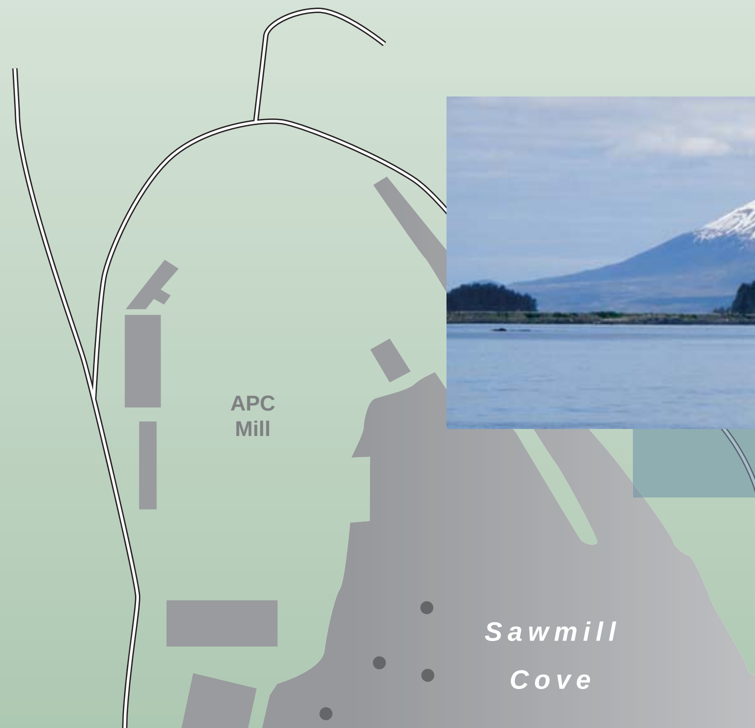
April 2012

Silver Bay Monitoring Program

2011 Long Term Benthic Monitoring and Bioaccumulation Survey in Sawmill Cove, Ak



Prepared for:

City and Borough of Sitka
100 Lincoln Street,
Sitka, Alaska 99835

Purchase Order 11-0024907

Prepared by:

Germano & Associates, Inc.
12100 SE 46th Place
Bellevue, WA 98006

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The Ballad of Sawmill Cove, 2011

by Joe Germano

Come and listen for a moment, friends, take heed of what I say
About what we found in samples that we took in Silver Bay,
Well, Alaska Pulp shut down the mill way back in '93
And the tests were done to see if there was some toxicity.
Instead of mud, the bottom of the Cove was logs and pulp
And the costs of all the RI sampling made some people gulp
So they drew a line where wood was found and called it AOC
And then analyzed for metals, PAH and PCBs.

Well the RI did in fact conclude there were no COC's
So the Record of Decision said: "Natural Recovery"
Even though there were alternatives with engineering force
The solution was to just let mother nature run her course.
But some monitoring was needed to insure that this took place
Or else the City and ADEC would have egg on their face.
So in summer of 2000 all the baseline tasks were done
To see if a wasteland did exist or recovery had begun.

Then with video and bottom grabs and profile camera too
The whole AOC in Sawmill Cove was sampled through and through.
And when areas that fish and shrimp used were put on the map
It would reassure them they were right when they said not to cap.
The profile camera and the grabs did show for all to see
Most of the site's recolonized with Stages 1 through 3.
And it's really not surprising that things happened as they should
After all, this isn't hazardous waste, it's just a pile of wood.

Well, ten years have passed and just as planned, we had returned to see
If the spread of benthos had increased inside the AOC.
And to minimize the risks and prove that all the goals were met,
Some more mud was analyzed to prove dioxin was no threat.
Even though the wood chips still look fresh and found throughout the site,
Dioxin risk does not exist and benthos are all right.
So the problems caused by APC are part of history
Because Silver Bay is on its way to full recovery.

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LIST OF ACRONYMS

ACE	U.S. Army Corps of Engineers
AKDT	Alaska Daylight Time
AOC	Area of Concern
aRPD	apparent Redox Potential Discontinuity
BAF	bioaccumulation factor
BSAF	Biota-sediment accumulation factor
CAS	Columbia Analytical Services
cm	centimeter
DEC	Alaska Department of Environmental Conservation
DGPS	Differential Global Positioning System
DO	Dissolved Oxygen
EDL	Estimated Detection Limit
Eh	Voltage potential with respect to the standard hydrogen electrode
EPA	U.S. Environmental Protection Agency
EVS	EVS Environment Consultants
G&A	Germano & Associates
HRGC/HRMS	Gas Chromatography/High Resolution Mass Spectrometry
Ind	Indeterminate
JPEG	Joint Photographic Expert Group
KM	Kaplan Meier
LOAEL	Lowest observed adverse effects level
m	meter
m^{-2}	per square meter
MDL	Method Detection Limit
$mg\ L^{-1}$	milligrams per liter
mL	milliliter
mm	millimeter
$m\ sec^{-1}$	meter per second
n	Number of observations
NEF	Nikon Exchange Format
NH_3	Un-ionized ammonia
NH_4^+	Ionized ammonia
NOAEL	No observed adverse effects level
p	Probability

PDF	Portable Document Format
pg g^{-1}	picograms per gram
pH	Negative log of hydrogen ion concentration
PV	Plan View
PVI	Plan View Imaging
QAPP	Quality Assurance Project Plan
r	Measure of the linear relationship between two variables
RAO	Remedial Action Objective
RPD	Relative Percent Difference
ROD	Record of Decision
SOD	Sediment Oxygen Demand
SPI	Sediment Profile Imaging
SPI/PV	Sediment Profile Image/Plan View Image
TCDD	Tetrachlorodibenzo-*p*-dioxin
TEF	Toxicity Equivalent Factor
TEQ	Toxicity Equivalent
TOC	Total organic carbon
TRV	Toxicity Reference Value
UHF	Ultra-High Frequency
UTM	Universal Transverse Mercator
WGS	World Geodetic System
WHO	World Health Organization
wt	Weight
α	Type-1 error
δ	Ecologically meaningful difference
ϕ	Phi

Executive Summary

Sawmill Cove is located near the mouth of Silver Bay in southeast Alaska approximately three miles east of the City and Borough of Sitka. The cove was the receiving point for effluent and storm water discharges from the Alaska Pulp Mill, which produced pulp at the site from 1959 to 1993. Operations at the mill resulted in the accumulation of wood solids and associated contaminants on the seafloor from an historic outfall adjacent to the site.

A remedial investigation of the Bay Operable Unit, which encompassed Sawmill Cove and the shoreline area of Silver Bay and Galankin Island, was conducted in the mid-1990's, and the results from those studies indicated that a portion of Sawmill Cove, designated as the initial AOC, remained adversely affected from past operations. The option chosen in the final the remedial action objective (RAO) issued by the Alaska Department of Environmental Conservation (DEC) was natural recovery with continued monitoring at 10-year intervals; the baseline survey for the RAO was carried out in 2000 by EVS Environment Consultants. Baseline results indicated that benthic habitat conditions and recovery status could be assessed using *in situ* photographs of the sediment, and that it was no longer necessary to include benthic community analysis of discrete sediment samples. Other findings indicated that the first two RAO recovery milestones (shown in Table E-1) had been achieved by 2000: 81 percent of the site was covered with decomposers (bacterial colonies, most likely *Beggiatoa* spp.) (Milestone 1), and primary consumers (Stage 1 polychaetes) were present in sufficient densities (89 percent) of the stations sampled (Milestone 2). Approximately 16 percent of the initial AOC had fully recovered and achieved the final milestone, and therefore required no further monitoring. Twenty-two (22) percent was in transition to the final recovery stage with notable abundances of deposit-feeding taxa. Sixty-two percent of the initial AOC was still considered seriously impaired in 2000 as far as benthic community status. Based on these results, the AOC designated for continued monitoring was stratified and reduced in area by approximately 16 percent.

Table E-1. AOC Recovery Milestones.

Milestone	Area	Time (Years)	Successional Stage
1	>75 % coverage of the Initial AOC	5–10	Decomposers and primary producers
2	>75 % coverage of the Initial AOC	10–20	Primary consumers and detritivores
3	>75 % coverage of the Initial AOC	20–40	Secondary consumers
4	>75 % coverage of the Initial AOC	> 40	Climax (equilibrium) community

In May 2011, Germano and Associates (G&A) on behalf of the City and Borough of Sitka conducted the first "post baseline" 10-year interval monitoring survey (to verify if the minimum requirements outlined in Milestone 2 of the above table had been met or exceeded). The overall objectives of the 2011 monitoring program were as follows:

> **Performance Measure 1**: *"Document the observable succession of benthic species (living both on and in the sediments) that will result in balanced, stable communities as assessed by measures of abundance and diversity at various locations over time."*

Performance Measure 2: *"Include a bioaccumulation survey to evaluate the potential change in dioxin concentrations that may occur, over time, in the tissues of various target species."*

The ultimate goal for Performance Measure 1 is to have at least 75 percent of the initial Sawmill Cove Area of Concern (AOC) in an equilibrium community by the year 2040 based on the ecological recovery management milestones shown in Table E-1. The objective of Performance Measure 2 was to determine if there is a potential for the mill-related sediment contaminant, dioxin, to bioaccumulate to harmful levels in targeted marine species in the AOC.

A combination of sediment profile and plan-view (SPI/PV) imaging was performed to address Performance Measure 1, and sediment sampling with resulting chemical analyses and bioaccumulation testing were performed to address Performance Measure 2. The results from the combined SPI/PV survey provided a comprehensive update to the earlier baseline study results from eleven years ago.

There were two significant findings from the 2011 SPI/PV survey that update the predictions/trends documented in the 2000 baseline survey (which compared its results to the earlier 1994-95 Remedial Investigation data):

1. The rate of decomposition of the wood waste particles is much slower than anticipated.
2. An additional major source of organic input to the Sawmill Cove benthic ecosystem since the 2000 survey will undoubtedly affect the rate of recovery the remaining areas of bottom still affected by the wood waste.

While there is a substantial increase in stations showing the presence of bacterial colonies compared to the 2000 survey, future source control efforts at the Silver Bay Seafoods plant should ameliorate this effect. Even though increased organic loading can cause a retrograde in benthic successional status, the benthic community in Sawmill Cove has continued to improve since the baseline survey in 2000. All of Stratum 2, which was indicated as "transitional" after the 2000 survey results were analyzed, is now fully recovered.

Out of the original 100 acres (approximately) of AOC seafloor identified in the original Record of Decision (ROD) as having a severely compromised benthic ecosystem, the current status as a result of the 2011 survey is as follows:

Table E-2. Current status of the AOC

2011 AOC Description	Acres
Stratum 1 (area of impact)	17.0
Stratum 2 (transitional)	29.0
Stratum 3 (recovered) – to 2011 border	37.3
Stratum 3 (recovered) – to original AOC border	54.6

With Stratum 2 (transitional) meeting the recovery milestone of having “secondary consumers”, there are now approximately 83 acres of seafloor that have achieved Milestone 3 (TableE-1) from the original ROD, which was originally anticipated to occur sometime between 2020–2040.

Results from the May 2011 sediment chemical analyses and bioaccumulation studies showed that AOC sediment dioxin concentrations remain elevated compared to local background concentrations. Although mean sediment dioxin concentrations in the AOC exceeded draft guidelines considered protective of west coast marine habitats, dioxin was neither bioavailable nor did it bioaccumulate in benthic organisms exposed to AOC sediment. The sediments in the AOC, therefore, pose no adverse risk to higher trophic organisms, including fish, from dioxin. Although low part-per-trillion levels of sediment dioxin remain, concentrations are roughly half of the concentrations measured in Sawmill Cove surface sediment in the 1996 remedial survey, suggesting that chemical recovery of the AOC is in step with the benthic infaunal recovery documented through use of SPI and plan view images.

With 54% of the AOC having a completely recovered benthic community, the City and Borough of Sitka has achieved better-than-expected results from this latest round of monitoring. Not only have the most recent monitoring results confirmed earlier indications that there are no threats to ecosystem or human health from any persistent contaminants of concern in the sediments, but the original decision of natural recovery as the preferred remedial option turned out to be a wise choice. Not only is benthic ecosystem recovery proceeding as anticipated, it is actually occurring at a much faster rate than originally predicted.

1 INTRODUCTION AND STUDY OBJECTIVES

This report presents results, data interpretation, and recommendations for the May 2011 environmental monitoring of Sawmill Cove located in Silver Bay, Alaska. The program was conducted by Germano and Associates (G&A) on behalf of the City and Borough of Sitka to satisfy the long-term monitoring requirement of the remedial action objective (RAO) issued by the Alaska Department of Environmental Conservation (DEC) for the former Alaska Pulp Company (APC) mill. The monitoring program was conducted as specified in the DEC-approved document, "*2011 Sawmill Cove/Silver Bay Environmental Monitoring Quality Assurance Project Plan*" (G&A, April 20, 2011) (herein referred to as the QAPP), which provides detail on the monitoring approach, design, and methods for the collection, analysis, and interpretation of environmental data.

The overall objectives of the 2011 monitoring program were to complete and validate the established performance measures of the 5-year review report (DEC 2005) and the amended monitoring requirements (DEC 2001), respectively, as follows:

> **Performance Measure 1**: *"Document the observable succession of benthic species (living both on and in the sediments) that will result in balanced, stable communities as assessed by measures of abundance and diversity at various locations over time."*
>
> **Performance Measure 2**: *"Include a bioaccumulation survey to evaluate the potential change in dioxin concentrations that may occur, over time, in the tissues of various target species."*

The initial DEC-stated goal of Performance Measure 1 was to reduce ecologically significant adverse effects to populations of bottom-dwelling life from hazardous substances associated with former pulp mill operations, including wood-waste degradation chemicals (DEC 1999). This goal was later revised to an observable succession of benthic species that will result in balanced, stable communities (Stage 3, sensu Rhoads and Germano 1982, 1986; EVS 2001) through natural recovery as assessed by photographic image analysis at various locations over time (DEC 2005). The ultimate goal is to have at least 75 percent of the initial Sawmill Cove Area of Concern (AOC) in an equilibrium community by the year 2040 based on the ecological recovery management milestones shown in Table 1-1.

Table 1-1. AOC Recovery Milestones (from EVS 2001).

Milestone	Area	Time (Years)	Successional Stage
1	>75 % coverage of the Initial AOC	5–10	Decomposers and primary producers
2	>75 % coverage of the Initial AOC	10–20	Primary consumers and detritivores
3	>75 % coverage of the Initial AOC	20–40	Secondary consumers
4	>75 % coverage of the Initial AOC	> 40	Climax (equilibrium) community

The objective of Performance Measure 2 was to determine if there is a potential for the mill-related sediment contaminant, dioxin, to bioaccumulate to harmful levels in targeted marine species in the AOC. Dioxin refers to the toxic equivalent (TEQ) derived from seven dioxin and ten furan compounds identified by the World Health Organization (WHO) (Van den Berg et al. 2006).

To evaluate Performance Measure 2, the DEC (2001) required that the2011 monitoring event include a bioaccumulation study following the approach "…described in Section 3.4.3 of Foster Wheeler's Long-

Term Benthic Monitoring Program and Bioaccumulation Survey report (July 1999)." The approach was based on collection and analysis of AOC targeted marine organisms for comparison to results reported for resident tissues analyzed in 1996 (Foster Wheeler 1998b). A review of the 1996 data (G&A 2010) found this approach unsuitable to evaluate change in dioxin concentrations for the following reasons:

- Tissue data did not meet statistical test assumptions regarding distribution and power;
- Information from past reports and records was insufficient to reproduce the 1996 sampling design; and,
- Measured bioaccumulation in tissue could not be attributed solely to the AOC.

In place of collecting AOC organisms, a tiered approach detailed in the 2011 QAPP was approved by DEC, based on bioaccumulation using standard laboratory methods and ecological risk assessment following EPA guidelines (EPA 1993, 1998).

The 1999 Record of Decision (ROD) and subsequent amendments also called for an adaptive management approach to promote the use of new monitoring technologies and regulatory/risk guidance that develop over time and can be used to satisfy performance objectives for the recovery of benthic habitat. A summary of the 2011 adaptive monitoring approach, which includes a statistically based sampling design, is presented in Section 1.2.

1.1 Site Background

Sawmill Cove is located near the mouth of Silver Bay in southeast Alaska approximately three miles east of the City and Borough of Sitka (Figure 1-1). The cove was the receiving point for effluent and storm water discharges from the Alaska Pulp Mill, which produced pulp at the site from 1959 to 1993. Operations at the mill resulted in the accumulation of wood solids and associated contaminants on the seafloor from an historic outfall adjacent to the site (see Figure 1-2).

A remedial investigation of the Bay Operable Unit, which encompassed Sawmill Cove and the shoreline area of Silver Bay and Galankin Island, was conducted in 1996 by Foster Wheeler (1998a, 1998b). Results for sediment and water chemistry, tissue chemistry (bioaccumulation), and acute and chronic toxicity of aquatic organisms indicated that a portion of Sawmill Cove, designated as the initial AOC, remained adversely affected from past operations and warranted continued monitoring. The initial AOC was reinvestigated in 2000 by EVS Environment Consultants (EVS) to establish a benthic baseline using Sediment Profile Imaging (SPI), underwater towed video, discrete benthic infaunal analysis, and physical/chemical measures of surface sediment (EVS 2001). Baseline results indicated that benthic habitat conditions and recovery status could be assessed using *in situ* photographs of the sediment, and that it was no longer necessary to include benthic community analysis of discrete sediment samples. Other findings indicated that the first two RAO recovery milestones (shown in Table 1-1) had been achieved by 2000: 81 percent of the site was covered with decomposers (bacterial colonies, most likely *Beggiatoa* spp.) (Milestone 1), and primary consumers (Stage 1 polychaetes) were present in sufficient densities (89 percent) of the stations sampled (Milestone 2). Approximately 16 percent of the initial AOC had fully recovered and achieved the final milestone, and therefore required no further monitoring. Twenty-two (22) percent was in transition to the final recovery stage with notable abundances of deposit-feeding taxa. Sixty-two percent of the initial AOC was still considered seriously impaired in 2000 as far as benthic community status. Based on these results, the AOC designated for continued monitoring was stratified and reduced in area by approximately 16 percent. The resulting 2011 AOC and two sampling strata are shown in Figure 1-2.

Figure 1-1. Sawmill Cove AOC and Galankin Island reference sites designated for 2011 monitoring.

1.2 Monitoring Approach and Sampling Design

The 2011 monitoring approach was designed to produce the type, quality, and quantity of data necessary to satisfy Performance Measures 1 and 2 and support regulatory decisions regarding future monitoring of the AOC. Performance Measure 1 data consist of Sediment Profile and Plan View Images (SPI/PV). Performance Measure 2 data consist of three different types of chemical data: 1) dioxin and total organic carbon (TOC) concentrations in sediment from the AOC and Galankin Island reference site; 2) dioxin concentrations in invertebrate tissues exposed to those sediments in laboratory bioaccumulation tests; and 3) wood-degrading chemicals (total ammonia and total sulfides) in porewater from those same sediments. Summary descriptions of the sampling design, data analysis, and interpretation of results for each performance measure follow. Detailed information on the monitoring approach is presented in the QAPP, which can be found on the accompanying CD-ROM. Geographic coordinates for each station are provided in Appendix A.

1.2.1 Performance Measure 1

The 2011 sampling design is based on an approximate 200-ft-interval grid throughout the AOC, with co-located SPI and PV images collected at each of 73 stations − 50 in Stratum 1 and 23 in Stratum 2. In addition, four stations were sampled outside the AOC, around an operational outfall (see Figure 1-2) to screen for potential confounding organic loading sources from the fish processing plant that now occupies the former site of the APC mill. Station locations within the AOC were in the same vicinity as those used in the 2000 baseline study (EVS 2001), permitting temporal comparison of results if needed.

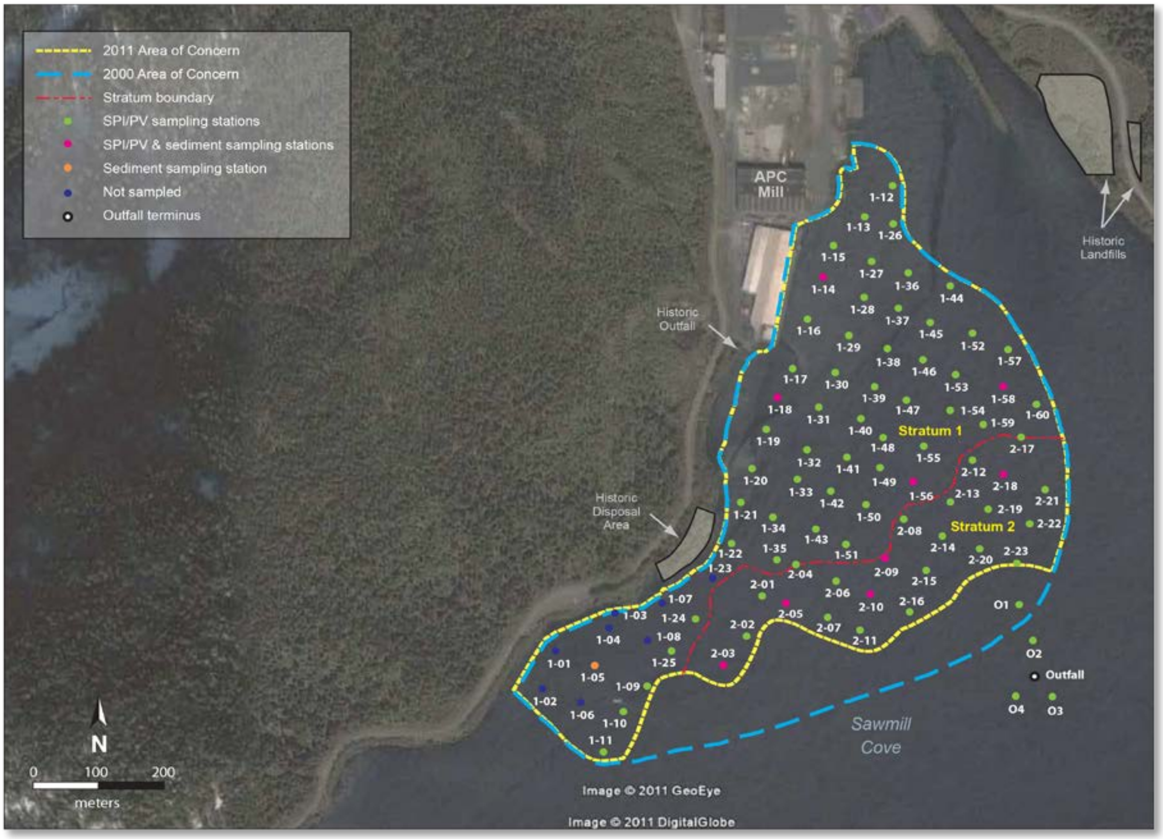

Figure 1-2. 2011 AOC Stratum 1 and Stratum 2 sediment sampling stations. Note: The 2011 AOC is approximately 16 percent smaller than the 2000 AOC due to removal of recovered area (G&A 2001).

Collection and interpretation of SPI data were consistent with methods used in the 2000 survey (EVS 2001) except for an upgrade to the internal camera in the SPI system from a film system used in the 2000 survey to a high-resolution (16.2 megapixel) digital camera used in this current survey. In brief, two to three replicate SPI images were taken at each AOC station. Numerical measurements were averaged across replicates. Indeterminate observations were treated as missing values.

The following results were recorded for each station:

A. Successional stage, ranging from Azoic (lowest) to Stage 2 on 3 (highest) (total of 8 stages) (Rhoads and Germano 1986);

B. Mean apparent Redox Potential Discontinuity (aRPD), representing average depth of the observed surface oxidized layer, indicating a rapid transition from oxygenated sediment to a reduced (anoxic) sediment environment.

C. Low dissolved oxygen, *Beggiatoa* colonies, and sub-surface methane, recorded as either present or absent. If observed in any of the replicate images, the result was recorded as "present" for the station.

All results were recorded; however, infaunal successional stage (A) and *Beggiatoa* presence (C) were the only parameters used to determine the extent of recovery relative to the milestones in Table 1-1. Stations with successional stage values > Stage 2 → 3 were recorded as recovered. Evaluation of SPI/PV results did not include collection of reference site data, because the AOC recovery was based on the threshold criterion for benthic infaunal successional stage only.

Optical data from the PV camera, like the towed video collected in 2000 (EVS 2001), are qualitative and used primarily to augment SPI and discrete sample data. A list of all SPI and PV parameters is presented in Section 2 (Methods). Figure 1-3 depicts a flowchart for the collection, interpretation, and resulting monitoring recommendations for SPI/PV optical data collected within each stratum.

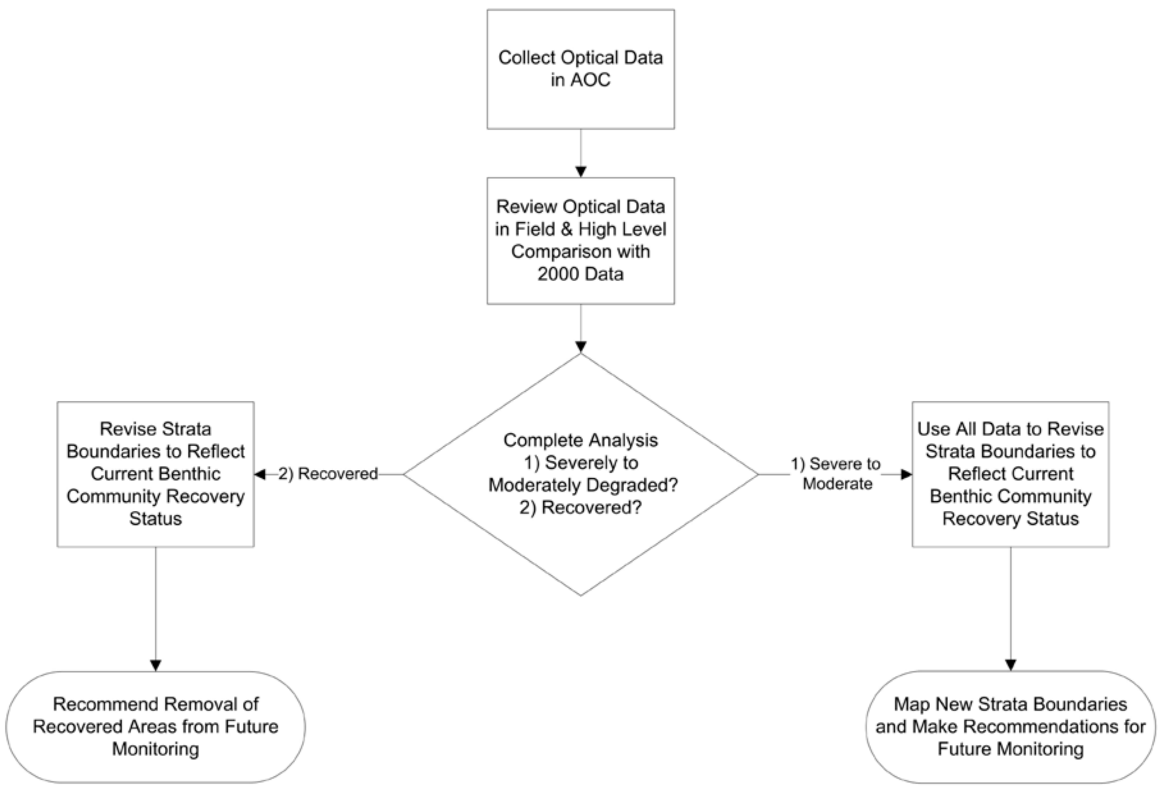

Figure 1-3. Performance Measure 1 SPI data collection, interpretation, and future monitoring decision criteria.

1.2.2 Performance Measure 2

Performance Measure 2 sediment data, consisting of 17 dioxin/furan analytes, total organic carbon (TOC), total ammonia, and total sulfides were measured at 15 sediment stations – five each located within Stratum 1, Stratum 2, and at the Galankin Island reference site (Figure 1-2). The reference location was used in statistical comparisons for all parameters, especially to account for potential dioxin contamination from regional sources other than the historic operation of the Alaska Pulp Mill. Potential regional sources of dioxin include forest fires, burning of municipal trash, and leaching from treated pier pilings, all of which can result in anthropogenic background concentrations in the part-per-trillion range. Reference and AOC station locations are shown in Figures 1-1 and 1-2, respectively.

A tiered approach, depicted in Figure 1-4, was used to evaluate Performance Measure 2 dioxin data. The approach began with the analysis of AOC sediment to determine if dioxin toxicity equivalent (TEQ) concentrations (Van den Berg et al. 2006) were: 1) above thresholds used to evaluate other west coast sediment sites; and 2) significantly higher than local background sediment concentrations. Bioaccumulation testing was performed only after both conditions were met, because dioxin in environmental media has natural (e.g., forest fires) as well as anthropogenic sources, especially at low part-per-trillion concentrations.

Rationale for the selection of sediment dioxin threshold concentrations is presented in the QAPP and is based on recent background goals published by the Army Corps of Engineers (ACE) Seattle District, US EPA Region X, and the Washington Department of Ecology (ACE 2010) for Puget Sound sediment. These interim goals, used to evaluate AOC sediment, are a mean of 4 $pg\ g^{-1}$ dioxin TEQ per stratum and corresponding maximum of 10 $pg\ g^{-1}$ dioxin TEQ in any individual sediment sample (within each stratum). Laboratory bioaccumulation tests using the polychaete worm *Nereis virens* were performed if either threshold was exceeded and the mean sediment concentration of the corresponding stratum was statistically elevated compared to the reference mean.

In the event that mean dioxin concentrations were elevated in worm tissue from either AOC stratum compared to mean reference tissue, sediment-biota bioaccumulation factors (BAFs) would be calculated and used to model fish tissue burdens of dioxin 2,3,7,8-TCDD following established EPA ecological risk procedure (EPA 2010) and use of a protective toxicity reference value (TRV) for fish fry based on the mid-point between the “no observed apparent effects level” (NOAEL) and the “lowest observed apparent effects level” (LOAEL) shown in Table 1-2. Toxicity data used to formulate risk guidance are based on laboratory-controlled toxicity studies using 2,3,7,8-TCDD rather than mixtures of dioxin compounds, hence a concentration of 44 $pg\ g^{-1}$ 2,3,7,8-TCDD (the average of the lowest cited NOAEL and LOAEL) was used as a conservative threshold for the protection of AOC fish.

The primary transfer of 2,3,7,8-TCDD occurs between benthic infauna and fish as first order prey (food). Other potential transfer mechanisms, including gill exposure from dioxin in water or dermal contact to sediment, were considered insignificant compared to ingestion from contaminated prey and therefore, were not evaluated. Modeled results exceeding 44 $pg\ g^{-1}$ 2,3,7,8-TCDD in targeted species would indicate that AOC sediment concentrations pose significant risk to fish and that bioaccumulation tests and ecological risk assessment should be retained in future monitoring until either dioxin concentrations in sediment or bioaccumulated in tissue are at safe levels.

Table 1-2. Summary of toxicity data for dioxin (2,3,7,8-TCDD) (adapted from Gatehouse 2004).

Organism	Studies	Toxic effects	Lowest NOAEL	Lowest LOAEL	Reference
Fish fry	Large number of studies with mainly freshwater species*	Sacfry mortality	34 $pg\ g^{-1}$ wet weight	55 $pg\ g^{-1}$ wet weight	Walker et al., 1991

*NOAEL for the most sensitive freshwater fish species is considered protective for all other fish species (including marine species, which are less sensitive to dioxin than freshwater species)

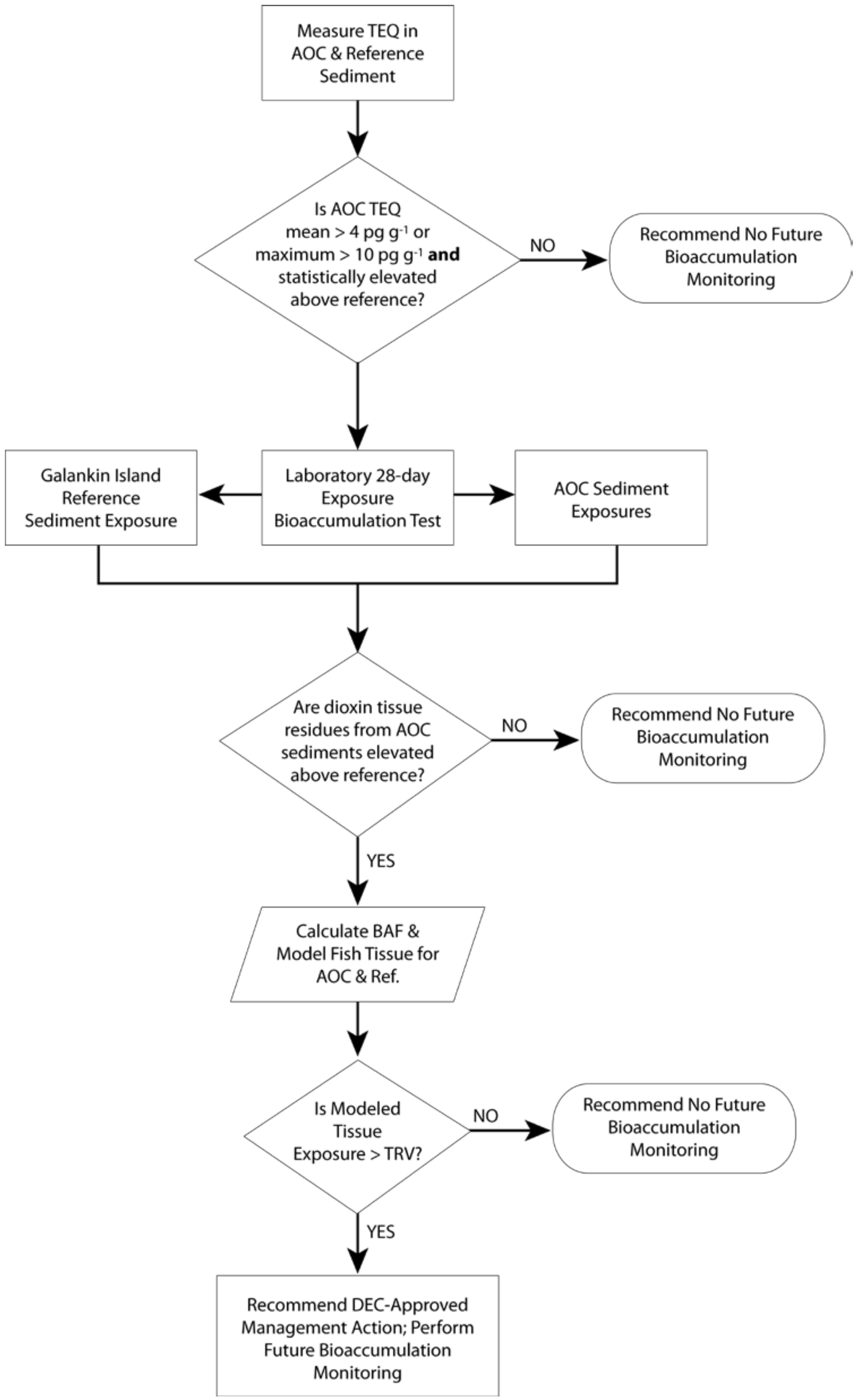

Figure 1-4. Flow diagram for execution of bioaccumulation evaluation (Performance Measure 2). BAF = Bioaccumulation Factor (tissue concentration/sediment concentration); TRV = species specific toxicity reference value for 2,3,7,8-TCDD adapted from Gatehouse (2004); TEQ = total dioxin TEQ for fish.

1.3 Report Organization

This report is organized into two parts, the main report body and the appendices (A-D). Station identification and location data are presented in Appendix A. SPI empirical results for each station are presented in Appendix B; PV image results are presented in Appendix C. Porewater, sediment, and tissue results for each station are shown in Appendix D.

Accompanying this report is a CD-ROM containing report files (in Adobe® Acrobat), a "pop-up" map of Sawmill Cove with all SPI/PV thumbnail images, MS Excel databases containing results for each station, and the associated QAPP. Complete data packages submitted by the analytical laboratories for TOC, dioxin, and bioaccumulation tests also are included on the CD-ROM. All high-resolution SPI/PV digital image files were sent on a separate DVD to the City's Project Manager (Mark Buggins) in June 2011. The main report body is organized into six sections.

Section 1 – Introduction and Study Objectives presents the objectives of the 2011 monitoring survey, the study design, decision criteria for future monitoring, and sample inventories for sediment, porewater, and SPI/PV images.

Section 2 - Methods presents field, laboratory, and data analytical procedures. Field methods are presented for navigation and station positioning, and sample collection, processing and transfer to laboratories. Laboratory analytical methods are summarized for chemical, physical, and biological samples, including sample preparation, instrumentation, quality control, and reporting.

Section 3 – SPI/PV Results – Performance Measure 1 presents results for SPI and PV images collected throughout Sawmill Cove and the AOC. Results are evaluated using established decision criteria for Performance Measure 1 based on benthic infauna successional stage and percent recovery of Strata 1 and 2 within the AOC. Quality control results for SPI/PV images also are discussed relative to data interpretation.

Section 4 - Sediment and Bioaccumulation Results –Performance Measure 2 presents data for total ammonia and sulfide concentrations in porewater, sediment total organic carbon and dioxin, and dioxin concentrations in worm tissues following 28-day laboratory exposures to AOC and reference sediment. Statistical results are summarized, presenting central tendencies, range and variation by sampling area, and results for inference tests. Dioxin concentrations measured in sediment and tissue also are evaluated using established decision criteria for Performance Measure 2 to address potential dioxin bioaccumulation in AOC fish. Quality control data for sediment and tissue chemistry, and laboratory bioaccumulation tests are discussed relative to potential effects on results interpretation.

Section 5 - Conclusions and Recommendations for recovery status of the AOC and future monitoring, respectively, are presented in this section.

Section 6 – References provides a complete list of cited work and publications.

2 METHODS

This section summarizes field and analytical methods used to collect and analyze Sediment Profile and Plan View images (SPI/PV) along with discrete sediment samples to satisfy Performance Measure 1 and 2 objectives. Detailed procedures for sample collection, laboratory analysis, and interpretation of monitoring data are presented in the QAPP.

2.1 Field Methods

Field operations were conducted from the F/V *Lisa Jean*, a 15.5 meter (m) commercial fishing vessel operated by Brian Blankenship out of Sitka, Alaska. The vessel was outfitted with a 1-m Pilkington purse winch, two picking booms, dry work areas, refrigerated storage, and stainless steel countertops. General vessel navigation and bathymetry were reported from the wheelhouse via a computer-aided Nobeltec 9 bottom mapping system (depth accuracy ± 0.3 m).

2.1.1 Station Locations

Station locations were recorded using a Trimble Ag GPS132 differential global positioning system (DGPS) coupled to a laptop computer running HYPAC™ hydrographic survey software. Real-time differential corrections were applied to position solutions using ultra-high frequency signals transmitted from nearby U.S. Coast Guard base stations to achieve sub-meter horizontal accuracy. Sampling stations were recorded in eastings and northings (UTM zone 8V, meters), and latitudes and longitudes (WGS 84, decimal degrees) in local time. Station position and water depth (m) were entered into a navigation log book at the time of sample collection and recorded electronically onto a laptop computer using the HYPAC™ software. Electronic data were transferred to the field database upon completion of the survey. Summarized station location data are presented in Appendix A.

2.1.2 SPI and Plan View

SPI/PV photographs were acquired (Figure 2-1) at each of 73 AOC stations using high resolution digital cameras in underwater housings that were mounted on a stainless-steel frame and lowering the system to the seafloor. Three replicate SPI images and corresponding PV photos were taken at each station. An Ocean Imaging Model 3731 digital SPI system, Ocean Imaging Model DSC16000 plan-view underwater camera, and two Ocean Imaging Model 400-37 Deep Sea Scaling lasers were deployed using the vessel's picking booms and purse winch. A Kodak® Color Separation Guide was photographed through the SPI camera at the start of the survey for subsequent image calibration during laboratory analysis.

Once on station, the camera system was lowered to the seafloor at a rate of approximately 1 meter per second (m sec^{-1}). 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 2 red dots that were separated by a constant distance (26 cm) regardless of the field of view of the PV camera, which can be varied by increasing or decreasing the length of the trigger wire. As the camera apparatus was lowered to the seafloor, the weight attached to the bounce trigger contacted the seafloor prior to the camera frame hitting the bottom and triggered the PV system (Figure 2-1). Details of the camera settings for each digital image are available in the associated parameters file embedded in each electronic image file; for this survey, the ISO-equivalent was set at 400. The additional camera settings used were as follows:

shutter speed was 1/30, f11, white balance set to flash, color mode to Adobe RGB, sharpening to none, noise reduction off, and storage in compressed raw Nikon Electronic Format (NEF) files (approximately 20 MB each). Electronic files were converted to high-resolution jpeg (8-bit) format files (3264 x 4928 pixels) using Nikon Capture NX2 software. After completion of the first station, the SPI system was returned to the deck and the camera frame counters, SPI penetration, exposure settings, triggering distance of the PV camera, and initial photo quality were checked. If necessary, adjustments to total system weight, SPI penetration velocity, and PV triggering distance were made. Subsequent stations were sampled by raising the system 5-10 m off the bottom of the seafloor and towed to the next station. Up to 10 stations were sampled in this manner before the SPI system was returned to the deck and all photographs were transferred to a laptop computer.

Acceptable PV photos covered a minimum area of approximately 0.4 m^2 with good resolution. Acceptable SPI images showed the sediment-water interface and at least 8-10 cm of the sediment profile below the interface. A minimum of two acceptable SPI photos and one acceptable PV image were acquired at each station. All acceptable photographs were interpreted.

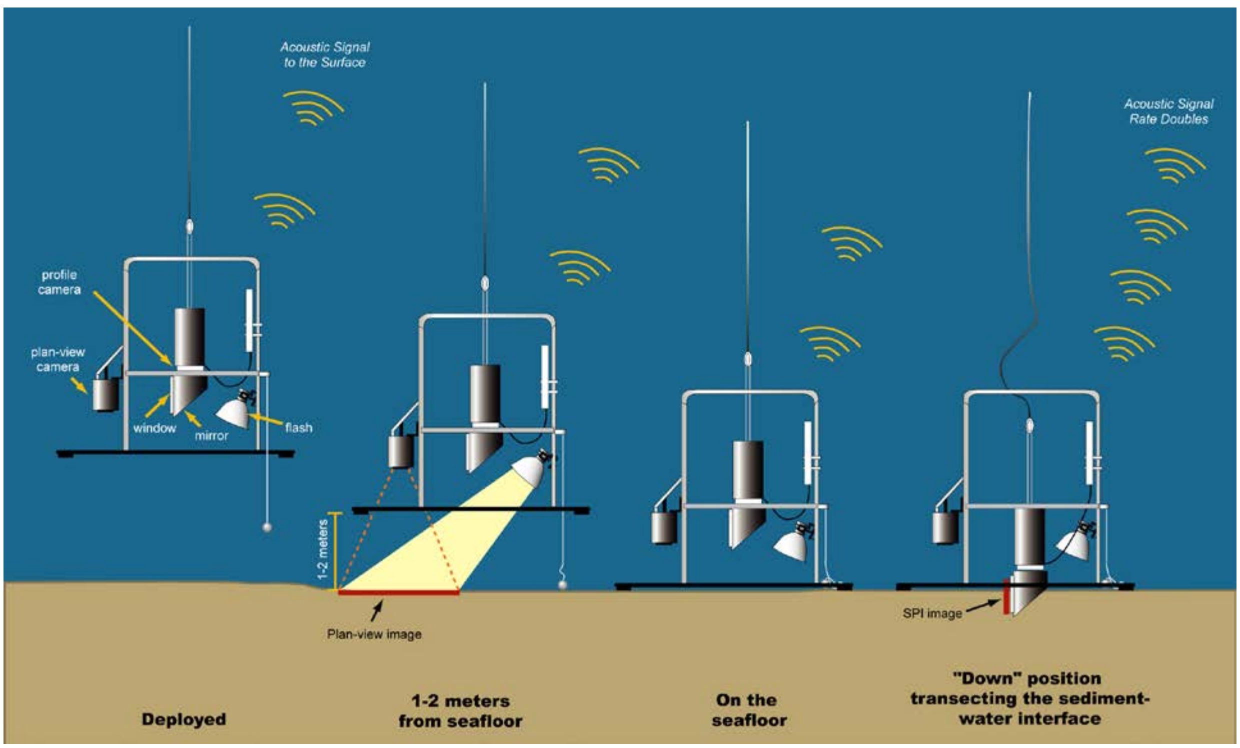

Figure 2-1. Diagram showing deployment of the SPI/PV camera system used in Sawmill Cove.

2.1.3 Sediment Sample Collection

Sediment samples were collected using a 0.1 m^2 stainless steel Van Veen grab sampler (shown in Figure 2-2) that was decontaminated before sampling at each station. Overlying water was removed and the top 3 cm of a small section of the grab was sub-sampled. Sediment samples designated for dioxin and organic carbon analyses were placed directly into labeled, certified-clean borosilicate glass containers with Teflon-lined lids.

Following chemical sub-sampling, the remaining sediment was collected in a bucket with a clean polyethylene bag for bioaccumulation testing. Overlying water was removed several times before the sample was stored on ice.

Dioxin, total organic carbon (TOC), and bioaccumulation samples were refrigerated on the vessel at approximately 4°C until shipment under chain-of-custody on frozen blue ice via next-day air to Columbia Analytical Systems laboratory in Houston, TX. Sediment samples designated for potential bioaccumulation testing were shipped on blue ice via next day air to Nautilus Environmental Laboratory, located in San Diego, CA, and stored refrigerated until sediment dioxin results were reported 28 days later.

Figure 2-2. Sediment sample collection from the Van Veen grab in Sawmill Cove.

2.1.4 Field Analysis of Porewater

The wood degradation products, total ammonia and total sulfides, were measured in sediment porewater collected at 15 discrete sediment stations (see Section 1, Figure 1-2) using Hach™ colorimetric test kits in the field. Approximately 5-10 milliliters (mL) of porewater were extracted from 25 mL sediment subsamples using a manually-operated centrifuge. Samples with visible suspended material were pre-treated following the test protocol.

Total ammonia (un-ionized and ionized) was measured using a Hach™ test kit (no. 2428700) designed for seawater with a reporting range of <0.2 to 2.5 mg L^{-1}. Total sulfides were measured using a Hach™

hydrogen sulfide test kit Model HS-WR, a methylene blue wet chemical determination modified from EPA method 376.2 for the measurement of seawater. The sulfides test is standardized to span three reporting ranges: 0.05-0.55, 0.05-2.25, and 0.05-11.25 mg L^{-1}. For both tests, independent results were recorded by two different field technicians, and the resulting average was recorded in the field notebook. Samples with results greater than 15% relative percent difference (RPD) between field technicians were rejected, and the sample was reanalyzed.

2.2 Laboratory Methods

2.2.1 Image Analysis

SPI and PV images obtained at each station were analyzed using Sigmascan Pro® (Aspire Software International) or Adobe Photoshop CS5. Calibration information was determined by measuring 1-cm gradations from the Kodak® Color Separation Guide. This calibration information was applied to all SPI images analyzed. Linear and area measurements were recorded as number of pixels and converted to scientific units using the calibration information. Additionally, PV images from each station were analyzed for identification of significant features, including wood chips, epifaunal organisms, presence of fish waste and thiophilic bacterial mats.

Measured parameters were recorded on a Microsoft Excel© spreadsheet. G&A's senior scientist (Dr. J. Germano) subsequently checked all SPI/PV data as an independent quality assurance/quality control review of the measurements before final interpretation was performed.

2.2.1.1 SPI Sediment Type

The sediment grain-size major mode and range were visually estimated from the color images by overlaying a grain-size comparator that was at the same scale. This comparator was prepared by photographing a series of Udden-Wentworth size classes (equal to or less than coarse silt up to granule and larger sizes) with the SPI camera. Seven grain-size classes were on this comparator: >4 ϕ (silt-clay), 4−3 ϕ (very fine sand), 3—2 ϕ (fine sand), 2–1 ϕ (medium sand), 1−0 ϕ (coarse sand), 0 −(-)1 ϕ (very coarse sand), < -1 ϕ (granule and larger). The lower limit of optical resolution of the photographic system was about 62 microns, allowing recognition of grain sizes equal to or greater than coarse silt (≥ 4 ϕ). The accuracy of this method has been documented by comparing SPI estimates with grain-size statistics determined from laboratory sieve analyses (Germano et al. 2011).

The comparison of the SPI images with Udden-Wentworth sediment standards photographed through the SPI optical system was also used to map near-surface stratigraphy such as sand-over-mud and mud-over-sand. When mapped on a local scale, this stratigraphy can provide information on relative transport magnitude and frequency.

2.2.1.2 SPI Prism Penetration Depth

The SPI prism penetration depth was measured from the bottom of the image to the sediment-water interface. The area of the entire cross-sectional sedimentary portion of the image was digitized, and this number was divided by the calibrated linear width of the image to determine the average penetration depth. Linear maximum and minimum depths of penetration were also measured. All three measurements (maximum, minimum, and average penetration depths) were recorded in the data file.

Prism penetration is a noteworthy parameter; if the number of weights used in the camera is held constant throughout a survey, the camera functions as a static-load penetrometer. Comparative penetration values from sites of similar grain size give an indication of the relative water content of the sediment. Highly bioturbated sediments and rapidly accumulating sediments tend to have the highest water contents and greatest prism penetration depths.

The depth of penetration also reflects the bearing capacity and shear strength of the sediments. Overconsolidated or relic sediments and shell-bearing sands resist camera penetration. Highly bioturbated, sulfitic, or methanogenic muds are the least consolidated, and deep penetration is typical. Seasonal changes in camera prism penetration have been observed at the same station in other studies and are related to the control of sediment geotechnical properties by bioturbation (Rhoads and Boyer 1982). The effect of water temperature on bioturbation rates appears to be important in controlling both biogenic surface relief and prism penetration depth (Rhoads and Germano 1982).

2.2.1.3 SPI Small-Scale Surface Boundary Roughness

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 (sediment surface relief) measured over the width of sediment profile images typically ranges from 0.02−3.8 cm, and may be related to either physical structures (ripples, rip-up structures, mud clasts) or biogenic features (burrow openings, fecal mounds, foraging depressions). Biogenic roughness typically changes seasonally and is related to the interaction of bottom turbulence and bioturbation.

The camera must be level in order to take accurate boundary roughness measurements. In sandy sediments, boundary roughness can be a measure of sand wave height. On silt-clay bottoms, boundary roughness values often reflect biogenic features such as fecal mounds or surface burrows. The size and scale of boundary roughness values can have dramatic effects on both sediment erodibility and localized oxygen penetration into the bottom (Huettel et al. 1996).

2.2.1.4 SPI Thickness of Depositional Layers

Because of the camera's unique design, SPI can be used to detect the thickness of depositional and dredged material layers. SPI is effective in measuring layers ranging in thickness from 1 mm to 20 cm (the height of the SPI optical window). During image analysis, the thickness of the newly deposited sedimentary layers can be determined by measuring the distance between the pre- and post-disposal sediment-water interface. Recently deposited material is usually evident because of its unique optical reflectance and/or color relative to the underlying material representing the pre-disposal surface. Also, in most cases, the point of contact between the two layers is clearly visible as a textural change in sediment composition, facilitating measurement of the thickness of the newly deposited layer.

2.2.1.5 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 about the seafloor. These mud clasts can be seen at the sediment-water interface in SPI images. During analysis, the number of clasts was counted, the diameter of a typical clast was measured, and their oxidation state was assessed. The abundance, distribution, oxidation state, and angularity of mud clasts can be used to make inferences about the recent pattern of seafloor disturbance in an area.

Depending on their place of origin and the depth of disturbance of the sediment column, mud clasts can be reduced or oxidized. In SPI images, the oxidation state is apparent from the reflectance; see Section 2.1.6. Also, once at the sediment-water interface, these mud clasts are subject to bottom-water oxygen concentrations and currents. Evidence from laboratory microcosm observations of reduced sediments placed within an aerobic environment indicates that oxidation of reduced surface layers by diffusion alone is quite rapid, occurring within 6–12 hours (Germano 1983). Consequently, the detection of reduced mud clasts in an obviously aerobic setting suggests a recent origin. The size and shape of the mud clasts are also revealing; some clasts seen in the profile images are artifacts caused by the camera deployment (mud clots falling off the back of the prism or the wiper blade). Naturally-occurring mud clasts may be moved and broken by bottom currents and animals (macro- or meiofauna; Germano 1983). Over time, these naturally-occurring, large angular clasts become small and rounded.

