

TECHNICAL MEMO:

**FAR FIELD SURVEYS OF
SUSPENDED SEDIMENT PLUMES
ASSOCIATED WITH HARBOR
DEEPENING DREDGING IN
NEWARK BAY**

Prepared for
**U.S. Army Corps of Engineers - New York
District**

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1.0 Introduction

In February 2008, as part of the larger U.S. Army Corps of Engineers (USACE) New York District's Near Field Turbidity/Total Suspended Solids (TSS) Pilot Study (hereafter the Pilot Study), two far field surveys (one on the ebb and one on the flood tide) were conducted to assess the spatial extent and temporal dynamics of suspended sediment plumes associated with mechanical dredging of fine-grained sediment in the main navigational channel of the Newark Bay-1 Contract Area (S-NB-1). These mobile surveys were conducted using a vessel-mounted Acoustic Doppler Current Profiler (ADCP) and consisted of predetermined parallel transects run perpendicular to the axis of the suspended sediment plume. Transects were designed to encompass the entire footprint of the plume's acoustic signature (i.e., the detectable signature above ambient backscatter) and were conducted adjacent to and down-current of the active dredge operation.

1.1 Study Area & Dredge Plant

During the recent near-field (defined as the area at and immediately adjacent to the bucket and dredge platform) Pilot Study, two additional far-field surveys were conducted to assess the spatial and temporal extent of the dredge plume during both an ebb tide (2 February 2008) and a flood tide (14 February 2008). The surveys were conducted in the vicinity of a dredge operating within the Newark Bay S-NB-1 Contract Area (Figure 1). For both surveys the dredge plant was situated in the Middle Reach of the Main Navigational Channel east of Port Elizabeth Marine Terminal and just north of the entrance to the Port Elizabeth Channel marked by the Red "2" Channel Buoy. The Newark Bay Channel at this location is approximately 250 meters wide with water depths that typically range to 14 meters or approximately 45 feet. This is a high volume vessel traffic area frequented by tugs and barges as well as large deep draft commercial vessels including container ships and car carriers. The channel is flanked on both sides by extensive flats with prevailing depths of three meters or less.

The dredge contractor for this study was Great Lakes Dredge & Dock Company (GLDD), operating the Dredge #53 configured with a twenty-six (26) cubic-yard capacity Cable Arm bucket. The Cable Arm bucket is a variation of an environmental "closed" clamshell bucket designed to minimize release of sediment to the water column. In contrast to conventional "grab" buckets, the cable arm can produce a relatively level cut when removing bottom sediment, thereby enhancing vertical as well as horizontal control. In addition to the use of a closed clamshell bucket, operational measures including

restriction of hoist speed to no more than two feet/second hoist speed and the use of dredging instrumentation ensuring full bucket closure were collectively used as management practices to reduce overall sediment re-suspension. Figure 1a shows a photograph of the bucket in use during the February 2008 far-field plume surveys described in this report. During routine operation, flaps covering vents arrayed in rows on both sides of the bucket serve to maximize retention of cohesive sediments and minimize spillage of sediment/water slurries.

2.0 Methods

2.1 Survey Design of Mobile ADCP Transects

Suspended sediment plumes were characterized using an RD Instruments 600-kHz Mariner Workhorse Monitor Series ADCP. RD Instruments WinRiver software was used for real time display of plume acoustic signatures and data recording. The ADCP operates by emitting acoustic pulses into the water column at set time intervals. Each group of pulses, referred to as an "ensemble," is vertically stratified into discrete, fixed-depth increments, or "bins." The number of bins and size of each bin is a configurable operation parameter of the instrument. In this study, 30 bins of 0.5-meter depth were used. After the instrument emits a pulse, the ADCP then "listens" for the return of any sound (i.e. backscatter) that has been reflected from particles in the water column (in this case, a "particle" is any acoustic reflector, including sediment, plankton, fish, air bubbles etc.). The relative frequency and intensity of the reflected pulses can then be analyzed and an estimate of current velocity, and by extension, suspended sediment concentration, can be determined. Navigation data and dredge operational data (e.g. barge position, bucket position and bucket open/closed) were also collected concurrently and integrated during post-processing. The backscatter data were collected during both an ebb tide (2 February 2008) and a flood tide (14 February 2008) to provide a range of tidal conditions.

Mobile ADCP survey transects were oriented in a direction perpendicular to the channel and extended down-current until plume acoustic signatures could not be detected against background conditions. Background conditions on the days of the survey were determined by conducting ambient transects up-current of the plume and outside the dredging area. Individual transect length was generally determined by bathymetry at the site, but always with the objective of extending beyond the detectable boundaries of the plume. The number, and consequently spacing, of cross-plume transects were maximized

within each designated tidal phase in order to provide complete spatial coverage of the detectable plumes and optimal resolution of internal plume structure.

2.2 Water Sample Collection

In addition to the mobile ADCP transects, water samples were collected to directly measure TSS concentrations (mg/l) and turbidity (NTU) throughout the water column. The water samples were collected using an onboard winch system and a Sea-Bird Electronics SBE32C Compact Carousel Water Sampler equipped with six 1.7L Niskin sample bottles. A D&A Instrument Company's OBS 3A optical backscatter sensor and a Falmouth Scientific, Inc. 3" MicroCTD were also mounted to the Carousel Sampler and hardwired directly to an onboard laptop. The OBS unit provided real-time turbidity values while the CTD provided water conductivity, temperature and real-time depth of the entire sampling apparatus. The Carousel Sampler was also connected electronically to an onboard laptop and features a magnetically-actuated lanyard release system used to remotely "fire" the sample bottles using a custom application that recorded the exact time that each bottle fired to the nearest second.

Each of the water samples collected in the field was processed in the laboratory by Test America Laboratories, Inc. for optical turbidity (Method SM 2130-B) and for the gravimetric analysis of TSS concentration (Method SM 2540-D). The laboratory results were then used to provide a robust calibration data set to convert the raw ADCP backscatter measurements to estimates of TSS concentration using the Sediview methodology as further described below.

2.3 Sediview Calibration

The raw acoustic backscatter measurements collected by the ADCP were then 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. A total of 127 water samples collected and analyzed gravimetrically during the Pilot Study.

The sample population represents the concentration gradient at the study site and is used to "ground truth" the acoustic data. The calibration samples were collected at known locations within the water column, so that individual gravimetric samples can be directly

compared with acoustic estimates of TSS concentration for a “bin” of water as close to the water sample as possible. Because air is injected into the water column as the bucket breaks the air-water interface, and air bubbles are acoustic reflectors, care must be exercised in converting acoustic data derived very close to the operating bucket. Bubbles dissipate by rising to the surface with time. The distance down-current of bubble interference of the signal is therefore influenced by current velocities. During the present study, current flows were relatively slow to moderate, consistent with flows observed in the Providence River where a closed bucket was monitored during maintenance dredging operations (Reine et al. 2006). Experiments during the Providence River monitoring, in which the bucket was intentionally plunged through the air-water interface without removing sediment from the bottom, determined that the “bubble signature” pattern dissipated within approximately 50 meters of the source. Beyond 50 meters estimates of TSS concentration for the calibrated ADCP should be accurate.

Following the Sediview calibration, the results were then applied to all of the ADCP files recorded during each of the two far-field surveys, resulting in an ADCP-derived estimate of TSS concentration for each recorded ADCP bin.

2.4 Sediment Sample Collection

When possible, in situ sediment samples were collected from the dredge scow and the sediment bed using a ponar grab sampler. These samples were analyzed in the laboratory by Applied Marine Sciences, Inc. for sediment grain size distribution (ASTM D422 Method), bulk density (EM 1110-2-1906 Method) and Atterberg Limits (ASTM D4318 Method).

3.0 Results

Results of the water and sediment sample collections as well as the two far-field survey events are presented below. Results for the ADCP plume transects are presented graphically in four (4) ways:

- Vertical Profile Plots – Vertical cross-section profiles representing individual transects are examined in detail for TSS concentration gradient structure of the plume at known distances from the source.

- Plan View Plots – TSS concentrations are presented as composite horizontal “slices” through the plume signature at two meter depth increments.
- Three-dimensional (3-D) Plot Depiction – TSS concentrations are plotted in X and Y coordinates with an exaggerated Z (depth) axis.
- Finally, selected transects from both the ebb and flood surveys were plotted three dimensionally and then superimposed on the existing bathymetry to show the spatial extent of the plume within the channel. Channel bathymetry was obtained during the S-NB-1 pre-dredge survey and, when unavailable, from ADCP data collected during the Pilot Study.

Unless otherwise noted on the figures, backscatter above ambient is assumed to be associated with dredging activities.

3.1 Laboratory Analysis of Water Samples

A total of 127 water samples were collected on site in Newark Bay over the course of two sampling days (8 February 2008 and 13 February 2008). The laboratory results of the optical turbidity and the gravimetric analysis of TSS concentration of those 127 samples are presented in Table 1. To accommodate the requirement for calibration of the ADCP backscatter, samples were taken from locations specifically to represent the broadest possible concentration gradient from ambient to as close to the source as possible. Logistical and safety constraints made it difficult to collect high TSS concentration samples.

In this study, the TSS concentrations of the 127 water samples ranged from 29 to 300 mg/l. (Table 1). Figure 8 plots both the gravimetric measurements and acoustic estimates arranged in rank order (Figure 8a) and in paired order (Figure 8b). A relatively strong correspondence exists between the two measures throughout most of the sampled range, although some variation is seen for individual pairs primarily at the very low and high ends of the range.

3.2 Mobile ADCP Surveys

3.2.1 Ambient Conditions

It is important to consider that no single TSS concentration adequately represents ambient conditions; instead a range of concentrations is a better representation of the dynamic nature of suspended sediment concentration. However, for purposes of display and comparison, a conservative approach was used to determine a single background concentration. The average gravimetric estimate of TSS concentration based on eight (8) water samples collected and analyzed (Table 1) was 43 mg/l ($\sigma = 6$ mg/l). Whereas, the average TSS concentration based on acoustic measurements was 23 mg/l ($\sigma = 6$ mg/l), and 26 mg/l ($\sigma = 5$ mg/l), on 2/02 and 2/14, respectively. Therefore, an ambient concentration of 29 mg/l (23+6) was used as a conservative estimate of an upper threshold of background concentration. In this study, all acoustically estimated TSS concentrations greater than 29 mg/l are herein considered above background and attributable to the dredging-induced plume unless otherwise noted, e.g., clearly attributable to air entrainment or other sources of disturbance such ship passage.

3.2.2 February 2, 2008 (*Ebb Tide Survey*)

A mobile ADCP plume characterization survey was completed during the second half of an ebbing tide from approximately 1030 to 1230 hours on 2 February 2008 with peak ebb occurring at approximately 0900 at the South Reach, Newark Bay. The entire survey consisted of a total of 25 transects. Vertical profile plots representing successive transects at increasing distance from the dredge source are given in Figures 2a – 2y. Three (3) ambient transects (Figures 2a - 2c) were conducted on the up-current side of the dredging operation, just north of the Green “15A” Channel Marker, beginning approximately 25 meters astern of the dredge out to approximately 75 meters astern. Twenty-two (22) transects (Figures 2d -2y) were occupied down-current from the dredge in the direction of plume movement. The first transect was located approximately 36 meters from the bow of the dredge platform. Subsequent transects were conducted south of this position, towards the mouth of Elizabeth Channel and the Red “14” Channel Marker, at progressive increments of approximately 25 meters and then 50 meters for the outer two transects. The outermost down-current transect was a distance of approximately 601 meters from the bow of the dredge platform. Transects were orientated perpendicular to the channel and the axis of the dredge plant and were run back and forth in a general east-west direction. Transect length ranged from approximately 168 to 339 meters (Table 2).

To examine plume structure in as complete detail as possible, a series of plan view layouts of the ADCP transects in two meter depth increments are given in Figures 3a – 3g while Figures 4a & 4b provide three-dimensional depictions of average acoustic backscatter for the entire far field survey. A summary of each of the graphically represented transects is presented in Table 2. Estimated TSS concentrations above ambient (29 mg/l) associated with the dredging operation on 2 February 2008 in S-NB-1 extend throughout the water column, but are primarily concentrated in the upper five (5) meters of the water column and within 125 meters down-current from the source (Figures 2d – 2g). Maximum TSS concentrations near the surface approached 300 mg/l with the core signature ranging between 100 and 200 mg/l. Successive vertical profiles (Figures 2h – 2y), show progressive plume decay, although a faint acoustic signature (less than 40 mg/l) is still present in the middle water column at 600 meters from the source (Figure 2y).

Although some lateral spreading of the plume was observed near the bottom, particularly in the first 125 meters down current, the main stem of the plume was typically no more than 50 to 75 meters in width and was always confined within the channel side slopes (Figure 4c). Some acoustic backscatter observed near the source in the upper five (5) meters of the water column may be attributable to air entrainment caused by the repeated entrance and exit of the bucket into the water. Similarly, the patches of high surface backscatter observed in Figures 2k, 2l and 2t can be attributed to air entrainment caused by the vessel prop wash of passing tugs as noted in the field datasheets (Table 2).

3.2.3 February 14, 2008 (Flood Tide Survey)

A mobile ADCP plume characterization survey was completed during a flooding tide from approximately 1000 to 1445 hours on 14 February 2008 with peak flood occurring at approximately 1045 at the South Reach, Newark Bay. The entire survey consisted of 27 transects at increasing distance from the dredge source (Figures 5a – 5zz). Three (3) ambient transects (Figures 5a – 5c) were conducted on the up-current side of the dredging operation, just south of the Green “15A” Channel Marker and at the Red “2” Buoy marking the entrance to Elizabeth Channel, beginning approximately 62 meters off the bow of the dredge platform out to approximately 162 meters from the bow. Twenty-four (24) transects (Figures 5d – 5zz) were occupied down-current from the dredge in the direction of plume movement.

The first two down-current transects were located approximately five (5) meters off the stern of the dredge platform. Subsequent transects were run north of this position at

progressive increments of approximately 25 meters. Of note, after the fourth down-current transect at approximately 55 meters from the platform, dredging operations were halted for approximately one hour and the dredge was rotated 180 degrees with the bucket then facing north. As a result, the remaining down current transects were occupied off the bow of the dredge platform. The outermost down-current transect was located at a distance of approximately 517 meters from the source bucket. Transects were orientated perpendicular to the channel and the axis of the dredge plant and were run back and forth in a general east-west direction. Transect length typically ranged from approximately 109 to 433 meters (Table 3), although the final transect was extended to approximately 633 meters into the adjacent flats to complete the survey.

To examine plume structure in as complete detail as possible, a series of plan view plots of the ADCP transects in two meter depth increments are given in Figures 6a – 6g while Figures 7a & 7b provide three-dimensional depictions of average acoustic backscatter for the entire far-field survey. A summary of each of the graphically represented transects is presented in Table 3. Estimated TSS concentrations above ambient (29 mg/l) associated with the dredging operation on 14 February 2008 in S-NB-1 extend throughout the water column, but primarily within the upper two (2) meters and lower five (5) meters of the water column and within the first 100 meters down-current from the source (Figures 5d – 5j). Maximum TSS concentrations near the surface approach 200 mg/l, but typically range between 80 and 150 mg/l in both the surface and bottom components of the plume. Successive vertical profiles (Figures 5k – 5o) show a steady progression of plume decay.

However, there are additional sources of backscatter as shown in Figures 5p-5r. At transect T012 (Figure 5p), which is approximately 242 meters from the dredge, there is an increase in backscatter due to ship traffic in the project area. A large container ship with attending tugs created a column-wide plume within the channel as it entered Port Elizabeth. This acoustic signature, approximately 200 meters wide with TSS concentrations approaching 150 mg/l, dwarfed the remaining signature of the dredge plume and was prominent on the next two transects (Figures 5q & 5r) until it too gradually decayed over the remaining far- field transects (Figures 5s – 5zz). In addition, the acoustic signature observed on the flats in less than three (3) meters of water in Figures 5q through 5r is backscatter noise from the shallow depth or prop wash from the survey vessel.

Although some lateral spreading of the plume was observed within the first 50 meters of the source (Figure 5d), it appears that the main stem of the plume typically extended no

more than 50 to 75 meters across and was confined to the channel (Figure 7c). As previously noted, some acoustic backscatter observed near the source in the upper two (2) meters of the water column may be attributable to air entrainment caused by the repeated entrance and exit of the bucket into the water.

3.3 Sediment Samples

Seven (7) sediment samples were collected during the course of the Pilot Study: six from the dredge scow and one from the sediment bed (Table 4). Sediments collected from the S-NB-1 study area was predominantly composed of silt (53% to 57% of the samples) and clay (39% to 42%) with fine sand (3% to 6%) typically composing the rest of the samples. The sediment bed sample was similar in grain size distribution to the six dredge scow samples; although it was slightly lower in moisture content and in the Atterberg plasticity index (Table 4).

4.0 Discussion

During the course of dredging operations, some sediment is resuspended into the water column. In many cases, this suspended sediment is evident as a visible turbidity plume within the immediate vicinity of the dredge operation. Because suspended sediment plumes are dynamic rather than static phenomena and because they vary over large areas in short periods of time, particularly when driven by tidal forces, characterizing plumes can present a difficult challenge. Data collected at arbitrary determined points in time at fixed locations are inadequate to assess dredge plume structure. However, advanced acoustic technologies offer advantages in capturing data at appropriate spatial and temporal scales to allow more accurate interpretation of plume dynamics.

The acoustic backscatter patterns and dimensions observed during the two far-field surveys conducted in February 2008 in the S-NB-1 Contract Area were consistent with the results of previous mechanical dredge plume monitoring efforts conducted within the Newark Bay Study Area (USACE 2007). Although exact comparisons between studies is impossible due to varying hydrodynamic conditions as well as varying sediment types within the two study areas (Arthur Kill Channel versus Newark Bay), some consistent patterns have emerged. During the previous Arthur Kill surveys conducted in 2006 maximum TSS concentrations measured acoustically by the ADCP approached 300 mg/l within 10 meters of the dredge source near the surface but decreased to less than 50 mg/l at a distance of approximately 150 meters and to 20 mg/l at 350 meters, although faint

plume signatures with concentrations less than 10 mg/l above background did persist as far as 620 meters from the source (USACE 2007).

Maximum TSS concentrations measured acoustically during this survey also approached 300 mg/l near the surface, although air entrainment likely affected these measurements to some degree. The core of the plumes typically ranged between 80 and 200 mg/l within the first 75 meters down current from the source. For both plumes surveyed in 2008, a consistent pattern was observed of relatively rapid decay and settlement within the water column. TSS concentrations 150 meters down current from the source generally did not exceed 100 mg/l. Moreover, the suspended sediment plumes exhibited minimal lateral diffusion with distance traveled down current, seldom measuring more than 75 meters across at substantial concentrations above background. Both Figures 4c (ebb survey) and 7c (flood survey) provide evidence that the spatial extent of dredge induced plumes are almost inconsequential in the context of the larger channel and that, as in previous studies (USACE 2007; SAIC 2002), the movements of plumes are generally confined to the bottom of the navigation channel with no evidence of plume excursion beyond the channel side slopes.

5.0 Literature Cited:

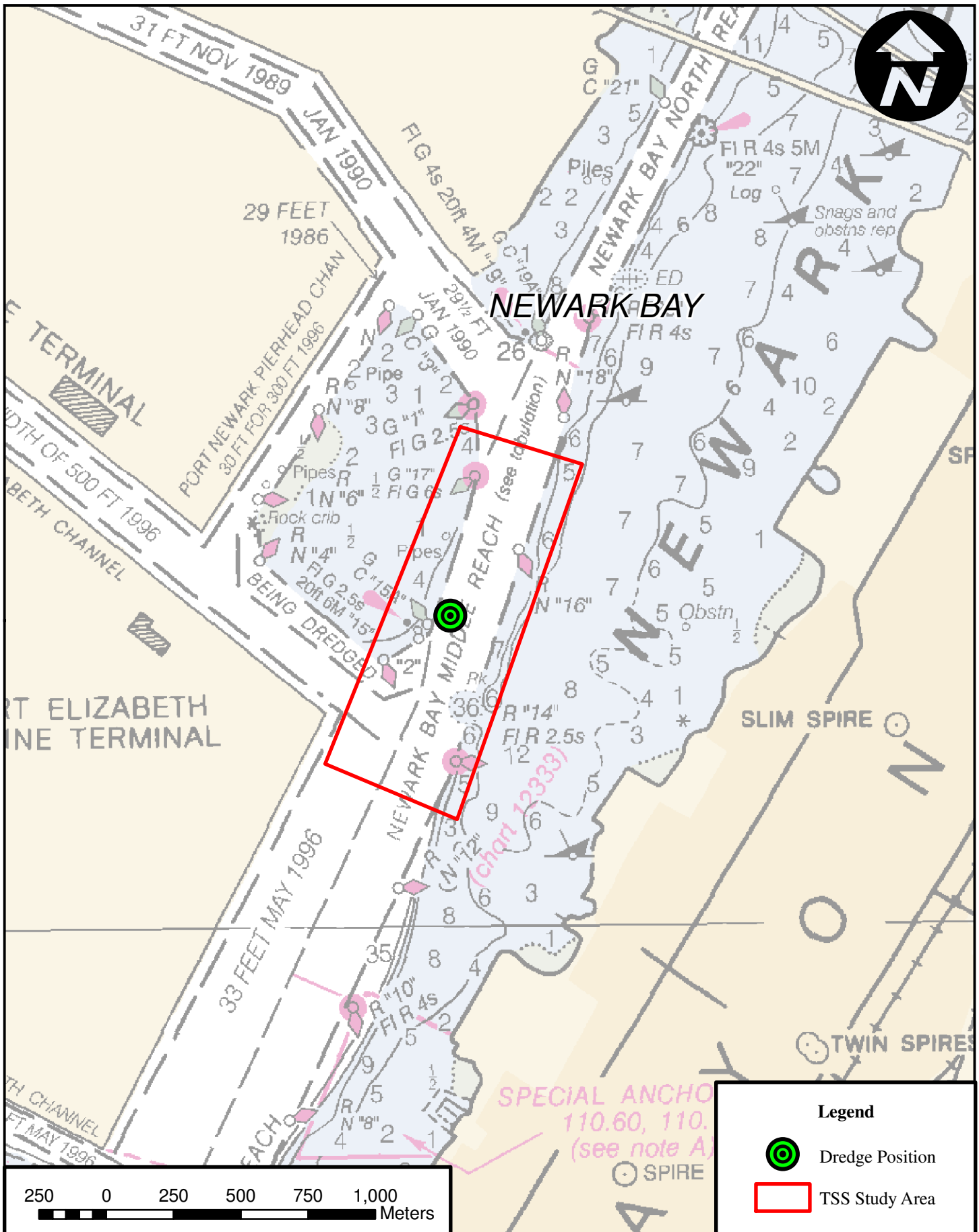
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Newark Bay Far-Field Study Area

Job No.	Date	Figure
78698	6/6/08	1



Figure 1a: Showing the modified environmental bucket during typical dredging operations in Newark Bay during the Near-Field Pilot Study in February 2008.

Table 1. Laboratory Results of Water Samples

Sample Date	Sample Time	Location	Turbidity (NTU)	TSS (mg/l)
2/8/08	08:34:36	Ambient	11.5	38
2/8/08	08:34:56	Ambient	14.1	49
2/8/08	08:35:22	Ambient	7.4	31
2/8/08	08:49:38	Ambient	13.1	48
2/8/08	08:50:01	Ambient	12.8	46
2/8/08	08:50:11	Ambient	11.2	41
2/8/08	08:50:26	Ambient	8.1	47
2/8/08	08:50:47	Ambient	9.7	41
2/8/08	09:03:37	Plume	8.2	39
2/8/08	09:03:55	Plume	10.6	54
2/8/08	09:04:02	Plume	10.6	37
2/8/08	09:04:12	Plume	8.7	33
2/8/08	09:04:21	Plume	7.4	37
2/8/08	09:04:28	Plume	7.6	35
2/8/08	09:16:02	Plume	12.5	37
2/8/08	09:16:16	Plume	4.4	33
2/8/08	09:16:24	Plume	5.5	33
2/8/08	09:16:29	Plume	7.7	39
2/8/08	09:16:33	Plume	8.8	30
2/8/08	09:16:38	Plume	3.3	33
2/8/08	09:30:38	Plume	4.0	56
2/8/08	09:30:43	Plume	15.4	44
2/8/08	09:30:47	Plume	10.3	49
2/8/08	09:30:50	Plume	15.5	55
2/8/08	09:30:57	Plume	2.5	50
2/8/08	09:31:01	Plume	12.6	46
2/8/08	10:58:34	Plume	31.1	70
2/8/08	10:58:48	Plume	14.2	71
2/8/08	10:59:03	Plume	19.5	82
2/8/08	10:59:06	Plume	10.6	32
2/8/08	10:59:11	Plume	8.1	33
2/8/08	10:59:55	Plume	7.3	44
2/8/08	11:30:57	Plume	31.6	63
2/8/08	11:31:26	Plume	8.5	32
2/8/08	11:31:32	Plume	10.3	38
2/8/08	11:31:39	Plume	13.1	43
2/8/08	11:31:43	Plume	13.1	41
2/8/08	11:31:49	Plume	8.7	53
2/8/08	12:30:52	Plume	19.0	52
2/8/08	12:31:23	Plume	11.8	34
2/8/08	12:31:43	Plume	6.9	31
2/8/08	12:32:00	Plume	16.6	57
2/8/08	12:32:19	Plume	25.9	57
2/8/08	12:43:27	Plume	12.0	34
2/8/08	12:44:02	Plume	16.3	39
2/8/08	12:44:08	Plume	16.8	76
2/8/08	12:44:14	Plume	25.6	56
2/8/08	12:44:19	Plume	16.6	45

