APPENDIX C

Water Quality/Total Suspended Solids Survey Methods and Results

ACRONYMS

ADCP – Acoustic Doppler Current Profiler

ANOVA - Analysis of Variance

BMP - Best Management Practice

CY – Cubic Yards

DGPS – Differential Global Positioning System

ERDC – Engineer Research and Development Center

FLEAS - Fish Larval Exposure Assessment System

ft/s – Feet per Second

FTU – Formazin Turbidity Units

***g* –** g force

HARS – Historic Area Remediation Site

HDP – NY and NJ Harbor Deepening Project

m/s – Meters per Second

MLW – Mean Low Water

NBSA – Newark Bay Study Area

NFT/TSS – Near Field Turbidity/Total Suspended Solids

NJDEP – New Jersey Department of Environmental Protection

NOAA – National Oceanic and Atmospheric Administration

NTU – Nephelometric Turbidity Units

OBS – Optical Back Scatter

SEC – South Elizabeth Channel

TSS – Total Suspended Solid

USACE – United States Army Corps of Engineers

WQC – Water Quality Certificate

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1.0 Methods

Turbidity and total suspended solid (TSS) water quality monitoring as described below was conducted using a 25-ft research vessel both before and during normal dredging operation of the Delaware Bay in South Elizabeth Channel within the S-NB-2 Contract Area during the removal of non-HARS fine-grained sediment and was consistent with monitoring methodologies used previously by USACE within Newark Bay (USACE 2007a, USACE 2007b, USACE 2008, USACE 2009 and USACE 2010).

1.1 Technical Approach

The pilot study was developed to meet the requirements outlined in the Stipulation and Order to monitor the effectiveness of a silt curtain at limiting the transport of dredging induced re-suspended sediment and to evaluate the feasibility of the curtain's use in future HDP dredging within the NBSA.

To meet this objective, a comprehensive field study was developed that included five survey events as described below. See Figure 2-1 for a timeline of the silt curtain installation and concurrent monitoring events. During each survey event, data was collected during flood and ebb tidal stages and included the following basic components:

1. Mobile surveys using a vessel-mounted Acoustic Doppler Current Profiler (ADCP) to measure acoustic backscatter and hydrodynamic conditions (current velocity).
2. Measurement of turbidity using optical backscatter sensors (OBS)
3. Collection of discrete water samples for the gravimetric analysis of TSS concentrations and laboratory measurement of turbidity.
4. Sediment sample collection for the laboratory analysis of sediment grain size distribution, bulk density, and Atterberg Limits.

SURVEY #1: AMBIENT CONDITIONS PRIOR TO SILT CURTAIN INSTALLATION

Prior to the installation of the silt curtain, turbidity and TSS monitoring was conducted during a two-day period (June 12 – June 13, 2011) when no active dredging was occurring in the project area so as to ascertain ambient or background conditions.

SURVEY #2: DREDGE PLUME CHARACTERIZATION PRIOR TO SILT CURTAIN INSTALLATION

Prior to the installation of the silt curtain, turbidity and TSS monitoring was conducted during a two-day period (June 14 – June 15, 2011) when active dredging of non-HARS fine-grained sediment was occurring in the project area using the Dredge Delaware Bay equipped with the Cable Arm environmental bucket.

SURVEY #3: SILT CURTAIN INSTALLATION

Turbidity and TSS monitoring was conducted during the silt curtain installation on June 16 and 17 to measure the sediment re-suspension that would result from the silt curtain installation. Dredging was not conducted within the project area during sit curtain installation.

SURVEY #4: DREDGE PLUME CHARACTERIZATION WITH SILT CURTAIN DEPLOYED

Turbidity and TSS monitoring was conducted while the silt curtain was deployed during periods of active dredging from June 18 to June 22, 2011 to measure dredge-induced plumes and the effectiveness of the curtain at limiting the transport of dredge induced resuspended sediment.

SURVEY #5: SILT CURTAIN REMOVAL

Turbidity and TSS monitoring was conducted during the silt curtain removal on June 24, 2011 to measure the sediment re-suspension that would result from the silt curtain removal.

1.2 Mobile ADCP Surveys

A vessel-mounted Teledyne RD Instruments 600-kHz Workhorse Monitor Series ADCP was used to conduct mobile transects and collect acoustic backscatter data throughout the course of the study. WinRiver software was used for real-time display of acoustic signatures and data recording on board the vessel. The real-time display was used to determine the boundaries of the suspended sediment plume and to determine the three dimensional spatial scales of the plume during different tidal and silt curtain installation stages.

ADCP transects were conducted both up-current and down-current of the operating dredge and the silt curtain installation. These consisted of parallel transects, approximately perpendicular to the longitudinal axis of the plume and were designed to encompass the entire “footprint” of the plume’s acoustic signature, i.e., detection against ambient backscatter. The number of survey transects and the distances between transects were optimized to provide maximum resolution of plume boundaries and internal backscatter gradients. The length of each transect was determined by the onsite bathymetry, the position of the dredge, location of the curtain (if applicable), current, and measured ADCP backscatter.

Current data collected by the ADCP was used to determine the plume duration at a particular location. Replicate ADCP transects at specific distances from the dredge were also used to estimate the amount of sediment released into the water column. A greater number of replicate transects were conducted closer to the dredge and the number was decreased as distance from the dredge increased.

The real-time backscatter data collected with the ADCP was then correlated into estimates of TSS concentrations using the gravimetric water samples and the Sediview methodology and software described below.

1.3 Fixed Buoy Turbidity Stations

Campbell Scientific, Inc. OBS-3A optical backscatter sensors were deployed at several predetermined locations inside and outside of the plume, and on both sides of the silt curtain in order to record turbidity at fixed locations over the course of the survey. Each fixed buoy and anchor assembly consisted of single or multiple OBS units tethered to a taut line set at a predetermined depth based on the depth at the given station. The number of OBS units on each array was also determined by the station depth. In shallow waters, for example, one OBS unit at mid-depth was used, in deeper waters two or more units were equally spaced along the length of the array. Up to 10 OBS units were deployed at any one time.

The OBS units used in this survey were pre-calibrated by the manufacturer against known turbidity standards and were programmed to measure turbidities in the 0-1,000 Nephelometric Turbidity Unit (NTU) range. During the study, the OBS units were set to record water temperature (°C), depth (meters), salinity (ppt), and turbidity (NTU) at fixed intervals sufficient to maximize capability to examine temporal variation in plume concentration gradients attributable to the repetitive pulsed nature of the components of the mechanical dredge "bucket" cycle or installation/removal of the silt curtain. Readings were logged internally every 10 seconds and the data retrieved from the units at the end of each daily survey.

1.4 Discrete Water Sample Collection

To characterize ambient and within-plume TSS concentrations throughout the water column and to correlate these concentrations with ADCP and OBS measurements, discrete water samples were collected throughout the survey to directly measure TSS (mg/l) and turbidity (NTU) in the laboratory. The water samples were collected from the survey vessel using an onboard pump sampler equipped with a Campbell Scientific, Inc. OBS-3A optical backscatter sensor hardwired directly to an onboard laptop. The OBS unit provided real-time depth, temperature, salinity and turbidity values of the entire water profile.

At each sample location, optical and acoustic backscatter (OBS and ADCP) were measured concurrently with collection of the water samples. Water samples were collected at locations determined onsite and based on real time ADCP backscatter data and OBS turbidity data to encompass the entire range of ambient and within-plume concentrations throughout the water column. All the water samples collected in the field were later processed in the laboratory by Test America Laboratories, Inc. for optical turbidity (Method SM 2130-B) and for the gravimetric analysis of the TSS concentration (Method SM 2540-D). The laboratory results provided a robust data set that was then used to convert the raw ADCP backscatter measurements into estimates of TSS concentration using the Sediview methodology and software described below.

1.5 Sediment Sampling

During each survey day (except where noted), sediment grab samples were collected from the dredge barge and the sediment bed within the survey area. Dredge barge samples were collected by the dredge operators and *in situ* sediments from the dredge field were collected using a ponar grab sampler. The sediment samples were analyzed in the laboratory by Test America Laboratories, Inc. for sediment grain size distribution (ASTM D-422 Method), density (ASTM D-2937 Method), and Atterberg Limits (ASTM D-4318). Additional *in situ* sediments were collected within the study area for later use in cross-calibrating the OBS units in this study (see below).

1.6 ADCP Calibration

Following the field data collection effort, the raw acoustic backscatter measurements collected by the ADCP were converted to estimates of suspended sediment concentration using Sediview Software provided by Dredging Research, Ltd. The Sediview Method (Land and Bray 2000) derives estimates of suspended solids concentration in each ADCP data bin by converting relative backscatter intensity to TSS concentration. This process requires collecting a calibration data set consisting of discrete water samples (see above) and concurrently recorded ADCP acoustic backscatter data. The degree of confidence that can be placed in the estimates of TSS is proportional to the strength of the calibration data set. The quality of the calibration is in turn dependent on the collection of adequate water samples to represent sediments in suspension at all depths in the water column and across the entire gradient of concentrations occurring in ambient as well as plume conditions.

Samples were collected at known locations within the water column, so that individual gravimetric samples could be directly compared with acoustic estimates of TSS concentration for a “bin” of water as close to the water sample as possible. Following the Sediview calibration, the results were then applied to all of the ADCP files recorded during each of the pilot study surveys, resulting in an ADCP-derived estimate of TSS concentration for each recorded ADCP bin. Note, because of the continuously changing ambient conditions present in estuaries, it is important to collect water samples frequently and it is often necessary to perform multiple calibrations specific to the time period where the ADCP data were collected. It is also important to collect enough samples to constitute a statistically robust sample size as it is occasionally necessary for some samples to be excluded from the calibration (i.e. sampler disturbs bottom sediment or air bubbles).

1.7 OBS Calibration

All OBS units used in the study were cross-calibrated after the survey using sediments collected within the study area (see above) and by placing the units in a Fish Larval Exposure Assessment System (FLEAS), an apparatus designed to determine exposure tolerances of larval fishes to suspended sediments. Sediment collected from the site was used to create suspensions measured individually by each OBS Unit. The system injected sediment into a holding tank until the mixture reached a specified turbidity or TSS concentration. Each OBS sensor was tested in multiple solutions of increasing TSS concentration. FLEAS maintained a stable turbidity/TSS concentration for each test and each OBS unit placed in the sediment mixture measured turbidity for two minutes. After completion of measurements by all sensors, a 500 ml water sample was collected for gravimetric analysis to determine total suspended solids (TSS in mg/l). The turbidity/TSS concentration of the suspension was then increased and the measurement process repeated. Total suspended solids obtained from gravimetric analysis and mean turbidity (NTU) measured during testing of each OBS sensor were compared by regression to obtain a TSS-NTU relationship equation. To determine variation among measurements between individual sensors, mean turbidity readings were also subjected to one-way Analysis of Variance (ANOVA) tests.

2.0 Results

A general summary of monitoring events can be found in Table 3-1.

2.1 Sediment Analysis

2.1.1 In Situ Sediment Samples

A total of 12 *in situ* sediment samples were collected by ponar grab from the South Elizabeth Channel (SEC) from 12- 24 June 2011. Each sample was analyzed for percent solids, density, liquid limit, plastic limit and plasticity index, as well as grain size distribution. Percent solids ranged from 35.3 to 46.1% (mean = 38.9%). In place density as determined by the Drive Cylinder Method ranged from 0.449 to 0.638 g/cc (mean = 0.502 g/cc). Plastic limits were low, ranging from 27 to 36 (mean = 33.6), indicative of sediment with high silt content (62.6 – 75.7%). After silt, the second largest fraction of each sediment sample was clay, which accounted for 14.7 to 34.4% (mean = 21.9%) of the total grain size distribution. Sand accounted for 2.9 to 20.3% (mean = 9%) of the grain size distribution. By far this consisted mostly of fine sand (range = 2.9-19.7%, mean = 8.4%). In all but one sample (#15704-2 at 1.2%), medium sand accounted for less than 1% of the grain size distribution (range = 0-0.8%). Only four of the twelve samples taken from the SEC had coarse sand, which accounted for less than 0.5% of the total distribution (range = 0.1-0.5%). Gravel was not found in any of the twelve sediment samples taken from the SEC (Table 3-2).

One additional *in situ* sediment sample was collected on the north and south sides of the deployed silt curtain location. On the north side of the silt curtain, percent solids totaled 45.6%, whereas south of the curtain percent solids was 65.7%. In place density was considerably higher for the sample south of the curtain at 1.2 g/cc when compared to the sample (0.673 g/cc) taken north of the curtain. Both the north (12.4%) and the south (13.2%) samples had similar clay fractions. They differed however in terms of silt content, which varied from 41.3% (south sample) to 61.5% (north sample). The sand fraction also differed from north (23.5%) to south (43.8%). Fine sand accounted for the majority of the sand grain size distribution at 18.8% (north sample) and 41.3% (south sample). The north sample also had somewhat higher gravel content at 2.6% when compared to the south sample at 0.7%.

2.1.2 Dredge Barge

A total of nine sediment samples were taken from the dredge barge from 14-21 June 2011. Percent solids were greater for sediment samples taken from the barge (range = 40.4-65.7%, mean = 52.9%) when compared to the average (38.9%) of the *in situ* samples. In place density was also greater for the barge samples at 0.764 g/cc when compared to the *in situ* samples (0.502

g/cc). Plastic limits were low, ranging from 21 to 29 indicative of samples with high silt content. The silt fraction of the samples taken from the dredge barge ranged from 42.3 to 80.5% (mean = 61.7%), or slightly more than 7% lower than the *in situ* samples. Likewise the clay fraction was also slightly more than 7% lower when compared to the *in situ* samples. Samples taken from the barge had a much higher sand content, which ranged from 1.8 to 43.8 % (mean = 22.6%), or nearly 14% higher when compared to *in situ* samples. Similar to all samples taken during the study, the majority of the sand fell within the fine sand grain size category. Gravel (mean = 1%) was also found in the samples taken from the barge, whereas no *in situ* sample taken from the SEC channel contained gravel (Table 3-2).

2.2 WATER SAMPLING AND ADCP CALIBRATION

2.2.1 Ambient Water Samples

Ambient turbidity was measured both in the field and in the lab. In the field, ambient turbidity was determined using an OBS-3A turbidity sensor mounted on the water sampler. One hundred water samples were collected, 50 during the ebbing tide and 50 during the flooding tide on 13 June 2011. Turbidity for the corresponding water sample was determined by laboratory analysis. Ambient turbidity measured in the field during the ebbing tide ranged from 3.9 to 9.3 NTU (mean = 5.4 SD $\pm$1.3 NTU). Corresponding turbidities obtained from laboratory analyses ranged from 3.6 to 8.8 NTU (mean = 5.1, SD $\pm$1.1 NTU). During the flooding tide, turbidities measured in the field ranged from 5.2 to 25.4 NTU (mean = 15.1, SD $\pm$6.3 NTU). Highest turbidity values were associated with peak flow conditions. Laboratory-determined turbidities were comparable to the field values, ranging from 4.4 to 24.8 NTU (mean = 15.8, SD $\pm$6.8 NTU).

2.2.2 Dredge Plume Samples

Water samples were collected to characterize total suspended solids (TSS) concentration gradients within the dredge plume. A total of 236 within-plume water samples were taken during the silt curtain performance study. Of these, 53 were collected during an ebbing tide with TSS concentrations ranging from 14.5 to 119 mg/l (mean = 30.6 mg/l, SD $\pm$20.2). Corresponding turbidities ranged from 5.1 to 49 NTU (mean = 10.1 NTU, SD $\pm$7.9). The remainder (n = 233) were collected during a flooding tide with concentrations ranging from 19.5 to 151 mg/l (mean = 55.8 mg/l, SD $\pm$26.6). Corresponding turbidities ranged from 3.9 to 58.3 NTU (mean = 16.9 NTU, SD $\pm$11.3).

2.2.3 ADCP Calibration

Water sample data characterizing ambient and within-plume suspended sediment concentrations were also used for calibration of the raw ADCP acoustic backscatter data for conversion to total suspended solids (TSS in mg/l). Conversion of acoustic backscatter data to estimates of TSS concentration required application of the calibration procedure described by Land and Bray (2000) and detailed in the methods above. The quality of the calibration is dependent on the collection of adequate water samples of sediments in suspension representative of the span of depths and distances from the source across the plume gradient as well as in ambient portions of the water column. The calibration data set consisted of a total of 336 water samples. In Figures 3-1 and 3-2 the populations of gravimetric and acoustic concentration measurements are compared in both “linked” and “unlinked” order. Linked order follows the actual time-series in which the data were obtained, maintaning pairs of synoptic acoustic and gravimetric measurements. Unlinked order plots both parameters in order of increasing absolute value, thereby portraying the relationship across the entire population of data points. The observed relationship between gravimetric and acoustic measures had a high degree of correspondence. Acoustic estimates tended to be slightly higher than gravimetric estimates in the 30 to 45 mg/l range (Figure 3-2).

Among the 336 water samples collected for gravimetric analysis concentrations ranged from 9 to 151 mg/l (mean = 47.8 mg/l, SD $\pm$26.6). Corresponding turbidities for *in situ* measuremnets ranged from 3.9 to 58.3 NTU (mean = 16.9 NTU, SD $\pm$11.3). The regression between field measurements of turbidity and gravimetrically determined TSS concentrations is given in Figure 3-3. Some scatter is present in the data as indicated by the R^2 value of 0.657. Samples above 40 mg/l were subject to the greatest degree of scatter. Some scatter can be accounted for by entrained air bubbles that may create some degree of noise in the acoustic data near the source.

2.3 Survey #1: Ambient Conditions Prior to Silt Curtain Installation

2.3.1 Turbidity

Six OBS-3A turbidity sensors were deployed on 12 June from 0805 hrs to 1536 hrs at four locations; 3 stations over the South Elizabeth flats and one in the navigation channel near Channel Marker #7, as depicted in Figure 3-4. Results from 3 OBS sensors (#119, #121 and #478) deployed on 12 June over the SEC flats indicated that ambient turbidities ranged from 2.0 to 12.8 NTU (mean= 6.2 NTU) during an ebbing tide. Corresponding ambient turbidities increased slightly during the flooding tide (range = 2.4 to 26.4 NTU). Average ambient turbidity for the survey was 9 NTU. Turbidities measured in 10 second intervals during both ebb and flood tides are presented in Figure 3-5. All monitoring stations over the SEC flats had sensor depths of slightly less than 2 m.

Three additional sensors (#350, #252 and #122) measured ambient turbidities in the navigation channel near the entrance to the SEC (northeast corner of project site). During the ebbing tide, turbidities ranged from 3.2 to 13.3 NTU, similar to values measured over the flats. Highest average ambient turbidity during the ebb tide monitoring period was 6.9 NTU. Slightly higher ambient turbidities were recorded at the lower sensor (10.7 m) when compared to the upper (3.3 m) and mid-water (7.7 m) sensors. During the flooding tide, turbidities ranged from 3.2 to 25.8 NTU. It should be noted that turbidity sensors were not deployed during the entire flooding tide phase as was the case during the ebbing tide. Figure 3-5 shows ambient turbidity values during the early stages of the flood tide to be similar to those of the ebbing tide. However, as current flow increased, turbidity values increased. This trend was observed at all sensors deployed in the navigation channel and over the flats.

Turbidity sensors were re-deployed at the same locations as above on 13 June 2011 from 1130 hrs to 1623 hrs as depicted in Figure 3-6. Monitoring occurred for only the last two hours of the ebbing tide. Ambient turbidities were similar to that from the previous day ranging from 2.6 to 9.4 NTU over the flats and 4.8-10.3 NTU in the navigation channel. Consistent with results of 12 June, turbidities increased slightly during the flooding tide. Average turbidities increased by as much as 3 NTU at sensors deployed over the flats from ebb to flood tidal cycles. Figure 3-7 shows peak turbidities exceeding 20 NTU occurring during maximum flow conditions. Flooding current velocities peaked at 1600 hrs on 13 June at 0.67 m/sec in the main channel of Newark Bay. Turbidities are summarized by sensor depth, deployment location and date of deployment in Table 3-3.

2.3.2 Acoustic estimates of TSS concentration during an ebbing tide

Mobile ADCP plume survey SCAA was conducted from approximately 0928 hrs to 1116 hours on 12 June 2011. Peak ebb current velocities occurred at 1013 hrs in the South Reach of Newark Bay. Background TSS concentrations were obtained at three primary locations: the South Elizabeth Channel, the SEC flats and the main navigation channel of Newark Bay. Figure 3-4 shows a plan view of 20 ADCP transects for the survey completed during an ebbing tide. Note that the primary focus was on the immediate vicinity of the SEC and nearby flats, and not all transects occupied within the main channel are shown on Figure 3-4. Depth-averaged TSS concentration and current velocity data are summarized in Table 3- 4. Example vertical profiles of ambient TSS and navigation tracks with depth-averaged current vectors can be found in Figure 3-8.

Transects SCAA1-4 were occupied in the SEC channel running in an east-west direction. Depth-averaged TSS concentrations were similar along all four SEC transects, averaging 30 mg/l. Near-bottom (lowest 3 m), depth-averaged concentrations ranged from 30 to 35 mg/l. Individual ADCP bins with low concentrations (approximately 12 mg/l) occurred in the upper water column, whereas highest single bin concentrations (approaching 50 mg/l) were largely confined to the lower 3 m of the water column. Within the SEC, TSS concentrations increased as depth increased as exemplified by vertical profile SCAA1, given in Figure 8. Depth-averaged current velocities within the SEC were relatively low ranging from 0.08 to 0.14 m/sec. A stratified flow was present with surface vectors having a westerly component while bottom vectors were oriented to the east.

Vertical profiles SCAA5 and SCAA6 (Figure 8) describe ambient TSS concentrations over the SEC flats. Transect SCAA5 ran in a southeasterly direction along the 18 foot bottom depth contour parallel to the long axis of the SEC. TSS concentrations were consistently less than 20 mg/l at water depths of greater than 5 m. TSS concentrations between 20 and 32 mg/l were limited to the lower 2-m of the water column. Transect SCAA6 ran in a south-southeasterly direction from Channel Marker #1 to Channel Marker #7, covering a portion of both the 18 foot bottom contour and the main channel of Newark Bay. TSS concentrations less than 25 mg/l were found at water depths less than 12.3 m. Maximum TSS concentrations approached 47.3 mg/l. Depth-averaged current velocity for this profile was 0.38 m/sec. Primary flow direction was to the southwest. Transect SCAA7 (Figure 8) ran in a south-southwesterly direction from Channel Marker #7 to Channel Marker #5. This profile was similar to those from the SEC in which TSS concentrations increased with water depth. Three “bands” (TSS of < 20 mg/l, < 30 mg/l and < 40 mg/l) are clearly visible on vertical profile SCAA7. Current velocities increased to 0.43 m/sec. Dominant flow direction was to the southwest.

Transect SCAA17 (Figure 8) was run in northerly direction across the main channel of Newark Bay. TSS concentrations increased with increasing water depth in “bands” throughout the study area. TSS concentrations ranged from 10 mg/l in the upper 0.5 m of the water column to 45 mg/l along a portion of the channel bottom. One notable difference was an area of higher TSS concentration (peak = 58.1 mg/l) along the northern shoal. Current velocity averaged 0.46 m/sec with uniform vectors oriented to the southwest.

2.3.3 Acoustic estimates of TSS concentration during a flooding tide

Mobile ADCP plume survey SCAB was conducted during the first half of a flooding tide from approximately1419 hrs to 1628 hours on 12 June 2011. Peak flood conditions occurred at 1600 hrs in the South Reach of Newark Bay. The entire survey consisted of 21 transects, however Transects SCAB5-SCAB7 were excluded due to their proximity to an active dredging operation not associated with the silt curtain study. A plan view of ADCP transects for this survey can be found in Figure 6. Note that several of the upstream transects (SCAB1-SCAB7) crossing the Newark Bay main channel are not shown in Figure 6. Depth-averaged TSS concentration and current velocity data are summarized in Table 5. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 9. Transects SCAB8-SCAB10 ran in a northeasterly direction across the long-axis of the SEC. A representative vertical profile of TSS concentrations for the SEC can be found in Figure 9 (Transect SCAB8). TSS concentrations typically averaged less than 20 mg/l from the surface to within 2-m of the channel bottom. Near-bottom concentrations were slightly higher (21.5 to 28.3 mg/l). Peak ambient concentration in the SEC was 48.2 mg/l. Within the SEC depth-averaged current velocities ranged from 0.12 to 0.16 m/sec. Dominant current direction was to the northeast. Current velocity profiles for some transects did show westerly vectors near the port bulkhead. Higher flow velocities generally occurred on the southern side of the SEC.

Transect SCAB11 ran in a southeasterly direction parallel to the long axis of the SEC along the 18-foot contour, terminating at Channel Marker #1. Transect SCAB12 ran in a southwesterly direction from SEC Channel Marker #1 to Channel Marker #7, and SCAB 13 ran in a southwesterly direction from Channel Marker #7 to Channel Marker #5. TSS concentrations were lowest along Transect SCAB11, averaging slightly less than 20 mg/l the upper water column and 23 mg/l near the bottom. At completion of Transect SCAB11, current velocity had increased to 0.22 m/sec. Vertical Profile SCAB12 (Figure 9) shows TSS concentrations exceeding 30 mg/l near the bottom along the 18-ft depth contour. Current velocities at this point in the survey had increased to 0.40 m/sec. Highest ambient TSS concentrations (see right side of vertical profile SCAB13, Figure 9) occurred on the southern end of the Transect, which terminated just outside of the Newark Bay navigation channel. TSS in excess of 100 mg/l occurred at water depths greater than 9 m. The highest single bin TSS concentration value was 344.7 mg/l.

Transects SCAB14 through SCAB16 ran in the reverse directions of the previous three across the SEC flats, generally north-northwesterly (357^{o}) from Channel Marker #5, terminating midway between Berths 96 and 98. Background TSS concentrations ranged from 36.8 mg/l near the surface to 45.3 mg/l near the bottom over the SEC flats, west of Channel Marker #5. An area of higher TSS concentrations (32.1-97.6 mg/l) was found on Transect SCAB16 (Figure 9), which was run in a northwesterly direction across the flats parallel to the SEC channel. Dominant current direction was to the west-northwest with a depth-averaged velocity of 0.38 m/sec.

Transects SCAB17 through SCAB19 ran in a southeasterly direction, reversing the direction of SCAB14 through16, starting midway between Berths 96 and 98 and terminating at Channel Marker #5. Transect SCAB17 was occupied over the northeast corner of the SEC flats. Current velocities peaked at 0.67 m/sec in the northwesterly flow. Background TSS concentrations approached 70 mg/l in the lower water column. Two additional transects (SCAB20 and SCAB21, Figure 9) were occupied across the main navigation channel. Peak TSS concentrations approached 150 mg/l along the eastern shoal of the main channel. The deep half of the main navigation channel had TSS concentrations exceeding 70 mg/l (SCAB21, Figure 9). Current vectors on the west side of the channel were oriented to the northeast at velocities ranging from 0.75 to 0.85 m/sec. Current velocity decreased from west to east across the channel. On the east side of the channel, near Channel Marker #5, current velocity was considerably slower at 0.27 m/sec with current vectors at the terminal end of the transect oriented to the southeast.

2.4 Survey #2: Dredging Plume Characterization Prior to Silt Curtain Installation

2.4.1 Turbidity

Flood Tide Deployment: Turbidity sensors were deployed from approximately 1520 hrs to 1730 hrs during active dredging prior to silt curtain installation during a flooding tide on 14 June 2011. Three stations with single turbidity sensors (#119, #121 and #478) were located over the SEC flats. Deployment depths were slightly less than 2 m. Two additional stations were established down-current from the dredge to measure near- and far-field turbidities in the dredge plume, while one station was placed sufficiently far upstream to record ambient conditions. OBS locations during the flooding tide are presented in Figure 10. Measurements collected at the three SEC flats stations are presented in Figure 11. During the early phase of the tidal cycle, turbidities were less than 10 NTU, but peaked at 25 NTU during peak flow conditions. Average turbidities at these three sensors ranged from 9 to 11.5 NTU. Results were very consistent with those obtained on 12 June during monitoring of ambient conditions during a flooding tide prior to the start of dredging activities.

OBS sensors #126 and #180 were deployed at a distance of 150 m up-current from the dredge at depths of 4.9m and 10.1m respectively. The deeper sensor (#180, grey line, Figure 11) did not show any indication of turbidities exceeding ambient conditions during the monitoring period. Turbidities ranged from 5.6 to 25.7 NTU (mean = 11.8 NTU). This result was expected because the station was located on the up-current (non-plume) side of the dredging operation. However, the lower sensor did record short-pulses of increased turbidities, averaged 19 NTU (range = 5.6 to 46.9 NTU), which exceeded background conditions by as much as 10 NTU. The near-field array had three sensors, deployed 135 m down-current from the dredging operation. Sensor depths were 3.3 m (#350), 7.8 m (#351), and 10.4 m (#122), respectively. Near-field turbidities exceeded ambient by as much as 10 NTU at the mid-water sensor and by 15 NTU at the deepest sensor. The far-field array had two sensors at water depths of 4.7 m (#477) and 10.4 m (# 120), positioned 245 m down-current from the dredge. The deep (10.4 m) turbidity sensor (yellow data line, Figure 12) recorded only two brief episodes during which turbidities exceeded background conditions by a much as 5 NTU. These observations occurred late in the monitoring session under near-peak flow conditions. Overall averages in turbidity at the far-field sensors did not differ from averages obtained during ambient monitoring. Turbidity data are summarized in Table 3.

Ebb Tide Deployment: Turbidity sensors were redeployed from 0900 hrs to 1430 hrs during active dredging operations on 15 June 2011 prior to silt curtain installation following the same protocol used the preceding day. OBS station locations are presented in Figure 13. Results for the three SEC flats stations as well as the array moored up-current from the dredge are presented in Figure 14. Depths for OBS units deployed on the SEC flats were all less than 2 m. In approximately 5.5 hours of monitoring covering almost the entire ebb tidal cycle, only one OBS sensor (#121, deployed 300 m from the dredge) on the SEC flats had turbidities that exceeded background levels (light blue line, Figure 14). At this sensor, turbidities ranged from 4.3 to 19.3 NTU. Peak turbidity exceeded ambient turbidity by 6.5 NTU during one brief time period. However, the overall mean (mean = 5.7 NTU) for 15 June did not differ from the overall averages (4.1 to 6.2 NTU) of measurements at the three sensors deployed over two days of ambient data collection (12-13 June) during ebb tides.

OBS sensors #126 and #180 were deployed 130 m up-current on the non-plume side of the dredge at depths of 4.8 m and 10.2 m respectively. Results are presented in Figure 14. Turbidities at the upper sensor (#126) did not exceed background levels during the monitoring period. At the lower sensor (#180), peak turbidities exceeded ambient by 7.5 NTU for approximately 30 minutes at the start of monitoring. This increase in turbidity was attributed to a tug working near the port bulkhead at the entrance to the SEC (Berth 94). The lower sensor did not exceed background after this single event. Three near-field turbidity sensors were deployed 135 m downcurrent of the dredge. Turbidity readings from the upper sensor (#350), deployed at a depth of 3.3 m, did not exceed background levels. However, Sensor #351, deployed at a depth of 7.7 m, recorded peak turbidities of 45.6 NTU or 32.8 NTU above background. These peak events were infrequent and short-lived in that the overall average (mean = 6.5 NTU) was similar when compared to background turbidity (mean = 6.0 NTU) obtained from the same sensor during an ebbing tide on 13 June. Turbidity frequently exceeded background levels at the deep sensor

(#122), deployed at a depth of 10.6 m. Turbidities exceeding ambient by at least 10 NTU were common throughout the monitoring event (Figure 15). Using a peak ambient value of 13.3 NTU obtained on 12 June as a basis for comparison, peak turbidity (64.8 NTU) exceeded ambient by 51.5 NTU at the lower sensor.

2.4.2 ADCP Plume Characterization, Ebb Tide Surveys

A mobile ADCP plume survey was conducted from 1016 hrs to 1149 hrs on 14 June 2011 during an ebbing tide with peak ebb occurring at 1107 hrs at the South Reach, Newark Bay. The entire survey consisted of 15 transects. A plan view layout of transects can be found in Figure 13. Depth-averaged TSS concentrations and current velocity data are summarized in Table 6. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 16. Seven transects were occupied up-current from the dredge. These included: Transect SCPA1, which ran in a southeasterly direction 222 m up-current from the dredge from the corner bulkhead of the SEC and terminated midway along the main navigation channel; Transect SCPA2, which ran in a northwesterly direction from midway along the main channel to Channel Marker #1; Transect SCPA3 continued from the previous transect's terminus to Channel Marker # 1 in a northwesterly direction down the long axis of the SEC channel; Transect SCPA4 which ran in a southeasterly direction down the 18 ft depth contour parallel to the long-axis of the SEC; Transect SCPA5 began at Channel Marker #1, passed the port side of the dredge on the 18 ft depth contour and terminated near Channel Marker #5; and Transects SCPA6 and SCPA7, which ran in the opposite direction from Channel Marker #5, northwesterly along the 11 ft depth contour (SEC flats) to well inside the SEC channel. All up-current transects (SCPA1-7) had TSS concentrations which corresponded closely to background conditions observed during ambient surveys completed during an ebbing tide on 12 June. Vertical profiles SCPA1-7(Figure 16) show typical TSS concentrations of 10 to 15 mg/l in the upper half of the water column, whereas TSS concentrations of 15 to 30 mg/l were common in the lower half of the water column. Only Transect SCPA5 had somewhat elevated depth-averaged TSS concentrations between 30 mg/l and 40 mg/l (peak = 57.1 mg/l) at water depths greater than 9 m.

Eight parallel transects (SCPA8-15) were occupied down-current from the dredge in the general direction of plume movement at distances ranging from 72 m to 665 m. Transect SCPA8 (Figure 16) shows a well-defined plume signature 72 m down-current from the dredge, with a peak TSS concentration of 210 mg/l (160 mg/l above background) in a narrow core extending from mid-water depths (7 m) to the channel bottom (14 m). Lower water column concentrations approaching 150 mg/l (100 mg/l above background) predominated. Some acoustic backscatter observed near the source in the upper 5 m of the water column may be attributable to air entrainment caused by the repeated entrance and exit of the bucket from the water. Prevailing current velocity was 0.43 m/sec in a primarily southwesterly direction. Transect SCPA9 ran in an east-southeasterly direction, 147 m down-current from the dredge where the plume was in close proximity to the channel slide slope. The central core of the plume with the highest TSS concentrations (> 125 mg/l) occurred at water depths exceeding 10 m. A larger plume area with TSS concentrations above 100 mg/l but less than 135 mg/l was evident in a swath approximately 50 m wide extending from mid-water depth (7 m) to the channel bottom. A small area of entrained air remained in the upper 2 m of the water column. Over the next four transects (SCPA10-13, Figure 16), which extended nearly 500 m down-current from the dredge the plume came into contact with the channel side slope. Highest TSS concentrations (70 to 100 mg/l) were found in the lower 4 m of the water column. These TSS concentrations exceeded ambient by 20 to 50 mg/l. Depth-averaged current velocities peaked at 0.50 m/sec on Transect SCPA12. Current vectors were oriented in a southwesterly direction. A faint plume signature can be seen 573 m down-current from the dredge on vertical profile SCPA14 (Figure 16), with a maximum TSS concentration of 68.4 mg/l or less than 20 mg/l above background. At 800 m down-current from the dredge the plume signature became indistinguishable from background conditions (Figure 16, left side of vertical profile SCPA15 along the channel side slope). This profile does show an increase in TSS above background on the opposite side of the channel, which was associated with a concurrent dredging operation working in the main navigation channel as part of the Harbor Deeping Project. A residual plume created by passage of a deep-draft container ship was also apparent. During Survey SCPA, completed during an ebbing tide, there was no evidence of dredge plume excursion over the SEC flats.