2.2.1.6 SPI Apparent Redox Potential Discontinuity Depth

The boundary between the colored ferric hydroxide surface sediment and underlying gray to black sediment is called the apparent redox potential discontinuity (aRPD). Aerobic near-surface marine sediments typically have higher reflectance relative to underlying hypoxic or anoxic sediments. Surface sands washed free of mud also have higher optical reflectance than underlying muddy sands. These differences in optical reflectance are readily apparent in SPI images; the oxidized surface sediment contains particles coated with ferric hydroxide (an olive or tan color when associated with particles), while reduced and muddy sediments below this oxygenated layer are darker, generally gray to black (Fenchel 1969; Lyle 1983).

The depth of the aRPD in the sediment column is an important time-integrator of dissolved oxygen concentrations in porewater. In the absence of bioturbating organisms, this high reflectance layer (in muds) will typically reach a thickness of 2 mm below the sediment-water interface (Rhoads 1974). This depth is related to the supply rate of molecular oxygen by diffusion into the bottom and the consumption of that oxygen by the sediment and associated microflora. In sediments that have very high sediment oxygen demand (SOD), the sediment may lack a high reflectance layer even when the overlying water column is aerobic.

In the presence of bioturbating macrofauna, the thickness of the high reflectance layer may be several centimeters. The relationship between the thickness of this high reflectance layer and the presence or absence of free molecular oxygen in the associated porewater must be considered with caution. The actual RPD is the boundary or horizon that separates the positive Eh region of the sediment column from the underlying negative Eh region. The location of this Eh = 0 boundary can be determined accurately only with microelectrodes; hence, the relationship between the change in optical reflectance, as imaged with the SPI camera, and the actual RPD can be determined only by making the appropriate *in situ* Eh measurements. For this reason, the optical reflectance boundary, as imaged, was described in this study as the “apparent” RPD and it was mapped as a mean value. In general, the depth of the actual Eh = 0 horizon will be either equal to or slightly shallower than the depth of the optical reflectance boundary (Rosenberg et al. 2001). This is because bioturbating organisms can mix ferric hydroxide-coated particles downward into the bottom below the Eh = 0 horizon. As a result, the mean aRPD depth can be used as an estimate of the depth of porewater exchange, usually through irrigation (bioturbation).

Biogenic particle mixing depths can be estimated by measuring the maximum and minimum depths of imaged feeding voids in the sediment column. This parameter represents the particle mixing depths of head-down feeders, mainly polychaetes.

The rate of depression of the apparent RPD within the sediment is relatively slow in organic-rich muds, on the order of 200–300 micrometers per day; therefore this parameter has a long time constant (Germano and Rhoads 1984). The rebound in the apparent RPD is also slow (Germano 1983). Measurable changes in the apparent RPD depth using the SPI optical technique can be detected over periods of 1 or 2 months. This parameter is used effectively to document changes (or gradients) that develop over a seasonal or yearly cycle related to water temperature effects on bioturbation rates, seasonal hypoxia, SOD, and infaunal recruitment. Time-series RPD measurements following a disturbance can be a critical diagnostic element in monitoring the degree of recolonization in an area by the ambient benthos (Rhoads and Germano 1986).

The apparent mean RPD depth also can be affected by local erosion. The peaks of disposal mounds commonly are scoured by divergent flow over the mound. This scouring can wash away fines and shell or gravel lag deposits, and can result in very thin surface oxidized layer. During storm periods, erosion may completely remove any evidence of the apparent RPD (Fredette et al. 1988).

Another important characteristic of the apparent RPD is the contrast in reflectance at this boundary. This contrast is related to the interactions among the degree of organic loading, the bioturbation activity in the sediment, and the concentrations of bottom-water dissolved oxygen in an area. High inputs of labile organic material increase SOD and, subsequently, sulfate reduction rates and the associated abundance of sulfide end products. This results in more highly reduced, lower-reflectance sediments at depth and higher RPD contrasts. In a region of generally low aRPD contrasts, images with high aRPD contrasts indicate localized sites of relatively large inputs of organic-rich material such as phytoplankton, other naturally-occurring organic detritus, dredged material, discharged fish processing wastes, or sewage sludge.

Because the determination of the aRPD requires discrimination of optical contrast between oxidized and reduced particles, it is difficult, if not impossible, to determine the depth of the aRPD in well-sorted sands of any size that have little to no silt or organic matter in them (Painter et al. 2007). When using SPI technology on sand bottoms, little information other than grain-size, prism penetration depth, and boundary roughness values can be measured; while oxygen has no doubt penetrated the sand beneath the sediment-water interface just due to physical forcing factors acting on surface roughness elements (Ziebis et al. 1996; Huettel et al. 1998), estimates of the mean aRPD depths in these types of sediment are indeterminate with conventional white light photography.

2.2.1.7 SPI 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, and the number and total area covered by all methane pockets can be measured. 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).

2.2.1.8 Infaunal Successional Stage

The mapping of infaunal successional stages is readily accomplished with SPI technology. These stages are recognized in SPI images by the presence of dense assemblages of near-surface polychaetes and/or the presence of subsurface feeding voids; both may be present in the same image. Mapping of successional stages is based on the theory that organism-sediment interactions in fine-grained sediments follow a predictable sequence after a major seafloor perturbation. This theory states that primary succession results in "...the predictable appearance of macrobenthic invertebrates belonging to specific functional types following a benthic disturbance. These invertebrates interact with sediment in specific ways. Because functional types are the biological units of interest..., our definition does not demand a sequential appearance of particular invertebrate species or genera." (Rhoads and Boyer 1982). This theory is presented in Pearson and Rosenberg (1978) and further developed in Rhoads and Germano (1982) and Rhoads and Boyer (1982).

This continuum of change in animal communities after a disturbance (primary succession) 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 2-3).

After an area of bottom is disturbed by natural or anthropogenic events, the first invertebrate assemblage (Stage 1) appears within days after the disturbance. Stage 1 consists of assemblages of tiny tube-dwelling marine polychaetes that reach population densities of 10^4–10^6 individuals m^{-2}. These animals feed at or near the sediment-water interface and physically stabilize or bind the sediment surface by producing a mucous “glue” that they use to build their tubes. Sometimes deposited dredged material layers contain Stage 1 tubes still attached to mud clasts from their location of origin; these transported individuals are considered as part of the *in situ* fauna in our assignment of successional stages.

If there are no repeated disturbances to the newly colonized area, then these initial tube-dwelling suspension or surface-deposit feeding taxa are followed by burrowing, head-down deposit-feeders that rework the sediment deeper and deeper over time and mix oxygen from the overlying water into the sediment. The animals in these later-appearing communities (Stage 2 or 3) are larger, have lower overall population densities (10–100 individuals m^{-2}), and can rework the sediments to depths of 3–20 cm or more. These animals “loosen” the sedimentary fabric, increase the water content in the sediment, thereby lowering the sediment shear strength, and actively recycle nutrients because of the high exchange rate with the overlying waters resulting from their burrowing and feeding activities.

In dynamic estuarine and coastal 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 depicted in Figure 2-3. 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.

While the successional dynamics of invertebrate communities in fine-grained sediments have been well-documented, the successional dynamics of invertebrate communities in sand and coarser sediments are not well-known. Subsequently, the insights gained from sediment profile imaging technology regarding biological community structure and dynamics in sandy and coarse-grained bottoms are fairly limited.

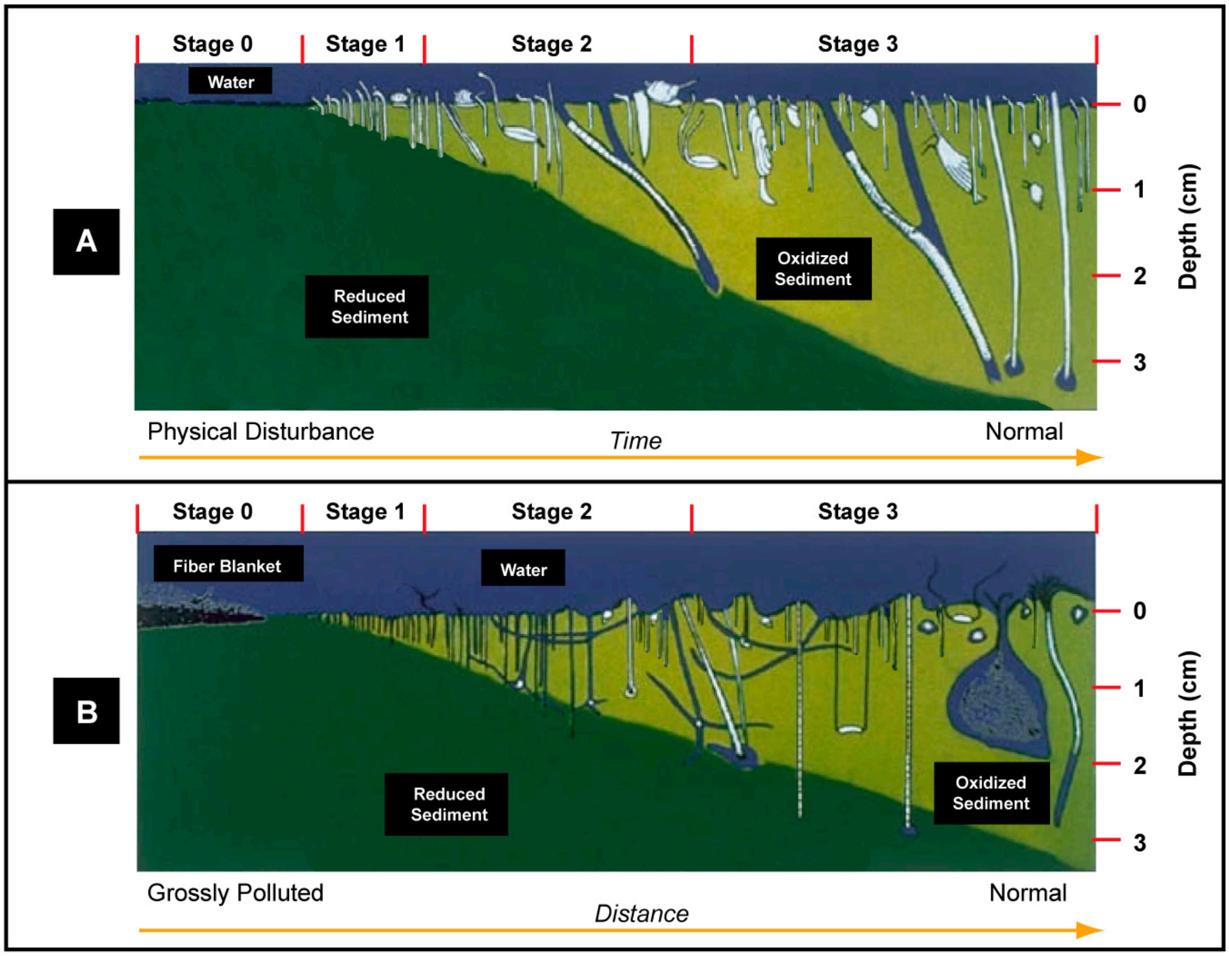

Figure 2-3. Diagram of soft-bottom benthic community response to disturbance (A, top panel) or organic enrichment (B, bottom panel). From Rhoads and Germano, 1982.

2.2.1.9. Plan View Image Analysis

The plan view (PV) images provide a much larger field of view than the sediment profile images. They also provide valuable information about the landscape ecology and sediment topography in the area where the pinpoint “optical core” of the sediment profile was taken. Unusual surface sediment layers/textures or structures detected in any of the sediment profile images can be interpreted in light of the larger context of surface sediment features, i.e., is a surface layer or topographic feature a regularly occurring feature and typical of the bottom in this general vicinity or just an isolated anomaly? The scale information provided by the underwater lasers allows accurate density counts (number per square meter, m^{-2}) of attached epifaunal colonies, sediment burrow openings, or larger macrofauna or fish which may be missed in the sediment profile cross-section. Presence of *Beggiatoa* colonies along with information on sediment transport dynamics and bedform wavelength also were available from plan view image analysis.

2.2.2 Sediment and Tissue Chemical Analysis

Total organic carbon (TOC) was analyzed by Columbia Analytical Services (CAS) laboratory in Kelso, Washington following a modification of method ASTM D4129-82M, using high temperature oxidation and coulometric detection of carbon dioxide. Dioxin was analyzed by CAS laboratory in Houston, Texas following EPA 1613B, an isotope dilution method, using high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) to detect low or sub part-per-trillion concentrations in sediment and tissue. Results for 17 dioxin/furan congeners for each sample were reported, including determination of 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachloro-dibenzofuran (2,3,7,8-TCDF). A complete list of target analytes reported by the laboratories is shown in Appendix C.

Prior to dioxin analysis, an approximate 20 g aliquot of sediment was spiked with labeled compounds and homogenized thoroughly, then mixed with sodium sulfate, allowed to dry for 12-24 hours, and extracted for 24 hours using methylene chloride:hexane (1:1) in a Soxhlet extractor. The extract was evaporated to dryness. The same extraction procedure was used for tissue samples, except that a composite sample was used to estimate percent dryness and lipids due to the limited mass of tissue available from each sample.

Dioxin results were converted to Toxicity Equivalencies (TEQs) by multiplying each of the 17 congener concentrations in each sample by the corresponding Toxic Equivalency Factor (TEF) and summing the results to provide a concentration-based estimate of relative toxicity following 2005 guidance from the World Health Organization (WHO), described in Van den Berg et al. (2006). Dioxin TEQ results are reported on a dry-weight basis for sediments and on a wet-weight basis for tissues (both in picograms per gram [pg g^{-1}]). The non-parametric Kaplan-Meier substitution method (Helsel 2010) was used for any congener result reported below the estimated detection limit (EDL) in the TEQ calculation, providing that there were <50% non-detect results in the sample. If there were ≥50% non-detect results for any sample, then substitution at ½ the congener-specific EDL was used for any non-detect value.

2.2.3 Laboratory Bioaccumulation Tests

Bioaccumulation was performed following Performance Measure 2 decision criteria (see Figure 1-4, Section 1), which required laboratory tests if the mean or maximum sediment dioxin threshold was exceeded, <u>and</u> the mean sediment dioxin TEQ concentration was significantly elevated in one or both AOC strata above the reference mean.

Bioaccumulation tests were performed by Nautilus Environmental (San Diego, CA) following a modified Green Book method (EPA/ACE 1991), using the burrowing marine polychaete worm (*Nereis virens*) exposed to AOC, Galankin Island, and native "home" sediment for 28 days. Of the standard test organisms available, *N. virens* was used because it actively burrows and ingests sediment and, therefore, has a high potential to accumulate dioxin relative to other suitable test organisms (e.g., clams).

Table 2-1 presents bioaccumulation test conditions and the organism source. Monitoring of pH, dissolved oxygen, salinity, and temperature were made on a daily basis for days 1-28 and ammonia determinations were made weekly on days 7, 14, 21, and 28. Daily observations were made for mortality and dead organisms were removed, counted, and results were recorded. At the test conclusion, surviving *N. virens* for each sample were depurated for 24 hours and placed in certified-clean jars, frozen, and shipped to the CAS laboratory in Houston for measurement of tissue dioxin as previously described. Results were reported on a wet-weight basis, with percent moisture reported for a representative subsample of all tissues received.

Table 2-1. Bioaccumulation test conditions and test organism source.

Parameter	Value or Test Requirement
Test organism	Marine polychaete *Nereis virens*
Test organism source (home sediment)	Damariscotta River in Maine
Test organism age at initiation	Adult (field caught)
Test duration	28-day exposure + 24-hour depuration period
Test solution renewal	Continuous flow-through (> 2 exchanges/day)
Feeding	None
Test chamber; Sediment depth	38-L glass aquarium with aeration; 5-6 cm
Overlying water volume	Approximately 26 L
Test temperature	15 ± 1°C test-wide mean, 15 ± 3°C instantaneous
Dissolved oxygen	≥ 4 mg L^{-1}
Dilution water	Undiluted natural seawater (34 ppt)
Test concentrations	Undiluted sediment
Number of organisms per chamber	10
Number of replicates	1 per sediment station
Laboratory (negative) control	"Home" sediment from test organism collection location
Photoperiod; Sediment holding time	16 hours light/8 hours dark; ≤ 6 weeks

2.3 Data Analysis

2.3.1 Sediment Dioxin Threshold Comparisons

The mean sediment dioxin TEQ for each stratum was compared to the mean threshold concentration of 4 pg g^{-1} TEQ dry weight following Performance Measure 2 decision criteria set forth in the QAPP (see Figure 1-4, Section 1). The stratum mean consists of the simple arithmetic mean of the calculated total dioxin TEQ for each sample. Similarly, the individual dioxin TEQ for each station within each stratum was compared to the maximum threshold of 10 pg g^{-1} TEQ dry weight.

2.3.2 Interval Hypothesis Tests

Statistical comparisons between the mean sediment dioxin TEQ for each AOC stratum (n=5) and the reference site (n=5) were performed to confirm that any elevated concentrations measured in the AOC were likely due to historic mill activities and not confounded by regional contamination from other sources (such as forest fires). Statistical comparisons were performed using a one-sided interval test on the difference of the means as described in the QAPP. In brief, a one-sided interval test is simply a confidence bound on the observed difference between the test and reference sites (e.g., AOC strata and Galankin Island). The interval test may be based on parametric assumptions, requiring that data within each test group are approximately normally distributed with equal variances. These assumptions were tested using Shapiro-Wilk's test for normality (α=0.1) and Levene's test for equality of variances (α =0.1). If normality was not rejected but equality of variances was, then the variance for the difference equation was based on separate variances for each group. If normality was rejected, a non-parametric bootstrapped interval test was used.

The interval test was performed using a precautionary null hypothesis. This "proof of safety" null hypothesis assumes that the difference between AOC stratum and reference site means is large, and requires proof that the difference is actually small. The null (H_0) and alternative (H_A) hypotheses are:

H_0: $d \geq \delta$ (presumes the difference is large)

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

If the upper confidence bound on the observed difference (d = stratum mean – reference mean) was within the tolerance (δ) considered to be effectively similar for measureable values in a single reference population, then we reject the null hypothesis and conclude that the stratum and reference sites were functionally equivalent, within our specified tolerance. On the other hand, if the upper confidence bound exceeded the tolerance of what was considered to be functionally equivalent, then we fail to reject the null hypothesis and conclude that the stratum was significantly elevated above reference at a level that was functionally meaningful. Note that if the observed difference (d) was greater than δ, then the upper bound on d will naturally exceed δ. In this situation, no statistical test was required to conclude that the two areas compared were significantly different beyond the specified tolerance.

This approach required the establishment of a functionally meaningful difference or tolerance (δ) to compare results between test and reference sites. To accomplish this, dioxin TEQ data from a 2008 survey of ambient and reference sediment sites in Puget Sound WA (DMMP 2009) were used. Dioxin TEQs were calculated in the same manner as used in the present investigation. Three of the Puget Sound ambient/reference stations with relatively high dioxin TEQ values (i.e., >5.0 pg g^{-1}) were excluded from the δ calculation, following similar treatment of the data in the original data report (DMMP 2009). Data distributions for the Puget Sound ambient and reference sites were similar (Wilcoxon test, p=0.46, Kolmogorov-Smirnoff test, p=0.25) so a pooled data set (n=67) was used. These data were used to bootstrap samples of size 5 (the sample size used in the present investigation) and then construct a 90/90 tolerance interval on the bootstrapped means. This tolerance interval is the statistical interval expected to contain 90% of the ambient/reference means with 90% confidence. The width of this tolerance interval was 1.8 pg g^{-1}dioxin TEQ, representing δ: the maximum allowable difference between two ambient/reference area means. Differences statistically greater than this δ were considered to be functionally meaningful, as they were beyond the tolerance estimated for the ambient/reference distribution. Statistical results are presented in Section 4.

2.3.3 Bioaccumulation Evaluation and Screening Ecological Risk Assessment

The bioaccumulation evaluation outlined in Performance Measure 2 (shown in Figure 1-4, Section 1) required comparison of modeled 2,3,7,8-TCDD in AOC fish (from ingestion of benthic prey) to a threshold concentration of 44 pg g^{-1} 2,3,7,8-TCDD derived from published fish toxicity studies (see QAPP), providing that dioxin concentrations in AOC tissues were elevated compared to reference. Dioxin TEQ represents the toxic equivalent of 2,3,7,8-TCDD, and therefore would be appropriate for the statistical comparisons of *N. virens* (benthic prey) tissue results between each AOC stratum (n=5) and the reference site (n=5). The statistical test was designed to identify whether TEQ concentrations in tissues exposed to AOC sediment were elevated above concentrations in tissues exposed to reference sediments. If the test found that that AOC and reference site exposed tissues were functionally equivalent, this would confirm that dioxin measured in AOC or reference site tissues were derived from sources other than the APC mill site. Statistical comparisons were to be performed using the same one-sided interval test applied to sediment results. However, because >50% of dioxin congeners were non-detect in all samples, a qualitative evaluation of the observed ranges for the most widely detected congeners was used instead.

In addition, sediment-tissue bioaccumulation factors (BAFs) were to be calculated to evaluate the potential transfer of dioxin from AOC sediment to exposed polychaete worms as a proxy for any potential benthic prey consumed by fish or higher-order marine organisms. The BAF is a simple calculation of tissue dioxin concentration divided by sediment dioxin concentration (both in wet weight) for each station. However, BAF values were not calculated because of the lack of data above detection in the laboratory exposed tissues.

2.3.4 Correlations and Pairwise Scatterplots

Pairwise scatterplots were used to identify possible relationships among key variables (e.g., sediment and tissue dioxin concentrations; ammonia and TOC); and Spearman's rank correlation was used to summarize the magnitude of the correlation, and assess significance. Spearman's correlation provides a measure of any monotonic trend in the data, even if the trend is non-linear. Spearman's rank correlation is appropriate when there are data below the detection limit, which occurred for more than half of the total sulfide results. Where the data were all detected, and the relationships appeared linear, Pearson's correlation coefficient for linear relationships was also computed. Statistical significance (two-tailed, $\alpha = 0.05$) was used to identify positive or negative trends that were stronger than what would be expected by random chance alone.

3 SPI/PV RESULTS – PERFORMANCE MEASURE 1

This section presents results and interpretation of Sediment Profile Imaging (SPI) and Plan View (PV) camera data for Sawmill Cove. To satisfy Performance Measure 1, SPI results were evaluated to document the benthic infaunal successional stage so that areas with balanced, stable communities, as required by the DEC (2001) (see Section 1) could be identified. A complete set of all summary data measured from each sediment profile image is presented in Appendix B; summary data from the plan view images are presented in Appendix C. An electronic "pop-up" map of all SPI/PV images collected in Sawmill Cove can be found on the accompanying CD-ROM (Sitka 2011 popup map.pdf).

3.1 Image Analysis Results

The interpretation of SPI data was consistent with methods used in the 2000 survey (EVS 2001). The Plan View camera was used to provide a larger scale, areal overview of the seafloor in place of the towed underwater video that was used in the 2000 baseline survey (EVS 2001). Optical data from the PV camera and towed video are qualitative, and were used primarily to augment SPI and discrete sample data.

The SPI and PV survey methods provide complimentary but distinct data at different scales. Plan view images are good for seeing large objects on the surface of the sediment in the centimeter-to-meter size range (the average width of the images from this survey ranged from 0.5-2 m), whereas the SPI camera can detect structures in the sediment on the millimeter-to-centimeter scale. The two technologies are effectively combined to map large-scale attributes such as the presence or absence of wood waste or presence of sulfur-oxidizing bacterial colonies in the AOC. The SPI camera can view benthic infauna and wood chips to smaller wood fibers or pulp particles in the fine-sand to coarse silt-sized range. The PV camera can reveal the presence of epifauna and larger wood pieces and logs on the sediment surface.

Parameters such as boundary roughness and mud clast data (number, size) provide supplemental information pertaining to the physical regime and bottom sediment transport activity at a site. Even though mud clasts are definitive characteristics whose presence can indicate physical disturbance of some form, the mud clasts noted in the images from this survey were either biogenic in origin or artifacts due to sampling (mud clumps clinging to the frame base) and not indicative of physical disturbance or sediment transport activities. Therefore, mud clast data were not used as individual parameters for interpretation.

The results for some SPI parameters are sometimes indicated in the data appendix or on the figure maps as being “Indeterminate” (Ind). This is a result of the sediments being either: 1) too compact for the profile camera to penetrate adequately, preventing observation of surface or subsurface sediment features, or, 2) too soft to bear the weight of the camera, resulting in over-penetration to the point where the sediment/water interface was above the window (imaging area) on the camera prism (the sediment/water interface must be visible to measure most of the key SPI parameters like aRPD depth, penetration depth, and infaunal successional stage).

3.1.1 Grain Size

The sediment grain-size major mode for the most part fell into one of two categories: silty very fine sand (4-3 phi) or primarily silt-clay (> 4 phi; see Figure 3-1). Stations closer to shore on the bathymetric slope had a slightly higher fraction of very-fine to fine sand mixed in with the silty sediments (Figure 3-2), and the same areas that had hard cobble bottom preventing prism penetration back in the 2000 baseline survey (EVS 2001) also had similar sediment grain-size ranges during this survey (Stations 1-13 and 1-26 on Figure 3-1; see Figures 3-3 and 3-4). As one moved away from shore into the deeper areas of the site, sediment grain size was fairly uniform, with silt-clay predominating at most of the stations; wood fragments were still quite evident in the majority of the profile images, from larger chips/chunks of wood (larger than 1 cm in diameter; see Figure 3-5) to finer fibers/shreds mixed in with the silt-clay sedimentary matrix (Figure 3-6).

3.1.2 Prism Penetration Depth

The stop collar settings on the camera for prism penetration depth were adjusted occasionally (see Appendix B), but for the most part, the camera settings were consistent and mud doors were used on the base sled because of the soft nature of the sediments; lead weights were only used at 2 stations (O-3 and O-4) in the outfall area. Given the fairly uniform nature of the sediment grain-size, the variation in penetration depth of the camera (Figure 3-7) was a good indicator of the relative shear strength of the sediment as a function of both sediment geotechnical properties and biological mixing depth. Average station prism penetration depth ranged from 1.7 to 20.4 cm, with an overall site average of 12.5 cm; not surprisingly, the shallowest penetration values corresponded to the two stations where pebbles and cobble were seen on the sediment surface (Figures 3-3 and 3-4). Harder bottom (lower penetration values) were also found in the immediate vicinity of the fish processing outfall.

Figure 3-1. Sediment grain-size major mode (phi units) in the AOC during the May 2011 survey.

Figure 3-2. The higher fraction of very fine sand mixed in with wood fibers and silt-clay sediments was typical of the stations sampled closest to the shoreline of the former APC site. Scale: width of profile image = 14.4 cm.

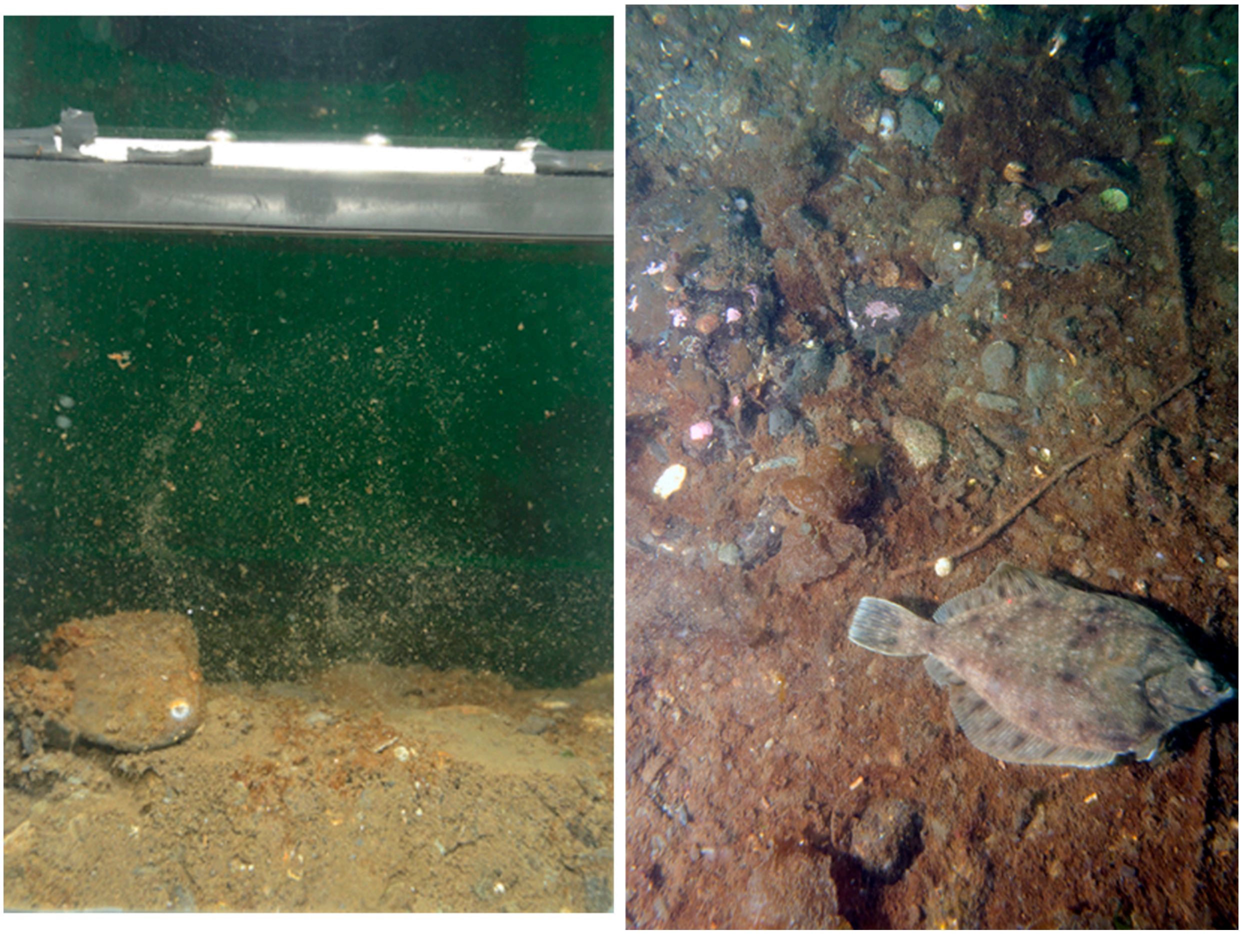

Figure 3-3. This plan view image (right) and profile image (left) from Station 1-13 shows the poorly-sorted cobble-silt bottom in the northeast area of the AOC. Stations closest to shore in the southwest corner of the AOC also couldn't be sampled due to the hard bottom and steep slope of the area. Scale: width of profile image = 14.4 cm; width of plan view image = 56 cm.

Figure 3-4. This plan view image (right) and profile image (left) from Station 1-26 shows a similar hard cobble bottom to the sampling results from the 2000 baseline survey. No accumulation of wood waste or excess organics would be expected in areas like this within the AOC, so these stations can be considered fully recovered. Scale: width of profile image = 14.4 cm; width of plan view image = 86.1 cm.

Figure 3-5. This profile image from Station 1-17 shows the persistent presence of large chips/chunks of word waste similar to those found in the 2000 baseline survey; the refractory nature of the wood particles results in extremely slow decomposition rates. Scale: width of profile image = 14.4 cm.

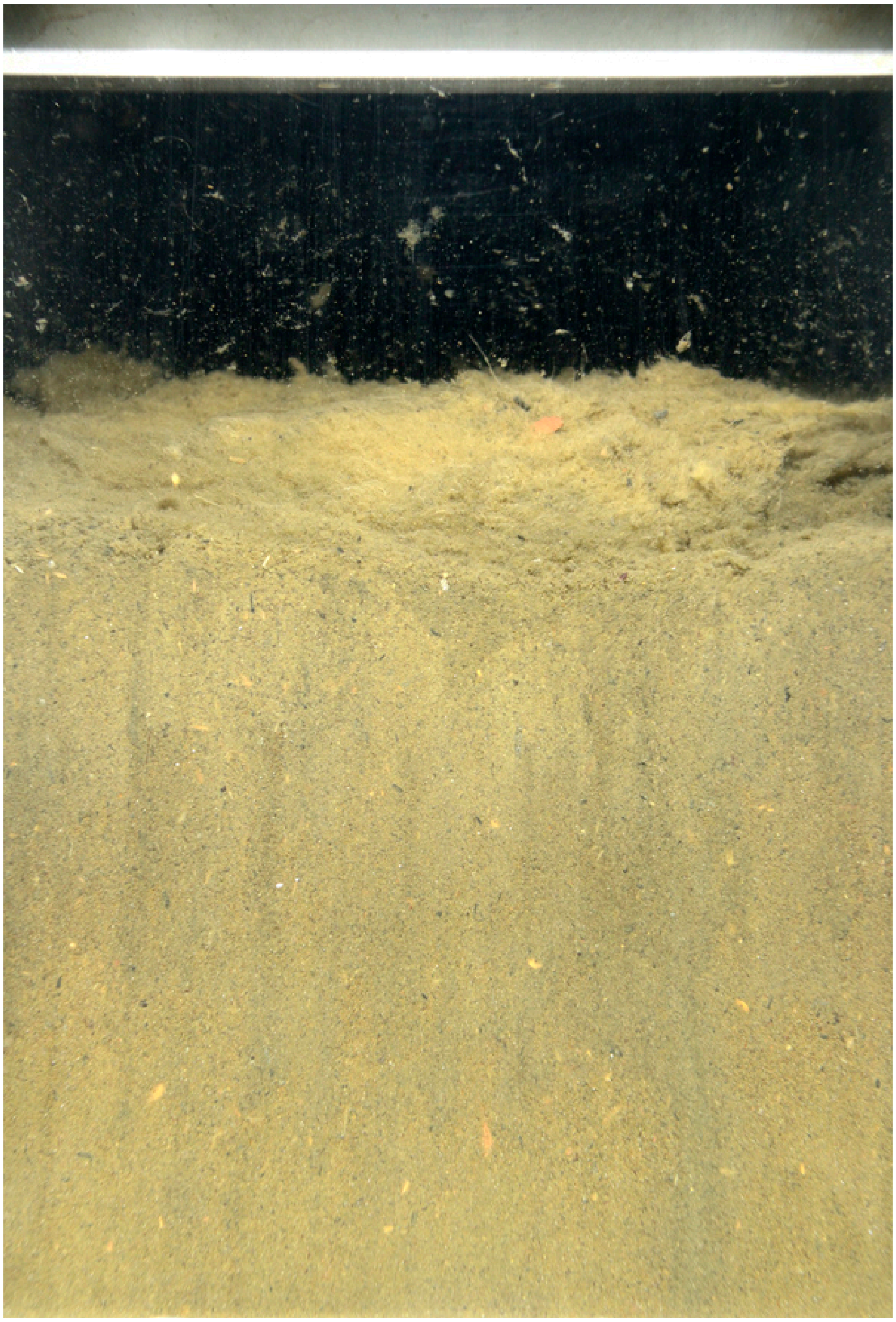

Figure 3-6. Small wood fibers are still readily apparent in the predominantly silt-clay sedimentary matrix seen at Station 1-51, typical of most stations in the deeper areas of Stratum 1. Note the layer of fluffy organic detritus which has settled on the sediment surface. Scale : width of image = 14.4 cm.

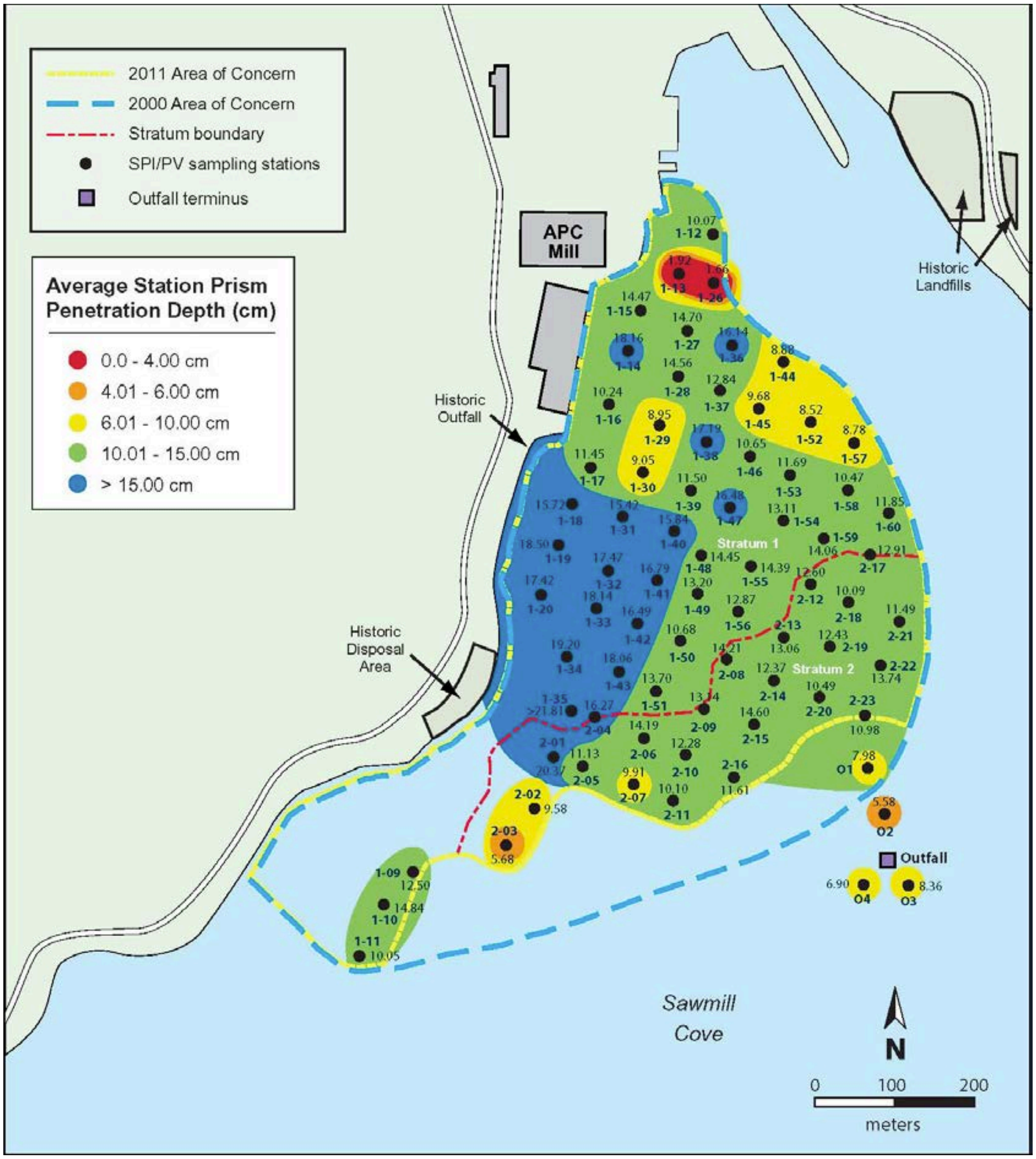

Figure 3-7. Spatial distribution of average station camera prism penetration depth (cm) in Sawmill Cove, May 2011.

3.1.3 Surface Boundary Roughness

Small-scale surface boundary roughness ranged from 0.6 to 4.2 cm with an overall site average value of 1.5 cm (Figure 3-8); boundary roughness values were quite similar in both strata, with the highest value occurring at Station 1-31. The high value at Station 1-31 was because of one outlier value in one of the replicate images (Figure 3-9) and not representative of the two images at this station. Approximately 60% of the boundary roughness values were due to biogenic processes (fecal mounds, burrow openings) altering sediment surface topography (Appendix B), while the other 40% were due to physical structures (wood/rocks/logs) or bottom slope.

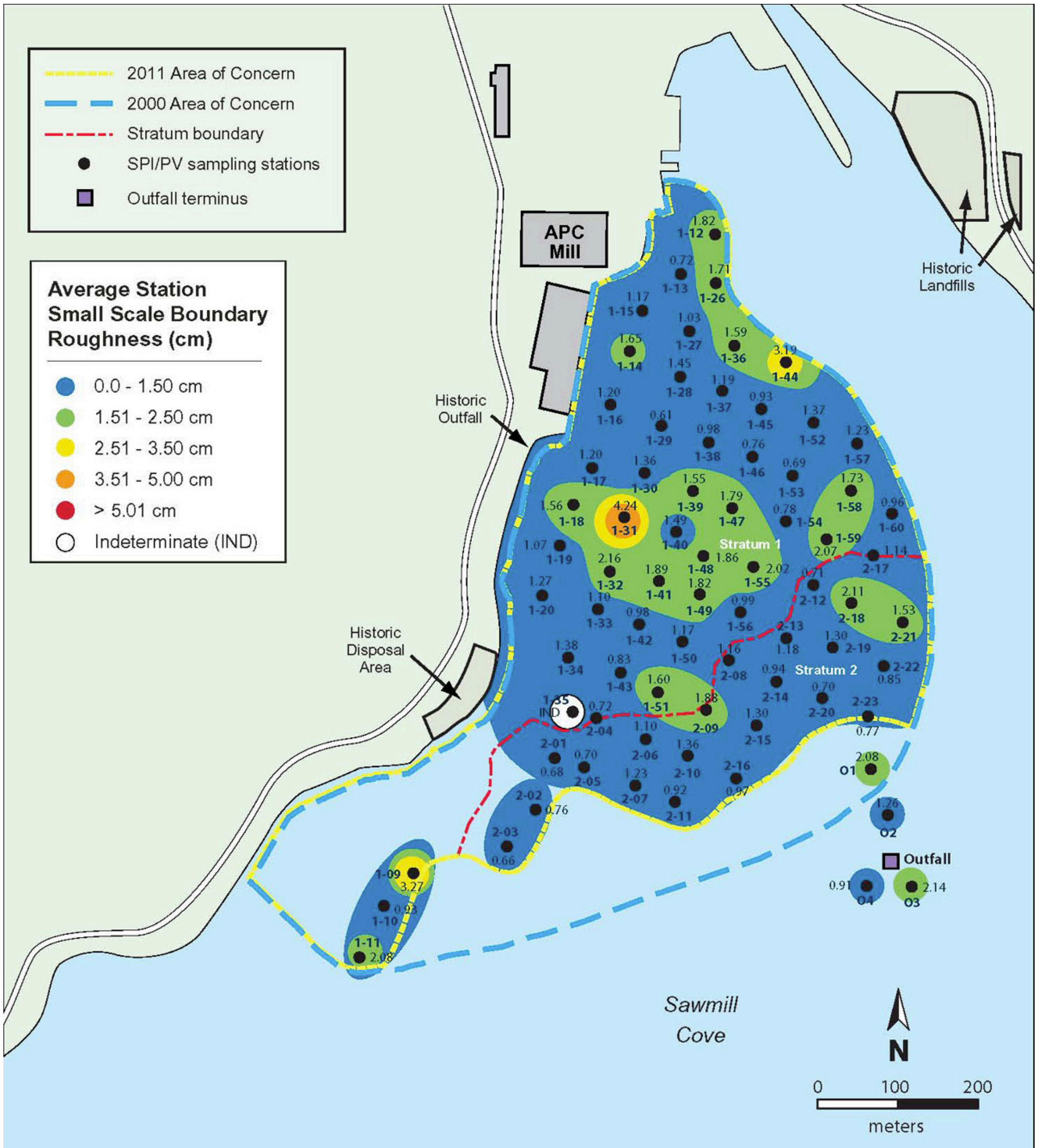

Figure 3-8. Spatial distribution of average station small-scale boundary roughness values (cm) in Sawmill Cove, May 2011.

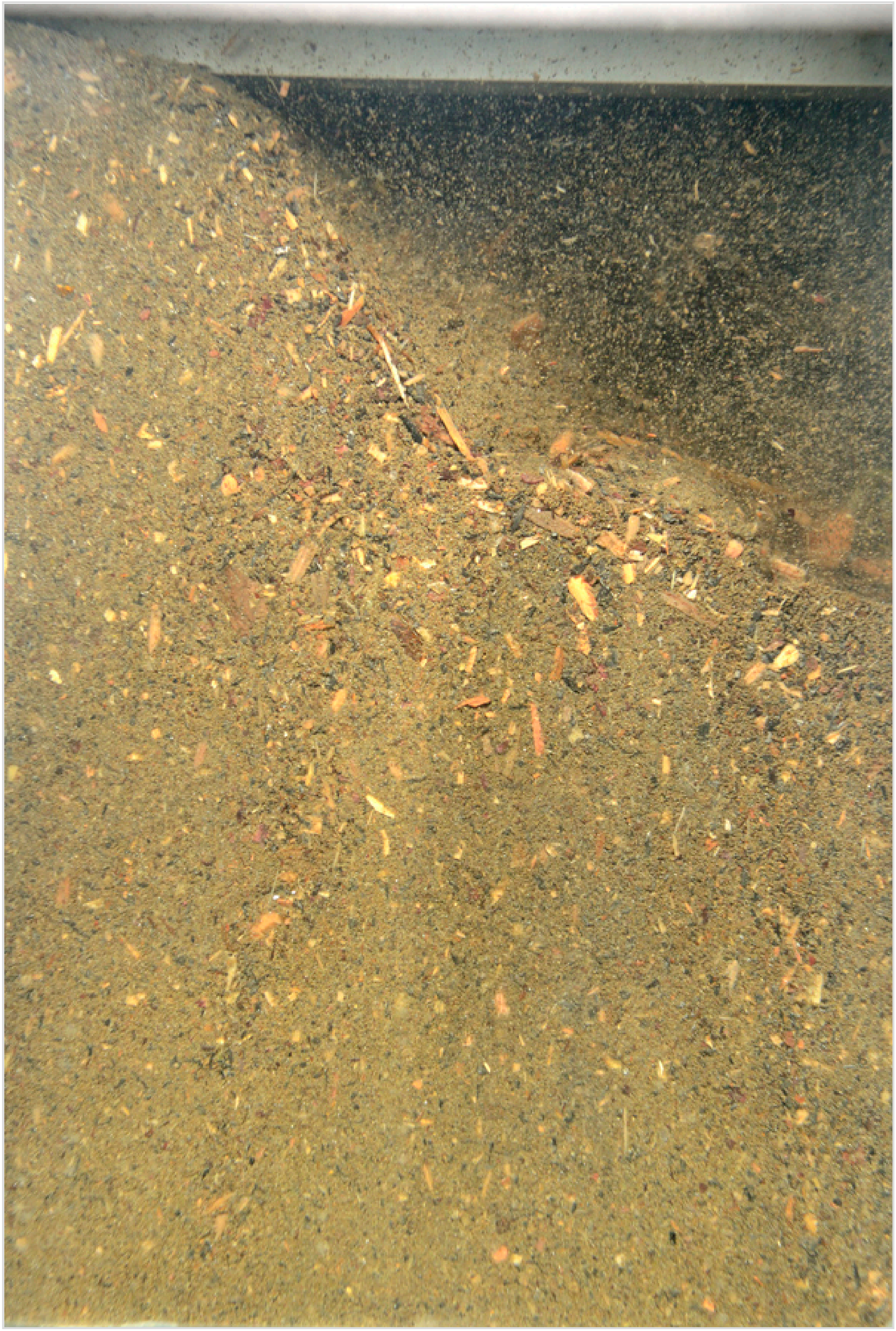

Figure 3-9. This profile image from Station 1-31 had an unusually high boundary roughness value (9.8 cm) due to a sloping bottom. Scale: width of image = 14.4 cm.

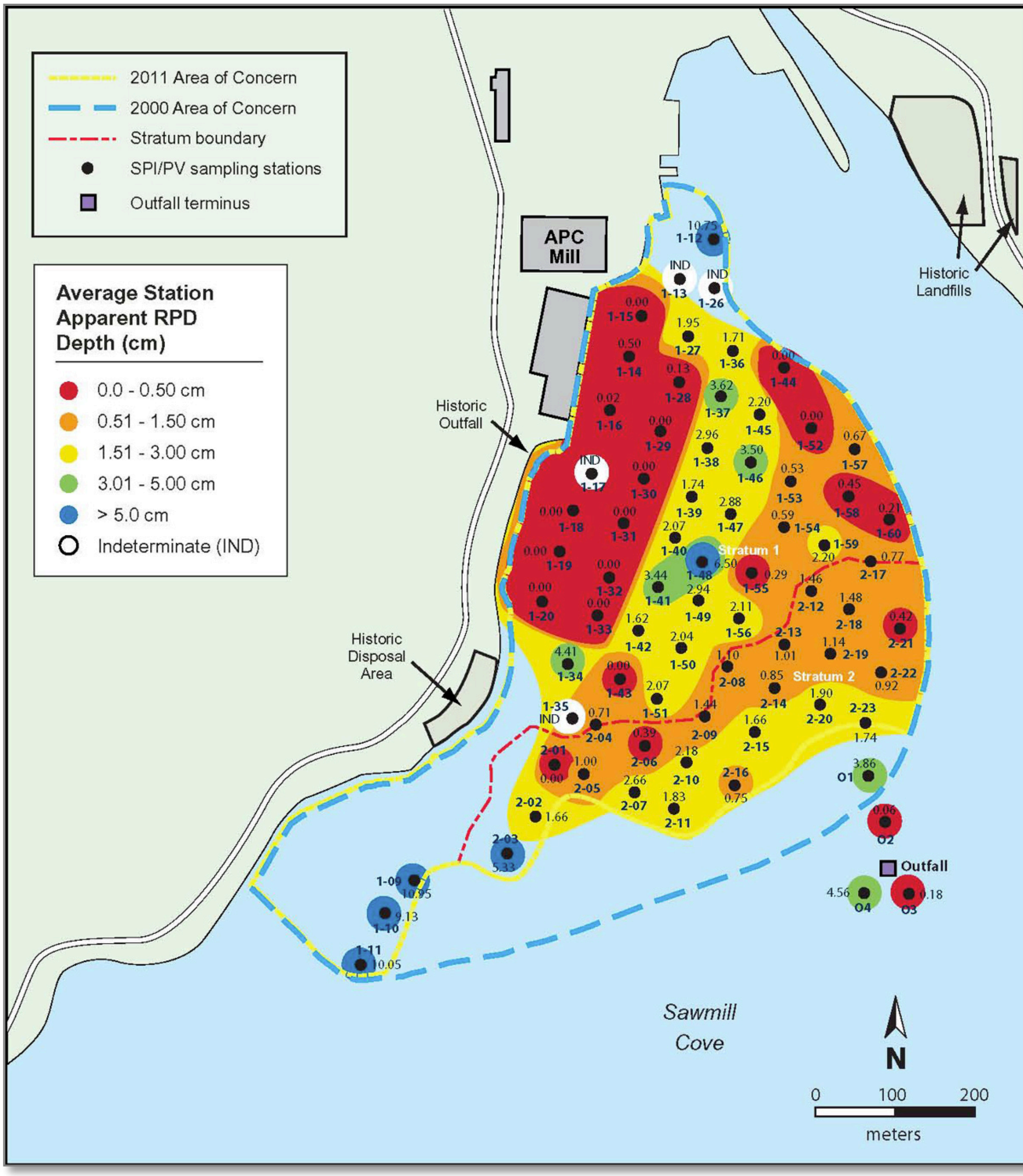

Figure 3-10. Spatial distribution of average station aRPD depths (cm) in Sawmill Cove, May 2011.

3.1.4 Apparent Redox Potential Discontinuity Depth

Measured values for the aRPD depth ranged from 0.0 to 11.0 cm throughout the entire site, with an overall site average depth of 1.9 cm (Figure 3-10). Only a relatively small number of stations (12 out of 73, or 16%) had aRPD values greater than 3 cm, and most of those were in Stratum 1. As was the case in the 2000 survey, aRPD values were substantially lower at stations closest to the shore, with many stations having no measurable aRPD values (Figure 3-11). Values at 4 stations could not measured because of inadequate prism penetration (Stations 1-13 and 1-26, see Figures 3-3 and 3-4), unusually high wood particle content so that there was no color change in the sediment profile (Station 1-17, see Figure 3-5), or camera prism over-penetration so that the sediment-water interface was not visible (Station 1-35).

Figure 3-11. These profile images from Station 1-19 (left) and 1-32 (right) are typical of the locations where sediment-oxygen demand was so high that no detectable aRPD could be measured. Scale: width of each profile image = 14.4 cm.

3.1.5 Organic Enrichment, Sedimentary Methane, Fish Waste, and Thiophilic Bacterial Colonies

There were multiple sources of organic enrichment contributing to the sediment oxygen demand (SOD) in the AOC detected in the May 2011 survey: wood waste from the former APC operations, natural phytoplankton detritus from the water column spring bloom, and fish waste being generated by the new fish processing plant that is operating in the former mill site and being discharged from the outfall just beyond the AOC. Visual evidence of wood waste could been seen at all but two of the stations sampled (Stations 1-13 and 1-26; see Appendix B), and only trace amounts of wood waste could be seen at four of the stations in Stratum 1 (Stations 1-9 through 1-11 in the southwest corner of the site and at Station 1-57). Surface fluff layers of phytoplankton detritus were quite common in the fine-grained stations in the deeper parts of the AOC where the bottom flattened out from the steep slope that exists near the shoreline (Figure 3-12). Even though SOD was quite pronounced at many locations (red areas in Figure 3-10), subsurface methane was only detected at two locations (Figure 3-13).