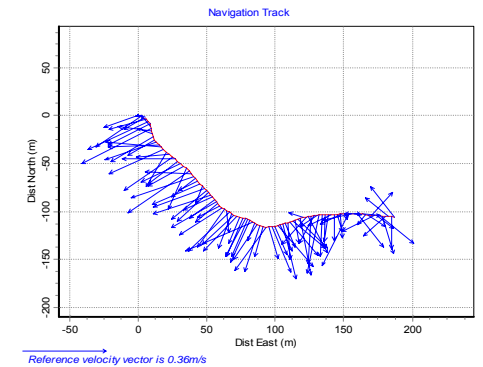
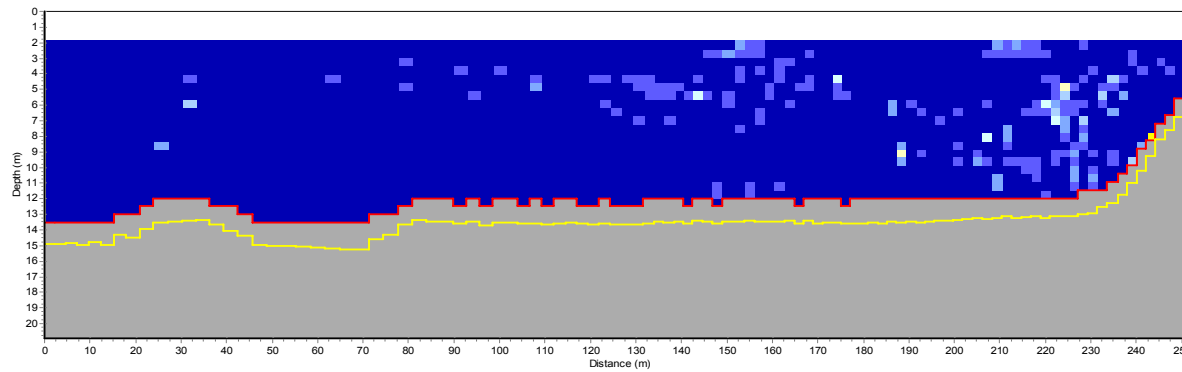
Sample Date	Sample Time	Location	Turbidity (NTU)	TSS (mg/l)
2/8/08	12:44:35	Plume	36.7	65
2/8/08	13:06:50	Plume	13.4	34
2/8/08	13:07:51	Plume	12.1	32
2/8/08	13:08:25	Plume	10.1	30
2/8/08	13:08:44	Plume	11.2	29
2/8/08	13:08:51	Plume	10.1	34
2/8/08	13:08:57	Plume	10.6	31
2/8/08	13:46:03	Plume	15.4	37
2/8/08	13:47:06	Plume	15.5	52
2/8/08	13:47:17	Plume	25.6	56
2/8/08	13:47:24	Plume	129.0	300
2/8/08	13:47:34	Plume	74.0	153
2/8/08	14:00:17	Plume	20.5	50
2/8/08	14:04:54	Plume	19.5	54
2/8/08	14:05:51	Plume	37.7	88
2/8/08	14:05:58	Plume	39.0	88
2/8/08	14:06:07	Plume	24.9	65
2/8/08	14:19:07	Plume	14.1	37
2/8/08	14:20:48	Plume	10.3	36
2/8/08	14:23:28	Plume	21.4	44
2/8/08	14:27:05	Plume	15.5	43
2/8/08	14:27:13	Plume	14.4	42
2/8/08	14:27:20	Plume	14.1	59
2/13/08	10:33:44	Plume	30.5	87
2/13/08	10:33:57	Plume	30.8	87
2/13/08	10:34:26	Plume	48.6	144
2/13/08	10:34:44	Plume	56.4	134
2/13/08	10:34:53	Plume	64.4	148
2/13/08	10:35:17	Plume	46.8	146
2/13/08	10:49:48	Plume	94.0	212
2/13/08	10:50:22	Plume	83.0	201
2/13/08	10:50:43	Plume	75.5	197
2/13/08	10:50:57	Plume	68.5	179
2/13/08	10:51:09	Plume	69.0	152
2/13/08	11:15:53	Plume	16.7	96
2/13/08	11:17:03	Plume	17.2	42
2/13/08	11:17:17	Plume	17.3	52
2/13/08	11:17:25	Plume	19.5	60
2/13/08	11:17:52	Plume	18.4	61
2/13/08	14:18:04	Plume	80.0	183
2/13/08	14:18:23	Plume	59.6	147
2/13/08	14:19:27	Plume	53.0	140
2/13/08	14:20:37	Plume	38.2	115
2/13/08	14:20:56	Plume	46.0	119
2/13/08	14:21:44	Plume	45.4	132
2/13/08	14:33:40	Plume	33.4	99
2/13/08	14:34:20	Plume	31.7	98
2/13/08	14:35:59	Plume	31.2	125
2/13/08	14:36:20	Plume	27.5	102
2/13/08	14:36:55	Plume	27.9	114

Sample Date	Sample Time	Location	Turbidity (NTU)	TSS (mg/l)
2/13/08	14:37:32	Plume	27.5	103
2/13/08	14:54:37	Plume	42.4	127
2/13/08	14:55:32	Plume	33.4	122
2/13/08	14:57:20	Plume	64.4	154
2/13/08	14:58:28	Plume	71.8	191
2/13/08	14:58:38	Plume	79.0	193
2/13/08	15:15:18	Plume	47.4	109
2/13/08	15:15:24	Plume	79.4	141
2/13/08	15:15:40	Plume	68.0	154
2/13/08	15:15:50	Plume	58.0	149
2/13/08	15:17:17	Plume	30.9	109
2/13/08	15:20:14	Plume	23.0	65
2/13/08	15:26:09	Plume	47.0	98
2/13/08	15:26:33	Plume	50.6	125
2/13/08	15:27:56	Plume	30.8	103
2/13/08	15:31:28	Plume	38.7	119
2/13/08	15:44:20	Plume	5.8	30
2/13/08	16:25:15	Plume	17.5	52
2/13/08	16:29:03	Plume	25.5	75
2/13/08	16:30:56	Plume	19.0	47
2/13/08	16:41:06	Plume	26.7	66
2/13/08	16:41:45	Plume	31.6	74
2/13/08	16:45:58	Plume	24.0	69
2/13/08	16:51:20	Plume	26.1	72
2/13/08	16:52:42	Plume	63.2	163
2/13/08	16:53:00	Plume	77.0	173
2/13/08	16:53:14	Plume	60.8	157
2/13/08	16:53:33	Plume	79.0	210
2/13/08	16:53:51	Plume	77.8	184

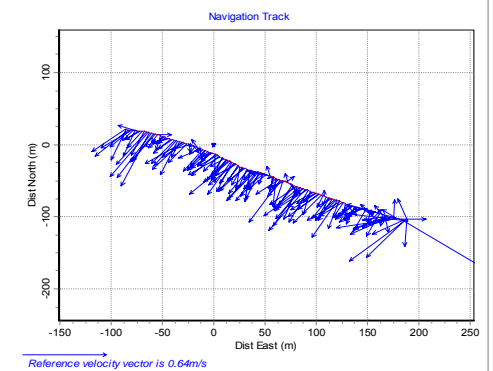
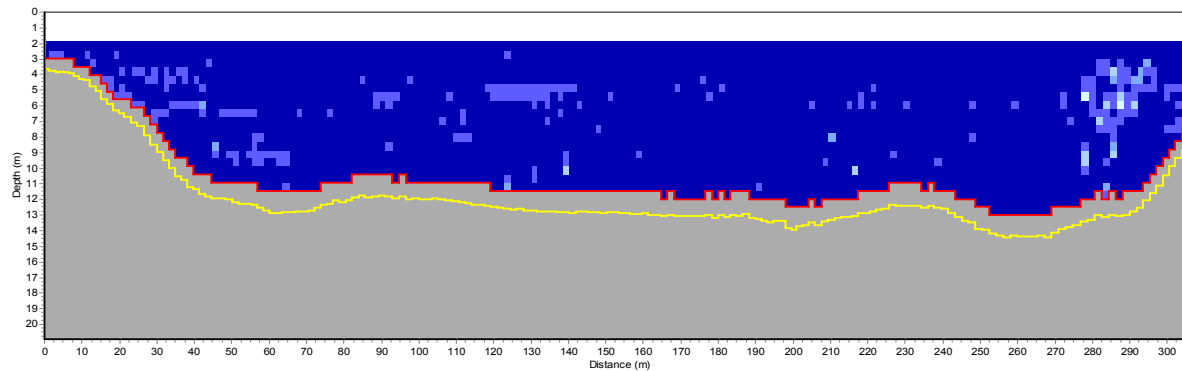
Table 2. 2 February 2008 Far Field Ebb Tide Survey Transect Summary Table

Transect Number	Figure Number	Time	Approximate Distance to Dredge (m)	Transect Length (m)	Plume Description	Additional Remarks
A00	2a	9:29:23	25	253	Ambient	Transects astern of dredge
A01	2b	9:32:18	50	308	Ambient	Astern of dredge
A02	2c	9:37:29	70	290	Ambient	Some prop wash astern of dredge
T00	2d	10:55:14	36	254	Plume approx. 50 m wide throughout the water column with max concentrations between 200-300 mg/l	Transects off the bow of the platform
T01	2e	10:58:35	51	176	Plume approx. 70 m wide with max concentrations near the surface between 200-300 mg/l	Short transect due to Green Buoy "15A"
T02	2f	11:01:30	76	272	Plume approx. 70 m wide with max concentrations near the surface between 200-300 mg/l	
T03	2g	11:05:00	101	299	Plume approx. 70 m wide with max concentrations between 100-150 mg/l	
T04	2h	11:09:19	126	261	Plume approx. 70 m wide with max concentrations < 80 mg/l	
T05	2i	11:12:53	151	274	Plume approx. 70 m wide with max concentrations < 80 mg/l	
T06	2j	11:16:20	176	274	Plume approx. 70 m wide with max concentrations < 80 mg/l near the surface	
T07	2k	11:19:59	201	276	Plume approx. 70 m wide with max concentrations < 80 mg/l near the surface	Tug prop wash towards end of transect
T08	2l	11:23:11	226	278	Plume approx. 70 m wide with max concentrations < 60 mg/l	Tug prop wash towards beginning of transect
T09	2m	11:26:57	251	294	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T10	2n	11:30:19	276	331	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T11	2o	11:34:39	301	301	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T12	2p	11:38:21	326	300	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T13	2q	11:42:21	351	302	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T14	2r	11:46:51	376	302	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T15	2s	11:50:48	401	168	Plume approx. 50 m wide with max concentrations < 60 mg/l near the surface	Transect short, tug passing
T16	2t	11:56:50	426	318	Plume approx. 50 m wide with max concentrations < 60 mg/l near the surface	Prop wash from tug
T17	2u	12:02:20	451	311	Plume approx. 50 m wide with max concentrations < 60 mg/l near the surface	
T18	2v	12:06:38	476	339	Core of plume < 40 mg/l	
T19	2w	12:11:26	501	338	Core of plume < 40 mg/l	
T20	2x	12:15:43	551	317	Core of plume < 40 mg/l	50 meter transect increments
T21	2y	12:20:45	601	337	Core of plume < 40 mg/l	

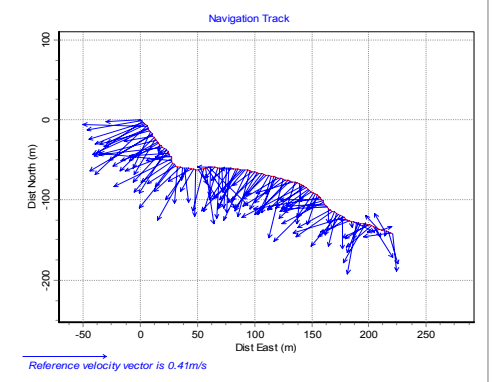
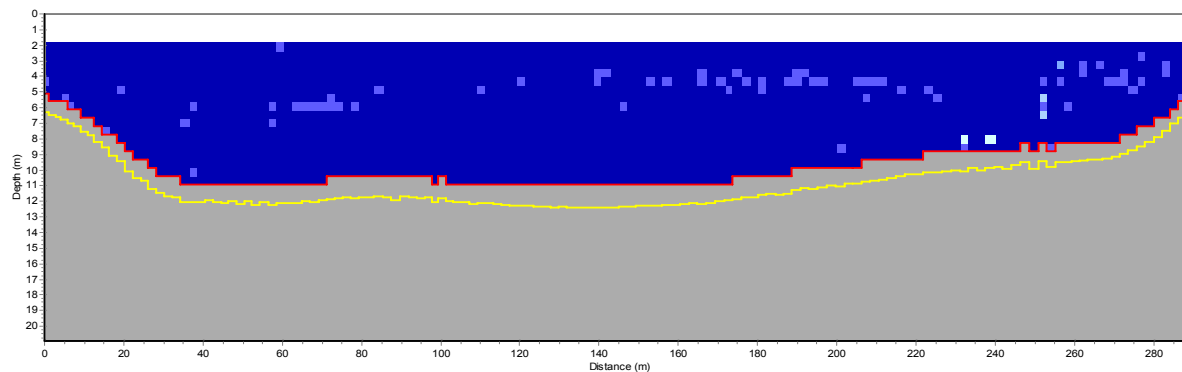
a) Ambient A00 - Upcurrent 25 m*



b) Ambient A01 - Upcurrent 50 m*



c) Ambient A02 - Upcurrent 75 m*



*Approximate distance upcurrent from source

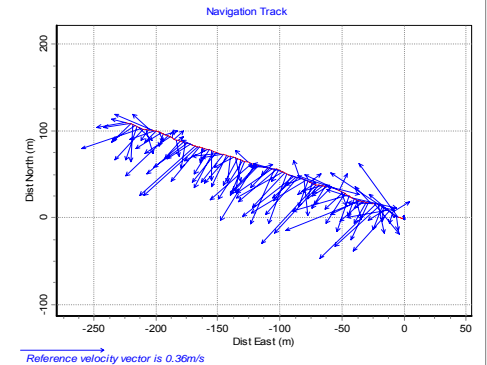
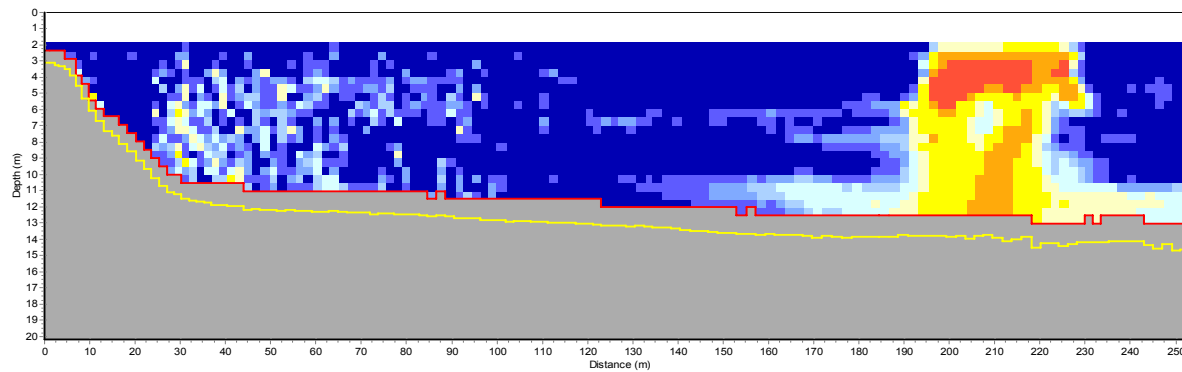
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



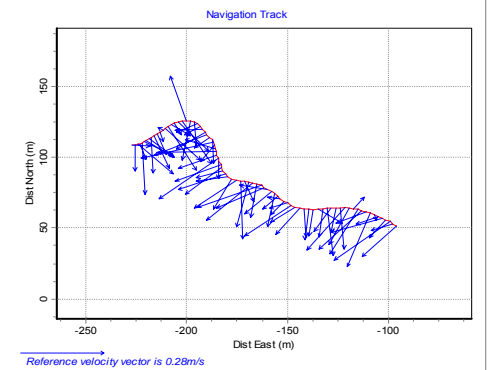
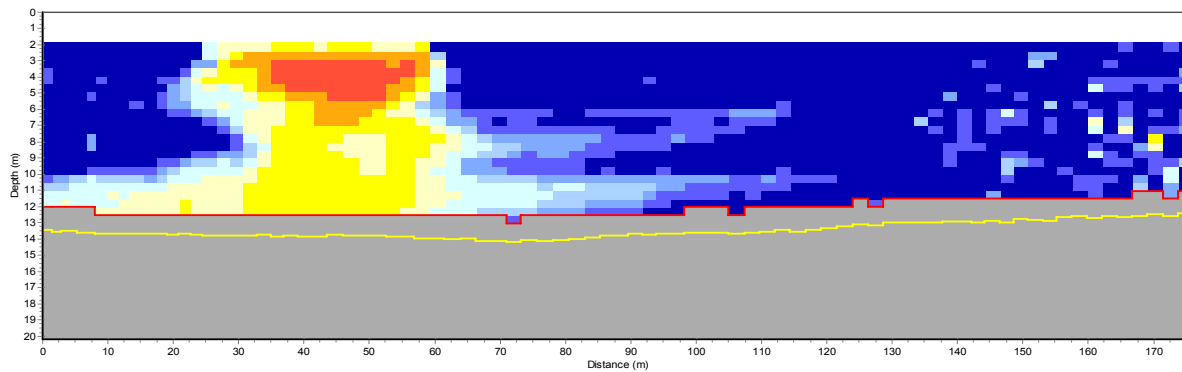
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2a-c

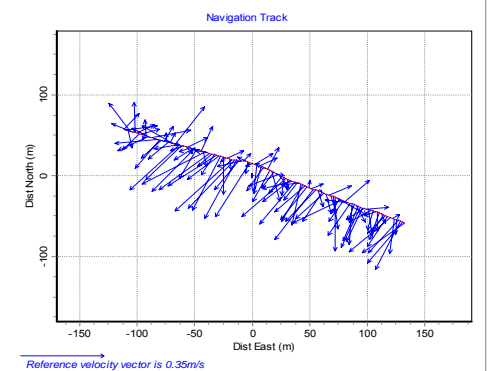
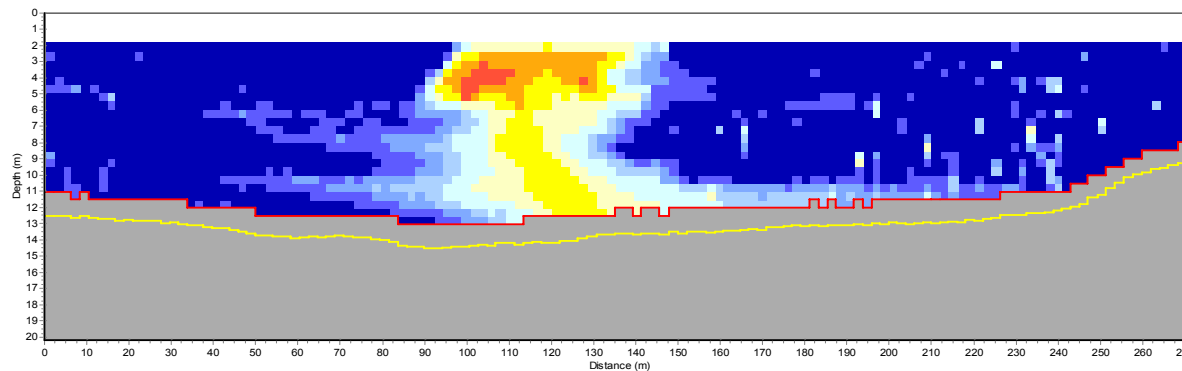
d) Transect T00 - Downcurrent 36 m*



e) Transect T01 - Downcurrent 51 m*



f) Transect T02 - Downcurrent 76 m*



*Approximate distance downcurrent from source

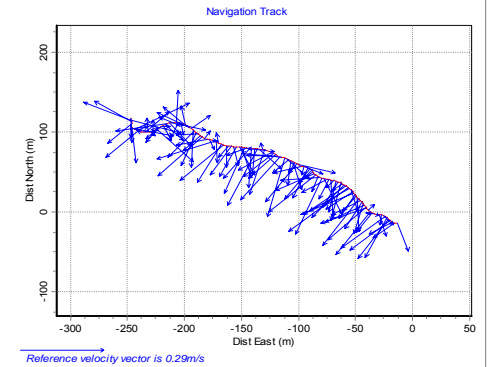
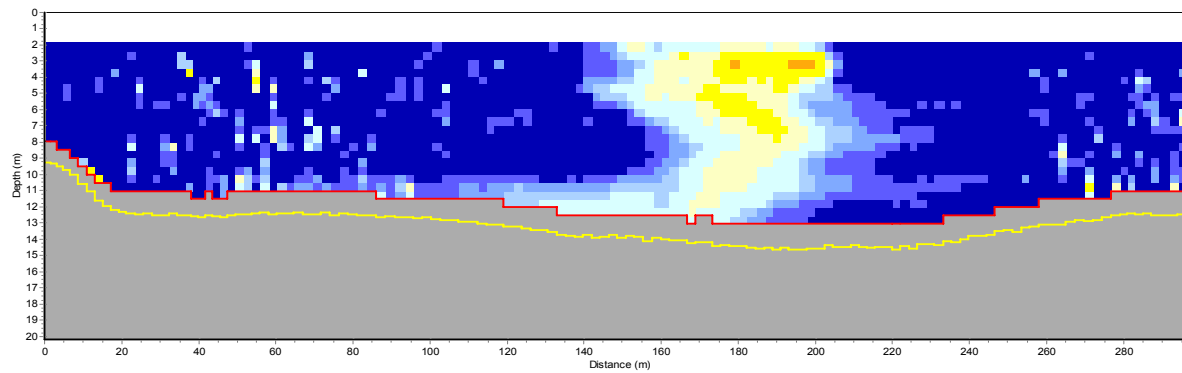
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



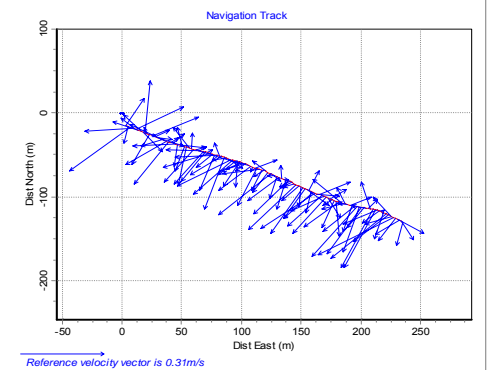
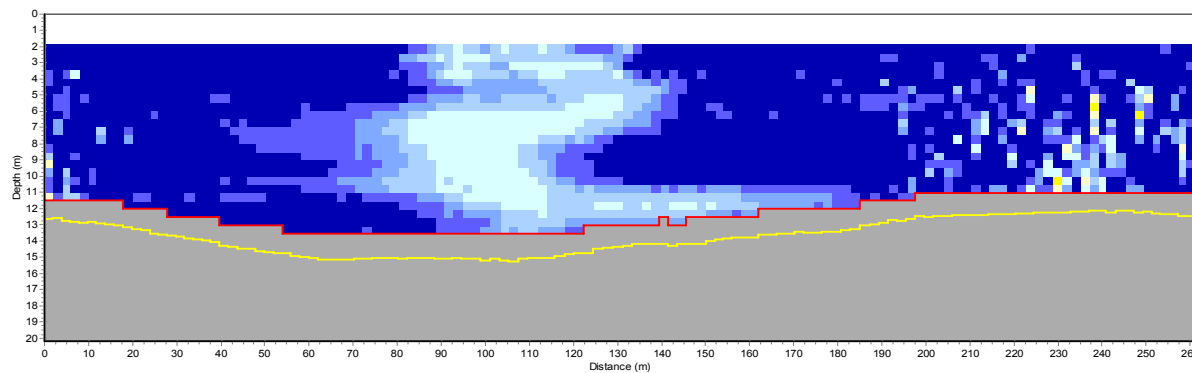
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2d-f

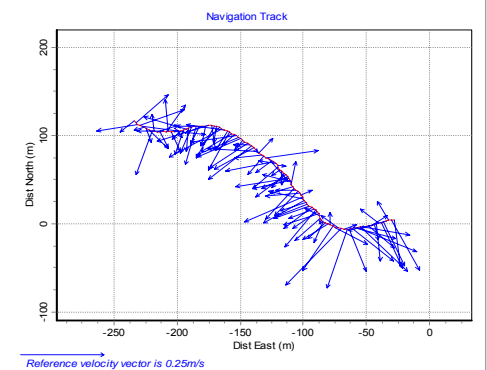
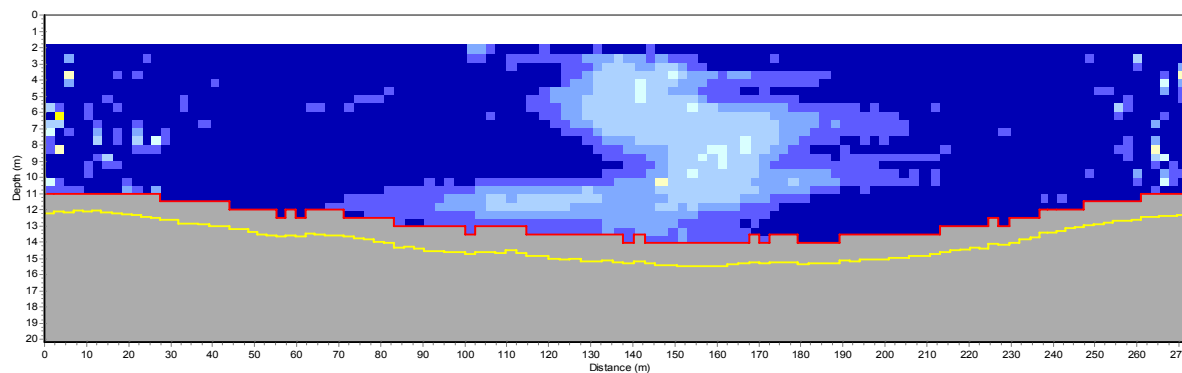
g) Transect T03 - Downcurrent 101 m*



h) Transect T04 - Downcurrent 126 m*



i) Transect T05 - Downcurrent 151 m*



*Approximate distance downcurrent from source

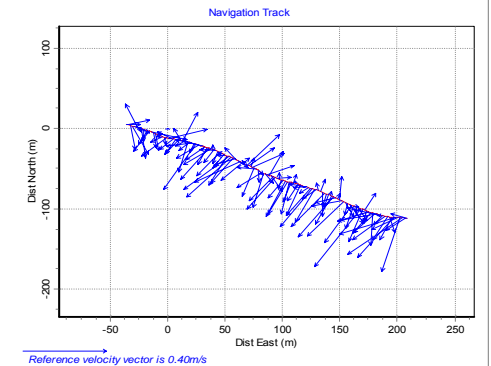
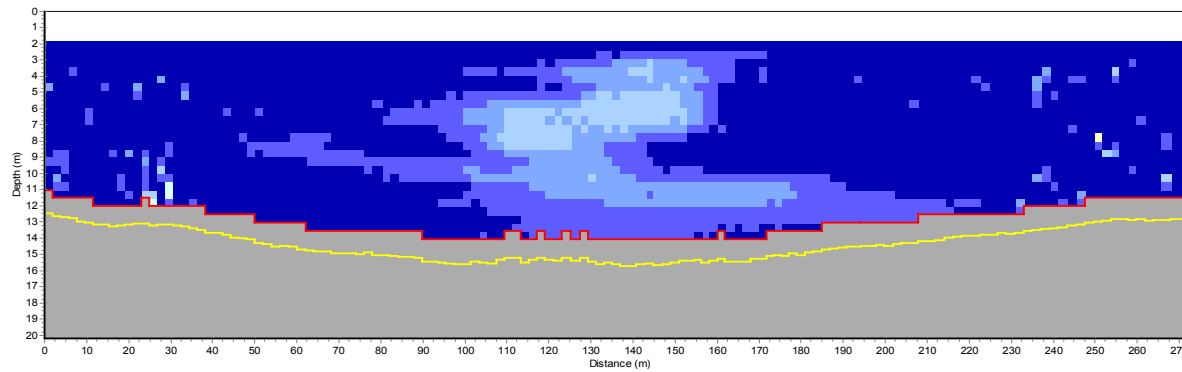
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