A second mobile ADCP plume survey (Survey SCPF) was conducted between1228 hrs and 1326 hrs on 15 June 2011 during an ebbing tide. Peak ebb occurred at 1201 hrs in the South Reach of Newark Bay. The entire survey consisted of 10 transects. A plan view layout of transects can be found in Figure 17. Depth averaged TSS concentrations and current velocity data are summarized in Table 7. Vertical profiles of plume TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 18. Transects SCPF1 and SCPF2 were occupied up-current (non-plume side) from the dredge. TSS concentrations mirrored ambient profiles taken on 12 June. Transect SCPF3 depicts the plume signature 167 m down-current from the dredge. The core of the plume consisted of TSS concentrations between 75 and 100 mg/l (maximum = 101.4 mg/l), which exceeded ambient by 50 mg/l. Plume width was typically less than 100 m. Similar to the previous survey completed during an ebbing tide, the trajectory of elevated suspended sediment associated with the plume followed the channel side slope downstream. A slight increase in TSS concentration can be seen in vertical profiles SCPF5 and SCPF6 along the 11 ft depth contour. With the exception of vertical profile SCPF9, elevated TSS concentrations were not detected at water depths associated the SEC flats (Figure 18). The main body of the plume was confined to the middle and lower portions of the water column at distances beyond 300 m down-current from the dredge. At 580 m down-current (Transect SCPF9, Figure 18), higher TSS concentrations were only found in the lower 2-m of the water column along the toe of the side slope. Maximum TSS concentration was 59.4 mg/l or less than 10 mg/l above background. At 700 m down-current, TSS concentrations (<49.0 mg/l) approximated background conditions.

2.4.3 ADCP Plume Characterization, Flood Tide Survey

A mobile ADCP plume survey was conducted between 1536 and 1633 hrs on 14 June 2011 during a flooding tide. Peak flood occurred at 1651 hrs in the South Reach of Newark Bay. The entire survey consisted of 8 transects. A plan view layout of these transects is given in Figure 10. Depth-averaged TSS concentrations and current velocity data are summarized in Table 8. Transect SCPB1 ran from east to west at a distance of 81 m up-current from the dredge. For all reported transect distances from the dredge, subtract 15 m to estimate distance to the bucket itself. Transect SCPB2 ran from west to east at a distance of 125 m up-current from the dredge. Both vertical profiles show ambient conditions across the SEC flats and an area of higher TSS concentrations largely confined to the channel side slope (Figure 19). This area of increased TSS concentration was not associated with the dredging process, but rather was typical of sediment resuspension in the main channel during the flooding tide. Transect SCPB3 ran to the northeast parallel to the port side of the dredge from the SEC flats across both the 11 ft and 18 ft depth contours, and terminated at the entrance to the SEC. TSS concentrations were well within background conditions, i.e. less than 20 mg/l from the surface to mid-water depths (7m) and less than 35 mg/l from mid-water to the bottom. Transect SCPB4 (Figure 19) ran in a southeasterly direction and detected a well-defined plume 10 m astern of the dredge. Plume trajectory tended away from the SEC flats, moving towards the centerline of the main navigation channel. TSS concentrations as high as 237 mg/l (approximately 187 mg/l above background) were found in the central core of the plume in the lower water column. Plume width generally did not exceed 100 m at its widest point. Some air entrainment was evident in the upper water column; therefore values exceeding 150 mg/l from surface to mid-water are probably overestimated. At 171 m from the bucket (Transect SCPB5, Figure 19), the plume had diminished to a mid- to lower water column feature with a maximum TSS concentration of 85 mg/l, or approximately 35 mg/l above background. In the upper 4 m of the water column TSS concentrations were at background levels. At 262 m, the plume was confined to the lower 3-m of the water column. TSS concentrations still exceed 75 mg/l or approximately 25 mg/l above background. Transects SCPB7 and SCPB8 were occupied 325 m and 393 m down-current from the dredge. Vertical profiles show bottom TSS concentrations exceeding 75 mg/l along both transects. Depth-averaged current velocities approached 0.5 m/sec. In contrast to the ambient sediment resupension signature in the main channel during a flooding tide, the plume generated by the dredging process was almost indistinguishable against background except in very close proximity to the dredge.

2.5 Survey #3: Silt Curtain Installation

2.5.1 Turbidity

Three OBS turbidity sensors were deployed over the SEC flats from 0630 hrs to 1430 hrs. Sensor locations are shown on Figure 20. Turbidities were generally below 20 NTU during the flooding tide with the exception of two spikes of less than 5 minutes duration each in which turbidity ranged as high as 30 mg/l. These spikes in turbidity were not associated with the silt curtain deployment because prevailing flow direction would carry resuspended sediment away from the monitoring sites. These turbidity readings were well within background levels. During approximately 5.5 hrs of monitoring during an ebbing tide, turbidities exceeded 10 NTU only once (OBS #478, yellow data line, Figure 21). Given the short duration of this spike, this event is most likely associated with boat traffic passing near the sensor. The overwhelming majority of turbidity measurements were at or below 5 NTU for all three sensors, typical of background levels.

2.5.2 ADCP Sediment Re-suspension Survey

A mobile ADCP plume survey was conducted between 0929 and 1324 hrs on 16 June 2011 during an ebbing tide. Peak ebb occurred at 1254 hrs in the South Reach of Newark Bay. The survey consisted of 6 transects. A plan view layout of transects is given in Figure 20. Depth-averaged TSS concentrations and current velocity data are summarized in Table 9. Example vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 22. Only transects occupied during an ebbing tide are presented in this section because any sediment resupended during the installation of the silt curtain would not be transported in the direction of the SEC flats. Transect SCPL36 ran in a northwesterly direction from Channel Marker 7 and terminated inside the SEC. This transect was occupied on the up-current side of the silt curtain, whereas ensuing transects were on the down-current side. TSS concentrations ranged from 10 to 20 mg/l across the SEC flats. TSS concentrations did not exceed 20 mg/l at depths less than 6 m on any transect. This indicated that any sediment resuspended during silt curtain deployment was not sufficient to reach the nearby flats (See Transects SCPL36-41, Figure 22). Vertical profile SCPL38 does show two small areas with slightly elevated TSS concentrations, however field notes indicated that these areas were influenced by prop wash from vessels associated with curtain deployment. TSS concentrations exceeding 25 mg/l were limited to areas where transects extended beyond the SEC flats and into the deeper waters of the main channel. These areas of higher concentrations (60-70 mg/l) occurred along the channel side slopes and are visible on the left side of vertical profile SCPL38 (Figure 22). Depth-averaged current velocities were less than 0.25 m/sec on Transects SCPL36-38, but exceeded 0.5 m/sec for Transects SCPL 39-41.

2.6 Survey #4: Dredge Plume Characterization with Silt Curtain Deployed

2.6.1 Turbidity

Three moored OBS sensor arrays were deployed on both sides of the deployed silt curtain, forming three pairs directly opposite each other. For discussion purposes the arrays moored along the 18 ft depth contour will be designated herein as “outside” the silt curtain, whereas the corresponding arrays moored over the SEC flats will be designated as “inside” the curtain. Each of the three outside arrays consisted of two turbidity sensors (1 upper and 1 lower). Due to the shallow water depths over the flats, each of the three inside arrays had only one turbidity sensor. Locations of each pair are identified with respect to: 1) the “outer” pair located closest to the main Newark Bay navigation channel near the southeastern end of the silt curtain, 2) the “inner” pair located closest to the northwestern end of the silt curtain, and 3) the “middle” pair located approximately halfway between the “inner” and “outer” pairs. One additional turbidity sensor was deployed at the northwestern end of the SEC channel to monitor background conditions. Turbidities were measured during four days of dredging after the silt curtain was deployed. Results are presented for each day of monitoring below.

June 19, 2011: Deployment locations of paired OBS sensor arrays for 19 June is depicted in Figure 23. Sensors were deployed for approximately 8.5 hrs spanning the last four hours of the flooding tide and nearly all of the ensuing ebbing tide. Results for all three paired arrays are presented in Figures 24-26. The outer array (Figure 24) consisted of three sensors: #119 deployed over the flats at a depth of 1.2 m inside of the curtain, 274 m from the dredge, while OBS #477 and #120 were deployed 270 m from the dredging operation on the “outside” of the curtain at water depths of 2 m and 3.7 m respectively. Flood tide conditions prevalent during the first 4.5 hrs of deployment carried sediment resuspened by the dredging operation away from the turbidity sensors. Maximum turbidities did not exceed 16 NTU at the outer paired array, within the range of background conditions. During the ebbing tide, turbidities did not exceed 14 NTU for the two outer array sensors deployed on the “outside” of the curtain. One additional sensor deployed at a depth of 5.7 m in the northwestern end of the SEC, 547 m from the dredging operation, recorded a maximum turbidity of 10.3 NTU (Flood mean = 6.6 NTU, Ebb mean = 7.9 NTU).

The middle array also consisted of three sensors: #478 deployed 155 m from the dredge at a depth of 1.4 m on the “inside” of the curtain, and #126 and #180 deployed on the “outside” of the curtain at depths of 1.8 m and 3.3 m respectively. Turbidities peaked at 15 NTU at the inside sensor (OBS #119, red data line, Figure 25) deployed over the flats. The lower sensor (#180) deployed on the “outside” of the curtain had a single turbidity spike exceeding 20 NTU during flood tide. Turbidities were well within background levels during the flooding tide. During the ebbing tide, the two “outside” sensors (#126 and #180) detected several spikes in turbidity occurring primarily at the lower sensor (#180). At the lower sensor, peak turbidity reached 26.4 NTU, which exceeded ambient by 13-20 NTU during three spikes lasting less than 5 minutes (blue data line, Figure 25). Background turbidities ranged from 6 to 13 NTU during the ebb tide. Peak turbidity reached 18.4 NTU, exceeding ambient by 5 to 12 NTU in one spike lasting approximately 10 minutes. A small number of other turbidity spikes were less than 15 NTU, exceeding ambient by 2 to 9 NTU. Turbidities exceeding ambient are given as a range due to the different averages obtained from multiple sensors deployed during ambient data collection. At both outside sensors there were long periods between peaks where turbidities were in the range of ambient conditions. Measurements at inside sensor #478 showed no evidence of plume derived suspended sediments moving across the flats. Turbidities averaged 5 NTU during the majority of the monitoring period. One peak reached 10.3 NTU early in the monitoring session, but this was within the normal background range.

The inner sensor array (#350 and #351) was moored on the “outside” of the silt curtain 115 m from the dredging operation at water depths of 2.2 and 3.7 m. OBS sensor #121 was deployed on the “inside” of the curtain at a depth of 1.2 m. Results are summarized in Table 3. During flood tide, turbidities ranged from 5 to 7 NTU, with the exception of a one hour period coinciding with peak tidal flows when turbidities peaked at 16.5 NTU over the flats and 13.5 NTU at the lower sensor deployed at the 18 ft depth contour. These turbidity spikes were below peak turbidity values logged during ambient monitoring. During the ebbing tide, all three inner array sensors recorded turbidities which exceeded ambient conditions. The upper (#350) and lower (#351) sensors deployed within the 18 ft contour recorded peak turbidities of 28.9 and 31 NTU respectively (yellow and blue data lines, Figure 26). Using a peak ambient turbidity of 13.3 NTU as a basis for comparison, these values exceeded background conditions by 15.6 NTU at the upper sensor and 17.7 NTU at the lower sensor. Sensor #121 moored “inside” of the curtain recorded a maximum turbidity of 24.4 NTU (ambient peak for this sensor = 12.8 NTU), or 11.6 NTU above background (Figure 26). With the exception of one turbidity spike, maximum turbidities occurred during a 60 minute period prior to peak ebb flow conditions. One additional turbidity sensor was placed at the northwest end of the SEC, 547 m from the dredging operation.

Turbidities there were relatively constant throughout both tidal cycles averaging 7.9 NTU during the ebbing tide and 6.6 NTU during the flooding tide.

June 20, 2011: All turbidity sensors were redeployed on 20 June as depicted in Figure 27. The outer pair was moored south of Channel Marker #1 and was furthest from the dredging operation. Sensors #119 (depth = 1.4 m) was deployed on the "inside" of the curtain, 230 m from the dredge. Sensors #477 (depth = 2 m) and #120 (depth = 3.7 m) were deployed 188 m from the dredge. The middle paired array consisted of sensors #126 (depth = 1.9 m) and #180 (depth = 3.5 m) deployed on the "outside" of the curtain, 88 m from the dredge and sensor #478 (depth = 1.5 m) deployed on the "inside" of the curtain, 136 m from the dredge. The inner paired array consisted of sensors #350 (depth = 2.2 m) and #351 (depth = 3.7 m) deployed on the "outside" of the curtain, 109 m from the dredge, and sensor #119 (depth = 1.3 m) was deployed 165 m from the dredge on the "inside" of the curtain. Turbidity results for the three paired sensor arrays are presented in Figures 28-30. Results are summarized in Table 3.

During a flooding tide sediment resuspended by the dredging operation would move away from the turbidity sensor locations, therefore turbidity readings would not be expected to show any spikes exceeding the range of background conditions. During approximately four hours of monitoring, turbidities did not exceed 10 NTU, with the exception of two spikes lasting less than 10 minutes at sensor # 477 (yellow data line, Figure 28). Averages for all nine sensors were less than 6 NTU, conditions corresponding to background during an ebbing tide, indicating that less turbid water had entered the system.

During the ebb tide, turbidities remained well within the range of background conditions until 1515 hrs, when all sensors registered a sharp spike in turbidities. Maximum turbidities exceeded 30 NTU at sensors #120 and #180, located outside of the silt curtain on the 18 ft contour. Sensors #119 and #478 deployed on the inside of the curtain recorded turbidities above 25 NTU. Field notes indicated that a container ship passed through the main navigation channel at approximately 1500 hrs. Noticeably turbid waters were observed between Channel Markers #1 and #7 moving towards the SEC flats. These spikes in turbidity also occurred during peak ebb flows. It is probable that sediment resuspended by the passing ship contributed at least in part to turbidities recorded during this time period. This finding is supported by turbidity readings at the outer pair of sensors (#119, #477 and #120). Based on prevailing current vectors, these sensors were located in an area that should not have received resuspended sediments from the dredging operation.

June 21, 2011: Turbidity sensors were redeployed during the ebbing tide on 21 June as depicted in Figures 31 and 32. The outer paired array was moored just south of Channel Marker #1. Both the middle and inner paired arrays were moored directly across from the dredging operation. The dredge was working approximately midway between Berths 94 and 96. Results for all paired arrays are presented in Figures 33 to 35 and summarized in Table 3. Sensor #119 (outer array) was deployed at a depth of 1.4 m approximately 305 m from the dredge “inside” the curtain, whereas sensors #477 and #120 were deployed directly opposite #119, 278 m from the dredge at depths of 2 m and 3.4 m respectively. The middle paired array consisted of sensor #478 (depth 1.5 m) deployed on the “inside” of the curtain, 174 m from the dredge, and sensors #126 (depth = 1.9 m) and #180 (depth = 3.6 m) deployed “outside” the curtain, 118 m from the dredge. The inner paired array consisted of sensor #121 (depth 1.8 m) deployed “inside” the curtain, 162 m from the dredge, and sensors #350 (depth = 2.3 m) and #351 (depth 3.7 m) deployed “outside” the curtain, 95 m from the dredge. Note that both sensors #121 and #351 failed during this deployment. One additional turbidity sensor was deployed 418 m from the dredge at a depth of 5.8 m near the northwest end of the SEC.

Turbidities at the outer array ranged from 1 to 6.7 NTU, not exceeding ambient conditions on either side of the silt curtain (Figure 33). Turbidity averaged less than 4 NTU for each of the three outer array sensors. Turbidities exceeded ambient conditions at the middle paired array on both sides of the silt curtain. “Inside” the curtain turbidity sensor #478 recorded a peak of 13.3 NTU, exceeding background by up to 8 NTU. This spike in turbidity was likely associated with the dredging operation based on comparison with the simultaneous time series record of all sensors, as well as a consistent reading below 5 NTU both prior to and after this 30 minute spike (see red data line in Figure 34). The two sensors deployed “outside” the curtain also recorded spikes in turbidity, especially at the upper sensor (#126). Turbidity peaked at the upper sensor at 37.1 NTU, exceeding background by nearly 24 NTU. At the lower sensor (#180) turbidity peaked at 13.1 NTU. Turbidities prior to and after this spike also averaged 5 NTU. At the inner array, two of the three sensors (#121 and #351) failed during the monitoring session. The upper sensor (#350), deployed “outside” the curtain during an ebbing tide, had a peak turbidity of 25.4 NTU, exceeding ambient by 15 NTU (Figure 34). Turbidity sensor #122 was deployed 418 m from the dredge at the northwest end of the SEC. Turbidities ranged from 5.7 to 14 NTU (mean = 9.7 NTU).

June 22, 2011: Turbidity sensors were redeployed during both flood and ebb tides on 22 June after silt curtain installation. Locations of turbidity sensors are given in Figures 36 to 38. Results are summarized in Table 3. In general, turbidity readings during the flooding tide reflected background conditions. During the ebb tide, turbidity readings outside the silt curtain increased above background however, turbidity readings inside the silt curtain were not above background.

The outer paired array consisted of one sensor (#119, depth 1.3 m) deployed “inside” the silt curtain, 283 m from the dredge, and two sensors, an upper (#477, depth 2 m) and a lower sensor (#120, depth 3.5 m) deployed “outside” the curtain, 278 m from the dredge. Results for the outer paired array are presented in Figure 39. The middle paired array had one sensor (#478, depth 1.5 m) “inside” the curtain, 140 m from the dredge, and two sensors (#126 and #180) deployed at depths of 1.9 m and 3.6 m “outside” the silt curtain, 128 m from the dredge. Results for the middle paired array are presented in Figure 40. The inner paired array consisted of one sensor (#121) deployed “inside” the curtain, 105 m from the dredge, and two sensors (#350 and #351) deployed at depths of 2.2 m and 3.7 m “outside” the curtain, 70 m from the dredge. Sensors #121 and #351 failed during this deployment. Results for the inner paired array are presented in Figure 41.

As previously stated, sediment resuspended during a flooding tide would be conveyed away from the moored arrays; therefore turbidity readings during the flooding tide reflect background conditions. Waters became increasingly turbid during the flooding tide during this monitoring session as compared to results from 20 June, but were typical of ambient conditions observed on 12-13 June. A peak turbidity of 32.1 NTU occurred at sensor #350, deployed at 2.2 m (Figure 41). At least one sensor at all three arrays had turbidities that exceeded 20 NTU, although these spikes in turbidities typically lasted only a few minutes.

During the ebbing tide, no increase in turbidity was recorded at either the inside or outside sensors at the outer paired array. At the inside sensor (#119) over the SEC flats, turbidity peak at 5.9 NTU. At both the upper (#477) and lower (#120) sensors “outside” the curtain, turbidity peaked at less than 12 NTU. All turbidity readings were well within background levels at the outer array (Figure 39). At the middle paired array both sensors deployed “outside” the silt curtain measured turbidities which exceeded ambient conditions. Turbidity peaked at 30 NTU, or 17 NTU above background at the upper 1.9 m sensor (#126). Maximum turbidity at the lower sensor (#180) was 25 NTU, or 12 NTU above background. Sensor #478, deployed “inside” the silt curtain, did not detect an increase in turbidity above background. Turbidities at this sensor (red data line in Figure 40) ranged from 2.9 to 9.1 NTU (mean = 4.5 NTU). Sensor #350, deployed “outside” the curtain, recorded the highest turbidity (34.6 NTU). Turbidity exceeded ambient by slightly more than 21 NTU. Turbidity spikes occurred during a one hour time period (1600-1700 hrs), approximately one hour before peak ebb flow. The other two inner array sensors (#121 and #351) experienced sensor failure during this deployment.

2.6.2 ADCP Plume Characterization Surveys

Survey SCXB, Ebb Tide, 19 June: A mobile ADCP plume survey was completed between 1116 hrs and 1440 hrs on 19 June during an ebbing tide. Peak ebb occurred at 1519 hrs in the South Reach of Newark Bay. The entire survey consisted of 26 transects. A plan view layout of transects can be found in Figure 23. Depth-averaged TSS concentrations and current velocities are summarized in Table 10. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 42. Dredging resumed at 0930 hrs on 19 June, 85 m east of Channel Marker #1 near the entrance to the SEC, after 500 m of damaged curtain was replaced. Transect SCXB1 was run in a northwesterly direction, 20 m from the outside (up-current) of the silt curtain during slack tide. With the exception of a few near-bottom ‘bins” with TSS concentrations between 60 and 70 mg/l, TSS concentrations remained primarily in the 25 to 33 mg/l range, consistent with background conditions in the lower water column (6.5 to10.5 m). Higher concentrations detected near the channel bottom likely represented sediments resuspended during the previous flood tide. This result reflected the settlement of sediments as the tide switched from flood to ebb as the upper portion of the water column had TSS concentrations indicative of background levels. Transect SCXB2 ran in a southeasterly direction inside (down-current) the curtain, 47 m distance from the curtain boom. Depth-averaged concentrations ranged from 13 to 25 mg/l (mean =16.4, maximum = 31 mg/l), within the range of background conditions (mean = 18 mg/l, lower water column mean = 32 mg/l) for the SEC flats. Depth-averaged flow direction was to the southeast at 0.24 m/sec.

Transects SCXB3 and SCXB6 were repeats of Transect SCXB1 as the tide switched to an ebbing direction. Current direction had shifted to the southwest at 0.24 m/sec. These transects covered a portion of the deeper waters of the navigation channel running along the curtain axis within the 18 ft depth contour. Somewhat higher concentrations were found in the navigation channel when compared to shallower waters along the side of the SEC. Depth-averaged TSS concentrations ranged between 12.3 and 20.3 mg/l (peak = 31 mg/l, Table 10), which fell within the range of background estimates. Transects SCXB4 and SCXB5, which repeated Transect SCXB2, had ambient conditions prevalent along the SEC flats, although dredging had been underway for four hours (Figure 42). A few near-bottom “bins’ had maximum TSS concentrations between 44 and 50 mg/l, also within the range of peak ambient concentrations. It should be noted that dredging activities stopped on two occasions during the survey period, once for 3 minutes (0950-0953 hrs) and the other for 17 minutes (1258-1315 hrs). Short breaks in the progress of dredging projects are common.

Transects SCXB7-10 encircled the dredge. Transect SCXB7 ran parallel to the dredge in a southeasterly direction, 60 m off the port side. A turbidity plume was evident as a lower water column feature (9-14 m), approximately 100 m in width with maximum TSS concentrations less than 90 mg/l, or approximately 60 mg/l above background. Maximum TSS concentrations in the upper water column were 50 mg/l. Flow was to the west. Faster flows were detected at the terminus of this transect, which covered a portion of the entrance channel not obscured by the port bulkhead (see current vector plot, SCXB7, Figure 42). The terminus of Transect SCXB7 and the start of Transect SCXB008 (far left of vertical profile SCXB89, Figure 42) occurred 20 m astern of the dredge, and revealed an area of higher TSS concentrations between 70 and 80 mg/l. This area of elevated TSS concentrations did not appear to be associated with the Delaware Bay dredging operation, but rather appeared linked to a source in the main navigation channel.

Transect SCXB9 ran in a northwesterly direction, 51 m off the starboard side of the dredge and between the port bulkhead. TSS concentrations were consistent with background conditions (left side of vertical profile). Depth-averaged current velocities ranged from 0.10 m/sec inside the SEC as flow was impeded by the port bulkhead and 0.40 m/sec along the portion of the transect that extended into the main navigation channel (see vector plot SCXB9, Figure 42). The right side of this profile indicated higher TSS concentrations up to 50 mg/l (maximum = 84 mg/l) along the channel bottom within the main navigation channel. Transect SCXB10 ran in a southeasterly direction, across the dredge bow at a distance of 50 m. A small bottom plume with a peak TSS concentration of 98 mg/l, or approximately 60 mg/l above background, occurred in the lower 3-m of the water column. Upper water column concentrations did not exceed 50 mg/l, or approximately 20 mg/l above background.

Transects SCXB11-13 ran parallel to the port side of the dredge at distances of 40 m to 60 m. These transects covered an area within the SEC from the dredge to 28 m “outside” (up-current) the silt curtain. Dredging activities were intermittent during this time producing only a faint plume signature that drifted in the general direction of the silt curtain. TSS concentrations fell to below 65 mg/l within 50 m from the dredge, but then increased to 75 mg/l on Transect SCXB13 at a distance of 28 m from the curtain.

Transects SCXB14-SCXB18 resurveyed the SEC channel from 50 m off the port side of the dredge to within 20 m of the outside of the curtain. Transects SCAB14 and SCAB15 indicated a well-defined plume approximately 50 m from the dredge extending from the surface to the channel bottom. Maximum TSS concentration was 122.4 mg/l, or approximately 92 mg/l above ambient at a distance of 48 m from the dredge. Excluding the lower 1m of the water column, the plume consisted of TSS concentrations less than 100 mg/l. Depth averaged current velocity was less than 0.15 m/sec. Over the next 10 m (total distance 60 m from dredge), the plume signature faded substantially (compare Transects SCXB15 and SCXB16, Figure 42). By 90 m from the dredge and 59 m “outside” (up-current) the silt curtain, TSS concentrations were 10-15 mg/l above background throughout most of the water column, although a few near-bottom “bins” still had TSS concentrations between 75 and 90 mg/l. Transect SCXB18 was run in a southeasterly direction along the 18 ft depth contour, 155 m from the dredge and 20 m “outside” the curtain. Only one small area of elevated TSS (75 mg/l) exceeding ambient was detected near the silt curtain.

Transect SCXB19 surveyed the area “inside” the curtain to assess whether the plume had breached the curtain. Transect SCXB19 ran in a northwesterly direction across the SEC flats, 200 m from the dredging operation, “inside” (down-current) the curtain. TSS concentrations did not exceed background with the exception of two small areas (maximum TSS = 64 mg/l) along the entire transect length (Figure 42). It is unclear if this represented dredged sediment moving past the curtain or sediment disturbed by the increased flows passing through the damaged sections of the silt curtain. During this span of time the dredge was shut down temporally. Transects SCXB20 (outside the curtain) and SCXB21 (inside the curtain) repeated Transects SCAB18 and SCAB19 to determine if the areas of increased TSS remained while the dredge was shutdown. These two areas were still present on both Transects, but in reduced concentrations (< 50 mg/l) on SCXB21. Given that peak concentrations on the SEC flats reached as high as 50 mg/l during an ebbing tide. These concentrations approached or exceeded peak ambient conditions by as much as 10 mg/l or exceeded average ambient conditions by as much as 30 to 40 mg/l.

Transects SCXB22-26 repeated the above series of Transects (Transects SCXB15-19) during peak ebb flows. Transect SCXB22 showed a well-defined plume 33 m from the dredge. The plume signature was nearly 150 m wide extending throughout most of the water column. Lowest TSS concentrations (< 30 mg/l) occurred in the upper 2 m of the water column, exceeding ambient by 10 mg/l. TSS concentration peaked at 169 mg/l in a small plume core located in the lower 3-m of the water column, exceeding background by 139 mg/l. Over the next 30 m of transect, at a distance of 60 m from the dredge, TSS concentrations fell by nearly 55 mg/l (peak = 114 mg/l). Mixed current vectors split the plume into an upper and lower component. Transect SCXB25 ran in a southwesterly direction 103 m from the dredge (70 m from Transect SCXB22) and 26 m on the “outside” of the curtain. Only a faint plume signature remained with a small plume core 20 m wide with TSS concentrations greater than 75 mg/l. The final Transect of the survey (SCXB026) ran in a southeasterly direction 25 m from the inside of the curtain. With the exception of one small area in which TSS concentrations exceeded 100 mg/l, concentrations over the SEC flats were within background estimates.

Survey SCXD, Ebb Tide, 20 June 2011: A mobile ADCP plume survey was completed between 1430 hrs and 1517 hrs on 20 June during an ebbing tide. Peak ebb occurred at 1604 hrs in the South Reach of Newark Bay. The entire survey consisted of 17 transects. A plan view layout of transects can be found in Figure 27. Depth-averaged TSS concentrations and current velocity data are summarized in Table 11. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 43. The first four transects (SCXD1-4) encircled the dredge plant. Transect SCXD1 was run in a northwesterly direction parallel to the dredge, 43 m off the starboard side, between the dredge plant and the port bulkhead. TSS concentrations in the upper water column (< 7 m) were within the range of background conditions; however, there was movement of sediment along the channel bottom where TSS concentrations exceeded 100 mg/l (maximum = 108.7 mg/l) in the lower 1-m of the water column. Depth-averaged current vectors were mixed (vector plot, SCXD001, Figure 43). Flow direction varied from to the southeast (0.08 m/sec) in the upper water column to nearly due south in the lower water column. Current velocities were less than 0.2 m/sec. Transect SCXD2 ran south-southwesterly across the bow of the dredge. Concentrations exceeding ambient were confined to the lower half of the water column. Transect SCXD3 ran in a southeasterly direction parallel to the dredge, 34 m off the port side. The plume signature was visible throughout most of the water column, although highest TSS concentrations (101 mg/l) were found extending in a southeasterly direction within the lower 2-m of the water column. Transect SCXD4 completed the circle around the dredging operation, passing 60 astern of the dredge. Depth-averaged concentrations remained under 100 mg/l (maximum TSS = 144 mg/l, 114 mg/l above background) in the lower 2 m of the water column. TSS concentrations were within the range of background conditions in the upper 4-m of the water column. Depth-averaged current vectors indicated the presence of an eddy with flows on the northern side of the SEC channel oriented to the southeast, whereas flows on the southern side of the SEC were oriented to the west-southwest.

Plume signature intensity increased at a distance of 85 m astern of the dredge to a maximum of 403 mg/l (depth-averaged concentration = 161 mg/l) at a depth of 14 m. Surface (1.4 m) to mid-water depths (~7 m) had depth-averaged concentrations (12 to 29.6 mg/l) that fell within the range of background conditions (Table 11). Transect SCXD10 ran in a northwesterly direction, 95 m astern of the dredge. This transect terminated near the Berth 94 bulkhead. The ensuing Transect SCXD11 ran in the reverse direction, 135 m astern of the dredge. Several tugs moored in this area prevented surveying close to the bulkhead. Highest concentrations peaked at 123 mg/l, or approximately 93 mg/l above background, 95 m from the source (Transect SCXD10, right side of profile, Figure 43) falling to less than 80 mg/l at a distance of 135 m distance from the source. This eastern component of the plume exited into the main Newark Bay navigation channel.

Transects SCXD7 and SCXD8 ran across the bow of the dredge at distances of 81 and 106 m, respectively. Similar to conditions astern of the dredge, TSS concentrations fell within the range of background concentrations in the upper part of the water column (<6 m), while highest TSS concentrations (maximum = 121 mg/l) occurred in the lower 1-m of the water column.

The remaining Transects SCXD6 and SCXD12-16 ran parallel to the port side of the dredge at increasing distances, between the dredge plant and the silt curtain. Transect SCXD6 ran in a northwesterly direction parallel to the dredge, 50 m off the port side (Figure 43). Current vectors indicated movement of a plume in the lower water column to the east, and in the upper water column to the southwest. Highest concentrations occurred along the extreme channel bottom at 120 mg/l, or approximately 90 mg/l above background. This plume signature diminished in width and concentration and by 104 m off the port side of the dredge (Transect SCXD15) only a faint plume signature remained with maximum TSS concentrations less than 60 mg/l, or approximately 30 mg/l above ambient. A few individual “bins” along the extreme channel bottom had TSS concentrations that exceeded 100 mg/l. Transect SCXD16 ran in a northwesterly direction along the 18 ft depth contour “outside” (up-current) the silt curtain. TSS concentrations exceeded ambient by10 to 15 mg/l. The final transect in the survey ran in a southeasterly direction “inside” (down-current) the silt curtain. Depth-averaged concentrations by depth strata ranged from 14.7 mg/l at a depth of 1.4 m to 28 mg/l at 3.9 m (mean= 18.2 mg/l). Average background TSS for the SEC flats was 18 mg/l. The maximum concentration of 47.3 mg/l did not exceed the peak concentration (49.8 mg/l) measured during ambient surveys completed on 12-13 June.

Survey SCXF, Ebb Tide-1st Survey, 21 June 2011: Two mobile ADCP plume surveys were completed on 21 June. The first began approximately 1503 hrs and ended approximately 1550 hrs before peak ebb which occurred at 1657 hrs in the South Reach of Newark Bay. The entire survey consisted of 18 transects. A plan view layout of transects can be found in Figure 31. Depth-averaged TSS concentrations and current velocity data are summarized in Table 12. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 44. The dredge was working midway between Berths 94 and 96 in the SEC. Current vectors indicated a mixed flow in this area of the SEC, thereby allowing for portions of the resuspended sediments to be carried in various directions. However, the main body of the plume moved across the SEC towards the silt curtain (Figure 31). Current velocities ranged from 0.06 to 0.12 m/sec (mean = 0.08 m/sec). Over the SEC flats current velocities averaged 0.38 m/sec. During this survey the dredge shut down for 16 minutes to reposition slightly to the south.

Transect SCXF1 ran in a northwesterly direction parallel to both the dredge and port bulkhead. The turbidity plume was a mid- to lower water column feature with a maximum TSS concentration of 148 mg/l, or approximately 118 mg/l above background in a few near-bottom “bins”. Depth-averaged TSS concentrations by depth stratum peaked at water depths ranging from 7.9 to 9.9 m at slightly more than 60 mg/l (range = 60.5-64.5 mg/l). Surface concentrations (< 4 m) did not exceed background levels.

Transect SCFX4 ran in a northeasterly direction, 86 m (distance to bucket) astern of the dredge. Movement of sediment in this direction occurred primarily at mid-water depths (4-10 m) with TSS concentrations between 50 and 75 mg/l. The ensuing Transect SCFX5 was also occupied astern of the dredge at a distance of 117 m from the bucket. The plume signature consisted of a narrow band of elevated suspended sediments in the mid-water column. Transect SCXF10 indicated little change in the overall plume signature at 134 m astern of the dredge, and Transect SCXF11 indicated a fading plume signature at 168 m astern of the dredge (Figure 44). Excluding a few individual “bins” maximum TSS concentrations had fallen to less than 65 mg/l, or approximately 30 mg/l above background.

