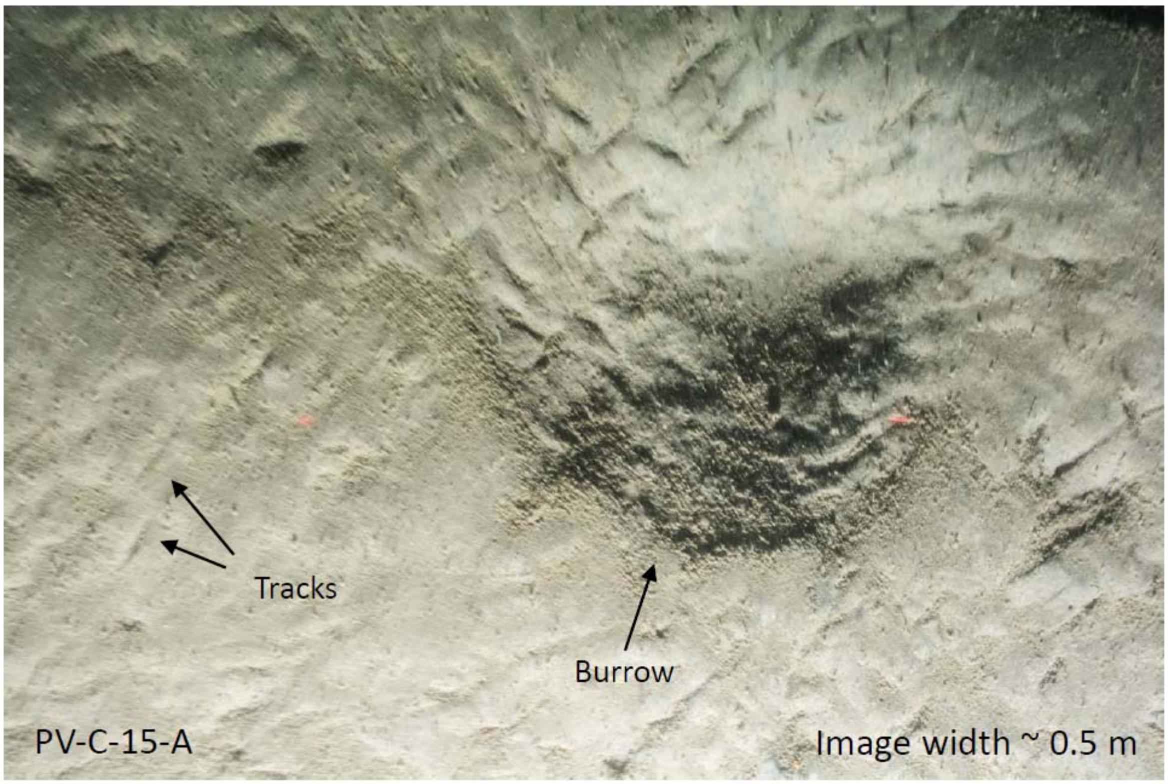
Monitoring Survey at the Cape Cod Bay Disposal Site
October 2016

Disposal Area Monitoring System DAMOS



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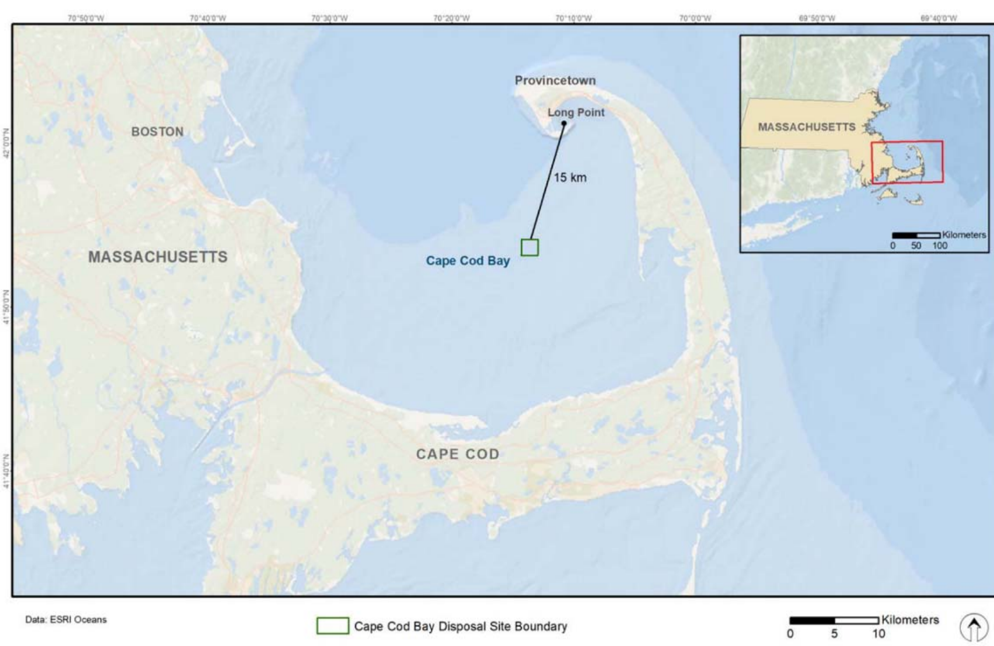
DISPOSAL AREA MONITORING SYSTEM



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Zach McKelvey

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INSPIRE Environmental
88 Silva Lane, Suite 4
Middletown, RI 02842

and

Battelle
141 Longwater Drive, Suite 202
Norwell, MA 02061

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13. ABSTRACT

A monitoring survey was conducted in October 2016 at the Cape Cod Bay Disposal Site (CCBDS) as part of the Disposal Area Monitoring System (DAMOS) Program. CCBDS is a regional dredged material disposal site in Massachusetts State waters that generally receives material from harbors surrounding Cape Cod Bay. The 2016 monitoring effort featured a high-resolution acoustic survey to characterize seafloor topography and dredged material distribution and a sediment-profile imaging (SPI)/plan-view imaging (PV) survey to assess benthic recolonization. The 2016 survey results documented changes at CCBDS since the previous survey in 2010 and the subsequent placement of close to 270,000 m^3 of dredged material at Mound C within CCBDS. The 2016 survey concluded that material was successfully placed at Mound C within the site boundaries and that it would be appropriate for the mound to continue to receive material in the future.

The high-resolution acoustic survey consisted of multibeam bathymetric, acoustic backscatter and side-scan sonar data acquisition. The acoustic survey was conducted over a 1500 x 2000 m area in the active, northern portion of the site that included Mounds B and C. Bathymetric data indicated that the site displayed relatively smooth bottom topography, except where dredged material had been placed at Mounds B and C. Mound B had most recently received material in 2010 and displayed a prominent raised feature approximately 7 m above the surrounding seafloor that did not appear to have changed in size or extent since a 2010 monitoring survey. Mound C was found to have a new, plateaued mound approximately 3 m above the surrounding area as a result of placement of material since 2010. Further acoustic results indicated that surficial sediment in areas that received dredged materials were harder and rougher than surrounding sediments.

Sediment-profile images and plan-view images were collected at both disposal target areas within CCBDS (Mound B and Mound C) and three reference areas (CCBRS, NWREF, and SWREF). The results of the 2016 survey at CCBDS supported the conclusion that surface sediments at both the historical target placement location (Mound B), and the recent target placement location (Mound C) have been recolonized by a benthic community that is ecologically equivalent to the reference areas. Evidence of Stage 3 successional stage was present in at least one replicate image from all survey stations at Mound C and all but three stations from Mound B. Mean apparent redox potential discontinuity (aRPD) depths and successional stage rank were statistically equivalent at both Mound B and Mound C compared to the reference areas. Mean aRPD depths at both disposal locations were significantly less deep compared to the same locations in the 2010 survey. However, the reduced mean aRPD depth was also observed in the reference areas between 2016 and 2010 surveys, supporting the conclusion that the change occurred over a relatively large spatial scale and was not caused by disposal activity at CCBDS.

Overall, the 2016 survey at CCBDS showed that both the Mound B previous disposal location and the recent Mound C disposal location within the site appeared stable, the benthic community appeared healthy, and the benthic community had reworked dredged material into the sediment matrix and recolonized areas of dredged material placement.

Based on the findings of the 2016 survey, our recommendations are:

R1: That Mound C can accommodate additional dredged material placement utilizing a similar approach to what has been used in the past based on the presence of stable mounds and normal benthic recolonization.

R2: Monitoring efforts should continue consistent with Tiered Monitoring Protocols based on volume placed at site.

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Submitted to:

New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Submitted by:

BATTELLE

141 Longwater Drive, Suite 202
Norwell, MA 02061

Prepared by:

INSPIRE ENVIRONMENTAL

88 Silva Lane, Suite 4
Middletown, RI 02842

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__Note on units of this report__: As a scientific data summary, information and data are presented in the metric system. However, given the prevalence of English units in the dredging industry of the United States, conversions to English units are provided for general information in Section 1. A table of common conversions can be found in Appendix A.

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LIST OF ACRONYMS

aRPD	Apparent redox potential discontinuity
ASCII	American Standard Code for Information Interchange
CCBDS	Cape Cod Bay Disposal Site
CI	Confidence interval
CLT	Central Limit Theorem
DAMOS	Disposal Area Monitoring System
DGPS	Digital Global Positioning System
DO	Dissolved oxygen
Eh	Redox potential (the potential generated between a platinum electrode and a standard hydrogen electrode when placed into the medium being tested, where hydrogen is considered the reference electrode)
GIS	Geographic information system
GPS	Global Positioning System
GRD	Gridded data
MBES	Multibeam echo sounder
MLLW	Mean Lower Low Water
MRU	Motion reference unit
NAD83	North American Datum of 1983
NAE	USACE, New England Division
NEF	Nikon Electronic Format
NOAA	National Oceanic and Atmospheric Association
NOS	National Ocean Service
PSD	Photoshop Document

PV	Plan-View
QAPP	Quality Assurance Project Plan
RTK	Real time kinematic GPS - vertical accuracy is approximately 2 cm, enabling use for tide corrections in some circumstances. RTK GPS is suitable for both horizontal and centimeter level vertical positioning, including tide corrections
R/V	Research vessel
SLR	Single-lens reflex
SD	Standard deviation
SOD	Sediment oxygen demand
SOP	Standard Operating Procedures
SPI	Sediment-Profile Imaging
TIF	Tagged image file
TOC	total organic carbon
UNH/NOAA CCOM	University of New Hampshire's NOAA Center for Coastal and Ocean Mapping
USACE	U.S. Army Corps of Engineers
VDATUM	Vertical Datum Transformation

EXECUTIVE SUMMARY

A monitoring survey was conducted in October 2016 at the Cape Cod Bay Disposal Site (CCBDS) as part of the Disposal Area Monitoring System (DAMOS) Program. CCBDS is a regional dredged material disposal site in Massachusetts State waters that generally receives material from harbors surrounding Cape Cod Bay. The 2016 monitoring effort featured a high-resolution acoustic survey to characterize seafloor topography and dredged material distribution and a sediment-profile imaging (SPI)/plan-view imaging (PV) survey to assess benthic recolonization. The 2016 survey results documented changes at CCBDS since the previous survey in 2010 and the subsequent placement of close to 270,000 m^3 of dredged material at Mound C within CCBDS. The 2016 survey concluded that material was successfully placed at Mound C within the site boundaries and that it would be appropriate for the mound to continue to receive material in the future.

The high-resolution acoustic survey consisted of multibeam bathymetric, acoustic backscatter and side-scan sonar data acquisition. The acoustic survey was conducted over a 1500 x 2000 m area in the active, northern portion of the site that included Mounds B and C. Bathymetric data indicated that the site displayed relatively smooth bottom topography, except where dredged material had been placed at Mounds B and C. Mound B had most recently received material in 2010 and displayed a prominent raised feature approximately 7 m above the surrounding seafloor that did not appear to have changed in size or extent since a 2010 monitoring survey. Mound C was found to have a new, plateaued mound approximately 3 m above the surrounding area as a result of placement of material since 2010. Further acoustic results indicated that surficial sediment in areas that received dredged materials were harder and rougher than surrounding sediments.

Sediment-profile images and plan-view images were collected at both disposal target areas within CCBDS (Mound B and Mound C) and three reference areas (CCBRS, NWREF, and SWREF). The results of the 2016 survey at CCBDS supported the conclusion that surface sediments at both the historical target placement location (Mound B), and the recent target placement location (Mound C) have been recolonized by a benthic community that is ecologically equivalent to the reference areas. Evidence of Stage 3 successional stage was present in at least one replicate image from all survey stations at Mound C and all but three stations from Mound B. Mean apparent redox potential discontinuity (aRPD) depths and successional stage rank were statistically equivalent at both Mound B and Mound C compared to the reference areas. Mean aRPD depths at both disposal locations were significantly less deep compared to the same locations in the 2010 survey. However, the reduced mean aRPD depth was also observed in the reference areas between 2016 and 2010 surveys, supporting the conclusion that the change occurred over a relatively large spatial scale and was not caused by disposal activity at CCBDS.

Overall, the 2016 survey at CCBDS showed that both the Mound B previous disposal location and the recent Mound C disposal location within the site appeared stable, the benthic

community appeared healthy, and the benthic community had reworked dredged material into the sediment matrix and recolonized areas of dredged material placement.

Based on the findings of the 2016 survey, our recommendations are:

R1: That Mound C can accommodate additional dredged material placement utilizing a similar approach to what has been used in the past based on the presence of stable mounds and normal benthic recolonization.

R2: Monitoring efforts should continue consistent with Tiered Monitoring Protocols based on volume placed at site.

1.0 INTRODUCTION

A monitoring survey was conducted at the Cape Cod Bay Disposal Site (CCBDS) as part of the U.S. Army Corps of Engineers (USACE) New England District (NAE) Disposal Area Monitoring System (DAMOS) Program. DAMOS is a comprehensive monitoring and management program designed and conducted to address environmental concerns associated with use of aquatic disposal sites throughout the New England region. An introduction to the DAMOS Program and CCBDS, including a brief description of previous dredged material disposal activities and previous monitoring surveys, is provided below.

1.1 Overview of the DAMOS Program

The DAMOS Program features a tiered management protocol designed to ensure that any potential adverse environmental impacts associated with dredged material disposal are promptly identified and addressed (Germano et al. 1994). For over 40 years, the DAMOS Program has collected and evaluated disposal site data throughout New England. Based on these data, patterns of physical, chemical, and biological responses of seafloor environments to dredged material disposal activity have been documented (Fredette and French 2004).

DAMOS monitoring surveys fall into two general categories: confirmatory studies and focused studies. The data collected and evaluated during these studies provide answers to strategic management questions in determining next steps in the disposal site management process. DAMOS monitoring results guide the management of disposal activities at existing sites, support planning for use of future sites, and evaluate the long-term status of historical sites (Wolf et al. 2012).

Confirmatory studies are designed to test hypotheses related to expected physical and ecological response patterns following placement of dredged material on the seafloor at established, active disposal sites. Two primary goals of DAMOS confirmatory monitoring surveys are to document the physical location and stability of dredged material placed into the aquatic environment and to evaluate the biological recovery of the benthic community following placement of dredged material. Several survey techniques are employed in order to characterize these responses to dredged material placement. Sequential acoustic monitoring surveys (including bathymetric, acoustic backscatter, and side-scan sonar data collection) are performed to characterize the height and spread of discrete dredged material deposits or mounds created at open water sites as well as the accumulation/consolidation of dredged material into confined aquatic disposal cells.

Sediment-profile (SPI) and plan-view (PV) imaging surveys are performed in confirmatory studies to provide further physical characterization of the material and to support evaluation of seafloor (benthic) habitat conditions and recovery over time. Each type of data collection activity is conducted periodically at disposal sites, and the conditions found after a defined period of disposal activity are compared with the long-term data set at specific sites to determine the next step in the disposal site management process (Germano et al. 1994).

Focused studies are periodically undertaken within the DAMOS Program to evaluate candidate sites, as baseline surveys at new sites, to evaluate inactive or historical disposal sites and contribute to the development of dredged material placement and monitoring techniques. Focused DAMOS monitoring surveys may also feature additional types of data collection activities as deemed appropriate to achieve specific survey objectives, such as grab sampling of sediment for physical and biological analysis, subbottom profiling, towed video, or sediment coring.

The October 2016 survey at CCBDS was designed as a confirmatory survey using multibeam acoustic data and SPI/PV images to provide characterization of seafloor topography, to track recent placement of dredged material, and to assess the condition of the older disposal mound. The survey was conducted to provide characterization of surficial sediments and benthic habitat quality to aid in management of the site.

1.2 Introduction to the Cape Cod Bay Disposal Site

CCBDS is a regional dredged material disposal site within the state waters of Massachusetts, located in Cape Cod Bay, approximately 15 km (8 nmi) southwest of Long Point, Provincetown, Massachusetts (Figure 1-1). CCBDS is defined as a 1.85 x 1.85 km (1 x 1 nmi) area on the seafloor, centered at 41º 54.406’ N, 70º 13.268’ W (NAD 83) which has a relatively flat topography and no natural bathymetric features (ENSR 2004, Figure 1-2). The seafloor slopes gently downward to the northwest across the site, with water depths ranging from 28 m (92 ft.) in the southeast corner to 31.5 m (103 ft.) in the northwest corner.

CCBDS was selected as an open water disposal site in 1990 in response to an increase in dredging needs at many regional harbors due to a steady rise in population and recreational boating activities on Cape Cod (SAIC 2003). The current site boundaries were established around the Historic Wellfleet Disposal Site, which received material from several small Wellfleet Harbor dredging projects in the 1970s and 1980s (Figure 1-2). This area of Cape Cod Bay is characterized by relatively low currents, which contributed to its selection as a depositional disposal site. An historic absence of endangered right whale sightings or commercially important lobster grounds in the vicinity also supported this site selection decision (SAIC 2003).

Monitoring and management of CCBDS is the joint responsibility of the Commonwealth of Massachusetts Department of Conservation and Recreation (DCR) and the DAMOS Program. DCR maintained a disposal buoy at the site until 2014 with the DAMOS Program providing input for buoy placement decisions. With the advances in electronic positioning for both the disposal scows and supporting tugboats, placement at the site is directed solely by target coordinates. The disposal season at the site is limited to June-December due to concerns over seasonal marine mammal populations (SAIC 2003).

Although the site was officially selected by the Commonwealth of Massachusetts in 1990, a disposal buoy was not placed at the site and disposal operations did not commence at the current disposal site until 1994 (SAIC 2003).

1.3 Historical Dredged Material Disposal Activity

Cape Cod Bay Disposal Site has received material from numerous projects over the last 20 years, and material has been placed at three target areas within CCBDS, denoted as Mounds A, B, and C (Figure 1-2; Table 1-1). During the winter of 1994-1995, approximately 112,000 m^3 (146,000 yd^3) of material from Wellfleet Harbor was deposited in the southeast quadrant of CCBDS forming Mound A (SAIC 2003, Figure 1-2). The disposal target buoy was then moved to the northeast quadrant of the site, and approximately 509,000 m^3 (666,000 yd^3) of material was placed at this location between 1996 and 2001, forming Mound B (SAIC 2003, Figure 1-2). In 2002, approximately 5,200 m^3 (6,800 yd^3) of material from Provincetown Harbor was deposited at a new target location in the northwest quadrant of CCBDS initiating formation of Mound C. Later that year, a small amount of additional material [(2,500 m^3 (3,300 yd^3)] from the same dredging project was placed on top of Mound A (ENSR 2004, Figure 1-2). Between 2003-2010, approximately 137,000 m^3 (179,000 yd^3) of material was directed to Mound C in the northwest quadrant of the site (Figure-1-2).

1.4 Previous Monitoring Events

A baseline survey was performed at CCBDS in 1994 with confirmatory surveys performed in 1995, 1996, 2001, 2003, and 2010 (AECOM 2012; Table 1-2). In 2010, a bathymetric and a SPI/PV survey were conducted around recent and historical disposal locations. The September 2010 SPI/PV survey was performed at Mounds A, B, and C. Recolonization had occurred at all three mounds, with at least one replicate at each of the disposal mound stations showing evidence of Stage 3 succession. All three mounds were found to have a mean aRPD depth consistent with reference areas, indicating a healthy benthic community at each disposal site.

1.5 Recent Dredged Material Disposal Activity

Since the most recent DAMOS survey in September 2010, approximately 270,000 m^3 (353,000 yd^3) of material has been deposited at CCBDS (Figure 1-3). The material originated from construction of New Bedford Harbor Confined Aquatic Disposal (CAD) Cell 3 and the Rock Harbor and Duxbury Federal Navigation Projects (Table 1-3). All post-2010 material was placed at Mound C (Figure 1-3).

A detailed record of barge disposal activity at CCBDS for the 2013 through 2015 disposal seasons, including the origin of dredged material, the volume deposited, and the disposal location, is provided in Appendix B.

1.6 2016 Survey Objectives

The October 2016 survey at CCBDS was designed as a confirmatory survey to track the recent placement of dredged material at Mound C as well as monitor the recovery of the benthic community at the active portion of CCBDS (Mound C) and at a region of historic material placement at Mound B. The survey objectives were to:

- Characterize the seafloor topography and surficial features over Mound C and Mound B of CCBDS and three reference areas (CCBRS, NWREF, and SWREF) by completing a multibeam bathymetric survey.

- Use SPI/PV to further define the physical characteristics of surficial sediment and to assess the benthic recolonization status (community recovery of the bottom-dwelling animals) of the site with recent disposal activity, the older disposal mounds, and the reference areas.

Table 1-1.

Historical Disposal Activity at CCBDS

Target Designation	Years of Disposal Activity	Volume (m^3)	Volume (yd^3)
Mound A	1994-1995 2002	112,000 2,500	146,000 3,300
Mound B	1996-2001	509,000	666,000
Mound C	2002 2003-2010	5,200 137,000	6,800 179,000

Table 1-2.

Overview of Survey Activities at CCBDS

Date	Purpose of Survey	Bathymetry Area	SPI Stations (location - #)	Additional Studies	DAMOS Report/ Contribution No.	Reference
April 1994	Pre-disposal	Site: 1000 x 1000 m Ref: 1000 x 1000	✓*	Sub-bottom and grab sampling	NA	OSI 1995a
January 1995	Post-disposal	✓*	---	Side-scan, Sub-bottom	NA	OSI 1995b
May 1996	Monitoring	Site: 1000 s 1500 m Ref: 1000 x 1500	Site: 13 Ref: 39	Side-scan, sub-bottom, sediment sampling	NA	CR Environmental, Inc. 1997
August 2001	Monitoring	Site: 2100 x 2200 m	Site: 38 Ref: 16	---	144	SAIC 2003
August 2003	Monitoring	Site: 1200 x 2100 m	Site: 26 Ref: 5	---	157	ENSR 2004
September 2010	Monitoring	Site: 2000 x 2100 m Multibeam	Site: 45 Ref: 45	---	188	AECOM 2012

✓* Survey was conducted; detailed data not available (i.e. survey size, number of stations).

Table 1-3.

Disposal Activity at Mound C of CCBDS since the September 2010 Monitoring Survey
(per Scow Logs provided by USACE, December 2016)

Permit number	**Project Name**	**Target Site Disposal Season**	**Load volume (m^3)**	**Load volume (yd^3)**
NAE-2007-2709	New Bedford Harbor CAD Cell 3/ New Bedford Harbor Phase II	Mound C 2013	81,930	107,160
NAE-2009-2185	North River Marine	Mound C 2015	3,479	4,550
NAE-2010-1589	Town of Duxbury	Mound C 2015	2,425	3,172
NAE-2013-1792	Rock Harbor	Mound C 2014	29,547	38,646
W912WJ-15-C-0022	Duxbury Federal Navigation Project	Mound C 2015	151,382	198,000
Total			**268,762**	**351,528**

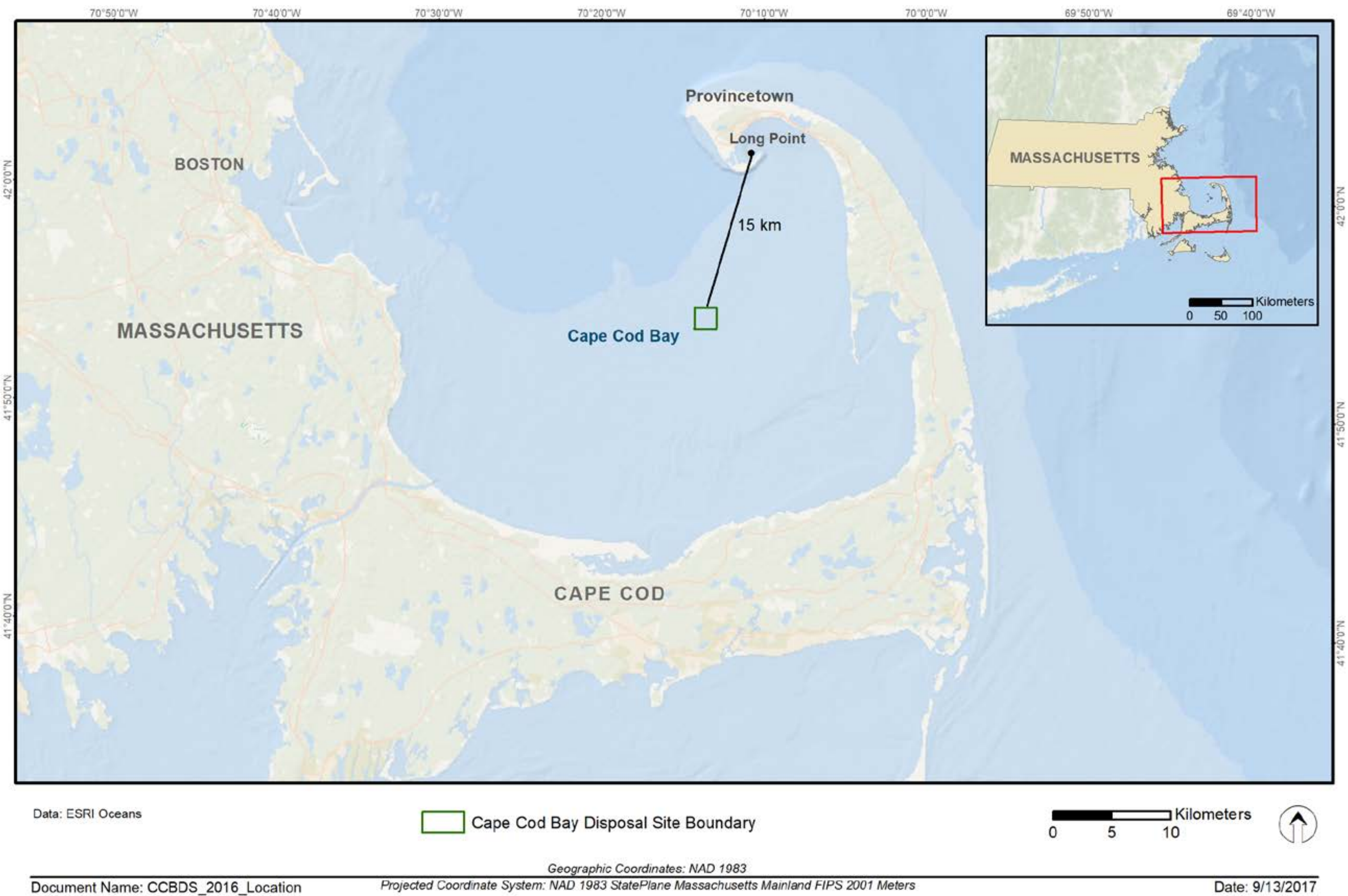


Figure 1-1. Location of the Cape Cod Bay Disposal Site (CCBDS)

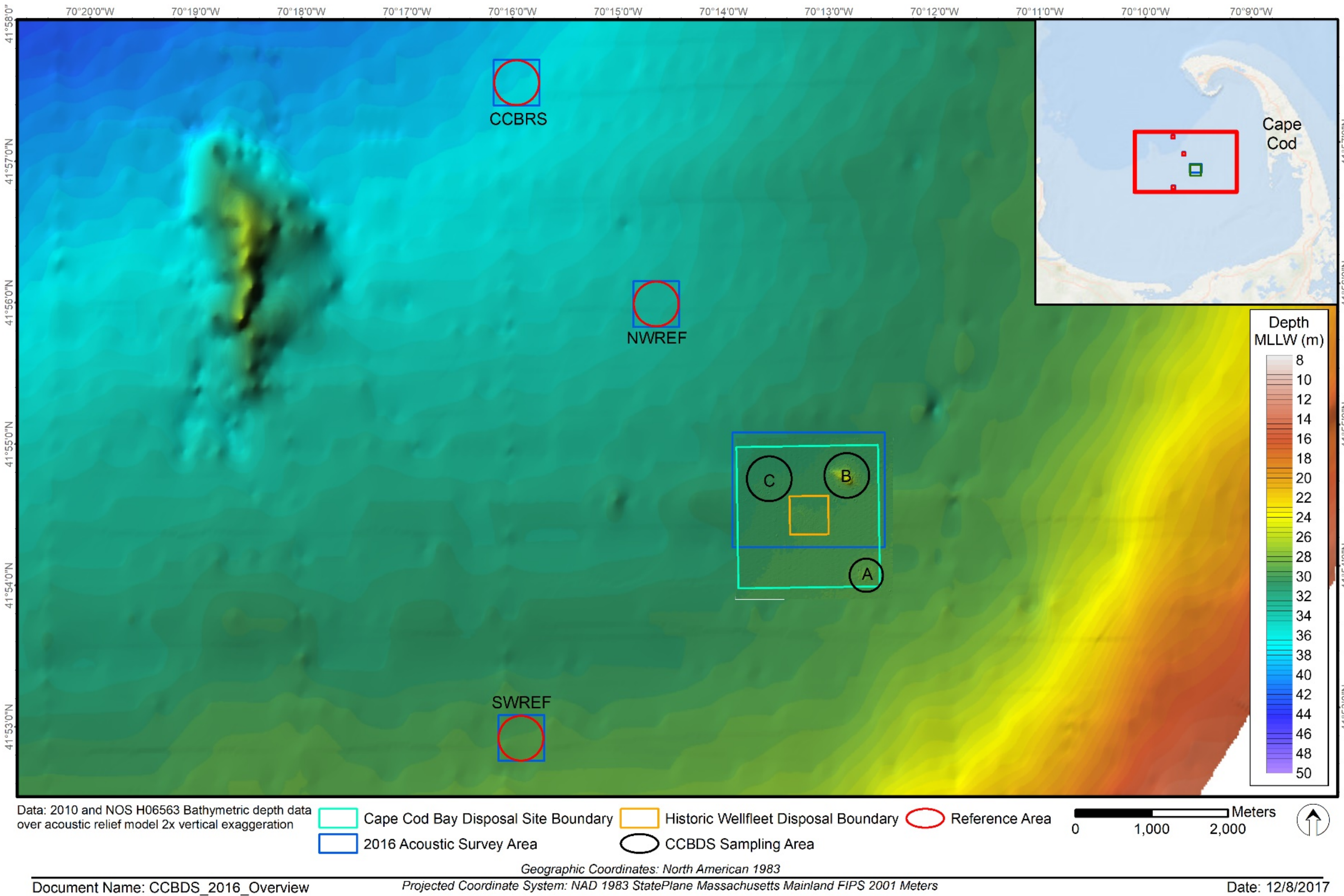


Figure 1-2. Overview of CCBDS with 2016 sampling areas indicated

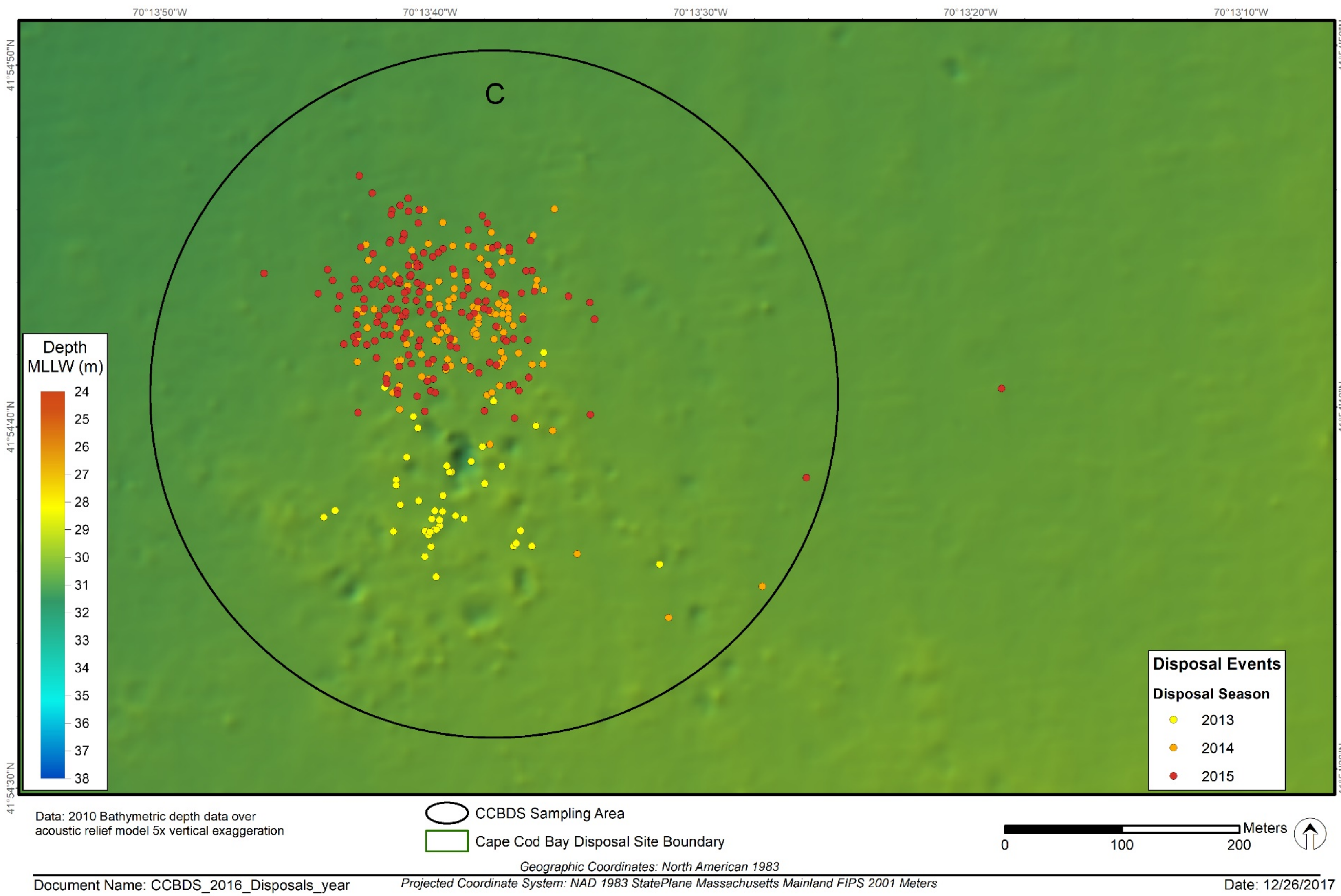


Figure 1-3. Location of reported scow disposal release points at target Mound C on 2010 bathymetry

2.0 METHODS

The October 2016 survey at CCBDS was conducted by a team of investigators from INSPIRE Environmental and CR Environmental aboard the 55-foot *R/V Jamie Hanna* including ACSM-certified hydrographer Christopher Wright (#266). The acoustic survey was conducted from 17-19 October 2016. The SPI/PV survey was conducted from 20-21 October 2016. Detailed Standard Operating Procedures (SOPs) for data collection and processing are available in the Quality Assurance Project Plan for the DAMOS Program (Battelle 2015).

2.1 Navigation and On-Board Data Acquisition

Navigation for the acoustic survey was accomplished using a Hemisphere VS-330 Real Time Kinematic Global Positioning System (RTK GPS) which received base station correction through the Keynet NTRIP broadcast. Horizontal position accuracy in fixed RTK mode was approximately 2 cm. A dual-antennae Hemisphere VS110 differential GPS (DGPS) was available if necessary as a backup. The GPS system was interfaced to a desktop computer running HYPACK hydrographic survey software. HYPACK continually recorded vessel position and GPS satellite quality and provided a steering display for the vessel captain to accurately maintain the position of the vessel along pre-established survey transects and targets. Vessel heading measurements were provided by an IxBlue Octans III fiber optic gyrocompass.

Navigation for the sediment grab sampling and SPI survey was accomplished using a Hemisphere R110 DGPS capable of sub-meter horizontal accuracy. Navigation data were recorded using HYPACK software.

2.2 Acoustic Survey

The acoustic survey included bathymetric, backscatter, and side-scan sonar data collection. The bathymetric data provided measurements of water depth that, when processed, were used to map the seafloor topography. Backscatter and side-scan sonar data provided images that supported characterization of surface sediment texture and roughness. Each of these acoustic data types is useful for assessing dredged material placement and surface sediment features.

2.2.1 Acoustic Survey Planning

The 1500 x 2000 m acoustic survey featured a high spatial resolution survey over the active portion of the site with recent disposal activity (Mound C) and over the older disposal mound (Mound B). Three 600 x 600 m surveys were also performed over the reference areas (CCBRS, NWREF, and SWREF). INSPIRE hydrographers coordinated with USACE NAE scientists and reviewed alternative survey designs. Hydrographers obtained site coordinates, imported them into geographic information system (GIS) software, and created maps to aid design of a survey that would provide greater than 100-percent coverage within the survey area. Base bathymetric data were obtained from the National Ocean Service Hydrographic Data Base to estimate the transect separation required to obtain full bottom coverage using an assumed beam angle limit of 90-degrees (45 degrees to port, 45 degrees to starboard). Transects spaced 50-60 m apart and cross-lines spaced 250-300 m apart were created to meet conservative beam angle constraints (Figure 2-1). The proposed survey area and design were then reviewed and approved by NAE scientists.

2.2.2 Acoustic Data Collection

The 2016 multibeam bathymetric survey of CCBDS was conducted 17-19 October 2016. Data layers generated by the survey included bathymetric, acoustic backscatter, and side-scan sonar and were collected using an R2Sonic 2022 broadband multibeam echo sounder (MBES). This 200-400 kHz system forms up to 256 1- to 2-degree beams (frequency dependent) distributed equiangularly or equidistantly across a 10- to 160-degree swath. For this survey, a frequency of 200 kHz and pulse length of 0.084 msec was selected to maximize the resolution of bathymetric data without compromising the quality of acoustic backscatter data. The MBES transducer was mounted amidships to the port rail of the survey vessel using a high strength adjustable boom. The primary GPS antenna was mounted atop the transducer boom. The transducer depth below the water surface (draft) and antenna height were checked and recorded at the beginning and end of data acquisition, and draft was confirmed using the “bar check” method.

An IxBlue Octans III motion reference unit (MRU) was interfaced to the MBES topside processor and to the acquisition computer. Precise linear offsets between the MRU and MBES were recorded and applied during acquisition. Depth and backscatter data were synchronized using pulse per second timing and transmitted to the HYPACK MAX® acquisition computer via Ethernet communications. Several patch tests were conducted during the survey to allow computation of angular offsets between the MBES system components.

The system was calibrated for local water mass speed of sound by performing sound velocity profile (SVP) casts at frequent intervals throughout the survey day using an AML, Inc. MinosX sound velocity profiler.

2.2.3 Bathymetric Data Processing

Bathymetric data were processed using HYPACK HYSWEEP® software. Processing components are described below and included:

- Adjustment of data for tidal elevation fluctuations
- Correction of ray bending (refraction) due to density variation in the water column
- Removal of spurious points associated with water column interference or system errors

- Development of a grid surface representing depth solutions
- Statistical estimation of sounding solution uncertainty
- Generation of data visualization products

Tidal adjustments were accomplished using RTK GPS verified against tide data using records obtained from the National Oceanic and Atmospheric Association's (NOAA) Boston Tide Station (#8443970) after application of a site-specific tide zoning model obtained from NOAA. Water surface elevations derived using RTK were adjusted to Mean Lower Low Water (MLLW) elevations using NOAA's VDATUM Model. Correction of sounding depth and position (range and azimuth) for refraction due to water column stratification was conducted using a series of twelve sound-velocity profiles acquired by the survey team. Data artifacts associated with refraction remain in the bathymetric surface model at a relatively fine scale (generally less than 5 to 10 cm) relative to the survey depth.

Bathymetric data were filtered to accept only beams falling within an angular limit of 60° to minimize refraction artifacts. Spurious sounding solutions were rejected based on the careful examination of data on a sweep-specific basis.

The R2Sonics 2022 MBES system was operated at 200 kHz. At this frequency, the system has a published beam width of 2.0°. Assuming an average depth of 31 m and a maximum beam angle of 60°, the average diameter of the beam footprint mid-swath was calculated at approximately 1.4× 1.2 m (~2.8 m^2). Data were reduced to a cell (grid) size of 2.0 × 2.0 m, acknowledging the system's fine range resolution while accommodating beam position uncertainty. This data reduction was accomplished by calculating and exporting the average elevation for each cell in accordance with USACE recommendations (USACE 2013).

Statistical analysis of data as summarized on Table 2-1 showed negligible tide bias and vertical uncertainty substantially lower than values recommended by USACE (2013) or NOAA (2015). Note that the most stringent National Ocean Service (NOS) standard for this project depth (Special Order 1A) would call for a 95th percentile confidence interval (95% CI) of 0.38 m at the maximum survey depth (37.9 m) and 0.34 m at the average site depth (31.0 m).

Reduced data were exported in ASCII text format with fields for Easting, Northing, and MLLW Elevation (meters). All data were projected to the Massachusetts Mainland State Plane West FIPS 2001, NAD83 (metric). A variety of data visualizations were generated using a combination of ESRI ArcMap (V.10.1) and Golden Software Surfer (V.13.6). Visualizations and data products included:

- ASCII data files of all processed soundings including MLLW depths and elevations,
- Contours of seabed elevation (25-cm, 50-cm and 1.0-m intervals) in a geospatial data file format suitable for plotting using GIS and computer-aided design software,

- 3-dimensional surface maps of the seabed created using 2× vertical exaggeration and artificial illumination to highlight fine-scale features not visible on contour layers delivered in grid and tagged image file (TIF) formats, and,
- An acoustic relief map of the survey area created using 2× vertical exaggeration, delivered in georeferenced TIF format.

2.2.4 Backscatter Data Processing

Backscatter data were extracted from cleaned MBES TruePix formatted files then used to provide an estimation of surface sediment texture based on seabed surface roughness. Mosaics of backscatter data were created using HYPACK's implementation of GeoCoder software developed by scientists at the University of New Hampshire's NOAA Center for Coastal and Ocean Mapping (UNH/NOAA CCOM). A seamless mosaic of unfiltered backscatter data was developed and exported in grayscale TIF format. Backscatter data were also exported in ASCII format with fields for Easting, Northing, and backscatter (dB). A Gaussian filter was applied to backscatter data to minimize nadir artifacts, and the filtered data were used to develop backscatter values on a 1-m grid. The grid was exported in ESRI binary GRD format to facilitate comparison with other data layers.

2.2.5 Side-Scan Sonar Data Processing

Side-scan sonar data were processed using Chesapeake Technology, Inc. Sonar Wiz software and GeoCoder software to generate a database of images that maximized both textural information and structural detail.

Seamless mosaics of side-scan sonar data were developed using SonarWiz and exported in grayscale TIF format using a resolution of 0.20-m per pixel. Data were processed using manual gain adjustment methods to minimize nadir artifacts and facilitate visualization of fine seabed structures.

2.2.6 Acoustic Data Analysis

The processed bathymetric grids were converted to rasters, and bathymetric contour lines and acoustic relief models were generated and displayed using GIS. The backscatter mosaics and filtered backscatter grid were combined with acoustic relief models in GIS to facilitate visualization of relationships between acoustic datasets. This is done by rendering images and color-coded grids with sufficient transparency to allow three-dimensional acoustic relief model to be visible underneath.

2.3 Sediment-Profile and Plan-View Imaging

Sediment-profile and plan-view imaging is a monitoring technique used to provide data on the physical characteristics of the seafloor and the status of the benthic biological community (Germano et al. 2011).

A 36-station SPI/PV survey was performed within the area of the Cape Cod Bay Disposal Site (Figure 2-2), including 12 stations located in the area of recent dredged material placement at CCBDS, 12 stations in the area of older dredged material placed within CCBDS, and four stations at each of the three reference areas (CCBRS, NWREF, and SWREF). SPI/PV station target locations are provided in Table 2-2 and SPI/PV station replicate locations are provided in Appendix C. The methodology for data acquisition and analysis for these images was consistent with the sampling methods described in detail in the Quality Assurance Project Plan (QAPP) (Battelle 2015) and INSPIRE standard operating procedures (SOPs).

2.3.1 Sediment-Profile Imaging

The SPI technique involves deploying an underwater camera system to photograph a cross-section of the sediment-water interface. High-resolution SPI images were acquired using a Nikon® D7100 digital single-lens reflex (SLR) camera mounted inside an Ocean Imaging® Model 3731 pressure housing. The pressure housing sat atop a wedge-shaped steel prism with a glass front faceplate and a back mirror, mounted at a 45° angle. The camera lens looked down at the mirror, which reflected the image from the faceplate. The prism had an internal strobe mounted inside at the back of the wedge to provide illumination for the image; this chamber was filled with distilled water, so the camera always had an optically clear path. As the prism penetrated the seafloor, a trigger activated a time-delay circuit that fired an internal strobe to obtain a cross-sectional image of the upper 15–20 cm of the sediment column (Figure 2-3). The camera remained on the seafloor for approximately 20 seconds to ensure that successful images were obtained.

Test exposures of a X-Rite Color Checker Classic Color Calibration Target were made on deck at the beginning of the survey to verify that all internal electronic systems were working to design specifications and to provide a color standard against which final images could be checked for proper color balance. Test images were also captured to confirm proper camera settings for site conditions. Images were checked periodically throughout the survey to confirm that the initial camera settings were still resulting in the highest possible quality images. All camera settings were recorded in the field log (Appendix D). For this survey, the ISO-equivalent was set at 640, shutter speed was 1/250, f-stop was f9, and storage was in compressed raw Nikon Electronic Format (NEF) files (approximately 30 MB each). Additional camera settings used were: white balance set to flash, color mode set to Adobe RGB, sharpening set to none, noise reduction off. Details of the camera settings for each digital image also are available in the associated parameters file embedded in each electronic image file.

Whenever the camera was brought back on board (typically after every third to fifth station), the frame counter was checked to ensure that the requisite number of replicates had been obtained. In addition, a prism penetration depth indicator on the camera frame was checked to verify that the optical prism had penetrated the bottom to a sufficient depth. If images were missed or the penetration depth was insufficient, the camera frame stop collars were adjusted and/or weights were added or removed, and additional replicate images were taken. Frame counts, changes in prism weight amounts, the presence or absence of mud doors, and frame stop collar positions were recorded in the field log for each replicate image (Appendix D). Visual checks and hand tightening checks of all nuts/bolts on the SPI/PV camera frame were conducted periodically to make sure nothing vibrated loose during the survey.

Prior to field operations, the internal clock in the digital SPI system was synchronized with the vessel's GPS navigation system. Each image was assigned a unique time stamp in the digital file attributes by the camera's data logger and cross-checked with the time stamp in the navigational system's computer data file. In addition, the field crew kept redundant written sample logs (Appendix D). Images were downloaded periodically to verify successful sample acquisition and/or to assess the type(s) of sediment/depositional layer present at a given station. Digital image files were renamed with the appropriate station names immediately after downloading as a further quality assurance step.

2.3.2 Plan-View Imaging

An Ocean Imaging® Model DSC24000 plan-view underwater camera (PV) system with two Ocean Imaging® Model 400-37 Deep Sea Scaling lasers was attached to the sediment-profile camera frame and used to collect plan-view photographs of the seafloor surface. Both SPI and PV images were collected during each "drop" of the system. The PV system consisted of a Nikon® D-7100 SLR camera encased in an aluminum housing, a 24 VDC autonomous power pack, a 500 W strobe, and a bounce trigger. A weight was attached to the bounce trigger with a stainless-steel cable so that the weight hung below the camera frame; the scaling lasers projected two red dots that were separated by a constant distance (26 cm) regardless of the field-of-view of the PV system. The field-of-view can be varied by increasing or decreasing the length of the trigger wire and, thereby, the camera height above the bottom when the picture is taken. As the SPI/PV camera system was lowered to the seafloor, the weight attached to the bounce trigger contacted the seafloor prior to the camera frame reaching the seafloor and triggered the PV camera (Figure 2-3).

During set up and testing of the PV camera, the positions of lasers on the PV camera were checked and calibrated to ensure separation of 26 cm. Test images were also captured to confirm proper camera settings for site conditions. Images were checked periodically throughout the survey to confirm that the initial camera settings were still resulting in the highest possible quality images. All camera settings were recorded in the field log (Appendix D). For this survey, the ISO-equivalent was set at 400, shutter speed was 1/30, f-stop was f14, and storage was in compressed raw Nikon Electronic Format (NEF) files (approximately 30 MB each). Additional camera settings used were: white balance set to flash, color mode set to Adobe RGB, sharpening set to none, noise reduction off. Details of the camera settings for each digital image also are available in the associated parameters file embedded in each electronic image file.

Prior to field operations, the internal clock in the digital PV system was synchronized with the vessel's GPS navigation system and the SPI camera. Each image was assigned a unique time stamp in the digital file attributes by the camera's data logger and cross-checked with the time stamp in the navigational system's computer data file. In addition, the field crew kept redundant written sample logs (Appendix D). Throughout the survey, PV images were downloaded at the same time as SPI images and were evaluated for successful image acquisition and image clarity. Digital image files were renamed with the appropriate station names immediately after downloading as a further quality assurance step.

The ability of the PV system to collect usable images is dependent on the clarity of the water column. Water conditions during this survey allowed use of a 0.5 m trigger wire, resulting in approximate image widths of 0.4 m.

2.3.3 SPI and PV Data Collection

The SPI/PV survey was conducted at CCBDS from October 20-21, 2016 aboard the *R/V Jamie Hanna*. At each station, the vessel was positioned at the target coordinates and the camera was deployed within a defined station tolerance of 10 m. Four replicate SPI and PV images were collected at each of the stations (Appendix C). The three replicates with the best quality images from each station were chosen for analysis (Appendix E).

The DGPS described above was interfaced to HYPACK® software via laptop serial ports to provide a method to locate and record sampling locations. Throughout the survey, the HYPACK® data acquisition system received DGPS data. The incoming data stream was digitally integrated and stored on the PC's hard drive. The system provided a steering display to enable the vessel captain to navigate to the pre-established survey target locations. The navigator electronically recorded the vessel's position when the equipment contacted the seafloor and the winch wire went slack. Each replicate SPI/PV position was recorded and time stamped. Actual SPI/PV sampling locations were recorded using this system.

2.3.4 Image Conversion and Calibration

Following completion of the field operations, the raw image files were color calibrated in Adobe Camera Raw® by synchronizing the raw color profiles to an X-Rite Color Checker Classic Color Calibration Target that was photographed prior to field operations with the SPI camera. The raw images were then converted to high-resolution Photoshop Document (PSD) format files, using a lossless conversion file process, maintaining an Adobe RGB (1998) color profile. The PSD images were then calibrated and analyzed in Adobe Photoshop®. Image calibration was achieved by measuring the pixel length of a 5-cm scale bar printed on the X-Rite Color Checker Target, providing a pixel per centimeter calibration. This calibration information was applied to all SPI images analyzed. Linear and area measurements were recorded as the number of pixels and converted to scientific units using the calibration information.

2.3.5 SPI and PV Data Analysis

Computer-aided analysis of SPI/PV images provided a set of standard measurements to allow comparisons among different locations and surveys. The DAMOS Program has successfully used this technique for over 30 years to map the distribution of disposed dredged material and to monitor benthic recolonization at disposal sites.

Measured parameters for SPI and PV images were recorded in Microsoft Excel© spreadsheets. These data were subsequently checked by one of INSPIRE's senior scientists as an independent quality assurance/quality control review before final interpretation was performed. Spatial distributions of SPI/PV parameters were mapped using ArcGIS.

2.3.5.1 Sediment-Profile Image Analysis Parameters

The parameters discussed below were assessed and/or measured for each replicate SPI image. Descriptive comments were also made for each replicate image.

Sediment Type – The sediment grain size major mode and range were estimated visually using a visual grain size comparator created at a similar scale. Results were reported using the phi scale. A cross-walk between phi size classes, mm size ranges, and Udden-Wentworth size classes is provided in Appendix F. The presence and thickness of dredged material were also assessed.

Penetration Depth – The depth to which the camera penetrated the seafloor was measured to provide an indication of the sediment bearing capacity and shear strength. The penetration depth can range from a minimum of 0 cm (i.e., no penetration on hard substrata) to a maximum of 20 cm (full penetration of very soft substrata).

Surface Boundary Roughness – Surface boundary roughness is a measure of the vertical relief of features at the sediment-water interface. Surface boundary roughness was determined by measuring the vertical distance between the highest and lowest points of the sediment-water interface. The surface boundary roughness measured over the width of sediment-profile images typically ranges from 0 to 4 cm and may be related to physical structures (e.g., ripples, rip-up structures) or biogenic features (e.g., burrow openings, fecal mounds, foraging depressions).

Mud Clasts – When fine-grained, cohesive sediments are disturbed, either by physical bottom scour or faunal activity (e.g., decapod foraging) intact clumps of sediment are often scattered across the seafloor. The number of clasts observed at the sediment-water interface were counted and their oxidation state assessed. The detection of reduced mud clasts in an obviously aerobic setting suggests a recent origin (Germano 1983). Mud clasts that are artefacts of SPI sampling (mud clots can fall off the back of the prism or wiper blade) are not recorded in the analysis sheet, but may be noted in the "Comments" field.

Apparent Redox Potential Discontinuity (aRPD) Depth – The aRPD depth provides a measure of the integrated time history of the balance between near-surface oxygen conditions and biological reworking of sediments. Oxidized surface sediments contain particles coated with ferric hydroxide (an olive or tan color when associated with particles) (Fenchel 1969; Lyle 1983). As the particles are buried or moved down by biological activity they are exposed to reducing oxygen concentrations in subsurface porewaters and their oxic coating slowly changes color to dark gray or black (Fenchel 1969; Lyle 1983). The aRPD serves as a proxy for the RPD, the boundary between positive Eh and negative Eh regions of the sediment column (where Eh=0) that indicates a switch from dominantly aerobic to dominantly anaerobic processes. The mean aRPD measured in SPI has been shown to be a suitable proxy for the RPD with the depth of the actual Eh = 0 horizon generally either equal to or slightly shallower than the depth of the optical reflectance boundary (Rosenberg et al. 2001; Simone and Grant 2017). When biological activity is high, the aRPD depth increases; when it is low or absent, the aRPD depth decreases. The aRPD depth was measured by visually assessing color and reflectance boundaries within the images and, for each image, a mean aRPD was calculated.

Sediment Oxygen Demand – Sediment oxygen demand (SOD) represents the overall rate of oxygen consumption, biologically and chemically, by the sediment column. Organic loading to a system results in increased SOD and results in reduced sediments. The relative amount of organic enrichment is indicated by sediment color; darker coloration indicates that sediment is more reduced and has greater organic loading (Fenchel 1969; Rhoads 1974; Lyle 1983; Bull and Williamson 2001). SOD levels (i.e., none, low, medium, and high) were assessed for all images.

Low Dissolved Oxygen – Images in which dark gray or black reduced sediments were in contact with the water column across the entire length of the sediment-water interface were recorded as having low dissolved oxygen condition.

Sedimentary Methane – If organic loading is extremely high, porewater sulfate is depleted and methanogenesis occurs. The process of methanogenesis is indicated by the appearance of methane bubbles in the sediment column. These gas-filled voids are readily discernable in SPI images because of their irregular, generally circular aspect and glassy texture (due to the reflection of the strobe off the gas bubble).

Thiophilic Bacteria (*Beggiatoa*) – The presence of sulfur-oxidizing bacterial colonies indicates hypoxic dissolved oxygen concentrations in the water column at the benthic boundary-layer (Rosenberg and Diaz 1993). The presence and extent (e.g., threads, trace, patches, mat) of the *Beggiatoa* or *Beggiatoa*-like colonies were noted.

Infaunal Successional Stage – Infaunal successional stage is a measure of the biological community inhabiting the seafloor. Current theory holds that organism-sediment interactions in fine-grained sediments follow a predictable sequence of development after a major disturbance (e.g., dredged material disposal) (Pearson and Rosenberg 1978; Rhoads and Germano 1982; Rhoads and Boyer 1982). This continuum has been divided subjectively into four stages: Stage 0, indicative of a sediment column that is largely devoid of macrofauna, occurs immediately following a physical disturbance or in close proximity to an organic enrichment source; Stage 1 is the initial community of tiny, densely populated polychaete assemblages; Stage 2 is the start of the transition to head-down deposit feeders; and Stage 3 is the mature, equilibrium community of deep-dwelling, head-down deposit feeders (Figure 2-4). In dynamic environments, it is simplistic to assume that benthic communities always progress completely and sequentially through all four stages in accordance with the idealized conceptual model (Figure 2-4). Various combinations of these basic successional stages are possible. For example, secondary succession can occur (Horn 1974) in response to additional labile carbon input to surface sediments, with surface-dwelling Stage 1 or 2 organisms co-existing at the same time and place with Stage 3, resulting in the assignment of a “Stage 1 on 3” or “Stage 2 on 3” designation. If both Stage 1 and Stage 2 organisms exists in an image with Stage 3 fauna, the Stage 1 on 3 designation is used because it is more important to document the presence of recruiting organisms than intermediate Stage 2 fauna. Additionally, “Stage 2 -> 3” is used to indicate that Stage 2 appears to be progressing to Stage 3; for example, evidence of deep burrowing resembles Stage 3 but not overt signs of Stage 3 taxa are present in the image. Successional stage was assigned by assessing the types of species or organism-related activities apparent in the images. Additional variables related to the infaunal community and their role in bioturbation are often important to consider as bioturbation is related not only to sediment oxygen dynamics, but also nutrient and contaminant fluxes (Reible and Thibodeaux 1999). In this study, the minimum and maximum linear distances from the sediment surface to feeding voids were measured.

2.3.5.2 Plan-View Analysis Parameters

Plan-view images provide a much larger field-of-view than SPI images and provide valuable information about the landscape ecology and sediment topography in the area where the pinpoint “optical core” of the sediment profile was taken (Figure 2-5). Unusual surface sediment layers, textures, or structures detected in any of the sediment-profile images can be interpreted considering the larger context of surface sediment features; i.e., is a surface layer or topographic feature a regularly occurring feature and typical of the seafloor in this general vicinity or an isolated anomaly? The scale information provided by the underwater lasers allows accurate density counts of attached epifaunal colonies, sediment burrow openings, or larger macrofauna or fish which may have been missed in the sediment-profile cross section, as well as measurements of the percent cover of *Beggiatoa* colonies and other features of interest observable on the seafloor at the sampling location. Information on sediment transport dynamics and bedform wavelength were also available from PV image analysis.

For each replicate PV image, the field-of-view was calculated and the sediment type, oxidation state of surface sediment, presence and type of bedforms; presence and notes related to dredged material; estimations of the relative percent cover of burrows, tubes, tracks, macrophytes; types of epifauna, flora, and debris; quantitative measures of *Beggiatoa* percent cover; number of fish; and descriptive comments were recorded.

