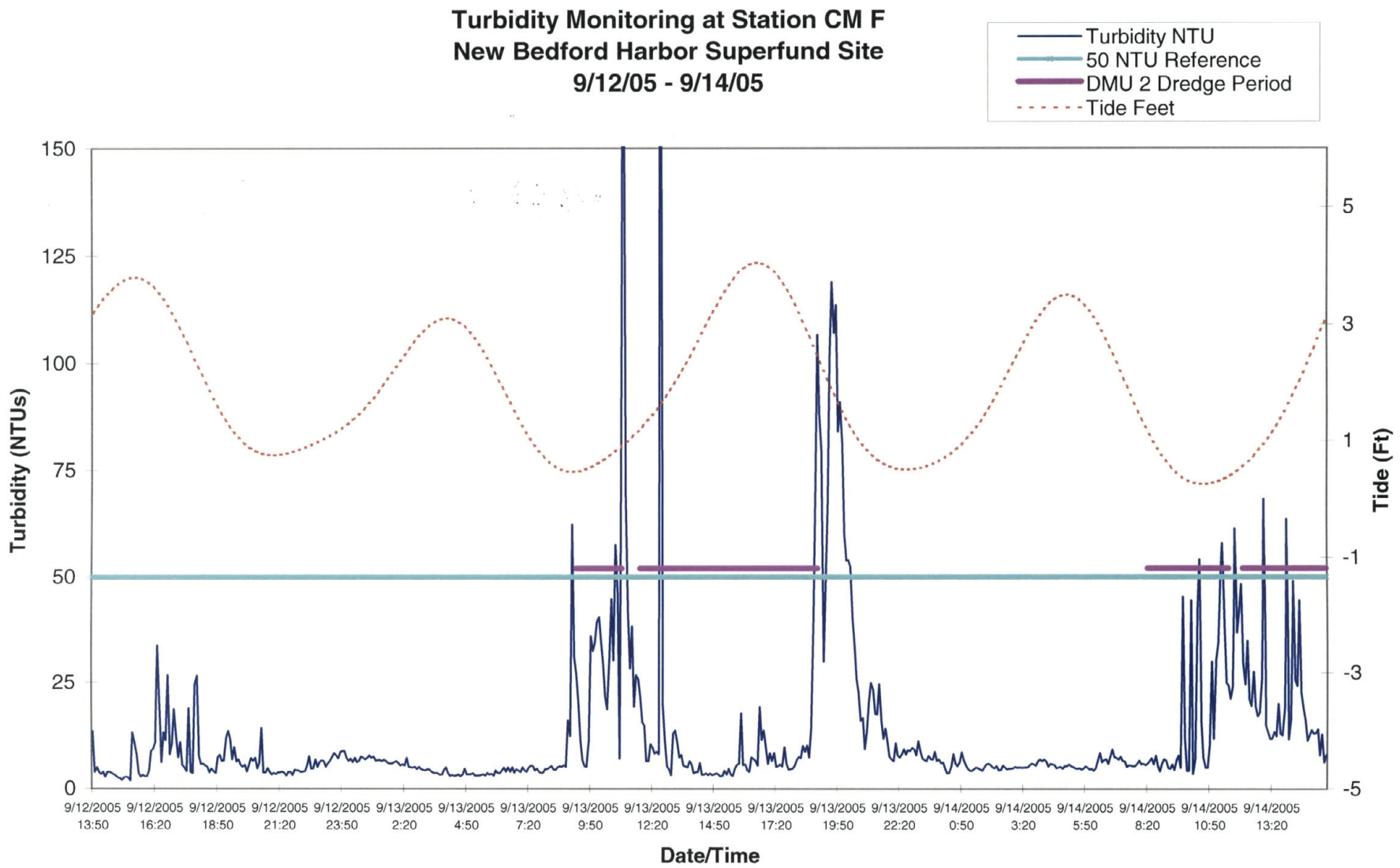
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DMU 2 Dredge Period
Tide Feet
Turbidity (NTUs)
Tide (Ft)
Date/Time
150
125
100
75
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25
0
5
3
1
-1
-3
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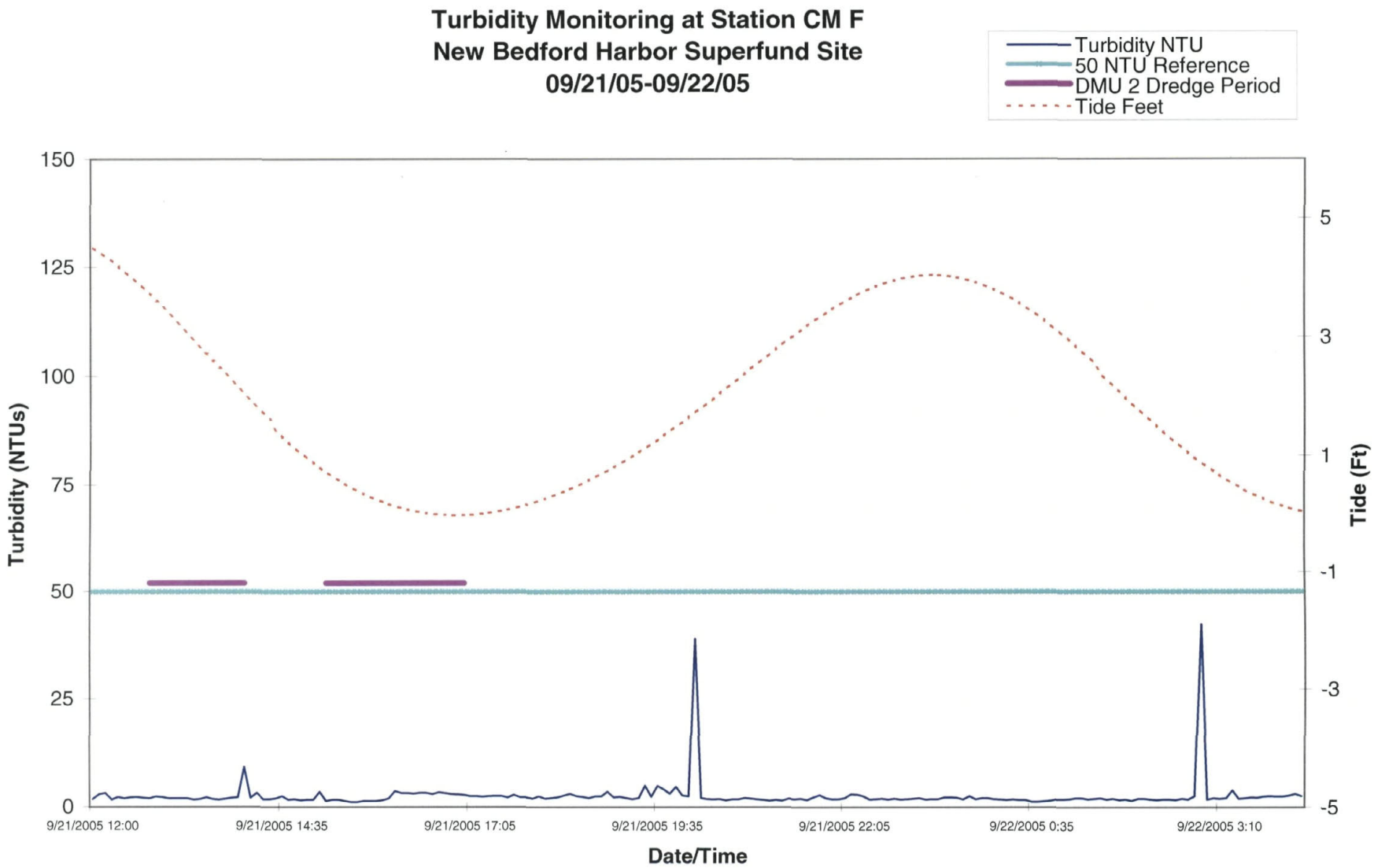

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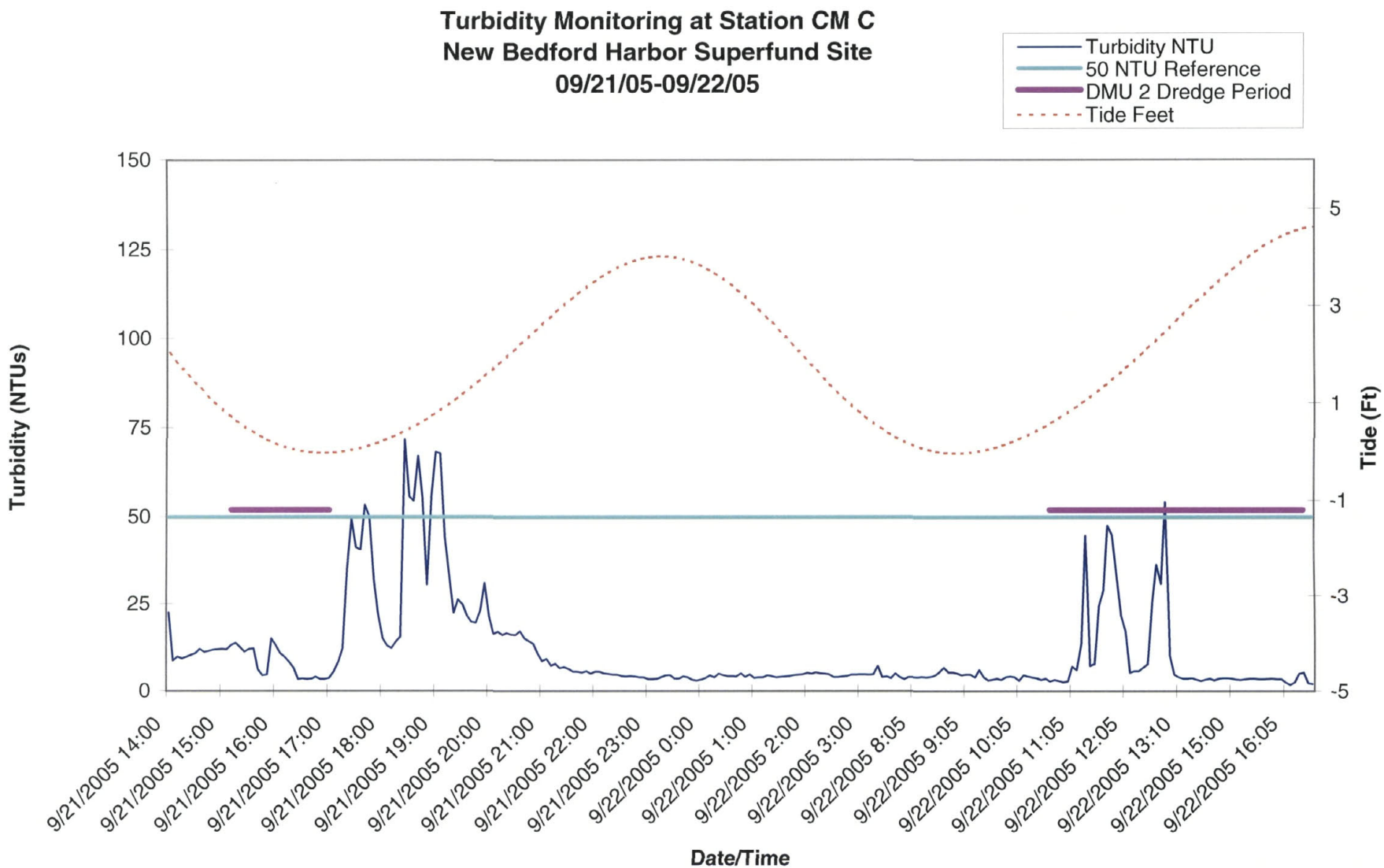
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Tide (Ft)
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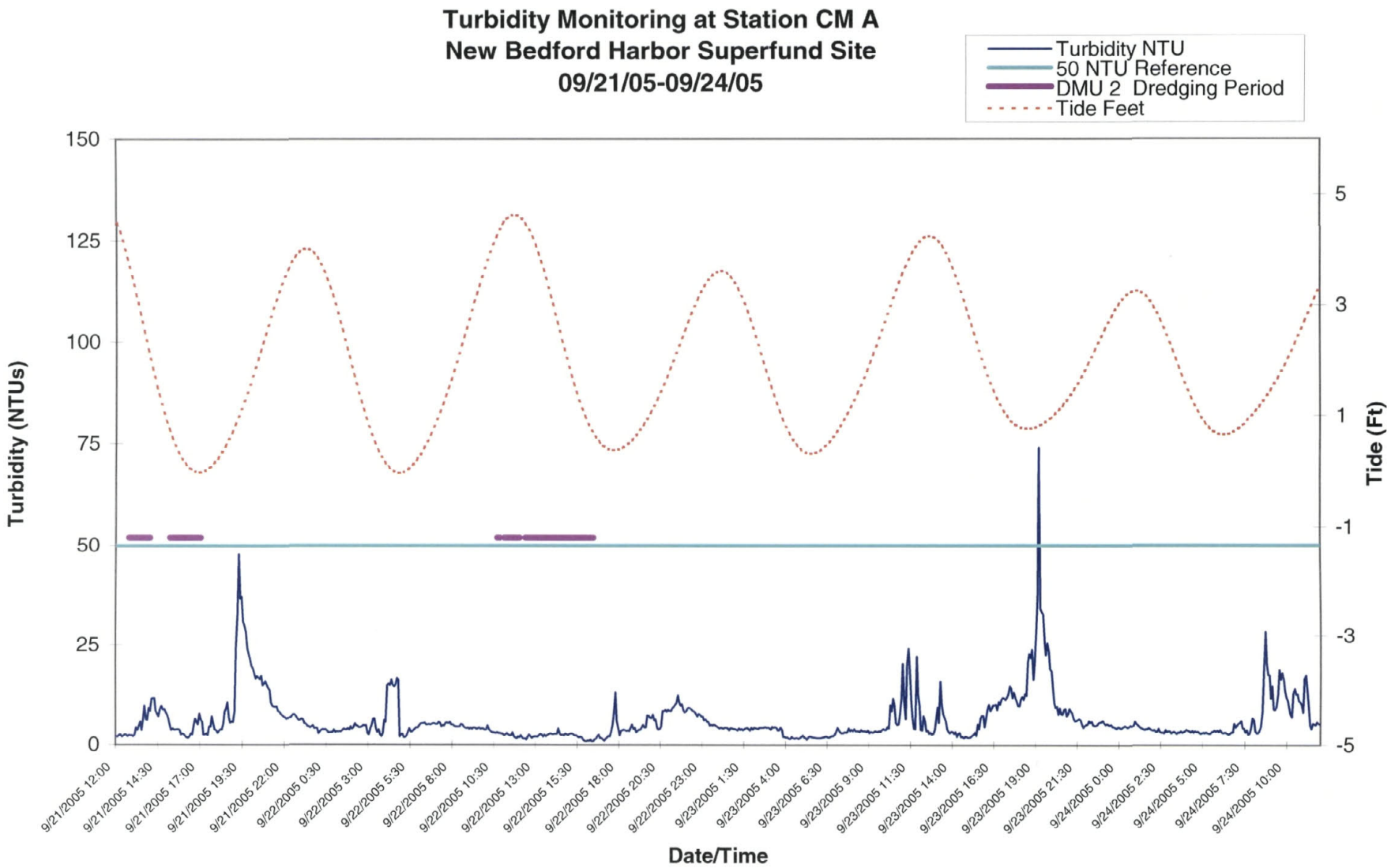

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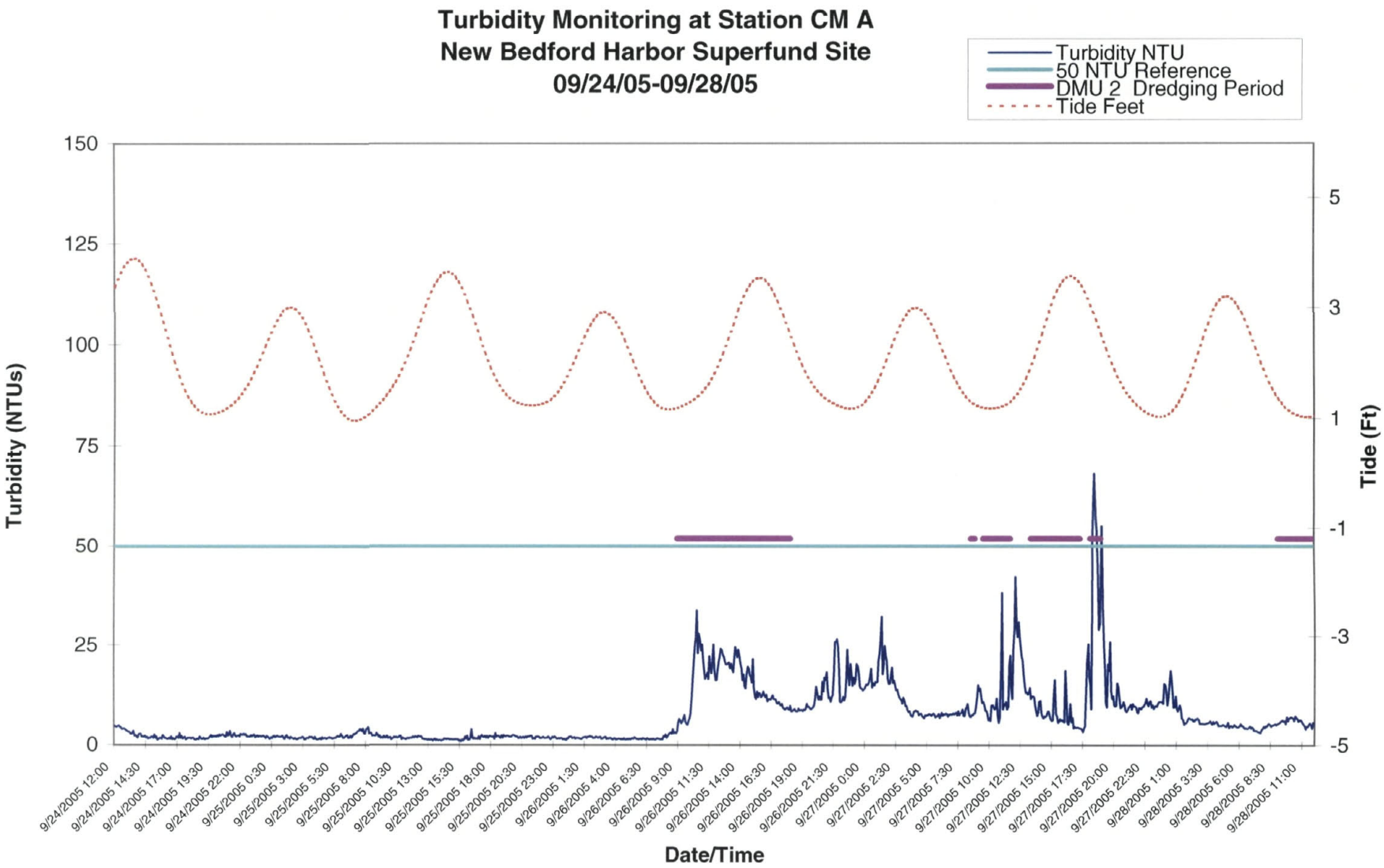
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Tide (Ft)
Date/Time
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125
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25
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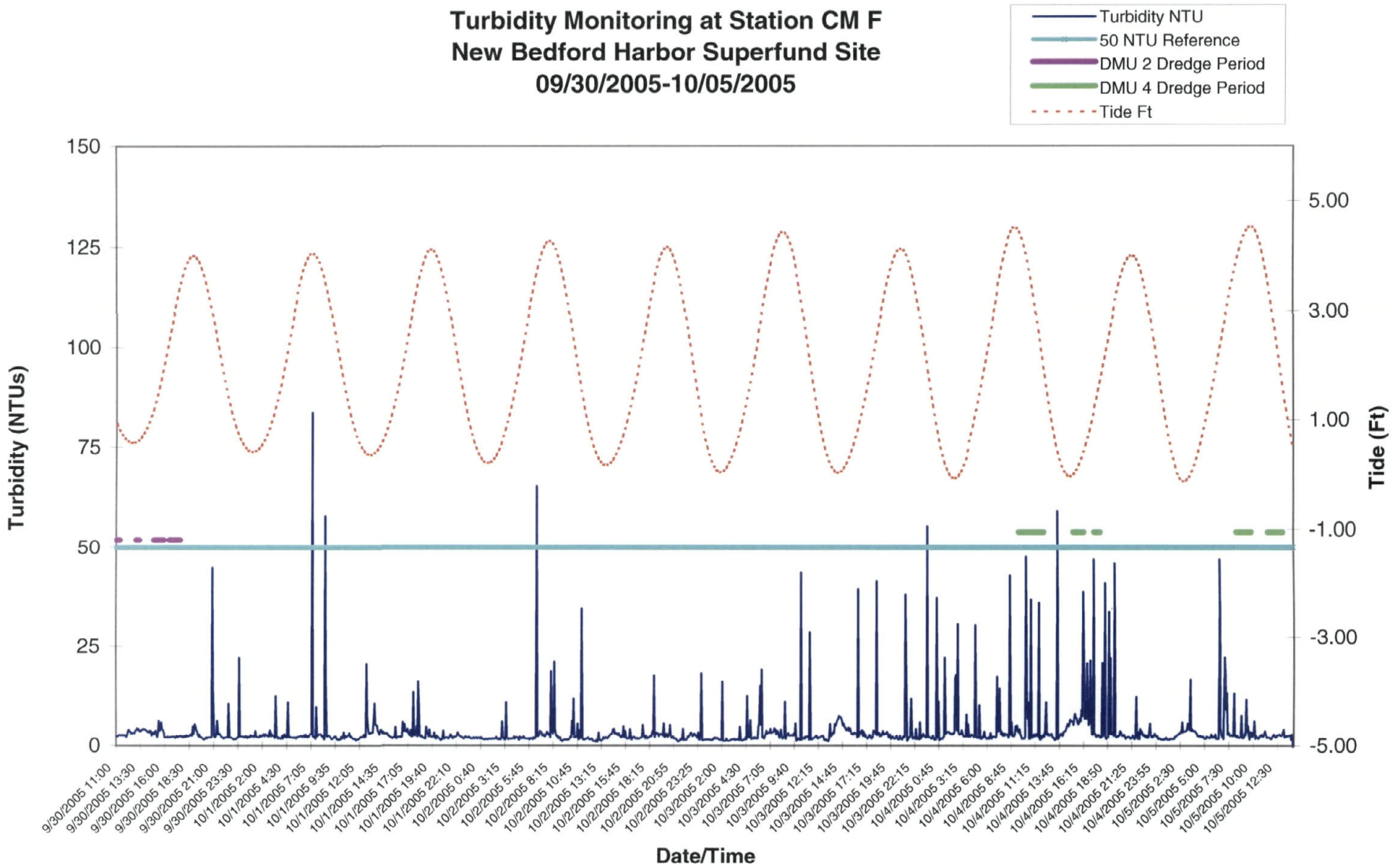