Transect SCXF2 ran in a southwesterly direction across the bow of the dredge at a distance of 45 m to the bucket. Again the plume was primarily a mid-water to bottom feature with ambient concentrations (depth-averaged < 30 mg/l) in the upper water column (< 6 m). Highest concentrations occurred in the lower 1-m (maximum TSS = 167.9 mg/l) of the water column, exceeding background by nearly 140 mg/l. Two additional cross-channel transects (SCFX7 and SCFX8) were occupied northwest of the bow of the dredge at 57 and 77 m from the bucket. Results indicated a slight increase in TSS concentrations along these two transects with peak TSS concentrations of 192 mg/l (SCFX7) and 178 mg/l (SCFX8) respectively. On both transects the plume moved along the channel bottom in a northwesterly direction in the lower 2-m of the water column (Figure 44). Highest concentrations were relatively stable over the 30 m distance from the initial transect across the bow. Because this segment of the plume extended down the channel and not towards the SEC flats, all remaining transects in the survey were concentrated between the port side of the dredge and the silt curtain.

Transect SCFX3 ran in a southeasterly direction parallel to the dredge, 30 m off the port side. A small area of entrained air can be seen in vertical profile SCFX3 (Figure 44) in the upper water column (2-5 m). Highest depth-averaged and peak concentrations occurred near the bottom (depth = 13.3 m) at 85.4 mg/l (35.4 mg/l above background) and slightly less than 120 mg/l, respectively. There was little change in the overall plume structure with increasing distance (from 61 m to 82 m) off the port side of the dredge (Transects SCXF 6, 9 and 12, Figure 44). The core of the plume was approximately 60 m wide with TSS concentrations that ranged from 75 to100 mg/l, or 45 to 70 mg/l above background. The upper 1 to 2 m of the water column remained at background levels. Transects SCFX13 through SCFX15 depict the decay of the plume from 85 m to102 m from the dredge as the plume approached the 18 ft depth contour. A small number of individual 'bins" showed an increase in TSS as the plume interacted with the shoal. At 102 m from the dredge and 20 m from the "outside" of the silt curtain, the segment of the plume moving southwest had only a small central core of higher TSS concentrations (maximum = 92 mg/l, near-bottom depth-averaged concentration = 46.7 mg/l) within 1-m of the bottom. Figure 31 shows that the plume movement was primarily to the southwest, although a plume signature was detected in all directions when using the dredge as a focal point. Transect SCFX17 ran in a northwesterly direction, whereas SCFX18 ran in a southeasterly direction, 25 and 70 m from the "inside" of the silt curtain. Transect SCFX17 (right side of vertical profile, Figure 44) indicated one area of elevated TSS (maximum = 48 mg/l) exceeding background by as much as 30 mg/l. When compared to the peak ambient TSS concentration (49.8 mg/l) obtained on 12-13 June, this result may not indicate plume movement beyond the curtain. At 70 m inside the curtain there were few near-bottom bins where TSS concentrations exceeded background by 10 mg/l.

Survey SCXG, Ebb Tide-2nd Survey, 21 June 2011: A second mobile ADCP plume survey was completed on 21 June between 1555 hrs and 1634 hrs during an ebbing tide. Peak ebb occurred at 1657 hrs in the South Reach of Newark Bay. The entire survey consisted of 20 transects. A plan view layout of transects can be found in Figure 32. Depth-averaged TSS concentrations and current velocity data are summarized in Table 13. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 45. A survey methodology similar to that of the previous survey was used. One transect ran between the port bulkhead and 45 m starboard of the dredge. Three cross-channel transects were established at increasing distances running across the bow of the dredge. Six additional cross-channel transects were established at increasing distances astern of the dredge. Seven parallel transects were occupied up- and downstream of the SEC between the port side of the dredge and the silt curtain. One transect ran along the length of the silt curtain within the 18 ft depth contour, and two transects ran parallel to the "inside" of the silt curtain over the SEC flats. Field notes indicated that part way through the completion of the survey (1620 hrs) the dredge stopped dredging due to maintenance. The dredge had been dredging for nearly 1-hour prior to a brief stoppage to change positions.

Transect SCXG1 ran in a northwesterly direction parallel to the channel bulkhead and 46 m off the starboard side of the dredge. As with the earlier survey, TSS concentrations in the upper water column (5 m) remained within background levels. Higher TSS concentrations (75-100 mg/l) occurred only in the lower depth strata (> 7 m). Overall flow was to the south-southeast with peak current velocities of 0.08 m/sec.

Three cross-channel transects (SCXG2, SCXG8 and SCXG9) ran perpendicular to the dredge bow at distances of 40 m, 55 m and 69 m. As observed in the previous survey some movement of sediment occurred in all directions when using the dredge as a focal point. One segment of the plume moved to the northwest within the SEC in the lower 4-m of the water column. At 40 m from the bucket peak TSS concentration was 182.5 mg/l, or approximately 153 mg/l above background. Depth-averaged concentrations exceeded 100 mg/l (range = 115.8-173.4 mg/l) in all depth strata deeper than 11.8 m (Table13). Over the next 30 m maximum TSS concentrations (122.5 mg/l) fell by 60 mg/l. In the upper water to mid-water column (1-9 m), depth-averaged concentrations were within the ambient range. Additional transects were not occupied across the bow since movement of this segment of the plume was along the South Elizabeth Channel bottom and was not moving in the direction of the SEC flats.

Six transects were occupied astern of the dredge at distances ranging from 115 m to 220 m. TSS concentrations were not as high as on the bow side of the dredge, but occupied a larger portion of the water column. At 115 m astern, a well-defined plume with a peak concentration of 91.4 mg/l occupied the majority of the water column with the exception of the upper 3-m where TSS concentrations did not exceed background levels (Transect SCXG4, Figure 45). Over the next 100 m (220 m from the bucket) the plume signature and peak concentrations (peak = 96.2 mg/l) did not change substantially. This component of the plume moved east-southeast along the northern half of the SEC (Figure 32). Figure 45 (e.g., SCXG14) shows the upper end of the current vector plot with depth-averaged current vectors oriented to the southeast and the right side of the vertical profile with higher TSS concentrations, whereas the lower end of the vector plot had depth-averaged vectors oriented in the upstream direction (northwest), with lower TSS concentrations on the left side of the vertical profile. At no time did this component of the turbidity plume move in the direction of the silt curtain. Part of the plume exited the SEC within the next 60 m and entered the main navigation channel. Net movement of the plume was to the east-southeast with maximum flows of 0.08 m/sec.

Seven transects were then conducted either in a northwesterly or southeasterly direction parallel to the long axis of the SEC and the port side of the dredge. Transect (SCXG3) passed closest to the port side of the dredge at a distance of 30 m. The plume signature was not well-defined, although TSS concentrations as high as 151.8 mg/l were found in the lower 2-m of the water column. Except in the immediate vicinity of where the bucket was exiting the water column, TSS concentrations in the upper water column were within the range of background conditions. Over the next 15 m (at a distance of 43 m from the bucket), maximum TSS concentration decreased by 88 mg/l to 64 mg/l, or approximately 35 mg/l above background. Maximum TSS concentration (64 mg/l) remained relatively unchanged over the next 10 m from the bucket. Transect SCXG13 (Figure 45) shows only a faint plume signature at 75 m from the dredge, extending from a depth of 4 m to the channel bottom, where TSS concentrations exceeded ambient by < 20 mg/l. This faint plume signature remained visible against background through Transect SCXG18 at a distance of 110 m from the dredge and 20 m "outside" (up-current) the silt curtain. TSS concentrations exceeded ambient by 10 mg/l in a small plume core approximately 50 m wide in the lower 2 m of the water column. A small number of "bins" along the immediate channel bottom had higher concentrations exceeding 75 mg/l from 75 m to 110 m from the bucket. Net current flow was to the south-southeast. Water velocities remained below 0.10 m/sec.

Transects SCXG19 and SCXG20 ran parallel to and "inside" the silt curtain at distances of 20m (148 m from the dredge) and 82 m (210 m from the dredge) respectively. With the exception of a small number of individual "bins" located along the bottom, TSS concentrations did not exceed background conditions. Maximum detected TSS concentrations were 50.7 mg/l (SCXG19) and 37.7 mg/l (SCXG20), respectively. These values were similar to maximum TSS concentrations observed on 12-13 June. Dominant flow direction was to the southwest across the flats. Current velocity was slightly less than 0.40 m/sec.

Survey SCXH, Flood Tide, 22 June 2011: A mobile ADCP plume survey was completed between 1200 hrs and 1253 hrs on 22 June during a flooding tide. Peak flood occurred at 1100 hrs in the South Reach of Newark Bay. The entire survey consisted of 23 transects, including three between the starboard side of the dredge and the port bulkhead, 6 between the port side of the dredge and the 18 ft depth contour, 4 astern of the dredge, 9 across the bow of the dredge, and 1 along the 11 ft depth contour inside the curtain. A plan view layout of transects is given in Figure 36. Depth-averaged TSS concentrations and current velocity data are summarized in Table 14. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 46. The dredge *Delaware Bay* was digging in the center of the channel approximately midway between Berths 94 and 96.

Three transects (SCXH1, SCXH5, and SCXH9) were run in a northwesterly direction between the starboard side of the dredge and the port bulkhead at distances of 45 m, 59 m and 75 m, respectively. Current directional vectors were mixed, with a northwesterly flow along the channel bottom and a northeasterly component carrying the plume towards the port bulkhead. Current velocities were less than 0.8 m/sec. Elevated TSS concentrations occurred primarily from mid-water to the channel bottom. Maximum TSS concentrations decreased from 95.6 mg/l at 45 m to 69.4 mg/l at 75 m from the bucket. Depth-averaged TSS concentrations were typically below 30 mg/l in the upper 2.5 m of the water column and exceeded 50 mg/l at a depth of 10 m. At water depths greater than 10 m, depth-averaged concentrations did not exceed 70 mg/l within any depth stratum (Table 14).

Transects SCXH4, SCXH8, and SCXH12 ran in a northwesterly direction at distances of 75 m, 117m and 158 m astern of the dredge, respectively. A final transect (SCXH13) ran in a southwesterly direction, 187 m from the bucket astern of the dredge. Vertical profiles (Figure 46) revealed no significant movement of a plume down the SEC astern of the dredge towards the channel entrance. The majority of the water column had TSS concentrations between 30 mg/l and 40 mg/l, or 10 mg/l above background. Also common was an area of elevated TSS primarily at the northwest terminus of each transect, near the channel bulkhead, where TSS concentrations were as high as 80 mg/l, or 50 mg/l above background.

Nine transects (SCXH- 2, 6, 10, 15, 16, and 19-22) oriented perpendicular to the dredge were run in front of the dredge at distances ranging from 55 m to 300 m. Vertical profiles (Figure 46) of these nine transects indicated plume movement to the northwest in the lower 4-m of the water column. The plume signature covered most of the length of the survey transect, although the plume's core containing the highest TSS concentrations was less than 30 m wide. Highest TSS concentrations peaked at 173.6 mg/l at a depth of 12.8 m, 59 m from the bucket. TSS concentrations did not exceed background levels in the upper 9 m of the water column. Maximum TSS concentrations (167.5 mg/l) remained largely unchanged at 141 m from the bucket. Over the next 36 m (total distance = 177 m) (Transect SCXH16, Figure 46) peak TSS concentrations decreased to 86 mg/l, or 56 mg/l above background. At 221 m up-channel (Transect SCXH20), highest TSS concentrations (74 mg/l) were found only in the lower 2.5 m of the water column on the northern side of the SEC channel. At 300 m up-channel from the dredge, only a faint plume signature was detected (SCXH22, Figure 46). TSS concentrations exceeded ambient by10 to 15 mg/l.

Six transects (SCXH- 3, 7, 11, 14, 17 and 18) oriented parallel to the port side of the dredge and the silt curtain were completed, at distances ranging from 40m to 90 m. Although each transect shows some evidence of plume movement toward the southern side of the SEC, no distinct, well-defined plume signature was detected. For example, Transect SCXH14 (Figure 46) shows a faint plume signature 62 m from the dredge with TSS concentrations exceeding ambient by 10 mg/l in the lower water column. Concentrations as high as 50 mg/l occurred in the middle portion of the water column. At 78 m from the dredge and 12 m "outside" the silt curtain, the plume consisted of a narrow band (< 50 m wide) with TSS concentrations up to 55 mg/l. The higher concentrations on the right side of the vertical profile for Transect SCXG17 (Figure 46) are associated with sources in the main channel and not the dredging operation.

The final transect of the survey (SCXH023) ran in a southeasterly direction "inside" the entire length of the curtain. A maximum TSS concentration of 32.7 mg/l occurred in one relatively small area. This value was below maximum concentrations observed during ambient surveys on 12-13 June. Depth-averaged TSS concentration was 14 mg/l, below the average ambient concentration (18 mg/l).

Survey SCXI, Ebb Tide-1st Survey, 22 June 2011: A mobile ADCP plume survey was completed between 1547 hrs and 1650 hrs on 22 June during an ebbing tide. Peak ebb occurred at 1753 hrs in the South Reach of Newark Bay. The entire survey consisted of 19 transects including 2 between the starboard side of the dredge and the port bulkhead, 5 between the port side of the dredge and the 18 ft depth contour; 4 astern of the dredge, 6 across the bow of the dredge, and 2 along the 11 ft depth contour “inside” the curtain. A plan view layout of transects is given in Figure 37. Depth-averaged TSS concentrations and current velocity data are summarized in Table 15. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 47. The dredge *Delaware Bay* was digging in the center of the channel approximately midway between Berths 94 and 96. Dredging resumed at 1429 hrs and had been in full production for a least one hour before the start of this survey.

Three cross-channel transects (SCXI- 1, 5, and 9) ran perpendicular to and astern of the dredge in a northeasterly direction at distances of 70 m, 92 m, and 120 m, respectively. One additional transect (SCXI10) ran in a southwesterly direction, 164 m astern of the dredge. Vertical profiles for transects occupied astern of the dredge did not detect any significant movement of sediment to the southeast toward the entrance of the SEC. Depth-averaged TSS concentrations were within the range of ambient values (< 30 mg/l) for the majority of the water column (Table 15). Concentrations exceeding ambient by 10 to 15 mg/l were found only in the lower 2-m of the water column, along the northern side of the SEC. Current vectors indicated the presence of an eddy with vectors initially oriented in the up-channel direction along most of the transect length, with a shift to the down-channel direction along the final third (see vector plot SCXI9, Figure 47). Current velocities averaged 0.09 m/sec.

Six transects (SCXI- 3, 7, 12, 13, 16 and 17) oriented perpendicular to and in front of the dredge ran either in a northeasterly or southwesterly direction. The component of the plume with the highest TSS concentrations moved in a northwesterly direction toward the terminal end of the SEC, in the lower 4-m of the water column (Figure 37). A maximum TSS concentration of 167.1 mg/l was detected in the lower 1-m above the channel bottom, 68 m from the bucket (SCXI7, Figure 47). At this distance depth-averaged TSS concentrations routinely exceeded 70 mg/l at water depths greater than 12.3 m. However, concentrations did not exceed ambient throughout the upper 9 m of the water column. At 93 m from the dredge, peak TSS concentration increased slightly to 176.3 mg/l. Depth-averaged concentrations exceeded 100 mg/l only in the lower 1-m of the water column (Table 15). Maximum concentrations decreased by slightly more than 40 mg/l over the next 47 m (total distance = 140 m). Highest TSS concentrations (range = 100-125 mg/l) occurred in a small plume less than 30 m wide occupying only the lower 2-m of the water column (Transect SCXI13, Figure 47). At a distance of 256 m from the bucket, the portion of the plume moving to the southeast exceeded background by 30 mg/l (68.5 mg/l) in the lower 0.5 m of the water column. Current velocities averaged less than 0.13 mg/l.

Two transects (SCXI2 and SCXI6) oriented parallel to the dredge and between the dredge and the port bulkhead were completed at distances of 45 m and 66 m, respectively. TSS concentrations between 75 and 100 mg/l were detected at a distance of 45 m. At 66 m, higher concentrations (75 mg/l) occurred only in the bottom 2-m of the water column.

Five transects (SCXI- 4, 8, 11, 14 and 15) oriented parallel to the long-axis of the SEC were run between the dredge and the "outside" face of the silt curtain. Vertical profiles showed a component of the plume moving in a southwesterly direction towards the SEC flats. Transect SCXI4 ran in a southeasterly direction, 45 m from the dredge. A maximum TSS concentration of 330 mg/l, or 300 mg/l above background, occurred at a depth of 13.8 m. Only four individual "bins" had TSS concentrations which exceed 200 mg/l, all located within the lower 0.5 m of the water column along the immediate channel bottom (SCXI4, Figure 47). At 50 m from the bucket (Transect SCXI8) maximum TSS concentrations decreased by 181 mg/l to 149 mg/l, or slightly less than 120 mg/l above background. The plume signature had a central core approximately 30 m wide with TSS concentrations less than 80 mg/l, or approximately 50 mg/l above background (Transect SCXI8, Figure 47). There were a small number of "bins" scattered along the channel bottom with TSS concentrations exceeding 125 mg/l. Depth-averaged near-bottom concentrations decreased from 109.8 mg/l to 68.7 mg/l at 45 m to 68 m from the bucket. Transect SCXI14 ran in a southeasterly direction, 62 m from the dredge and 21 m "outside" the silt curtain. A very small plume signature was still detectable against background with a peak TSS concentration of 79 mg/l, less than 20 m wide and confined to the bottom 1-m of the water column. This plume signature remained largely unchanged on Transect SCXI15, run a northwesterly direction 90 m off the port side of the dredge and just 5 m “outside” the silt curtain.

Transect SCXI18 (Figure 47) ran in a southeasterly direction, 94 m from the dredge at its closest point and 15 m “inside” the silt curtain. Although background conditions prevailed along most of the length of this transect, two locations were observed where suspended sediments derived from the dredging bypassed the damaged curtain. A final transect (SCXI19) was run in a northwesterly direction, 125 m from the dredge and 45 m “inside” the curtain. Two narrow swaths of slightly elevated TSS concentration in the 30 to 35 mg/l range (two individual bins exceed 40 mg/l) were detected. These two narrow plumes exceeded background levels by 12 to 17 mg/l.

Survey SCXJ, Ebb Tide-2nd Survey, 22 June 2011: A mobile ADCP plume survey was completed between 1644 hrs and 1820 hrs on 22 June during an ebbing tide. Peak ebb occurred at 1753 hrs in the South Reach of Newark Bay. The entire survey consisted of 19 transects including 4 between the starboard side of the dredge and the port bulkhead, 3 between the port side of the dredge and the 18 ft depth contour, 7 astern of the dredge, 4 across the bow of the dredge, and 1 along the 11 ft depth contour “inside” the curtain. A plan view layout of transects is given in Figure 38. Depth-averaged TSS concentrations and current velocity data are summarized in Table 16. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 48. The dredge *Delaware Bay* was digging in the center of the channel approximately midway between Berths 94 and 96.

Unlike the previous survey (SCXI) completed during the early part of the ebb tide, during which movement of the plume was primarily to the northwest along the channel bottom, plume movement within one hour of peak flow was primarily to the southeast toward the entrance to the SEC. Figure 38 indicates that highest depth-averaged TSS concentrations occurred between the starboard side of the dredge and the port bulkhead and astern of the dredge with general movement toward Channel Marker #1. Similar to the earlier survey, plume movement occurred within the lower 4 m of the water column. Transect SCXJ1 ran in a northeasterly direction, 80 m from the bucket astern of the dredge. A maximum concentration of 173 mg/l occurred at a depth of 13.8 m. Depth-averaged concentrations by depth stratum ranged from 13.5 mg/l at 1.4 m to 128.2 mg/l at 14.3 m (Table 16). Depth-averaged TSS concentrations remained below 40 mg/l or approximately 10 mg/l above background throughout the upper 11 m of the water column. The plume became slightly more prominent 125 m astern of the dredge. Transect SCXJ009 indicates an intense plume signature in the lower 2-m of the water column with peak concentrations reaching 184.6 mg/l, or approximately 155 mg/l above background (Figure 48). Depth-averaged TSS concentrations were within ambient levels in the upper 4 m of the water column. Maximum TSS concentrations were largely unchanged at a distance of 188 m from the bucket. By 231 m down-channel, peak concentrations decreased by 40 mg/l to 144.3 mg/l. With the exception of a small number of individual “bins” located along the channel bottom in which TSS concentrations approached 97 mg/l, TSS concentrations averaged less than 75 mg/l 266 m away from the bucket. The trajectory of this lower water column plume did not affect the adjacent SEC flats. Current velocities ranged from 0.08 to 0.13 m/sec. Current vectors were mixed with depth-averaged velocities slower than 0.13 m/sec.

Four cross-channel transects oriented perpendicular to the dredge and crossing the bow of the dredge were completed at distances between 45m and 115 m. Transect SCXJ3 (Figure 48) shows a narrow band of elevated TSS concentrations at depths between 9 and 12 m with a maximum concentration of 89.5 mg/l, or < 60 mg/l above ambient. Highest depth-averaged TSS concentrations of approximately 65 mg/l occurred between 9.9 m and 10 .9 m. Depth-averaged TSS concentrations did not exceed background levels (mean = 30 mg/l) in the upper 5 m of the water column. Transects SCXJ11 and SCXJ18 (Figure 48) occupied up-channel from the dredge crossed the bow at 81 m and 115 m and showed no evidence of turbidity plume movement to the northwest.

Some plume movement occurred from the center of the channel toward the Port bulkhead. Transect SCXJ2 ran parallel to the dredge, 40 m off the starboard side. A maximum TSS concentration of 174 mg/l occurred along the channel bottom (14.3 m). The plume signature occupied the majority of the water column with the exception of the upper 2- m. At mid-water depths, TSS concentrations were typically less than 80 mg/l. Depth-averaged concentrations exceeded background by as little as 7 mg/l in the 2.9 m depth stratum, increasing with water depth to nearly 70 mg/l along the channel bottom. Although peak concentrations decreased to slightly less than 100 mg/l, the plume continued to occupy most of the water column out to a distance of 80 m from the dredge. The final transect (SCXJ17, Figure 48), occupied on the starboard side of the dredge, ran in a northwesterly direction along the channel bulkhead. Highest TSS concentrations were found near the southeast end of the transect (left side of vertical profile SCXJ017, Figure 48) where prevailing currents steered the plume down-channel toward the stern of the dredge. Peak TSS concentrations were still near 100 mg/l in the lower 3-m of the water column. Ambient conditions persisted in the upper water column down to a depth of 6 m on the northwest (up-channel) end of this transect.

Only a slight increase in suspended sediments was detected on transects occupied in the southern half of the SEC. Transect SCXJ4 ran in a southeasterly direction parallel to the long axis of the channel between the dredge and the “outside” face of the silt curtain. At 24 m from the bucket, only a faint plume signature with maximum TSS concentrations less than 87 mg/l was detected. The plume signature remained largely unchanged out to a distance of 55 m from the bucket (Transect SCXJ8). Transect SCXJ12 ran in a southeasterly direction 68 m from the port side of the dredge and 15 m from the “outside” face of the silt curtain. TSS concentrations exceeded ambient by 10 mg/l near the channel bottom. Transect SCXJ19 ran in a south-southeasterly direction “inside” the silt curtain. Depth-averaged TSS concentration was less than 17 mg/l, within background conditions. A maximum TSS concentration of 43.3 mg/l was slightly below corresponding peak concentrations (49.8 mg/l) observed on 12-13 June.

2.7 Survey #5: Silt Curtain Removal

2.7.1 Turbidity

Three turbidity sensors were deployed over the SEC flats and one near the northwestern end of the SEC during an ebbing tide on 24 June to assess sediment resuspension during silt curtain removal. Sensor locations are presented in Figure 49. Turbidity results are presented in Figure 50. Sensor #119, deployed at a depth of 1.2 m measured turbidities ranging from 0.4 to 3.4 NTU (mean = 1.8 NTU). Sensor #478, deployed at a depth of 1.4 m, measured slightly higher turbidities ranging from 2.5 to 5.9 NTU (mean = 3.5 NTU). These values were lower than ambient readings obtained on 12-13 June, indicating that less turbid water had moved into the system and that no significant increased in turbidity was generated during silt curtain removal. Sensor #121, deployed at a depth of 1.8 m, failed during this monitoring session. One additional sensor (#122) was deployed at the northwest end of the SEC. Field notes indicated the arrival of the container vessel *Horizon Navigator* in the SEC at 0615 hrs. Sediment resuspended during the mooring of the ship produced turbidities which exceeded 50 NTU (purple data line, Figure 49). Turbidities decreased slowly to background levels over a span of two hours after the ship was moored.

2.7.2 ADCP Plume Characterization Survey

A mobile ADCP plume survey was completed between 0651 hrs and 1250 hrs on 24 June during an ebbing tide. Peak ebb occurred at 0708 hrs in the South Reach of Newark Bay. The entire survey consisted of 12 transects. A plan view layout of transects can be found in Figure 49. Depth-averaged TSS concentrations and current velocity data are summarized in Table 17. Vertical profiles of TSS concentrations and navigation tracks with depth-averaged current vectors are presented in Figure 51. Transect SCCR1 was a "pre-removal transect" run in a southeasterly direction along the "inside" face of the curtain. Depth-averaged TSS concentrations were lowest (16.1 mg/l) near the surface and highest (25.2 mg/l) in the lower 0.5 m of the water column. Maximum detected TSS concentration was 44 mg/l. Transect SCCR2 was also a pre-removal transect, but was run in a northwesterly direction "outside" the curtain. Depth-averaged TSS concentrations ranged from 17.7 mg/l near the surface to 32.2 mg/l in the lower 0.5 m of the water column. Maximum detected TSS concentration was 67.8 mg/l. Transect averages were 18.6 mg/l (SCCR1) and 19.6 mg/l (SCCR2). Background levels based on 12-13 June measurements averaged 18 mg/l.

Ten additional transects (SCCR3-12) were occupied over the SEC flats during silt curtain removal. Depth-averaged TSS concentrations ranged from 9.8 mg/l to 22.8 mg/l (Table 17). With the exception of a few 'bins" where concentrations reached 35 mg/l, most of the water column along the length of the surveyed area was within the range of background conditions. <u>There was no evidence that the curtain removal process resuspended significant amounts of sediment.</u>

2.8 Silt Curtain Observations

On 16 June 2011 the silt curtain for the South Elizabeth Channel Silt Curtain Study was installed along the periphery of the flats based on existing hydrodynamics and safety and navigation concerns within the NBSA. Thus the curtain was oriented at an overall acute angle to prevailing tidal flows. Installation of the curtain was completed on 17 June. The dredge *Delaware Bay* was moved into position near the entrance to the SEC, thereby creating the necessary conditions for initiation of the curtain performance tests. The initial configuration of the curtain is depicted in Figure 52, which shows a portion of the silt curtain with the boom anchored and the curtain furled and hanging from the boom. Figure 53 also shows the “Clean Venture” crew in the process of unfurling the silt curtain. Shortly after unfurling the curtain, tidal forces caused the curtain to “flare” upward toward the surface. Flaring of the curtain is shown clearly in Figure 54. Even at the northwestern end of the SEC, where current velocities were slower, the curtain’s original unfurled position comprising a nearly straight line running parallel to the long axis of the SEC was rapidly deformed by tidal forces (Figure 55). Each curtain panel can be seen forming concave deflections between the anchor points adjoining each panel. Each 100 ft panel between anchors was deflected in the direction of tidal flow.

Twenty-four hours after curtain installation, at approximately 0830 hrs on 18 June, an inspection by the curtain support crew determined that multiple sections of the installed curtain had been damaged overnight beyond repair. The most obvious factor contributing to the almost immediate silt curtain failure was prevailing currents. Current directions of both ebbing and flooding tides applied forces against the anchored curtain. Another factor acting on the installed curtain system that appeared to contribute to the excessive load was floating debris. Although difficult to quantify, debris striking against and collected within the concavities formed by the panels may have substantially added to forces applied to the individual curtain panels. This effect may have been exacerbated by prevailing exceptionally high tides (Figure 56). Some of the debris, which included tree limbs and large logs, had sufficient mass to cause structural damage to the curtain. A summary of the findings of the silt curtain inspection concluded the following: Section 1, the far northwest end of the curtain, has separated from its anchor; Section 2 is largely intact with only one tear on its eastern end; Section 3 has a 50 ft tear completely separated from the boom;

Sections 4-7 are fully intact, but the curtain is floating on the surface and is not functioning properly; Section 8 has a 20 ft section separated from the boom; and Sections 9-15, nearest the main navigation channel are damaged beyond repair. All 100 ft sections are no longer connected due to failure of the grommets and can no longer be rejoined (Figure 57). In sections where current velocities were highest, large sections of the silt curtain were separated from the boom (Figure 58). Thus within 24 hours following full deployment, a total of at least 800 linear ft of the curtain was damaged beyond repair, particularly among panels deployed between Channel Marker #1 and Channel Marker #7. A five hundred foot section of the curtain deployed toward the northwestern end of the SEC remained relatively functional, with the exception of separated seams between individual 100 ft panels and a small number of tears scattered among individual panels. Structural damage to this section was apparently minimized due to slower prevailing current velocities. Nevertheless, this section of the curtain was not functioning properly because the majority of the curtain flared upward to the surface.

The damaged curtain sections were removed and five damaged panels from the section south and west of the corners of berths 94 and 96 were replaced on 18 June. The curtain remained unfurled to prevent any possible damage to the new sections from the current overnight. The new sections were unfurled and the side panels attached to the previously installed silt curtain on the morning of 19 June before dredging recommenced adjacent to the corner of berths 94 and 96.

3.0 Literature Cited

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4.0 Tables

Table 1. Summary of ambient and ADCP plume characterization surveys. (*Dredging ongoing in the main channel of Newark Bay is not associated with the silt curtain study.Partial survey not used in report)**

Date	Survey ID	Survey Time	Survey Type	Silt Curtain Deployed	Tide	OBS Units Deployed		# of Sediment Samples		# of Water Samples
						Channel	Shoal	*In situ*	Scow	
12 June	SCAA	0826-1012	Ambient (No Dredging)*	No	Ebb	Y	Y	2	-	-
13 June	SCAB	1319-1525	Ambient (No Dredging)*	No	Flood	Y	Y	2	-	100
14 June	SCPA	1016-1153	Dredge Plume	No	Ebb	Y	Y	1	1	-
	SCPB	1536-1632	Dredge Plume	No	Flood	Y	Y	-	-	-
15 June	SCPF	1229-1331	Dredge Plume	No	Ebb	Y	Y	1	1	53
16 June	SCPL	0931-1328	No Dredging	Placement	Ebb	N	Y	1	1	-
18 June	SCXA**	0809-1022	Dredge Plume	Yes	Flood	N	N	1	-	-
19 June	SCXB	1116-1538	Dredge Plume	Yes	Ebb	Y	Y	1	1	-
20 June	SCXD	1430-1523	Dredge Plume	Yes	Ebb	Y	Y	1	1	43
21 June	SCXF	1529-1618	Dredge Plume	Yes	Ebb	Y	Y	1	1	140
	SCXG	1555-1640	Dredge Plume	Yes	Ebb	Y	Y	-	-	-
	SCXH	1503-1545	Dredge Plume	Yes	Flood	Y	Y	-	-	-
22 June	SCXI	1546-1642	Dredge Plume	Yes	Ebb	Y	Y	1	1	-
	SCXJ	1644-1723	Dredge Plume	Yes	Ebb	Y	Y	-	-	-
24 June	SCCR	0651-1252	No Dredging	Removal	Ebb	Y	Y	2	-	-

Table 2. Summary of sediment analysis results from the South Elizabeth Silt Curtain Study. (Note: SEC = South Elizabeth Channel)														
Lab ID	Date	Location	Solids (%)	In Place Density (g/cc)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel (%)	Sand (%)	Coarse Sand (%)	Med. Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)
15704-1	12-Jun	SEC	38.7	0.451	92	36	55	0.0	6.7	0.0	0.4	6.3	67.8	25.5
15704-2	12-Jun	SEC	38.7	0.480	89	33	56	0.0	11.4	0.0	1.2	10.2	73.9	14.7
15721-1	13-Jun	SEC	39.5	0.511	94	35	59	0.0	9.6	0.5	0.6	8.5	75.7	14.7
15721-2	13-Jun	SEC	37.7	0.480	88	34	54	0.0	6.6	0.0	0.2	6.4	67.6	25.8
15748-1	14-Jun	Scow	48.4	0.662	78	29	49	0.0	27.6	0.0	0.7	26.9	59.7	12.7
15748-2	14-Jun	SEC	39.8	0.520	77	31	46	0.0	12.3	0.1	0.8	11.4	66.6	21.1
15761-1	15-Jun	Scow	52.5	0.770	56	26	30	1.0	28.1	2.4	6.7	19.0	55.5	15.4
15761-2	15-Jun	SEC	39.1	0.500	82	32	50	0.0	15.1	0.0	0.5	14.6	64.9	20.0
15814-1	16-Jun	SEC	46.1	0.638	65	27	38	0.0	20.3	0.2	0.4	19.7	62.6	17.1
15814-2	16-Jun	Scow	60.7	0.964	42	22	19	1.6	38.8	2.0	3.3	33.5	47.9	11.7
15815-1	18-Jun	SEC	37.1	0.469	95	35	60	0.0	5.6	0.0	0.1	5.5	75.4	19.0
15816-1	19-Jun	Scow	59.6	0.914	63	26	37	1.8	28.4	2.1	5.2	21.1	52.0	17.8
15816-2	19-Jun	SEC	38.5	0.484	82	35	47	0.0	7.4	0.0	0.2	7.2	73.5	19.1
15827-1	20-Jun	Scow	63.3	0.521	85	33	52	0.7	6.1	0.7	1.2	4.2	79.9	13.3
15827-2	20-Jun	SEC	35.3	0.449	98	36	62	0.0	6.3	0.2	0.8	5.3	69.9	23.8
15893-1	21-Jun	SEC	36.9	0.489	109	35	73	0.0	2.9	0.0	0.0	2.9	62.7	34.4
15893-2	21-Jun	Scow	40.4	0.599	79	33	46	0.0	5.7	0.0	0.9	4.8	76.1	18.2
15892-1	22-Jun	SEC	39.7	0.563	105	35	69	0.0	3.2	0.0	0.3	2.9	69.0	27.8
15892-2	22-Jun	Scow	40.3	0.570	105	35	70	0.0	1.8	0.2	0.0	1.6	80.5	17.7
15894-1	24-Jun	N of Curtain	45.6	0.673	70	28	42	2.6	23.5	1.0	3.7	18.8	61.5	12.4
15894-2	24-Jun	S of Curtain	65.7	1.200	36	21	15	0.7	43.8	0.3	2.2	41.3	42.3	13.2

Table 3. NTU values for deployment of OBS units during the Silt Curtain Study. (Note: ND= No Dredging; SF = Sensor Failure; BC = Bottom Contact--Sensor deployed to deep for water depth.)											
Date	**OBS Unit ID**	**Buoy Location**	**General Description or Measurement**	**Sensor Depth (m)**	**Distance to Dredge**	**Ebb Range**		**Ebb Mean**	**Flood Range**		**Flood Mean**
						Min	***Max***		***Min***	***Max***	
12 June	119	Flats	Ambient	1.9	ND	2	10	4.1	2.4	20.1	7.1
	121	Flats	Ambient	1.8	ND	3.6	12.8	6.2	3.8	20.2	8.6
	478	Flats	Ambient	1.9	ND	3.7	7.5	4.7	5.0	26.4	9.0
	350	Channel	Ambient	3.3	ND	3.8	10.3	5.1	4.2	11.8	6.1
	351	Channel	Ambient	7.7	ND	3.2	7.3	4.8	3.2	12.1	5.8
	122	Channel	Ambient	10.7	ND	4.9	13.3	6.9	4.3	25.8	8.1
13 June	119	Flats	Ambient	1.9	ND	2.6	9.4	4.1	1.8	22.1	5.7
	121	Flats	Ambient	1.8	ND	3.7	6.2	5.1	3.8	21.0	9.5
	478	Flats	Ambient	1.9	ND	3.8	6.4	4.8	4.2	17.8	9.1
	350	Channel	Ambient	3.2	ND	4.8	10.3	6.2	4.4	15.6	6.9
	351	Channel	Ambient	7.6	ND	5.0	8.2	6.0	4.3	18.1	7.3
	122	Channel	Ambient	10.7	ND	DE	DE	DE	DE	DE	DE
14 June	119	Flats	Dredge-No Silt Curtain	1.7	333	--	--	--	2.8	25.7	9.1
	121	Flats	Dredge-No Silt Curtain	1.7	200	--	--	--	4.3	26.7	11.8
	478	Flats	Dredge-No Silt Curtain	1.8	160	--	--	--	4.9	23.6	11.5
	126	Channel	Ambient- Upcurrent of dredge	4.9	150	--	--	--	5.6	25.1	11.1
	180	Channel	Ambient- Upcurrent of dredge	10.1	150	--	--	--	7.5	46.9	19.0
	350	Channel	Near-Field Plume	3.3	160	--	--	--	5.5	22.6	10.1
	351	Channel	Near-Field Plume	7.8	160	--	--	--	5.4	24.9	11.2
	122	Channel	Near-Field Plume	11.0	160	--	--	--	7.2	29.4	13.6
	477	Channel	Far-Field Plume	4.7	300	--	--	--	4.8	18.2	8.4
	120	Channel	Far-Field Plume	10.4	300	--	--	--	4.8	28.1	10.9
15 June	119	Flats	Dredge-No Silt Curtain	1.5	274	1.9	5.4	3.8	--	--	--
	121	Flats	Dredge-No Silt Curtain	1.7	294	4.3	19.3	5.7	--	--	--
	478	Flats	Dredge-No Silt Curtain	1.7	215	4.6	7.5	5.7	--	--	--
	126	Channel	Ambient- Upcurrent of dredge	4.8	130	4.4	9.5	6.1	--	--	--
	180	Channel	Ambient- Upcurrent of dredge	10.2	130	6.0	20.3	7.8	--	--	--
	350	Channel	Near-Field Plume	3.3	135	4.1	13.3	5.7	--	--	--
	351	Channel	Near-Field Plume	7.7	135	4.8	45.6	6.5	--	--	--
	122	Channel	Near-Field Plume	10.6	135	5.9	64.8	13.2	--	--	--
	477	Channel	Far-Field Plume	4.7	245	3.5	7.6	5.2	--	--	--
	120	Channel	Far-Field Plume	10.3	245	4.3	21.7	7.0	--	--	--

Table 3 (Continued).