2.3.6 Statistical Methods

The objective of this survey was to assess the status of benthic community recolonization of the sediment at disposal areas relative to reference area conditions. Statistical analyses were conducted to compare key SPI variables between sampled disposal areas (Mound B and Mound C) and reference areas (CCBRS, NWREF, and SWREF). The aRPD depth and successional stage measured in each image are the best indicators of infaunal activity measured by SPI and were, therefore, used in this comparative analysis. Standard boxplots were generated for visual assessment of the central tendency and variation in each of these variables within each disposal area and each reference area. Tests rejecting the inequivalence between the reference and disposal areas were conducted, as described in detail below.

The objective to look for differences has conventionally been addressed using a point null hypothesis of the form, "There is no significant difference in benthic conditions between the reference area and the disposal target areas." However, there is always some difference (perhaps only to a very small decimal place) between groups, but the statistical significance of this difference may or may not be ecologically meaningful. On the other hand, differences may not be detected due to insufficient statistical power. Without a power analysis and specification of what constitutes an ecologically meaningful difference, the results of conventional point null hypothesis testing often provide inadequate information for ecological assessments (Germano 1999). An approach using an inequivalence null hypothesis will identify when groups are statistically similar, within a specified interval, which is more suited to the objectives of the DAMOS monitoring program.

For an inequivalence test, the null hypothesis presumes the difference is great; this is recognized as a "proof of safety" approach because rejection of the inequivalence null hypothesis requires sufficient proof that the difference was actually small (McBride 1999). The null and alternative hypotheses for the inequivalence hypothesis test are:

H_0: $d < -\delta$ or $d > \delta$ (presumes the difference is great)

H_A: $-\delta < d < \delta$ (requires proof that the difference is small)

where d is the difference between a reference mean and a site mean.

The test of this inequivalence (interval) hypothesis can be broken down into two one-sided tests (TOST) (McBride 1999, Schuirmann 1987). Assuming a symmetric distribution, the inequivalence hypothesis is rejected at α of 0.05 if the 90% confidence interval for the measured difference (or, equivalently, the 95% upper limit <u>and</u> the 95% lower limit for the difference) is wholly contained within the equivalence interval $[-\delta, +\delta]$. The size of δ should be determined from historical data, and/or professional judgment, to identify the bounds that are within background variability and is therefore not ecologically meaningful. Previously established δ values of 1 cm for aRPD depth and 0.5 for successional stage rank (on the 0-3 scale) were used.

The statistics used to test the interval hypotheses shown here are based on the Central Limit Theorem (CLT) and basic statistical properties of random variables. A simplification of the CLT states that the mean of any random variable is normally distributed. Linear combinations of normal random variables are also normal so a linear function of means is also normally distributed. When a linear function of means is divided by its standard error the ratio follows a t-distribution with degrees of freedom associated with the variance estimate. Hence, the t-distribution can be used to construct a confidence interval around any linear function of means.

In this survey, five distinct locations were sampled; three were categorized as reference areas (CCBRS, NWREF, and SWREF) and two were disposal locations (Mound B and Mound C). The difference equation of interest was the linear contrast of the average of the three reference means minus each disposal area mean, or

$$\hat{d} = [1/3 \times (\text{Mean}_{\text{CCBRS}} + \text{Mean}_{\text{NWREF}} + \text{Mean}_{\text{SWREF}}) - (\text{Mean}_{\text{Disposal}})] \qquad \text{[Eq. 1]}$$

where $\text{Mean}_{\text{Disposal}}$ was the mean for one of the disposal areas (Mounds B and C).

The three reference areas collectively represented ambient conditions, but if the means were different among these three areas, then pooling them into a single reference group would inflate the variance estimate because it would include the variability between areas, rather than only the variability between stations within each single homogeneous area. The effect of keeping the three reference areas separate had no effect on the grand reference mean when sample size was equal among these areas, but it ensured that the variance is truly the residual variance within a single population with a constant mean.

The difference equation, $\hat{d}$, for the comparison of interest was specified in Eq. 1 and the standard error of each difference equation used the fact that the variance of a sum is the sum of the variances for independent variables, or:

$$SE(\hat{d}) = \sqrt{\sum_j \left(S_j^2 c_j^2 / n_j\right)} \qquad \text{[Eq. 2]}$$

where:

c_j = coefficients for the j means in the difference equation, $\hat{d}$ [Eq. 1] (i.e., for equation 1 shown above, the coefficients were 1/3 for each of the 3 reference areas, and -1 for the disposal area).

S_j^2 = variance for the j_{th} area. If equal variances are assumed, the pooled residual variance estimate equal to the mean square error from an *ANOVA* based on all groups involved, can be used for each S_j^2.

n_j = number of stations for the j_{th} area.

The inequivalence null hypothesis was rejected (and equivalence concluded) if the confidence interval on the difference of means, $\hat{d}$, was fully contained within the interval [–δ, + δ]. Thus, the decision rule was to reject H_0 (the two groups were inequivalent) if:

$$D_L = \hat{d} - t_{\alpha,\upsilon} SE(\hat{d}) \geq -\delta \quad \text{and} \quad D_U = \hat{d} + t_{\alpha,\upsilon} SE(\hat{d}) \leq \delta \qquad \text{[Eq. 3]}$$

where:

$\hat{d}$ = observed difference in means between the Reference and Disposal Area.

$t_{\alpha,\upsilon}$ = upper (1-α)*100_{th} percentile of a Student's t-distribution with υ degrees of freedom (α = 0.05)

$SE(\hat{d})$ = standard error of the difference ([Eq. 2])

υ = degrees of freedom for the standard error. If a pooled residual variance estimate was used, this was the residual degrees of freedom from an ANOVA on all groups (total number of stations minus the number of groups); if separate variance estimates were used, degrees of freedom were calculated based on the Welch-Sattherthwaite estimation (Satterthwaite 1946, Zar 1996).

Validity of normality and equal variance assumptions was tested using Shapiro-Wilk's test for normality on the area residuals (α = 0.05) and Levene's test for equality of variances among areas (α =0.05). If normality was not rejected but equality of variances was, then normal parametric confidence bounds were calculated, using separate variance estimates for each group. If normality was rejected, then non-parametric bootstrapped estimates of the confidence bounds were calculated.

2.4 Fishing Gear Assessment via Surface Marker Buoy

During the CCBDS acoustic survey, each time a surface buoy marking fishing gear was observed alongside the vessel in and around the acoustic survey area, the location was time-stamped as a GPS fix within HYPACK. Each surface buoy was labeled based on its port/starboard position relative to the vessel's course and the marker buoy's color patterns. Real-time viewing of previously recorded buoys on the navigation system minimized duplicate records of individual marker buoys. A file of marker buoy GPS locations was created and was used to generate a map of surface marker buoy locations throughout CCBDS.

Table 2-1.

Accuracy and Uncertainty Analysis of Bathymetric Data

		Results (m)		
Survey Date	**Quality Control Metric**	**Mean**	**95% Uncertainty**	**Range**
10/18-19/2016	Cross-Line Swath Comparisons	0.00	0.11	
	Within Cell Uncertainty	0.05	0.10	0.00 - 0.69
	Beam Angle Uncertainty (0 - 60d)	0.00	0.11	0.10 - 0.12

Notes:

1. The mean of cross-line nadir and full swath comparisons are indicators of tide bias.
2. 95% uncertainty values were calculated using the sums of mean differences and standard deviations expressed at the 2-sigma level.
3. Within cell uncertainty values include biases and random errors.
4. Beam angle uncertainty was assessed by comparing cross-line data (60-degree swath limit) with a reference surface created using mainstay transect data.
5. Swath and cell based comparisons were conducted using 2 m x 2 m cell averages. These analyses do not exclude sounding variability associated with terrain slopes.

Table 2-2.

CCBDS 2016 Target SPI/PV Station IDs/Coordinates

Sample ID	Station ID	X	Y	Latitude	Longitude
CCBDS_16B1_SPI_B-01	B-01	157652.4	-193710.1	41.9099290	-70.2158460
CCBDS_16B1_SPI_B-02	B-02	157739.2	-193606.1	41.9108800	-70.2148260
CCBDS_16B1_SPI_B-03	B-03	157659.8	-193644.0	41.9105250	-70.2157740
CCBDS_16B1_SPI_B-04	B-04	157568.2	-193342.8	41.9132190	-70.2169490
CCBDS_16B1_SPI_B-05	B-05	157982.8	-193538.9	41.9115290	-70.2119070
CCBDS_16B1_SPI_B-06	B-06	157793.9	-193297.5	41.9136670	-70.2142410
CCBDS_16B1_SPI_B-07	B-07	157548.1	-193742.2	41.9096210	-70.2170960
CCBDS_16B1_SPI_B-08	B-08	157638.6	-193258.3	41.9139930	-70.2161220
CCBDS_16B1_SPI_B-09	B-09	157858.3	-193721.9	41.9098600	-70.2133630
CCBDS_16B1_SPI_B-10	B-10	157978.4	-193575.3	41.9112000	-70.2119510
CCBDS_16B1_SPI_B-11	B-11	157680.2	-193797.1	41.9091510	-70.2154910
CCBDS_16B1_SPI_B-12	B-12	157912.4	-193561.8	41.9113100	-70.2127490
CCBDS_16B1_SPI_C-13	C-13	156641.0	-193754.0	41.9093510	-70.2280220
CCBDS_16B1_SPI_C-14	C-14	156603.0	-193661.5	41.9101770	-70.2285020
CCBDS_16B1_SPI_C-15	C-15	156859.3	-193602.0	41.9107590	-70.2254280
CCBDS_16B1_SPI_C-16	C-16	156641.4	-193572.4	41.9109850	-70.2280620
CCBDS_16B1_SPI_C-17	C-17	156556.0	-193419.9	41.9123430	-70.2291270
CCBDS_16B1_SPI_C-18	C-18	156691.3	-193355.6	41.9129460	-70.2275120
CCBDS_16B1_SPI_C-19	C-19	156521.9	-193363.8	41.9128420	-70.2295520
CCBDS_16B1_SPI_C-20	C-20	156974.1	-193450.7	41.9121410	-70.2240820
CCBDS_16B1_SPI_C-21	C-21	156797.4	-193748.4	41.9094300	-70.2261390
CCBDS_16B1_SPI_C-22	C-22	156621.8	-193274.2	41.9136660	-70.2283700
CCBDS_16B1_SPI_C-23	C-23	156476.9	-193654.6	41.9102160	-70.2300230
CCBDS_16B1_SPI_C-24	C-24	156915.4	-193688.7	41.9099880	-70.2247320
CCBDS_16B1_SPI_CCBRS-01	CCBRS-01	153660.3	-188324.2	41.9576720	-70.2652810
CCBDS_16B1_SPI_CCBRS-02	CCBRS-02	153434.0	-188461.1	41.9563980	-70.2679770
CCBDS_16B1_SPI_CCBRS-03	CCBRS-03	153644.2	-188522.1	41.9558880	-70.2654270
CCBDS_16B1_SPI_CCBRS-04	CCBRS-04	153719.1	-188211.5	41.9586970	-70.2646010
CCBDS_16B1_SPI_NWREF-05	NWREF-05	155586.6	-191123.3	41.9328350	-70.2413690
CCBDS_16B1_SPI_NWREF-06	NWREF-06	155560.1	-191070.7	41.9333040	-70.2417020
CCBDS_16B1_SPI_NWREF-07	NWREF-07	155258.3	-191308.5	41.9311090	-70.2452810
CCBDS_16B1_SPI_NWREF-08	NWREF-08	155518.6	-191346.5	41.9308140	-70.2421350
CCBDS_16B1_SPI_SWREF-09	SWREF-09	153305.2	-196698.1	41.8822420	-70.2674820
CCBDS_16B1_SPI_SWREF-10	SWREF-10	153415.3	-196890.8	41.8805290	-70.2661080
CCBDS_16B1_SPI_SWREF-11	SWREF-11	153533.5	-196940.2	41.8801060	-70.2646730
CCBDS_16B1_SPI_SWREF-12	SWREF-12	153631.3	-196761.7	41.8817310	-70.2635380

Notes

1. Grid coordinates are NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001_Meters
2. Geographic coordinates are NAD83 decimal degrees

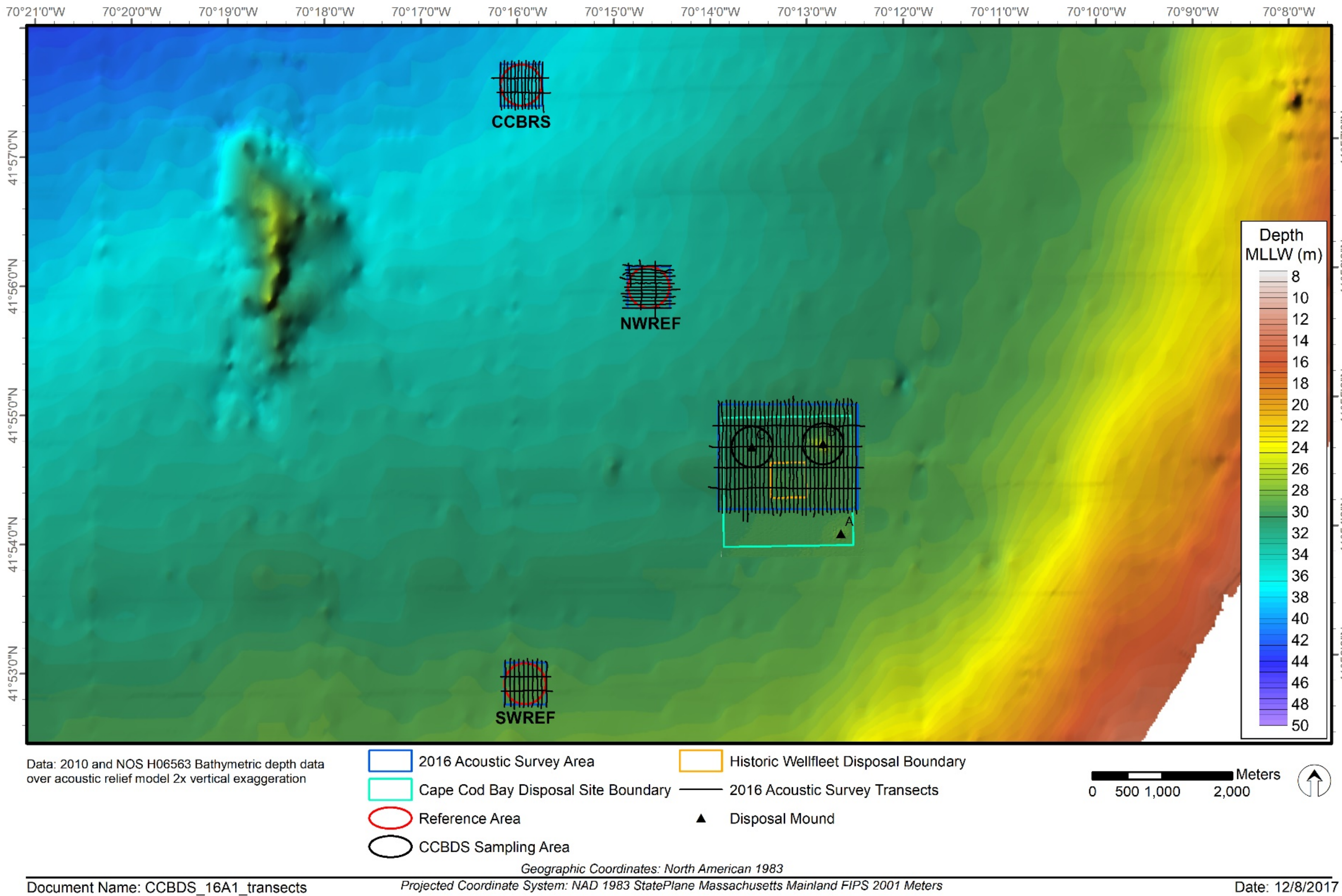


Figure 2-1. CCBDS 2016 acoustic survey area and tracklines

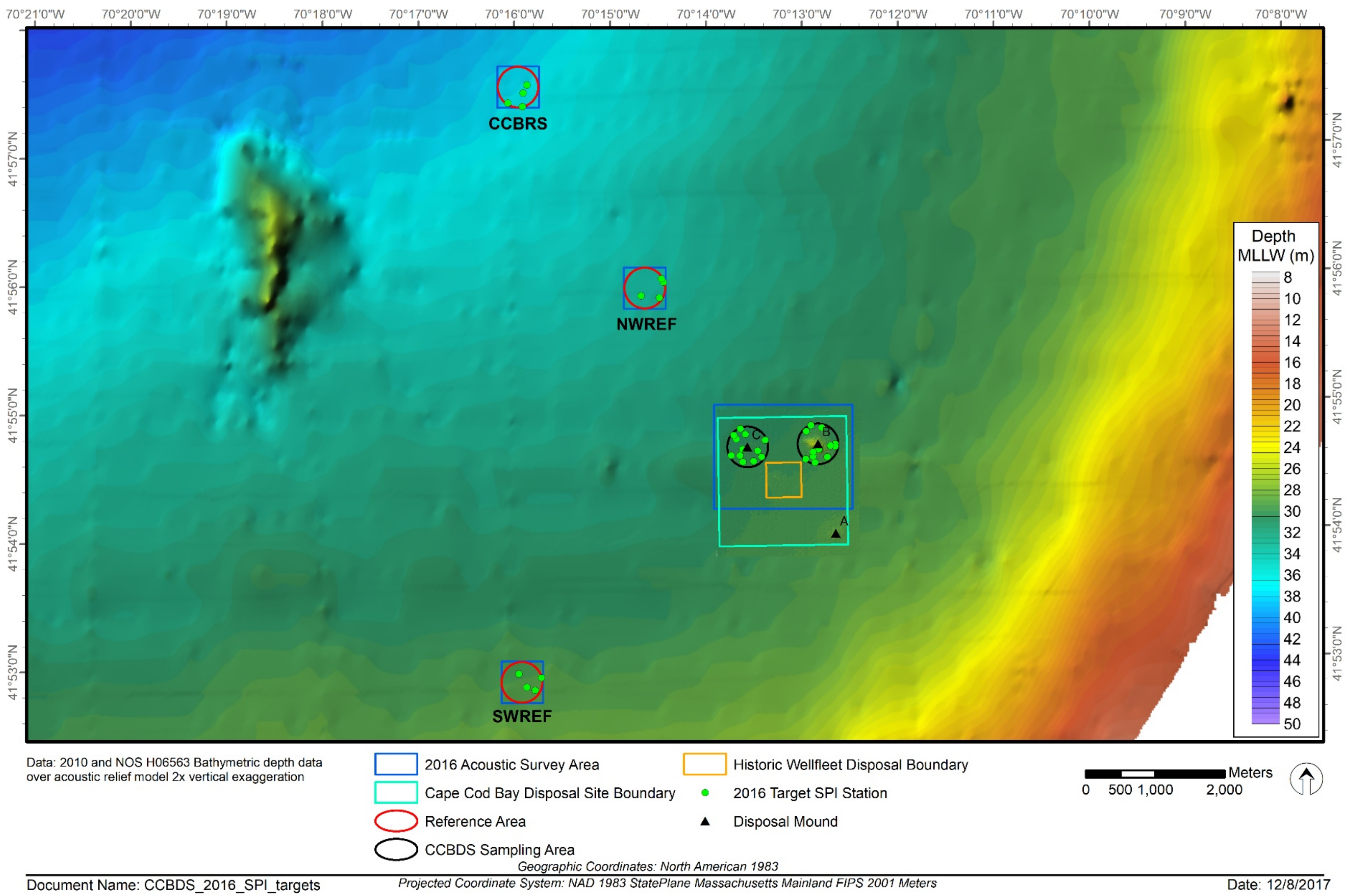


Figure 2-2. CCBDS 2010 bathymetry with target station locations

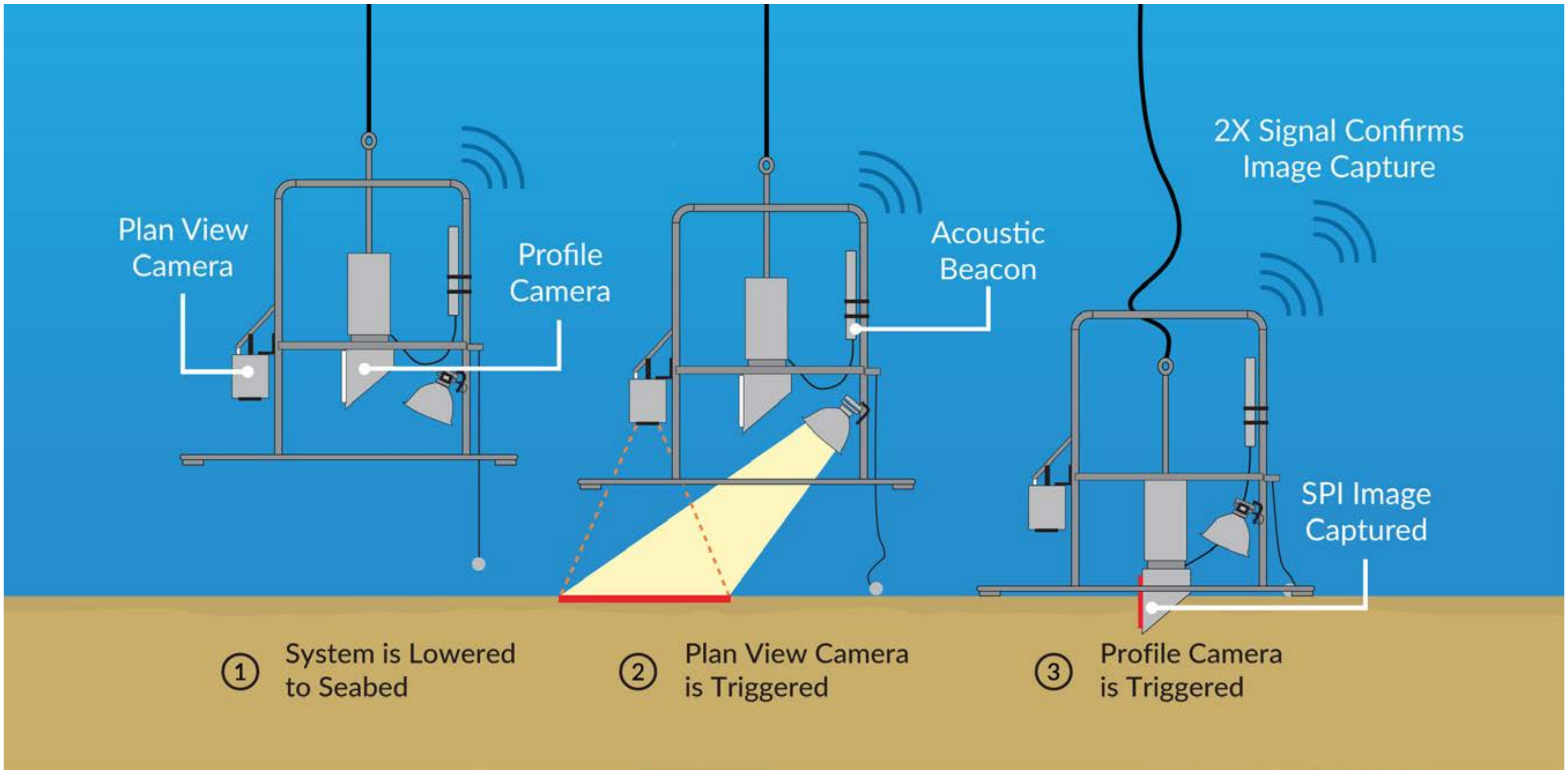


Figure 2-3. Operation of the sediment-profile and plan-view camera imaging system

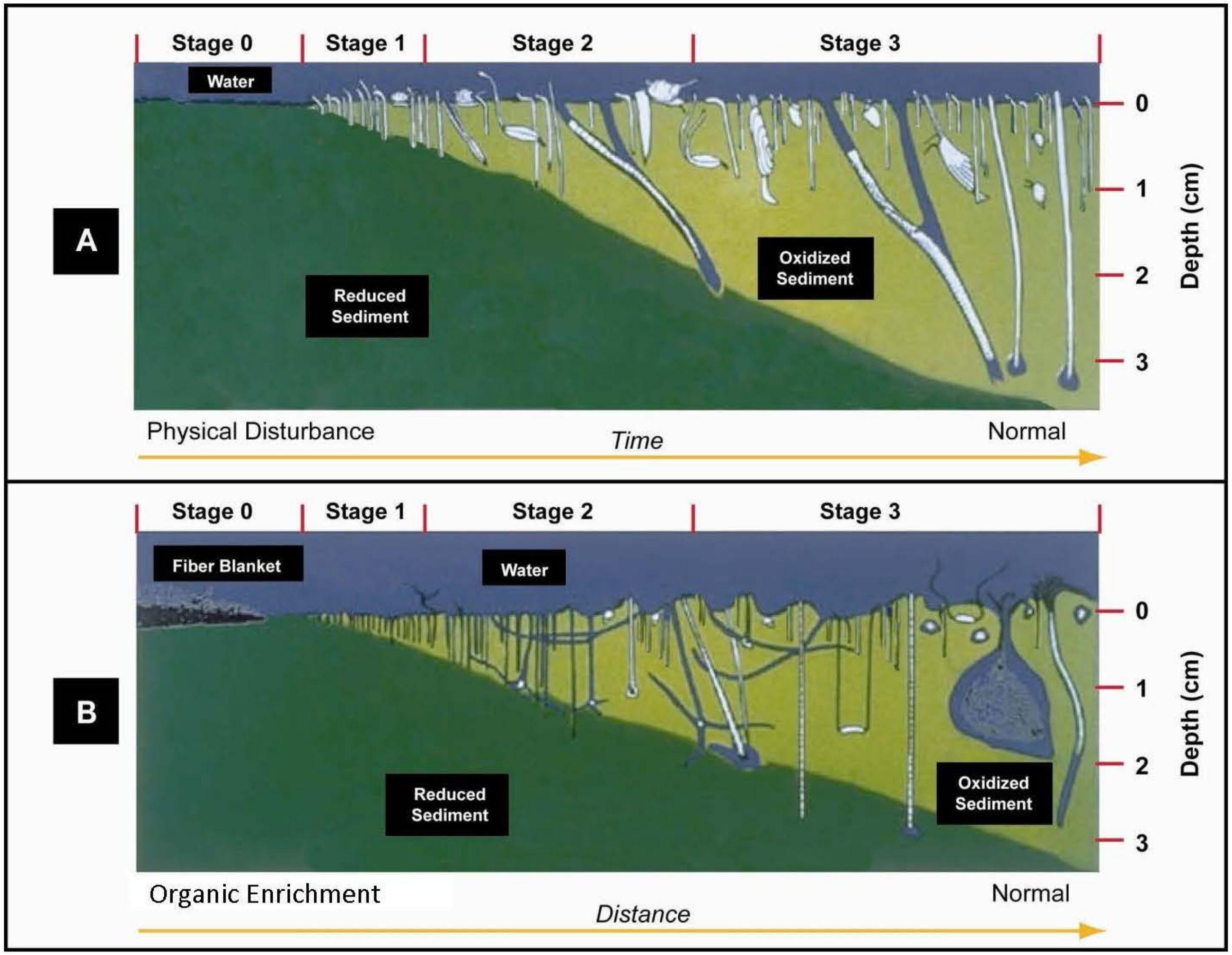


Figure 2-4. The stages of infaunal succession as a response of soft-bottom benthic communities to (A) physical disturbance or (B) organic enrichment; from Rhoads and Germano (1982)

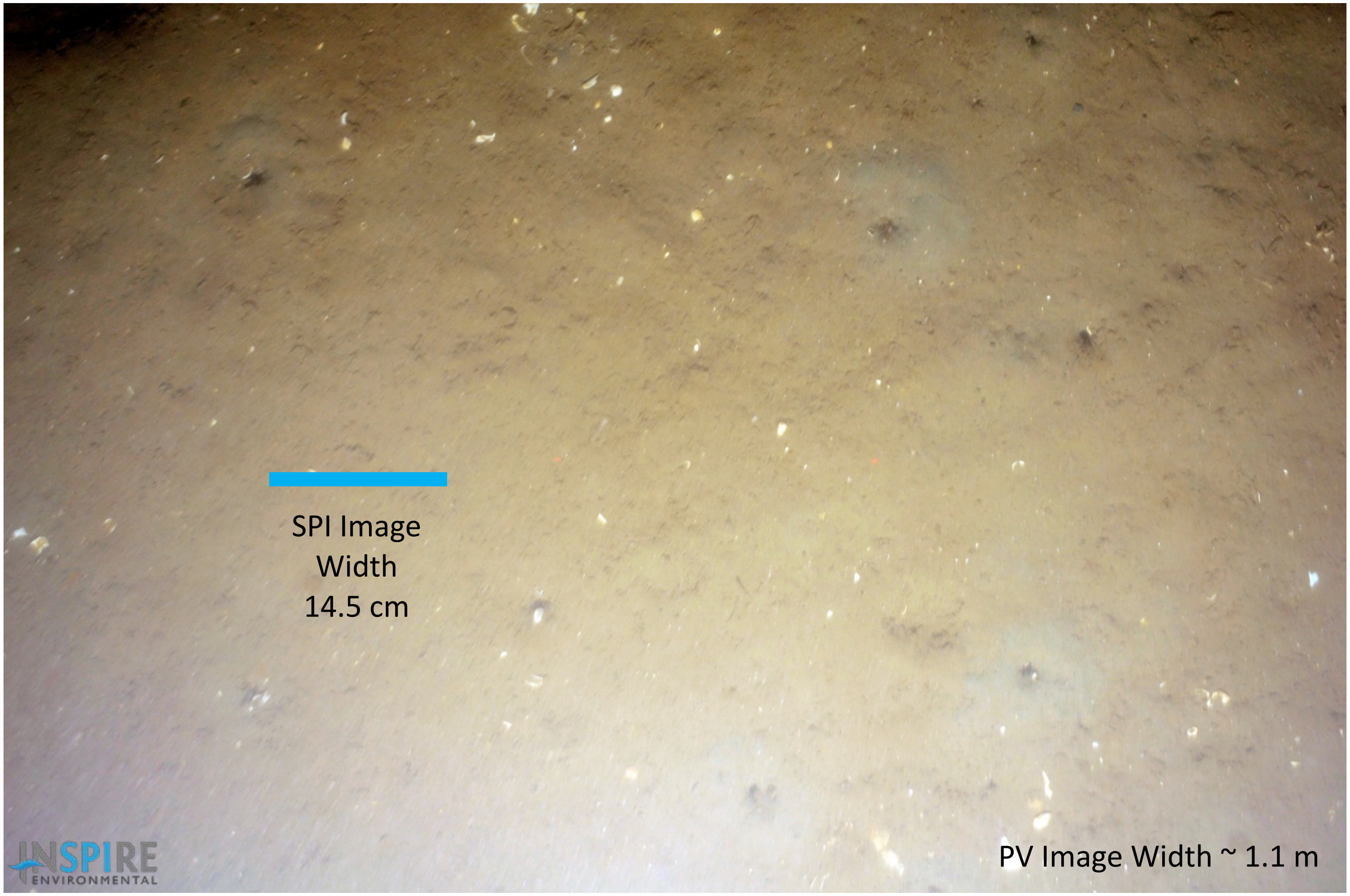


Figure 2-5. The blue scaling line on this representative plan-view image shows the sampling relationship between plan-view and sediment-profile images. Note: plan-view image coverage may vary between stations

3.0 RESULTS

The objectives of the October 2016 survey of CCBDS were to characterize seafloor topography and surficial features, to define the physical characteristics of the surface sediment, and to evaluate the recovery of the benthic community following recent placement of dredged material. The bathymetric surveys conducted during 2016 were designed to aid in management of material placement and assessment of long-term stability. Since the most recent DAMOS survey in September 2010, approximately 270,000 m^3 of material has been deposited at CCBDS. Survey tools were multibeam bathymetry and SPI/PV imaging.

3.1 Bathymetry

The acoustic survey (bathymetric, side-scan and backscatter data collection) was performed over the active portion of CCBDS (located in the northern portion of the site) and at three reference areas (CCBRS, NWREF, and SWREF; Figure 3-1a). Within CCBDS the survey covered Mounds B and C. (Figure 3-1b). Multibeam bathymetric data rendered as a depth-scaled acoustic relief model (color scale with hillshading) provided a more detailed representation of the survey area topography (Figures 3-2a and 3-2b). The bathymetry of reference areas surveyed in October 2016 indicated a relatively flat and featureless bottom at all three areas, with mean water depths of 38 m, 33 m, and 29 m at CCBRS, NWREF, and SWREF, respectively (Table 3-1; Figure 3-1a).

The bathymetry of CCBDS was relatively flat and was punctuated by Mounds B and C, which appeared as discrete formations rising above the surrounding seafloor. Mound C had a smooth plateau rising approximately 3 m above the surrounding seafloor. Mound B had an elongated crest approximately 5 to 7 m above the bottom with shoulder areas that were 1–2 m high. Each of these mounds had been previously identified (AECOM 2012) and were due to the legacy of dredged material disposal in this area. Color scale presentation of multibeam bathymetric data enhanced the visibility of irregular depressions that were in this location. A series of small craters, consistent with the placement of individual scow loads of dredged material, "pock-marked" the seafloor in the survey area (Figure 3-2b).

3.1.1 Acoustic Backscatter and Side-Scan Sonar

Acoustic backscatter provides an indication of the type of surficial sediment present in the survey area. Strong acoustic backscatter returns are typically indicative of coarse material or rough surfaces while weak acoustic backscatter returns are typically indicative of fine-grained materials or smooth surfaces (fine sands and silts). Unfiltered backscatter imagery of the reference areas revealed homogenous, weak returns across NWREF, CCBRS, and SWREF (Figure 3-3a). Unfiltered backscatter imagery of CCBDS revealed areas of stronger returns (dark areas in Figure 3-3b) at both disposal Mound B and disposal Mound C, and medium returns within the Historic Wellfleet disposal boundary located in the south-central portion of the surveyed area. Weaker returns were found in the areas surrounding the three disposal areas (lighter areas in Figure 3-3b).

Filtered backscatter provides a quantitative assessment of surface characteristics independent of slope effects. Overall backscatter returns as the reference areas were weak, with the strongest returns at SWREF (-30 to -34 dB), the weakest returns at NWREF (-34 to -38 dB), and returns between –32 and -36 dB at SWREF (Figure 3-4a). In the CCBDS survey area, the strongest filtered backscatter returns were observed at the topographic highs of the two mounds, with returns of -18 to -26 dB indicative of placement material (Figure 3-4b) and lower returns of -32 to -40 dB typical on the surrounding native seafloor. There was clear evidence of isolated disposal impact features and curved trails of dredged material that have been observed at other disposal sites (Carey et al. 2013 and Valente et al. 2012). Trails of material from barge disposal events were most visible extending from target placement location C in the western portion of the survey area, and the irregularity of the seafloor in and around the mounds was evident (Figure 3-4b). Patterns of disposal activity were also observed within the Historic Wellfleet disposal boundary (Figure 3-4b).

Side-scan sonar results showed few minor surficial features at any of the three reference areas (Figure 3-5a), but provided a clear representation of disposal activity over Mound B and Mound C, based on the presence of faint circular patterns (Figure 3-5b). Side-scan sonar results confirmed observations from backscatter results, but with additional detail. The side-scan sonar results have a higher resolution and are more responsive to minor surficial textural features and slope than backscatter results. Curved disposal tracks were visible around Mound C, and features of placement activity were also visible within the Historic Wellfleet disposal boundary.

3.1.2 Comparison with Previous Bathymetry and Backscatter

The bathymetric results in October 2016 were consistent with earlier survey results for CCBDS (AECOM 2012). A comparison of the elevation difference between depths measured in 2010 and 2016 demonstrated that dredged material placed after 2010 accumulated in a distinct flat mound at the Mound C disposal location (Figure 3-6). The disposed material was contained within the boundaries of CCBDS, with the highest elevation difference (2.6 to 3.4 m) centered on the mound over an approximately 250 x 200 m area. A smaller increase in elevation of approximately 0.4 to 1.0 m extends another 50 m around the highest accumulation.

3.2 Sediment-Profile and Plan-View Imaging

The following sections summarize the results for the reference areas (CCBRS, NWREF, and SWREF) and for each of the disposal mounds surveyed (Mound B and C). Detailed SPI and PV image analysis results are provided in Appendix E. Comparisons between reference areas and disposal mounds, as well as to the survey from 2010 is also provided in section 3.2.3. Mean aRPD was evaluated for statistical equivalence between reference and disposal areas sampled during the 2016 survey effort. Mound C and SWREF were sampled on the 20th of October 2016. Mound B was sampled on both the 20th and 21st of October 2016. NWREF and CCBRS were sampled on the 21st of October 2016.

Replicate stations for SPI and PV images were collected at the disposal mounds and reference areas (Figure 2-3). The area of seafloor captured in the PV images ranged from 0.08 – 0.24 m^2.

3.2.1 Reference Area Stations

3.2.1.1 Physical Sediment Characteristics

The reference areas were characterized by a soft bottom, with a predominant grain size of 4-3 phi documented at all of the stations in each of the three reference areas (Table 3-1, Figures 3-7 and 3-8). Mean replicate prism penetration among reference stations ranged from 14.5 to 19.7 cm with a mean value of 17.4 cm (SD±1.5) (Table 3-1; Figure 3-9). Two weights were added to each side of the system at station SWREF-09 to increase penetration depth (Appendix E). There was no evidence of dredged material at any of the stations sampled in the reference areas, and no evidence of low dissolved oxygen (DO) or sedimentary methane (Figure 3-10; Appendix E).

Small-scale boundary roughness ranged from 0.8 to 1.8 cm with a mean boundary roughness of 1.2 cm (SD±0.3) at the reference areas (Table 3-1; Figure 3-11). Mean boundary roughness was approximately similar at CCBRS (1.0 cm; SD±0.2), NWREF (1.3 cm; SD±0.4), and SWREF (1.4 cm; SD±0.3) (Table 3-1). All of the small-scale topography observed in the reference areas was attributed to the surface and sub-surface activity of benthic organisms, evidenced as small burrow openings and tubes (Figure 3-12).

3.2.1.2 Biological Conditions

At the reference areas, aRPD depths ranged from 1.2 to 4.0 cm with a mean of 2.2 cm (SD±0.9) (Table 3-1; Figure 3-13). Mean aRPD depths were deepest at CCBRS with a mean aRPD depth of 3.2 cm (SD±0.6), and were shallowest at SWREF with a mean depth of 1.3 cm (SD±0.3) (Table 3-1; Figure 3-14). NWREF had a mean aRPD depth of 2.1 cm (SD±0.3) with a range between 1.9 and 2.5 cm (Table 3-1; Figure 3-14).

Stage 3 infauna were present at all three reference areas (Table 3-1; Figure 3-15) with the majority of stations at each area containing mature successional taxa. Only one station in all three reference areas had no replicates containing Stage 3 infauna (NWREF-06, Table 3-1) which contained Stage 2->3 taxa. Stage 2 -> 3 taxa is a transitional successional state identified by medium to large tubes at the sediment water interface and a moderately reworked sediment column (Figure 3-16). Evidence for the presence of Stage 3 fauna included large-bodied infauna, deep subsurface burrows, and/or deep feeding voids (Figure 3-16). Stage 2 fauna are smaller than Stage 3 taxa and are active in the 2 – 4 cm zone below the sediment-water interface; they can coexist with the larger, deep-feeding Stage 3 organisms. The mean number of subsurface feeding voids, indicating Stage 3 fauna, ranged from 0.4 at CCBRS and SWREF to 0.8 at NWREF (Table 3-1). When present, voids were found deep within the sediment, with mean void depths of 12.9 (SD±1.1), 17.1 (SD±0.8), and 10.6 (SD±4.4) cm at CCBRS, NWREF, and SWREF, respectively (Table 3-1; Figure 3-17).

Further indications of subsurface faunal activity from Stage 2 and Stage 3 taxa was observed in the PV images as the presence of burrows, tubes, and tracks on the seafloor (Figure 3-18). Tubes were observed at a 'present' density (10-25% image coverage) in every replicate at NWREF and SWREF and in all but two replicates at CCBRS, which had 'sparse' tube density (>10% coverage) (Table 3-1). Burrow density ranged from no burrows to abundant burrows (25-75% coverage) in the reference areas while tracks across the seafloor, often created by epifauna (crabs, gastropods), were documented in at least one replicate at all three reference areas (Appendix E). PV images at CCBRS and NWREF showed the sediment surface densely covered in brittle stars (Figure-19).

3.2.2 Disposal Site Stations

For this analysis, Mound B and Mound C were considered separately. The most recent disposal events at Mound B occurred in the 2000-2001 season, while Mound C received material as recently as the 2015 season.

3.2.2.1 Physical Sediment Characteristics

Mound B had a mean depth of 30 m, ranging from 23 to 33 m (Table 3-2; Figure 3-2b). Sediments at Mound B were primarily very fine sand with a predominant grain size of 4-3 phi with the exception of station B-06 located at the highest point of the mound; Station B-06 contained coarser grained sediment (0 phi) (Table 3-2, Figures 3-20 and 3-21). Mean replicate camera penetration values ranged from 3.7 to 19.0 cm with a mean of 14.2 cm (SD±5.5) (Table 3-2, Figure 3-22). At stations B-02 and B-06, 4 weights were added per side to the system to achieve shallow penetration (Appendix E). Small scale boundary roughness ranged from 0.6 to 2.4 cm with a mean of 1.1 cm (SD±0.5) (Table 3-2; Figure 3-23). All boundary roughness was biological in origin with no discernible spatial patterns (Figure 3-24).

Mean dredged material thickness was 13.0 cm (SD±5.9) and ranged from 3.7 to 19.0 cm (Table 3-2, Figure 3-25). Dredged material thickness extended beyond prism penetration at all stations (Figure 3-26). Three stations did not contain dredged material (B-07, B-10, and B-11) and were located near the periphery of the boundaries of Mound B (Figure 3-27). There was evidence of methane bubbles at station B-04 (Figure 3-28).

Mound C had a mean depth of 30 m, ranging from 28 to 33 m (Table 3-2; Figure 3-2b). Sediments at Mound C were primarily very fine sand over silt-clay with a predominant grain size of 4-3/>4 phi. The exceptions were stations C-14 and C-15 which contained a sediment column of only very fine sand (Table 3-2, Figures 3-20 and 3-29). Mean replicate camera penetration values ranged from 14.1 to 19.8 cm with a mean of 14.1 cm (SD±1.9)

(Table 3-2; Figure 3-22). Small scale boundary roughness ranged from 0.5 to 1.9 cm with a mean of 1.1 cm (SD±0.4) (Table 3-2; Figure 3-23). All boundary roughness was biological in origin with no discernible spatial patterns (Figure 3-30).

Mean dredged material thickness was 17.2 cm (SD±1.9) and ranged from 14.1 to 19.8 cm (Table 3-2, Figure 3-25). Dredged material was documented at every station sampled, and the thickness of the dredged material extended beyond the prism penetration in all replicates (Figure 3-31). There was no evidence of low DO or sedimentary methane at Mound C (Appendix E).

3.2.2.2 Biological Conditions

At Mound B, mean aRPD depth was 1.7 cm (SD±0.3) and ranged from 1.2 to 2.2 cm (Table 3-2, Figure 3-32). Overall, aRPD depths at Mound B were relatively shallow and the optical reflectance of the sediments in this area (dark gray to black) indicated a sediment oxygen demand (SOD) of moderate to high (Figure 3-33). The majority of stations at Mound B contained at least one replicate with evidence of Stage 3 fauna, except Stations B-01, B-02, and B-06 (Table 3-2; Figure 3-34). Station B-01 was predominantly classified as Stage 2 transitioning to 3, Station B-02 was predominantly Stage 1 transitioning to 2, and Station B-06 had a replicate with Stage 1 taxa and another with evidence of Stage 2 fauna (Figure 3-21). When voids were present they were typically found deep within the sediment with a mean depth of 12.6 cm (SD±4.1) and a range of 7.2 to 19.3 cm (Table 3-2, Figure 3-35). Four stations (B-01, B-02, B-06, and B-08) did not contain any feeding voids (Appendix E). These stations were spatially located near the center of the mound on the topographic high of the peak and surrounding shoulder areas where shallow penetration limited visibility of deep sediment processes.

PV images at Mound B documented the biological activity present on the seafloor as tubes, burrows, and tracks (Figure 3-24). Tubes were observed in sparse to abundant densities in every replicate at Mound B (Appendix E). The majority of replicate images showed no burrows, with other images ranging from sparse to present burrows. Observation of tracks on the sediment surface created by epifauna ranged from no tracks to abundant tracks.

At Mound C, mean aRPD depth was 2.1 cm (SD±0.8) and ranged from 0.9 to 3.2 cm (Table 3-2, Figure 3-32). Overall aRPD depths at Mound C were relatively shallow similar to Mound B (Figure 3-33). There was one station at Mound C with a deep aRPD, Station 24 located at the center of Mound C on the rough plateau (Figure 3-36). All stations at Mound C contained at least one replicate with evidence of Stage 3 fauna (Table 3-2, Figures 3-34 and 3-36). Feeding voids were present in at least one replicate at every station at Mound C (Table 3-2). Voids were typically found deep within the sediment with a mean depth of 11.1 cm (SD±4.0) ranging from 5.2 to 17.6 cm (Figure 3-35). On the whole, successional taxa appeared to be more mature Mound C compared to B though shallow prism penetration at Mound B could impact this assessment.

Further indications of subsurface faunal activity from Stage 2 and Stage 3 taxa was observed in the PV images as the presence of burrows, tubes, and tracks (Figure 3-30). Mound C showed sparse to abundant tubes at every station except C-13 (Appendix E). Burrows were observed in at least one replicate at every station and ranged from no burrows to abundant burrows. Tracks were present in at least one replicate at every station except C-18, ranging from no tracks to abundant tracks across Mound C (Appendix E).

3.2.3 Comparison to Reference Areas

3.2.3.1 Mean aRPD Variable

Area mean aRPD depths at Mound B and C were 1.7 (SD±0.3) and 2.1 (SD±0.8) cm, respectively, comparable to the grand mean aRPD depth of the reference areas at 2.2 (SD±0.9) cm (Tables 3-2 and 3-3; Figure 3-37).

A statistical inequivalence test was performed to determine whether the differences observed in mean aRPD values between the three grouped reference areas against each of the two disposal areas were significantly dissimilar. The station mean aRPD data from all five locations were combined to assess normality and estimate pooled variance. Results for the normality test indicated that each area's residuals, i.e., each observation minus the area mean, was not significantly different from a normal distribution (Shapiro-Wilk's test p-value = 0.69, alpha = 0.05). Levene's test for equality of variances was rejected (p = 0.009, alpha = 0.05), so a single pooled variance estimate could not be used for all groups. Separate variances were used for Mound C (Figure 3-43). The confidence interval for the difference equations were constructed using parametric estimates with separate variances for Mound C and pooled variance for Mound B. The following statistical evaluations combined the three reference areas and treated reference as a single group (with n=12).

The confidence regions for the difference between the mean of the reference areas versus Mound B disposal area and versus Mound C disposal area were each contained within the interval [-1 cm, +1 cm] (Table 3-4). The conclusion was that the aRPD values from each of these two disposal areas were significantly equivalent to the pooled reference areas in the 2016 survey, i.e. there was no difference in aRPD depth between the disposal and the reference areas. The difference in means between reference and Mound B was 0.5 cm, and between reference and Mound C was 0.1 cm with the pooled reference areas having aRPD values roughly equivalent to Mound B and Mound C (Table 3-4).

3.2.3.2 Mean Successional Stage Rank

To evaluate these successional stages numerically, a successional stage rank variable was applied to each image. A value of 3 was assigned to Stage 3, 2 on 3, or 1 on 3 designations, a value of 2 was applied to Stage 2 or 1 on 2, a value of 1 was applied to Stage 1, intermediate ranks were assigned to the transitional assemblages (2.5 for Stage 2 transitioning to Stage 3, and 1.5 for 1 transition to 2), and images from which the stage could not be determined were excluded from calculations. The maximum successional stage rank among replicates was used to represent the station value.

The successional stage rank variable was either Stage 2 transitioning to Stage 3, or Stage 3 across all three reference areas and Mound C disposal area. Two stations from Mound B contained a successional stage rank variable of Stage 2. Bootstrapping was used to construct confidence intervals between the mean successional stage at disposal areas Mound B and Mound C versus the pooled reference areas.

The confidence region for the difference between the mean successional stage rank of the pooled reference areas (2.9) versus Mound B (2.8), and versus C (3.0) were each contained within the interval [-0.5, +0.5 cm] (Table 3-5), which indicates that the mean successional stages at Mound B and Mound C were statistically equivalent to reference.

3.2.4 Temporal Comparisons

3.2.4.1 Mean aRPD Variable

Area mean aRPD depths at Mound B disposal area in 2010 and 2016 were 2.7 and 1.7 cm, respectively; a decrease of 1.0 cm. Mound C had a decrease in mean aRPD depth of 1.1 cm, from 3.2 cm in 2010 to 2.1 cm in 2016. There was a decrease of 1.3 cm from 2010 to 2016 at the reference areas, from 3.5 to 2.2 cm (Table 3-6 and Figure 3-38).

Confidence intervals for the change over time (2016 minus 2010) were calculated for Mound B, Mound C, and the three reference areas combined. The residuals within each time period for Mound B, Mound C, and the grouped references were all approximately normally distributed (Mound B: Shapiro-Wilk's test p-value = 0.95, alpha 0.05; Mound C: Shapiro-Wilk's test p-value = 0.69, alpha 0.05; References: Shapiro-Wilk's test p-value = 0.85, alpha 0.05). Levene's test for equality of variances was rejected for all areas so separate variances were used for Mound B, Mound C, and the references (Mound B: Levene's test, p = 0.017, alpha 0.05; Mound C: Levene's test, p = 0.014, alpha 0.05; References: Levene's test, p = 0.045, alpha 0.05).

The 90% confidence interval for the change over time at the disposal area Mound B was [-1.39 cm to -0.73 cm] (Table 3-6) indicating that the two disposal area surveys had results that were significantly inequivalent within +/- 1 cm. The 90% confidence interval for the change over time at Mound C was [-1.60 cm to -0.74 cm] (Table 3-6) indicating that the two disposal area surveys had results that were significantly inequivalent within +/- 1 cm. The combined reference areas 90% confidence interval for the change over time was [-1.52 cm to -1.01 cm] (Table 3-6) indicating that the two reference area surveys had results that were significantly inequivalent within +/- 1 cm.

3.3 Fishing Gear Assessment

A total of 17 lobster trap-style surface marker boys were observed during the CCBDS multibeam survey (Figure 3-39). Of the 17, seven were observed within the Mound B Sampling Area. The coordinates and a notation of the buoy colors were recorded (Table 3-7).

Table 3-1.

Summary of CCBDS Reference Station Sediment-Profile Imaging Results (Station Means), October 2016

Area	Station	Water Depth (m)	Grain Size Major Mode (phi) [a]	Mean Prism Penetration Depth (cm)	Mean Boundary Roughness (cm)	Dominant Type of Boundary Roughness	Mean aRPD Depth (cm)	Mean Dredged Material Thickness (cm)	Mean # of Subsurface Feeding Voids	Mean of Maximum Feeding Void Depth (cm)	Methane Present?	Successional Stages Present [b]		
CCBRS	1	38	4 to 3	19.7	1.3	Biological	4.0	none	0.7	13.7	No	2 -> 3	1 on 3	1 on 3
CCBRS	2	38	4 to 3	16.9	0.9	Biological	3.1	none	0.7	11.7	No	2 -> 3	3	1 on 3
CCBRS	3	37	4 to 3	17.9	1.2	Biological	2.7	none	0.3	13.4	No	2 -> 3	2 -> 3	1 on 3
CCBRS	4	38	4 to 3	18.1	0.8	Biological	2.9	none	0.0	-	No	2 -> 3	2 -> 3	2 on 3
CCBRS	**Mean**	**38**		**18.1**	**1.0**		**3.2**		**0.4**	**12.9**				
	Standard Deviation			**1.1**	**0.2**		**0.6**			**1.1**				
NWREF	5	33	4 to 3	16.7	1.8	Biological	2.5	none	0.3	17.0	No	2 -> 3	2 -> 3	1 on 3
NWREF	6	34	4 to 3	17.7	0.9	Biological	2.0	none	0.0	-	No	2 -> 3	2 -> 3	2 -> 3
NWREF	7	34	4 to 3	18.5	1.0	Biological	1.9	none	2.0	18.0	No	2 -> 3	1 on 3	1 on 3
NWREF	8	33	4 to 3	17.5	1.4	Biological	1.9	none	1.0	16.3	No	2	1 on 3	1 on 3
NWREF	**Mean**	**33**		**17.6**	**1.3**		**2.1**		**0.8**	**17.1**				
	Standard Deviation			**0.8**	**0.4**		**0.3**			**0.8**				
SWREF	9	30	4 to 3	19.4	1.3	Biological	1.7	none	1.0	13.6	No	1 on 3	1 on 3	1 on 3
SWREF	10	29	4 to 3	16.1	1.0	Biological	1.3	none	0.3	12.6	No	2 -> 3	2 -> 3	1 on 3
SWREF	11	29	4 to 3	16.0	1.5	Biological	1.2	none	0.0	-	No	2 -> 3	2 -> 3	1 on 3
SWREF	12	29	4 to 3	14.5	1.5	Biological	1.2	none	0.3	5.6	No	2 -> 3	1 on 3	1 on 3
SWREF	**Mean**	**29**		**16.5**	**1.3**		**1.4**		**0.4**	**10.6**				
	Standard Deviation			**2.1**	**0.3**		**0.3**			**4.4**				
ALL REF AREAS	**Max**	**38**		**19.7**	**1.8**		**4.0**		**2.0**	**18.0**				
	Min	**29**		**14.5**	**0.8**		**1.2**		**0.0**	**5.6**				
	Mean	**33**		**17.4**	**1.2**		**2.2**		**0.6**	**13.5**				
	Standard Deviation			**1.5**	**0.3**		**0.9**			**3.7**				

a Grain Size: "/" indicates layer of one phi size range over another (see Appendix F)
b Successional Stage: "on" indicates one Stage is found on top of another Stage (i.e., 1 on 3); "->" indicates one Stage is progressing to another Stage (i.e., 2 -> 3)

Table 3-2.

Summary of CCBDS Disposal Areas Mounds B and C Sediment-Profile Imaging Results (Station Means), September 2016

Area	Station	Water Depth (m)	Grain Size Major Mode (phi) [a]	Mean Prism Penetration Depth (cm)	Mean Boundary Roughness (cm)	Dominant Type of Boundary Roughness	Mean aRPD Depth (cm)	Mean Dredged Material Thickness (cm) [c]	Mean # of Subsurface Feeding Voids	Mean of Maximum Feeding Void Depth (cm)	Methane Present?	Successional Stages Present [b]		
Mound B	1	32	4 to 3	19.0	0.7	Biological	1.4	19.0	0.0	-	No	2	2 -> 3	2 -> 3
Mound B	2	25	>4	5.3	1.8	Biological	1.8	5.3	0.0	-	No	2	1 -> 2	1 -> 2
Mound B	3	31	4 to 3	13.3	0.9	Biological	2.2	13.3	1.0	11.1	No	2 -> 3	1 on 3	1 on 3
Mound B	4	28	4 to 3	18.5	1.0	Biological	1.5	18.5	0.3	12.7	Yes	2 -> 3	1 on 3	1 on 3
Mound B	5	30	4 to 3	17.5	1.6	Biological	1.4	17.5	0.7	12.1	No	2 -> 3	1 on 3	1 on 3
Mound B	6	23	0/>4	3.7	2.4	Biological	1.9	3.7	0.0	-	No	1	2	IND
Mound B	7	33	4 to 3	16.9	1.1	Biological	1.5	none	1.0	11.6	No	2	1 on 3	2 on 3
Mound B	8	26	4 to 3	8.7	1.0	Biological	1.9	8.7	0.0	-	No	2	2	1 on 3
Mound B	9	33	4 to 3	18.4	0.6	Biological	1.9	18.4	0.3	19.3	No	2 -> 3	1 on 3	1 on 3
Mound B	10	32	4 to 3	18.9	0.8	Biological	1.2	none	1.0	17.5	No	1 on 3	1 on 3	1 on 3
Mound B	11	33	4 to 3	17.2	0.6	Biological	1.6	none	0.7	8.9	No	2	1 on 3	2 on 3
Mound B	12	32	4 to 3	12.8	1.0	Biological	1.8	12.8	0.3	7.2	No	2	1 on 3	1 on 3
Mound B	**Max**	**33**		**19.0**	**2.4**		**2.2**	**19.0**	**1.0**	**19.3**				
	Min	**23**		**3.7**	**0.6**		**1.2**	**3.7**	**0.0**	**7.2**				
	Mean	**30**		**14.2**	**1.1**		**1.7**	**13.0**	**0.4**	**12.6**				
	Standard Deviation			**5.5**	**0.5**		**0.3**	**5.9**		**4.1**				

IND = Indeterminate

a Grain Size: “/” indicates layer of one phi size range over another (see Appendix F)

b Successional Stage: “on” indicates one Stage is found on top of another Stage (i.e., 1 on 3); “->” indicates one Stage is progressing to another Stage (i.e., 2 -> 3)

c Dredged material extends below prism penetration depth (in each value other than ‘none’)

Table 3-2. **(continued)**

Summary of CCBDS Disposal Areas Mounds B and C Sediment-Profile Imaging Results (station means), September 2016

Area	Station	Water Depth (m)	Grain Size Major Mode (phi) [a]	Mean Prism Penetration Depth (cm)	Mean Boundary Roughness (cm)	Dominant Type of Boundary Roughness	Mean aRPD Depth (cm)	Mean Dredged Material Thickness (cm)[c]	Mean # of Subsurface Feeding Voids	Mean of Maximum Feeding Void Depth (cm)	Methane Present?	Successional Stages Present [b]		
Mound C	13	30	4 to 3 / >4	14.5	1.2	Biological	3.0	14. 5	0.7	5.2	No	2	1 on 3	1 on 3
Mound C	14	31	4 to 3	18.5	1.3	Biological	2.6	18.5	0.7	7.4	No	1 on 3	1 on 3	1 on 3
Mound C	15	33	4 to 3	18.9	0.6	Biological	0.9	18.9	1.0	16.2	No	1 on 3	1 on 3	1 on 3
Mound C	16	30	4 to 3 / >4	19.8	0.5	Biological	1.6	19.8	1.3	17.6	No	1 on 3	1 on 3	1 on 3
Mound C	17	33	4 to 3 / >4	17.7	0.9	Biological	1.2	17.7	1.0	9.9	No	2 -> 3	2 -> 3	1 on 3
Mound C	18	33	4 to 3 / >4	14.1	1.5	Biological	1.4	14.1	1.0	12.7	No	2 -> 3	1 on 3	1 on 3
Mound C	19	33	4 to 3 / >4	18.0	1.4	Biological	2.1	18.0	1.7	13.7	No	1 on 3	1 on 3	1 on 3
Mound C	20	29	4 to 3 / >4	17.0	0.9	Biological	2.2	17.0	0.7	9.3	No	2 -> 3	1 on 3	1 on 3
Mound C	21	29	4 to 3 / >4	17.7	0.8	Biological	2.7	17.7	0.3	6.2	No	2 -> 3	2 -> 3	1 on 3
Mound C	22	29	4 to 3 / >4	18.1	1.0	Biological	3.0	18.1	0.7	12.2	No	2 -> 3	1 on 3	1 on 3
Mound C	23	29	4 to 3 / >4	16.7	0.7	Biological	1.7	16.7	0.7	16.1	No	2	1 on 3	1 on 3
Mound C	24	29	4 to 3 / >4	18.9	1.4	Biological	3.2	18.9	1.0	9.6	No	2 -> 3	1 on 3	1 on 3
Mound C	25	28	4 to 3 / >4	14.2	1.9	Biological	1.2	14.2	0.7	7.9	No	2 -> 3	1 on 3	1 on 3
Mound C	**Max**	**33**		**19.8**	**1.9**		**3.2**	**19.8**	**1.7**	**17.6**				
	Min	**28**		**14.1**	**0.5**		**0.9**	**14.1**	**0.3**	**5.2**				
	Mean	**30**		**17.2**	**1.1**		**2.1**	**17.2**	**0.9**	**11.1**				
	Standard Deviation			**1.9**	**0.4**		**0.8**	**1.9**		**4.0**				

IND = Indeterminate

a Grain Size: "/" indicates layer of one phi size range over another (see Appendix F)

b Successional Stage: "on" indicates one Stage is found on top of another Stage (i.e., 1 on 3); "->" indicates one Stage is progressing to another Stage (i.e., 2 -> 3)

c Dredged material extends below prism penetration depth (in each value other than 'none')

Table 3-3.