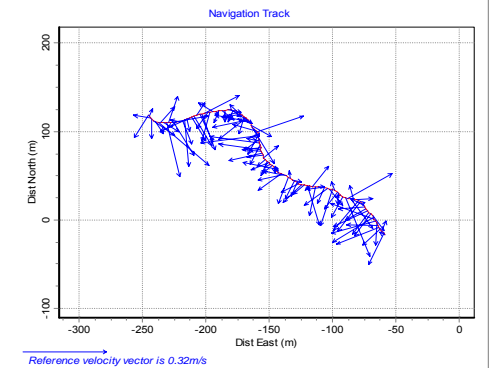
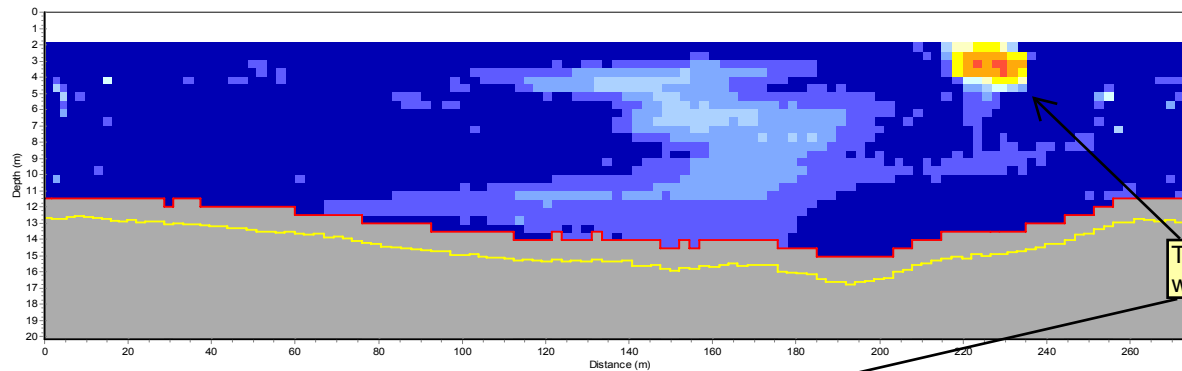
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2g-i

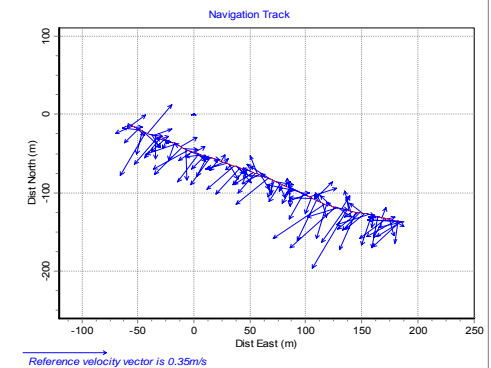
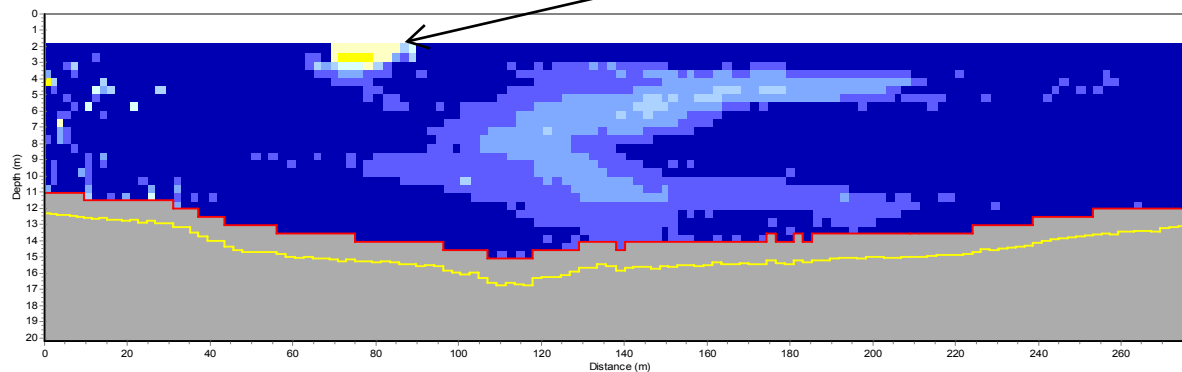
j) Transect T06 - Downcurrent 176 m*



k) Transect T07 - Downcurrent 201 m*



l) Transect T08 - Downcurrent 226 m*



*Approximate distance downcurrent from source

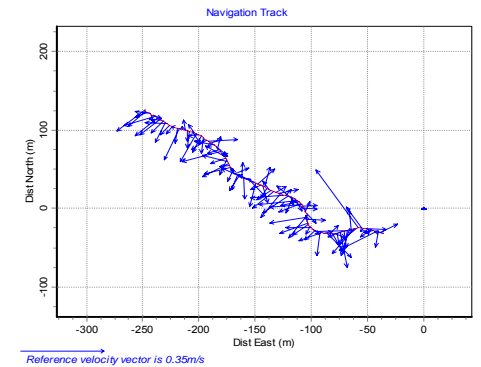
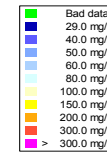
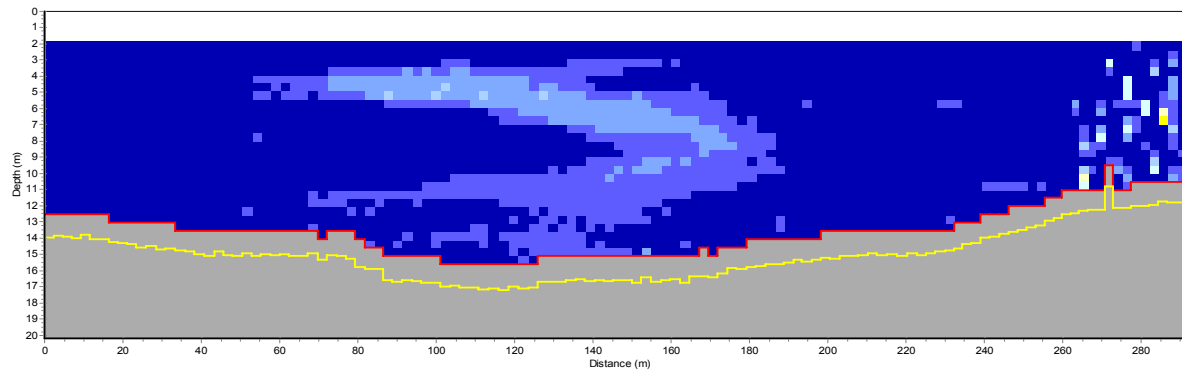
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



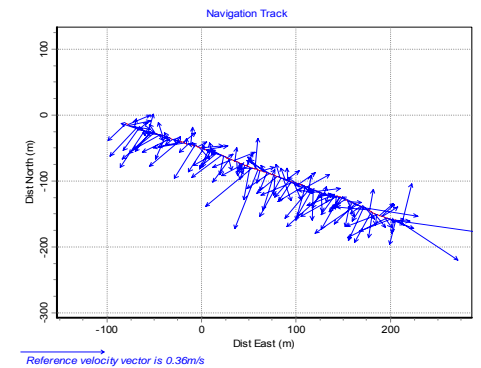
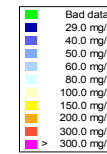
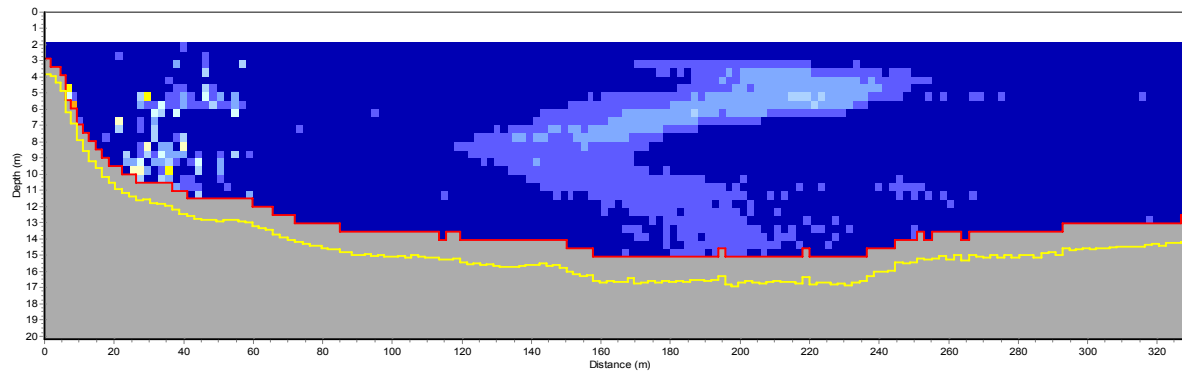
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2j-I

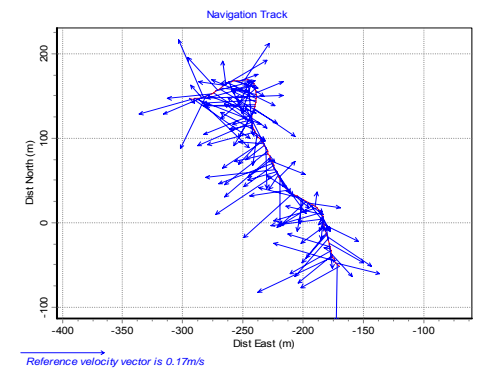
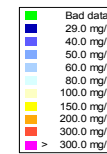
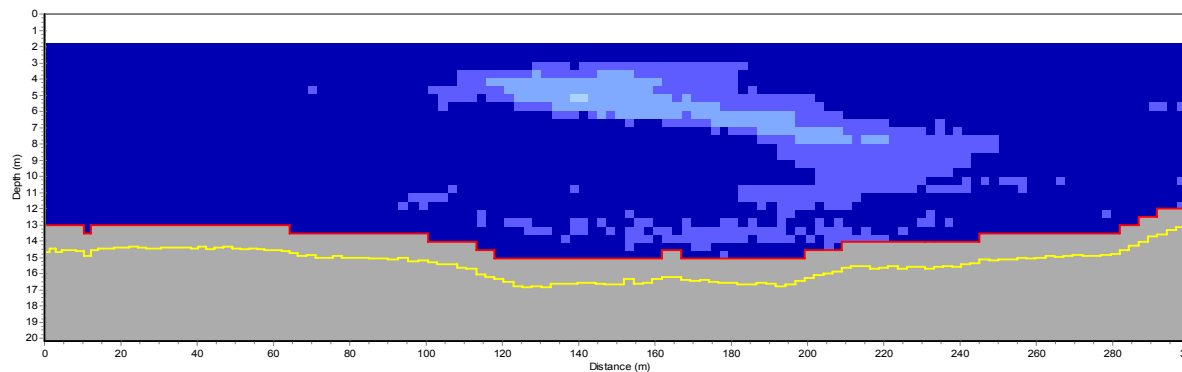
m) Transect T09 - Downcurrent 251 m*



n) Transect T10 - Downcurrent 276 m*



o) Transect T11 - Downcurrent 301 m*



*Approximate distance downcurrent from source

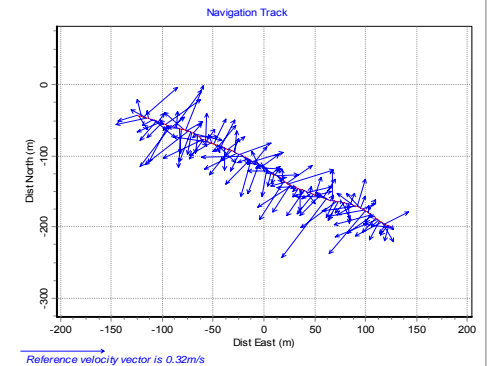
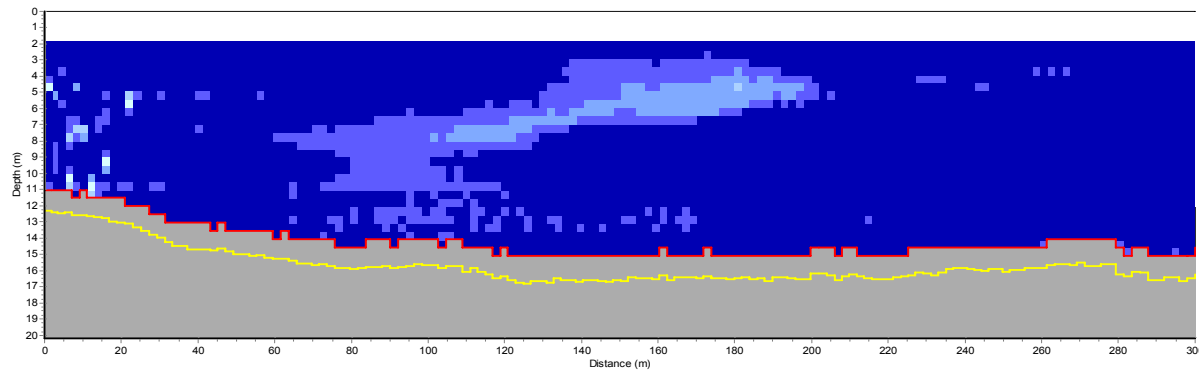
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



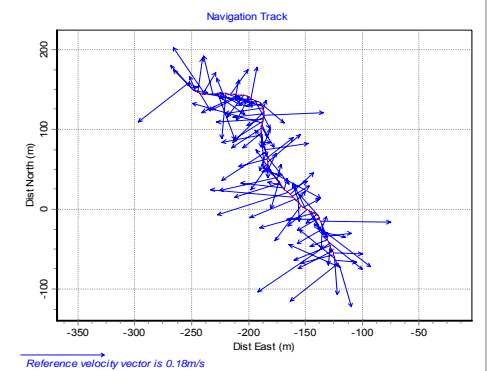
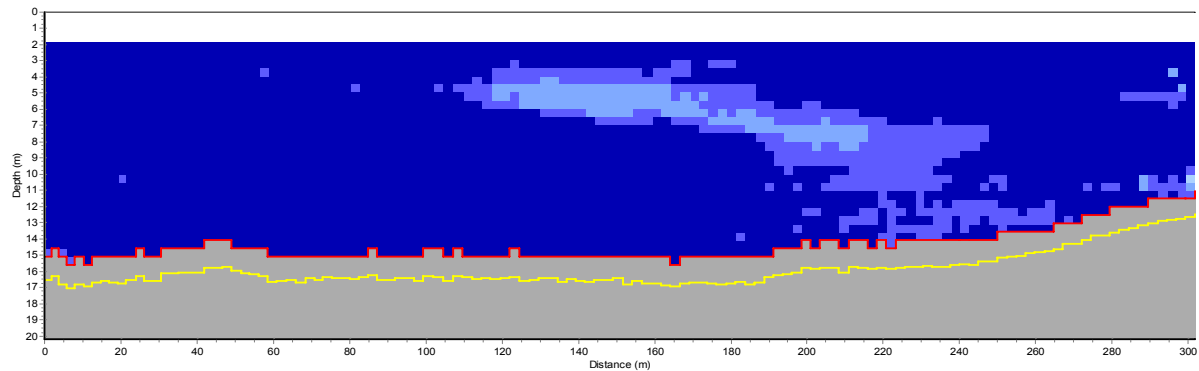
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2m-o

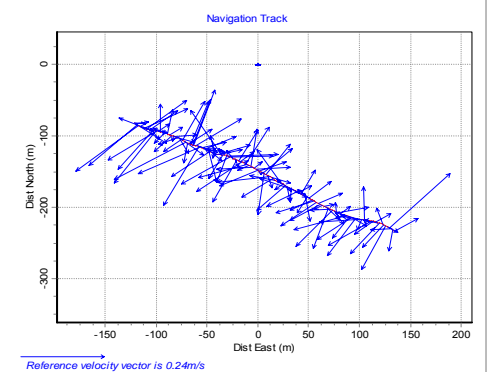
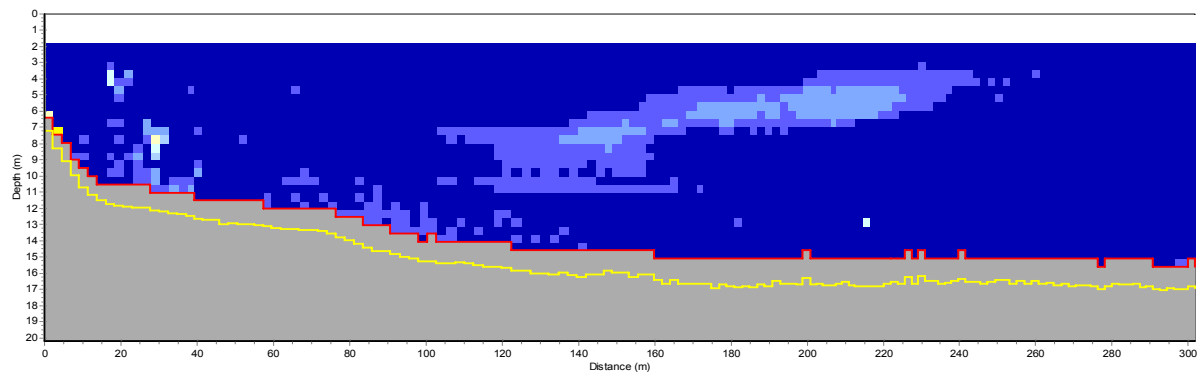
p) Transect T12 - Downcurrent 326 m*



q) Transect T13 - Downcurrent 351 m*



r) Transect T14 - Downcurrent 376 m*



*Approximate distance downcurrent from source

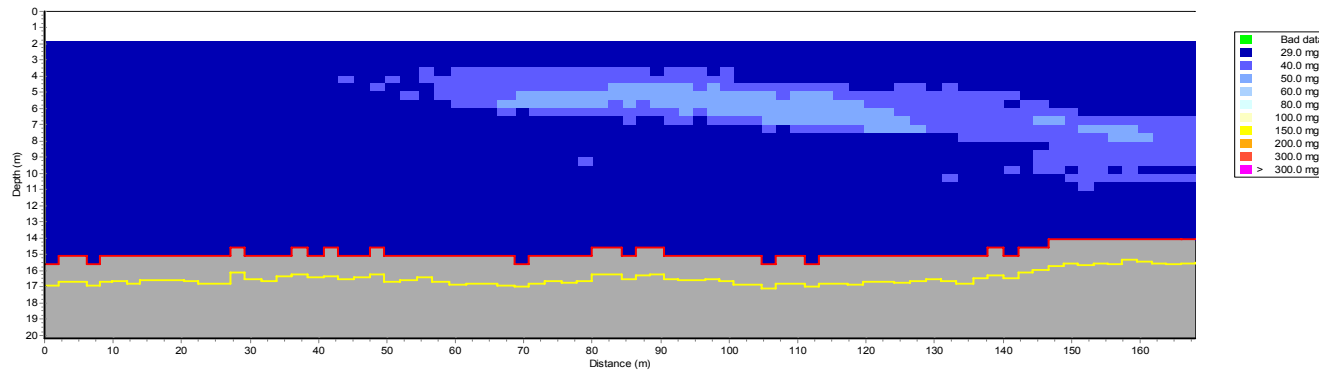
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



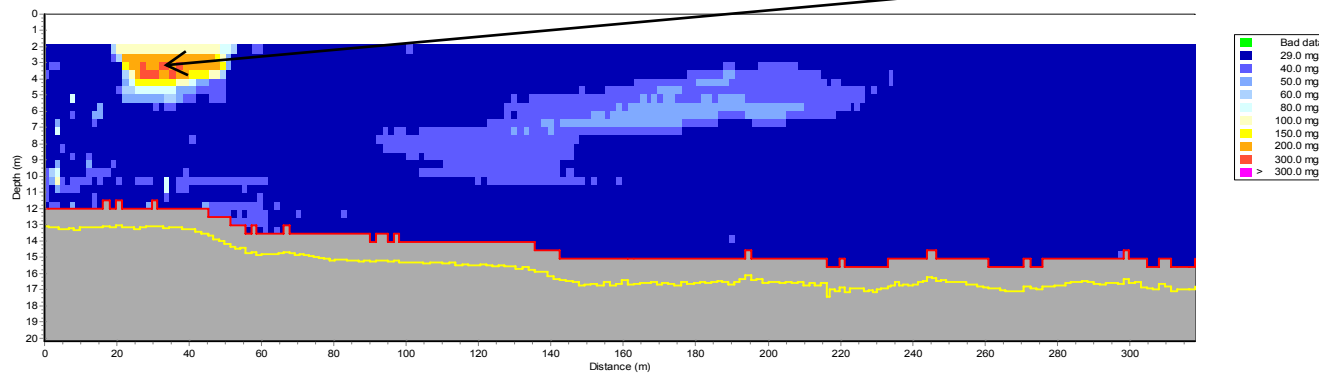
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2p-r

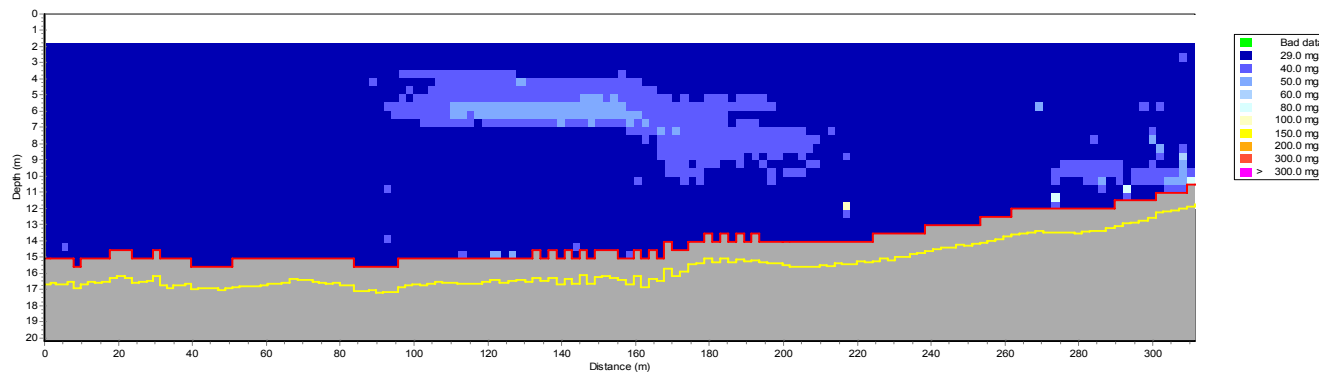
s) Transect T15 - Downcurrent 401 m*



t) Transect T16 - Downcurrent 426 m*



u) Transect T17 - Downcurrent 451 m*



*Approximate distance downcurrent from source

Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities

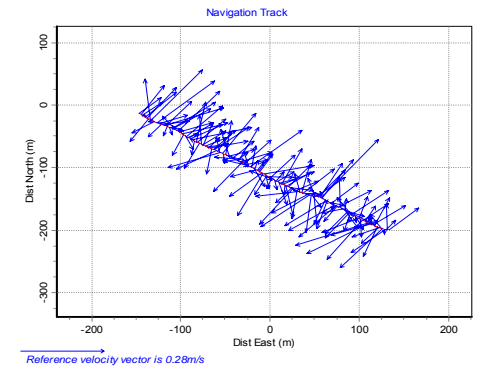
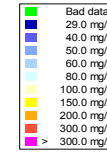
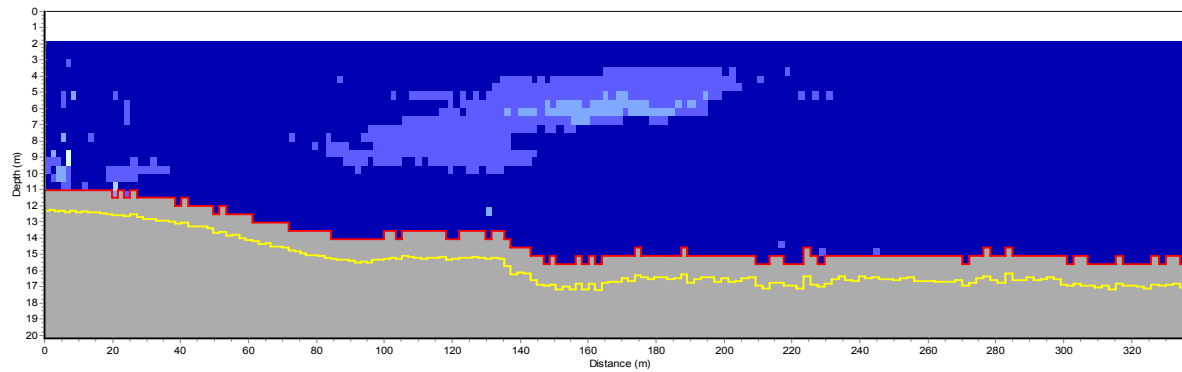


Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

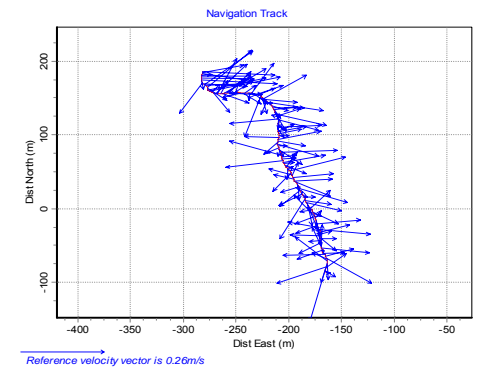
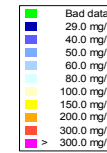
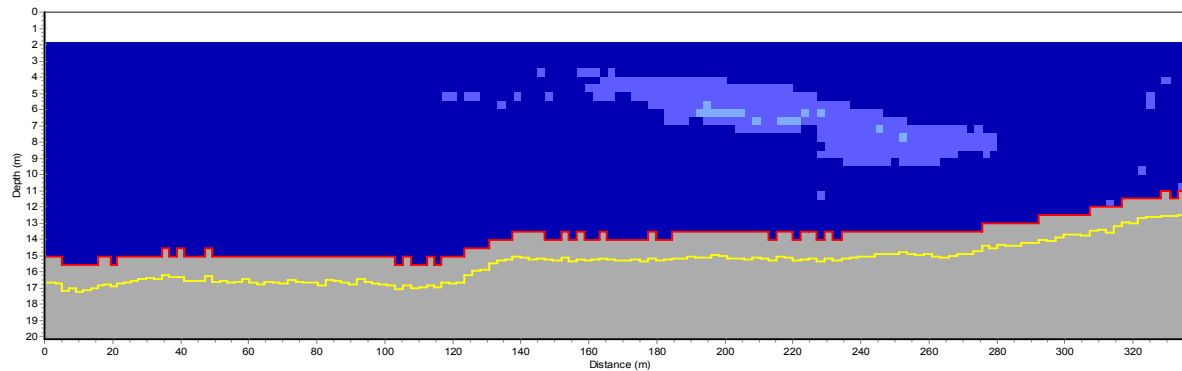
FIGURE