Date	OBS Unit ID	Buoy Location	General Description or Measurement	Sensor Depth (m)	Distance to Dredge	Ebb Range		Ebb Mean	Flood Range		Flood Mean
						Min	Max		Min	Max	
16 June	119	Flats	Silt Curtain Placement	1.1	ND	0.6	9.4	2.8	1.7	19.5	8.2
	121	Flats	Silt Curtain Placement	1.1	ND	3.5	9.2	4.9	4.7	28.8	10.4
	478	Flats	Silt Curtain Placement	1.3	ND	3.8	26.4	4.8	5.0	20.5	10.7
19 June	119	Flats	TSS Inside Silt Curtain	1.2	274	2.1	7.2	4.1	2.3	15.5	6.2
	477	18’ Contour	TSS Outside Silt Curtain	2.0	270	3.7	9.1	5.2	3.9	12.3	5.6
	120	18’ Contour	TSS Outside Silt Curtain	3.5	270	2.3	10.7	4.8	2.6	11.9	4.8
	478	Flats	TSS Inside Silt Curtain	1.4	155	3.9	10.3	5.5	4.1	15.1	7.0
	126	18’ Contour	TSS Outside Silt Curtain	1.8	122	4.5	18.4	7.7	3.8	12.0	6.1
	180	18’ Contour	TSS Outside Silt Curtain	3.3	122	5.1	26.4	8.4	5.5	12.2	6.9
	121	Flats	TSS Inside Silt Curtain	1.2	175	4.1	24.4	8.5	4.1	16.5	6.9
	350	18’ Contour	TSS Outside Silt Curtain	2.2	115	3.5	28.9	8.3	3.5	10.1	5.2
	351	18’ Contour	TSS Outside Silt Curtain	3.7	115	3.5	31.0	7.4	3.7	13.1	5.5
	122	SEC	Ambient NW end of SEC	5.7	547	6.2	10.3	7.9	5.3	11.1	6.6
20 June	119	Flats	TSS Inside Silt Curtain	1.4	230	1.7	29.1	6.6	1.7	9.2	3.9
	477	18’ Contour	TSS Outside Silt Curtain	2.0	188	3.1	29.1	7.2	2.9	13.3	4.7
	120	18’ Contour	TSS Outside Silt Curtain	3.7	188	1.4	32.5	6.8	1.6	8.6	3.8
	478	Flats	TSS Inside Silt Curtain	1.5	136	3.0	26.7	6.6	3.1	10.3	5.1
	126	18’ Contour	TSS Outside Silt Curtain	1.9	86	3.3	28.2	7.1	3.1	7.3	4.8
	180	18’ Contour	TSS Outside Silt Curtain	3.5	86	4.5	32.3	9.3	4.5	8.9	5.8
	121	Flats	TSS Inside Silt Curtain	1.3	165	SF	SF	SF	SF	SF	SF
	350	18’ Contour	TSS Outside Silt Curtain	2.2	109	3.0	18.5	6.1	2.9	6.8	4.1
	351	18’ Contour	TSS Outside Silt Curtain	3.7	109	2.7	20.8	6.5	2.7	6.5	4.0
	122	SEC	Ambient NW end of SEC	5.8	537	5.6	9.8	7.5	4.4	8.0	5.9
21 June	119	Flats	TSS Inside Silt Curtain	1.4	305	1.8	4.1	3.1	--	--	--
	477	18’ Contour	TSS Outside Silt Curtain	2.0	278	3.1	6.7	3.6	--	--	--
	120	18’ Contour	TSS Outside Silt Curtain	3.4	278	1.0	3.0	1.9	--	--	--
	478	Flats	TSS Inside Silt Curtain	1.5	174	3.1	13.1	4.9	--	--	--
	126	18’ Contour	TSS Outside Silt Curtain	1.9	118	3.8	37.0	7.1	--	--	--
	180	18’ Contour	TSS Outside Silt Curtain	3.6	118	4.7	13.1	6.3	--	--	--
	121	Flats	TSS Inside Silt Curtain	1.8	162	SF	SF	SF	--	--	--
	350	18’ Contour	TSS Outside Silt Curtain	2.3	95	3.2	25.4	4.6	--	--	--
	351	18’ Contour	TSS Outside Silt Curtain	3.7	95	SF	SF	SF	--	--	--
	122	SEC	Ambient NW end of SEC	5.8	418	5.7	14.0	9.7	--	--	--

Table 3 (Concluded).											
Date	**OBS Unit ID**	**Buoy Location**	**General Description or Measurement**	**Sensor Depth (m)**	**Distance to Dredge**	**Ebb Range**		**Ebb Mean**	**Flood Range**		**Flood Mean**
						Min	***Max***		***Min***	***Max***	
22 June	119	Flats	TSS Inside Silt Curtain	1.3	283	1.5	5.9	3.1	1.5	20.5	2.6
	477	18’ Contour	TSS Outside Silt Curtain	2.0	278	2.7	11.3	4.3	3.1	16.8	5.5
	120	18’ Contour	TSS Outside Silt Curtain	3.5	278	0.8	11.3	3.2	2.0	10.8	4.0
	478	Flats	TSS Inside Silt Curtain	1.5	140	2.9	9.1	4.5	2.8	5.7	3.5
	126	18’ Contour	TSS Outside Silt Curtain	1.9	128	3.4	30.0	7.5	3.5	28.9	7.9
	180	18’ Contour	TSS Outside Silt Curtain	3.6	128	3.9	26.4	7.1	4.3	25.0	6.2
	121	Flats	TSS Inside Silt Curtain	1.8	105	SF	SF	SF	SF	SF	SF
	350	18’ Contour	TSS Outside Silt Curtain	2.2	70	2.3	34.6	6.6	2.6	32.1	6.1
	351	18’ Contour	TSS Outside Silt Curtain	3.7	70	SF	SF	SF	SF	SF	SF
	122	SEC	Ambient NW end of SEC	5.8	343	4.1	10.2	6.3	3.6	11.1	6.4
24 June	119	Flats	Silt Curtain Removal	1.2	ND	0.4	3.4	1.8	1.4	3.9	2.2
	478	Flats	Silt Curtain Removal	1.4	ND	2.5	5.9	3.5	2.7	22.0	5.6
	121	Flats	Silt Curtain Removal	1.8	ND	SF	SF	SF	SF	SF	SF
	122	SEC	Ambient NW end of SEC	5.8	ND	3.4	52.6	7.9	3.1	6.1	4.4

Table 4. Acoustic data summary for ambient survey SCAA1-20 completed on 12 June 2011 during an ebbing tide. (Note: Files SCAA14-16 was not included in ambient data table due to their close proximity to an active dredging operation not associated with the silt curtain study.) Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l); DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration; *Length in meters

									Depth-Averaged Concentration by Depth Strata										
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**	**6.4**
SCAA1	0928	155	0.14	224	49.8	22.3	22.3	35.0	11.2	14.4	15.2	15.6	16.5	17.2	18.2	18.5	19.1	19.7	20.4
SCAA2	0930	152	0.10	206	46.9	22.0	22.0	30.5	9.0	13.5	15.6	17.5	19.2	20.4	21.2	22.0	23.0	23.8	24.6
SCAA3	0933	211	0.08	195	48.4	23.3	23.3	34.0	9.0	13.1	14.8	16.0	17.3	18.8	20.0	21.5	22.0	22.5	23.5
SCAA4	0936	141	0.11	197	38.7	20.3	20.3	30.2	8.0	11.3	13.0	14.2	15.1	16.0	16.9	18.7	19.5	21.0	21.2
SCAA5	0939	280	0.18	220	47.3	15.8	15.9	20.8	9.0	13.3	15.0	16.7	17.4	18.5	19.8	20.4	21.4	20.1	20.7
SCAA6	0945	350	0.38	209	42.5	16.3	16.3	23.9	9.0	13.0	14.7	15.2	15.6	15.5	15.7	16.3	17.0	18.1	18.6
SCAA7	0946	337	0.43	211	39.5	19.2	19.2	26.2	10.8	15.2	16.5	16.9	17.9	19.0	20.0	20.4	21.0	21.5	22.5
SCAA8	0952	372	0.63	216	20.3	12.2	12.2	13.3	10.3	15.3	16.9	16.0	17.0	17.4	18.4	-	-	-	-
SCAA9	0956	331	0.61	230	24.8	13.8	13.8	16.4	10.7	15.0	15.8	14.9	15.1	19.6	20.5	-	-	-	-
SCAA10	0959	522	0.43	197	30.3	11.6	11.6	13.7	9.4	13.4	15.2	16.0	18.6	18.4	-	-	-	-	-
SCAA11	1005	484	0.56	233	21.7	10.7	10.7	11.8	9.6	13.9	-	-	-	-	-	-	-	-	-
SCAA12	1009	301	0.63	239	25.7	15.2	15.2	17.8	12.0	17.8	19.5	19.1	18.4	22.2	-	-	-	-	-
SCAA13	1011	238	0.50	199	22.5	12.4	12.4	13.7	11.0	15.9	18.1	-	-	-	-	-	-	-	-
SCAA14	1021	360	0.46	214	48.1	23.1	23.1	36.8	10.4	13.2	16.6	17.7	18.8	19.2	19.7	19.9	20.1	20.4	20.8
SCAA18	1052	599	0.28	218	50.2	23.5	23.5	33.3	10.3	15.4	18.0	19.7	21.2	22.2	22.6	22.5	21.9	21.5	21.3
SCAA19	1108	519	0.29	233	55.5	28.9	28.9	40.9	12.4	18.5	21.1	22.8	24.0	24.9	25.7	26.2	26.5	26.3	26.0
SCAA20	1116	462	0.29	203	75.5	36.5	36.6	40.1	13.9	20.9	24.0	26.8	29.2	31.7	33.6	35.6	37.4	38.9	40.4

Table 4 (Concluded).																		
	Depth-Averaged Concentration by Depth Strata																	
Transect	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**	**15.3**
SCAA1	21.5	22.8	24.1	25.1	26.5	27.8	29.1	30.8	32.2	33.8	34.9	36.5	38.8	40.8	42.7	43.1	-	-
SCAA2	25.2	25.6	26.8	28.5	28.4	29.5	30.1	30.4	31.0	31.1	31.8	32.7	34.4	36.2	39.4	-	-	-
SCAA3	25.1	26.1	27.2	28.4	29.3	30.6	31.3	32.3	33.5	35.3	36.8	38.1	39.1	42.6	44.0	44.7	-	-
SCAA4	22.3	23.8	25.7	26.4	27.9	29.5	31.0	31.8	32.7	34.0	34.7	35.8	35.5	36.4	36.3	-	-	-
SCAA5	23.6	28.6	31.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA6	19.3	20.1	21.3	21.9	22.8	22.7	21.1	20.1	20.4	23.1	22.5	23.6	28.0	25.5	51.6	-	-	-
SCAA7	23.4	23.7	25.1	25.5	25.5	24.3	25.5	26.8	28.7	30.3	31.8	30.0	30.2	31.9	34.7	-	-	-
SCAA8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAA14	21.2	21.6	21.8	22.1	22.4	22.8	23.6	24.1	24.8	25.7	29.0	29.6	29.9	31.3	33.5	36.3	40.3	43.2
SCAA18	21.0	20.8	20.7	21.1	20.8	21.8	22.7	23.9	24.7	25.4	26.5	27.4	28.5	29.6	30.3	31.1	31.9	29.8
SCAA19	25.7	25.7	26.0	26.7	27.7	29.0	30.4	32.0	33.5	34.9	36.3	37.8	38.8	39.4	40.2	40.7	41.5	35.4
SCAA20	42.3	43.2	43.9	44.3	44.3	43.9	43.1	42.2	41.5	40.7	40.2	40.2	39.9	39.7	39.6	40.0	40.1	40.1

Table 5. Acoustic data summary for ambient survey SCAB1-20 completed on12 June 2011 during a flooding tide. (Note: Files SCAB4-7 was not included due to their close proximity to an active dredging operation not associated with the silt curtain study.) Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l); DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l); *Length in meters

									Depth-Average Concentration by Depth Strata										
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCAB1	1419	477	0.18	60.5	61.6	25.6	25.6	38.8	8.9	13.2	15.3	16.8	18.0	19.5	20.6	21.7	22.6	23.1
SCAB2	1426	499	0.20	54.6	68.7	22.2	22.2	32.0	8.3	12.1	13.6	14.7	15.8	17.0	17.8	18.8	19.7	20.8
SCAB3	1446	629	0.29	35.3	66.2	25.4	25.4	37.5	10.6	15.1	17.0	18.6	20.0	21.1	22.2	23.2	24.0	24.9
SCAB4	1455	588	0.19	118.7	56.1	17.4	17.4	25.3	9.2	13.2	14.6	15.6	15.6	15.8	15.8	15.9	15.9	15.9
SCAB8	1526	133	0.16	115.0	48.2	15.6	15.6	21.5	8.5	11.7	12.7	13.2	13.8	14.1	14.3	14.7	14.6	15.3
SCAB9	1529	153	0.12	118.6	34.0	18.7	18.7	25.6	10.4	14.5	15.8	16.3	16.5	17.0	17.1	16.5	16.3	16.5
SCAB10	1532	141	0.12	138.2	40.0	23.2	23.2	28.3	11.4	16.6	18.5	19.8	20.7	21.7	23.4	24.1	25.0	25.5
SCAB11	1534	548	0.22	102.6	49.9	19.9	19.9	23.4	12.4	17.2	18.9	19.9	20.6	21.0	21.2	21.3	21.4	21.5
SCAB12	1540	393	0.41	76.6	46.7	23.6	23.6	30.6	13.6	20.3	22.9	25.3	27.0	28.6	29.6	27.4	28.4	30.0
SCAB13	1544	266	0.33	62.4	344.7	54.4	54.4	133.9	22.8	32.3	35.1	37.3	39.6	43.2	47.7	50.0	54.9	64.4
SCAB14	1547	300	0.58	85.2	46.9	32.2	32.2	36.8	25.9	35.5	37.6	39.0	41.1	43.6	45.3	-	-	-
SCAB15	1550	335	0.50	93.6	50.0	28.0	27.9	34.5	19.0	27.8	31.3	37.5	40.3	44.6	45.8	45.1	-	-
SCAB16	1551	400	0.39	95.3	166.8	51.4	51.4	63.9	32.1	49.1	55.1	58.9	61.7	64.3	67.3	77.9	97.6	-
SCAB17	1600	484	0.67	100.6	89.5	39.4	39.4	47.4	30.5	45.0	46.6	42.7	-	-	-	-	-	-
SCAB18	1614	401	0.54	77.1	68.1	36.5	36.5	43.8	25.9	37.8	41.8	44.9	49.0	52.4	55.8	59.2	60.6	62.4
SCAB19	1617	240	0.62	63.1	48.5	30.9	30.9	38.1	22.3	33.5	39.9	41.0	43.7	-	-	-	-	-
SCAB20	1621	500	0.38	88.2	149.8	60.5	60.5	96.9	15.1	23.4	28.4	33.0	37.8	42.3	46.4	49.4	52.9	55.9
SCAB21	1628	523	0.35	71.6	144.8	52.0	51.9	87.2	18.7	27.1	30.2	32.9	35.5	37.7	40.3	42.6	44.4	46.4

Table 5 (Concluded).																			
Depth-Average Concentration by Depth Strata																			
Transect	**5.9**	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCAB1	23.1	23.5	24.2	25.1	25.5	26.1	27.0	28.2	28.9	30.0	31.2	31.8	32.9	33.4	33.9	34.7	35.5	36.7	38.1
SCAB2	20.8	21.7	22.6	23.0	23.6	24.6	25.2	25.9	26.2	26.8	27.3	27.8	28.7	29.3	29.8	30.4	31.0	31.9	33.9
SCAB3	24.9	26.1	26.6	26.9	26.7	26.5	26.6	27.1	27.9	28.4	29.6	31.1	32.4	33.3	34.0	34.3	34.7	34.8	34.8
SCAB4	15.9	15.9	16.4	16.8	17.0	17.2	17.5	18.2	18.7	19.4	20.2	21.1	21.9	22.0	22.9	24.5	24.9	-	-
SCAB8	15.3	15.8	15.9	16.2	16.5	17.2	17.7	18.0	18.4	19.7	20.4	20.3	22.0	22.2	22.0	22.3	20.9	-	-
SCAB9	16.5	16.8	17.4	17.9	18.5	19.0	19.8	20.8	21.8	22.6	23.2	23.9	24.8	25.4	25.8	25.4	25.2	25.7	-
SCAB10	25.5	26.3	26.9	27.4	27.5	27.2	27.9	28.4	28.6	29.1	29.6	29.6	29.6	29.6	29.8	28.7	28.7	-	-
SCAB11	21.5	22.3	22.6	23.8	24.2	25.7	25.3	-	-	-	-	-	-	-	-	-	-	-	-
SCAB12	30.0	31.5	31.6	32.5	32.0	32.6	32.8	33.0	34.0	33.7	33.7	33.5	-	-	-	-	-	-	-
SCAB13	64.4	76.6	79.4	78.2	79.4	89.1	96.1	123.6	114.9	141.9	156.6	149.4	264	-	-	-	-	-	-
SCAB14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAB15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAB16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAB17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAB18	62.4	66.2	67.3	67.3	68.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAB19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAB20	55.9	58.4	61.1	63.6	66.7	69.3	71.8	74.7	76.8	79.1	80.2	81.1	81.3	81.4	82.2	83.3	85.0	89.0	84.6
SCAB21	46.4	48.3	51.1	53.3	55.1	57.5	59.2	61.1	64.6	67.4	70.0	72.5	75.0	77.4	81.8	88.0	93.3	99.3	108.3

Table 6. Acoustic data summary for ADCP plume survey SCPA1-15 completed on 14 June 2011 during an ebbing tide, prior to silt curtain deployment. **Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l); DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l); *Length in meters**

									Depth-Averaged Concentration by Depth Strata								
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**
SCPA1	1016	238	0.26	219.3	45.1	19.0	18.9	27.3	12.5	16.1	15.7	14.5	13.7	13.5	14.1	14.7	15.3
SCPA2	1018	217	0.24	227.8	32.1	18.8	18.8	25.8	13.3	16.0	15.6	14.7	14.0	14.0	14.4	14.7	15.1
SCPA3	1021	508	0.11	219.2	41.0	21.7	21.7	29.2	10.1	13.6	14.8	15.9	16.8	17.9	18.8	19.4	19.9
SCPA4	1026	516	0.21	217.9	53.2	14.9	14.9	19.0	9.7	13.6	15.2	16.2	17.0	17.9	19.8	23.1	21.8
SCPA5	1032	585	0.44	217.2	57.1	17.1	17.1	21.5	11.9	16.1	17.1	17.9	18.1	18.1	18.6	19.4	19.5
SCPA6	1040	458	0.50	214.6	42.3	15.5	15.5	17.6	12.7	17.0	19.0	18.9	19.2	19.7	21.7	21.3	22.3
SCPA7	1046	527	0.37	220.4	43.4	15.2	15.2	17.7	11.6	15.9	17.6	17.5	18.0	19.0	17.8	18.6	-
SCPA8	1114	351	0.43	216.7	210.1	35.0	34.9	37.7	19.6	29.6	33.8	37.0	41.1	42.4	43.8	43.7	41.5
SCPA9	1118	388	0.43	211.8	131.9	26.9	26.9	31.4	14.9	21.0	22.7	23.8	24.5	26.0	27.4	28.8	29.8
SCPA10	1123	382	0.48	215.9	82.4	24.4	24.5	32.0	14.6	20.2	21.6	22.0	22.2	23.5	24.6	25.7	26.9
SCPA11	1127	445	0.47	214.7	96.1	24.1	24.1	32.2	14.1	19.2	20.2	20.6	21.4	22.4	23.0	23.6	24.5
SCPA12	1132	501	0.50	217.6	61.7	21.7	21.7	28.1	12.5	17.6	19.2	20.3	20.9	21.1	21.4	21.9	22.5
SCPA13	1138	398	0.39	219.3	56.9	25.2	25.2	34.4	12.5	18.0	19.6	20.6	21.3	22.1	22.7	23.4	23.9
SCPA14	1144	522	0.32	216.9	68.4	23.5	23.6	34.2	12.0	17.1	18.7	19.1	19.8	20.7	21.4	21.6	22.2
SCPA15	1149	391	0.25	201.2	64.8	27.1	27.1	42.6	11.9	17.1	19.2	20.6	21.3	22.1	22.8	22.7	23.1

Table 6 (Concluded).																				
	Depth-Averaged Concentration by Depth Strata																			
Transect	**5.9**	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**	**15.3**
SCPA1	15.9	16.2	16.8	17.5	18.3	19.4	20.1	21.0	21.6	21.8	22.7	22.7	23.2	23.5	24.3	24.8	25.8	26.5	27.5	75.2
SCPA2	15.7	16.6	17.6	18.1	18.8	19.6	20.3	21.0	21.6	22.0	22.1	22.2	22.7	23.2	23.9	24.7	25.4	26.5	27.7	-
SCPA3	20.3	20.8	21.5	22.2	22.7	23.2	23.8	24.6	25.0	25.6	26.1	26.7	27.2	27.8	28.4	28.0	28.3	27.4	-	-
SCPA4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCPA5	20.0	21.0	24.6	23.6	24.0	25.9	31.7	33.4	36.0	37.4	38.2	37.7	100.5	-	-	-	-	-	-	-
SCPA6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCPA7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCPA8	39.1	38.7	39.8	40.4	40.9	41.9	44.0	46.3	48.2	48.2	47.8	46.9	46.5	45.0	44.0	39.8	34.4	28.2	-	-
SCPA9	31.5	32.3	33.5	34.6	35.7	37.0	38.1	39.3	39.0	38.9	38.6	37.7	37.6	37.5	38.1	37.8	38.1	50.6	-	-
SCPA10	27.5	27.9	28.8	29.5	30.0	30.7	31.3	32.4	32.9	34.4	35.8	36.5	37.3	37.9	39.1	39.2	39.7	57.6	-	-
SCPA11	25.2	25.7	26.4	26.9	27.6	28.4	29.7	30.5	31.5	32.4	32.9	33.6	34.5	35.8	36.5	36.6	36.0	36.4	-	-
SCPA12	23.3	24.0	24.8	25.6	26.7	27.7	28.6	29.8	30.9	31.9	32.7	33.1	33.8	34.6	35.0	35.6	35.6	29.4	-	-
SCPA13	24.5	25.6	26.8	28.4	30.1	32.1	33.5	34.5	35.2	35.7	36.1	36.4	36.9	36.9	37.5	38.0	38.4	41.5	45.7	35.2
SCPA14	23.2	24.8	25.6	26.7	27.7	28.6	29.3	29.9	30.3	31.0	31.7	32.5	33.4	34.2	35.4	36.7	38.0	40.4	43.0	46.7
SCPA15	23.9	24.6	25.2	26.5	27.6	28.8	29.9	31.5	32.8	33.7	34.5	35.5	36.9	38.7	40.9	42.9	45.1	45.8	46.5	47.4

Table 7. Acoustic data summary for ADCP plume survey SCPF1-10 completed on 15 June 2011 during an ebbing tide, prior to silt curtain deployment. **Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.**

							Depth-Averaged Concentration by Depth Strata											
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	
SCPF1	1228	476	0.18	179	58.5	21.3	21.3	27.4	13.2	17.8	18.8	19.0	18.8	18.6	18.7	18.9	19.2	
SCPF2	1233	241	0.27	220	44.2	23.4	23.4	29.2	14.4	19.1	20.6	21.2	20.8	20.4	20.9	21.1	21.5	
SCPF3	1300	290	0.40	214	101.4	24.7	24.7	29.7	20.1	27.0	28.0	26.4	25.8	26.5	27.4	28.4	30.3	
SCPF4	1304	282	0.43	214	64.1	25.7	25.7	33.8	14.6	19.8	21.2	22.5	24.0	26.0	28.0	30.0	31.4	
SCPF5	1307	316	0.41	219	69.4	21.5	21.5	28.8	12.3	17.2	19.3	20.6	22.3	23.9	24.0	22.9	24.3	
SCPF6	1311	252	0.36	217	69.3	24.6	24.6	35.0	12.5	17.6	19.3	19.0	19.5	20.6	21.8	23.7	24.9	
SCPF7	1314	329	0.42	216	79.3	22.2	22.2	31.4	13.1	18.1	18.1	18.8	19.6	21.1	22.6	23.4	24.2	
SCPF8	1319	309	0.44	215	68.2	21.3	21.4	31.1	11.5	15.8	17.0	18.0	18.5	19.4	19.8	20.9	22.7	
SCPF9	1322	326	0.43	218	59.4	26.8	26.8	35.5	17.8	16.2	17.9	19.5	20.6	21.8	22.7	23.7	24.8	
SCPF10	1326	267	0.25	210	49.1	25.6	25.6	37.8	13.0	16.4	17.7	19.1	20.0	21.2	21.9	22.5	23.4	
	Depth-Averaged Concentration by Depth Strata																	
Transect	**5.9**	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCPF1	19.6	19.9	20.0	20.4	20.7	21.3	21.8	22.5	23.1	23.6	24.1	24.7	25.1	25.7	26.3	26.8	28.5	30.2	31.8
SCPF2	22.3	22.3	22.4	22.9	23.6	24.1	24.1	24.5	25.0	25.6	25.7	26.3	26.6	27.2	27.9	28.5	29.0	29.7	28.4
SCPF3	31.8	33.1	33.9	34.6	35.3	36.7	33.4	33.8	34.2	34.6	36.1	37.2	37.1	38.1	39.4	41.0	43.5	42.2	-
SCPF4	32.5	33.1	33.2	33.6	34.5	33.5	32.4	33.4	34.3	34.7	35.5	37.0	38.3	40.4	41.6	43.2	44.3	46.0	-
SCPF5	25.6	27.1	28.7	29.8	31.0	33.0	34.4	36.2	37.0	37.6	38.3	37.0	37.2	37.6	38.0	39.2	41.7	-	-
SCPF6	26.5	28.4	29.9	31.8	33.0	34.2	35.1	35.6	36.2	37.0	37.1	37.7	38.2	38.9	40.2	42.0	43.0	-	-
SCPF7	25.4	26.2	27.3	28.0	28.6	28.9	29.5	30.6	32.0	33.2	33.9	35.3	37.1	38.0	40.2	42.0	42.5	-	-
SCPF8	23.5	25.0	27.2	27.9	28.9	30.2	30.4	31.1	32.1	34.2	35.7	36.5	37.7	38.7	40.2	41.7	43.6	38.1	-
SCPF9	25.9	26.7	26.9	27.2	27.2	27.4	28.0	29.3	30.4	31.6	33.5	34.3	36.0	37.5	39.1	41.0	41.8	43.6	-
SCPF10	23.9	24.1	24.7	24.9	24.9	25.5	26.4	27.3	28.3	29.2	30.8	31.7	33.1	34.1	35.6	36.9	38.5	40.5	42.3

Table 8. Acoustic data summary for ADCP plume survey SCPB1-8 completed on 14 June 2011 during a flooding tide, prior to silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.

									Depth-Averaged Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCPB1	1536	347	0.38	38.6	76.9	25.6	25.6	46.8	11.5	15.4	16.3	16.9	17.5	18.2	18.9	19.5	20.0	20.9
SCPB2	1541	377	0.39	53.4	76.0	23.0	22.9	39.0	12.2	15.7	16.6	17.2	18.0	18.9	19.8	20.6	21.7	22.2
SCPB3	1545	341	0.25	97.3	44.1	17.5	17.5	22.5	13.1	16.6	17.3	17.7	17.9	18.1	18.2	18.5	18.7	18.3
SCPB4	1613	322	0.24	68.1	236.7	36.2	36.2	43.8	19.6	29.7	34.4	40.0	43.8	45.1	44.9	43.0	42.4	42.0
SCPB5	1617	342	0.22	91.3	85.3	27.4	27.4	43.4	12.6	18.0	20.1	21.8	23.1	23.2	23.6	23.9	24.1	24.1
SCPB6	1621	280	0.28	66.3	78.5	31.2	31.2	48.2	14.6	20.0	22.6	23.9	25.2	26.2	27.0	27.3	27.8	28.1
SCPB7	1626	275	0.32	61.6	80.1	35.0	35.0	56.7	14.0	19.8	23.4	25.3	26.8	28.0	29.0	29.9	30.7	31.1
SCPB8	1629	248	0.33	45.2	84.4	39.0	39.0	57.9	13.3	20.3	23.5	26.0	27.8	29.6	30.8	32.1	33.0	34.2

		Depth-Averaged Concentration by Depth Strata																
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**	**15.3**
SCPB1	21.6	22.4	23.4	24.6	25.9	28.0	30.4	33.3	36.3	39.7	43.0	45.9	49.0	51.1	54.0	56.7	54.0	-	-
SCPB2	22.5	23.1	23.7	24.8	26.0	27.2	28.3	29.6	31.6	33.0	34.7	36.4	39.2	42.7	46.0	49.5	52.6	-	-
SCPB3	18.2	18.7	19.7	20.8	21.9	23.0	24.5	25.4	26.4	27.7	28.5	29.7	30.6	31.5	33.3	-	-	-	-
SCPB4	41.5	40.6	41.8	41.9	41.8	42.8	43.8	44.5	45.1	46.4	49.0	51.7	54.5	55.7	58.6	57.0	56.1	56.9	-
SCPB5	24.7	25.2	25.8	26.4	27.6	28.4	29.7	31.0	32.2	33.1	34.6	36.7	38.6	41.5	45.4	58.0	63.6	60.9	57.5
SCPB6	28.2	28.5	29.1	29.5	30.6	31.1	31.8	32.9	33.8	34.8	35.6	36.5	37.8	39.4	41.3	43.7	46.9	47.9	49.1
SCPB7	31.4	31.6	31.8	32.1	32.5	33.1	33.9	35.3	37.3	38.9	40.4	41.8	43.2	43.9	45.1	46.5	49.0	53.2	54.8
SCPB8	35.5	36.6	37.5	38.5	39.9	41.2	42.1	43.1	44.0	45.0	45.9	47.0	48.2	49.2	50.1	51.3	52.6	55.3	57.1

Table 9. Acoustic data summary for ADCP plume survey SCPL36-41 completed on 16 June 2011 during an ebbing tide, to assess sediment resuspension during silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l) DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l); *Length in meters.