Summary of Station Means by Sampling Location

	Mean aRPD Depth (cm)			Maximum Successional Stage Rank		Number of Feeding Voids			Mean Maximum Feeding Void Depth (cm)	
Site	**N[1]**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**	**N[2]**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
2016										
Reference Areas										
CCBRS	4	3.2	0.6	3.0	0.0	3	0.4	0.3	12.9	1.1
NWREF	4	2.1	0.3	2.9	0.2	3	0.8	0.9	17.1	0.8
SWREF	4	1.4	0.3	3.0	0.0	3	0.4	0.4	10.6	4.4
Mean		2.2		3.0			0.6		13.5	
Disposal Areas										
Mound B	12	1.7	0.3	2.8	0.5	8	0.4	0.4	12.6	4.1
Mound C	13	2.1	0.8	3.0	0.1	13	0.9	0.3	11.1	4.0
Mean		1.9		2.9			0.7		11.6	

[1] Number of stations surveyed per area, including any stations which had no penetration (and indeterminate results).
[2] The number of feeding voids observed, useable N to determine means and standard deviations.

Table 3-4.

Summary Statistics and Results of Inequivalence Hypothesis Testing for aRPD Values

Difference Equation	**Observed Difference ($\hat{d}$)**	**SE $\hat{d}$**	***df* for SE**	**Confidence Bounds (D_L to D_U)[1]**	**Results[2]**
$Mean_{REF} - Mean_{Mound\ B}$	0.53	0.14	20	0.28 to 0.78	s
$Mean_{REF} - Mean_{Mound\ C}$	0.14	0.25	16.84	-0.29 to 0.57	s

[1] D_L and D_U as defined in [Eq. 3]

[2] s = Reject the null hypothesis of inequivalence: the two group means are significantly equivalent, within ± 1 cm.
d = Fail to reject the null hypothesis of inequivalence between the two group means, the two group means are different.

Table 3-5.

Summary Statistics and Results of Inequivalence Hypothesis Testing for Successional Stage Values

Difference Equation	Observed Difference ($\hat{d}$)	SE $\hat{d}$	*df* for SE	Confidence Bounds (D_L to D_U)[1]	Results[2]
$Mean_{REF} – Mean_{Mound\ B}$	0.17	0.12	22	-0.16 to 0.34	s
$Mean_{REF} – Mean_{Mound\ C}$	-0.04	0.04	23	-0.09 to -0.04	s

[1] D_L and D_U as defined in [Eq. 3]

[2] s = Reject the null hypothesis of inequivalence: the two group means are significantly equivalent, within ± 0.5.

d = Fail to reject the null hypothesis of inequivalence between the two group means, the two group means are different.

Table 3-6.

Summary Statistics and Results of Inequivalence Hypothesis Testing for Temporal Change in aRPD Values

Difference Equation	**Observed Difference ($\hat{d}$)**	**SE $\hat{d}$**	***df* for SE**	**Confidence Bounds (D_L to D_U)[1]**	**Results[2]**
Mound B_{2016} – Mound B_{2010}	-1.06	0.19	19.7	-1.39 to -0.73	s
Mound C_{2016} – Mound C_{2010}	-1.17	0.25	18.9	-1.60 to -0.74	s
REF_{2016} – REF_{2010}	-1.27	0.14	10.7	-1.52 to -1.01	s

[1] D_L and D_U as defined in [Eq. 3]
[2] s = Reject the null hypothesis of inequivalence: the two group means are significantly equivalent, within ± 1.0.
d = Fail to reject the null hypothesis of inequivalence between the two group means, the two group means are different.

Table 3-7.

Surface Marker Boys Observed During the 2016 CCBDS Multibeam Survey

Buoy Description	X	Y	Latitude	Longitude	Depth (m)
White w/Red Flag	305228.24	852255.46	41.9136012 N	70.23154461 W	31.8
Yellow/Red/Black	305225.94	851368.31	41.90561502 N	70.23173133 W	31.4
Red/Black	305524.18	851292.93	41.90489643 N	70.22815078 W	31.8
Black/Orange	306006.28	852418.99	41.91496881 N	70.22213774 W	33.3
Black/Orange	306124.07	852650.00	41.91703256 N	70.22067627 W	33.6
Yellow/Black	306309.67	851980.67	41.9109819 N	70.21856042 W	33.2
Black/Orange	306360.88	852067.05	41.9117526 N	70.21792758 W	33.0
Black/Orange	306547.53	852445.57	41.9151349 N	70.21560935 W	33.8
Black/Orange	306547.78	851568.35	41.90723779 N	70.21576554 W	33.4
Black/Orange	306600.53	852452.04	41.91518596 N	70.21496938 W	33.9
Grey (faded?)	306732.50	851942.49	41.91058088 N	70.21347141 W	32.7
Black/Orange	306783.75	851953.61	41.91067403 N	70.21285172 W	33.2
Black/Orange	306850.19	852091.41	41.91190553 N	70.21202591 W	33.7
Black/Orange	306903.02	852306.19	41.91383188 N	70.21135008 W	33.9
Black/Orange	306446.17	852291.94	41.9137656 N	70.21685888 W	33.7
Black/Orange	305806.22	852306.81	41.91398588 N	70.22456924 W	34.3
Black/Orange	306790.35	852007.57	41.9111589 N	70.21276236 W	33.0

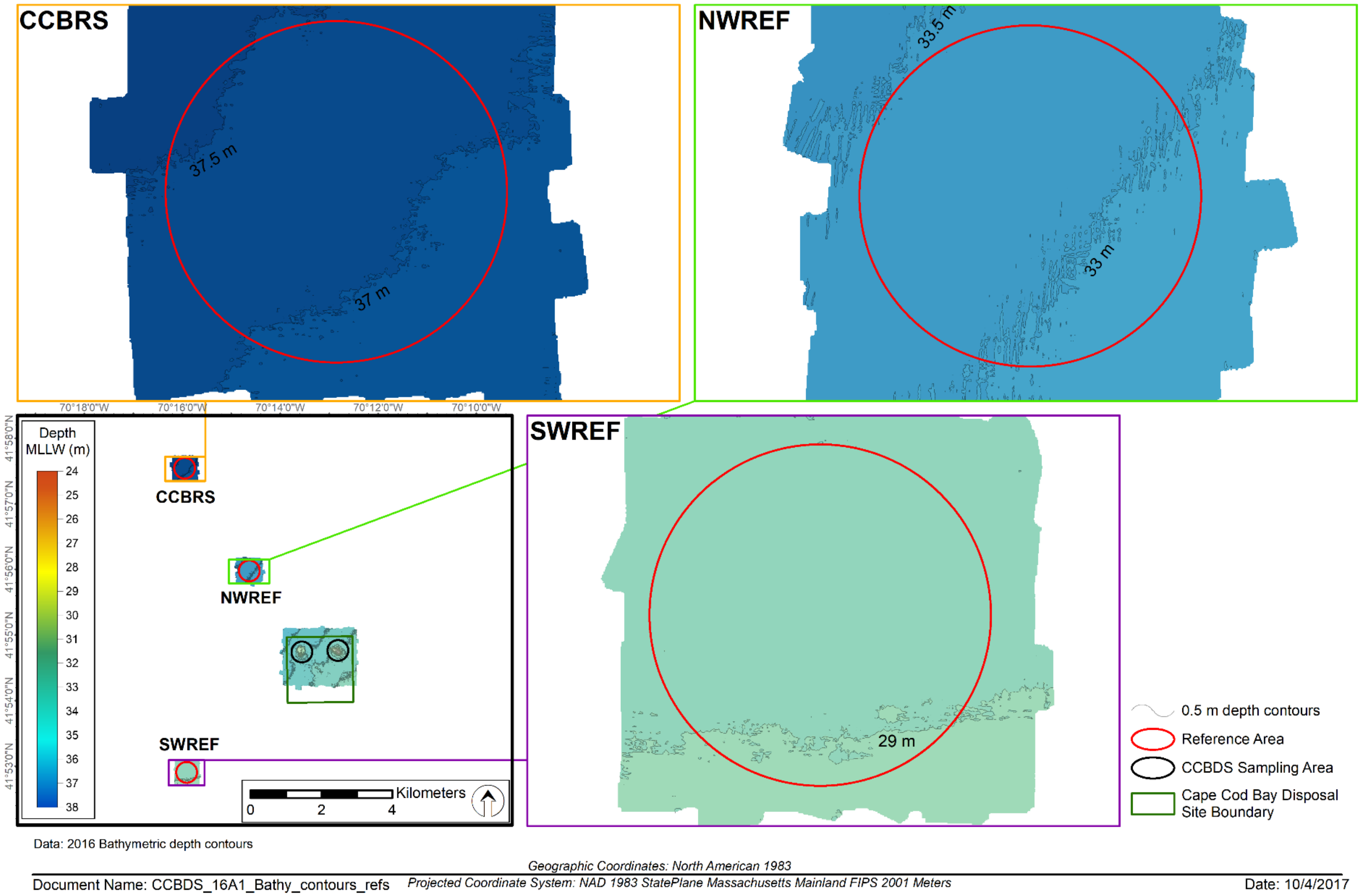


Figure 3-1a. Bathymetric contour map of reference areas – October 2016

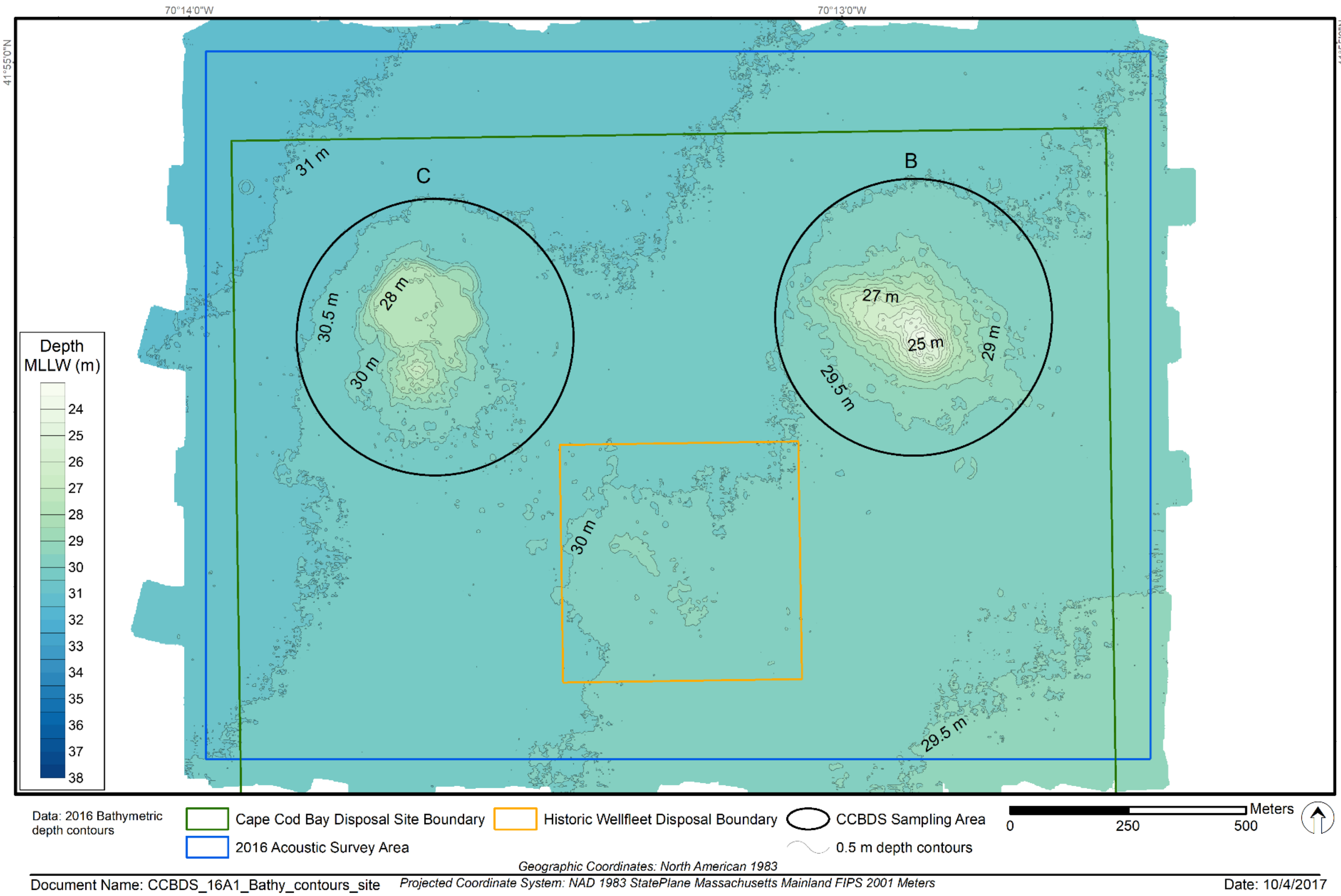


Figure 3-1b. Bathymetric contour map of CCBDS – October 2016

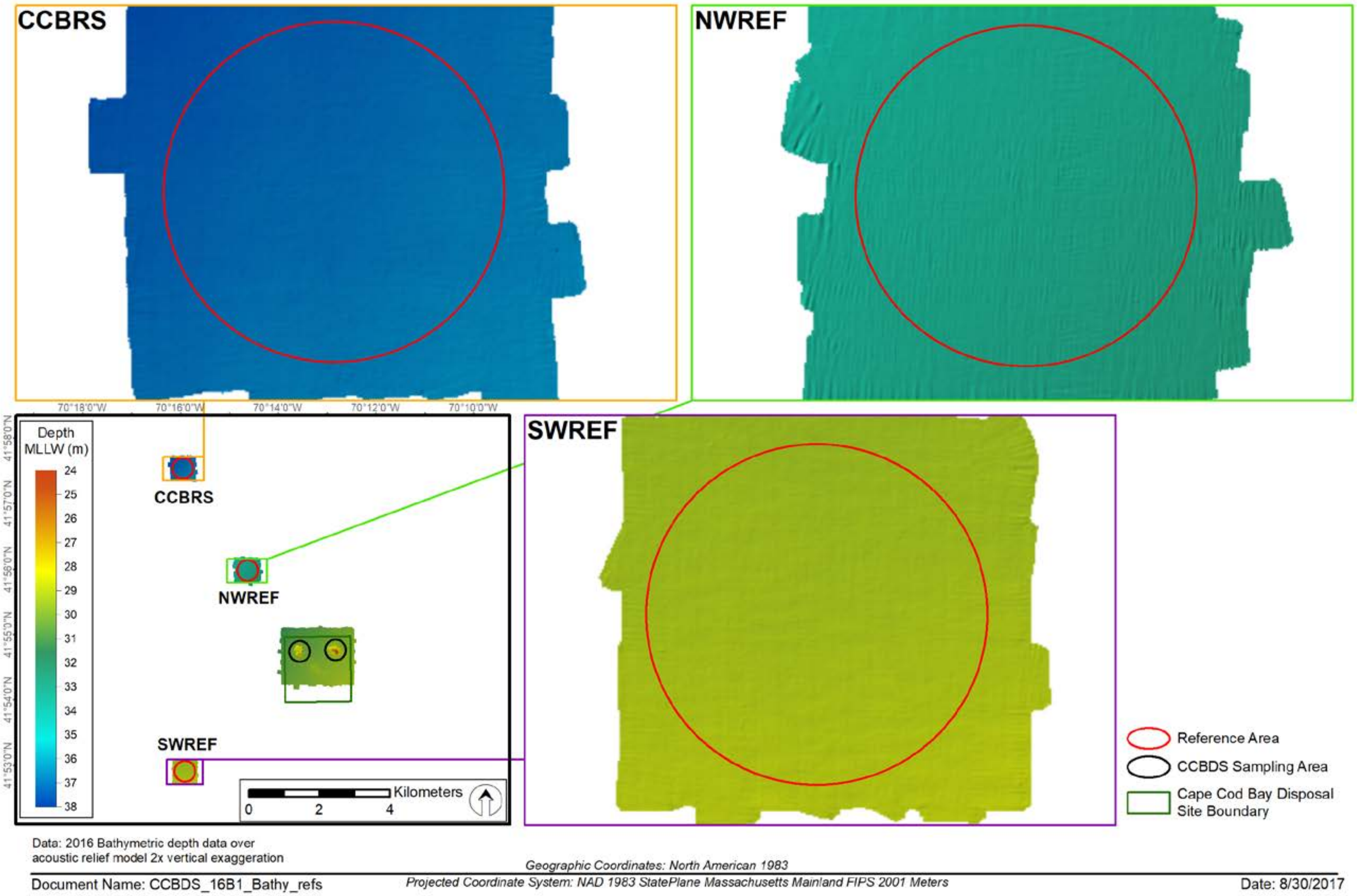


Figure 3-2a. Bathymetric depth data over acoustic relief model of reference areas – October 2016

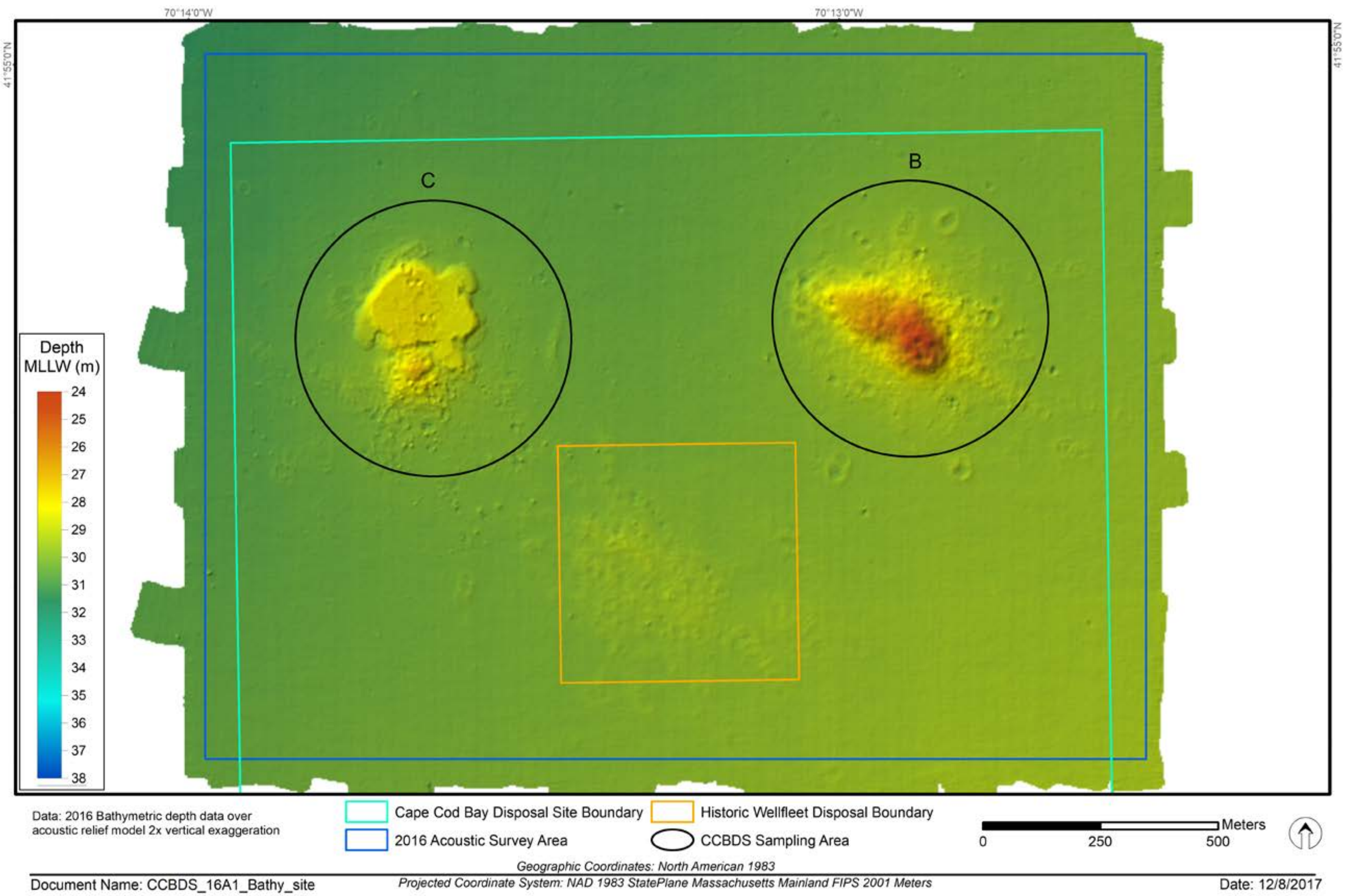


Figure 3-2b. Bathymetric depth data over acoustic relief model of CCBDS – October 2016

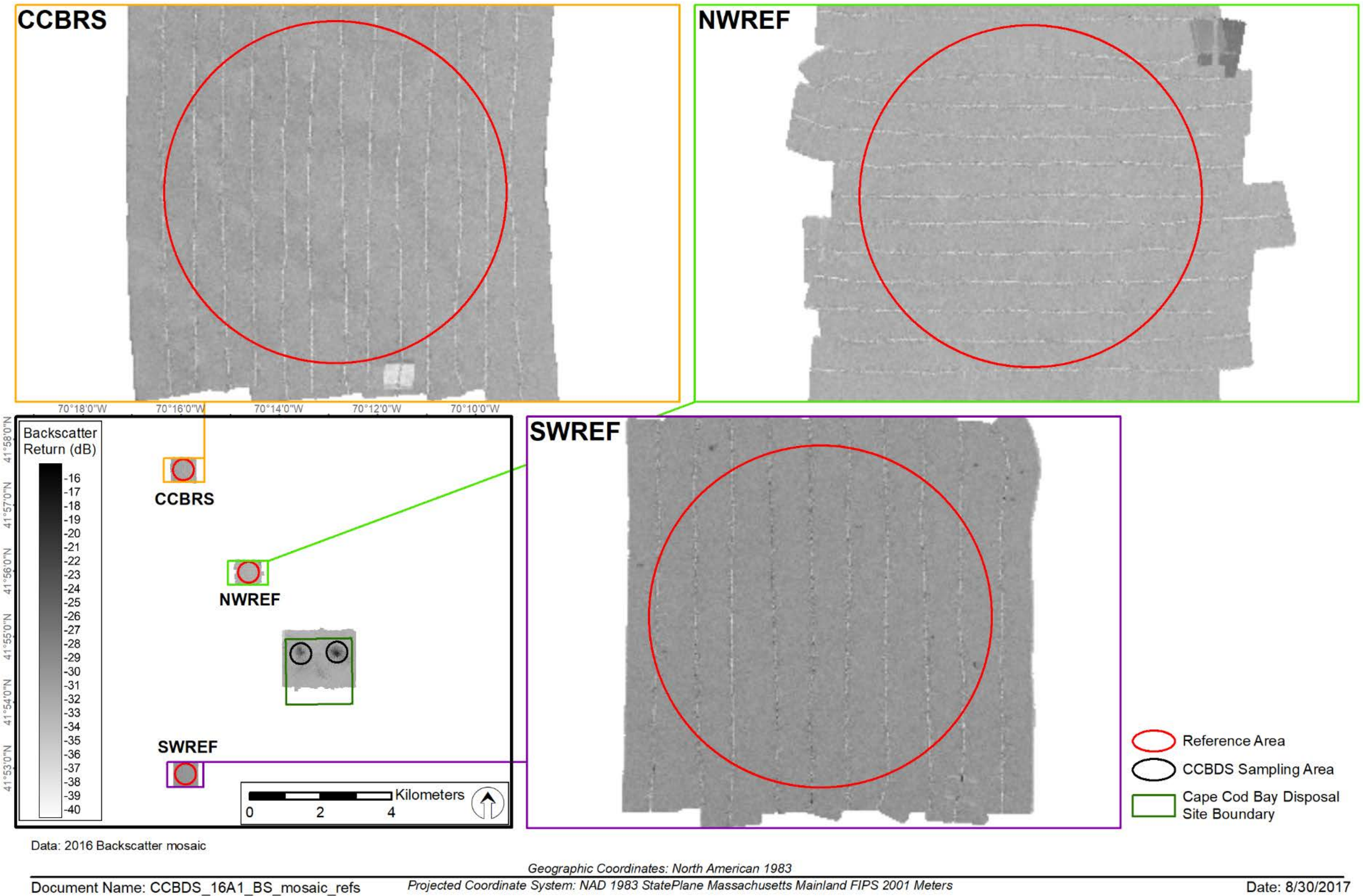


Figure 3-3a. Mosaic of unfiltered backscatter data of reference areas – October 2016

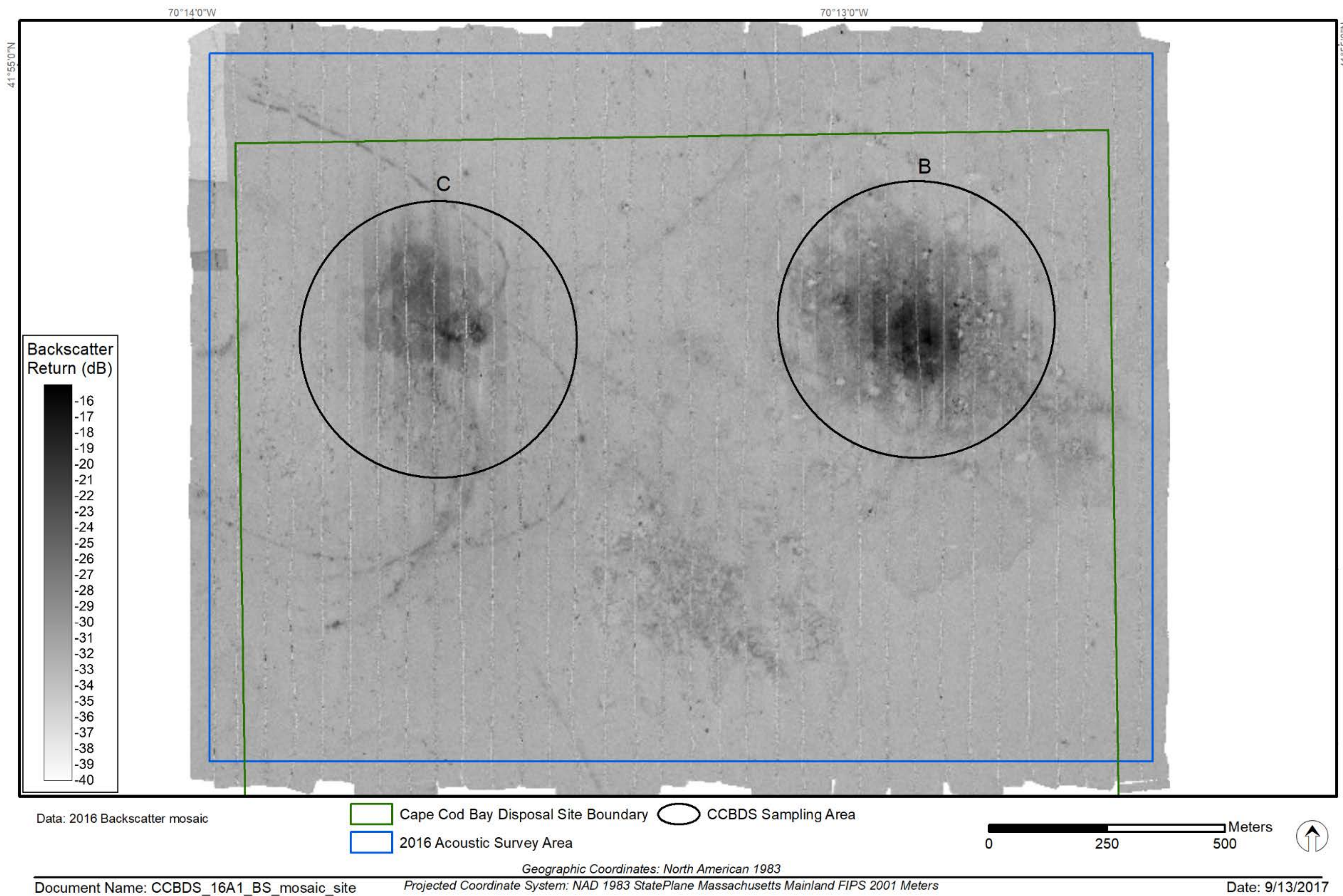


Figure 3-3b. Mosaic of unfiltered backscatter data of CCBDS – October 2016

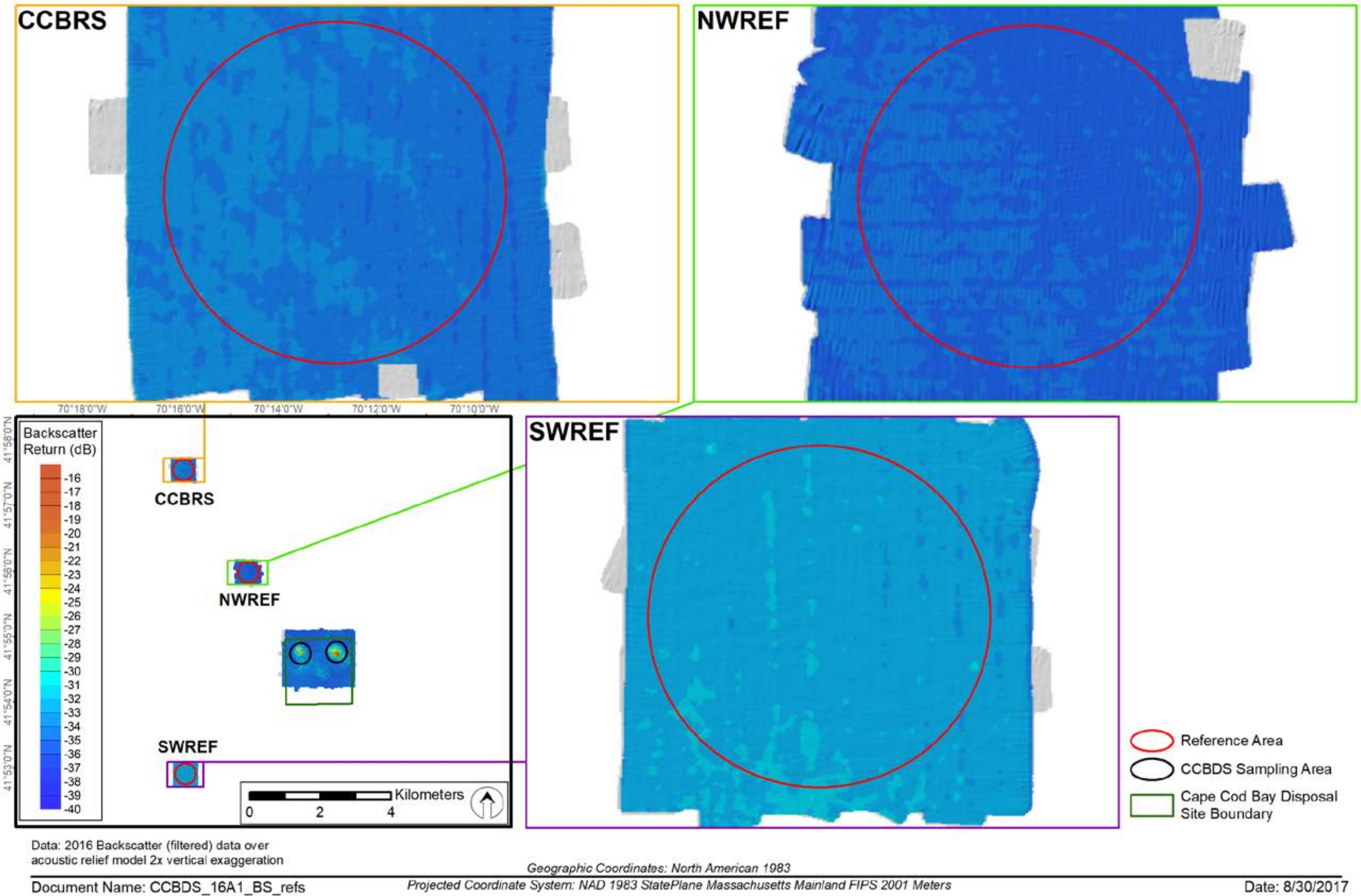


Figure 3-4a. Filtered backscatter over acoustic relief model of reference areas – October 2016

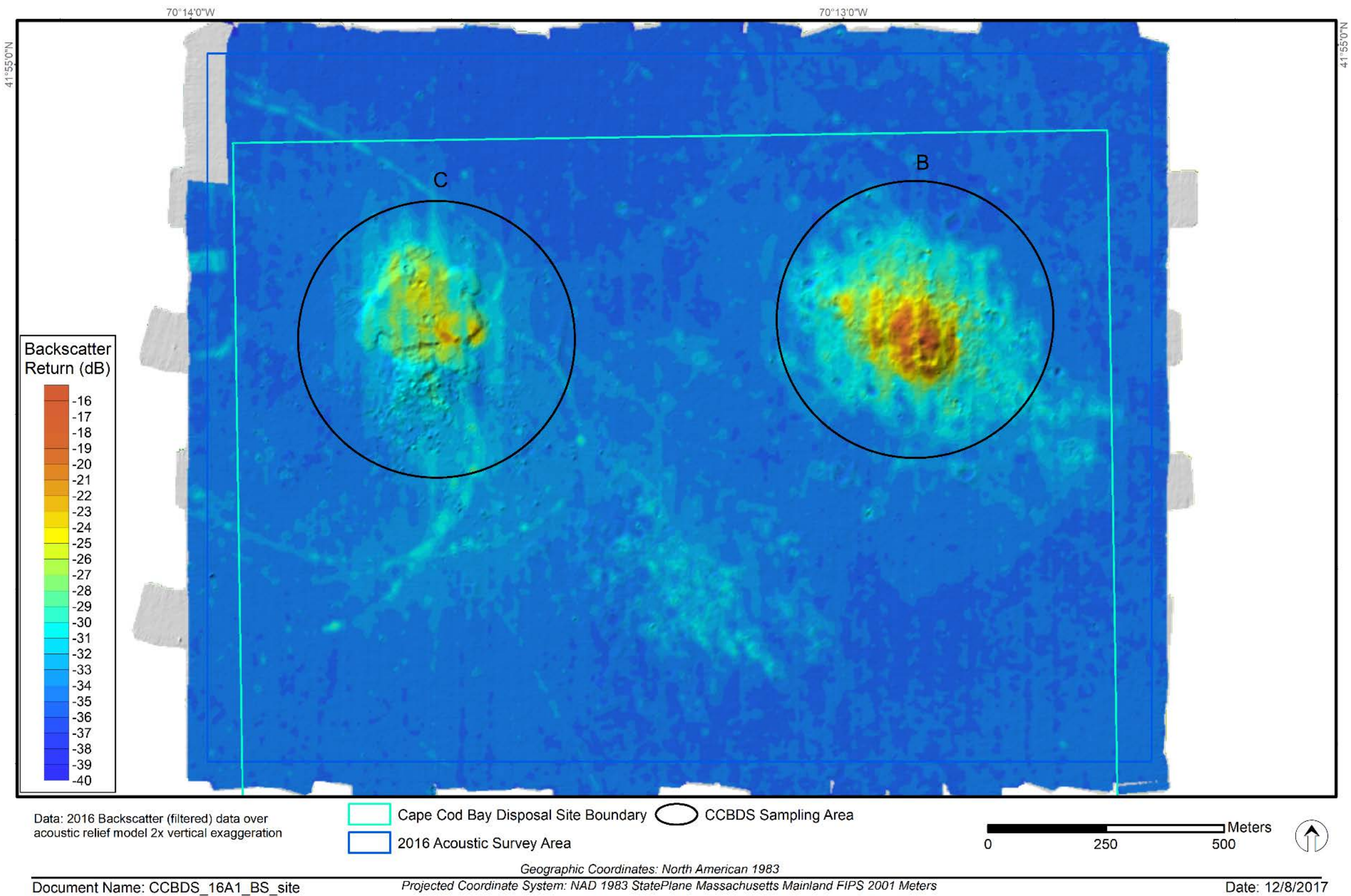


Figure 3-4b. Filtered backscatter over acoustic relief model of CCBDS – October 2016

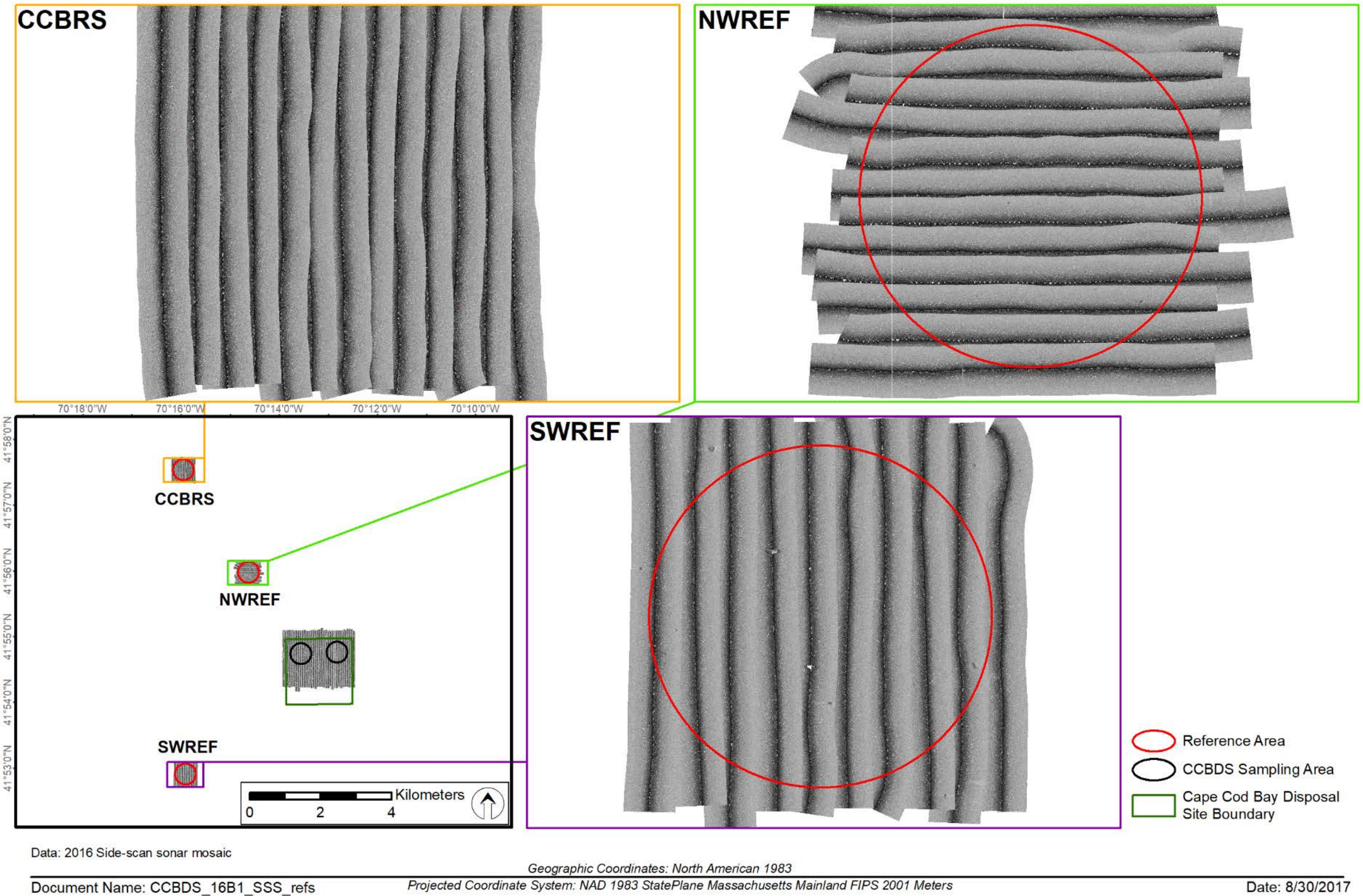


Figure 3-5a. Side-scan mosaic of reference areas – October 2016

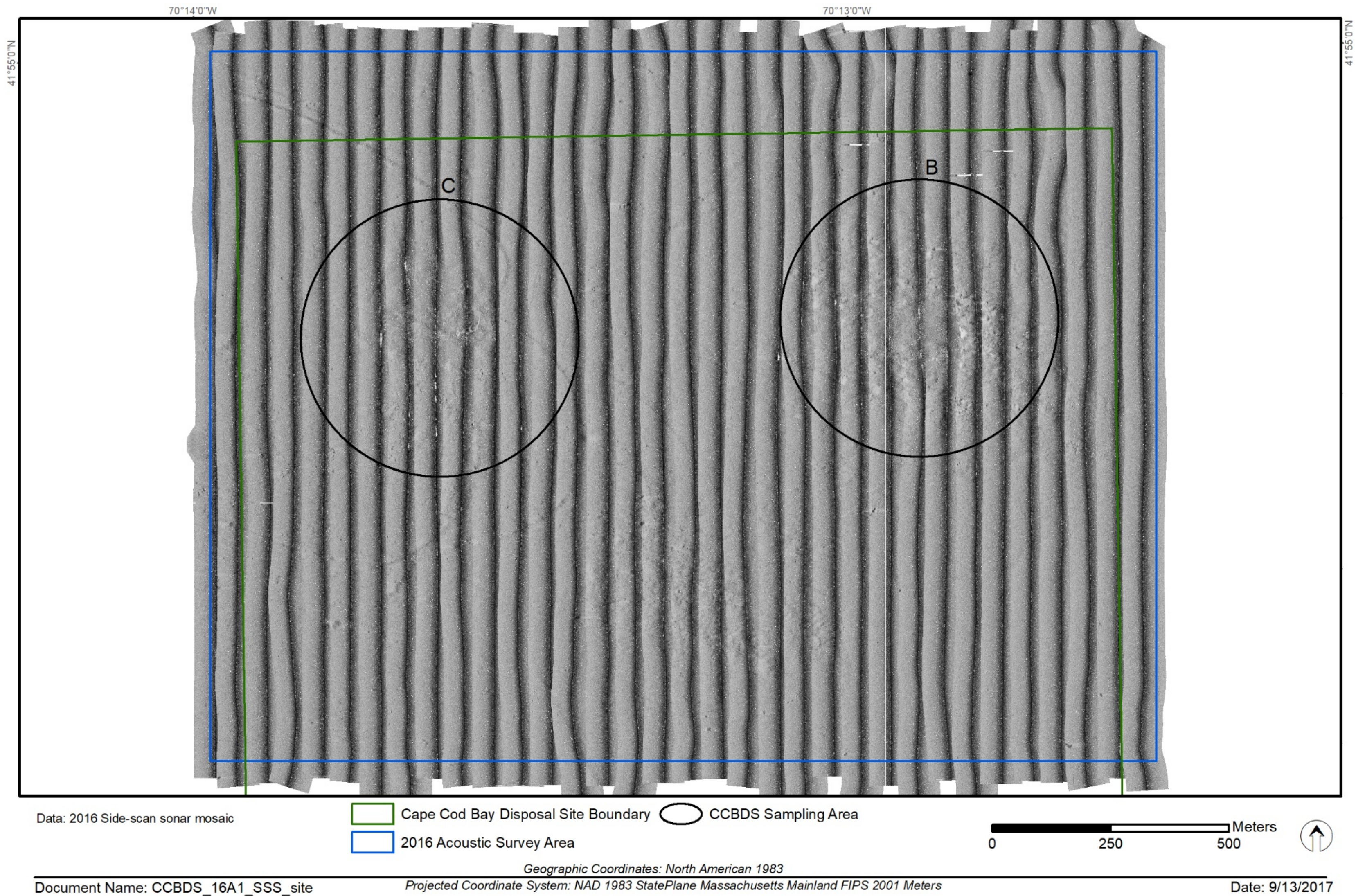


Figure 3-5b. Side-scan mosaic of CCBDS – October 2016

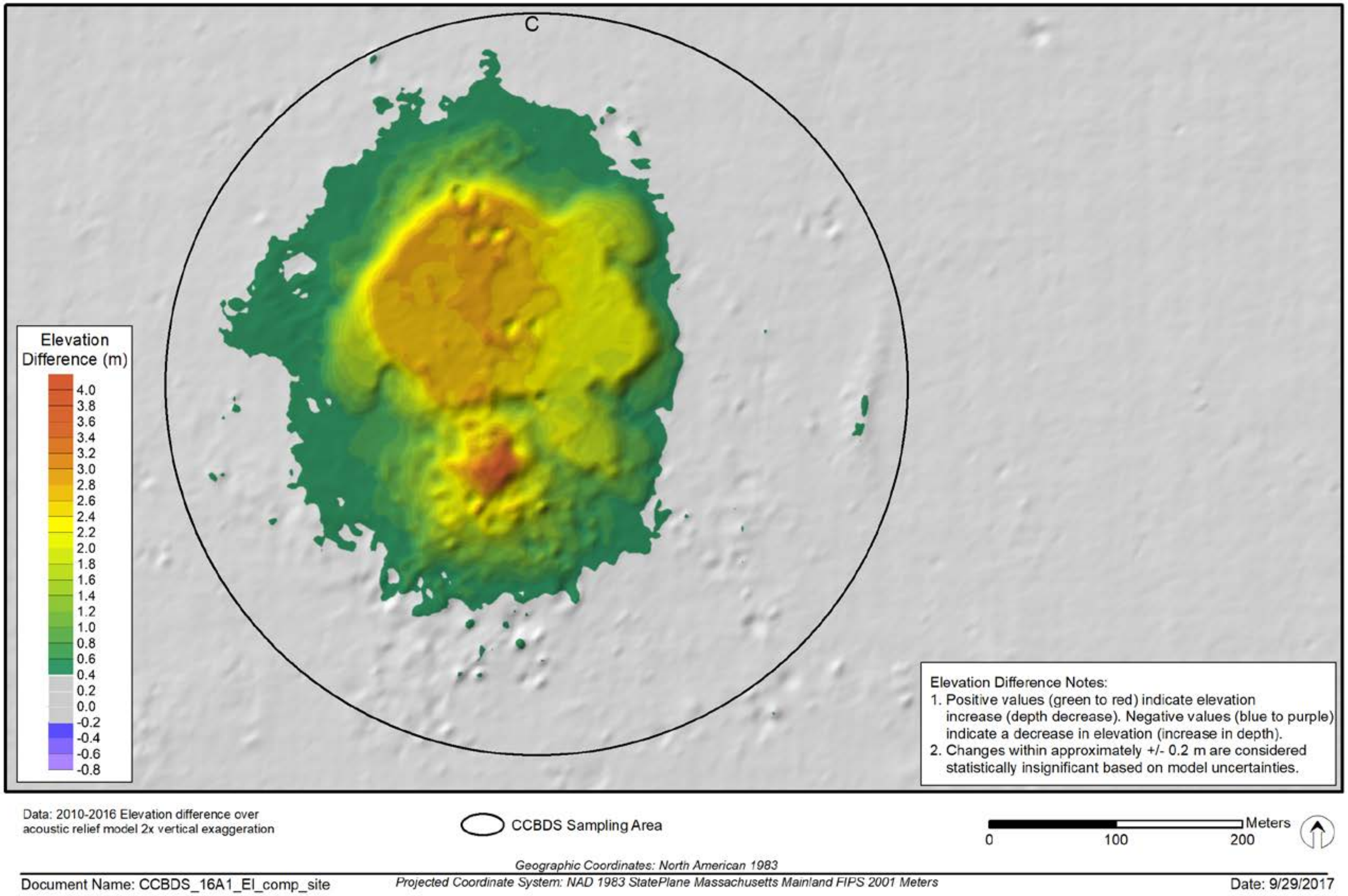


Figure 3-6. CCBDS disposal area elevation difference: 2016 vs. 2010

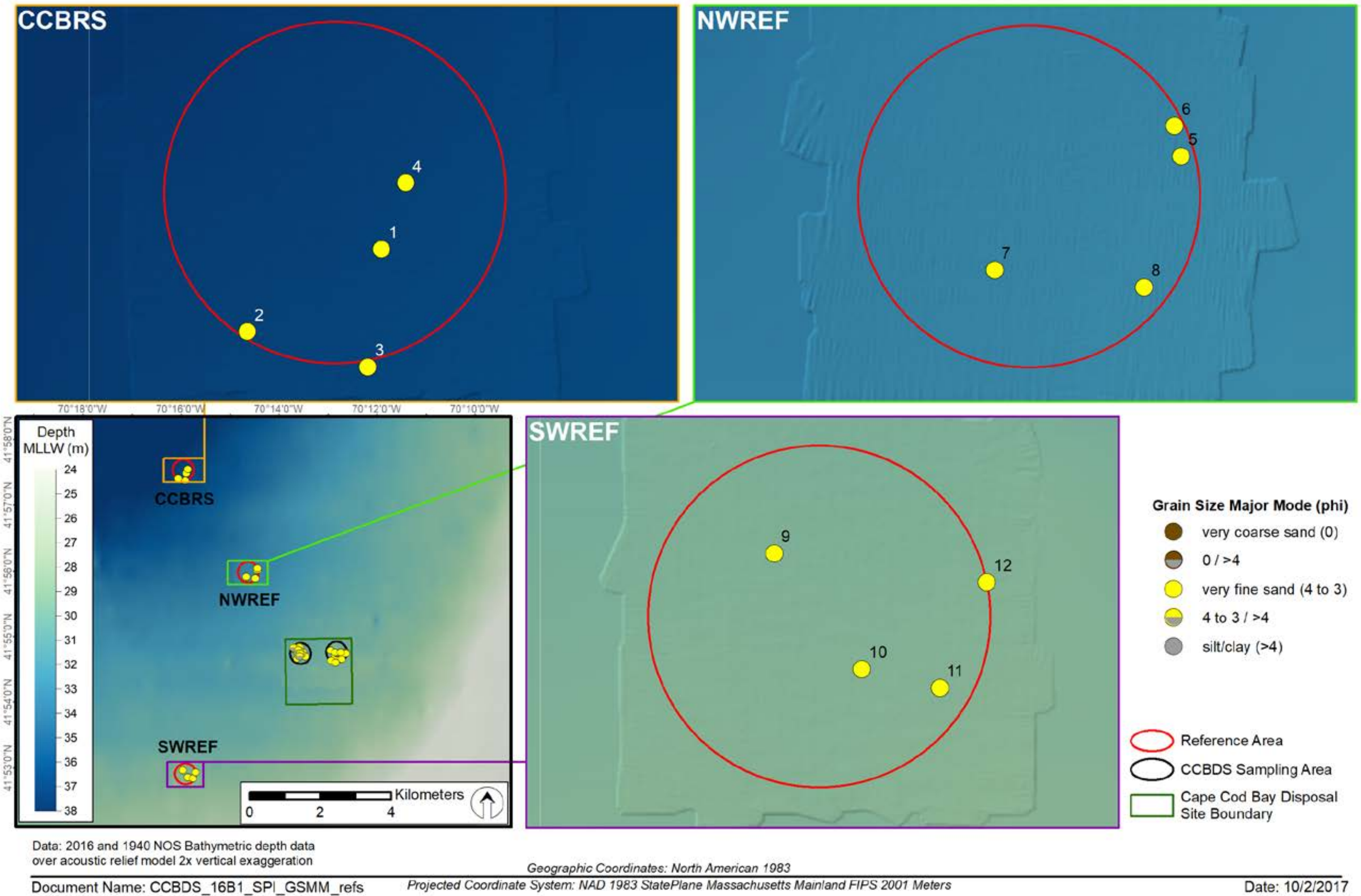
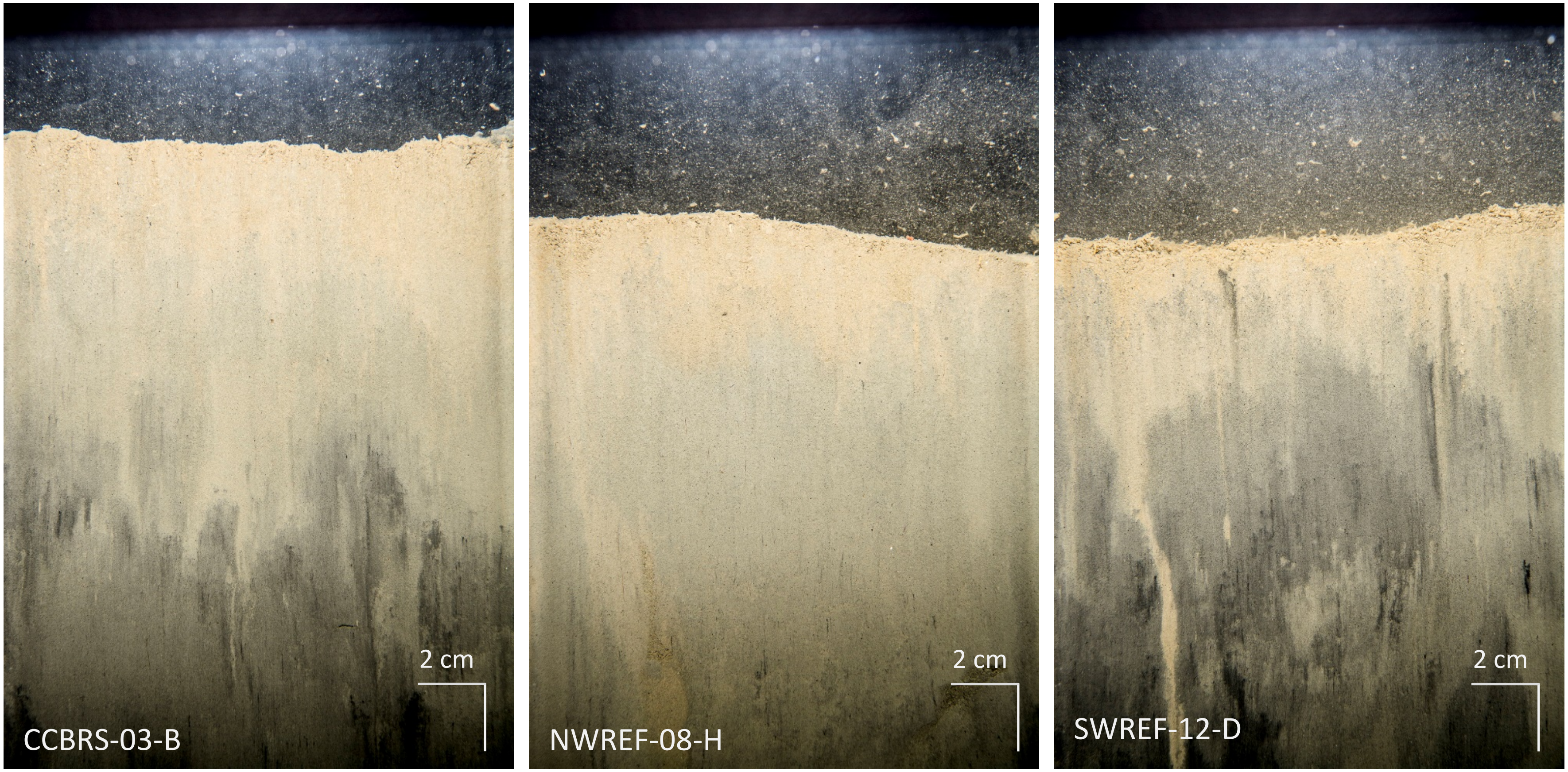


Figure 3-7. Sediment grain size major mode (phi units) at the CCBDS reference area stations



(A) **(B)** **(C)**

Figure 3-8. Sediment-profile images depicting very fine sand at all three reference areas; (A) Station CCBRS-03; (B) Station NWREF-08; and (C) Station SWREF-12

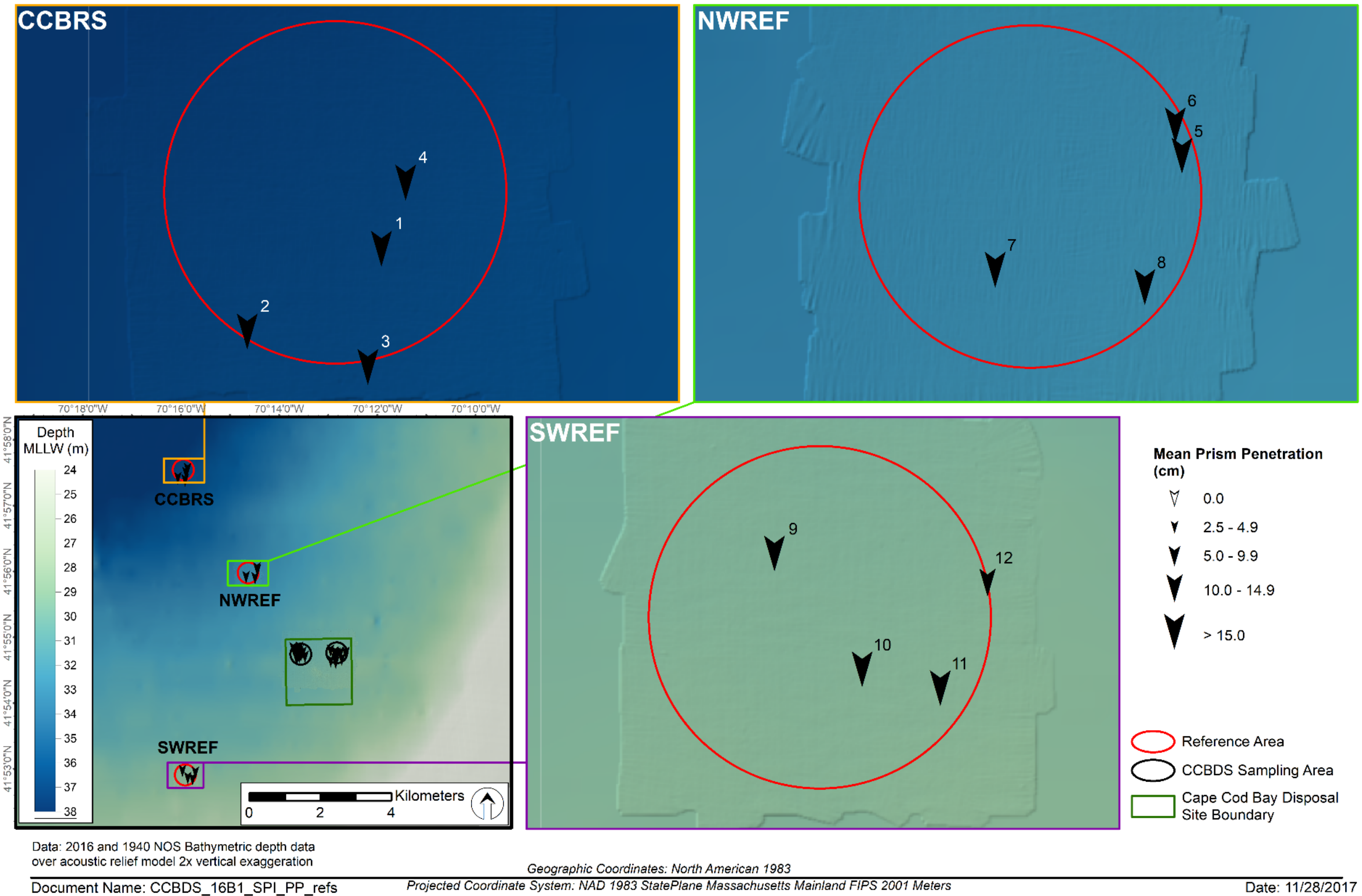


Figure 3-9. Mean station camera prism penetration depths (cm) at the CCBDS reference area stations