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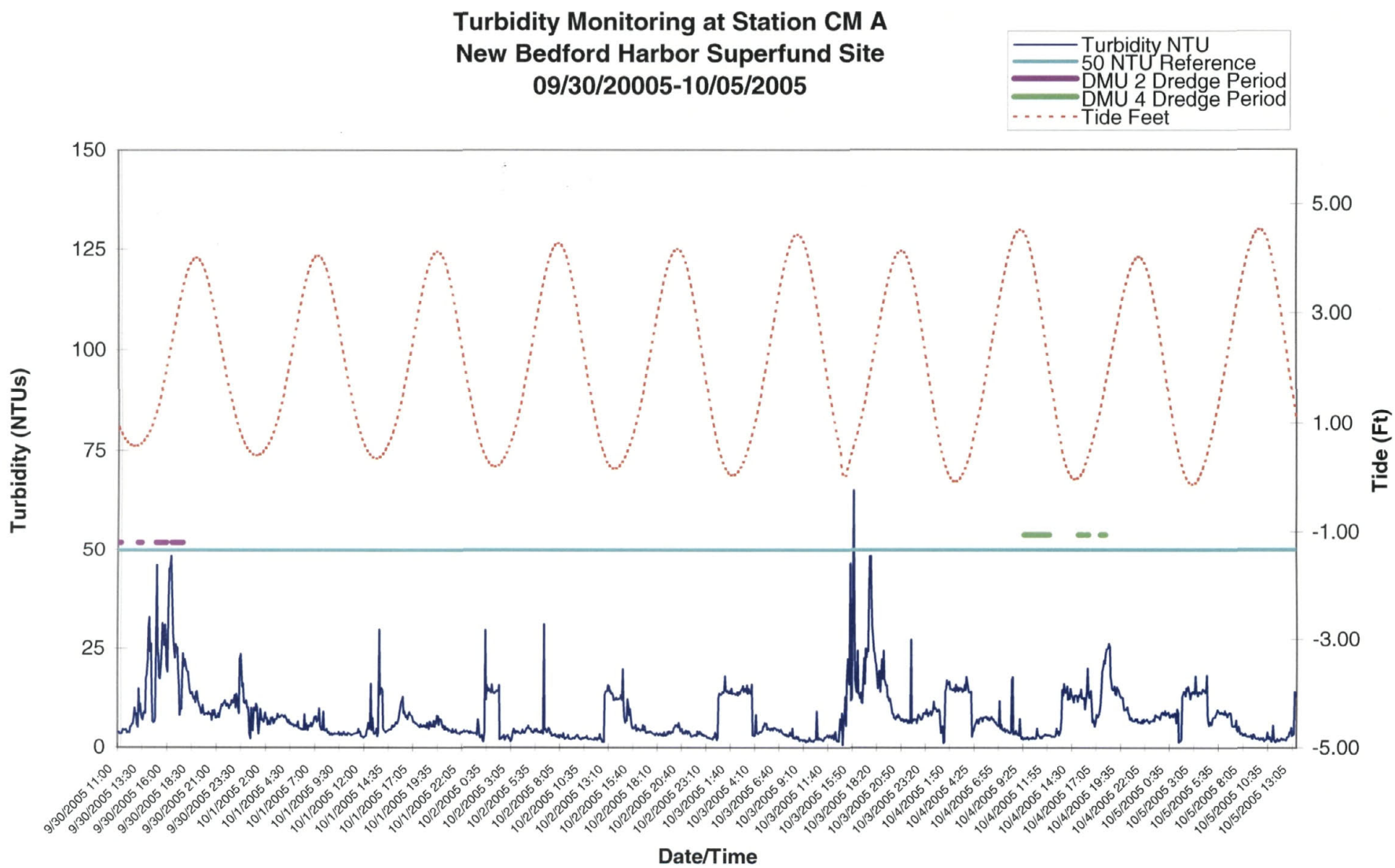
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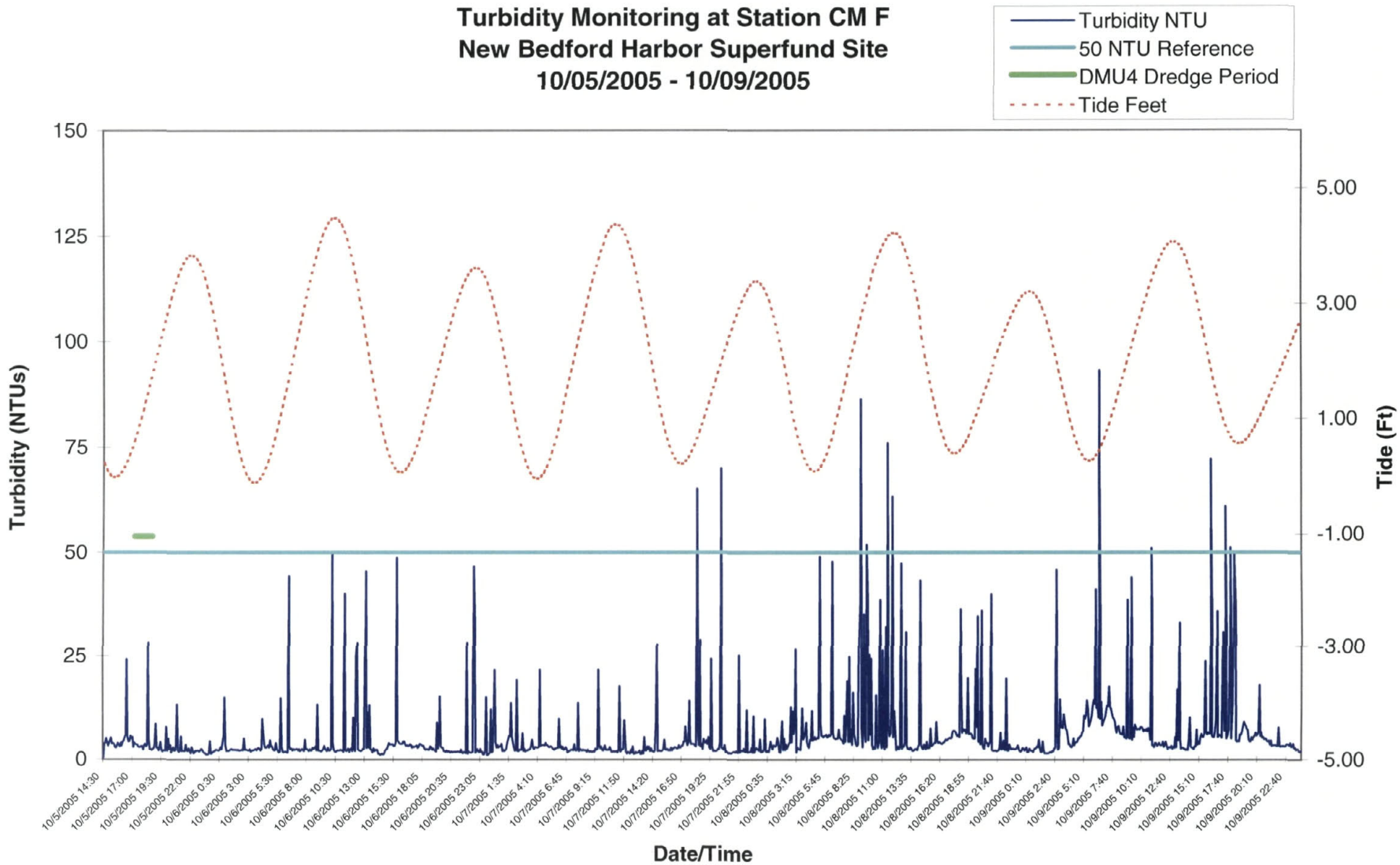
Tide Feet
Turbidity (NTUs)
Tide (Ft)
Date/Time



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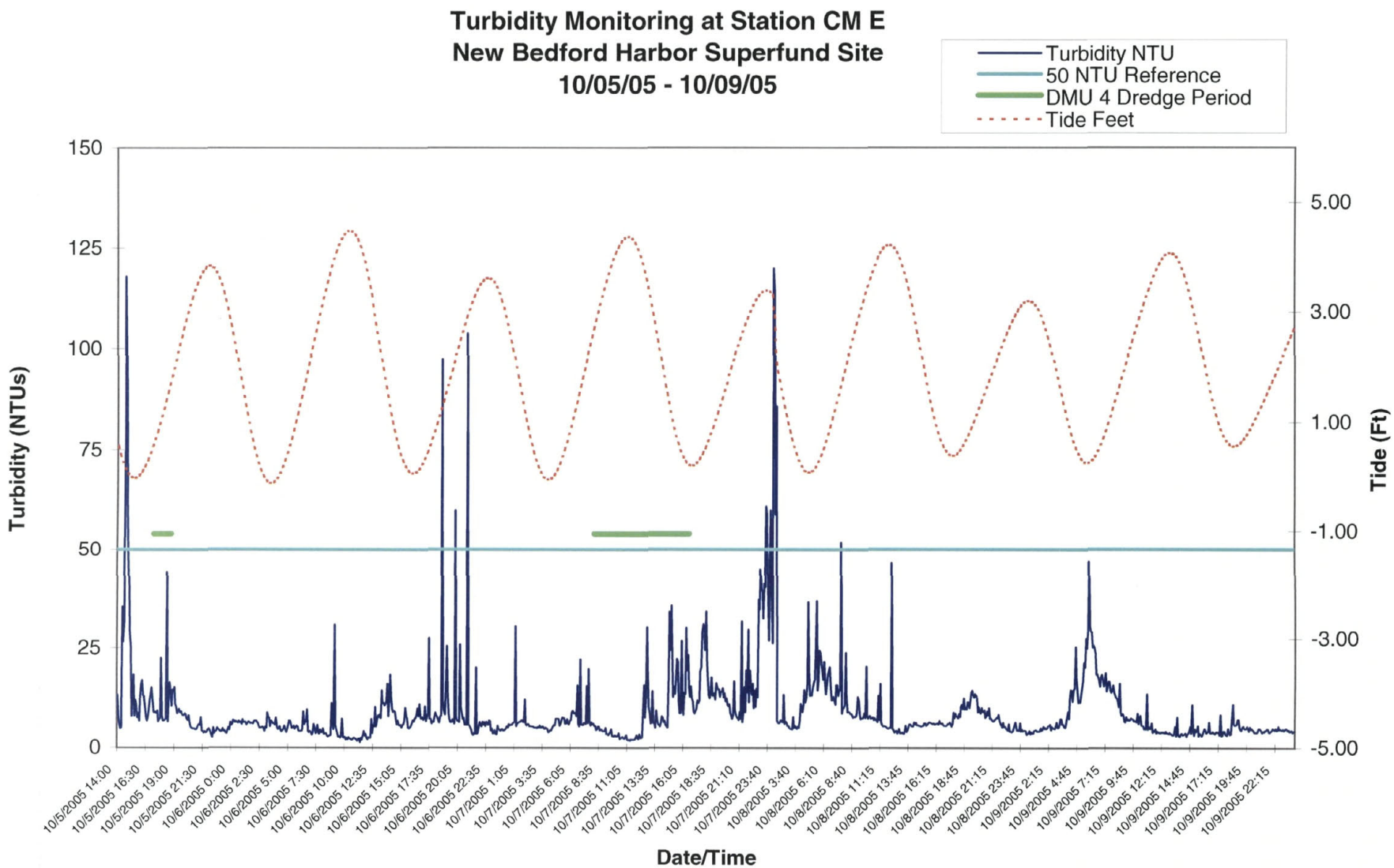

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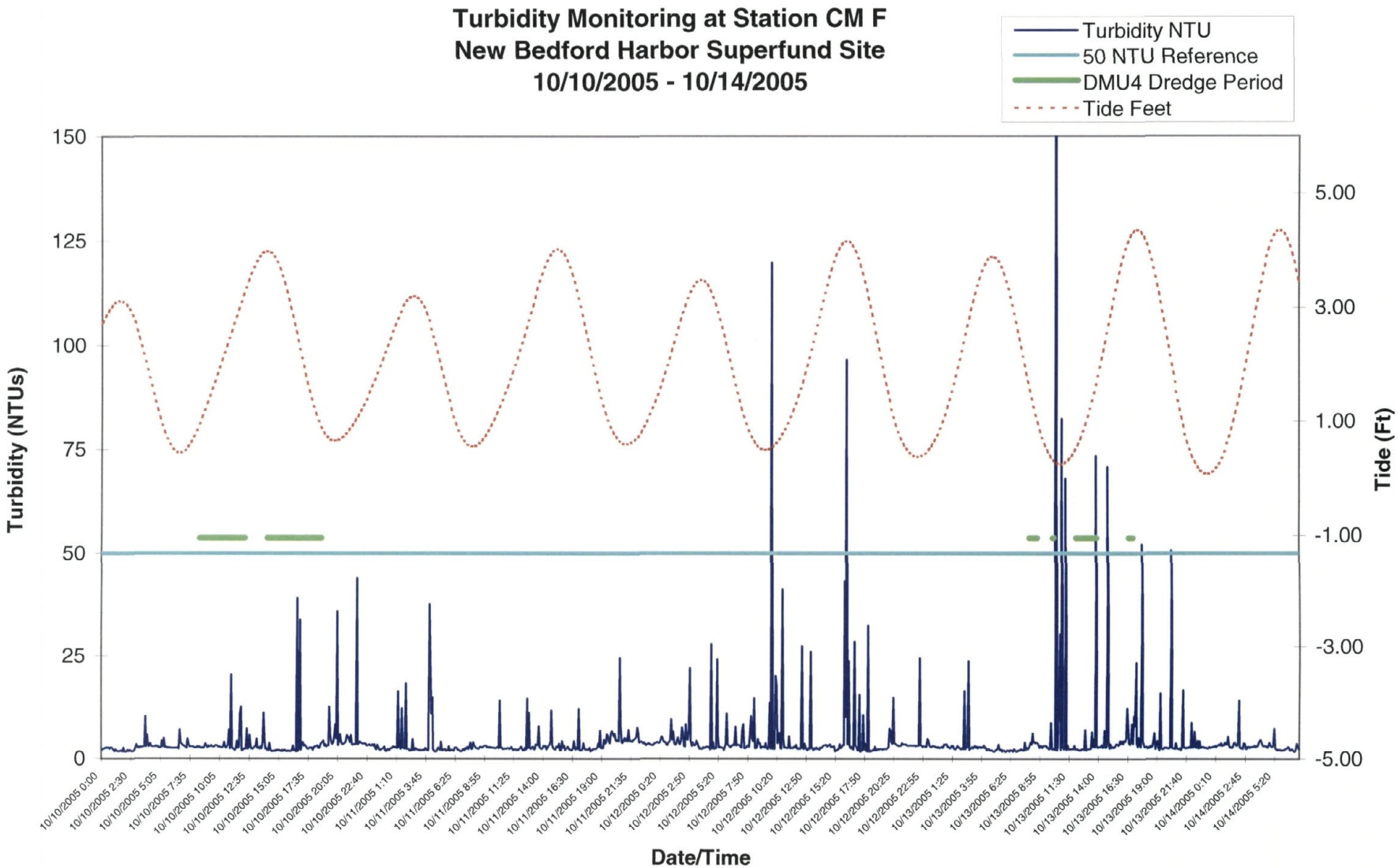

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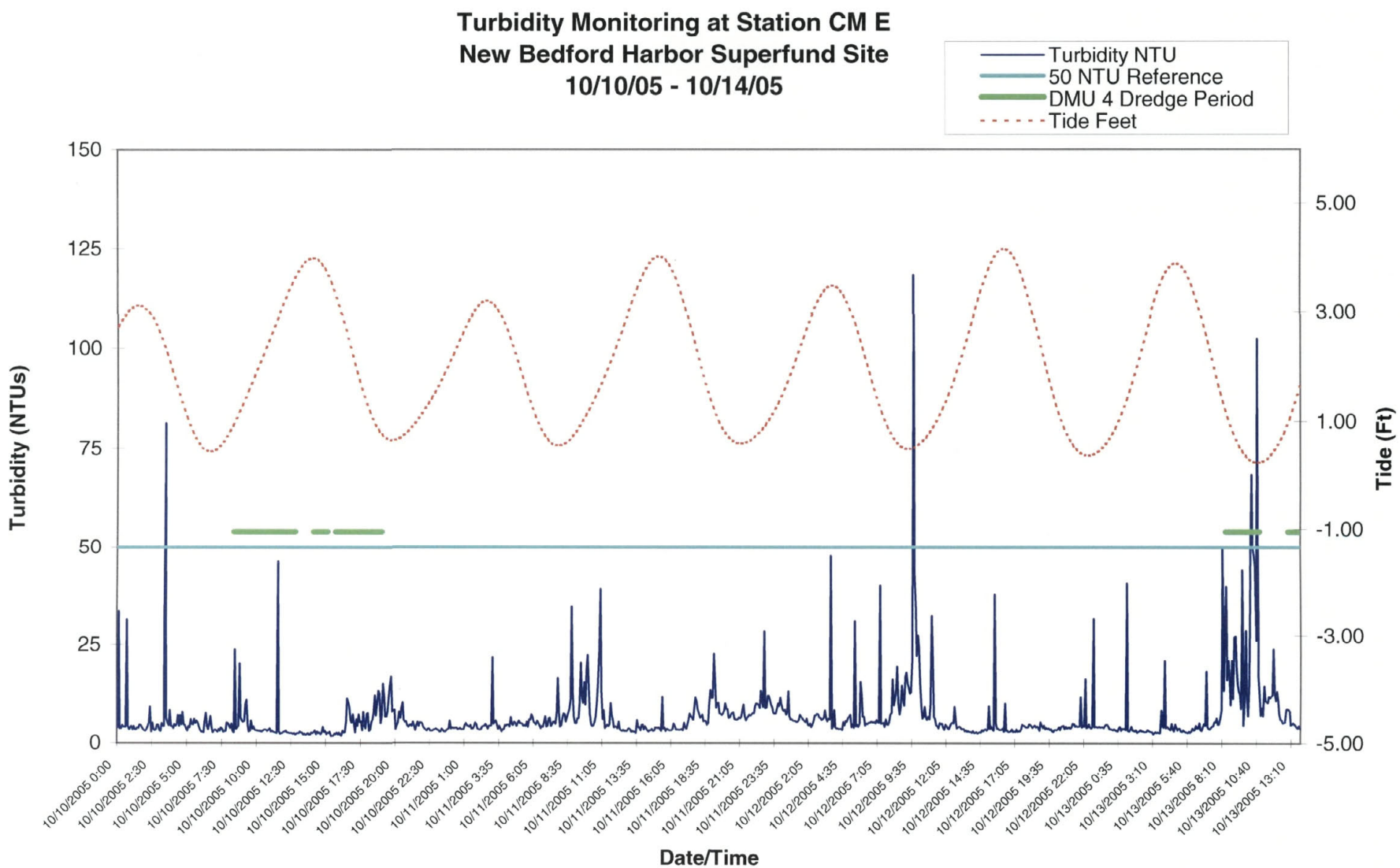

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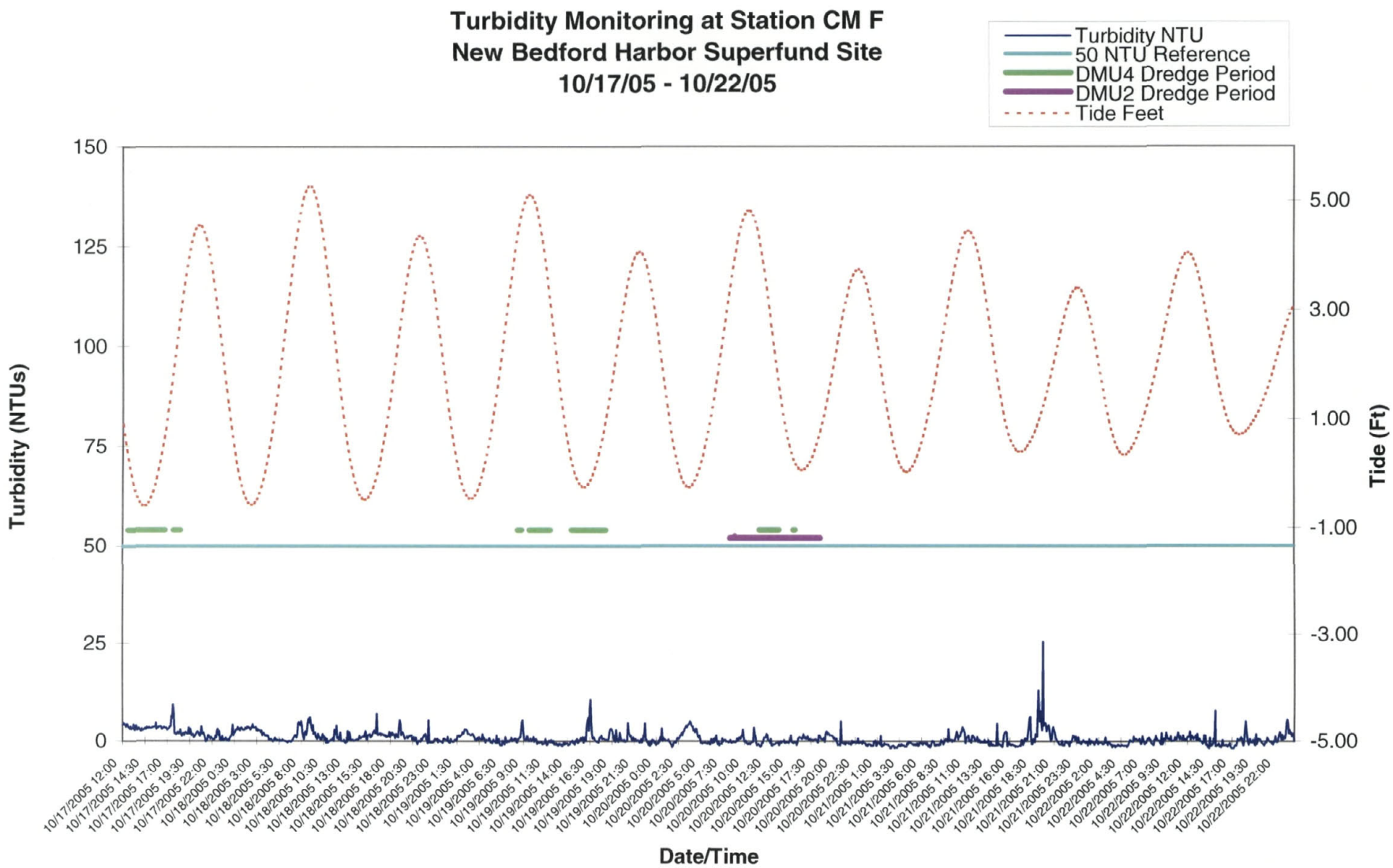