									Depth-Averaged Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCPL36	0929	481	0.24	163.6	62.7	15.4	15.4	22.1	8.2	11.9	14.1	16.0	15.3	14.5	15.4	16.2	17.1	18.9
SCPL37	0945	505	0.11	202.5	60.7	24.2	24.2	38.7	10.9	15.5	16.4	16.7	17.1	17.3	17.7	18.2	18.7	19.3
SCPL38	0950	561	0.21	177.3	71.2	20.1	20.1	25.2	15.1	19.8	20.3	21.4	20.9	20.5	19.9	19.9	19.9	20.0
SCPL39	1315	493	0.48	236.8	53.7	15.1	15.1	18.2	11.9	16.4	17.4	18.2	17.0	18.4	18.4	19.2	19.3	19.6
SCPL40	1320	336	0.68	236.6	38.3	13.8	13.8	15.7	11.9	16.7	-	-	-	-	-	-	-	-
SCPL41	1324	328	0.53	248.5	36.8	15.6	15.6	17.1	14.0	18.0	-	-	-	-	-	-	-	-

	Depth-Averaged Concentration by Depth Strata																
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCPL36	20.0	21.0	21.3	21.8	23.3	25.6	27.3	27.6	28.8	30.4	32.3	34.6	36.9	37.0	39.5	44.0	45.4	-
SCPL37	19.8	20.5	21.6	22.8	23.9	25.2	26.6	27.9	29.3	30.5	31.6	32.6	33.6	34.7	36.0	37.8	41.6	41.6
SCPL38	20.2	21.0	22.5	24.2	26.0	27.8	29.2	31.2	34.5	39.2	39.6	42.8	46.0	53.1	59.0	62.9	63.0	65.6
SCPL39	20.6	21.5	21.5	21.4	21.7	22.6	22.0	21.4	23.1	22.2	22.9	23.0	24.1	24.8	24.8	-	-	-
SCPL40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCPL41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 10. Acoustic data summary for ADCP plume survey SCXB1-23 completed on 19 June 2011 during an ebbing tide. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), DAC=Depth-Averaged Concentration (mg/l), MC = Maximum Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.																		
									Depth-Averaged Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCXB1	1116	493	0.17	166.6	118.9	21.1	21.1	38.0	10.8	15.6	17.0	18.2	19.8	20.6	21.2	21.3	22.6	23.3
SCXB2	1125	456	0.24	114.8	30.9	16.4	16.4	20.1	12.5	15.7	18.1	20.6	-	-	-	-	-	-
SCXB3	1154	466	0.13	185.3	116.7	22.4	22.4	36.0	13.3	18.4	20.6	21.6	22.5	23.1	23.7	24.9	24.8	25.9
SCXB4	1203	456	0.18	166.8	49.7	15.3	15.3	16.7	12.3	16.5	16.2	16.5	-	-	-	-	-	-
SCXB5	1325	428	0.33	237.5	44.4	16.7	16.7	19.4	12.9	17.7	19.5	20.3	-	-	-	-	-	-
SCXB6	1332	129	0.24	239.5	97.8	23.3	23.3	34.3	11.0	16.6	19.3	21.0	22.4	23.7	25.2	26.8	27.5	28.7
SCXB7	1340	118	0.18	272.3	88.3	34.0	34.0	47.1	16.6	21.4	22.7	24.1	25.9	27.7	28.7	30.0	31.0	31.3
SCXB8	1345	184	0.24	232.0	82.9	27.3	27.3	44.0	18.3	20.9	21.0	21.1	19.8	20.1	21.1	22.5	24.5	26.4
SCXB9	1347	256	0.19	211.6	84.4	23.3	23.3	36.5	17.3	21.1	19.7	17.7	17.8	18.0	18.6	19.4	20.5	20.7
SCXB10	1349	266	0.17	260.8	97.7	29.6	29.6	49.2	16.8	20.8	21.7	22.8	23.8	25.4	26.0	26.4	26.0	25.3
SCXB11	1354	245	0.20	232.1	98.8	24.9	24.9	32.6	14.9	19.5	21.1	22.6	24.1	25.4	26.4	27.7	28.5	28.9
SXCB12	1409	293	0.16	248.0	95.2	30.7	30.7	40.1	16.6	23.6	25.7	27.0	27.9	28.8	29.8	30.1	30.4	30.3
SCXB13	1414	284	0.15	229.9	74.5	32.8	32.8	39.0	16.6	23.6	26.6	28.5	29.7	30.4	31.3	31.9	32.7	33.3
SCXB14	1418	278	0.12	185.2	114.1	41.9	41.9	57.4	29.8	36.4	37.2	37.2	37.1	36.9	37.2	38.3	39.3	40.5
SCXB15	1425	250	0.14	202.4	122.4	40.8	40.8	53.5	21.5	29.3	31.6	33.7	35.6	38.2	40.7	44.1	46.4	47.9
SCXB16	1428	265	0.13	241.2	114.7	34.6	34.6	41.3	18.4	25.7	27.9	30.3	32.7	35.2	37.8	39.9	41.9	41.8
SCXB17	1434	254	0.14	236.9	88.0	27.0	26.9	36.2	16.7	22.6	25.0	26.7	27.9	29.0	29.3	28.8	27.4	26.3
SXCB18	1438	300	0.26	226.1	84.9	24.5	24.5	31.3	16.0	21.2	23.3	27.5	31.0	31.8	29.3	32.5	32.1	32.1
SCXB19	1445	417	0.41	220.4	64.6	22.0	22.0	23.7	20.4	23.6	20.6	24.8	-	-	-	-	-	-
SCXB20	1453	515	0.23	218.7	126.4	23.0	23.0	33.7	14.0	19.5	21.5	23.0	25.1	27.4	26.3	28.5	27.4	29.5
SCXB21	1501	390	0.49	227.8	50.1	19.6	19.6	21.0	18.2	21.3	18.3	17.9	-	-	-	-	-	-
SCXB22	1515	321	0.09	165.0	169.2	38.2	38.2	65.7	15.0	20.3	21.6	22.6	24.1	27.1	30.2	33.0	35.3	36.9
SCXB23	1522	334	0.09	174.7	114.5	35.3	35.3	51.2	15.0	21.7	24.1	25.8	28.6	32.5	36.4	39.7	42.7	44.5
SCXB24	1527	301	0.11	190.9	122.2	31.6	31.6	48.0	20.2	25.6	25.7	26.7	28.0	29.2	30.1	30.7	31.3	31.9
SCXB25	1534	284	0.14	185.0	93.1	26.5	26.5	36.3	15.6	21.5	23.4	24.8	26.5	27.9	29.8	30.2	29.9	29.3
SCXB26	1540	522	0.40	209.6	107.2	21.1	21.1	22.9	19.1	24.8	22.9	24.9	25.9	-	-	-	-	-

Table 10 (Concluded).																	
	Depth-Averaged Concentration by Depth Strata																
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**
SCXB1	24.3	25.6	27.1	27.7	29.2	27.2	27.4	30.3	33.0	41.3	40.5	44.9	-	-	-	-	-
SCXB2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB3	26.6	29.8	28.6	31.1	29.8	33.8	35.6	37.3	46.5	55.9	-	-	-	-	-	-	-
SCXB4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB6	30.5	33.3	38.4	35.7	36.5	34.9	35.3	36.1	37.3	33.2	-	-	-	-	-	-	-
SCXB7	31.7	32.1	32.9	33.9	34.9	35.8	37.2	38.5	40.2	40.9	41.4	41.7	42.7	44.1	45.6	47.2	47.0
SCXB8	28.0	27.5	26.0	24.6	23.9	23.8	23.9	25.1	26.8	29.4	32.2	35.3	37.3	39.8	41.2	42.7	38.6
SCXB9	21.7	21.9	22.4	22.9	23.8	24.2	25.5	27.2	28.8	31.3	30.1	29.7	29.2	29.4	30.3	29.7	30.8
SCXB10	25.2	25.5	26.7	28.4	29.3	30.1	31.3	32.0	33.2	34.5	36.6	39.2	43.1	44.9	48.1	51.4	46.1
SCXB11	28.7	28.6	29.1	29.8	31.3	30.8	31.4	32.4	33.5	34.7	36.0	37.1	39.9	51.0	-	-	-
SXCB12	30.2	29.5	29.2	29.6	30.4	31.3	31.9	32.8	34.0	35.0	35.9	37.3	38.3	40.6	41.1	41.2	43.2
SCXB13	33.0	33.1	33.2	33.1	33.7	34.3	35.0	35.6	36.3	36.5	36.7	37.1	37.4	37.8	37.7	38.7	40.6
SCXB14	41.0	41.4	41.5	41.6	41.2	40.7	40.9	41.8	42.9	44.5	46.1	47.8	49.8	52.0	55.7	65.1	74.4
SCXB15	48.5	49.0	49.0	47.7	44.7	41.0	38.0	36.4	35.7	36.1	37.3	39.0	40.8	43.8	47.8	60.1	79.7
SCXB16	41.3	40.5	39.4	37.8	36.4	35.0	33.8	33.0	32.7	33.1	33.3	35.2	35.6	37.1	39.4	42.1	49.7
SCXB17	25.8	26.0	26.3	27.0	28.5	29.3	32.8	33.6	35.9	36.7	40.6	43.1	49.3	54.6	-	-	-
SXCB18	31.7	32.2	39.3	32.5	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB20	26.1	26.4	55.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXB22	38.2	39.0	39.1	38.0	36.6	35.5	36.3	38.8	42.5	46.7	50.5	54.4	57.5	61.1	75.6	104.6	162.8
SCXB23	44.5	42.2	38.5	34.2	30.9	29.5	29.7	30.8	32.7	35.1	37.5	40.3	42.8	45.9	52.3	65.4	74.2
SCXB24	33.0	34.7	34.8	35.7	35.7	34.8	34.8	37.8	37.8	46.2	49.5	51.4	54.3	-	-	-	-
SCXB25	28.0	27.5	27.1	25.5	29.7	29.3	42.7	-	-	-	-	-	-	-	-	-	-
SCXB26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 11. Acoustic data summary for ADCP plume survey SCXD1-17 completed on 20 June 2011 during an ebbing tide, after silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l) DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.

									Depth-Averaged Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCXD1	1430	78	0.08	148	108.7	33.9	33.94	74.6	11.0	13.5	14.9	17.3	19.8	22.0	23.7	25.0	24.8	27.0
SCXD2	1432	60	0.07	195	82.4	35.9	35.91	58.0	10.2	14.6	19.3	23.9	26.1	26.7	27.3	28.7	30.8	32.9
SCXD3	1433	74	0.09	238	101.3	46.6	46.60	68.7	18.5	26.1	30.4	34.9	39.5	43.2	44.6	45.3	45.1	45.2
SCXD4	1436	59	0.07	194	143.6	55.1	55.10	127.9	16.3	16.9	16.3	17.1	19.2	20.3	22.9	25.3	28.5	32.1
SCXD5	1437	58	0.08	183	293.6	50.2	50.21	174.8	12.0	16.0	15.9	16.2	17.3	17.7	18.6	19.8	21.7	24.4
SCXD6	1438	170	0.10	249	119.3	46.3	46.35	66.1	14.1	23.1	29.8	34.7	38.2	40.9	43.2	44.7	45.6	45.8
SCXD7	1441	73	0.06	190	71.6	37.5	37.50	54.1	12.3	16.0	19.0	22.2	25.6	28.2	30.8	34.2	37.4	38.5
SCXD8	1442	84	0.07	206	120.6	33.7	33.66	54.7	12.2	15.3	17.4	20.1	22.2	23.8	25.2	26.6	28.4	30.6
SCXD9	1444	201	0.10	257	83.9	40.8	40.82	45.9	14.2	21.1	25.9	31.0	36.1	39.6	40.7	41.6	42.5	43.0
SCXD10	1448	60	0.10	237	123.3	36.8	36.77	57.6	12.7	17.4	16.5	15.7	15.7	17.7	20.4	22.9	26.2	29.5
SCXD11	1450	50	0.15	248	77.5	30.5	30.51	44.5	12.1	17.0	18.6	19.7	20.9	22.5	23.4	25.1	25.9	26.8
SXCD12	1451	310	0.12	248	82.7	31.0	31.00	38.1	13.4	18.0	20.4	23.0	25.4	28.3	31.2	33.3	33.6	33.6
SCXD13	1456	253	0.10	234	119.9	31.8	31.79	41.4	11.6	17.2	20.8	23.7	27.2	31.0	34.6	36.8	35.4	34.3
SCXD14	1501	280	0.09	194	105.5	30.4	30.43	42.9	11.7	16.3	18.4	20.8	23.3	25.2	28.3	30.8	32.2	31.5
SCXD15	1506	335	0.11	197	123.6	25.3	25.28	42.4	11.4	16.5	19.2	22.2	24.1	25.4	26.2	26.6	26.3	26.1
SCXD16	1512	271	0.16	211	49,2	23.6	23.57	28.3	12.4	17.9	21.2	23.3	25.3	27.2	28.0	27.8	27.6	29.0
SCXD17	1517	473	0.37	228	47.3	18.2	18.24	21.4	14.7	19.8	22.3	19.9	23.7	28.0	-	-	-	-

Table 11 (Concluded).																		
	Depth-Averaged Concentration by Depth Strata																	
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCXD1	29.2	32.1	34.7	36.7	40.1	44.2	48.5	52.1	55.4	61.7	79.9	100.7	92.9	-	-	-	-	-
SCXD2	34.4	36.2	38.4	38.7	40.8	43.9	44.2	44.6	45.3	46.5	47.8	48.5	50.6	54.5	60.6	66.6	63.6	-
SCXD3	45.1	44.7	44.9	44.9	45.1	45.6	45.8	45.9	47.3	50.3	53.4	56.4	59.4	60.9	63.3	67.2	78.2	100.2
SCXD4	34.5	37.7	41.1	43.1	45.1	47.8	52.9	60.1	67.6	73.8	80.2	86.2	91.5	99.2	109.4	117.4	123.2	128.9
SCXD5	26.6	28.7	29.6	31.7	33.7	36.1	40.2	45.7	53.4	61.4	72.8	88.0	103.9	118.2	146.8	160.7	137.2	144.1
SCXD6	46.1	46.3	46.5	46.2	46.1	46.3	47.0	49.2	51.0	51.7	52.9	54.0	56.5	59.1	61.8	68.9	84.1	106.7
SCXD7	39.5	41.1	42.1	42.0	41.9	41.5	41.8	42.6	43.7	44.9	45.5	45.8	46.2	47.3	49.9	61.8	57.3	-
SCXD8	32.5	33.9	35.0	36.6	37.2	38.7	39.7	40.7	41.5	42.9	44.2	46.1	46.6	47.9	52.3	54.1	59.4	56.5
SCXD9	43.3	44.1	44.4	44.0	44.7	45.3	46.2	47.0	47.4	47.4	46.7	45.9	45.2	44.8	45.1	44.8	37.4	-
SCXD10	32.0	34.6	37.0	39.5	41.9	44.5	48.8	52.7	54.4	53.7	51.7	49.9	48.6	48.0	49.9	52.4	57.2	82.5
SCXD11	27.6	30.0	30.8	33.0	34.9	35.9	36.7	36.2	36.1	37.1	37.4	36.5	36.7	37.7	39.3	41.7	45.1	-
SXCD12	34.4	34.5	34.7	34.2	34.0	33.5	33.2	32.9	33.0	33.1	33.8	34.5	34.9	36.4	38.1	32.3	26.7	-
SCXD13	33.8	33.7	33.7	33.4	33.2	33.2	33.1	33.3	33.6	34.0	34.5	35.3	35.8	36.4	38.8	37.6	34.5	-
SCXD14	31.4	31.6	31.5	31.8	32.4	33.2	33.5	34.0	34.5	35.3	35.8	36.6	38.1	39.9	40.2	42.3	29.2	-
SCXD15	26.5	27.1	30.6	30.7	31.3	33.7	34.2	31.0	35.8	35.7	54.1	-	-	-	-	-	-	-
SCXD16	30.6	32.9	34.2	33.4	34.1	34.8	35.9	35.8	35.7	97.6	77.8	-	-	-	-	-	-	-
SCXD17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 12. Acoustic data summary for ADCP plume survey SCXF1-18 completed on 21 June 2011 during an ebbing tide, after silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters

									Depth-Average Concentration by Depth Strata										
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**	**6.4**
SCXF1	1503	183	0.09	185	148.2	43.5	0.09	60.6	10.1	14.8	17.4	19.9	22.4	25.9	30.5	35.5	41.0	46.2	51.3
SCXF2	1505	60	0.07	192	167.9	43.0	0.06	106.4	9.7	13.0	15.7	17.4	18.8	20.6	21.4	23.6	26.0	29.5	33.0
SCXF3	1506	125	0.06	179	118.9	51.1	0.06	85.4	15.7	26.2	32.1	36.5	39.5	44.3	49.0	50.8	51.9	51.7	51.6
SCXF4	1508	76	0.07	204	75.5	43.1	0.07	32.1	10.1	16.0	21.1	27.1	34.6	41.6	48.3	52.7	55.9	58.0	58.6
SCXF5	1509	71	0.07	132	67.3	35.5	0.07	38.6	8.1	13.2	17.0	20.2	22.1	24.9	30.0	35.3	40.8	45.3	49.4
SCXF6	1510	147	0.07	178	94.3	44.6	0.07	50.6	12.5	22.0	29.4	35.5	40.2	44.1	47.0	48.5	48.3	48.9	49.1
SCXF7	1512	77	0.06	206	192.8	41.5	0.06	117.5	9.0	14.1	16.1	18.2	20.7	22.6	23.9	24.8	25.6	26.7	27.7
SCXF8	1513	87	0.06	175	177.6	36.5	0.06	105.5	8.5	12.9	14.7	16.8	18.5	20.5	22.2	23.4	24.6	25.8	27.5
SCXF9	1514	182	0.07	216	81.8	40.2	0.07	50.3	11.8	19.2	24.9	29.9	32.7	34.8	38.1	39.8	40.8	41.9	42.3
SCXF10	1516	81	0.09	209	69.2	30.6	0.09	33.6	9.0	14.9	18.1	21.4	24.2	27.9	30.5	32.1	34.1	37.1	38.8
SCXF11	1519	111	0.12	207	90.8	29.1	0.11	37.2	9.8	13.5	15.0	16.4	18.2	20.4	22.3	23.0	24.7	25.3	28.4
SCXF12	1519	223	0.08	227	97.3	33.4	0.08	46.2	10.8	16.9	21.0	24.6	27.0	29.3	31.5	33.5	34.7	36.2	37.7
SCXF13	1522	225	0.09	214	145.8	32.7	0.09	59.1	10.2	16.2	20.8	25.2	28.3	30.9	33.8	35.7	36.7	36.8	36.8
SCXF14	1525	285	0.11	236	122.8	27.2	0.11	46.7	10.8	16.0	18.6	20.9	23.7	26.1	27.9	29.9	31.9	33.9	34.8
SCXF15	1529	334	0.16	232	92.9	22.1	0.15	35.7	11.3	15.8	17.8	19.6	21.4	23.6	26.0	29.0	34.5	48.5	43.1
SCXF16	1533	206	0.34	233	95.6	17.2	0.32	27.2	8.9	13.0	15.0	15.7	17.4	19.6	21.2	23.0	28.2	30.6	34.9
SCXF17	1535	434	0.36	241	48.6	16.8	0.38	20.5	12.3	16.6	19.0	24.4	30.7	33.6	34.8	-	-	-	-
SCXF18	1540	453	0.38	243	35.6	14.9	0.37	17.8	11.2	16.4	18.3	18.5	14.9	-	-	-	-	-	-

Table 13. Acoustic data summary for ADCP plume survey SCXG1-20 completed on 21 June 2011 during an ebbing tide, after silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters

									Depth-Averaged Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCXG1	1555	120	0.08	164	91.3	34.9	34.87	59.2	11.9	15.7	18.2	20.1	21.5	22.8	26.5	31.2	32.8	35.3
SCXG2	1557	59	0.10	199	182.5	48.5	48.49	131.7	10.0	13.5	13.6	14.4	16.4	18.5	20.8	22.3	23.4	23.8
SCXG3	1558	144	0.06	174	151.8	36.9	36.90	55.4	13.4	18.9	21.7	24.4	27.2	29.2	29.2	29.3	29.3	29.5
SCXG4	1559	61	0.08	154	91.5	49.7	49.69	57.9	10.2	14.6	16.7	19.1	21.4	29.3	40.5	48.4	55.0	60.5
SCXG5	1600	74	0.08	165	79.3	36.3	36.25	54.1	9.5	12.9	14.8	15.9	17.6	20.4	24.1	27.2	29.2	31.4
SCXG6	1601	161	0.06	184	63.9	36.8	36.78	43.5	11.5	18.4	23.3	26.8	30.5	32.3	33.8	35.1	35.3	34.2
SCXG7	1603	72	0.06	183	173.1	45.6	45.56	132.4	8.8	11.4	13.4	15.5	17.7	20.1	21.6	22.8	24.3	24.6
SCXG8	1604	85	0.06	162	120.4	33.8	33.82	85.0	10.0	12.4	13.5	15.0	16.6	18.4	20.1	21.4	22.7	23.8
SCXG9	1605	200	0.07	173	64.1	31.9	31.90	44.5	10.7	15.4	18.5	21.5	24.5	27.2	28.4	28.6	28.7	29.0
SCXG10	1608	132	0.07	173	94.9	45.8	45.80	59.0	10.0	13.5	14.3	15.2	17.8	22.1	26.7	32.4	39.4	47.2
SCXG11	1609	91	0.08	177	78.5	36.5	36.45	56.9	9.5	12.8	12.8	13.8	15.7	17.2	18.5	20.9	23.4	27.4
SXCG12	1610	261	0.07	163	60.2	29.0	28.98	39.5	11.2	15.9	18.2	20.7	23.3	25.3	26.8	28.0	29.5	31.0
SCXG13	1613	275	0.09	162	94.8	25.1	25.11	39.5	9.8	13.5	16.0	18.7	21.9	24.1	26.1	28.5	29.7	29.7
SCXG14	1616	77	0.08	170	102.1	38.8	38.79	52.8	9.3	12.6	13.4	14.1	15.2	18.3	20.8	22.7	25.7	30.4
SCXG15	1617	132	0.08	157	96.3	34.4	34.45	50.5	9.6	13.0	14.4	15.5	16.6	17.1	18.2	19.2	20.6	21.9
SCXG16	1619	274	0.10	198	96.9	24.3	24.27	35.8	9.7	13.6	15.7	18.5	20.8	23.3	25.8	27.7	29.1	29.1
SCXG17	1622	256	0.14	213	98.5	22.9	22.95	37.6	9.8	13.8	15.6	17.8	19.0	22.0	24.5	25.8	26.8	28.1
SCXG18	1625	256	0.18	235	83.1	19.9	19.94	29.3	11.1	14.1	15.4	17.6	19.3	20.9	23.5	26.0	26.8	28.8
SCXG19	1628	483	0.34	223	50.7	15.7	15.73	19.3	12.1	16.7	17.0	17.6	18.5	22.7	25.0	-		-
SCXG20	1634	429	0.37	234	37.7	14.3	14.34	16.7	11.7	16.4	16.1	-	-	-	-	-		-

Table 13 (Concluded).																		
	Depth-Averaged Concentration by Depth Strata																	
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCXG1	38.1	40.9	43.4	45.4	48.2	51.9	51.6	52.2	55.4	54.0	60.6	62.0	-	-	-	-	-	-
SCXG2	24.1	25.0	26.9	29.9	36.4	39.2	45.8	54.2	64.6	76.3	92.6	115.8	142.4	161.7	167.6	173.4	168.1	169.4
SCXG3	29.4	29.8	30.9	34.1	38.7	43.2	46.6	48.7	49.3	49.6	50.3	52.3	54.3	55.7	55.9	48.6	-	-
SCXG4	64.6	66.0	65.4	65.3	66.0	65.5	64.9	62.0	60.4	59.0	59.4	58.2	57.4	56.7	56.2	56.0	54.4	-
SCXG5	33.3	35.3	38.1	42.0	46.1	49.3	52.4	54.6	55.6	55.6	55.0	55.7	56.6	57.6	57.2	55.7	54.5	-
SCXG6	33.3	33.3	34.5	35.9	38.5	41.5	44.5	47.6	49.8	49.4	48.5	47.0	45.6	45.0	43.6	42.1	39.9	-
SCXG7	24.8	25.7	26.4	27.7	29.7	32.7	38.2	46.4	57.0	66.8	76.3	86.1	99.6	116.2	136.9	161.5	167.1	-
SCXG8	25.0	26.4	27.9	29.3	30.2	31.2	31.6	32.7	36.2	43.3	49.4	56.7	67.0	75.8	84.0	94.4	109.1	-
SCXG9	30.1	31.5	32.9	33.8	35.0	36.4	38.0	39.3	40.0	40.9	41.8	42.7	43.6	44.0	40.3	31.3	25.6	-
SCXG10	53.4	56.8	58.2	59.2	61.4	62.2	62.9	63.1	61.8	61.1	60.0	58.4	58.1	58.1	58.2	56.5	62.7	-
SCXG11	32.3	36.5	39.3	41.6	46.0	51.8	56.9	59.9	64.3	64.4	59.9	52.5	50.7	48.8	50.9	52.5	53.5	57.2
SXCG12	31.4	31.7	31.4	30.6	30.6	30.3	30.2	30.3	31.1	33.1	34.4	35.7	36.6	38.1	39.2	32.3	25.5	-
SCXG13	29.3	28.7	28.0	27.4	27.6	29.6	28.5	29.6	33.8	34.5	35.1	35.5	34.3	32.9	50.8	-	-	-
SCXG14	36.1	40.2	43.0	45.2	47.6	48.7	50.4	51.4	53.7	56.1	58.3	60.4	59.1	57.2	55.9	54.7	50.5	-
SCXG15	23.7	27.0	31.4	35.8	39.6	43.8	48.8	53.8	58.2	59.9	58.6	55.7	52.4	50.2	48.3	45.7	44.2	-
SCXG16	28.8	28.2	27.8	27.8	30.8	33.4	39.9	57.2	-	-	-	-	-	-	-	-	-	-
SCXG17	30.0	30.8	34.6	32.6	37.3	40.1	34.5	58.4	-	-	-	-	-	-	-	-	-	-
SCXG18	27.9	29.6	23.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXG19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXG20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 14. Acoustic data summary for ADCP plume survey SCXH1-23 completed on 22 June 2011 during a flooding tide, after silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.																		
									Depth-Average Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCXH1	1200	108	0.06	210	95.6	45.4	45.4	67.1	27.5	29.1	30.9	33.5	35.2	36.3	36.2	38.2	40.0	40.4
SCXH2	1202	60	0.07	121	132.1	44.4	44.4	103.6	10.6	16.2	19.1	21.4	22.9	23.9	25.2	26.3	26.4	26.4
SCXH3	1203	130	0.07	143	86.1	36.3	36.3	52.1	14.8	21.1	23.6	25.6	27.4	28.5	29.5	30.6	31.7	31.1
SCXH4	1205	74	0.06	128	56.7	33.5	33.5	40.4	16.4	23.6	26.3	27.5	28.6	29.5	30.1	30.3	31.0	31.8
SCXH5	1207	139	0.07	161	70.9	37.3	37.3	63.1	12.0	18.6	21.7	24.0	26.4	28.4	30.3	32.0	33.3	33.9
SCXH6	1207	65	0.07	208	173.6	48.8	48.8	129.7	10.2	15.8	18.3	20.0	21.3	22.7	23.9	24.9	25.2	24.9
SCXH7	1208	172	0.10	138	99.0	33.8	33.8	55.7	13.5	18.8	21.0	23.4	25.7	27.7	28.8	29.3	30.1	30.9
SCXH8	1210	99	0.08	144	95.6	36.0	36.0	45.6	16.1	23.4	26.8	29.1	31.0	32.5	33.3	33.8	34.3	34.9
SCXH9	1211	192	0.08	191	68.4	35.6	35.6	54.4	11.3	17.7	21.1	23.6	25.7	27.6	29.3	31.2	33.2	34.7
SCXH10	1213	96	0.06	213	168.6	39.8	39.8	121.7	9.8	14.7	17.1	19.0	20.3	20.9	21.6	22.1	22.5	23.0
SCXH11	1215	231	0.12	128	96.6	31.1	31.1	52.0	19.3	24.6	24.8	25.9	27.9	28.9	29.1	28.9	28.9	29.7
SXCH12	1217	98	0.08	153	66.7	34.7	34.7	47.0	12.9	19.5	22.8	25.8	29.0	32.6	34.8	35.5	35.7	35.8
SCXH13	1218	132	0.08	175	65.8	36.2	36.2	52.7	13.8	21.1	24.5	27.5	30.4	33.0	34.5	35.2	35.6	36.5
SCXH14	1220	281	0.12	121	91.6	28.6	28.6	43.4	15.9	21.8	24.0	26.6	29.6	30.7	29.8	28.9	28.5	29.0
SCXH15	1224	118	0.06	192	167.5	36.9	36.9	94.9	9.0	13.9	16.1	17.4	19.1	20.5	21.6	23.1	23.9	24.7
SCXH16	1225	139	0.06	199	86.3	29.5	29.5	61.9	8.5	12.3	14.2	15.8	17.0	17.8	19.0	20.2	22.0	23.3
SCXH17	1227	621	0.16	148	142.0	25.1	25.1	39.7	11.6	17.3	20.6	22.8	24.5	25.3	26.3	27.4	29.7	29.8
SXCH18	1233	457	0.29	123	36.5	17.0	17.0	22.1	11.5	15.6	17.9	20.4	21.5	23.0	25.6	37.0	-	-
SXCH19	1240	147	0.08	181	77.2	24.7	24.7	44.3	7.5	11.9	13.7	14.9	16.7	19.1	20.7	22.4	23.8	24.9
SXCH20	1242	148	0.07	192	74.1	26.4	26.4	48.1	7.1	10.0	12.3	13.9	15.2	16.9	18.4	19.5	20.7	21.7
SXCH21	1244	148	0.08	195	78.4	21.1	21.1	36.3	7.4	9.6	10.4	12.1	13.7	15.7	18.3	21.5	22.6	23.3
SXCH22	1246	163	0.07	201	49.0	20.0	20.0	32.4	7.8	10.8	10.6	10.7	11.1	11.9	14.0	16.0	17.5	18.7
SXCH23	1248	451	0.29	139	32.7	13.9	13.9	16.8	10.0	15.4	17.5	18.3	21.0	25.2	-	-	-	-

Table 14 (Concluded).																			
		Depth-Average Concentration by Depth Strata																	
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**	**15.3**
SCXH1	41.0	41.0	40.7	41.0	41.6	42.2	44.1	47.4	50.2	53.2	57.3	58.9	61.1	62.5	64.1	65.4	67.4	-	-
SCXH2	25.6	24.1	23.6	23.5	24.3	28.7	40.1	53.2	62.8	67.3	70.9	76.5	83.8	90.2	96.9	99.2	99.5	85.2	-
SCXH3	31.3	31.4	31.8	31.8	32.4	34.7	38.9	43.5	47.3	49.5	50.9	51.9	53.3	53.7	53.5	45.1	40.1		-
SCXH4	32.6	33.0	34.1	35.2	36.3	38.4	40.6	40.5	39.0	38.0	37.6	36.9	35.9	36.3	37.1	38.7	40.8	41.6	-
SCXH5	35.1	36.3	37.4	38.5	39.4	41.4	43.6	46.1	48.6	49.7	51.2	53.1	57.1	54.9	60.0	111.1			-
SCXH6	24.9	24.1	24.3	23.8	25.8	30.3	40.0	52.8	61.7	68.1	74.5	82.0	94.6	111.3	121.9	128.2	124.8	120.9	-
SCXH7	31.8	32.9	34.3	35.3	36.4	38.3	40.2	42.0	44.7	48.6	54.4	62.0	66.1	66.6	65.2	68.3			-
SCXH8	35.7	36.7	37.9	39.3	39.7	39.5	39.9	39.8	39.8	41.3	42.8	40.7	40.8	39.6	40.6	41.9	43.4	44.7	-
SCXH9	35.8	37.1	38.2	39.1	39.4	41.0	43.4	46.0	47.9	49.3	51.0	52.5	47.8	57.2	-	-	-	-	-
SCXH10	23.6	23.1	23.5	24.4	25.0	25.4	28.1	34.7	42.4	50.7	58.4	65.7	74.7	87.2	101.6	108.1	117.9	125.7	-
SCXH11	30.5	32.0	33.5	35.1	38.6	40.8	42.0	38.7	45.5	52.5	47.0	53.0	49.6	44.6	-	-	-	-	-
SXCH12	36.4	36.7	35.9	35.5	35.1	35.1	35.1	35.4	36.6	37.5	39.7	40.7	41.9	42.9	44.1	46.3	48.3	50.2	-
SCXH13	36.7	36.7	36.4	36.0	35.9	36.5	37.3	37.3	38.5	40.3	41.8	43.4	44.7	45.8	47.9	50.1	52.6	54.8	-
SCXH14	30.2	31.3	33.5	35.9	38.9	34.1	38.2	44.1	42.4	55.9	-	-	-	-	-	-	-	-	-
SCXH15	24.8	24.2	24.2	25.1	27.1	29.8	33.7	38.5	43.2	46.4	52.7	62.8	74.6	89.1	102.4	117.0	137.6	152.6	-
SCXH16	22.3	22.6	23.1	23.6	25.4	27.6	30.5	33.7	37.8	43.0	47.2	49.7	53.2	57.4	63.9	71.5	92.9	-	-
SCXH17	32.9	34.5	36.0	37.1	36.7	39.8	43.0	48.1	54.4	57.7	63.2	-	-	-	-	-	-	-	-
SXCH18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SXCH19	25.1	25.1	24.8	24.8	25.5	27.3	29.2	32.3	36.5	40.6	44.1	47.6	50.7	53.5	58.9	65.0	76.0	-	-
SXCH20	22.2	23.2	23.1	22.8	23.6	25.7	28.8	32.4	36.4	40.8	44.5	47.1	48.8	49.1	51.5	61.7	67.9	-	-
SXCH21	23.9	24.2	23.7	23.9	25.2	26.8	28.3	28.7	29.5	31.5	33.0	34.2	37.4	37.5	40.3	44.2	52.6	56.2	-
SXCH22	19.9	21.1	21.5	22.2	22.8	24.1	26.4	27.4	28.7	29.0	28.6	28.5	29.3	30.6	31.8	31.9	34.8	40.1	44.5
SXCH23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 15. Acoustic data summary for ADCP plume survey SCXI1-19 completed on 22 June 2011 during an ebbing tide, after silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration, DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), ***Length in meters.**

									Depth-Averaged Concentration by Depth Strata										
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**	**6.4**
SCXI001	1547	65	0.10	185	44.0	26.6	26.6	34.5	13.8	19.8	23.2	24.0	22.8	21.9	20.7	20.0	20.3	21.4	22.9
SCXI002	1548	85	0.08	207	81.5	43.1	43.1	49.2	23.6	32.9	33.7	33.7	34.6	35.0	36.8	38.8	40.2	41.7	43.6
SCXI003	1549	60	0.08	237	133.1	38.7	38.7	82.3	16.4	19.9	21.2	21.4	19.3	18.9	19.4	19.3	19.7	20.3	19.9
SCXI004	1550	167	0.07	174	329.5	48.8	48.8	109.8	13.7	20.1	25.3	29.1	30.0	30.2	30.7	31.4	32.4	34.4	36.6
SCXI005	1553	71	0.08	205	41.5	25.8	25.8	35.0	11.8	16.5	18.5	21.9	24.4	24.9	24.1	23.7	22.7	22.9	24.1
SCXI006	1554	133	0.07	188	96.7	31.1	31.1	46.7	16.1	18.5	18.8	21.0	23.0	25.1	26.9	27.4	28.0	29.2	31.0
SCXI007	1556	90	0.09	198	167.1	34.5	34.5	102.9	9.9	12.9	13.9	15.0	15.8	15.4	15.5	16.3	16.9	17.4	18.1
SCXI008	1557	200	0.10	171	148.6	34.0	34.0	68.7	11.8	17.8	20.5	23.5	27.1	30.3	31.4	30.1	29.1	30.8	32.6
SCXI009	1603	90	0.08	194	48.7	25.1	25.1	32.8	10.8	15.7	18.3	20.5	23.0	23.7	23.8	23.9	23.8	24.4	25.3
SCXI010	1604	92	0.08	185	57.7	24.1	24.1	35.1	10.5	14.3	15.4	15.7	17.8	19.3	18.8	19.2	19.6	20.8	22.1
SCXI011	1606	216	0.08	185	91.2	30.6	30.6	45.1	11.2	16.2	19.4	23.1	25.8	28.3	31.1	31.6	31.8	33.0	33.7
SCXI012	1609	117	0.08	174	176.3	29.2	29.2	81.1	10.0	13.1	12.6	13.1	13.6	14.5	15.4	16.1	17.0	17.4	18.5
SCXI013	1612	134	0.07	184	134.7	25.9	25.9	62.7	9.2	11.8	12.6	13.5	15.5	15.3	15.1	15.3	15.6	16.4	17.1
SCXI014	1614	297	0.10	190	79.3	21.5	21.5	32.9	10.8	15.4	16.8	18.4	20.3	22.0	23.9	25.6	27.5	30.8	31.2
SCXI015	1618	335	0.13	186	93.9	20.0	20.0	28.8	11.3	15.2	16.2	18.1	20.3	21.4	23.1	23.5	25.5	31.4	30.7
SCXI016	1622	135	0.08	192	62.3	20.2	20.2	36.7	9.1	13.4	14.4	13.5	13.8	14.4	14.5	14.6	14.7	15.3	16.5
SCXI017	1625	132	0.06	175	68.5	21.2	21.2	39.5	9.9	15.5	15.4	14.5	13.8	13.7	13.7	14.0	14.4	15.1	16.2
SCXI018	1630	402	0.31	215.5	92.7	20.4	20.4	22.6	18.4	20.0	20.5	20.5	22.8	26.5	33.9	-	-	-	-
SCXI019	1638	344	0.30	232.3	48.3	18.1	18.1	18.9	17.1	18.3	18.9	19.7	-	-	-	-	-	-	-

Table 15 (Concluded).																	
	Depth-Averaged Concentration by Depth Strata																
Transect	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCXI001	25.2	28.6	29.5	29.4	29.7	29.7	29.7	30.1	30.5	30.8	31.6	32.1	32.5	33.3	33.4	33.9	36.9
SCXI002	45.9	48.1	49.2	48.3	47.6	48.9	49.9	50.8	49.0	46.3	45.6	45.6	46.5	48.1	49.1	49.5	48.5
SCXI003	21.0	22.7	24.6	26.5	27.9	31.2	36.3	43.0	51.3	61.3	70.3	78.2	84.1	84.8	82.4	73.1	65.7
SCXI004	38.8	40.8	43.0	45.7	48.2	49.4	51.5	55.3	61.1	68.0	73.7	81.4	90.7	97.6	109.6	114.7	-
SCXI005	25.4	25.8	25.3	25.1	26.0	25.9	26.0	27.0	28.1	29.1	30.5	31.5	32.2	33.2	34.2	34.7	40.5
SCXI006	32.2	32.3	33.0	34.0	35.9	37.8	39.0	39.6	40.7	41.5	42.6	37.7	38.0	38.1	46.5	39.6	-
SCXI007	19.2	21.1	23.2	24.4	25.5	27.8	31.8	40.3	47.5	53.1	59.4	70.2	91.7	111.6	111.4	93.2	72.8
SCXI008	33.7	35.3	37.1	38.8	40.9	46.4	44.8	46.2	48.9	50.0	48.4	53.5	70.2	75.5	102.5	125.7	-
SCXI009	25.9	25.6	25.4	25.6	25.8	25.7	26.4	27.3	27.8	28.5	29.5	29.8	30.7	31.0	31.9	33.0	37.6
SCXI010	23.1	23.8	24.6	24.9	25.8	27.0	27.9	28.3	28.9	28.9	29.4	30.4	31.4	32.4	33.5	35.0	38.6
SCXI011	34.2	35.1	36.7	37.6	40.3	41.8	43.3	44.6	45.9	47.8	59.7	69.5	-	-	-	-	-
SXCI012	19.8	20.5	22.5	25.1	25.0	26.3	27.7	31.2	37.5	45.2	53.6	63.0	72.3	82.6	102.8	121.0	111.7
SCXI013	18.3	19.4	20.8	22.9	24.2	25.1	26.7	28.6	31.1	34.9	39.4	44.9	51.6	58.7	70.7	83.3	83.0
SCXI014	26.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXI015	28.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCXI016	17.2	18.1	19.6	21.6	23.2	25.2	26.4	27.9	30.0	33.1	36.8	39.4	41.8	45.6	48.9	-	-
SCXI017	17.3	18.6	19.2	20.2	21.8	24.1	26.8	29.9	31.2	32.2	32.7	34.7	37.3	41.4	48.5	-	-
SXCI018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SXCI019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 16. Acoustic data summary for ADCP plume survey SCXJ1-19 completed on 22 June 2011 during an ebbing tide, after silt curtain deployment. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.