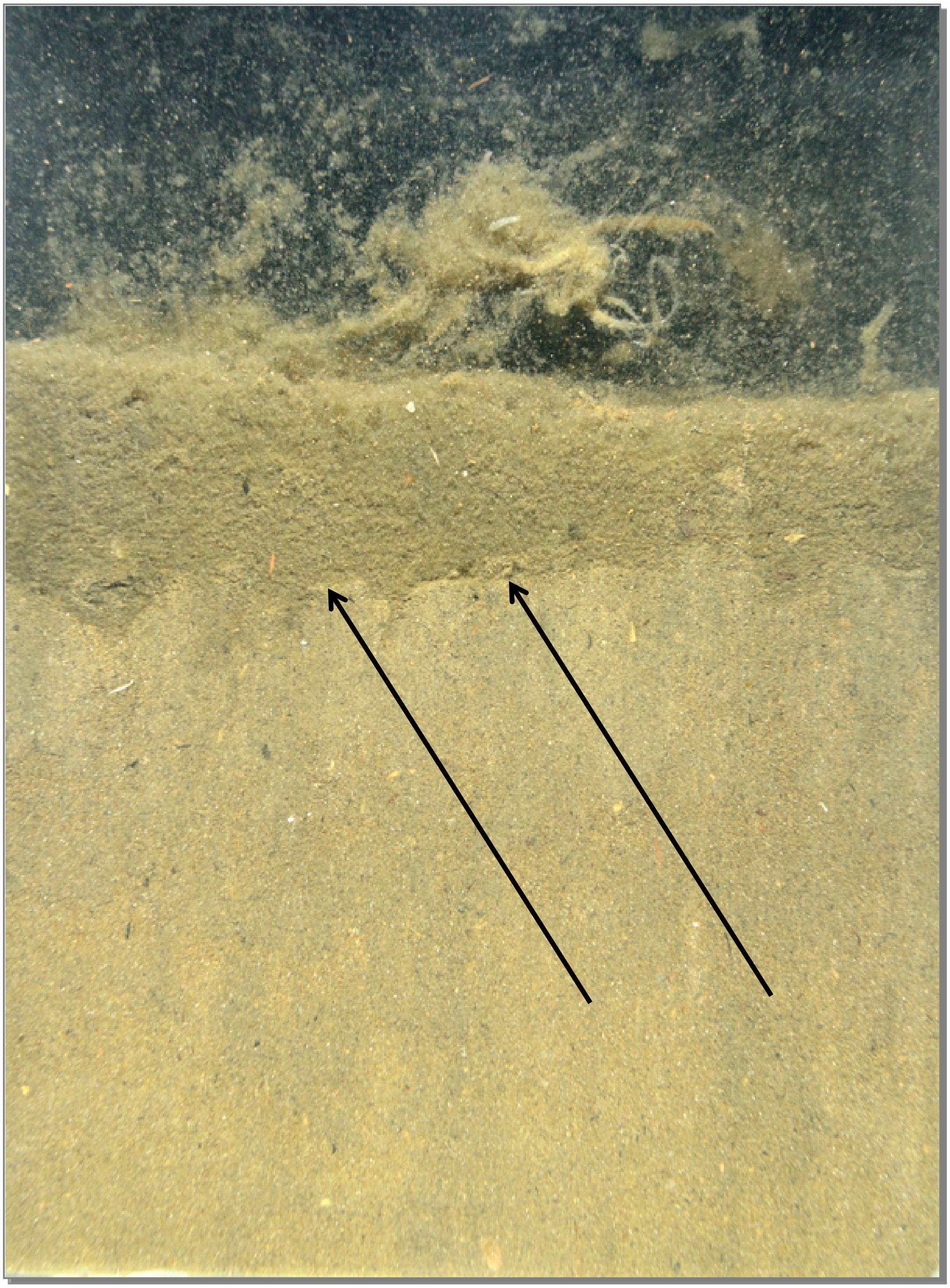

Figure 3-12. The contact boundary (arrow) between the recently-settled phytoplankton detritus and sediment surface is readily apparent in this profile image from Station 1-45. Scale: width of image = 14.4 cm

Figure 3-13. Spatial distribution of subsurface methane detected in Sawmill Cove, May 2011.

The new source (since the last survey was performed) of labile organic material to the seafloor in Sawmill Cove was the fish waste discharge from the outfall just outside the AOC boundary. Fish waste was apparent either as a distinct accumulation of bones or decomposing tissue (Figure 3-14) or as traces of scattered skeletal fragments/fin rays on the sediment surface (Figure 3-15); fish waste was found in either trace amounts or accumulated deposits at almost half of the stations surveyed (Figure 3-16).

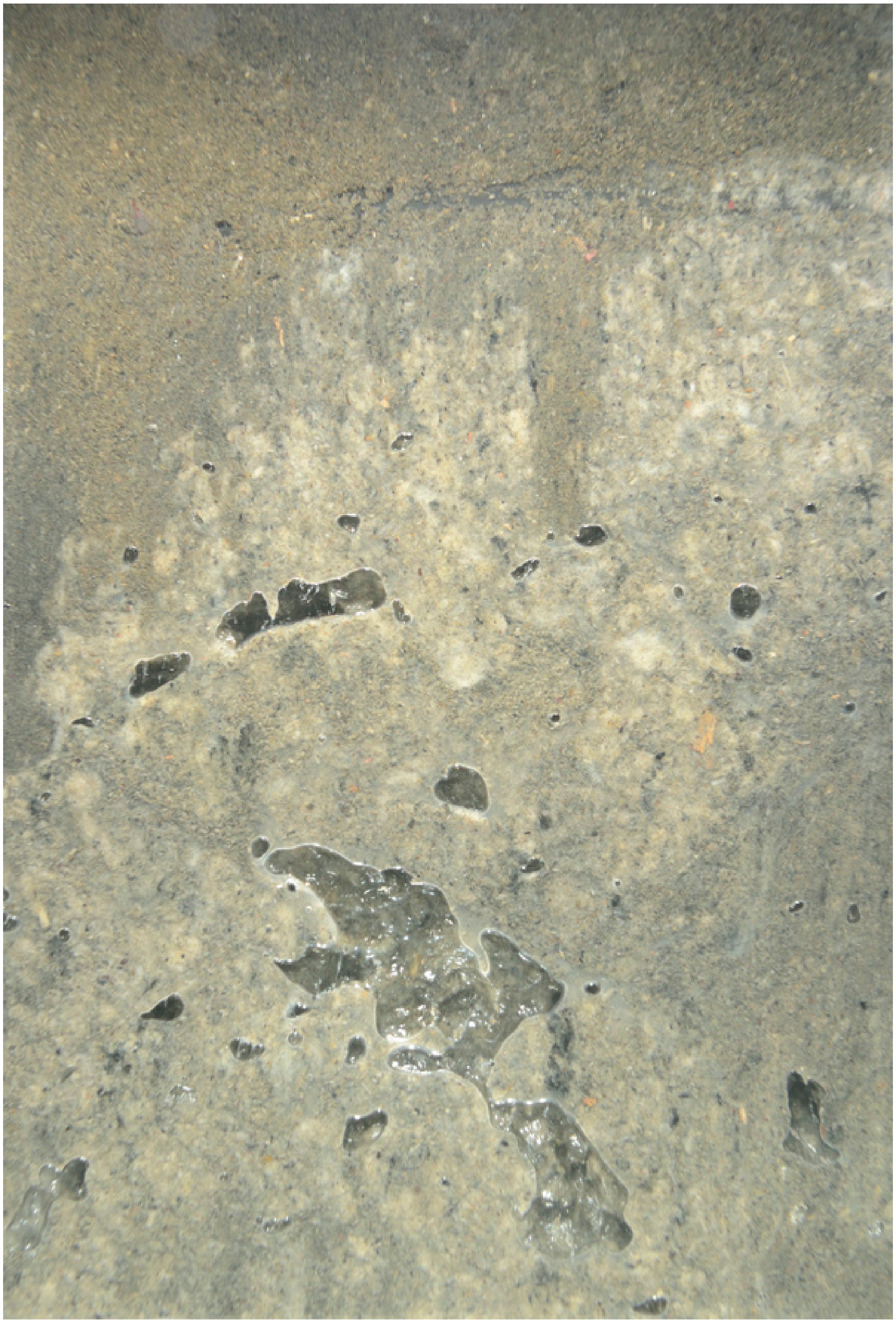

Figure 3-14. This profile image from Station 1-35 shows an accumulation of decomposing fish tissues that exceeds the penetration depth of the camera prism and subsurface methane gas being generated by anaerobic decomposition of the organic waste. Scale: width of image = 14.4 cm.

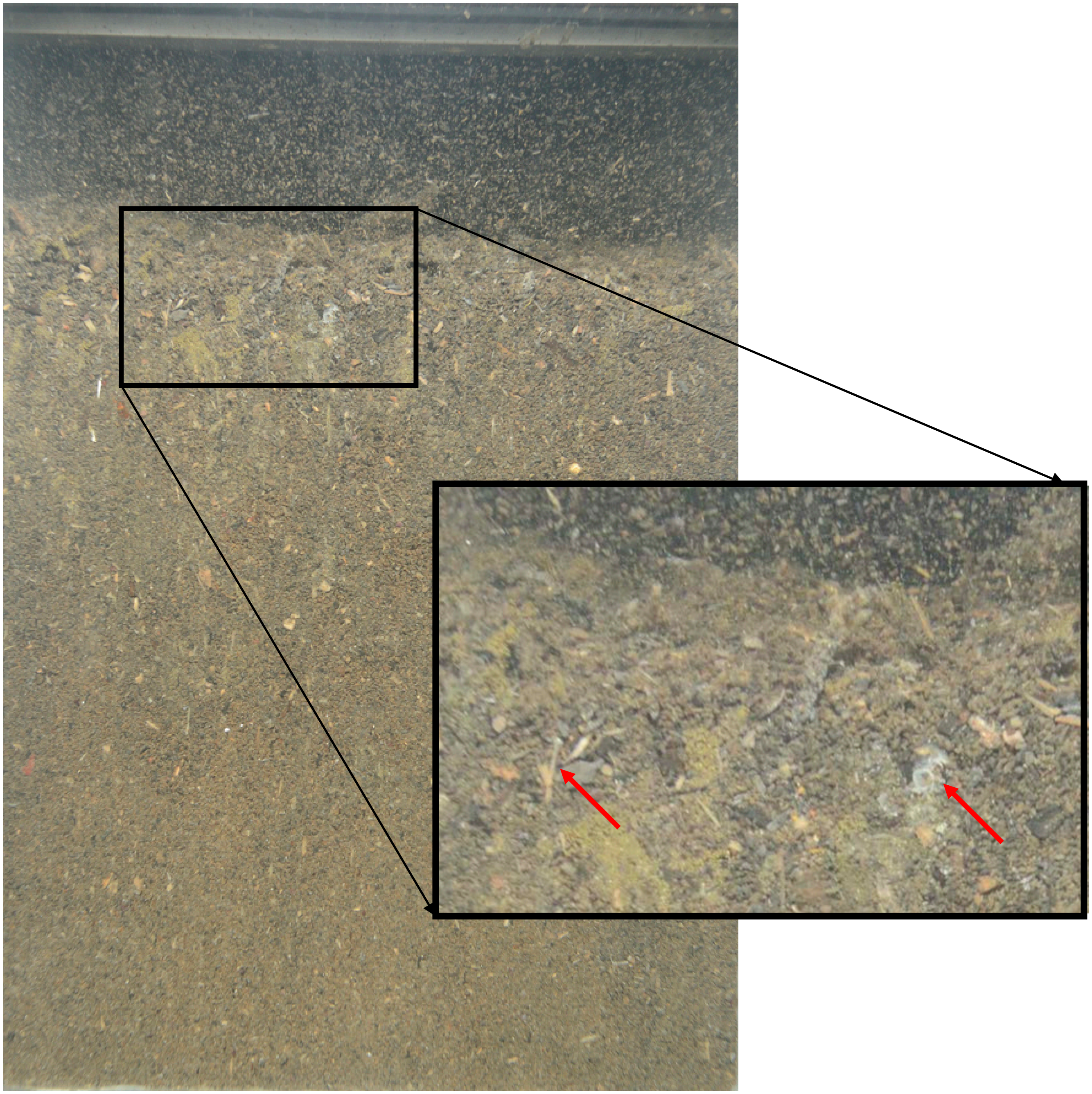

Figure 3-15. This profile image from Station 1-32 shows scattered fish bones/vertebrae in the upper few centimeters of sediment (see magnified inset). Scale: width of profile image = 14.4 cm.

Figure 3-16. Spatial distribution of fish waste, *Beggiatoa* colonies, and presence of low dissolved oxygen in the benthic boundary layer at locations sampled in Sawmill Cove, May 2011.

Once all these sources of organic input exceed the capacity of the benthic ecosystem to process the available organic carbon, the excess amounts will adversely affect the sediment in the form of high SOD; the high SOD will either result in low aRPD values or potentially low dissolved oxygen in the benthic boundary layer which will stimulate population growth of thiophilic (sulfur-loving) bacterial colonies such as *Beggiatoa.* Thiophilic bacterial colonies were found either in scattered colonies, small patches (Figure 3-17), or thick mats on the sediment surface (Figure 3-18) at the majority of stations surveyed (Figure 3-16). Out of the 73 stations sampled in the AOC, there were only 8 stations where thiophilic bacteria were not detected. The presence of the thick mats (Figure 3-18) of thiophilic bacteria provided an excellent indication of areas where accumulation of labile organic matter was the greatest (Figure 3-19).

Figure 3-17. This plan view image from Station 1-48 shows isolated white patches on the sediment surface indicating the presence of *Beggiatoa* colonies in response to lowered dissolved oxygen in the benthic boundary layer. Scale: width of image = 92.2 cm.

3.1.6 Infaunal Successional Stage

The mapped distribution of infaunal successional stages is shown in Figure 3-20. While stations closest to the shoreline still showed the greatest amount of disturbance to the benthic community by being restricted to primarily opportunistic (Stage 1) assemblages, evidence of equilibrium community (Stage 3) assemblages was detected at 30 stations, and evidence of low densities of Stage 3 taxa were seen at an additional 17 stations.

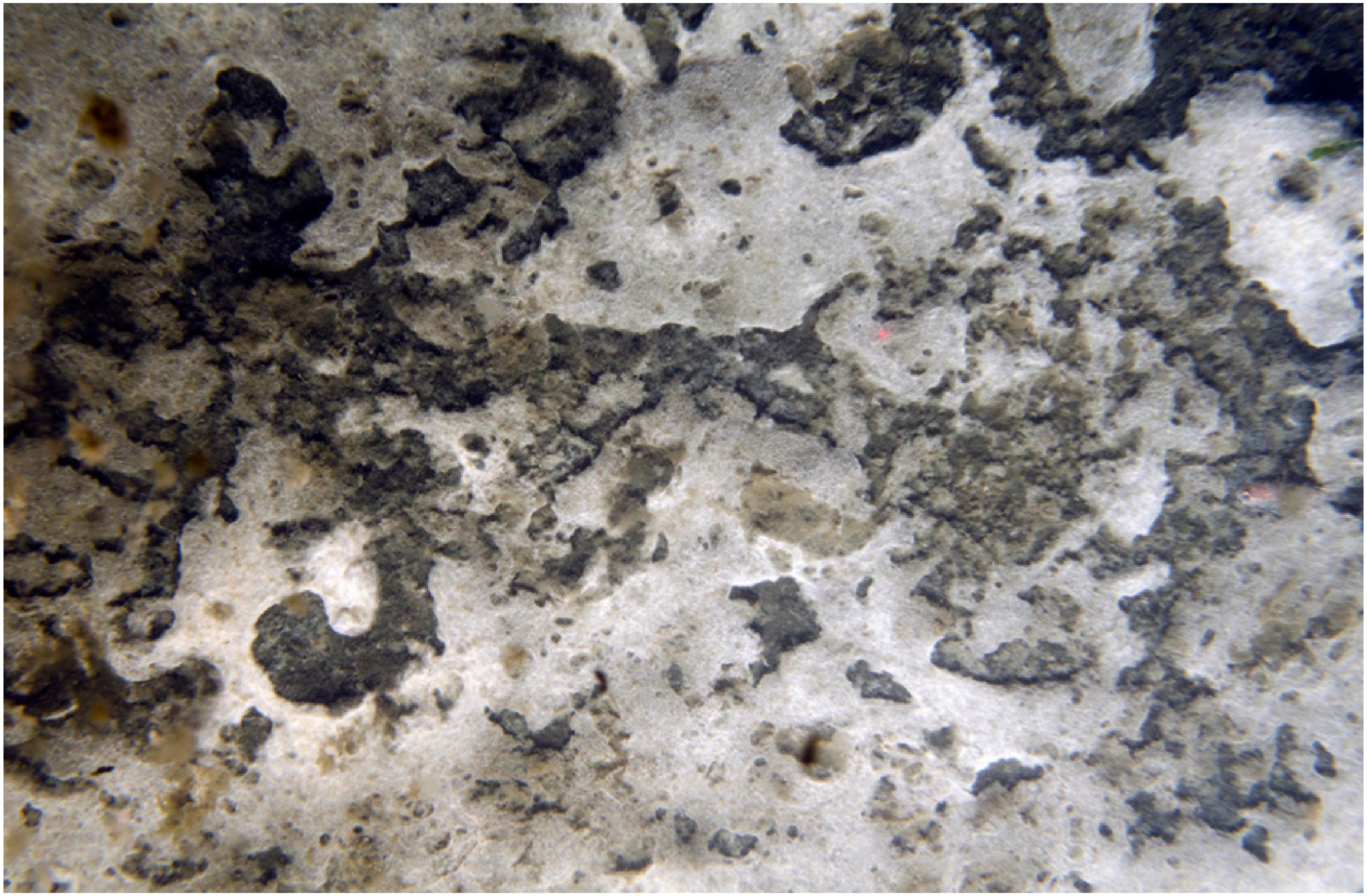

Figure 3-18. This plan view image from Station 1-50 shows an almost continuous, thick mat of thiophilic bacteria colonies on the sediment surface. Scale: width of plan view image = approx 80 cm.

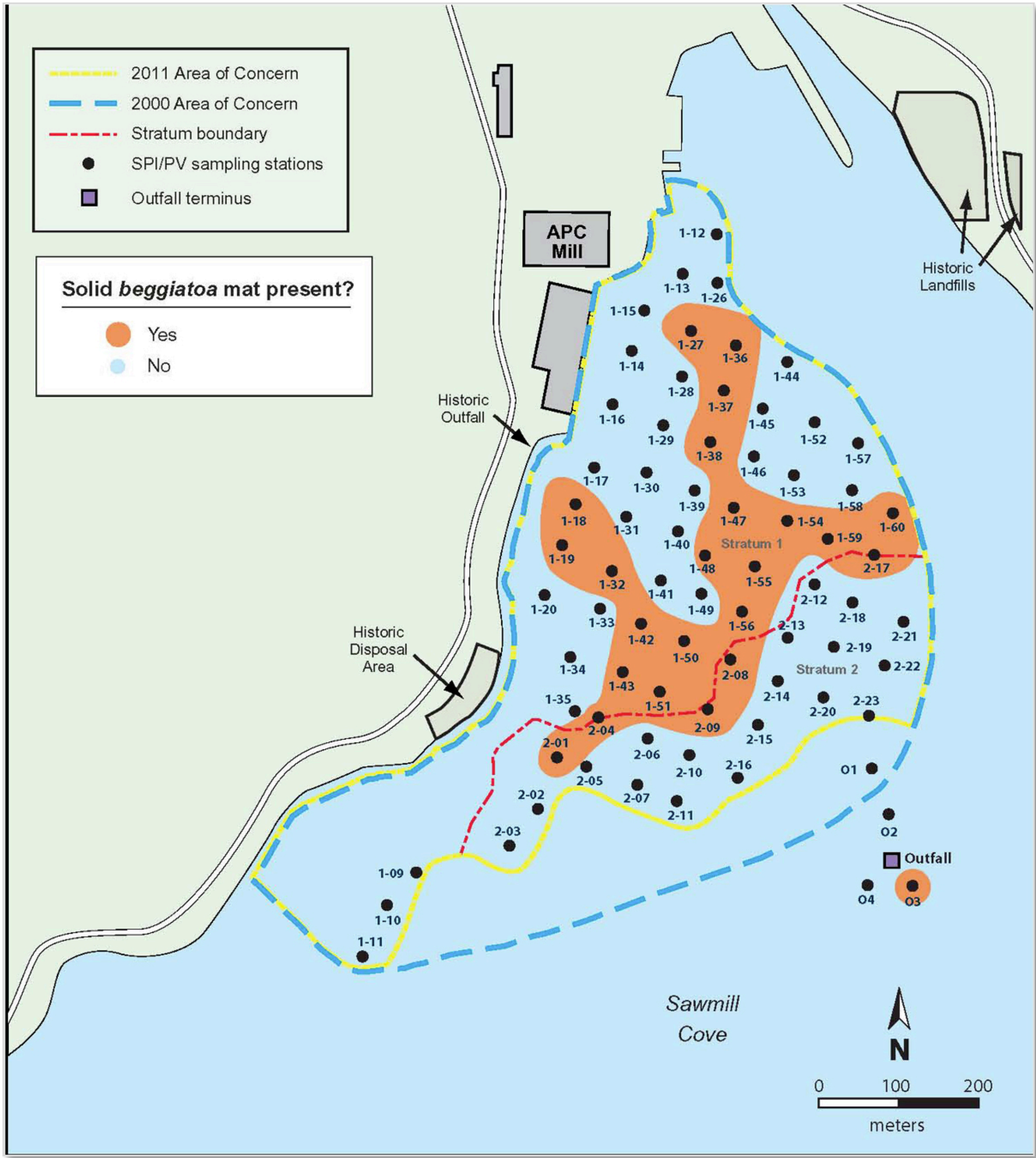

Figure 3-19. Locations in Sawmill Cove where thick bacterial mats (see previous figure) were detected on the sediment surface in plan view images.

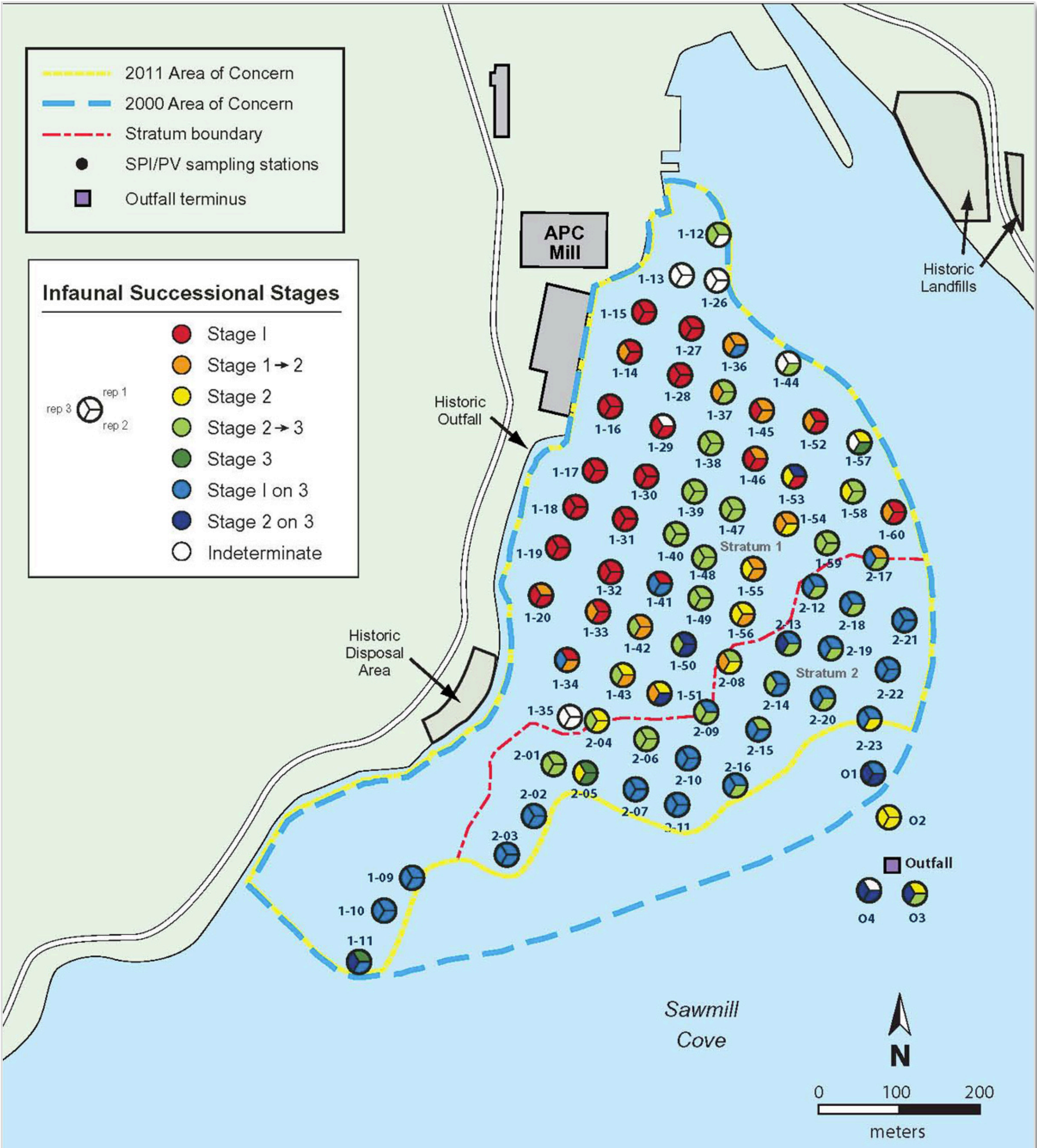

Figure 3-20. Spatial distribution of benthic infaunal successional stages in Sawmill Cove, May 2011.

3.2 Performance Measure 1 Discussion

The results from the combined SPI/PV survey provided a comprehensive update to the earlier baseline study results from eleven years ago. The substitution of the plan view camera system for the towed-video was an excellent replacement; not only were synoptic, large-scale aerial views obtained at the same locations where the profile images were collected, but the earlier problems encountered with towing the video camera through a field of unknown obstructions were eliminated (much of the video footage from the 2000 survey was of limited value because of the height above the bottom at which the camera needed to be towed to avoid obstructions combined with poor water visibility). Like the video survey during the 2000 baseline effort, the plan view images provided the perspective to view the presence of the larger pieces of wood (Figure 3-21) as well as the presence of epifaunal foragers (Figures 3-3 and 3-22).

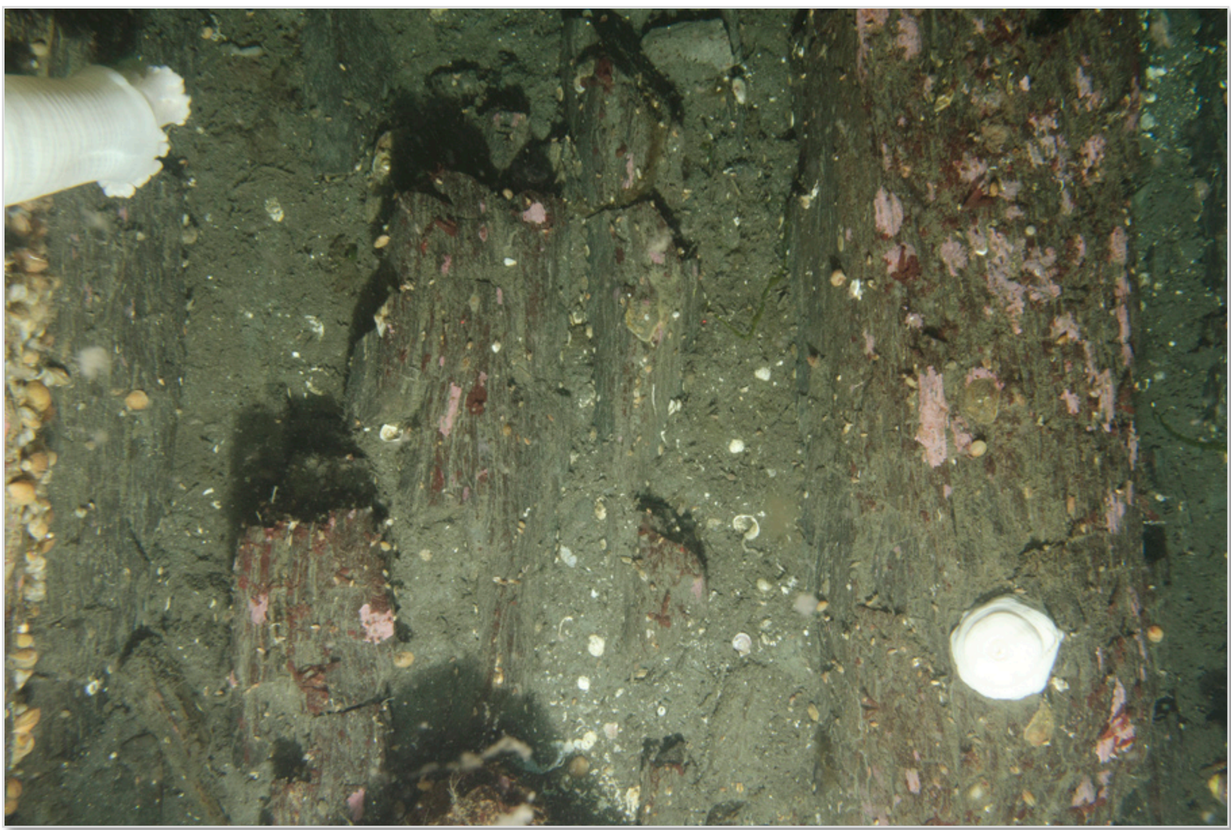

Figure 3-21. This plan view image from Station 1-32 shows portions of larger logs on the sediment surface that have been colonized by fouling epifauna (algae, anemones, tunicates, etc.). Scale: width of image = 131 cm.

In addition to the small-scale (mm to cm) features detected in the profile images, there were a few locations on the steep sloped area closest to shore (see comment field in Appendix B) where evidence of groundwater discharge from the sediments was found (not surprising given the study site location and proximity to coastal freshwater source inputs; see Figure 3-23).

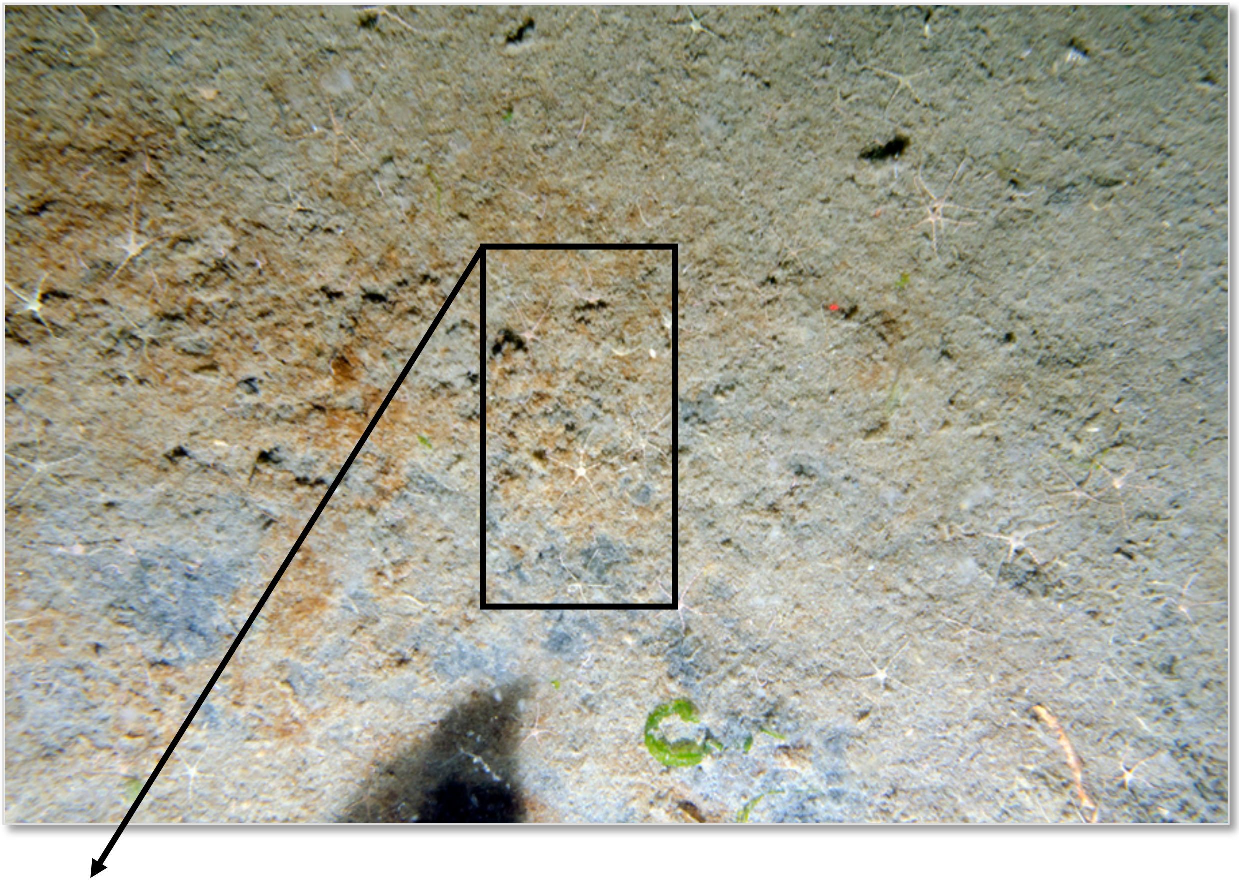

Figure 3-22. This plan view image from Station 1-12 and the enlarged inset shows a high density of ophiuroids (brittle stars) foraging on the sediment surface. The rust-colored layer on the sediment surface is most likely from some iron precipitation from groundwater discharge (see next figure) Scale: width of larger plan view image = 82 cm.

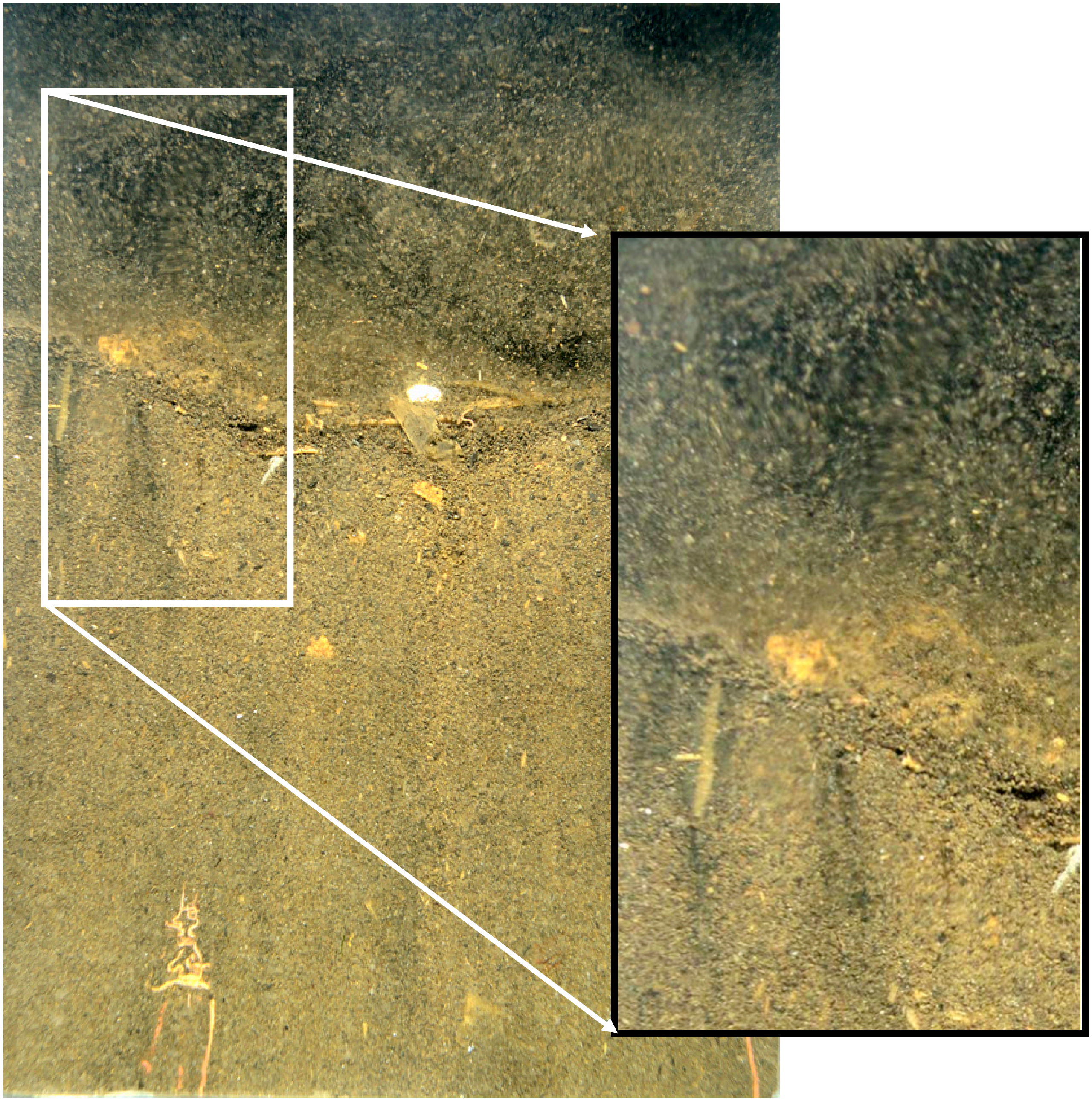

Figure 3-23. This corresponding profile image from Station 1-12 (also shown in Fig. 3-22) shows evidence of coastal groundwater (freshwater) discharge from sediment. The close-up magnified inset shows the distortions to the imaged particles both in the sediment and suspended in the overlying water due to density differences in the freshwater emerging from just below the sediment surface. Scale: width of larger profile image = 14.4 cm.

There were two significant findings from the 2011 survey that update the predictions/trends documented in the 2000 baseline survey (which compared its results to the earlier 1994-95 Remedial Investigation data):

1. The rate of decomposition of the wood waste particles is much slower than anticipated.

2. An additional major source of organic input to the Sawmill Cove benthic ecosystem since the 2000 survey will undoubtedly affect the rate of recovery the remaining areas of bottom still affected by the wood waste.

One of the more striking findings, which corroborated earlier investigations by G&A in Thorne Bay, AK (Prince of Wales Island) for Alaska DEC (G&A 2007), was the apparent "freshness" of much of the wood waste seen in the plan view and profile images. Just as brine is used to pickle and preserve other plant material, many of the larger chunks of wood appeared as if they were "quite fresh" and recently cut, not showing any signs of decomposition/aging despite the mill operation closing down almost 20 years ago (Figures 3-24 and 3-25). The refractory nature of the wood waste as a source of organic carbon along with the preservative effects of the brine (and cold water temperatures) is actually a benefit to the benthic ecosystem recovery process, because the system is already stressed enough with two additional sources of labile organic carbon input. The first is from normal phytoplankton blooms (Figure 3-26), which was also documented as a eutrophication source in the 2000 baseline survey; the second (new) source is the waste being discharged from the outfall just beyond the AOC that is generated by the fish processing plant (Silver Bay Seafoods) located at the former mill site. While the circulation patterns in Silver Bay are not known in order to predict where the bulk of the material discharged from the plant is ending up, the effects of the plant's fish waste discharge on the AOC as an additional stressor is quite apparent.

In the four years since Silver Bay Seafood started processing fish and discharging into Sawmill cove, a thin, discontinuous layer of fish waste has been deposited throughout much of the site (Figure 3-16), with accumulations thicker in some locations than others (Figures 3-27 and 3-28). Even though the discharge of fish waste from Silver Bay Seafoods has increased organic loading to the general benthic ecosystem in Sawmill Cove, the plant has recently taken steps to reduce their discharge (30% reduction from 2010 to 2011) by shipping out all salmon waste to be used as pet food. While there is a substantial increase in stations showing the presence of thiophilic bacterial colonies compared to the 2000 survey, future source control efforts at the plant should ameliorate this effect. Even though increased organic loading can cause a retrograde in benthic successional status (Pearson and Rosenberg 1978; see Figure 2-3, Section 2), the benthic community in Sawmill Cove has continued to improve since the baseline survey in 2000. All of Stratum 2, which was indicated as "transitional" after the 2000 survey results were analyzed, is now fully recovered (Figure 3-29).

Out of the original 100 acres (approximately) of AOC seafloor identified in the original Record of Decision (ROD) as having a severely compromised benthic ecosystem, the current status as a result of the 2011 survey is as follows:

Table 3-1. Current status of the AOC (see Figure 3-29 for delineation of strata)

2011 AOC Description	Acres
Stratum 1 (area of impact)	17.0
Stratum 2 (transitional)	29.0
Stratum 3 (recovered) – to 2011 border	37.3
Stratum 3 (recovered) – to original AOC border	54.6

With Stratum 2 (transitional) meeting the recovery milestone of having “secondary consumers”, there are now approximately 83 acres of seafloor that have achieved Milestone 3 (Table 1-1, Section 1) from the original ROD, which was originally anticipated to occur sometime between 2020–2040. Once an additional 21 acres of Stratum 2 has Stage 3 benthic assemblages, then all of the ROD recovery milestones will have been met.

Figure 3-24. This plan view image from Station 1-19 (above) and profile image from nearby Station 1-17 (left) shows what appears to be fresh, recently deposited wood waste even though it was deposited almost 20 years ago. Scale: width of profile image = 14.4 cm; width of plan view image = 66.7 cm.

Figure 3-25. This plan view image from Station 1-29 (above) and profile image from Station 1-16 (left) show more examples of “cold temperature, brine-preserved” wood waste that appears relatively fresh. Scale: width of profile image = 14.4 cm; width of plan view image = 99.2 cm.

Figure 3-26. This profile image from Station 1-36 shows a 3-5 cm surface layer of phytoplankton detritus whose decomposition is already depleting boundary layer waters of dissolved oxygen as evidenced by the white strands of Beggiatoa seen most prominently in the left half of the image (arrow). Scale: width of profile image = 14.4 cm.

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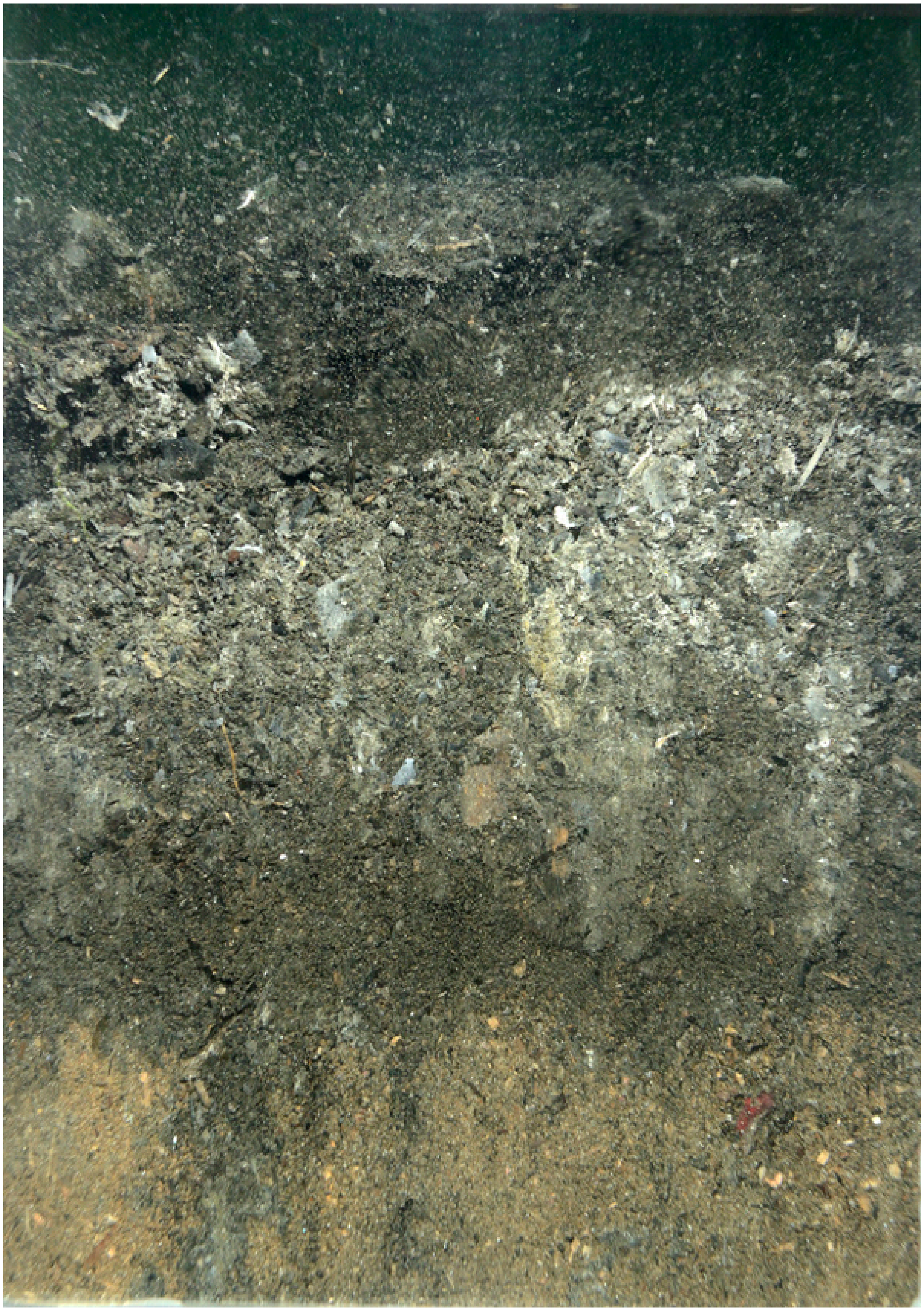

Figure 3-27. This profile image from Station 1-14 shows a layer of fish waste accumulation well in excess of 10 cm with extremely high SOD and no aRPD. Scale: width of image = 14.4 cm.

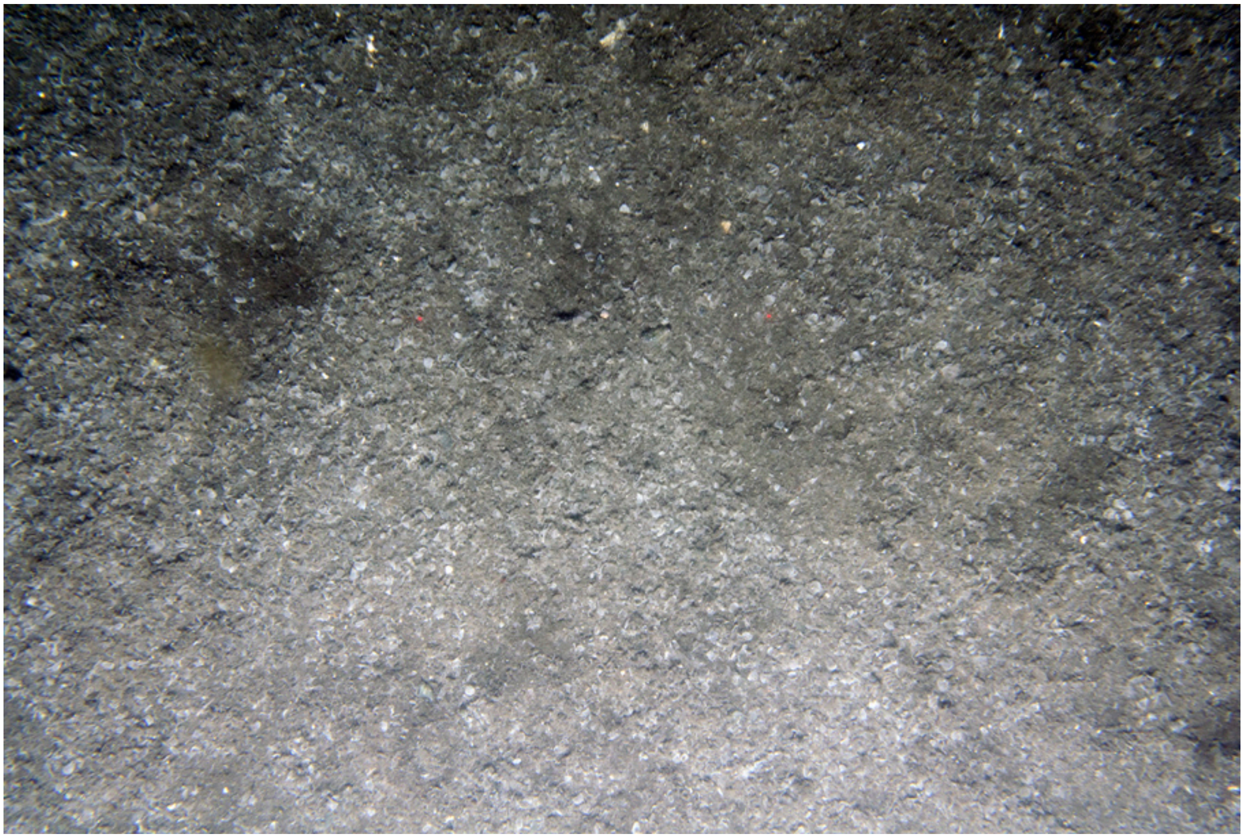

Figure 3-28. This plan view image from Station O-2 near the outfall just outside the AOC shows the surface expression of fish waste accumulations such as those seen in cross section in the previous figure. Scale: width of image = 91.9 cm.

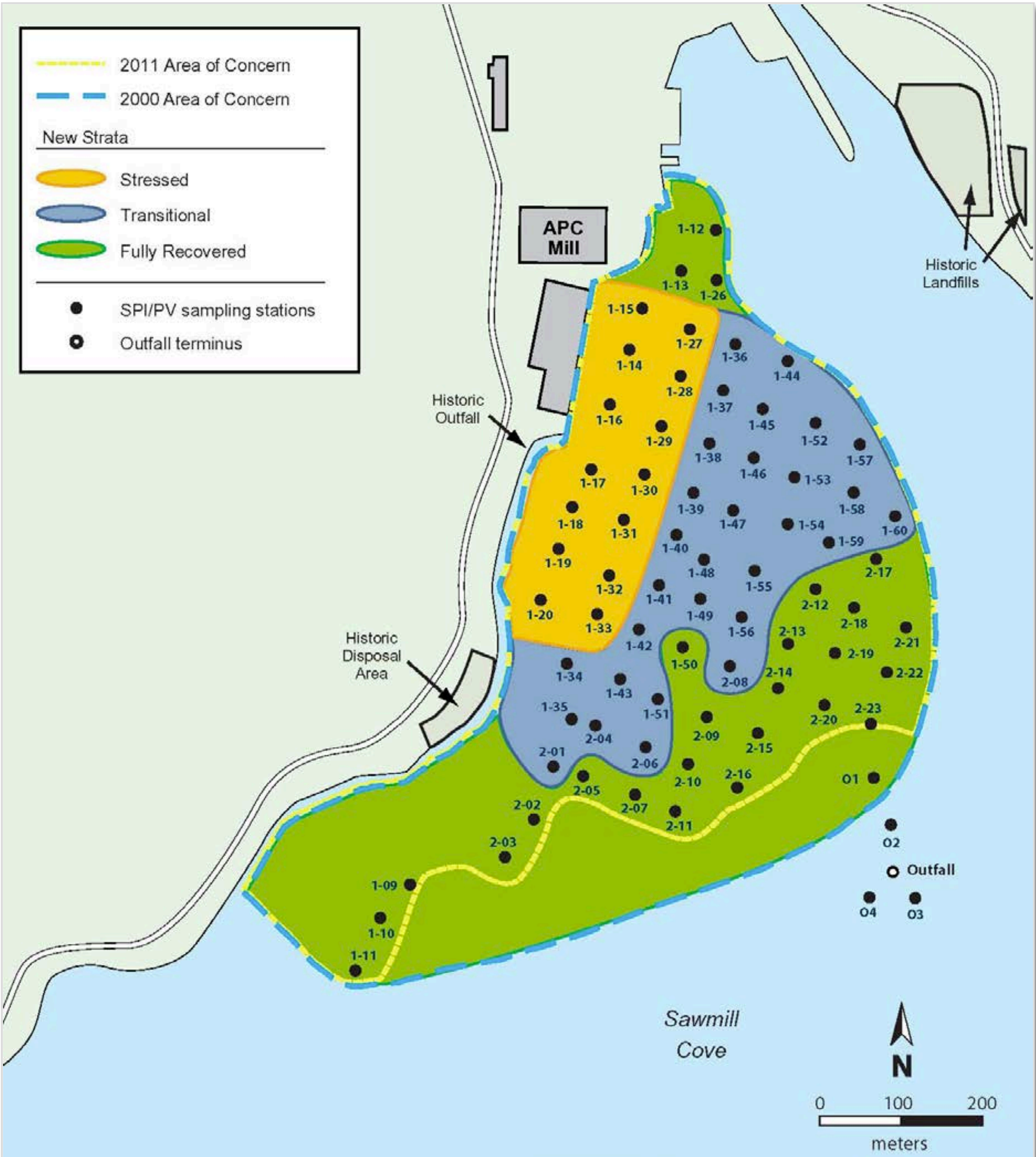

Figure 3-29. The status of infaunal benthic communities (Performance Measure 1) in the AOC as of May 2011.