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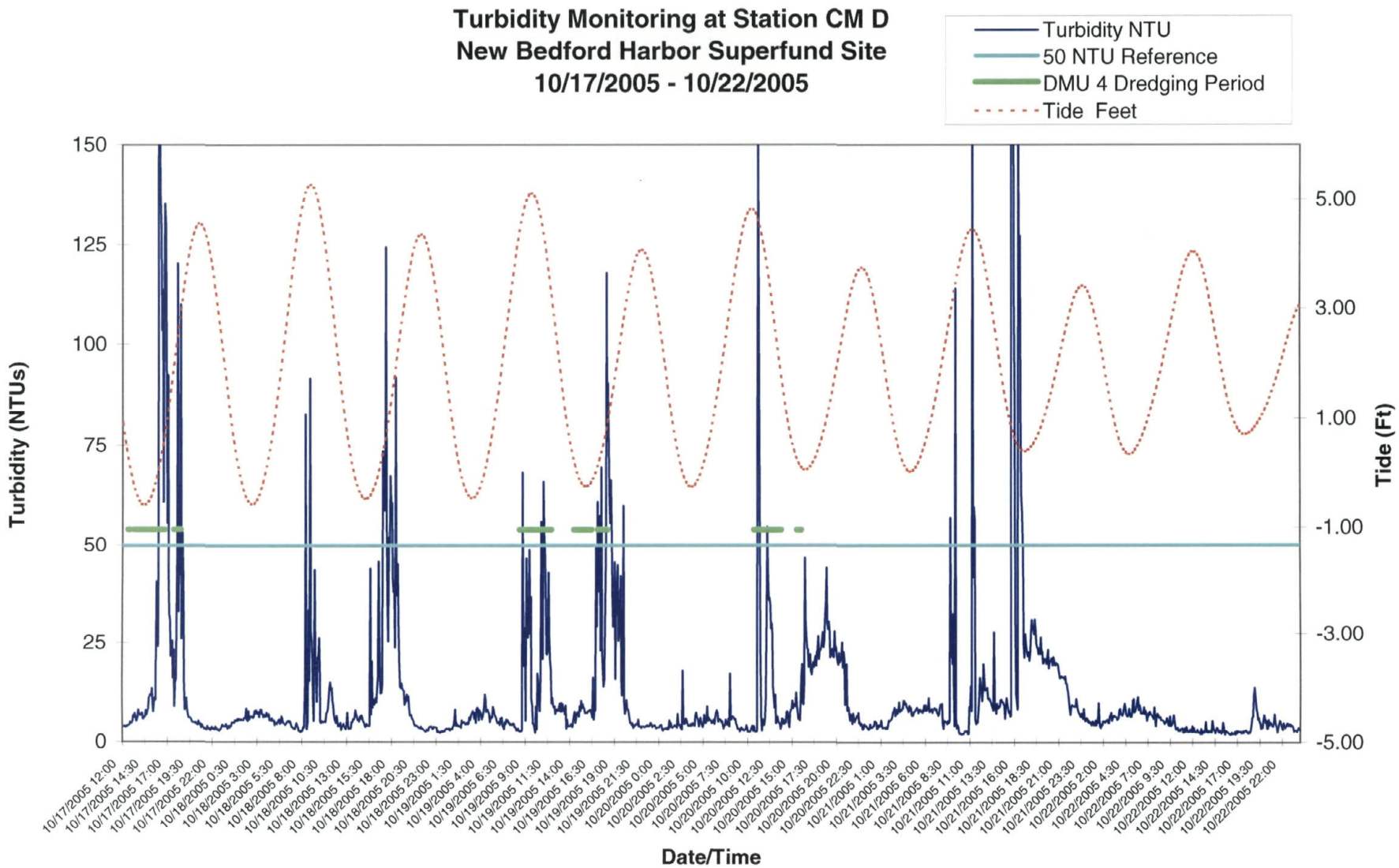
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Tide (Ft)
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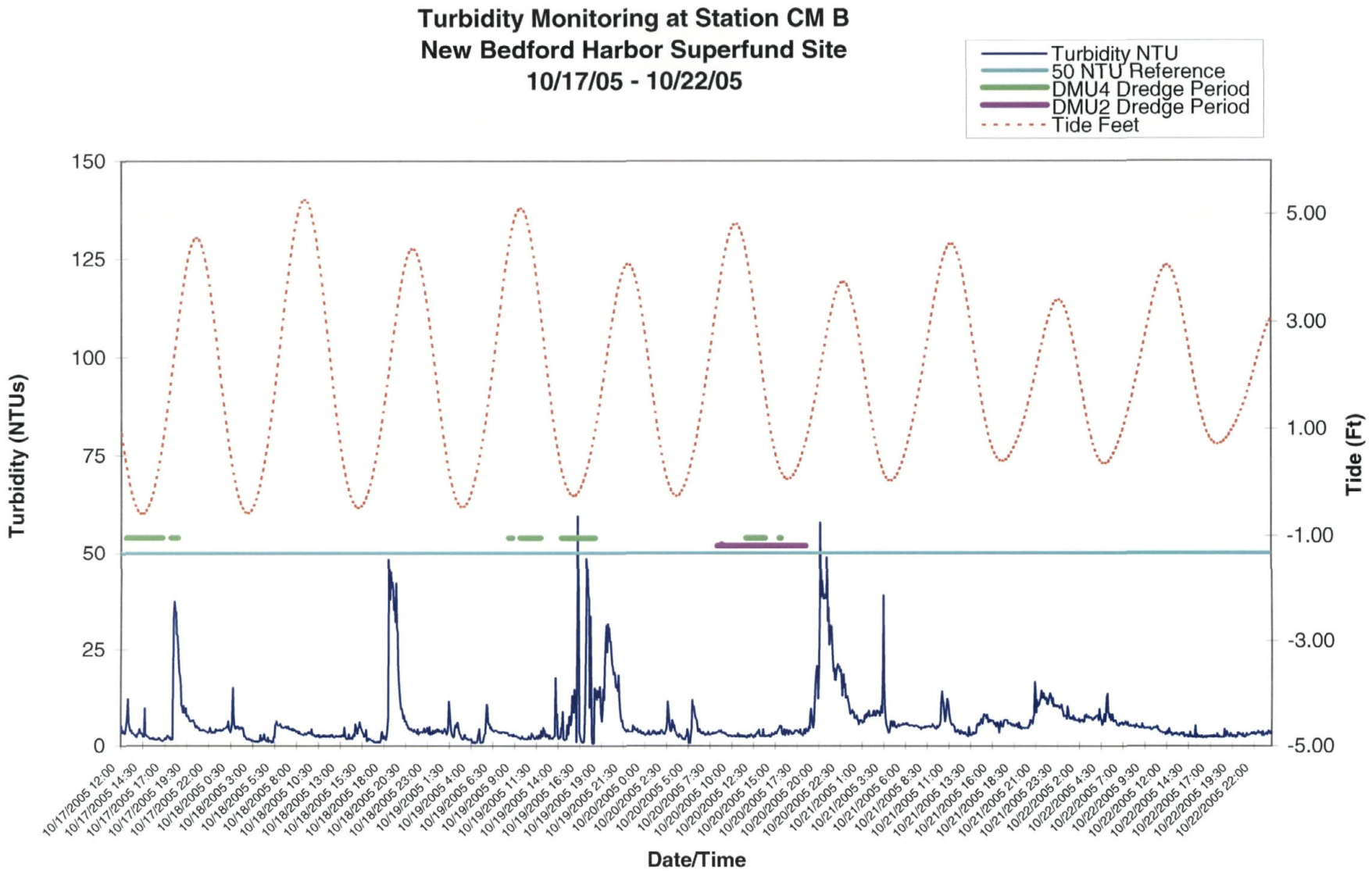

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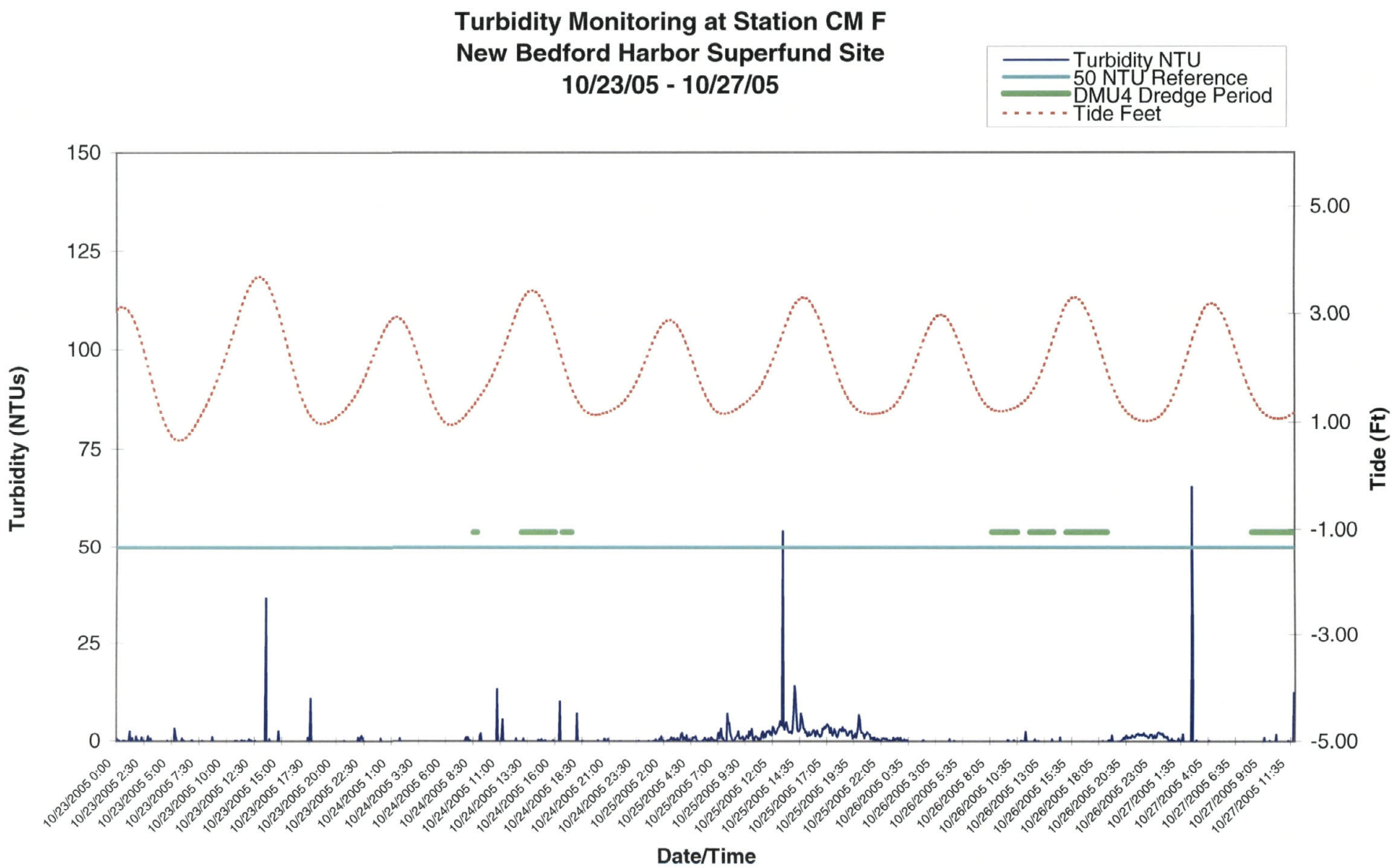

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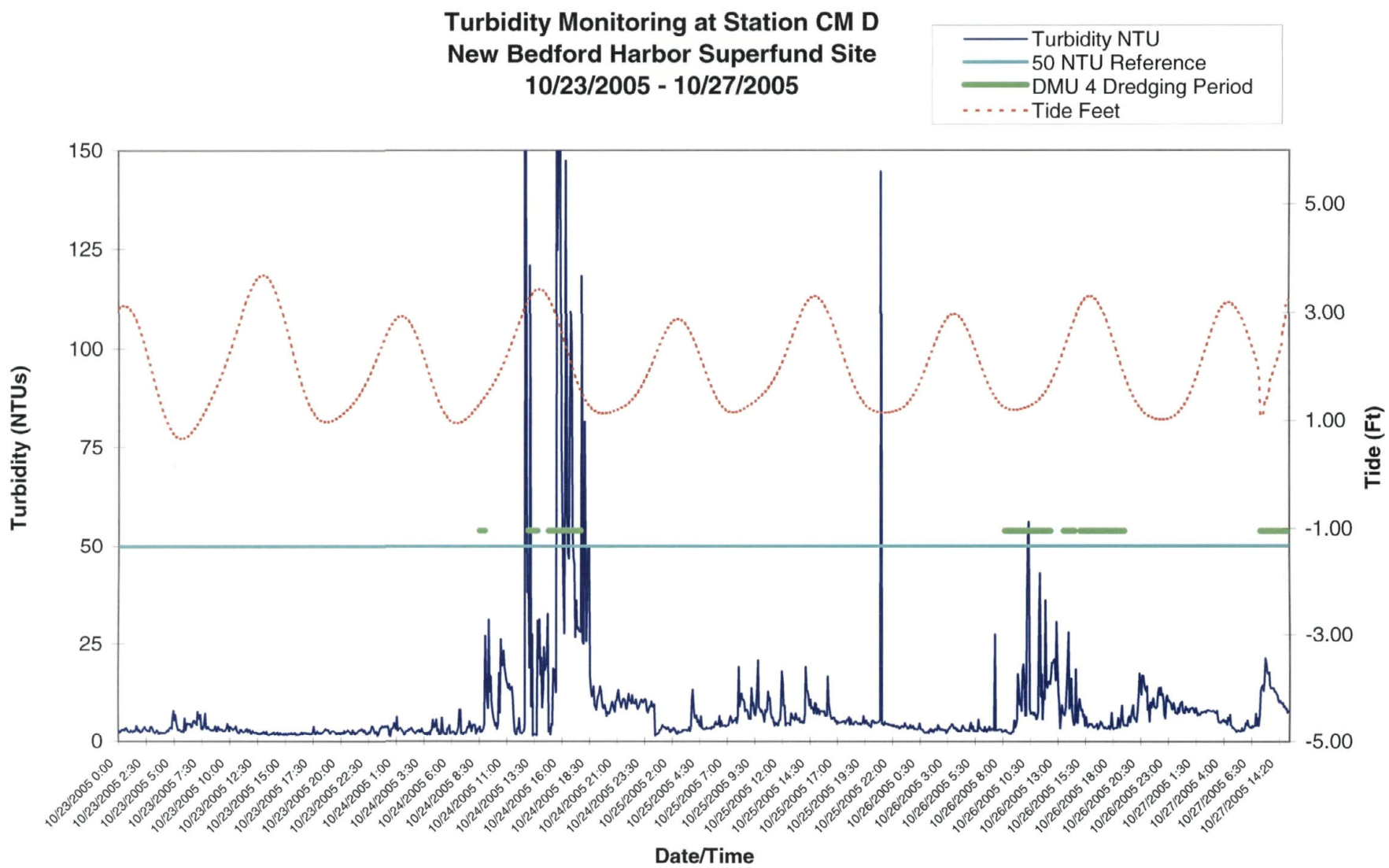
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Tide (Ft)
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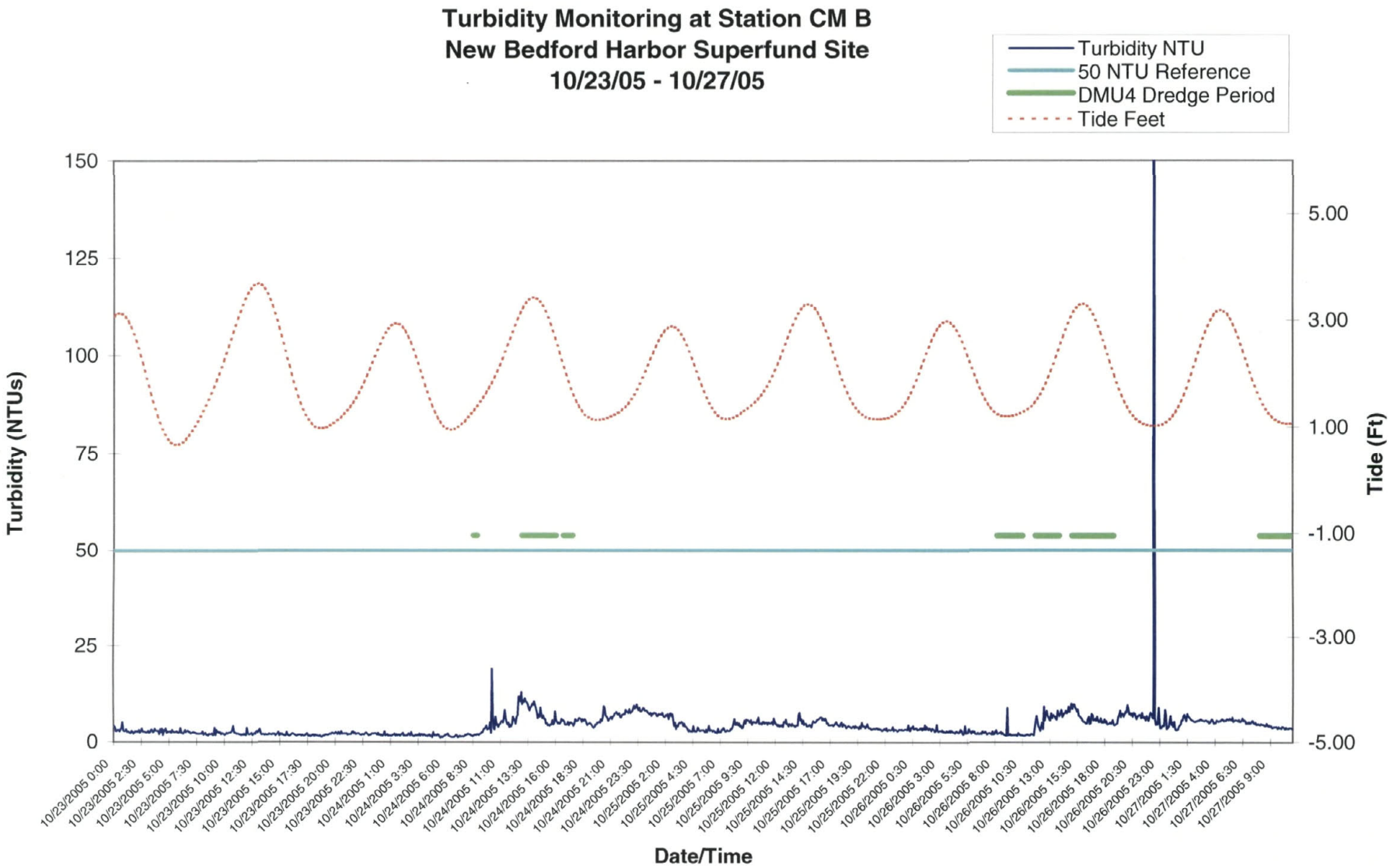

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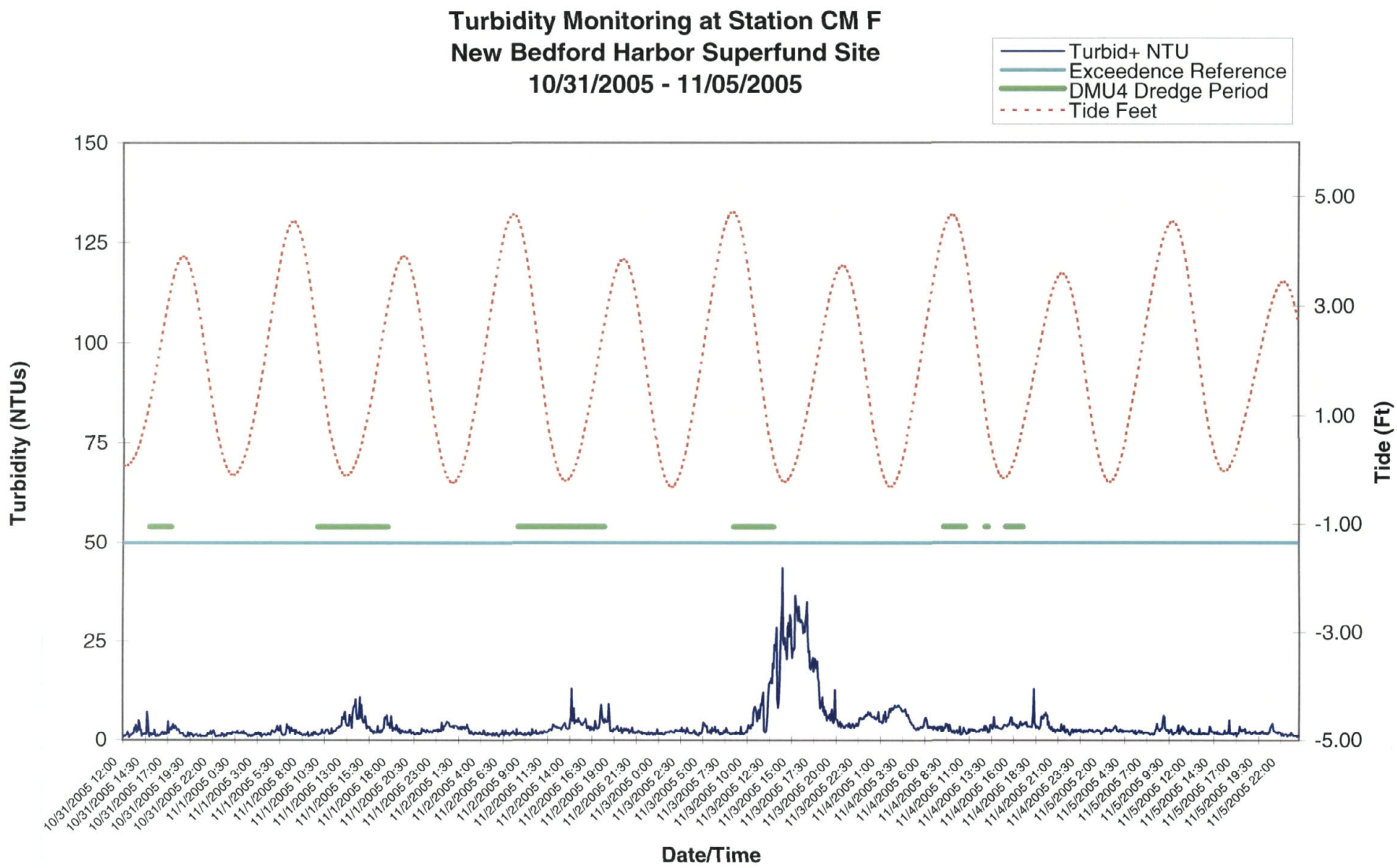
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Turbidity (NTUs)
Tide (Ft)
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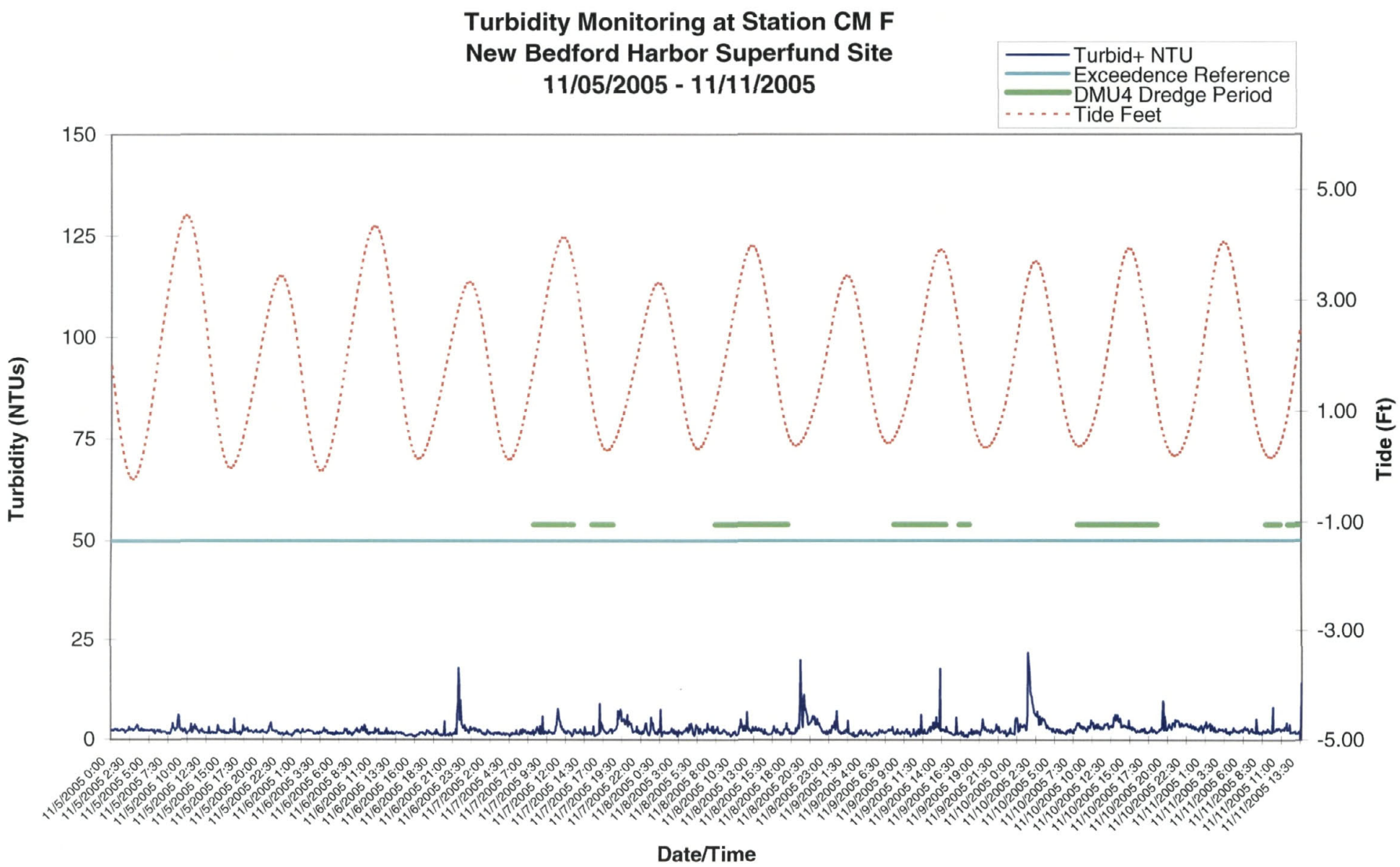