2s-u

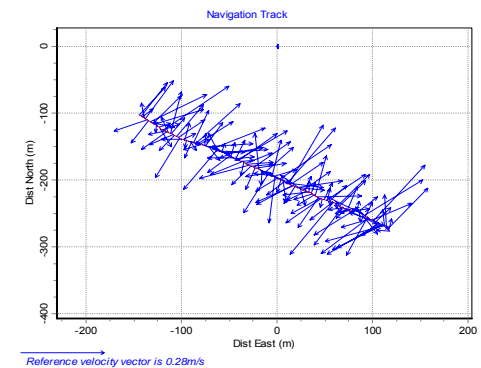
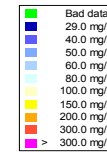
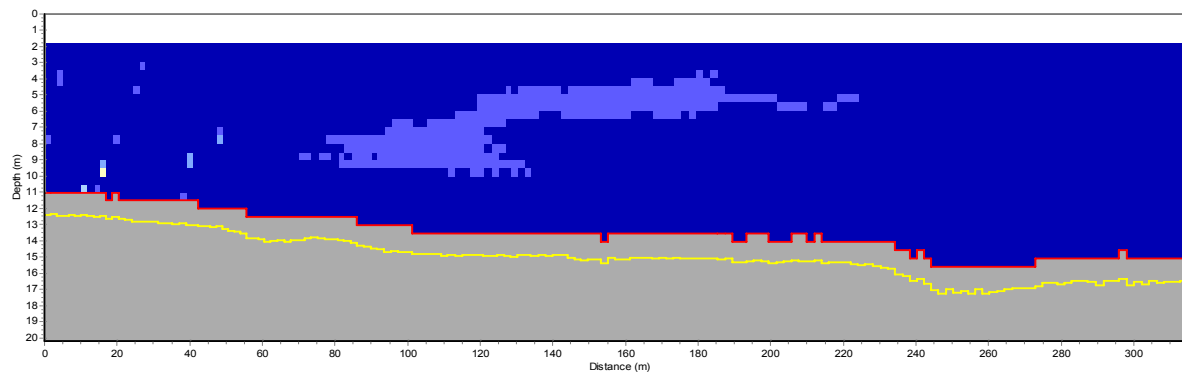
v) Transect T18 - Downcurrent 476 m*



w) Transect T19 - Downcurrent 501 m*



x) Transect T20 - Downcurrent 551 m*



*Approximate distance downcurrent from source

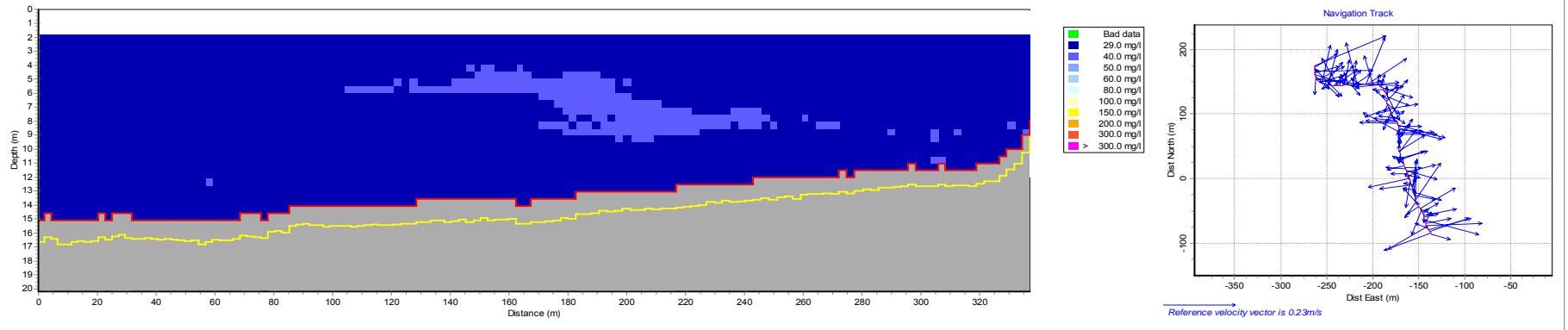
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2v-x

y) Transect T21 - Downcurrent 601 m*



Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities

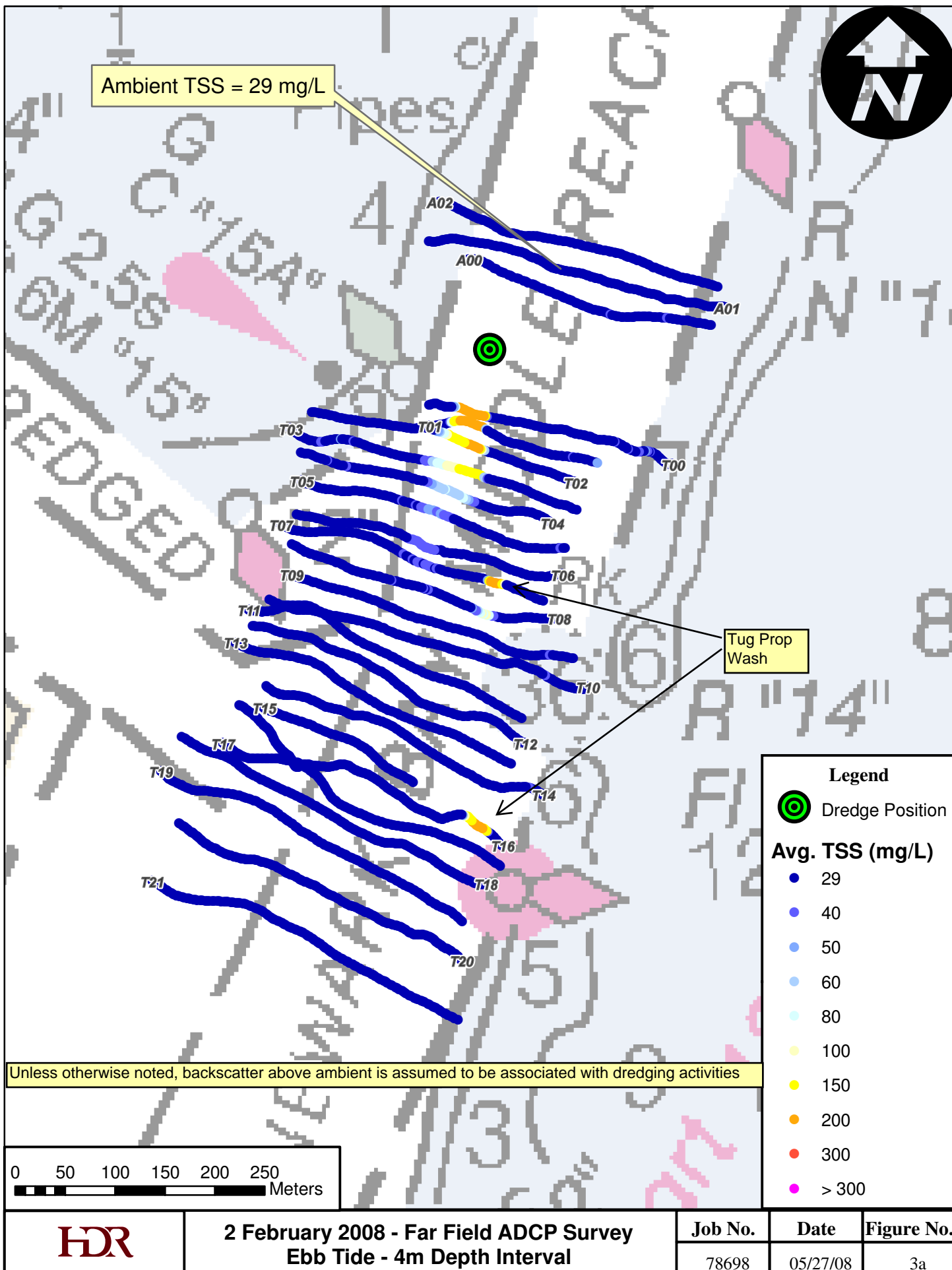
*Approximate distance downcurrent from source

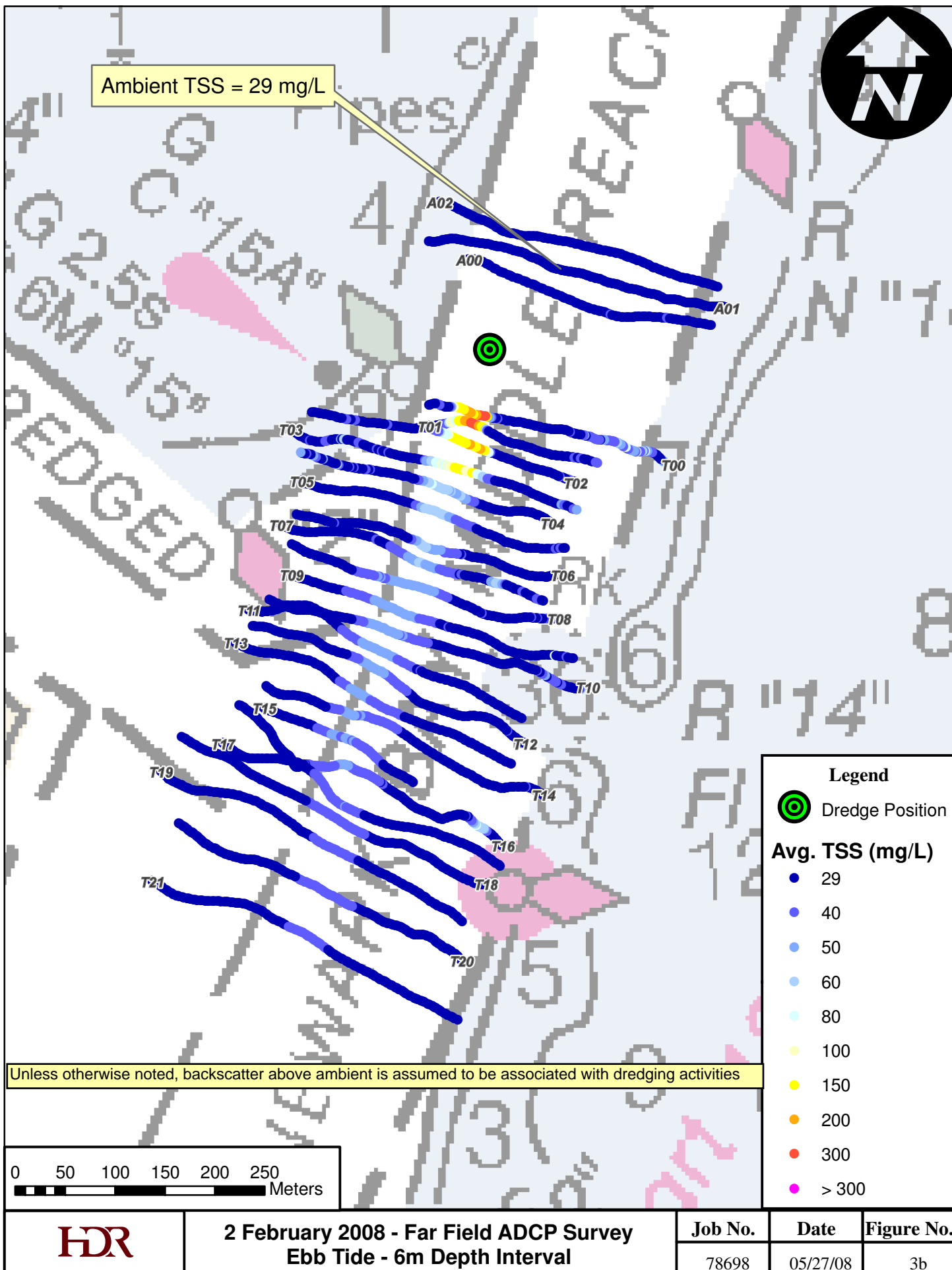


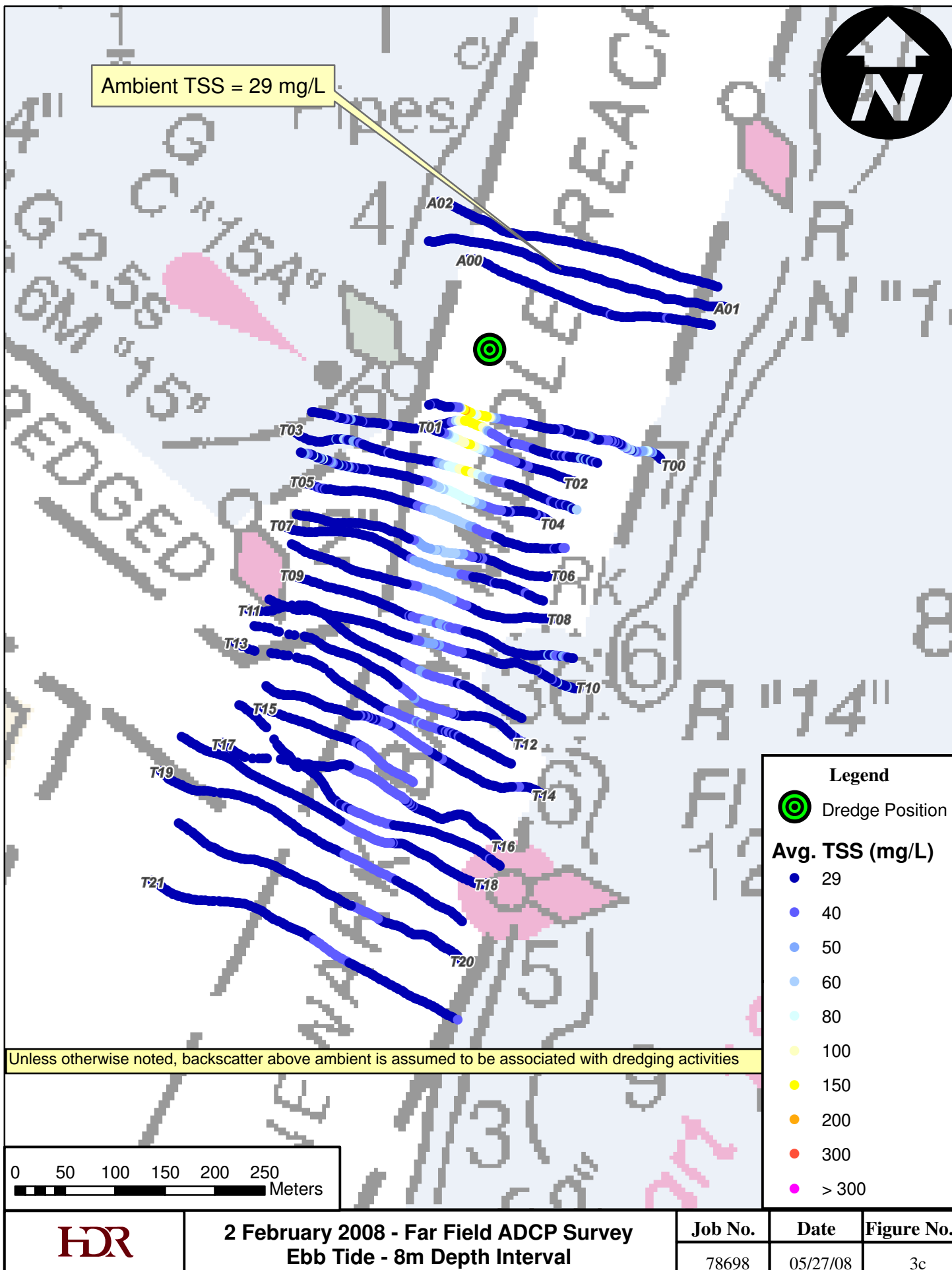
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