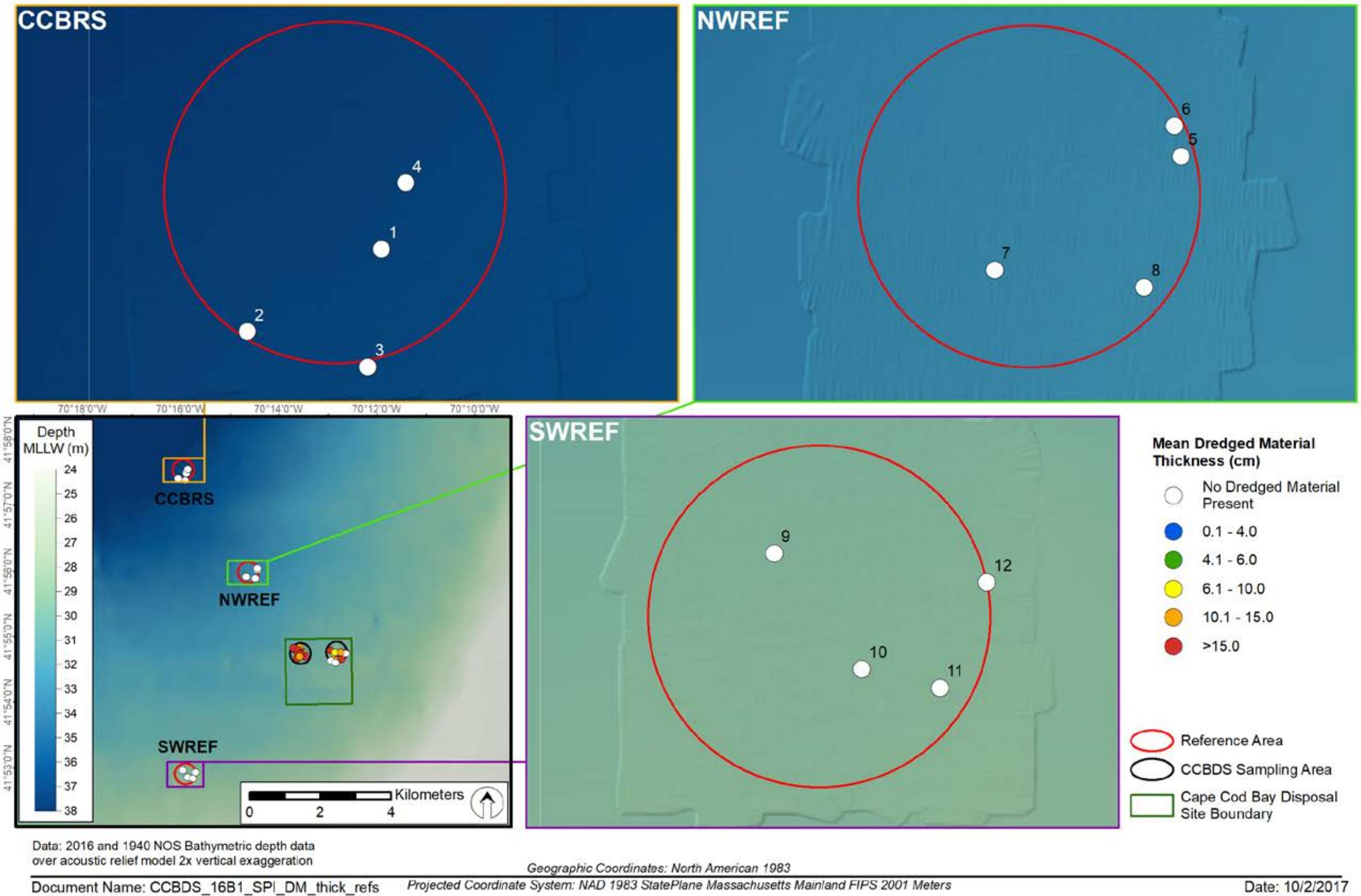


Figure 3-10. Mean dredged material thickness at the CCBDS reference area stations

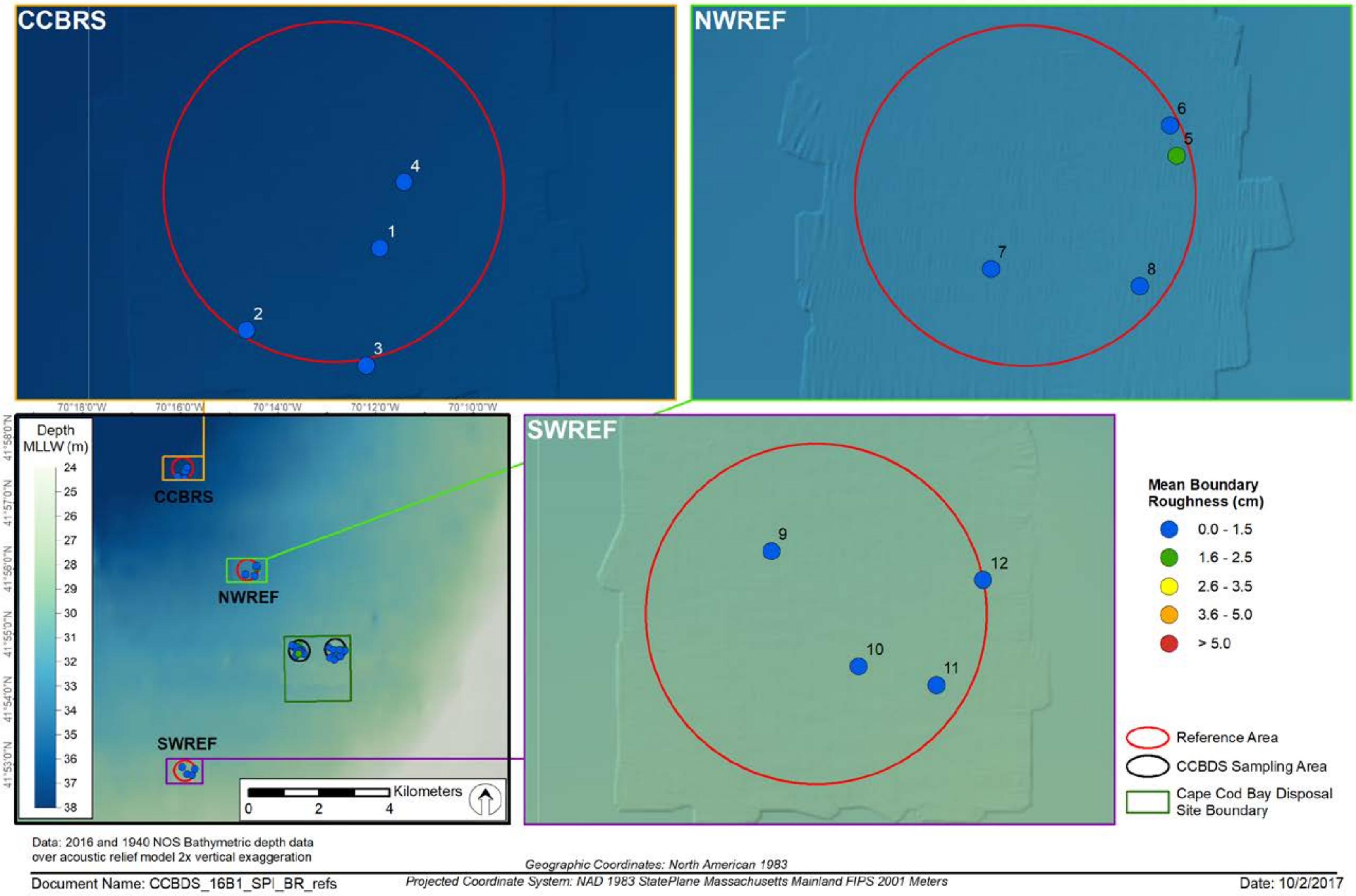
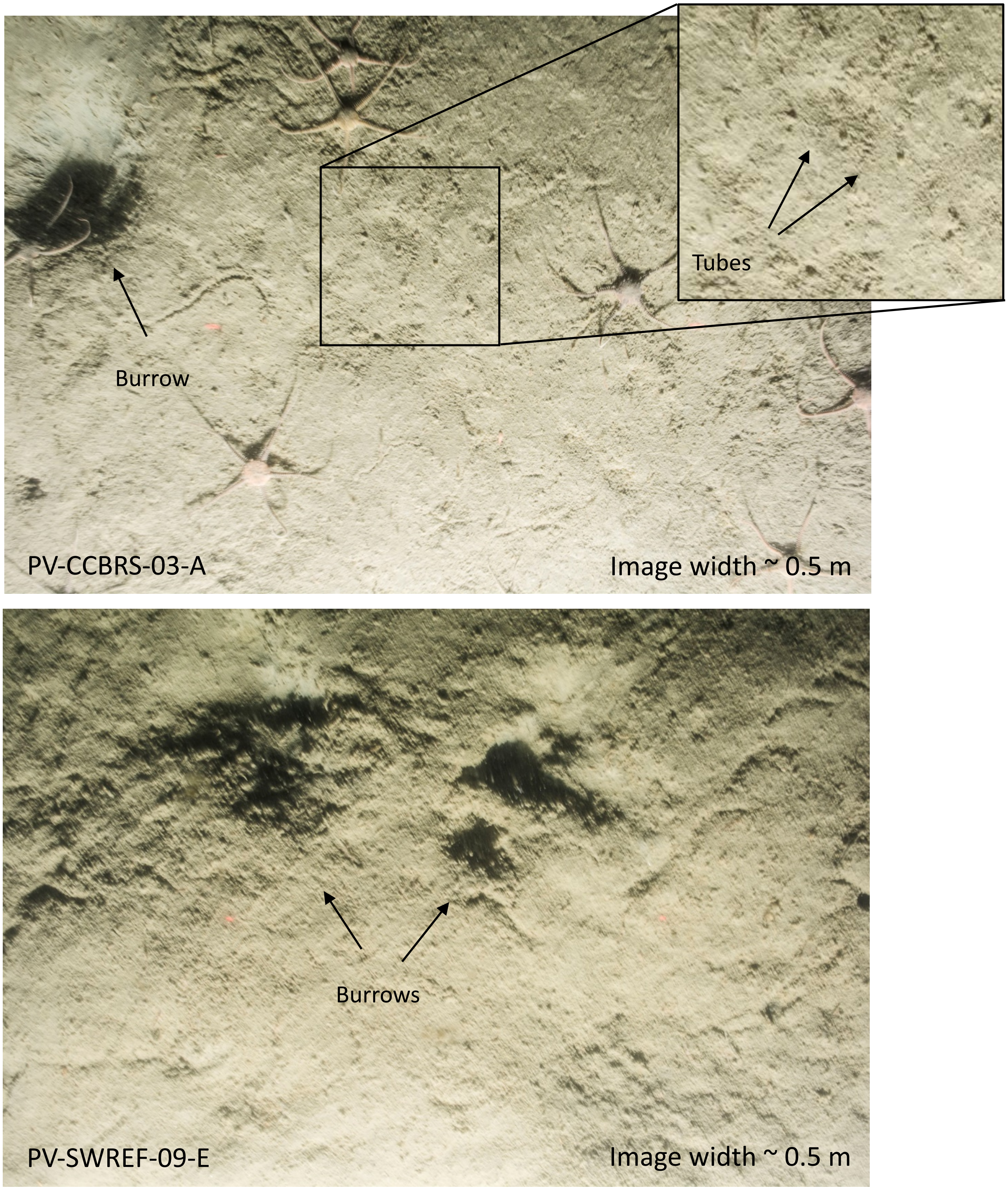


Figure 3-11. Mean station small-scale boundary roughness values (cm) at the CCBDS reference area stations



(A)

(B)

Figure 3-12. Plan-view images depicting examples of boundary roughness at reference areas; (A) Station CCBRS-03 showing tubes and a burrow and; (B) Station SWREF-09 showing burrows

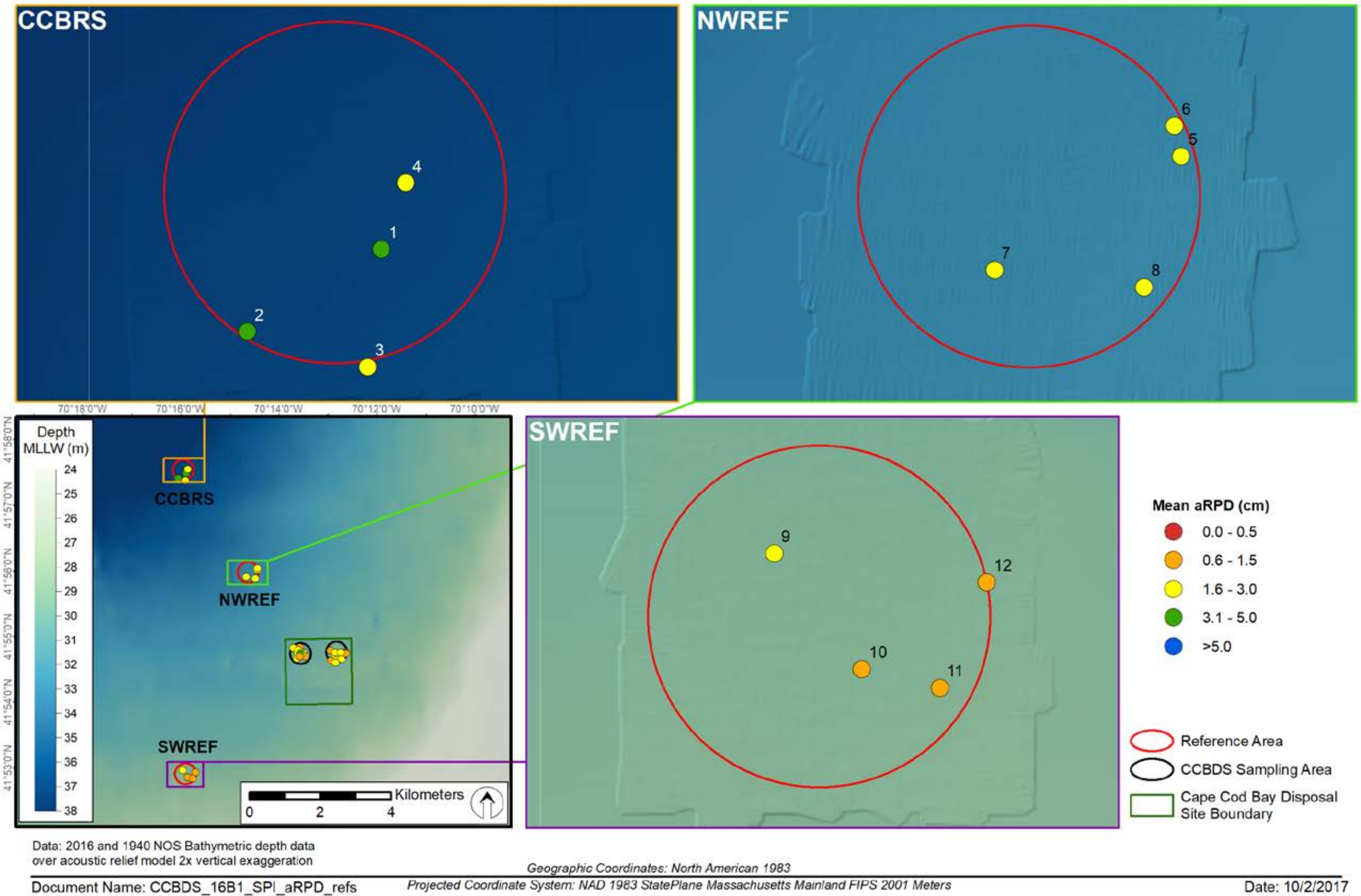
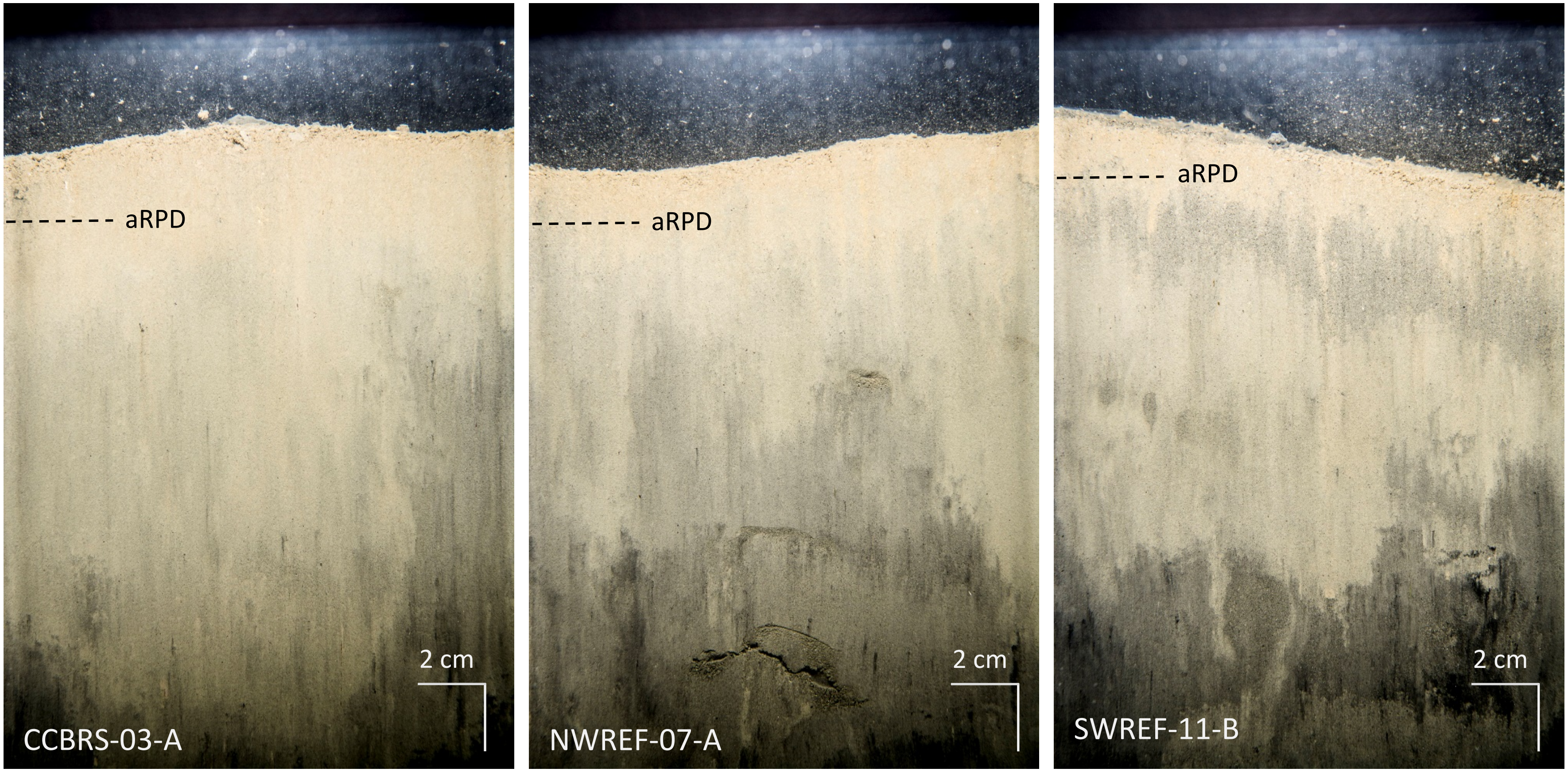


Figure 3-13. Mean station aRPD depth values (cm) at the CCBDS reference area stations



(A) **(B)** **(C)**

Figure 3-14. Sediment-profile images of aRPD depth at each reference area; (A) Station CCBRS-03; (B) Station NWREF-07; and (C) Station SWREF-11

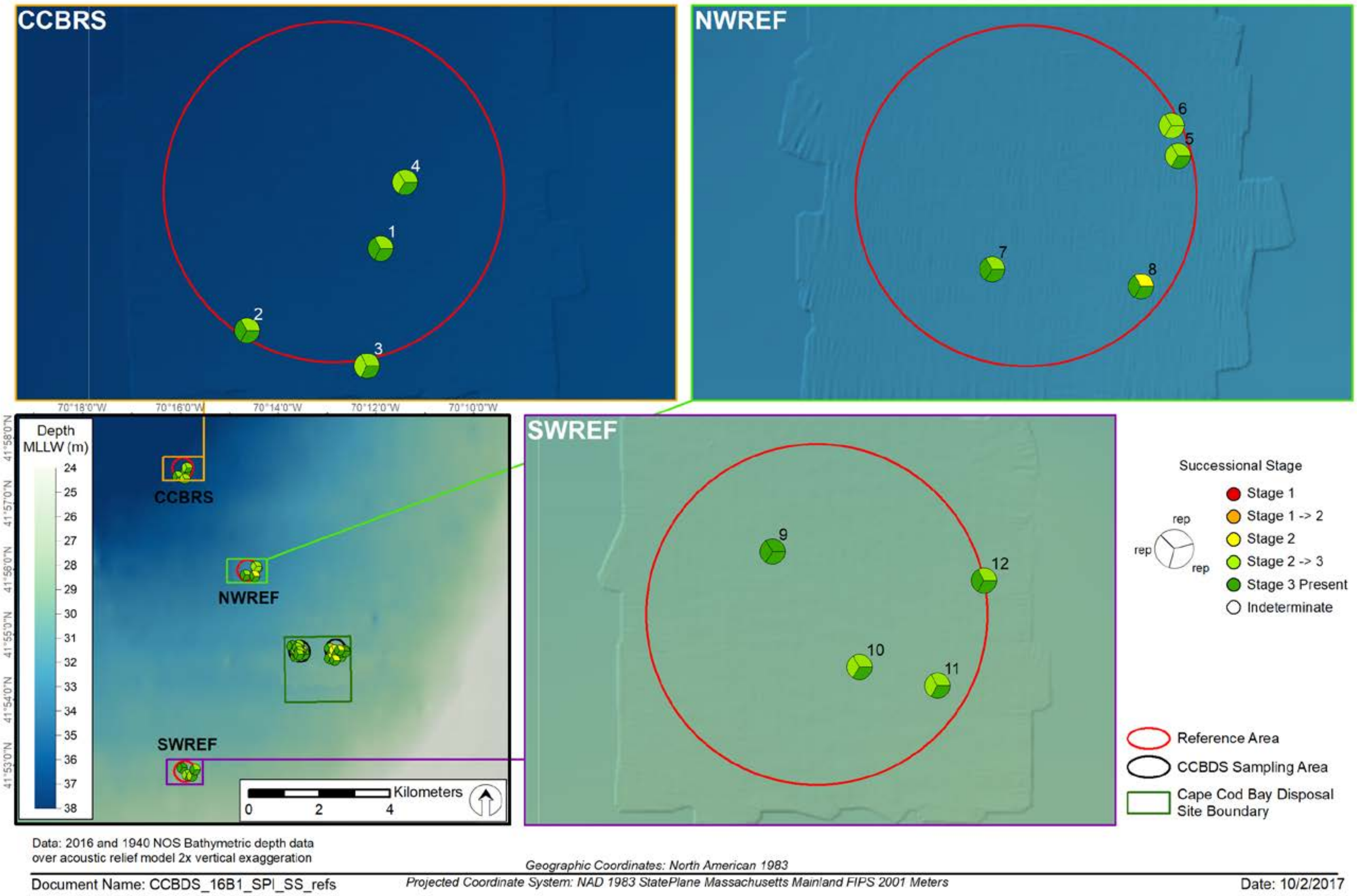


Figure 3-15. Infaunal successional stages found at the CCBDS reference area stations

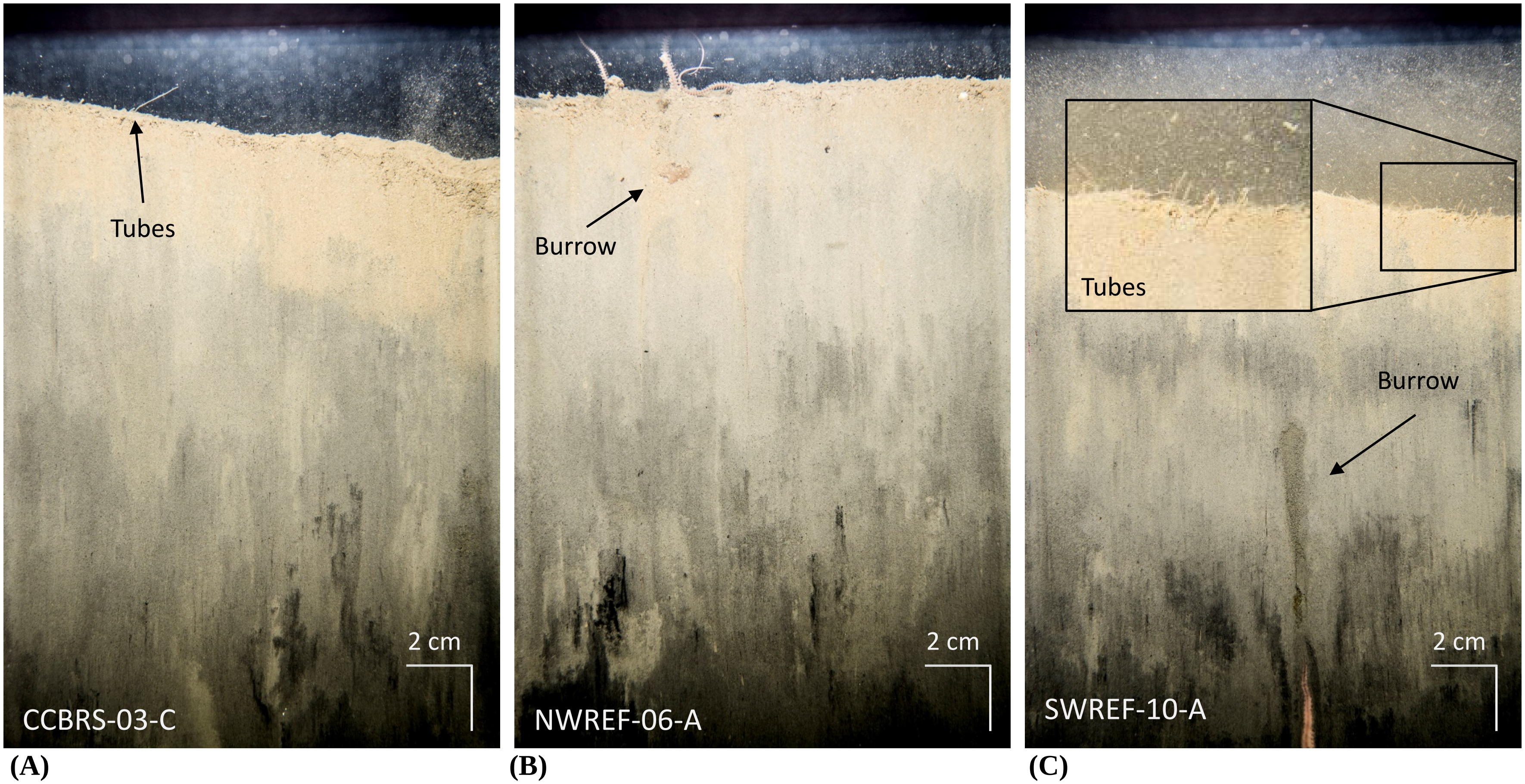


Figure 3-16. Sediment-profile images from (A) Station CCBRS-03 indicating Stage 1 on 3 fauna represented by tubes at the sediment-water interface and evidence of deeper bioturbation; (B) Station NWREF-06 indicating Stage 2 transitioning to 3 fauna with shallow burrowing; and (C) Station SWREF-10 depicting Stage 1 on 3 represented by small tubes at the sediment-water interface and a burrow with a large, visible worm

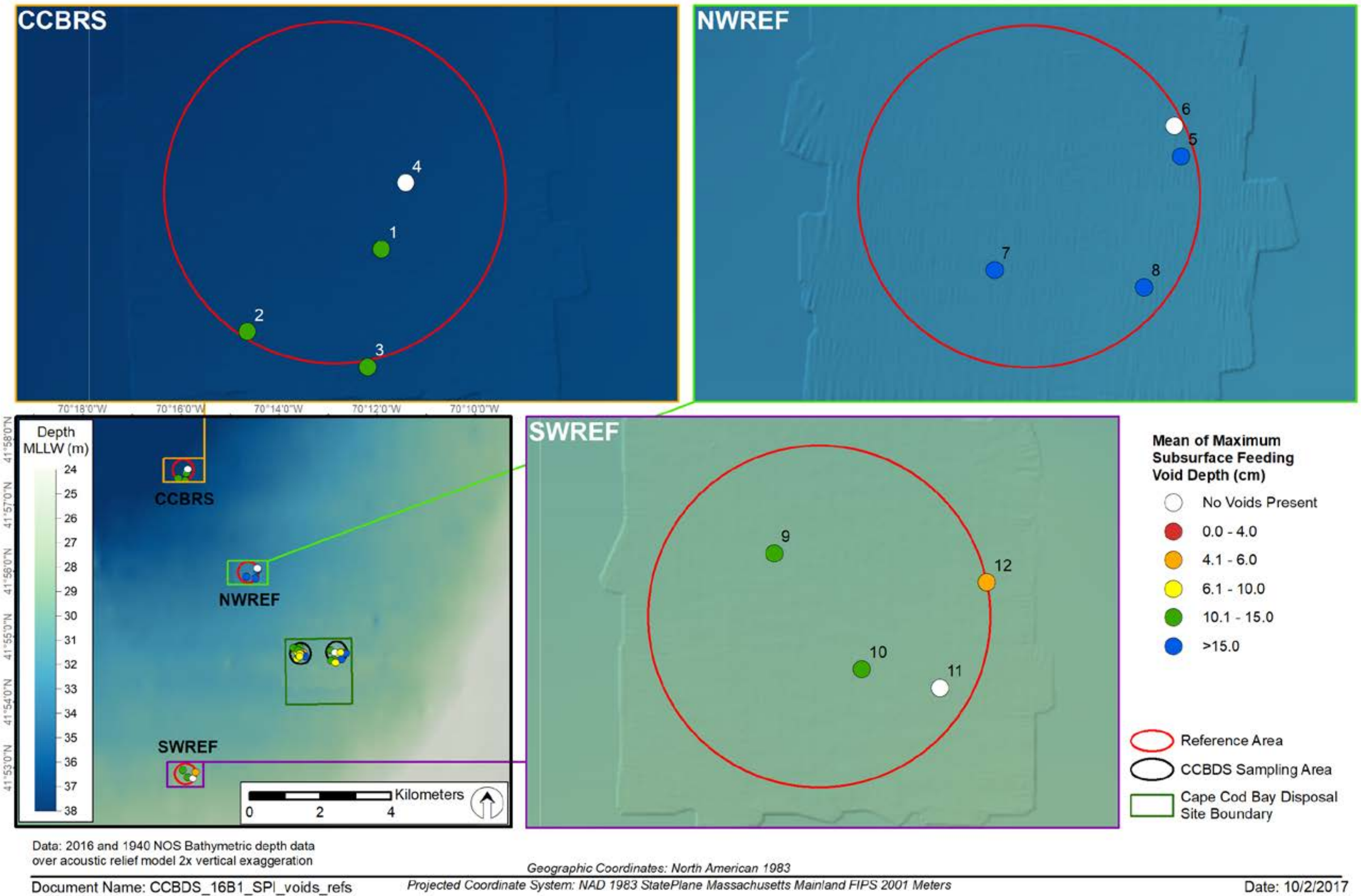
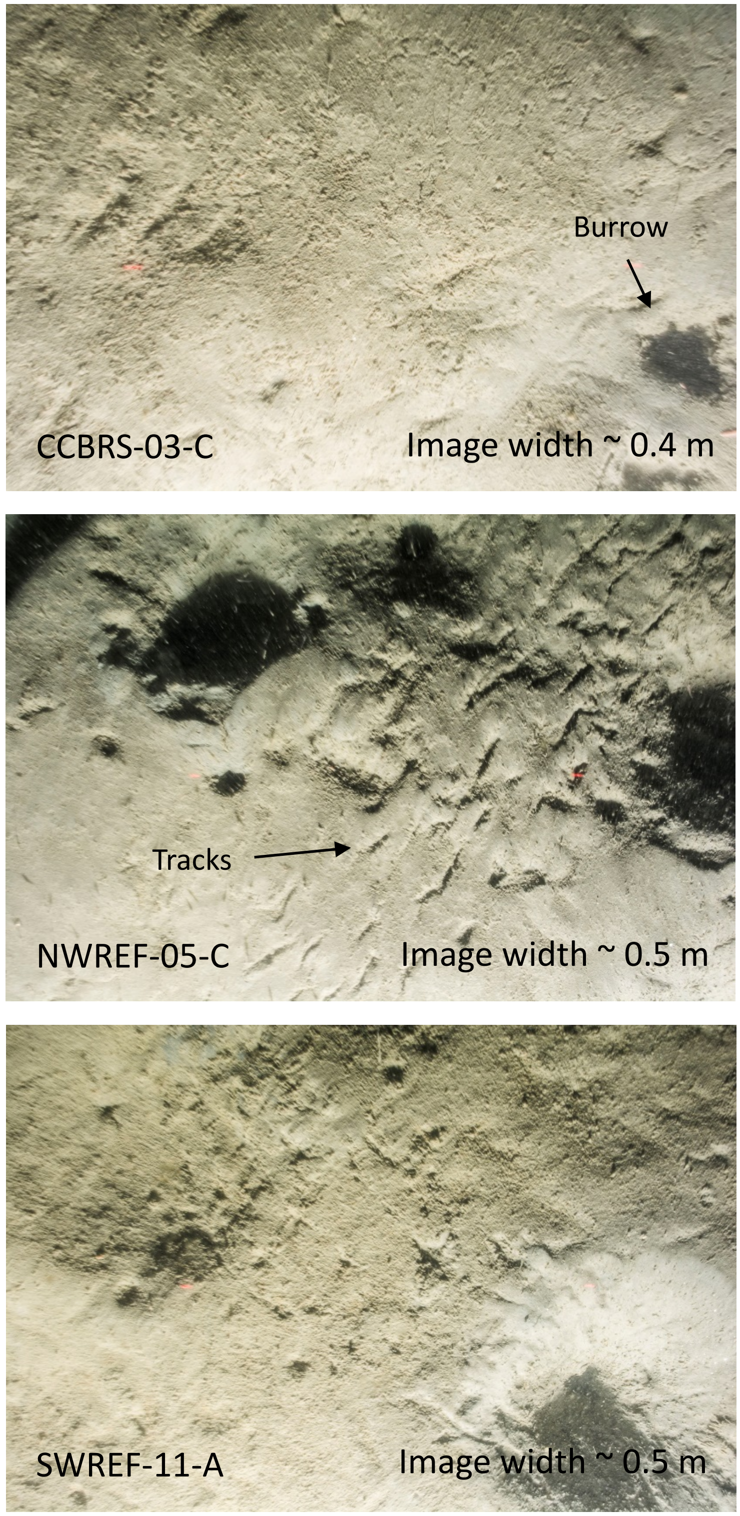


Figure 3-17. Mean depth of subsurface feeding voids at the CCBDS reference area stations

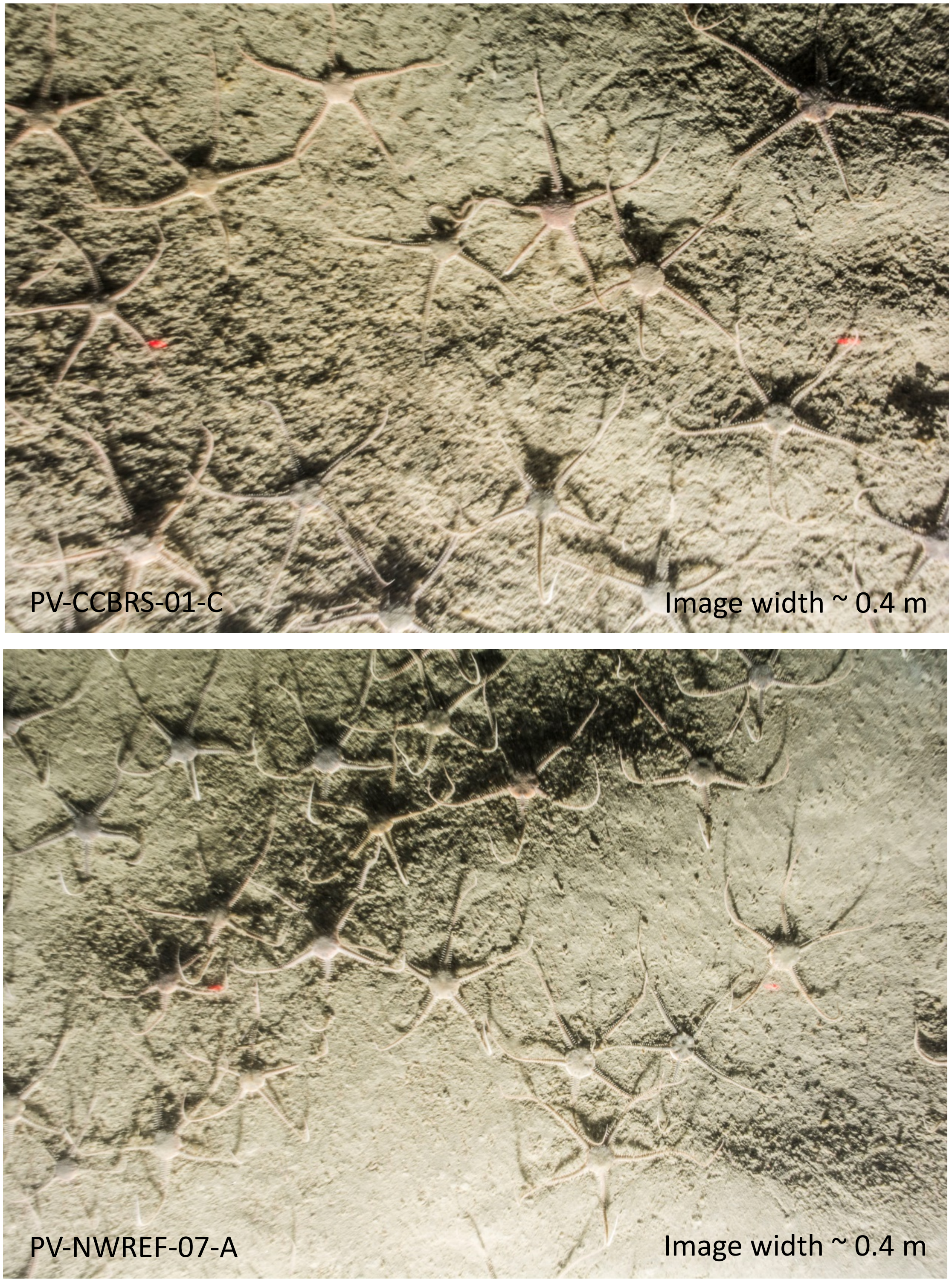


(A)

(B)

(C)

Figure 3-18. Plan-view images from the reference areas; (A) Station CCBRS-03 depicting burrows and small tubes; (B) Station NWREF-05 depicting burrows and tracks; and (C) Station SWREF-11 depicting burrow openings and tracks



(A)

(B)

Figure 3-19. Plan-view images from the reference areas containing brittle stars at; (A) CCBRS-01; and (B) NWREF-07

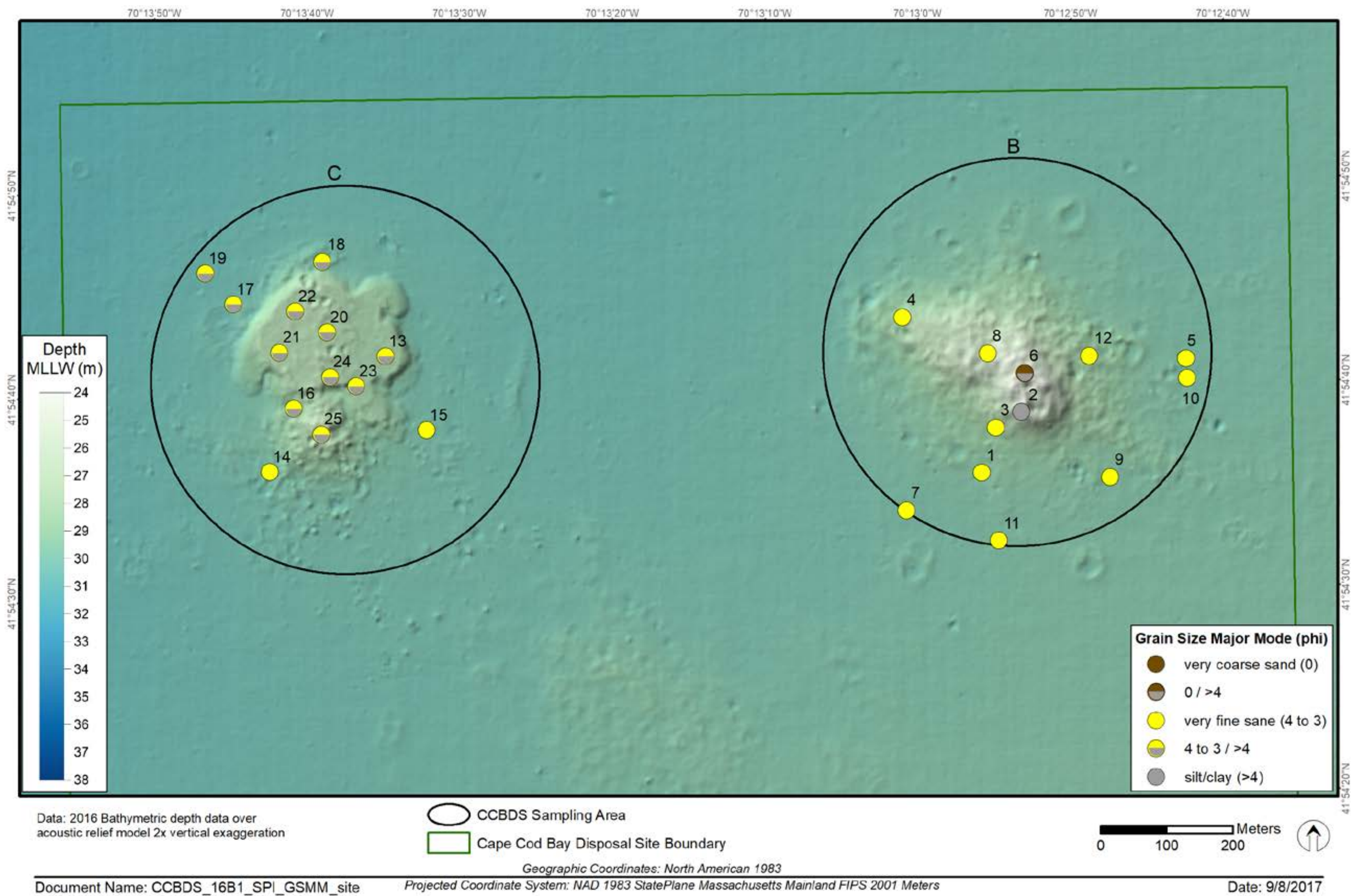
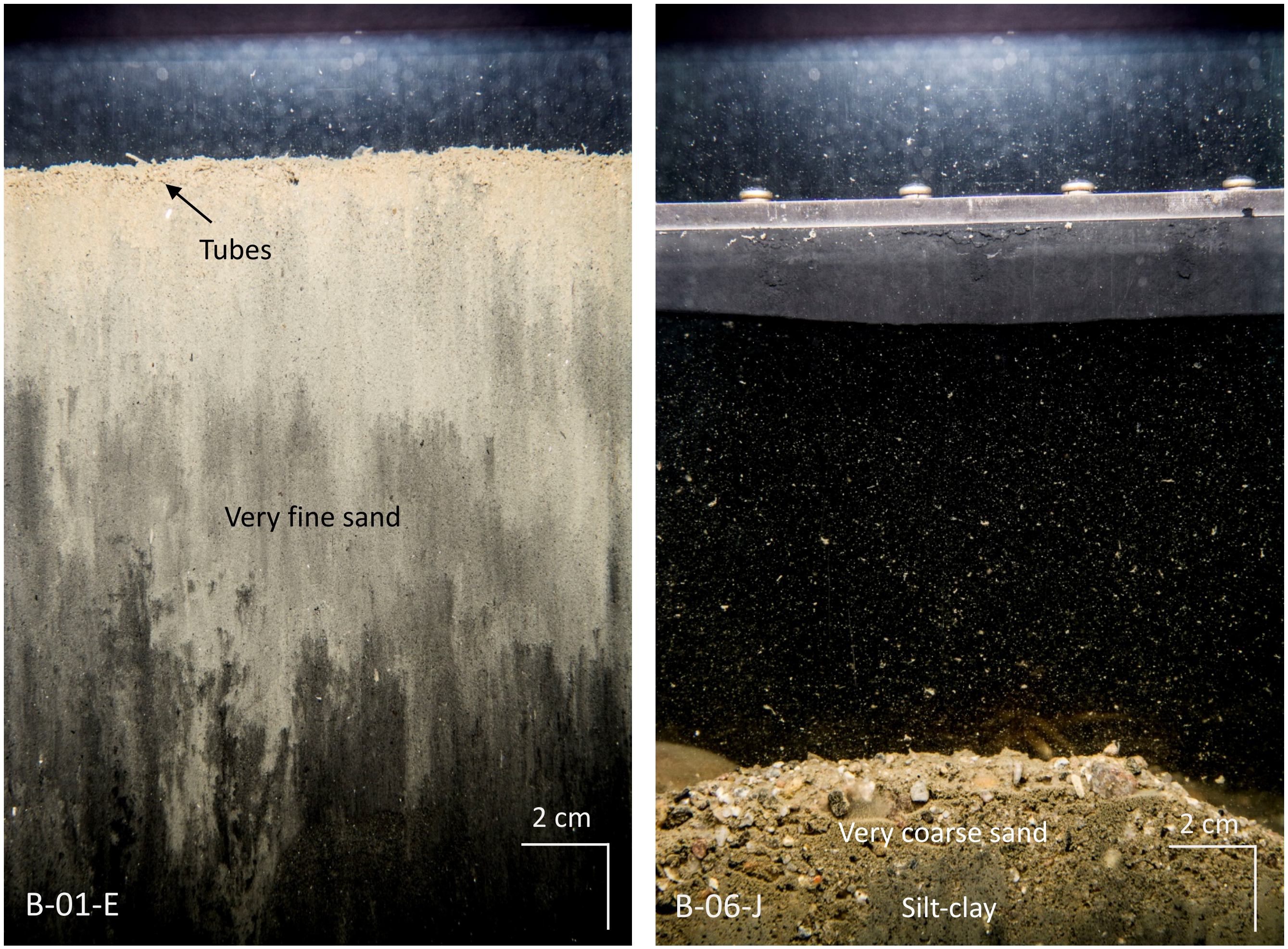


Figure 3-20. Sediment grain size major mode (phi units) at the CCBDS disposal area stations



(A) **(B)**

Figure 3-21. Sediment-profile images from disposal Mound B (A) Station B-01 depicting very fine sand with tubes at the sediment-water interface; and (B) Station B-06 showing very coarse sand over silt-clay with shallow burrowing

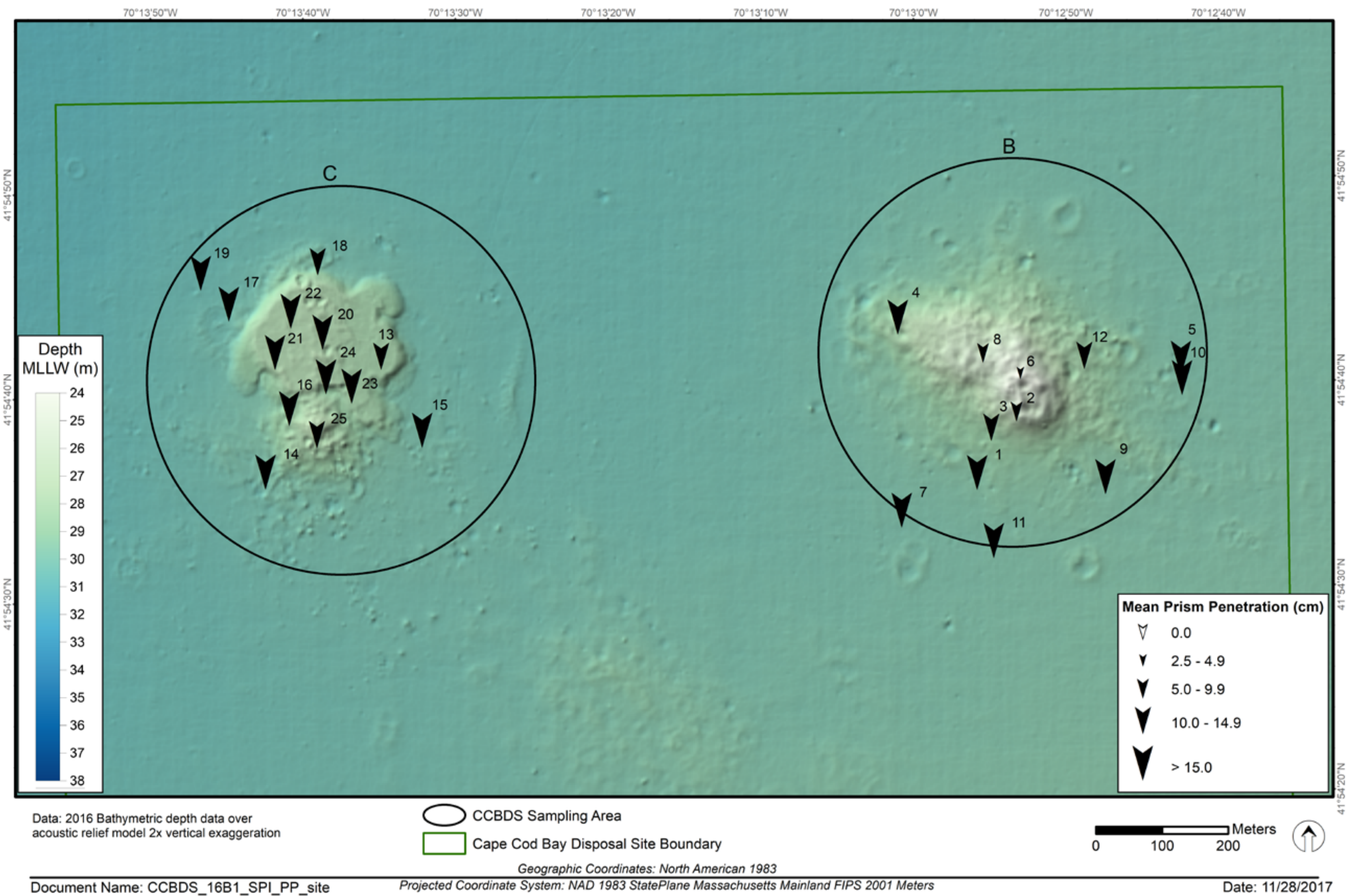


Figure 3-22. Mean station camera prism penetration depths (cm) at the CCBDS disposal area stations

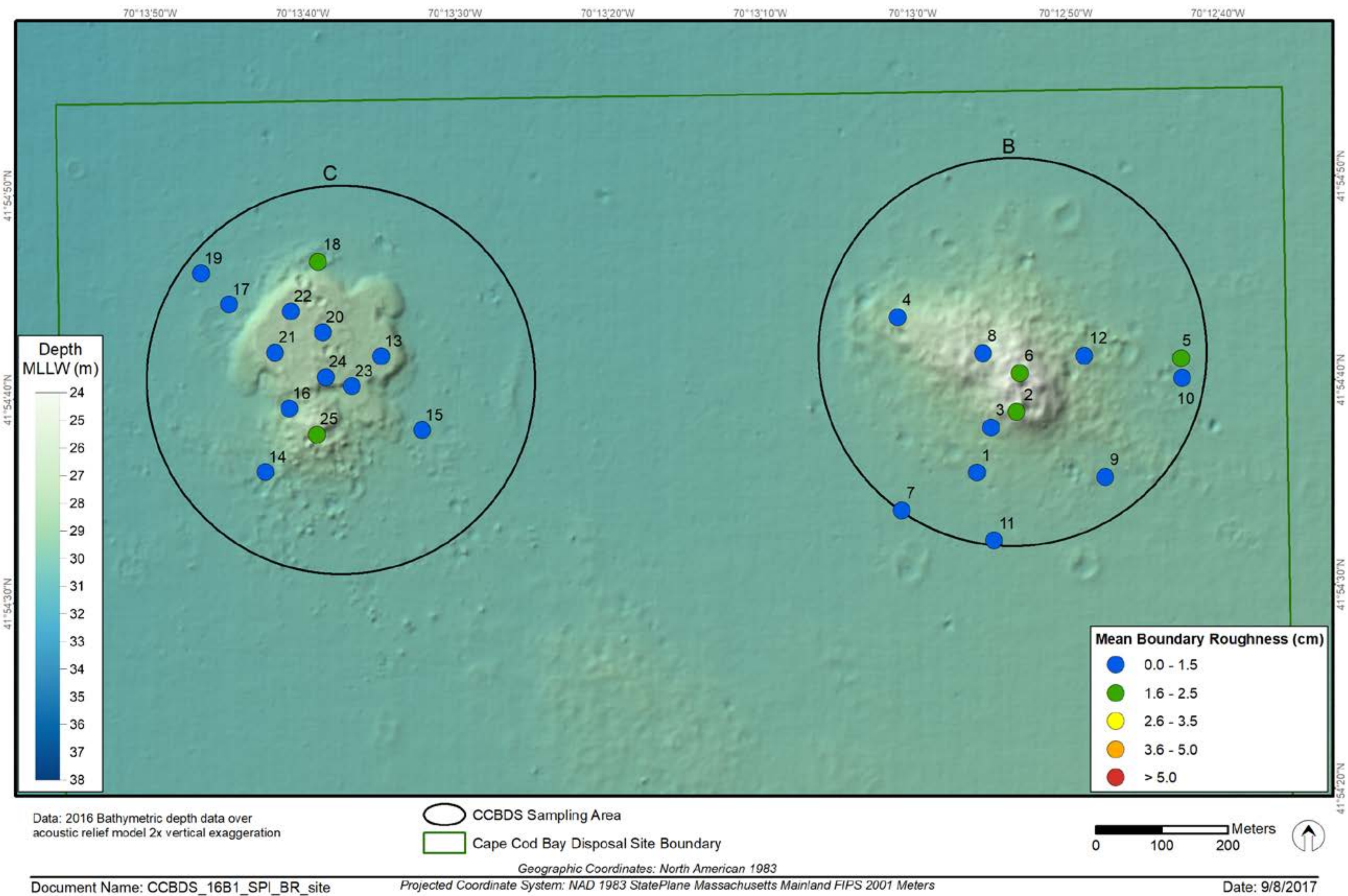
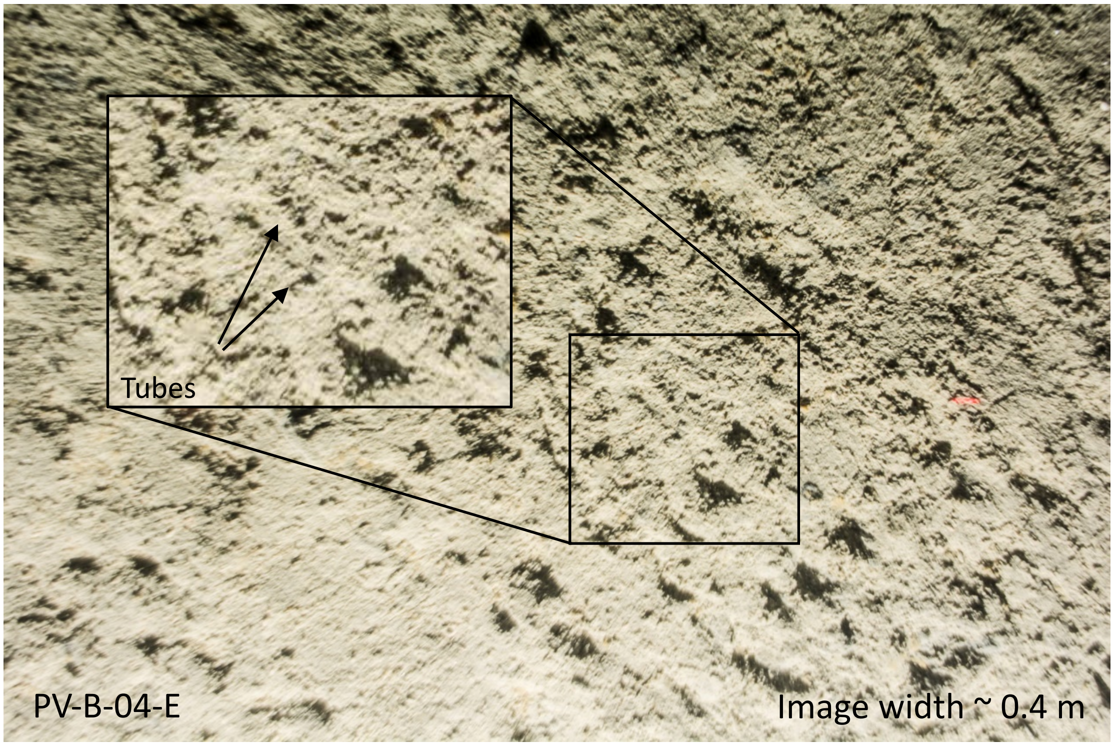
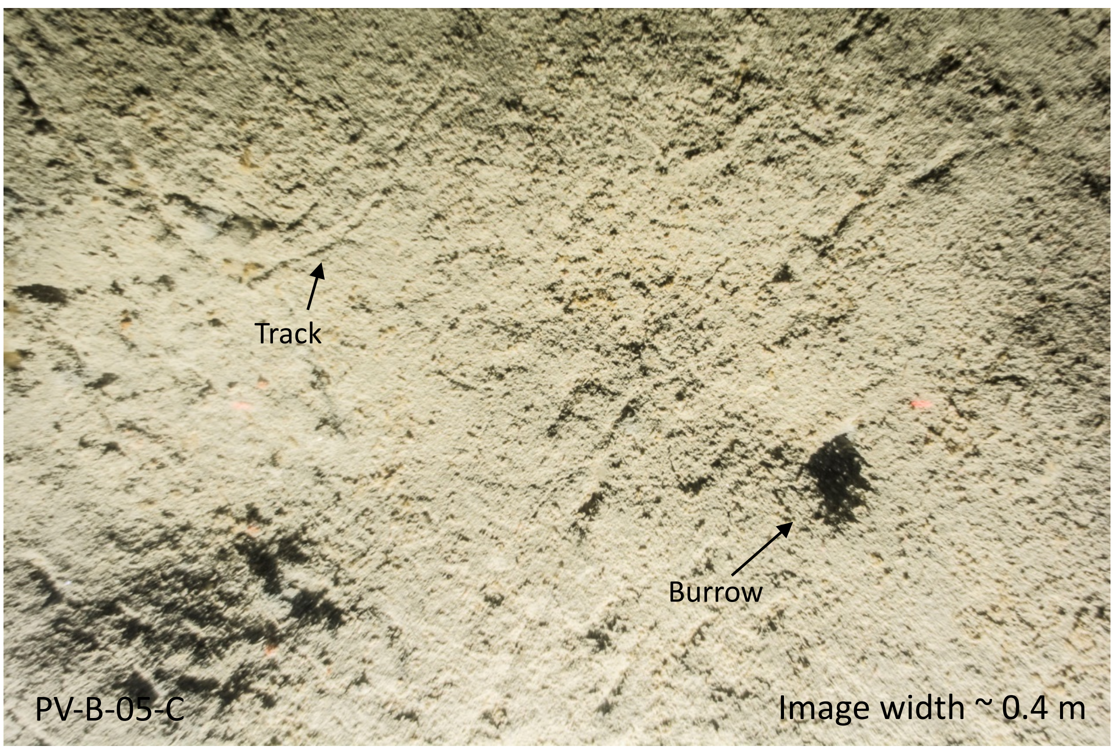


Figure 3-23. Mean station small-scale boundary roughness values (cm) at the CCBDS disposal area stations.