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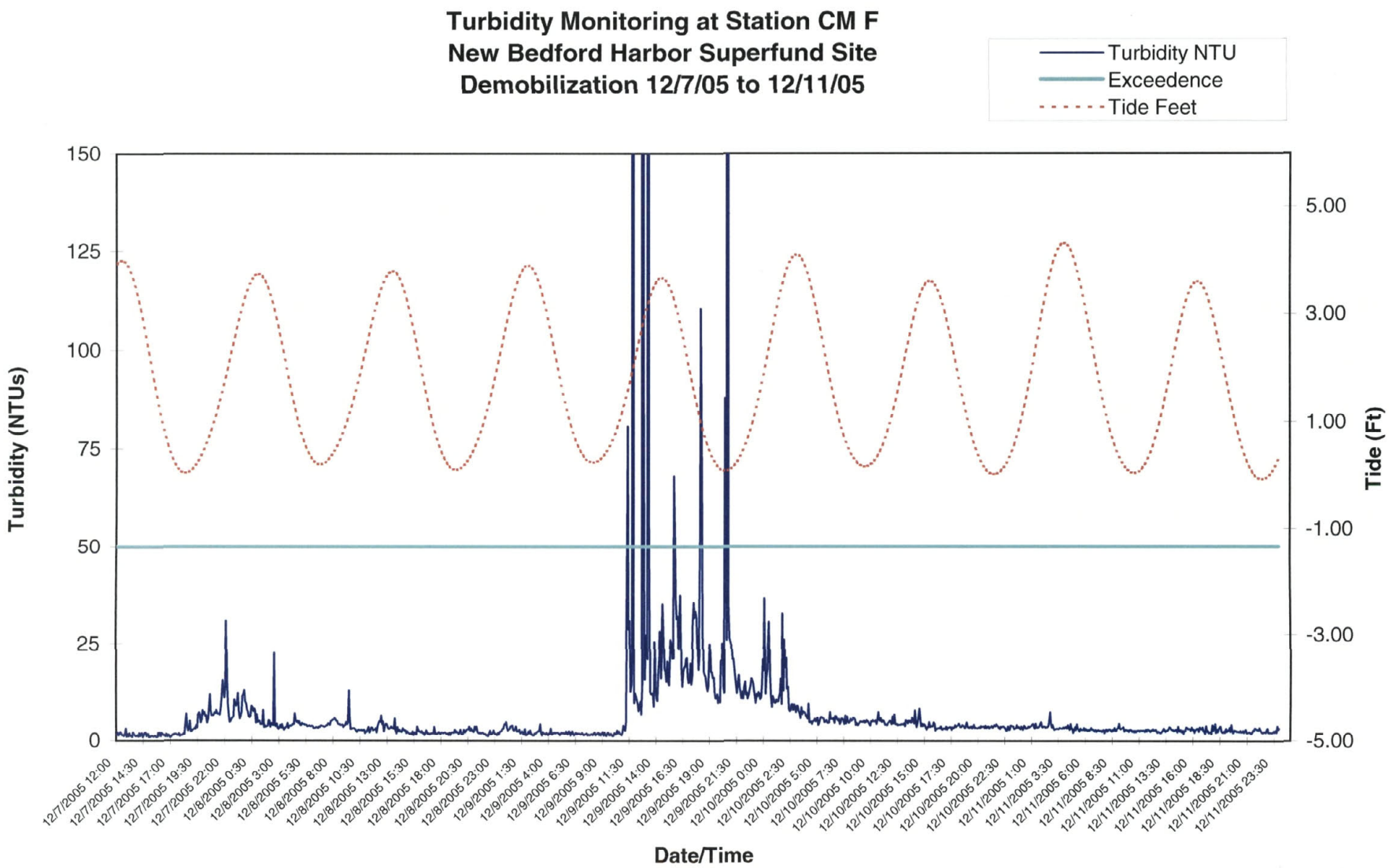

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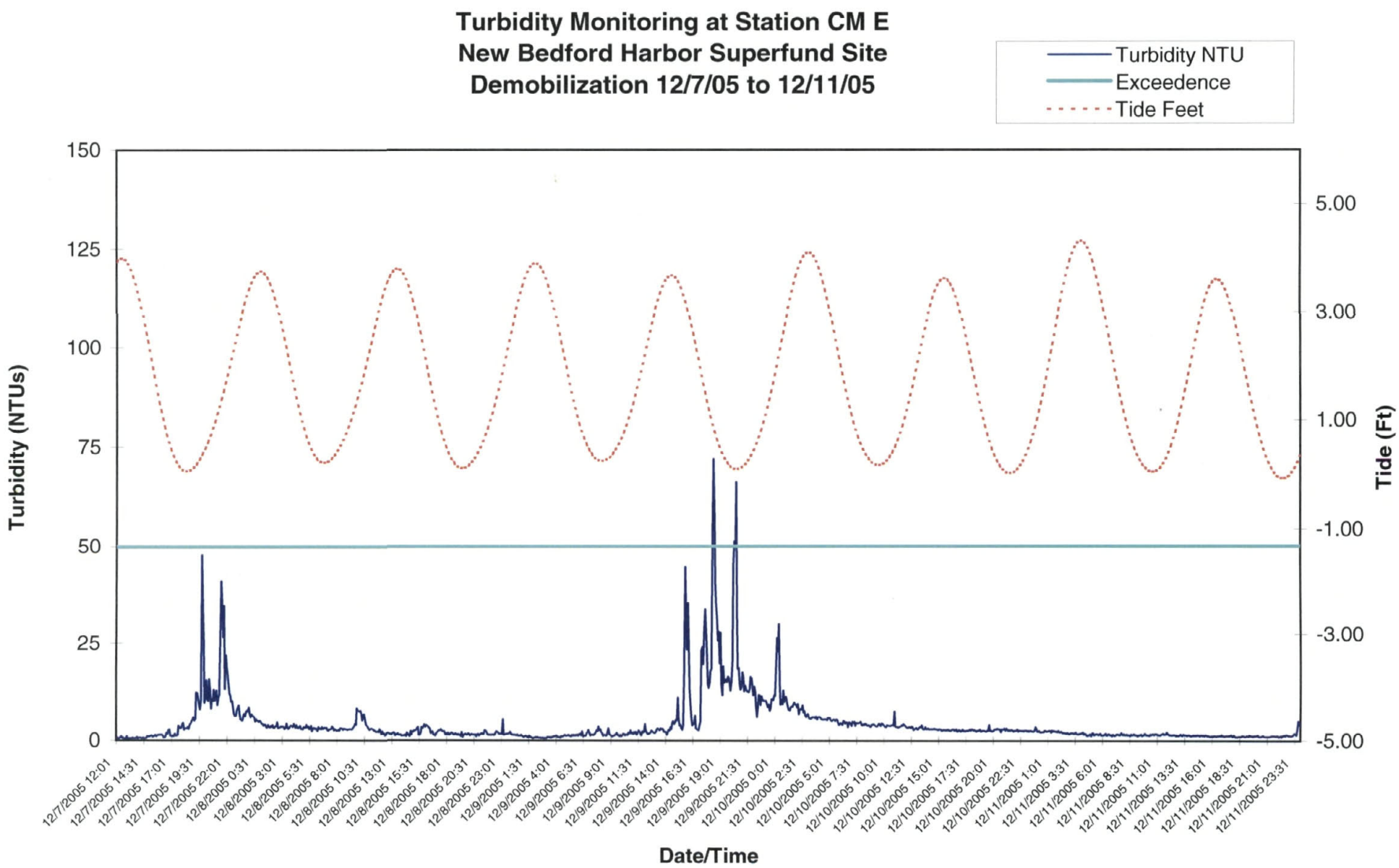

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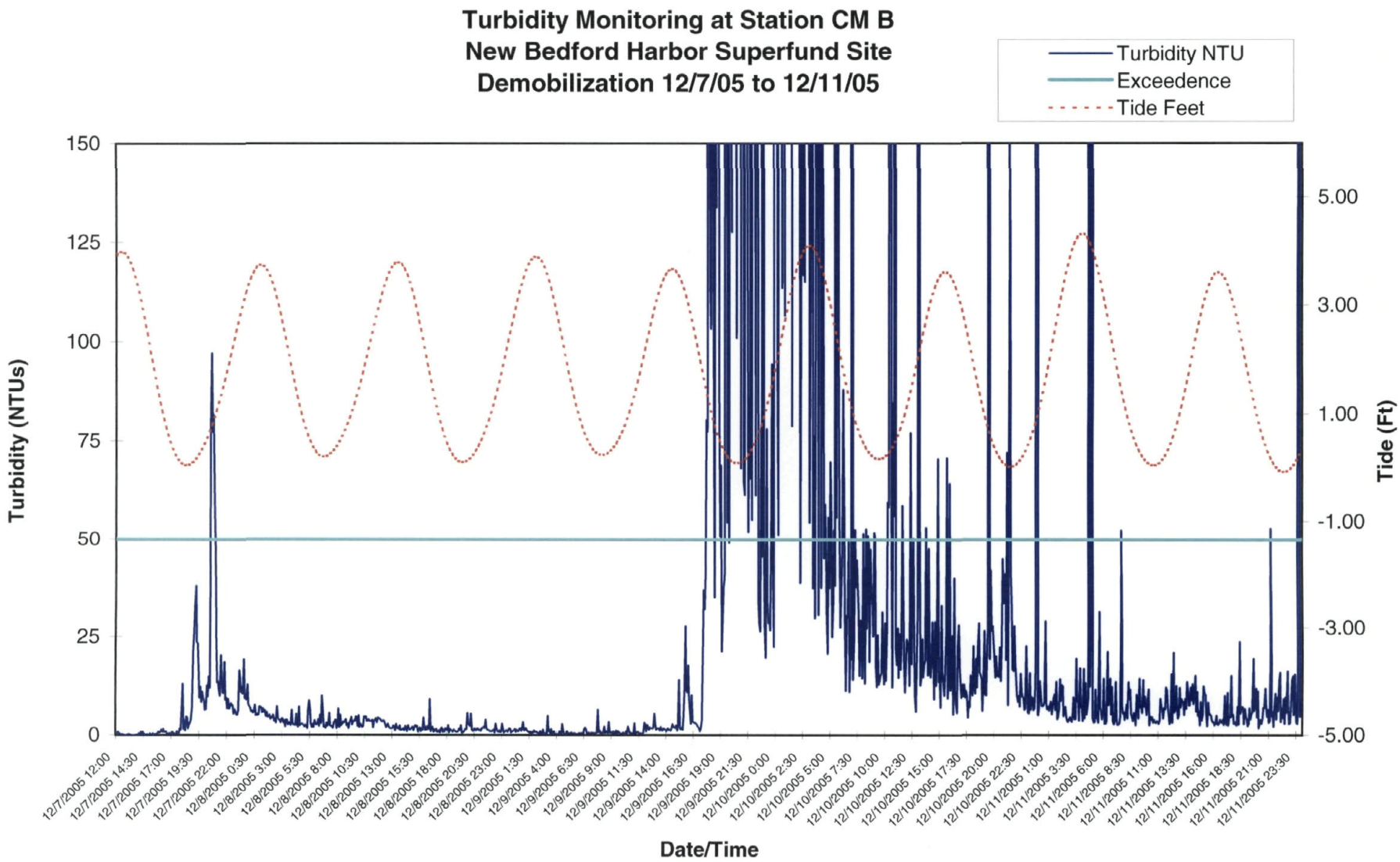

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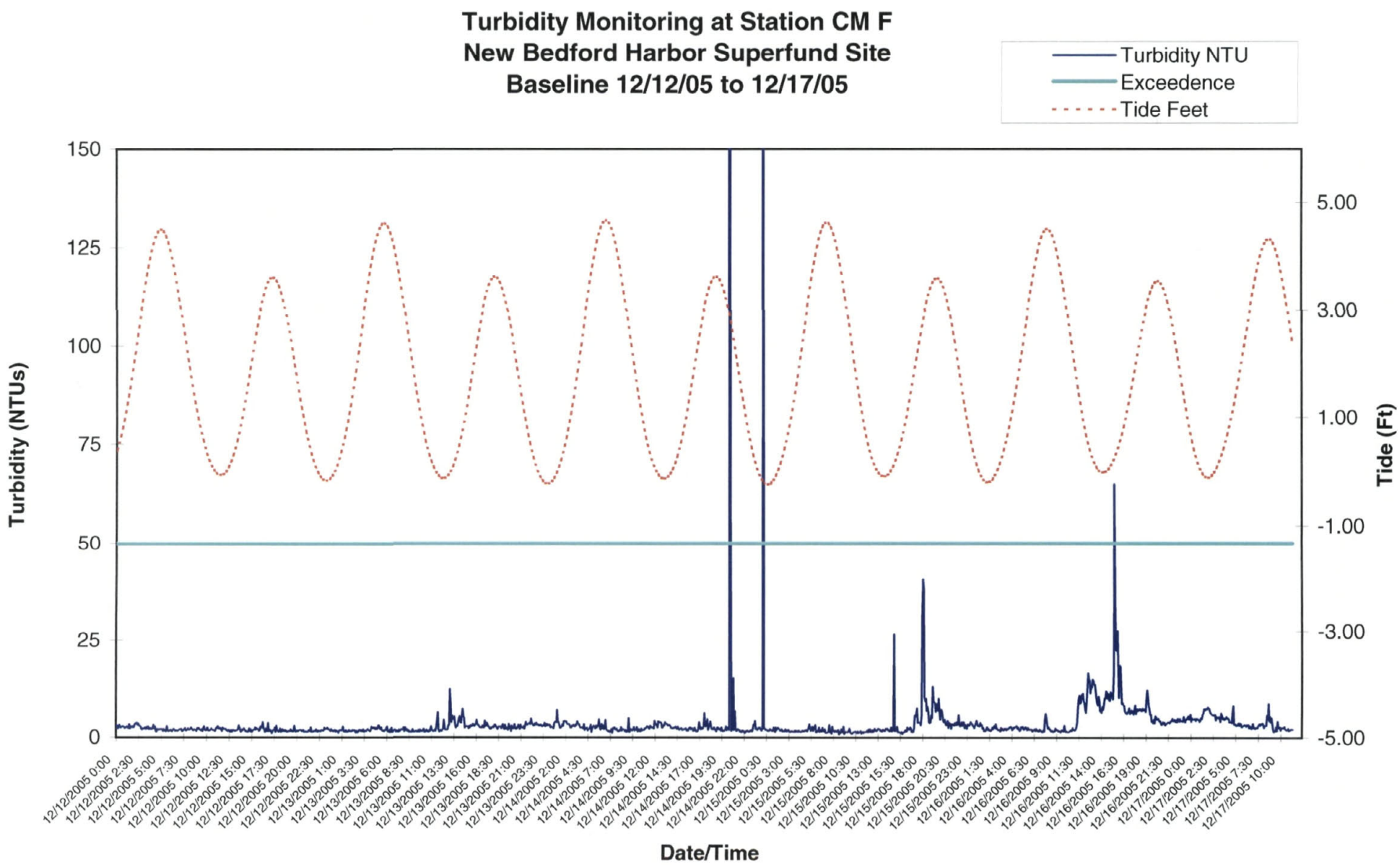

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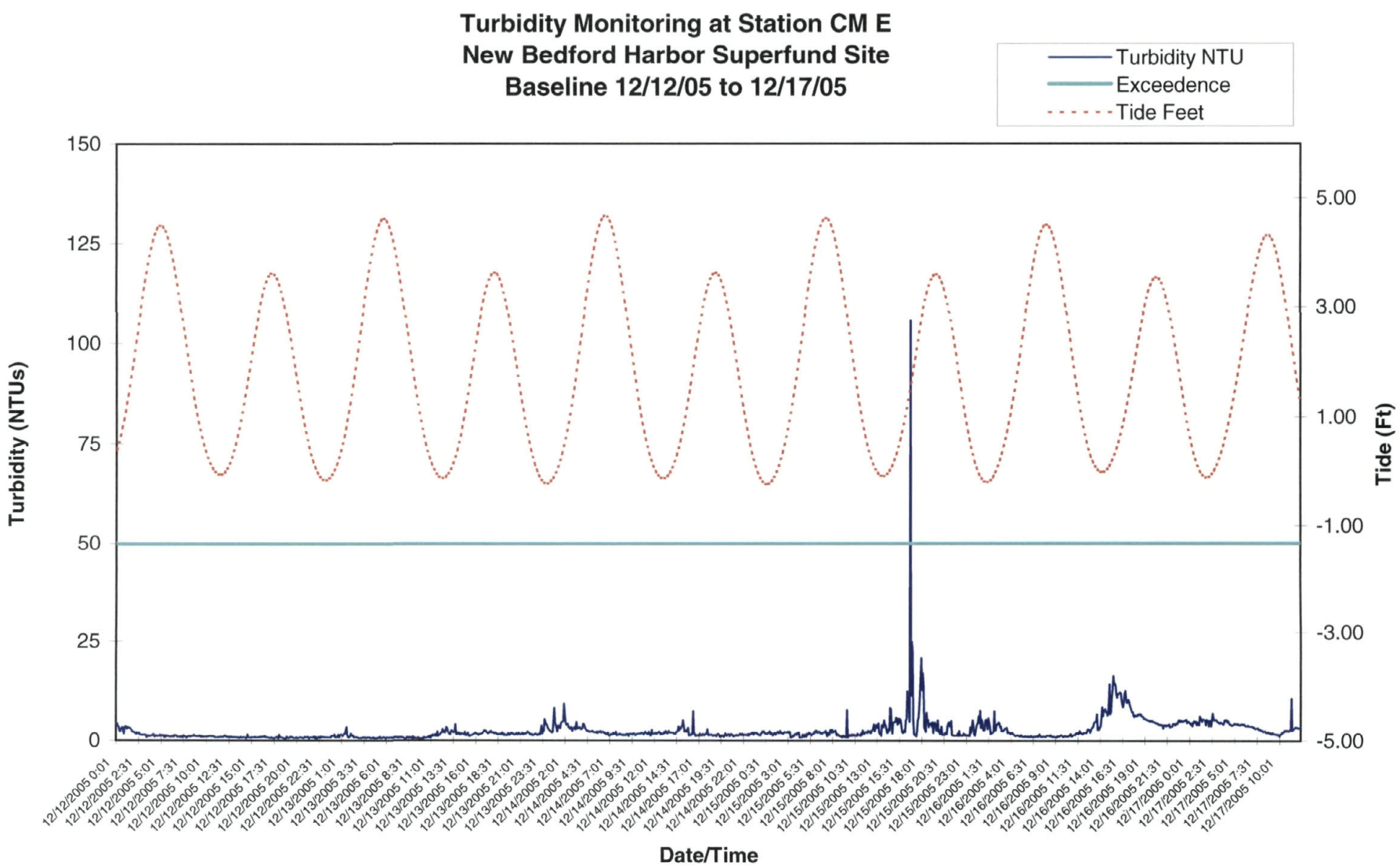

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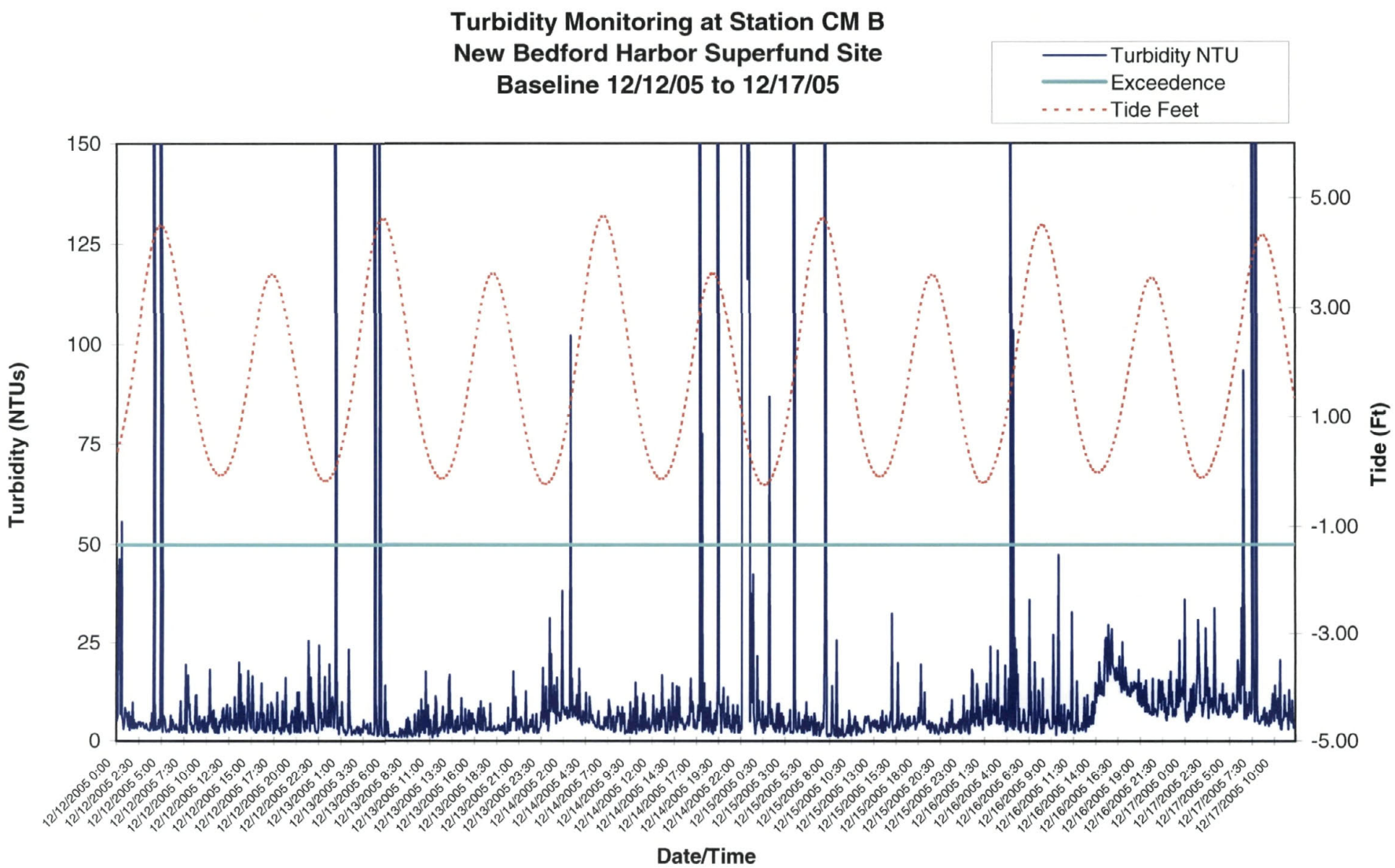

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North of Wood St.