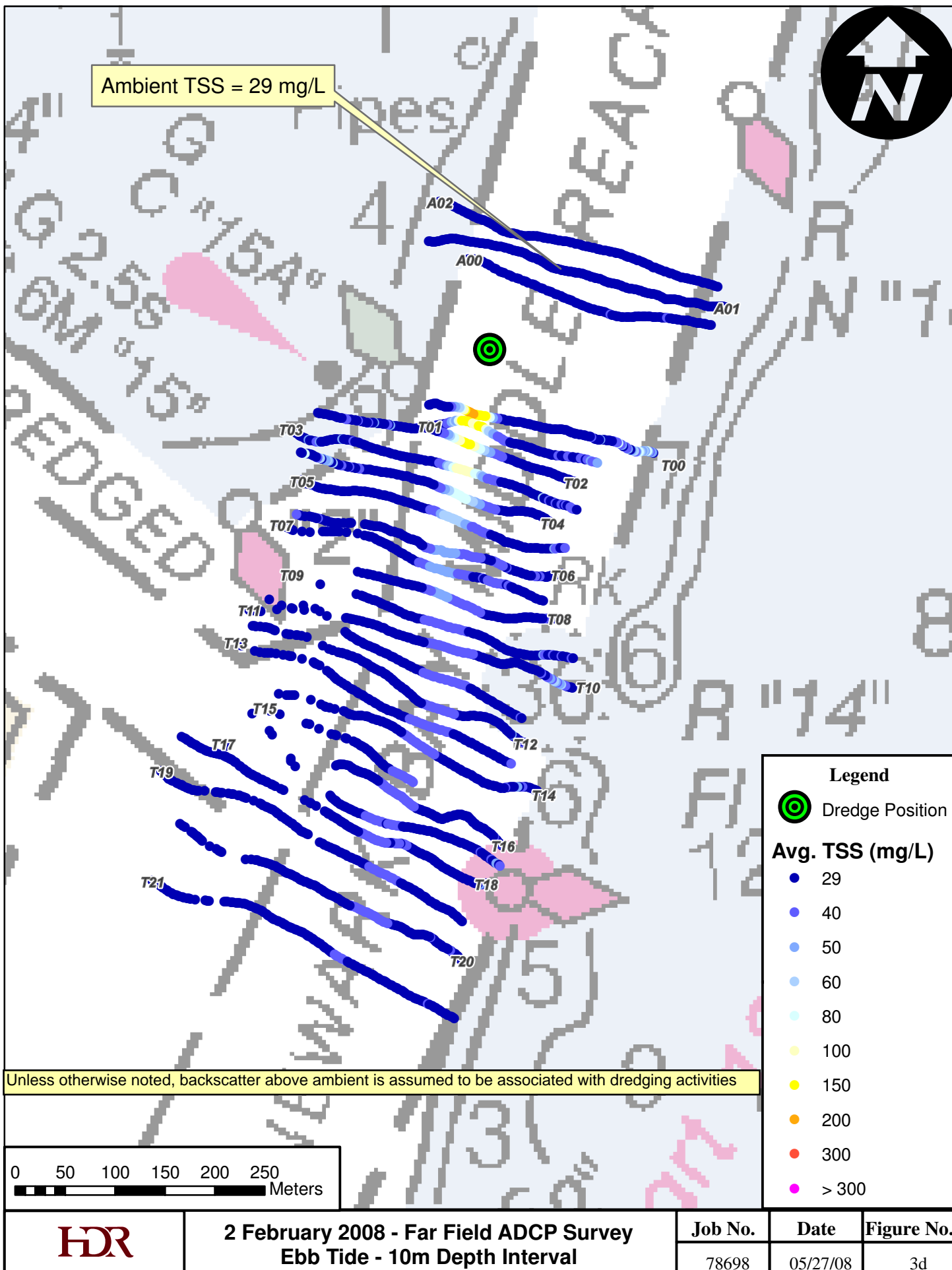
FIGURE

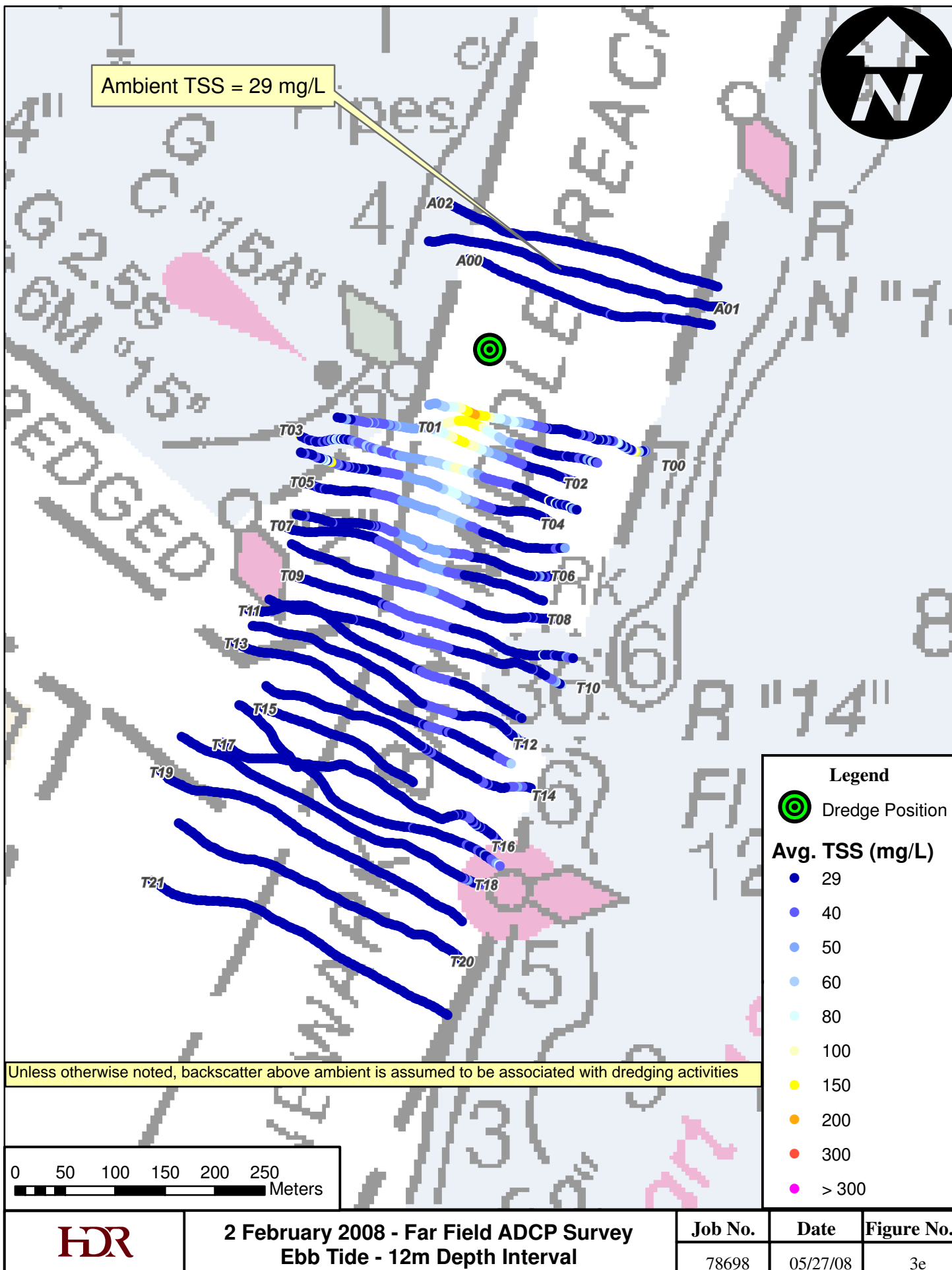
2y

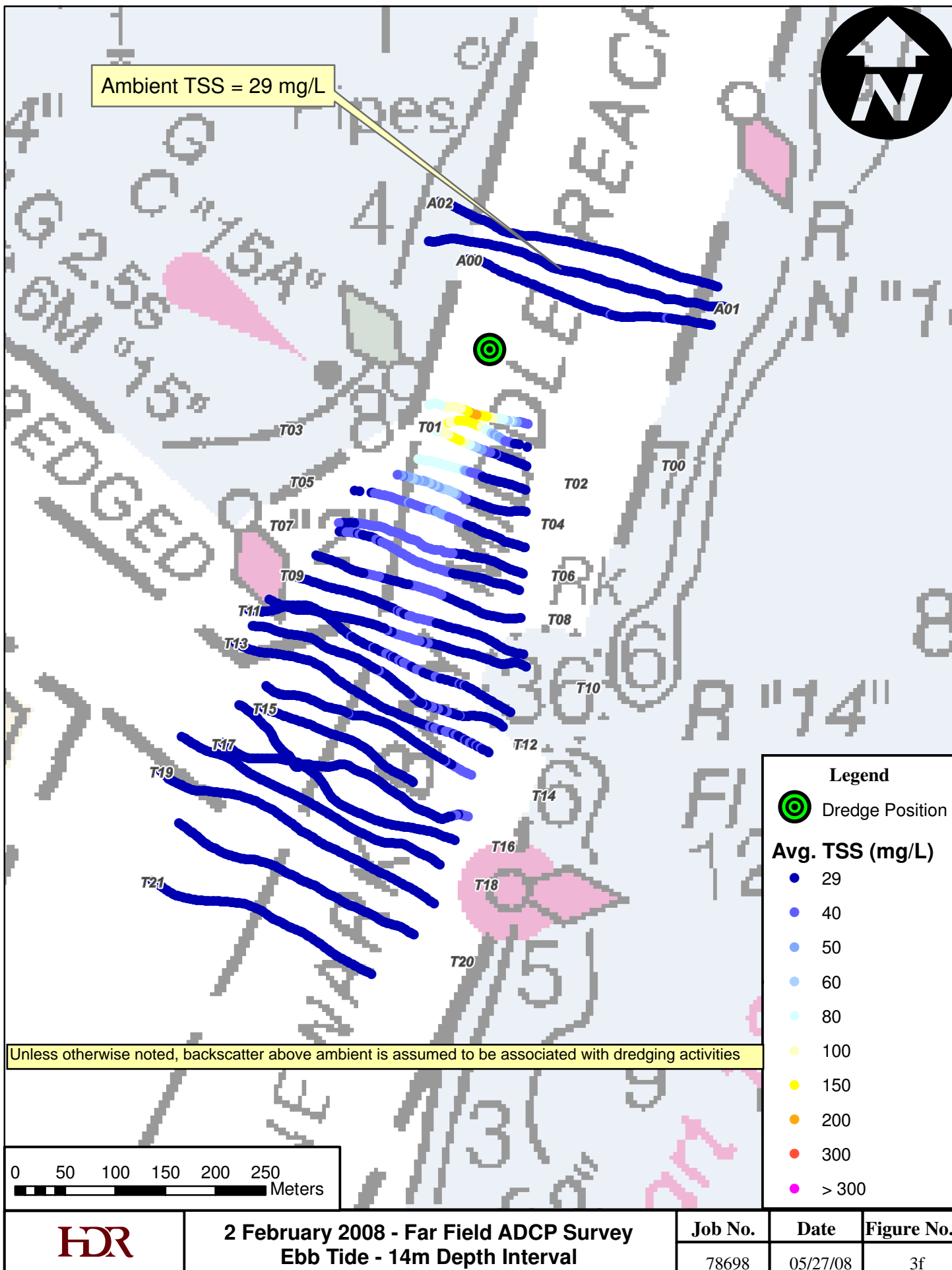


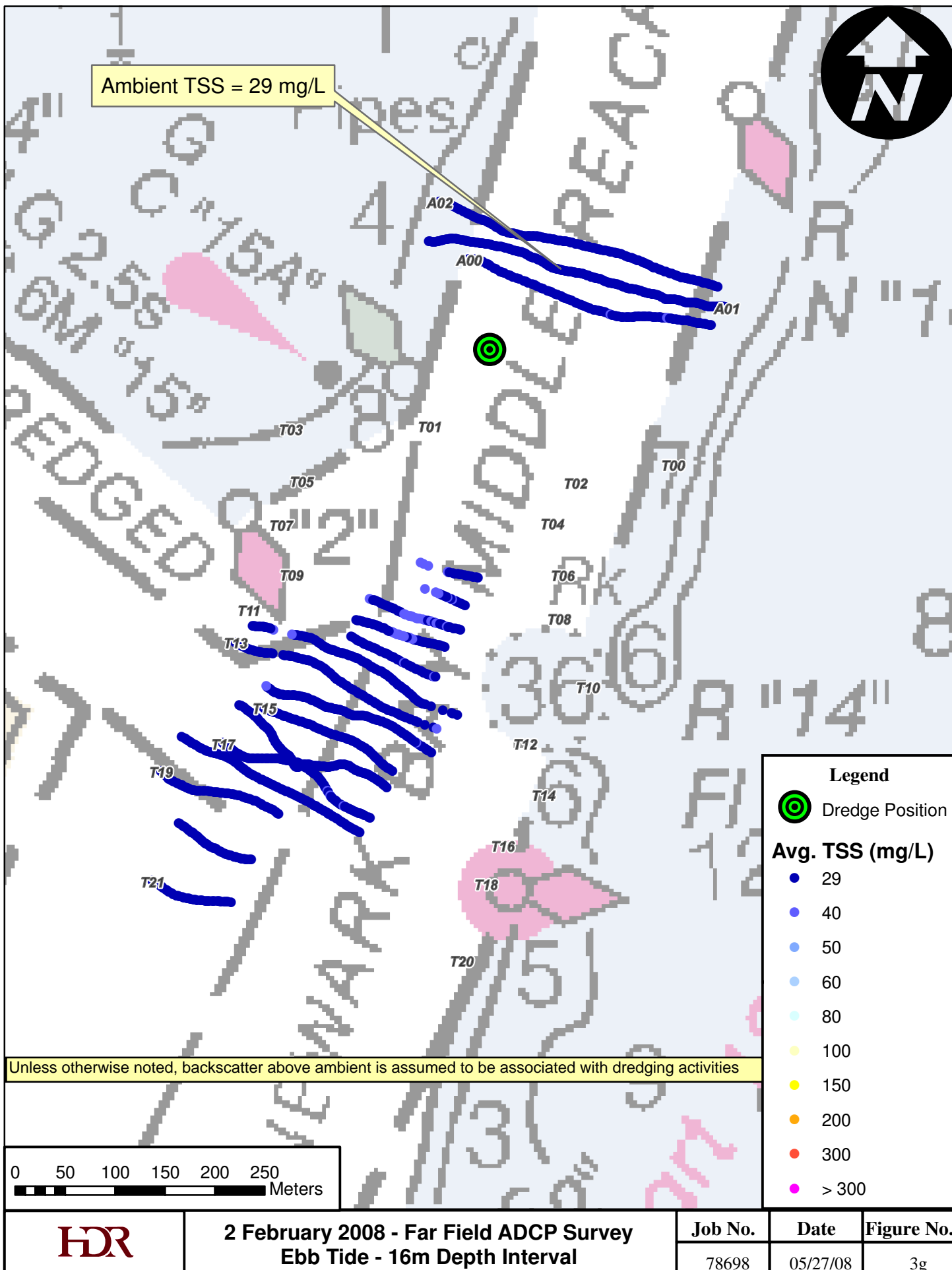


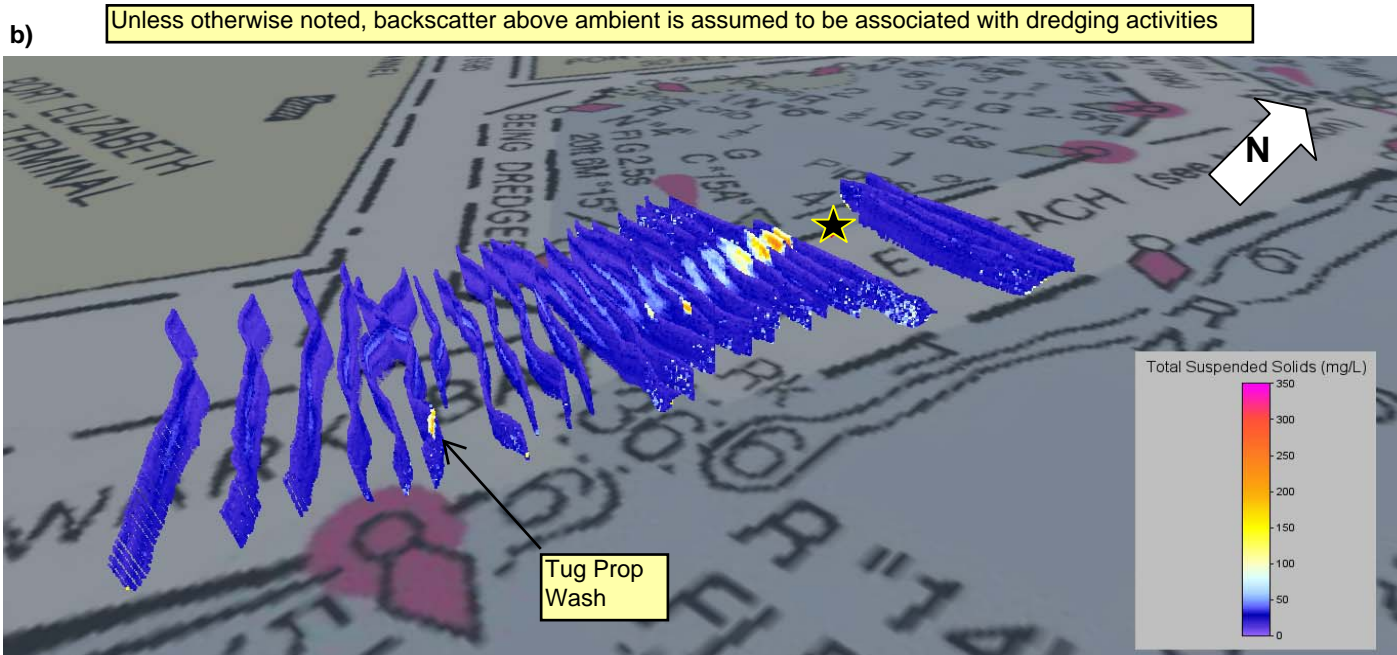
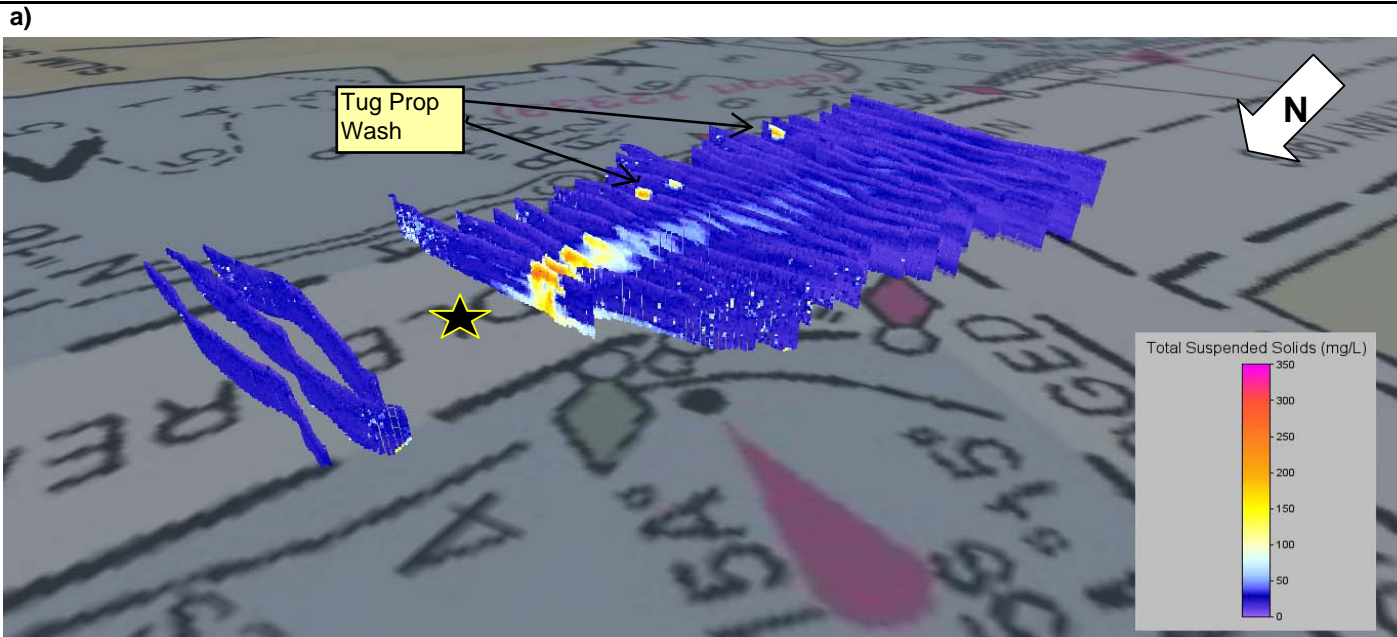












*Dredge position indicated by star



ADCP Average TSS Values with Respect to their x, y and z Coordinates
2 February 2008 Far Field Survey - Ebb Tide

FIGURE

4a-b

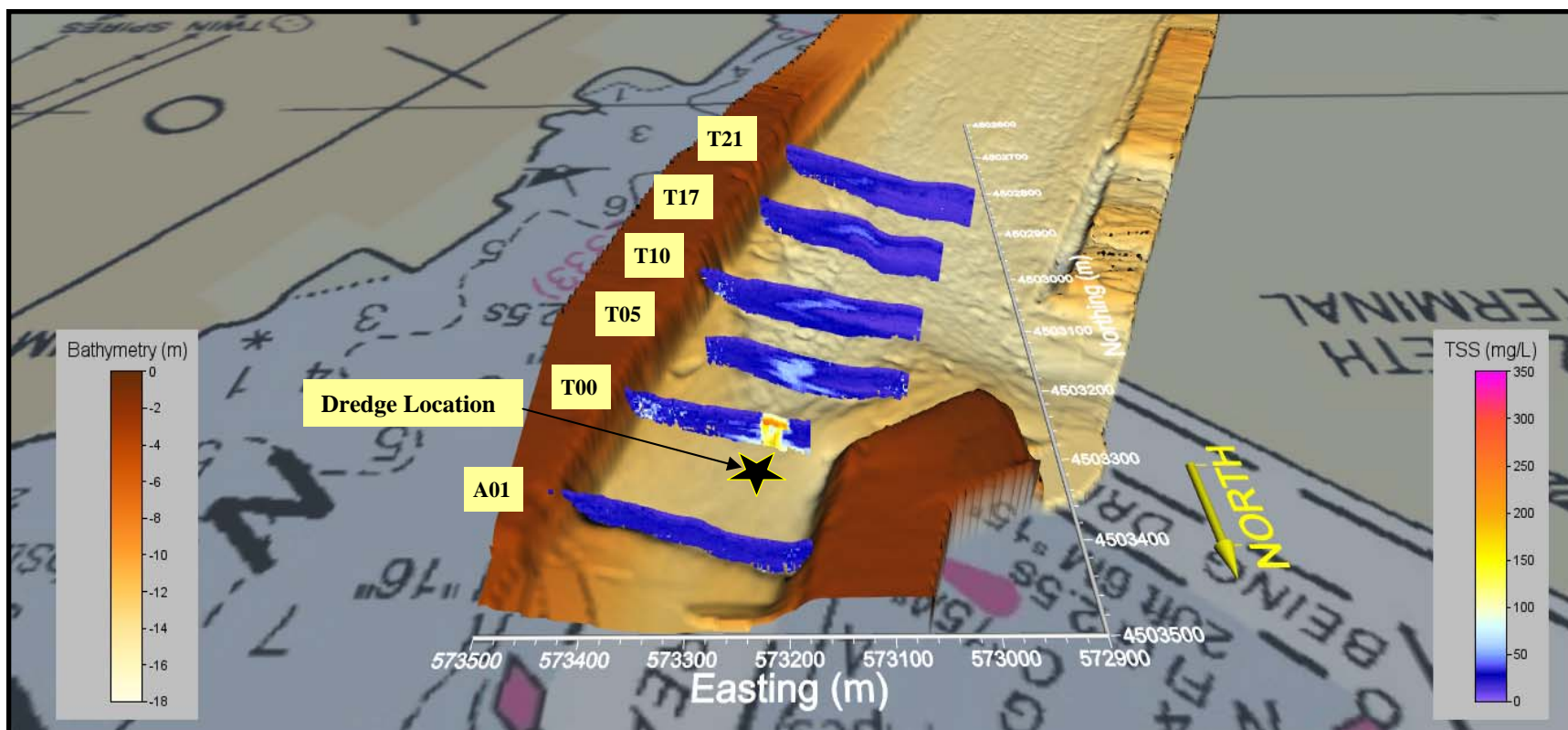
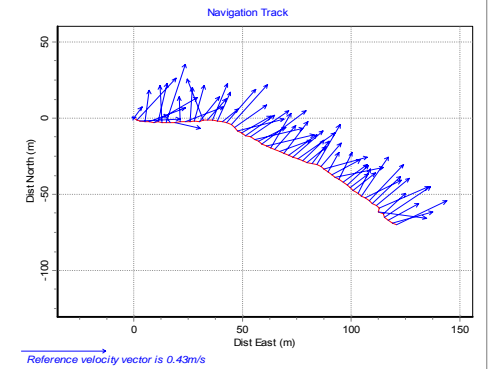
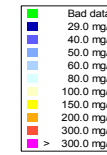
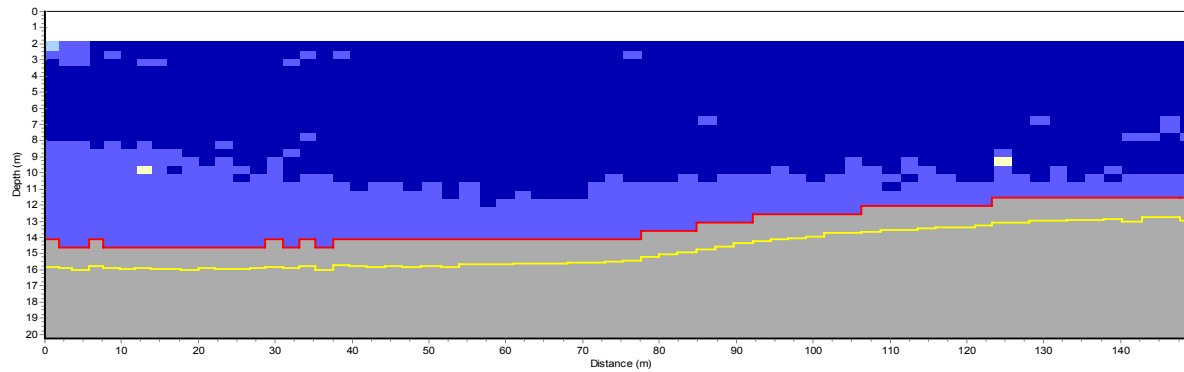


Figure 4c: ADCP Average TSS Values with Respect to their x, y and z Coordinates Superimposed on Channel Bathymetry. 2 February 2008 Far Field Survey - Ebb Tide.

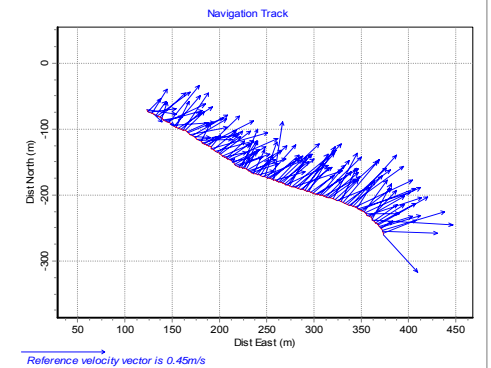
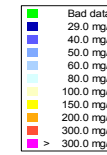
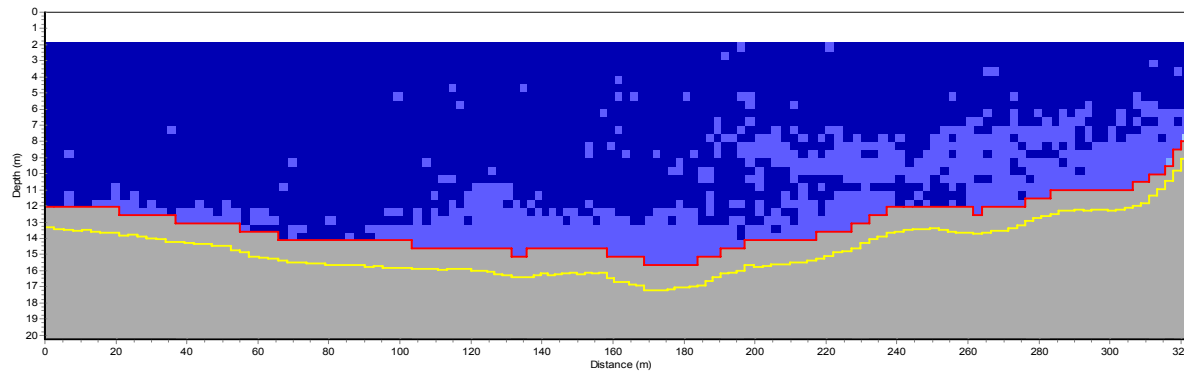
Table 3. 14 February 2008 Far Field Flood Tide Survey Transect Summary Table

Transect Number	Figure Number	Time	Approximate Distance to Dredge (m)	Transect Length (m)	Plume Description	Additional Remarks
A01	5a	10:02:42	62	150	Ambient	Transects off the bow of platform
A03	5b	10:09:05	112	325	Ambient	
A05	5c	10:17:29	162	232	Ambient	
T00	5d	11:13:52	5	109	Plume approx. 50 m wide throughout the water column with max concentrations <150 mg/l at the surface & bottom	Transect cut short due to vessel traffic
T01	5e	11:18:49	5	268	Plume approx. 50 m wide throughout the water column with max concentrations <150 mg/l at the surface	Transects off the stern of platform. Tug prop wash noted adjacent to the plume.
T02	5f	11:22:34	30	236	Plume approx. 50 m wide with core concentrations <100 mg/l	
T03	5g	11:26:16	55	170	Plume approx. 50 m wide with core concentrations <80 mg/l	Dredging halted/dredge rotated 180 degrees
T04	5h	12:36:35	42	415	Plume approx. 50 m wide throughout the water column with max concentrations <200 mg/l at the surface	Transects now off the bow of platform
T05	5i	12:41:55	67	225	Plume approx. 70 m wide with core concentrations <80 mg/l	
T06	5j	12:44:50	92	224	Plume approx. 70 m wide with core concentrations <80 mg/l	
T07	5k	12:47:50	117	177	Plume approx. 70 m wide with core concentrations <80 mg/l	
T08	5l	12:49:56	142	148	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T09	5m	12:52:08	167	116	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T10	5n	12:53:07	192	402	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T11	5o	13:00:02	217	341	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T12	5p	13:17:58	242	379	Dredge plume signature masked	Visible plume from passing container ship
T13	5q	13:23:39	267	346	Dredge plume signature masked	Some survey vessel prop wash in shallows
T14	5r	13:28:51	292	426	Dredge plume signature masked	
T15	5s	13:41:18	317	340	Dredge plume signature masked	Remnant of container ship plume near bottom
T16	5t	13:55:36	342	400	Dredge plume signature masked	Tug prop wash near surface with remnant of ship plume near bottom
T17	5u	14:06:43	367	351	Dredge plume signature masked	Remnant of container ship plume near bottom
T18	5v	14:16:43	392	433	Dredge plume signature masked	Remnant of container ship plume near bottom
T19	5w	14:21:53	417	339	Dredge plume signature masked	Remnant of container ship plume near bottom
T20	5x	14:25:53	442	362	Dredge plume signature masked	Remnant of container ship plume near bottom
T21	5y	14:30:41	467	319	Dredge plume signature masked	Remnant of container ship plume near bottom
T22	5z	14:34:50	492	364	Dredge plume signature masked	Remnant of container ship plume near bottom
T23	5zz	14:39:19	517	633	Dredge plume signature masked	Remnant of container ship plume near bottom

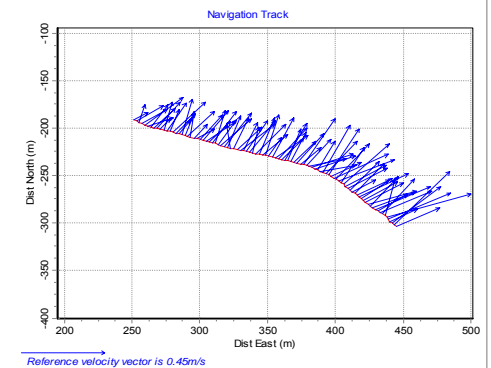
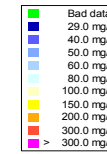
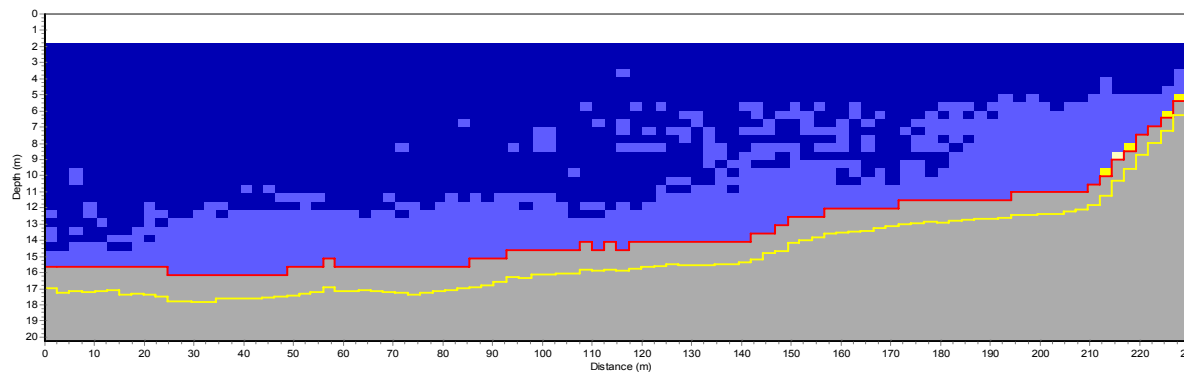
a) Ambient A01 - Upcurrent 62 m*



b) Ambient A03 - Upcurrent 112 m*



c) Ambient A05 - Upcurrent 162 m*



*Approximate distance upcurrent from source

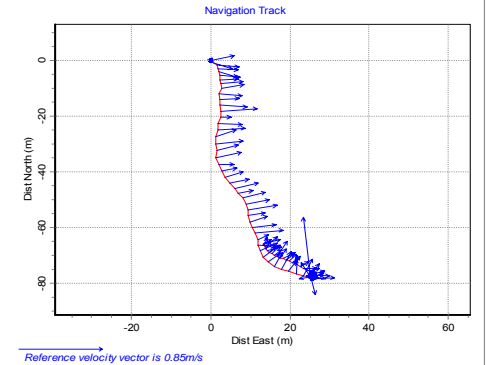
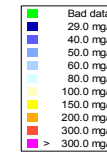
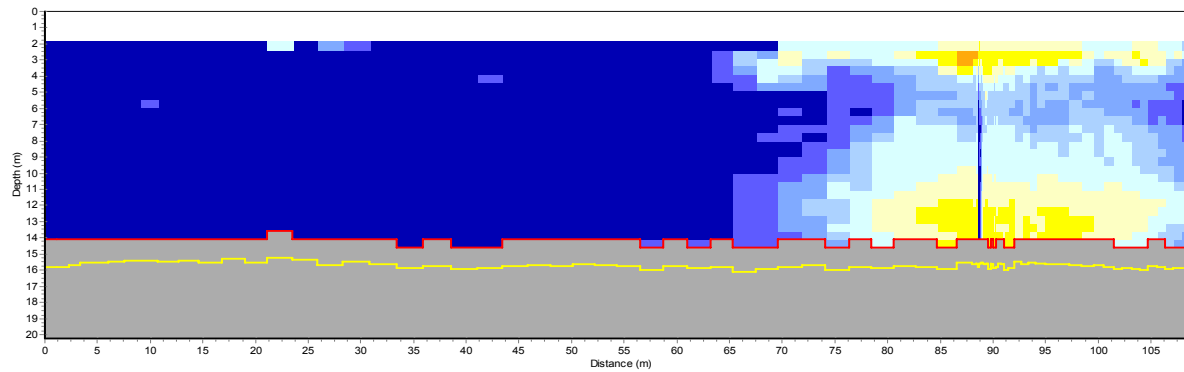
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



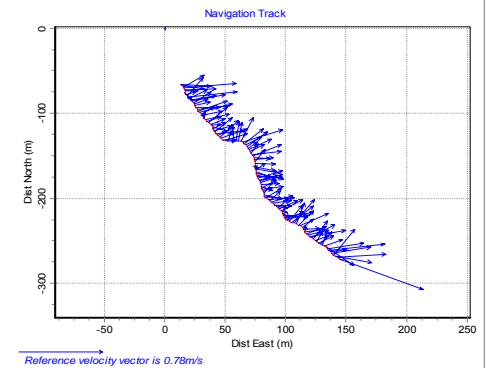
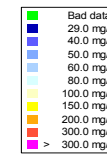
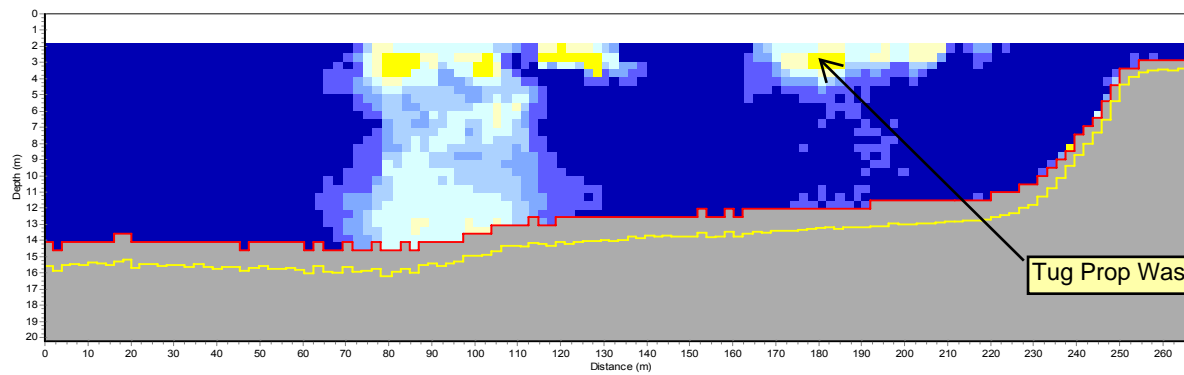
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5a-c