(A)



(B)

Figure 3-24. Plan-view images depicting examples of boundary roughness at Mound B; (A) Station B-04 showing small tubes and burrows; and (B) Station B-05 depicting a burrow and tracks on the sediment surface

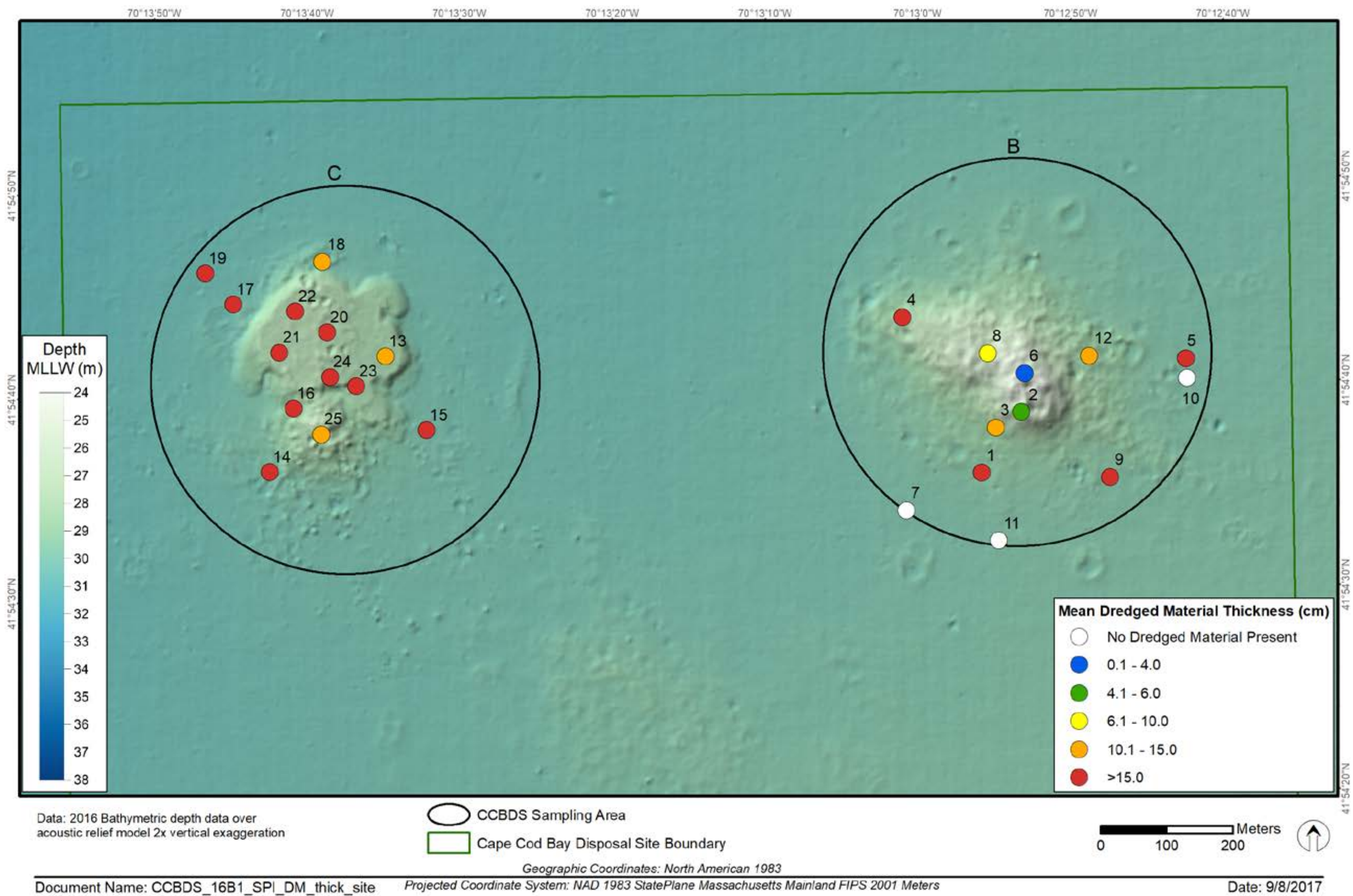
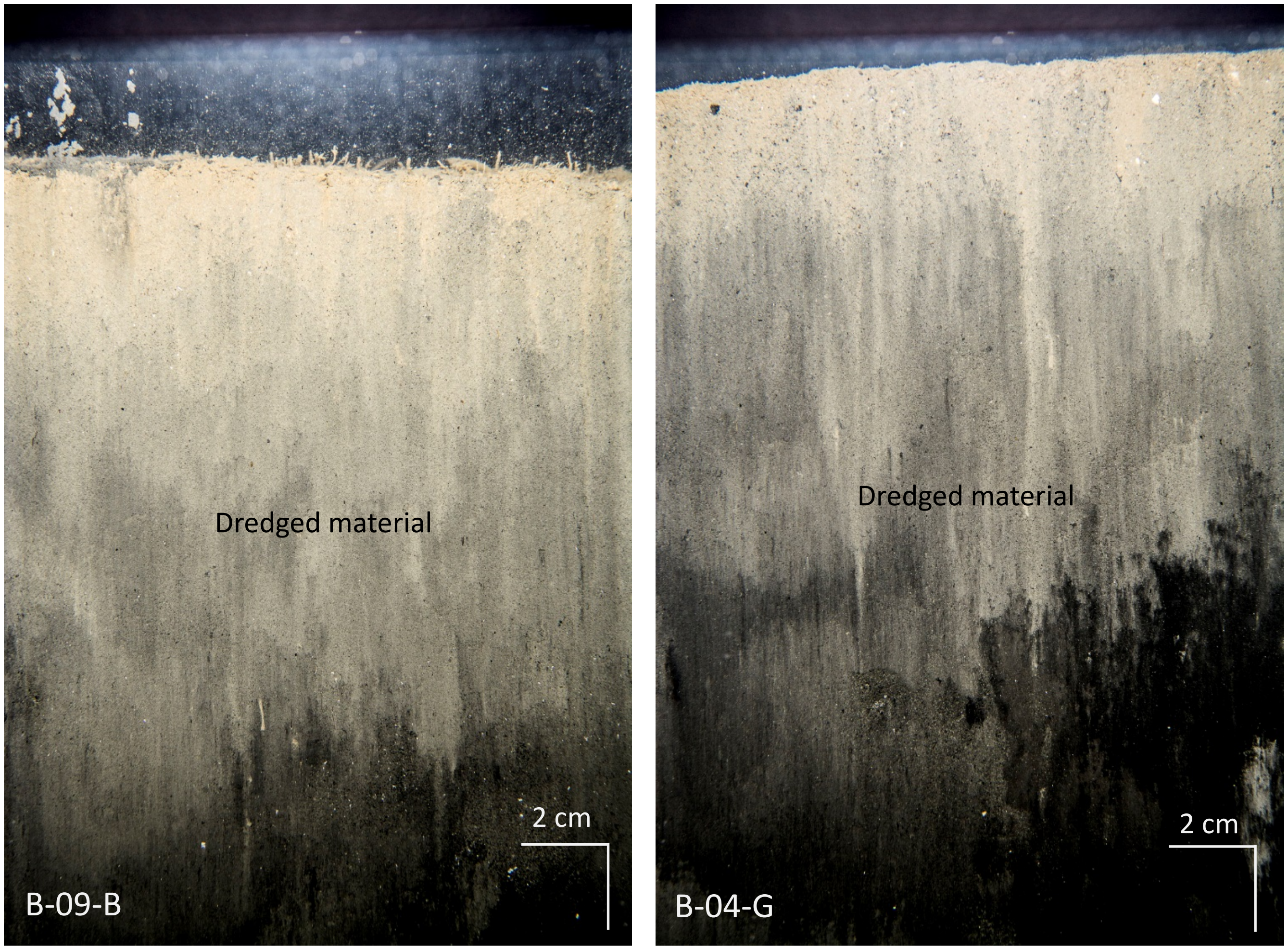
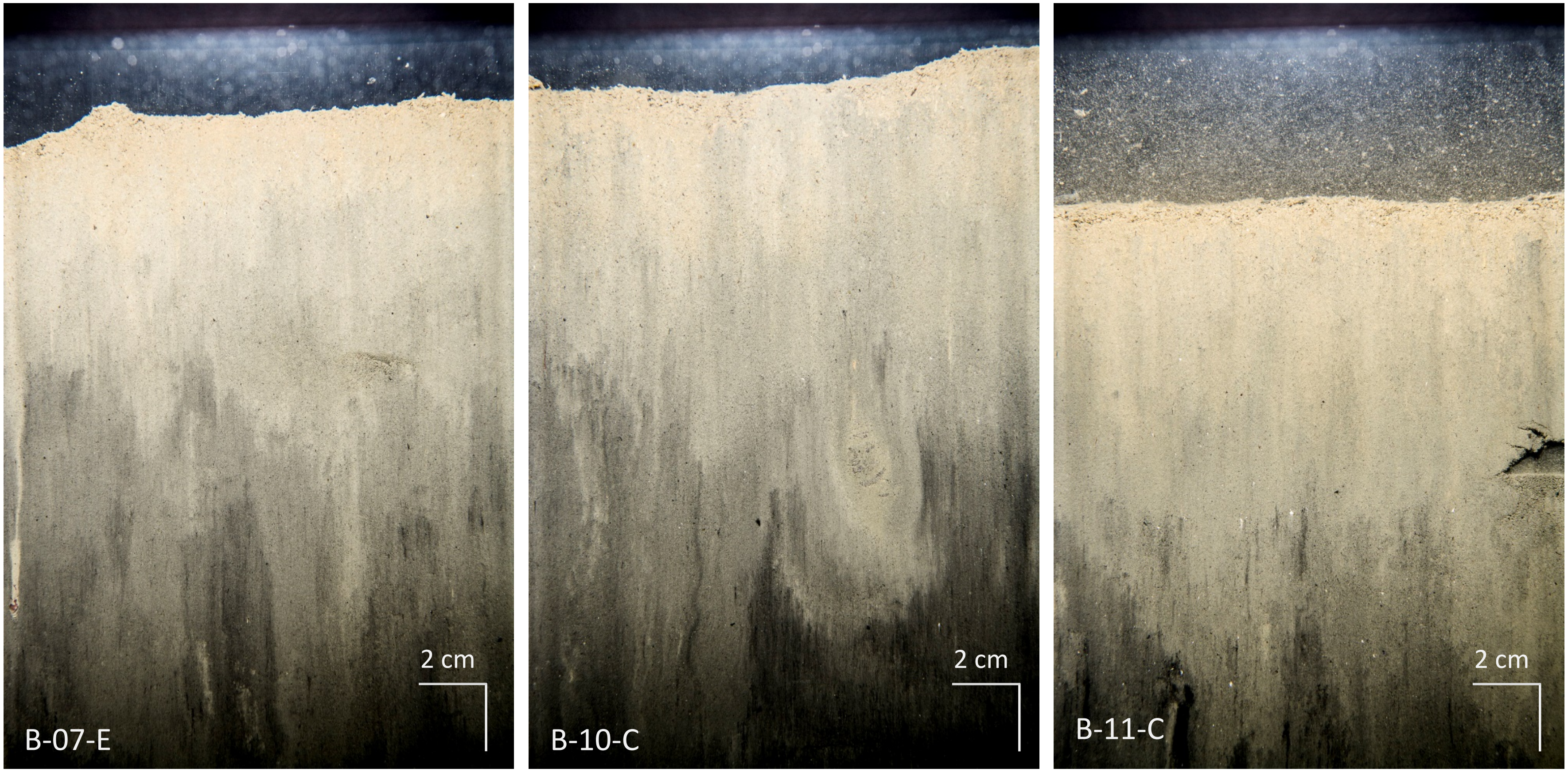


Figure 3-25. Mean dredged material thickness at the CCBDS disposal area stations



(A) **(B)**

Figure 3-26. Sediment-profile images from disposal Mound B; (A) Station B-09; and (B) Station B-04 both depicting a thick layer of partially reworked dredged material extending beyond camera prism penetration depth



(A) **(B)** **(C)**

Figure 3-27. Sediment-profile images from disposal Mound B depicting stations that did not show evidence of dredged material at; (A) Station B-07; (B) Station B-10; and (C) Station B-11

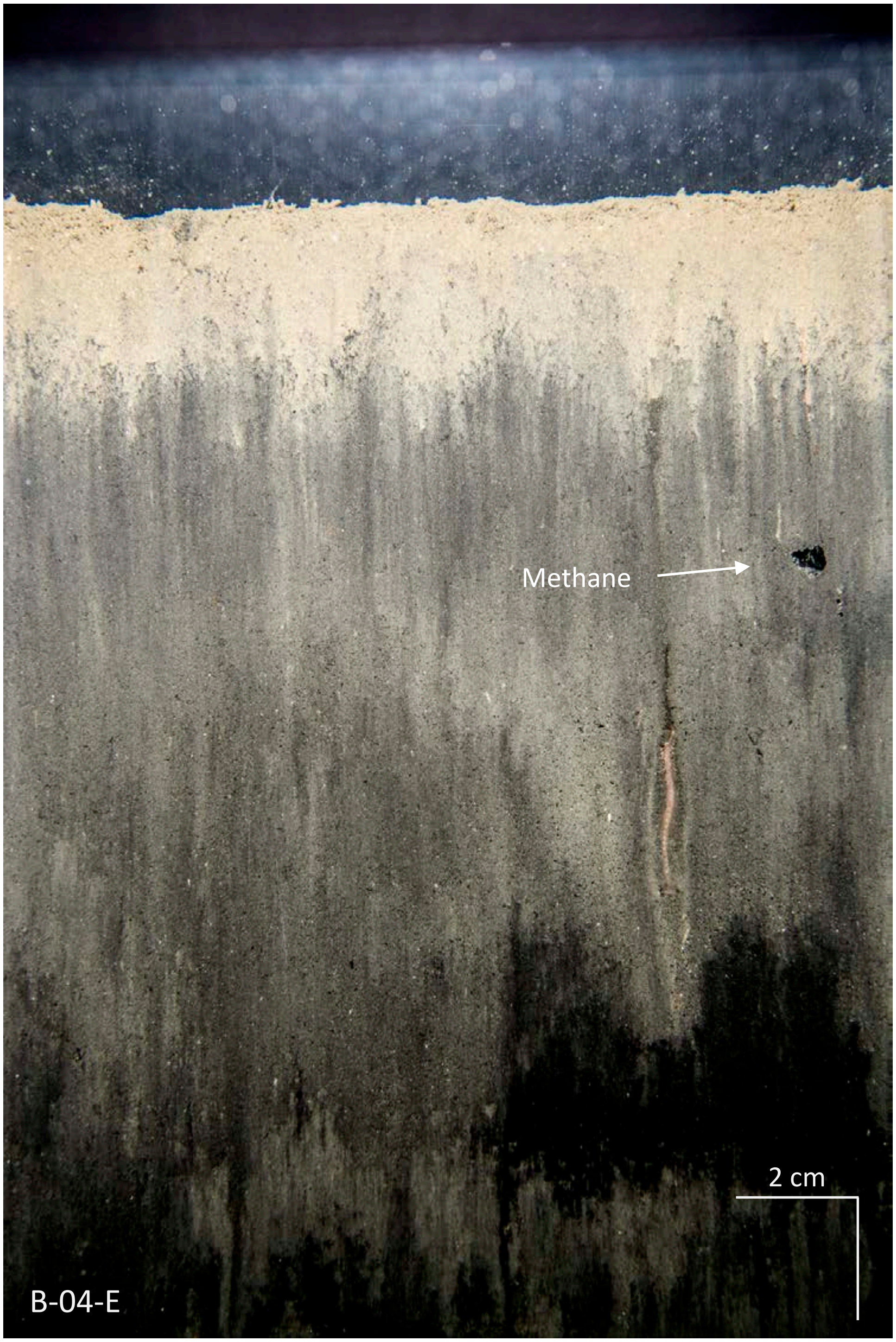
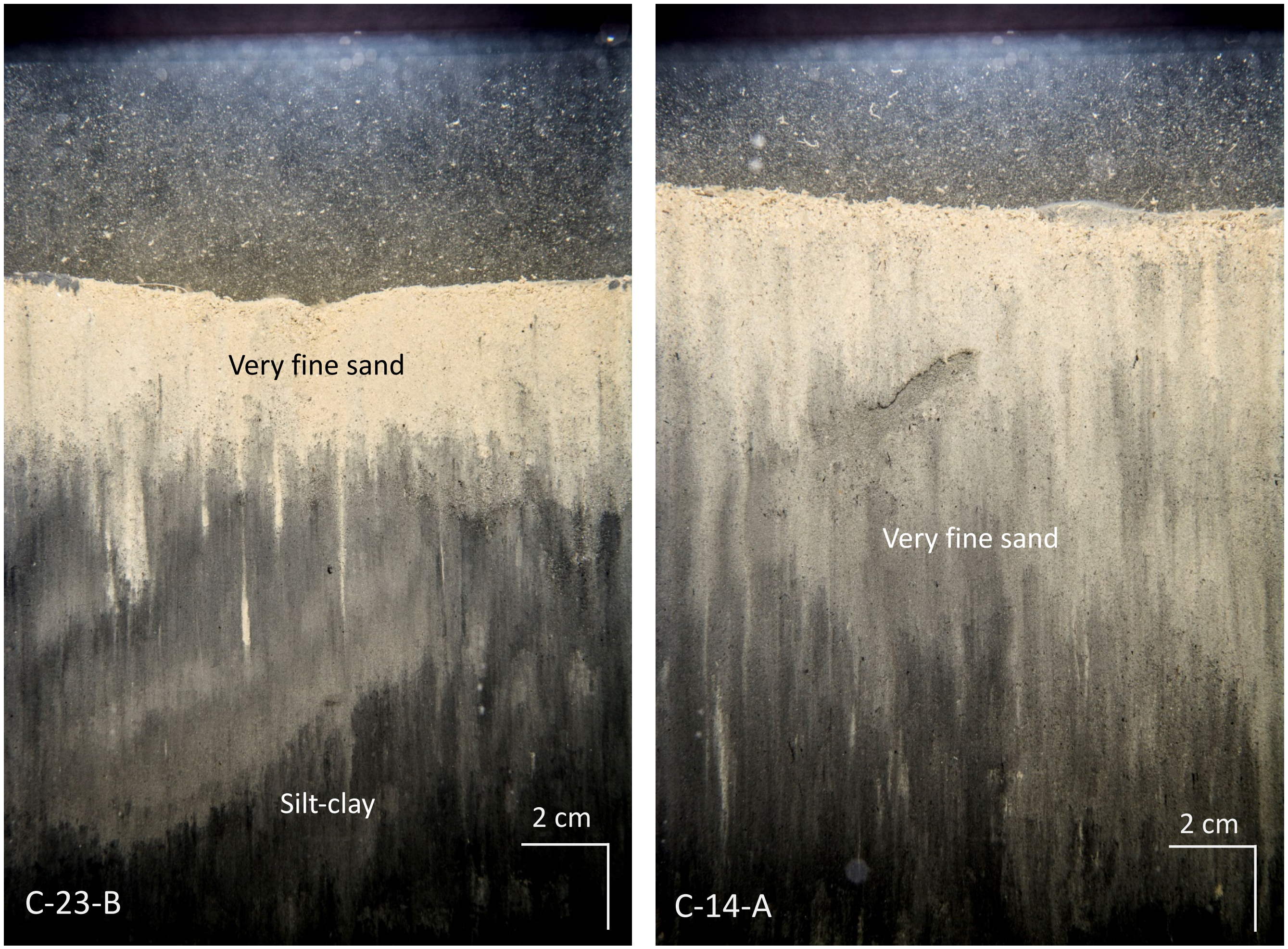
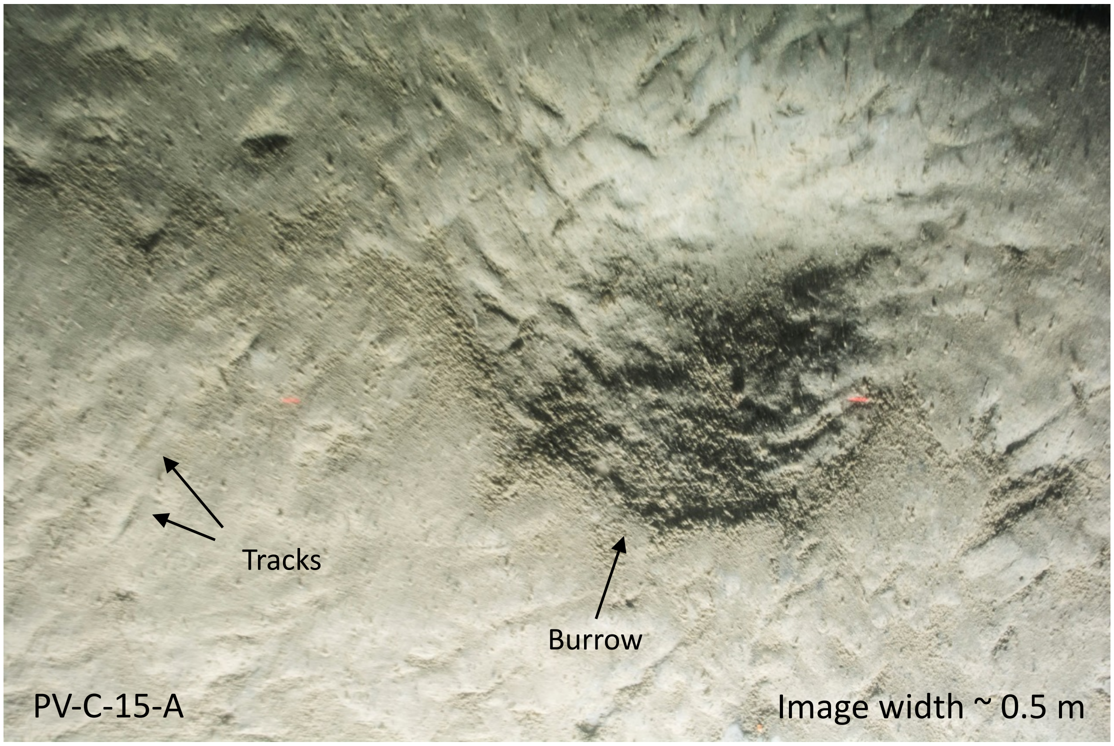


Figure 3-28. Sediment-profile image depicting the presence of methane at Station B-04

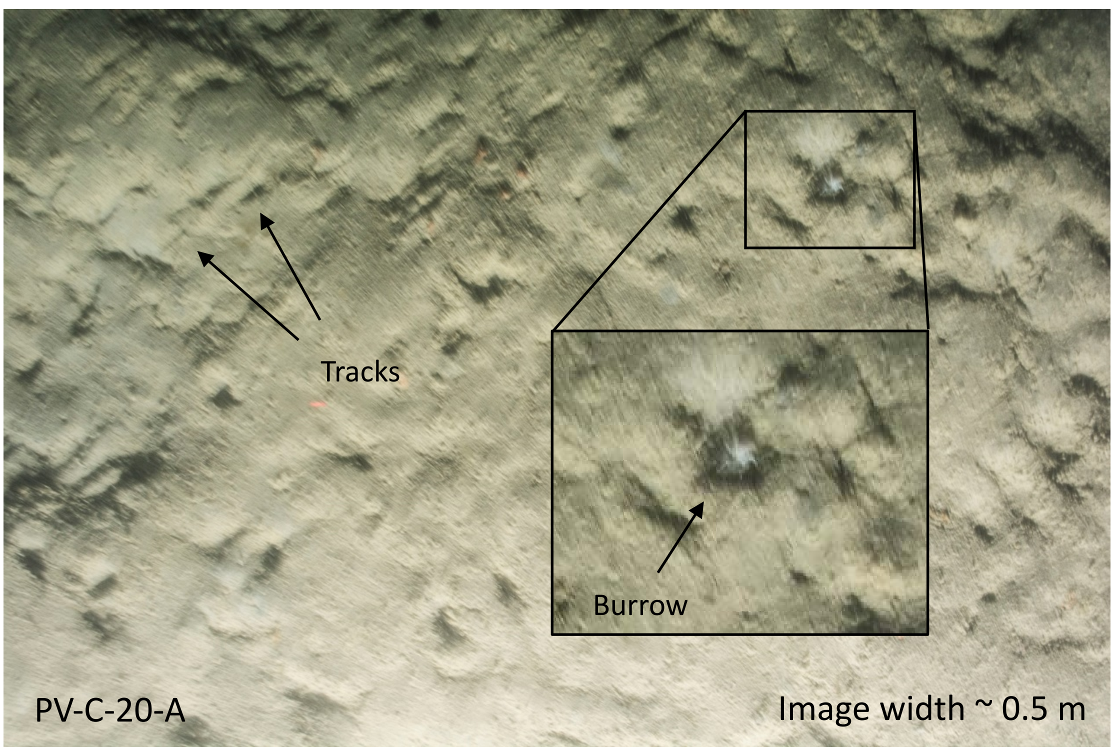


(A) **(B)**

Figure 3-29. Sediment-profile image from disposal Mound C (A) Station C-23 depicting a layer of very fine sand over silt-clay; and (B) Station C-14 showing very fine sand

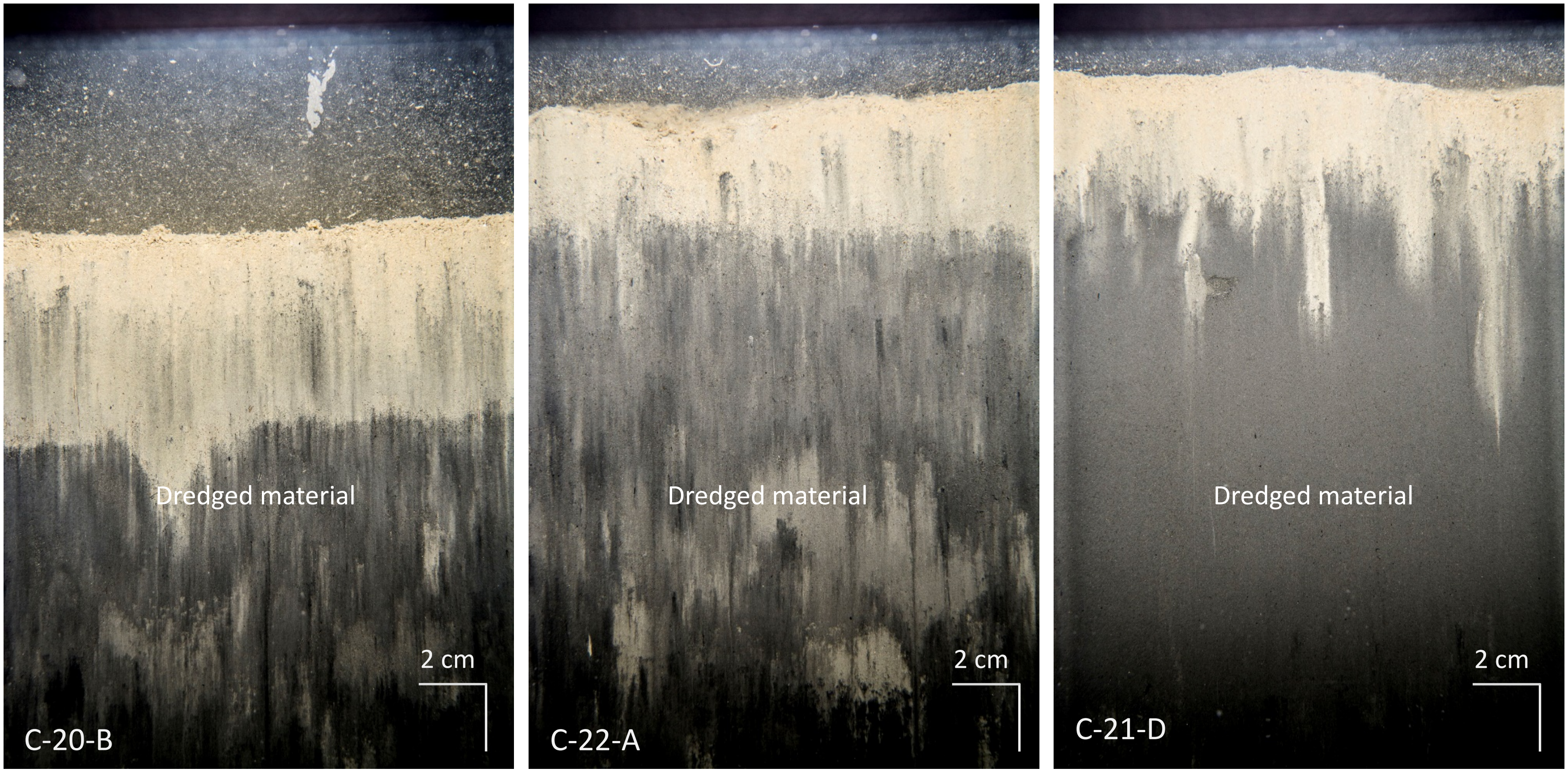


(A)



(B)

Figure 3-30. Plan-view images depicting examples of boundary roughness at Mound C; (A) Station C-15 depicting a burrow and tracks and; (B) Station C-20 depicting small burrows and tracks



(A) (B) (C)

Figure 3-31. Sediment-profile images from disposal Mound C; (A) Station C-20 ;(B) Station C-22; and (C) Station C-21 all showing a thick layer of dredged material extending beyond camera prism penetration that has begun being reworked

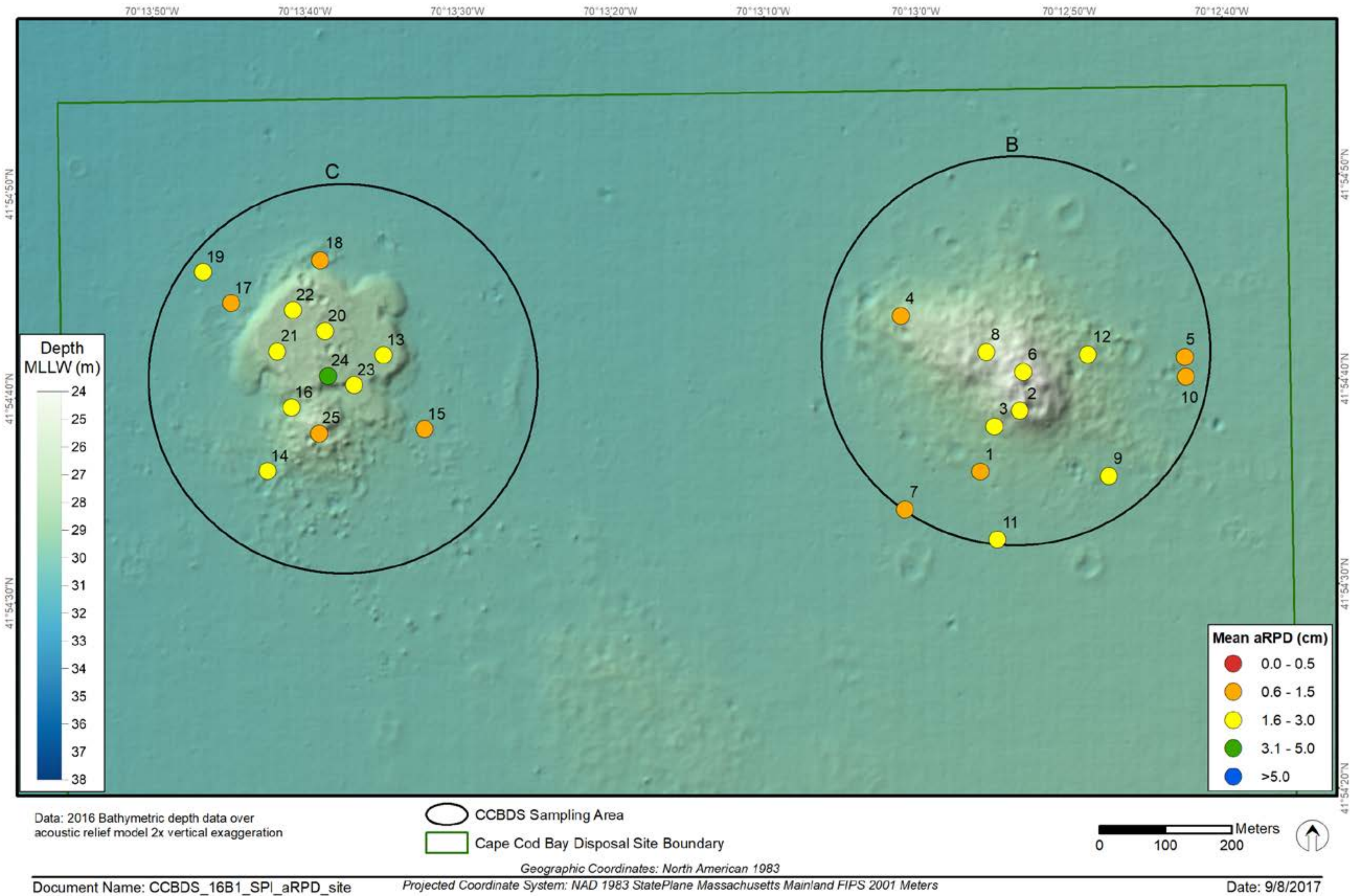
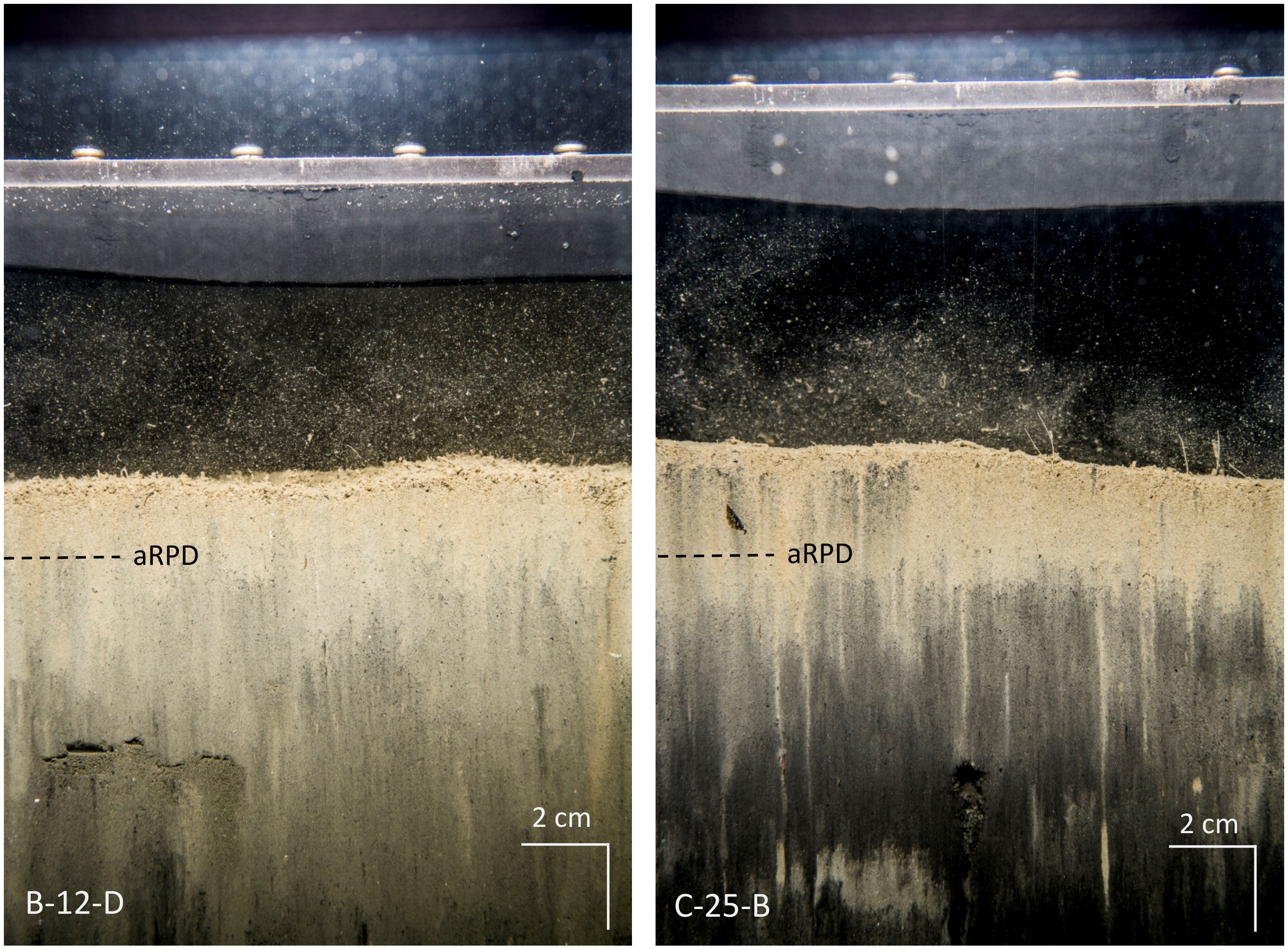


Figure 3-32. Mean station aRPD depth values (cm) at the CCBDS disposal area station



(A) **(B)**

Figure 3-33. Sediment-profile images from; (A) Mound B-12 and (B) Mound C-25 both depicting typical aRPD depths for the disposal areas

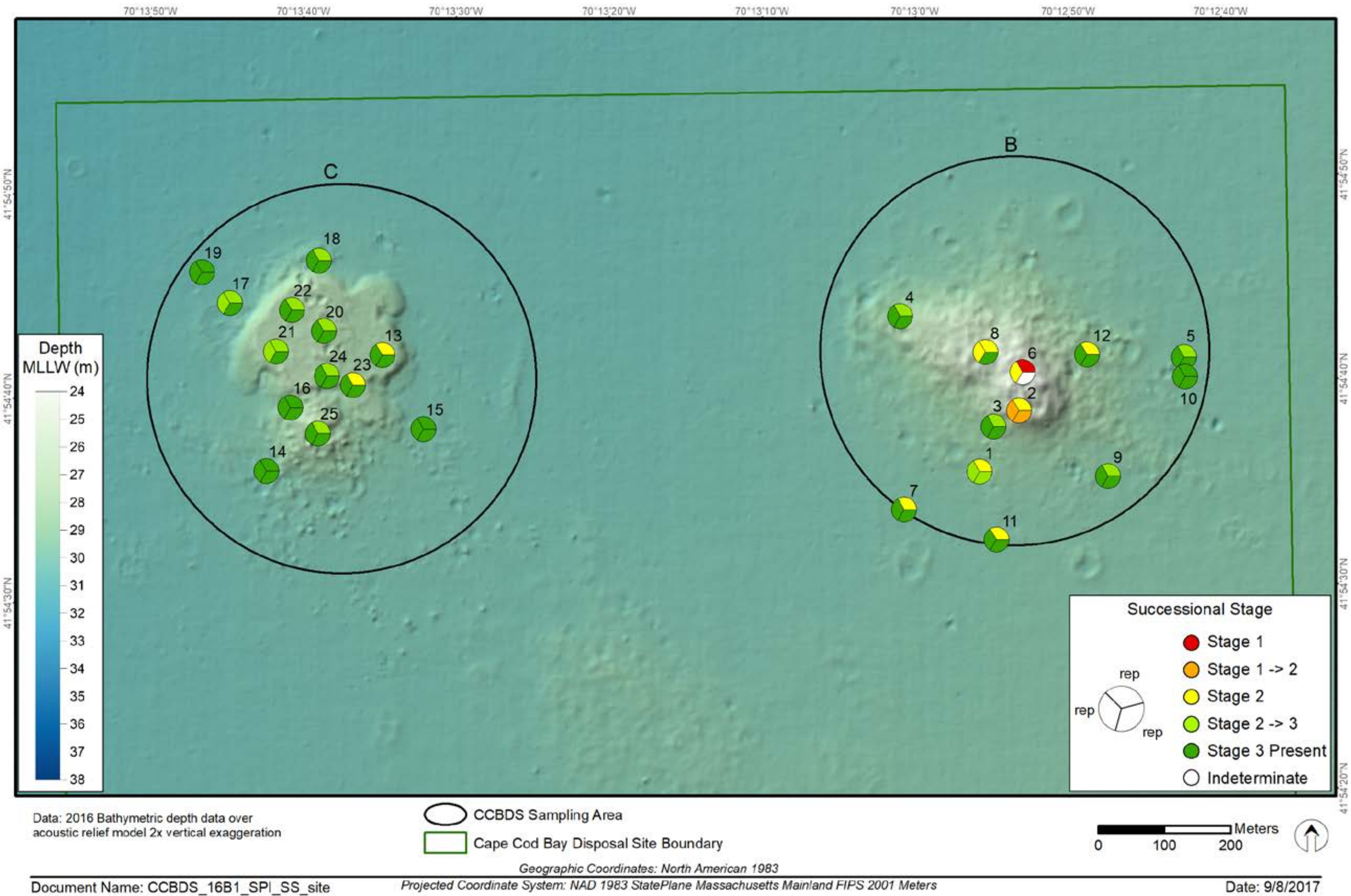


Figure 3-34. Infaunal successional stages found at the CCBDS disposal area stations

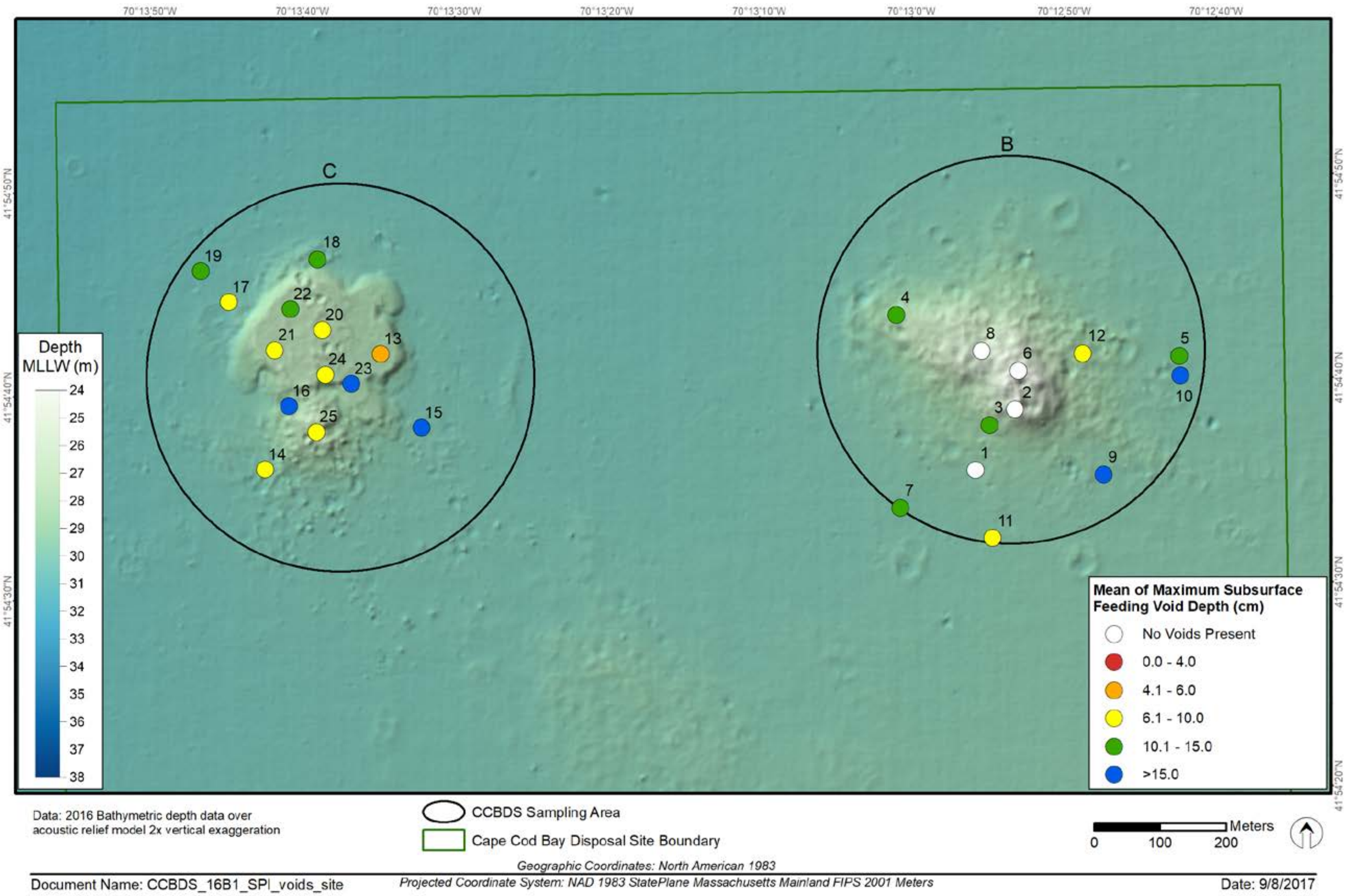


Figure 3-35. Mean depth of subsurface feeding voids at the CCBDS disposal area stations

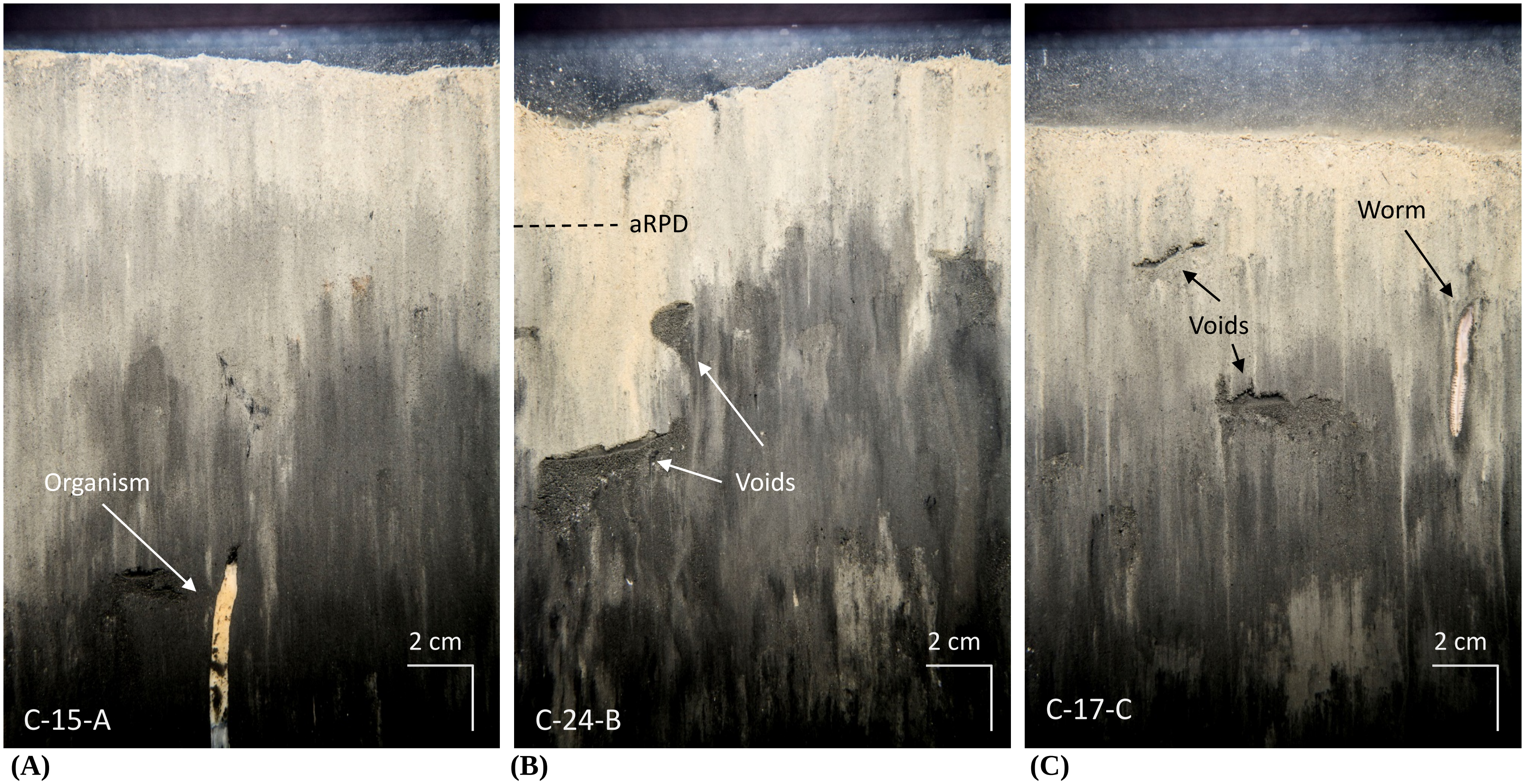


Figure 3-36. Sediment-profile images from disposal Mound C; (A) Station C-15 indicating Stage 1 on 3 fauna represented by tubes at the sediment-water interface and a large organism in a deep burrow; (B) Station C-24 indicating Stage 1 on 3 represented by small tubes at the sediment-water interface and open feeding voids at depth as well as a deep aRPD; and (C) Station C-17 depicting Stage 1 on 3 fauna represented by shallow, open voids, and a large worm visible in a burrow

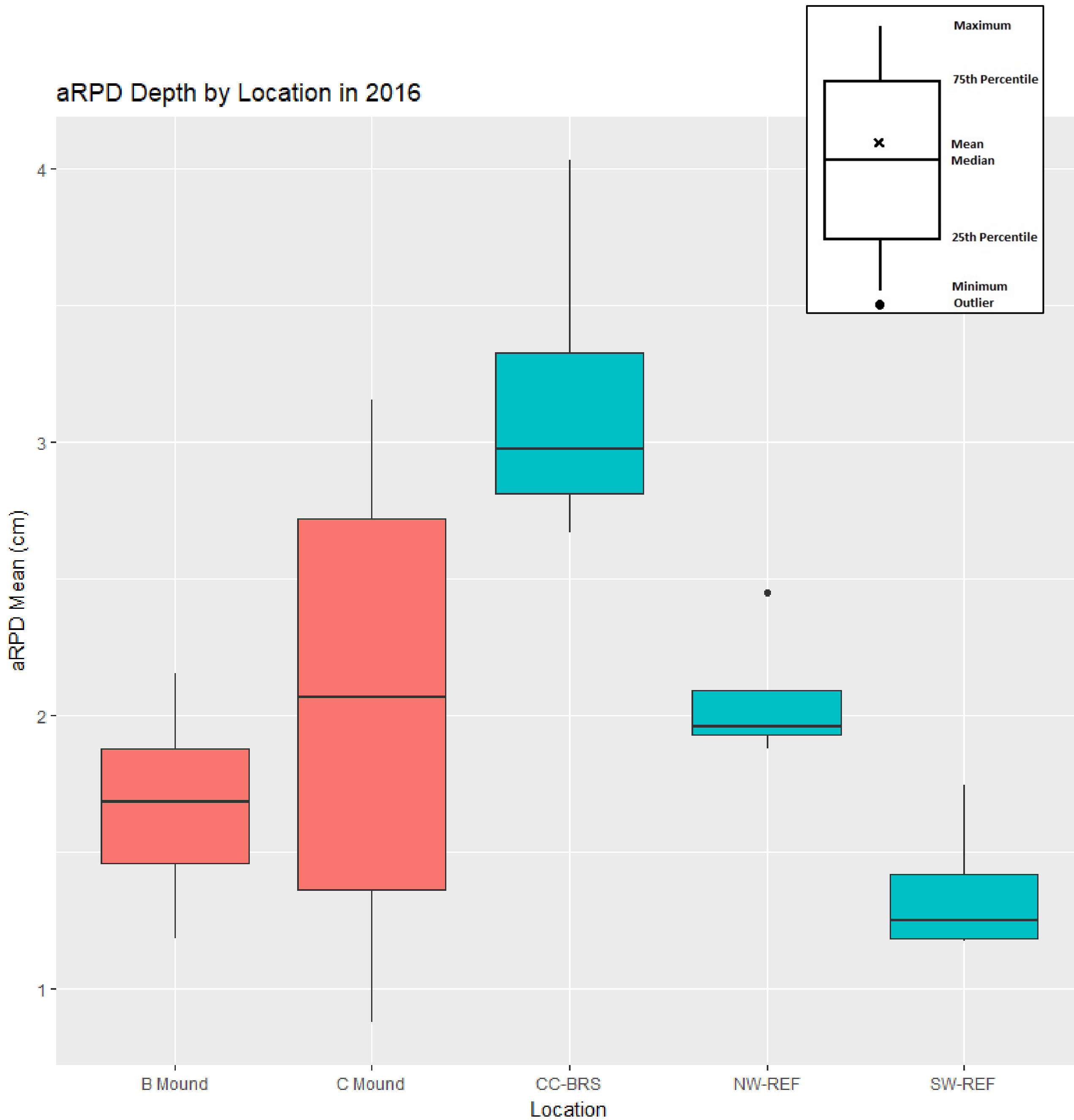


Figure 3-37. Boxplots showing the distribution of mean aRPD depths measured at the disposal site and reference area stations in the 2016 survey

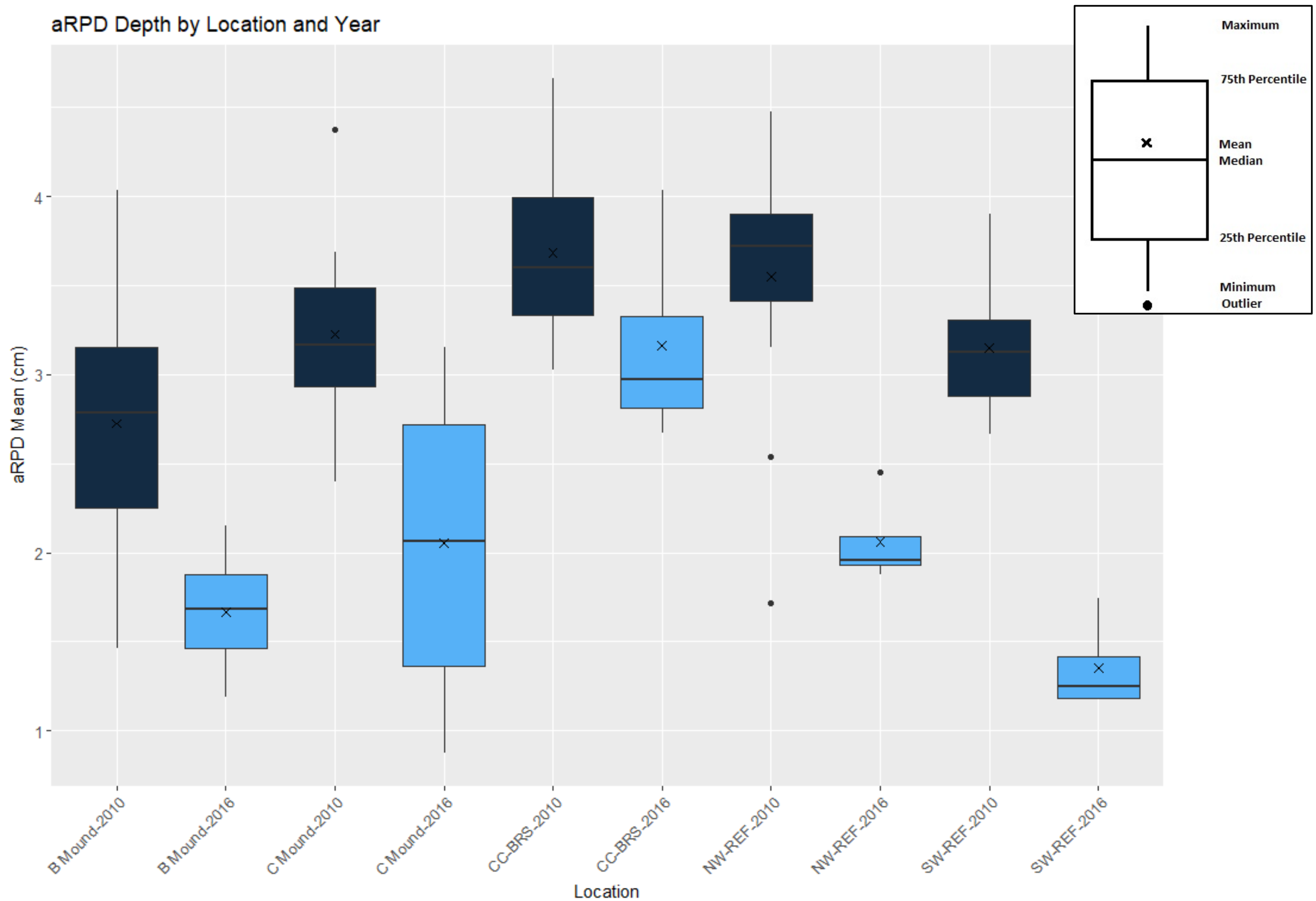


Figure 3-38. Boxplots showing the distribution of mean aRPD depths measured at the disposal area stations and reference area stations in the 2010 and 2016 surveys

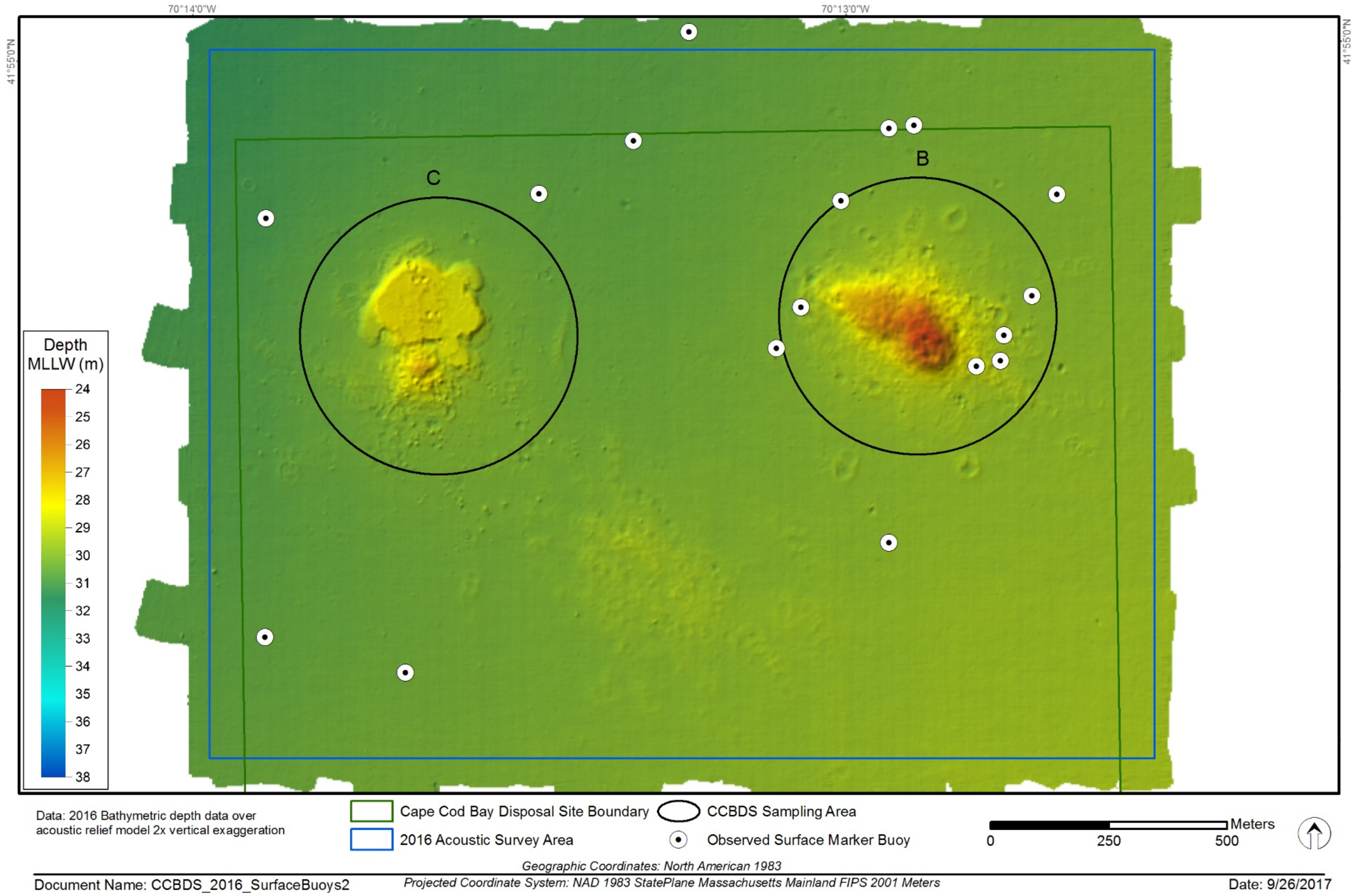


Figure 3-39. Surface marker buoy observations during the acoustic survey at CCBDS – October 2016

4.0 DISCUSSION

4.1 Accuracy of Dredged Material Placement

Since September 2010, approximately 270,000 m^3 of material has been placed at Mound C (Figure 1-3) at CCBDS. Prior to September 2010, material was placed at Mound B and at other locations within CCBDS. The topography of the seafloor recorded at CCBDS was characterized by pronounced raised features at Mounds B and C. Mound B contained a distinct elongated peak and reached approximately 7 m in elevation compared to the surrounding area while Mound C formed a rough plateau approximately 3 m above the surrounding area. The distinct topographic features observed in CCBDS were noticeably absent at the reference areas. All three reference areas (CCBRS, NWREF, and SWREF) had a relatively flat seafloor that was devoid of large-scale topographic features.