US Army Corps of Engineers®
New England District

U.S. Environmental Protection Agency

2005 Monitoring Summary Report

North of Wood Street Area Sampling

New Bedford Harbor Superfund Site – New Bedford Massachusetts

Prepared by:

ENSR | AECOM

CR ENVIRONMENTAL, INC. WBE

Contract:
DACW33-00-D-0003
Task Order 12
ENSR Document No.
09000-350-710

Final - August 2006

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EXECUTIVE SUMMARY

Sediment and soil sampling was performed in 2005 and early 2006 in Upper New Bedford Harbor at the North of Wood Street Area. This area was previously remediated and restored in 2002-03 to remove polychlorinated biphenyl (PCB) contaminated sediments and soils from the Acushnet River and surrounding shoreline as part of the overall remediation of the New Bedford Harbor Superfund Site. The objectives of the 2005-06 sampling effort were twofold: 1) to evaluate potential changes in river sediment PCB concentrations that may have occurred due to seasonal influences or due to ongoing dredging/remediation efforts in nearby areas; and 2) to provide continued support in mapping out an area of elevated PCB concentrations found in un-remediated soils along the eastern shoreline of the North of Wood Street Area.

River sediments were collected from a series of stations located along the river in the study area in May 2005 to gather data under spring flow conditions and in September 2005 to gather data under late summer flow conditions and as a baseline prior to the start of remedial dredging performed in the fall approximately one-half mile to the south. Samples were also collected in January 2006 following completion of dredging activities. All samples were collected using a push core system, with the top 6 inches of the recovered core sectioned for analysis of PCBs.

The resulting sediment concentrations were compared between events and with previous data collected in 2002-03 (immediately following remediation) and in August 2004 (prior to the start of the 2004 dredge season). Samples from these two earlier data sets were collected using different sampling techniques. Highest concentrations were measured for the August 2004 samples, but the sampling technique (subsampling a 6 inch segment from a larger grab sample) was considered to have potentially biased the results to higher concentrations by including a larger percentage of fine surficial sediments. PCB concentrations declined in the May and September 2005 samples, and increased somewhat in the January 2006 samples.

Some of the changes in sediment concentration noted between the different events may have been related to spatial variability of PCB concentration, i.e., concentration distribution is patchy and can vary significantly over short distances. However, the changes in concentration, particularly those for the 2005-06 events performed using identical sampling techniques, suggest a relatively dynamic sediment system within the main portion of the river channel. Factors that could have contributed to the increase in PCB concentrations between the September 2005 and January 2006 sampling include normal redistribution of sediment within the Upper Harbor, transport of suspended material from the dredging that took place from late September to November approximately one-half mile south of the study area, and potential release of material during the remedial excavation that took place along the eastern shoreline adjacent to the sampled area in November and December.

Shoreline soil sampling was performed in a phased approach with five separate collection efforts during 2005. The combined rounds of sampling and analysis revealed two areas of soil with elevated PCB concentrations along the eastern shoreline, one area approximately 130 feet in length and 40 feet in width just south of River View Park and a smaller second one approximately 150 feet further south. These two areas had not been included in the 2002-03 NWS cleanup due to the lack of characterization data for them (at that time, the area had been thickly vegetated), and thus the areas do not represent areas of recontamination. These areas were excavated, and soils were transported for off-site disposal in November-December 2005.

1.0 INTRODUCTION

This report summarizes the investigative soil and sediment sampling conducted in 2005-06 in Upper New Bedford Harbor at the North of Wood Street Area. This area was previously remediated in 2002-03 to remove polychlorinated biphenyl (PCB) contaminated sediments and soils from the Acushnet River and surrounding shoreline as part of the overall remediation of the New Bedford Harbor Superfund Site. The objectives of the 2005-06 sampling effort were to evaluate potential changes in sediment total PCB concentrations that may have occurred due to seasonality or dredging/remediation related influences and to provide continued support in mapping out an area of elevated PCB concentrations found in shoreline soils south of River View Park in 2004 (ENSR, 2005). This report is organized into five sections. Background information is provided in Section 1. Details of the methodology of sampling are presented in Section 2. The resulting data are presented in Section 3 and discussed in Section 4. Cited references are included in Section 5. This work was performed by ENSR Corporation and its subcontractor CR Environmental under contract to the USACE (Contract No. DACW33-00-D-0003, Task Order 12).

1.1 Superfund Site Background

New Bedford Harbor is located approximately 50 miles south of Boston on the waters of Buzzards Bay in Bristol County, Massachusetts. The sediments in many areas of the Harbor are contaminated with PCBs and metals, primarily from the manufacture of electrical components which occurred at several areas around the Harbor between the 1940s and the mid-1970s. Based on human health concerns and ecological risk assessments, the U.S. Environmental Protection Agency (USEPA) added New Bedford Harbor to the National Priorities List in 1983 as a designated Superfund Site. A 1998 Record of Decision stipulated that remedial measures were required to remove PCB-contaminated sediments from the Harbor. Through an Interagency Agreement between the USEPA and the U.S. Army Corps of Engineers, New England District (USACE), the USACE is responsible for carrying out the design and implementation of the remedial measures.

The New Bedford Harbor Superfund Site extends from the shallow northern reaches of the Acushnet River estuary, south through the commercial harbor of New Bedford and out beyond the City's hurricane barrier into 17,000 adjacent acres of Buzzards Bay. The Superfund Site is divided into three areas: the Upper, Lower, and Outer Harbors defined by geographic features of the Harbor and gradients of sediment contamination (Figure 1). The industrial discharge of PCB contaminated waste, either directly into the Harbor or indirectly through the City's sewer system, was most significant in the Upper Harbor. The location of the associated PCB discharge and the hydrodynamics of the Harbor contributed to the deposition of significant levels of PCB contamination in the Upper Harbor.

The highest sediment PCB concentrations or "hot-spots", which contained PCB concentrations in excess of 100,000 mg/kg, resided in the sediments located in the immediate area of one discharge in

the Upper Harbor. These "hot-spot" sediments were removed between 1994 and 1995 as part of the USEPA's first cleanup phase (USEPA 1997). Remediation and restoration of wetland and mudflat areas in the northernmost section of the Upper Harbor were performed in 2002-2003 (Tetra Tech FW 2004). Much of the remaining sediment in the Upper Harbor, an area of approximately 190 acres, is still heavily contaminated. Following completion of a sediment dewatering, water treatment, and material handling facility, full-scale dredging was performed in the fall of 2004 and 2005 in the northern portion of the Upper Harbor (Figure 1). The intervals of remedial dredging are expected to continue annually in upcoming years.

1.2 Background on Early Action and North of Wood Street Areas

The Early Action and North of Wood Street Site Areas (abbreviated as EA/NWS Areas) are located in the northern reach of the Acushnet River in Upper New Bedford Harbor (Figure 2). The Early Action Area included approximately 500 feet of shoreline and intertidal area along the eastern side of the river with total PCB concentrations as high as 20,000 mg/kg (TTFW, 2005). The North of Wood Street Area included river sediments and marsh soils along both sides of the Acushnet River extending from the Early Action Area to just south of the Wood Street Bridge (Figures 3 and 4). Sediments and soils in this area had total PCB concentrations as high as 46,000 mg/kg. These areas were prioritized for remediation given their proximity to local residences and shoreline parks.

In May 2001, approximately 2,500 cubic yards of contaminated soil and sediment were excavated from the Early Action Area, and the area was backfilled with clean material and restored with marsh or upland plantings (Figure 3). Remediation activities North of Wood Street were accomplished in the dry; temporary dams were built across the Acushnet to the north and the south, and river flow was diverted through a pump and pipe system. The area was subdivided into six separate compliance demonstration areas based on topography and location. Approximately 15,600 cubic yards of material was excavated in total during the winter months of 2002-03. Shoreline areas were backfilled with clean material, and areas above the low water elevation were restored with marsh or upland plantings (Figure 4). Excavation activities were completed in February 2003, and restoration was completed in the spring of 2003.

Confirmatory soil and sediment samples were collected to determine the endpoint for the remediation of the Early Action and North of Wood Street Areas (TTFW 2004) with the results compared to the cleanup criteria for the site (1 mg/kg for residential intertidal areas [first foot], 10 mg/kg for sub-tidal and mudflat areas and 25 mg/kg for vegetated public access intertidal areas –"beachcombing areas" [first foot]). Sampling was performed in August 2004 to assess potential changes in PCB contamination in marsh soils and river sediments three years following completion of the Early Action effort and a year and a half following completion of the North of Wood Street effort (ENSR, 2005). Results of the August 2004 sampling identified elevated PCB concentrations in river sediments indicating potential recontamination of the area or a potential sampling bias (confirmatory samples following remediation were collected by hand in dry conditions; the 2004 samples were collected by boat using a sediment

grab; ENSR, 2005). The 2004 sampling also identified two locations along the eastern shoreline with elevated PCB concentrations, one in the Early Action Area and one in the North of Wood Street Area. Given the limited extent of elevated PCBs identified in the Early Action Area, no further sampling was required. Follow up sampling was performed at the North of Wood Street Area, and elevated PCB concentrations appeared to extend further along the shoreline south of River View Park. Based on the location of the elevated PCB concentrations (higher in elevation than the previously excavated and restored areas) this area represented an area that had not been included in the previous remediation efforts, rather than recontamination of a clean area (ENSR, 2005).

The sampling summarized in this report includes work performed in May 2005 through January 2006 to further monitor potential changes in river sediments and to fully map the extent of PCB concentrations along the shoreline south of River View Park in preparation for remediation of that area (performed in December 2005).

2.0 METHODS

2.1 Sediment and Soil Sampling

The 2005-06 sampling efforts continued investigations initiated in 2004 (ENSR, 2005) and consisted of two separate components. Sampling of sediments was performed within the Acushnet River at a subset of the stations sampled in 2004 where elevated PCB concentrations had been identified (Figure 5). Sampling was performed in May and September 2005 and January 2006 to evaluate potential seasonal influences on sediment PCB concentrations as well as potential impacts related to the fall 2005 dredging effort. Additional shoreline soil sampling was performed to fully define the spatial extent of contamination that was originally identified in the area of Station C003-013 and south of River View Park in 2004 (Figure 5). This follow up soil sampling was conducted in a series of efforts in May, July, October, and November 2005.

2.1.1 Navigation

The position established for each sediment station is listed on Table 1, and the position for each soil station is listed on Table 2. The coordinate system is NAD-83, Massachusetts State Plane (feet). Navigation to each station was achieved utilizing a Trimble Pro-XRS Differential GPS (DGPS) field unit. The target coordinates for each station were loaded into the Trimble DGPS as a waypoint. Once a station was selected from the navigation menu, the data logger provided range and bearing guidance to the field team to accurately position sampling equipment. The accuracy of the GPS unit guided sampling activities to within approximately 3 feet of the intended target. However, it was necessary to adjust the actual position for sediment sampling stations (as needed) in order to obtain a suitable sample. The initial round of soil stations sampled in May 2005 was located by measuring 25 feet out from the limits of soil contamination determined in 2004. After the sampling point was established, the position was recorded using the GPS unit. The three subsequent rounds of soil sampling were driven by PCB soil data from the previous round of sampling and, in similar fashion, incrementally expanded the spatial boundaries as required.

2.1.2 River Sediments

Sediment collection activities were conducted from an 8 by 12-foot raft platform (Figure 6) equipped with spud poles for station keeping. The raft platform was maneuvered between stations using a Jon-boat. Sampling was performed with a piston type push core sampler (Figure 7) with the collection of samples in hard plastic liners that were decontaminated prior to departure. The core sampler was equipped with a sliding piston designed to ride inside the plastic core liner to assist in recovering an intact sediment-water interface in soft sediments. The core liner and internal piston were secured firmly inside a stainless steel socket assembly that was attached to a T-handled push bar to provide the necessary leverage to drive the core liner to the desired depth and subsequently extract the core liner from the bottom sediment after sample collection.

The general procedure for operation of the piston core sampler was to lower the plastic liner, with the piston sitting just inside the leading edge of the liner, to just above the sediment-water interface. At this point, the line attached to back side of the piston was secured, thus fixing the elevation of the piston with respect to the sediment-water interface. The core liner was pushed into the sediment to the point of refusal, and with the piston held at constant elevation, it effectively slid up in the core barrel as the barrel was being forced into the sediment. The relative motion of the piston thus acts as a syringe, providing negative pressure on the core during retrieval to aid in recovering representative samples with an intact sediment/ water interface.

Once at the surface, the exterior of the core was rinsed with site water. The piston was then extracted from the top of the liner, and the core liner was securely capped at each end (Figure 7). The core sample was labeled, the recovery length was measured, and the particulars of each sample were documented in the field log book. All sampling equipment was washed and decontaminated prior to departing for the next station using a solution of Alconox and tap water. All samples were maintained on ice during field sampling activities and then transferred to a chest freezer for storage at the USACE environmental trailer at the Sawyer Street facility. Frozen core samples were delivered to the project laboratory (Alpha Woods Hole Group), and the top 6 inches of each core was sectioned off and analyzed for total PCBs.

Sediment traps consisted of a weighted plastic bucket which housed a 1-liter Nalgene bottle capped with wide-mouth funnel. The sediment trap was gently lowered to the river bottom by a light line fitted with a marker float. Upon recovery, the Nalgene bottle was removed from the sediment trap and allowed time to settle after which the bottle was weighed and compared to the tare weight of the bottle filled with clean seawater to determine the weight of sediment collected. The deposition rate of sediment recorded by the sediment trap ($mg/m^2/day$) was determined from the recorded weight of sediment collected during the known deployment period across the open area of the funnel. The collection of a sample for PCB analysis was conducted by decanting all the water out of the Nalgene bottle and transferring all the sediment to a glass jar provided by the laboratory (see Section 2.2 for laboratory methods).

2.1.3 Shoreline Soils

Shore-based field sampling was conducted with a stainless-steel AMS Core Soil Sampler using pre-cleaned, removable, butyrate sample liners (6 or 12 inch lengths depending on desired sampling depth). Accessibility to the marsh stations was tidally dependent and was limited to the span of time that was approximately 2 hours either side of low tide. At each station, the sampler was driven to the full penetration depth then carefully removed from the hole (Figure 8). The core liner was then extracted from the core barrel, and sealed at both ends with plastic caps and tape, cleaned, and labeled (Figure 8). The soil sampling approach included the use of new, pre-cleaned core liners at each station. Since soil samples did not come into contact with the core barrel, equipment decontamination was limited to removal of residual soil from the outer core barrel and rinsing with tap water. Soil samples were stored on ice during the field day and transferred to a chest freezer for

storage at the USACE environmental trailer at the Sawyer Street facility. Frozen core samples were delivered to the project laboratory (Alpha Woods Hole Group) and analyzed for PCBs as NOAA 18 congeners or to ESS Laboratory for the analysis of PCBs as Aroclors.

2.2 Laboratory Analyses

Sediment samples selected for analysis were further homogenized at the laboratory, and PCBs were extracted according to EPA's method 3545 (SW-846 method for Pressurized Fluid Extraction). The samples were extracted using a solvent mixture of acetone and dichloromethane and exchanged to hexane for analysis. Diatomaceous earth was also used in the procedure which, along with acetone, desiccates the sample. Extract cleanup steps included activated copper and sulfuric acid before injection to either dual-column GC/ECD or GC/MS instrumentation. Samples selected for homologue analysis were analyzed using LRMS while samples selected for the 18 NOAA congener subset analyses utilized the GC/ECD instrumentation.

Dual-column results were processed as specified in the program QAPP (Jacobs 2005) so that the lowest value obtained between the two columns was reported unless analyst discretion required otherwise (e.g. selecting the result without an interference signal). The final total PCB concentration presented in the results represents the sum of the 18 NOAA congeners multiplied by the New Bedford Harbor translation factor of 2.6. All non-detect results were included in the sum at one-half the laboratory's reporting limit.

Soil samples selected for analysis were delivered to ESS Laboratory for a rapid screening level analysis for the determination of PCB Aroclors by EPA's SW-846 method 8082 by gas chromatography with an electron capture device (GC/ECD). Sample segments selected for analysis were homogenized at ESS, and the samples were extracted according to EPA's SW-846 method 3541 (Automated Soxhlet Extraction) using a 1:1 solvent mixture of acetone and hexane. The hexane/acetone solvent extraction may be more effective as an extraction solvent for PCBs in some environmental samples than the methylene chloride/acetone solvent mixture. Use of hexane/acetone generally reduces the amount of co-extracted interferences and improves the signal-to-noise ratio. Diatomaceous earth was also used in the procedure which, along with acetone, desiccated the sample. Extract clean-up steps taken prior to analysis included activated copper clean-up (SW-846 method 3660B) and sulfuric acid clean-up (SW-846 method 3665A). Positive sample results were confirmed by a secondary column confirmation analysis with the higher of the two results reported, unless analyst discretion required otherwise (e.g. the result without an interference signal was selected).

Further details on sample handling and analytical methods can be found in the Project QAPP (Jacobs 2005).

3.0 RESULTS

3.1 River Sediments

Physical Characteristics

A total of 46 sediment cores were collected over the three separate sampling events (May and September 2005, January 2006). Coordinates of target station locations are presented in Table 1, and the locations are shown in Figure 9. Sediment samples collected from the in-water stations were typically black silt material overlying a layer of olive silt or coarse to medium-grained sand. A description of the sediment samples collected is presented in Table 3. The black silt layer composed the top 2 to 6 inch layer for most of the stations. Many of the collected sediments had a faint to mild hydrogen sulfide odor.

PCB Concentrations

The results of PCB analysis for the three 2005-06 sediment sampling efforts are presented together in Table 4 and individually on Figure 10 (May 2005), Figure 11 (September 2005), and Figure 12 (January 2006). Previous sampling efforts are also presented in Table 4; post remediation PCB concentrations ranged from less than 1 to 20 mg/kg, and August 2004 sediment sampling showed elevated PCB concentrations throughout the river (22 to 160 mg/kg). Eight locations sampled in August 2004 were revisited in May 2005, and PCB concentrations ranged from 4 to 81 mg/kg. Twelve locations (including five previously sampled in May 2005) were sampled in September 2005, prior to the start of dredge operations in the Upper Harbor, and PCB concentrations ranged from less than 1 to 82 mg/kg. These 12 locations were resampled in January 2006, 45 days after the completion of 2005 dredging operations, and total PCB concentrations ranged from 1 to 187 mg/kg. A complete record of the analytical results is provided in Appendix A.

A sediment trap was deployed at a location just north of the Wood Street Bridge once nearing the end of the 2005 dredging and once following completion of dredging and demobilization activities (Table 5). The total PCB concentration in the sample collected while dredging was ongoing was 41 mg/kg, and the concentration in the sample collected following completion of dredging activities was 267 mg/kg (Table 5); it is worth noting that the deployment period (11/21 through 12/07/05) partially overlapped the timeframe of the Acushnet shoreline remediation (initiated in December 2005).

3.2 Shoreline Soils

Physical Characteristics

A total of 36 core samples of the top 6 inches of soil were collected over five separate sampling events (January, May, July, October, and November 2005). Coordinates of target station locations are presented in Table 2, and the locations are shown in Figure 13. Soils samples recovered from the eastern shoreline of the Acushnet River south of River View Park were typically highly organic marsh soils, ranging in characteristics from a sandy loam to medium to dark brown peat with organic fibers visible in many samples. Given the remediation/restoration completed in this area in 2002-03, some samples collected along, or in the vicinity of the remediation boundary had characteristics of an engineered sandy loam mixture. A description of the soil samples collected is presented in Table 6.

PCB Concentrations

The results of the five individual soil sampling efforts are presented in Table 7 and are presented on Figure 14. Total PCB concentrations were calculated by multiplying the sum of NOAA 18 congeners by the New Bedford Harbor translation factor of 2.6. For the samples submitted for a rapid assessment of PCB Aroclors, the total PCB concentration was determined by summing the results of the individual Aroclors. A complete record of the analytical results is provided in Appendix A.

From the point of elevated PCB concentrations found at Station C003-013RMc (910 mg/kg) in 2004 (ENSR, 2005), four additional stations (C003-013RMcN, C003-013RMcE, C003-013RMcS, and C003-013RMcW) were sampled in January 2005. PCB concentrations ranged from 1 to 2550 mg/kg in the top 6 inch segment, with the peak value observed at station C003-013RMcN. Visible surface staining, similar to that shown in Figure 14, was associated with the elevated PCB concentrations. The spatial extent of sampling was expanded to stations 05-NWS-01 to 05-NWS-12 in May 2005. The PCB concentrations for this second round of sampling ranged from 1 to 4200 mg/kg in the top 6 inches, prompting additional characterization of the area.

Stations 05-NWS-13 through 05-NWS-23 were sampled in July 2005. Stations north of the drainage swale (05-NWS-13 through 05-NWS-17) had total PCB concentrations ranging from less than 1 to 13 mg/kg. Stations south of the drainage swale (05-NWS-18 to 05-NWS-23) had PCB concentrations ranging from 1 to 166 mg/kg, with the peak value observed at station 05-NWS-22 (Figures 13 and 14).

In October 2005, a 12 inch sample was collected at Stations 05-NWS-24 through 05-NWS-28 to determine PCB concentrations around a stand of mature trees. A visible oily sheen was present in these areas during the sampling event (Figure 14). PCB concentrations in the top 6 inch segments ranged from less than 1 to 103 mg/kg and less than 1 to 251 mg/kg in the 6 to 12 inch segments. A final round of sampling conducted in November 2005 collected 12 inch cores from stations 05-NWS-29

through 05-NWS-32 (Figure 13). PCB concentrations ranged from 1 to 33 mg/kg in the top 6 inch segments and ranged from less than 1 to 39 mg/kg in the 6 to 12 inch segments.

3.3 Data QC and Database Entry

Upon data receipt from the laboratory, ENSR provided a cursory review for completeness and loaded the data into a temporary database for use in draft data reporting. ENSR also performed a quick check of the QC sample results from the temporary database to evaluate overall data quality before transmitting the data to the program database. Electronic files of the hardcopy laboratory reports were generated and provided to Battelle Ocean Sciences for subsequent data validation efforts and uploading into the Project database.

4.0 DISCUSSION

The sediment and soil sampling that was performed in the North of the Wood Street Bridge Area of Upper New Bedford in 2005-06 had two distinct objectives: 1) to evaluate potential changes in sediment PCB concentrations that may have occurred due to seasonal or dredging related influences; and 2) to provide continued support in mapping out an area of elevated PCB concentrations identified in shoreline soils south of River View Park on the Acushnet side of the river in 2004 (ENSR, 2005). Results of the separate sampling efforts are discussed below.

4.1 River Sediments

River sediment PCB data collected in 2005-06 were compared to previous sediment data collected in 2004 and to sediment data collected after the completion of remediation efforts in 2002-03. These data are presented together in Table 4 along with summary statistics. Lowest concentrations were found in the 2002-03 sampling immediately following completion of the remediation effort, with both the median and mean values well below the cleanup criterion of 10 mg/kg (total PCBs) designated for subtidal sediments. For this initial confirmatory sampling, an upper 6 inch composite sample was collected in the dry at each station prior to reflooding of the waterway.