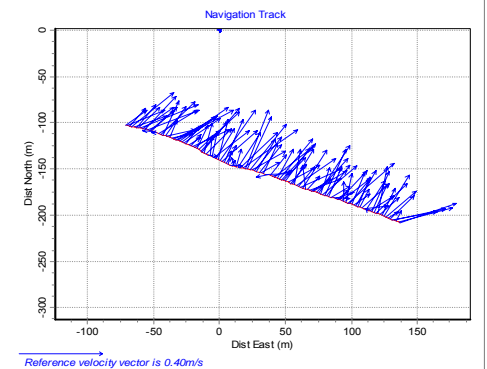
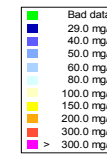
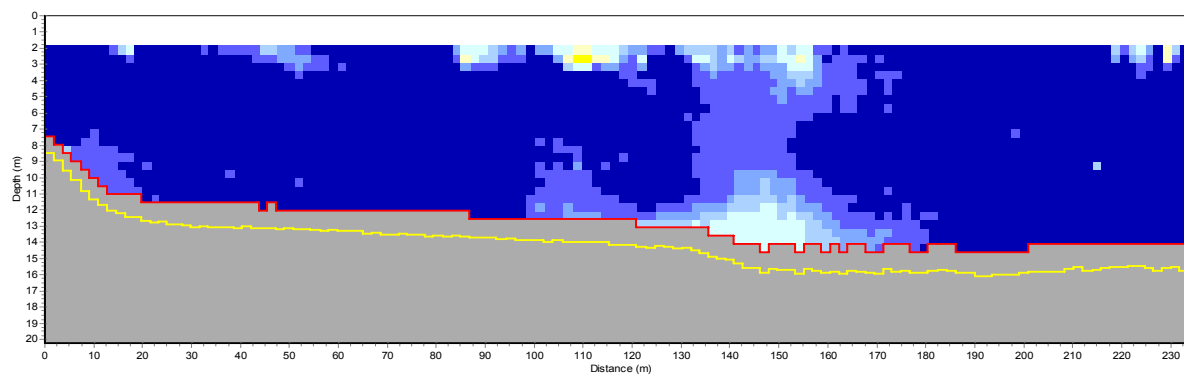
d) Transect T00 - Downcurrent 5 m*



e) Transect T01 - Downcurrent 5 m*



f) Transect T02 - Downcurrent 30 m*



*Approximate distance downcurrent from source

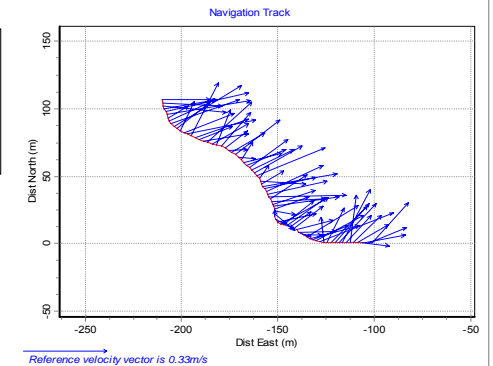
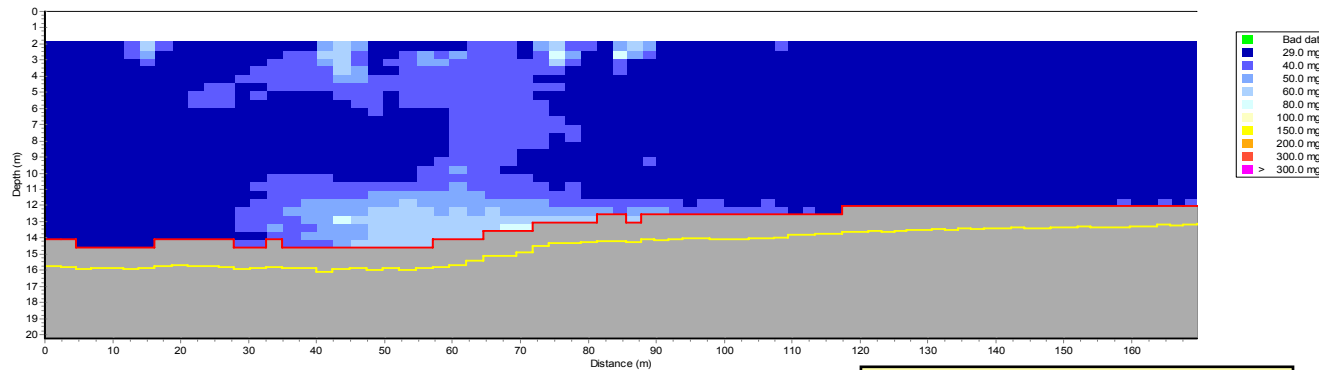
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

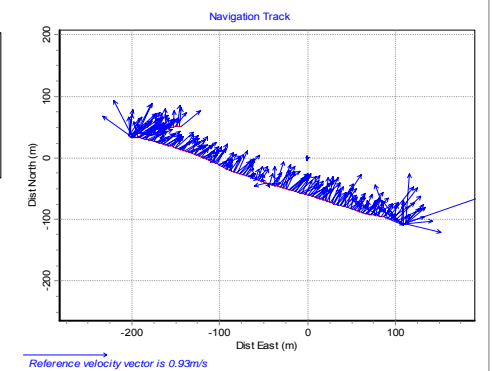
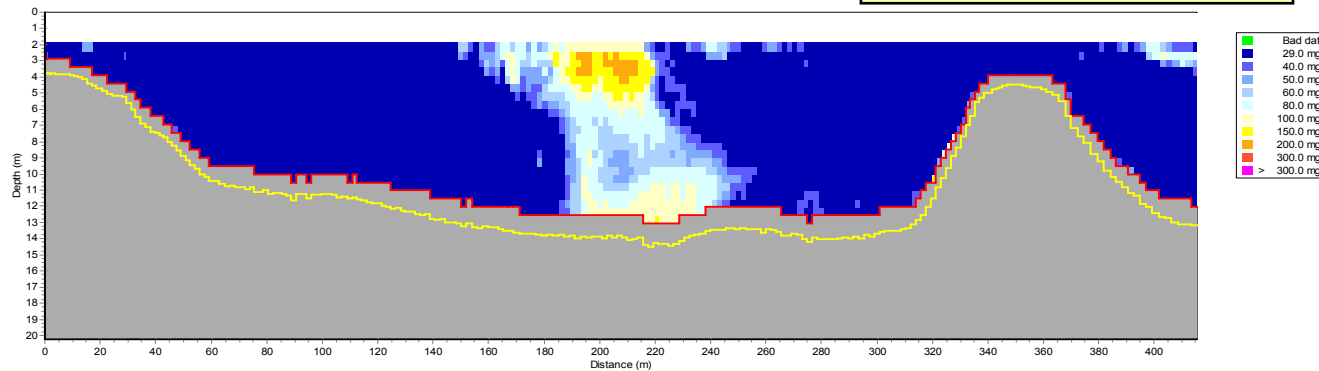
FIGURE
5d-f

g) Transect T03 - Downcurrent 55 m*

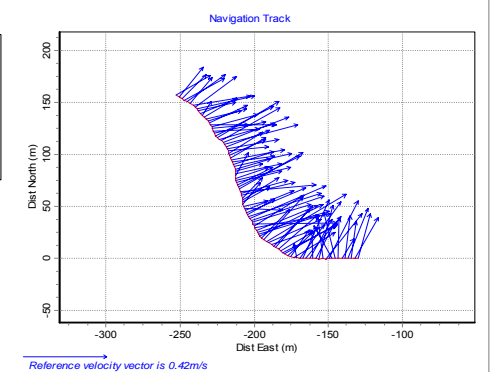
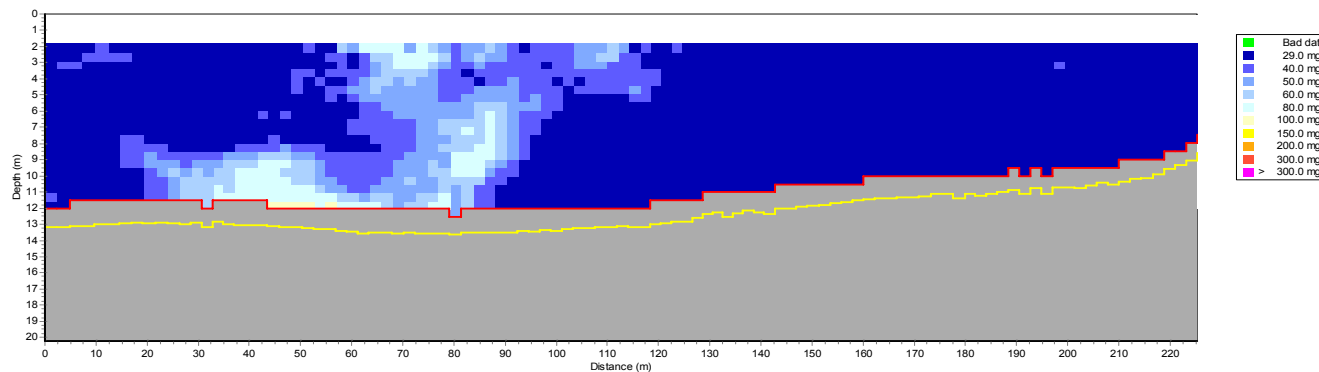


h) Transect T04 - Downcurrent 42 m* ←

First down-current transect after dredge platform was rotated 180 degrees



i) Transect T05 - Downcurrent 67 m*



*Approximate distance downcurrent from source

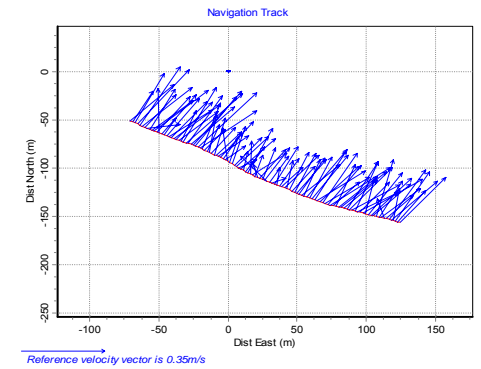
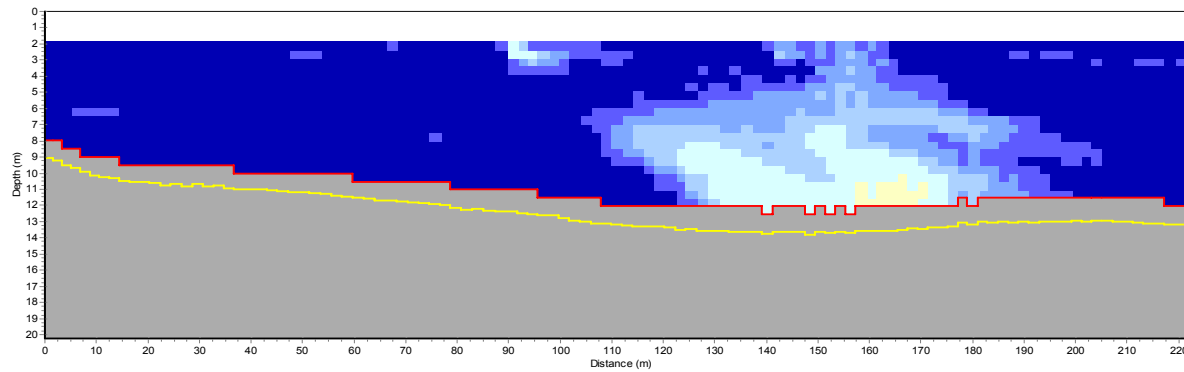
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



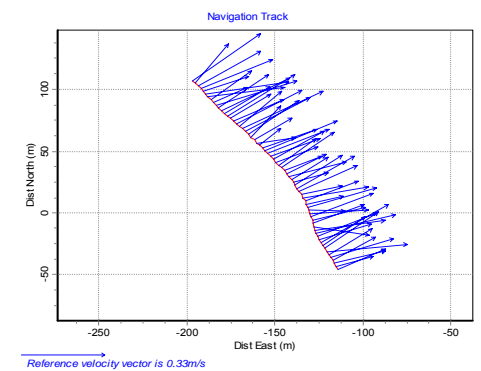
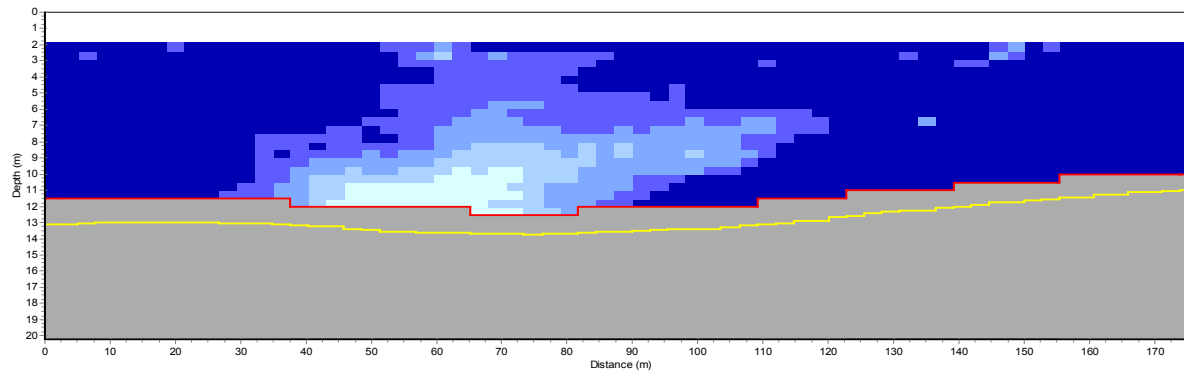
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5g-i

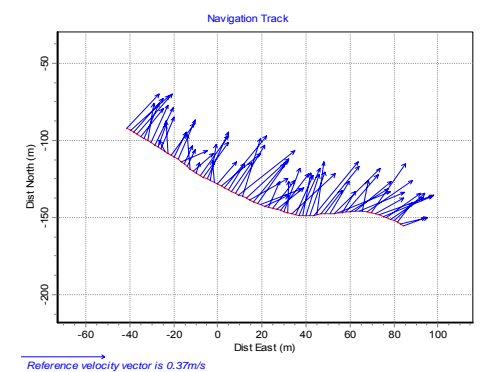
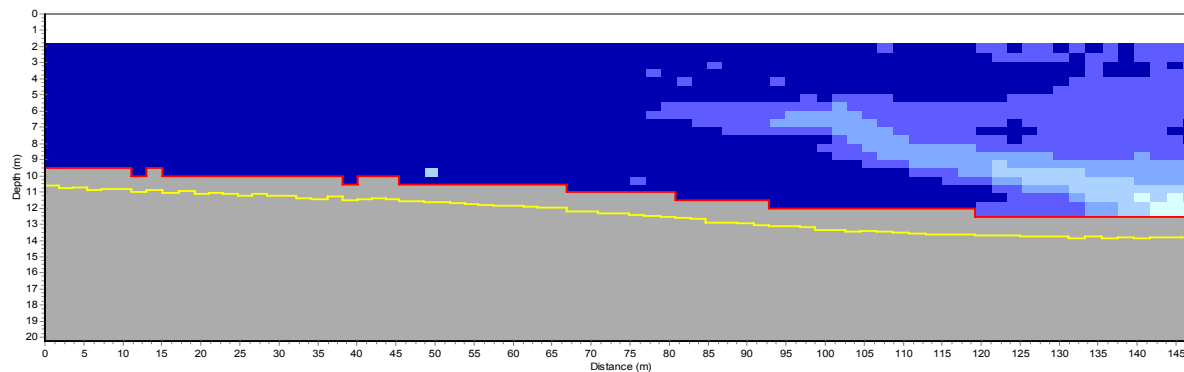
j) Transect T06 - Downcurrent 92 m*



k) Transect T07 - Downcurrent 117 m*



l) Transect T08 - Downcurrent 142 m*



*Approximate distance downcurrent from source

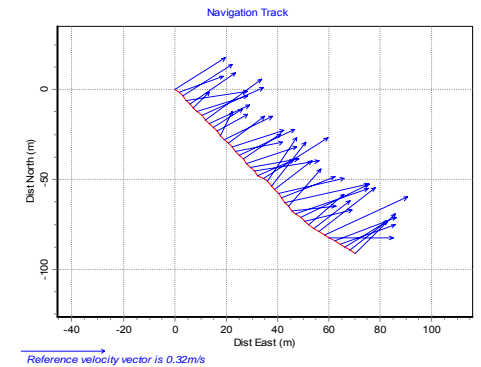
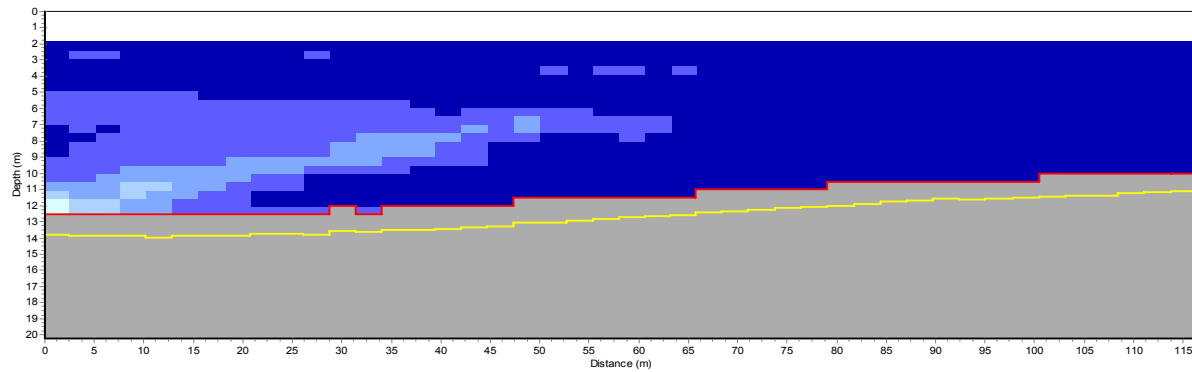
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



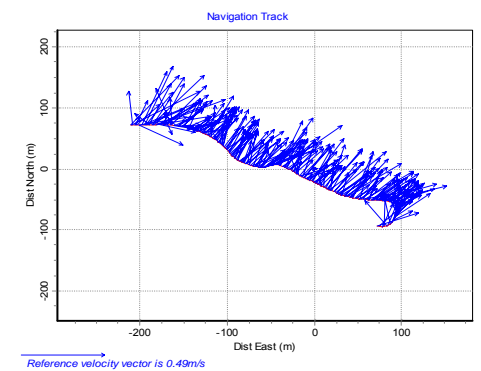
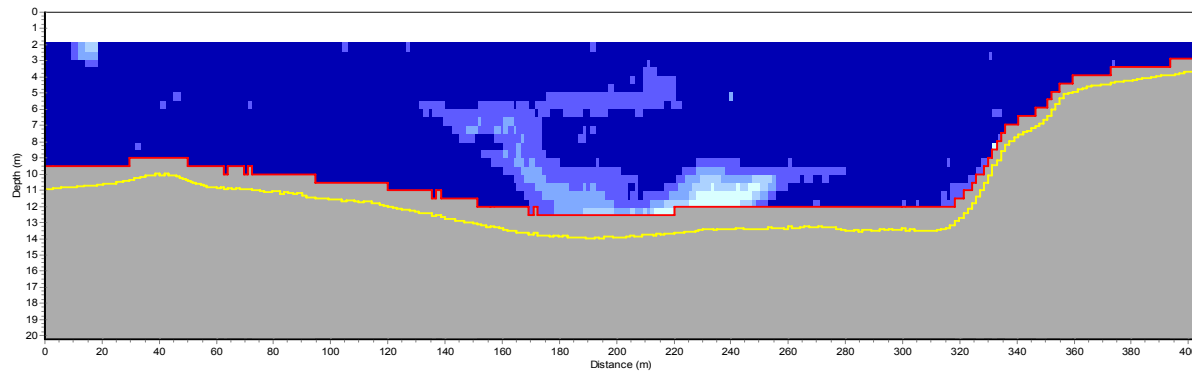
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5j-I

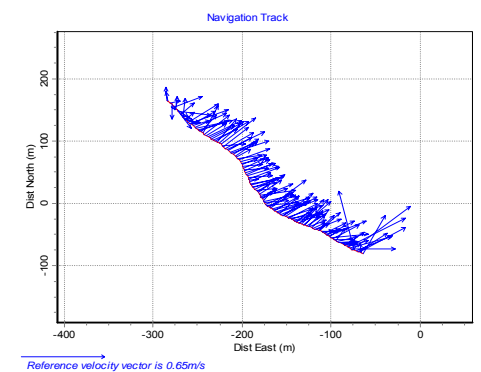
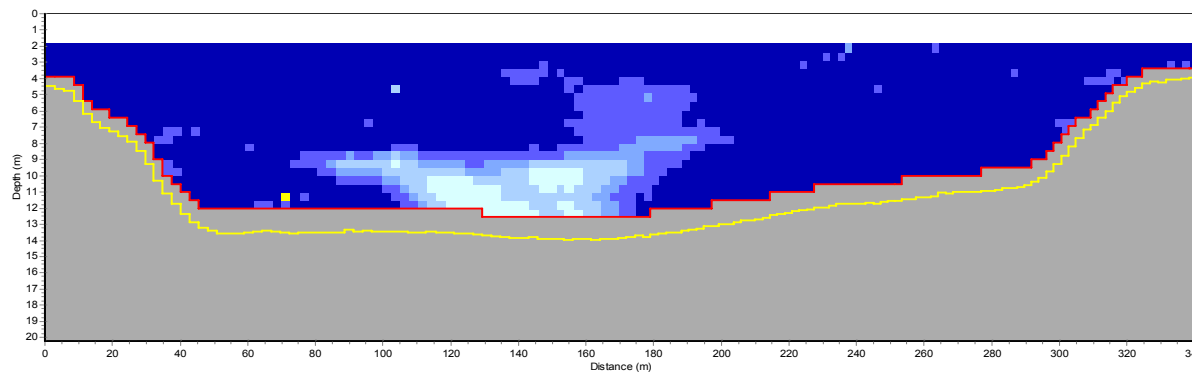
m) Transect T09 - Downcurrent 167 m*



n) Transect T10 - Downcurrent 192 m*



o) Transect T11 - Downcurrent 217 m*



*Approximate distance downcurrent from source

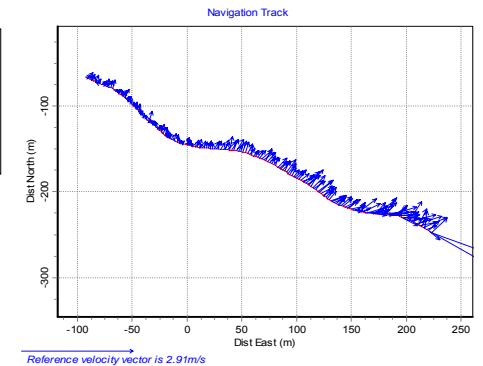
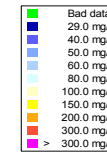
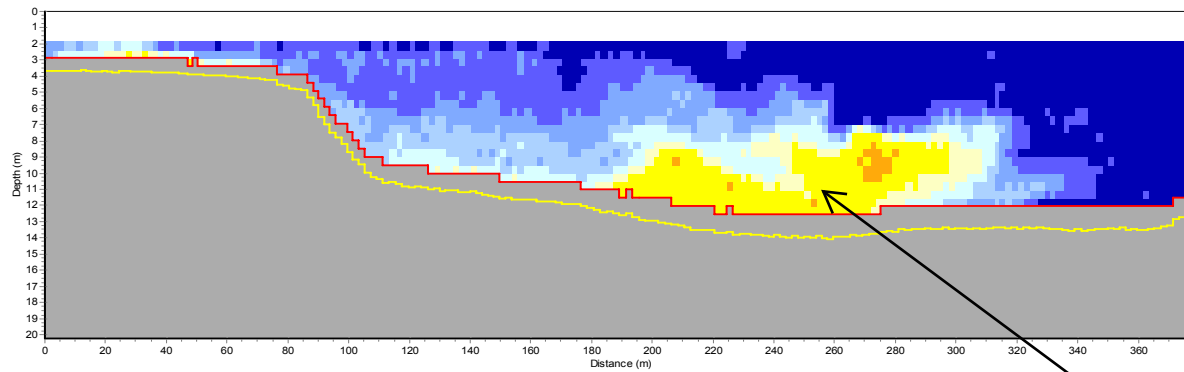
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



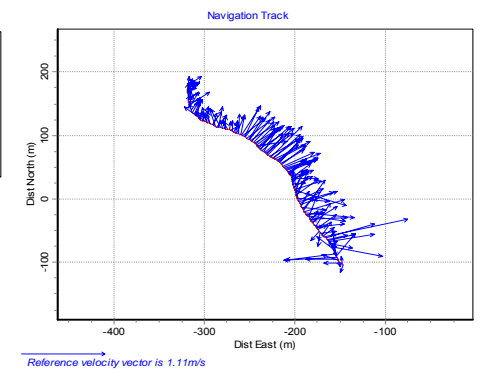
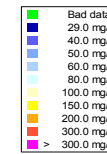
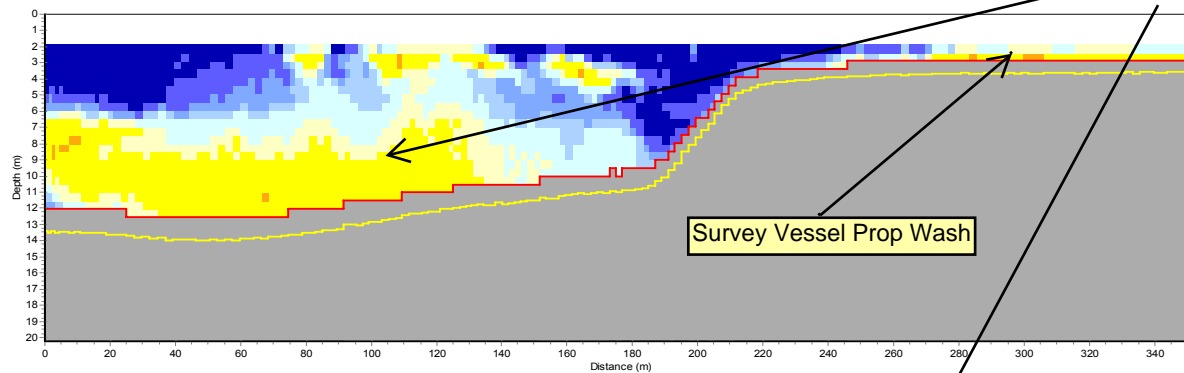
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5m-o