4 SEDIMENT AND BIOACCUMULATION RESULTS - PERFORMANCE MEASURE 2

This section presents results for sediment chemistry and bioaccumulation tests. Five sediment samples each were analyzed from Stratum 1, Stratum 2, and the Galankin Island reference site for total organic carbon (TOC), dioxin, and total ammonia and sulfides in porewater. Polychaete worm tissue samples exposed to sediment from the same 15 stations in laboratory bioaccumulation tests were analyzed for dioxin. In addition, a quality control tissue sample was analyzed from the same batch of polychaete worms exposed to their home sediment collected from the Damariscotta River in Maine.

Sediment TOC and total ammonia/sulfides in porewater were measured as general indicators of wood waste and associated degradation products, respectively. Dioxin sediment and tissue concentrations were measured to satisfy the bioaccumulation evaluation requirement established by the DEC (2001), as stated in Performance Measure 2 (see Section 1). Sediment and tissue results for each station are presented in Appendix D. Complete reports, including quality control results, from the analytical and bioaccumulation testing laboratories are included on the accompanying CD-ROM.

4.1 TOC, Total Sulfides, and Total Ammonia

Summary results for TOC, sulfides, and ammonia are presented in Table 4-1 for each stratum in the Sawmill Cove Area of Concern (AOC) and the Galankin Island reference site. Spatial distributions in AOC sediment and porewater are shown in Figures 4-1 and 4-2. The scatterplots generated to facilitate data interpretation are not shown, but relationships between the parameters measured in AOC sediment are summarized by the correlation results shown in Table 4-2.

Total organic carbon measurements provide an indication of the amount of organic matter, including wood waste, present in surface sediment. Naturally elevated organic carbon (>1-4%) occurs in fine-grained sediment from low-energy depositional areas, such as Sawmill Cove and portions of the Galankin Island reference site. Concentrations of TOC in nine of ten AOC samples were much higher (>16%) with visible wood chips/fibers in nearly all samples (see Figure 4-2 and Section 3). Four of five reference sample TOC concentrations were typical of fine-grained, depositional sediment, ranging from 1.55−3.60% (dry weight). However, a result of 6.37% at reference Station R-03 indicates that naturally occurring concentrations can be higher. The wood chips/fiber present in both AOC strata produced mean TOC concentrations at nearly 10 times the mean value observed at the reference site (Table 4-1). TOC concentrations increased significantly with increasing total ammonia in AOC samples (Spearman's correlation, $p<0.05$, Table 4-2), suggesting active degradation of organic debris in Sawmill Cove.

Ammonia and sulfides occur naturally in seawater in trace amounts. They are considered pollutants when concentrations are sufficient to cause chronic or lethal effects to aquatic organisms. Total ammonia measured in AOC porewater consists of both un-ionized ammonia (NH_3) and the ionized form (NH_4^+). Un-ionized ammonia is toxic to most aquatic species in low concentrations, while the ionized form is toxic only at highly elevated concentrations. In relatively cold seawater (<15˚C), nearly all ammonia (>98%) exists as NH_4^+. Protective guidance typically ranges from 0.05−1 mg L^{-1} for un-ionized ammonia in seawater (Nixon 1995; Meade 1985). Williams and Brown (1992) estimated a 96 hour LC_{50}

of 0.787 mg L^{-1} NH_3 for the nauplius of the marine copepod *Tisbe battagliai* and a No Observed Apparent Effect Level (NOAEL) of 0.106 mg L^{-1} NH_3 for a study based on tests using several life stages.

Concentrations of ionized and un-ionized ammonia typically increase with increasing pH and temperature. Past results reported by the EPA for pH and temperature in Sawmill Cove ranged from 5.49–7.81 pH units and 6.7–15.1˚C (EPA 1991). Assuming these values apply to current porewater conditions, un-ionized ammonia would range from approximately 0.46–1.3% of the measured total ammonia in seawater (http://www.fao.org/docrep/field/003/AC183E/AC183E18.htm). The highest concentration of total ammonia measured in the AOC in the present survey was 1.8 mg L^{-1} (Station 2-09), which would result in a maximum concentration of 0.023 mg L^{-1} NH_3, well below reported toxic threshold concentrations.

Table 4-1. Summary of ammonia, sulfides, and TOC results for the AOC and reference sites (*n*=5 per site).

Parameter	Site	Mean	Median	Minimum	Maximum	Maximum Station
Total Ammonia[1] (mg L^{-1})	Stratum 1	1.06	1.15	0.4	1.7	1-18
	Stratum 2	0.69	0.45	0.3	1.8	2-09
	Reference	0.37	0.35	0.1	0.75	R-02
Total Sulfides[1] (mg L^{-1})	Stratum 1	0.22	0.20	0.05	0.45	1-18
	Stratum 2[2]	0.49	<0.05	<0.05	2.35	2-09
	Reference[3]	<0.05	<0.05	<0.05	0.05	R-03
TOC (%)	Stratum 1	24.9	21.7	16.9	36.0	1-18
	Stratum 2	19.0	19.3	6.99	26.9	2-10
	Reference	2.95	2.29	0.92	6.37	R-03

[1]Measured in porewater; [2]4 out of 5 samples had non-detect values (<0.05 mg L^{-1}); [3]All non-detect values

Total sulfides consist of numerous chemicals of dissolved and suspended sulfides, including hydrogen sulfide and generally less toxic sulfide salts, and as such, have no specific regulatory criteria for the protection of marine organisms. Detected concentrations in the AOC ranged from 2–100 times higher than those measured at the reference site. Both AOC strata means were elevated relative to the reference mean; however, the high mean for Stratum 2 was due to a single result measured at Station 2-09 (2.35 mg L^{-1} total sulfides). The remaining four results for Stratum 2 and all five reference site results were non-detect (<0.05 mg L^{-1}).

In summary, elevated concentrations of TOC in both strata compared with the reference site further substantiate SPI results that major portions of the AOC remain affected by wood waste. Ammonia concentrations in AOC porewater were slightly elevated relative to reference and significantly correlated with sulfides and TOC, indicating wood degrading activity. The elevated total sulfides measured in Stratum 1 and at one station in Stratum 2 are consistent with the thiophilic bacteria observed in SPI images in the AOC. Other potential sulfide sources are the various forms of sulfur byproducts that entered the environment from the dissolving sulfite pulping process utilized by the mill

(Oetken et al. 1990). The sulfur by-products would have contained primarily oxidized forms, which would have been reduced gradually to sulfides by bacterial as well as geochemical processes in AOC sediment.

Figure 4-1. Spatial distribution of TOC in AOC surface sediment (left) and visible wood chips in sediment collected at Station 1-18 (right); also see Figures 3-7, 3-26, & 3-27 for other examples of visible wood waste.

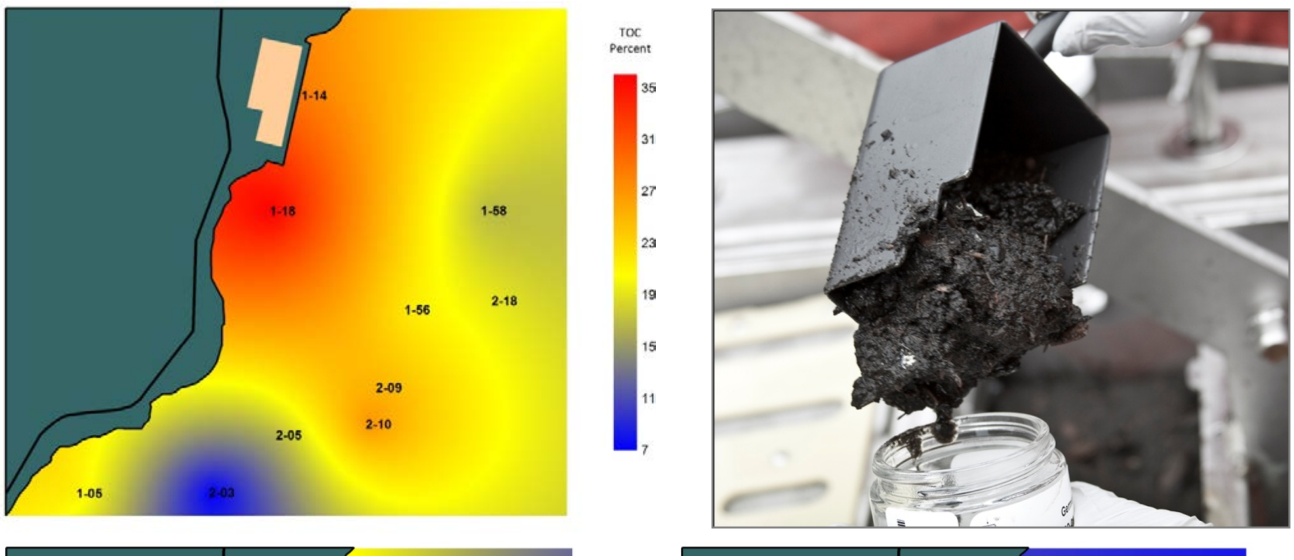

Figure 4-2. Spatial distribution of total ammonia (left) and total sulfides (right) in AOC sediment porewater.

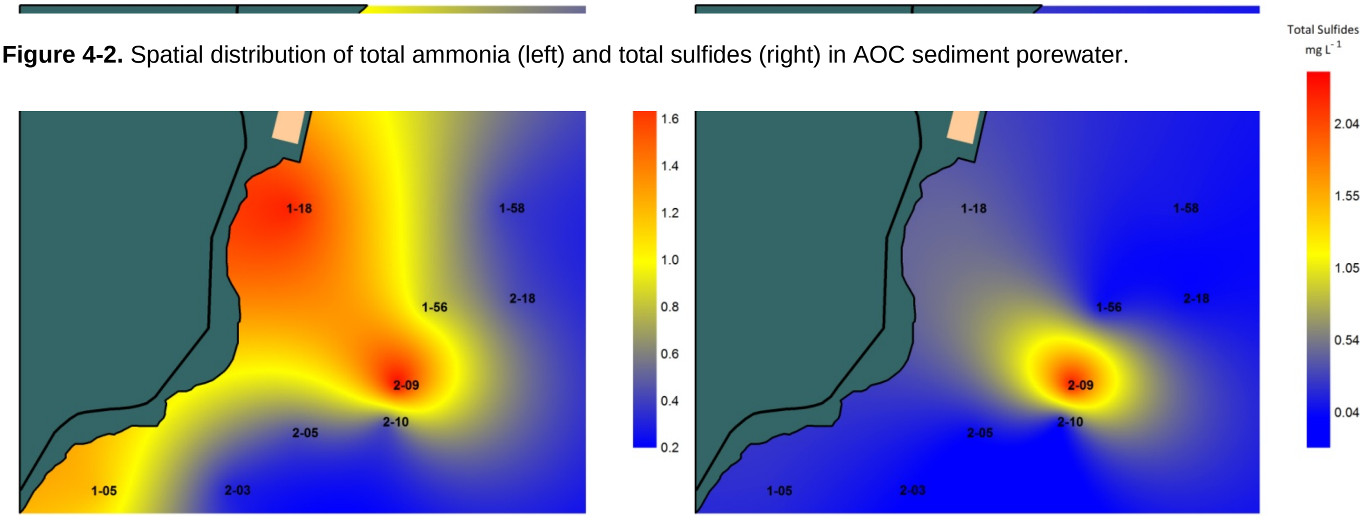

Table 4-2. Spearman's rank correlation results for AOC sediments (*n*=10). Bold indicates statistically significant rank correlations at $p<0.05$.

Parameter	Total Ammonia	Total Sulfides[1]	TOC
Total Ammonia	-	**0.71**	**0.73**[2]
Total Sulfides[1]	**0.71**	-	**0.73**
Dioxin TEQ	**0.67**[2]	**0.59**	**0.83**[2]

[1]More than half the results for Sulfides were below detection, so only a rank-based correlation method appropriate for censored data sets was used. [2]These data were all detected, and the relationships were linear and found to be significant by Pearson's correlation (p<0.05).

4.2 Dioxin Results

Dioxin results, evaluated primarily as total dioxin TEQ in sediment and tissue samples, are summarized in Table 4-3. Spatial distribution in AOC sediment is shown in Figure 4-3. Sediment results are reported in dry weight for direct comparison to conventional regulatory guidelines and published values; tissue results are reported in wet weight, as a standard basis used to assess bioaccumulation.

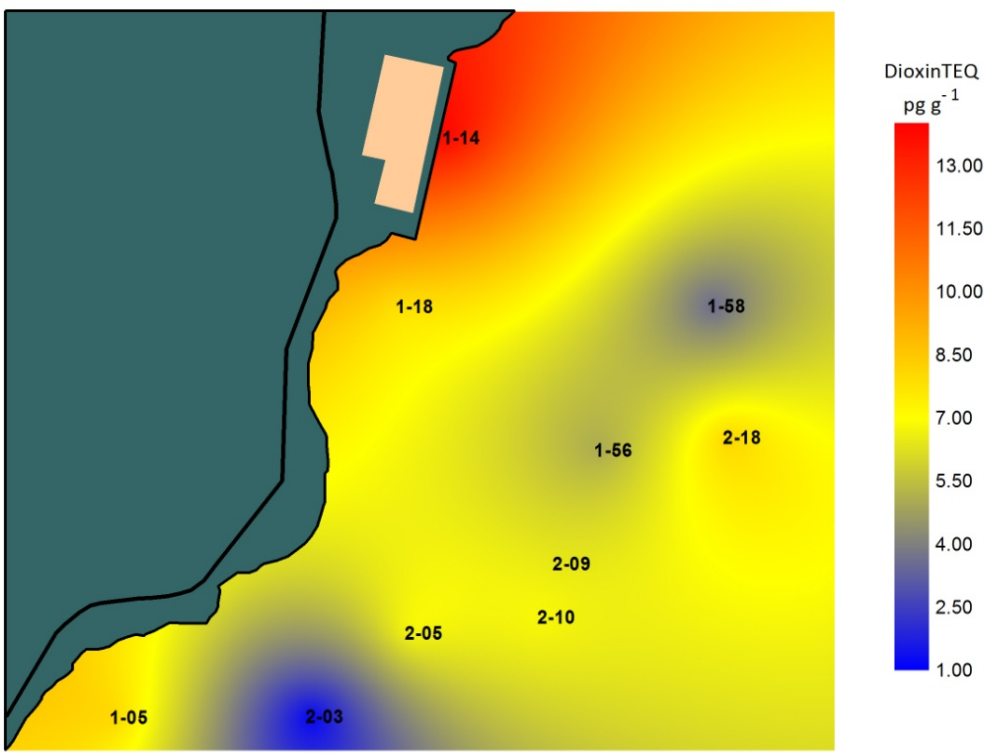

Figure 4-3. Spatial distribution of dioxin TEQ in AOC sediments.

Table 4-3. Summary results for sediment and tissue total dioxin TEQ for AOC strata and the Galankin Island reference site (*n*=5) and the home sediment control site (*n*=1). Results in **bold and underlined** exceed Performance Measure 2 threshold concentrations for AOC strata means or individual stations.

Parameter	Site	Mean	Standard Deviation	Minimum	Maximum	Minimum Station	Maximum Station
Sediment Dioxin TEQ[1] ($pg\ g^{-1}$ dry wt)	Stratum 1	**7.26**	3.88	3.27	**13.45**	1-58	1-14
	Stratum 2	**5.49**	2.77	0.66	7.77	2-03	2-18
	Reference	0.76	0.38	0.33	1.34	R-01	R-03
Tissue Dioxin TEQ[1] ($pg\ g^{-1}$ wet wt)	Stratum 1	0.17	0.02	0.14	0.20	1-58	1-05
	Stratum 2	0.17	0.05	0.12	0.24	2-09	2-03
	Reference	0.16	0.03	0.12	0.19	R-02	R-05
	Control[2]	0.13	-	0.13	0.13	-	-

[1]Non-detect results were incorporated into the TEQ sum by substitution with ½ EDL for tissues, and either substitution with ½ EDL or a Kaplan-Meier estimation procedure for sediments (methods described in QAPP). [2]Results for tissues exposed to Damariscotta River (Maine) sediment

4.2.1 Sediment Dioxin

Sediment dioxin TEQ ranged from 0.33−13.45 pg g^{-1} dry weight, with the highest concentration reported for sediment collected closest to the former mill site in Stratum 1. Mean dioxin concentrations for both strata exceeded the Performance Measure 2 mean threshold of 4 pg g^{-1} TEQ (Table 4-3). The single sample maximum threshold of 10 pg g^{-1} TEQ was exceeded at only Station 1-14 in Stratum 1. Although elevated, dioxin TEQs in 2011 were roughly half the concentrations recorded in the 1996 survey of Sawmill Cove West (Foster Wheeler 1998a), an area that corresponds roughly to AOC Stratum 1. In 1996, mean and maximum dioxin TEQ concentrations (recalculated using WHO 2005 TEF values) in Sawmill Cove West were 15.4 and 53 pg g^{-1}, respectively. In contrast, sediment concentrations measured at the Galankin Island reference site were stable over the 15 year period between surveys, indicating that observed decreases were field related, and not caused by differences in laboratory methods or sampling-related artifacts. Recalculated dioxin concentrations measured in two Galankin Island sediment samples were 0.15 and 1.68 pg g^{-1} TEQ in 1996 (Foster Wheeler 1998a) compared with a range of 0.33−1.34 pg g^{-1} TEQ (*n*=5) for the present study.

As described in Section 2.3.2, statistical comparisons were performed using a one-sided interval test and the "proof of safety" hypothesis on the difference between mean dioxin TEQs for each stratum and the reference site ($Mean_{Stratum} – Mean_{Ref}$). A difference (d) that is significantly greater than 1.8 pg g^{-1} (δ) indicates that dioxin TEQ in the corresponding AOC stratum is statistically and meaningfully elevated compared to the reference site. The observed differences were themselves greater than the specified tolerance (Table 4-4) so no statistical test was required to conclude that both strata are significantly elevated relative to reference. However, we conducted the interval test in order to estimate the extent of these elevations above reference. Prior to conducting the interval tests, dioxin TEQ residuals (i.e., each sample result minus the corresponding site mean) from AOC strata and the reference site were combined to assess normality and equality of variance to meet test assumptions. Results for the normality test indicated that site residuals were skewed and significantly different from a normal distribution (Shapiro-Wilk's test p-value < 0.10). Consequently, a non-parametric bootstrap estimate was used to calculate the confidence bound on the differences between each stratum and the reference site (Table 4-4). Mean TEQ values for both strata are significantly and functionally higher than the reference mean, because the upper confidence bounds on the differences are greater than 1.8 pg g^{-1} TEQ.

Following the decision criteria for Performance Measure 2, bioaccumulation testing was performed because both strata had mean dioxin TEQ values that: 1) exceeded the 4 pg g^{-1} threshold; and 2) were statistically elevated compared to the Galankin Island reference site mean.

Table 4-4. Summary statistics and results for interval hypotheses on sediment dioxin TEQ (pg g^{-1}).

Difference Equation $\mathbf{Mean_{Stratum} - Mean_{Ref}}$	**Observed Difference (d)**	**SE (d)**	**df for SE(d)**	**Bootstrapped 95% Upper Confidence Bound on d**	**Conclusion**
Stratum 1	6.50	1.75	12	9.15	ELEVATED
Stratum 2	4.73	1.75	12	10.3	ELEVATED

ELEVATED = fail to reject the "proof of safety" hypothesis, and conclude that the Stratum mean is significantly higher than reference mean.

4.2.2 Bioaccumulation Results

Overall, results indicated no increased potential for bioaccumulation of dioxin in benthic invertebrates exposed to AOC sediment compared to bioaccumulation potential at the reference site. Ultra-trace concentrations (<1 pg g^{-1} total dioxin TEQ) were measured in tissues of the test organism, the polychaete *Nereis virens,* exposed to AOC and reference sediment. However, AOC tissue concentrations were commensurate with results for the reference sediment as well as the control tissue (i.e., *N. virens* exposed to clean sediment from the Damariscotta River in Maine; Table 4-3).

Detection frequencies of individual congeners ranged from 6–24% in AOC tissues, and from 12–24% in reference tissues. Statistical comparisons of the dioxin TEQ values in tissues were not performed due to the dominance of non-detect results in tissues from all sites. If performed, statistical analysis of these data would be a measure of the variability in detection limits rather than a meaningful comparison between AOC strata and the reference site. For similar reasons, the bioaccumulation factors were not calculated.

All samples, including the quality control and reference site tissues, had four or fewer of the 17 dioxin/furan congeners detected. Similar to sediment results, low toxicity dioxin congeners, octachlorodibenzo-p-dioxin (OCDD; TEF = 0.0003) and 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (HpCDD; TEF = 0.01) were detected at the highest frequency and raw concentration in all samples. The mean values for these two congeners were actually highest in tissues exposed to reference site sediments. Because these and other dioxin congeners also were detected in tissues exposed to clean sediment from the Damariscotta River, our results confirm the widespread distribution of ultra-trace concentrations of dioxin in the environment. These results indicate that there is no greater potential for benthic organisms to bioaccumulate dioxin from AOC sediment compared to sediment from either Galankin Island in Sitka or the Damariscotta River in Maine.

4.3 Quality Control and Effect on Interpretation of Data

There were three types of quality control results generated from the bioaccumulation tests: 1) percent survival of test organisms exposed to sediment over a 28-day period; 2) results for quality control chemical samples generated by the analytical laboratory; and 3) bioaccumulation results for tissues collected from the sediment control site (discussed previously to support interpretation of AOC results).

4.3.1 Percent Survival of Test Organisms

The health and survival of the bioaccumulation test organism (*N.virens)* is of primary importance in laboratory testing. Highly stressed organisms may exhibit reduced metabolic rates and thus limit the uptake of chemicals of concern (Rand and Petrocelli 1985). General organism health is determined by the percentage of control organisms surviving at the end of the 28-day exposure period, with test acceptability criteria of 90%. Control survival for the 28-day exposure period was 100%, indicating that the test organisms were healthy and the test was valid.

Survival results for *N. virens* are summarized in Table 4-5. Overall survival was high with an average of 86.6%, ranging from 73—100%, after 28 days of exposure to AOC and reference sediment. Only Station 2-18 exhibited less than 80% survival; however, the average Stratum 2 mean survival was 84.0%. It is important to note that no signs of stress, such as sediment avoidance, non-burial, reduced ventilation, or sediment processing rates (EPA 1993) were observed during the test.

High survivals are expected based on results from other studies, which indicate that benthic invertebrates, including the polychaete worm used in this study, are not sensitive to the toxic effects of dioxins (Gatehouse 2004). In particular, the ability of *N. virens* to efficiently accumulate relatively high concentrations of dioxin in the absence of toxic effects make it a reliable test species to evaluate the transfer of contaminants through aquatic food webs to higher trophic organisms, including fish.

Table 4-5. Summary statistics for bioaccumulation percent survival with *N. virens* (28-day exposure).

Site	*n*	Mean	Standard Deviation	Minimum	Maximum	Minimum Station	Maximum Station
Stratum 1	5	89.2	5.8	80	93	1-14	1-58
Stratum 2	5	84.0	10.2	73	100	2-18	2-03
Reference	5	89.4	7.5	80	100	R-02	R-04
Control	1	100.0	-	-	-	-	-

4.3.2 Sediment and Tissue Dioxin Quality Control Results

Seven types of laboratory quality control (QC) samples/procedures were analyzed to determine the precision and accuracy of dioxin results measured in sediment and tissue samples (Table 4-6). These QC procedures and samples were applied both to individual samples and two analytical batches, which consisted of 15 site sediments and 16 tissue samples. In summary, all results met QC specifications shown in Table 4-6 for the extraction and analysis of sediment and tissue samples for 17 dioxin/furan compounds using EPA Method 1613B, an isotope dilution method, using high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS).

Although method QC data quality objectives were satisfied, ultra-trace concentrations (<1-3 pg g^{-1}, not adjusted for TEQ) of several individual dioxin and furan compounds were detected in associated laboratory method blanks for both sediment and tissue analyses. However, detected concentrations were for the less toxic compounds with much lower TEF values (e.g., octachlorodibenzo-p-dioxin [OCDD]; TEF=0.0003), and therefore, did not significantly increase calculated TEQ results for site samples. OCDD, in particular, is a ubiquitous environmental contaminant present in nearly all environmental media in trace or ultra-trace concentrations. It is also prevalent in environmental laboratories through cross-contamination of environmental samples, and is therefore, nearly impossible to control at low part-per-trillion concentrations.

Table 4-6. Dioxin/furan data quality objectives for batch analysis of sediment and tissue samples.

QC Parameter	Frequency	Acceptance Criteria	Corrective Actions
Instrument Check	1 per analytical run	±15% recovery	Reanalyze or document justification.
Surrogate recovery	17 per sample	64−164%	Reanalyze or document justification. Flag impacted data.
Procedural blank	1 per batch of 20 samples	No target analytes > 5X MDL	Reanalyze or document justification. Flag impacted data.
Laboratory Control Sample (Blank Spike)	1 per batch of 20 samples	63−170%	Reanalyze or document justification. Flag impacted data.
Laboratory Sample Duplicate	1 per batch of 20 samples	63−170%; RPD ≤50%	Review data to assess impact of matrix. Reanalyze or document justification. Flag impacted data.
Instrument Calibration – Initial Calibration	Initial 5-point prior to sample analysis	±25% RSD single compound average of 15%	Re-calibration or document justification.
Instrument Calibration - Check	Continuing checks every 10 samples and at completion of sequence	±25% RPD for 90% of the target analytes	Remedial maintenance, new initial calibration or document justification.

4.4 Performance Measure 2 Discussion

Results from the May 2011 survey indicate that AOC sediment dioxin concentrations fail to meet draft sediment quality guidelines proposed for Puget Sound and remain elevated compared to local background concentrations. However, concentrations are not bioaccumulating in benthic organisms exposed to AOC sediment, and therefore, there is no adverse risk to higher trophic organisms, including fish, from dioxin in AOC sediment. Although low part-per-trillion levels of sediment dioxin remain, concentrations are roughly half of the concentrations measured in Sawmill Cove surface sediment in the 1996 remedial survey (Foster Wheeler 1998a), suggesting that chemical recovery of the AOC is in step with the benthic infaunal recovery documented through use of SPI and plan view images. The reduction in sediment dioxin concentrations over the 15 years between studies likely occurred from multiple processes, including burial from sedimentation and bioturbation, as well as chemical transformation through deoxygenases. The most common form of deoxygenases are bacterial enzymes that cleave the aryl ether bond in dioxin and furan molecules with the resulting metabolites eventually mineralized to carbon dioxide, water, and inorganic salts (Halden et. al. 1999).

5 CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions and recommendations for future monitoring of the Sawmill Cove AOC following Performance Measures 1 and 2 guidance presented in Section 1 and results presented in Sections 3 and 4, respectively.

5.1 Performance Measure 1 - AOC Recovery Status

The infaunal benthic community in the AOC has improved substantially since completion of the 2000 baseline survey. Even though there are areas still showing impacts from organic enrichment (see Figure 3-29, Section 3), the occurrence of Stage 3 taxa (Figure 2-3, Section 2) was much more widespread throughout the site and evident in both the plan view (Figure 5-1) and SPI images (Figure 5-2). While 62% of the AOC was considered seriously impaired in regard to benthic community status at the conclusion of the 2000 baseline survey (EVS 2001), only 17% of the AOC now fits in that category (Table 3-1; Section 3).

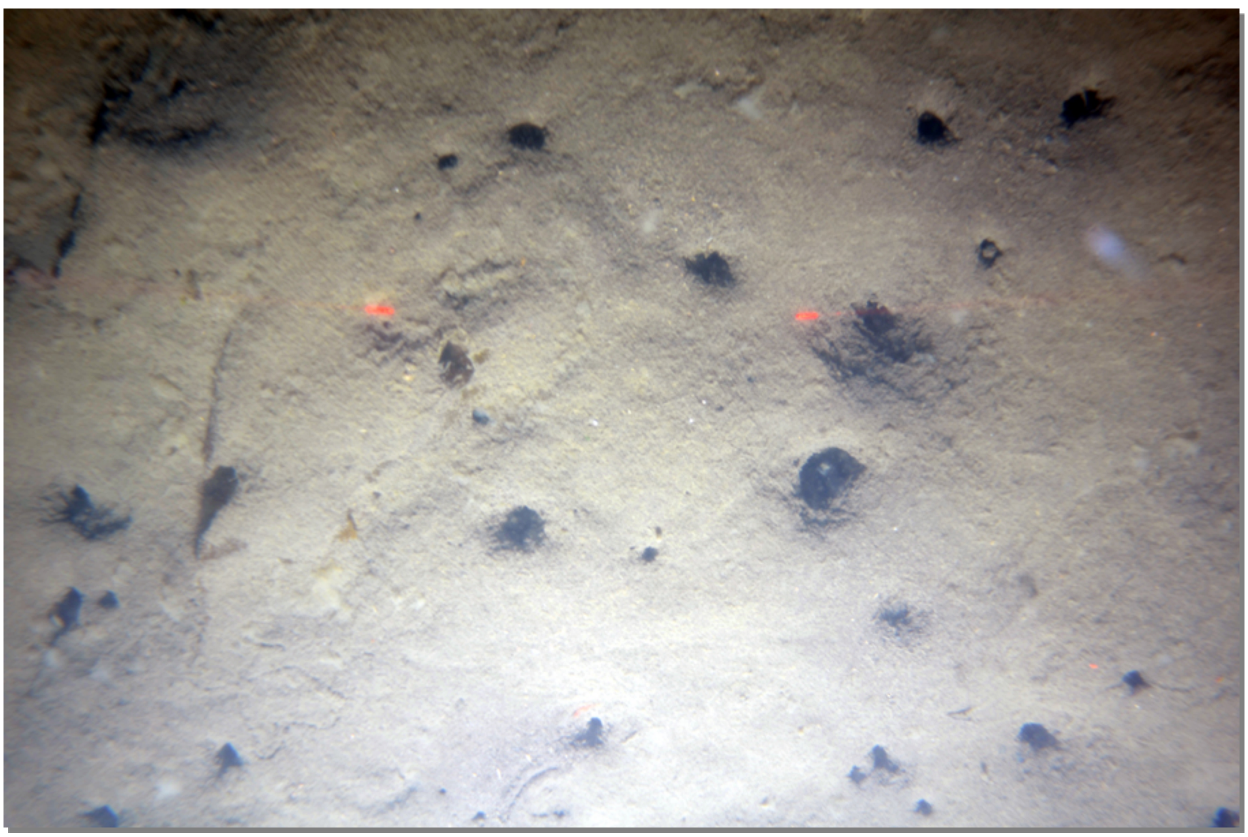

Figure 5-1. The burrow openings of Stage 3 deposit-feeding taxa are readily apparent in this plan view image from Station 1-09. Scale: width of image = 76.8 cm.

Out of the approximately 100 acres that were designated initially as the "Area of Concern", there are now approximately 83 acres of seafloor that have achieved Milestone 3 (Table 1-1, Section 1) from the original ROD, which was originally anticipated to occur sometime between 2020–2040. It is quite impressive to realize that the milestones originally anticipated to occur in 10-30 years from now have already been achieved through natural recovery processes. Once an additional 21 acres of Stratum 2 has Stage 3 benthic assemblages, then all of the ROD recovery milestones will have been met. At the current rate of recovery, this could mean that all milestones will have been achieved by the time of the next scheduled monitoring event (2020-2021), which would signal the end of all future monitoring requirements related to the original APC impacts.

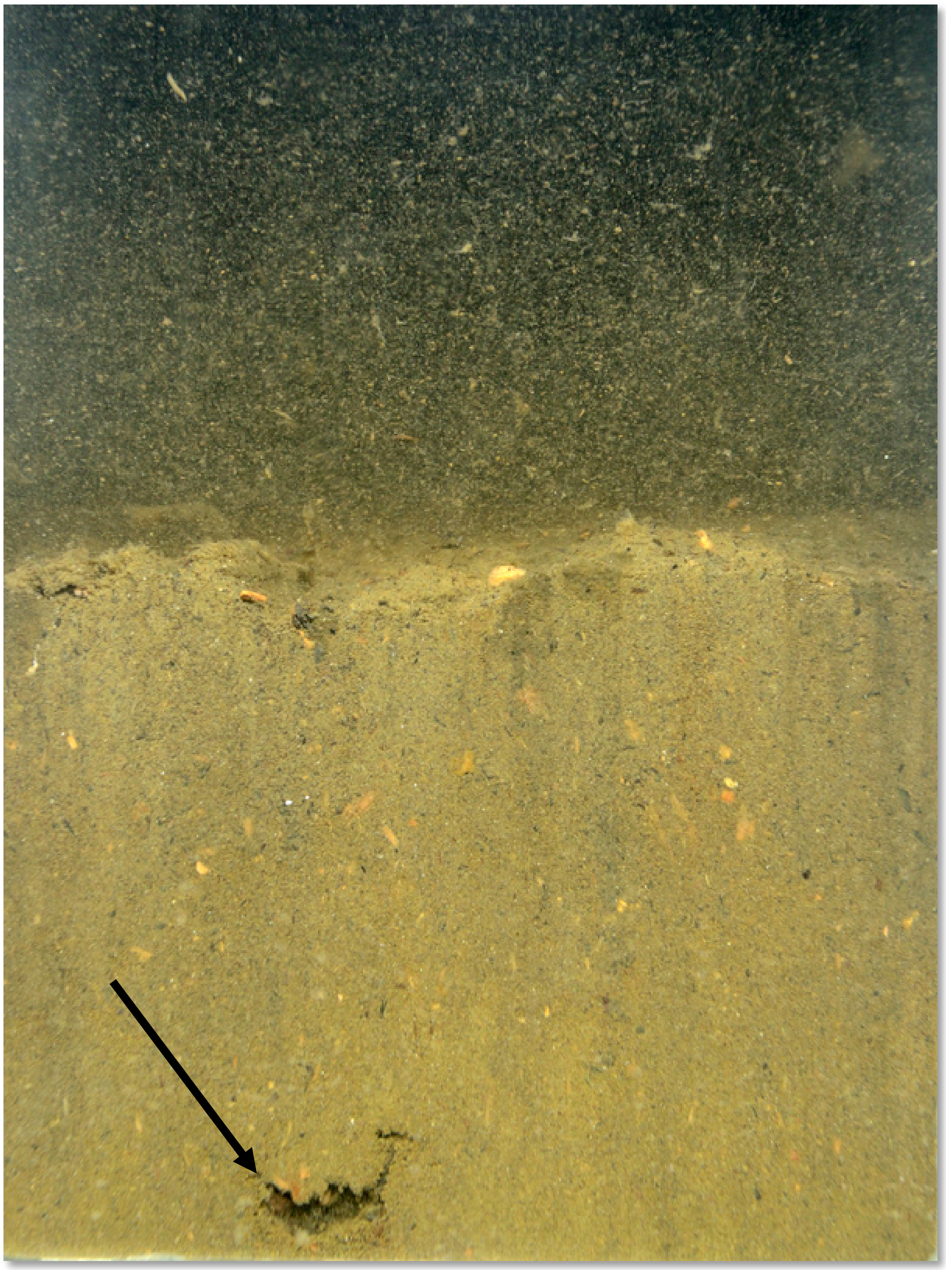

Figure 5-2. Both feeding voids and subsurface burrows are evidence of Stage 3 taxa as seen in this example of a feeding void at depth (arrow) in this profile image from Station 1-50. Scale: width of image = 14.4 cm.

The steep slope and hard bottom in the southwest corner of the AOC prevented successful camera or grab sampling; given that the benthic community in this area would always be an epifaunal "fouling" community such as the type that grows on elevated rocks or pilings in the water, it seems foolhardy to continue to include this nearshore area in future sampling efforts. Likewise the hard bottom in the northeast area of the AOC (Stations 1-13 and 1-26; see Figures 3-5 and 3-6; Section 3) also warrants elimination from future monitoring efforts.

Given the advanced state of recovery of 54% of the AOC, the recommended future monitoring area and stations are shown in Figure 5-3. The one new input variable to the system that potentially may slow the rate of future recovery in the AOC is the additional organic loadings to Sawmill Cove from the shore-based fish processing plant and any floating plants that may be operating in Sawmill Cove in the future. The increased amount of suspended fish protein in the water column in colloidal form most likely has contributed to a more persistent organic nepheloid layer instead of the naturally-occurring detrital deposit that settles out seasonally due to the bi-annual phytoplankton blooms; evidence of this near-bottom suspended layer was evident in many of the plan view and profile images (Figure 5-4). Even though there was a substantial increase in the area covered by thiophilic bacterial mats because of the higher SOD caused by the more labile organic waste from the fish plant discharge that has settled out in the area, it is noteworthy that Silver Bay Seafoods has taken steps to decrease the impact of this additional organic loading by reducing their waste discharge volumes. Continued efforts in source reduction from the fish processing plant can only help in promoting future benthic infaunal recovery.

Figure 5-3. Recommended sampling locations for Strata 1 and 2 in the next round of monitoring scheduled for 2020.

We would advocate that close attention be paid in the future to the discharge volumes of fish waste in the Sawmill Cove area; excess organic loading from outside sources in addition to the large pulses of organic input that naturally occur twice a year in Silver Bay due to phytoplankton blooms will only slow down the natural recovery of the benthic infaunal community.

Figure 5-4. The near-bottom fluff layer of suspended labile organic detritus (both phytoplankton and fish waste) with a high sediment oxygen demand and co-occurring *Beggiatoa* colonies can be seen in the lower right corner of this plan view image, while typical sediment surface (wood chips, fibers, and silt-clay) can be seen in the upper left. Scale: width of image = 94.1 cm.

5.2 Performance Measure 2 - Evaluation of Dioxin Bioaccumulation from AOC Sediment

Although mean sediment dioxin concentrations in both strata exceeded draft guidelines considered protective of west coast marine habitats, dioxin was neither bioavailable nor did it bioaccumulate in benthic organisms exposed to AOC sediment. Therefore, our recommendation is that sediment chemistry samples will no longer need to be taken as part of any future monitoring efforts related to the original APC impacts, and there is no future monitoring required for dioxin, because there is no potential for bioaccumulation in the Sawmill Cove marine food web from AOC sediment.

The statistically significant positive correlation observed between sediment dioxin and total organic carbon suggests that dioxin may not be bioavailable because it is tightly bound in the organic matrix, thereby making it unavailable for uptake. Physico-chemical properties of marine sediment, especially the content and nature of organic carbon, have a major bearing on not only the sorption and accumulation of dioxin and furan, but also their degradation and bioavailability.

Similar to results from SPI and plan view images, the most affected sediment within the AOC was located in Stratum 1, closest to the former mill site. Indicators of wood waste and wood-degrading activity generally were most pronounced in Stratum 1, although not necessarily at the same locations with the highest concentrations of dioxin. In comparison, only one station in Stratum 2 had any indication of wood-degrading activity, which appeared to have no effect on the health of benthic infauna; the corresponding SPI results indicated that all five stations where sediment samples were taken in Stratum 2 were fully recovered.

Sediment dioxin concentrations appear to be abating over time; the dioxin concentrations measured in this most recent survey are roughly half the concentrations measured in the 1996 remedial investigation of Sawmill Cove. Although it is not possible to predict what concentrations will be in the future, average reductions >45% in Stratum 1 and >27% in Stratum 2 would indicate that dioxin concentrations in AOC sediment will most likely be within the boundaries of current draft guidelines by the time of the next scheduled monitoring survey. However, the time frame to achieve this will primarily be a function of the physical, geochemical, and biological processes that bury, cleave, and ultimately mineralize dioxin within the AOC of Sawmill Cove.

In summary, the City and Borough of Sitka has achieved better-than-expected results from this latest round of monitoring. Not only have the most recent monitoring results confirmed earlier indications that there are no threats to ecosystem or human health from any persistent contaminants of concern in the sediments, but the original decision of natural recovery as the preferred remedial option turned out to be a wise choice. Not only is benthic ecosystem recovery proceeding as anticipated, it is actually occurring at a much faster rate than originally predicted.

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Appendix A:

Sampling Station Locations

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Station Name	Sample Type	Easting (UTM8N,m)	Northing (UTM8N, m)	Longitude (WGS84)	Latitude (WGS84)	Depth (ftm)	Time (AKDT)	Date	Comment
2-03 Grab	Sediment	485891.24	6321796.22	135 13 56.9896 W	57 02 21.8543 N	33.6	8:49:04	5/22/2011	NG
2-03 Grab	Sediment	485883.5	6321803.72	135 13 57.4503 W	57 02 22.096 N	33.6	9:03:03	5/22/2011	Good
2-05 Grab	Sediment	485983.78	6321888.97	135 13 51.5184 W	57 02 24.864 N	33	9:34:42	5/22/2011	Good
2-10 Grab	Sediment	486118.09	6321905.44	135 13 43.5538 W	57 02 25.4113 N	32.6	9:47:43	5/22/2011	Good
2-09 Grab	Sediment	486133.7	6321959.89	135 13 42.6385 W	57 02 27.1739 N	32.3	10:04:14	5/22/2011	Good
1-56 Grab	Sediment	486175.72	6322075.93	135 13 40.1686 W	57 02 30.9312 N	31.3	10:16:22	5/22/2011	Good
2-18 Grab	Sediment	486306.24	6322088.93	135 13 32.4277 W	57 02 31.3656 N	31.7	10:27:22	5/22/2011	Good
1-58 Grab	Sediment	486290.38	6322223.28	135 13 33.3951 W	57 02 35.7088 N	30.7	10:45:37	5/22/2011	Good
1-14 Grab	Sediment	486021.43	6322395.51	135 13 49.3863 W	57 02 41.2497 N	5	10:58:14	5/22/2011	Good
1-18 Grab	Sediment	485974.39	6322222.85	135 13 52.1426 W	57 02 35.6607 N	7	11:15:12	5/22/2011	Good
1-05 Grab	Sediment	485696.79	6321801.2	135 14 8.5261 W	57 02 21.9938 N	19.6	11:31:46	5/22/2011	NG
1-05 Grab 2	Sediment	485695.26	6321800.69	135 14 8.6168 W	57 02 21.9772 N	18.2	11:34:28	5/22/2011	NG
1-05 Grab 3	Sediment	485688.85	6321803.28	135 14 8.9976 W	57 02 22.0602 N	17.1	11:43:19	5/22/2011	NG
1-05 Grab 4	Sediment	485687.84	6321806.62	135 14 9.0582 W	57 02 22.1681 N	16.2	11:45:36	5/22/2011	NG
1-05 Grab 5	Sediment	485685.12	6321802.58	135 14 9.2187 W	57 02 22.0372 N	17	11:49:12	5/22/2011	Good
R04 Grab	Sediment	480513.84	6320485.8	135 19 15.6288 W	57 01 38.7706 N	4	13:24:24	5/22/2011	NG
R04 Grab 2	Sediment	480598.76	6320419.63	135 19 10.5743 W	57 01 36.6435 N	13.5	13:29:33	5/22/2011	NG
R04 Grab 3	Sediment	480623.12	6320697.69	135 19 9.2068 W	57 01 45.6396 N	17.1	13:37:30	5/22/2011	Good
R03 Grab	Sediment	480861.8	6320811.4	135 18 55.0825 W	57 01 49.3529 N	14.5	14:00:32	5/22/2011	NG
R03 Grab 2	Sediment	480888.06	6321017.81	135 18 53.5815 W	57 01 56.0321 N	13.5	14:08:14	5/22/2011	NG
R03 Grab 3	Sediment	480641.62	6321137.98	135 19 8.2316 W	57 01 59.8814 N	8.3	14:16:47	5/22/2011	NG
R03 Grab 4	Sediment	481243.23	6320934.45	135 18 32.4934 W	57 01 53.3887 N	25.9	14:26:06	5/22/2011	Good
R05 Grab	Sediment	479620.87	6320598.95	135 20 8.6184 W	57 01 42.291 N	15.3	14:49:07	5/22/2011	Good
R02 Grab	Sediment	479350.31	6320842.43	135 20 24.7361 W	57 01 50.1218 N	20.7	15:00:41	5/22/2011	Good
R01 Grab	Sediment	479688.64	6321051.34	135 20 4.7308 W	57 01 56.932 N	11.3	15:12:03	5/22/2011	Good
1-14 Grab 2	Sediment	486030.65	6322404.14	135 13 48.8409 W	57 02 41.5298 N	6.5	9:09:37	5/23/2011	Good
1-14A	Photo	486035.36	6322402.86	135 13 48.5612 W	57 02 41.4889 N	7.5	9:43:27	5/23/2011	
1-14B	Photo	486042.21	6322404.64	135 13 48.1552 W	57 02 41.5472 N	7.3	9:46:28	5/23/2011	
1-14C	Photo	486042.81	6322396.88	135 13 48.118 W	57 02 41.2963 N	7.6	9:51:10	5/23/2011	
1-14D	Photo	486030.46	6322401.37	135 13 48.8517 W	57 02 41.4402 N	6.5	10:17:55	5/23/2011	
1-14E	Photo	486032.89	6322401.3	135 13 48.7075 W	57 02 41.4382 N	6.9	10:19:02	5/23/2011	
1-14F	Photo	486035.94	6322402.34	135 13 48.5267 W	57 02 41.4722 N	7.1	10:20:09	5/23/2011	
1-14G	Photo	486038.14	6322399.7	135 13 48.3957 W	57 02 41.387 N	7.1	10:21:13	5/23/2011	
1-12A	Photo	486139.74	6322545.96	135 13 42.3965 W	57 02 46.1281 N	8	10:41:14	5/23/2011	
1-12B	Photo	486135.68	6322545.04	135 13 42.6372 W	57 02 46.0979 N	8	10:42:22	5/23/2011	
1-12C	Photo	486135.17	6322543.45	135 13 42.6672 W	57 02 46.0464 N	7.9	10:43:18	5/23/2011	
1-12D	Photo	486135.85	6322543.32	135 13 42.6268 W	57 02 46.0423 N	8	10:44:12	5/23/2011	
1-13A	Photo	486096.92	6322497.16	135 13 44.9275 W	57 02 44.5453 N	6.1	10:48:02	5/23/2011	
1-13B	Photo	486098.17	6322496.56	135 13 44.8532 W	57 02 44.526 N	6.4	10:48:54	5/23/2011	
1-13C	Photo	486098.09	6322495.01	135 13 44.8577 W	57 02 44.4759 N	6.9	10:49:49	5/23/2011	
1-13D	Photo	486101.03	6322495.63	135 13 44.6833 W	57 02 44.4962 N	6.6	10:50:45	5/23/2011	
1-15A	Photo	486052.2	6322452.65	135 13 47.572 W	57 02 43.101 N	10	10:54:32	5/23/2011	
1-15B	Photo	486052.94	6322451.58	135 13 47.5279 W	57 02 43.0664 N	10.1	10:55:33	5/23/2011	
1-15C	Photo	486053.75	6322451.56	135 13 47.4798 W	57 02 43.0659 N	10.2	10:56:37	5/23/2011	
1-15D	Photo	486055.65	6322453.83	135 13 47.3676 W	57 02 43.1395 N	10.3	10:57:37	5/23/2011	
1-16A	Photo	486012.58	6322340.22	135 13 49.9003 W	57 02 39.4606 N	6	11:02:37	5/23/2011	
1-16B	Photo	486013.86	6322339.62	135 13 49.8242 W	57 02 39.4414 N	6.1	11:03:40	5/23/2011	
1-16C	Photo	486014.83	6322340.11	135 13 49.7668 W	57 02 39.4573 N	5.9	11:04:32	5/23/2011	
1-16D	Photo	486017.39	6322338.8	135 13 49.6146 W	57 02 39.4152 N	5.8	11:05:30	5/23/2011	
1-17A	Photo	485988.62	6322262.84	135 13 51.3063 W	57 02 36.9555 N	7.1	11:10:49	5/23/2011	
1-17B	Photo	485989	6322261.03	135 13 51.2834 W	57 02 36.8971 N	7.2	11:11:55	5/23/2011	
1-17C	Photo	485988.85	6322259.94	135 13 51.2921 W	57 02 36.8618 N	7.4	11:12:46	5/23/2011	
1-17D	Photo	485990.46	6322259.24	135 13 51.1964 W	57 02 36.8393 N	7.3	11:13:44	5/23/2011	
1-18A	Photo	485967.42	6322217.04	135 13 52.5549 W	57 02 35.4721 N	7.5	11:33:06	5/23/2011	
1-18B	Photo	485971.76	6322216.91	135 13 52.2974 W	57 02 35.4683 N	8	11:34:02	5/23/2011	
1-18C	Photo	485973.27	6322216.96	135 13 52.2078 W	57 02 35.4701 N	8.1	11:35:00	5/23/2011	
1-18D	Photo	485974.79	6322215.68	135 13 52.1174 W	57 02 35.4289 N	8.5	11:36:00	5/23/2011	
1-19A	Photo	485950.6	6322166.3	135 13 53.5426 W	57 02 33.8293 N	11.5	11:39:36	5/23/2011	
1-19B	Photo	485951.77	6322165.41	135 13 53.473 W	57 02 33.8006 N	11.5	11:40:30	5/23/2011	
1-19C	Photo	485953.65	6322166.7	135 13 53.3618 W	57 02 33.8425 N	11.6	11:41:26	5/23/2011	
1-19D	Photo	485954.82	6322164.73	135 13 53.292 W	57 02 33.779 N	11.7	11:42:30	5/23/2011	
1-20A	Photo	485930.25	6322106.32	135 13 54.7379 W	57 02 31.8873 N	12.1	11:46:19	5/23/2011	
1-20B	Photo	485933.64	6322106.6	135 13 54.5368 W	57 02 31.8967 N	12.4	11:47:18	5/23/2011	
1-20C	Photo	485935.9	6322108.41	135 13 54.4031 W	57 02 31.9555 N	12.5	11:48:19	5/23/2011	
1-20D	Photo	485936.45	6322109.67	135 13 54.3707 W	57 02 31.9963 N	12.8	11:49:28	5/23/2011	
1-21A	Photo	485912.39	6322053.26	135 13 55.7868 W	57 02 30.1694 N	7.2	11:53:27	5/23/2011	
1-21B	Photo	485911.82	6322050.92	135 13 55.8201 W	57 02 30.0936 N	7.5	11:54:28	5/23/2011	
1-21C	Photo	485912.16	6322048.81	135 13 55.7995 W	57 02 30.0254 N	7.7	11:55:16	5/23/2011	
1-21D	Photo	485914.16	6322045.57	135 13 55.6802 W	57 02 29.9209 N	9.1	11:56:18	5/23/2011	
1-22A	Photo	485896.69	6321988.29	135 13 56.7051 W	57 02 28.0665 N	7.5	11:59:46	5/23/2011	
1-22B	Photo	485900.11	6321987.78	135 13 56.5021 W	57 02 28.0504 N	8.2	12:01:16	5/23/2011	
1-22C	Photo	485903.37	6321990.95	135 13 56.3093 W	57 02 28.1533 N	8.6	12:03:12	5/23/2011	
1-22D	Photo	485909.88	6321987.34	135 13 55.9224 W	57 02 28.0372 N	13	12:05:02	5/23/2011	
1-26A	Photo	486140.27	6322487.08	135 13 42.3534 W	57 02 44.224 N	12.3	13:27:39	5/23/2011	
1-26B	Photo	486139.2	6322491.83	135 13 42.4178 W	57 02 44.3775 N	11.1	13:31:33	5/23/2011	
1-26C	Photo	486142.58	6322489.95	135 13 42.2169 W	57 02 44.317 N	12.7	13:32:28	5/23/2011	
1-26D	Photo	486140.4	6322493.35	135 13 42.3469 W	57 02 44.4268 N	11.4	13:34:55	5/23/2011	
1-27A	Photo	486109.35	6322428.62	135 13 44.1764 W	57 02 42.33 N	18.5	13:38:29	5/23/2011	
1-27B	Photo	486106.24	6322425.37	135 13 44.3602 W	57 02 42.2246 N	17.6	13:39:33	5/23/2011	