In August 2004, a Ponar grab sampler was used to collect surficial sediments, and a 6 inch subsample was collected from each grab for analysis. This sampling was performed prior to the start of the 2004 remedial dredge season. Total PCB concentrations were approximately ten times higher than for the 2002-03 sampling with a mean of 54 mg/kg (Table 4), and with the elevated concentrations distributed throughout the sampled area (Figure 5). Factors that were considered to have potentially contributed to this change in concentration included sampling bias (subsampling the grab may have weighted the sample to more fine material as compared to the surficial samples collected in the dry in freezing condition as the endpoint of the remediation effort) or recontamination of the area with residual sediment left from the EA/NWS remediation or with sediment from the highly contaminated area of the Upper Harbor to the south of the remediated area.

Based on the 2004 sampling data, it was decided that future sampling of river sediments in the area would be performed using a push core with the upper 6 inches submitted for analysis. A subset of the stations were sampled in May 2005 using this technique, and PCB concentrations were significantly less, with a mean of 22 mg/kg and a median of 9.9 mg/kg total PCBs (Table 4, Figure 10). Sampling was performed in September 2005 prior to the start of the 2005 remedial dredging, and concentrations had decreased further, with a mean of 16 mg/kg and median of 3.4 mg/kg total PCBs (Table 4, Figure 11). Core sampling of river sediments was performed again in January 2006 following completion of the 2005 remedial dredging (approximately one-half mile south of the Wood Street Bridge, Figure 1) and completion of the shoreline remedial excavation that was performed adjacent to

the study area (Figure 15). PCB concentrations increased at most locations, with the overall mean increasing to 30 mg/kg and the median increasing to 10 mg/kg (Table 4, Figure 15).

The time history of PCB concentration was plotted for five stations spanning approximately 400 feet of the river to better view the changes over time (Figure 16). The plots show that the maximum PCB concentration was measured in the August 2004 sample for four of the five stations, with concentrations dropping through September 2005 and increasing somewhat or remaining nearly constant in January 2006. For the fifth station, C006-040, concentrations remained elevated at 70+ mg/kg for the August 2004 through September 2005 samples and increased further to 190 mg/kg in the January 2006 sample.

Some of the changes in sediment concentration noted above may be related to spatial variability of PCB concentration, i.e., concentration distribution is patchy and can vary significantly over short distances. However, the changes in concentration, particularly those for the last three events performed using identical sampling techniques, suggest a relatively dynamic sediment system within the main portion of the river channel. Sampling that proved successful at a given location during one event had to be moved in follow up events for some stations because redistribution of sediments had left exposed hard bottom that could not be hand cored.

Factors that could have contributed to the increase in PCB concentrations between the September 2005 and January 2006 sampling include normal redistribution of sediment within the Upper Harbor, transport of suspended material from the dredging that took place from late September to November approximately one-half mile south of the Wood Street Bridge, and release of material during the remedial excavation along the eastern shoreline of the river performed in November and December (Figure 15). Ongoing transport of contaminated sediments under normal (non-remediation) conditions has been established at locations further south in the Upper Harbor (ENSR, 2006), but no baseline data exist for the North of Wood Street Area. Although monitoring of the dredging operations in 2005 demonstrated nearfield release and deposition of suspended sediment with associated PCB contamination (ENSR, 2006), the limited sediment trap data for the North of Wood Street Area revealed movement of sediment with higher PCB concentrations during the period following completion of dredging when shoreline excavation was ongoing in the area (270 mg/kg during shoreline excavation vs. 41 mg/kg during dredging operations; Table 5, Figure 15). The potential influence of the eastern shoreline soil contamination on river sediments is further supported by the location of the highest sediment concentrations measured in the January 2006 sampling (located immediately adjacent to and down river of the shoreline area with elevated PCB concentrations).

4.2 Shoreline Soils

The combined rounds of shoreline sampling and analysis revealed two areas of soil with elevated PCB concentrations, one area approximately 130 feet in length and 40 feet in width just south of River View Park and a smaller area approximately 150 feet further south along the eastern shore (Figure 15).

These two areas had not been included in the 2002-03 NWS cleanup due to the lack of characterization data for them (at that time, the area had been thickly vegetated), and thus the areas do not represent areas of recontamination. These areas were excavated, and soils were transported for off-site disposal in December 2005 by Jacobs Engineering.

5.0 REFERENCES

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TABLES

Table 1

Station Coordinates – May 2005, September 2005, and January 2006 Sediment Sampling Stations at the North of Wood Street Area

Date Sampled	Station ID	Easting	Northing
5/11/2005	C006-023	815415.463	2708821.773
5/11/2005	C006-028	815403.060	2708710.097
5/11/2005	C006-033	815415.725	2708618.023
5/11/2005	C006-034	815455.801	2708622.483
5/11/2005	C006-039	815413.280	2708518.878
5/11/2005	C006-040	815467.033	2708520.557
5/11/2005	C006-048	815418.918	2708388.645
5/11/2005	C006-049	815469.892	2708409.095
9/6/2005	C006-023	815416.976	2708810.128
9/6/2005	C006-028	815415.989	2708710.397
9/6/2005	C006-033	815412.697	2708613.814
9/6/2005	C006-038	815389.933	2708520.813
9/6/2005	C006-040	815457.297	2708509.956
9/7/2005	C006-010	815353.616	2709106.631
9/7/2005	C006-016	815402.356	2708975.106
9/7/2005	C006-030W	815498.698	2708682.575
9/7/2005	C006-030E	815363.074	2708653.127
9/7/2005	C006-049	815491.224	2708390.753
9/7/2005	C006-055	815459.050	2708259.545
9/7/2005	C006-062	815558.685	2708163.465
1/11/2006	C006-010	815381.861	2709110.881
1/11/2006	C006-016	815416.192	2708973.021
1/11/2006	C006-023	815416.930	2708822.218
1/11/2006	C006-028	815413.147	2708726.724
1/11/2006	C006-030W	815393.223	2708646.346
1/11/2006	C006-030E	815483.841	2708684.013
1/11/2006	C006-033	815414.707	2708622.195
1/11/2006	C006-038	815371.712	2708532.214
1/11/2006	C006-040	815491.205	2708523.249
1/11/2006	C006-049	815478.675	2708410.563
1/11/2006	C006-055	815461.507	2708267.224
1/11/2006	C006-062	815558.742	2708177.009

Notes: Geographic Reference: NAD 83 Massachusetts State Plane Mainland FIPS 2001 Feet

Table 2

Station Coordinates – January - November 2005 Soil Sampling Stations at the North of Wood Street Area

Date Sampled	Station ID	Easting	Northing
1/13/2005	C003-013RMcN	815495.99	2708835.12
1/13/2005	C003-013RMcE	815522.55	2708820.21
1/13/2005	C003-013RMcS	815505.08	2708784.34
1/13/2005	C003-013RMcW	815477.82	2708806.23
5/9/2005	05-NWS-01	815532.634	2708825.524
5/9/2005	05-NWS-02	815517.705	2708833.236
5/9/2005	05-NWS-03	815513.308	2708843.528
5/9/2005	05-NWS-04	815527.126	2708852.015
5/9/2005	05-NWS-05	815492.137	2708860.524
5/9/2005	05-NWS-06	815508.834	2708869.766
5/9/2005	05-NWS-07	815521.796	2708874.232
5/9/2005	05-NWS-08	815488.700	2708878.873
5/9/2005	05-NWS-09	815510.873	2708885.586
5/9/2005	05-NWS-10	815498.238	2708896.316
5/9/2005	05-NWS-11	815500.814	2708799.483
5/9/2005	05-NWS-12	815520.301	2708797.043
7/8/2005	05-NWS-13	815539.334	2708801.482
7/8/2005	05-NWS-14	815516.316	2708767.867
7/8/2005	05-NWS-15	815542.701	2708775.658
7/8/2005	05-NWS-16	815518.400	2708750.470
7/8/2005	05-NWS-17	815541.633	2708758.321
7/8/2005	05-NWS-18	815521.457	2708723.663
7/8/2005	05-NWS-19	815544.183	2708726.875
7/8/2005	05-NWS-20	815548.589	2708703.658
7/8/2005	05-NWS-21	815524.793	2708697.259
7/8/2005	05-NWS-22	815552.123	2708678.047
7/8/2005	05-NWS-23	815529.251	2708667.969
10/13/2005	05-NWS-24	815531.058	2708773.402
10/13/2005	05-NWS-25	815530.853	2708786.763
10/13/2005	05-NWS-26	815519.633	2708784.983
10/13/2005	05-NWS-27	815526.901	2708796.750
10/13/2005	05-NWS-28	815523.937	2708803.800
11/2/2005	05-NWS-29	815532.651	2708653.206
11/2/2005	05-NWS-30	815532.186	2708661.505
11/2/2005	05-NWS-31	815543.734	2708667.555
11/2/2005	05-NWS-32	815541.399	2708690.682

Notes: Geographic Reference: NAD 83 Massachusetts State Plane Mainland FIPS 2001 Feet

Table 3

Description of Sediment Samples Recovered from the North of Wood Street Area During the 2005-06 Sampling Effort

Date Sampled	Station ID	Recovery (inches)	Description
5/11/2005	C006-023	13.5	2" black silt over 11.5" of olive silt. Mild H2S odor.
5/11/2005	C006-028	16	4" black silt over 12" of olive silt. Mild H2S odor.
5/11/2005	C006-033	17.5	7" black silt over 3" of black sand and 7.5" of brown sand. Mild H2S odor.
5/11/2005	C006-034	14.5	7" black silt over 7.5" of olive grey silt with shell hash. Mild H2S odor.
5/11/2005	C006-039	17	6" black silt over 11" of olive grey silt. Moderate H2S odor.
5/11/2005	C006-040	10	2" black silt over 8" of olive grey silt. No H2S odor.
5/11/2005	C006-048	7.5	Top 3" black silt over 2" of black silty sand and 2.5" of olive grey silt
5/11/2005	C006-049	9	4" black silt over 5" of olive grey silt.
9/6/2005	C006-023	13	3.5" black silt over 3.5" transition zone (black silt and olive brown sediment mix) and 6" olive brown sediment. H2S odor.
9/6/2005	C006-028	9	1.5" black silt over 2" transition zone (black silt and olive brown sediment mix) and 5.5" olive brown sediment.
9/6/2005	C006-033	12	1.5" black silt over 3" of coarse sand olive sediment and 7.5" of brown olive sediment.
9/6/2005	C006-038	8	4" black silt over 1" of coarse sandy brown sediment with silt and 3" sandy coarse brown sediment.
9/6/2005	C006-040	11	6" black silt over 5" dark olive silt with black silty clay.
9/7/2005	C006-010	7	Black silt.
9/7/2005	C006-016	5.5	Dark brown olive silty sediment.
9/7/2005	C006-030W	6	Brown sandy loam.
9/7/2005	C006-030E	6	Brown sandy loam with plant material.
9/7/2005	C006-049	13	3" black silt over 4" transition zone (black silt and olive brown sediment mix) and 6" olive sediment.
9/7/2005	C006-055	6	2.5" black silt over 3.5" of brown coarse sand.
9/7/2005	C006-062	10.5	2" black silt over 8.5" of olive brown material with sand.
1/11/2006	C006-010	10	Coarse sand and gravel
1/11/2006	C006-016	7	Coarse sand and gravel with fine material
1/11/2006	C006-023	9.5	Top 1.5" black silt over 8" of olive colored sediment
1/11/2006	C006-028	14	Black silt over 9" of olive sediment
1/11/2006	C006-030W	6	3" black silt over 3" of olive sediment
1/11/2006	C006-030E	6	3" black silt over 3" of olive sediment
1/11/2006	C006-033	8	Dark olive sediment mixed with black silt over 2" of olive colored fine sand
1/11/2006	C006-038	11	1" black silt over coarse to fine sands
1/11/2006	C006-040	8	2" of black silt over olive sediment
1/11/2006	C006-049	13	2" of black silt over olive sediment
1/11/2006	C006-055	12	6" of black silt over olive sediment
1/11/2006	C006-062	14.5	Olive sediment

Table 4

Total PCB Concentrations for Sediment Samples Collected from the Acushnet River in the North of Wood Street Area

Station ID	February 2003 PCB Concentration (mg/kg)	August 2004 PCB Concentration (mg/kg)	May 2005 PCB Concentration (mg/kg)	September 2005 PCB Concentration (mg/kg)	January 2006 PCB Concentration (mg/kg)
C006-010	6.1	20	-	82	1
C006-016	4.6	13	-	18	16
C006-023	8.3	22	4	2	4
C006-028	0.5	63	10	0.2	11
C006-030	4.8	63	-	-	-
C006-030E	-	-	-	0.7	89
C006-030W	-	-	-	0.4	5
C006-033	0.4	65	22	1	17
C006-034	20	71	10	-	-
C006-038	0.5	36	-	5	9
C006-039	0.5	64	5	-	-
C006-040	2.9	72	81	73	187[3]
C006-048	0.4	23	9	-	-
C006-049	12	160	37	6	4
C006-055	0.4	61	-	7	20
C006-062	7.4	19	-	0.9	1
Mean	4.9	54	22	16	30
Median	3.8	62	9.9	3.4	10

Notes:

1. Reported concentrations are total PCB based on the sum of NOAA-18 congeners multiplied by the New Bedford Harbor translation factor of 2.6
2. All samples represent a composite of the top 6" of sediment. The August 2004 samples were collected by grab sampler and all 2005 samples were collected by push core device. February 2003 represent post-remediation PCB concentrations for samples that were collected in the dry prior to restoring normal river flows
3. January 2006 sample collected at Station C006-040 was approximately 30 feet closer to the Acushnet shoreline, which may have been impacted by the December 2005 intertidal clean-up.

Table 5

Total PCB Concentration in Sediment Trap Samples from North of Wood Street Bridge, Fall 2005

Station ID	Date Deployed	Date Collected	Number of Days Deployed	Number of Dredge Days	Total PCB* mg/Kg
During Dredging					
NWS-ST-1	11/8/2005	11/21/2005	14	7	41
After Dredging					
NWS-ST-1	11/21/2005	12/07/2005	17	0	267**

Notes:

* (18 NOAA Congeners) x (Site specific 2.6 multiplier)

** Sample volume too small to perform final % moisture test, sample results based on assumed 100% solids and results may be biased low. After dredging sample had a deployment period which briefly overlapped with the Acushnet shoreline clean-up effort initiated in December 2005.

N/A = No data available

Table 6

Description of Soil Samples Recovered from the North of Wood Street Area during the 2005 Sampling Effort

Date Sampled	Station ID	Core Size (inches)	Description
1/13/2005	C003-013RMcN	6	Engineered organic sandy loam matrix with a well drained substrate.
1/13/2005	C003-013RMcE	6	Engineered organic sandy loam matrix with a well drained substrate.
1/13/2005	C003-013RMcS	6	Engineered organic sandy loam matrix with a well drained substrate.
1/13/2005	C003-013RMcW	6	Engineered organic sandy loam matrix with a well drained substrate.
5/9/2005	05-NWS-01-0.0-0.5	6	Engineered organic sandy loam matrix with a well drained substrate.
5/9/2005	05-NWS-02-0.0-0.5	6	Engineered organic sandy loam matrix with a well drained substrate.
5/9/2005	05-NWS-03-0.0-0.5	6	Engineered organic sandy loam matrix with a well drained substrate.
5/9/2005	05-NWS-04-0.0-0.5	6	Engineered organic sandy loam matrix with a well drained substrate.
5/9/2005	05-NWS-05-0.0-0.5	6	Sandy loam with root fibers.
5/9/2005	05-NWS-06-0.0-0.5	6	Sandy loam with root fibers.
5/9/2005	05-NWS-07-0.0-0.5	6	Light to medium brown sandy peat.
5/9/2005	05-NWS-08-0.0-0.5	6	Medium brown peat with some fine sand.
5/9/2005	05-NWS-09-0.0-0.5	6	Sandy loam with wood chips.
5/9/2005	05-NWS-10-0.0-0.5	6	Medium brown sandy loam with root fibers.
5/9/2005	05-NWS-11-0.0-0.5	6	Engineered organic sandy loam matrix with a well drained substrate.
5/9/2005	05-NWS-12-0.0-0.5	6	Dark brown sandy peat.
7/8/2005	05-NWS-13-0.0-0.5	6	Dark brown organic material with root debris.
7/8/2005	05-NWS-14-0.0-0.5	6	Medium brown material, loam with fine sand.
7/8/2005	05-NWS-15-0.0-0.5	6	Organic material, dark to medium brown, some fine sand and some reddish mottles.
7/8/2005	05-NWS-16-0.0-0.5	6	0-2" black to dark brown loam with fine sand, 2-6" medium brown loam with fine sand.
7/8/2005	05-NWS-17-0.0-0.5	6	0-1.5" medium brown organic material with fine sand, 1.5-6" dark brown organic material.
7/8/2005	05-NWS-18-0.0-0.5	6	Dark brown loam with fine sand.
7/8/2005	05-NWS-19-0.0-0.5	6	Dark brown organic material, some fine sand, with root debris.
7/8/2005	05-NWS-20-0.0-0.5	6	Loose dark brown loam, with organic matter.
7/8/2005	05-NWS-21-0.0-0.5	6	Medium/ dark brown organic material, some fine sand.
7/8/2005	05-NWS-22-0.0-0.5	6	Loose dark brown loam, with organic matter.
7/8/2005	05-NWS-23-0.0-0.5	6	Loose dark brown loam, with organic matter.
10/13/2005	05-NWS-24-0.0-0.5	12	Dark brown sandy loam with organic material.
10/13/2005	05-NWS-24-0.5-1.0	12	Dark brown sandy loam with organic material.
10/13/2005	05-NWS-25-0.0-0.5	12	Dark brown sandy loam peat.
10/13/2005	05-NWS-25-0.5-1.0	12	Peat with organic material.
10/13/2005	05-NWS-26-0.0-0.5	12	Dark brown sandy peat.
10/13/2005	05-NWS-26-0.5-1.0	12	Dark brown sandy peat.
10/13/2005	05-NWS-27-0.0-0.5	12	Dark brown sandy loamy peat.
10/13/2005	05-NWS-27-0.5-1.0	12	Dark brown sandy loamy peat.
10/13/2005	05-NWS-28-0.0-0.5	12	Dark brown peaty sand.
10/13/2005	05-NWS-28-0.5-1.0	12	Tan sandy loam.
11/2/2005	05-NWS-29-0.0-0.5	12	Dark to light brown sandy loam with organic material.
11/2/2005	05-NWS-29-0.5-1.0	12	Dark brown loam with coarse sand.
11/2/2005	05-NWS-30-0.0-0.5	12	Dark brown sandy loam with organic material.
11/2/2005	05-NWS-30-0.5-1.0	12	Dark brown sandy loam with organic material.
11/2/2005	05-NWS-31-0.0-0.5	12	Dark brown sandy loam with organic material.
11/2/2005	05-NWS-31-0.5-1.0	12	Light brown loam with fine sands.
11/2/2005	05-NWS-32-0.0-0.5	12	Light to medium brown sandy loam with organic material.
11/2/2005	05-NWS-32-0.5-1.0	12	Dark brown loam with fine sands.

Table 7

Total PCB Concentrations in North of Wood Street Area Soil Samples Collected in 2005

Date Sampled	Station ID	PCB Concentration (mg/kg)
1/13/2005	C003-013RMcN	2550
1/13/2005	C003-013RMcE	30
1/13/2005	C003-013RMcS	1
1/13/2005	C003-013RMcW	1
5/9/2005	05-NWS-01-0.0-0.5	9
5/9/2005	05-NWS-02-0.0-0.5	28
5/9/2005	05-NWS-03-0.0-0.5	129
5/9/2005	05-NWS-04-0.0-0.5	12
5/9/2005	05-NWS-05-0.0-0.5	4200
5/9/2005	05-NWS-06-0.0-0.5	14
5/9/2005	05-NWS-07-0.0-0.5	1
5/9/2005	05-NWS-08-0.0-0.5	239
5/9/2005	05-NWS-09-0.0-0.5	8
5/9/2005	05-NWS-10-0.0-0.5	12
5/9/2005	05-NWS-11-0.0-0.5	1
5/9/2005	05-NWS-12-0.0-0.5	373
7/8/2005	05-NWS-13-0.0-0.5	1
7/8/2005	05-NWS-14-0.0-0.5	< 1
7/8/2005	05-NWS-15-0.0-0.5	13
7/8/2005	05-NWS-16-0.0-0.5	1
7/8/2005	05-NWS-17-0.0-0.5	8
7/8/2005	05-NWS-18-0.0-0.5	**3**
7/8/2005	05-NWS-19-0.0-0.5	**3**
7/8/2005	05-NWS-20-0.0-0.5	**25**
7/8/2005	05-NWS-21-0.0-0.5	**1**
7/8/2005	05-NWS-22-0.0-0.5	**166**
7/8/2005	05-NWS-23-0.0-0.5	**10**
10/13/2005	05-NWS-24-0.0-0.5	26
10/13/2005	05-NWS-24-0.5-1.0	251
10/13/2005	05-NWS-25-0.0-0.5	103
10/13/2005	05-NWS-25-0.5-1.0	26
10/13/2005	05-NWS-26-0.0-0.5	< 1
10/13/2005	05-NWS-26-0.5-1.0	< 1
10/13/2005	05-NWS-27-0.0-0.5	67
10/13/2005	05-NWS-27-0.5-1.0	48
10/13/2005	05-NWS-28-0.0-0.5	65
10/13/2005	05-NWS-28-0.5-1.0	2
11/2/2005	05-NWS-29-0.0-0.5	**13**
11/2/2005	05-NWS-29-0.5-1.0	**6**
11/2/2005	05-NWS-30-0.0-0.5	**33**
11/2/2005	05-NWS-30-0.5-1.0	**39**
11/2/2005	05-NWS-31-0.0-0.5	**1**
11/2/2005	05-NWS-31-0.5-1.0	**< 1**
11/2/2005	05-NWS-32-0.0-0.5	**3**
11/2/2005	05-NWS-32-0.5-1.0	**< 1**

Notes: 1. Reported concentrations are total PCBs based on the sum of NOAA-18 congeners multiplied by the New Bedford Harbor translation factor of 2.6. Bold numbers represent total PCBs based on sum of Aroclors.