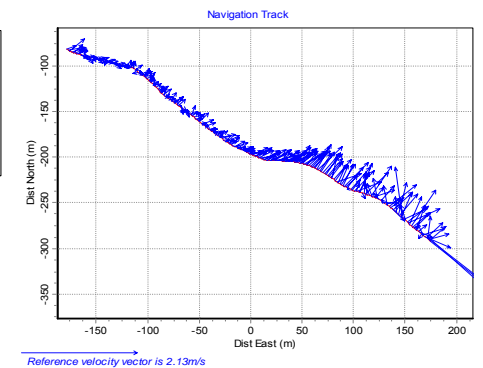
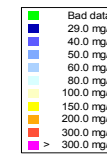
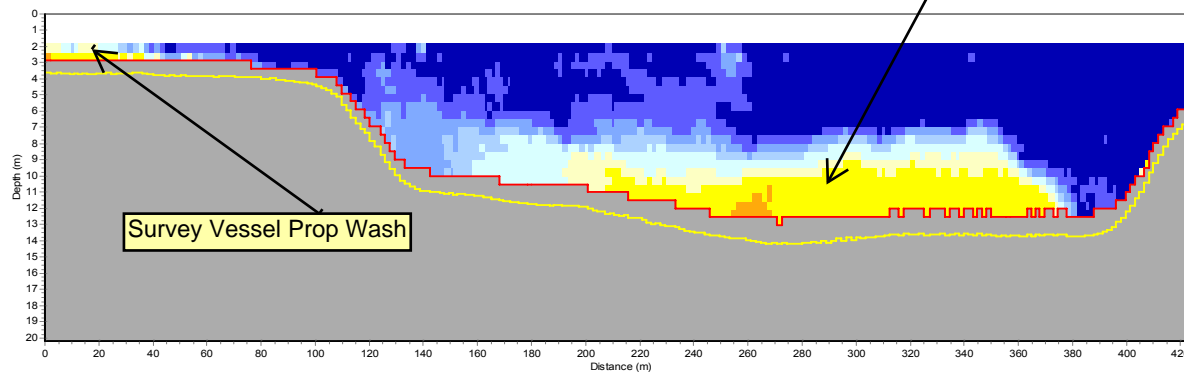
p) Transect T12 - Downcurrent 242 m*



q) Transect T13 - Downcurrent 267 m*



r) Transect T14 - Downcurrent 292 m*



*Approximate distance downcurrent from source

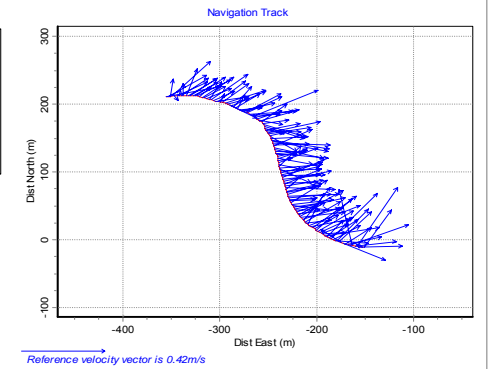
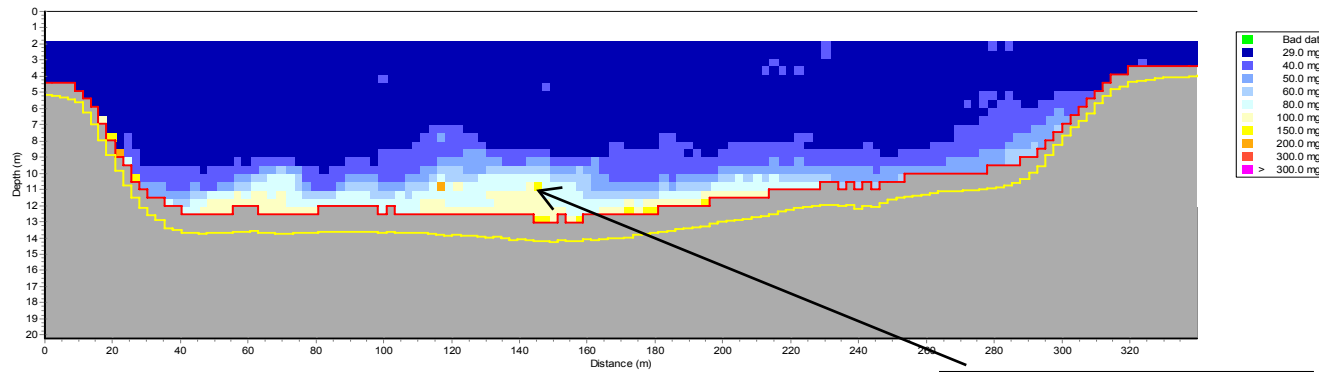
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



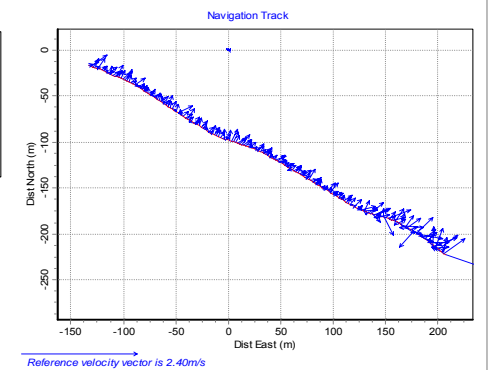
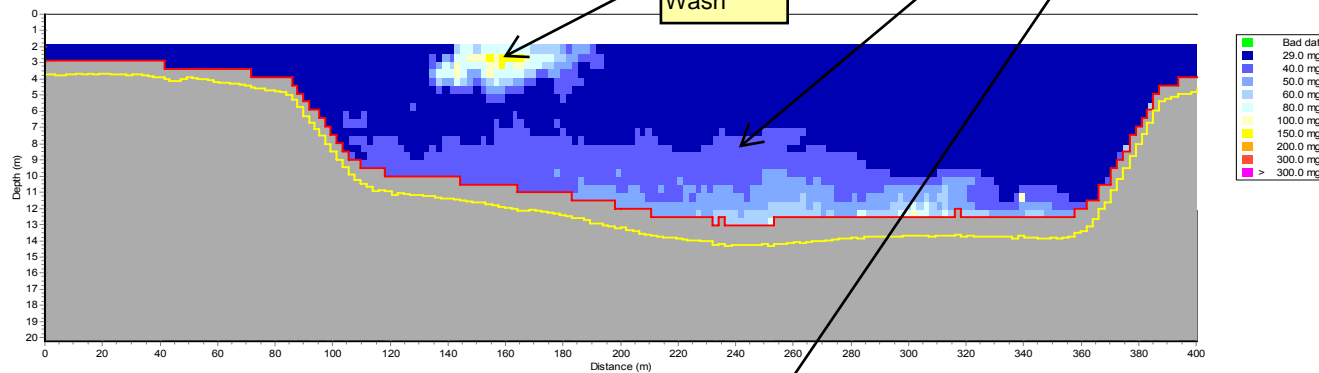
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5p-r

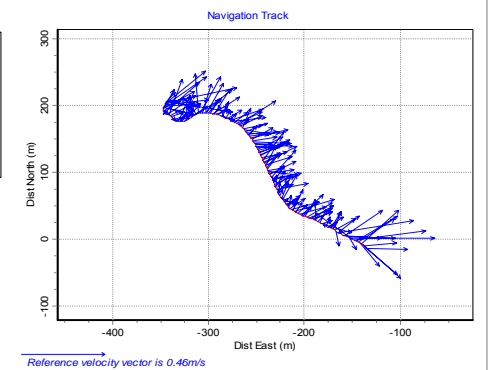
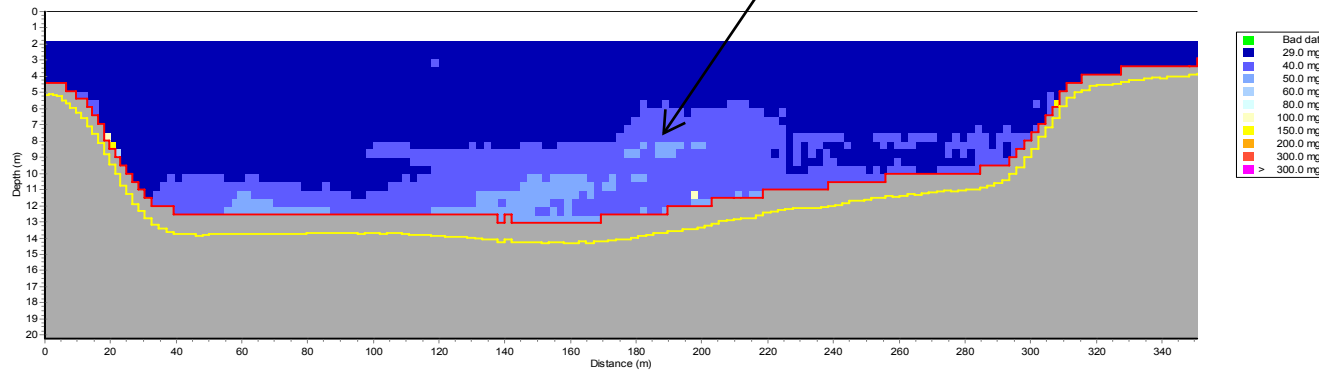
s) Transect T15 - Downcurrent 317 m*



t) Transect T16 - Downcurrent 342 m*



u) Transect T17 - Downcurrent 367 m*



*Approximate distance downcurrent from source

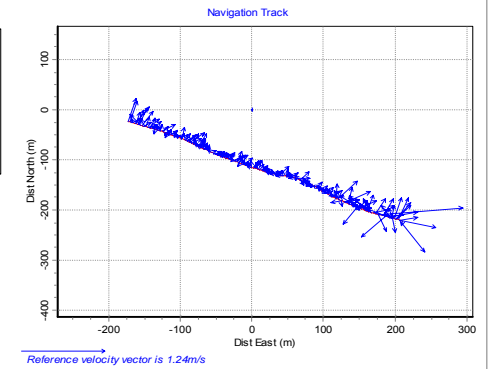
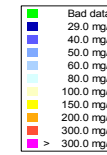
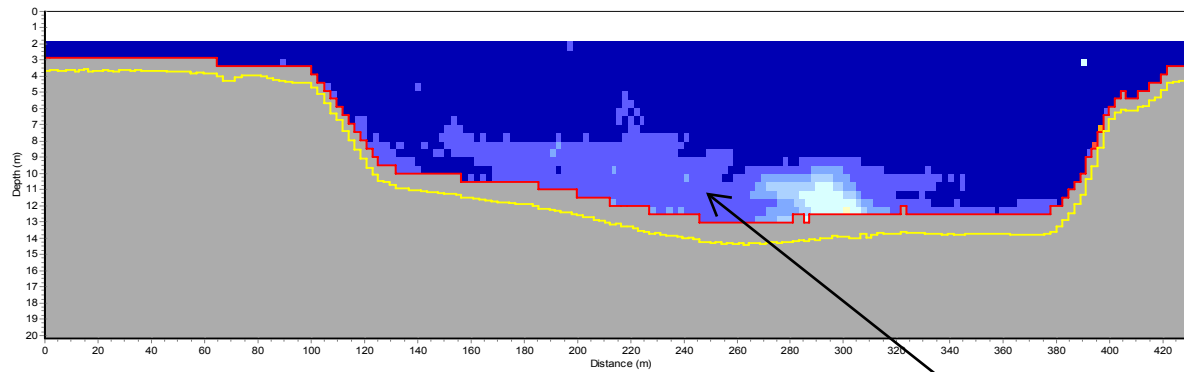
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



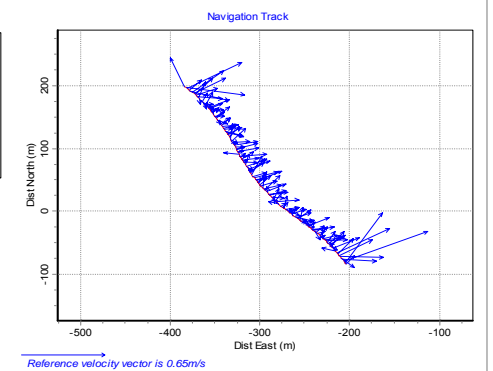
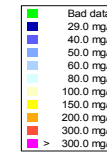
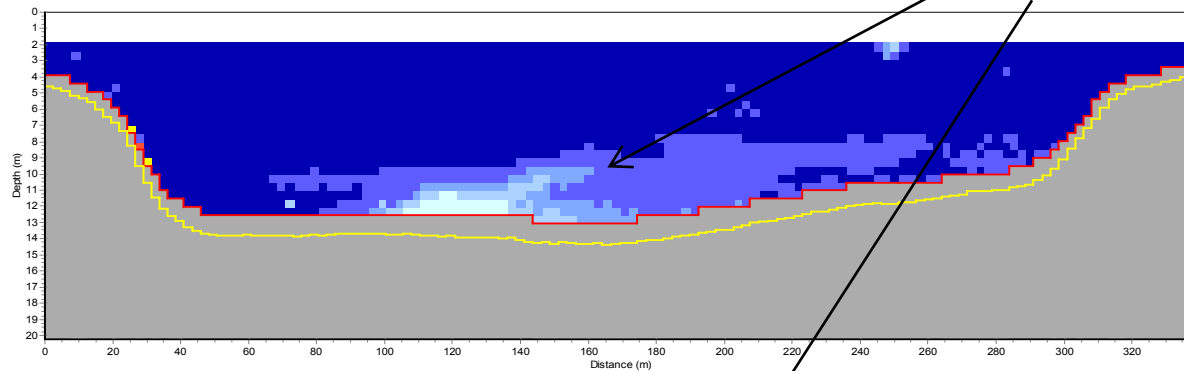
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5s-u

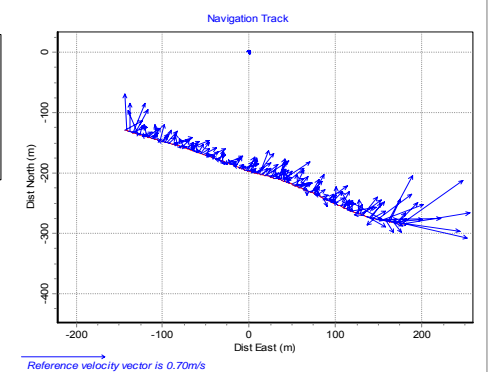
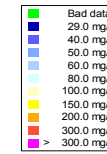
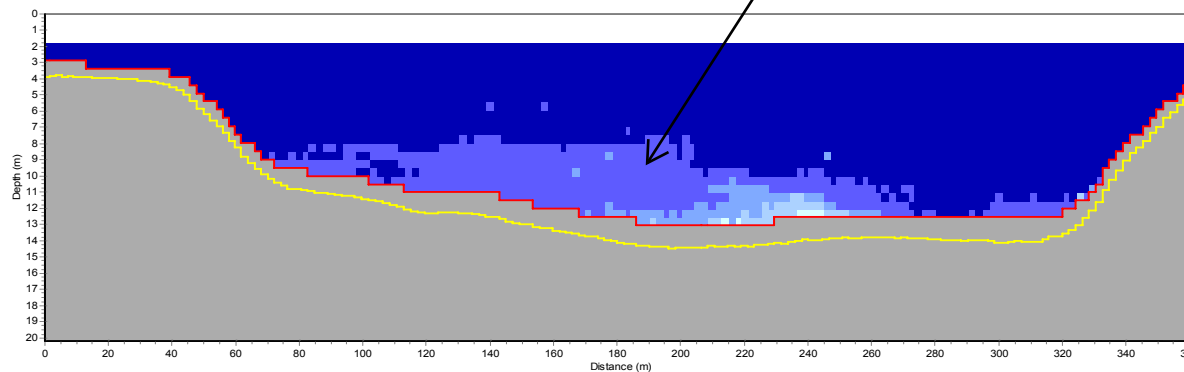
v) Transect T18 - Downcurrent 392 m*



w) Transect T19 - Downcurrent 417 m*



x) Transect T20 - Downcurrent 442 m*



*Approximate distance downcurrent from source

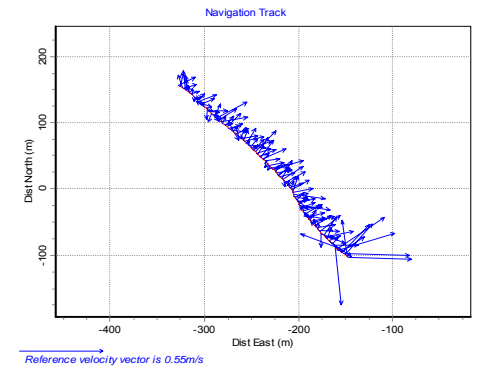
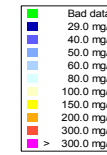
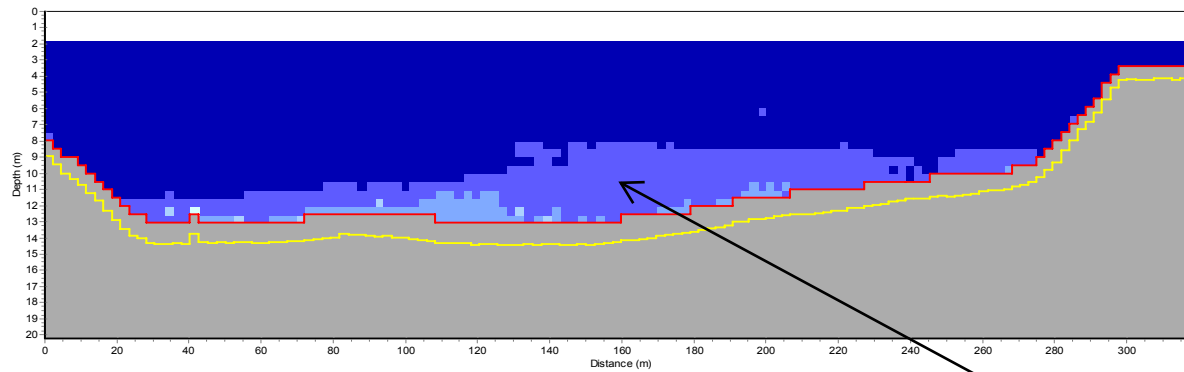
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



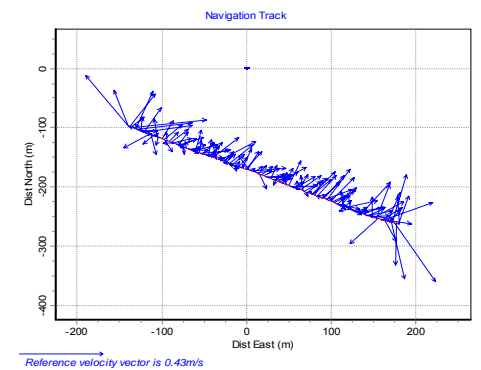
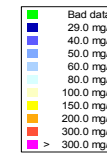
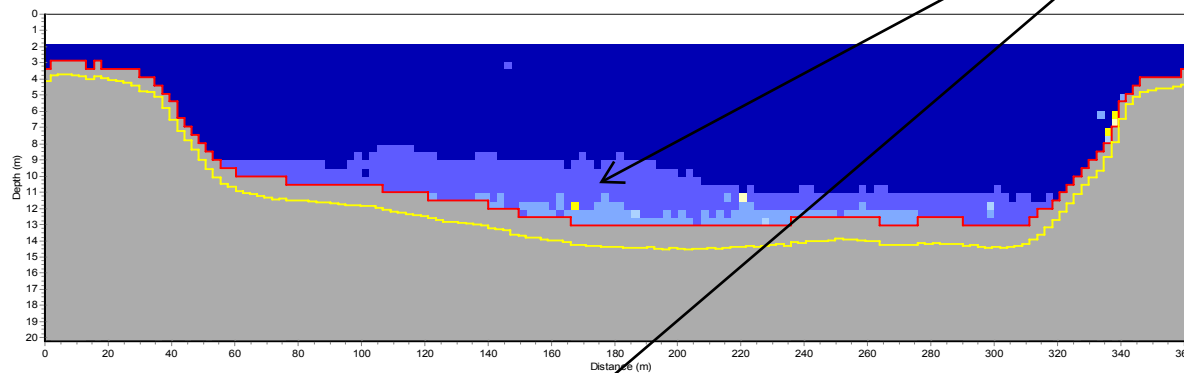
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5v-x

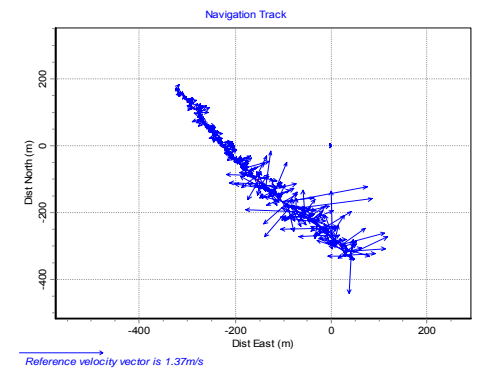
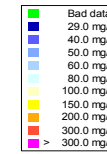
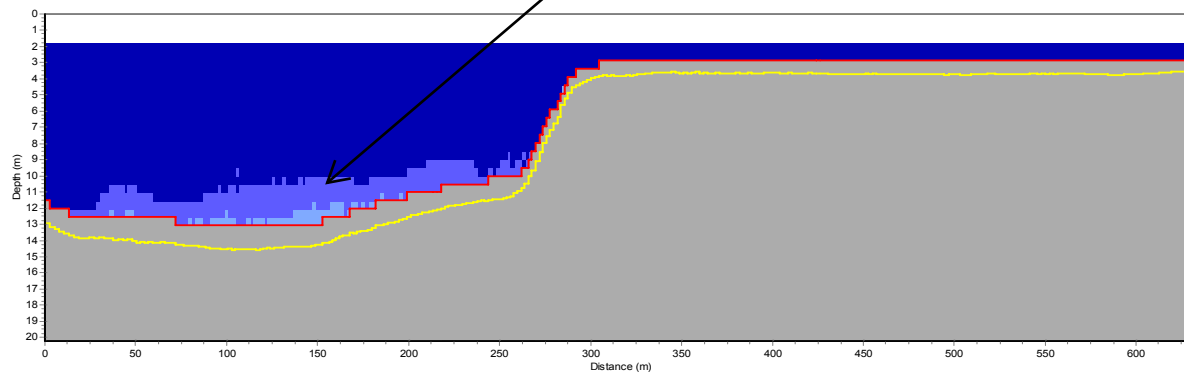
y) Transect T21 - Downcurrent 467 m*



z) Transect T22 - Downcurrent 492 m*



zz) Transect T23 - Downcurrent 517 m*



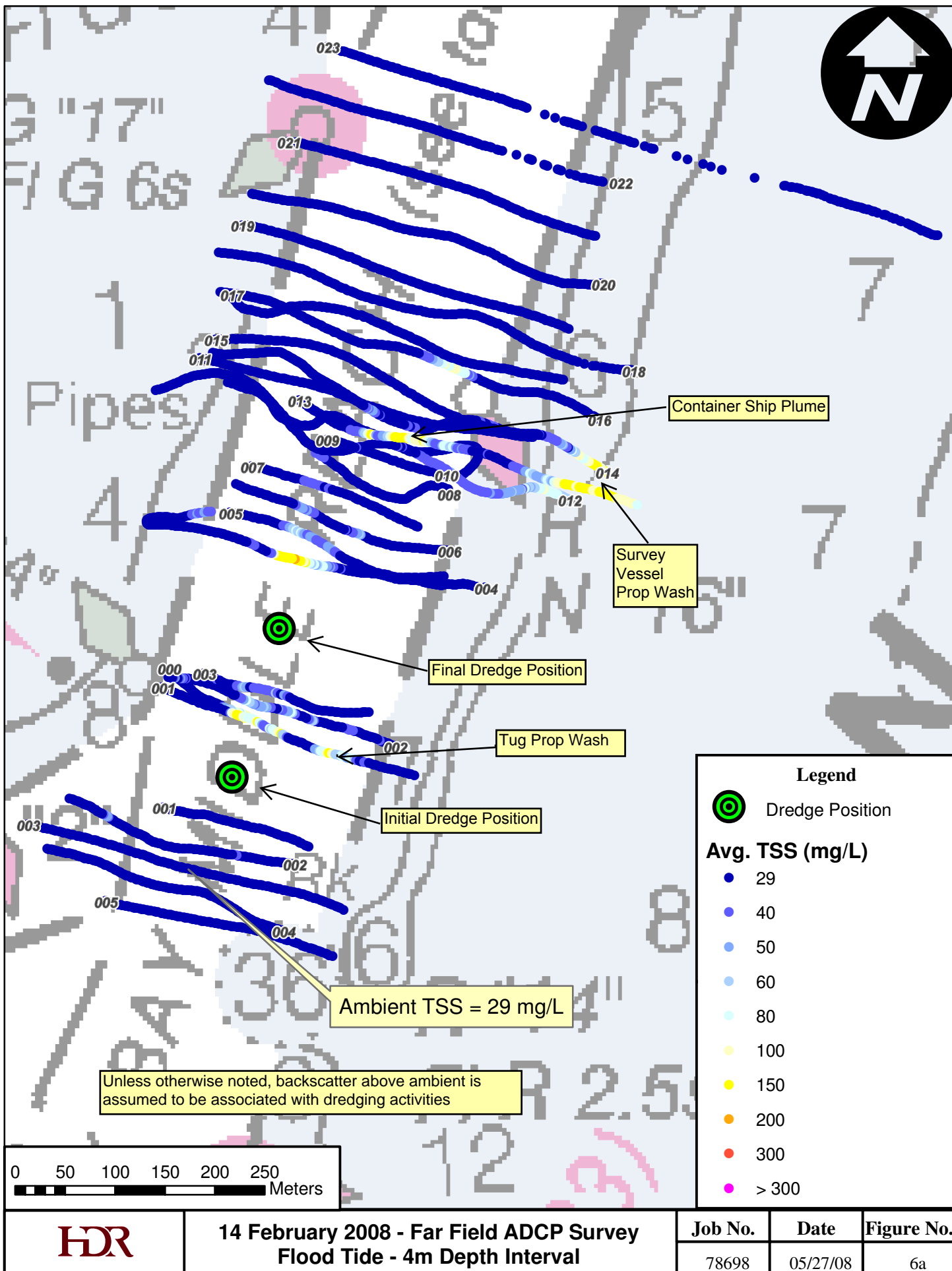
*Approximate distance downcurrent from source