All stations surveyed at Mound C exhibited dredged material (Appendix E). Elevation comparisons at Mound C between 2010 and 2016 indicated that the material placed during these years increased the height of the mound above the seafloor by up to 3.4 m (Figure 3-6). SPI/PV sampling indicated that stations on the periphery of Mound C also contained dredged material (Figure 3-25). Dredged material was present at all but three stations at Mound B (Figure 3-25). The stations closest to the periphery of the Mound B area did not contain dredged material (Stations B-07, B-10, and B-11; Appendix E). This suggests that historical dredged material placed at Mound B has remained within the site boundaries.

4.2 Long Term Stability of Placed Sediment

CCBDS has cumulatively received approximately 766,000 m^3 of dredged material since the selection of this site in 1990 (AECOM 2012). Historically, the largest projects resulted in the creation of Mound A during the 1994-1995 disposal season and the creation of Mound B during the disposal seasons between 1996 and 2001. A 2010 survey found possible evidence of tidal currents winnowing out fine-grained sediments from the peak of Mound B (AECOM 2012). Coarse grained sediments were found to be located at the peak of Mound B in the 2016 survey, suggesting that winnowing had likely occurred with no significant change in peak height.

The most recent placement of close to 270,000 m^3 of dredged material was at Mound C during disposal seasons 2013, 2014, and 2015 (Figure 1-3). Depth difference observations show that a distinct topographic feature was created at Mound C with the deposited material (Figure 3-6). Bathymetric observations of Mound C found the disposal mound was constrained within the boundaries of the disposal area (Figure 3-2b). This suggests that little spatial transport of the deposited material has occurred. Mound C was observed to be a smooth, plateaued topographic high rising approximately 3 m above the surrounding seafloor.

Existing bathymetry at CCBDS showed the maximum height of Mound B to be 6.4 m above the ambient seafloor (peak = -23.6 m MLLW). The mean slope of the sides of Mound B was calculated as 3 degrees (rise/run = 1/19). Assuming a maximum deposit elevation of -23.6 m MLLW and a buffer width adequate to minimize the potential for dredged material sloughing outside of the 1850 m x 1850 m site boundary, the remaining capacity at CCBDS would be approximately 17.4 million m^3.

4.3 Biological Recovery of the Benthic Community

The results of the 2016 SPI survey indicated a relatively high degree of benthic recolonization at Mound B and Mound C sites at the time of the survey. Recovery of the benthic community at CCBDS was evident in the aRPD depths and successional taxa observed from SPI and plan-view images.

SPI images from Mound B and Mound C showed abundant evidence of mature, deposit-feeding, benthic taxa. The PV images reinforced the SPI results in showing numerous burrow openings, tubes, and tracks on the sediment surface at almost all stations. Stage 3 taxa were equally abundant at all three reference areas with evidence of mature, deposit-feeding fauna observed at all but one station (NWREF 06; Table 3-1). Similar to Mound B and Mound C, there were extensive organism tracks, burrow openings, and pits visible in plan-view images from the reference area stations. Successional stage at both Mound B and Mound C were statistically equivalent to the reference areas which implies that these areas had recovered to background levels.

Mean aRPD depths were statistically equivalent between both Mound B and Mound C disposal areas compared to the reference areas. The aRPD depth is often mediated by biological activity, and its depth within the sediment column provides an indication of biological reworking of the sediment column (Rosenberg et al. 2001; Kristensen et al. 2012). Statistical equivalence in aRPD depths between the disposal and reference areas supports the observation of benthic recovery equivalent to background at Mound B and Mound C.

Temporal comparison of the aRPD depth at the disposal areas (Mound B and Mound C) as well as the temporal comparison at the reference areas (CCBRS, NWREF, and SWREF) found statistical inequivalence between the 2010 and 2016 observations for both groups. Inequivalence is not due to seasonal differences, as both 2010 and 2016 SPI surveys occurred in the fall. The disposal mounds and the reference areas in 2016 were found to have aRPD depths that were shallower than in 2010. Given that aRPD depth and successional stage were found to be statistically equivalent between disposal and reference areas in 2016, the inequivalence found between survey years is likely due to overall change of the aRPD depth in the CCBDS region over time.

4.4 Management Considerations

The patterns of dredged material on the seafloor at CCBDS are detectable based on elevation difference calculations between years of placement, through distinct signatures in the backscatter and side-scan sonar, and through optical observations from SPI. These patterns indicate that dredged material placed within the Mound B and Mound C areas is stable (Figure 1-3).

There was no identification of dredged material at any of the reference locations, and the sediment characteristics and water depth of the reference areas were similar to the disposal areas. On this basis, the reference areas are still considered valid for comparison with disposal site conditions.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The October 2016 survey at CCBDS was conducted to collect bathymetric data over a portion of the disposal site that received dredged material placed since 2010 and to collect SPI and plan-view imaging at two disposal areas and three reference areas. The survey was designed to assess changes at the site after placement of approximately 270,000 m^3 of dredged material since the previous survey in 2010. The 2016 SPI and bathymetric surveys successfully characterized the seafloor topography and defined the physical characteristics to assess benthic recovery with the following results:

- The benthic communities at the two disposal sites located in the northern portion of CCBDS (Mound B and Mound C) recovered consistent with the expected recovery paradigm. Both Mound B and Mound C were statistically ecologically equivalent to reference stations, confirming a full recovery at both mounds, neither of which have received dredged material for at least one year.

- Mature benthic communities had developed at both disposal mounds, including the most recently used mound (Mound C).

- Dredged material placed at Mound C was constrained to a discrete, plateaued mound, and there were no observations of spatial displacement of deposited material.

- The results of the 2016 survey identified the following recommendations:

  R1: The presence of stable mounds and normal benthic recolonization indicate that the Mound C could accommodate additional dredged material placement utilizing a similar approach to what has been used in the past.

  R2: Monitoring efforts should continue consistent with Tiered Monitoring Protocols based on volume placed at site.

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APPENDIX A

TABLE OF COMMON CONVERSIONS

APPENDIX A

TABLE OF COMMON CONVERSIONS

Metric Unit Conversion to English Unit		English Unit Conversion to Metric Unit	
1 meter	3.2808 ft.	1 foot	0.3048 m
1 m		1 ft.	
1 square meter	10.7639 ft^2	1 square foot	0.0929 m^2
1 m^2		1 ft^2	
1 kilometer	0.6214 mi	1 mile	1.6093 km
1 km		1 mi	
1 cubic meter	1.3080 yd^3	1 cubic yard	0.7646 m^3
1 m^3		1 yd^3	
1 centimeter	0.3937 in	1 inch	2.54 cm
1 cm		1 in	

APPENDIX B

CCBDS DISPOSAL LOG DATA FOR DISPOSAL SEASONS 2013, 2014, AND 2015

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	03-Jun-13	41.910793	-70.227423	New Bedford	MA	1,918	2,508	1533048	57248
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	03-Jun-13	41.910417	-70.227805	New Bedford	MA	1,918	2,508	1533052	57245
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	04-Jun-13	41.910135	-70.226812	New Bedford	MA	1,918	2,508	1535724	57247
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	07-Jun-13	41.91027	-70.227812	New Bedford	MA	1,918	2,508	1558004	57254
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	09-Jun-13	41.911143	-70.228012	New Bedford	MA	1,918	2,508	1557995	57256
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	09-Jun-13	41.910263	-70.227907	New Bedford	MA	1,918	2,508	1557988	57255
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	10-Jun-13	41.910715	-70.227627	New Bedford	MA	1,918	2,508	1558005	57257
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	10-Jun-13	41.911253	-70.227183	New Bedford	MA	1,918	2,508	1557989	57259
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	11-Jun-13	41.910432	-70.22883	New Bedford	MA	1,918	2,508	1558006	57260
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	11-Jun-13	41.91038	-70.228945	New Bedford	MA	1,918	2,508	1561735	57261
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	12-Jun-13	41.910143	-70.22785	New Bedford	MA	1,918	2,508	1561741	57262
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	13-Jun-13	41.910255	-70.226927	New Bedford	MA	1,918	2,508	1565367	57263
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	13-Jun-13	41.910302	-70.227758	New Bedford	MA	1,918	2,508	1565354	57264
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	13-Jun-13	41.910832	-70.228085	New Bedford	MA	1,918	2,508	1568898	57265
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	15-Jun-13	41.911055	-70.227967	New Bedford	MA	1,918	2,508	1581515	57266
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	15-Jun-13	41.910713	-70.227648	New Bedford	MA	1,918	2,508	1581501	57267
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	16-Jun-13	41.911058	-70.226752	New Bedford	MA	1,918	2,508	1581511	57271
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	18-Jun-13	41.910355	-70.227838	New Bedford	MA	1,918	2,508	1584822	57274
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	18-Jun-13	41.911372	-70.2283	New Bedford	MA	1,918	2,508	1589049	57275
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	18-Jun-13	41.910353	-70.227503	New Bedford	MA	1,918	2,508	1589058	57276
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	19-Jun-13	41.910233	-70.227873	New Bedford	MA	1,918	2,508	1592403	57277
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	19-Jun-13	41.90991	-70.227802	New Bedford	MA	1,918	2,508	1592402	57278
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	20-Jun-13	41.91066	-70.228197	New Bedford	MA	1,918	2,508	1592406	57279
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	27-Jun-13	41.91062	-70.228198	New Bedford	MA	1,918	2,508	1683872	57300
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	28-Jun-13	41.910275	-70.227792	New Bedford	MA	1,918	2,508	1635318	57301
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	28-Jun-13	41.910137	-70.227002	New Bedford	MA	1,918	2,508	1635322	57302
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	29-Jun-13	41.91162	-70.226662	New Bedford	MA	1,918	2,508	1635310	57304
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	29-Jun-13	41.910497	-70.22797	New Bedford	MA	1,918	2,508	1635369	57303
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	29-Jun-13	41.910378	-70.227592	New Bedford	MA	1,918	2,508	1635319	57305
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	30-Jun-13	41.91076	-70.227675	New Bedford	MA	1,918	2,508	1635323	57306
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	30-Jun-13	41.910157	-70.226973	New Bedford	MA	1,918	2,508	1635311	57307
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	01-Jul-13	41.910533	-70.227718	New Bedford	MA	1,918	2,508	1635341	57308
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	01-Jul-13	41.910412	-70.227727	New Bedford	MA	1,918	2,508	1635334	57309
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	01-Jul-13	41.910467	-70.228157	New Bedford	MA	1,918	2,508	1635324	57310
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	02-Jul-13	41.910753	-70.227108	New Bedford	MA	1,918	2,508	1635448	57312
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	02-Jul-13	41.91062	-70.227288	New Bedford	MA	1,918	2,508	1635441	57313
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	02-Jul-13	41.910067	-70.227915	New Bedford	MA	1,918	2,508	1635437	57311
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	03-Jul-13	41.910258	-70.227857	New Bedford	MA	1,918	2,508	1635449	57315
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	11-Jul-13	41.90998	-70.225503	New Bedford	MA	1,918	2,508	1665980	57333

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	11-Jul-13	41.910347	-70.227758	New Bedford	MA	1,918	2,508	1665972	57332
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	12-Jul-13	41.910905	-70.227305	New Bedford	MA	1,918	2,508	1666010	57335
CCBDS	New Bedford Harbor CAD3	NAE-2007-2709	CCBDS 12/13	26-Aug-13	41.910263	-70.228233	New Bedford	MA	1,918	2,508	2055353	57344
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	07-Oct-14	41.91178	-70.22738	Eastham	MA	261	342	1	56179
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	08-Oct-14	41.91228	-70.2283	Eastham	MA	261	342	1	56213
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	08-Oct-14	41.91153	-70.22667	Eastham	MA	261	342	2	56180
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	09-Oct-14	41.91155	-70.2271	Eastham	MA	261	342	2	56214
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	09-Oct-14	41.9124	-70.22707	Eastham	MA	261	342	3	56181
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Oct-14	41.91195	-70.22852	Eastham	MA	261	342	3	56215
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Oct-14	41.91212	-70.22757	Eastham	MA	261	342	4	56182
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Oct-14	41.91188	-70.22702	Eastham	MA	261	342	4	56216
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Oct-14	41.9123	-70.22722	Eastham	MA	261	342	5	56183
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Oct-14	41.91198	-70.22738	Eastham	MA	261	342	6	56184
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Oct-14	41.91172	-70.22775	Eastham	MA	261	342	5	56217
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Oct-14	41.91145	-70.22792	Eastham	MA	261	342	7	56185
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	12-Oct-14	41.91158	-70.22765	Eastham	MA	261	342	6	56218
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	12-Oct-14	41.91183	-70.22847	Eastham	MA	261	342	8	56186
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	12-Oct-14	41.91155	-70.22783	Eastham	MA	261	342	7	56219
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	12-Oct-14	41.91235	-70.22845	Eastham	MA	261	342	9	56187
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	13-Oct-14	41.91232	-70.22708	Eastham	MA	261	342	10	56188
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	13-Oct-14	41.91138	-70.22815	Eastham	MA	261	342	8	56220
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	13-Oct-14	41.91205	-70.22758	Eastham	MA	261	342	11	56189
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	14-Oct-14	41.91183	-70.22817	Eastham	MA	261	342	9	56221
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	14-Oct-14	41.91247	-70.22847	Eastham	MA	261	342	12	56190
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	15-Oct-14	41.91158	-70.22813	Eastham	MA	261	342	10	56222
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	15-Oct-14	41.91133	-70.22822	Eastham	MA	261	342	13	56191
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	15-Oct-14	41.91197	-70.22857	Eastham	MA	261	342	11	56223
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	15-Oct-14	41.91152	-70.22713	Eastham	MA	261	342	14	56192
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	16-Oct-14	41.9113	-70.22725	Eastham	MA	261	342	15	56193
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	16-Oct-14	41.91173	-70.22758	Eastham	MA	261	342	12	56224
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	16-Oct-14	41.91153	-70.22678	Eastham	MA	261	342	16	56194
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	16-Oct-14	41.912	-70.22773	Eastham	MA	261	342	13	56225
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	17-Oct-14	41.91153	-70.22762	Eastham	MA	261	342	14	56226
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	17-Oct-14	41.9118	-70.22765	Eastham	MA	261	342	17	56195
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	17-Oct-14	41.91245	-70.22742	Eastham	MA	261	342	15	56227
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	17-Oct-14	41.91178	-70.22772	Eastham	MA	261	342	18	56196
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	18-Oct-14	41.91205	-70.22783	Eastham	MA	261	342	19	56197
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	18-Oct-14	41.91162	-70.22692	Eastham	MA	261	342	16	56228
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	18-Oct-14	41.90957	-70.22542	Eastham	MA	261	342	17	56229

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	18-Oct-14	41.91198	-70.22763	Eastham	MA	261	342	20	56198
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	20-Oct-14	41.91218	-70.22672	Eastham	MA	261	342	18	56230
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	21-Oct-14	41.91092	-70.22723	Eastham	MA	261	342	19	56231
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	21-Oct-14	41.91102	-70.22658	Eastham	MA	261	342	21	56199
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	21-Oct-14	41.91007	-70.22635	Eastham	MA	261	342	20	56232
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	21-Oct-14	41.9098	-70.22445	Eastham	MA	261	342	22	56200
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	22-Oct-14	41.91193	-70.2272	Eastham	MA	261	342	21	56233
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	22-Oct-14	41.91182	-70.22713	Eastham	MA	261	342	23	56201
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	22-Oct-14	41.91143	-70.22785	Eastham	MA	261	342	22	56234
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	22-Oct-14	41.91233	-70.22697	Eastham	MA	261	342	24	56202
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	25-Oct-14	41.91235	-70.2273	Eastham	MA	261	342	23	56235
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	26-Oct-14	41.91175	-70.22735	Eastham	MA	261	342	24	56236
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	26-Oct-14	41.9119	-70.22687	Eastham	MA	261	342	25	56203
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	26-Oct-14	41.91157	-70.22817	Eastham	MA	261	342	26	56204
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	27-Oct-14	41.9112	-70.22815	Eastham	MA	261	342	28	56206
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	27-Oct-14	41.91192	-70.22702	Eastham	MA	261	342	27	56205
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	28-Oct-14	41.91192	-70.22715	Eastham	MA	261	342	25	56237
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	28-Oct-14	41.91178	-70.22707	Eastham	MA	261	342	26	56238
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	28-Oct-14	41.9123	-70.22797	Eastham	MA	261	342	29	56207
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	29-Oct-14	41.91218	-70.22773	Eastham	MA	261	342	27	56239
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	29-Oct-14	41.91213	-70.22673	Eastham	MA	261	342	30	56208
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	29-Oct-14	41.91235	-70.2273	Eastham	MA	261	342	28	56240
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	29-Oct-14	41.91273	-70.22787	Eastham	MA	261	342	31	56209
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	30-Oct-14	41.91183	-70.22768	Eastham	MA	261	342	29	56241
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	30-Oct-14	41.91203	-70.22705	Eastham	MA	261	342	32	56210
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	30-Oct-14	41.91197	-70.22772	Eastham	MA	261	342	30	56242
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	31-Oct-14	41.91197	-70.22702	Eastham	MA	261	342	33	56211
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	31-Oct-14	41.91192	-70.22812	Eastham	MA	261	342	31	56243
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	31-Oct-14	41.91243	-70.22722	Eastham	MA	261	342	34	56212
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	04-Nov-14	41.91197	-70.22733	Eastham	MA	261	342	32	56265
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	04-Nov-14	41.91213	-70.22722	Eastham	MA	261	342	35	56244
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	04-Nov-14	41.91188	-70.22733	Eastham	MA	261	342	33	56266
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	05-Nov-14	41.91198	-70.22708	Eastham	MA	261	342	36	56245
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	05-Nov-14	41.91215	-70.22805	Eastham	MA	261	342	34	56267
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	05-Nov-14	41.91183	-70.22697	Eastham	MA	261	342	37	56246
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	06-Nov-14	41.91162	-70.22792	Eastham	MA	261	342	35	56268
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	06-Nov-14	41.91188	-70.22837	Eastham	MA	261	342	38	56247
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	06-Nov-14	41.91175	-70.22857	Eastham	MA	261	342	36	56269
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	06-Nov-14	41.91223	-70.22817	Eastham	MA	261	342	39	56248

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	07-Nov-14	41.91203	-70.22763	Eastham	MA	261	342	37	56270
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	07-Nov-14	41.91173	-70.22763	Eastham	MA	261	342	40	56249
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	08-Nov-14	41.91173	-70.22717	Eastham	MA	261	342	38	56271
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	09-Nov-14	41.91132	-70.2272	Eastham	MA	261	342	39	56272
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	09-Nov-14	41.91247	-70.22783	Eastham	MA	261	342	41	56250
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	09-Nov-14	41.91195	-70.2272	Eastham	MA	261	342	40	56273
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	09-Nov-14	41.91202	-70.22725	Eastham	MA	261	342	42	56251
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Nov-14	41.91157	-70.22748	Eastham	MA	261	342	41	56274
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Nov-14	41.91213	-70.22783	Eastham	MA	261	342	43	56252
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Nov-14	41.9117	-70.22807	Eastham	MA	261	342	42	56275
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	10-Nov-14	41.91223	-70.22757	Eastham	MA	261	342	44	56253
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Nov-14	41.91197	-70.2284	Eastham	MA	261	342	43	56276
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Nov-14	41.91215	-70.22727	Eastham	MA	261	342	45	56254
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Nov-14	41.91185	-70.22783	Eastham	MA	261	342	44	56277
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	11-Nov-14	41.91242	-70.228	Eastham	MA	261	342	46	56255
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	12-Nov-14	41.91178	-70.22803	Eastham	MA	261	342	45	56278
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	12-Nov-14	41.91163	-70.2271	Eastham	MA	261	342	47	56256
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	13-Nov-14	41.91157	-70.22858	Eastham	MA	261	342	46	56279
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	13-Nov-14	41.9119	-70.22733	Eastham	MA	261	342	47	56280
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	13-Nov-14	41.91245	-70.22758	Eastham	MA	261	342	48	56257
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	14-Nov-14	41.9118	-70.22737	Eastham	MA	261	342	49	56258
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	16-Nov-14	41.91185	-70.22733	Eastham	MA	261	342	51	56259
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	16-Nov-14	41.91192	-70.22708	Eastham	MA	261	342	48	56281
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	17-Nov-14	41.9115	-70.22767	Eastham	MA	261	342	49	56282
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	19-Nov-14	41.91177	-70.22735	Eastham	MA	261	342	50	56283
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	20-Nov-14	41.91207	-70.22708	Eastham	MA	261	342	53	56261
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	20-Nov-14	41.91272	-70.22653	Eastham	MA	261	342	51	56284
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	21-Nov-14	41.91218	-70.22743	Eastham	MA	261	342	52	56260
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	23-Nov-14	41.91263	-70.22768	Eastham	MA	261	342	53	56285
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	24-Nov-14	41.9115	-70.22742	Eastham	MA	261	342	54	56286
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	24-Nov-14	41.91255	-70.22718	Eastham	MA	261	342	55	56287
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	24-Nov-14	41.91137	-70.22712	Eastham	MA	261	342	54	56262
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	25-Nov-14	41.9121	-70.22665	Eastham	MA	261	342	56	56288
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	25-Nov-14	41.912	-70.22712	Eastham	MA	261	342	55	56263
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	25-Nov-14	41.91252	-70.22675	Eastham	MA	261	342	57	56289
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	26-Nov-14	41.91195	-70.22735	Eastham	MA	261	342	56	56264
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	26-Nov-14	41.91158	-70.22707	Eastham	MA	261	342	58	56290
CCBDS	Rock Harbor	NAE-2013-1792	CCBDS	29-Nov-14	41.91173	-70.22778	Eastham	MA	261	342	59	56291
CCBDS	Town of Duxbury	NAE-2010-1589	CCBDS 15/16	30-Jan-15	41.91147	-70.22827	Duxbury	MA	1,213	1,586	4993350	57447

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	15-Oct-15	41.91248	-70.22678	Duxbury	MA	995	1,302	4583229	57464
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Oct-15	41.91143	-70.22682	Duxbury	MA	995	1,302	4601712	57479
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	20-Oct-15	41.91253	-70.22808	Duxbury	MA	995	1,302	4601713	57483
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Oct-15	41.91168	-70.22762	Duxbury	MA	995	1,302	4602185	57484
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	27-Oct-15	41.91217	-70.22813	Duxbury	MA	995	1,302	4623461	57488
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	27-Oct-15	41.912	-70.22783	Duxbury	MA	995	1,302	4676860	57491
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	31-Oct-15	41.91215	-70.22832	Scituate	MA	497	650	4632142	57440
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	31-Oct-15	41.91215	-70.2279	Duxbury	MA	995	1,302	4676861	57492
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	01-Nov-15	41.9125	-70.22822	Scituate	MA	497	650	4636309	57441
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Nov-15	41.91243	-70.22717	Duxbury	MA	995	1,302	4650647	57489
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	02-Nov-15	41.91152	-70.22742	Scituate	MA	497	650	4638968	57442
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Nov-15	41.91273	-70.2282	Duxbury	MA	995	1,302	4676862	57493
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	03-Nov-15	41.91158	-70.2278	Scituate	MA	497	650	4643176	57443
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	04-Nov-15	41.91193	-70.22737	Duxbury	MA	995	1,302	4676248	57494
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	04-Nov-15	41.913	-70.22853	Duxbury	MA	995	1,302	4676863	57495
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	05-Nov-15	41.91243	-70.22768	Duxbury	MA	995	1,302	4676249	57502
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Nov-15	41.91153	-70.22715	Duxbury	MA	995	1,302	4676251	57508
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Nov-15	41.9124	-70.227	Duxbury	MA	995	1,302	4676864	57496
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Nov-15	41.91188	-70.2277	Duxbury	MA	995	1,302	4676250	57505
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Nov-15	41.91152	-70.22767	Duxbury	MA	995	1,302	4676865	57497
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	09-Nov-15	41.91135	-70.22817	Scituate	MA	497	650	4676244	57444
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	09-Nov-15	41.9113	-70.22797	Duxbury	MA	995	1,302	4676866	57498
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	10-Nov-15	41.9122	-70.22827	Duxbury	MA	995	1,302	4676252	57511
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	10-Nov-15	41.91168	-70.22795	Scituate	MA	497	650	4676684	57445
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	10-Nov-15	41.91195	-70.22792	Duxbury	MA	995	1,302	4676867	57499
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	15-Nov-15	41.91212	-70.22743	Duxbury	MA	995	1,302	4807303	57500
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	16-Nov-15	41.9122	-70.22837	Duxbury	MA	995	1,302	4807306	57509
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	16-Nov-15	41.91155	-70.22785	Duxbury	MA	995	1,302	4806732	57514
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	16-Nov-15	41.91192	-70.22808	Duxbury	MA	995	1,302	4807304	57503
CCBDS	North River Marine	NAE-2009-2185	CCBDS 15/16	17-Nov-15	41.91155	-70.22722	Scituate	MA	497	650	4689060	57446
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Nov-15	41.911292	-70.221962	Duxbury	MA	995	1,302	4690896	57480
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Nov-15	41.91173	-70.22707	Duxbury	MA	995	1,302	4807305	57506
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Nov-15	41.9114	-70.22828	Duxbury	MA	995	1,302	4806733	57517
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	20-Nov-15	41.912307	-70.22793	Duxbury	MA	995	1,302	4719195	57481
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	21-Nov-15	41.91211	-70.228055	Duxbury	MA	995	1,302	4775859	57482
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Nov-15	41.912203	-70.228595	Duxbury	MA	995	1,302	4775878	57485
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Nov-15	41.91232	-70.22795	Duxbury	MA	995	1,302	4807307	57512
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Nov-15	41.91195	-70.22722	Duxbury	MA	995	1,302	4806734	57520
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	24-Nov-15	41.912173	-70.228148	Duxbury	MA	995	1,302	4797863	57486

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	24-Nov-15	41.91143	-70.2278	Duxbury	MA	995	1,302	4806735	57523
CCBDS	New Bedford Harbor Phase II	NAE-2007-2709	CCBDS 12/13	25-Nov-15	41.912033	-70.227963	New Bedford	MA	1,395	1,824	4304147	57380
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	25-Nov-15	41.91225	-70.22745	Duxbury	MA	995	1,302	4807308	57515
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	25-Nov-15	41.912047	-70.228223	Duxbury	MA	995	1,302	4816385	57487
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	25-Nov-15	41.91205	-70.2285	Duxbury	MA	995	1,302	4806736	57526
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	26-Nov-15	41.911738	-70.22762	Duxbury	MA	995	1,302	4816370	57490
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	26-Nov-15	41.911868	-70.228138	Duxbury	MA	995	1,302	4816406	57501
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	28-Nov-15	41.912225	-70.22718	Duxbury	MA	995	1,302	4816516	57504
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	28-Nov-15	41.91202	-70.22733	Duxbury	MA	995	1,302	4807309	57518
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	28-Nov-15	41.911855	-70.228578	Duxbury	MA	995	1,302	4816434	57507
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	28-Nov-15	41.911338	-70.22783	Duxbury	MA	995	1,302	4828655	57510
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	29-Nov-15	41.91173	-70.22793	Duxbury	MA	995	1,302	4842851	57521
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	29-Nov-15	41.912177	-70.228145	Duxbury	MA	995	1,302	4828659	57513
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	30-Nov-15	41.911708	-70.228715	Duxbury	MA	995	1,302	4816715	57516
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	30-Nov-15	41.911773	-70.22824	Duxbury	MA	995	1,302	4816477	57519
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	30-Nov-15	41.91222	-70.22802	Duxbury	MA	995	1,302	4812119	57529
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Dec-15	41.911762	-70.228612	Duxbury	MA	995	1,302	4816772	57522
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Dec-15	41.9121	-70.22793	Duxbury	MA	995	1,302	4842852	57524
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Dec-15	41.912305	-70.22804	Duxbury	MA	995	1,302	4816487	57525
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Dec-15	41.91208	-70.22875	Duxbury	MA	995	1,302	4814860	57532
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Dec-15	41.911437	-70.228285	Duxbury	MA	995	1,302	4816790	57527
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Dec-15	41.911617	-70.22805	Duxbury	MA	995	1,302	4818287	57530
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Dec-15	41.912767	-70.228115	Duxbury	MA	995	1,302	4818284	57533
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Dec-15	41.91243	-70.227	Duxbury	MA	995	1,302	4842853	57528
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Dec-15	41.911962	-70.228182	Duxbury	MA	995	1,302	4820268	57536
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	04-Dec-15	41.912098	-70.228083	Duxbury	MA	995	1,302	4828713	57538
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	04-Dec-15	41.91225	-70.22683	Duxbury	MA	995	1,302	4820503	57535
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	04-Dec-15	41.911922	-70.228348	Duxbury	MA	995	1,302	4828721	57541
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	05-Dec-15	41.91225	-70.22677	Duxbury	MA	995	1,302	4842854	57531
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	05-Dec-15	41.912163	-70.22841	Duxbury	MA	995	1,302	4828732	57544
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	05-Dec-15	41.91137	-70.22702	Duxbury	MA	995	1,302	4823156	57539
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	05-Dec-15	41.911775	-70.228303	Duxbury	MA	995	1,302	4828751	57547
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Dec-15	41.91257	-70.22742	Duxbury	MA	995	1,302	4842855	57534
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Dec-15	41.91173	-70.228395	Duxbury	MA	995	1,302	4828686	57550
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Dec-15	41.91207	-70.22748	Duxbury	MA	995	1,302	4855281	57542
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Dec-15	41.912037	-70.228073	Duxbury	MA	995	1,302	4828764	57552
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Dec-15	41.91245	-70.22712	Duxbury	MA	995	1,302	4842856	57537
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Dec-15	41.91192	-70.22811	Duxbury	MA	995	1,302	4828735	57554
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Dec-15	41.912172	-70.228233	Duxbury	MA	995	1,302	4831352	57557

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Dec-15	41.9124	-70.22788	Duxbury	MA	995	1,302	4855282	57545
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	08-Dec-15	41.912223	-70.228027	Duxbury	MA	995	1,302	4831350	57560
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	08-Dec-15	41.91132	-70.22817	Duxbury	MA	995	1,302	4842857	57540
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	09-Dec-15	41.912232	-70.228015	Duxbury	MA	995	1,302	4834427	57564
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	09-Dec-15	41.91213	-70.22855	Duxbury	MA	995	1,302	4842858	57543
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	09-Dec-15	41.912092	-70.226747	Duxbury	MA	995	1,302	4837223	57568
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	10-Dec-15	41.91237	-70.227787	Duxbury	MA	995	1,302	4845355	57570
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	10-Dec-15	41.91222	-70.22745	Duxbury	MA	995	1,302	4842859	57546
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	11-Dec-15	41.91217	-70.22795	Duxbury	MA	995	1,302	4855283	57548
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	11-Dec-15	41.91225	-70.2272	Duxbury	MA	995	1,302	4855142	57549
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	11-Dec-15	41.911965	-70.22727	Duxbury	MA	995	1,302	4845414	57572
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	12-Dec-15	41.91237	-70.22798	Duxbury	MA	995	1,302	4855284	57551
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	12-Dec-15	41.9116	-70.22838	Duxbury	MA	995	1,302	4855143	57561
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	12-Dec-15	41.912293	-70.227953	Duxbury	MA	995	1,302	4845411	57577
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	13-Dec-15	41.91193	-70.22858	Duxbury	MA	995	1,302	4855285	57562
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	13-Dec-15	41.911667	-70.227555	Duxbury	MA	995	1,302	4845456	57580
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	13-Dec-15	41.9123	-70.22792	Duxbury	MA	995	1,302	4855144	57553
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	13-Dec-15	41.911712	-70.227043	Duxbury	MA	995	1,302	4845454	57583
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	13-Dec-15	41.911413	-70.227862	Duxbury	MA	995	1,302	4845487	57585
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	13-Dec-15	41.91248	-70.22823	Duxbury	MA	995	1,302	4855286	57555
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	14-Dec-15	41.9124	-70.2284	Duxbury	MA	995	1,302	4855145	57556
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	14-Dec-15	41.911325	-70.227782	Duxbury	MA	995	1,302	4848028	57586
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	14-Dec-15	41.91255	-70.22808	Duxbury	MA	995	1,302	4855287	57558
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	15-Dec-15	41.912165	-70.2284	Duxbury	MA	995	1,302	4848031	57587
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	17-Dec-15	41.91226	-70.229522	Duxbury	MA	995	1,302	4860508	57588
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	17-Dec-15	41.91155	-70.22802	Duxbury	MA	995	1,302	4855146	57559
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	17-Dec-15	41.912442	-70.22737	Duxbury	MA	995	1,302	4860470	57589
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Dec-15	41.912127	-70.228597	Duxbury	MA	995	1,302	4860543	57590
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Dec-15	41.91198	-70.228262	Duxbury	MA	995	1,302	4866540	57591
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	18-Dec-15	41.91133	-70.22692	Duxbury	MA	995	1,302	4857943	57563
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	19-Dec-15	41.912865	-70.228398	Duxbury	MA	995	1,302	4866526	57592
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	19-Dec-15	41.911827	-70.227147	Duxbury	MA	995	1,302	4866589	57593
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	20-Dec-15	41.911928	-70.227782	Duxbury	MA	995	1,302	4866592	57594
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	20-Dec-15	41.91063	-70.22398	Duxbury	MA	995	1,302	4862261	57567
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	20-Dec-15	41.911848	-70.228297	Duxbury	MA	995	1,302	4866660	57595
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	20-Dec-15	41.91188	-70.22687	Duxbury	MA	995	1,302	4870942	57566
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	21-Dec-15	41.912273	-70.227583	Duxbury	MA	995	1,302	4866662	57596
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	21-Dec-15	41.911905	-70.227417	Duxbury	MA	995	1,302	4871738	57597
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Dec-15	41.91245	-70.228525	Duxbury	MA	995	1,302	4871740	57598

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Dec-15	41.91282	-70.22803	Duxbury	MA	995	1,302	4870943	57573
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Dec-15	41.912023	-70.227245	Duxbury	MA	995	1,302	4871770	57599
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Dec-15	41.91262	-70.22722	Duxbury	MA	995	1,302	4870961	57569
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	23-Dec-15	41.911968	-70.228162	Duxbury	MA	995	1,302	4871772	57600
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	23-Dec-15	41.91147	-70.22733	Duxbury	MA	995	1,302	4870944	57574
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	23-Dec-15	41.911182	-70.227893	Duxbury	MA	995	1,302	4874698	57601
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	23-Dec-15	41.91263	-70.22793	Duxbury	MA	995	1,302	4872256	57571
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	24-Dec-15	41.912282	-70.22887	Duxbury	MA	995	1,302	4874700	57602
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	25-Dec-15	41.91187	-70.22837	Duxbury	MA	995	1,302	4877623	57575
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	27-Dec-15	41.9122	-70.22813	Duxbury	MA	995	1,302	4880120	57576
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	27-Dec-15	41.9125	-70.2281	Duxbury	MA	995	1,302	4882039	57578
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	28-Dec-15	41.912698	-70.228207	Duxbury	MA	995	1,302	4886876	57603
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	31-Dec-15	41.91187	-70.226135	Duxbury	MA	995	1,302	4903565	57604
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	31-Dec-15	41.91172	-70.22682	Duxbury	MA	995	1,302	4891336	57581
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	31-Dec-15	41.911948	-70.228075	Duxbury	MA	995	1,302	4902727	57605
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	31-Dec-15	41.91182	-70.22775	Duxbury	MA	995	1,302	4892648	57579
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Jan-16	41.911138	-70.226193	Duxbury	MA	995	1,302	4903578	57606
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Jan-16	41.91118	-70.22728	Duxbury	MA	995	1,302	4893249	57584
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Jan-16	41.91153	-70.22815	Duxbury	MA	995	1,302	4894181	57582
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	01-Jan-16	41.911967	-70.228287	Duxbury	MA	995	1,302	4902753	57607
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Jan-16	41.91138	-70.22697	Duxbury	MA	995	1,302	4896094	57609
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Jan-16	41.911938	-70.227498	Duxbury	MA	995	1,302	4903601	57627
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	02-Jan-16	41.911747	-70.228098	Duxbury	MA	995	1,302	4902785	57628
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Jan-16	41.91225	-70.22722	Duxbury	MA	995	1,302	4898372	57608
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Jan-16	41.9121	-70.22897	Duxbury	MA	995	1,302	4898525	57611
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	03-Jan-16	41.911715	-70.22859	Duxbury	MA	995	1,302	4903634	57629
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	04-Jan-16	41.911785	-70.22807	Duxbury	MA	995	1,302	4906740	57630
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Jan-16	41.91118	-70.22858	Duxbury	MA	995	1,302	4909293	57613
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	06-Jan-16	41.91208	-70.22708	Duxbury	MA	995	1,302	4910416	57610
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Jan-16	41.9117	-70.22848	Duxbury	MA	995	1,302	4912062	57615
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	07-Jan-16	41.9124	-70.22773	Duxbury	MA	995	1,302	4933416	57612
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	08-Jan-16	41.91198	-70.22877	Duxbury	MA	995	1,302	4933275	57617
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	12-Jan-16	41.91198	-70.2285	Duxbury	MA	995	1,302	4933417	57614
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	12-Jan-16	41.912	-70.22618	Duxbury	MA	995	1,302	4933276	57619
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	14-Jan-16	41.91207	-70.22705	Duxbury	MA	995	1,302	4936417	57616
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	15-Jan-16	41.91205	-70.2264	Duxbury	MA	995	1,302	4937642	57621
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	16-Jan-16	41.91178	-70.22857	Duxbury	MA	995	1,302	4940824	57618
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Jan-16	41.91272	-70.22803	Duxbury	MA	995	1,302	4972275	57620
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	22-Jan-16	41.91112	-70.22697	Duxbury	MA	995	1,302	4972263	57623

Placement site name	Project name	Permit number	Target Site Code	Placement date/time	Placement latitude	Placement longitude	City/town	State	Load volume (cubic meters)	Load volume (cubic yards)	DQM trip number	Placement ID
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	26-Jan-16	41.91273	-70.22792	Duxbury	MA	995	1,302	4970485	57622
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	27-Jan-16	41.91208	-70.22688	Duxbury	MA	995	1,302	4975264	57625
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	28-Jan-16	41.91173	-70.22697	Duxbury	MA	995	1,302	4976382	57624
CCBDS	Duxbury FNP	W912WJ-15-C-0022	CCBDS 15/16	29-Jan-16	41.9122	-70.22882	Duxbury	MA	1,069	1,398	4979343	57626
CCBDS	Town of Duxbury	NAE-2010-1589	CCBDS 15/16	31-Jan-16	41.91268	-70.22727	Duxbury	MA	1,213	1,586	4993306	57448

APPENDIX C

ACTUAL SPI/PV REPLICATE LOCATIONS

CCBDS 2016 Actual SPI/PV Station IDs/Coordinates							
Station ID	**Replicate**	**Date**	**Time**	**X**	**Y**	**Latitude**	**Longitude**
Mound B-01	A	10/20/2016	15:00:46	306566.4	851867.1	41.9099243	-70.2154868
Mound B-01	B	10/20/2016	15:01:37	306555.1	851866.6	41.9099217	-70.2156236
Mound B-01	C	10/20/2016	15:02:32	306540.4	851864.6	41.9099059	-70.2158013
Mound B-01	D	10/20/2016	15:03:10	306531.9	851864.5	41.9099058	-70.2159028
Mound B-01	E	10/20/2016	15:03:56	306523.2	851861.9	41.9098839	-70.2160085
Mound B-02	A	10/20/2016	15:19:10	306649.9	851988.9	41.9110099	-70.2144582
Mound B-02	B	10/20/2016	15:20:48	306643.5	851990.8	41.9110280	-70.2145356
Mound B-02	C	10/20/2016	15:21:12	306637.9	851991.6	41.9110358	-70.2146021
Mound B-02	D	10/20/2016	15:21:56	306622.6	851990.7	41.9110300	-70.2147876
Mound B-02	E	10/20/2016	15:22:40	306610.3	851992.8	41.9110505	-70.2149347
Mound B-02	E	10/21/2016	10:19:44	306613.8	851958.3	41.9107393	-70.2148992
Mound B-02	F	10/21/2016	10:20:22	306614.4	851958.9	41.9107445	-70.2148915
Mound B-02	G	10/21/2016	10:20:58	306614.2	851963.7	41.9107875	-70.2148928
Mound B-02	H	10/21/2016	10:21:37	306611.6	851965.5	41.9108040	-70.2149244
Mound B-03	A	10/20/2016	15:10:20	306576.2	851935.0	41.9105347	-70.2153562
Mound B-03	B	10/20/2016	15:11:10	306567.2	851938.1	41.9105636	-70.2154639
Mound B-03	C	10/20/2016	15:12:01	306553.2	851937.2	41.9105576	-70.2156329
Mound B-03	D	10/20/2016	15:12:53	306542.5	851934.4	41.9105336	-70.2157634
Mound B-04	A	10/21/2016	9:15:00	306435.2	852101.4	41.9120513	-70.2170260
Mound B-04	B	10/21/2016	9:15:44	306430.9	852103.3	41.9120694	-70.2170770
Mound B-04	C	10/21/2016	9:16:26	306426.9	852104.7	41.9120829	-70.2171253
Mound B-04	D	10/21/2016	9:18:20	306442.1	852091.5	41.9119615	-70.2169449
Mound B-05	A	10/21/2016	9:37:47	306862.9	852039.6	41.9114369	-70.2118822
Mound B-05	B	10/21/2016	9:38:24	306856.9	852044.5	41.9114821	-70.2119539
Mound B-05	C	10/21/2016	9:39:05	306859.1	852046.8	41.9115030	-70.2119262
Mound B-05	D	10/21/2016	9:39:45	306864.3	852044.9	41.9114846	-70.2118647
Mound B-06	A	10/21/2016	9:28:58	306629.6	852013.7	41.9112362	-70.2146986
Mound B-06	B	10/21/2016	9:29:40	306625.9	852014.4	41.9112425	-70.2147437
Mound B-06	C	10/21/2016	9:30:19	306625.4	852014.7	41.9112455	-70.2147495
Mound B-06	D	10/21/2016	9:31:01	306628.1	852018.3	41.9112778	-70.2147160
Mound B-06	E	10/21/2016	10:03:29	306626.4	852011.1	41.9112130	-70.2147380
Mound B-06	F	10/21/2016	10:04:10	306627.0	852010.7	41.9112096	-70.2147301
Mound B-06	G	10/21/2016	10:04:47	306623.6	852005.8	41.9111653	-70.2147726
Mound B-06	H	10/21/2016	10:05:23	306619.9	852002.1	41.9111326	-70.2148180
Mound B-06	I	10/21/2016	10:10:38	306623.5	852004.7	41.9111559	-70.2147733
Mound B-06	J	10/21/2016	10:12:19	306619.9	852017.2	41.9112689	-70.2148145
Mound B-06	K	10/21/2016	10:12:56	306622.0	852013.9	41.9112389	-70.2147908
Mound B-06	L	10/21/2016	10:13:35	306619.6	852014.3	41.9112426	-70.2148186
Mound B-07	A	10/20/2016	14:39:31	306453.5	851811.4	41.9094383	-70.2168572
Mound B-07	B	10/20/2016	14:40:13	306451.5	851813.2	41.9094549	-70.2168821

CCBDS 2016 Actual SPI/PV Station IDs/Coordinates							
Station ID	**Replicate**	**Date**	**Time**	**X**	**Y**	**Latitude**	**Longitude**
Mound B-07	C	10/20/2016	14:41:11	306441.2	851809.8	41.9094262	-70.2170057
Mound B-07	D	10/20/2016	14:42:01	306426.5	851814.0	41.9094657	-70.2171830
Mound B-07	E	10/20/2016	14:42:53	306419.0	851810.3	41.9094333	-70.2172743
Mound B-08	A	10/21/2016	9:22:35	306573.5	852054.0	41.9116066	-70.2153678
Mound B-08	B	10/21/2016	9:23:16	306573.8	852051.9	41.9115876	-70.2153642
Mound B-08	C	10/21/2016	9:23:54	306569.3	852052.2	41.9115907	-70.2154179
Mound B-08	D	10/21/2016	9:24:31	306563.8	852047.3	41.9115473	-70.2154857
Mound B-08	E	10/21/2016	10:27:09	306566.0	852029.3	41.9113851	-70.2154619
Mound B-08	F	10/21/2016	10:27:47	306569.3	852030.7	41.9113971	-70.2154225
Mound B-08	G	10/21/2016	10:28:27	306566.2	852028.3	41.9113761	-70.2154597
Mound B-08	H	10/21/2016	10:29:05	306563.4	852027.9	41.9113726	-70.2154943
Mound B-09	A	10/20/2016	15:46:57	306765.8	851856.7	41.9098044	-70.2130856
Mound B-09	B	10/20/2016	15:48:29	306748.9	851860.4	41.9098399	-70.2132890
Mound B-09	C	10/20/2016	15:48:49	306746.1	851858.4	41.9098218	-70.2133223
Mound B-09	D	10/20/2016	15:49:32	306737.7	851856.7	41.9098081	-70.2134241
Mound B-09	E	10/20/2016	15:50:17	306731.1	851850.6	41.9097539	-70.2135050
Mound B-10	A	10/20/2016	16:39:11	306864.6	852009.9	41.9111698	-70.2118676
Mound B-10	B	10/20/2016	16:40:16	306859.0	852004.4	41.9111214	-70.2119360
Mound B-10	C	10/20/2016	16:40:50	306860.3	852001.8	41.9110975	-70.2119200
Mound B-10	D	10/20/2016	16:41:42	306859.7	851994.6	41.9110324	-70.2119288
Mound B-11	A	10/20/2016	14:53:22	306580.3	851764.1	41.9089957	-70.2153382
Mound B-11	B	10/20/2016	14:54:12	306575.1	851765.4	41.9090080	-70.2154004
Mound B-11	C	10/20/2016	14:54:54	306566.6	851763.6	41.9089930	-70.2155028
Mound B-11	D	10/20/2016	14:55:41	306561.1	851761.9	41.9089782	-70.2155694
Mound B-12	A	10/20/2016	15:58:18	306716.8	852043.6	41.9114933	-70.2136425
Mound B-12	B	10/20/2016	15:58:35	306712.9	852042.6	41.9114851	-70.2136899
Mound B-12	C	10/20/2016	15:59:35	306694.5	852047.8	41.9115339	-70.2139105
Mound B-12	D	10/20/2016	16:00:04	306690.8	852046.0	41.9115187	-70.2139552
Mound B-12	E	10/20/2016	16:30:27	306746.1	852033.0	41.9113942	-70.2132907
Mound B-12	F	10/20/2016	16:31:09	306749.8	852023.9	41.9113116	-70.2132483
Mound B-12	G	10/20/2016	16:31:35	306753.3	852017.0	41.9112491	-70.2132069
Mound B-12	H	10/20/2016	16:32:09	306755.4	852013.3	41.9112151	-70.2131825
Mound C-13	A	10/20/2016	12:33:09	305654.7	852042.3	41.9116254	-70.2264427
Mound C-13	B	10/20/2016	12:33:51	305646.8	852038.3	41.9115904	-70.2265387
Mound C-13	C	10/20/2016	12:34:38	305640.1	852037.0	41.9115796	-70.2266196
Mound C-13	D	10/20/2016	12:35:24	305621.9	852032.9	41.9115451	-70.2268405
Mound C-14	A	10/20/2016	12:11:22	305480.4	851867.3	41.9100734	-70.2285757
Mound C-14	B	10/20/2016	12:13:15	305475.0	851851.7	41.9099333	-70.2286431
Mound C-14	C	10/20/2016	12:13:35	305471.7	851846.0	41.9098824	-70.2286838
Mound C-14	D	10/20/2016	12:13:50	305468.7	851842.4	41.9098508	-70.2287207

CCBDS 2016 Actual SPI/PV Station IDs/Coordinates							
Station ID	**Replicate**	**Date**	**Time**	**X**	**Y**	**Latitude**	**Longitude**
Mound C-15	A	10/20/2016	13:48:58	305717.1	851930.7	41.9106118	-70.2257110
Mound C-15	B	10/20/2016	13:49:53	305715.9	851920.5	41.9105204	-70.2257279
Mound C-15	C	10/20/2016	13:50:49	305710.1	851909.4	41.9104214	-70.2257992
Mound C-15	D	10/20/2016	13:51:19	305703.2	851908.0	41.9104093	-70.2258833
Mound C-16	A	10/20/2016	12:22:28	305516.5	851963.2	41.9109317	-70.2281235
Mound C-16	B	10/20/2016	12:23:30	305507.1	851962.4	41.9109259	-70.2282358
Mound C-16	C	10/20/2016	12:24:01	305502.0	851957.0	41.9108778	-70.2282984
Mound C-16	D	10/20/2016	12:24:50	305491.7	851952.5	41.9108388	-70.2284238
Mound C-17	A	10/20/2016	13:56:14	305425.0	852120.7	41.9123615	-70.2291975
Mound C-17	B	10/20/2016	13:57:20	305416.1	852117.0	41.9123293	-70.2293051
Mound C-17	C	10/20/2016	13:57:52	305417.9	852111.1	41.9122760	-70.2292844
Mound C-17	D	10/20/2016	13:58:40	305415.5	852096.4	41.9121437	-70.2293164
Mound C-18	A	10/20/2016	14:06:31	305559.0	852184.9	41.9129220	-70.2275708
Mound C-18	B	10/20/2016	14:07:18	305543.3	852181.4	41.9128918	-70.2277609
Mound C-18	C	10/20/2016	14:08:10	305533.4	852180.1	41.9128821	-70.2278808
Mound C-18	D	10/20/2016	14:09:02	305527.2	852173.7	41.9128250	-70.2279567
Mound C-19	A	10/20/2016	14:12:28	305382.7	852167.3	41.9127870	-70.2296992
Mound C-19	B	10/20/2016	14:13:20	305369.8	852166.1	41.9127775	-70.2298551
Mound C-19	C	10/20/2016	14:14:19	305363.3	852164.7	41.9127658	-70.2299335
Mound C-19	D	10/20/2016	14:14:46	305356.0	852166.0	41.9127788	-70.2300208
Mound C-20	A	10/20/2016	11:19:01	305566.1	852084.6	41.9120179	-70.2275036
Mound C-20	B	10/20/2016	11:19:34	305566.7	852078.5	41.9119623	-70.2274976
Mound C-20	C	10/20/2016	11:20:47	305556.8	852064.8	41.9118408	-70.2276195
Mound C-20	D	10/20/2016	11:21:33	305550.2	852048.2	41.9116925	-70.2277019
Mound C-20	E	10/20/2016	11:22:06	305551.3	852037.6	41.9115966	-70.2276906
Mound C-21	A	10/20/2016	11:29:03	305492.7	852048.8	41.9117050	-70.2283940
Mound C-21	B	10/20/2016	11:29:34	305494.8	852047.9	41.9116972	-70.2283692
Mound C-21	C	10/20/2016	11:30:34	305488.7	852040.7	41.9116328	-70.2284438
Mound C-21	D	10/20/2016	11:31:02	305489.9	852036.0	41.9115900	-70.2284303
Mound C-22	A	10/20/2016	11:06:32	305518.6	852110.1	41.9122540	-70.2280715
Mound C-22	B	10/20/2016	11:07:33	305513.6	852095.1	41.9121192	-70.2281341
Mound C-22	C	10/20/2016	11:08:01	305516.3	852088.9	41.9120628	-70.2281022
Mound C-22	D	10/20/2016	11:08:47	305518.2	852074.2	41.9119304	-70.2280829
Mound C-23	A	10/20/2016	11:43:35	305610.4	851997.1	41.9112236	-70.2269855
Mound C-23	B	10/20/2016	11:44:20	305609.9	851990.9	41.9111687	-70.2269920
Mound C-23	C	10/20/2016	11:45:20	305598.2	851987.9	41.9111427	-70.2271333
Mound C-23	D	10/20/2016	11:46:05	305585.2	851983.1	41.9111015	-70.2272916
Mound C-23	E	10/20/2016	11:46:59	305567.8	851976.3	41.9110424	-70.2275025
Mound C-24	A	10/20/2016	11:53:02	305571.6	852011.2	41.9113566	-70.2274505
Mound C-24	B	10/20/2016	11:53:43	305564.4	852005.9	41.9113092	-70.2275385

CCBDS 2016 Actual SPI/PV Station IDs/Coordinates							
Station ID	**Replicate**	**Date**	**Time**	**X**	**Y**	**Latitude**	**Longitude**
Mound C-24	C	10/20/2016	11:54:37	305561.2	851992.7	41.9111914	-70.2275785
Mound C-24	D	10/20/2016	11:55:25	305557.2	851977.0	41.9110501	-70.2276294
Mound C-25	A	10/20/2016	12:03:41	305557.8	851924.1	41.9105740	-70.2276319
Mound C-25	B	10/20/2016	12:04:17	305555.3	851918.3	41.9105225	-70.2276631
Mound C-25	C	10/20/2016	12:04:30	305552.0	851914.5	41.9104885	-70.2277041
Mound C-25	D	10/20/2016	12:05:11	305550.0	851904.8	41.9104014	-70.2277298
CCBRS-01	A	10/21/2016	12:00:07	302365.2	857097.1	41.9575660	-70.2652073
CCBRS-01	B	10/21/2016	12:00:45	302362.9	857099.7	41.9575892	-70.2652348
CCBRS-01	C	10/21/2016	12:01:25	302359.2	857093.4	41.9575335	-70.2652797
CCBRS-01	D	10/21/2016	12:02:39	302356.2	857094.6	41.9575443	-70.2653161
CCBRS-02	A	10/21/2016	11:51:31	302135.2	856955.3	41.9563196	-70.2680054
CCBRS-02	B	10/21/2016	11:52:08	302133.9	856957.4	41.9563385	-70.2680208
CCBRS-02	C	10/21/2016	11:52:50	302135.2	856959.7	41.9563587	-70.2680052
CCBRS-02	D	10/21/2016	11:53:28	302132.9	856958.1	41.9563447	-70.2680329
CCBRS-03	A	10/21/2016	11:43:43	302342.0	856894.7	41.9557470	-70.2655223
CCBRS-03	B	10/21/2016	11:44:23	302341.9	856895.3	41.9557520	-70.2655238
CCBRS-03	C	10/21/2016	11:45:01	302341.0	856896.6	41.9557639	-70.2655340
CCBRS-03	D	10/21/2016	11:45:41	302342.7	856898.7	41.9557828	-70.2655132
CCBRS-04	A	10/21/2016	12:08:08	302406.5	857210.6	41.9585820	-70.2646885
CCBRS-04	B	10/21/2016	12:08:51	302406.1	857211.2	41.9585878	-70.2646938
CCBRS-04	C	10/21/2016	12:09:29	302403.7	857206.7	41.9585478	-70.2647238
CCBRS-04	D	10/21/2016	12:10:06	302405.1	857208.6	41.9585643	-70.2647057
NWREF-05	A	10/21/2016	11:24:05	304374.8	854364.9	41.9327049	-70.2414552
NWREF-05	B	10/21/2016	11:24:43	304373.7	854362.5	41.9326840	-70.2414696
NWREF-05	C	10/21/2016	11:25:20	304368.8	854371.1	41.9327619	-70.2415271
NWREF-05	D	10/21/2016	11:25:56	304366.3	854366.7	41.9327228	-70.2415578
NWREF-06	A	10/21/2016	11:29:31	304363.5	854417.1	41.9331764	-70.2415827
NWREF-06	B	10/21/2016	11:30:07	304361.1	854416.3	41.9331698	-70.2416119
NWREF-06	C	10/21/2016	11:30:44	304360.8	854416.9	41.9331753	-70.2416156
NWREF-06	D	10/21/2016	11:31:22	304358.6	854417.2	41.9331780	-70.2416415
NWREF-07	A	10/21/2016	11:14:51	304054.8	854169.8	41.9309907	-70.2453477
NWREF-07	B	10/21/2016	11:15:28	304052.5	854166.6	41.9309625	-70.2453761
NWREF-07	C	10/21/2016	11:16:07	304052.0	854163.1	41.9309308	-70.2453828
NWREF-07	D	10/21/2016	11:16:46	304050.1	854163.3	41.9309333	-70.2454066
NWREF-08	A	10/21/2016	10:53:50	304318.0	854138.0	41.9306695	-70.2421811
NWREF-08	B	10/21/2016	10:54:25	304317.2	854134.8	41.9306409	-70.2421907
NWREF-08	C	10/21/2016	10:55:03	304317.0	854137.3	41.9306633	-70.2421928
NWREF-08	D	10/21/2016	10:55:41	304314.5	854138.3	41.9306730	-70.2422230
NWREF-08	E	10/21/2016	11:05:44	304314.3	854135.8	41.9306506	-70.2422260
NWREF-08	F	10/21/2016	11:06:21	304311.3	854140.0	41.9306890	-70.2422610