1-27C	Photo	486102.62	6322422.96	135 13 44.5745 W	57 02 42.1463 N	17.4	13:40:31	5/23/2011
1-27D	Photo	486097.98	6322423.81	135 13 44.85 W	57 02 42.1732 N	17.6	13:41:41	5/23/2011
1-28A	Photo	486097.65	6322372.7	135 13 44.8594 W	57 02 40.5203 N	19.5	13:45:44	5/23/2011
1-28B	Photo	486095.62	6322369.76	135 13 44.9793 W	57 02 40.425 N	19.5	13:46:46	5/23/2011
1-28C	Photo	486088.65	6322372.52	135 13 45.3934 W	57 02 40.5135 N	18.5	13:47:41	5/23/2011
1-28D	Photo	486087.82	6322375.43	135 13 45.4432 W	57 02 40.6075 N	18.3	13:48:36	5/23/2011
1-29A	Photo	486073.69	6322313.38	135 13 46.2692 W	57 02 38.5993 N	10.3	13:52:07	5/23/2011
1-29B	Photo	486076.85	6322313.05	135 13 46.0816 W	57 02 38.589 N	10.5	13:53:04	5/23/2011
1-29C	Photo	486076.8	6322308	135 13 46.0836 W	57 02 38.4256 N	10.3	13:54:05	5/23/2011
1-29D	Photo	486079.47	6322306.04	135 13 45.9248 W	57 02 38.3625 N	10.2	13:54:56	5/23/2011
1-30A	Photo	486052.59	6322255.92	135 13 47.5096 W	57 02 36.7387 N	13.5	13:58:04	5/23/2011
1-30B	Photo	486053.08	6322256.75	135 13 47.4807 W	57 02 36.7656 N	13.2	13:59:10	5/23/2011
1-30C	Photo	486056.36	6322255.21	135 13 47.2858 W	57 02 36.7162 N	13.5	14:00:19	5/23/2011
1-30D	Photo	486052.65	6322251.42	135 13 47.5051 W	57 02 36.5932 N	13.8	14:01:18	5/23/2011
1-36A	Photo	486162.63	6322411.07	135 13 41.0116 W	57 02 41.7682 N	21.5	14:14:37	5/23/2011
1-36B	Photo	486162.94	6322413.16	135 13 40.9937 W	57 02 41.8359 N	21.7	14:15:37	5/23/2011
1-36C	Photo	486168.18	6322411.12	135 13 40.6824 W	57 02 41.7704 N	21.5	14:16:43	5/23/2011
1-36D	Photo	486173.03	6322410.37	135 13 40.3944 W	57 02 41.7467 N	21.7	14:17:45	5/23/2011
1-37A	Photo	486147.42	6322354.33	135 13 41.9028 W	57 02 39.9316 N	24.2	14:28:22	5/23/2011
1-37B	Photo	486150.49	6322354.4	135 13 41.7207 W	57 02 39.9342 N	24	14:29:25	5/23/2011
1-37C	Photo	486151.72	6322351.83	135 13 41.6472 W	57 02 39.8512 N	23.8	14:30:19	5/23/2011
1-37D	Photo	486152.7	6322345.98	135 13 41.5879 W	57 02 39.6621 N	24	14:31:14	5/23/2011
1-38A	Photo	486131.3	6322291.07	135 13 42.8467 W	57 02 37.884 N	22	14:36:16	5/23/2011
1-38B	Photo	486137.71	6322296.97	135 13 42.4676 W	57 02 38.0755 N	23.4	14:37:27	5/23/2011
1-38C	Photo	486130.74	6322308.05	135 13 42.8833 W	57 02 38.4331 N	23.2	14:38:19	5/23/2011
1-38D	Photo	486133.31	6322292.32	135 13 42.7277 W	57 02 37.9247 N	22.5	14:39:21	5/23/2011
1-39A	Photo	486111.66	6322232.88	135 13 44 W	57 02 36 N	17.3	14:43:15	5/23/2011
1-39B	Photo	486113.61	6322236.19	135 13 43.8853 W	57 02 36.1073 N	17.8	14:44:17	5/23/2011
1-39C	Photo	486108.87	6322240.77	135 13 44.1675 W	57 02 36.2549 N	17.5	14:45:19	5/23/2011
1-39D	Photo	486103.21	6322244.52	135 13 44.504 W	57 02 36.3756 N	16.9	14:46:16	5/23/2011
1-44A	Photo	486226.84	6322391.21	135 13 37.198 W	57 02 41.1329 N	23.6	14:53:55	5/23/2011
1-44B	Photo	486220.52	6322391.03	135 13 37.5729 W	57 02 41.1264 N	22.6	14:55:01	5/23/2011
1-44C	Photo	486215.39	6322385.97	135 13 37.8763 W	57 02 40.9622 N	22.5	14:55:48	5/23/2011
1-44D	Photo	486221.64	6322387.68	135 13 37.5058 W	57 02 41.0182 N	22.8	14:57:03	5/23/2011
1-45A	Photo	486195.58	6322333.85	135 13 39.0414 W	57 02 39.2745 N	26.7	15:29:42	5/23/2011
1-45B	Photo	486201.19	6322337.12	135 13 38.7092 W	57 02 39.3808 N	27.3	15:30:46	5/23/2011
1-45C	Photo	486203.39	6322331.25	135 13 38.5775 W	57 02 39.1912 N	27.1	15:31:49	5/23/2011
1-45D	Photo	486199.47	6322332.54	135 13 38.8103 W	57 02 39.2325 N	27.1	15:32:47	5/23/2011
1-46A	Photo	486185.71	6322274.47	135 13 39.6152 W	57 02 37.3531 N	28	15:38:46	5/23/2011
1-46B	Photo	486179.56	6322275.73	135 13 39.9804 W	57 02 37.3931 N	28	15:39:55	5/23/2011
1-46C	Photo	486179.8	6322275.83	135 13 39.9661 W	57 02 37.3964 N	28	15:41:03	5/23/2011
1-46D	Photo	486179.6	6322274.8	135 13 39.9778 W	57 02 37.3631 N	27.8	15:42:16	5/23/2011
1-47A	Photo	486162.28	6322212.38	135 13 40.993 W	57 02 35.3425 N	22.1	15:48:14	5/23/2011
1-47B	Photo	486164.87	6322216.47	135 13 40.8402 W	57 02 35.4751 N	22.6	15:49:27	5/23/2011
1-47C	Photo	486165.67	6322216.18	135 13 40.7927 W	57 02 35.4658 N	22.8	15:50:33	5/23/2011
1-47D	Photo	486168.11	6322221.51	135 13 40.6489 W	57 02 35.6384 N	23.8	15:51:28	5/23/2011
1-52A	Photo	486260.28	6322316.19	135 13 35.1992 W	57 02 38.7103 N	29	15:59:51	5/23/2011
1-52B	Photo	486263.99	6322318.96	135 13 34.9796 W	57 02 38.8003 N	28.2	16:00:43	5/23/2011
1-52C	Photo	486256.06	6322316.17	135 13 35.4495 W	57 02 38.7092 N	28.6	16:01:51	5/23/2011
1-52D	Photo	486242.72	6322316.49	135 13 36.2411 W	57 02 38.7181 N	29.2	16:02:55	5/23/2011
1-53A	Photo	486233.78	6322252.42	135 13 36.7589 W	57 02 36.6451 N	30.1	16:08:49	5/23/2011
1-53B	Photo	486233.9	6322254.69	135 13 36.7522 W	57 02 36.7186 N	29.8	16:10:02	5/23/2011
1-53C	Photo	486239.93	6322249.45	135 13 36.3934 W	57 02 36.5498 N	30	16:11:06	5/23/2011
1-53D	Photo	486244.22	6322254.45	135 13 36.1399 W	57 02 36.7119 N	29.8	16:12:22	5/23/2011
1-54A	Photo	486226.7	6322193.53	135 13 37.1673 W	57 02 34.7399 N	32	16:34:09	5/23/2011
1-54B	Photo	486222.09	6322192.61	135 13 37.4406 W	57 02 34.7096 N	31.1	16:35:25	5/23/2011
1-54C	Photo	486220.86	6322195.68	135 13 37.5142 W	57 02 34.8088 N	30.9	16:36:23	5/23/2011
1-54D	Photo	486217.94	6322200	135 13 37.6883 W	57 02 34.9482 N	31.5	16:37:17	5/23/2011
1-57A	Photo	486312.16	6322290.39	135 13 32.116 W	57 02 37.8815 N	30.1	16:44:16	5/23/2011
1-57B	Photo	486314.74	6322293.33	135 13 31.9635 W	57 02 37.9768 N	30	16:45:21	5/23/2011
1-57C	Photo	486315.47	6322292.81	135 13 31.9201 W	57 02 37.9601 N	30	16:46:26	5/23/2011
1-57D	Photo	486314.02	6322288.57	135 13 32 W	57 02 37.8228 N	30.9	16:47:31	5/23/2011
1-58A	Photo	486304.79	6322234.46	135 13 32.5423 W	57 02 36.0719 N	32.1	16:52:26	5/23/2011
1-58B	Photo	486291.69	6322233.66	135 13 33.3194 W	57 02 36.0446 N	32.3	16:54:05	5/23/2011
1-58C	Photo	486293.34	6322229.08	135 13 33.2206 W	57 02 35.8967 N	31.1	16:55:11	5/23/2011
1-58D	Photo	486299.51	6322231.18	135 13 32.8549 W	57 02 35.9653 N	31.1	16:56:17	5/23/2011
1-59A	Photo	486275.49	6322174.42	135 13 34.2689 W	57 02 34.1271 N	31.9	17:02:29	5/23/2011
1-59B	Photo	486278.36	6322174.11	135 13 34.0985 W	57 02 34.1174 N	31.9	17:03:40	5/23/2011
1-59C	Photo	486277.37	6322175.74	135 13 34.1576 W	57 02 34.17 N	32.5	17:04:51	5/23/2011
1-59D	Photo	486264.33	6322179.54	135 13 34.932 W	57 02 34.2915 N	32.3	17:06:19	5/23/2011
1-60A	Photo	486355.94	6322204.99	135 13 29.5018 W	57 02 35.1243 N	32.8	17:12:39	5/23/2011
1-60B	Photo	486366.89	6322212.9	135 13 28.8537 W	57 02 35.3813 N	32.5	17:14:03	5/23/2011
1-60C	Photo	486358.26	6322203.42	135 13 29.3639 W	57 02 35.0738 N	32.8	17:15:26	5/23/2011
1-60D	Photo	486359.77	6322210.9	135 13 29.2757 W	57 02 35.3159 N	32.5	17:16:43	5/23/2011
2-17A	Photo	486331.8	6322155.37	135 13 30.9243 W	57 02 33.517 N	32.8	17:23:04	5/23/2011
2-17B	Photo	486329.83	6322156.72	135 13 31.0415 W	57 02 33.5605 N	32.1	17:24:43	5/23/2011
2-17C	Photo	486326.78	6322155.72	135 13 31.2222 W	57 02 33.5278 N	32.1	17:25:58	5/23/2011
2-17D	Photo	486328.79	6322158.29	135 13 31.1035 W	57 02 33.6111 N	32.5	17:27:14	5/23/2011
1-12E	Photo	486122.6	6322561.47	135 13 43.4166 W	57 02 46.6278 N	8.2	10:22:52	5/24/2011
1-12F	Photo	486124.46	6322560.15	135 13 43.306 W	57 02 46.5854 N	8.2	10:23:49	5/24/2011
1-12G	Photo	486124.98	6322560.5	135 13 43.2752 W	57 02 46.5967 N	8.2	10:24:41	5/24/2011

1-12H	Photo	486122.67	6322555.6	135 13 43.4113 W	57 02 46.438 N	8.6	10:25:57	5/24/2011
1-27E	Photo	486114.79	6322426.93	135 13 43.8533 W	57 02 42.276 N	18.2	10:31:12	5/24/2011
1-27F	Photo	486115.14	6322425.54	135 13 43.8322 W	57 02 42.2311 N	18.2	10:32:14	5/24/2011
1-27G	Photo	486115.4	6322423.09	135 13 43.8163 W	57 02 42.1518 N	18.4	10:33:19	5/24/2011
1-27H	Photo	486117.03	6322426.4	135 13 43.7202 W	57 02 42.2591 N	18.2	10:34:33	5/24/2011
1-27I	Photo	486118.38	6322425.09	135 13 43.6399 W	57 02 42.2168 N	18.6	10:35:39	5/24/2011
1-28E	Photo	486087.92	6322374.58	135 13 45.4371 W	57 02 40.58 N	18.2	10:40:26	5/24/2011
1-28F	Photo	486088.05	6322377.61	135 13 45.43 W	57 02 40.6781 N	18.2	10:41:35	5/24/2011
1-28G	Photo	486087.6	6322377.56	135 13 45.4567 W	57 02 40.6764 N	18	10:42:30	5/24/2011
1-28H	Photo	486088.51	6322381.41	135 13 45.4034 W	57 02 40.801 N	18.2	10:43:29	5/24/2011
1-29E	Photo	486072.99	6322313.4	135 13 46.3107 W	57 02 38.5999 N	10.7	10:47:43	5/24/2011
1-29F	Photo	486074.03	6322313.13	135 13 46.249 W	57 02 38.5912 N	10.5	10:48:41	5/24/2011
1-29G	Photo	486075.8	6322313.54	135 13 46.144 W	57 02 38.6047 N	10.7	10:49:41	5/24/2011
1-29H	Photo	486078.95	6322314.21	135 13 45.9573 W	57 02 38.6267 N	11.3	10:50:43	5/24/2011
1-30E	Photo	486048.26	6322258.03	135 13 47.7669 W	57 02 36.8065 N	12.6	10:55:09	5/24/2011
1-30F	Photo	486044.31	6322255.29	135 13 48 W	57 02 36.7175 N	12.5	10:56:07	5/24/2011
1-30G	Photo	486041.34	6322254.6	135 13 48.1768 W	57 02 36.6948 N	11.9	10:57:15	5/24/2011
1-30H	Photo	486039.8	6322259.32	135 13 48.2691 W	57 02 36.8473 N	11.1	10:58:11	5/24/2011
1-37E	Photo	486152.58	6322352.27	135 13 41.5963 W	57 02 39.8655 N	23.6	11:21:07	5/24/2011
1-37F	Photo	486150.81	6322351.22	135 13 41.7011 W	57 02 39.8314 N	23.6	11:22:07	5/24/2011
1-37G	Photo	486150.62	6322352.69	135 13 41.7126 W	57 02 39.8789 N	23.8	11:23:06	5/24/2011
1-37H	Photo	486151.42	6322356.11	135 13 41.6659 W	57 02 39.9896 N	23.6	11:24:13	5/24/2011
1-38E	Photo	486129.92	6322295.76	135 13 42.9295 W	57 02 38.0356 N	22.3	11:28:46	5/24/2011
1-38F	Photo	486131.61	6322294.93	135 13 42.8291 W	57 02 38 N	22.5	11:29:54	5/24/2011
1-38G	Photo	486133.18	6322295.1	135 13 42.7359 W	57 02 38.0146 N	22.6	11:30:59	5/24/2011
1-38H	Photo	486135.21	6322298.67	135 13 42.6162 W	57 02 38.1302 N	23.2	11:32:06	5/24/2011
1-19E	Photo	485953.15	6322164.08	135 13 53.3909 W	57 02 33.7578 N	11.3	11:39:14	5/24/2011
1-19F	Photo	485951.9	6322165.52	135 13 53.4654 W	57 02 33.8042 N	10.9	11:40:17	5/24/2011
1-19G	Photo	485949.66	6322164.6	135 13 53.5981 W	57 02 33.7742 N	11.3	11:41:31	5/24/2011
1-19H	Photo	485946.61	6322161.29	135 13 53.7784 W	57 02 33.6668 N	11.7	11:42:36	5/24/2011
1-20E	Photo	485932.91	6322111.22	135 13 54.5811 W	57 02 32.046 N	12.6	11:47:10	5/24/2011
1-20F	Photo	485933.07	6322108.51	135 13 54.571 W	57 02 31.9584 N	12.5	11:48:08	5/24/2011
1-20G	Photo	485934.63	6322106.09	135 13 54.478 W	57 02 31.8803 N	12.3	11:49:17	5/24/2011
1-20H	Photo	485935.79	6322105.06	135 13 54.409 W	57 02 31.8471 N	12.6	11:50:17	5/24/2011
1-31A	Photo	486028.19	6322201.65	135 13 48.9464 W	57 02 34.981 N	14.3	11:58:24	5/24/2011
1-31B	Photo	486028.85	6322201.82	135 13 48.9073 W	57 02 34.9865 N	14.5	11:59:32	5/24/2011
1-31C	Photo	486028.71	6322204.82	135 13 48.9162 W	57 02 35.0836 N	14.2	12:00:35	5/24/2011
1-31D	Photo	486028.01	6322206.09	135 13 48.958 W	57 02 35.1245 N	14.2	12:01:42	5/24/2011
1-40A	Photo	486090.06	6322183.53	135 13 45.2721 W	57 02 34.4017 N	19.8	13:05:08	5/24/2011
1-40B	Photo	486093.28	6322190.07	135 13 45.0823 W	57 02 34.6136 N	20	13:06:04	5/24/2011
1-40C	Photo	486085.63	6322188.72	135 13 45.5359 W	57 02 34.5691 N	19.2	13:07:14	5/24/2011
1-40D	Photo	486080.13	6322187.17	135 13 45.8619 W	57 02 34.5183 N	19.2	13:08:09	5/24/2011
1-48A	Photo	486124.76	6322153.16	135 13 43.2073 W	57 02 33.4233 N	23.8	13:13:29	5/24/2011
1-48B	Photo	486142.48	6322159.91	135 13 42.1573 W	57 02 33.6435 N	24.6	13:16:25	5/24/2011
1-48C	Photo	486137.35	6322164.45	135 13 42.4626 W	57 02 33.7898 N	24	13:17:20	5/24/2011
1-48D	Photo	486139.65	6322169.81	135 13 42.3272 W	57 02 33.9634 N	23	13:18:18	5/24/2011
1-55A	Photo	486189.16	6322139.92	135 13 39.3839 W	57 02 33 N	31.3	13:23:51	5/24/2011
1-55B	Photo	486190.94	6322136.7	135 13 39.2777 W	57 02 32.8981 N	30.7	13:24:52	5/24/2011
1-55C	Photo	486198.02	6322138.45	135 13 38.858 W	57 02 32.9555 N	30.7	13:25:59	5/24/2011
1-55D	Photo	486200.29	6322148.69	135 13 38.7253 W	57 02 33.2869 N	30.7	13:27:00	5/24/2011
2-12A	Photo	486259.24	6322119.59	135 13 35.2222 W	57 02 32.3521 N	31.5	13:32:49	5/24/2011
2-12B	Photo	486258.52	6322118.18	135 13 35.2646 W	57 02 32.3065 N	30.9	13:34:12	5/24/2011
2-12C	Photo	486254.94	6322124.1	135 13 35.4782 W	57 02 32.4975 N	30.7	13:35:15	5/24/2011
2-12D	Photo	486246.18	6322123.58	135 13 35.9978 W	57 02 32.4798 N	31.7	13:36:17	5/24/2011
2-18A	Photo	486304.67	6322096.3	135 13 32.5223 W	57 02 31.6038 N	31.3	13:43:22	5/24/2011
2-18B	Photo	486304.91	6322095.43	135 13 32.5079 W	57 02 31.5757 N	31.1	13:44:26	5/24/2011
2-18C	Photo	486306.44	6322096.83	135 13 32.4174 W	57 02 31.6211 N	30.9	13:45:36	5/24/2011
2-18D	Photo	486311.12	6322104.03	135 13 32.1412 W	57 02 31.8545 N	31.1	13:46:41	5/24/2011
2-21A	Photo	486366.67	6322073.6	135 13 28.8396 W	57 02 30.8763 N	31.3	14:04:18	5/24/2011
2-21B	Photo	486374.27	6322075.57	135 13 28.3891 W	57 02 30.9408 N	31.5	14:05:16	5/24/2011
2-21C	Photo	486370.51	6322077.03	135 13 28.6124 W	57 02 30.9876 N	31.5	14:06:15	5/24/2011
2-21D	Photo	486368.37	6322082.51	135 13 28.7405 W	57 02 31.1646 N	31.3	14:07:10	5/24/2011
2-22A	Photo	486344	6322017.44	135 13 30.1735 W	57 02 29.0577 N	31.7	14:13:35	5/24/2011
2-22B	Photo	486340.83	6322020.44	135 13 30.3622 W	57 02 29.1543 N	31.7	14:14:36	5/24/2011
2-22C	Photo	486336.28	6322016.18	135 13 30.6313 W	57 02 29.0161 N	31.7	14:15:39	5/24/2011
2-22D	Photo	486341.53	6322022.09	135 13 30.321 W	57 02 29.2078 N	31.7	14:16:43	5/24/2011
2-19A	Photo	486281.65	6322040.83	135 13 33.8772 W	57 02 29.8074 N	31.3	14:22:56	5/24/2011
2-19B	Photo	486286.44	6322042.52	135 13 33.5933 W	57 02 29.8626 N	31.5	14:24:00	5/24/2011
2-19C	Photo	486293.95	6322043.83	135 13 33.148 W	57 02 29.9058 N	31.5	14:25:04	5/24/2011
2-19D	Photo	486291.21	6322038.73	135 13 33.3096 W	57 02 29.7405 N	31.5	14:26:04	5/24/2011
2-13A	Photo	486224.97	6322053.16	135 13 37.2423 W	57 02 30.2001 N	31.9	14:31:54	5/24/2011
2-13B	Photo	486233.6	6322055.38	135 13 36.7307 W	57 02 30.2728 N	31.3	14:32:58	5/24/2011
2-13C	Photo	486242.17	6322060.47	135 13 36.2233 W	57 02 30.4384 N	31.3	14:34:11	5/24/2011
2-13D	Photo	486247.8	6322080.05	135 13 35.8931 W	57 02 31.0722 N	31.3	14:35:17	5/24/2011
1-56A	Photo	486172.13	6322082.64	135 13 40.3829 W	57 02 31.1478 N	30.9	14:41:49	5/24/2011
1-56B	Photo	486174.5	6322081.78	135 13 40.2422 W	57 02 31.1202 N	30.9	14:42:44	5/24/2011
1-56C	Photo	486176.63	6322084.83	135 13 40.1164 W	57 02 31.2191 N	30.9	14:43:52	5/24/2011
1-56D	Photo	486177.53	6322088.58	135 13 40.0638 W	57 02 31.3405 N	30.9	14:44:59	5/24/2011
1-49A	Photo	486120.56	6322106.05	135 13 43.4471 W	57 02 31.8993 N	28.2	15:02:51	5/24/2011
1-49B	Photo	486116.76	6322104.96	135 13 43.6724 W	57 02 31.8636 N	28.4	15:03:50	5/24/2011
1-49C	Photo	486119.95	6322106.78	135 13 43.4835 W	57 02 31.9228 N	28.4	15:04:57	5/24/2011

1-49D	Photo	486120.66	6322107.92	135 13 43.4416 W	57 02 31.9598 N	28.4	15:05:59	5/24/2011	
1-41A	Photo	486071.59	6322122.37	135 13 46.3557 W	57 02 32.4218 N	26.7	15:12:17	5/24/2011	
1-41B	Photo	486071.4	6322121.03	135 13 46.3667 W	57 02 32.3784 N	26.9	15:13:25	5/24/2011	
1-41C	Photo	486075.78	6322124.9	135 13 46.1076 W	57 02 32.5041 N	26.5	15:14:26	5/24/2011	
1-41D	Photo	486073.67	6322127.18	135 13 46.2332 W	57 02 32.5776 N	26.1	15:15:24	5/24/2011	
1-32A	Photo	486010.38	6322135.33	135 13 49.9898 W	57 02 32.8342 N	16.1	15:19:23	5/24/2011	
1-32B	Photo	486004.71	6322138.13	135 13 50.3267 W	57 02 32.9242 N	15.9	15:20:27	5/24/2011	
1-32C	Photo	486002.76	6322140.61	135 13 50.4429 W	57 02 33 N	16.1	15:21:26	5/24/2011	
1-32D	Photo	485999.56	6322140.68	135 13 50.6328 W	57 02 33 N	15.9	15:22:31	5/24/2011	
1-33A	Photo	485998.41	6322088.36	135 13 50.6905 W	57 02 31.3139 N	20.7	15:26:55	5/24/2011	
1-33B	Photo	485994.06	6322087.33	135 13 50.9484 W	57 02 31.2801 N	20.1	15:27:54	5/24/2011	
1-33C	Photo	485988.22	6322089.95	135 13 51.2954 W	57 02 31.3642 N	19.6	15:28:53	5/24/2011	
1-33D	Photo	485987.81	6322090.75	135 13 51.3199 W	57 02 31.3901 N	18.6	15:29:50	5/24/2011	
1-42A	Photo	486047.36	6322070.92	135 13 47.7829 W	57 02 30.7552 N	27.5	15:34:07	5/24/2011	
1-42B	Photo	486049.11	6322066.58	135 13 47.6782 W	57 02 30.6151 N	27.8	15:35:14	5/24/2011	
1-42C	Photo	486052.67	6322068.33	135 13 47.4674 W	57 02 30.6721 N	28.2	15:36:16	5/24/2011	
1-42D	Photo	486058.85	6322068.76	135 13 47.1008 W	57 02 30.6866 N	30	15:37:20	5/24/2011	
1-50A	Photo	486100.64	6322048.5	135 13 44.6175 W	57 02 30.036 N	31.1	15:52:01	5/24/2011	
1-50B	Photo	486103.24	6322044.35	135 13 44.4624 W	57 02 29.902 N	31.1	15:53:04	5/24/2011	
1-50C	Photo	486106.67	6322045.88	135 13 44.2592 W	57 02 29.9519 N	30.9	15:54:05	5/24/2011	
1-50D	Photo	486107.06	6322051.06	135 13 44.2371 W	57 02 30.1195 N	31.1	15:55:03	5/24/2011	
1-42E	Photo	486041.83	6322065.97	135 13 48.11 W	57 02 30.5946 N	28	16:01:08	5/24/2011	
1-42F	Photo	486045.61	6322061.5	135 13 47.8849 W	57 02 30.4504 N	28.8	16:02:13	5/24/2011	
1-42G	Photo	486049.79	6322069.05	135 13 47.6384 W	57 02 30.695 N	28.2	16:03:14	5/24/2011	
1-42H	Photo	486042.09	6322076.04	135 13 48.0966 W	57 02 30.9203 N	26.1	16:04:06	5/24/2011	
2-08A	Photo	486157.12	6322026.03	135 13 41.2622 W	57 02 29.3154 N	31.5	16:09:44	5/24/2011	
2-08B	Photo	486160.66	6322026.15	135 13 41.0522 W	57 02 29.3197 N	31.5	16:10:45	5/24/2011	
2-08C	Photo	486163.6	6322028.99	135 13 40.8784 W	57 02 29.4118 N	31.7	16:11:44	5/24/2011	
2-08D	Photo	486155.92	6322035.57	135 13 41.3353 W	57 02 29.6238 N	32.2	16:12:45	5/24/2011	
2-14A	Photo	486213.18	6322001.39	135 13 37.9315 W	57 02 28.5246 N	31.9	16:18:17	5/24/2011	
2-14B	Photo	486214.3	6322001.27	135 13 37.865 W	57 02 28.5208 N	31.9	16:19:17	5/24/2011	
2-14C	Photo	486217.26	6322003.83	135 13 37.6899 W	57 02 28.6039 N	31.9	16:20:17	5/24/2011	
2-14D	Photo	486214.95	6322007.6	135 13 37.8277 W	57 02 28.7256 N	32.1	16:21:18	5/24/2011	
2-20A	Photo	486271.85	6321981.04	135 13 34.4468 W	57 02 27.8728 N	32.3	16:27:23	5/24/2011	
2-20B	Photo	486272.98	6321981.01	135 13 34.3798 W	57 02 27.8719 N	32.3	16:28:23	5/24/2011	
2-20C	Photo	486265.41	6321986.36	135 13 34.8299 W	57 02 28.0441 N	32.3	16:29:47	5/24/2011	
2-20D	Photo	486280.4	6321983.62	135 13 33.9401 W	57 02 27.9571 N	32.3	16:32:02	5/24/2011	
2-23A	Photo	486325.89	6321957.99	135 13 31.2363 W	57 02 27.1331 N	32.6	16:48:35	5/24/2011	
2-23B	Photo	486328.67	6321956.32	135 13 31.0711 W	57 02 27.0794 N	32.6	16:49:40	5/24/2011	
2-23C	Photo	486330.44	6321957.06	135 13 30.9662 W	57 02 27.1035 N	32.6	16:50:41	5/24/2011	
2-23D	Photo	486331.27	6321960.21	135 13 30.9176 W	57 02 27.2055 N	32.6	16:51:51	5/24/2011	
O1A	Photo	486328.44	6321893.61	135 13 31.0724 W	57 02 25.0513 N	33.6	16:57:34	5/24/2011	
O1B	Photo	486324.66	6321886.48	135 13 31.2953 W	57 02 24.8203 N	33.8	16:58:38	5/24/2011	
O1C	Photo	486343.22	6321896.23	135 13 30.1961 W	57 02 25.1376 N	33	17:02:09	5/24/2011	
O1D	Photo	486349.68	6321902.6	135 13 29.8141 W	57 02 25.3443 N	33.4	17:03:13	5/24/2011	
O2A	Photo	486348.83	6321836.99	135 13 29.8517 W	57 02 23.2224 N	34	17:09:43	5/24/2011	
O2B	Photo	486360.21	6321848.53	135 13 29.1789 W	57 02 23.5968 N	33.2	17:10:48	5/24/2011	
O2C	Photo	486354.64	6321839.77	135 13 29.5076 W	57 02 23.3129 N	33.4	17:12:01	5/24/2011	
O2D	Photo	486345.42	6321838.24	135 13 30.0543 W	57 02 23.2625 N	33.6	17:13:14	5/24/2011	
1-34A	Photo	485960.87	6322030.14	135 13 52.906 W	57 02 29.427 N	24.2	9:06:43	5/25/2011	
1-34B	Photo	485960.89	6322031.64	135 13 52.9051 W	57 02 29.4755 N	24	9:07:39	5/25/2011	
1-34C	Photo	485963.22	6322032.41	135 13 52.767 W	57 02 29.5006 N	24	9:08:36	5/25/2011	
1-34D	Photo	485962.79	6322032.4	135 13 52.7925 W	57 02 29.5003 N	24.4	9:09:40	5/25/2011	
1-34E	Photo	485988.12	6322022.13	135 13 51.2877 W	57 02 29.1709 N	27.3	9:29:03	5/25/2011	Moved E, Steep slope
1-34F	Photo	485981.37	6322024.76	135 13 51.6887 W	57 02 29.2552 N	26.7	9:30:04	5/25/2011	Moved E, Steep slope
1-34G	Photo	485984.28	6322025.49	135 13 51.5162 W	57 02 29.2792 N	26.7	9:31:06	5/25/2011	Moved E, Steep slope
1-34H	Photo	485988.75	6322025.77	135 13 51.251 W	57 02 29.2887 N	26.7	9:32:01	5/25/2011	Moved E, Steep slope
1-43A	Photo	486023.63	6322012.62	135 13 49.1791 W	57 02 28.8672 N	31.5	9:37:36	5/25/2011	
1-43B	Photo	486021.64	6322011.08	135 13 49.2968 W	57 02 28.8172 N	31.5	9:38:44	5/25/2011	
1-43C	Photo	486022.02	6322008.75	135 13 49.2738 W	57 02 28.7419 N	31.3	9:39:44	5/25/2011	
1-43D	Photo	486021.03	6322011.1	135 13 49.333 W	57 02 28.8178 N	30.5	9:40:47	5/25/2011	
1-51A	Photo	486068.92	6321987.45	135 13 46.4872 W	57 02 28.0582 N	33	9:46:25	5/25/2011	
1-51B	Photo	486068.82	6321980.09	135 13 46.4916 W	57 02 27.8201 N	32.3	9:47:27	5/25/2011	
1-51C	Photo	486068.31	6321978.99	135 13 46.5217 W	57 02 27.7845 N	33	9:48:29	5/25/2011	
1-51D	Photo	486081.67	6321980.65	135 13 45.7294 W	57 02 27.8396 N	33	9:49:23	5/25/2011	
2-09A	Photo	486127.83	6321964.87	135 13 42.9878 W	57 02 27.3343 N	32.3	9:55:21	5/25/2011	
2-09B	Photo	486133.94	6321960.5	135 13 42.6244 W	57 02 27.1937 N	32.6	9:56:22	5/25/2011	
2-09C	Photo	486131.53	6321960.31	135 13 42.7674 W	57 02 27.1873 N	32.6	9:57:28	5/25/2011	
2-09D	Photo	486132.03	6321957	135 13 42.737 W	57 02 27.0803 N	32.5	9:58:29	5/25/2011	
2-15A	Photo	486189.78	6321946.3	135 13 39.3089 W	57 02 26.7405 N	32.8	10:04:43	5/25/2011	
2-15B	Photo	486187.32	6321942.54	135 13 39.4541 W	57 02 26.6186 N	33	10:05:53	5/25/2011	
2-15C	Photo	486182.16	6321945.6	135 13 39.7608 W	57 02 26.717 N	32.8	10:06:49	5/25/2011	
2-15D	Photo	486185.5	6321937.73	135 13 39.5611 W	57 02 26.4628 N	32.5	10:07:59	5/25/2011	
1-35A	Photo	485965.07	6321963.45	135 13 52.6434 W	57 02 27.2707 N	29.2	10:27:55	5/25/2011	Moved E, Steep slope
1-35B	Photo	485966.41	6321963.62	135 13 52.5639 W	57 02 27.2763 N	29.2	10:28:56	5/25/2011	Moved E, Steep slope
1-35C	Photo	485967.23	6321963.61	135 13 52.5153 W	57 02 27.2761 N	30.3	10:30:00	5/25/2011	Moved E, Steep slope
1-35D	Photo	485968.44	6321965.02	135 13 52.4438 W	57 02 27.3218 N	30.3	10:31:11	5/25/2011	Moved E, Steep slope
2-04A	Photo	485995.54	6321956.31	135 13 50.8343 W	57 02 27.0431 N	31.9	10:38:20	5/25/2011	
2-04B	Photo	485999.45	6321952.75	135 13 50.6016 W	57 02 26.9284 N	32.1	10:39:20	5/25/2011	
2-04C	Photo	485999.69	6321953.91	135 13 50.5876 W	57 02 26.9659 N	32.1	10:40:23	5/25/2011	
2-04D	Photo	486000.4	6321955.33	135 13 50.5458 W	57 02 27.0119 N	32.1	10:41:28	5/25/2011	

2-06A	Photo	486054.29	6321932.24	135 13 47.3441 W	57 02 26.2711 N	32.6	10:47:13	5/25/2011	
2-06B	Photo	486055.05	6321929.44	135 13 47.2984 W	57 02 26.1806 N	32.6	10:48:14	5/25/2011	
2-06C	Photo	486056.3	6321927.22	135 13 47.2238 W	57 02 26.109 N	32.5	10:49:11	5/25/2011	
2-06D	Photo	486054.86	6321927.53	135 13 47.3093 W	57 02 26.1188 N	32.5	10:50:11	5/25/2011	
2-10A	Photo	486107.67	6321910.39	135 13 44.1729 W	57 02 25.5702 N	32.5	10:56:16	5/25/2011	
2-10B	Photo	486112.36	6321901.47	135 13 43.8929 W	57 02 25.2823 N	32.6	10:57:25	5/25/2011	
2-10C	Photo	486112.24	6321900.24	135 13 43.8998 W	57 02 25.2425 N	32.8	10:58:23	5/25/2011	
2-10D	Photo	486112.48	6321907.22	135 13 43.887 W	57 02 25.4683 N	32.6	10:59:26	5/25/2011	
2-16A	Photo	486165.64	6321884.16	135 13 40.7287 W	57 02 24.7282 N	32.2	11:05:26	5/25/2011	
2-16B	Photo	486163.6	6321885.54	135 13 40.85 W	57 02 24.7726 N	32.5	11:06:28	5/25/2011	
2-16C	Photo	486163.1	6321883.05	135 13 40.8791 W	57 02 24.6921 N	32.5	11:07:32	5/25/2011	
2-16D	Photo	486164.11	6321878.63	135 13 40.8183 W	57 02 24.5492 N	32.5	11:08:38	5/25/2011	
2-01A	Photo	485943.84	6321907.38	135 13 53.8916 W	57 02 25.455 N	27	11:29:52	5/25/2011	Moved E, Steep slope
2-01B	Photo	485950.39	6321909.69	135 13 53.5035 W	57 02 25.5305 N	28	11:31:02	5/25/2011	Moved E, Steep slope
2-01C	Photo	485954.26	6321910.05	135 13 53.274 W	57 02 25.5425 N	29.6	11:32:03	5/25/2011	Moved E, Steep slope
2-01D	Photo	485954.85	6321910.7	135 13 53.2391 W	57 02 25.5636 N	30	11:32:58	5/25/2011	Moved E, Steep slope
2-05A	Photo	485982.29	6321896.45	135 13 51.6083 W	57 02 25.1058 N	32.6	11:38:34	5/25/2011	
2-05B	Photo	485981.37	6321898.84	135 13 51.6634 W	57 02 25.183 N	32.6	11:39:34	5/25/2011	
2-05C	Photo	485974	6321894.5	135 13 52.0998 W	57 02 25.0418 N	32.6	11:40:41	5/25/2011	
2-05D	Photo	485975.69	6321896	135 13 52 W	57 02 25.0905 N	32.6	11:41:48	5/25/2011	
2-07A	Photo	486042.03	6321874.01	135 13 48.0598 W	57 02 24.3866 N	32.8	11:47:15	5/25/2011	
2-07B	Photo	486039.82	6321868.79	135 13 48.1898 W	57 02 24.2175 N	32.8	11:48:19	5/25/2011	
2-07C	Photo	486044.96	6321872.01	135 13 47.8856 W	57 02 24.3222 N	32.6	11:49:20	5/25/2011	
2-07D	Photo	486047.26	6321873.13	135 13 47.7493 W	57 02 24.3587 N	32.8	11:50:26	5/25/2011	
2-11A	Photo	486090.81	6321854.42	135 13 45.162 W	57 02 23.7583 N	33.6	11:56:49	5/25/2011	
2-11B	Photo	486089.07	6321852.66	135 13 45.2649 W	57 02 23.7012 N	33.4	11:57:55	5/25/2011	
2-11C	Photo	486087.57	6321846.02	135 13 45.3526 W	57 02 23.4863 N	32.8	11:59:00	5/25/2011	
2-11D	Photo	486089.38	6321850.26	135 13 45.246 W	57 02 23.6237 N	32.8	11:59:58	5/25/2011	
2-02A	Photo	485922.71	6321845.94	135 13 55.1327 W	57 02 23.4657 N	32.8	12:07:56	5/25/2011	Moved E, Steep slope
2-02B	Photo	485918.5	6321848.11	135 13 55.3829 W	57 02 23.5355 N	33	12:08:59	5/25/2011	Moved E, Steep slope
2-02C	Photo	485922.54	6321840.78	135 13 55.1418 W	57 02 23.2988 N	32.8	12:10:05	5/25/2011	Moved E, Steep slope
2-02D	Photo	485916.89	6321839.68	135 13 55.4768 W	57 02 23.2627 N	33.6	12:11:07	5/25/2011	Moved E, Steep slope
2-03A	Photo	485885.32	6321799.71	135 13 57.3415 W	57 02 21.9665 N	33.6	12:16:50	5/25/2011	
2-03B	Photo	485883.19	6321798.19	135 13 57.4676 W	57 02 21.9172 N	33.2	12:17:52	5/25/2011	
2-03C	Photo	485882.64	6321799.09	135 13 57.5004 W	57 02 21.9462 N	33.2	12:19:00	5/25/2011	
2-03D	Photo	485879.05	6321797.79	135 13 57.7131 W	57 02 21.9038 N	33.2	12:20:08	5/25/2011	
1-10A	Photo	485735.18	6321726.9	135 14 6.2335 W	57 02 19.5952 N	34.6	13:29:18	5/25/2011	
1-10B	Photo	485723.14	6321730.24	135 14 6.9484 W	57 02 19.7019 N	34.4	13:30:27	5/25/2011	
1-10C	Photo	485716.91	6321731.44	135 14 7.3183 W	57 02 19.74 N	34.2	13:31:27	5/25/2011	
1-10D	Photo	485728.66	6321734	135 14 6.6218 W	57 02 19.8241 N	33.4	13:32:23	5/25/2011	
1-11A	Photo	485708.18	6321663.16	135 14 7.8222 W	57 02 17.5309 N	34.4	13:38:46	5/25/2011	
1-11B	Photo	485698.53	6321667.32	135 14 8.3955 W	57 02 17.6643 N	34.2	13:39:53	5/25/2011	
1-11C	Photo	485702.15	6321669.88	135 14 8.1813 W	57 02 17.7475 N	35	13:40:55	5/25/2011	
1-11D	Photo	485703.44	6321655.56	135 14 8.1018 W	57 02 17.2846 N	34.2	13:41:56	5/25/2011	
1-09A	Photo	485775.42	6321767.86	135 14 3.8547 W	57 02 20.9244 N	33.4	13:49:30	5/25/2011	Moved E, Steep slope
1-09B	Photo	485774.43	6321761.21	135 14 3.9121 W	57 02 20.7092 N	34.2	13:50:38	5/25/2011	Moved E, Steep slope
1-09C	Photo	485777.73	6321763.3	135 14 3.7168 W	57 02 20.7771 N	33.4	13:51:43	5/25/2011	Moved E, Steep slope
1-09D	Photo	485773.63	6321766.06	135 14 3.9605 W	57 02 20.866 N	33.6	13:52:46	5/25/2011	Moved E, Steep slope
1-25A	Photo	485810.42	6321820.65	135 14 1.7891 W	57 02 22.6355 N	16.5	14:02:44	5/25/2011	
1-25B	Photo	485822.23	6321819.6	135 14 1.0883 W	57 02 22.6028 N	17.6	14:04:23	5/25/2011	
1-24A	Photo	485845.94	6321870.17	135 13 59.692 W	57 02 24.2409 N	10	14:13:10	5/25/2011	PV only
1-24B	Photo	485846.2	6321874.17	135 13 59.6774 W	57 02 24.3703 N	9.8	14:13:43	5/25/2011	PV only
1-24C	Photo	485850.04	6321877.21	135 13 59.4502 W	57 02 24.469 N	10.3	14:14:33	5/25/2011	PV only
2-01E	Photo	485954.66	6321906.27	135 13 53.2495 W	57 02 25.4203 N	30.9	14:20:32	5/25/2011	
2-01F	Photo	485945.69	6321904.14	135 13 53.7812 W	57 02 25.3505 N	26.9	14:21:24	5/25/2011	
2-01G	Photo	485935.28	6321913.06	135 13 54.4006 W	57 02 25.6378 N	29.2	14:22:17	5/25/2011	
2-01H	Photo	485955.75	6321899.38	135 13 53.1834 W	57 02 25.1976 N	30.5	14:23:24	5/25/2011	
1-35E	Photo	485966.17	6321960.44	135 13 52.5775 W	57 02 27.1735 N	28.2	14:31:53	5/25/2011	
1-35F	Photo	485965.94	6321958.72	135 13 52.5908 W	57 02 27.1178 N	29.6	14:33:04	5/25/2011	
1-35G	Photo	485963.97	6321958.43	135 13 52.7076 W	57 02 27.1082 N	29.6	14:34:01	5/25/2011	
1-35H	Photo	485967.86	6321957.73	135 13 52.4767 W	57 02 27.086 N	29.6	14:35:10	5/25/2011	
O3A	Photo	486378.86	6321749.89	135 13 28.0532 W	57 02 20.4088 N	33	14:47:57	5/25/2011	
03B	Photo	486375.54	6321745.86	135 13 28.2494 W	57 02 20.2781 N	33.2	14:48:56	5/25/2011	
O3C	Photo	486367.85	6321747.37	135 13 28.7059 W	57 02 20.3261 N	33	14:50:06	5/25/2011	
O3D	Photo	486348.01	6321747.25	135 13 29.8828 W	57 02 20.3201 N	34	14:51:07	5/25/2011	
O4A	Photo	486325.91	6321750.06	135 13 31.1944 W	57 02 20.4086 N	33.8	14:52:35	5/25/2011	
O4B	Photo	486325.98	6321755.96	135 13 31.1914 W	57 02 20.5995 N	33.8	14:53:31	5/25/2011	
O4C	Photo	486314.73	6321757.87	135 13 31.8592 W	57 02 20.66 N	33.8	14:54:30	5/25/2011	
O4D	Photo	486300.63	6321763.65	135 13 32.6968 W	57 02 20.8454 N	33.6	14:55:30	5/25/2011	
O3E	Photo	486370.34	6321748.82	135 13 28.5585 W	57 02 20.3733 N	33.4	15:29:06	5/25/2011	
O3F	Photo	486366.13	6321745.63	135 13 28.8076 W	57 02 20.2697 N	33.2	15:30:11	5/25/2011	
O3G	Photo	486356.29	6321746.89	135 13 29.3916 W	57 02 20.3094 N	33.2	15:31:13	5/25/2011	
O3H	Photo	486349.79	6321745.38	135 13 29.7769 W	57 02 20.2598 N	33.4	15:32:12	5/25/2011	
O4E	Photo	486337.4	6321741.44	135 13 30.5111 W	57 02 20.1311 N	33.2	15:33:11	5/25/2011	
O4F	Photo	486329.23	6321728.26	135 13 30.9932 W	57 02 19.704 N	34	15:34:06	5/25/2011	
O4G	Photo	486328.51	6321718.56	135 13 31.034 W	57 02 19.3902 N	34	15:35:10	5/25/2011	
O4H	Photo	486317.18	6321719.49	135 13 31.7063 W	57 02 19.4191 N	33.6	15:36:28	5/25/2011	

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Appendix B:

SPI Analytical Results

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Station	Rep	DATE	TIME	Water Depth (ft)	Successional Stage	Grain Size Major Mode (phi)	Grain Size Maximum (phi)	Grain Size Minimum (phi)	Grain Size (phi)	Penetration Area (cm^2)	Average Penetration (cm)	Minimum Penetration (cm)	Maximum Penetration (cm)	Boundary Roughness (cm)	Origin of Boundary Roughness	RPD Area (cm^2)	Mean RPD (cm)	Mud Clast Number	Mud Clast State	Methane	Low DO	Fish Waste (presence)	Wood (presence)	Wood Type
1-09	A	5/25/2011	13:48:30	200.4	Stage 1 on 3	3-2/>4-3	-1	>4	>4 to -1	179.64	12.44	8.42	14.65	6.23	Biogenic	179.64	12.44	0	-	0	No	Trace	Yes	fine
1-09	C	5/25/2011	13:50:43	200.4	Stage 1 on 3	3-2/>4-3	-1	>4	>4 to -1	158.21	10.95	9.81	11.40	1.59	Biogenic	158.21	10.95	0	-	0	No	Trace	Yes	fine
1-09	D	5/25/2011	13:51:47	201.6	Stage 1 on 3	4-3	-1	>4	>4 to -1	203.91	14.12	12.78	14.76	1.98	Biogenic	136.37	9.44	0	-	0	No	Trace	Yes	fine, chips
1-10	A	5/25/2011	13:28:15	207.6	Stage 1 on 3	4-3	0	>4	>4 to 0	175.94	12.18	11.47	12.96	1.49	Biogenic	175.94	12.18	0	-	0	No	Trace	Yes	fine
1-10	C	5/25/2011	13:30:25	205.2	Stage 1 on 3	4-3	0	>4	>4 to 0	227.97	15.78	15.61	16.11	0.50	Biogenic	53.98	3.74	0	-	0	No	Trace	Yes	fine
1-10	D	5/25/2011	13:31:24	200.4	Stage 1 on 3	4-3	1	>4	>4 to 1	239.25	16.57	16.25	17.06	0.81	Biogenic	165.71	11.47	0	-	0	No	Trace	Yes	fine
1-11	A	5/25/2011	13:37:47	206.4	Stage 3	4-3	-1	>4	>4 to -1	146.62	10.15	7.59	12.18	4.59	Biogenic	146.62	10.15	0	-	0	No	Trace	Yes	fine
1-11	B	5/25/2011	13:38:52	205.2	Stage 1 on 3	4-3	0	>4	>4 to 0	139.07	9.63	8.88	10.05	1.17	Biogenic	139.07	9.63	0	-	0	No	Trace	Yes	fine
1-11	C	5/25/2011	13:39:54	210	Stage 2 on 3	4-3	0	>4	>4 to 0	149.71	10.37	10.19	10.69	0.50	Biogenic	149.71	10.37	0	-	0	No	No	Yes	fine
1-12	E	5/24/2011	10:21:47	49.2	Stage 2 -> 3	4-3	0	>4	>4 to 0	123.45	8.55	8.30	9.00	0.69	Biogenic	123.45	8.55	0	-	0	No	No	Yes	chips
1-12	G	5/24/2011	10:23:38	49.2	Indeterminate	4-3	0	>4	>4 to 0	125.69	8.70	7.86	10.34	2.48	Physical	Indeterminate	Indeterminate	0	-	0	No	No	Yes	chips
1-12	H	5/24/2011	10:24:54	51.6	Stage 2 -> 3	4-3	0	>4	>4 to 0	187.17	12.96	12.04	14.34	2.30	Biogenic	187.17	12.96	0	-	0	No	No	Yes	chips
1-13	B	5/23/2011	10:47:53	38.4	Indeterminate	Indeterminate	-9	>4	>4 to -9	15.71	1.09	0.71	1.27	0.57	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-13	C	5/23/2011	10:48:48	41.4	Indeterminate	-6 - (-7)	-10	>4	>4 to -10	48.46	3.36	3.05	3.69	0.64	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-13	D	5/23/2011	10:49:49		Indeterminate	-2 - (-4)	-10	>4	>4 to -10	18.98	1.31	0.82	1.78	0.96	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-14	D	5/23/2011	10:16:54	39	Stage 1	4-3	0	>4	>4 to 0	200.79	13.90	12.57	15.22	2.65	Physical	0.00	0.00	0	-	0	Yes	Yes	Yes	medium, chips
1-14	E	5/23/2011	10:18:01	41.4	Stage 1	4-3	0	>4	>4 to 0	300.47	20.80	20.07	21.13	1.06	Physical	0.00	0.00	0	-	0	Yes	Yes	Yes	fine to medium, chips
1-14	F	5/23/2011	10:19:09		Stage 1 -> 2	4-3	0	>4	>4 to 0	285.63	19.78	19.19	20.42	1.24	Physical	21.81	1.51	0	-	0	No	Yes	Yes	fine, chips
1-15	A	5/23/2011	10:53:32	60	Stage 1	3-2	-1	>4	>4 to -1	174.91	12.11	11.72	12.57	0.85	Physical	0.00	0.00	0	-	0	Yes	Yes	Yes	fine
1-15	B	5/23/2011	10:54:34		Stage 1	3-2/4-3	-1	>4	>4 to -1	226.18	15.66	14.83	16.32	1.49	Physical	0.00	0.00	0	-	0	Yes	Yes	Yes	fine, chips
1-15	D	5/23/2011	10:56:38	61.8	Stage 1	3-2/4-3	-1	>4	>4 to -1	225.66	15.62	14.97	16.14	1.17	Physical	0.00	0.00	0	-	0	Yes	Yes	Yes	fine
1-16	A	5/23/2011	11:01:36	36	Stage 1	4-3	-1	>4	>4 to -1	136.74	9.47	8.74	10.34	1.59	Physical	0.29	0.02	0	-	0	No	Yes	Yes	fine
1-16	C	5/23/2011	11:03:31	35.4	Stage 1	4-3	-3	>4	>4 to -3	147.59	10.22	9.77	10.73	0.96	Physical	0.29	0.02	0	-	0	No	No	Yes	medium, chips
1-16	D	5/23/2011	11:04:29	34.8	Stage 1	4-3	-2	>4	>4 to -2	159.49	11.04	10.37	11.43	1.06	Physical	0.29	0.02	0	-	0	No	No	Yes	fine to medium, chips
1-17	A	5/23/2011	11:09:47	42.6	Stage 1	4-3	0	>4	>4 to 0	159.07	11.01	10.12	11.54	1.42	Physical	Indeterminate	Indeterminate	0	-	0	No	No	Yes	medium, chips
1-17	B	5/23/2011	11:10:52	43.2	Stage 1	4-3	0	>4	>4 to 0	161.04	11.15	10.41	11.33	0.92	Physical	Indeterminate	Indeterminate	0	-	0	No	No	Yes	medium, chips
1-17	C	5/23/2011	11:11:45	44.4	Stage 1	4-3	0	>4	>4 to 0	175.96	12.18	11.43	12.71	1.27	Physical	Indeterminate	Indeterminate	0	-	0	No	No	Yes	medium, chips
1-18	B	5/23/2011	11:33:02		Stage 1	4-3	0	>4	>4 to 0	237.51	16.45	14.83	17.45	2.62	Physical	0.00	0.00	0	-	0	Yes	No	Yes	medium, chips
1-18	C	5/23/2011	11:34:00	48.6	Stage 1	4-3	0	>4	>4 to 0	227.20	15.73	15.40	16.25	0.85	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine to medium, chips
1-18	D	5/23/2011	11:35:01	51	Stage 1	3-2/4-3	-1	>4	>4 to -1	216.25	14.97	14.12	15.33	1.20	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine to medium, chips
1-19	E	5/24/2011	11:38:12	67.8	Stage 1	>4	0	>4	>4 to 0	255.78	17.71	17.31	18.48	1.17	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine, chips
1-19	F	5/24/2011	11:39:14	65.4	Stage 1	>4	-1	>4	>4 to -1	263.81	18.27	17.59	19.04	1.45	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine, chips
1-19	G	5/24/2011	11:40:27	67.8	Stage 1	>4	0	>4	>4 to 0	281.88	19.52	19.22	19.82	0.60	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine, chips
1-20	F	5/24/2011	11:47:05	75	Stage 1 -> 2	4-3	0	>4	>4 to 0	241.55	16.73	15.72	17.31	1.59	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine, chips
1-20	G	5/24/2011	11:48:13	73.8	Stage 1	4-3	1	>4	>4 to 1	259.40	17.96	16.88	18.76	1.88	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine, chips
1-20	H	5/24/2011	11:49:16	75.6	Stage 1	4-3	1	>4	>4 to 1	253.60	17.56	17.45	17.81	0.35	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine
1-21																								
1-22																								
1-24	A																							
1-25	A																							
1-26	A	5/23/2011	13:26:40	73.8	Indeterminate	-6 - (-8)	-9	>4	>4 to -9	52.41	3.63	0.93	4.70	3.77	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-26	B	5/23/2011	13:30:35	66.6	Indeterminate	-6 - (-8)	-8	>4	>4 to -8	19.52	1.35	0.55	1.89	1.35	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-26	C	5/23/2011	13:31:33	76.2	Indeterminate	-6 - (-8)	-9	>4	>4 to -9	0.00	0.00	0.00	0	0.00	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-27	E	5/24/2011	10:30:13	109.2	Stage 1	4-3	0	>4	>4 to 0	191.02	13.23	12.76	14.18	1.42	Physical	33.41	2.31	0	-	0	No	Trace	Yes	fine, chips
1-27	G	5/24/2011	10:32:18	104.4	Stage 1	4-3	0	>4	>4 to 0	220.53	15.27	15.04	15.55	0.50	Physical	30.67	2.12	0	-	0	No	Trace	Yes	fine
1-27	H	5/24/2011	10:33:35	109.2	Stage 1	4-3	0	>4	>4 to 0	225.39	15.61	14.73	15.89	1.17	Physical	20.27	1.40	0	-	0	No	Trace	Yes	fine