									Depth-Averaged Concentration by Depth Strata									
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**	**4.4**	**4.9**	**5.4**	**5.9**
SCXJ1	1644	68	0.11	139	172.6	42.7	42.7	114.9	13.5	17.9	22.1	26.0	30.0	31.7	30.3	29.4	30.7	31.8
SCXJ2	1645	117	0.07	141	174.8	55.7	55.7	105.3	14.0	22.2	29.4	36.5	42.3	47.0	50.6	54.6	55.2	55.1
SCXJ3	1646	50	0.07	177	89.5	42.8	42.8	47.7	12.0	16.3	15.6	15.9	17.2	20.4	26.4	35.7	42.1	46.4
SCXJ4	1647	152	0.08	146	86.9	34.9	34.9	45.8	14.7	20.1	22.5	23.9	25.2	27.1	29.0	30.7	31.2	32.3
SCXJ5	1649	64	0.08	149	162.3	47.7	47.7	129.7	12.7	17.5	20.9	25.7	28.8	31.4	33.3	34.9	37.5	40.1
SCXJ6	1650	137	0.07	167	99.5	48.9	48.9	64.2	14.0	17.3	18.9	22.5	28.3	34.4	40.6	46.1	51.0	55.3
SCXJ7	1651	62	0.06	191	63.7	28.7	28.7	32.7	14.3	17.3	16.1	13.4	12.9	14.3	18.0	23.2	28.1	33.6
SCXJ8	1652	174	0.08	143	96.1	30.5	30.5	50.5	12.7	18.6	21.1	22.1	23.5	24.8	25.6	26.8	28.1	28.8
SCXJ9	1654	82	0.07	142	184.6	43.2	43.2	117.9	12.3	16.1	19.1	21.8	26.1	29.8	33.5	35.6	37.0	38.0
SCXJ10	1655	178	0.07	150	77.7	38.9	38.9	57.4	12.2	15.9	15.9	16.7	19.2	23.7	29.3	35.2	39.4	41.6
SCXJ11	1657	89	0.09	133	39.4	16.9	16.9	21.6	10.4	11.7	11.8	10.4	10.1	10.6	10.9	12.8	15.7	20.3
SXCJ12	1659	172	0.16	160	49.1	21.3	21.3	30.0	12.2	16.7	18.4	18.8	18.6	18.8	20.9	21.8	22.7	24.5
SCXJ13	1701	83	0.08	155	182.1	37.9	37.9	97.4	12.0	17.2	21.0	25.1	28.3	29.8	29.9	30.7	31.7	31.9
SCXJ14	1703	107	0.09	165	174.8	36.6	36.6	95.5	0.3	147.3	95.5	11.9	16.0	19.8	22.0	23.3	24.4	26.1
SCXJ15	1705	151	0.13	214	144.3	28.8	28.8	66.7	0.3	164.7	66.7	17.2	18.4	19.2	20.0	22.4	23.8	25.6
SCXJ16	1708	129	0.13	218	96.3	30.4	30.4	50.9	0.3	161.9	50.9	16.4	20.5	19.7	21.0	21.7	22.1	22.6
SCXJ17	1713	208	0.08	183	99.2	33.9	33.9	56.3	0.2	177.5	56.3	10.3	14.8	16.4	17.8	18.0	18.3	20.6
SXCJ18	1715	140	0.08	166	67.8	20.8	20.8	29.4	0.3	163.6	29.4	9.3	12.6	14.3	15.3	15.3	14.5	14.1
SXCJ19	1718	145	0.30	212	42.3	16.6	16.6	18.4	0.4	214.6	18.4	14.3	17.2	18.3	15.4	14.4	15.0	17.9

Table 16 (Concluded).																		
	Depth-Averaged Concentration by Depth Strata																	
Transect	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**	**10.9**	**11.3**	**11.8**	**12.3**	**12.8**	**13.3**	**13.8**	**14.3**	**14.8**
SCXJ1	33.9	33.7	32.7	31.1	30.2	29.6	29.4	30.5	33.0	39.1	49.6	61.4	76.1	92.3	105.4	113.4	128.2	-
SCXJ2	54.2	53.0	51.8	50.2	49.0	48.1	48.4	49.9	55.0	60.5	67.3	72.4	76.2	79.6	86.0	97.1	106.5	-
SCXJ3	49.4	50.5	48.5	47.9	49.1	53.6	59.5	65.0	67.6	64.7	59.0	54.4	50.1	47.6	46.0	46.6	48.9	49.3
SCXJ4	33.5	34.1	34.3	35.4	36.9	39.2	42.9	45.0	44.9	44.3	43.7	43.4	43.1	43.3	44.6	51.0	56.0	-
SCXJ5	41.4	41.2	38.7	36.3	35.1	34.1	33.7	34.9	38.1	43.2	50.1	59.7	73.0	91.6	113.1	126.3	124.8	132.1
SCXJ6	58.1	59.7	59.5	58.4	58.5	58.8	58.3	58.6	58.4	58.9	59.7	60.5	60.2	59.2	62.5	55.6	54.3	-
SCXJ7	38.9	40.1	37.2	31.9	30.0	29.7	33.0	38.3	41.4	41.3	37.2	33.0	31.2	30.8	31.8	31.4	31.7	32.3
SCXJ8	29.5	30.8	32.0	33.0	33.9	34.6	35.6	35.6	36.0	36.8	38.6	41.8	43.8	39.5	46.0	41.2	-	-
SCXJ9	38.6	37.6	36.3	33.9	32.0	30.9	30.7	30.4	31.7	35.4	42.9	54.3	69.8	84.6	98.3	112.3	117.6	149.7
SCXJ10	41.7	43.0	45.9	49.5	52.7	55.6	57.0	57.0	56.0	54.1	51.9	47.7	51.8	54.6	53.9	54.3	54.6	-
SCXJ11	22.3	21.4	19.7	18.5	18.2	18.2	18.2	18.9	19.5	20.2	20.3	20.2	19.6	19.1	19.9	20.4	21.5	-
SXCJ12	26.9	27.4	27.1	29.4	31.3	29.5	24.4	26.1	45.6	-	-	-	-	-	-	-	-	-
SCXJ13	32.1	31.9	30.8	29.8	29.0	27.0	26.5	26.4	27.5	30.2	38.5	53.7	72.3	92.3	110.4	123.3	128.4	-
SCXJ14	26.5	26.8	27.5	28.9	27.7	27.7	26.9	26.2	26.1	26.8	28.1	30.9	35.6	43.3	53.8	67.7	83.7	96.3
SCXJ15	29.6	27.6	25.9	27.7	28.4	29.1	28.7	28.8	29.9	29.1	28.9	30.4	31.1	33.1	37.8	48.1	62.6	77.4
SCXJ16	23.9	25.5	26.7	28.4	30.5	31.8	33.4	34.3	34.9	36.3	36.6	36.6	37.2	37.7	37.9	39.1	40.6	47.0
SCXJ17	24.3	28.0	31.7	34.9	38.8	42.7	45.5	47.0	48.9	50.8	52.2	53.5	55.4	62.4	85.1	89.1	-	-
SXCJ18	14.2	14.5	16.1	18.0	20.9	23.6	25.8	28.6	30.2	31.1	29.5	28.0	26.2	25.5	25.4	26.1	27.2	28.4
SXCJ19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 17. Acoustic data summary for ADCP plume survey SCCR1-12 completed on 24 June 2011 during an ebbing tide during silt curtain removal. Legend: DVV=Depth Averaged Velocity (mg/l), DVD=Depth-Averaged Direction (mg/l), MC = Maximum Concentration (mg/l), DAC=Depth-Averaged Concentration (mg/l), NSC=Near Surface Concentration (mg/l), NBC=Near Bottom Concentration (mg/l), *Length in meters.

									Depth-Averaged Concentration by Depth Strata					
Transect	**Time**	**Length***	**DVV**	**DVD**	**MC**	**DAC**	**NSC**	**NBC**	**1.4**	**1.9**	**2.4**	**2.9**	**3.4**	**3.9**
SCCR1	0651	181	0.38	227	44.6	18.8	18.8	21.5	16.1	20.3	19.8	18.9	25.2	-
SCCR2	0657	192	0.30	224	53.9	18.6	18.6	25.9	11.0	15.7	17.7	18.3	20.3	21.6
SCCR3	0737	176	0.38	197	22.1	12.3	12.3	13.9	10.6	17.2	24.2	-	-	-
SCCR4	0830	171	0.35	207	42.4	13.4	13.4	14.5	12.4	15.3	-	-	-	-
SCCR5	0905	275	0.37	189	38.2	17.2	17.2	19.6	14.8	20.8	18.0	-	-	-
SCCR6	0911	275	0.31	202	38.9	18.0	18.0	20.0	16.1	19.7	-	-	-	-
SCCR7	0944	345	0.36	197	29.5	15.5	15.5	18.6	12.5	18.7	15.7	-	-	-
SCCR8	0947	274	0.44	204	39.5	17.8	17.8	20.0	15.7	22.8	-	-	-	-
SCCR9	1036	127	0.25	197	30.8	12.2	12.2	14.8	9.3	14.4	20.0	22.4	-	-
SCCR10	1121	138	0.35	169	39.8	19.2	19.2	21.3	17.2	21.3	-	-	-	-
SCCR11	1123	112	0.24	127	20.7	12.3	12.3	13.6	11.0	13.6	15.6	-	-	-
SCCR12	1156	132	0.26	119	22.7	9.5	9.5	10.5	8.6	9.8	11.1	-	-	-

	Depth-Averaged Concentration by Depth Strata												
Transect	**4.4**	**4.9**	**5.4**	**5.9**	**6.4**	**6.9**	**7.4**	**7.9**	**8.4**	**8.9**	**9.4**	**9.9**	**10.4**
SCCR1	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR2	22.7	23.6	24.5	24.2	25.5	28.7	31.2	28.3	26.0	25.7	23.8	25.2	32.2
SCCR3	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR4	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR5	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR6	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR7	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR8	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR9	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR10	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR11	-	-	-	-	-	-	-	-	-	-	-	-	-
SCCR12	-	-	-	-	-	-	-	-	-	-	-	-	-

5.0 Figures

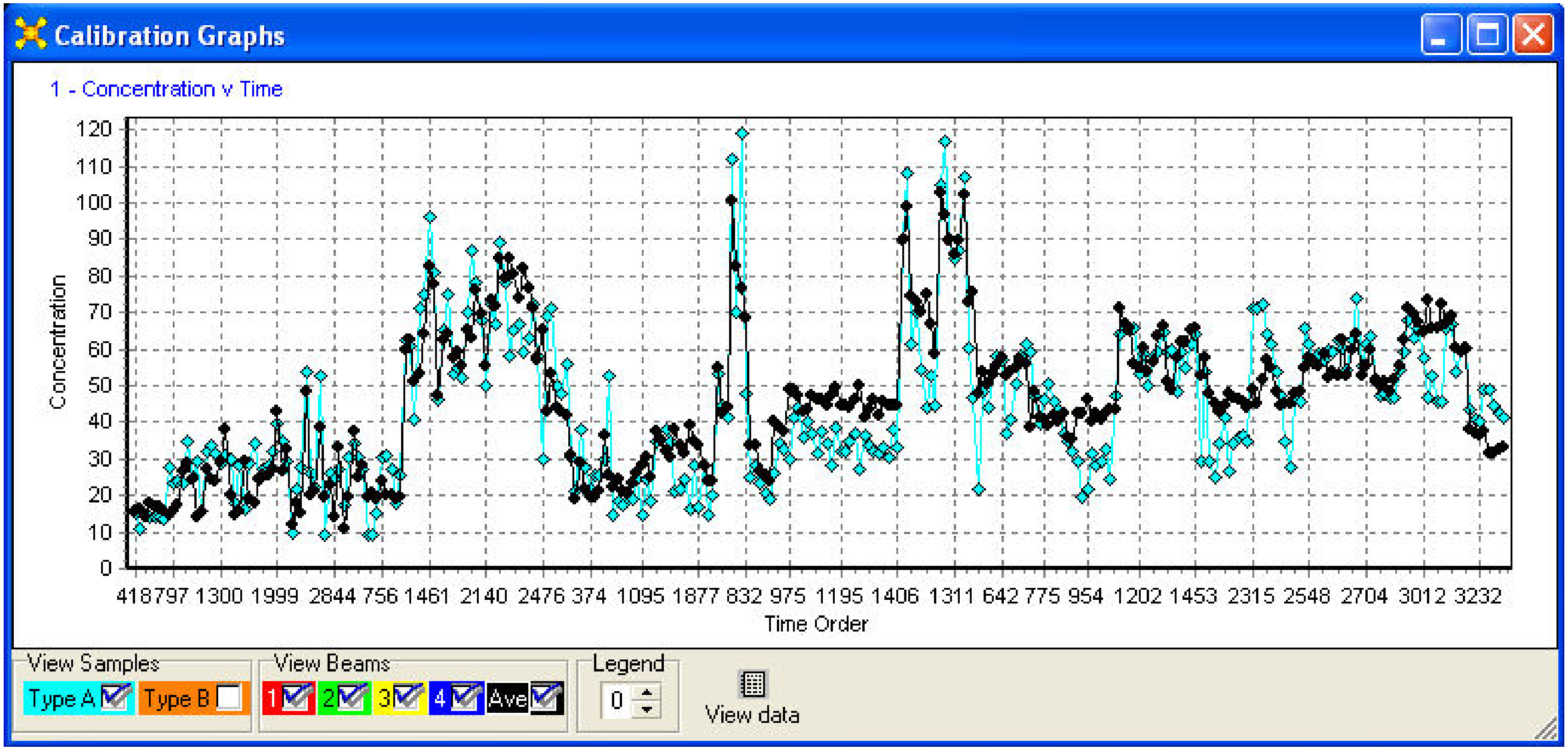


Figure 1. Comparison of acoustic and gravimetric measurements of suspended sediment concentration in linked time order. (Note: Black = acoustic concentration, Blue = gravimetric concentration)

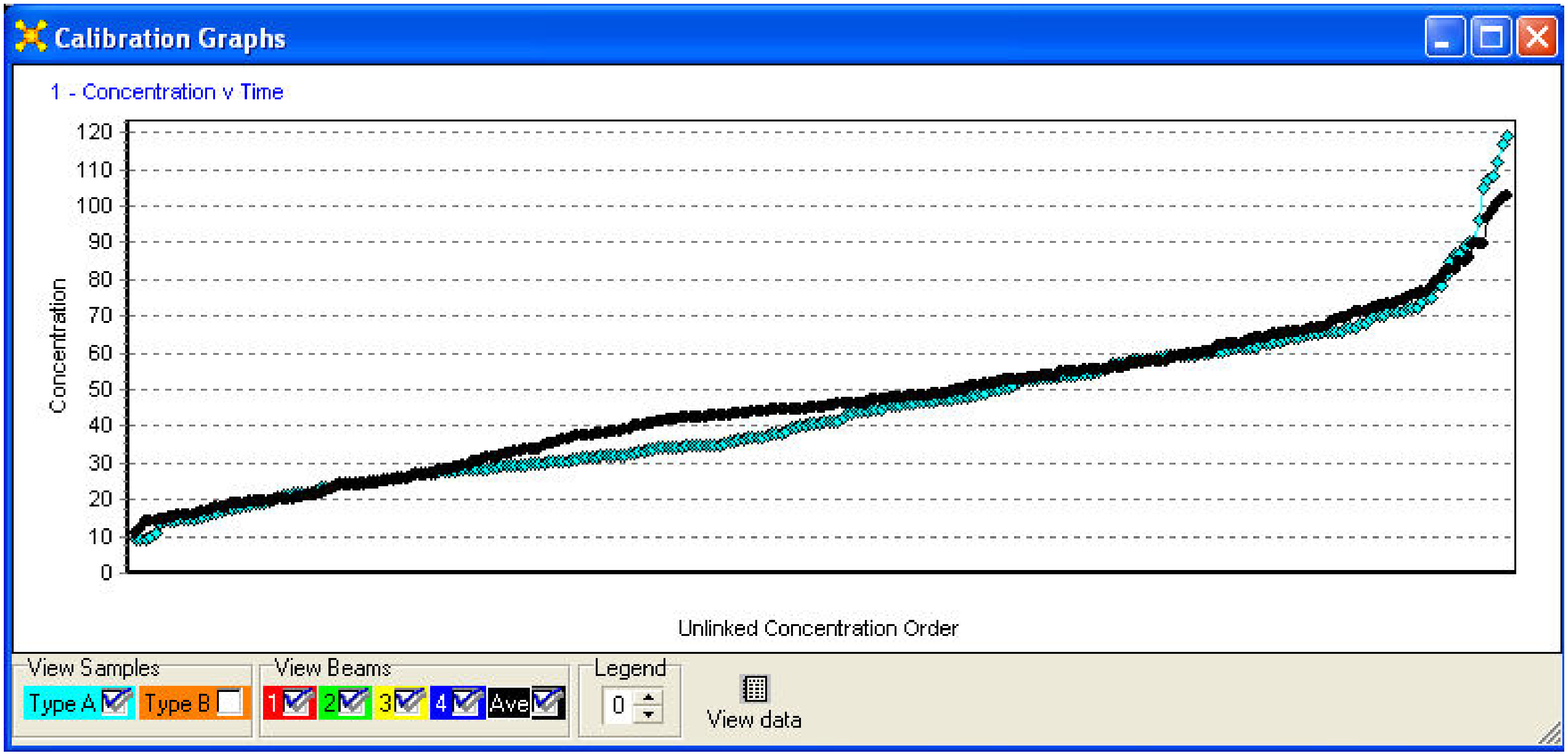


Figure 2. Comparison of acoustic and gravimetric measurements of suspended sediment concentrations in rank order. (Note: Black = acoustic concentration, Blue = gravimetric concentration)

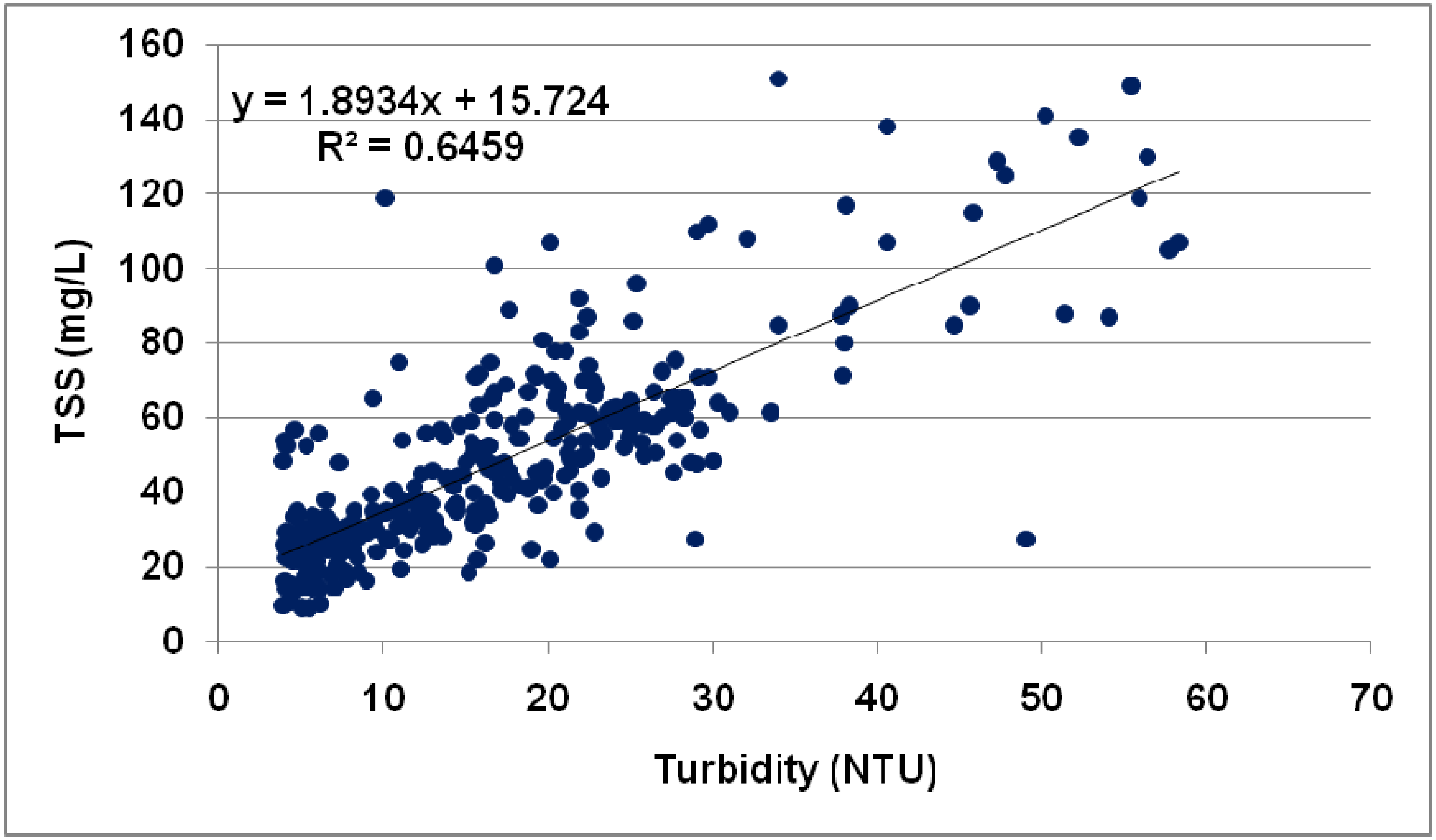
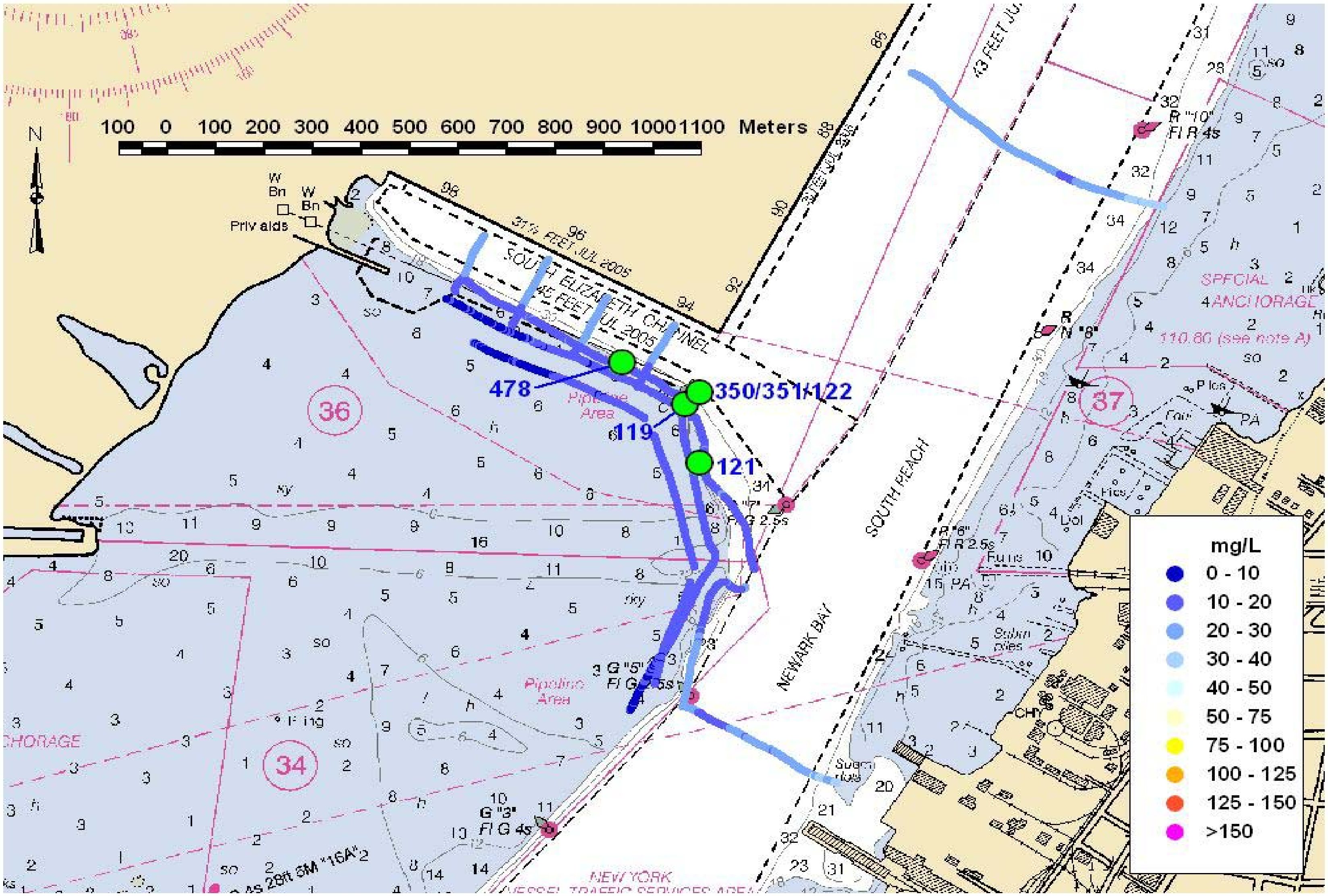


Figure 3. Relationship between turbidity (*In situ*) and total suspended solids concentration for 336 water samples.



N
100 0 100 200 300 400 500 600 700 800 900 1000 1100 Meters
SOUTH ELIZABETH CHANNEL
478
350/351/122
119
121
NEWARK BAY
SOUTH REACH
SPECIAL ANCHORAGE
NEW YORK VESSEL TRAFFIC SERVICES AREA
Pipeline Area
36
37
34
mg/L
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 75
75 - 100
100 - 125
125 - 150
>150

Figure 4. Mobile ADCP plume transects and OBS deployment locations for ambient survey SCAA completed during an ebbing tide on 12 June 2011.

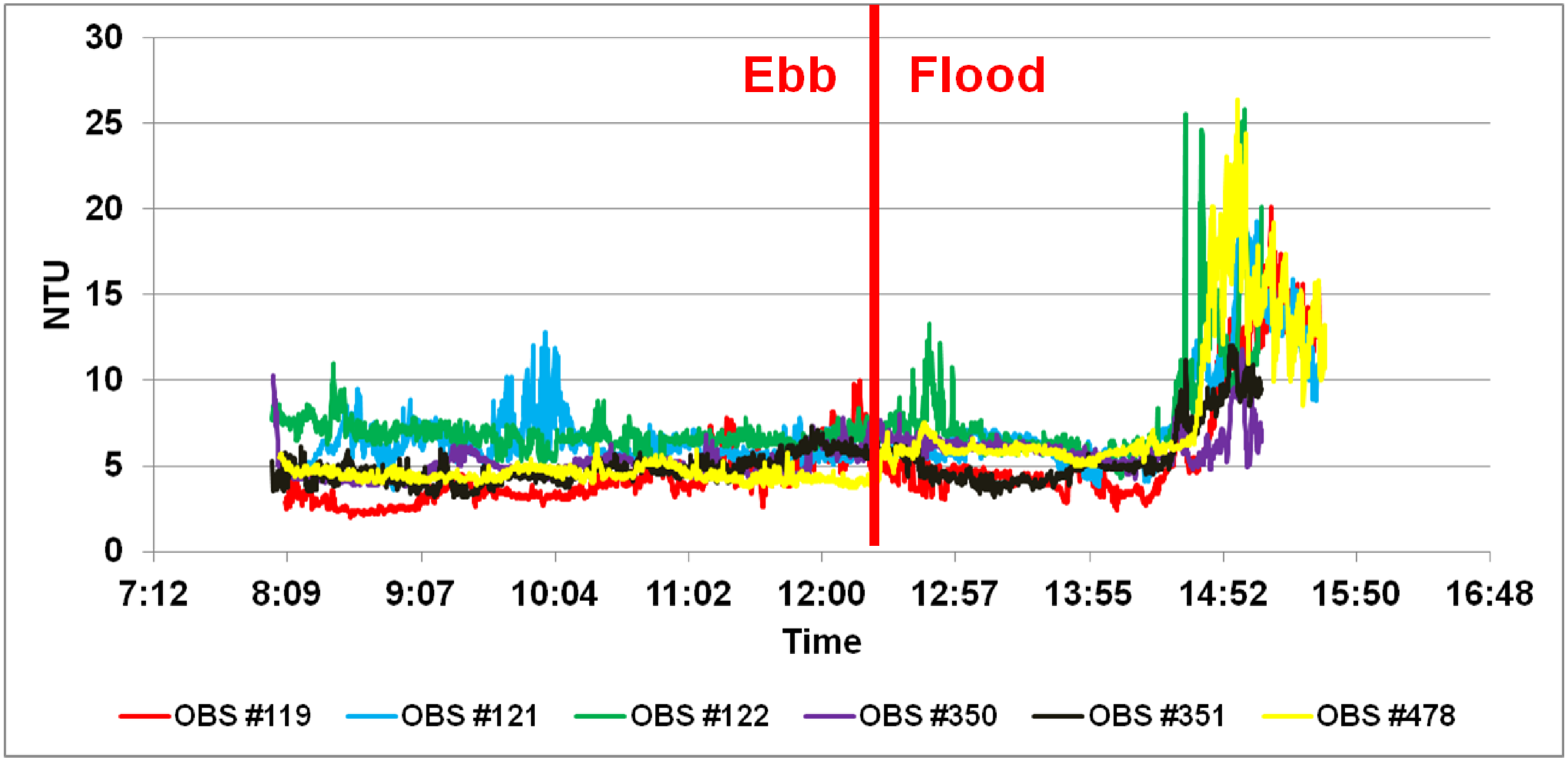
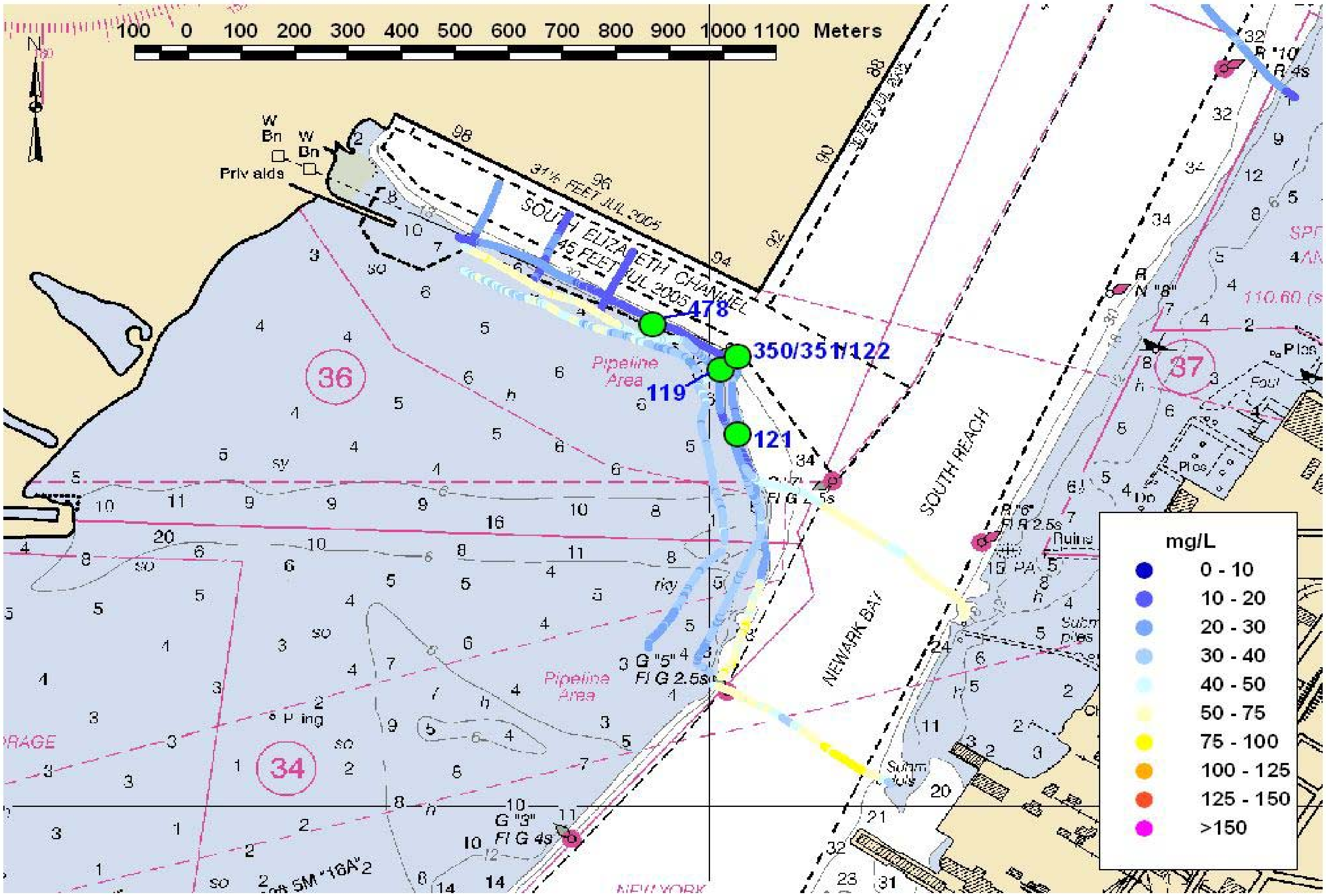


Figure 5. Turbidities (NTU) measured on12 June to assess ambient conditions prior to silt curtain deployment. (See Figure 4 for OBS deployment locations and Table 3 for turbidity summary.)