CCBDS 2016 Actual SPI/PV Station IDs/Coordinates							
Station ID	**Replicate**	**Date**	**Time**	**X**	**Y**	**Latitude**	**Longitude**
NWREF-08	G	10/21/2016	11:07:03	304309.8	854140.6	41.9306940	-70.2422791
NWREF-08	H	10/21/2016	11:07:48	304306.5	854142.9	41.9307159	-70.2423183
SWREF-09	A	10/20/2016	9:29:21	302263.9	848718.7	41.8821529	-70.2678881
SWREF-09	B	10/20/2016	9:29:49	302264.0	848717.0	41.8821371	-70.2678871
SWREF-09	C	10/20/2016	9:30:42	302258.0	848709.3	41.8820693	-70.2679617
SWREF-09	D	10/20/2016	9:31:47	302247.5	848700.0	41.8819864	-70.2680892
SWREF-09	E	10/20/2016	9:32:31	302238.3	848696.7	41.8819577	-70.2682006
SWREF-10	A	10/20/2016	9:52:35	302414.0	848520.2	41.8803461	-70.2661150
SWREF-10	B	10/20/2016	9:53:25	302404.0	848517.0	41.8803191	-70.2662360
SWREF-10	C	10/20/2016	9:54:06	302395.9	848516.8	41.8803179	-70.2663333
SWREF-10	D	10/20/2016	9:54:49	302392.5	848512.9	41.8802834	-70.2663756
SWREF-11	A	10/20/2016	10:04:46	302548.0	848488.0	41.8800391	-70.2645069
SWREF-11	B	10/20/2016	10:05:29	302541.7	848483.5	41.8799990	-70.2645836
SWREF-11	C	10/20/2016	10:06:17	302536.5	848477.4	41.8799451	-70.2646467
SWREF-11	D	10/20/2016	10:06:55	302530.9	848474.4	41.8799187	-70.2647150
SWREF-12	A	10/20/2016	10:16:36	302637.5	848672.8	41.8816913	-70.2633954
SWREF-12	B	10/20/2016	10:17:22	302628.8	848669.1	41.8816586	-70.2635013
SWREF-12	C	10/20/2016	10:18:25	302619.6	848661.0	41.8815873	-70.2636136
SWREF-12	D	10/20/2016	10:18:58	302612.4	848659.1	41.8815711	-70.2637008

Notes

1. Grid coordinates are NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001_Meters
2. Geographic coordinates are NAD83 decimal degrees

APPENDIX D

SPI/PV FIELD LOG

StationID	Replicate	Date	Time	Frame	Stops_inches	Weights_per_side	Depth_ft	Comments	QC_Notes
SWREF-09	A	10/20/2016	9:28:38	4	14	2	98	SPI: 1/250, ISO 640, F9; PV: 1/30, ISO 400, F14	
SWREF-09	B	10/20/2016	9:29:38	5	14	2	98		
SWREF-09	C	10/20/2016	9:30:42	6	14	2	98		
SWREF-09	D	10/20/2016	9:31:34	7	14	2	98		
SWREF-09	E	10/20/2016	9:32:23	8	14	2	96	On Deck, Download; Frame Count 9	
SWREF-10	A	10/20/2016	9:52:33	10	14	0	96		
SWREF-10	B	10/20/2016	9:53:24	11	14	0	96		
SWREF-10	C	10/20/2016	9:54:04	12	14	0	96		
SWREF-10	D	10/20/2016	9:54:48	13	14	0	96		
SWREF-11	A	10/20/2016	10:04:45	14	14	0	96		
SWREF-11	B	10/20/2016	10:05:28	15	14	0	96		
SWREF-11	C	10/20/2016	10:06:10	16	14	0	96		
SWREF-11	D	10/20/2016	10:06:45	17	14	0	96		
SWREF-12	A	10/20/2016	10:16:35	18	14	0	96	Lost Frame	
SWREF-12	B	10/20/2016	10:17:20	19	14	0	96		
SWREF-12	C	10/20/2016	10:18:09	20	14	0	96		
SWREF-12	D	10/20/2016	10:18:50	21	14	0	96	On Deck, Download; Frame Count 20	
C22	A	10/20/2016	11:06:27	21	14	0	94		
C22	B	10/20/2016	11:07:15	22	14	0	94		
C22	C	10/20/2016	11:07:56	23	14	0	94		
C22	D	10/20/2016	11:08:54	24	14	0	94		
C20	A	10/20/2016	11:18:43	25	14	0	94		
C20	B	10/20/2016	11:19:33	26	14	0	94		
C20	C	10/20/2016	11:20:22	27	14	0	94		
C20	D	10/20/2016	11:21:07	28	14	0	94		
C20	E	10/20/2016	11:22:06	29	14	0	94		
C21	A	10/20/2016	11:28:37	30	14	0	94		
C21	B	10/20/2016	11:29:25	31	14	0	94		
C21	C	10/20/2016	11:30:17	32	14	0	94		
C21	D	10/20/2016	11:31:00	33	14	0	94		
C23	A	10/20/2016	11:43:26	34	14	0	96		
C23	B	10/20/2016	11:44:17	35	14	0	96		
C23	C	10/20/2016	11:45:07	36	14	0	96		
C23	D	10/20/2016	11:46:04	37	14	0	96		
C23	E	10/20/2016	11:46:53	38	14	0	96		
C24	A	10/20/2016	11:52:54	39	14	0	95		
C24	B	10/20/2016	11:53:42	40	14	0	95		
C24	C	10/20/2016	11:54:28	41	14	0	95		
C24	D	10/20/2016	11:55:13	42	14	0	95		
C25	A	10/20/2016	12:03:31	43	14	0	93		
C25	B	10/20/2016	12:04:20	44	14	0	93		

StationID	Replicate	Date	Time	Frame	Stops_inches	Weights_per_side	Depth_ft	Comments	QC_Notes
C25	C	10/20/2016	12:05:06	45	14	0	93		
C25	D	10/20/2016	12:05:51	46	14	0	93		
C14	A	10/20/2016	12:11:16	47	14	0	101		
C14	B	10/20/2016	12:12:04	48	14	0	101		
C14	C	10/20/2016	12:12:52	49	14	0	101		
C14	D	10/20/2016	12:13:47	50	14	0	101		
C16	A	10/20/2016	12:22:27	51	14	0	98		
C16	B	10/20/2016	12:23:16	52	14	0	98		
C16	C	10/20/2016	12:23:59	53	14	0	98		
C16	D	10/20/2016	12:24:47	54	14	0	98		
C13	A	10/20/2016	12:33:08	55	14	0	99		
C13	B	10/20/2016	12:33:49	56	14	0	99		
C13	C	10/20/2016	12:34:36	57	14	0	99		
C13	D	10/20/2016	12:35:21	58	14	0	99	On Deck, Download; Frame Count 58	
C15	A	10/20/2016	13:48:04	59	13	0	107		
C15	B	10/20/2016	13:48:55	60	13	0	107		
C15	C	10/20/2016	13:49:47	61	13	0	107		
C15	D	10/20/2016	13:50:38	62	13	0	107		
C17	A	10/20/2016	13:56:12	63	13	0	109		
C17	B	10/20/2016	13:57:00	64	13	0	109		
C17	C	10/20/2016	13:57:50	65	13	0	109		
C17	D	10/20/2016	13:58:38	66	13	0	109		
C18	A	10/20/2016	14:06:27	67	13	0	107		
C18	B	10/20/2016	14:07:16	68	13	0	107		
C18	C	10/20/2016	14:08:07	69	13	0	107		
C18	D	10/20/2016	14:09:01	70	13	0	107		
C19	A	10/20/2016	14:12:23	71	13	0	109		
C19	B	10/20/2016	14:13:18	72	13	0	109		
C19	C	10/20/2016	14:14:18	73	13	0	109		
C19	D	10/20/2016	14:15:03	74	13	0	109	Lost Frame	
B07	A	10/20/2016	14:39:30	75	13	0	108		
B07	B	10/20/2016	14:40:15	76	13	0	108		
B07	C	10/20/2016	14:41:10	77	13	0	108		
B07	D	10/20/2016	14:41:59	78	13	0	108		
B07	E	10/20/2016	14:42:51	79	13	0	108	On Deck; Frame Count 78	
B11	A	10/20/2016	14:53:20	79	13	0	107		
B11	B	10/20/2016	14:54:10	80	13	0	107		
B11	C	10/20/2016	14:54:53	81	13	0	107		
B11	D	10/20/2016	14:55:37	82	13	0	107		
B01	A	10/20/2016	15:00:45	83	13	0			
B01	B	10/20/2016	15:01:39	84	13	0			
B01	C	10/20/2016	15:02:23	85	13	0			

StationID	Replicate	Date	Time	Frame	Stops_inches	Weights_per_side	Depth_ft	Comments	QC_Notes
B01	D	10/20/2016	15:03:09	86	13	0			
B01	E	10/20/2016	15:03:54	87	13	0			
B03	A	10/20/2016	15:10:18	88	13	0	103		
B03	B	10/20/2016	15:11:10	89	13	0	103		
B03	C	10/20/2016	15:12:00	90	13	0	103		
B03	D	10/20/2016	15:12:47	91	13	0	103		
B02	A	10/20/2016	15:18:50	92	13	0	90		
B02	B	10/20/2016	15:20:29	93	13	0	90		
B02	C	10/20/2016	15:21:10	94	13	0	90		
B02	D	10/20/2016	15:21:49	95	13	0	90		
B02	E	10/20/2016	15:22:37	96	13	0	90	On Deck, Download; Redo Station with Weights	
B09	A	10/20/2016	15:46:54	97	13	0	107		
B09	B	10/20/2016	15:47:49	98	13	0	107		
B09	C	10/20/2016	15:48:36	99	13	0	107		
B09	D	10/20/2016	15:49:24	100	13	0	107		
B09	E	10/20/2016	15:50:12	101	13	0	107		
B12	A	10/20/2016	15:57:34	102	13	0	105		
B12	B	10/20/2016	15:58:25	103	13	0	105		
B12	C	10/20/2016	15:59:08	104	13	0	105		
B12	D	10/20/2016	15:59:59	105	13	0	105	On Deck	
B12	E	10/20/2016	16:29:38	106	14	2	105		
B12	F	10/20/2016	16:30:27	107	14	2	105		
B12	G	10/20/2016	16:31:16	108	14	2	105		
B12	H	10/20/2016	16:32:04	109	14	2	105		
B10	A	10/20/2016	16:39:09	110	14	2	106		
B10	B	10/20/2016	16:40:00	111	14	2	106		
B10	C	10/20/2016	16:40:50	112	14	2	106		
B10	D	10/20/2016	16:40:48	113	14	2	106	On Deck; Frame Count 115	
B04	A	10/21/2016	8:58:42	116	14	0	99		
B04	B	10/21/2016	8:59:17	117	14	0	99		
B04	C	10/21/2016	8:59:55	118	14	0	99		
B04	D	10/21/2016	9:00:33	119	14	0	99		
B08	A	10/21/2016	9:04:50	120	14	0	98		
B08	B	10/21/2016	9:05:29	121	14	0	98		
B08	C	10/21/2016	9:06:11	122	14	0	98		
B08	D	10/21/2016	9:06:55	123	14	0	98		
B04	E	10/21/2016	9:15:01	124	14	0	91		EB20170126: Updated Replicate from A
B04	F	10/21/2016	9:15:44	125	14	0	91		EB20170126: Updated Replicate from B
B04	G	10/21/2016	9:16:26	126	14	0	91		EB20170126: Updated Replicate from C
B04	H	10/21/2016	9:18:25	127	14	0	91		EB20170126: Updated Replicate from D
B08	E	10/21/2016	9:22:33	128	14	0	85		EB20170126: Updated Replicate from A

StationID	Replicate	Date	Time	Frame	Stops_inches	Weights_per_side	Depth_ft	Comments	QC_Notes
B08	F	10/21/2016	9:23:17	129	14	0	85		EB20170126: Updated Replicate from B
B08	G	10/21/2016	9:23:54	130	14	0	85		EB20170126: Updated Replicate from C
B08	H	10/21/2016	9:24:32	131	14	0	85		EB20170126: Updated Replicate from D
B06	A	10/21/2016	9:29:00	132	14	0	78		
B06	B	10/21/2016	9:29:40	133	14	0	78		
B06	C	10/21/2016	9:30:20	134	14	0	78	Missing	
B06	D	10/21/2016	9:31:01	135	14	0	78	Missing	
B05	A	10/21/2016	9:37:48	136	14	0	97		
B05	B	10/21/2016	9:38:25	137	14	0	97		
B05	C	10/21/2016	9:39:06	138	14	0	97		
B05	D	10/21/2016	9:39:45	139	14	0	97	On Deck, Download; Frame Count 138	
B06	E	10/21/2016	10:03:32	139	14	2	78		
B06	F	10/21/2016	10:04:11	140	14	2	78		
B06	G	10/21/2016	10:04:47	141	14	2	78		
B06	H	10/21/2016	10:05:22	142	14	2	78		
B06	I	10/21/2016	10:10:39	143	14	4	77		
B06	J	10/21/2016	10:12:19	144	14	4	77		
B06	K	10/21/2016	10:12:56	145	14	4	77		
B06	L	10/21/2016	10:13:34	146	14	4	77		
B02	F	10/21/2016	10:19:45	147	14	4	82		EB20170126: Updated Replicate from E
B02	G	10/21/2016	10:20:22	148	14	4	82		EB20170126: Updated Replicate from F
B02	H	10/21/2016	10:20:58	149	14	4	82		EB20170126: Updated Replicate from G
B02	I	10/21/2016	10:21:38	150	14	4	82		EB20170126: Updated Replicate from H
B08	I	10/21/2016	10:27:09	151	14	4	83		EB20170126: Updated Replicate from E
B08	J	10/21/2016	10:27:48	152	14	4	83		EB20170126: Updated Replicate from F
B08	K	10/21/2016	10:28:28	153	14	4	83		EB20170126: Updated Replicate from G
B08	L	10/21/2016	10:29:05	154	14	4	83	On Deck, Download: Frame Count 156	EB20170126: Updated Replicate from H
NWREF-08	A	10/21/2016	10:53:52	157	14	0	108		
NWREF-08	B	10/21/2016	10:54:26	158	14	0	108		
NWREF-08	C	10/21/2016	10:55:03	159	14	0	108		
NWREF-08	D	10/21/2016	10:55:41	160	14	0	108	On Deck, Stops changed	
NWREF-08	E	10/21/2016	11:05:45	161	13	0	109		
NWREF-08	F	10/21/2016	11:06:22	162	13	0	109		
NWREF-08	G	10/21/2016	11:07:04	163	13	0	109		
NWREF-08	H	10/21/2016	11:07:47	164	13	0	109		
NWREF-07	A	10/21/2016	11:14:51	165	13	0	110		
NWREF-07	B	10/21/2016	11:15:30	166	13	0	110		
NWREF-07	C	10/21/2016	11:16:08	167	13	0	110		
NWREF-07	D	10/21/2016	11:16:48	168	13	0	110		
NWREF-05	A	10/21/2016	11:24:06	169	13	0	109		
NWREF-05	B	10/21/2016	11:24:43	170	13	0	109		
NWREF-05	C	10/21/2016	11:25:21	171	13	0	109		

StationID	Replicate	Date	Time	Frame	Stops_inches	Weights_per_side	Depth_ft	Comments	QC_Notes
NWREF-05	D	10/21/2016	11:25:57	172	13	0	109		
NWREF-06	A	10/21/2016	11:29:31	173	13	0	110		
NWREF-06	B	10/21/2016	11:30:08	174	13	0	110		
NWREF-06	C	10/21/2016	11:30:45	175	13	0	110		
NWREF-06	D	10/21/2016	11:31:22	176	13	0	110	On Deck; Frame Count 176	
CCBRS-03	A	10/21/2016	11:43:45	177	13	0	123		
CCBRS-03	B	10/21/2016	11:44:24	178	13	0	123		
CCBRS-03	C	10/21/2016	11:45:01	179	13	0	123		
CCBRS-03	D	10/21/2016	11:45:42	180	13	0	123		
CCBRS-02	A	10/21/2016	11:51:31	181	13	0	124		
CCBRS-02	B	10/21/2016	11:52:09	182	13	0	124		
CCBRS-02	C	10/21/2016	11:52:51	183	13	0	124		
CCBRS-02	D	10/21/2016	11:53:28	184	13	0	124		
CCBRS-01	A	10/21/2016	12:00:07	185	13	0	124		
CCBRS-01	B	10/21/2016	12:00:46	186	13	0	124		
CCBRS-01	C	10/21/2016	12:01:26	187	13	0	124		
CCBRS-01	D	10/21/2016	12:02:40	188	13	0	124		
CCBRS-04	A	10/21/2016	12:08:08	189	13	0	124		
CCBRS-04	B	10/21/2016	12:08:52	190	13	0	124		
CCBRS-04	C	10/21/2016	12:09:30	191	13	0	124		
CCBRS-04	D	10/21/2016	12:10:06	192	13	0	124		

DAMOS 2016
SPI ONLY

"Rite in the Rain"®
ALL-WEATHER WRITING PAPER

LEVEL

All-Weather Notebook
No. 311

Rockland RDS 12-14 Sep 2016
Portland PDS 17-19 Sep 2016
Central Long Island CLDS 29 Sep to 2 Oct 2016
Cape Cod Bay CCBDS 20-~~21~~ Oct 2016 2016

4 5/8" x 7" - 48 Numbered Pages

STA	REP	FRAME	TIME	DEPTH (ft)
CLIS	A	228	10:59:56	87
REF-02	B	229	11:00:52	
	C	230	11:01:40	
	D	231	11:02:27	
CLIS	A	232	11:06:23	86
REF-01	B	233	11:07:11	
	C	234	11:07:53	
	D	235	11:08:32	

ON DECK DOWNLOAD FRAME 235

STA	REP	FRAME	TIME	DEPTH (ft)
2500W-02	A	236	11:46:45	64
	B	237	11:47:32	
	C	238	11:48:14	
	D	239	11:49:06	
2500W-01	A	240	11:51:10	64
	B	241	11:52:00	
	C	242	11:52:48	
	D	243	11:53:23	
2500W-04	A	244	12:00:13	64
	B	245	12:01:00	
	C	246	12:01:41	
	D	247	12:02:28	

STA	REP	FRAME	TIME	DEPTH (ft)
2500W-03	A	248	12:05:50	64
	B	249	12:06:33	
	C	250	12:07:13	
	D	251	12:07:53	
2500W-05	A	252	12:12:28	63
	B	253	12:13:14	
	C	254	12:14:29	
	D	255	12:15:10	

EOD

10/20/2016

Cape Cod Disposal Site (CCDS)
SPI/PV Survey

06:50 @ dock
07:30 depart dock

settings

SPI	PV
1/250	1/30
ISO 640	ISO 400
f9	f14

STA	REP	FRAME	14+2	TIME	DEPTH (ft)
SWREF 09	A	04		09:28:38	95
	B	05		09:29:38	
	C	06		09:30:42	
	D	07		09:31:34	
	E	08		09:32:23	

ON Deck DOWNLOAD Frame 09

STA	REP	FRAME	14+2	TIME	DEPTH (ft)
SWREF 10	A	10	14+0	09:52:33	96
	B	11		09:53:24	
	C	12		09:54:04	
	D	13		09:54:48	
SWREF 11	A	14		10:04:45	96
	B	15		10:05:28	
	C	16		10:06:10	
	D	17		10:06:45	
SWREF 12		18	lost frame	10:16:35	96
		19		10:17:20	
		20		10:18:09	
		21		10:18:50	

ON DECK DOWNLOAD FRAME 20

STA	REP	FRAME	TIME	DEPTH (ft)
C-22_new	A	21	11:06:27	94
	B	22	11:07:15	
	C	23	11:07:56	
	D	24	11:08:44	
C-20_new	A	25	11:18:43	94
	B	26	11:19:33	
	C	27	11:20:22	
	D	28	11:21:07	
	E	29	11:22:00	
C-21_new	A	30	11:28:37	
	B	31	11:29:25	
	C	32	11:30:17	
	D	33	11:31:00	
C-23_New	A	34	11:43:26	96
	B	35	11:44:17	
	C	36	11:45:07	
	D	37	11:46:04	
	E	38	11:46:55	
C-24_New	A	39	11:52:54	95
	B	40	11:53:42	
	C	41	11:54:28	
	D	42	11:55:13	

STA	REP	FRAME		TIME	DEPTH (ft)
C-25_New	A	43		12:03:31	93
	B	44		12:04:20	
	C	45		12:05:06	
	D	46		12:05:51	
C-14	A	47		12:11:16	101
	B	48		12:12:04	
	C	49		12:12:52	
	D	50		12:13:47	
C-16	A	51		12:22:27	98
	B	52		12:23:16	
	C	53		12:23:59	
	D	54		12:24:47	
C-13_New	A	55		12:33:08	99
	B	56		12:33:49	
	C	57		12:34:36	
	D	58		12:35:21	
ON Deck	DOWNLOAD	FRAME 58	Lunch	Time	
C-15	A	59	B+O	13:48:04	107
	B	60		13:48:55	
	C	61		13:49:47	
	D	62		13:50:38	

STA	REP	FRAME		TIME	DEPTH (ft)
C-17	A	63		13:56:12	109
	B	64		13:57:00	
	C	65		13:57:50	
	D	66		13:58:36	
C-18	A	67		14:06:27	107
	B	68		14:07:16	
	C	69		14:08:07	
	D	70		14:09:01	
C-19	A	71		14:12:23	109
	B	72		14:13:18	
	C	73		14:14:18	
	D	74	missed frame	14:15:03	
B-07	A	75		14:39:30	108
	B	76		14:40:15	
	C	77		14:41:10	
	D	78		14:41:59	
	E	79		14:42:51	
ON Deck	Frame	count 78			
B-11	A	79		14:53:20	107
	B	80		14:54:10	
	C	81		14:54:53	
	D	82		14:55:37	

STA	REP	FRAME		TIME	DEPTH (ft)
B-01	A	83		15:00:45	106
	B	84		15:01:39	
	C	85		15:02:23	
	D	86		15:03:09	
	E	87		15:03:54	
B-03	A	88		15:10:18	103
	B	89		15:11:10	
	C	90		15:12:00	
	D	91		15:12:47	
B-02	A	92	redo	15:18:50	90
	B	93	station w/	15:20:29	
	C	94	weights	15:21:10	
	D	95	4 wgts	15:21:49	
	E	96		15:22:37	

ON DECK DOWNLOAD

STA	REP	FRAME		TIME	DEPTH (ft)
B-09	A	97		15:46:54	107
	B	98		15:47:49	
	C	99		15:48:36	
	D	100		15:49:24	
	E	101		15:50:12	

STA	REP	FRAME		TIME	DEPTH (ft)
B-12	A	102		15:57:34	105
	B	103		15:58:25	
	C	104		15:59:08	
	D	105		15:59:59	

ON DECK

STA	REP	FRAME		TIME	DEPTH (ft)
B-12	E	106	14&2	16:29:38	105
	F	107		16:30:27	
	G	108		16:31:16	
	H	109		16:32:04	
B-10	A	110		16:39:09	106
	B	111		16:40:00	
	C	112		16:40:48	
	D	113		16:41:40	

ON DECK FRAME 115

EOD 16:47; headed back to dock

10/21/2016

07:00 @ Dock 07:40 Leave Dock for site

STA	REP	FRAME		TIME	DEPTH (ft)
B-04	A	116	14+0	08:58:42	99
	B	117		08:59:17	
	C	118		08:59:55	
	D	119		09:00:33	

STA	REP	FRAME		TIME	DEPTH(m)
B-08	A	120		98'	09:04:50
	B	121			09:05:29
	C	122			09:06:11
	D	123			09:06:55
B-04_New	A	124		09:15:01	91
	B	125		09:15:44	
	C	126		09:16:26	
	D	127		09:18:21	
B-08_New	A	128	redo all	09:22:33	85
	B	129	2 nights	09:23:17	
	C	130		09:23:54	
	D	131		09:24:32	
B-06_New	A	132	redo all	09:29:00	78
	B	133	redo 2 nights	09:29:40	
	C	134	missing	09:30:20	
	D	135	missing	09:31:01	
B-05	A	136		09:37:48	97
	B	137		09:38:25	
	C	138		09:39:06	
	D	139		09:39:45	

ON DECK DOWNLOAD FRAME 138

STA	REP	FRAME		TIME	DEPTH(m)
B-06_New	E	139	14+2	10:03:32	78
	F	140		10:04:11	
	G	141		10:04:47	
	H	142		10:05:22	
B-06_New	I	143	14+4	10:10:39	77
	J	144		10:12:19	
	K	145		10:12:56	
	L	146		10:13:34	
B-02_New	E	147		10:19:45	82
	F	148		10:20:22	
	G	149		10:20:58	
	H	150		10:21:38	
B-08_New	E	151		10:27:09	83
	F	152		10:27:48	
	G	153		10:28:28	
	H	154		10:29:05	

ON DECK DOWNLOAD FRAME 156

STA	REP	FRAME		TIME	DEPTH(m)
NWREF 08	A	157	14+0	10:53:52	108
	B	158		10:54:26	
	C	159		10:55:03	
	D	160		10:55:41	

ON DECK; STOP. changed

STA	REP	FRAME		TIME	DEPTH (ft)
NWREF 08	E	161	1340	11:05:45	109
	F	162		11:06:22	
	G	163		11:07:04	
	H	164		11:07:47	
NW REF 07	A	165		11:14:51	110
	B	166		11:15:30	
	C	167		11:16:08	
	D	168		11:16:48	
NWREF 05	A	169		11:24:06	109
	B	170		11:24:43	
	C	171		11:25:21	
	D	172		11:25:57	
NWREF 06	A	173		11:29:31	110
	B	174		11:30:08	
	C	175		11:30:45	
	D	176		11:31:22	

ON DECK FRAME 176

STA	REP	FRAME	TIME	DEPTH (ft)
CCBRS 03	A	177	11:43:45	123
	B	178	11:44:24	
	C	179	11:45:01	
	D	180	11:45:42	

STA	REP	FRAME	TIME	DEPTH (ft)
CCBRS 02	A	181	11:51:31	124
	B	182	11:52:09	
	C	183	11:52:51	
	D	184	11:53:28	
CCBRS 01	A	185	12:00:07	124
	B	186	12:00:46	
	C	187	12:01:26	
	D	188	12:02:40	
CCBRS 04	A	189	12:08:08	124
	B	190	12:08:52	
	C	191	12:09:30	
	D	192	12:10:09	

EOD 13:00 Back @ Dock

APPENDIX E

SEDIMENT-PROFILE AND PLAN-VIEW IMAGE ANALYSIS RESULTS

Area	Location	StationID	Replicate	Date	Time	Water Depth (m)	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Boundary Roughness (cm)	Boundary Roughness Type
Disposal	Mound B	B01	B	10/20/2016	15:01:26	106	13	0	14.47	4 to 3	>4	2	>4 to 2	19.59	17.16	21.71	IND	Physical
Disposal	Mound B	B01	D	10/20/2016	15:02:58	106	13	0	14.47	4 to 3	>4	2	>4 to 2	19.28	18.95	19.73	0.77	Biological
Disposal	Mound B	B01	E	10/20/2016	15:03:42	106	13	0	14.47	4 to 3	>4	2	>4 to 2	18.12	17.77	18.37	0.60	Biological
Disposal	Mound B	B02	G	10/21/2016	10:20:09	82	14	4	14.47	>4	>4	-5	>4 to -5	5.14	3.78	6.40	2.62	Biological
Disposal	Mound B	B02	H	10/21/2016	10:20:44	82	14	4	14.47	>4	>4	-3	>4 to -3	3.20	2.48	3.91	1.43	Biological
Disposal	Mound B	B02	I	10/21/2016	10:21:25	82	14	4	14.47	>4	>4	2	>4 to 2	7.43	6.90	8.15	1.26	Biological
Disposal	Mound B	B03	A	10/20/2016	15:10:07	103	13	0	14.47	4 to 3	>4	2	>4 to 2	9.48	8.53	9.87	1.34	Biological
Disposal	Mound B	B03	B	10/20/2016	15:10:58	103	13	0	14.47	4 to 3	>4	2	>4 to 2	14.29	13.80	14.42	0.63	Biological
Disposal	Mound B	B03	C	10/20/2016	15:11:49	103	13	0	14.47	4 to 3	>4	2	>4 to 2	16.11	15.78	16.37	0.59	Biological
Disposal	Mound B	B04	E	10/21/2016	9:14:50	91	14	0	14.47	4 to 3	>4	2	>4 to 2	18.46	18.20	18.72	0.51	Biological
Disposal	Mound B	B04	G	10/21/2016	9:16:16	91	14	0	14.47	4 to 3	>4	2	>4 to 2	20.28	19.62	20.69	1.07	Biological
Disposal	Mound B	B04	H	10/21/2016	9:18:11	91	14	0	14.47	4 to 3	>4	2	>4 to 2	16.71	16.18	17.67	1.48	Biological
Disposal	Mound B	B05	A	10/21/2016	9:37:37	97	14	0	14.47	4 to 3	>4	2	>4 to 2	18.44	18.12	18.92	0.80	Biological
Disposal	Mound B	B05	B	10/21/2016	9:38:14	97	14	0	14.47	4 to 3	>4	2	>4 to 2	16.31	14.88	17.56	2.68	Biological
Disposal	Mound B	B05	C	10/21/2016	9:38:55	97	14	0	14.47	4 to 3	>4	2	>4 to 2	17.69	17.19	18.51	1.33	Biological
Disposal	Mound B	B06	J	10/21/2016	10:12:06	77	14	4	14.47	0 to -1 / >4	>4	-4	>4 to -4	3.59	0.17	4.10	3.93	Biological
Disposal	Mound B	B06	K	10/21/2016	10:12:43	77	14	4	14.47	>4	>4	-2	>4 to -2	3.21	2.58	3.87	1.30	Biological
Disposal	Mound B	B06	L	10/21/2016	10:13:21	77	14	4	14.47	1 to 0 / >4	>4	-3	>4 to -3	4.27	2.95	4.92	1.96	Biological
Disposal	Mound B	B07	C	10/20/2016	14:40:59	108	13	0	14.47	4 to 3	>4	2	>4 to 2	16.05	15.59	16.50	0.91	Biological
Disposal	Mound B	B07	D	10/20/2016	14:41:48	108	13	0	14.47	4 to 3	>4	2	>4 to 2	16.13	15.77	16.49	0.72	Biological
Disposal	Mound B	B07	E	10/20/2016	14:42:40	108	13	0	14.47	4 to 3	>4	2	>4 to 2	18.60	17.52	19.04	1.52	Biological
Disposal	Mound B	B08	H	10/21/2016	9:24:20	85	14	0	14.47	4 to 3	>4	0	>4 to 0	8.56	8.31	8.80	0.49	Biological
Disposal	Mound B	B08	J	10/21/2016	10:27:35	83	14	4	14.47	4 to 3	>4	0	>4 to 0	7.83	7.13	8.58	1.45	Biological
Disposal	Mound B	B08	L	10/21/2016	10:28:52	83	14	4	14.47	4 to 3	>4	0	>4 to 0	9.79	9.10	10.23	1.13	Biological
Disposal	Mound B	B09	B	10/20/2016	15:47:37	107	13	0	14.47	4 to 3	>4	1	>4 to 1	17.94	17.45	18.10	0.65	Biological
Disposal	Mound B	B09	C	10/20/2016	15:48:25	107	13	0	14.47	4 to 3	>4	0	>4 to 0	18.24	18.02	18.45	0.43	Biological
Disposal	Mound B	B09	D	10/20/2016	15:49:13	107	13	0	14.47	4 to 3	>4	1	>4 to 1	19.13	18.82	19.40	0.58	Biological
Disposal	Mound B	B10	A	10/20/2016	16:38:57	106	14	2	14.47	4 to 3	>4	2	>4 to 2	18.64	18.32	18.76	0.43	Biological
Disposal	Mound B	B10	B	10/20/2016	16:39:49	106	14	2	14.47	4 to 3	>4	2	>4 to 2	18.56	18.25	18.87	0.63	Biological
Disposal	Mound B	B10	C	10/20/2016	16:40:35	106	14	2	14.47	4 to 3	>4	2	>4 to 2	19.52	19.01	20.47	1.47	Biological

Area	Location	StationID	Replicate	Date	Time	Water Depth (m)	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Boundary Roughness (cm)	Boundary Roughness Type
Disposal	Mound B	B11	A	10/20/2016	14:53:09	107	13	0	14.47	4 to 3	>4	2	>4 to 2	18.33	18.06	18.67	0.61	Biological
Disposal	Mound B	B11	B	10/20/2016	14:53:58	107	13	0	14.47	4 to 3	>4	2	>4 to 2	17.28	17.05	17.54	0.49	Biological
Disposal	Mound B	B11	C	10/20/2016	14:54:43	107	13	0	14.47	4 to 3	>4	2	>4 to 2	16.00	15.69	16.36	0.66	Biological
Disposal	Mound B	B12	A	10/20/2016	15:57:24	105	13	0	14.47	4 to 3	>4	2	>4 to 2	9.29	8.70	9.83	1.14	Biological
Disposal	Mound B	B12	D	10/20/2016	15:59:48	105	13	0	14.47	4 to 3	>4	2	>4 to 2	10.72	10.41	10.97	0.56	Biological
Disposal	Mound B	B12	G	10/20/2016	16:31:03	105	14	2	14.47	4 to 3	>4	2	>4 to 2	18.51	17.86	19.07	1.22	Biological
Disposal	Mound C	C13	A	10/20/2016	12:32:56	99	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	13.68	12.84	14.12	1.28	Biological
Disposal	Mound C	C13	B	10/20/2016	12:33:38	99	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	13.45	12.99	14.16	1.16	Biological
Disposal	Mound C	C13	C	10/20/2016	12:34:25	99	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	16.41	15.79	17.00	1.21	Biological
Disposal	Mound C	C14	A	10/20/2016	12:11:06	101	14	0	14.47	4 to 3	>4	2	>4 to 2	17.05	16.76	17.57	0.81	Biological
Disposal	Mound C	C14	B	10/20/2016	12:11:55	101	14	0	14.47	4 to 3	>4	2	>4 to 2	19.98	18.94	21.42	2.47	Biological
Disposal	Mound C	C14	C	10/20/2016	12:12:42	101	14	0	14.47	4 to 3	>4	2	>4 to 2	18.59	18.39	18.90	0.51	Biological
Disposal	Mound C	C15	A	10/20/2016	13:47:53	107	13	0	14.47	4 to 3	>4	2	>4 to 2	20.02	19.69	20.35	0.66	Biological
Disposal	Mound C	C15	B	10/20/2016	13:48:45	107	13	0	14.47	4 to 3	>4	2	>4 to 2	17.80	17.46	18.19	0.73	Biological
Disposal	Mound C	C15	C	10/20/2016	13:49:37	107	13	0	14.47	4 to 3	>4	2	>4 to 2	18.85	18.68	19.00	0.31	Biological
Disposal	Mound C	C16	A	10/20/2016	12:22:17	98	14	0	14.47	4 to 3	>4	2	>4 to 2	20.33	18.89	21.71	IND	IND
Disposal	Mound C	C16	B	10/20/2016	12:23:05	98	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.29	19.16	19.80	0.64	Biological
Disposal	Mound C	C16	C	10/20/2016	12:23:49	98	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.76	19.57	20.01	0.45	Biological
Disposal	Mound C	C17	A	10/20/2016	13:56:03	109	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	17.29	17.01	17.62	0.61	Biological
Disposal	Mound C	C17	B	10/20/2016	13:56:49	109	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	18.08	17.57	18.78	1.22	Biological
Disposal	Mound C	C17	C	10/20/2016	13:57:39	109	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	17.76	17.25	18.12	0.87	Biological
Disposal	Mound C	C18	A	10/20/2016	14:06:15	107	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	13.90	13.17	15.30	2.13	Biological
Disposal	Mound C	C18	B	10/20/2016	14:07:06	107	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	15.50	15.21	15.86	0.65	Biological
Disposal	Mound C	C18	C	10/20/2016	14:07:57	107	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	12.92	11.78	13.52	1.75	Biological
Disposal	Mound C	C19	A	10/20/2016	14:12:13	109	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.72	18.09	20.55	2.46	Biological
Disposal	Mound C	C19	B	10/20/2016	14:13:08	109	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	16.42	15.92	17.14	1.22	Biological
Disposal	Mound C	C19	C	10/20/2016	14:14:08	109	13	0	14.47	4 to 3 / >4	>4	2	>4 to 2	17.83	17.47	18.07	0.60	Biological
Disposal	Mound C	C20	B	10/20/2016	11:19:22	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	15.27	14.93	15.86	0.93	Biological
Disposal	Mound C	C20	C	10/20/2016	11:20:13	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	17.71	17.13	18.33	1.20	Biological
Disposal	Mound C	C20	D	10/20/2016	11:20:58	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	18.08	17.80	18.42	0.62	Biological
Disposal	Mound C	C21	B	10/20/2016	11:29:14	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	16.56	15.92	16.94	1.02	Biological

Area	Location	StationID	Replicate	Date	Time	Water Depth (m)	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Boundary Roughness (cm)	Boundary Roughness Type
Disposal	Mound C	C21	C	10/20/2016	11:30:07	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	16.84	16.60	17.03	0.43	Biological
Disposal	Mound C	C21	D	10/20/2016	11:30:50	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.56	19.10	19.92	0.82	Biological
Disposal	Mound C	C22	A	10/20/2016	11:06:17	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	18.69	18.02	19.41	1.39	Biological
Disposal	Mound C	C22	B	10/20/2016	11:07:05	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	16.60	16.35	16.98	0.63	Biological
Disposal	Mound C	C22	C	10/20/2016	11:07:46	94	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.13	18.71	19.78	1.07	Biological
Disposal	Mound C	C23	A	10/20/2016	11:43:14	96	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	15.84	15.28	16.11	0.83	Biological
Disposal	Mound C	C23	B	10/20/2016	11:44:08	96	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	15.15	14.57	15.38	0.82	Biological
Disposal	Mound C	C23	C	10/20/2016	11:44:56	96	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.25	18.94	19.48	0.54	Biological
Disposal	Mound C	C24	A	10/20/2016	11:52:43	95	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	18.20	17.82	18.68	0.86	Biological
Disposal	Mound C	C24	B	10/20/2016	11:53:30	95	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.17	17.79	20.13	2.35	Biological
Disposal	Mound C	C24	C	10/20/2016	11:54:18	95	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	19.49	18.96	19.97	1.01	Biological
Disposal	Mound C	C25	A	10/20/2016	12:03:19	93	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	16.24	14.32	18.22	3.90	Biological
Disposal	Mound C	C25	B	10/20/2016	12:04:08	93	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	11.27	10.63	11.64	1.02	Biological
Disposal	Mound C	C25	D	10/20/2016	12:05:41	93	14	0	14.47	4 to 3 / >4	>4	2	>4 to 2	15.05	14.59	15.44	0.85	Biological
Reference	CC-BRS	CCBRS-01	A	10/21/2016	11:59:56	124	13	0	14.47	4 to 3	>4	2	>4 to 2	20.32	19.99	20.78	0.80	Biological
Reference	CC-BRS	CCBRS-01	B	10/21/2016	12:00:36	124	13	0	14.47	4 to 3	>4	2	>4 to 2	19.79	19.38	20.18	0.80	Biological
Reference	CC-BRS	CCBRS-01	C	10/21/2016	12:01:15	124	13	0	14.47	4 to 3	>4	2	>4 to 2	18.89	18.02	20.20	2.18	Biological
Reference	CC-BRS	CCBRS-02	A	10/21/2016	11:51:21	124	13	0	14.47	4 to 3	>4	2	>4 to 2	14.95	14.63	15.53	0.90	Biological
Reference	CC-BRS	CCBRS-02	B	10/21/2016	11:51:59	124	13	0	14.47	4 to 3	>4	2	>4 to 2	17.98	17.53	18.60	1.07	Biological
Reference	CC-BRS	CCBRS-02	D	10/21/2016	11:53:18	124	13	0	14.47	4 to 3	>4	2	>4 to 2	17.76	17.43	18.02	0.59	Biological
Reference	CC-BRS	CCBRS-03	A	10/21/2016	11:43:33	123	13	0	14.47	4 to 3	>4	2	>4 to 2	17.98	17.34	18.28	0.94	Biological
Reference	CC-BRS	CCBRS-03	B	10/21/2016	11:44:13	123	13	0	14.47	4 to 3	>4	2	>4 to 2	17.76	17.40	18.14	0.74	Biological
Reference	CC-BRS	CCBRS-03	C	10/21/2016	11:44:51	123	13	0	14.47	4 to 3	>4	2	>4 to 2	17.99	17.05	19.01	1.96	Biological
Reference	CC-BRS	CCBRS-04	A	10/21/2016	12:07:57	124	13	0	14.47	4 to 3	>4	2	>4 to 2	17.89	17.69	18.12	0.42	Biological
Reference	CC-BRS	CCBRS-04	B	10/21/2016	12:08:41	124	13	0	14.47	4 to 3	>4	2	>4 to 2	16.69	16.35	17.22	0.87	Biological
Reference	CC-BRS	CCBRS-04	C	10/21/2016	12:09:19	124	13	0	14.47	4 to 3	>4	2	>4 to 2	19.65	19.11	20.32	1.20	Biological
Reference	NW-REF	NWREF-05	A	10/21/2016	11:23:55	109	13	0	14.47	4 to 3	>4	2	>4 to 2	17.15	16.61	18.29	1.68	Biological
Reference	NW-REF	NWREF-05	B	10/21/2016	11:24:33	109	13	0	14.47	4 to 3	>4	2	>4 to 2	15.37	14.89	16.30	1.41	Biological
Reference	NW-REF	NWREF-05	D	10/21/2016	11:25:46	109	13	0	14.47	4 to 3	>4	2	>4 to 2	17.43	16.49	18.66	2.17	Biological
Reference	NW-REF	NWREF-06	A	10/21/2016	11:29:21	110	13	0	14.47	4 to 3	>4	2	>4 to 2	19.30	18.83	19.54	0.71	Biological
Reference	NW-REF	NWREF-06	B	10/21/2016	11:29:57	110	13	0	14.47	4 to 3	>4	2	>4 to 2	18.46	18.54	18.78	0.24	Biological
Reference	NW-REF	NWREF-06	C	10/21/2016	11:30:34	110	13	0	14.47	4 to 3	>4	2	>4 to 2	15.25	14.24	16.10	1.86	Biological
Reference	NW-REF	NWREF-07	A	10/21/2016	11:14:41	110	13	0	14.47	4 to 3	>4	2	>4 to 2	17.46	16.87	18.27	1.40	Biological
Reference	NW-REF	NWREF-07	B	10/21/2016	11:15:18	110	13	0	14.47	4 to 3	>4	2	>4 to 2	18.17	17.81	18.60	0.79	Biological
Reference	NW-REF	NWREF-07	C	10/21/2016	11:15:57	110	13	0	14.47	4 to 3	>4	2	>4 to 2	19.98	19.53	20.25	0.73	Biological
Reference	NW-REF	NWREF-08	F	10/21/2016	11:06:10	109	13	0	14.47	4 to 3	>4	2	>4 to 2	18.06	17.53	19.20	1.67	Biological

Area	Location	StationID	Replicate	Date	Time	Water Depth (m)	Stop Collar Setting (in)	# of Weights (per side)	Image Width (cm)	Grain Size Major Mode (phi)	Grain Size Minimum (phi)	Grain Size Maximum (phi)	Grain Size Range (phi)	Penetration Mean (cm)	Penetration Minimum (cm)	Penetration Maximum (cm)	Boundary Roughness (cm)	Boundary Roughness Type
Reference	NW-REF	NWREF-08	G	10/21/2016	11:06:53	109	13	0	14.47	4 to 3	>4	2	>4 to 2	19.05	18.63	19.60	0.97	Biological
Reference	NW-REF	NWREF-08	H	10/21/2016	11:07:38	109	13	0	14.47	4 to 3	>4	2	>4 to 2	15.27	14.24	15.75	1.51	Biological
Reference	SW-REF	SWREF-09	A	10/20/2016	9:28:16	98	14	2	14.47	4 to 3	>4	2	>4 to 2	19.64	19.31	19.85	0.54	Biological
Reference	SW-REF	SWREF-09	C	10/20/2016	9:30:26	98	14	2	14.47	4 to 3	>4	2	>4 to 2	18.99	18.23	19.84	1.61	Biological
Reference	SW-REF	SWREF-09	E	10/20/2016	9:32:07	96	14	2	14.47	4 to 3	>4	2	>4 to 2	19.53	18.91	20.52	1.61	Biological
Reference	SW-REF	SWREF-10	A	10/20/2016	9:52:22	96	14	0	14.47	4 to 3	>4	2	>4 to 2	15.99	15.39	16.59	1.20	Biological
Reference	SW-REF	SWREF-10	B	10/20/2016	9:53:13	96	14	0	14.47	4 to 3	>4	2	>4 to 2	15.79	15.33	16.31	0.98	Biological
Reference	SW-REF	SWREF-10	C	10/20/2016	9:53:54	96	14	0	14.47	4 to 3	>4	2	>4 to 2	16.60	16.30	16.98	0.68	Biological
Reference	SW-REF	SWREF-11	A	10/20/2016	10:04:34	96	14	0	14.47	4 to 3	>4	2	>4 to 2	15.89	15.47	16.34	0.87	Biological
Reference	SW-REF	SWREF-11	B	10/20/2016	10:05:18	96	14	0	14.47	4 to 3	>4	1	>4 to 1	17.50	16.27	18.67	2.40	Biological
Reference	SW-REF	SWREF-11	C	10/20/2016	10:06:00	96	14	0	14.47	4 to 3	>4	2	>4 to 2	14.63	14.22	15.42	1.20	Biological
Reference	SW-REF	SWREF-12	B	10/20/2016	10:17:10	96	14	0	14.47	4 to 3	>4	2	>4 to 2	13.60	13.43	13.80	0.37	Biological
Reference	SW-REF	SWREF-12	C	10/20/2016	10:17:59	96	14	0	14.47	4 to 3	>4	2	>4 to 2	14.66	13.26	16.10	2.83	Biological
Reference	SW-REF	SWREF-12	D	10/20/2016	10:18:40	96	14	0	14.47	4 to 3	>4	2	>4 to 2	15.17	14.66	15.93	1.27	Biological

Area	Location	StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Methane Present?	Number of Methane Bubbles	Dredged Material Present?	Mean depth below Sediment Surface of top of Dredged Material Layer (cm)	Dredged Material Layer Mean Thickness (cm)	Dredged Material > Pen
Disposal	Mound B	B01	B	IND		0		No	0	Yes		19.59	TRUE
Disposal	Mound B	B01	D	1.44		0		No	0	Yes		19.28	TRUE
Disposal	Mound B	B01	E	1.38		0		No	0	Yes		18.12	TRUE
Disposal	Mound B	B02	G	2.81		0		No	0	Yes		2.81	TRUE
Disposal	Mound B	B02	H	1.43		0		No	0	Yes		3.20	TRUE
Disposal	Mound B	B02	I	1.21		0		No	0	Yes		7.43	TRUE
Disposal	Mound B	B03	A	1.80		0		No	0	Yes		9.48	TRUE
Disposal	Mound B	B03	B	2.36		0		No	0	Yes		14.29	TRUE
Disposal	Mound B	B03	C	2.28		0		No	0	No			
Disposal	Mound B	B04	E	1.83		0		Yes	3	Yes		18.46	TRUE
Disposal	Mound B	B04	G	1.12		0		No	0	Yes		20.28	TRUE
Disposal	Mound B	B04	H	1.50		0		No	0	Yes		16.71	TRUE
Disposal	Mound B	B05	A	1.65		0		No	0	Yes		18.44	
Disposal	Mound B	B05	B	1.06		0		No	0	Yes		16.31	
Disposal	Mound B	B05	C	1.54		0		No	0	Yes		17.69	
Disposal	Mound B	B06	J	1.92		0		No	0	Yes		3.59	TRUE
Disposal	Mound B	B06	K	2.35		0		No	0	Yes		3.21	TRUE
Disposal	Mound B	B06	L	1.48		0		No	0	Yes		4.27	TRUE
Disposal	Mound B	B07	C	1.30		0		No	0	No			
Disposal	Mound B	B07	D	0.79		0		No	0	No			
Disposal	Mound B	B07	E	2.33		0		No	0	No			
Disposal	Mound B	B08	H	1.43		0		No	0	Yes		8.56	TRUE
Disposal	Mound B	B08	J	2.01		0		No	0	Yes		7.83	TRUE
Disposal	Mound B	B08	L	2.22		0		No	0	Yes		9.79	TRUE
Disposal	Mound B	B09	B	1.83		0		No	0	Yes		17.94	
Disposal	Mound B	B09	C	2.37		0		No	0	Yes		18.24	
Disposal	Mound B	B09	D	1.42		0		No	0	Yes		19.13	
Disposal	Mound B	B10	A	0.89		0		No	0	No			
Disposal	Mound B	B10	B	1.26		0		No	0	No			
Disposal	Mound B	B10	C	1.41		0		No	0	No			

Area	Location	StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Methane Present?	Number of Methane Bubbles	Dredged Material Present?	Mean depth below Sediment Surface of top of Dredged Material Layer (cm)	Dredged Material Layer Mean Thickness (cm)	Dredged Material > Pen
Disposal	Mound B	B11	A	2.10		0		No	0	No			
Disposal	Mound B	B11	B	1.27		0		No	0	No			
Disposal	Mound B	B11	C	1.30		0		No	0	No			
Disposal	Mound B	B12	A	1.70		0		No	0	Yes		9.29	
Disposal	Mound B	B12	D	1.81		0		No	0	Yes		10.72	
Disposal	Mound B	B12	G	1.99		0		No	0	Yes		18.51	
Disposal	Mound C	C13	A	1.29		0		No	0	Yes		13.68	TRUE
Disposal	Mound C	C13	B	3.80		0		No	0	Yes		13.45	TRUE
Disposal	Mound C	C13	C	3.82		0		No	0	Yes		16.41	TRUE
Disposal	Mound C	C14	A	2.81		0		No	0	Yes		17.05	TRUE
Disposal	Mound C	C14	B	3.27		0		No	0	Yes		19.98	TRUE
Disposal	Mound C	C14	C	1.68		0		No	0	Yes		18.59	TRUE
Disposal	Mound C	C15	A	0.48		0		No	0	Yes		20.02	TRUE
Disposal	Mound C	C15	B	0.92		0		No	0	Yes		17.80	TRUE
Disposal	Mound C	C15	C	1.23		0		No	0	Yes		18.85	TRUE
Disposal	Mound C	C16	A	IND		0		No	0	Yes		20.33	TRUE
Disposal	Mound C	C16	B	1.89		0		No	0	Yes		19.29	TRUE
Disposal	Mound C	C16	C	1.33		0		No	0	Yes		19.76	TRUE
Disposal	Mound C	C17	A	1.24		0		No	0	Yes		17.29	TRUE
Disposal	Mound C	C17	B	0.98		0		No	0	Yes		18.08	TRUE
Disposal	Mound C	C17	C	1.42		0		No	0	Yes		17.76	TRUE
Disposal	Mound C	C18	A	1.70		0		No	0	Yes		13.90	TRUE
Disposal	Mound C	C18	B	1.09		0		No	0	Yes		15.50	TRUE
Disposal	Mound C	C18	C	1.29		0		No	0	Yes		12.92	TRUE
Disposal	Mound C	C19	A	1.73		0		No	0	Yes		19.72	
Disposal	Mound C	C19	B	2.30		0		No	0	Yes		16.42	
Disposal	Mound C	C19	C	2.17		0		No	0	Yes		17.83	
Disposal	Mound C	C20	B	1.59		0		No	0	Yes		15.27	TRUE
Disposal	Mound C	C20	C	2.71		0		No	0	Yes		17.71	TRUE
Disposal	Mound C	C20	D	2.37		0		No	0	Yes		18.08	TRUE
Disposal	Mound C	C21	B	IND		0		No	0	Yes		16.56	TRUE

Area	Location	StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Methane Present?	Number of Methane Bubbles	Dredged Material Present?	Mean depth below Sediment Surface of top of Dredged Material Layer (cm)	Dredged Material Layer Mean Thickness (cm)	Dredged Material > Pen
Disposal	Mound C	C21	C	3.12		0		No	0	Yes		16.84	TRUE
Disposal	Mound C	C21	D	2.31		0		No	0	Yes		19.56	TRUE
Disposal	Mound C	C22	A	2.03		0		No	0	Yes		18.69	TRUE
Disposal	Mound C	C22	B	4.06		0		No	0	Yes		16.60	TRUE
Disposal	Mound C	C22	C	IND		0		No	0	Yes		19.13	TRUE
Disposal	Mound C	C23	A	0.98		0		No	0	Yes		15.84	TRUE
Disposal	Mound C	C23	B	2.62		0		No	0	Yes		15.15	TRUE
Disposal	Mound C	C23	C	1.45		0		No	0	Yes		19.25	TRUE
Disposal	Mound C	C24	A	3.36		0		No	0	Yes		18.20	TRUE
Disposal	Mound C	C24	B	3.93		0		No	0	Yes		19.17	TRUE
Disposal	Mound C	C24	C	2.16		0		No	0	Yes		19.49	TRUE
Disposal	Mound C	C25	A	1.32		0		No	0	Yes		16.24	TRUE
Disposal	Mound C	C25	B	0.86		0		No	0	Yes		11.27	TRUE
Disposal	Mound C	C25	D	1.43		0		No	0	Yes		15.05	TRUE
Reference	CC-BRS	CCBRS-01	A	4.41		0		No	0	No			
Reference	CC-BRS	CCBRS-01	B	4.77		0		No	0	No			
Reference	CC-BRS	CCBRS-01	C	2.92		0		No	0	No			
Reference	CC-BRS	CCBRS-02	A	2.78		0		No	0	No			
Reference	CC-BRS	CCBRS-02	B	2.89		0		No	0	No			
Reference	CC-BRS	CCBRS-02	D	3.60		0		No	0	No			
Reference	CC-BRS	CCBRS-03	A	3.23		0		No	0	No			
Reference	CC-BRS	CCBRS-03	B	2.40		0		No	0	No			
Reference	CC-BRS	CCBRS-03	C	2.38		0		No	0	No			
Reference	CC-BRS	CCBRS-04	A	3.47		0		No	0	No			
Reference	CC-BRS	CCBRS-04	B	2.49		0		No	0	No			
Reference	CC-BRS	CCBRS-04	C	2.61		0		No	0	No			
Reference	NW-REF	NWREF-05	A	2.49		0		No	0	No			
Reference	NW-REF	NWREF-05	B	2.30		0		No	0	No			
Reference	NW-REF	NWREF-05	D	2.56		0		No	0	No			
Reference	NW-REF	NWREF-06	A	2.60		0		No	0	No			
Reference	NW-REF	NWREF-06	B	1.60		0		No	0	No			
Reference	NW-REF	NWREF-06	C	1.71		0		No	0	No			
Reference	NW-REF	NWREF-07	A	2.12		0		No	0	No			
Reference	NW-REF	NWREF-07	B	1.57		0		No	0	No			
Reference	NW-REF	NWREF-07	C	1.95		0		No	0	No			
Reference	NW-REF	NWREF-08	F	2.12		0		No	0	No			

Area	Location	StationID	Replicate	aRPD Mean (cm)	aRPD > Pen	Mud Clast Number	Mud Clast State	Methane Present?	Number of Methane Bubbles	Dredged Material Present?	Mean depth below Sediment Surface of top of Dredged Material Layer (cm)	Dredged Material Layer Mean Thickness (cm)	Dredged Material > Pen
Reference	NW-REF	NWREF-08	G	1.96		0		No	0	No			
Reference	NW-REF	NWREF-08	H	1.76		0		No	0	No			
Reference	SW-REF	SWREF-09	A	1.84		0		No	0	No			
Reference	SW-REF	SWREF-09	C	2.12		0		No	0	No			
Reference	SW-REF	SWREF-09	E	1.27		0		No	0	No			
Reference	SW-REF	SWREF-10	A	1.59		0		No	0	No			
Reference	SW-REF	SWREF-10	B	1.07		0		No	0	No			
Reference	SW-REF	SWREF-10	C	1.27		0		No	0	No			
Reference	SW-REF	SWREF-11	A	0.64		0		No	0	No			
Reference	SW-REF	SWREF-11	B	1.64		0		No	0	No			
Reference	SW-REF	SWREF-11	C	1.28		0		No	0	No			
Reference	SW-REF	SWREF-12	B	1.13		0		No	0	No			
Reference	SW-REF	SWREF-12	C	1.10		0		No	0	No			
Reference	SW-REF	SWREF-12	D	1.29		0		No	0	No			

Area	Location	StationID	Replicate	Dredged Material Notes	Low DO Present?	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage
Disposal	Mound B	B01	B		No	Low	No		0			2 -> 3
Disposal	Mound B	B01	D	Crescent of much darker material deep in sediment column, may be dragdown. Similar sediment seen in ref stations.	No	Low	No		0			2
Disposal	Mound B	B01	E		No	Low	No		0			2 -> 3
Disposal	Mound B	B02	G	Poorly sorted coarse sands and gravels.	No	Low	No		0			1 -> 2
Disposal	Mound B	B02	H	Poorly sorted coarse sands and gravels.	No	Low	No		0			1 -> 2
Disposal	Mound B	B02	I	Very fine black sand and silt to penetration.	No	Medium	No		0			2
Disposal	Mound B	B03	A		No	Low	No		1	7.03	8.36	1 on 3
Disposal	Mound B	B03	B		No	Low	No		2	0.52	13.93	1 on 3
Disposal	Mound B	B03	C		No	Low	No		0			2 -> 3
Disposal	Mound B	B04	E	Pale gray laminated layers with mottled black near penetration maximum.	No	High	No		0			1 on 3
Disposal	Mound B	B04	G	Pale gray laminated layers with mottled black near penetration maximum.	No	High	No		0			2 -> 3
Disposal	Mound B	B04	H	Pale tan fines with large patch of gray at SWI. Coarse patches and mottled fines near pen max.	No	Medium	No		1	10.66	12.68	1 on 3
Disposal	Mound B	B05	A		No	Medium	No		1	5.62	6.77	1 on 3
Disposal	Mound B	B05	B	Fine to medium gray sand over native sediment.	No	Medium	No		0			2 -> 3
Disposal	Mound B	B05	C	Trace DM as mottled light and very dark sediment in deepest section of image.	No	Medium	No		1	16.78	17.43	1 on 3
Disposal	Mound B	B06	J	Coarse sands and gravels mixed with fines.	No	Low	No		0			IND
Disposal	Mound B	B06	K	Coarse sands mixed with fines.	No	Low	No		0			1
Disposal	Mound B	B06	L	Coarse sands mixed with very dark fines.	No	Medium	No		0			2
Disposal	Mound B	B07	C		No	Medium	No		2	10.61	15.33	2 on 3
Disposal	Mound B	B07	D		No	Medium	No		0			2
Disposal	Mound B	B07	E		No	Medium	No		1	6.91	7.83	1 on 3
Disposal	Mound B	B08	H	Very dark fines with high organic content and shell particles.	No	High	No		0			2
Disposal	Mound B	B08	J	Very dark fines with high organic content and shell particles.	No	Medium	No		0			1 on 3
Disposal	Mound B	B08	L	Very dark fines with high organic content and shell particles.	No	High	No		0			2
Disposal	Mound B	B09	B		No	Medium	No		0			2 -> 3
Disposal	Mound B	B09	C		No	Medium	No		0			1 on 3
Disposal	Mound B	B09	D		No	Medium	No		1	17.21	19.26	1 on 3
Disposal	Mound B	B10	A		No	Low	No		1	14.79	15.37	1 on 3
Disposal	Mound B	B10	B		No	Medium	No		1	17.68	18.37	1 on 3
Disposal	Mound B	B10	C		No	Low	No		1	18.70	18.90	1 on 3