Station	Rep	Beggiatoa (presence)	Bacteria Type (Fibers or Mat)	Feeding Voids (#)	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Void Average Depth (cm)	Stop Collar Settings (in.)	Weights/ Chassis (#)	Calibration Constant	COMMENT
1-09	A	No		0	-	-		12	0+Doors	14.442	Poorly sorted silty fine sand grading over silty very fine sand. Large biogenic mound transected, bulk of sediment particles are aggregated in fecal pellets; collapsed tubes and wood fibers subsurface. aRPD exceeeds penetration depth, deep reworking; Evidence of burrows throughout profile.
1-09	C	No		0	-	-		12	0+Doors	14.442	Silty fine sand over silty very fine sand. Couple tubes at SWI. collapsed tubes and debris, including wood fibers. collapsed tubes and wood fibers subsurface. aRPD exceeds penetration depth of camera; high percentage of fecal pellets in cross-section, Sand-lined burrows in upper cms.
1-09	D	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand with wood fibers and high percentage of fecal pellets in cross section; traces of incipient Beggiatoa.Tubes and wood fibers subsurface. Evidence of shallow burrowing and relict end of larger burrow or void.
1-10	A	No		0	-	-		12	0+Doors	14.442	Silty very fine sand with highly pelletized surface; aRPD exceeds penetration depth of camera, deep bioturbation. Few collapsed tubes at surface. Fine wood fibers subsurface.
1-10	C	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand with traces of incipient Beggiatoa and fin ray pieces from fish waste. Few collapsed tubes at surface. Fine wood fibers subsurface. Fecal pellet layer. Evidence of burrowing throughout profile.
1-10	D	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand with traces of incipient Beggiatoa and fin ray pieces from fish waste. Few collapsed tubes at surface. Fine wood fibers subsurface. Fecal pellet layer. Evidence of burrowing throughout profile.
1-11	A	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty fine and very find sand with a few Beggiatoa fibers and high percentage of fecal pellets. Crab legs on surface and below, on right. aRPD exceeds penetration dpeth, evidence of subsurface burrowing at lower left corner & in PV image
1-11	B	No		0	-	-		12	0+Doors	14.442	Sitly very fine sand with high percentage of fecal pellets and fish bone/ray particles admixed. Few tubes, collapsed tubes, and debris at surface. Fine wood fibers subsurface. Sus sed. aRPD exceeds penetration depth of camera.
1-11	C	No		0	-	-		12	0+Doors	14.442	Silty very fine sand with shallow dwelling bivalves, oligochaetes visible in upper few cm. Fine wood fibers subsurface. aRPD exceeds penetration depth.
1-12	E	No		0	-	-		12	0+Doors	14.442	Poorly sorted, silty very fine sand. Lots of debris, some phytodetritus in background. Med-sized wood chip on surface, few smaller ones at surface and subsurface. Ophiurid arms at 1.9 cm and 5.0 cm. Fecal pellets.
1-12	G	No		0	-	-		12	0+Doors	14.442	Poorly sorted silty very fine sand. Larger wood chips at surface. Ophiurids by wood chips on surface. Profile is loaded with fecal pellets throughout entire cross-section; SWI (and aRPD) distorted by drag-down of surface debris (plastic trash?) against faceplate
1-12	H	No		0	-	-		12	0+Doors	14.442	Silty very fine sand with wood chips at surface and fecal pellets throughout entire profile. Ophiurids or just arms, one at surface, at depth ~9.5cm. aRPD exceeds psim penetration, evidence of burrowing throughout.
1-13	B	No		Indeterminate	-	-		11	0	14.442	Hard bottom, poorly sorted silty sand with cobble & gravel, very little penetration. Fine phytodetritus covering surface. Piece of brown algae on right.
1-13	C	No		Indeterminate	-	-		11	0	14.442	Poorly sorted medium sand. Gravel, pebbles, and boulders (-10phi) on surface. Fine phytodetritus covering surface.
1-13	D	No		Indeterminate	-	-		11	0	14.442	Poorly sorted medium sand. Gravel, pebbles, and boulders (-10phi) on surface. Fine phytodetritus covering surface. White calcareous worm tubes on boulder in middle. Hermit crab in lower right corner. Water depth not recorded.
1-14	D	Yes	Fibers	0	-	-		12	0	14.442	Layer of dark gray, reduced fish waste on top of wood chips/fibers;. No aRPD, small worms present in sediment.
1-14	E	Yes	Fibers	0	-	-		12	0	14.442	Layer of high SOD gray sediment with fish waste, then poorly sorted very fine sand with numerous wood fibers and small wood chips incorporated. No aRPD. Almost over-penetration, SWI only visible on far right.
1-14	F	Yes	Fibers	0	-	-		12	0	14.442	Silty very fine sand, with abundant fecal pellets; some groundwater discharge through subsurface sediment (blurred profile from density difference); wood waste fibers at surface and w/ small chips subsurface. Small worms burrowing at depth. Water depth not recorded.
1-15	A	No		0	-	-		11	0	14.442	Silty very fine sand. Lots of detritus and fine wood fibers and small chips at surface. Grayish sediment with white fine sand-sized particles, evidence of thin burrows throughout profile. No aRPD.
1-15	B	No		0	-	-		11	0	14.442	Poorly sorted very fine and fine sand. Debris and large wood chips at surface. Some fish waste residue and scales against faceplate in upper few cms. No aRPD. Small worms burrowing throughout profile. Water depth not recorded.
1-15	D	No		0	-	-		11	0	14.442	Poorly sorted very fine and fine sand. Debris and wood fibers and small chips at surface. No aRPD. Sediment is darkish gray in upper several cms with abundant small black fish residue througout subsurface. Small burrows throughout profile.
1-16	A	Yes	fibers	0	-	-		11	0	14.442	Silty very fine sand, poorly sorted in upper cms. Layer of fine wood fibers and small chips on surface. Some microplankton or phytodetritus on surface. Diffusional aRPD, incipient Beggiatoa, and fish waste remants in profile
1-16	C	Yes	fibers	0	-	-		11	0	14.442	Silty very fine sand, poorly sorted in upper cms. Layer of fine to medium wood fibers and medium to large chips on surface and in upper cms. Clumps of phytodetritus on surface. Diffusional aRPD. Some pebbles on surface. Dense Stage 1 worms
1-16	D	Yes	fibers	0	-	-		11	0	14.442	Silty very fine sand, poorly sorted in upper cms. Layer of fine to medium wood fibers and medium to large chips on surface and in upper cms. Incipient Beggiatoa in upper cm. Diffusional aRPD. Some pebbles on surface. Dense Stage 1 worms
1-17	A	Yes	fibers	0	-	-		11	0	14.442	Entire image is wood waste, fine to medium fibers, medium to large chips at surface. Size of waste gets smaller w/ depth. Sediment w/in wood fibers in very fine sand. Phytodetritus on surface. Bits of brown algae in background. aRPD is most likely diffusional & surface crust dragged over underlying reduced sediment; dense Stage 1 worms.
1-17	B	Yes	fibers	0	-	-		11	0	14.442	Entire image is wood waste, fine to medium fibers, medium to large chips at surface. Size of waste gets smaller w/ depth. Sediment w/in wood fibers in very fine sand. Phytodetritus on surface. Bits of brown algae in background. aRPD is most likely diffusional & surface crust dragged over underlying reduced sediment; dense Stage 1 worms.
1-17	C	Yes	fibers	0	-	-		11	0	14.442	Entire image is wood waste, fine to medium fibers, medium to large chips at surface. Size of waste gets smaller w/ depth. Sediment w/in wood fibers in very fine sand. Phytodetritus on surface. Bits of brown algae in background. aRPD is most likely diffusional & surface crust dragged over underlying reduced sediment; dense Stage 1 worms.
1-18	B	Yes	fine fibers	0	-	-		11	0	14.442	Silty very fine sand. Layer of fine Beggiatoa fibers on surface. Two phytodetritus clumps in surface. Medium wood fibers and chips incorporated throughout subsurface. No aRPD.
1-18	C	Yes	fine fibers	0	-	-		11	0	14.442	Silty very fine sand. Fine Beggiatoa fibers on surface. Fine to medium wood fibers and chips at surface and incorporated throughout subsurface. No aRPD. Stage 1 worms visible.
1-18	D	Yes	fine fibers	0	-	-		11	0	14.442	Poorly sorted silty fine and very fine sand. Fine to medium wood fibers and chips on surface and mixed in w/ sediment subsurface. Clump of phytodetritus on surface. Fine grayish layer on surface- Beggiatoa. No aRPD. Stage 1 worms visible in sediment.
1-19	E	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine wood fibers and small chips on surface and subsurface. Debris on surface. No aRPD.
1-19	F	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine wood fibers and small chips on surface and subsurface. No aRPD. Stage 1 worms present.
1-19	G	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine wood fibers and small chips on surface and subsurface. No aRPD. Stage 1 worms present.
1-20	F	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty fine and very fine sandwith wood fibers, few large wood chips on surface, some fibers subsurface, and Beggiatoa fibers. Bit of green algae subsurface. Mussel on surface at left- shells are open, so probably not alive. No aRPD. Stage 1 worms with some evidence of deeper bioturbation.
1-20	G	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty fine and very fine sand. Dark sediment. Debris layer at surface, mostly of fine wood fibers and wood chips, also 1/3 mussel shell. Some wood fibers subsurface. No aRPD. Stage 1 worms visible in profile in low density along with incipient Beggiatoa
1-20	H	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty fine and very fine sand. Dark sediment. Debris layer at surface, mostly of fine wood fibers and wood chips, also 1/3 mussel shell. Some wood fibers subsurface. No aRPD. Stage 1 worms visible in profile in low density along with incipient Beggiatoa
1-21											No sediment penetration in any of the 4 reps
1-22											No sediment penetration in any of the 2 reps
1-24	A										No penetration
1-25	A										Only a little penetration on left, suspended sediment, dark silt, no oxidized sediment or visible fauna
1-26	A	No		Indeterminate	-	-		11	0	14.442	Cobble-strewed surface, covering fine sand. Bit of green algae on surface. Fine layer of phytodetritus.
1-26	B	No		Indeterminate	-	-		11	0	14.442	Cobble-strewed surface, covering fine sand. Bit of green algae on surface. Fine layer of phytodetritus.
1-26	C	No		Indeterminate	-	-		11	0	14.442	Large rocks (boulders in phi size) on surface. Sediment surface not visible.
1-27	E	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Debris and wood chips on surface. Fine wood fibers at surface and in subsurface. Dense concentration of fecal pellets throughout profile; incipient Beggiatoa present as well as groundwater release thruogh sediment.
1-27	G	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Flocculant detritus on surface, fine wood fibers, mostly subsurface. Few small sand-lined burrows in upper cm. Low density of Beggiatoa present, Stage 1 worms visible throughout profile, high percentage of profile is fecal pellets.
1-27	H	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Flocculant detritus on surface, fine wood fibers, mostly subsurface. Few small sand-lined burrows in upper cm. Low density of Beggiatoa present, Stage 1 worms visible throughout profile, high percentage of profile is fecal pellets.

Station	Rep	DATE	TIME	Water Depth (ft)	Successional Stage	Grain Size Major Mode (phi)	Grain Size Maximum (phi)	Grain Size Minimum (phi)	Grain Size (phi)	Penetration Area (cm^2)	Average Penetration (cm)	Minimum Penetration (cm)	Maximum Penetration (cm)	Boundary Roughness (cm)	Origin of Boundary Roughness	RPD Area (cm^2)	Mean RPD (cm)	Mud Clast Number	Mud Clast State	Methane	Low DO	Fish Waste (presence)	Wood (presence)	Wood Type
1-28	F	5/24/2011	10:40:36	109.2	Stage 1	>4	0	>4	>4 to 0	220.02	15.23	14.19	15.79	1.59	Physical	0.00	0.00	0	-	0	No	Trace	Yes	fine to medium, chips
1-28	G	5/24/2011	10:41:31	108	Stage 1	>4	0	>4	>4 to 0	187.61	12.99	12.50	13.38	0.88	Physical	5.49	0.38	0	-	0	No	Trace	Yes	fine to medium, chips
1-28	H	5/24/2011	10:42:31	109.2	Stage 1	>4	0	>4	>4 to 0	223.38	15.47	14.58	16.46	1.88	Physical	0.00	0.00	0	-	0	No	Trace	Yes	fine to medium, chips
1-29	D	5/23/2011	13:53:55	61.8	Indeterminate	-6 - (-7)	-9	>4	>4 to -9	0.00	0.00	0.00	0.00	0.00	Physical	Indeterminate	Indeterminate	0	-	0	No	No	No	
1-29	G	5/24/2011	10:48:38	64.2	Stage 1	4-3	-1	>4	>4 to -1	181.89	12.59	12.15	12.76	0.61	Physical	0.00	0.00	0	-	0	Yes	No	Yes	medium, chips
1-29	H	5/24/2011	10:49:41	67.8	Stage 1	4-3	0	>4	>4 to 0	205.87	14.25	13.66	14.88	1.22	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium, chips
1-30	F	5/24/2011	10:55:05	75	Stage 1	4-3	0	>4	>4 to 0	136.49	9.45	8.25	10.51	2.27	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium, chips
1-30	G	5/24/2011	10:56:12	71.4	Stage 1	4-3	-1	>4	>4 to -1	120.56	8.35	7.83	8.94	1.12	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine to medium, chips
1-30	H	5/24/2011	10:57:09	66.6	Stage 1	4-3	-1	>4	>4 to -1	134.99	9.35	8.97	9.66	0.69	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium, chips
1-31	B	5/24/2011	11:58:30	87	Stage 1	4-3	-1	>4	>4 to -1	236.77	16.39	11.79	21.59	9.81	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	medium, chips
1-31	C	5/24/2011	11:59:35	85.2	Stage 1	4-3	-1	>4	>4 to -1	234.63	16.25	15.50	17.03	1.52	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium, chips
1-31	D	5/24/2011	12:00:40	85.2	Stage 1	4-3	-1	>4	>4 to -1	196.55	13.61	13.13	14.51	1.38	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium, chips
1-32	B	5/24/2011	15:19:29	95.4	Stage 1	4-3	0	>4	>4 to 0	277.95	19.25	17.45	20.74	3.29	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-32	C	5/24/2011	15:20:25	96.6	Stage 1	4-3	0	>4	>4 to 0	243.25	16.84	15.50	17.91	2.41	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine, chips
1-32	D	5/24/2011	15:21:31	95.4	Stage 1	4-3	-1	>4	>4 to -1	235.90	16.33	16.00	16.78	0.78	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine
1-33	A	5/24/2011	15:25:58	124.2	Stage 1	4-3	0	>4	>4 to 0	295.61	20.47	19.96	21.13	1.17	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine
1-33	C	5/24/2011	15:27:54	117.6	Stage 1	4-3	0	>4	>4 to 0	242.65	16.80	16.46	17.38	0.92	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine, chips
1-33	D	5/24/2011	15:28:50	111.6	Stage 1 -> 2	4-3	-1	>4	>4 to -1	247.87	17.16	16.46	17.66	1.20	Physical	0.00	0.00	0	-	0	Yes	Trace	Yes	fine to medium, chips
1-34	F	5/25/2011	9:29:04	160.2	Stage 1	4-3	0	>4	>4 to 0	300.61	>20.81	>20.81	>20.81	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	0	No	Indeterminate	Yes	fine
1-34	G	5/25/2011	9:30:06	160.2	Stage 1 -> 2	4-3	0	>4	>4 to 0	293.06	20.29	19.89	20.67	0.78	Physical	52.99	3.67	0	-	0	No	Trace	Yes	fine
1-34	H	5/25/2011	9:31:02	160.2	Stage 1 on 3	4-3	-1	>4	>4 to -1	261.49	18.11	17.13	19.12	1.98	Physical	74.29	5.14	0	-	0	No	Trace	Yes	fine, chips
1-35	B	5/25/2011	10:28:03	175.2	Indeterminate	4-3	0	>4	>4 to 0	>314.92	>21.81	>21.8	>21.8	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Yes	Indeterminate	Indeterminate	Yes	fine
1-35	E	5/25/2011	14:31:00	169.2	Indeterminate	>4	1	>4	>4 to 1	>314.92	>21.81	>21.8	>21.8	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Yes	Indeterminate	Yes	Yes	fine
1-35	F	5/25/2011	14:32:11	177.6	Indeterminate	>4	0	>4	>4 to 0	>314.92	>21.81	>21.8	>21.8	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Yes	Indeterminate	Yes	Yes	fine
1-36	A	5/23/2011	14:13:41	129	Stage 1 -> 2	>4	0	>4	>4 to 0	218.84	15.15	13.52	16.42	2.90	Biogenic	32.15	2.23	0	-	0	No	No	Yes	fine
1-36	C	5/23/2011	14:15:45	129	Stage 1 on 3	>4	1	>4	>4 to 1	244.20	16.91	16.53	17.35	0.81	Biogenic	26.85	1.86	0	-	0	No	No	Yes	fine
1-36	D	5/23/2011	14:16:48	130.2	Stage 1 -> 2	>4	0	>4	>4 to 0	236.37	16.37	15.58	16.64	1.06	Biogenic	15.28	1.06	0	-	0	No	No	Yes	fine
1-37	E	5/24/2011	11:20:05	141.6	Stage 2 -> 3	>4	0	>4	>4 to 0	186.80	12.93	11.82	13.63	1.81	Biogenic	53.96	3.74	0	-	0	No	No	Yes	fine
1-37	F	5/24/2011	11:21:07	141.6	Stage 2 -> 3	>4	0	>4	>4 to 0	186.17	12.89	12.07	13.35	1.27	Biogenic	46.67	3.23	0	-	0	No	No	Yes	fine, chips
1-37	H	5/24/2011	11:23:12	141.6	Stage 1 -> 2	>4	0	>4	>4 to 0	183.19	12.68	12.32	12.81	0.50	Biogenic	56.14	3.89	0	-	0	No	No	Yes	fine
1-38	F	5/24/2011	11:28:57	135	Stage 2 -> 3	>4	0	>4	>4 to 0	259.27	17.95	17.10	18.65	1.56	Physical	44.50	3.08	0	-	0	No	No	Yes	fine
1-38	G	5/24/2011	11:30:00	135.6	Stage 2 -> 3	>4	0	>4	>4 to 0	277.50	19.21	18.69	19.58	0.88	Physical	33.13	2.29	0	-	0	No	Trace	Yes	fine
1-38	H	5/24/2011	11:31:05	139.2	Stage 2 -> 3	>4	-1	>4	>4 to -1	207.84	14.39	14.23	14.73	0.50	Physical	50.73	3.51	0	-	0	No	Trace	Yes	fine, chips
1-39	A	5/23/2011	14:42:19	103.8	Stage 2 -> 3	>4	0	>4	>4 to 0	122.86	8.51	8.07	9.13	1.06	Physical	31.05	2.15	0	-	0	No	No	Yes	fine to medium
1-39	B	5/23/2011	14:43:20	106.8	Stage 2 -> 3	4-3	-5	>4	>4 to -5	134.01	9.28	8.42	10.27	1.84	Physical	18.96	1.31	0	-	0	No	Yes	Yes	fine to medium, chips
1-39	D	5/23/2011	14:45:16	101.4	Stage 2 -> 3	>4	-1	>4	>4 to -1	241.49	16.72	15.50	17.24	1.73	Physical	25.54	1.77	0	-	0	No	Trace	Yes	fine to medium
1-40	A	5/24/2011	13:04:06	118.8	Stage 2 -> 3	>4	0	>4	>4 to 0	229.48	15.89	14.58	16.96	2.37	Biogenic	16.10	1.11	0	-	0	No	No	Yes	fine, chips
1-40	C	5/24/2011	13:06:12	115.2	Stage 2 -> 3	>4	0	>4	>4 to 0	232.19	16.08	15.33	16.57	1.24	Biogenic	51.63	3.57	0	-	0	No	Trace	Yes	fine to medium, chips
1-40	D	5/24/2011	13:07:09	115.2	Stage 2 -> 3	>4	0	>4	>4 to 0	224.54	15.55	14.90	15.75	0.85	Biogenic	21.75	1.51	0	-	0	No	Trace	Yes	fine to medium
1-41	A	5/24/2011	15:11:18	160.2	Stage 1	>4	1	>4	>4 to 1	264.16	18.29	17.24	19.36	2.12	Biogenic	0.00	0.00	0	-	0	Yes	Yes	Yes	fine
1-41	B	5/24/2011	15:12:26	161.4	Stage 1 on 3	>4	0	>4	>4 to 0	274.38	19.00	18.44	19.43	0.99	Biogenic	80.15	5.55	0	-	0	No	Trace	Yes	fine
1-41	D	5/24/2011	15:14:25	156.6	Stage 1 on 3	>4	-1	>4	>4 to -1	188.80	13.07	12.28	14.83	2.55	Biogenic	68.69	4.76	0	-	0	No	Trace	Yes	fine to medium
1-42	B	5/24/2011	15:34:13	166.8	Stage 1 -> 2	>4	1	>4	>4 to 1	248.66	17.22	17.20	17.24	0.04	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-42	D	5/24/2011	15:36:22	180	Stage 1 -> 2	>4	-1	>4	>4 to -1	207.4602967	14.36	13.81	15.40	1.59	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-42	F	5/24/2011	16:01:14	172.8	Stage 2 -> 3	>4	0	>4	>4 to 0	258.27	17.88	17.24	18.55	1.31	Physical	70.31	4.87	0	-	0	No	No	Yes	fine
1-43	A	5/25/2011	9:36:38	189	Stage 2	>4	1	>4	>4 to 1	298.83	20.69	20.39	20.99	0.60	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-43	B	5/25/2011	9:37:46	189	Stage 1 -> 2	>4	1	>4	>4 to 1	227.81	15.77	15.26	16.07	0.81	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-43	C	5/25/2011	9:38:45	187.8	Stage 2 -> 3	>4	1	>4	>4 to 1	256.05	17.73	17.45	18.51	1.06	Biogenic	0.00	0.00	0	-	0	Yes	Trace	Yes	fine

Station	Rep	Beggiatoa (presence)	Bacteria Type (Fibers or Mat)	Feeding Voids (#)	Void Minimum Depth (cm)	Void Maximu m Depth (cm)	Void Average Depth (cm)	Stop Collar Settings (in.)	Weights/ Chassis (#)	Calibration Constant	COMMENT
1-28	F	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Layer of phytodetritus on surface. Fine to medium wood fibers and few small chips throughout subsurface. No aRPD, but high density of fecal pellets and incipient Beggiatoa.
1-28	G	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Debris on surface. Old gray sand tube on surface, possibly Pectinaria tube. Fine to medium wood fibers and few small chips at surface and throughout subsurface. Discontinuous aRPD. Stage 1 worms and fecal pellets visible throughout profile.
1-28	H	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine to medium wood fibers and few small chips at surface and throughout subsurface. No aRPD. Bit of green algae subsurface. Fecal pellets and Stage 1 worms visible.
1-29	D	No		Indeterminate	-	-		11	0	14.442	No penetration. Surface covered w/ cobbles/boulders. Bits of detritus on surface.
1-29	G	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand that is almost completely pelletized. Medium wood fibers and chips, plus one long chip (~4cm) on surface, some fibers subsurface. Bits of high sed oxy demand gray sed. Stage 1 worms visible throughout profile.
1-29	H	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand with high degree of pelletization. Fine to medium wood fibers and chips on surface, some fibers subsurface. Layer of soft detritus on surface. Bits of high sed oxy demand gray sed. Stage 1 worms visible throughout profile.
1-30	F	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand, coarser grains in upper cm with high percentage of pellets. Lots of wood waste- fine and medium fibers and small chips covering surface and throughout subsurface. One larger chip just below SWI. No aRPD. Stage 1 worms visible throughout.
1-30	G	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand, coarser grains in upper cm with high percentage of pellets. Lots of wood waste- fine and medium fibers and small chips covering surface and throughout subsurface. One larger chip just below SWI. No aRPD. Stage 1 worms visible throughout.
1-30	H	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand, coarser grains in upper cm with high percentage of pellets. Lots of wood waste- fine and medium fibers and small chips covering surface and throughout subsurface. No aRPD. Stage 1 worms visible throughout.
1-31	B	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand with some coarse grains throughout, extensive wood chips & fibers as well as fecal pellets.No aRPD. Stage 1 worms visible throughout upper 5 cm.
1-31	C	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand , extensive wood chips & fibers with some large wood chips at SWI as well as fecal pellets throughout profile. No aRPD. Stage 1 worms visible throughout upper 5 cm.
1-31	D	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand with some coarse grains throughout and pebbles near SWI. Detritus on surface and sus. Lots of wood waste- fine to medium fibers, at surface and throughout subsurface. Numerous large chips on surface. Gray sed with high sed oxy demand. No aRPD. Stage 1 worms visible in sediment.
1-32	B	Yes	Fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Fine wood fibers and chips throughout. No aRPD. Gray high sed oxy demand. No aRPD; Stage 1 worms visible in sediment. Ground water discharge through profile.
1-32	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted silty very fine and fine sand. Fine wood fibers throughout, wood chips. No aRPD. Gray high sed oxy demand. Stage 1 worms visible in sed, extensive fecal pellets.
1-32	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted silty very fine and fine sand. Fine wood fibers throughout, wood chips. No aRPD. Gray high sed oxy demand. Stage 1 worms visible in sed, extensive fecal pellets, some trace fish vertebrae & fin rays.
1-33	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand. Fine wood fibers at surface and throughout subsurface. Almost over-penetration. Some high sed oxy demand sed. No aRPD. Extensive pellets, Stage 1 worms visible in sediment.
1-33	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand, fine wood fibers at chips at surface and some subsurface. Detritus layer at surface. Old gray sand tube at surface. No aRPD. Some high sed oxy sed. Traces of fin rays, Stage 1 worms visible in subsurface sediment & a few tubes at SWI.
1-33	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand with coarser grains scattered throughout. Fine to medium wood fibers on surface, medium to large chip few cms down. Some high sed oxy demand sed. No aRPD. Stage 1 worms visible at depth with start of some subsurface burrows
1-34	F	Indeterminate		0	-	-		12	0+Doors	14.442	Overpenetration. Silty very fine sand w/ fine wood fibers throughout. Some aRPD visible, can't measure b/c of over-penetration. Some gray high sed oxy demand sediment at depth.
1-34	G	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand, most bound up into fecal pellets. Small wood chips & fibers along with traces of fish waste, Stage 1 worms visible with evidence of some deeper burrowing.
1-34	H	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand, most bound up into fecal pellets with incipient Beggiatoa. Small wood chips & fibers along with traces of fish waste, Stage 1 worms visible with deeper burrowing polychaetes visible against faceplate at depth.
1-35	B	Indeterminate		0	-	-		12	0+Doors	14.442	Overpenetration. Silty very fine sand. Methane at depth and fine wood fibers throughout.
1-35	E	Indeterminate		0	-	-		10.5	0+Doors	14.442	Overpenetration. Most of image is fish waste with silt and fine wood fibers. Lots of methane bubbles from small to large. Most likely there is no aRPD, but SWI not visible to confirm. Beggiatoa present in PV images from this location.
1-35	F	Indeterminate		0	-	-		10.5	0+Doors	14.442	Overpenetration. Most of image is fish waste with silt and fine wood fibers. Not as much methane as previous replicate. Most likely there is no aRPD, but SWI not visible to confirm.
1-36	A	Yes	fibers	0	-	-		11	0	14.442	Well-sorted very fine sandy silt. Phytodetritus at surface. Short and long tubes at surface, plus fecal pellets. Few fine wood fibers subsurface. Trace of Beggiatoa fibers but dense patches visible in corresponding plan view image.
1-36	C	Yes	fibers	0	-	-		11	0	14.442	Very fine sandy silt with layer of phytoplankton detritus on surface; many fecal pellets. Sand-lined burrows, few at 2.5 cms, larger polychaete at depth, Beggitoa visible in PV as well as in profile image
1-36	D	Yes	fibers	0	-	-		11	0	14.442	Very fine sandy silt with fecal pellets. Few fine wood fibers in subsurface. aRPD is below fluffy layer of phytodetritus that extends 2.5 cm below SWI. Sand-lined burrows, few at 2.5 cms. Larger polychaete against faceplate in mid subsurface left of center.
1-37	E	Yes	fibers	0	-	-		12	0+Doors	14.442	Well-sorted very fine sandy silt. aRPD is present but very low contrast b/c of high degree of wood fibers. Some small sand-lined burrows in upper 3-4 cms, burrow transected in lower right corner at base of image.
1-37	F	Yes	fibers	0	-	-		12	0+Doors	14.442	Well -sorted very fine sandy silt. Very fine layer of detritus. aRPD is present but low contrast. Gray sand tube on surface and one in sediment matrix, against faceplate, but somewhat collapsed. Long tube in background. Some fine wood fibers and chips on surface, some fibers subsurface, high proportion of fecal pellets in profile.
1-37	H	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, layer of phytodetritus on surface and in suspension. aRPD is present but low contrast. Few fine wood fibers subsurface. Few sand-lined burrows in upper 2 cm, high percentage of fecal pellets.
1-38	F	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of fecal pellets. Low contrast aRPD. Sand-lined burrows in upper cm and evidence of subsurface burrowing throughout depth of profile.
1-38	G	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of fecal pellets and wood fibers. Low contrast aRPD, edge of large burrow transected aty bottom center.
1-38	H	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of fecal pellets and wood fibers. Low contrast aRPD, evidence of subsurface burrowing throughout profile.
1-39	A	Yes	fibers	0	-	-		10	0	14.442	Fine sandy silt. Fine to medium wood fibers on surface and in upper cms. Fine detritus on surfacewith long thin tubes in background. Low contrast aRPD but evidence of burrowing throughout.
1-39	B	Yes	fibers	0	-	-		10	0	14.442	Silty fine sand, cobble on surface. Fine to medium wood fibers and chips on surface and in upper cms. Fine layer of detritus and flecks of decomposing fish tissue on surface and suspended in water. Area of gray high sed oxy demand sed on surface and extending a few cm below SWI in center. Beggiatoa fibers in this gray sed area and also extending along edge of detritus layer. aRPD discontinuous, patchy, however, evidence of burrowing throughout profile.
1-39	D	Yes	fibers	0	-	-		10	0	14.442	Very fine sandy silt, SWI disturbed by wiper blade. Fine to medium wood fibers at surface and throughout prfile, evidence of burrowing throughout profile.
1-40	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine detritus at surface. Several large tubes at SWI and in background. aRPD is discontinuous and low contrast. Infauna visible at left, just below SWI; high percentage of fecal pellets in profile, evidence of burrowing throughout.
1-40	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of wood chips and fecal pellets; some buried plant material (leaf fragments) at depth. Low contrast aRPD, evidence of burrowing throughout profile.
1-40	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of wood chips and fecal pellets. Low contrast aRPD, evidence of burrowing throughout profile.
1-41	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of fecal pellets underneath surface organic layer. Area of dark gray high sed oxy demand sed in contact w/ surface, mostly on right. Fine thin layer of reduced fecal pellets on surface. Fine wood fibers incorporated in sed, mostly subsurface.
1-41	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Deep aRPD. Some grayish phytoplankton detritus smeared at middle in upper cm. Fine wood fibers and chips throughout subsurface, tube at SWI. Evidence of burrowing throughout profile
1-41	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Deep aRPD. Layer of grayish phytoplankton detritus at the surface. Fine wood fibers and chips throughout subsurface, tubes at SWI. Evidence of burrowing throughout profile
1-42	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of wood fibers. ~2.3 cm layer of phytoplankton detritus as well as 1-2 cm layer of high SOD material; however, evidence of small burrowing polychaetes at depth.
1-42	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of wood fibers. ~2.3 cm layer of phytoplankton detritus at SWI with high SOD & Beggiatoa fibers throughout; however, evidence of small burrowing polychaetes at depth. Interesting to compare with PV image
1-42	F	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, distinct from other 2 reps because of detectable aRPD. Fine wood fibers incorporated into sed at depth. Some debris on surface. Sand-line burrows in upper cms.
1-43	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with ~3.5 cm layer of high SOD phytoplankton detritus in upper cm. Some bits of oxy sed below this layer. Fine wood fibers incorporated in sed at depth. High sed oxy demand at surface, but evidence of infaunal burrowing throughout - BBL hypoxia is obviously not a long-term stressor, just response to seasonal phytoplankton pulse.
1-43	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with ~3.5 cm layer of high SOD phytoplankton detritus in upper cm. Some bits of oxy sed below this layer. Fine wood fibers incorporated in sed at depth. High sed oxy demand at surface, but evidence of infaunal burrowing throughout - BBL hypoxia is obviously not a long-term stressor, just response to seasonal phytoplankton pulse.
1-43	C	Yes	fibers	0	-	-		12	0+Doors	14.442	same as previous replicate, evidence of deeper burrowing and phytoplankton layer not as thick.

Station	Rep	DATE	TIME	Water Depth (ft)	Successional Stage	Grain Size Major Mode (phi)	Grain Size Maximum (phi)	Grain Size Minimum (phi)	Grain Size (phi)	Penetration Area (cm^2)	Average Penetration (cm)	Minimum Penetration (cm)	Maximum Penetration (cm)	Boundary Roughness (cm)	Origin of Boundary Roughness	RPD Area (cm^2)	Mean RPD (cm)	Mud Clast Number	Mud Clast State	Methane	Low DO	Fish Waste (presence)	Wood (presence)	Wood Type
1-44	A	5/23/2011	14:52:55	141.6	Indeterminate	>4	1	>4	>4 to 1	37.89	2.62	0.00	4.67	4.67	Physical	Indeterminate	Indeterminate	0	-	0	Indeterminate	No	Indeterminate	
1-44	B	5/23/2011	14:54:04	135.6	Stage 2 -> 3	>4	1	>4	>4 to 1	218.63	15.14	14.44	16.14	1.70	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-44	C	5/23/2011	14:54:48	135	Indeterminate									Indeterminate		Indeterminate	Indeterminate				Indeterminate	Indeterminate	Indeterminate	
1-45	A	5/23/2011	15:28:41	160.2	Stage 1 -> 2	4-3	0	>4	>4 to 0	169.69	11.75	11.25	12.04	0.80	Biogenic	38.01	2.63	0	-	0	No	No	Yes	small chips at depth
1-45	B	5/23/2011	15:29:48	163.8	Stage 1 -> 2	>4	0	>4	>4 to 0	130.85	9.06	8.46	9.81	1.35	Biogenic	26.45	1.83	0	-	0	No	No	Yes	small chips at depth
1-45	C	5/23/2011	15:30:51	162.6	Stage 1	>4	1	>4	>4 to 1	118.80	8.23	7.96	8.60	0.64	Biogenic	31.05	2.15	0	-	0	No	No	Yes	small chips at depth
1-46	A	5/23/2011	15:37:48	168	Stage 1 -> 2	>4	0	>4	>4 to 0	139.57	9.66	9.52	10.41	0.88	Biogenic	35.47	2.46	0	-	0	No	No	Yes	fine to medium
1-46	B	5/23/2011	15:38:58	168	Stage 1	>4	1	>4	>4 to 1	159.03	11.01	10.83	11.33	0.50	Biogenic	65.89	4.56	0	-	0	No	Trace	Yes	fine
1-46	D	5/23/2011	15:41:19	166.8	Stage 1	>4	1	>4	>4 to 1	162.97	11.28	10.87	11.75	0.88	Biogenic	50.16	3.47	0	-	0	No	Trace	Yes	fine
1-47	A	5/23/2011	15:47:19	132.6	Stage 2 -> 3	>4	0	>4	>4 to 0	>297.09	>20.57	18.37	21.10	Indeterminate	Physical	Indeterminate	Indeterminate	0	-	0	No	No	Yes	fine
1-47	B	5/23/2011	15:48:29	135.6	Stage 2 -> 3	>4	0	>4	>4 to 0	271.71	18.81	17.27	19.93	2.65	Biogenic	31.53	2.18	0	-	0	-	Trace	Yes	fine
1-47	C	5/23/2011	15:49:35	136.8	Stage 2 -> 3	>4	0	>4	>4 to 0	204.40	14.15	13.73	14.65	0.92	Biogenic	51.63	3.57	0	-	0	No	Trace	Yes	fine
1-48	A	5/24/2011	13:12:31	142.8	Stage 2 -> 3	>4	0	>4	>4 to 0	299.99	>20.77	20.50	>20.99	Indeterminate	Indeterminate	Indeterminate	Indeterminate	0	-	0	No	Trace	Yes	fine
1-48	C	5/24/2011	13:16:23	144	Stage 2 -> 3	>4	0	>4	>4 to 0	180.15	12.47	12.21	12.74	0.53	Biogenic	120.95	8.37	0	-	0	No	No	Yes	fine
1-48	D	5/24/2011	13:17:25	138	Stage 2 -> 3	>4	1	>4	>4 to 1	237.16	16.42	14.69	17.88	3.19	Biogenic	66.79	4.62	0	-	0	No	No	Yes	fine, chips
1-49	B	5/24/2011	15:02:50	170.4	Stage 2 -> 3	>4	0	>4	>4 to 0	191.90	13.29	12.88	13.84	0.96	Biogenic	41.70	2.89	0	-	0	No	Trace	Yes	fine
1-49	C	5/24/2011	15:03:56	170.4	Stage 2 -> 3	>4	-1	>4	>4 to -1	182.94	12.67	10.83	14.69	3.86	Physical	40.90	2.83	0	-	0	No	No	Yes	fine
1-49	D	5/24/2011	15:04:58	170.4	Stage 2 -> 3	>4	0	>4	>4 to 0	197.25	13.66	13.38	14.02	0.64	Biogenic	44.86	3.11	0	-	0	No	No	Yes	fine
1-50	A	5/24/2011	15:51:00	186.6	Stage 2 on 3	>4	-1	>4	>4 to -1	152.32	10.55	9.95	11.04	1.10	Biogenic	23.44	1.62	0	-	0	No	Trace	Yes	fine to medium, chips
1-50	B	5/24/2011	15:52:04	186.6	Stage 2 on 3	>4	-1	>4	>4 to -1	193.35	13.39	12.60	14.19	1.59	Biogenic	35.57	2.46	0	-	0	No	No	Yes	fine to medium, chips
1-50	D	5/24/2011	15:54:04	186.6	Stage 2 -> 3	>4	-1	>4	>4 to -1	117.11	8.11	7.74	8.57	0.83	Biogenic	Indeterminate	Indeterminate	0	-	0	-	Trace	Yes	fine to medium, chips
1-51	A	5/25/2011	9:45:26	198	Stage 2	>4	0	>4	>4 to 0	182.29	12.62	12.18	13.24	1.06	Physical	36.18	2.51	0	-	0	Yes	Trace	Yes	fine, chips
1-51	B	5/25/2011	9:46:25	193.8	Stage 2	>4	0	>4	>4 to 0	212.11	14.69	13.56	16.21	2.65	Physical	Indeterminate	Indeterminate	0	-	0	Yes	Trace	Yes	fine to medium
1-51	D	5/25/2011	9:48:24	198	Stage 1 -> 2	>4	0	>4	>4 to 0	199.23	13.79	13.35	14.44	1.10	Physical	23.56	1.63	0	-	0	Yes	Trace	Yes	fine
1-52	B	5/23/2011	15:59:46	169.2	Stage 1	>4	-3	>4	>4 to -3	114.36	7.92	7.27	8.44	1.17	Physical	0.00	0.00	0	-	0	Yes	No	Yes	chips
1-52	C	5/23/2011	16:00:53	171.6	Stage 1	>4-3	1	>4	>4 to 1	79.42	5.50	4.64	7.04	2.41	Physical	0.00	0.00	0	-	0	No	No	Yes	fine
1-52	D	5/23/2011	16:01:57	175.2	Stage 1 -> 2	>4	-1	>4	>4 to -1	175.20	12.13	11.75	12.28	0.53	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-53	B	5/23/2011	16:09:03	178.8	Stage 2 on 3	>4	0	>4	>4 to 0	200.66	13.89	13.70	14.09	0.39	Biogenic	23.04	1.60	0	-	0	No	No	Yes	fine
1-53	C	5/23/2011	16:10:09	180	Stage 1	>4	0	>4	>4 to 0	143.32	9.92	9.53	10.35	0.82	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-53	D	5/23/2011	16:11:21	178.8	Stage 2	>4	1	>4	>4 to 1	162.45	11.25	10.90	11.75	0.85	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-54	B	5/23/2011	16:34:25	186.6	Stage 1 -> 2	>4	0	>4	>4 to 0	214.29	14.84	14.58	15.40	0.81	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-54	C	5/23/2011	16:35:25	185.4	Stage 2	>4	0	>4	>4 to 0	184.13	12.75	12.39	13.10	0.71	Biogenic	25.54	1.77	0	-	0	No	No	Yes	fine
1-54	D	5/23/2011	16:36:20	189	Stage 1 -> 2	>4	0	>4	>4 to 0	169.64	11.75	11.47	12.28	0.81	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-55	B	5/24/2011	13:23:55	184.2	Stage 1 -> 2	>4	0	>4	>4 to 0	212.43	14.71	13.88	15.72	1.84	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-55	C	5/24/2011	13:25:01	184.2	Stage 1 -> 2	>4	0	>4	>4 to 0	198.82	13.77	12.78	14.27	1.49	Biogenic	9.39	0.65	0	-	0	No	No	Yes	fine
1-55	D	5/24/2011	13:26:00	184.2	Stage 2	>4	0	>4	>4 to 0	212.15	14.69	13.03	15.75	2.73	Biogenic	3.27	0.23	0	-	0	Yes	No	Yes	fine
1-56	A	5/24/2011	14:40:51	185.4	Stage 2	>4	0	>4	>4 to 0	198.56	13.75	13.70	14.30	0.60	Biogenic	47.93	3.32	0	-	0	No	No	Yes	fine
1-56	B	5/24/2011	14:41:47	185.4	Stage 1 -> 2	>4	0	>4	>4 to 0	187.89	13.01	12.60	13.59	0.99	Biogenic	23.56	1.63	0	-	0	No	No	Yes	fine to medium
1-56	C	5/24/2011	14:42:54	185.4	Stage 2	>4	0	>4	>4 to 0	171.12	11.85	11.05	12.43	1.38	Biogenic	20.13	1.39	0	-	0	No	No	Yes	fine to medium
1-57	B	5/23/2011	16:44:24	180	Stage 2	>4	0	>4	>4 to 0	163.77	11.34	10.94	11.65	0.71	Biogenic	0.00	0.00	0	-	0	Yes	No	Trace	fine
1-57	C	5/23/2011	16:45:30	180	Stage 3	4-3	0	>4	>4 to 0	177.77	12.31	11.33	12.96	1.63	Biogenic	19.40	1.34	0	-	0	No	No	Trace	fine
1-57	D	5/23/2011	16:46:33	185.4	Indeterminate	4-3	1	>4	>4 to 1	39.08	2.71	2.09	3.43	1.35	Biogenic	Indeterminate	Indeterminate	0	-	0	Indeterminate	No	Indeterminate	
1-58	A	5/23/2011	16:51:26	192.6	Stage 2 -> 3	>4	0	>4	>4 to 0	146.48	10.14	9.49	10.76	1.27	Physical	13.00	0.90	0	-	0	Yes	Trace	Yes	fine
1-58	C	5/23/2011	16:54:13	186.6	Stage 2 -> 3	>4	0	>4	>4 to 0	141.18	9.78	9.13	10.37	1.24	Physical	Indeterminate	Indeterminate	0	-	0	Yes	No	Yes	fine
1-58	D	5/23/2011	16:55:18	186.6	Stage 2	>4	0	>4	>4 to 0	165.84	11.48	10.30	12.99	2.69	Physical	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium
1-59	B	5/23/2011	17:02:41	191.4	Stage 2 -> 3	>4	1	>4	>4 to 1	208.91	14.47	14.05	14.76	0.71	Biogenic	25.54	1.77	0	-	0	No	No	Yes	fine
1-59	C	5/23/2011	17:03:53	195	Stage 2 -> 3	>4	0	>4	>4 to 0	220.00	15.23	13.42	16.88	3.47	Physical	50.64	3.51	0	-	0	No	No	Yes	fine
1-59	D	5/23/2011	17:05:22	193.8	Stage 2 -> 3	>4	0	>4	>4 to 0	180.36	12.49	11.75	13.78	2.03	Biogenic	19.28	1.33	0	-	0	No	No	Yes	fine, chips
1-60	A	5/23/2011	17:11:39	196.8	Stage 1	>4	-1	>4	>4 to -1	156.24	10.82	10.34	11.26	0.92	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-60	C	5/23/2011	17:14:25	196.8	Stage 1	>4	0	>4	>4 to 0	166.50	11.53	11.22	11.93	0.71	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
1-60	D	5/23/2011	17:15:46	195	Stage 1 -> 2	>4	0	>4	>4 to 0	190.60	13.20	12.42	13.66	1.24	Biogenic	8.97	0.62	0	-	0	No	No	Yes	fine
2-1	B	5/25/2011	11:30:03	168	Stage 2 -> 3	>4	0	>4	>4 to 0	300.15	20.78	20.35	21.03	0.67	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium

Station	Rep	Beggiatoa (presence)	Bacteria Type (Fibers or Mat)	Feeding Voids (#)	Void Minimum Depth (cm)	Void Maximu m Depth (cm)	Void Average Depth (cm)	Stop Collar Settings (in.)	Weights/ Chassis (#)	Calibration Constant	COMMENT
1-44	A	Yes	fibers	Indeterminate	-	-		10	0	14.442	Only a small bit of penetration, slopes to right. Very fine sandy silt with layer of phytoplankton detritus and bit of green algae on surface. Possible tubes in surface detritus.
1-44	B	Yes	fibers	0	-	-		10	0	14.442	Very fine sandy silt with 3-4 cm layer of high SOD phytoplankton detritus in upper cm. Fine wood fibers incorporated in sed at depth. High sed oxy demand at surface, but evidence of infaunal burrowing throughout - BBL hypoxia is obviously not a long-term stressor, just response to seasonal phytoplankton pulse.
1-44	C	Indeterminate						10	0	14.442	No penetration. sus sed, sand, some object or fauna on surface-orangish in color
1-45	A	No		0	-	-		12	0+Doors	14.442	Silty very fine sand. Lots of tubes on sandy surface. Very little detritus on surface. Low contrast aRPD. Few shallow sand-lined burrows.
1-45	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with uneven layer of dark phytoplankton detritus on surface; small polychaetes visible in upper few cm & evidence of deeper burrowing.
1-45	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with 1-2 cm layer of phytoplankton detritus; smalll polychaetes visible in upper cm.
1-46	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with fine to medium wood fibers subsurface. aRPD low contrast, evidence of small polychaetes in upper cm and some deeper burrowing.
1-46	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with 1 cm layer of phytoplankton detritus on surface.Fine wood fibers on surface and subsurface. Small polychaetes visible in upper few cm.
1-46	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with 1-2 cm layer of phytoplankton detritus on surface.Fine wood fibers on surface and subsurface. Small polychaetes visible in upper few cm.
1-47	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with partial overpenetration.Fine wood fibers throughout sediment. Burrow structure visible throughout subsurface profile.
1-47	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with fine wood fibers throughout sediment. Burrow structure visible throughout subsurface profile.
1-47	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with 1-2 cm layer of phytoplankton detritus on surface.Fine wood fibers on surface and subsurface. Small polychaetes visible in upper few cm with deeper burrowing evidnet; edge of void with animal in lower right corner.
1-48	A	Yes	mat	0	-	-		12	0+Doors	14.442	Very fine sandy silt, over-penetration, SWI barely visible on right. Wood fibers throughout subsurface. Beggiatoa mat visible in PV
1-48	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Coarser grains in upper cms. Fine debris layer on surface with whitish/gray sand in upper layer. Extremely low contrast aRPD with fine wood fibers throughout subsurface. Worms visible to deph with burrow sturctions, burrow openings & Beggiatoa visible in PV.
1-48	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Coarser grains in upper cms. Fine debris layer on surface with whitish/gray sand in upper layer. Fine wood fibers and some chipsthroughout subsurface. Worms visible to deph with burrow sturctions, burrow openings & Beggiatoa visible in PV.
1-49	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with phytoplankton detritus on surface. Fine wood & small fibers & chips in subsurface sediment along with traces of fish bones/scales. Worms visible against faceplate & evidence of subsurface burrowing.
1-49	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, surface appears physically disturbed. High percentage of fecal pellets in cross-section, signs of burrowing throughout profile. Few fine wood fibers in subsurface sediment, one larger chip on surface in background.
1-49	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Bits of fine detritus on surface. Low contrast aRPD Fine wood fibers & small chips in subsurface sediment. Evidence of subsurface burrowing throughout entire profile.
1-50	A	Yes	fibers	1	8.07	9.77	8.92	12	0+Doors	14.442	Very fine sandy silt with fine to medium wood chips on surface and subsubsurface. aRPD is patchy and low contrast. Burrows visible throughout profile along with trace fish waste & Beggiatoa fibers in upper few cm.
1-50	B	Yes	fibers	2	9.76	12.71	11.24	12	0+Doors	14.442	Very fine sandy silt with an upper layer (1.5 to 4 cm thick) of fluffy phytoplankton detritus. Fine to medium wood fibers and small chips at surface and in subsurface. Two voids are connected and part of fauna visible.
1-50	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt with Beggiatoa fibers in sus sed. Fine to medium wood fibers and small chips at surface and subsurface. No aRPD, but bits of oxygenated sed. Sand-lined burrow at 1.56 cm. and evidence of other subsurface burrowing throughout profile.
1-51	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with Beggiatoa fibers in surface layer of detritus and phytodetritus. Small wood chip on surface, fine wood fibers at surface and throughout subsurface. Low contrast aRPD. Few short sand-lined burrows in upper cm and evidence of burrowing at depth.
1-51	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with Beggiatoa fibers in surface layer of detritus and phytodetritus. Fine wood fibers and chips throughout subsurface. Low contrast aRPD. Surface disturbed from sampling, unable to accurately measure aRPD; evidence of burrowing throughout profile.
1-51	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with Beggiatoa fibers in surface layer of detritus and phytodetritus. Fine wood fibers and chips throughout subsurface. Low contrast aRPD. Evidence of burrowing throughout profile.
1-52	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with large wood chips on surface; large stick upended by camera and is against faceplate. Wood fibers and chips visible behind and against faceplate. Abundant fecal pellets and small worms evident.
1-52	C	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Rope against faceplate at SWI and below. Bits of gray sand sed. Debris on surface. No aRPD due to detrital accumulation but Stage 1 worms still visible in sediment proifle.
1-52	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with phytodetritus-covered surface. High sed oxy demand in detrital layer with some oxygenated sediment below. Fine wood fibers incorporated in sediment subsurface.
1-53	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Gray sand tube at surface- *Pectinaria,* head-down part visible below SWI. Fecal pellets. Fine detritus on surface. Fine wood fibers incorporated in subsurface sed, burrowing @ depth.
1-53	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt; high SOD sediment in upper few cms (detritus deposition). Fine wood fibers at surface and subsurface. Small polychaetes visible @ depth
1-53	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Reduced phytodetritus covered surface. Fine wood fibers incorporated in sediment subsurface. Large polychaete tubes at surface (extended palps visible on left tube; surface deposit feeders)
1-54	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Layer of reduced phytodetritus on surface with Beggiatoa. Fine wood fibers incorporated in sediment subsurface. Evidence of burrowing throughout profile.
1-54	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers in sus sed. Reduced phytodetritus covered surface. Fine wood fibers incorporated in sediment subsurface. Small polychaetes burrowing throughout profile.
1-54	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers in reduced phytodetritus covered surface. Fine wood fibers incorporated in sediment subsurface. Small polychaetes burrowing throughout profile.
1-55	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers in reduced phytodetritus covered surface. Fine wood fibers incorporated in sediment subsurface. Small polychaetes burrowing throughout profile.
1-55	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers at SWI, but phytoplankton detrital layer has started to become oxidized. Fine wood fibers subsurface. Evidence of small polychaetes burrowing at depth.
1-55	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers at SWI, but phytoplankton detrital layer has started to become oxidized. Fine wood fibers subsurface. Evidence of small bivalves & polychaetes at depth.
1-56	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with Beggiatoa fibers in surface & suspended sed. Few fine wood fibers & chps in subsurface sed, small polychates & evidence of sub-surface burrows
1-56	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with Beggiatoa fibers in surface & suspended sed. Few fine wood fibers & chps in subsurface sed, small polychates & evidence of sub-surface burrows
1-56	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with coarser grains near SWI. Phytoplankton detritus covering surface with Beggiatoa fibers. Fine to medium wood fibers in subsurface sed. Oxygenated burrows at depth, surface SOD from phytoplankton fall-out.
1-57	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Surface covered w/ phytodetritus. Couple long tubes, one gray, at surface. Upper cms are a layer of darkish fine high sed oxy demand sed. Oxygenated sediment below this layer. One longer burrow w/ hint of fauna on right, extends a few cm below SWI. Couple fine wood fibers at depth.
1-57	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand. Low contrast aRPD . Couple bits of algae or tubes on surface; top of gray sed tube (*Pectinaria* ?) on surface. Indications of burrowing through and below aRPD- one fauna or mud tube near base of image on right. Just a couple fine wood fibers subsurface.
1-57	D	Yes	fibers	Indeterminate	-	-		12	0+Doors	14.442	Silty very fine sand. Low penetration. Some sed on left is oxy, but no clear begininng of aRPD or burrowing.
1-58	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with reduced phytoplankton detritus on surface. Few fine wood fibers in subsurface. Gray sand tube visible in background.
1-58	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with reduced phytoplankton detritus on surface. Few fine wood fibers in subsurface. Large tubes visible in background.
1-58	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with a layer of reduced phytodetritus on surface and Beggiatoa . Few fine to medium wood fibers in subsurface. Evidence of small subsurface burrowing.
1-59	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with a layer of reduced phytodetritus on surface and Beggiatoa . Few fine to medium wood fibers in subsurface. Evidence of small subsurface burrowing.
1-59	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Very uneven and lumpy surface with collections of reduced phytoplankton detritus in surface depressions. Couple small white bivalves and fine wood fibers in subsurface. Evidence of sand-lined burrows at bottom right.
1-59	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Small wood chip on surface and in subsurface along w/ fine wood fibers. Fine detritus on surface. Few small sand-lined burrows in upper cm., evidence of burrowing at depth.
1-60	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers and detritus on surface. Upper 1-2 cms is darkish fine high sed oxy demand sed layer. No aRPD. Few fine wood fibers in subsurface.
1-60	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers and detritus on surface. Upper 1-2 cms is darkish fine high sed oxy demand sed layer. No aRPD. Few fine wood fibers in subsurface.
1-60	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with Beggiatoa fibers and detritus on surface. Small wood chip on surface, fine wood fibers in subsurface. aRPD is discontinuous. High sed oxy demand sed. Few small sand-lined burrows in upper layers with some burrowing at depth.
2-1	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, almost over-penetration, no aRPD. High sed oxy demand sed. Fine wood fibers & extensive fecal pellets in subsurface, burrowing evident at depth

Station	Rep	DATE	TIME	Water Depth (ft)	Successional Stage	Grain Size Major Mode (phi)	Grain Size Maximum (phi)	Grain Size Minimum (phi)	Grain Size (phi)	Penetration Area (cm^2)	Average Penetration (cm)	Minimum Penetration (cm)	Maximum Penetration (cm)	Boundary Roughness (cm)	Origin of Boundary Roughness	RPD Area (cm^2)	Mean RPD (cm)	Mud Clast Number	Mud Clast State	Methane	Low DO	Fish Waste (presence)	Wood (presence)	Wood Type
2-1	C	5/25/2011	11:31:05	177.6	Stage 2 -> 3	>4	1	>4	>4 to 1	297.82	20.62	20.35	20.85	0.50	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
2-1	D	5/25/2011	11:31:59	180	Stage 2 -> 3	>4	0	>4	>4 to 0	284.80	19.72	19.29	20.18	0.88	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
2-2	A	5/25/2011	12:06:57	196.8	Stage 1 on 3	4-3	-1	>4	>4 to -1	139.29	9.64	9.35	9.95	0.60	Biogenic	12.10	0.84	0	-	0	No	No	Yes	fine, chips
2-2	B	5/25/2011	12:08:00	196.8	Stage 1 on 3	4-3	1	>4	>4 to 1	125.19	8.67	7.93	8.99	1.06	Biogenic	26.36	1.82	0	-	0	No	No	Yes	fine, chips
2-2	D	5/25/2011	12:10:08	201.6	Stage 1 on 3	4-3	0	>4	>4 to 0	150.72	10.44	10.23	10.83	0.60	Biogenic	33.63	2.33	0	-	0	No	No	Yes	fine
2-3	B	5/25/2011	12:16:53	199.2	Stage 1 on 3	4-3	-1	>4	>4 to -1	86.76	6.01	5.42	6.27	0.85	Biogenic	86.76	6.01	0	-	0	No	No	Yes	fine, chips
2-3	C	5/25/2011	12:18:01	199.2	Stage 1 on 3	4-3	0	>4	>4 to 0	80.72	5.59	5.27	5.73	0.46	Biogenic	67.16	4.65	0	-	0	No	No	Yes	fine
2-3	D	5/25/2011	12:19:09	199.2	Stage 1 on 3	3-2/4-3	-1	>4	>4 to -1	78.80	5.46	5.06	5.73	0.67	Physical	Indeterminate	Indeterminate	0	-	0	No	No	Yes	fine, chips
2-4	A	5/25/2011	10:37:19	191.4	Stage 2	>4	0	>4	>4 to 0	223.11	15.45	14.97	15.86	0.88	Biogenic	30.78	2.13	0	-	Yes	No	No	Yes	fine
2-4	B	5/25/2011	10:38:18	192.6	Stage 2	>4	0	>4	>4 to 0	246.18	17.05	16.67	17.31	0.64	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
2-4	C	5/25/2011	10:39:24	192.6	Stage 2 -> 3	>4	0	>4	>4 to 0	235.60	16.31	16.04	16.67	0.64	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
2-5	A	5/25/2011	11:37:35	195.6	Stage 3	>4	0	>4	>4 to 0	141.05	9.77	9.56	10.09	0.53	Biogenic	4.93	0.34	0	-	0	No	No	Yes	fine
2-5	B	5/25/2011	11:38:34	195.6	Stage 3	>4	0	>4	>4 to 0	170.46	11.80	11.50	12.14	0.64	Biogenic	22.93	1.59	0	-	0	No	No	Yes	fine, chips
2-5	C	5/25/2011	11:39:37	195.6	Stage 2	>4	0	>4	>4 to 0	170.62	11.81	11.58	12.50	0.92	Biogenic	15.32	1.06	0	-	0	No	No	Yes	fine
2-6	B	5/25/2011	10:47:14	195.6	Stage 2 -> 3	>4-3	0	>4	>4 to 0	157.82	10.93	10.48	11.72	1.24	Biogenic	17.00	1.18	0	-	0	No	No	Yes	fine to medium
2-6	C	5/25/2011	10:48:12	195	Stage 2 -> 3	>4	0	>4	>4 to 0	253.10	17.52	16.67	18.16	1.49	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium
2-6	D	5/25/2011	10:49:13	195	Stage 2 -> 3	>4	0	>4	>4 to 0	203.75	14.11	13.84	14.41	0.57	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine to medium
2-7	B	5/25/2011	11:47:18	196.8	Stage 1 on 3	4-3	-1	>4	>4 to -1	123.26	8.53	7.82	8.96	1.13	Biogenic	40.32	2.79	0	-	0	No	No	Yes	fine
2-7	C	5/25/2011	11:48:22	195.6	Stage 1 on 3	>4	0	>4	>4 to 0	168.84	11.69	10.73	12.42	1.70	Biogenic	39.90	2.76	0	-	0	No	Trace	Yes	fine
2-7	D	5/25/2011	11:49:27	195.6	Stage 1 on 3	4-3	0	>4	>4 to 0	137.37	9.51	9.06	9.91	0.85	Biogenic	34.93	2.42	0	-	0	No	No	Yes	fine, chips
2-8	B	5/24/2011	16:09:46	189	Stage 2 -> 3	>4	-1	>4	>4 to -1	219.50	15.20	14.51	15.47	0.96	Biogenic	32.88	2.28	0	-	0	No	Trace	Yes	fine, chips
2-8	C	5/24/2011	16:10:46	190.2	Stage 2	>4	-1	>4	>4 to -1	217.56	15.06	14.41	15.75	1.35	Biogenic	14.97	1.04	0	-	0	No	Trace	Yes	fine
2-8	D	5/24/2011	16:11:48	190.2	Stage 1 -> 2	>4	0	>4	>4 to 0	178.61	12.37	11.65	12.81	1.17	Biogenic	0.00	0.00	0	-	0	Yes	No	Yes	fine
2-9	A	5/25/2011	9:54:22	193.8	Stage 1 on 3	>4	0	>4	>4 to 0	162.50	11.25	9.42	12.21	2.80	Biogenic	4.02	0.28	0	-	0	Yes	No	Yes	fine
2-9	C	5/25/2011	9:56:27	141.6	Stage 2 -> 3	>4	-1	>4	>4 to -1	200.36	13.87	13.59	14.05	0.46	Biogenic	16.99	1.18	0	-	0	No	Trace	Yes	fine to medium
2-9	D	5/25/2011	9:57:29	195	Stage 2 -> 3	>4	-1	>4	>4 to -1	206.33	14.29	12.99	15.36	2.37	Biogenic	41.43	2.87	0	-	0	No	No	Yes	fine
2-10	A	5/25/2011	10:55:16	195	Stage 1 on 3	>4	-1	>4	>4 to -1	189.04	13.09	12.71	13.73	1.03	Biogenic	26.45	1.83	0	-	0	No	No	Yes	fine, chips
2-10	C	5/25/2011	10:57:25	196.8	Stage 1 on 3	>4	-1	>4	>4 to -1	164.17	11.37	10.55	12.71	2.16	Biogenic	34.57	2.39	0	-	0	No	No	Yes	fine
2-10	D	5/25/2011	10:58:27	195.6	Stage 1 on 3	>4	-1	>4	>4 to -1	179.02	12.40	12.04	12.92	0.88	Biogenic	33.53	2.32	0	-	0	No	No	Yes	fine to medium
2-11	B	5/25/2011	11:56:54	200.4	Stage 1 on 3	>4	-1	>4	>4 to -1	156.26	10.82	10.23	11.19	0.96	Biogenic	28.55	1.98	0	-	0	No	No	Yes	fine, chips
2-11	C	5/25/2011	11:57:58	196.8	Stage 1 on 3	>4	-1	>4	>4 to -1	122.77	8.50	7.93	9.03	1.10	Biogenic	38.90	2.69	0	-	0	No	No	Yes	fine
2-11	D	5/25/2011	11:59:00	196.8	Stage 1 on 3	>4	-1	>4	>4 to -1	158.72	10.99	10.76	11.47	0.71	Biogenic	11.82	0.82	0	-	0	No	Trace	Yes	fine, chips
2-12	A	5/24/2011	13:31:48	189	Stage 1 on 3	>4	0	>4	>4 to 0	159.59	11.05	10.69	11.26	0.57	Biogenic	25.09	1.74	0	-	0	No	No	Yes	fine, chips
2-12	B	5/24/2011	13:33:11	185.4	Stage 2 -> 3	>4	-1	>4	>4 to -1	166.53	11.53	11.40	11.79	0.39	Biogenic	8.24	0.57	0	-	0	No	No	Yes	fine
2-12	D	5/24/2011	13:35:18	190.2	Stage 1 on 3	>4	0	>4	>4 to 0	219.68	15.21	14.51	15.68	1.17	Biogenic	Indeterminate	2.06	0	-	0	No	No	Yes	fine, chips
2-13	A	5/24/2011	14:30:53	191.4	Stage 1 on 3	>4	-1	>4	>4 to -1	165.95	11.49	11.01	11.96	0.96	Biogenic	10.81	0.75	0	-	0	No	No	Yes	fine
2-13	B	5/24/2011	14:31:59	187.8	Stage 2 -> 3	>4	0	>4	>4 to 0	206.67	14.31	13.98	14.73	0.74	Biogenic	14.11	0.98	0	-	0	No	No	Yes	fine
2-13	D	5/24/2011	14:34:17	187.8	Stage 2 on 3	>4	-1	>4	>4 to -1	193.08	13.37	12.07	13.91	1.84	Biogenic	19.05	1.32	0	-	0	No	No	Yes	fine
2-14	B	5/24/2011	16:18:18	191.4	Stage 1 on 3	>4	-1	>4	>4 to -1	168.87	11.69	10.97	12.32	1.35	Physical	13.26	0.92	0	-	0	No	Trace	Yes	fine
2-14	C	5/24/2011	16:19:18	191.4	Stage 1 on 3	>4	-1	>4	>4 to -1	154.46	10.69	10.41	11.12	0.71	Biogenic	23.56	1.63	0	-	0	No	Trace	Yes	fine, chips
2-14	D	5/24/2011	16:20:20	192.6	Stage 2 -> 3	>4	-1	>4	>4 to -1	212.48	14.71	14.23	15.01	0.78	Biogenic	0.00	0.00	0	-	0	No	Yes	Yes	fine, chips
2-15	A	5/25/2011	10:03:44	196.8	Stage 2 -> 3	>4	-1	>4	>4 to -1	208.88	14.46	13.91	15.33	1.42	Biogenic	21.43	1.48	0	-	0	No	Trace	Yes	fine
2-15	B	5/25/2011	10:04:51	198	Stage 1 on 3	>4	-1	>4	>4 to -1	192.57	13.33	12.99	13.77	0.78	Biogenic	50.64	3.51	0	-	0	No	Trace	Yes	fine to medium
2-15	C	5/25/2011	10:05:50	196.8	Stage 1 on 3	>4	-1	>4	>4 to -1	230.94	15.99	14.87	16.57	1.70	Biogenic	0.00	0.00	0	-	0	No	Trace	Yes	fine to medium
2-16	A	5/25/2011	11:04:25	193.2	Stage 1 on 3	>4	-1	>4	>4 to -1	160.28	11.10	10.62	11.68	1.06	Biogenic	5.72	0.40	0	-	0	No	No	Yes	fine, chips

Station	Rep	Beggiatoa (presence)	Bacteria Type (Fibers or Mat)	Feeding Voids (#)	Void Minimum Depth (cm)	Void Maximu m Depth (cm)	Void Average Depth (cm)	Stop Collar Settings (in.)	Weights/ Chassis (#)	Calibration Constant	COMMENT
2-1	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, almost over-penetration, no aRPD. High sed oxy demand sed. Fine wood fibers & extensive fecal pellets in subsurface, burrowing evident at depth
2-1	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, almost over-penetration, no aRPD. High sed oxy demand sed. Fine wood fibers & extensive fecal pellets in subsurface, burrowing evident at depth
2-2	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Fine detritus on surface. Fine wood fibers on surface and subsurface; one small chip on surface. 2 tubes on surface in background. Likely *Pectinaria* tube above and below SWI at left.
2-2	B	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand. Some detritus on surface. Numerous tubes on surface. Medium wood chip on surface in background; fine wood fibers subsurface.
2-2	D	Trace	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand. Detritus on surface. Worm at 6.36 cm on right. Few fine wood fibers incorporated in subsurface sed.
2-3	B	No		0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. One medium wood chip on surface, one subsurface, few wood fibers subsurface. Detritus on surface. aRPD exceeds penetration depth, entire profile oxidized.
2-3	C	No		0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. Few fine wood fibers subsurface. Detritus and phytodetrits on surface. Larger polychaete sand tubes on surface. Low contrast aRPD. Shallow sand-lined burrows,
2-3	D	No		0	-	-		12	0+Doors	14.442	Silty very fine and fine sand, coarser grains in upper cm. Numerous short tubes on surface in background. Small wood chip at surface, fine wood fibers subsurface. Detritus and phytodetrits on surface. Gray tube subsurface on right.
2-4	A	Yes	fibers/mat	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers, some in a small mat on the left, at surface. Some fine wood fibers incorporated in subsurface sediment. One small methane gas bubble in center, evidence of small polychaetes burrowing at depth.
2-4	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with high percentage of fecal pellets throughout. Upper 1-2 cm is high SOD phytoplankton detritus. White bivalve at base of upper layer. Bits of oxy sed below upper layer, so short term hypoxia. Few fine wood fibers incorporated in subsurface sediment, evidence of sub-surface burrows.
2-4	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with 2-3 cm layer of reduced, high SOD phytoplankton detritus on surface. Few fine wood fibers incorporated in subsurface sediment with sand-lined burrows throughout subsurface profile.
2-5	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with patchy deposit of phytoplankton detritus on surfac.Numerous larger tubes on surface and in background. Small white bivalve just below SWI. Edge of gray *Pectinaria* tube at far left. Fine wood fibers in subsurface sediment.
2-5	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with thing layer of phytoplankton detritus being worked into surface sediment. Fine wood fibers and small chips in subsurface sediment. Small burrows at <2 cm. at center and at depth; distinct layering of fines on top of historical wood deposit.
2-5	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. aRPD is patchy because of phytoplankton detrital accumulation at SWI. Fine wood fibers in subsurface sediment. Evidence of small burrows throughout profile.
2-6	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine sand. High SOD detritus on surface. Fine to medium wood fibers in subsurface sediment. Nematode at 2cm. Tubicolous fauna on surface in background.
2-6	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with upper layer from 1 cm to 5.25 cm thick of reduced, high SOD detritus. Fine to medium wood fibers in subsurface. Evidence of subsurface burrowing throughout probiel with some oxygenated burrow halos at depth.
2-6	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with upper 1-3 cm layer of reduced, high SOD detritus. Fine to medium wood fibers in subsurface. Portion of larger polychaete against faceplate at right edge about 3.5 cm below SWI.
2-7	B	No		0	-	-		12	0+Doors	14.442	Silty very fine and fine sand, coarser in upper cm. Few pebbles at surface. Numerous small tubes at surface and in background. aRPD is very low contrast; *Pectinaria* tubes lying on surface. Few fine wood fibers at base of image. Portion of fauna against faceplate at base of image.
2-7	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. aRPD is very low contrast. Detritus on surface. Few fine wood fibers and very small chips in subsurface. Possible gray tube at depth at left, oxidized burrow transected in lower right corner.
2-7	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. aRPD is very low contrast. Detritus on surface. Old thin tube at SWI. Top of *Pectinaria* tube at SWI, next to old tube. Medium wood chip on surface. Fine wood fibers subsurface, evidence of burrowing at depth.
2-8	B	Yes	mat	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers, in small mats, some subsurface. Fine wood fibers and small chips in subsurface sed. aRPD is a bit darker in color. Evidence of burrowing at depth
2-8	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa fibers and phytodetritus at surface. Fine wood fibers and small chips in subsurface sed. Evidence of small subsurface burrows.
2-8	D	Yes	mat	0	-	-		12	0+Doors	14.442	Very fine sandy silt with partial mat of Beggiatoa on surface, fibers extending into subsurface. No aRPD. Fine wood fibers in subsurface sed. Layer (1-3 cm) of reduced, high SOD phytoplankton detritus on surface. Evidence of small polychaetes at depth.
2-9	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. aRPD is patchy and discontinuous. Beggiatoa fibers on surface and in sus sed. Detritus and debris/sticks on surface. Fine wood fibers throughout subsurface sed. Polychaete at far right, and a part of one in patch of aRPD on left and on left. Few sand-line burrows in aRPD area. High sed oxy demand sed, polychaete on right edge @ SWI is possible escape response.
2-9	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. aRPD is only on left side. Beggiatoa fibers visible below SWI on right side. Fine detritus on surface. Few tubes on left surface. Fine to medium wood fibers at surface and subsurface. Sand-lined burrows on left side, in center and at depth on right.
2-9	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine detritus on surface. Beggiatoa fibers visible below SWI at center. Gray end of *Pectinaria* tube ~3cm below SWI at center. Couple sand-lined burrows. Few tubes on surface. Fine wood fibers at surface and subsurface.
2-10	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt. Fine detritus on surface. Small wood chip at surface, fine wood fibers throughout subsurface sed. aRPD is low contrast. Oblong fecal pellets at SWI. Possible tubes on surface, somewhat obscured by sus sed.
2-10	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt with coarser particles near surface. aRPD is patchy and discontinuous. Long tube and small white bivalve at SWI. Few other tubes in background. Fine wood fibers at surface and throughout subsurface sed.
2-10	D	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt, with some coarser grains. Fine detritus at surface. Fine to medium wood fibers at surface and throughout subsurface. *Pectinaria* tube in subsurface, top is at 3.15cm. Couple tubes at surface. Evidence of subsurface burrowing throughout profile.
2-11	B	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt. Fine wood fibers and small chips at surface and throughout subsurface. Fine detritus at surface. Evidence of subsurface burrowing.
2-11	C	No		0	-	-		12	0+Doors	14.442	Fine sandy silt with tubes on surface. Bits of detritus on surface. Few shallow sand-lined burrows. Fine wood fibers at surface and in subsurface. aRPD is low contrast.
2-11	D	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt, coarser grains near surface. Few tubes at SWI and in background on surface. Fine wood fibers at surface and throughout subsurface sed, small chip in subsurface. aRPD is low contrast and patchy. Few small white bivalves in upper cms and sand-lined burrows at depth.
2-12	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Upper 1-2 cm is reduced layer of high SOD phytoplankton detritus. Fine wood fibers and small chips in subsurface sed. Small polychaete against faceplate in center at 3.3 cm. Tube at surface on left, dark at base, then lighter in color.
2-12	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. aRPD is low contrast and patchy . Fine wood fibers at surface and in subsurface. Evidence of burrowing throughout profile.
2-12	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt; aRPD obscured by smear of high SOD detritus, estimated from linear measurement of oxidized patch of sediment at center. Three tubes at surface, one also extending into subsurface.
2-13	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt, few small pebbles on surface. aRPD is patchy and discontinuous. Fine wood fibers in subsurface. Phytodetritus on surface. Small sand-lined burrows throughout profile.
2-13	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with 1-2 cm layer of reduced phytoplankton detritus being worked into sediment. aRPD is patchy; tubes at surface. Fine wood fibers in subsurface sed. Possible end of gray *Pectinaria* tube on left. Some kind of white worm- at 7.72 cm.
2-13	D	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Long *Pectinaria* tube, most extending above SWI on right. Fine detritus on surface. Fine wood fibers in subsurface sed. Sand-lined burrows, one at 2.35 cm.
2-14	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt. Couple tubes at surface. Fine wood fibers throughout subsurface sed. aRPD is patchy and discontinuous. Evidence of burrowing throughout profile.
2-14	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt, coarser grains near surface. aRPD is patchy with tubes at SWI. Fine wood fibers at surface and in subsurface along with small chips. Evidence of burrowing throughout profile.
2-14	D	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt with 1-4 cm layer of mixed organic detritus (phytoplankton & fish waste). Fine wood fibers in subsurface sed, few small chips. Evidence of subsurface burrowing.
2-15	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with fine wood fibers on surface and throughout subsurface sed. Fine organic detritus (fish waste & phytoplankton) on surface. Extensive small wood chips throughout profile along with evidence of subsurface burrowing.
2-15	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt with high density of fine to medium wood fibers & chips throughout subsurface sed. Short tubes at surface. Multiple small worms and evidence of subsurface burrowing.
2-15	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with detritus on surface. High sed oxy demand sed. No aRPD. Long (~4 cm) *Pectinaria* tube (relict) in center, gray above SWI, reduced at SWI & darker below. Lots of fine to medium wood fibers & chips throughout subsurface and some at surface.
2-16	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Detritus and clumps of phytodetritus on surface. High SOD sediment; aRPD is patch on right. *Pectinaria* tube in center. Fine wood fibers at surface and throughout subsurface. Surface tubes in background, burrowing at depth.

Station	Rep	DATE	TIME	Water Depth (ft)	Successional Stage	Grain Size Major Mode (phi)	Grain Size Maximum (phi)	Grain Size Minimum (phi)	Grain Size (phi)	Penetration Area (cm^2)	Average Penetration (cm)	Minimum Penetration (cm)	Maximum Penetration (cm)	Boundary Roughness (cm)	Origin of Boundary Roughness	RPD Area (cm^2)	Mean RPD (cm)	Mud Clast Number	Mud Clast State	Methane	Low DO	Fish Waste (presence)	Wood (presence)	Wood Type
2-16	B	5/25/2011	11:05:29	195	Stage 2 -> 3	>4	-1	>4	>4 to -1	179.57	12.43	12.07	12.64	0.57	Biogenic	9.34	0.65	0	-	0	No	Trace	Yes	fine to medium
2-16	C	5/25/2011	11:06:31	141	Stage 1 on 3	>4	-1	>4	>4 to -1	163.06	11.29	10.94	12.21	1.27	Biogenic	17.39	1.20	0	-	0	No	Trace	Yes	fine, chips
2-17	A	5/23/2011	17:22:05	196.8	Stage 1 -> 2	>4	0	>4	>4 to 0	184.65	12.79	12.46	13.20	0.74	Biogenic	0.00	0.00	0	-	0	No	No	Yes	fine
2-17	C	5/23/2011	17:24:57	192.6	Stage 2 -> 3	>4	-1	>4	>4 to -1	188.87	13.08	12.53	13.52	0.99	Biogenic	33.15	2.30	0	-	0	No	No	Yes	fine
2-17	D	5/23/2011	17:26:14	195	Stage 1 on 3	>4	0	>4	>4 to 0	186.00	12.88	12.00	13.70	1.70	Biogenic	0.00	0.00	0	-	0	No	No	Yes	fine
2-18	A	5/24/2011	13:42:19	187.8	Stage 1 on 3	>4	-1	>4	>4 to -1	142.56	9.87	8.28	12.11	3.82	Biogenic	21.30	1.47	0	-	0	No	No	Yes	fine to medium, chips
2-18	B	5/24/2011	13:43:27	189	Stage 2 -> 3	>4-3	-1	>4	>4 to -1	144.71	10.02	9.77	10.34	0.57	Biogenic	10.15	0.70	0	-	0	No	No	Yes	ne to medium, chips, stic
2-18	C	5/24/2011	13:44:35	189	Stage 1 on 3	>4	-1	>4	>4 to -1	149.70	10.36	9.45	11.40	1.95	Physical	32.49	2.25	0	-	0	No	No	Yes	fine to medium, chips
2-19	A	5/24/2011	14:21:57	187.7	Stage 1 on 3	4-3	0	>4	>4 to 0	148.86	10.31	9.42	11.65	2.23	Biogenic	10.92	0.76	0	-	0	No	No	Yes	fine
2-19	B	5/24/2011	14:23:00	189	Stage 2 -> 3	>4	0	>4	>4 to 0	185.24	12.83	12.28	13.31	1.03	Biogenic	24.21	1.68	0	-	0	No	No	Yes	fine
2-19	D	5/24/2011	14:25:04	189	Stage 1 on 3	>4	0	>4	>4 to 0	204.43	14.15	13.88	14.51	0.64	Biogenic	14.17	0.98	0	-	0	No	No	Yes	fine
2-20	A	5/24/2011	16:26:22	193.8	Stage 1 on 3	4-3	0	>4	>4 to 0	158.07	10.94	10.30	11.25	0.95	Biogenic	12.37	0.86	0	-	0	No	Trace	Yes	fine
2-20	B	5/24/2011	16:27:23	193.8	Stage 2 -> 3	>4	0	>4	>4 to 0	161.53	11.18	11.12	11.30	0.19	Biogenic	26.81	1.86	0	-	0	No	Trace	Yes	fine
2-20	C	5/24/2011	16:28:48	193.8	Stage 1 on 3	>4	-1	>4	>4 to -1	134.95	9.34	8.96	9.91	0.96	Biogenic	43.12	2.99	0	-	0	No	Trace	Yes	fine, chips
2-21	B	5/24/2011	14:04:16	189	Stage 1 on 3	>4	0	>4	>4 to 0	151.66	10.50	9.63	11.50	1.88	Biogenic	8.73	0.60	0	-	0	No	No	Yes	fine
2-21	C	5/24/2011	14:05:15	189	Stage 1 on 3	>4	-1	>4	>4 to -1	177.34	12.28	11.22	13.06	1.84	Biogenic	4.24	0.29	0	-	0	No	No	Yes	fine
2-21	D	5/24/2011	14:06:11	187.8	Stage 1 on 3	>4	1	>4	>4 to 1	168.99	11.70	11.26	12.14	0.88	Biogenic	5.13	0.36	0	-	0	No	No	Yes	fine
2-22	A	5/24/2011	14:12:35	190.2	Stage 1 on 3	>4	-2	>4	>4 to -2	201.54	13.95	13.42	14.58	1.17	Biogenic	3.52	0.24	0	-	0	No	No	Yes	fine
2-22	B	5/24/2011	14:13:36	190.2	Stage 1 on 3	>4	0	>4	>4 to 0	187.41	12.98	12.64	13.35	0.71	Biogenic	31.15	2.16	0	-	0	No	Trace	Yes	fine
2-22	C	5/24/2011	14:14:40	190.2	Stage 1 on 3	>4	1	>4	>4 to 1	206.55	14.30	13.91	14.58	0.67	Biogenic	5.37	0.37	0	-	0	No	No	Yes	fine
2-23	A	5/24/2011	16:47:36	195.6	Stage 1 on 3	>4	0	>4	>4 to 0	157.10	10.88	10.09	11.22	1.13	Biogenic	48.73	3.37	0	-	0	No	No	Yes	fine
2-23	B	5/24/2011	16:48:40	195.6	Stage 2	>4-3	0	>4	>4 to 0	156.82	10.86	10.56	11.14	0.58	Biogenic	2.43	0.17	0	-	0	No	Trace	Yes	fine
2-23	D	5/24/2011	16:50:51	195.6	Stage 1 on 3	>4	0	>4	>4 to 0	161.98	11.22	10.90	11.49	0.58	Biogenic	24.10	1.67	0	-	0	No	No	Yes	fine
01	A	5/24/2011	16:56:36	201.6	Stage 1 on 3	>4	0	>4	>4 to 0	160.63	11.12	10.62	11.68	1.06	Biogenic	62.26	4.31	0	-	0	No	No	Yes	fine
01	B	5/24/2011	16:57:41	202.8	Stage 2 on 3	>4-3	-1	>4	>4 to -1	68.10	4.72	3.50	6.09	2.58	Biogenic	68.10	4.72	0	-	0	No	No	Yes	fine
01	D	5/24/2011	17:02:12	200.4	Stage 2 on 3	>4	0	>4	>4 to 0	116.94	8.10	6.62	9.20	2.58	Biogenic	36.94	2.56	0	-	0	No	No	Yes	fine
02	A	5/24/2011	17:08:43	200.4	Stage 2	3-2	-1	>4	>4 to -1	88.57	6.13	5.78	6.77	0.98	Biogenic	2.71	0.19	0	-	0	No	Yes	No	
02	C	5/24/2011	17:11:02	200.4	Stage 2	>4-3	-1	>4	>4 to -1	115.28	7.98	7.64	8.28	0.64	Biogenic	0.00	0.00	0	-	0	Yes	Yes	Yes	fine
02	D	5/24/2011	17:12:14	201.6	Stage 2	3-2	-1	>4	>4 to -1	37.84	2.62	1.27	3.42	2.15	Biogenic	0.00	0.00	0	-	0	Yes	Yes	Yes	fine, chips
03	E	5/25/2011	15:28:01	200.4	Stage 2	4-3	0	>4	>4 to 0	126.04	8.73	6.44	9.70	3.26	Biogenic	0.00	0.00	0	-	0	Yes	Yes	Yes	fine, chips
03	G	5/25/2011	15:30:08	199.2	Stage 2 -> 3	3-2	0	>4	>4 to 0	110.51	7.65	6.23	8.71	2.48	Biogenic	3.42	0.24	0	-	0	No	Yes	No	
03	H	5/25/2011	15:31:07	200.4	Stage 2 on 3	4-3	-1	>4	>4 to -1	125.72	8.70	8.42	9.10	0.67	Biogenic	4.37	0.30	0	-	0	No	No	Yes	stick
04	C				Indeterminate																			
04	E	5/25/2011	15:33:03		Stage 2 on 3	3-2	-6	>4	>4 to -6	95.79	6.63	5.91	7.22	1.31	Physical	28.10	1.95	0	-	0	No	No	Yes	fine
04	H	5/25/2011	15:35:23	201.6	Stage 2 on 3	3-2	-5	>4	>4 to -5	103.65	7.18	6.48	7.89	1.42	Physical	103.65	7.18	0	-	0	No	No	Yes	chips

Station	Rep	Beggiatoa (presence)	Bacteria Type (Fibers or Mat)	Feeding Voids (#)	Void Minimum Depth (cm)	Void Maximum Depth (cm)	Void Average Depth (cm)	Stop Collar Settings (in.)	Weights/ Chassis (#)	Calibration Constant	COMMENT
2-16	B	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt. Fine detritus at surface with wood fibers and trace fish waste residue . aRPD is patchy and low contrast. Old tubes and longer fecal pellets at SWI. High SOD sediment at right side of image, evidnce of burrowing at depth.
2-16	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Poorly sorted very fine sandy silt. Fine detritus at surface with wood fibers & smal chips throughout subsurface sed. Long gray tube extending from SWI to 3.3 cm below, tube looks flat. aRPD is patchy and thin. Evidence of burrows throughout profile.
2-17	A	Yes	mat	0	-	-		12	0+Doors	14.442	Poorly-sorted silt-clay. Beggiatoa mat. Upper 1-2 cm is fine darkish high sed oxy demand sed. Bits of oxy sed below. Few fine wood fibers at depth. Evidence of small burrows at depth.
2-17	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Dense Beggiatoa fibers at surface and against faceplate for upper few cm. Fine wood fibers at depth. Evidence of transected burrows at depth.
2-17	D	Yes	mat	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Beggiatoa mat visibe on right, sus upper 1-3 cm is high SOD detritus. Few fine wood fibers in subsurface. Vertical burrow transected at right with portion of animal visible against faceplate in lower right corner
2-18	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Very fine sandy silt with short tubes and accumulation of organic detritus at surface. Fine to medium wood fibers at surface and in subsurface, medium chip in subsurface. aRPD is discontinuous, none at far right. *Pectinaria* tube on surface. Possible small white bivalve at far left and two in subsurface at right. Sand-lined burrow at 1.75 cm on right, other burrows at depth.
2-18	B	Yes	trace	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand. aRPD is patchy and discontinuous, only on right. Three small white bivalves in aRPD and one at center. *Pectinaria* tube extending above surface. Small to medium wood fibers at surface and subsurface. Few wood chips and one large stick on surface.
2-18	C	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt, coarser grains at surface. Lots of long tubes at SWI and in background, some are *Pectinaria* tubes, at least one of these lying on surface. Several small white bivalves in upper few cms. aRPD is patchy and discontinuous, mostly center and left. Lots of fine to medium wood fibers at chips on surface, some in subsurface.
2-19	A	No		0	-	-		12	0+Doors	14.442	Well-sorted silty very fine sand. Two long tubes at left, *Pectinaria* tube at right. Small coils of tubes in subsurface. Few fine wood fibers incorporated into subsurface sed.
2-19	B	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt with traces of incipient Beggiatoa. Some fine wood fibers in subsurface sed. Shallow sand-lined burrows along with evidence of burrowing at depth.
2-19	D	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt. Several long tubes at surface and in background. aRPD is patchy and low contrast. Some high sed oxy demand sed. Fine wood fibers incorporated into subsurface sed.
2-20	A	Yes	trace	0	-	-		12	0+Doors	14.442	Silty very fine and fine sand, coarser grains near surface. Detritus at surface. Minimal aRPD, few bits of oxy sed. Lots of tubes on surface on left and in background. Fine wood fibers at surface and subsurface.
2-20	B	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt with a surface layer of detritus. aRPD is patchy. Fine wood fibers throughout subsurface sed. Short tube in background on left. Oblong fecal pellet at SWI.
2-20	C	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt, coarser grains near surface. Detritus, small leaf, on surface. Fine wood fibers and small chips on surface and in subsurface. Short and long tubes on surface in background. Small orange gastropod at SWI on left. Evidence of small burrows throughout profile.
2-21	B	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt with layer of fine detritus. Fine wood fibers at surface and subsurface. High sed oxy demand sed. aRPD is disctontinuous, mostly on right. Few tubes on surface and some at SWI against faceplate and one long sand-lined burrow, in aRPD area.
2-21	C	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt with fine detritus at surface and in sus sed. Fine wood fibers at surface and subsurface. High sed oxy demand sed. Some bits of oxy sed and only one in contact w/ SWI. Small tubes and fecal pellets at SWI.
2-21	D	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt with fine detritus at surface. Numerous long mud tubes at surface, some at angle toward parallel w/ SWI. Fine wood fibers in subsurface. High sed oxy demand sed. aRPD is discontinuous and low contrast.
2-22	A	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt with patchy aRPD, only a bit left of center. High sed oxy demand. Evidence of small sand-lined burrows connected to SWI. Edge of large oxygenated halo transected in lower right corner.
2-22	B	Yes	trace	0	-	-		12	0+Doors	14.442	Very fine sandy silt with fine wood fibers at depth. aRPD is patchy , none on far left, high sed oxy demand sed. Detritus and phytodetritus on surface. Small white bivalve and some sand-lined burrows in upper few cms. Tubes on surface, evidence of burrowing at depth.
2-22	C	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt with large tube at SWI. aRPD is discontinuous at left, layer of dark high sed oxy demand sed below, then more oxy sed (oxygenation of settled detrital layer). Fine wood fibers & evidence of burrowing at depth.
2-23	A	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt. First live *Pectinaria* tube detected in SPI photos (extending above SWI on far right). Numerous tubes & fecal mounds on surface. Low contrast aRPD with fine wood fibers in subsurface sed.
2-23	B	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt with high SOD detritus on surface. Diffusional aRPD, but bits of oxy sed below detrital layer. Fine wood fibers at surface and in subsurface. Sus sed obscures much of SWI. Some fecal pellets at surface.
2-23	D	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt with thin layer of light-colored fecal pellets at surface. Fine wood fibers at surface and in subsurface. aRPD is patchy and mixed w/ high sed oxy demand sed, very low contrast. Three bivalves in upper cms. Burrowing evidence visible throughout profile.
01	A	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt. Short tubes at surface; thin sand tubes lying on surface. Low contrast aRPD. Fine wood fibers in subsurface. Evidence of burrowing @ depth.
01	B	No		0	-	-		12	0+Doors	14.442	Silty very fine sand. Large pit w/ medium/large bivalve just below on left. *Pectinaria* tube against faceplate on right. aRPD is low contrast & exceeds prism penetration depth.
01	D	No		0	-	-		12	0+Doors	14.442	Very fine sandy silt. Right half of image is pit/depression. aRPD is low contrast. Few short and few thin tubes at surface. Two small white bivalve at ~1cm. Few fecal pellets and shallow burrows. Fine wood fibers in subsurface sed.
02	A	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty fine sand covered with fish scales and bones; evidnece of burrowing
02	C	Yes	fibers	0	-	-		12	0+Doors	14.442	Silty fine sand. Pebbles and fish debris on surface. High sed oxy demand sed. Slightest hint of low contrast, diffusional aRPD (ca 1 mm or less). Tube with Beggiatoa on tip at right, showing BBL is hypoxic. Few fine wood fibers in subsurface sed.
02	D	Yes	fibers, mat	0	-	-		12	0+Doors	14.442	Silty fine sand. Surface covered w/ pebbles, fish waste, some wood chips/sticks. Few fine wood fibers in subsurace. No aRPD. A few burrows visible, small mat of Beggiatoa on far right.
03	E	Yes	fibers, mat	0	-	-		14	3	14.442	Very fine silty sand, with detrital layer at surface. No aRPD. Dark high sed oxy demand sed. Fine wood fibers and small chips at surface and just subsurface. Thick Beggiatoa mat in background. Empty small white bivalve shells. Evidence of burrowing.
03	G	Yes	fibers, mat	0	-	-		14	3	14.442	Silty fine sand, coarser grains and pebbles at surface. Some short tubes and a few longer ones at right. Diffusional low contrast aRPD. Evidence of burrows @ depth.
03	H	Yes	trace	0	-	-		14	3	14.442	Silty very fine and fine sand, coarser grains and few pebbles at surface. Large wood stick on right, on end, extending into water column. Top of two tubes visible on left at SWI. Few short tubes in background. White bivalve at ~2cm on left. Long sand-lined burrows at depth.
04	C										No penetration, sus sed only; all other reps look like this
04	E	No		0	-	-		14	3	14.442	Silty fine sand. Few large cobbles on surface. Tubes on surface and rocks; white fauna at SWI. aRPD extends below pen depth. Portion of polychaete at depth on right. Couple fine wood fibers in subsurface sed. Long sand-lined burrows down to 3.3 cm. Water depth not recorded.
04	H	No		0	-	-		14	3	14.442	Poorly sorted silty fine sand. Few cobbles on surface. Wood chip at surface on left. Abundant tubes and tubicolous fauna at surface. aRPD is greater than pen depth. Infaunal worms at 1.83 and 2.54 cm.

Appendix C:

Plan View (PV) Analytical Results

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Station	Rep	Date	Time	Sediment Type	Bedforms (presence)	Burrows (presence)	Tubes (presence)	Tracks (presence)	Epifauna	Mudclasts (presence)	Debris (presence)	Wood Debris Coverage (%)	Wood Debris Type	Beggiatoa (presence)	Fish Waste (presence)	Image Width (cm)	Image Height (cm)	Field of View Imaged (m^2)	Comment
1-09	A	5/25/2011	13:48:00	silty fine sand	No	Yes	Yes	Yes	No	No	Yes-algae	1 to 3	Fibers	No	No	76.82	50.88	0.39	Silt. Bit of algae near center. Numerous burrows (~3cm across), few tracks near burrows.
1-09	B	5/25/2011	13:49:08	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Yes	Indeterminate	Indeterminate	Indeterminate	Indeterminate	No	No	75.91	50.27	0.38	Most of image is obscured by sed cloud. Crab, carapace 8.9cm across.
1-09	C	5/25/2011	13:50:11	silty fine sand	No	Yes	Yes	No	No	No	No	1 to 3	Fibers	No	No	76.27	50.51	0.39	Silty fine sand. Numerous burrows (~1.5 - 2.5 cm across).
1-10	A	5/25/2011	13:27:48	silty fine sand	No	Yes	Yes	Yes	No	No	No	1 to 3	Fibers	No	No	74.93	49.63	0.37	Silty fine sand. Numerous burrows, some ~0.4 cm in diameter, some ~ 3.5 cm.
1-10	B	5/25/2011	13:28:58	silty fine sand	No	Yes	Yes	Yes	No	No	No	1 to 3	Fibers	No	No	74.67	49.45	0.37	Silty fine sand. Numerous burrows ~ 3.5 cm in diameter. Track marks, two thin ones in parallel.
1-10	C	5/25/2011	13:29:55	silty fine sand	No	Yes	Yes	Yes	No	No	No	1 to 3	Fibers	No	No	76.95	50.97	0.39	Silty sand. Several burrows (~ 3cm in diameter). Small bits of decaying macroalgal fluff in lower left quadrant of image.
1-10	D	5/25/2011	13:30:53	silty fine sand	No	Yes	Yes	Yes	No	No	No	1 to 3	Fibers	No	No	75.19	49.80	0.37	Silty fine sand. Numerous burrows (mostly 1.4 - 4 cm in diameter), few smaller burrows (~0.5 cm). Small bits of macroalgal fluff @ SWI
1-11	A	5/25/2011	13:37:17	silty fine sand	No	Yes	Yes	Yes	No	No	No	1 to 3	Fibers	No	No	81.30	53.85	0.44	Silty fine sand. Numerous small burrows (~0.3 cm in diameter), few larger ones or pits in upper right with deep tracks or furrows.
1-11	C	5/25/2011	13:39:23	silty fine sand	No	Yes	Yes	Yes	No	No	No	<1	Fibers	No	No	82.88	54.89	0.45	Silty fine sand. Numerous burrows (~0.3 - 0.6 cm in diameter); small bits of amalgamated, decaying detrital fluff
1-12	A	5/23/2011	10:39:49	Indeterminate	No	No	Yes	No	Yes	No	Yes-algae and fibers	20-30	Fibers, pulp	Present	No	Indeterminate	Indeterminate	Indeterminate	Left laser not visible. Likely sand, looks relatively hard packed. Abundant ophiurids across surface. Few bits of green algae on surface. Possible additional epifauna in lower right corner, resolution makes it difficult to determine what it is. Brownish benthic algae.
1-12	E	5/24/2011	10:21:24	Indeterminate	No	No	Yes	No	Yes	Yes	Yes	40	Fibers, pulp	Present	No	81.66	54.09	0.44	Sediment is Indeterminate b/c of algal and fiber covering covering, looks like it might be hard packed sand. Numerous ophiurids, ~0.4 cm diameter. Clasts of sediment on surface, origin of clasts unclear.
1-13	A	5/23/2011	10:46:33	gravel	No	No	No	No	Yes	No	Yes-algae, stick	5 to 10	Stick and bark/chips	No	No	84.57	56.02	0.47	Rocky, esp on left half of image. Fine brownish flocculants on sediment surface. Flounder, ~34 cm long. Algae and sticks on surface. Purple/pink coralline algae on rocks
1-14	A	5/23/2011	9:41:59	Indeterminate	No	No	No	No	No	No	Yes-wood chips	>90	Small fragments and chips	No	Present	Indeterminate	Indeterminate	Indeterminate	Lasers difficult to find. Surface completely covered with wood & fish waste, fibers, and chips. Filamentous green algae and decaying floccular macroalgae. White worm
1-14	B	5/23/2011	9:45:36	Indeterminate	No	No	Yes	No	No	No	Yes-wood chips, algae	>90	Small fragments and chips	No	Present	Indeterminate	Indeterminate	Indeterminate	Only one laser visible. Surface completely covered with wood waste, fibers, and chips. Bits of green algae and other debris on surface. Clear thin tubes. Much of fibrous material may be fish skeletal rays.
1-14	C	5/23/2011	9:49:42	Indeterminate	No	Yes	Yes	No	No	No	Yes-wood chips	>90	Fragments and bark chips	No	Trace	Indeterminate	Indeterminate	Indeterminate	Surface completely covered with wood & fish waste, fibers, and chips. Bark appears reddish. Small fragments of decaying floccular algae.
1-15	A	5/23/2011	10:53:06	Indeterminate	No	Yes	Yes	No	No	No	Yes-wood chips, algae, shell frag	50	Mix of small pulp/fragments and larger wood chips	No	Present	66.32	43.93	0.29	Sediment difficult to determine under covering on fine debris, fish waste, and wood chips. Larger wood chips (~2 cm long), green algae, small shells on surface. Few small burrows (~25cm in diameter). Spiochaetopterus tube recumbent on sediment surface.
1-16	A	5/23/2011	11:01:10	silty sand	No	Yes	Yes	No	Yes	No	Yes-wood fibers, algae	50	Mix of small pulp/fragments and larger wood chips	Present	Present	99.79	66.09	0.66	Silty sand. Wood fibers, fish waste, and fine debris across surface. Hermit crab. Possible very small burrows. Bits of green algae on surface. Possible fish rays. Incipient beggiatoa.
1-17	A	5/23/2011	11:09:21	Indeterminate	No	Yes	No	No	Yes	No	Yes-wood chips, algae	80	wood and bark fragments	Present	Trace	85.76	56.80	0.49	Wood fibers and chips covering most of surface with traces of fish waste. Bits of green and brown algae at surface. Cerianthid in bottom right.
1-18	A	5/23/2011	11:31:40	Indeterminate	No	No	No	No	Yes	No	Yes-wood waste	>90	Small fragments and chips	Present	Present	90.36	59.85	0.54	Wood waste ranging from fine debris to chips and a few sticks cover surface. Other debris on surface as well. Possible epifauna to left of upper middle. Sediment surface is patchy in color- dark/debris and a lighter gray. Beggiatoa mats. Fish vertebrae and possible rays in upper left.
1-18	B	5/23/2011	11:32:35	silty sand	No	Yes	Yes	No	Yes	No	Yes-wood waste	50	Fibers, pulp, small chips	Present	No	96.05	63.62	0.61	Silty sand. Irregular coating of small wood fibers and fragments along with brown marcoalage. Patches of beggiatoa. Epifaunal white worms and partically buried crab in left center. Decaying floccular algae.
1-19	A	5/23/2011	11:38:11	silty sand	No	Yes	Yes	No	Yes	No	Yes-algae and wood waste	50	Small fragments and chips	Present	Present	66.73	44.20	0.29	Silty sand, covered with dark fine debris and wood fibers. Patches of lighter gray sed. Old or recumbent spiochaetopterus tubes. Beggiatoa upper left.
1-19	E	5/24/2011	11:37:46	silty sand	No	No	Yes	No	No	No	Yes-wood waste	>90	Small fragments and chips	Present	Present	90.10	59.68	0.54	Silty sand, covered with dark fine debris and wood fibers. Patches of beggiatoa.
1-20	A	5/23/2011	11:44:52	organic-covered silty sand	No	No	Yes	No	No	No	Yes-algae	1 to 3	Fibers	Present	trace	76.95	50.97	0.39	Silty sand, covered with fine sediment or debris, w/ bits of small wood fiber. Bits of green algae and decaying floccular algae.
1-20	E	5/24/2011	11:45:41	silt-covered sand	No	Yes	Yes	No	No	No	Yes-algae	5	Fibers	Present	No	67.79	44.90	0.30	Sandy silt covered with patches of fine sediment or debris, w/ bits of small wood fiber. Bits of green algae. Large patches of beggiatoa. Bits of decaying brown macroalgae as well as bits of decaying floccular macroalgae. Tubes in center to lower center.
1-21	A	5/23/2011	11:52:00	gravel, rocks	No	No	No	No	Yes	No	Yes-algae	0	-	No	No	97.07	64.29	0.62	Sand and gravel Algae on some rocks. Puple-pink anthozoans/soft coral on rocks. Rocks are angular. Encrusting epifaunal worms on some of the hard surfaces.
1-21	B	5/23/2011	11:52:56	gravel, rocks	No	No	No	No	Yes	No	Yes-algae	0	-	No	No	102.18	67.67	0.69	Gravel and rocks. Algae on some rocks. Possible sessile epifauna and worm tubes on rocks. Pink purple anthozoans/coralline algae. Small chiton in lower left.
1-21	D	5/23/2011	11:54:53	cobble	No	No	No	No	Yes	No	Yes-algae	0	-	No	No	72.63	48.11	0.35	Cobble. Encrustations of anthozoans/soft coral as well as several types of algae (Faucea, rhodymenia and gigartina). Limpets.
1-22	A	5/23/2011	11:58:19	sandy silt/clay	No	Yes	Yes	No	Yes	No	Yes-algae, shells	20	Stick and fibers	Trace	Trace	78.13	51.75	0.40	Sand w/ hard substrate (wood or rocks) on right. Red, green and brown algae. Shells. At least one small burrow (~0.5 cm in diameter). Algae and sessile epifauna on hard substrate- chiton, hermit crab, anemone, possible hydroids.
1-22	B	5/23/2011	11:59:49	Gravelly sand over rock	No	Yes	Yes	No	Yes	No	Yes-algae, shells	<1	Fibers	No	No	116.27	77.01	0.90	Gravelly sand and rock. Ledge/rock on right 1/3 of image, with epifauna growth. Bottom covered in shell fragments. Bits of green algae on surface.
1-22	D	5/23/2011	12:01:53	silt covered Log	No	No	No	No	Yes	No	Yes-phytodetritus	>90	Logs	No	No	74.15	49.11	0.36	Silt-covered log with longitudinal cracks; epifaunal bivalves and some decaying detritus/macroalgae.
1-24	B	5/25/2011	14:12:51	silt covered Log	No	No	No	No	Yes	No	Yes-algae, shell frag	>90	Logs	No	No	80.28	53.17	0.43	Sandy silt veneer w/ shell fragments over log that shows fracture planes. Two grooved pieces of wood. Green algae. Abundant ophiurids.
1-25	A	5/25/2011	14:01:11	Indeterminate	No	Indeterminate	Yes	Indeterminate	Indeterminate	No	Yes-wood, shell	10	Wood chips, possible fiber		Indeterminate	36.98	24.49	0.09	Blurry. A few wood fragments and several proteinaceous tubes. Only macrofeatures determinable.
1-26	A	5/23/2011	13:26:13	gravel	No	No	Yes	No	Yes	No	Yes-shells, algae	0	-	No	No	117.76	78.00	0.92	Detrital mantling over angular gravel. Epizoan worm and some anthozoans. Minor decaying macroalgae. Anthozoans
1-26	B	5/23/2011	13:30:06	gravel	No	Yes	Yes	No	Yes	No	Yes-algae, phytodetritus	0	-	No	No	104.00	68.88	0.72	Detrital mantling over gravel. Red and green algae as well as kelp fragments. Anthozoans on some gravels as well as epizoic encrusting worms. Small tubes of several types.
1-26	C	5/23/2011	13:31:00	coarse gravel/cobble	No	No	No	No	Yes	No	Yes-algae	0	-	No	No	129.95	86.07	1.12	Coarse angular gravel and cobble with ecrusting epizoans. Anthozoans/soft coral, chitons, encrusting worms, anenome. Minor detrital coating and several fragments of green and red algae.
1-27	A	5/23/2011	13:37:02	Indeterminate/silt?	No	Yes	Yes	No	Yes	No	No	Indeterminate	Indeterminate	Dense	Trace	67.01	44.38	0.30	Dense beggiatoa at SWI. Small shapes scattered on surface- one looks like it might be a tube structure or epifauna, other may be skeletal fragments. Some epizoic worms on surface.
1-27	C	5/23/2011	13:39:01	Indeterminate/silt?	No	No	No	No	Yes	No	No	Indeterminate	Indeterminate	Dense	Trace	70.63	46.78	0.33	Dense beggiatoa at SWI. Small shapes scattered on surface similar to rep A and may be skeletal fragments. Some epizoic worms on surface.
1-27	E	5/24/2011	10:29:42	silt/clay	No	No	Yes	No	No	No	No	Indeterminate	Indeterminate	Dense	Present	95.05	62.96	0.60	Beggiatoa and decaying macroalgae over silt. Bones, skeletal ray visible to left of frame. Recumbent tube outlines. High SOD. Small green algae fragments.
1-28	A	5/23/2011	13:44:17	silt/clay	No	Yes	Yes	No	No	No	Yes-wood fibers	20-30	Fibers and small chips	Dense	Trace	94.07	62.31	0.59	Organic silt with abundant small wood fibers and chips. Possible bone fragments or pectinarid tube at left. Decaying macroalgae and beggiatoa.
1-28	D	5/23/2011	13:47:02	silt/clay	No	Yes	Yes	No	No	No	Yes-alage, wood chip	30	Fibers and small chips	Dense	Present	96.34	63.81	0.61	Organic silt with abundant small wood fibers and chips. Possible bone fragments . Decaying macroalgae and beggiatoa. Some recumbent tubes at SWI. Similar to A.