100 0 100 200 300 400 500 600 700 800 900 1000 1100 Meters
SOUTH ELIZABETH CHANNEL
45 FEET JUL 2005
Pipeline Area
478
350/351/122
119
121
SOUTH REACH
NEWARK BAY
36
34
37
mg/L
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 75
75 - 100
100 - 125
125 - 150
>150

Figure 6. Mobile ADCP plume transects and OBS deployment locations for ambient survey SCAB completed during a flooding tide on 12 June 2011.

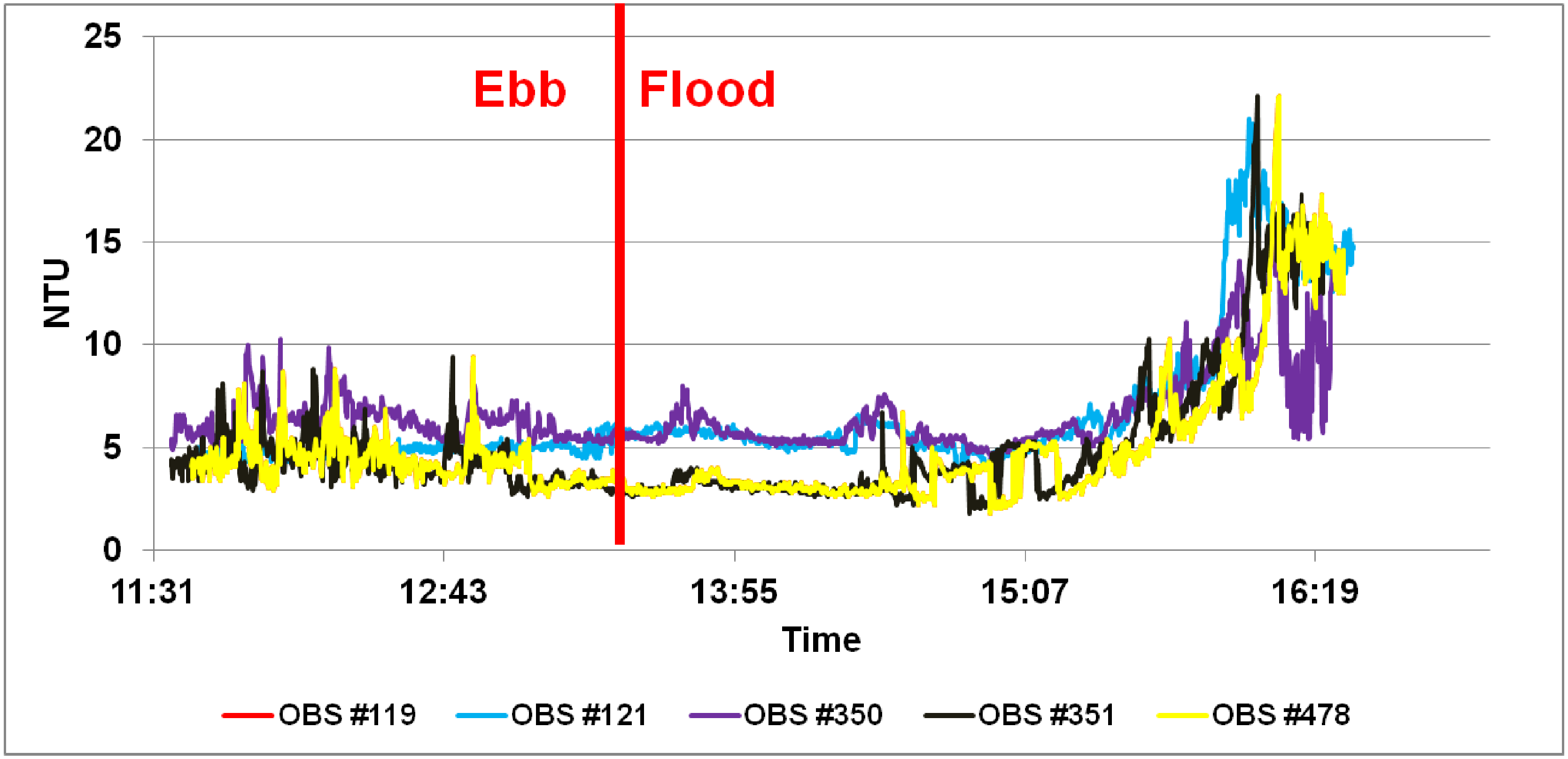
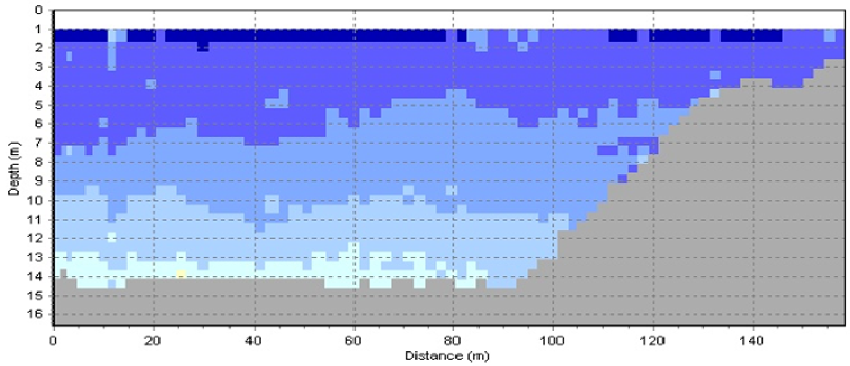
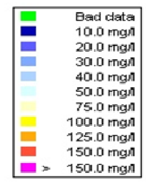
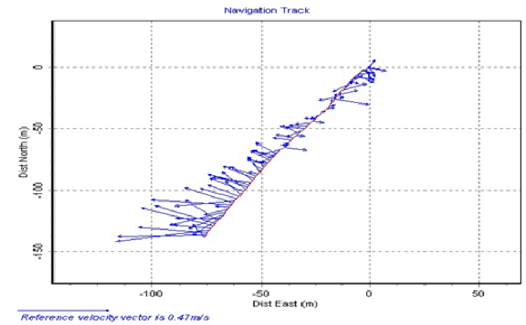


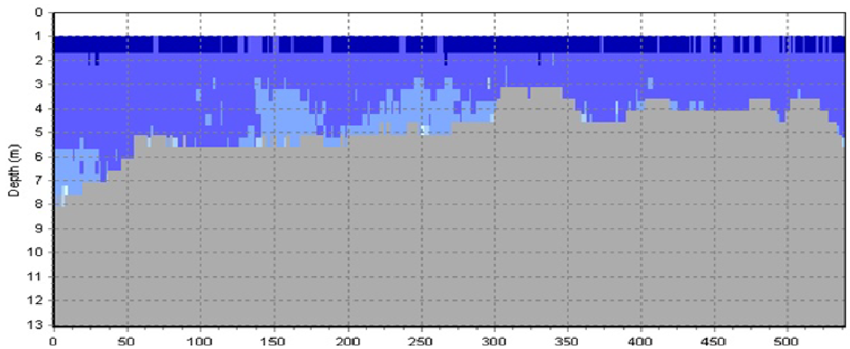
Figure 7. Turbidities (NTU) measured on13 June to assess ambient conditions prior to silt curtain deployment. (See Figure 6 for OBS deployment locations and Table 3 for turbidity summary.)

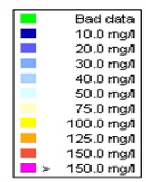




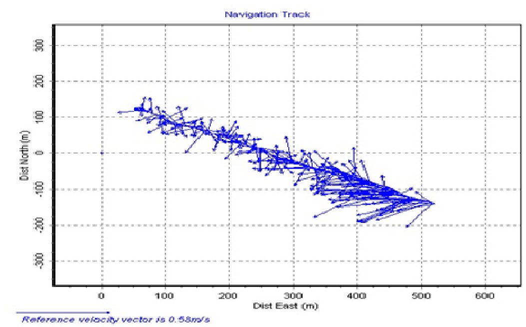
SCAA1

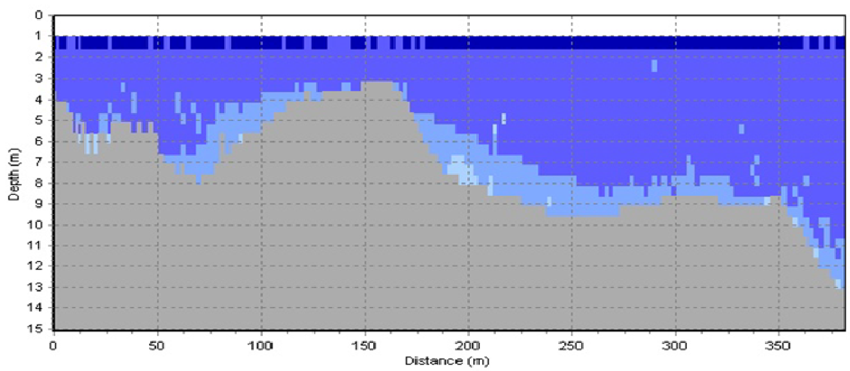


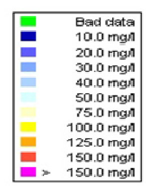




SCAA5







SCAA6

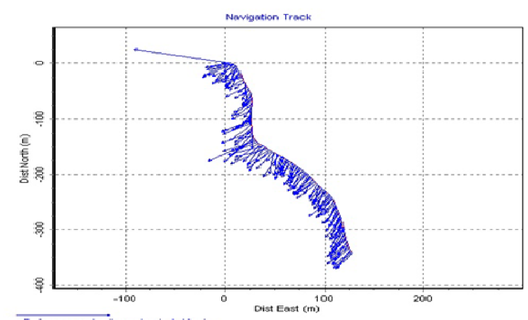


Figure 8. Example vertical profiles (Survey SCAA) of ambient TSS and navigation tracks with depth-averaged current vectors during an ebbing tide. Transect SCAA1 was run in a SW direction across the South Elizabeth Channel. Transect SCAA5 was run in a SE direction along the South Elizabeth shoal towards Channel Marker #1. Transect SCAA6 was run in a NNW from Channel Marker #1 to Channel Marker #7.

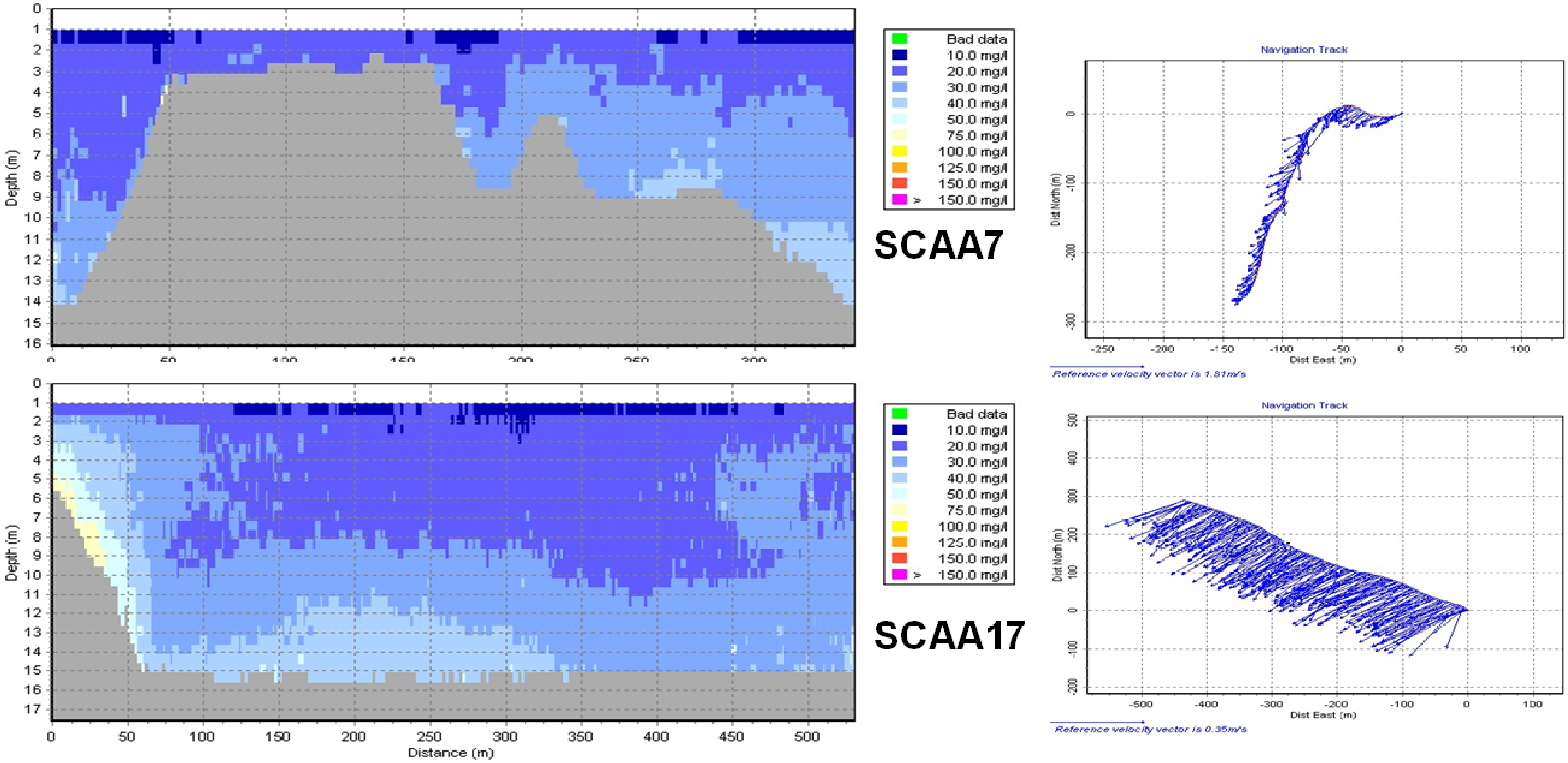


Figure 8 (Concluded). Transect SCAA7 was run in a southerly direction from Channel Marker #7 to Channel Marker #5. Transect SCAA17 was run in a NW direction across the Newark Bay navigation channel.

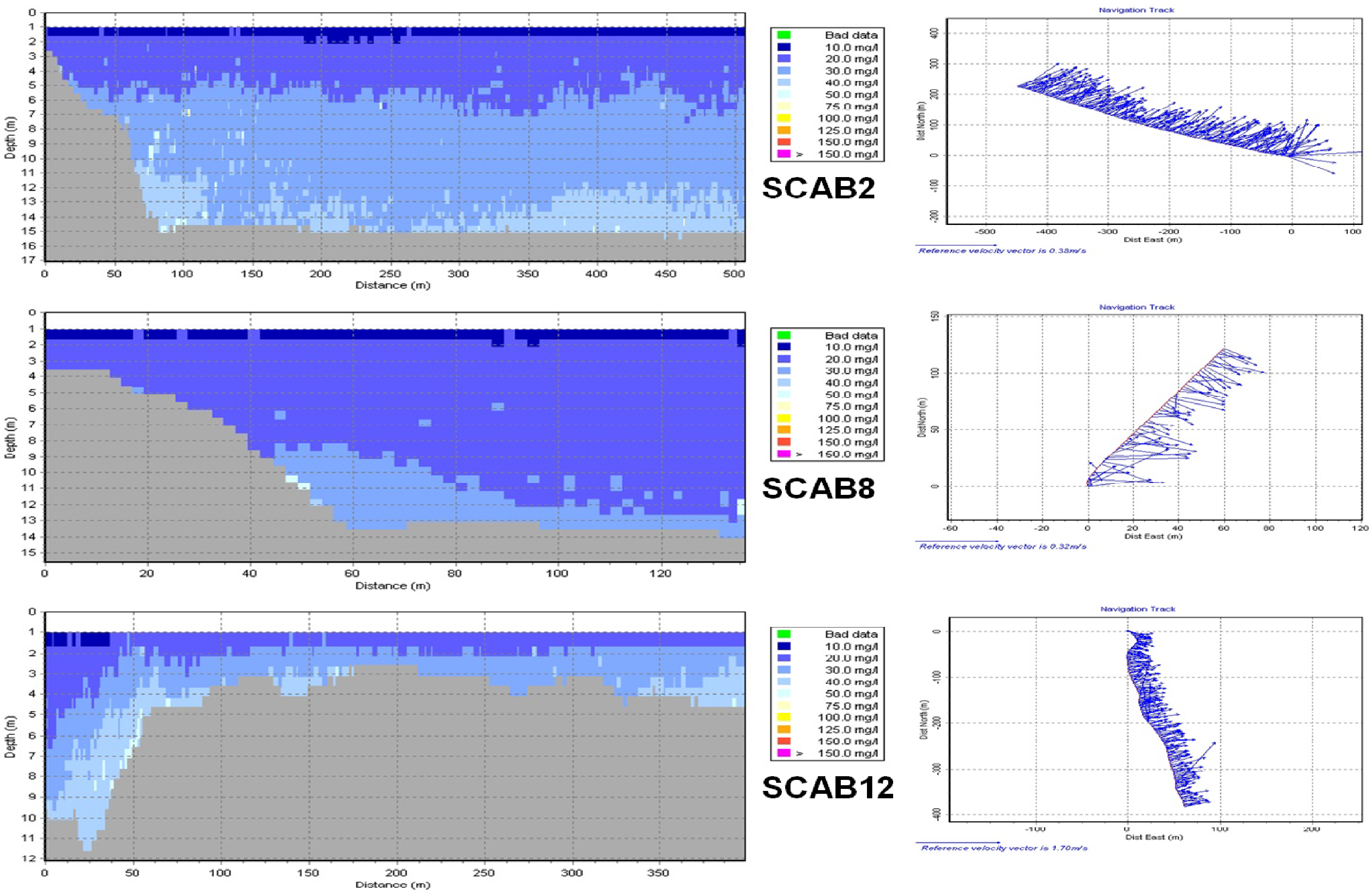


Figure 9. Example vertical profiles (Survey SCAB) of ambient TSS and navigation tracks with depth-averaged current vectors during a flooding tide. Transect SCAB2 run in a SE direction across the main navigation channel (Newark Bay) and ends at Channel Marker #14. Transect SCAB8 runs in a NE direction across the SEC. Transect SCAB12 runs in a southerly direction from Channel Marker #1 to Channel Marker #7.

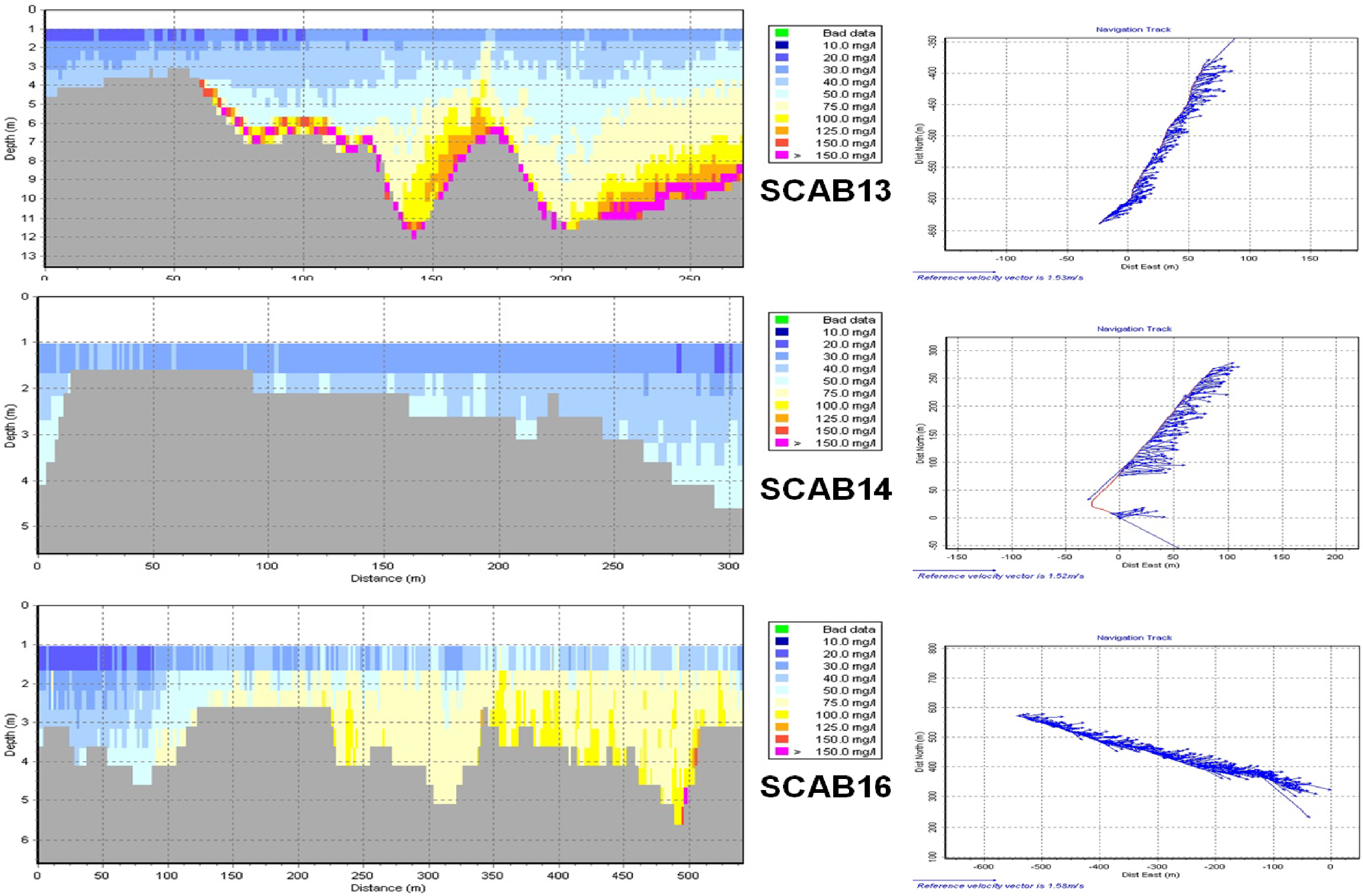


Figure 9 (Continued). Transect SCAB13 runs in a SSW direction, from Channel Marker #7 to Channel Marker #5; Transect SCAB14 runs in a northerly direction from Channel Marker #5 to Channel Marker #7; Transect SCAB16 runs in a NNW direction from Channel Marker #1 along the 3-4 m depth contour of the South Elizabeth Channel shoal.

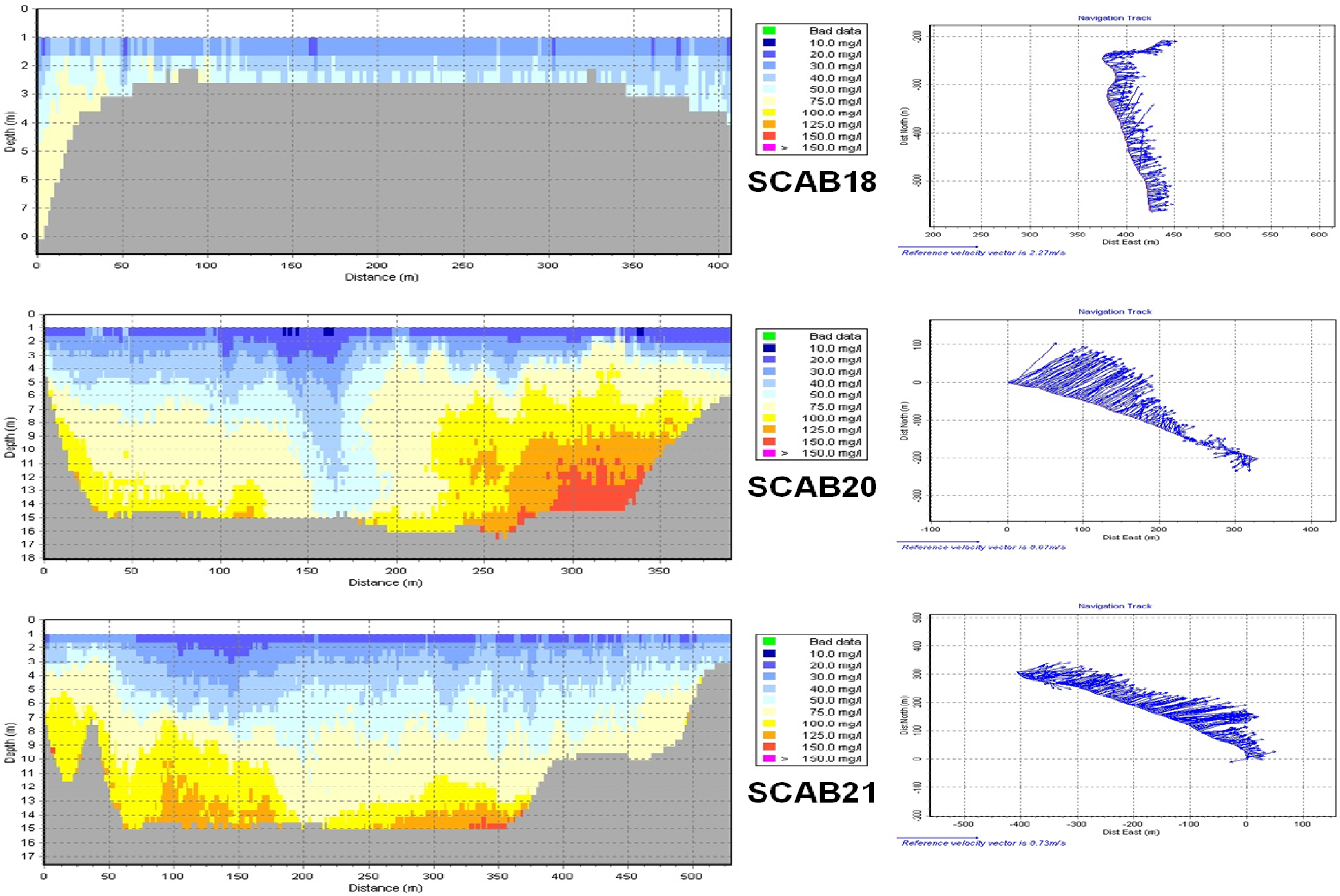


Figure 9 (Concluded). Transect SCAB18 runs in a SSW direction from Channel Marker #1 to Channel Marker #7; Transect SCAB20 runs a SE direction across Newark Bay main channel from Channel Marker #5; Transect SCAB21 runs in a NW direction across main channel of Newark Bay.

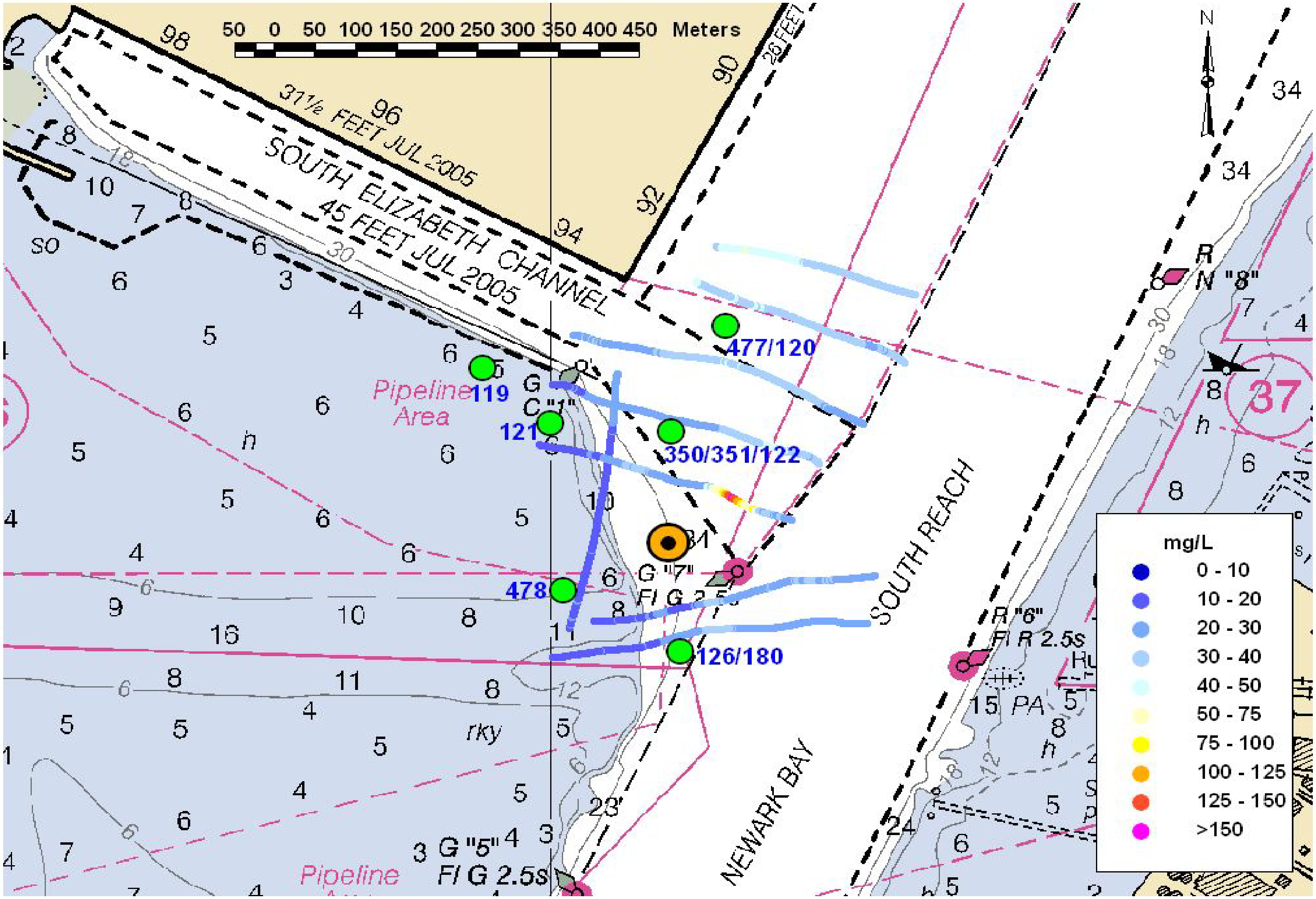


Figure 10. Mobile ADCP transects and OBS deployment locations for plume survey SCPB completed prior to silt curtain deployment during a flooding tide on 14 June 2011.

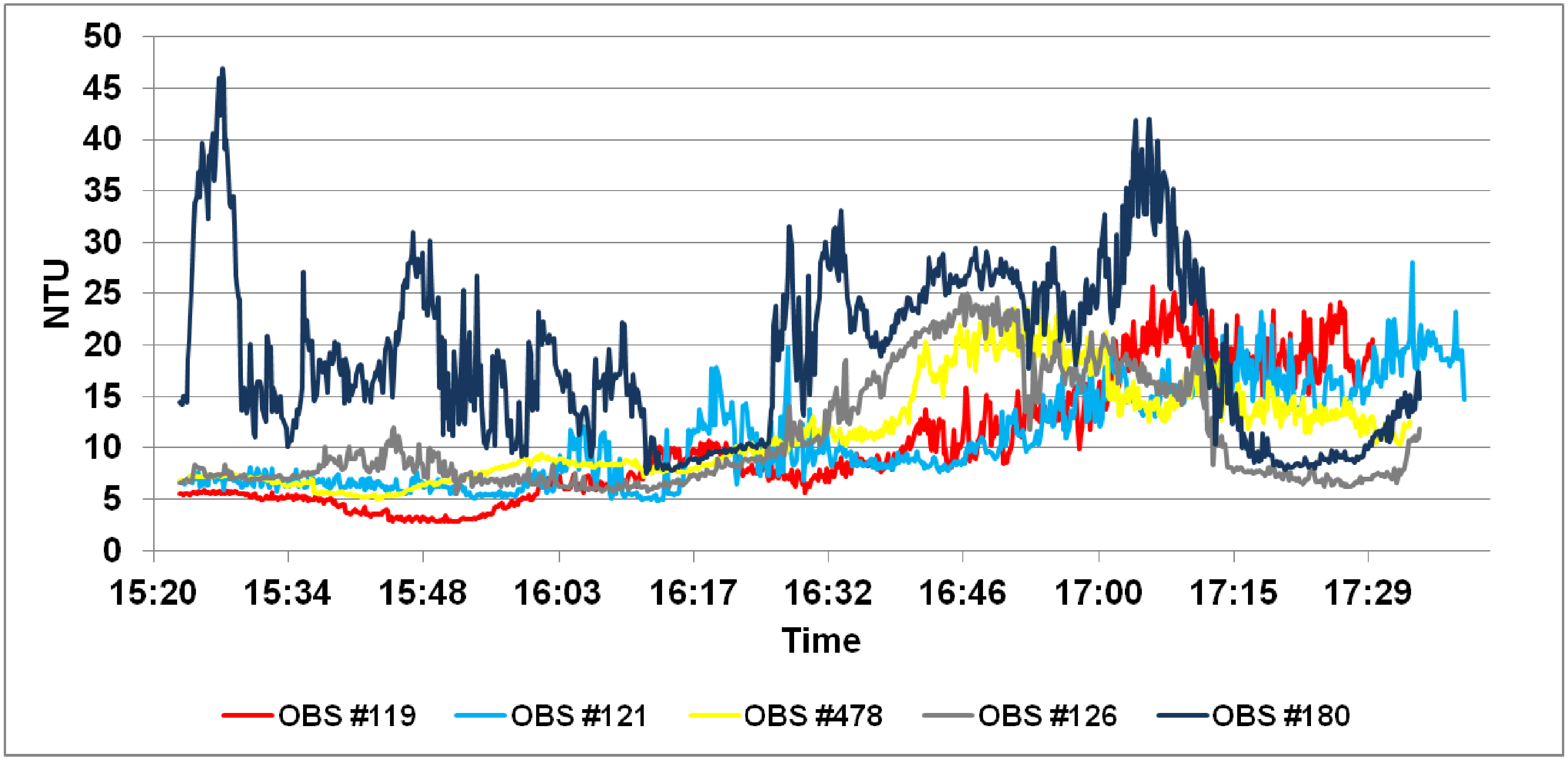


Figure 11. Turbidities (NTU) measured on14 June during ADCP plume surveys completed during a flooding tide prior to silt curtain deployment. Note: OBS sensors #119 (1.7 m, 333 m), #121 (1.7 m, 200 m) and #478 (1.8 m, 160 m) were deployed over the Elizabeth Flats. OBS sensors #126 (4.9 m, 150 m) and #180 (10.1 m, 150 m) were deployed within the South Elizabeth Channel on the non-plume (ambient) side of the dredge. Sensor depth and deployment distance to the dredge is given in the parenthesis next to the sensor number. See Figure 10 for OBS deployment locations and Table 3 turbidity summary.