2. All samples collected with push core device

FIGURES

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Figure 1 - New Bedford Harbor Overview Showing Early Action / North of Wood Street Areas

Sources:MassGIS 2-m orthophotos
NAD 83 Mass State Plane m
Date: 03.02.06

Dredged Areas
- 2005 Area - A
- 2005 Area - B
- 2004 DMU-2

ENSR AECOM

0 0.25 0.5 1 Miles

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Figure 2. Early Action and North of Wood Street Areas

Sources: MassGIS 2-m orthophotos (20 Nov 2003)
NAD 83 Mass State Plane ft
Date: 02.09.06

Early Action Area remediated in 2001

Area remediated as part of North of Wood Street effort in 2002-03

0 62.5 125 250 375 500 Feet

ENSR AECOM

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Figure 3. Early Action Area (Foreground) and Acushnet River Following Remediation and Restoration (looking south - 2002)

Figure 4. Acushnet River and North of Wood Street Area After Remediation (eastern bank, looking north – August 2004)

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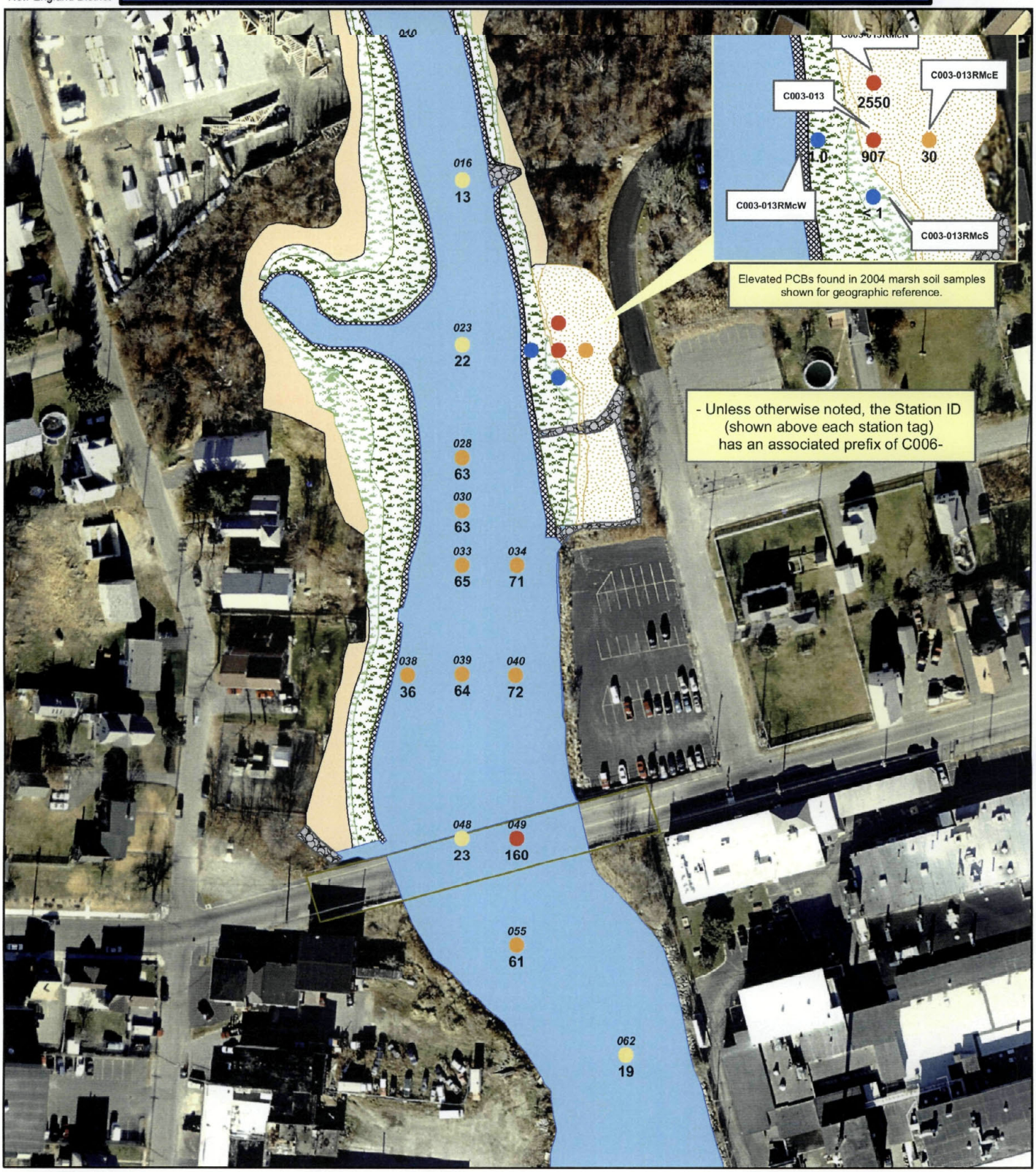

Figure 5. North of Wood Street Sediment Sampling Locations - 2004

Sources: MassGIS 2-m orthophoto
NAD 83 Mass State Plane Feet
Date: 08.01.06

Note: -Sediment samples collected in August 2004
-Soil samples collected in August 2004 and January 2005

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0 25 50 100 150 200 Feet

Habitat Cover Type

- High Marsh Planting
- Low Marsh Planting
- Phragmites Removal Area
- Upland Seed Mix
- Rip-Rap
- River
- Toe Stone

PCB Concentration (mg/kg)*

- 0.0 - 1.0
- 1.1 - 10.0
- 10.1 - 25.0
- 25.1 - 100.0
- > 100.1

* Based on sum of NOAA Congeners * 2.6

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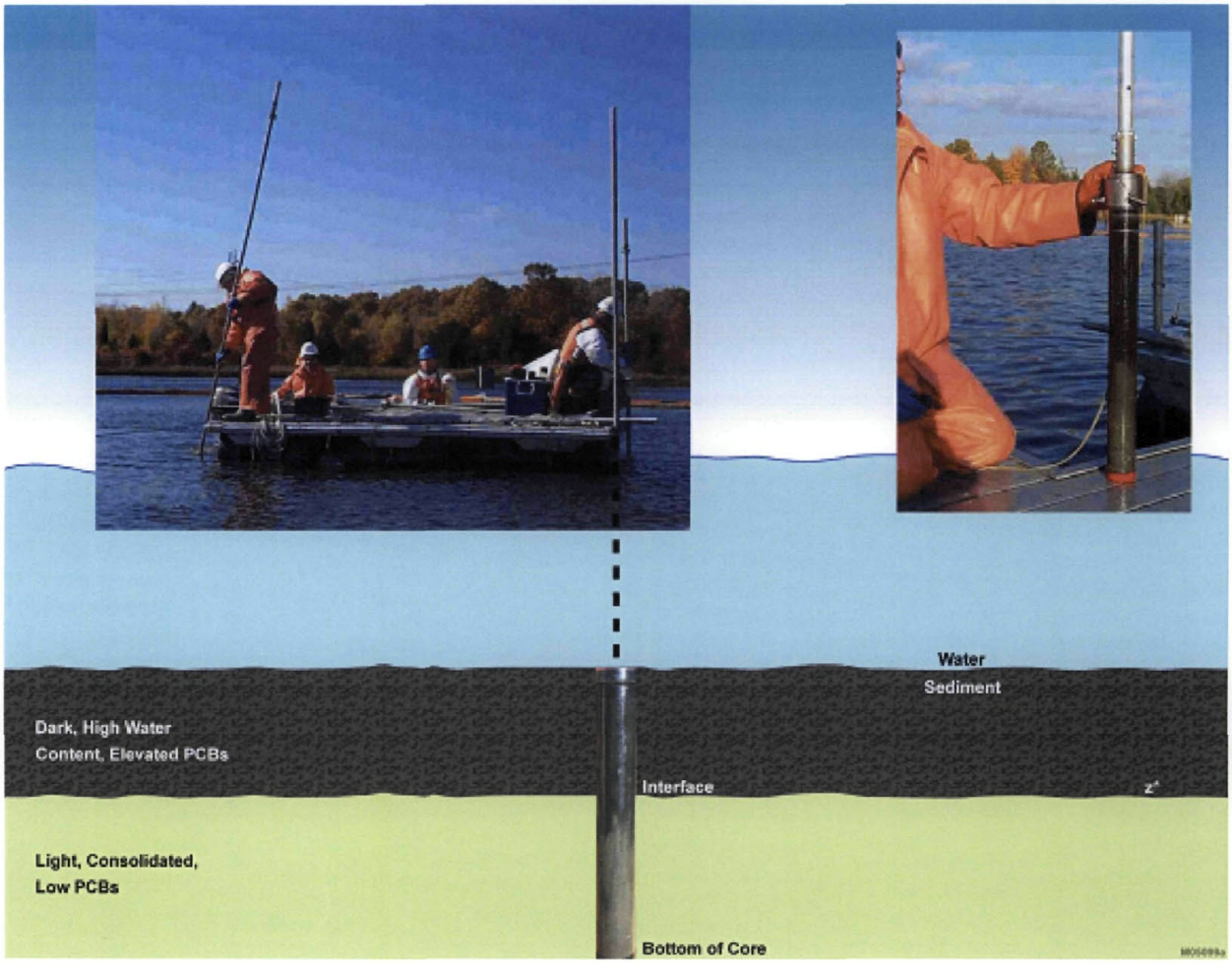
Figure 6. Coring Approach for Harbor Sediments



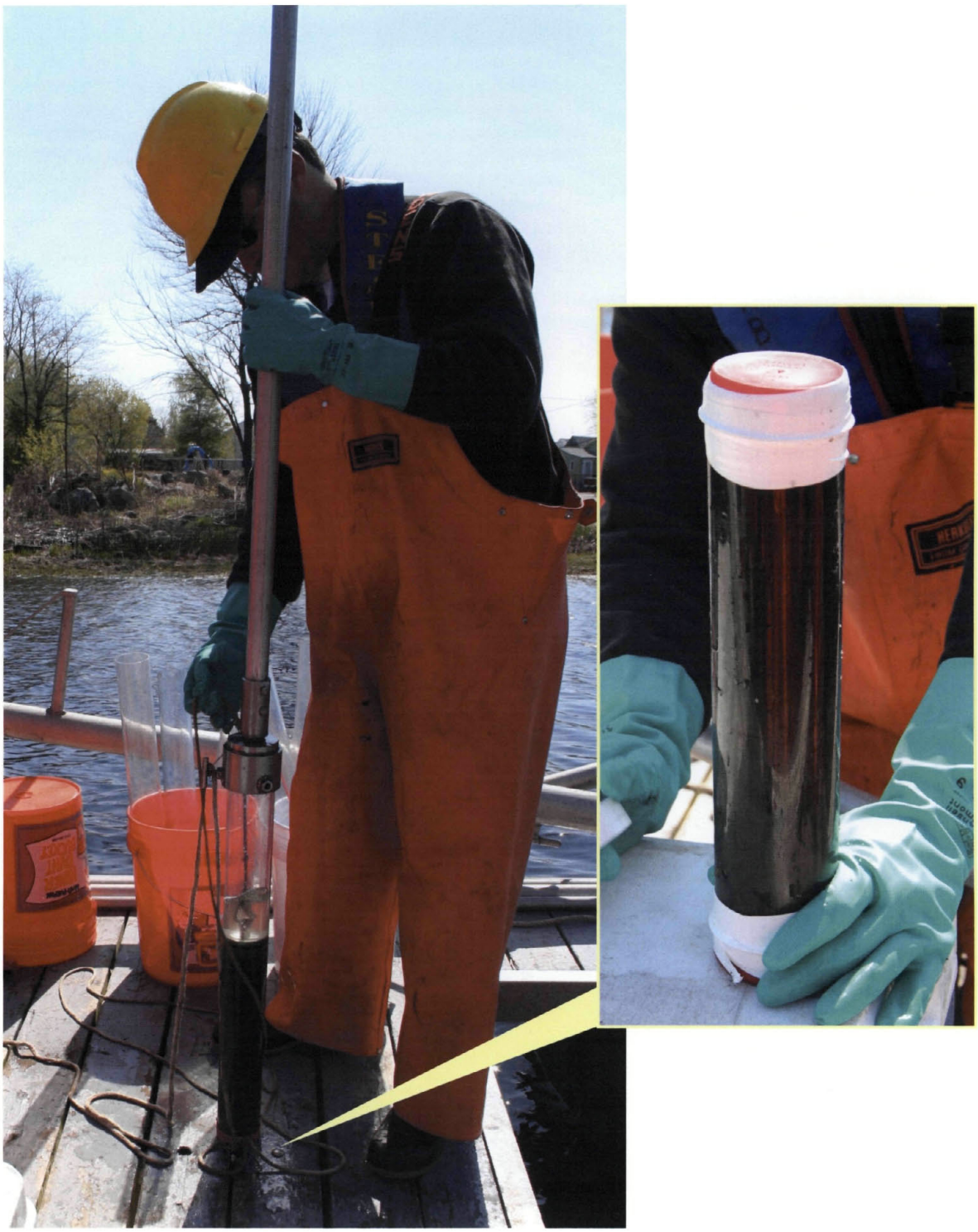


Figure 8. Push Core Sampler and Typical Soil Core at Station 05-NWS-2 – July 2005

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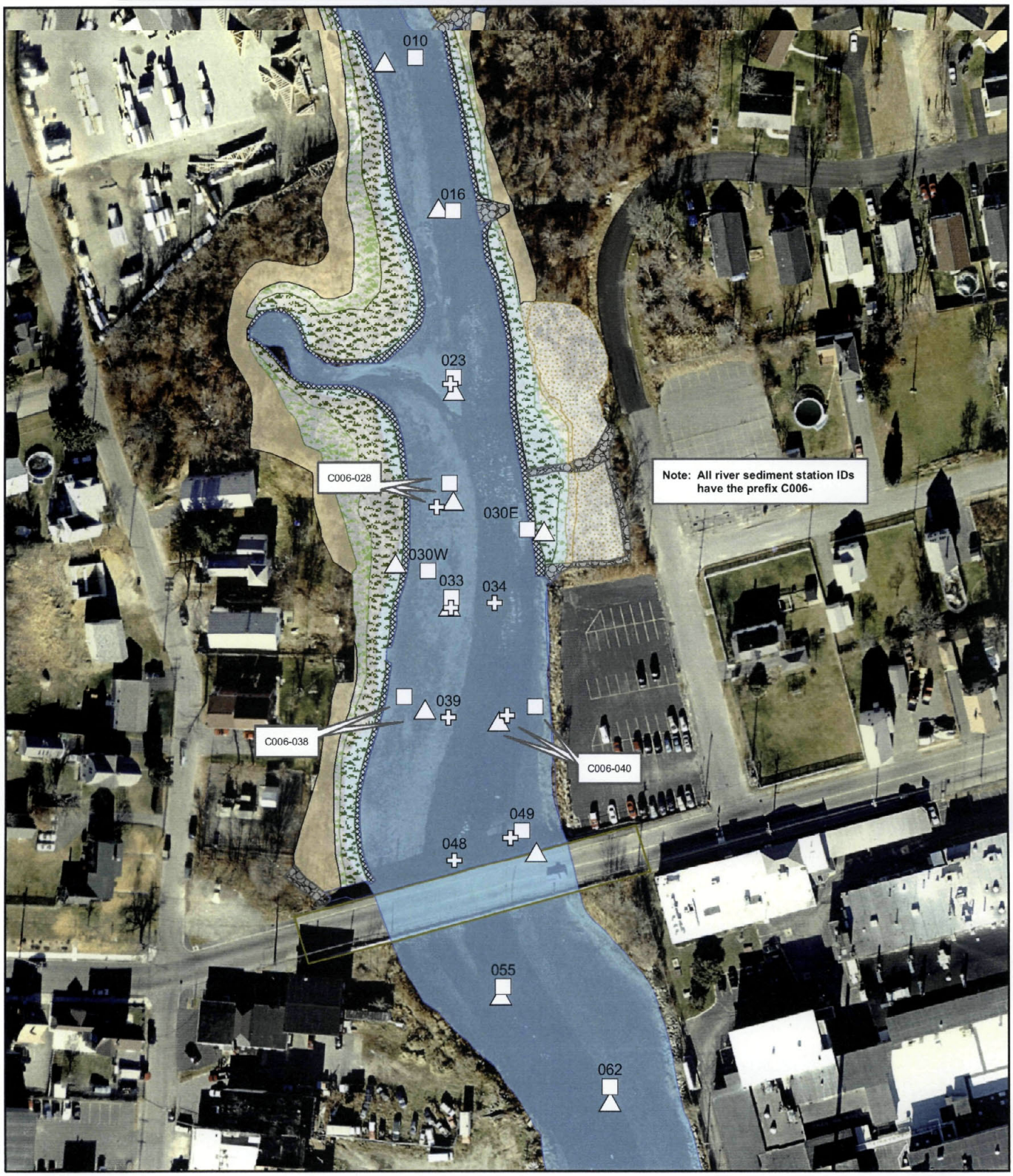

Figure 9. North of Wood Street Sediment Sampling - 2005-06 Locations - Acushnet River

Sources: MassGIS 2-m orthophoto
NAD 83 Mass State Plane Feet
Date: 08.01.06

May 2005 Sampling Stations
September 2005 Sampling Stations
January 2006 Sampling Stations

Habitat Cover Type

High Marsh Planting
Low Marsh Planting
Phragmites Removal Area
Upland Seed Mix
Rip-Rap
River
Toe Stone

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0 25 50 100 150 200 Feet

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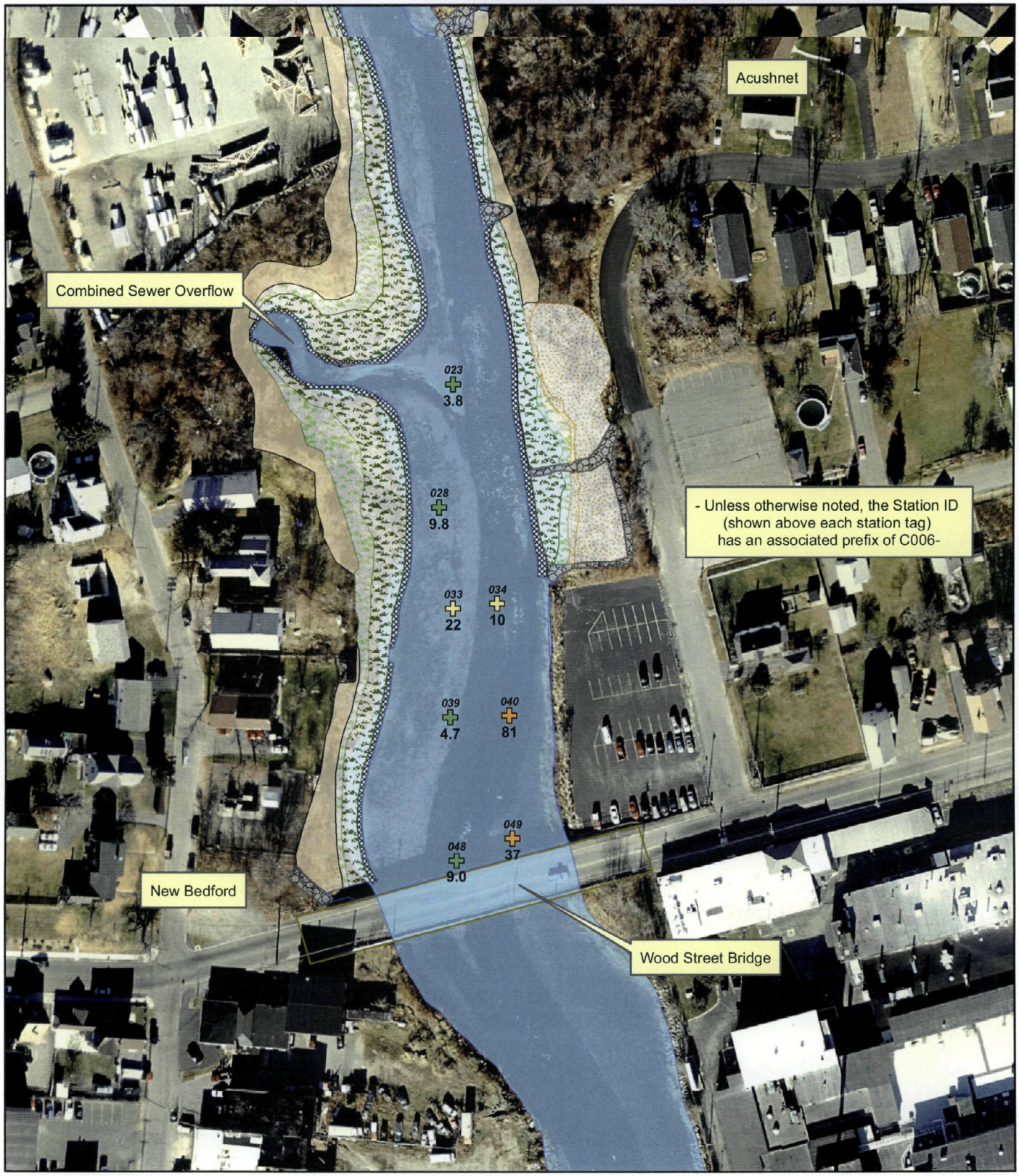

Figure 10. North of Wood Street Sediment Sampling - May 2005 Locations w/ PCB Concentrations - Acushnet River

Sources: MassGIS 2-m orthophoto
NAD 83 Mass State Plane Feet
Date: 08.01.06

May 2005 Sampling Stations

Habitat Cover Type

- High Marsh Planting
- Low Marsh Planting
- Phragmites Removal Area
- Upland Seed Mix
- Rip-Rap
- River
- Toe Stone

PCB Concentrations

- 0.0 - 1.0
- 1.1 - 10.0
- 10.1 - 25.0
- 25.1 - 100.0
- > 100.1

*PCB Values are in mg/kg (ppm)
** Based on (sum of NOAA Congeners) * 2.6

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0 25 50 100 150 200 Feet

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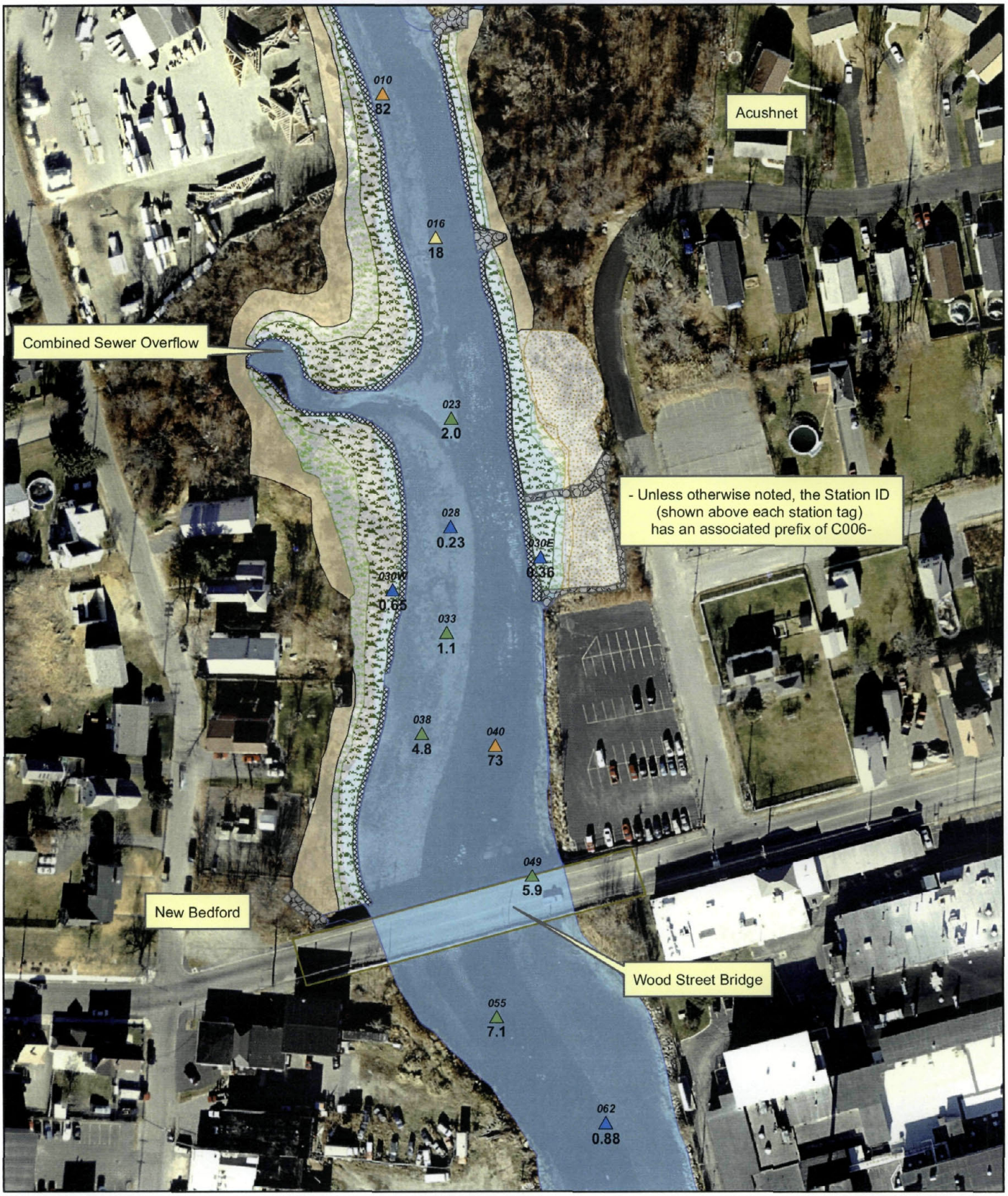