Station	Rep	Date	Time	Sediment Type	Bedforms (presence)	Burrows (presence)	Tubes (presence)	Tracks (presence)	Epifauna	Mudclasts (presence)	Debris (presence)	Wood Debris Coverage (%)	Wood Debris Type	Beggiatoa (presence)	Fish Waste (presence)	Image Width (cm)	Image Height (cm)	Field of View Imaged (m^2)	Comment
1-28	E	5/24/2011	2:18:00	silt/clay	No	Yes	Yes	No	No	No	Yes-wood chips, algae	40-50	Fibers and small chips	Present	Trace	101.53	67.25	0.68	Organic silt with abundant small wood fibers and chips. Possible bone fragments . Decaying Macroalgae and beggiatoa patches. Minor shell fragments. Some recumbent tubes at SWI. Similar to A .
1-29	A	5/23/2011	13:50:40	silt/clay	No	No	Yes	Yes	Yes	No	Yes-?wood waste, algae	10 to 20	Fibers and small chips	Present	Trace	99.17	65.68	0.65	Organic silt/clay with wood fragments/fibers and some shell debris. Some small ophiurids, in fine sed patches. Bits of green algae. Some visible wood fibers, chips, and fish bones. Oxidized detrital mantling and some beggiatoa. Some tubes at SWI as well as a snail and a hermit crab.
1-29	D	5/23/2011	13:53:28	Gravel	No	No	Yes	No	Yes	No	Yes-algae, phytodetritus	1 to 3	Fibers	No	No	105.37	69.79	0.74	Angular gravel with detrital mantling. Anthozoans and epifaunal worms. Some spiochaetopterus tubes in interstital areas. Anenome. Some small wood fibers/fragments in detrital amntling.
1-29	E	5/24/2011	10:46:15	silt/clay	No	Yes	Yes	No	No	No	Yes-wood chips	40-50	Chips and fibers	Present	trace	47.51	31.47	0.15	Organic silt with abundant small wood chips and fibers. Beggiatoa at left and bottom of image, fish bones visible. High SOD. Elongate tubes that project well above sed surface at left. Some decaying detritus/macroalgae.
1-30	A	5/23/2011	13:56:33	silt/clay	No	Yes	Yes	No	Yes	No	Yes-algae, wood fibers and stick	20-30	Chips and fibers	Present	Present	83.96	55.61	0.47	Organic silt with abundant small wood chips and fibers; fin rays and skeletal fragments present. Patches of beggiatoa, high SOD. Stick with epizoans and tunicates at left. Some decaying detritus/macroalgae.
1-30	E	5/24/2011	10:53:39	silt/clay	No	Yes	Yes	No	No	No	Yes-wood chips, algae	20-30	Chips and fibers	Present	Trace	96.48	63.90	0.62	Organic silt with abundant small wood chips and fibers. Beggiatoa and fishe skeletal fragments. Some decaying detritus/macroalgae as well as intact green algae.
1-30	H	5/24/2011	10:56:41	sandy silt/clay	No	Yes	Yes	No	No	No	Yes-wood chips, algae, phytodetritus	50-60	Chips and fibers	Present	Trace	97.96	64.88	0.64	Entire surface covered w/ scattered wood fibers and chips. Beggiatoa patches exposed under surface layer. High SOD. Recumbent tube fragments at SWI. Green and brown algal fragments as well some decaying detritus/macroalgae. Three reps are similar in terms of surface wood chip/fiber types. Fish vertebrae in lower left.
1-31	A	5/24/2011	11:56:53	silt/clay	No	Yes	Yes	No	No	No	Yes-algae, wood waste	20	Chips and fibers	Present	Trace	95.76	63.43	0.61	Organic silt/clay with abundant small wood ships and fibers. Large patches of beggiatoa, Scattered green algae fragments and fish bones with a few small recumbent tube fragments at SWI.
1-32	A	5/24/2011	15:17:51	silt covered Log	No	Yes	Yes	Yes	Yes	No	Yes-shells, algae	>90	Logs	Present	No	131.41	87.04	1.14	Logs with anthozoans and Beggiatoa fibers;sediment inbetween with infaunal burrows and tubes. Metridium. Shell fragments and some intact red algae.
1-32	B	5/24/2011	15:18:59	silt/clay	No	No	Yes	Indeterminate	No	No	Yes-algae, wood waste	20	Small chips and fibers	Present	Trace	96.34	63.81	0.61	Organic sandy silt/clay with abundant wood fibers/small fragments. Possible fish skeletal material present as elongate tapered bone fragments/rays. Beggiatoa. Green algae fragments and some underlying structure at top of frame.
1-33	A	5/24/2011	15:25:27	sandy silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-algae	5	Small chips and fibers	Present	Trace	94.28	62.45	0.59	Sandy silt clay with dense tubes. Scattered small wood fragments and fibers. Patches of beggiatoa and scattered fish bone traces. Several fragments of green algae.
1-33	C	5/24/2011	15:27:23	sandy silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-algae	10	Small chips and fibers	Present	Trace	100.89	66.82	0.67	Sandy silt clay with dense tubes. Scattered small wood fragments and fibers. Patches of beggiatoa. Elongate chitonous/skeletal fragments scattered at SWI.
1-33	D	5/24/2011	15:28:20	sandy silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-algae, stick	5	Stick, fibers	Present	Trace	87.52	57.97	0.51	Tube covered sandy silt with fine wood fibers and stick in upper portion of frame. Skeletal fragment/fin rays in lower left. Dense tubes and large patches of beggiatoa at >50% cover. Green and brown algae. Three reps all have abundant tubes.
1-34	A	5/25/2011	9:05:11	sandy silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-algae, wood waste	5 to 10	Chips and fibers	Present	Trace	125.86	83.36	1.05	Sandy silt with abundant shell fragments. Two gunnels and patches of decaying macroalgal detritus; fish bones visible at SWI and Beggiatoa present.
1-35	E	5/25/2011	14:30:23	sandy silt/clay	No	Yes	Yes	No	No	Yes	Yes-wood fibers	5 to 10	Chips and fibers	Present	Trace	70.63	46.78	0.33	Sandy silt with wood fibers scattered across surface. Beggiatoa and fish bones present on surface.
1-35	SLOPE	5/25/2011	10:21:47	Fine sandy silt	No	Yes	Yes	No	Yes	No	Yes-leaves, wood waste	5 to 10	Chips and fibers	Present	Trace	98.11	64.98	0.64	Dense tubes in fine sandy silt. Several alder leaves and some wood fibers and chips on surface. Some algal fragments. Tail end of a fish (gunnel?) in upper right of frame. Several elongate skeletal fragments.
1-36	A	5/23/2011	14:13:10	silt/clay	No	No	Yes	No	No	No	Yes-algae	1 to 3	Fibers	Present	No	99.63	65.99	0.66	Floccular organic surface with patches of beggiatoa in upper portion of the frame. Abundant tubes. Several fragments of green algae. Appears fine grained. Small worms/organisms at SWI.
1-36	C	5/23/2011	14:15:13	silt/clay	No	No	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	85.30	56.50	0.48	Cover of decaying detritus/algae with several tubes projecting above. Beggiatoa at SWI and adhered to tubes.
1-36	D	5/23/2011	14:16:18	silt/clay	No	No	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	78.80	52.19	0.41	Detritus and decaying macroalgae at SWI along with beggiatoa.
1-37	B	5/23/2011	14:27:56	Indeterminate	No	No	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	83.74	55.47	0.46	Detritus and decaying macroalgae at SWI along with beggiatoa. Several small fragments of algae; tubes visible underneath detrital layer.
1-37	E	5/24/2011	11:19:37	Indeterminate	No	No	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	73.89	48.94	0.36	Detrital/macroalgal film at SWI that is decaying with beggiatoa. Fecal casing visible. A few small fragments of green algae.
1-38	A	5/23/2011	14:34:50	Indeterminate	No	No	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	84.52	55.98	0.47	Thick detrital/macroalgal veneer at SWI that obscures sediment surface. Some green algae. The detrital mantling is decaying with dense beggiatoa within detrital layer.
1-38	B	5/23/2011	14:35:58	silt/clay	No	No	Yes	No	No	No	Yes-algae, phytodetritus	Indeterminate	Indeterminate	Dense	Trace	88.43	58.57	0.52	Detrital/macroalgal veneer at SWI. Dense beggiatoa within decaying detritus. Sediment surface visible at right and appears to be silt/clay. Bone/fin ray at right.
1-38	E	5/24/2011	11:27:17	silt/clay	No	No	Yes	No	No	No	Yes-alage	1 to 3	Chips and fibers	Dense	No	102.83	68.11	0.70	Silt/clay with distinct detrital/magroalgal veneer at SWI. Recument tube. A few small wood fragments/chips at lower right. Detritus is decaying with beggiatoa within detrital film.
1-39	B	5/23/2011	14:42:48	fine sandy silt	No	Yes	Yes	No	No	No	Yes-wood waste, algae	20	Chips and fragments	Present	Present	84.41	55.91	0.47	Fine sandy silt with wood and bark fragments at SWI and some partial buried by sediment. A few tubes. Several skeletal fragments/fin rays. Fragments of green algae.
1-39	D	5/23/2011	14:44:47	fine sandy silt	No	Yes	Yes	No	No	No	Yes-wood chips, algae	10 to 15	Chips and fibers	Present	Present	75.10	49.74	0.37	Fine sandy silt with wood and bark fragments at SWI and some partial buried by sediment. A few tubes. Several skeletal fragments/fin rays. Fragments of green algae.
1-40	A	5/24/2011	13:03:39	fine sandy silt	No	Yes	Yes	No	No	No	Yes-algae, wood waste?	Indeterminate	Indeterminate	Present	Trace	89.85	59.51	0.53	Detrital veneer of silt/clay with a few tubes poking through veneer and burrow structure visible through film. Several bits of green algae. There may be wood fibers present but structure or outline of large particles not visible through veneer.
1-40	B	5/24/2011	13:04:34	silt/clay	No	No	Yes	No	Yes	No	Yes-algae, pipe	20	Chips, fibers and fragments	Present	Present	90.23	59.76	0.54	Silt/clay with decaying detritus/macroalgae that has localized beggiatoa. Pipe (outfall?) has thin detrtial mantling and epizoic growth. Small trash fragment or fish waste in upper right.
1-41	A	5/24/2011	15:10:47	Indeterminate	No	Yes	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	83.53	55.32	0.46	Detrital/macroalgal film at SWI that obscures sediment surface. The detritus/macroalgae is decaying with some localized beggiatoa mats.
1-42	A	5/24/2011	15:32:36	Indeterminate	No	No	Yes	Yes	Yes	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	99.17	65.68	0.65	Detrital/macroalgal film at SWI that obscures sediment surface. The detritus/macroalgae is decaying with some localized beggiatoa mats/patches. A few tubes poke through film and ophiuroid on film surface. Change in surface texture in upper right.
1-42	E	5/24/2011	15:59:32	Indeterminate	No	No	No	No	Yes	No	Yes-shells	0	-	No	No	104.34	69.11	0.72	High relief. Unclear as to what hard substratum is but there is a thin silt/detrital dusting. Metridium, tunicates, shell fragments. Unusual.
1-43	A	5/25/2011	9:36:04	silt/clay	No	No	No	No	No	No	No	Indeterminate	Indeterminate	Dense	Indeterminate	155.31	102.87	1.60	Silt/clay with thick detrital layer and large beggiatoa mats that obscure all other surface and near surface structure.
1-44	A	5/23/2011	14:52:26	fine sandy silt	No	Yes	Yes	Yes	No	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	78.61	52.06	0.41	Detrital/macroalgal veneer over sandy silt. Several small 0.4 cm burrows at left. Tube lower frame. Localized beggiatoa patches on decaying detrital veneer. Veneer obscures some fine surface structure.
1-44	D	5/23/2011	14:54:19	gravelly silty sand	No	No	Yes	Yes	No	No	Yes-algae	5	Small fragments and chips	No	No	54.20	35.90	0.19	Oxidized detrital mantling over fine gravelly sand. Several tubes at SWI and algae. Different from A.
1-45	C	5/23/2011	15:30:20	Indeterminate	No	Indeterminate	Yes	No	Indeterminate	No	Yes-phytodetritus	Indeterminate	Indeterminate	Present	Indeterminate	77.65	51.43	0.40	Detrital/macroalgal film at SWI that obscures sediment surface. The detritus/macroalgae is decaying with localized beggiatoa colonies.
1-46	A	5/23/2011	15:37:19	Indeterminate	No	Indeterminate	Yes	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Present	Indeterminate	80.79	53.51	0.43	Detrital/macroalgal film at SWI that obscures sediment surface. The detritus/macroalgae is decaying with localized beggiatoa colonies.
1-47	A	5/23/2011	15:46:46	Indeterminate	No	Yes	Yes	No	No	No	Yes-phytodetritus	>=5	Small fragments and chips	Present	Indeterminate	101.05	66.93	0.68	Detrital mantling with beggiatoa amalgamation throughout entire frame. Several tubes project above detritus/macroalgal film and some of the tubes have organism projecting out of tube. Wood chips/fragments at left though fine scaled features are obscured by decaying film. High SOD.

Station	Rep	Date	Time	Sediment Type	Bedforms (presence)	Burrows (presence)	Tubes (presence)	Tracks (presence)	Epifauna	Mudclasts (presence)	Debris (presence)	Wood Debris Coverage (%)	Wood Debris Type	Beggiatoa (presence)	Fish Waste (presence)	Image Width (cm)	Image Height (cm)	Field of View Imaged (m^2)	Comment
1-47	B	5/23/2011	15:47:58	Indeterminate	No	No	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	95.90	63.52	0.61	Detrital and beggiatoa surface that obscures sediment type and fine scaled structure although larger structure is faintly visible. Several worms on detritus layer surface.
1-47	D	5/23/2011	15:49:59	Indeterminate	No	Yes	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	91.13	60.36	0.55	Detrital and beggiatoa surface that obscures sediment type and fine scaled structure. Ophiuroid and some worms at SWI.
1-48	A	5/24/2011	13:11:57	fine sandy silt	No	Yes	Yes	No	No	No	Yes-algae, wood fibers	1 to 3	Fibers	Present	No	92.18	61.05	0.56	Fine sandy silt with some macrofloccular veneer that has localized beggiatoa. Small burrows and several tubes visible. Scattered green algae.
1-48	C	5/24/2011	13:15:50	fine sandy silt	No	Yes	Yes	No	Yes	No	Yes-alage	1 to 3	Fibers	Present	Trace	55.61	36.83	0.20	Fine sandy silt with some macrofloccular veneer that has localized beggiatoa. Small burrows and several tubes visible. Ophiuroids visible. Dense tubes in upper right. Scattered green algae fragments.
1-49	A	5/24/2011	15:01:22	silt/clay	No	No	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Trace	Trace	89.85	59.51	0.53	Macrofloccular layer over sediment surface with some small epifaunal worms at surface of flocc layer. A few fragments of green algae.
1-49	B	5/24/2011	15:02:21	silt/clay	No	No	Yes	Yes	No	No	Yes-algae	Indeterminate	Indeterminate	Trace	Indeterminate	88.61	58.69	0.52	Macrofloccular layer over sediment surface with epifaunal tracks in flocc layer (large one at lower right). A few fragments of green algae.
1-50	B	5/24/2011	15:51:35	silt/clay	No	No	Yes	No	No	No	Yes	0	-	Dense	Present	78.22	51.81	0.41	Organic silt with dense macrofloccular and beggiatoa cover in upper frame. Tube visible. Skeletal fragments/fine rays. High SOD. Exposed sediment appears very organic.
1-50	D	5/24/2011	15:53:34	silt/clay	No	No	No	No	No	No	No	Indeterminate	Indeterminate	Dense	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Beggiatoa-covered surface, entire image. Bits of phytoplankton detritus settled on top. Extreme organic loading. Sediment and structure obscured by beggiatoa.
1-51	A	5/25/2011	9:44:53	silt/clay	No	Indeterminate	Indeterminate	No	No	No	Indeterminate	Indeterminate	Indeterminate	Present	Indeterminate	157.79	104.51	1.65	Beggiatoa crust covering most of surface, patchy. Water column is slightly cloudy. Fine scaled structure and sediment type is obscured.
1-52	A	5/23/2011	15:58:23	silt/clay	No	No	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	78.90	52.26	0.41	Macrofloccular layer at SWI and there is small piece of wood/plant debris protruding through film at right. Ophiuroid. Localized beggiatoa in decaying flocc layer.
1-53	A	5/23/2011	16:07:22	silt/clay	No	Yes	Yes	No	No	No	No	Indeterminate	Indeterminate	Present	Indeterminate	83.53	55.32	0.46	Macrofloccular layer at SWI. Localized beggiatoa in decaying flocc layer. Fine structure is obscured.
1-54	A	5/23/2011	16:32:40	silt/clay	No	Indeterminate	Indeterminate	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	81.40	53.92	0.44	Beggiatoa-covered surface, entire image. Bits of green and brown algae on surface. Extreme organic loading. Fine structure obscured by beggiatoa.
1-54	B	5/23/2011	16:33:54	silt/clay	No	Indeterminate	Yes	No	Yes	No	Yes	5	Fibers	No	No	Indeterminate	Indeterminate	Indeterminate	Silt/clay with some wood fibers and tubes. Some floccs at sediment surface. Some hard surface present that is not visible.. White plumed anemone *Metridium Giganteum* , also blocks red laser.
1-54	D	5/23/2011	16:35:50	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	80.99	53.64	0.43	Beggiatoa-covered surface, entire image. Bits of green and brown algae on surface. Extreme organic loading. Fine structure obscured by beggiatoa.
1-55	A	5/24/2011	13:22:23	silt/clay	No	Indeterminate	Yes	No	No	No	No	Indeterminate	Indeterminate	Dense	Indeterminate	78.13	51.75	0.40	Beggiatoa-covered surface, entire image. Extreme organic loading. Fine structure obscured by beggiatoa.
1-55	B	5/24/2011	13:23:24	silt/clay	No	Indeterminate	Yes	No	No	No	No	Indeterminate	Indeterminate	Dense	Indeterminate	79.83	52.87	0.42	Beggiatoa-covered surface, entire image. Extreme organic loading. Fine structure obscured by beggiatoa.
1-56	A	5/24/2011	14:40:20	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-phytodetritus	3 to 5	Fibers	Present	No	81.30	53.85	0.44	Silt/clay with detrital/macrofloccular mantling.
1-57	B	5/23/2011	16:43:53	silt/clay	No	Indeterminate	Yes	No	No	Yes	Yes-phytodetritus, wood waste	3 to 5	Fibers	Present	No	83.74	55.47	0.46	Silt clay with macrofloccular/detrital layer that has localized beggiatoa. A few small wood fibers visible. Ophiuroid is faintly visible. Amagamated detrital/mudclasts present.
1-58	A	5/23/2011	16:50:57	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Present	Indeterminate	76.27	50.51	0.39	Macrofloccular layer at SWI. Localized beggiatoa in decaying flocc layer. Fine structure is obscured.
1-58	B	5/23/2011	16:52:37	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-alage	Indeterminate	Indeterminate	Present	Indeterminate	83.09	55.04	0.46	Macrofloccular layer at SWI. Localized beggiatoa in decaying flocc layer. Fine structure is obscured.
1-59	A	5/23/2011	17:00:59	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	82.66	54.75	0.45	Macrofloccular layer at SWI. Dense beggiatoa amalgamating decaying flocc layer. Fine structure is obscured.
1-59	C	5/23/2011	17:04:53	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Present	Indeterminate	84.52	55.98	0.47	Macrofloccular layer at SWI. Localized beggiatoa in decaying flocc layer. Fine structure is obscured. Fine tube protrudes through flocc layer in center of frame
1-60	A	5/23/2011	17:11:10	silt/clay	No	Indeterminate	Indeterminate	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	76.18	50.45	0.38	Macrofloccular layer at SWI. Dense beggiatoa amalgamating decaying flocc layer. Fine structure is obscured.
1-60	B	5/23/2011	17:12:35	silt/clay	No	Indeterminate	Indeterminate	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	72.02	47.70	0.34	Macrofloccular layer at SWI. Dense beggiatoa amalgamating decaying flocc layer. Fine structure is obscured. Flocc or suspended organic sediment over beggiatoa in right half of image.
1-60	D	5/23/2011	17:15:17	silt/clay	No	Indeterminate	Indeterminate	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	77.19	51.12	0.39	Macrofloccular layer at SWI. Dense beggiatoa amalgamating decaying flocc layer. Fine structure is obscured.
2-01	E	5/25/2011	14:19:02	silt/clay	No	No	Yes	Yes	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Present	Indeterminate	85.53	56.65	0.48	Macrofloccular/detrital layer over silt/clay. Some localized beggiatoa in decaying macrofloccular layer. Fine structure obscured.
2-01	F	5/25/2011	14:19:55	silt/clay	No	Indeterminate	Yes	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	86.46	57.26	0.50	Macrofloccular/detrital layer over silt/clay. Some localized beggiatoa in decaying macrofloccular layer. Fine structure obscured.
2-01	G	5/25/2011	14:20:47	silt/clay	No	No	Yes	No	No	No	Yes-alage	Indeterminate	Indeterminate	Present	Indeterminate	62.93	41.68	0.26	Macrofloccular/detrital layer over silt/clay. Some localized beggiatoa in decaying macrofloccular layer. Fine structure obscured.
2-02	C	5/25/2011	12:08:33	silt/clay	No	Yes	Yes	Indeterminate	No	No	Yes-wood chips	5	Chips	No	No	168.15	111.37	1.87	Silt/clay. Wood chips. Possible small burrows. Some settled fine phytodetritus at upper left. Turbid water with abundant amalgamated planktonic seston is water column. A few elongate tubes at SWI
2-03	A	5/25/2011	12:15:16	Indeterminate	No	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Yes-phytodetritus, kelp	Indeterminate	Indeterminate	Ind	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Abundant phytodetritus/planktonic seston in water colum. Jellyfish/ctenophore in upper center. Kelp/laminaria?/wood? Fragment in lower portion of frame. Although obscured by turbid water, morphology suggest algae.
2-04	C	5/25/2011	10:38:51	silt/clay	No	Indeterminate	Indeterminate	Indeterminate	No	No	No	Indeterminate	Indeterminate	Dense	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Dense beggiatoa at SWI. Fine structure obscured.
2-05																			no images w/ decent resolution
2-06	B	5/25/2011	10:46:42	silt/clay	No	Yes	Yes	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	No	No	155.87	103.24	1.61	Slightly turbid. Silt/clay. Left part of image obscured by suspended sed. Jellyfish. Couple small burrows. Some tubes and fecal castings visible at SWI. Fine structure is obscured.
2-07	B	5/25/2011	11:46:45	silt/clay	No	Yes	Yes	No	No	No	Yes-phytodetritus	5	Chips and fragments	No	No	164.90	109.22	1.80	Silt/clay with abundant small tubes and several burrows visible through slightly turbid water. Scattered small wood ships fragments at the SWI.
2-08	A	5/24/2011	16:08:15	silt/clay	No	Indeterminate	Yes	No	Yes	No	Yes-algae, phytodetritus, wood waste	Indeterminate	Indeterminate	Present	Indeterminate	84.18	55.76	0.47	Dense beggiatoa at SWI. Fine structure obscured. Several gastropods grazing on beggiatoa/macrofloccular/detrital layer.
2-08	D	5/24/2011	16:11:17	silt/clay	No	No	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	88.73	58.77	0.52	Dense beggiatoa at SWI. Fine structure obscured. Tube in lower center. A few shell/test fragments.
2-09	A	5/25/2011	9:53:48	silt/clay	No	No	Yes	No	No	No	Yes-phytodetritus, sticks	3 to 5	Sticks	Dense	Indeterminate	155.87	103.24	1.61	Beggiatoa-covered silt/clay, ~70% of image. Lots of fine and clumped phytodetritus. Sticks with detrtial mantling at SWI and they appear to be relatively recent deposition based on their retaining of dendritic structure.
2-09	B	5/25/2011	9:54:49	silt/clay	No	Indeterminate	Indeterminate	No	No	No	Yes-phytodetritus	Indeterminate	Indeterminate	Dense	Indeterminate	157.41	104.26	1.64	Dense beggiatoa at SWI. Fine structure obscured. Slightly turbid water column.
2-09	C	5/25/2011	9:55:54	silt/clay	No	No	Yes	No	Yes	No	Yes-phytodetritus, wood fragments	10	Small fragments and chips	Present	No	154.74	102.49	1.59	Macrofloccular material and seston with some of the macrofloccular material having localized beggiatoa. Crab in lower right. Scattered small wood fragments and chips thoughout frame, some suspended in water column from sampling activity.
2-10																			no images w/ decent resolution
2-11	D	5/25/2011	11:57:25	silt/clay	No	No	Yes	No	No	No	No	1 to 3	Fibers	No	No	161.78	107.15	1.73	Silt/clay with abundant small tubes and scattered wood fragments. Turbid overlying water from planktonic seston. Scattered red and green algae fragments.
2-12	A	5/24/2011	13:31:19	silt/clay	No	No	Yes	No	Yes	No	Yes-algae, wood fibers	1 to 3	Fibers	No	No	82.13	54.40	0.45	Macrofloccular/detritus layer of sediment surface with a couple of fine tubes protruding. Snails on surface of floccs. Several small wood fibers visible but fine structure at SWI is obscured by floccs and estimate is a minimum estimate of wood presence.
2-12	C	5/24/2011	13:33:46	silt/clay	No	No	Yes	No	Yes	No	Yes	1 to 3	Fibers	Present	Present	81.71	54.12	0.44	Organic silt clay with tubes and beggiatoa. Organically loaded. Appear to be several pearlescent skeletal fragments across SWI. Two jellyfish. Interesting photo.
2-12	D	5/24/2011	13:34:47	silt/clay	No	Indeterminate	Indeterminate	No	Yes	No	Yes-phytodetritus, wood fragments	1 to 3	Fibers	Present	Indeterminate	77.00	51.00	0.39	Silt/clay with macrofloccular veneer/detritus that obscures fine scaled features at the SWI. Small crab/crustacean in upper left.

Station	Rep	Date	Time	Sediment Type	Bedforms (presence)	Burrows (presence)	Tubes (presence)	Tracks (presence)	Epifauna	Mudclasts (presence)	Debris (presence)	Wood Debris Coverage (%)	Wood Debris Type	Beggiatoa (presence)	Fish Waste (presence)	Image Width (cm)	Image Height (cm)	Field of View Imaged (m^2)	Comment
2-13	A	5/24/2011	14:30:23	silt/clay	No	Yes	Yes	No	No	Indeterminate	Yes-phytodetritus, wood fragments	3 to 5	Stick and fibers	No	No	78.51	52.00	0.41	Silt/clay with detritus/macrofloccular mantling. Tubes visible and a few burrows in upper right.
2-13	B	5/24/2011	14:31:28	silt/clay	No	Yes	Yes	Yes	No	No	Yes-algae	3 to 5	Fibers	No	No	81.04	53.68	0.44	Silt/clay with detritus/macrofloccular mantling. Tubes visible and a few burrows. Epifaunal tracks/furrows at SWI and scattered algal fragments.
2-14	A	5/24/2011	16:16:47	silt/clay	No	No	Yes	Yes	Yes	No	Yes-phytodetritus	Indeterminate	Indeterminate	Present	Indeterminate	83.09	55.04	0.46	Macrofloccular/detrital layer over silt/clay. Some localized beggiatoa in decaying macrofloccular layer. Fine structure obscured. A couple of tubes protruding from floccs. Abundant gastropods on flocc layer. The tube-like structure in the center is round and also shares morphologic characteristics with a fish vertebrae fragment.
2-15	C	5/25/2011	10:05:17	sandy silt/clay	No	Yes	Yes	No	Yes	No	Yes-algae, wood fibers/chips	10	Fibers and small fragments	No	No	161.37	106.88	1.72	Sandy silt/clay with abundant planktonic seston/detritus in the water column. Elongate fish. Scattered small wood fibers/fragments at SWI and some green algae. Turbid water obscures fine grained features.
2-16																			no images w/ decent resolution
2-17	A	5/23/2011	17:21:36	silt/clay	No	Indeterminate	Indeterminate	Indeterminate	Yes	No	Yes-algae	Indeterminate	Indeterminate	Dense	Indeterminate	76.95	50.97	0.39	Dense beggiatoa at SWI. Fine structure obscured. Tube in lower center. A few shell/test fragments. Nudibranch at right.
2-18	A	5/24/2011	13:41:49	silt/clay	No	Yes	Yes	Yes	No	No	Yes	Indeterminate	Indeterminate	No	Indeterminate	83.63	55.39	0.46	Silt/clay with macrofloccular/detrital layer at SWI that obscures much fine structure at the SWI. Several tubes protruding through floccs. Tracks in lower frame.
2-19	A	5/24/2011	14:21:27	silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-phytodetritus	1 to 3	Small fibers	No	No	80.74	53.47	0.43	Silt/clay with some phytodetritus/thin macrofloccs. Some burrows (up to ~1 cm in diameter). Small tracks near a burrow. Several small tubes. Small fragments of macroalgae. Gastropods.
2-19	D	5/24/2011	14:24:34	silt/clay	No	No	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Trace	Indeterminate	79.98	52.97	0.42	Silt/clay with macrofloccular/detrital layer at SWI that obscures much fine structure at the SWI. Several tubes protruding through floccs. Localized beggiatoa patches. Gastropods.
2-20	A	5/24/2011	16:25:51	silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-wood fibers	10 to 20	Small fibers	Present	No	90.49	59.93	0.54	Silt/clay with thin veneer of macrofloccular detritis. A few tubes and burows visible as well as several small gastropods. Small wood fiber at the limit of visiblilty evenly distributed across frame.
2-20	C	5/24/2011	16:28:17	silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-wood fibers	30	Fibers and small fragments	Present	Present	86.46	57.26	0.50	Silt clay with evenly distributed small wood fibers,chips, & fish bones throughout frame. Several tubes. Some macrofloccular detritus that is starting to decay. Small flounder (11.4 cm in length) at middle right.
2-21	A	5/24/2011	14:02:49	silt/clay	No	Yes	Yes	No	Yes	No	Yes-algae	Indeterminate	Indeterminate	Trace	Indeterminate	82.77	54.82	0.45	Silt/clay with macrofloccular veneer/detritus that obscures fine scaled features at the SWI. A few small burrows, gastropod in right/center. A few algal fragments/clumps at SWI.
2-21	B	5/24/2011	14:03:47	silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-algae	1 to 3	Small fibers	Present	No	80.58	53.37	0.43	Silt/clay with some phytodetritus/thin macrofloccs. Some burrows (up to ~1 cm in diameter). Tracks near a burrow. Several small tubes. Small fragments of macroalgae. Small gastropods.
2-22	A	5/24/2011	14:12:06	silt/clay	No	No	Yes	Yes	Yes	No	Yes-phytodetritus	Indeterminate	Indeterminate	No	Indeterminate	79.48	52.65	0.42	Silt/clay with macrofloccular veneer/detritus that obscures fine scaled features at the SWI. A few small tubes and several gastrops on the surface of the macrofloccular layer.
2-22	C	5/24/2011	14:14:08	silt/clay	No	Yes	Yes	No	Yes	No	Yes-phytodetritus	1 to 3	Small fibers	Trace	No	81.04	53.68	0.44	Silt/clay with thin veneer of macrofloccular detritis. A few tubes and burows visible as well as several small gastropods. Sparse small wood fibers.
2-23	A	5/24/2011	16:47:07	silt/clay	No	Yes	Yes	Yes	Yes	No	No	1 to 3	Small fibers	No	No	83.58	55.36	0.46	Silt/clay with thin veneer of macrofloccular detritis. A few tubes and burows (0.6cm) visible. Sparse small wood fibers. Small gastropods in upper right.
2-23	B	5/24/2011	16:48:10	silt/clay	No	Yes	Yes	Yes	Yes	No	Yes	1 to 3	Small fibers	Trace	Present	84.57	56.02	0.47	Silt/caly with several tubes and some beggiatoa. Organically lodaed. There appear to be several bones/fin rays at the SWI. Very different than previous rep.
01	A	5/24/2011	16:56:04	silt/clay	No	Yes	Yes	Yes	Yes	No	No	1 to 3	Small fragments and chips	No	No	62.32	41.28	0.26	Silt/clay with heavy epifaunal tracking. Tubes and burrows and wood/stick fragment in lower center.
01	B	5/24/2011	16:57:09	silt/clay	No	Yes	Yes	Yes	Yes	No	Yes-algae	1 to 3	Small fragments and chips	No	No	94.70	62.72	0.59	Silt/clay with burrows and tracks. Bark/wood fragments. Small sculpin.
01	D	5/24/2011	17:01:41	silt/clay	No	Yes	Yes	Yes	No	No	No	1	Small fragments and chips	Trace	No	83.91	55.58	0.47	Silt/clay with heavy epifaunal tracking. Tubes and burrows sparse small wood fragments/fibers. Three reps are similar
02	A	5/24/2011	17:08:12	Bones	No	No	Yes	No	No	No	Yes-skeletal fragments	0	-	Present	100% Cover	91.85	60.83	0.56	Fish waste/bones across entire image, beggiatoa, high SOD. Range of skeletal fragment in waste.
02	C	5/24/2011	17:10:31	sandy silt/clay	No	No	Yes	No	No	No	Yes-wood fibers and chips	40	Chips, fibers and fragments	Present	50% cover	90.74	60.10	0.55	wood fragments and chips and abundant fish wase skeletal material. Organically loaded. Beggiatoa. Nice pic.
02	D	5/24/2011	17:11:45	sandy silt/clay	No	No	Yes	No	No	No	Yes-wood waste	20	Chips, fibers and fragments	Present	70%cover	91.65	60.70	0.56	wood fragments and chips and abundant fish wase skeletal material. Organically loaded. Beggiatoa. Nice pic.
03	E	5/25/2011	15:27:36	silt/clay	No	No	Yes	No	No	No	Yes-algae	Indeterminate	Indeterminate	Dense	Present	93.05	61.63	0.57	Dense beggiatoa at Swi that obscures fine features. Some fine skeletal material visible.
03	G	5/25/2011	15:29:43	sandy silt/clay	No	No	Yes	Yes	No	No	Yes-wood chips	25	large chips	trace	Present	94.07	62.31	0.59	Silty fine sand. Some wood chips on surface and a few skeletals rays. Shell fragments.
03	H	5/25/2011	15:30:42	sandy silt/clay	No	No	Yes	Yes	No	No	Yes-wood fibers	10	Chips, fibers and fragments	Present	Present	96.77	64.10	0.62	Silt/clay with sand fraction. Slightly turbid water. Several elongate wood fragments and few skeletal fragments.
04	C	5/25/2011	14:53:01	sandy silt/clay	No	No	Yes	No	Yes	No	No	1	Small fragments and chips	Trace	Trace	91.52	60.62	0.55	Sandy silt clay with dense assemblage of epizoan suspension feeders (anenomes, bryazoans). A few skeletal fragments at SWI-- trace).
04	E	5/25/2011	15:31:38	sandy silt/clay	No	No	Yes	No	Yes	No	Yes	1	Small fragments and chips	Trace	Trace	94.07	62.31	0.59	Sandy silt/clay with scattered small fibers. Scattered skeletal fragments and a sediment mantled bivalve shell.
04	H	5/25/2011	15:34:57	sandy silt/clay	No	No	Yes	No	Yes	No	Yes-wood chips	20	Chips	Trace	Trace	94.91	62.86	0.60	Sandy silt/clay with sediment mantled woodchips. Trace skeletal fragments

Appendix D:

Porewater, Sediment, and Tissue Results

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	Station	1-05	1-14	1-18	1-56
	Sample ID	CSA010	CSA008	CSA009	CSA005
	Date	22MAY2011	22MAY2011	22MAY2011	22MAY2011
	Sample Depth (m)	35.8	9.1	12.8	57.8
Porewater/Sediment Physical Parameters					
Total Organic Carbon (%)		21.3	28.6	36	21.7
Solids (%)		16.2	21.1	20.1	16
Total Ammonia (mg L^{-1})		1.2	1.15	1.7	0.85
Total Sulfides (mg L^{-1})		0.2	0.3	0.45	0.05
Sediment Dioxin and Furans (pg g^{-1} dry weight)					
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)		1.44	1.41	0.839	0.958
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)		0.896	2.15	1.04	0.814
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		1.11	2.63	5	0.97
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		4.07	15.6	6.09	3.18
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)		3.2	7.54	3.53	2.5
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)		65.3	311	137	44.4
Octachlorodibenzo-p-dioxin (OCDD)		522	2490	1250	328
2,3,7,8-Tetrachlorodibenzofuran (TCDF)		23.2	19.1	16.3	12.3
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)		1.34	1.43	0.798	0.806
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)		1.33	1.29	0.83	0.734
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)		1.94	3.71	1.88	1.85
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)		0.91	1.87	0.881	0.564
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)		< 0.0891	< 0.25	< 0.125	< 0.244
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)		0.859	1.33	0.623	0.514
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)		8.13	33.3	14.9	6.25
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)		< 0.207	2.29	1.2	0.801
Octachlorodibenzofuran (OCDF)		32.3	157	75.8	26.1
Dioxin TEQ (WHO 2005)		7.209	13.451	7.523	4.838
Tissue Dioxin and Furans (pg g^{-1} wet weight)					
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)		< 0.123	< 0.102	< 0.0899	< 0.104
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)		< 0.121	< 0.101	< 0.0855	< 0.0957
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		< 0.0803	< 0.0999	< 0.0953	< 0.0714
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		< 0.0996	< 0.123	< 0.12	< 0.0882
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)		< 0.0864	< 0.107	< 0.104	< 0.0766
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)		0.288	0.247	0.273	< 0.0825
Octachlorodibenzo-p-dioxin (OCDD)		1.13	1.23	1.18	0.554
2,3,7,8-Tetrachlorodibenzofuran (TCDF)		0.378	0.254	0.388	< 0.108
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)		< 0.0951	< 0.104	< 0.0985	< 0.079
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)		< 0.0883	< 0.0921	< 0.0876	< 0.0747
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.0526	< 0.0671	< 0.0569	< 0.0773
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.0494	< 0.0629	< 0.0553	< 0.0739
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)		< 0.0666	< 0.0771	< 0.0731	< 0.0945
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.0554	< 0.0688	< 0.0611	< 0.0827
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)		< 0.0839	< 0.0833	< 0.0631	< 0.0704
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)		< 0.103	< 0.097	< 0.0738	< 0.0798
Octachlorodibenzofuran (OCDF)		< 0.109	< 0.123	< 0.119	< 0.126
Dioxin TEQ (WHO 2005)		0.203	0.176	0.173	0.147

	Station	1-58	2-03	2-05	2-09
	Sample ID	CSA007	CSA001	CSA002	CSA004
	Date	22MAY2011	22MAY2011	22MAY2011	22MAY2011
	Sample Depth (m)	56.1	61.45	60.4	58.5
Porewater/Sediment Physical Parameters					
Total Organic Carbon (%)		16.9	6.99	16.8	24.9
Solids (%)		22.4	28.4	19.1	16.7
Total Ammonia (mg L^{-1})		0.4	0.3	0.45	1.8
Total Sulfides (mg L^{-1})		0.1	<0.05	<0.05	2.35
Sediment Dioxin and Furans (pg g^{-1} dry weight)					
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)		0.663	< 0.0968	0.966	1.25
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)		0.481	< 0.125	0.842	0.732
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		0.715	< 0.111	1.2	1.15
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		2.36	0.603	5	3.93
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)		1.69	0.456	3.04	3.22
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)		37.8	10.9	84.3	79.1
Octachlorodibenzo-p-dioxin (OCDD)		313	83.2	662	624
2,3,7,8-Tetrachlorodibenzofuran (TCDF)		7.79	2.64	19.4	15.5
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)		0.493	< 0.103	1.14	1.05
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)		0.548	0.184	1.12	1.14
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)		1.1	0.326	1.88	1.88
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)		0.345	< 0.0869	0.586	0.726
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)		< 0.167	< 0.0987	< 0.168	< 0.157
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.159	< 0.0862	0.37	0.774
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)		4.86	1.34	10.9	10.9
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)		0.378	< 0.125	0.902	0.921
Octachlorodibenzofuran (OCDF)		22.8	6.11	56.4	45
Dioxin TEQ (WHO 2005)		3.271	0.659	6.511	6.195
Tissue Dioxin and Furans (pg g^{-1} wet weight)					
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)		< 0.101	< 0.128	< 0.113	< 0.0958
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)		< 0.0815	< 0.138	< 0.108	< 0.0584
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		< 0.062	< 0.111	< 0.101	< 0.0645
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)		< 0.077	< 0.141	< 0.128	< 0.0799
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)		< 0.0668	< 0.121	< 0.11	< 0.0694
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)		0.196	0.426	0.275	0.208
Octachlorodibenzo-p-dioxin (OCDD)		1.14	1.82	1.45	0.572
2,3,7,8-Tetrachlorodibenzofuran (TCDF)		0.16	0.505	< 0.145	< 0.103
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)		< 0.0772	< 0.112	< 0.11	< 0.0775
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)		< 0.071	< 0.102	< 0.102	< 0.0714
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.0449	< 0.0764	< 0.0679	< 0.0449
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.0422	< 0.0719	< 0.0647	< 0.0426
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)		< 0.0602	< 0.0936	< 0.0844	< 0.0545
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)		< 0.0495	< 0.0802	< 0.0732	< 0.0484
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)		< 0.0484	< 0.0793	< 0.0722	< 0.0564
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)		< 0.0575	< 0.0925	< 0.0829	< 0.0632
Octachlorodibenzofuran (OCDF)		0.0949	< 0.14	< 0.164	< 0.112
Dioxin TEQ (WHO 2005)		0.142	0.241	0.17	0.117

Station	2-10	2-18	R-01	R-02
Sample ID	CSA003	CSA006	CSA015	CSA014
Date	22MAY2011	22MAY2011	22MAY2011	22MAY2011
Sample Depth (m)	59.6	60	20.7	37.9
Porewater/Sediment Physical Parameters				
Total Organic Carbon (%)	26.9	19.3	1.55	3.6
Solids (%)	17.1	19.8	46.6	30.4
Total Ammonia (mg L^{-1})	0.45	0.45	0.1	0.75
Total Sulfides (mg L^{-1})	<0.05	<0.05	<0.05	<0.05
Sediment Dioxin and Furans (pg g^{-1} dry weight)				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.885	1.39	< 0.0628	< 0.0931
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.79	1.09	< 0.0857	< 0.161
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.667	1.27	< 0.0834	< 0.0872
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	4.68	5.84	0.628	0.932
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	2.23	3.45	0.336	< 0.0931
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	113	114	13.5	20.6
Octachlorodibenzo-p-dioxin (OCDD)	1560	1310	111	163
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	14.4	17.3	< 0.0591	0.524
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.908	1.28	< 0.0698	< 0.0944
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	1.23	1.31	< 0.0689	< 0.0954
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	2.13	1.83	< 0.0595	0.427
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.693	0.745	< 0.0591	< 0.0957
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	< 0.312	< 0.171	< 0.0693	< 0.115
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.308	0.967	< 0.0628	0.207
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	10.5	13.9	2.31	3.36
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.89	1.15	0.217	< 0.197
Octachlorodibenzofuran (OCDF)	34.3	77.6	8.37	9.95
Dioxin TEQ (WHO 2005)	6.304	7.77	0.398	0.664
Tissue Dioxin and Furans (pg g^{-1} wet weight)				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	< 0.0895	< 0.122	< 0.15	< 0.0916
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	< 0.0791	< 0.0907	< 0.08	< 0.0691
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	< 0.0682	< 0.0515	< 0.0597	< 0.0512
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	< 0.0862	< 0.0645	< 0.0742	< 0.0652
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	< 0.0741	< 0.0558	< 0.0643	< 0.0558
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.273	< 0.0783	0.159	0.236
Octachlorodibenzo-p-dioxin (OCDD)	1.28	0.548	0.759	0.949
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.363	< 0.134	< 0.13	< 0.12
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	< 0.0864	< 0.0793	< 0.0887	< 0.0668
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	< 0.0819	< 0.0759	< 0.0785	< 0.0596
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.0669	< 0.062	< 0.0523	< 0.0442
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.0641	< 0.0587	< 0.0489	< 0.0418
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	< 0.0818	< 0.0745	< 0.0697	< 0.0539
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.0714	< 0.0673	< 0.0549	< 0.0476
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	< 0.0771	< 0.0513	0.0675	< 0.0474
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	< 0.0861	< 0.0601	< 0.0734	< 0.0555
Octachlorodibenzofuran (OCDF)	< 0.132	< 0.135	< 0.0917	< 0.059
Dioxin TEQ (WHO 2005)	0.164	0.148	0.159	0.117

Station	R-03	R-04	R-05	Lab Control
Sample ID	CSA012	CSA011	CSA013	Lab Control
Date	22MAY2011	22MAY2011	22MAY2011	29July2011
Sample Depth (m)	47.4	31.3	28	NA
Porewater/Sediment Physical Parameters				
Total Organic Carbon (%)	6.37	2.29	0.92	
Solids (%)	27.4	43.5	57.8	
Total Ammonia (mg L^{-1})	0.2	0.45	0.35	
Total Sulfides (mg L^{-1})	<0.05	<0.05	0.025	
Sediment Dioxin and Furans (pg g^{-1} dry weight)				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	< 0.106	< 0.0402	< 0.0577	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	< 0.126	< 0.0469	< 0.0723	
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.325	0.277	< 0.056	
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	1.83	1.49	0.47	
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	1.3	0.952	0.171	
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	40.8	30.5	20.9	
Octachlorodibenzo-p-dioxin (OCDD)	327	253	267	
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.907	0.544	< 0.0746	
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	< 0.0868	< 0.0628	< 0.0473	
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.328	< 0.0674	< 0.0487	
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.63	0.392	0.199	
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.184	0.199	0.113	
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	< 0.207	< 0.151	< 0.0643	
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.503	0.327	< 0.06	
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	7.46	4.48	2.03	
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.384	0.328	< 0.102	
Octachlorodibenzofuran (OCDF)	28.9	13.8	11.8	
Dioxin TEQ (WHO 2005)	1.343	0.896	0.495	
Tissue Dioxin and Furans (pg g^{-1} wet weight)				
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	< 0.103	< 0.108	< 0.145	< 0.0765
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	< 0.105	< 0.0843	< 0.111	< 0.0746
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	< 0.0665	< 0.071	< 0.0852	< 0.06
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	< 0.0829	< 0.0905	< 0.109	< 0.0738
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	< 0.0717	< 0.0775	< 0.093	< 0.0642
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.283	0.377	0.326	0.121
Octachlorodibenzo-p-dioxin (OCDD)	0.833	1.77	1.74	1.1
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.259	< 0.134	< 0.149	0.204
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	< 0.0988	< 0.0779	< 0.101	< 0.0912
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	< 0.0899	< 0.0721	< 0.093	< 0.0853
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.053	< 0.0502	< 0.076	< 0.0386
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.0508	< 0.0475	< 0.0715	< 0.0368
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	< 0.0658	< 0.0607	< 0.0965	< 0.0487
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	< 0.0548	< 0.0524	< 0.0803	< 0.0409
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	< 0.0545	0.102	0.143	0.102
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	< 0.0642	< 0.0789	< 0.102	< 0.0558
Octachlorodibenzofuran (OCDF)	0.205	0.17	0.237	< 0.102
Dioxin TEQ (WHO 2005)	0.171	0.143	0.187	0.131