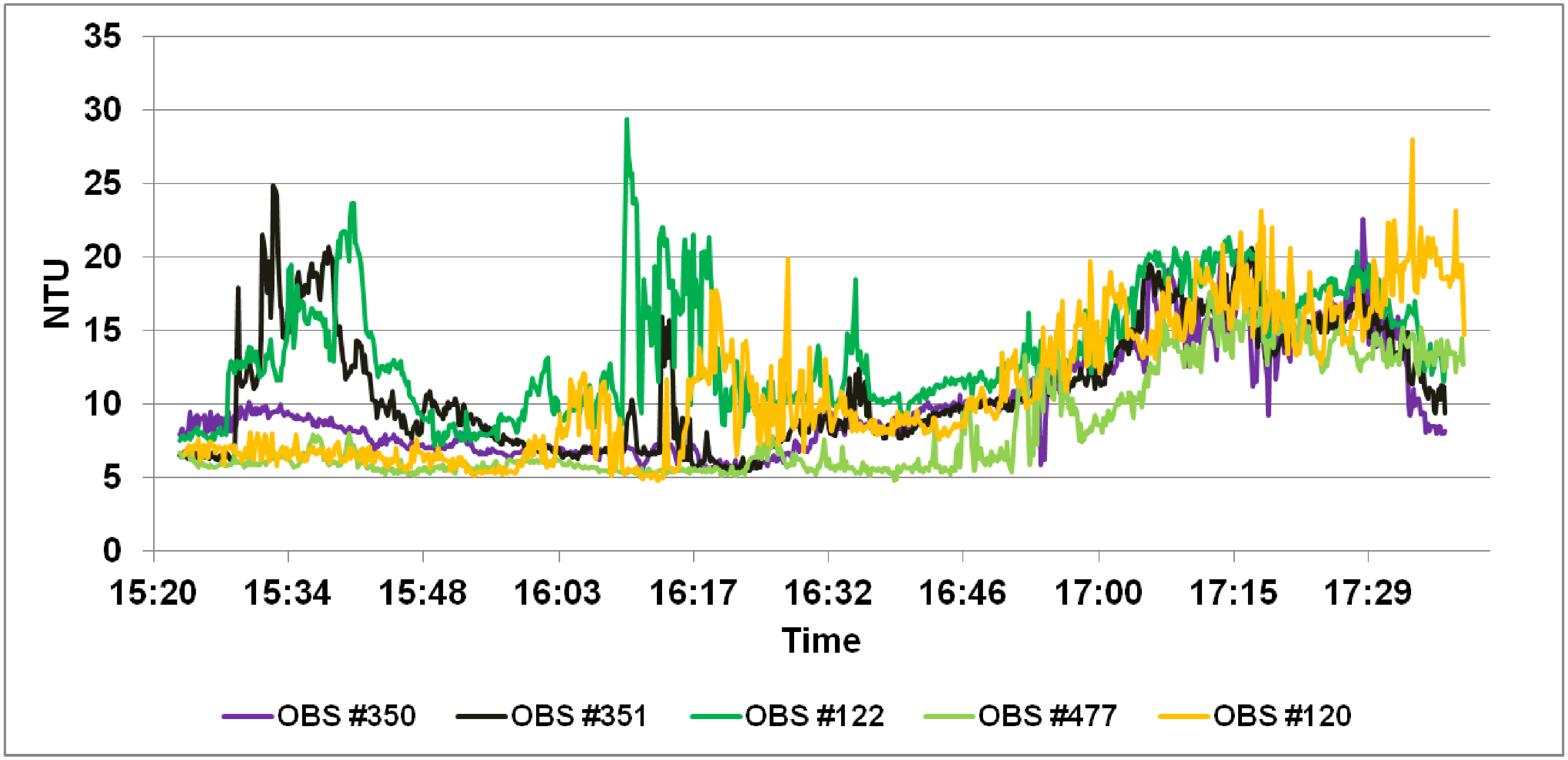


Figure 12. Turbidities (NTU) measured on14 June during ADCP plume surveys completed during a flooding tide prior to silt curtain deployment. Note: OBS sensors #350 (3.3 m, 160 m), #352 (7.8 m, 160 m) and #122 (11 m, 160 m) were deployed in the near-field, 135 m from the bucket. OBS sensor # 477 (4.7 m, 300 m) and #120 (10.4 m, 300 m) were deployed in the far field, 245 m from the bucket. Sensor depth and deployment distance to the dredge is given in the parenthesis next to the sensor number. See Figure 10 for OBS deployment locations and Table 3 for turbidity summary.

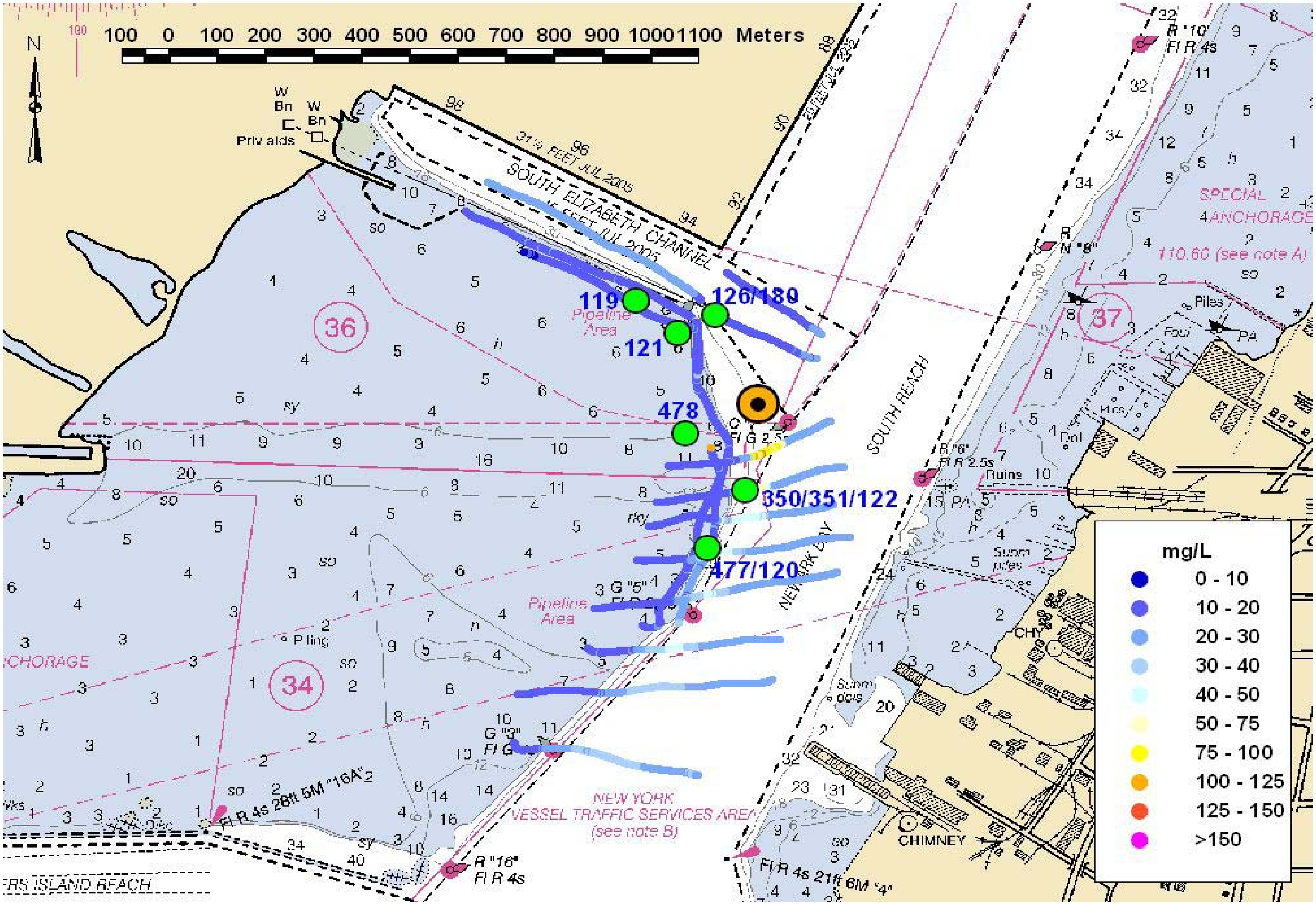


Figure 13. Mobile ADCP transects and OBS deployment locations for plume survey SCPA completed prior to silt curtain deployment during an ebbing tide on 14 June 2011.

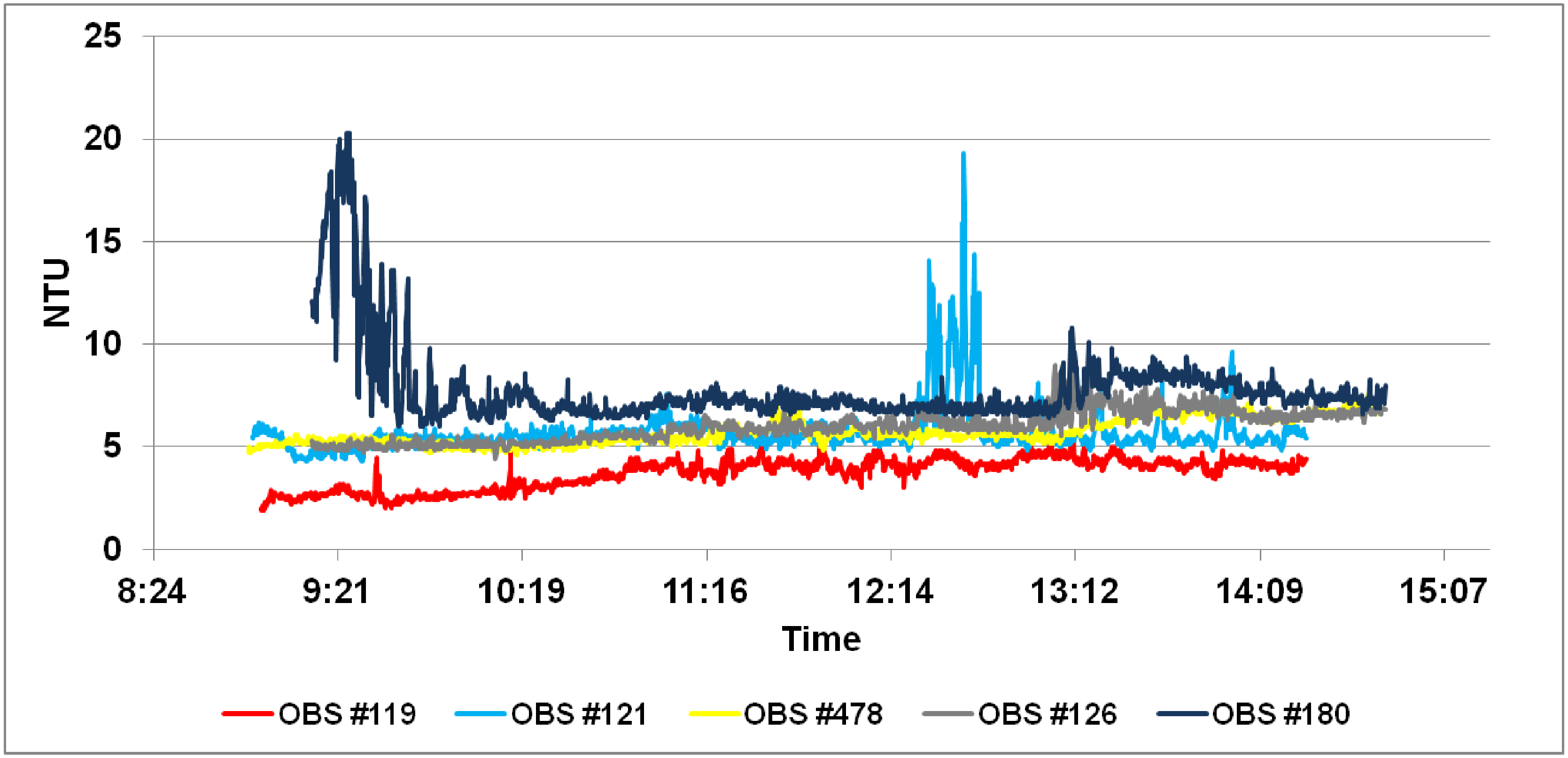


Figure 14. Turbidities (NTU) measured on 15 June during ADCP plume surveys completed prior to silt curtain deployment. Note: OBS sensors #119 (1.5 m, 274 m), #121 (1.7 m, 294 m), and #478 (1.7 m, 215 m) were deployed over the Elizabeth Flats. OBS sensors #126 (4.8 m, 130 m) and #180 (10.2 m, 130 m) were deployed upcurrent on the non-plume (ambient) side of the dredge. Sensor depth and deployment distance to the dredge is given in the parenthesis next to the sensor number. See Figure 13 for OBS deployment locations and Table 3 turbidity summary.

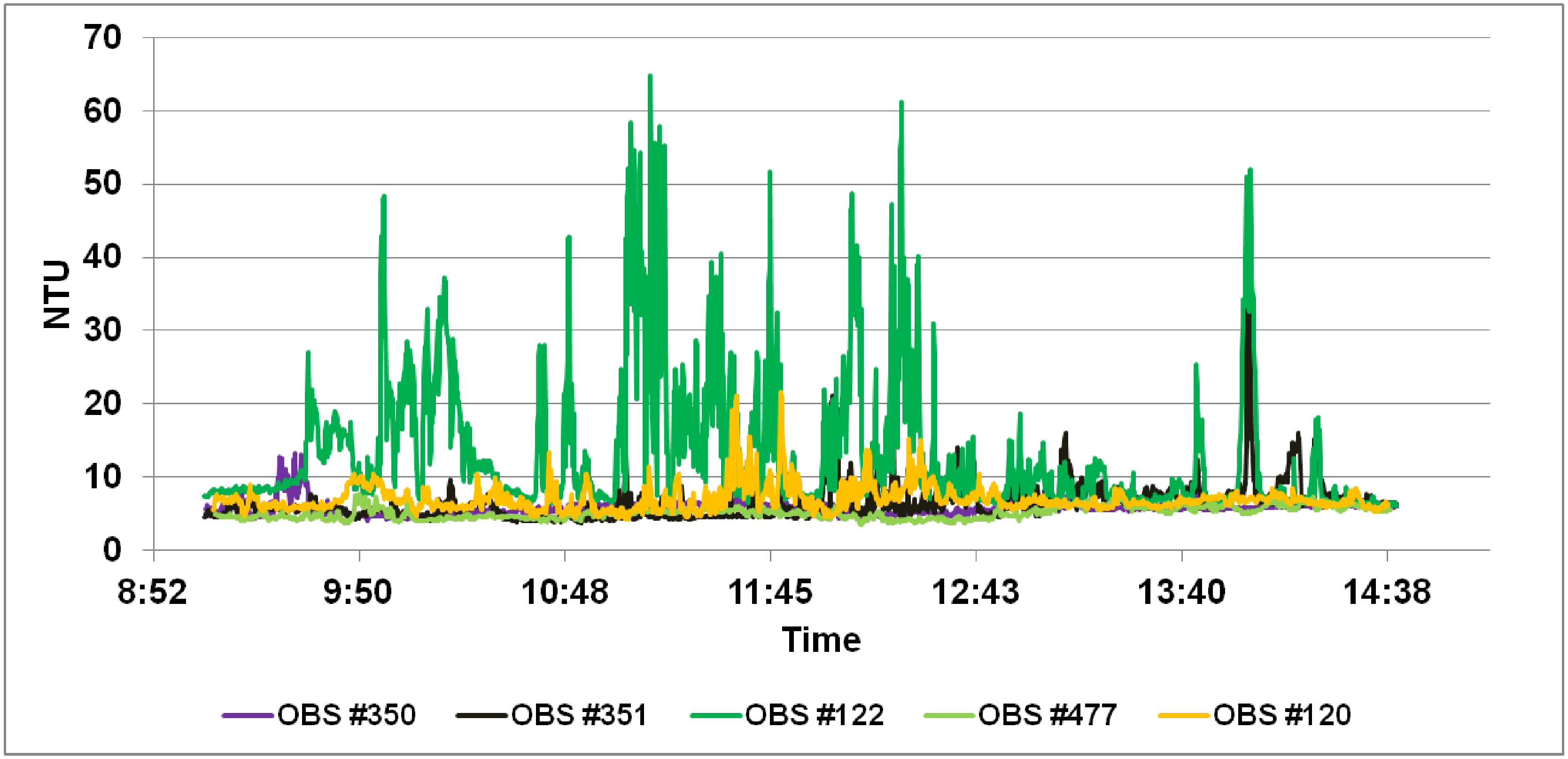


Figure 15. Near- and far-field turbidities (NTU) measured on 15 June during ADCP plume surveys completed during an ebbing tide prior to silt curtain deployment. Note: OBS sensors #350 (3.3 m), #352 (7.7 m) and #122 (10.6 m), were deployed in the near-field, 135 m from the bucket. OBS sensor # 477 (4.7 m) and #120 (10.3 m) were deployed in the far field, 245 m from the bucket. Sensor depth is given in the parenthesis next to the sensor number. See Figure 13 for OBS deployment locations and Table 3 for turbidity summary.

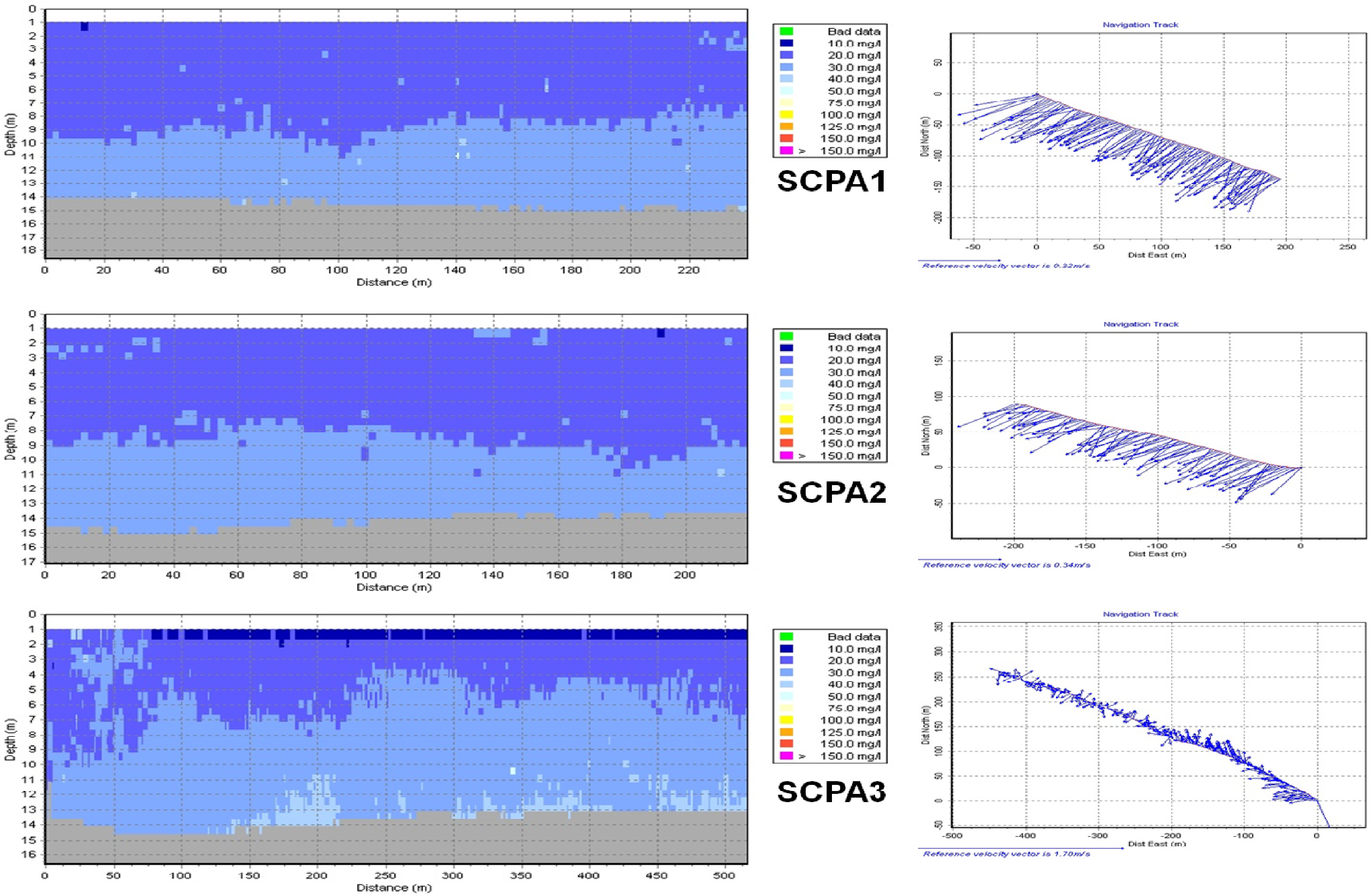


Figure 16. Vertical profiles of TSS plumes and navigation tracks with depth-averaged current vectors for a plume survey (SCPA) during an ebbing tide prior to silt curtain deployment. Transect SCPA1 runs in a SE direction, 222 m upcurrent (non-plume side) of the dredge. Transect SCPA2 runs in a NW diection, 217 m upcurrent (non-plume side) of the dredge, terminating at Channel Marker #1. Transect SCPA3 runs a NW direction, 135 m upcurrent (non-plume side) from Channel Marker #1 into the SEC.

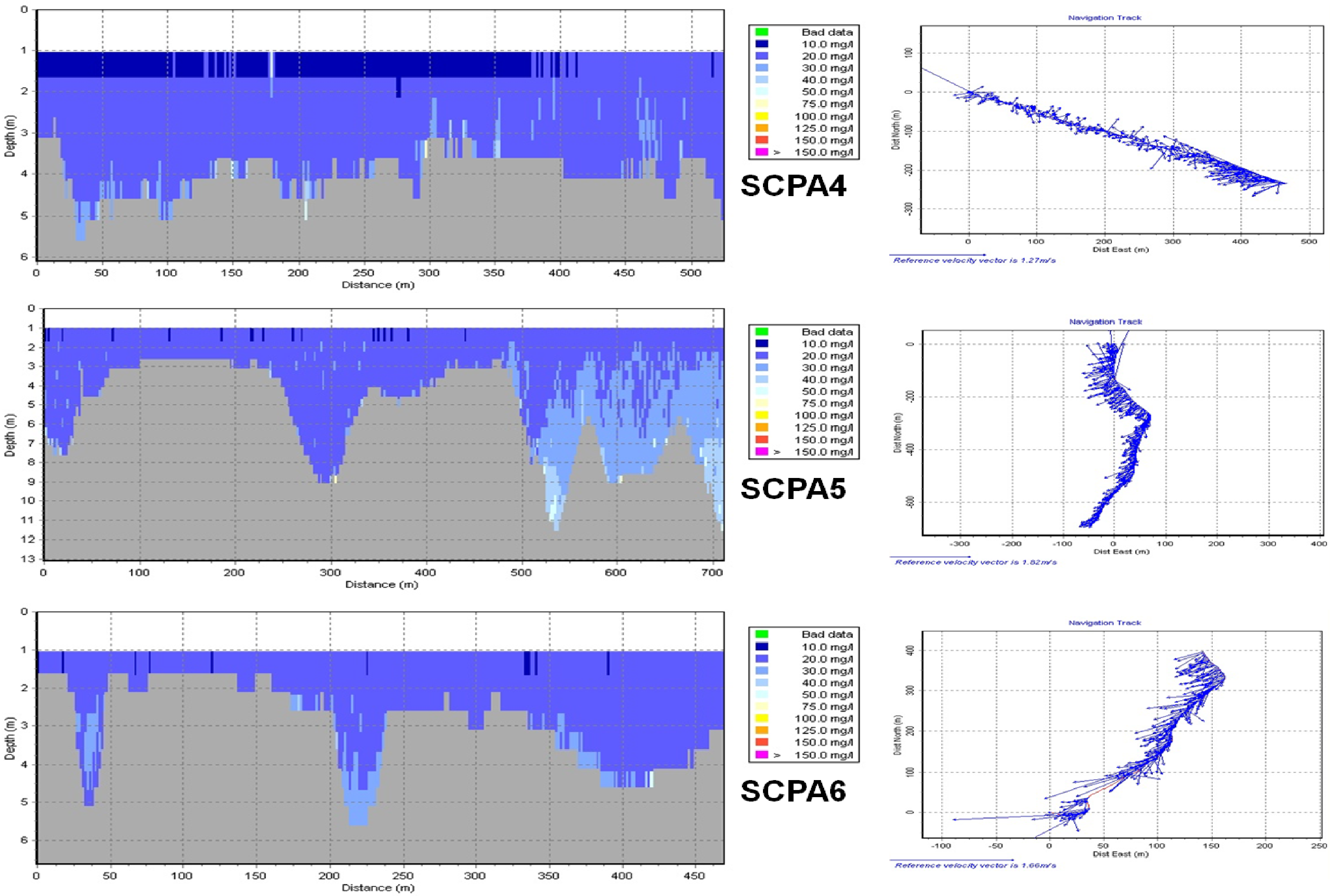


Figure 16 (Continued). Transect SCPA4 runs in an easterly direction, 650 m upcurrent (non-plume side) of the dredge following the 18 ft contour and terminating at Channel Marker #1. Transect SCPA5 runs in a SE direction passing lateral of the dredge's position from up- to downcurrent. Transect SCPA6 runs in a NE direction along the 11 ft contour of the SEC flats.

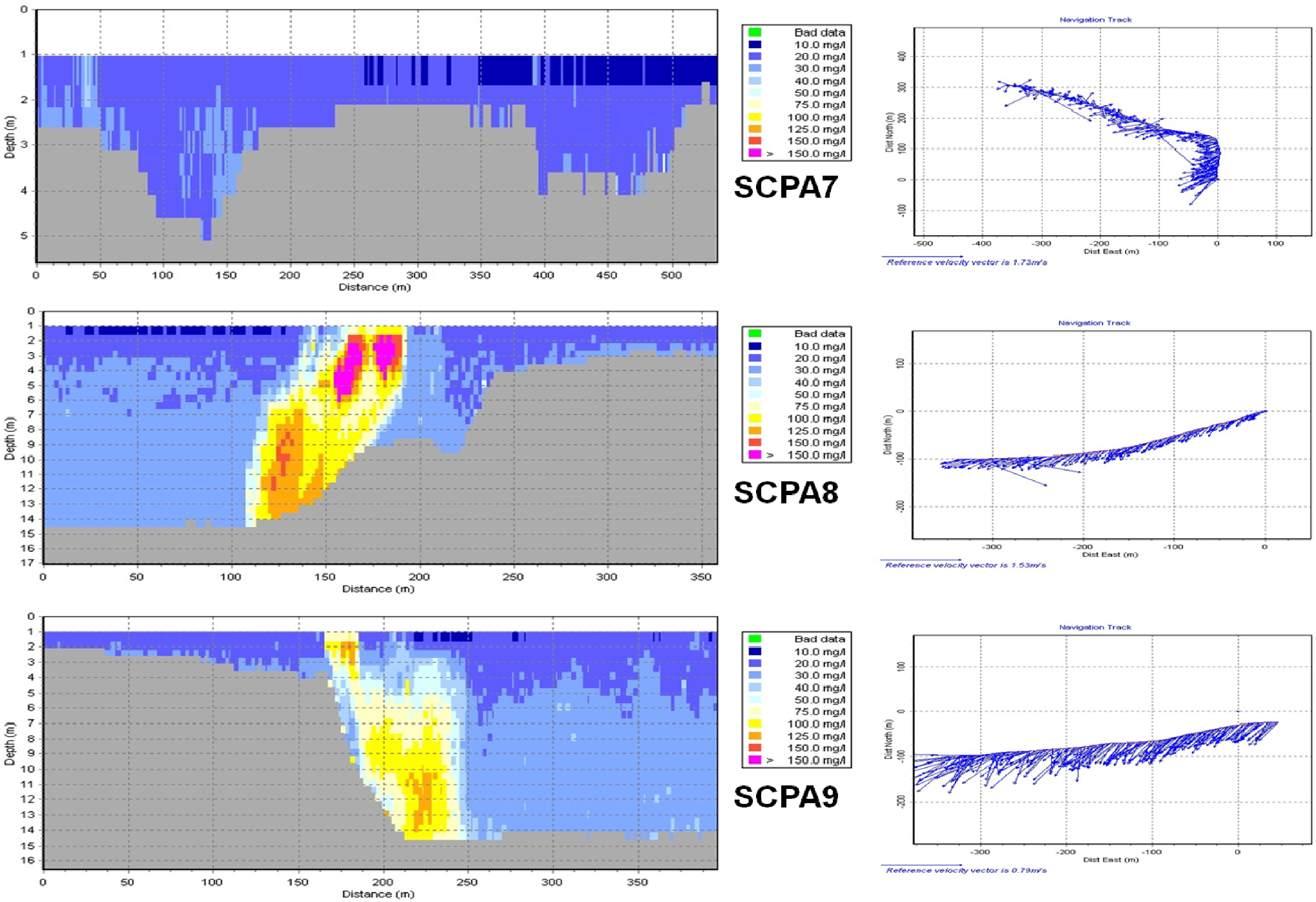


Figure 16 (Continued). Transect SCPA7 runs in a NNE direction along 11 ft contour towards Channel Marker #1. Transect SCPA8 runs a westerly direction, 72 m downcurrent of dredge. Transect SCPA9 runs in an easterly direction, 147 m downcurrent of dredge.

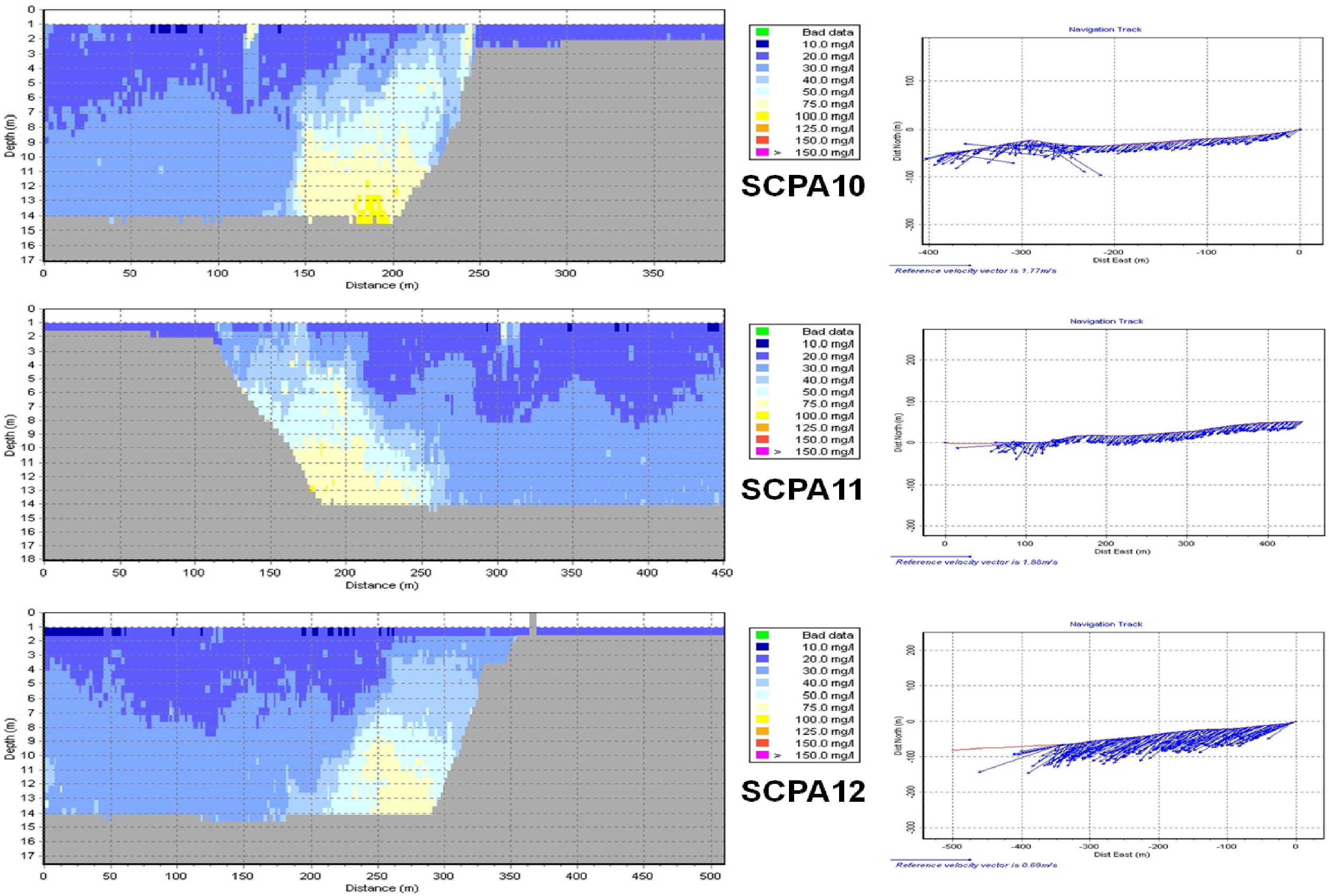


Figure 16 (Continued). Transect SCPA10 runs in a westerly, 225 m downcurrent of dredge. Transect SCPA11 runs in a easterly, 288 m downcurrent of dredge. Transect SCPA12 runs in a westerly direction, 375 m downcurrent of dredge.