Figure 11. North of Wood Street Sediment Sampling - September 2005 Locations w/ PCB Concentrations - Acushnet River

Sources: MassGIS 2-m orthophoto
NAD 83 Mass State Plane Feet
Date: 08.01.06

△ September 2005 Sampling Stations

Habitat Cover Type

- High Marsh Planting
- Low Marsh Planting
- Phragmites Removal Area
- Upland Seed Mix
- Rip-Rap
- River
- Toe Stone

PCB Concentrations

- 0.0 - 1.0
- 1.1 - 10.0
- 10.1 - 25.0
- 25.1 - 100.0
- > 100.1

*PCB Values are in mg/kg (ppm)
** Based on (sum of NOAA Congeners) * 2.6

ENSR | AECOM

0 25 50 100 150 200 Feet

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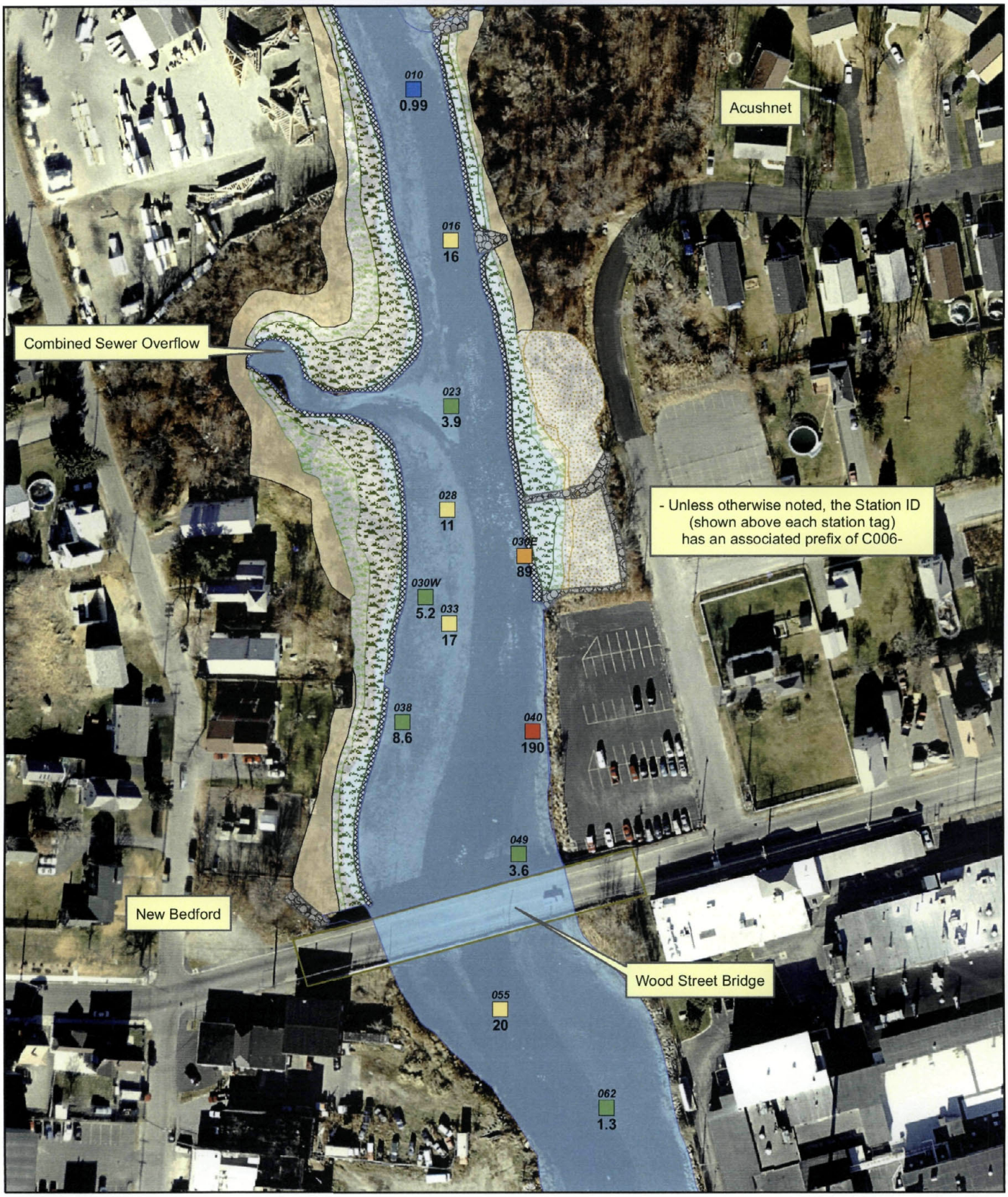

Figure 12. North of Wood Street Sediment Sampling - January 2006 Locations w/ PCB Concentrations - Acushnet River

Sources: MassGIS 2-m orthophoto
NAD 83 Mass State Plane Feet
Date: 08.01.06

January 2006 Sampling Stations

Habitat Cover Type

- High Marsh Planting
- Low Marsh Planting
- Phragmites Removal Area
- Upland Seed Mix
- Rip-Rap
- River
- Toe Stone

PCB Concentrations

- 0.0 - 1.0
- 1.1 - 10.0
- 10.1 - 25.0
- 25.1 - 100.0
- > 100.1

*PCB Values are in mg/kg (ppm)
** Based on (sum of NOAA Congeners) * 2.6

ENSR | AECOM

0 25 50 100 150 200 Feet

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Figure 13. North of Wood Street Soil Sampling - 2005 Locations - Acushnet River

Sources:
NAD 83 Mass State Plane ft
Date: 02.02.06

ENSR | AECOM

0 5 10 20 30 40 50 Feet

Stations Sampled in Aug 2004 / Jan 2005
Stations Sampled in May 2005
Stations Sampled in July 2005
Stations Sampled in October 2005
Stations Sampled in November 2005

Habitat Cover Type

High Marsh Planting
Low Marsh Planting
Phragmites Removal Area
Upland Seed Mix
Rip-Rap
River
Toe Stone

Note: Unless otherwise noted, all station IDs have the prefix 05-NWS

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Figure 14. North of Wood Street Soil Sampling - 2005 Locations w/ PCB Concentrations

Sources:
NAD 83 Mass State Plane ft
Date: 08.01.06

ENSR | AECOM

- ○ Stations Sampled in Aug 2004 / Jan 2005
- ✚ Stations Sampled in May 2005
- ◊ Stations Sampled in July 2005
- △ Stations Sampled in October 2005
- □ Stations Sampled in November 2005

0 10 20 40 60 80 100 Feet

Habitat Cover Type

- High Marsh Planting
- Low Marsh Planting
- Phragmites Removal Area
- Upland Seed Mix
- Rip-Rap
- River
- Toe Stone

PCB Concentration (mg/kg)*
Total Detected PCB Aroclors**

- 0.0 - 1.0
- 1.1 - 10.0
- 10.1 - 25.0
- 25.1 - 100.0
- > 100.1

Notes: * Based on (sum of NOAA Congeners) * 2.6
PCB results are based on the 0 - 6 inch layer.

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US Army Corps of Engineers®
New England District

U.S. Army Corps of Engineers
New Bedford Harbor Superfund Site

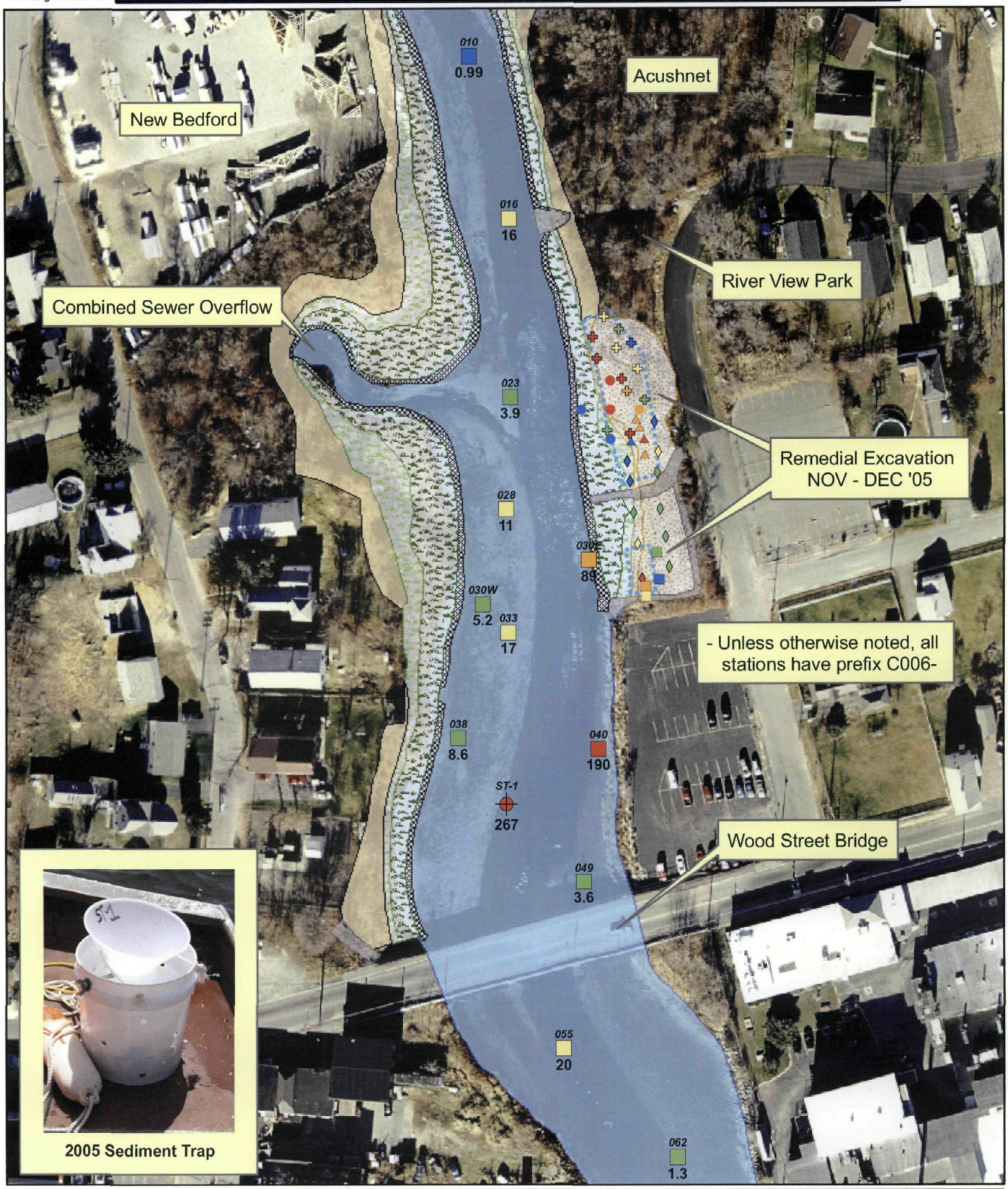

Figure 15. North of Wood Street - Sediment Trap Location and 2006 PCB Concentrations

Sources:
NAD 83 Mass State Plane ft
Date: 03.02.06

ENSR | AECOM

- January 2006 Sampling Stations
- Sediment Trap Location - Data from December 2005
- NWS Post Excavation

0 50 100 200 300 400 Feet

Habitat Cover Type

- High Marsh Planting
- Low Marsh Planting
- Phragmites Removal Area
- Upland Seed Mix
- Rip-Rap
- River
- Toe Stone

PCB Concentration (mg/kg)*

- 0.0 - 1.0
- 1.1 - 10.0
- 10.1 - 25.0
- 25.1 - 100.0
- 100.1 - 10000.0

Notes: PCB Concentrations are rounded to the nearest whole number
* Based on (sum of NOAA Congeners) * 2.6

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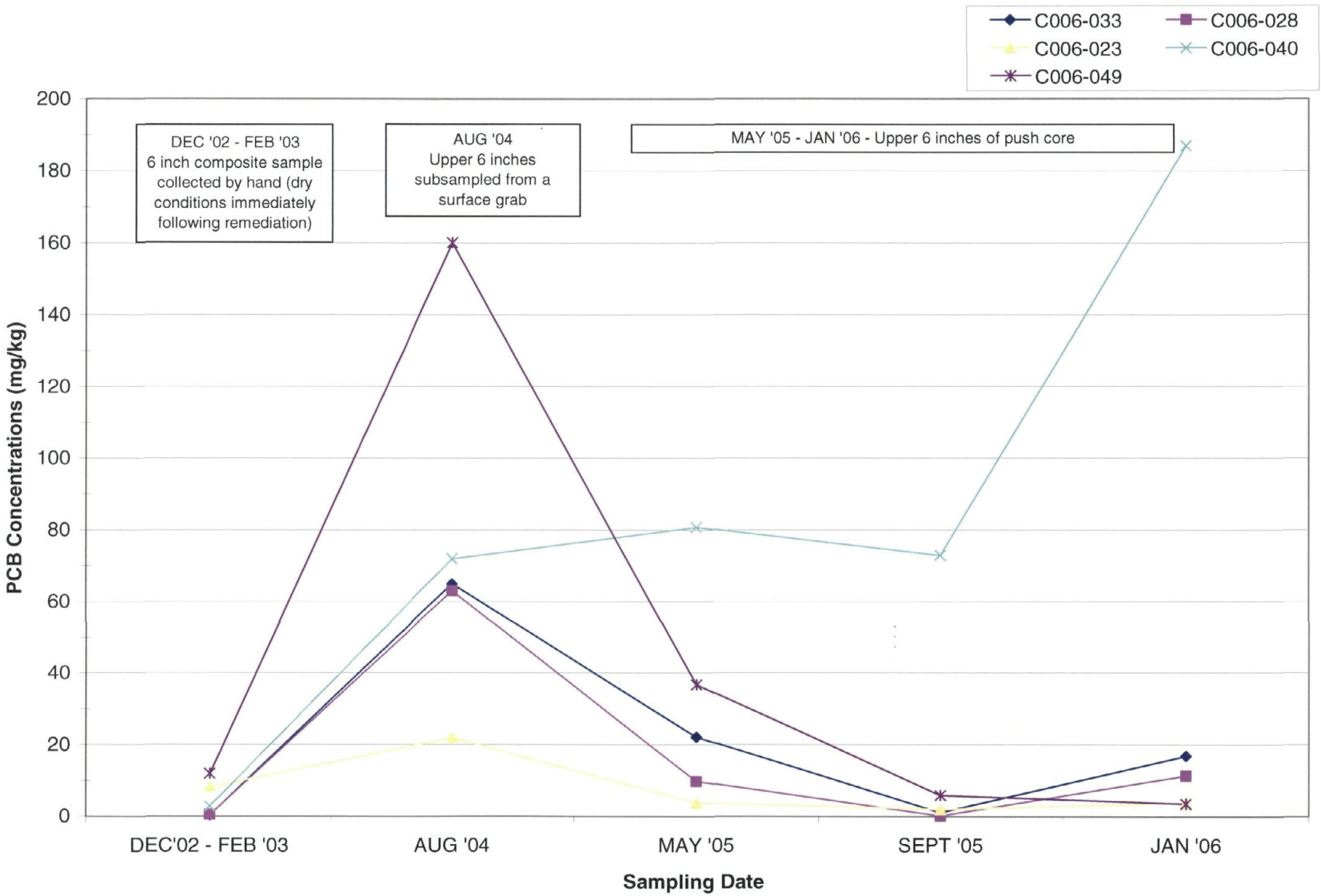
Figure 16. Push Core Sampler and Typical Soil Core at Station 05-NWS-2 – July 2005



APPENDIX

APPENDIX A

SUMMARY OF PCB DATA FROM SOIL AND SEDIMENT SAMPLING CONDUCTED AT THE NORTH OF WOOD STREET SITE – 2005-06

Sample ID	Sample Date	Unit	Total PCB
S-05A-C003-013E-0.0-0.5	13-Jan-05	mg/kg_DRYWT	**30**
S-05A-C003-013N-0.0-0.5	13-Jan-05	mg/kg_DRYWT	**2550**
S-05A-C003-013S-0.0-0.5	13-Jan-05	mg/kg_DRYWT	**1**
S-05A-C003-013W-0.0-0.5	13-Jan-05	mg/kg_DRYWT	**1**
05-NWS-01-0.0-0.5	5-May-05	mg/kg_DRYWT	**9**
05-NWS-02-0.0-0.5	5-May-05	mg/kg_DRYWT	**28**
05-NWS-03-0.0-0.5	5-May-05	mg/kg_DRYWT	**129**
05-NWS-04-0.0-0.5	5-May-05	mg/kg_DRYWT	**12**
05-NWS-05-0.0-0.5	5-May-05	mg/kg_DRYWT	**4199**
05-NWS-06-0.0-0.5	5-May-05	mg/kg_DRYWT	**14**
05-NWS-07-0.0-0.5	5-May-05	mg/kg_DRYWT	**1**
05-NWS-08-0.0-0.5	5-May-05	mg/kg_DRYWT	**239**
05-NWS-09-0.0-0.5	5-May-05	mg/kg_DRYWT	**8**
05-NWS-10-0.0-0.5	5-May-05	mg/kg_DRYWT	**12**
05-NWS-11-0.0-0.5	5-May-05	mg/kg_DRYWT	**1**
05-NWS-12-0.0-0.5	5-May-05	mg/kg_DRYWT	**373**
05-NWS-13-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**1**
05-NWS-14-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**0.2**
05-NWS-15-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**13**
05-NWS-15-REP-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**20**
05-NWS-16-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**1**
05-NWS-17-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**8**
05-NWS-18-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**3[1]**
05-NWS-19-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**3[1]**
05-NWS-20-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**25[1]**
05-NWS-21-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**1[1]**
05-NWS-22-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**166[1]**
05-NWS-23-0.0-0.5	8-Jul-05	mg/kg_DRYWT	**10[1]**
05-NWS-24-0.0-0.5	13-Oct-05	mg/kg_DRYWT	**26**
05-NWS-24-0.5-1.0	13-Oct-05	mg/kg_DRYWT	**251**
05-NWS-24-REP-0.0-0.5	13-Oct-05	mg/kg_DRYWT	**15**
05-NWS-25-0.0-0.5	13-Oct-05	mg/kg_DRYWT	**103**
05-NWS-25-0.5-1.0	13-Oct-05	mg/kg_DRYWT	**26**
05-NWS-26-0.0-0.5	13-Oct-05	mg/kg_DRYWT	**0.2**
05-NWS-26-0.5-1.0	13-Oct-05	mg/kg_DRYWT	**0.1**
05-NWS-27-0.0-0.5	13-Oct-05	mg/kg_DRYWT	**67**
05-NWS-27-0.5-1.0	13-Oct-05	mg/kg_DRYWT	**48**
05-NWS-28-0.0-0.5	13-Oct-05	mg/kg_DRYWT	**65**
05-NWS-28-0.5-1.0	13-Oct-05	mg/kg_DRYWT	**2**

- [1] indicates Total PCB Aroclors
- Non-detects were replaced with ½ the reporting limit
- Total PCB congeners were estimated using a multiplier of 2.6
- Total PCB Aroclors were summed

Sample ID	Sample Date	Unit	Total PCB
05-NWS-29-0.0-0.5	11-Nov-05	mg/kg_DRYWT	**13[1]**
05-NWS-29-0.5-1.0	11-Nov-05	mg/kg_DRYWT	**6[1]**
05-NWS-30-0.0-0.5	11-Nov-05	mg/kg_DRYWT	**33[1]**
05-NWS-30-0.5-1.0	11-Nov-05	mg/kg_DRYWT	**39[1]**
05-NWS-31-0.0-0.5	11-Nov-05	mg/kg_DRYWT	**1[1]**
05-NWS-31-0.5-1.0	11-Nov-05	mg/kg_DRYWT	**0.2[1]**
05-NWS-32-0.0-0.5	11-Nov-05	mg/kg_DRYWT	**3[1]**
05-NWS-32-0.5-1.0	11-Nov-05	mg/kg_DRYWT	**0.3[1]**
C006-023-0.0-0.5	11-May-05	mg/kg_DRYWT	**4**
C006-028-0.0-0.5	11-May-05	mg/kg_DRYWT	**10**
C006-033-0.0-0.5	11-May-05	mg/kg_DRYWT	**22**
C006-034-0.0-0.5	11-May-05	mg/kg_DRYWT	**10**
C006-039-0.0-0.5	11-May-05	mg/kg_DRYWT	**5**
C006-040-0.0-0.5	11-May-05	mg/kg_DRYWT	**81**
C006-040-QA-0.0-0.5	11-May-05	mg/kg_DRYWT	**77**
C006-048-0.0-0.5	11-May-05	mg/kg_DRYWT	**9**
C006-049-0.0-0.5	11-May-05	mg/kg_DRYWT	**37**
C006-049-REP-0.0-0.5	11-May-05	mg/kg_DRYWT	**14**
C006-023-0.0-0.5	6-Sep-05	mg/kg_DRYWT	**1**
C006-028-0.0-0.5	6-Sep-05	mg/kg_DRYWT	**0.1**
C006-033-0.0-0.5	6-Sep-05	mg/kg_DRYWT	**0.4**
C006-038-0.0-0.5	6-Sep-05	mg/kg_DRYWT	**2**
C006-040-0.0-0.5	6-Sep-05	mg/kg_DRYWT	**28**
C006-010-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**31**
C006-016-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**7**
C006-016-REP-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**5**
C006-030W-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**0.1**
C006-030E-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**0.3**
C006-049-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**2**
C006-055-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**3**
C006-062-0.0-0.5	7-Sep-05	mg/kg_DRYWT	**0.3**
C006-010-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**1**
C006-016-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**16**
C006-023-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**4**
C006-023-0.0-0.5 MS/MSD	11-Jan-06	mg/kg_DRYWT	**3**
C006-023-0.0-0.5 MS/MSDMS	11-Jan-06	mg/kg_DRYWT	**5**
C006-023-0.0-0.5 MS/MSDMSD	11-Jan-06	mg/kg_DRYWT	**8**
C006-028-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**11**
C006-028-REP-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**4**

- [1] *indicates Total PCB Aroclors*
- Non-detects were replaced with ½ the reporting limit
- Total PCB congeners were estimated using a multiplier of 2.6
- Total PCB Aroclors were summed

-

Sample ID	Sample Date	Unit	Total PCB
C006-030W-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**5**
C006-030E-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**89**
C006-033-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**17**
C006-038-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**9**
C006-040-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**187**
C006-049-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**4**
C006-055-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**20**
C006-062-0.0-0.5	11-Jan-06	mg/kg_DRYWT	**1**

- [1] indicates Total PCB Aroclors
- Non-detects were replaced with ½ the reporting limit
- Total PCB congeners were estimated using a multiplier of 2.6
- Total PCB Aroclors were summed