Area	Location	StationID	Replicate	Dredged Material Notes	Low DO Present?	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage
Disposal	Mound B	B11	A		No	Medium	No		0			2
Disposal	Mound B	B11	B		No	Low	No		1	7.61	8.83	1 on 3
Disposal	Mound B	B11	C		No	Low	No		1	6.47	8.96	2 on 3
Disposal	Mound B	B12	A		No	Low	No		0			2
Disposal	Mound B	B12	D		No	Low	No		1	5.84	7.22	1 on 3
Disposal	Mound B	B12	G		No	Low	No		0			1 on 3
Disposal	Mound C	C13	A	Pale gray fines over mottled light and dark gray silt/clay.	No	Medium	No		2	3.53	5.19	1 on 3
Disposal	Mound C	C13	B	Pale gray fines over mottled light and dark gray silt/clay.	No	Low	No		0			2
Disposal	Mound C	C13	C	Pale gray fines over mottled light and dark gray silt/clay.	No	Medium	No		0			1 on 3
Disposal	Mound C	C14	A	Pale gray fines over mottled light and dark gray silt/clay.	No	Low	No		1	3.21	4.90	1 on 3
Disposal	Mound C	C14	B	Pale gray fines over mottled light and dark gray silt/clay.	No	Low	No		0			1 on 3
Disposal	Mound C	C14	C	Pale gray fines over mottled light and dark gray silt/clay.	No	Low	No		1	8.56	9.91	1 on 3
Disposal	Mound C	C15	A	Pale tan fines with high organic content over very dark fines	No	Medium	No		2	14.13	15.82	1 on 3
Disposal	Mound C	C15	B	Pale tan fines with high organic content over very dark fines	No	Medium	No		1	16.31	16.51	1 on 3
Disposal	Mound C	C15	C	Pale tan fines with high organic content over very dark fines	No	Medium	No		0			1 on 3
Disposal	Mound C	C16	A	Pale tan fines with high organic content over very dark fines	No	Medium	No		1	17.50	17.71	1 on 3
Disposal	Mound C	C16	B	Pale tan fines with high organic content over very dark fines	No	Medium	No		2	12.17	15.46	1 on 3
Disposal	Mound C	C16	C	Pale tan fines with high organic content over very dark fines	No	Medium	No		1	11.88	19.72	1 on 3
Disposal	Mound C	C17	A	Pale tan fines with high organic content over very dark fines	No	Medium	No		0			2 -> 3
Disposal	Mound C	C17	B	Pale tan fines with high organic content over very dark fines	No	Medium	No		0			2 -> 3
Disposal	Mound C	C17	C	Pale tan fines with high organic content over very dark fines	No	Medium	No		3	3.04	9.89	1 on 3
Disposal	Mound C	C18	A	Pale tan fines with high organic content over very dark fines	No	Medium	No		1	9.70	10.33	1 on 3
Disposal	Mound C	C18	B	Pale tan fines with high organic content over very dark fines	No	Medium	No		2	5.42	15.04	1 on 3
Disposal	Mound C	C18	C	Pale tan fines with high organic content over very dark fines	No	Medium	No		0			2 -> 3
Disposal	Mound C	C19	A		No	Medium	No		3	11.84	16.62	1 on 3
Disposal	Mound C	C19	B		No	Medium	No		2	3.58	10.84	1 on 3
Disposal	Mound C	C19	C		No	Medium	No		0			1 on 3
Disposal	Mound C	C20	B	Tan fines over dark gray mottled sediment.	No	Medium	No		0			2 -> 3
Disposal	Mound C	C20	C	Tan fines over dark gray mottled sediment.	No	Medium	No		2	0.00	9.26	1 on 3
Disposal	Mound C	C20	D	Tan fines over dark gray mottled sediment.	No	Medium	No		0			1 on 3
Disposal	Mound C	C21	B	Tan fines over dark gray mottled sediment.	No	High	No		0			2 -> 3

Area	Location	StationID	Replicate	Dredged Material Notes	Low DO Present?	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage
Disposal	Mound C	C21	C	Tan fines over dark gray mottled sediment.	No	Medium	No		0			2 -> 3
Disposal	Mound C	C21	D	Uniform very dark fines to penetration.	No	High	No		1	5.64	6.20	1 on 3
Disposal	Mound C	C22	A	Tan fines over dark gray mottled sediment.	No	High	No		0			2 -> 3
Disposal	Mound C	C22	B	Tan fines over dark gray mottled sediment.	No	High	No		1	4.18	5.36	1 on 3
Disposal	Mound C	C22	C	Tan fines over dark gray mottled sediment.	No	High	No		1	18.43	18.98	1 on 3
Disposal	Mound C	C23	A	Tan fines over dark gray mottled sediment.	No	High	No		1	14.65	15.22	1 on 3
Disposal	Mound C	C23	B	Tan fines over dark gray mottled sediment.	No	High	No		0			2
Disposal	Mound C	C23	C	Tan fines over dark gray mottled sediment.	No	High	No		1	14.82	16.90	1 on 3
Disposal	Mound C	C24	A	Tan fines over dark gray mottled sediment.	No	High	No		0			2 -> 3
Disposal	Mound C	C24	B	Tan fines over dark gray mottled sediment.	No	High	No		2	5.52	11.70	1 on 3
Disposal	Mound C	C24	C	Tan fines over dark gray mottled sediment.	No	High	No		1	6.37	7.48	1 on 3
Disposal	Mound C	C25	A	Tan fines over dark gray mottled sediment.	No	High	No		0			2 -> 3
Disposal	Mound C	C25	B	Tan fines over dark gray mottled sediment.	No	High	No		1	7.19	9.27	1 on 3
Disposal	Mound C	C25	D	Tan fines over dark gray mottled sediment.	No	Medium	No		1	6.16	6.48	1 on 3
Reference	CC-BRS	CCBRS-01	A		No	Low	No		0			2 -> 3
Reference	CC-BRS	CCBRS-01	B		No	Low	No		1	7.07	9.28	1 on 3
Reference	CC-BRS	CCBRS-01	C		No	Low	No		1	13.28	18.11	1 on 3
Reference	CC-BRS	CCBRS-02	A		No	Low	No		1	9.10	11.60	1 on 3
Reference	CC-BRS	CCBRS-02	B		No	Low	No		0			2 -> 3
Reference	CC-BRS	CCBRS-02	D		No	Low	No		1	11.31	11.73	3
Reference	CC-BRS	CCBRS-03	A		No	Low	No		0			2 -> 3
Reference	CC-BRS	CCBRS-03	B		No	Low	No		1	13.31	13.44	1 on 3
Reference	CC-BRS	CCBRS-03	C		No	Low	No		0			2 -> 3
Reference	CC-BRS	CCBRS-04	A		No	Low	No		0			2 -> 3
Reference	CC-BRS	CCBRS-04	B		No	Low	No		0			1 on 3
Reference	CC-BRS	CCBRS-04	C		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-05	A		No	Low	No		1	16.01	17.02	1 on 3
Reference	NW-REF	NWREF-05	B		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-05	D		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-06	A		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-06	B		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-06	C		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-07	A		No	Low	No		2	6.59	16.00	1 on 3
Reference	NW-REF	NWREF-07	B		No	Low	No		0			2 -> 3
Reference	NW-REF	NWREF-07	C		No	Low	No		4	10.79	20.04	1 on 3
Reference	NW-REF	NWREF-08	F		No	Low	No		0			2

Area	Location	StationID	Replicate	Dredged Material Notes	Low DO Present?	Sediment Oxygen Demand	Beggiatoa Present?	Beggiatoa Type/Extent	# of Feeding Voids	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Successional Stage
Reference	NW-REF	NWREF-08	G		No	Low	No		2	13.63	18.94	1 on 3
Reference	NW-REF	NWREF-08	H		No	Low	No		1	11.70	13.74	1 on 3
Reference	SW-REF	SWREF-09	A		No	Low	No		1	17.67	19.25	1 on 3
Reference	SW-REF	SWREF-09	C		No	Low	No		2	4.15	7.93	1 on 3
Reference	SW-REF	SWREF-09	E		No	Low	No		0			1 on 3
Reference	SW-REF	SWREF-10	A		No	Low	No		1	6.62	12.58	1 on 3
Reference	SW-REF	SWREF-10	B		No	Low	No		0			2 -> 3
Reference	SW-REF	SWREF-10	C		No	Low	No		0			2 -> 3
Reference	SW-REF	SWREF-11	A		No	Low	No		0			1 on 3
Reference	SW-REF	SWREF-11	B		No	Low	No		0			2 -> 3
Reference	SW-REF	SWREF-11	C		No	Low	No		0			2 -> 3
Reference	SW-REF	SWREF-12	B		No	Low	No		0			2 -> 3
Reference	SW-REF	SWREF-12	C		No	Low	No		1	4.87	5.57	1 on 3
Reference	SW-REF	SWREF-12	D		No	Low	No		0			1 on 3

Area	Location	StationID	Replicate	Comment
Disposal	Mound B	B01	B	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Underlying darker material contains high amount of coarser white particles. SWI appears disturbed and partially over penetrated. Evidence of deep burrowing. Worms against faceplate deep in sed column at right.
Disposal	Mound B	B01	D	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Coarse white particles throughout sediment column. Crescent of dark material deep in sediment may be drag down. Stage 1 tubes at SWI. Medium length burrow halos in sediment.
Disposal	Mound B	B01	E	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Sediment is mottled with patches of coarser material near penetration maximum. Stage 1 tubes at SWI.
Disposal	Mound B	B02	G	Sorted fines with interstitial coarse material. Thin aPRD. Low penetration. Stage 1 tubes visible in PV and at SWI.
Disposal	Mound B	B02	H	Sorted fines with interstitial coarse material. Thin aPRD. Low penetration. Stage 2 tubes visible at SWI. Large shell fragments at SWI.
Disposal	Mound B	B02	I	Very dark silt/clay with thin, distinct aRPD. Stage 1 tubes ad pellets at SWI. Stage 2 inferred by depth of burrow halos.
Disposal	Mound B	B03	A	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Coarse white particles throughout sediment column. Small void near left edge of image. Carpet of stage 1 tubes at SWI.
Disposal	Mound B	B03	B	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Coarse white particles throughout sediment column. Large burrow transected. Carpet of stage 1 tubes at SWI.
Disposal	Mound B	B03	C	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Coarse white particles throughout sediment column. Long burrows transected. Carpet of stage 1 tubes at SWI. Evidence of deep burrowing. Transected burrows at depth.
Disposal	Mound B	B04	E	Very fine pale gray sand is especially mottled near penetration maximum. Bright thin aRPD at SWI. Small methane bubbles. Infauna visible in sediment column.
Disposal	Mound B	B04	G	Very fine pale gray sand is especially mottled near penetration maximum. Pale tan thin aRPD at SWI. Burrow textures visible in sediment.
Disposal	Mound B	B04	H	Very fine pale tan sand over mottled dark fines. Large void deep in sediment. Dark gray material deposited at SWI. Deep burrow halos. Stage 1 tubes at SWI.
Disposal	Mound B	B05	A	Very fine pale tan sand over lightly mottled dark and light fines. Small void in sediment. Stage 1 tubes at SWI.
Disposal	Mound B	B05	B	Very fine pale gray sand with fine and medium sand mixed into native sediment at SWI. Sediment is lightly mottled in deeper layers of sediment column, similar to ref areas. Small infauna visible in upper few cm of sediment and thing long worms also visible against face plate deep in sed column.
Disposal	Mound B	B05	C	Very fine pale gray sand over lightly mottled layer of dark sediment and light gray silt/clay. Burrow textures near pen maximum.
Disposal	Mound B	B06	J	Coarse sands and gravels mixed with silt/clay. Very little penetration. RPD is not apparent. Large crustacean in far field.
Disposal	Mound B	B06	K	Coarse sands mixed with fines. Very little penetration. Stage 1 tubes visible in water column.
Disposal	Mound B	B06	L	Coarse sands mixed with very dark fines. Very little penetration. Stage 1 tubes visible in water column. Bivalve siphon visible in plan view image.
Disposal	Mound B	B07	C	Very fine pale gray sand over pale gray fines with small area of near black in bottom right corner. Two large voids. Ophiuroid at WI.
Disposal	Mound B	B07	D	Very fine pale gray sand mottled with darker fines to penetration. Shallow aRPD. Abundant ophiuroids visible in plan view pair.
Disposal	Mound B	B07	E	Very fine pale tan sand over mottled dark and light fines to penetration. Long burrow halo with infauna visible to left side of image. Burrowing textures/void visible. Stage 1 tubes visible at SWI.
Disposal	Mound B	B08	H	Very fine dark sand mixed with coarse sand with thin aRPD and high organic content to penetration. Sediment shows abundant shell particles mixed through column. Stage 1 tubes at SWI. Evidence of burrowing below aRPD.
Disposal	Mound B	B08	J	Very fine dark sand mixed with coarse sand; high organic content to penetration. Sediment shows abundant shell particles mixed through column. Stage 1 tubes at SWI. Large infauna transected.
Disposal	Mound B	B08	L	Very fine dark sand mixed with coarse sand; high organic content to penetration. Sediment shows abundant shell particles mixed through column. Stage 1 tubes at SWI.
Disposal	Mound B	B09	B	Very fine pale tan sand over slightly darker material. Small patch of coarse sediment in lower right corner of image. Carpet of stage 1 tubes at SWI. Infauna visible deep in sediment.
Disposal	Mound B	B09	C	Very fine pale tan sand over successive layers of varying color and grain size composition. Coarsest material in bottom of image. Large infauna visible deep in sediment column.
Disposal	Mound B	B09	D	Very fine pale tan sand over lightly mottled pale fines. Small void deep in sediment column. Coarse material mixed into lowest portion of visible area.
Disposal	Mound B	B10	A	Very fine pale tan sand over lightly mottled pale fines. Small void deep in sediment column. Infauna and long burrow halos visible. Stage 1 tube carpet at SWI.
Disposal	Mound B	B10	B	Very fine pale tan sand over lightly mottled pale fines. Large void deep in sediment column. Infauna and long burrow halos visible. Stage 1 tube carpet at SWI.
Disposal	Mound B	B10	C	Very fine pale tan sand over lightly mottled pale fines. Thin void deep in sediment column. Large object dragged down creating a halo of oxidized sediment.

Area	Location	StationID	Replicate	Comment
Disposal	Mound B	B11	A	Very fine pale tan sand over lightly mottled pale and darker fines. Ophiuroid at SWI. Small shell particles deep in sediment column.
Disposal	Mound B	B11	B	Very fine pale tan sand over lightly mottled pale and darker fines. Small void visible in sediment column.
Disposal	Mound B	B11	C	Very fine pale tan sand over lightly mottled pale and darker fines. Large void visible in sediment column. Plan view image is covered with ophiuroids.
Disposal	Mound B	B12	A	Very fine pale tan sand over Successively darker layers. Stage 1 tubes at SWI. Small patch of black material near pen max. Deep burrow halos.
Disposal	Mound B	B12	D	Very fine pale tan sand over successively darker layers. Carpet of stage 1 tubes at SWI. Large void in sediment column.
Disposal	Mound B	B12	G	Very fine pale tan sand over successively darker layers. Carpet of stage 1 tubes at SWI. Long burrow halo deep in sediment. Shell particles buried in deepest portion of image.
Disposal	Mound C	C13	A	Pale gray silt/clay with thin aRPD over mottled light and dark fines. Two small voids. Stage 1 tubes at SWI. Coarse particles buried in deepest visible sediment.
Disposal	Mound C	C13	B	Pale gray silt/clay with thin aRPD over mottled light and dark fines. Deep burrow halos. Stage 1 tubes at SWI. Coarse particles buried in deepest visible sediment. Large object contacted and shifted upward by prism.
Disposal	Mound C	C13	C	Pale gray silt/clay with thin aRPD over mottled dark fines. Large patch of pale gray in center of image. Deep burrow halos and medium-sized worm against faceplate. Stage 1 tubes at SWI.
Disposal	Mound C	C14	A	Pale gray silt/clay with thin aRPD over lightly mottled dark fines. Stage 1 tubes at SWI. Large void visible.
Disposal	Mound C	C14	B	Pale gray silt/clay with thin aRPD over lightly mottled dark fines. Stage 1 tubes at SWI. Thin worms visible against faceplate deep in sed column. Deep burrow halos extending to penetration max and below.
Disposal	Mound C	C14	C	Pale gray silt/clay with thin aRPD over lightly mottled dark fines. Stage 1 tubes at SWI. Partially infilled void visible.
Disposal	Mound C	C15	A	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Large infauna and void near penetration max.
Disposal	Mound C	C15	B	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Small void near penetration maximum.
Disposal	Mound C	C15	C	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Thin worms visible against faceplate deep in sed column. Long oxidized burrow halos visible in sediment column.
Disposal	Mound C	C16	A	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Long oxidized halos visible in sediment column. Partially over penetrated. Small void.
Disposal	Mound C	C16	B	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Two voids in sediment column.
Disposal	Mound C	C16	C	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Large void near penetration maximum.
Disposal	Mound C	C17	A	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Long oxidized halos visible in sediment column.
Disposal	Mound C	C17	B	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Thin worms visible against faceplate deep in sed column. Long oxidized halos visible in sediment column. Burrows visible in PV.
Disposal	Mound C	C17	C	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Large polychaete visible. Several voids.
Disposal	Mound C	C18	A	Pale tan fines form a thin aRPD over streaky layer of very dark gray sediment. Abundant black and white fine particles throughout image. Single small void.
Disposal	Mound C	C18	B	Pale tan fines form a thin aRPD over streaky, mottled, layer of very dark gray sediment. Abundant black and white fine particles throughout image. Two small voids.
Disposal	Mound C	C18	C	Pale tan fines form a thin aRPD over streaky, mottled, layer of very dark gray sediment. Large burrows visible in PV.
Disposal	Mound C	C19	A	Pale tan very fine sand over very fine, lightly mottled, dark gray sand. Two large voids.
Disposal	Mound C	C19	B	Pale tan very fine sand over very fine, uniform, dark gray sand. Two large voids.
Disposal	Mound C	C19	C	Pale tan very fine sand over very fine, lightly mottled, dark gray sand. Long burrow halos visible in sediment column.
Disposal	Mound C	C20	B	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Thin worms visible against faceplate deep in sed column. Long burrow halos visible in sediment column. Infauna visible. Dragdown from aRPD appears as cleanly horizontal line.
Disposal	Mound C	C20	C	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Long burrow/void network transected.
Disposal	Mound C	C20	D	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Long burrow halo visible.
Disposal	Mound C	C21	B	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Redeposited reduced sediment dragged over aRPD area. Infauna visible in sediment. Burrows visible in PV.

Area	Location	StationID	Replicate	Comment
Disposal	Mound C	C21	C	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Thin worms visible against faceplate deep in sed column. Deep burrow halos visible.
Disposal	Mound C	C21	D	Pale tan fines over uniform dark brown/gray silt/clay. Single small void in sediment. Evidence of numerous deep thin burrows.
Disposal	Mound C	C22	A	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Burrows visible in PV.
Disposal	Mound C	C22	B	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Single infilled void. Several large burrows and infauna visible.
Disposal	Mound C	C22	C	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Redeposited reduced sediment dragged over aRPD area. Infauna visible in sediment. Void visible deep in sediment.
Disposal	Mound C	C23	A	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Void deep in sed column at left. Burrows visible in PV.
Disposal	Mound C	C23	B	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Deep burrow halos visible.
Disposal	Mound C	C23	C	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Deep burrow and void halos visible. Small infauna visible.
Disposal	Mound C	C24	A	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Deep burrow halos visible. Small infauna visible.
Disposal	Mound C	C24	B	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. SWI is very rough. Two large burrows transected.
Disposal	Mound C	C24	C	Pale tan very fine sand over very fine, heavily mottled, dark gray and pale gray sand. Void transected. Adjacent infilled void.
Disposal	Mound C	C25	A	Pale tan very fine sand over very fine, lightly mottled, dark gray and pale gray sand. Deep burrow halos visible. Large object emerging from SWI.
Disposal	Mound C	C25	B	Pale tan very fine sand over very fine, lightly mottled, dark gray and pale gray sand. Void visible in center of image.
Disposal	Mound C	C25	D	Pale tan very fine sand over very fine, lightly mottled, dark gray and light tan sand. Very small void visible near infauna.
Reference	CC-BRS	CCBRS-01	A	Very fine pale tan sand with substantial drag down over slightly darker material. Vey small infauna visible. PV image shows small burrows.
Reference	CC-BRS	CCBRS-01	B	Very fine pale tan sand over lightly mottled and slightly darker material. Small void visible in sediment.
Reference	CC-BRS	CCBRS-01	C	Very fine pale tan sand over lightly mottled and slightly darker material. Large void visible in sediment.
Reference	CC-BRS	CCBRS-02	A	Very fine pale tan sand over lightly mottled and slightly darker material. Large void visible in sediment. Ophiuroid arm visible at SWI.
Reference	CC-BRS	CCBRS-02	B	Very fine pale tan sand over lightly mottled and slightly darker material. Worms visible against faceplate deep in sed column. Ophiuroids visible in PV image.
Reference	CC-BRS	CCBRS-02	D	Very fine pale tan sand over lightly mottled and slightly darker material. Small void visible in sediment. Worms visible against faceplate deep in sed column. Ophiuroid arms visible at SWI.
Reference	CC-BRS	CCBRS-03	A	Very fine pale tan sand over lightly mottled and slightly darker material. Worms visible against faceplate deep in sed column. Ophiuroids and large burrow openings visible in PV.
Reference	CC-BRS	CCBRS-03	B	Very fine pale tan sand over lightly mottled and slightly darker material. Small void visible in sediment. Ophiuroids in PV.
Reference	CC-BRS	CCBRS-03	C	Very fine pale tan sand over lightly mottled and slightly darker material. Worms visible against faceplate deep in sed column. Burrows in PV.
Reference	CC-BRS	CCBRS-04	A	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Underlying material is slightly mottled with oxidized sediment. Coarse white particles throughout sediment column. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column. Large ophiuroid at SWI. Small red infauna in sediment column.
Reference	CC-BRS	CCBRS-04	B	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Underlying material is mottled with pale gray and darker gray sediment. Infauna and large burrow transected. Stage 1 tubes at SWI.
Reference	CC-BRS	CCBRS-04	C	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Underlying material is mottled with pale gray and darker gray sediment. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column. Ophiuroid arms visible at SWI. Stage 1 tubes at SWI.
Reference	NW-REF	NWREF-05	A	Very fine pale tan sand and silt/clay over darker material of similar GSMM. Underlying material is lightly mottled with pale gray and darker gray sediment. Partially infilled void at pen maximum.
Reference	NW-REF	NWREF-05	B	Very fine pale tan sand over lightly mottled and slightly darker material. Medium sized burrow halo in sed column. Ophiuroids in PV.
Reference	NW-REF	NWREF-05	D	Very fine pale tan sand over lightly mottled and slightly darker material. Ophiuroids at SWI. Large burrow openings in PV.
Reference	NW-REF	NWREF-06	A	Very fine pale tan sand over lightly mottled and slightly darker material. Small patch of black sediment near pen max. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column. Ophiuroids in PV.
Reference	NW-REF	NWREF-06	B	Very fine pale tan sand over lightly mottled and slightly darker material. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column. Ophiuroids in PV.
Reference	NW-REF	NWREF-06	C	Very fine pale tan sand over lightly mottled and slightly darker material. Ophiuroids visible at SWI. Small burrows visible in PV.
Reference	NW-REF	NWREF-07	A	Very fine pale tan sand over lightly mottled and slightly darker material. Two voids visible deep in sediment column. Stage 1 tubes at SWI.
Reference	NW-REF	NWREF-07	B	Very fine pale tan sand over lightly mottled and slightly darker material. Long burrow halos in sediment column. Ophiuroid visible at SWI.
Reference	NW-REF	NWREF-07	C	Very fine pale tan sand over lightly mottled and slightly darker material. Four voids visible deep in sediment column. Stage 1 tubes at SWI.
Reference	NW-REF	NWREF-08	F	Very fine pale tan sand over lightly mottled and slightly darker material. Ophiuroids in PV.

Area	Location	StationID	Replicate	Comment
Reference	NW-REF	NWREF-08	G	Very fine pale tan sand over lightly mottled and slightly darker material. Two voids visible deep in sediment column. Stage 1 tubes at SWI.
Reference	NW-REF	NWREF-08	H	Very fine pale tan sand over lightly mottled and slightly darker material. Single void visible deep in sediment column. Stage 1 tubes at SWI.
Reference	SW-REF	SWREF-09	A	Very fine pale tan sand over lightly mottled and slightly darker material. Two voids visible deep in sediment column. Stage 1 tubes at SWI.
Reference	SW-REF	SWREF-09	C	Very fine pale tan sand over lightly mottled and slightly darker material. Two voids visible in sediment column. Stage 1 tubes at SWI.
Reference	SW-REF	SWREF-09	E	Very fine pale tan sand over lightly mottled and slightly darker material. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column. Small burrows visible in PV.
Reference	SW-REF	SWREF-10	A	Very fine pale tan sand over lightly mottled and slightly darker material. Large void and burrow transected with polychaete visible. Stage 1 tubes at SWI.
Reference	SW-REF	SWREF-10	B	Very fine pale tan sand over lightly mottled and slightly darker material. Long burrow halos visible. Stage 1 tubes at SWI. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column.
Reference	SW-REF	SWREF-10	C	Very fine pale tan sand over lightly mottled and slightly darker material. Long burrow halos visible. Stage 1 tubes at SWI. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column.
Reference	SW-REF	SWREF-11	A	Very fine pale tan sand over lightly mottled and slightly darker material. Stage 1 tubes at SWI. Deep burrowing textures visible. Large burrow openings in PV.
Reference	SW-REF	SWREF-11	B	Thin layer of very fine pale sand over 2cm thick layer gray fine sand. Tan and pale gray very fine sand to penetration; slightly mottled. Stage 1 tubes at SWI. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column.
Reference	SW-REF	SWREF-11	C	Very fine pale tan sand over lightly mottled and slightly darker material. Stage 1 and 2 tubes at SWI. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column.
Reference	SW-REF	SWREF-12	B	Very fine pale tan sand over lightly mottled and slightly darker material. Stage 1 tubes at SWI. Small organism in midfield at SWI. Long burrow halos in sediment. Worms visible against faceplate deep in sed column. Burrowing textures deep in sed column.
Reference	SW-REF	SWREF-12	C	Very fine pale tan sand over lightly mottled and slightly darker material. Single small void visible in sediment column. Stage 1 tubes at SWI.
Reference	SW-REF	SWREF-12	D	Very fine pale tan sand over lightly mottled and slightly darker material. Long burrow transected extending past max penetration. Stage 1 tubes at SWI.

Area	Location	StationID	Replicate	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?
Disposal	Mound B	B01	A	10/20/2016	15:00:14	52.10	34.74	0.18	Silt/clay	Ox	No		No
Disposal	Mound B	B01	D	10/20/2016	15:02:37	46.96	31.31	0.15	Silt/clay	Ox	No		No
Disposal	Mound B	B01	E	10/20/2016	15:03:22	37.02	24.68	0.09	Silt/clay	Ox	No		No
Disposal	Mound B	B02	G	10/21/2016	10:19:51	IND	IND	IND	Silt/clay	Ox	No		No
Disposal	Mound B	B02	H	10/21/2016	10:20:27	51.69	34.46	0.18	Silt/clay	Ox	No		No
Disposal	Mound B	B02	I	10/21/2016	10:21:07	49.71	33.14	0.16	Silt/clay	Ox	No		No
Disposal	Mound B	B03	A	10/20/2016	15:09:47	46.62	31.08	0.14	Silt/clay	Ox	No		No
Disposal	Mound B	B03	B	10/20/2016	15:10:37	49.12	32.75	0.16	Silt/clay	Ox	No		No
Disposal	Mound B	B03	C	10/20/2016	15:11:29	45.92	30.62	0.14	Silt/clay	Ox	No		No
Disposal	Mound B	B04	C	10/21/2016	8:59:24	43.94	29.30	0.13	Silt/clay	Ox	No		No
Disposal	Mound B	B04	E	10/21/2016	9:14:30	36.91	24.60	0.09	Silt/clay	Ox	No		No
Disposal	Mound B	B04	H	10/21/2016	9:17:50	40.40	26.94	0.11	Silt/clay	Ox	No		No
Disposal	Mound B	B05	A	10/21/2016	9:37:17	34.95	23.30	0.08	Silt/clay	Ox	No		No
Disposal	Mound B	B05	B	10/21/2016	9:37:54	46.73	31.16	0.15	Silt/clay	Ox	No		No
Disposal	Mound B	B05	C	10/21/2016	9:38:35	42.35	28.23	0.12	Silt/clay	Ox	No		No
Disposal	Mound B	B06	I	10/21/2016	10:10:08	54.85	36.57	0.20	Cobble	Ox	No		Yes
Disposal	Mound B	B06	J	10/21/2016	10:11:49	48.90	32.60	0.16	Cobble	Ox	No		Yes
Disposal	Mound B	B06	L	10/21/2016	10:13:03	49.04	32.69	0.16	Gravel	Ox	No		Yes
Disposal	Mound B	B07	C	10/20/2016	14:40:39	42.75	28.50	0.12	Silt/clay	Ox	No		No
Disposal	Mound B	B07	D	10/20/2016	14:41:28	45.64	30.43	0.14	Silt/clay	Ox	No		No
Disposal	Mound B	B07	E	10/20/2016	14:42:20	44.98	29.99	0.13	Silt/clay	Ox	No		No
Disposal	Mound B	B08	I	10/21/2016	10:26:38	47.40	31.60	0.15	Silt/clay	Ox	No		No
Disposal	Mound B	B08	J	10/21/2016	10:27:17	43.87	29.25	0.13	Silt/clay	Ox	No		No
Disposal	Mound B	B08	L	10/21/2016	10:28:34	44.48	29.65	0.13	Silt/clay	Ox	No		No
Disposal	Mound B	B09	C	10/20/2016	15:48:05	35.63	23.76	0.08	Silt/clay	Ox	No		No
Disposal	Mound B	B09	D	10/20/2016	15:48:53	39.13	26.08	0.10	Silt/clay	Ox	No		No
Disposal	Mound B	B09	E	10/20/2016	15:49:41	41.17	27.45	0.11	Silt/clay	Ox	No		No
Disposal	Mound B	B10	A	10/20/2016	16:38:38	39.21	26.14	0.10	Silt/clay	Ox	No		No
Disposal	Mound B	B10	B	10/20/2016	16:39:30	44.50	29.66	0.13	Silt/clay	Ox	No		No
Disposal	Mound B	B10	C	10/20/2016	16:40:16	36.59	24.40	0.09	Silt/clay	Ox	No		No

Area	Location	StationID	Replicate	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?
Disposal	Mound B	B11	A	10/20/2016	14:52:48	57.14	38.10	0.22	Silt/clay	Ox	No		No
Disposal	Mound B	B11	B	10/20/2016	14:53:37	39.92	26.61	0.11	Silt/clay	Ox	No		No
Disposal	Mound B	B11	D	10/20/2016	14:55:06	43.02	28.68	0.12	Silt/clay	Ox	No		No
Disposal	Mound B	B12	E	10/20/2016	16:29:06	34.73	23.15	0.08	Silt/clay	Ox	No		No
Disposal	Mound B	B12	G	10/20/2016	16:30:43	39.29	26.20	0.10	Silt/clay	Ox	No		No
Disposal	Mound B	B12	H	10/20/2016	16:31:33	41.85	27.90	0.12	Silt/clay	Ox	No		No
Disposal	Mound C	C13	A	10/20/2016	12:32:36	57.78	38.52	0.22	Silt/clay	Ox	No		No
Disposal	Mound C	C13	B	10/20/2016	12:33:18	51.90	34.60	0.18	Silt/clay	Ox	No		No
Disposal	Mound C	C13	C	10/20/2016	12:34:05	42.74	28.49	0.12	Silt/clay	Ox	No		No
Disposal	Mound C	C14	A	10/20/2016	12:10:45	51.45	34.30	0.18	Silt/clay	Ox	No		No
Disposal	Mound C	C14	B	10/20/2016	12:11:34	44.33	29.55	0.13	Silt/clay	Ox	No		No
Disposal	Mound C	C14	C	10/20/2016	12:12:22	33.75	22.50	0.08	Silt/clay	Ox	No		No
Disposal	Mound C	C15	A	10/20/2016	13:47:33	50.75	33.83	0.17	Silt/clay	Ox	No		No
Disposal	Mound C	C15	B	10/20/2016	13:48:24	38.25	25.50	0.10	Silt/clay	Ox	No		No
Disposal	Mound C	C15	C	10/20/2016	13:49:16	39.98	26.65	0.11	Silt/clay	Ox	No		No
Disposal	Mound C	C16	B	10/20/2016	12:22:44	37.73	25.15	0.09	Silt/clay	Ox	No		No
Disposal	Mound C	C16	C	10/20/2016	12:23:28	47.76	31.84	0.15	Silt/clay	Ox	No		No
Disposal	Mound C	C16	D	10/20/2016	12:24:17	43.88	29.25	0.13	Silt/clay	Ox	No		No
Disposal	Mound C	C17	A	10/20/2016	13:55:42	53.72	35.81	0.19	Silt/clay	Ox	No		No
Disposal	Mound C	C17	B	10/20/2016	13:56:29	48.61	32.41	0.16	Silt/clay	Ox	No		No
Disposal	Mound C	C17	D	10/20/2016	13:58:08	34.03	22.69	0.08	Silt/clay	Ox	No		No
Disposal	Mound C	C18	A	10/20/2016	14:05:54	50.21	33.47	0.17	Silt/clay	Ox	No		No
Disposal	Mound C	C18	B	10/20/2016	14:06:45	54.00	36.00	0.19	Silt/clay	Ox	No		No
Disposal	Mound C	C18	C	10/20/2016	14:07:37	38.95	25.97	0.10	Silt/clay	Ox	No		No
Disposal	Mound C	C19	A	10/20/2016	14:11:53	51.38	34.26	0.18	Silt/clay	Ox	No		No
Disposal	Mound C	C19	B	10/20/2016	14:12:47	47.42	31.61	0.15	Silt/clay	Ox	No		No
Disposal	Mound C	C19	C	10/20/2016	14:13:46	49.35	32.90	0.16	Silt/clay	Ox	No		No
Disposal	Mound C	C20	A	10/20/2016	11:18:13	54.30	36.20	0.20	Silt/clay	Ox	No		No
Disposal	Mound C	C20	B	10/20/2016	11:19:02	48.46	32.31	0.16	Silt/clay	Ox	No		No
Disposal	Mound C	C20	C	10/20/2016	11:19:52	40.66	27.10	0.11	Silt/clay	Ox	No		No
Disposal	Mound C	C21	A	10/20/2016	11:28:07	46.15	30.77	0.14	Silt/clay	Ox	No		No
Disposal	Mound C	C21	B	10/20/2016	11:28:53	52.60	35.06	0.18	Silt/clay	Ox	No		No
Disposal	Mound C	C21	D	10/20/2016	11:30:29	36.65	24.43	0.09	Silt/clay	Ox	No		No
Disposal	Mound C	C22	A	10/20/2016	11:05:57	53.79	35.86	0.19	Silt/clay	>50% Ox	No		No
Disposal	Mound C	C22	B	10/20/2016	11:06:44	47.10	31.40	0.15	Silt/clay	Ox	No		No

Area	Location	StationID	Replicate	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?
Disposal	Mound C	C22	C	10/20/2016	11:07:26	39.54	26.36	0.10	Silt/clay	>50% Ox	No		No
Disposal	Mound C	C23	A	10/20/2016	11:42:53	60.02	40.02	0.24	Silt/clay	Ox	No		No
Disposal	Mound C	C23	B	10/20/2016	11:43:47	39.22	26.14	0.10	Silt/clay	Ox	No		No
Disposal	Mound C	C23	C	10/20/2016	11:44:36	40.63	27.08	0.11	Silt/clay	Ox	No		No
Disposal	Mound C	C24	A	10/20/2016	11:52:23	46.25	30.83	0.14	Silt/clay	Ox	No		No
Disposal	Mound C	C24	C	10/20/2016	11:53:57	54.09	36.06	0.20	Silt/clay	Ox	No		No
Disposal	Mound C	C24	D	10/20/2016	11:54:42	49.41	32.94	0.16	Silt/clay	Ox	No		No
Disposal	Mound C	C25	A	10/20/2016	12:02:58	54.15	36.10	0.20	Silt/clay	Ox	No		No
Disposal	Mound C	C25	B	10/20/2016	12:03:47	52.51	35.01	0.18	Silt/clay	Ox	No		No
Disposal	Mound C	C25	C	10/20/2016	12:04:34	52.63	35.09	0.18	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-01	A	10/21/2016	11:59:35	42.74	28.49	0.12	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-01	B	10/21/2016	12:00:15	41.96	27.97	0.12	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-01	C	10/21/2016	12:00:55	35.57	23.71	0.08	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-02	A	10/21/2016	11:51:00	44.60	29.73	0.13	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-02	B	10/21/2016	11:51:38	38.64	25.76	0.10	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-02	C	10/21/2016	11:52:19	35.85	23.90	0.09	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-03	A	10/21/2016	11:43:13	46.43	30.95	0.14	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-03	B	10/21/2016	11:43:53	46.13	30.75	0.14	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-03	C	10/21/2016	11:44:30	38.06	25.37	0.10	Silt/clay	Ox	No		No
Reference	CC-BRS	CCBRS-04	A	10/21/2016	12:07:37	38.38	25.58	0.10	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-05	A	10/21/2016	11:23:35	42.51	28.34	0.12	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-05	C	10/21/2016	11:24:49	49.90	33.27	0.17	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-05	D	10/21/2016	11:25:26	39.63	26.42	0.10	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-06	A	10/21/2016	11:29:00	41.73	27.82	0.12	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-06	B	10/21/2016	11:29:37	41.38	27.59	0.11	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-06	D	10/21/2016	11:30:51	39.51	26.34	0.10	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-07	A	10/21/2016	11:14:21	44.22	29.48	0.13	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-08	F	10/21/2016	11:05:50	41.53	27.69	0.12	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-08	G	10/21/2016	11:06:33	44.41	29.60	0.13	Silt/clay	Ox	No		No
Reference	NW-REF	NWREF-08	H	10/21/2016	11:07:17	45.18	30.12	0.14	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-09	A	10/20/2016	9:27:57	38.20	25.47	0.10	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-09	D	10/20/2016	9:30:57	51.20	34.13	0.17	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-09	E	10/20/2016	9:31:47	52.30	34.86	0.18	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-10	B	10/20/2016	9:52:53	39.55	26.37	0.10	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-10	C	10/20/2016	9:53:34	48.31	32.21	0.16	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-10	D	10/20/2016	9:54:18	44.50	29.66	0.13	Silt/clay	Ox	No		No

Area	Location	StationID	Replicate	Date	Time	Image Width (cm)	Image Height (cm)	Field of View	Sediment Type	Surface Oxidation	Beggiatoa Present?	Beggiatoa Type/Extent	Dredged Material Present?
Reference	SW-REF	SWREF-11	A	10/20/2016	10:04:57	46.76	31.18	0.15	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-11	B	10/20/2016	10:05:39	40.59	27.06	0.11	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-11	C	10/20/2016	10:06:16	45.09	30.06	0.14	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-12	A	10/20/2016	10:16:04	42.26	28.18	0.12	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-12	B	10/20/2016	10:16:49	47.32	31.54	0.15	Silt/clay	Ox	No		No
Reference	SW-REF	SWREF-12	D	10/20/2016	10:18:20	43.66	29.11	0.13	Silt/clay	Ox	No		No

Area	Location	StationID	Replicate	Dredged Material Notes	Debris	Bedforms	Tubes	Burrows	Tracks
Disposal	Mound B	B01	A		None	None	Abundant (25-75%)	None	Sparse (<10%)
Disposal	Mound B	B01	D		None	None	Abundant (25-75%)	None	Sparse (<10%)
Disposal	Mound B	B01	E		None	None	Present (10-25%)	Present (10-25%)	Present (10-25%)
Disposal	Mound B	B02	G		Large shell fragments	None	Present (10-25%)	None	None
Disposal	Mound B	B02	H		Large shell fragments	None	Present (10-25%)	None	Present (10-25%)
Disposal	Mound B	B02	I		None	None	Present (10-25%)	Sparse (<10%)	Present (10-25%)
Disposal	Mound B	B03	A		None	None	Present (10-25%)	Sparse (<10%)	None
Disposal	Mound B	B03	B		None	None	Sparse (<10%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound B	B03	C		None	None	Present (10-25%)	None	None
Disposal	Mound B	B04	C		None	None	Present (10-25%)	None	Sparse (<10%)
Disposal	Mound B	B04	E		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound B	B04	H		None	None	Abundant (25-75%)	Present (10-25%)	Present (10-25%)
Disposal	Mound B	B05	A		None	None	Present (10-25%)	None	Sparse (<10%)
Disposal	Mound B	B05	B		None	None	Present (10-25%)	None	Abundant (25-75%)
Disposal	Mound B	B05	C		None	None	Present (10-25%)	Present (10-25%)	Present (10-25%)
Disposal	Mound B	B06	I	Cobbles and coarse sediment	Cobbles	None	Sparse (<10%)	None	None
Disposal	Mound B	B06	J	Cobbles and coarse sediment	Cobbles	None	Sparse (<10%)	None	None
Disposal	Mound B	B06	L	Cobbles and coarse sediment	Cobbles	None	Sparse (<10%)	None	None
Disposal	Mound B	B07	C		None	None	Sparse (<10%)	None	None
Disposal	Mound B	B07	D		None	None	Sparse (<10%)	None	None
Disposal	Mound B	B07	E		None	None	Sparse (<10%)	None	None
Disposal	Mound B	B08	I		Large shell fragments and cobbles	None	Sparse (<10%)	None	None
Disposal	Mound B	B08	J		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound B	B08	L		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound B	B09	C		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound B	B09	D		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound B	B09	E		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound B	B10	A		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound B	B10	B		None	None	Abundant (25-75%)	None	Present (10-25%)
Disposal	Mound B	B10	C		None	None	Present (10-25%)	Present (10-25%)	Present (10-25%)

Area	Location	StationID	Replicate	Dredged Material Notes	Debris	Bedforms	Tubes	Burrows	Tracks
Disposal	Mound B	B11	A		None	None	Sparse (<10%)	None	None
Disposal	Mound B	B11	B		None	None	Present (10-25%)	None	Sparse (<10%)
Disposal	Mound B	B11	D		None	None	Sparse (<10%)	None	None
Disposal	Mound B	B12	E		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound B	B12	G		None	None	Sparse (<10%)	None	Abundant (25-75%)
Disposal	Mound B	B12	H		None	None	Sparse (<10%)	None	Sparse (<10%)
Disposal	Mound C	C13	A		None	None	None	Sparse (<10%)	Present (10-25%)
Disposal	Mound C	C13	B		None	None	None	Sparse (<10%)	Present (10-25%)
Disposal	Mound C	C13	C		None	None	None	Sparse (<10%)	Present (10-25%)
Disposal	Mound C	C14	A		None	None	Sparse (<10%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound C	C14	B		None	None	Sparse (<10%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C14	C		None	None	Sparse (<10%)	None	Present (10-25%)
Disposal	Mound C	C15	A		None	None	Present (10-25%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C15	B		None	None	Present (10-25%)	None	None
Disposal	Mound C	C15	C		None	None	Present (10-25%)	None	Sparse (<10%)
Disposal	Mound C	C16	B		None	None	Present (10-25%)	Sparse (<10%)	Present (10-25%)
Disposal	Mound C	C16	C		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C16	D		None	None	Present (10-25%)	Abundant (25-75%)	Present (10-25%)
Disposal	Mound C	C17	A		None	None	Sparse (<10%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C17	B		None	None	Sparse (<10%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C17	D		None	None	Present (10-25%)	None	None
Disposal	Mound C	C18	A		None	None	Sparse (<10%)	None	None
Disposal	Mound C	C18	B		None	None	Sparse (<10%)	None	None
Disposal	Mound C	C18	C		None	None	Sparse (<10%)	Abundant (25-75%)	None
Disposal	Mound C	C19	A		None	None	Present (10-25%)	Present (10-25%)	None
Disposal	Mound C	C19	B		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound C	C19	C		None	None	Sparse (<10%)	None	None
Disposal	Mound C	C20	A		None	None	Sparse (<10%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C20	B		None	None	Present (10-25%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C20	C		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C21	A		None	None	Sparse (<10%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C21	B		None	None	Sparse (<10%)	Sparse (<10%)	Abundant (25-75%)
Disposal	Mound C	C21	D		None	None	Present (10-25%)	None	Sparse (<10%)
Disposal	Mound C	C22	A		None	None	Present (10-25%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C22	B		None	None	Present (10-25%)	Sparse (<10%)	None

Area	Location	StationID	Replicate	Dredged Material Notes	Debris	Bedforms	Tubes	Burrows	Tracks
Disposal	Mound C	C22	C		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C23	A		None	None	Sparse (<10%)	Present (10-25%)	Present (10-25%)
Disposal	Mound C	C23	B		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C23	C		None	None	Abundant (25-75%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C24	A		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound C	C24	C		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound C	C24	D		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound C	C25	A		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Disposal	Mound C	C25	B		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Disposal	Mound C	C25	C		None	None	Abundant (25-75%)	Present (10-25%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-01	A		None	None	Sparse (<10%)	Sparse (<10%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-01	B		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-01	C		None	None	Sparse (<10%)	None	None
Reference	CC-BRS	CCBRS-02	A		None	None	Present (10-25%)	None	Sparse (<10%)
Reference	CC-BRS	CCBRS-02	B		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-02	C		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-03	A		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-03	B		None	None	Present (10-25%)	None	None
Reference	CC-BRS	CCBRS-03	C		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Reference	CC-BRS	CCBRS-04	A		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	NW-REF	NWREF-05	A		None	None	Present (10-25%)	None	None
Reference	NW-REF	NWREF-05	C		None	None	Present (10-25%)	Abundant (25-75%)	Abundant (25-75%)
Reference	NW-REF	NWREF-05	D		None	None	Present (10-25%)	Sparse (<10%)	None
Reference	NW-REF	NWREF-06	A		None	None	Present (10-25%)	None	None
Reference	NW-REF	NWREF-06	B		None	None	Present (10-25%)	None	None
Reference	NW-REF	NWREF-06	D		None	None	Present (10-25%)	Sparse (<10%)	None
Reference	NW-REF	NWREF-07	A		None	None	Present (10-25%)	None	None
Reference	NW-REF	NWREF-08	F		None	None	Present (10-25%)	None	None
Reference	NW-REF	NWREF-08	G		None	None	Present (10-25%)	None	None
Reference	NW-REF	NWREF-08	H		None	None	Present (10-25%)	None	None
Reference	SW-REF	SWREF-09	A		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	SW-REF	SWREF-09	D		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	SW-REF	SWREF-09	E		None	None	Present (10-25%)	Present (10-25%)	Sparse (<10%)
Reference	SW-REF	SWREF-10	B		None	None	Present (10-25%)	Present (10-25%)	None
Reference	SW-REF	SWREF-10	C		None	None	Present (10-25%)	None	None
Reference	SW-REF	SWREF-10	D		None	None	Present (10-25%)	None	Sparse (<10%)

Area	Location	StationID	Replicate	Dredged Material Notes	Debris	Bedforms	Tubes	Burrows	Tracks
Reference	SW-REF	SWREF-11	A		None	None	Present (10-25%)	Abundant (25-75%)	Sparse (<10%)
Reference	SW-REF	SWREF-11	B		None	None	Present (10-25%)	None	None
Reference	SW-REF	SWREF-11	C		None	None	Present (10-25%)	Sparse (<10%)	None
Reference	SW-REF	SWREF-12	A		None	None	Present (10-25%)	Sparse (<10%)	Sparse (<10%)
Reference	SW-REF	SWREF-12	B		None	None	Present (10-25%)	Sparse (<10%)	Present (10-25%)
Reference	SW-REF	SWREF-12	D		None	None	Present (10-25%)	None	Present (10-25%)

Area	Location	StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
Disposal	Mound B	B01	A	None	None	0	Pale tan fines with many small tubes visible.
Disposal	Mound B	B01	D	None	None	0	Pale tan fines with many small tubes visible.
Disposal	Mound B	B01	E	None	None	0	Pale tan fines with many small tubes visible. Several burrows visible. Thin line of tracks.
Disposal	Mound B	B02	G	None	None	0	Pale tan fines with gravels and shell fragments. Small tubes visible. Right laser not visible.
Disposal	Mound B	B02	H	None	None	0	Pale tan fines with gravels and shell fragments. Small tubes visible. Thin tracks in sediment.
Disposal	Mound B	B02	I	Gastropods	None	0	Pale tan fines with small tubes visible. Thin tracks. Several small orange gastropods.
Disposal	Mound B	B03	A	None	None	0	Pale tan fines with small tubes visible. Few small burrows
Disposal	Mound B	B03	B	Gastropods	None	0	Pale tan fines with small tubes visible. Few small burrows. Thin tracks. Small orange gastropods
Disposal	Mound B	B03	C	None	None	0	Pale tan fines with many small tubes visible.
Disposal	Mound B	B04	C	None	None	0	Pale tan fines with many small tubes visible. Small tracks.
Disposal	Mound B	B04	E	None	None	0	Pale tan fines with many small tubes visible. Small tracks. Small burrows. Image taken very close to sediment.
Disposal	Mound B	B04	H	None	None	0	Pale tan fines with many small tubes visible. Small tracks. Small burrows.
Disposal	Mound B	B05	A	None	None	0	Pale tan fines with small tubes visible. Few thin tracks.
Disposal	Mound B	B05	B	None	None	0	Pale tan fines with small tubes visible. Many thin tracks visible over sediment.
Disposal	Mound B	B05	C	Gastropods	None	0	Pale tan fines with small tubes visible. Many thin tracks vis Small burrow openings visible. Very small gastropods visible over sediment.
Disposal	Mound B	B06	I	Hydroids, sponges	None	0	Pale tan sand between large cobbles. Cobbles are encrusted with hydroids and sponges.
Disposal	Mound B	B06	J	Hydroids, sponges	None	0	Pale tan sand and gravels between large cobbles. Cobbles are encrusted with hydroids and sponges.
Disposal	Mound B	B06	L	Hydroids, sponges	None	0	Pale tan sand and gravels between large cobbles. Bivalve siphon visible in sediment.
Disposal	Mound B	B07	C	Ophiuroids	None	0	Pale tan fines covered with ophiuroids.
Disposal	Mound B	B07	D	Ophiuroids	None	0	Pale tan fines covered with ophiuroids.
Disposal	Mound B	B07	E	Ophiuroids	None	0	Pale tan fines covered with ophiuroids.
Disposal	Mound B	B08	I	Paguroid	None	0	Pale tan fines covered with cobbles and large shell fragments
Disposal	Mound B	B08	J	None	None	0	Pale tan fines with few small tubes and thin shallow tracks.
Disposal	Mound B	B08	L	None	None	0	Pale tan fines with few small tubes and thin shallow tracks. Large hole in sediment.
Disposal	Mound B	B09	C	Crab	None	0	Pale tan fines with few small tubes and thin shallow tracks. Large crab in view.
Disposal	Mound B	B09	D	None	None	0	Pale tan fines with few small tubes and thin shallow tracks. Reduced material strewn over sediment surface; likely from previous penetration.
Disposal	Mound B	B09	E	None	None	0	Pale tan fines with few small tubes and thin shallow tracks.
Disposal	Mound B	B10	A	None	None	0	Pale tan fines with small tubes and several large burrow openings.
Disposal	Mound B	B10	B	None	None	0	Pale tan fines with small tubes and thin shallow tracks.
Disposal	Mound B	B10	C	None	None	0	Pale tan fines with small tubes and single large burrow opening.

Area	Location	StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
Disposal	Mound B	B11	A	Ophiuroids	None	0	Pale tan fines covered with ophiuroids.
Disposal	Mound B	B11	B	None	None	0	Pale tan fines with small tubes and thin shallow tracks.
Disposal	Mound B	B11	D	Ophiuroids, paguroid	None	0	Pale tan fines covered with ophiuroids. Small hermit crab.
Disposal	Mound B	B12	E	None	None	0	Pale tan fines with small tubes and thin shallow tracks.
Disposal	Mound B	B12	G	None	None	0	Pale tan fines with small tubes and many large tracks.
Disposal	Mound B	B12	H	None	None	0	Pale tan fines with small tubes and thin shallow tracks.
Disposal	Mound C	C13	A	Nudibranchs	None	0	Pale tan silt/clay with large tracks and burrow openings. Image is blurred.
Disposal	Mound C	C13	B	Nudibranchs	None	0	Pale tan silt/clay with large tracks and burrow openings.
Disposal	Mound C	C13	C	None	None	0	Pale tan silt/clay with large tracks and burrow openings.
Disposal	Mound C	C14	A	Nudibranchs	None	0	Pale tan silt/clay with few small tubes, single large burrow opening.
Disposal	Mound C	C14	B	None	None	0	Pale tan silt/clay with few small tubes, few tracks.
Disposal	Mound C	C14	C	None	None	0	Pale tan silt/clay with few small tubes, few tracks.
Disposal	Mound C	C15	A	None	None	0	Pale tan silt/clay with small tubes and thin tracks. Large burrow depression visible.
Disposal	Mound C	C15	B	None	None	0	Pale tan silt/clay with few small tubes.
Disposal	Mound C	C15	C	None	None	0	Pale tan silt/clay with few small tubes.
Disposal	Mound C	C16	B	Nudibranchs	None	0	Pale tan silt/clay with few small tubes, few tracks. Small burrows.
Disposal	Mound C	C16	C	Nudibranchs	None	0	Pale tan silt/clay with few small tubes, few tracks. Small burrows.
Disposal	Mound C	C16	D	None	None	0	Pale tan silt/clay with few small tubes, few tracks. Large burrows.
Disposal	Mound C	C17	A	None	None	0	Pale tan silt/clay with few small tubes, small burrows. Lines of parallel tracks.
Disposal	Mound C	C17	B	None	None	0	Pale tan silt/clay with few small tubes, small burrows. Small tracks in lower right.
Disposal	Mound C	C17	D	None	None	0	Pale tan silt/clay with few small tubes. Reduced material I n lower right.
Disposal	Mound C	C18	A	None	None	0	Pale tan silt/clay with few small tubes.
Disposal	Mound C	C18	B	Nudibranchs	None	0	Pale tan silt/clay with few small tubes.
Disposal	Mound C	C18	C	None	None	0	Pale tan silt/clay with few small tubes. Large burrow opening with organisms visible on side of burrow.
Disposal	Mound C	C19	A	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Two large burrows visible.
Disposal	Mound C	C19	B	None	None	0	Pale tan silt/clay with few small tubes. Small burrows present.
Disposal	Mound C	C19	C	None	None	0	Pale tan silt/clay with few small tubes.
Disposal	Mound C	C20	A	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Many small burrows and track depressions. Gastropods.
Disposal	Mound C	C20	B	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Many small burrows and track depressions. Gastropods. Small patches of gray sediment.
Disposal	Mound C	C20	C	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Few small burrows and tracks. Gastropods.
Disposal	Mound C	C21	A	None	None	0	Pale tan silt/clay with few small tubes. Few small burrows and tracks.
Disposal	Mound C	C21	B	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Few small burrows and abundant tracks.
Disposal	Mound C	C21	D	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Few small tracks.
Disposal	Mound C	C22	A	None	None	0	Pale tan silt/clay with few small tubes. Long thin tracks. Small and few large burrow openings visible. Small patches of reduced sediment visible.
Disposal	Mound C	C22	B	Nudibranchs	None	0	Pale tan silt/clay with few small tubes. Large reduced clast impacting sediment.

Area	Location	StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
Disposal	Mound C	C22	C	None	None	0	Pale tan silt/clay with few small tubes. Few small tracks. Small patch of reduced sediment.
Disposal	Mound C	C23	A	None	None	0	Pale tan silt/clay with few small tubes. Few small tracks. Surface is slightly hummocky.
Disposal	Mound C	C23	B	None	None	0	Pale tan silt/clay with few small tubes. Long thin tracks visible.
Disposal	Mound C	C23	C	Nudibranchs	None	0	Pale tan silt/clay with small tubes. Nudibranchs.
Disposal	Mound C	C24	A	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Disposal	Mound C	C24	C	Nudibranchs	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Disposal	Mound C	C24	D	Nudibranchs	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Disposal	Mound C	C25	A	Shrimp, gastropods	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,. Gastropods and shrimp on sediment.
Disposal	Mound C	C25	B	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Disposal	Mound C	C25	C	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Reference	CC-BRS	CCBRS-01	A	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Reference	CC-BRS	CCBRS-01	B	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Reference	CC-BRS	CCBRS-01	C	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Abundant ophiuroids over sediment.
Reference	CC-BRS	CCBRS-02	A	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Abundant ophiuroids over sediment.
Reference	CC-BRS	CCBRS-02	B	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Abundant ophiuroids over sediment.
Reference	CC-BRS	CCBRS-02	C	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Abundant ophiuroids over sediment.
Reference	CC-BRS	CCBRS-03	A	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Abundant ophiuroids over sediment.
Reference	CC-BRS	CCBRS-03	B	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	CC-BRS	CCBRS-03	C	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids arms visible. Large burrow.
Reference	CC-BRS	CCBRS-04	A	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-05	A	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-05	C	None	None	0	Pale tan silt/clay with small tubes. Three very large burrows in sediment. Several smaller burrows. Abundant long and thin tracks.
Reference	NW-REF	NWREF-05	D	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-06	A	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-06	B	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-06	D	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-07	A	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-08	F	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-08	G	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	NW-REF	NWREF-08	H	Ophiuroids	None	0	Pale tan silt/clay with small tubes. Ophiuroids over sediment.
Reference	SW-REF	SWREF-09	A	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Reference	SW-REF	SWREF-09	D	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Reference	SW-REF	SWREF-09	E	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible,.
Reference	SW-REF	SWREF-10	B	None	None	0	Pale tan silt/clay with small tubes.
Reference	SW-REF	SWREF-10	C	Nudibranchs	None	0	Pale tan silt/clay with small tubes. Small nudibranch visible.
Reference	SW-REF	SWREF-10	D	None	None	0	Pale tan silt/clay with small tubes. Tracks visible,.

Area	Location	StationID	Replicate	Epifauna	Flora	Number of Fish	Comments
Reference	SW-REF	SWREF-11	A	None	None	0	Pale tan silt/clay with small tubes. Tracks visible. Very large burrows in sediment.
Reference	SW-REF	SWREF-11	B	Seastar	None	0	Pale tan silt/clay with small tubes. Arm of sea star visible.
Reference	SW-REF	SWREF-11	C	None	None	0	Pale tan silt/clay with small tubes. Single small burrow.
Reference	SW-REF	SWREF-12	A	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible.
Reference	SW-REF	SWREF-12	B	None	None	0	Pale tan silt/clay with small tubes. Tracks and burrows visible.
Reference	SW-REF	SWREF-12	D	None	None	0	Pale tan silt/clay with small tubes. Tracks visible.

APPENDIX F

GRAIN SIZE SCALE FOR SEDIMENTS

APPENDIX F

GRAIN SIZE SCALE FOR SEDIMENTS

Phi (Φ) Size	**Size Range (mm)**	**Size Class (Wentworth Class)**
<-1	>2	Gravel
0 to –1	1 to 2	Very coarse sand
1 to 0	0.5 to 1	Coarse sand
2 to 1	0.25 to 0.5	Medium sand
3 to 2	0.125 to 0.25	Fine sand
4 to 3	0.0625 to 0.125	Very fine sand
>4	<0.0625	Silt/clay