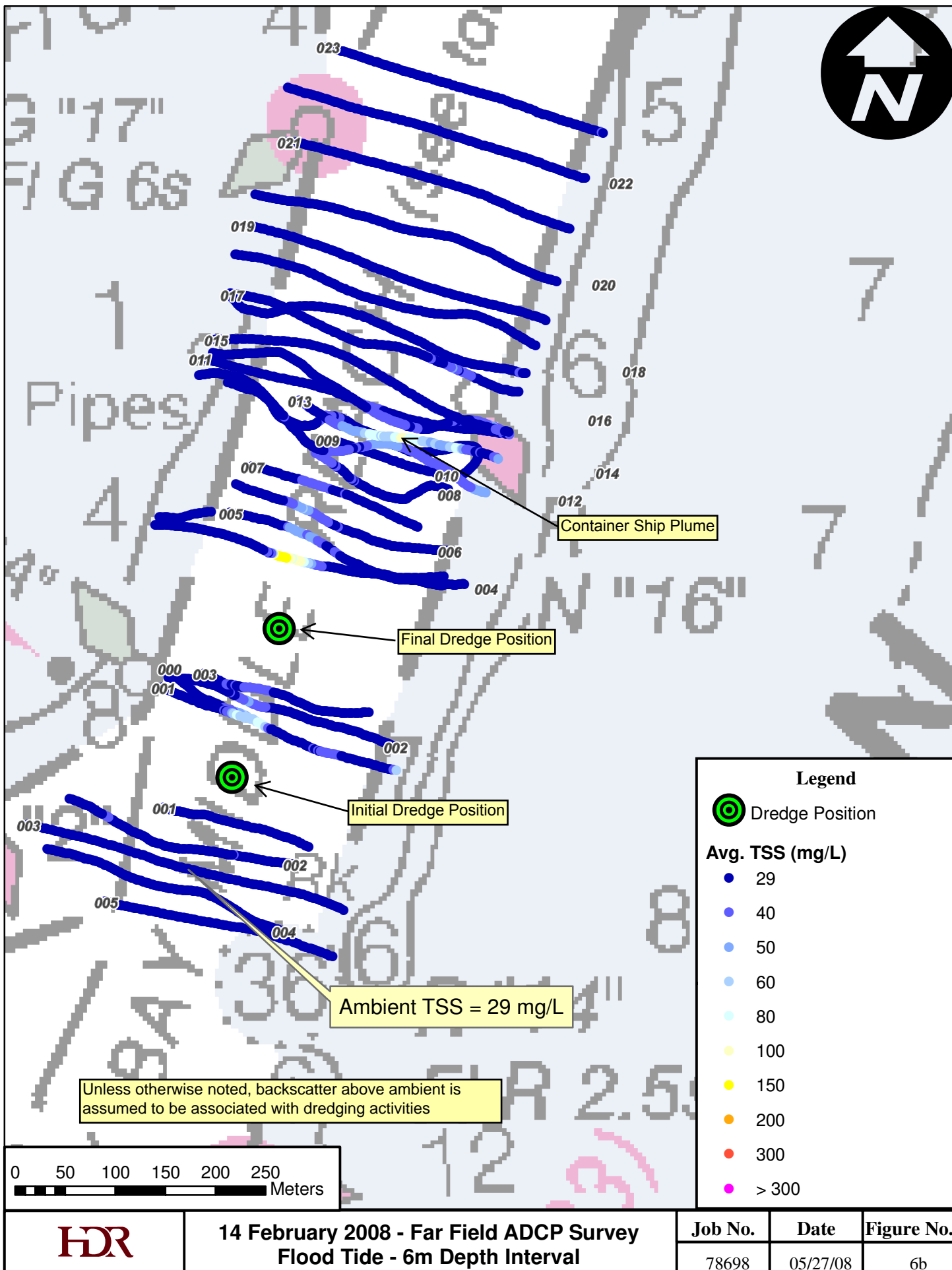
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities

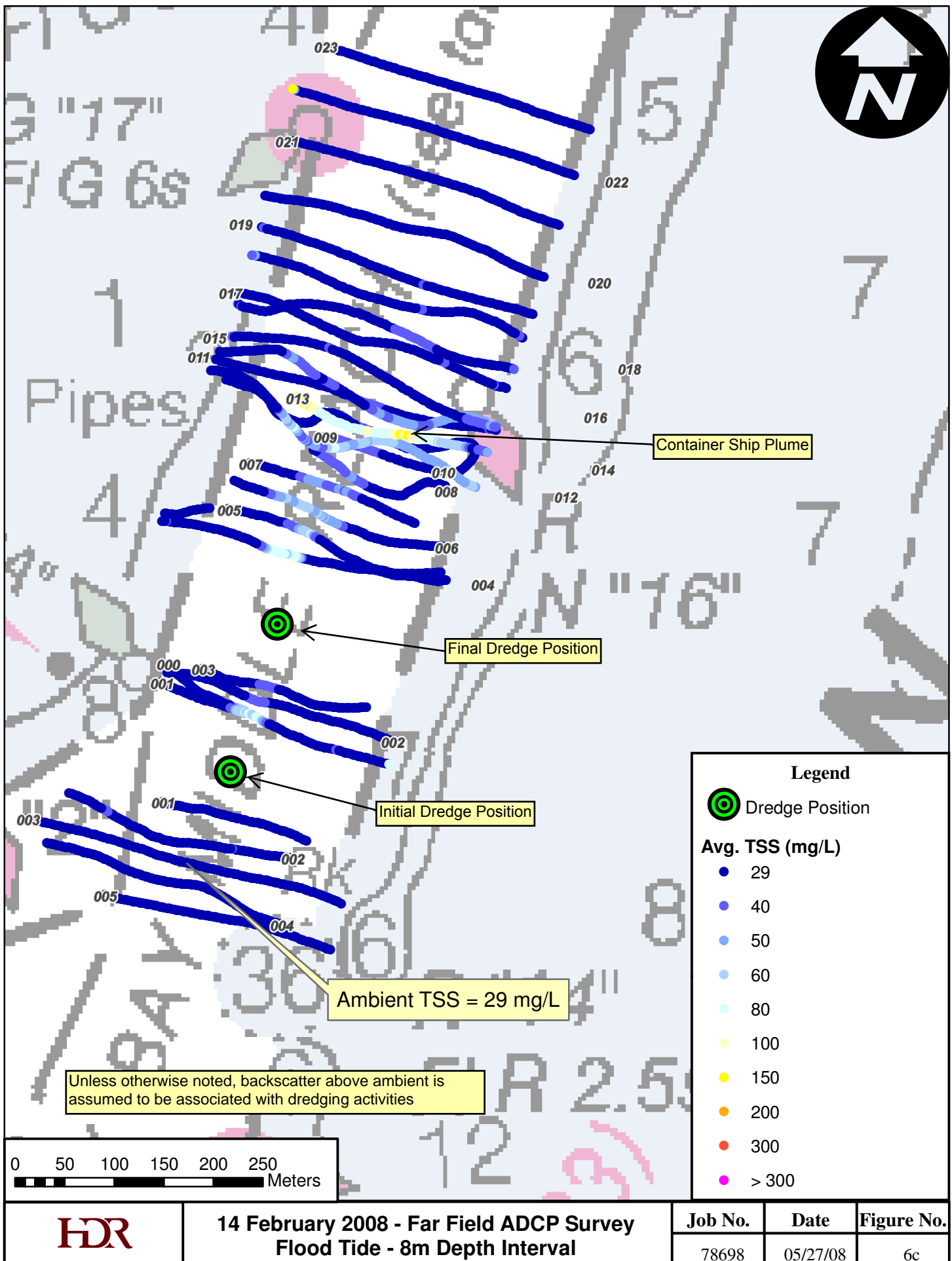


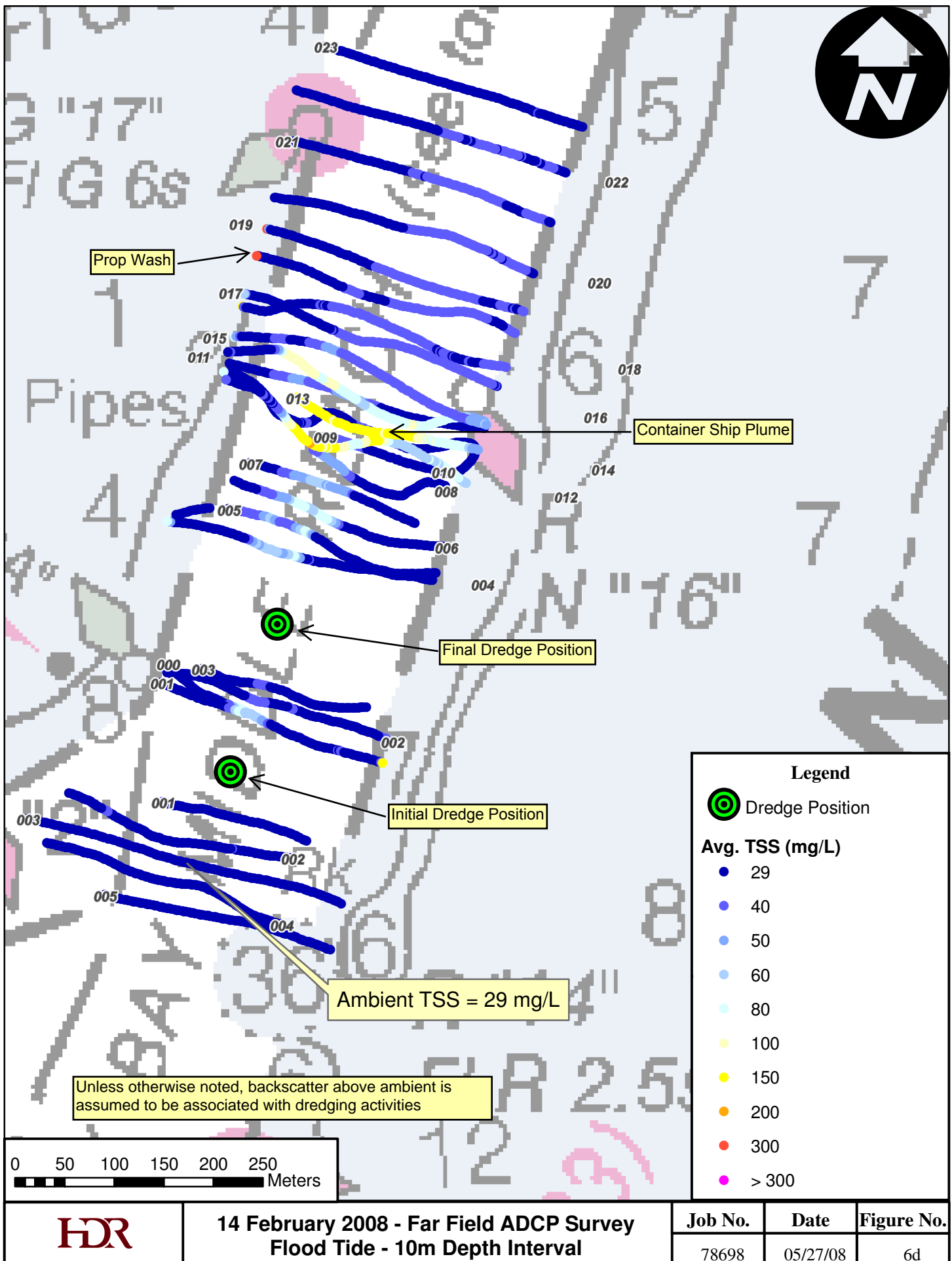
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

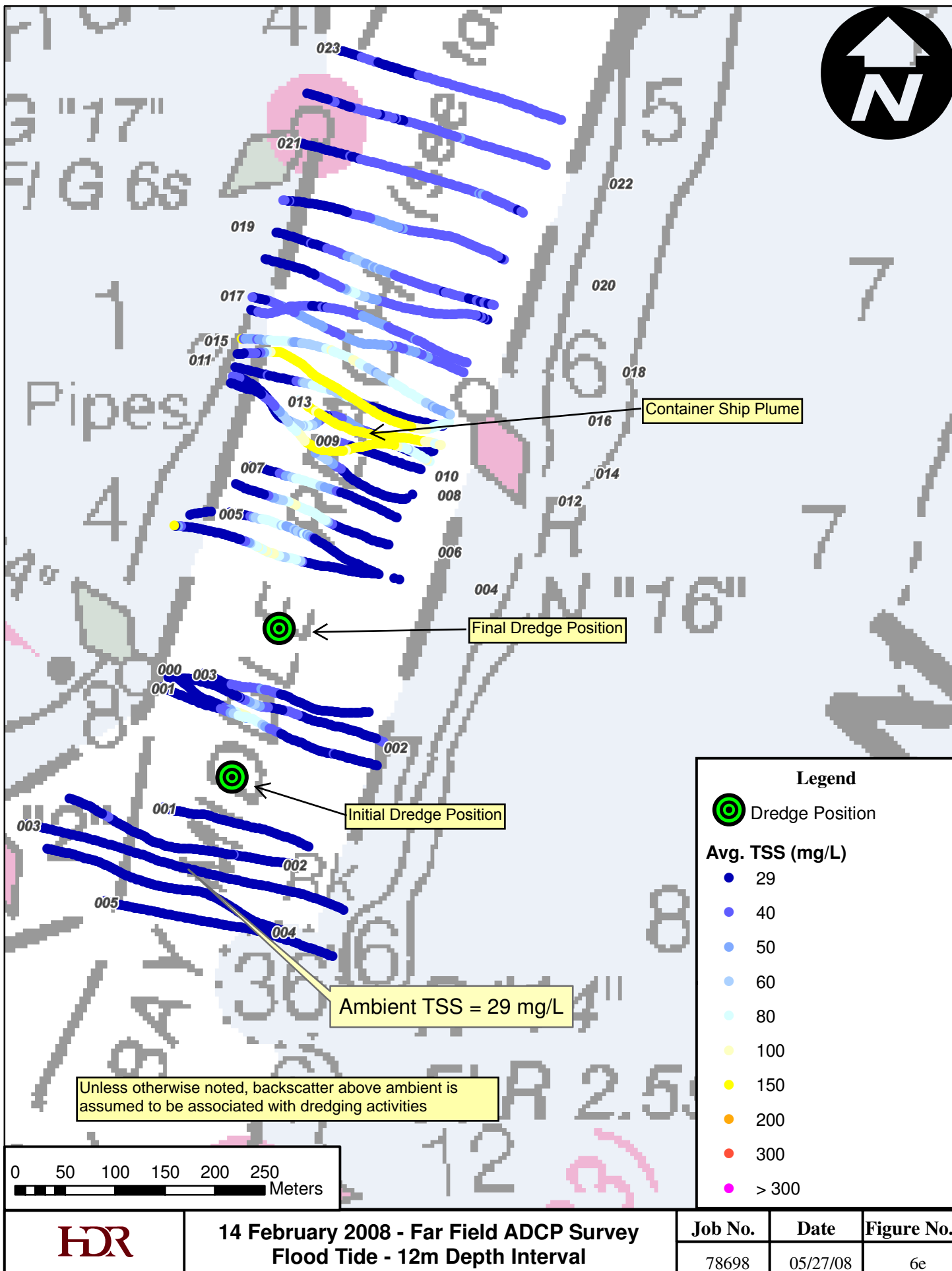
FIGURE
5y-zz

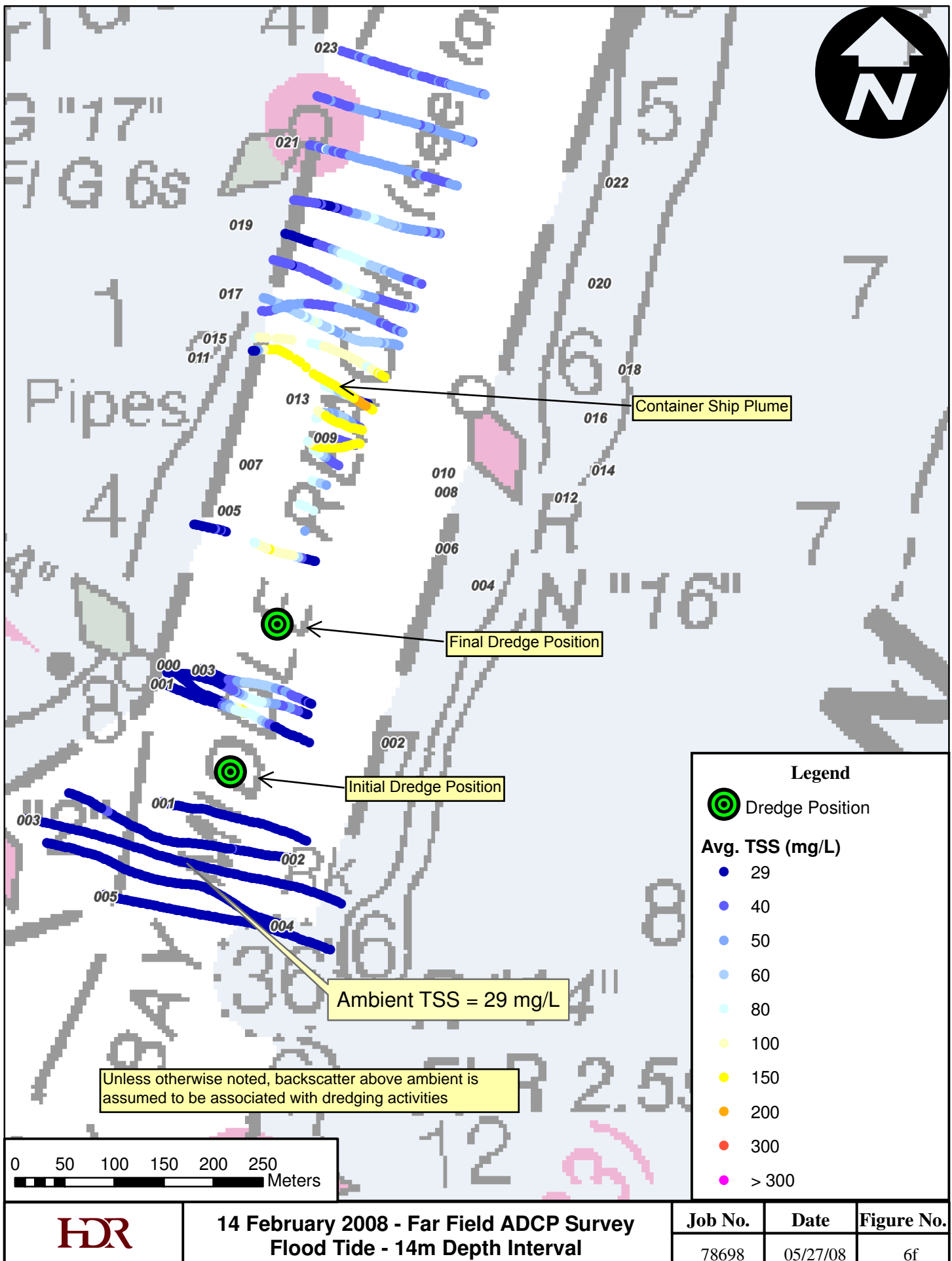


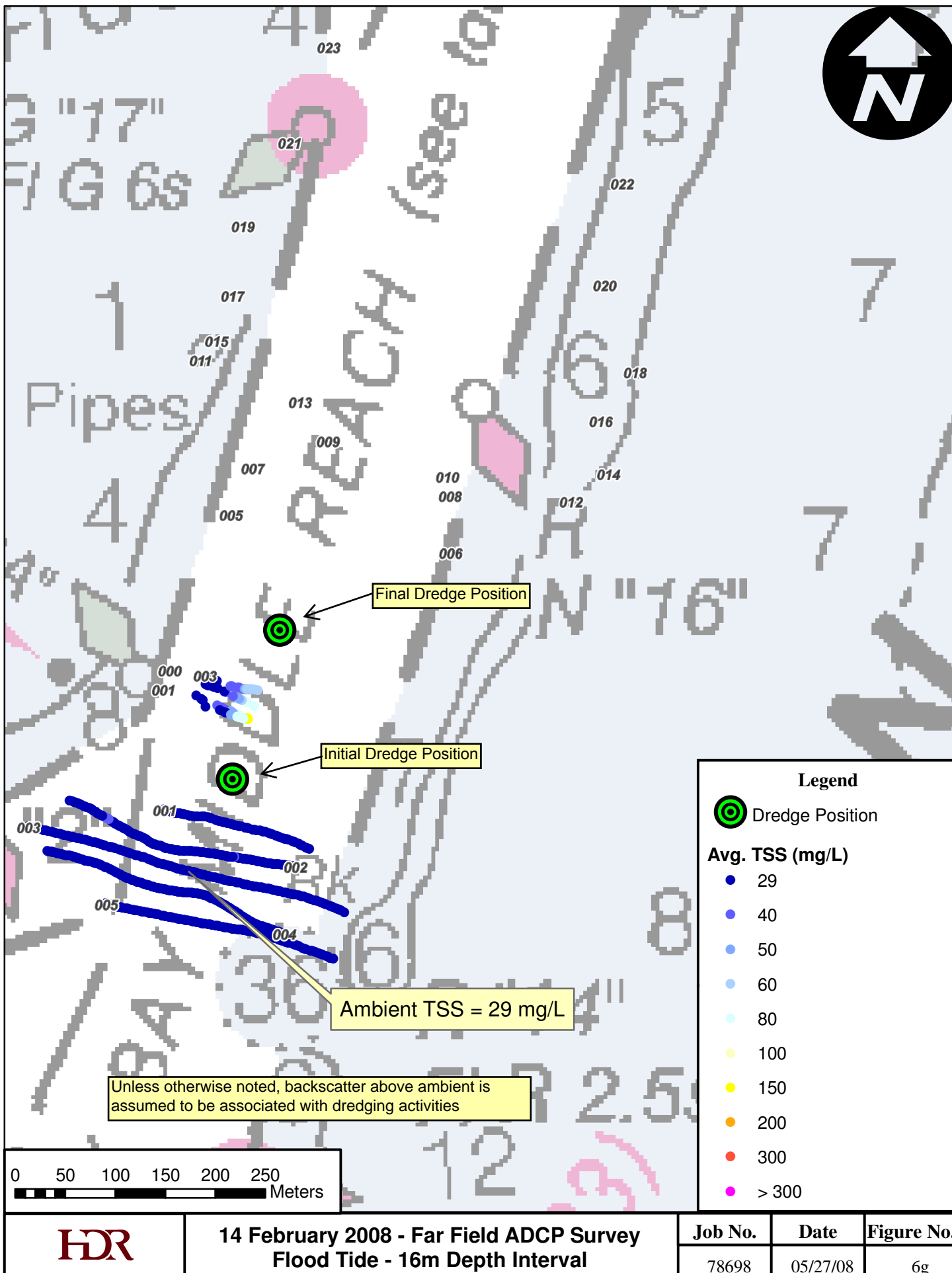


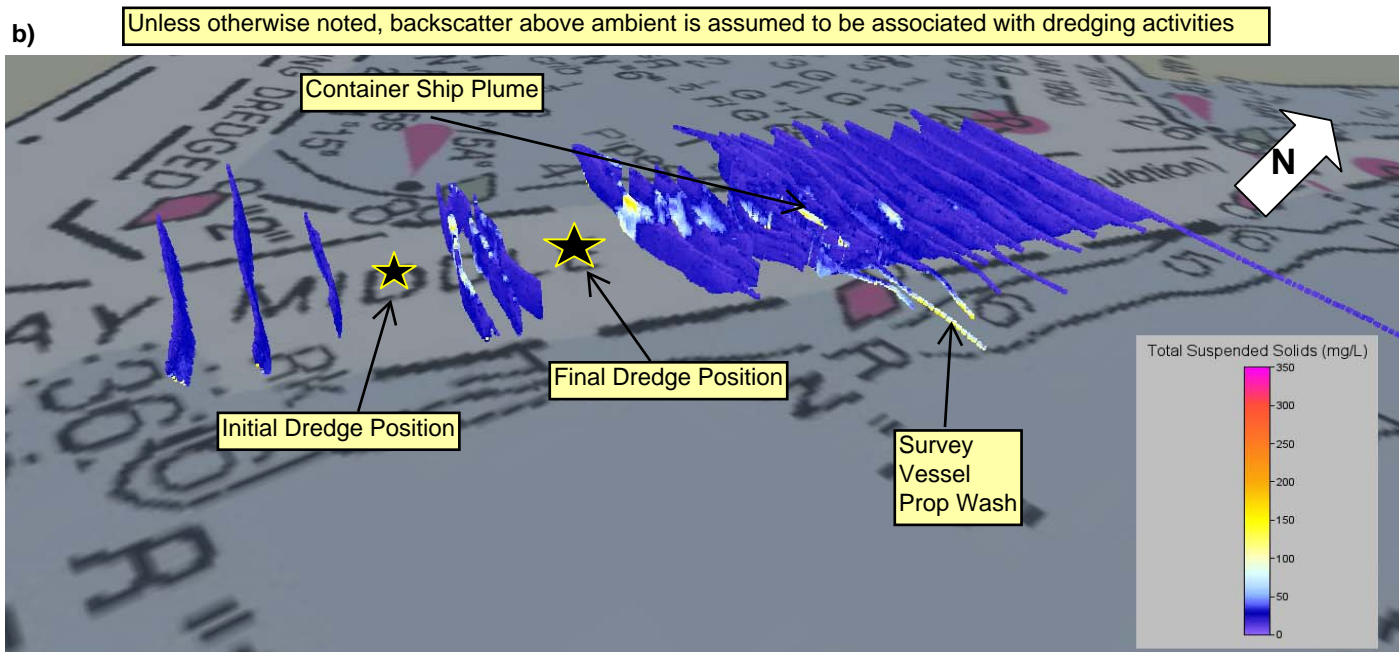
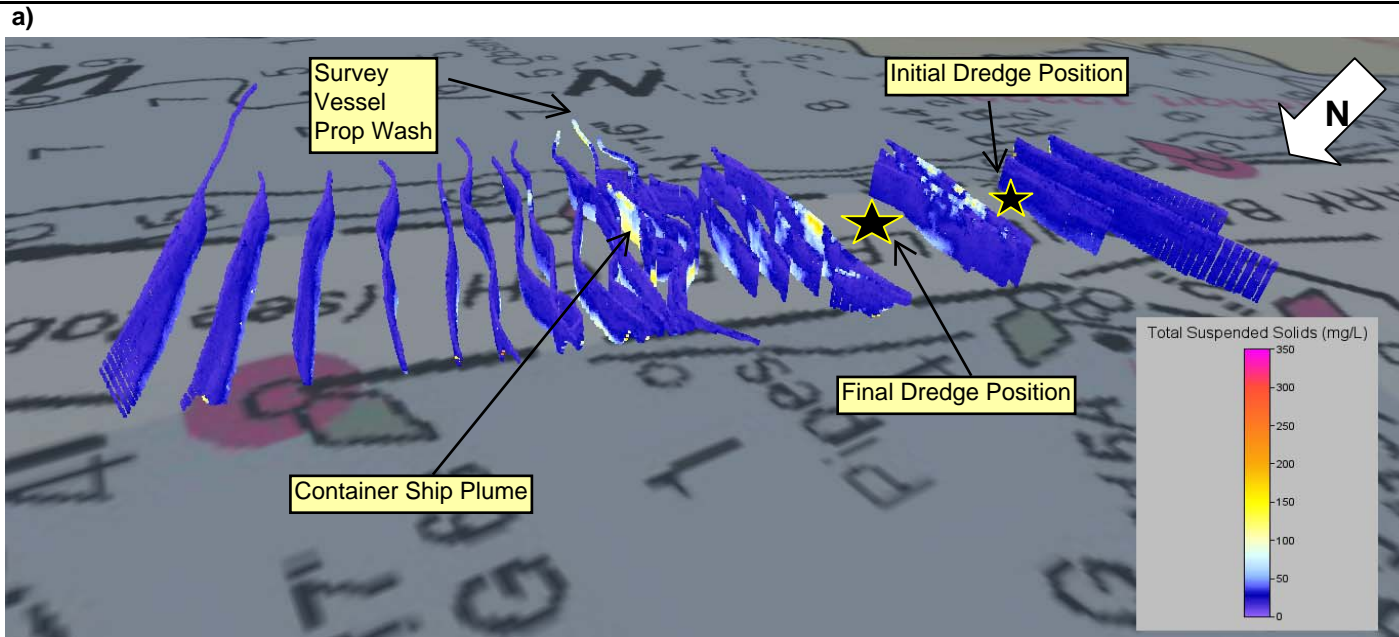












*Dredge position indicated by star



ADCP Average TSS Values with Respect to their x, y and z Coordinates
14 February 2008 Far Field Survey - Flood Tide

FIGURE

7a-b

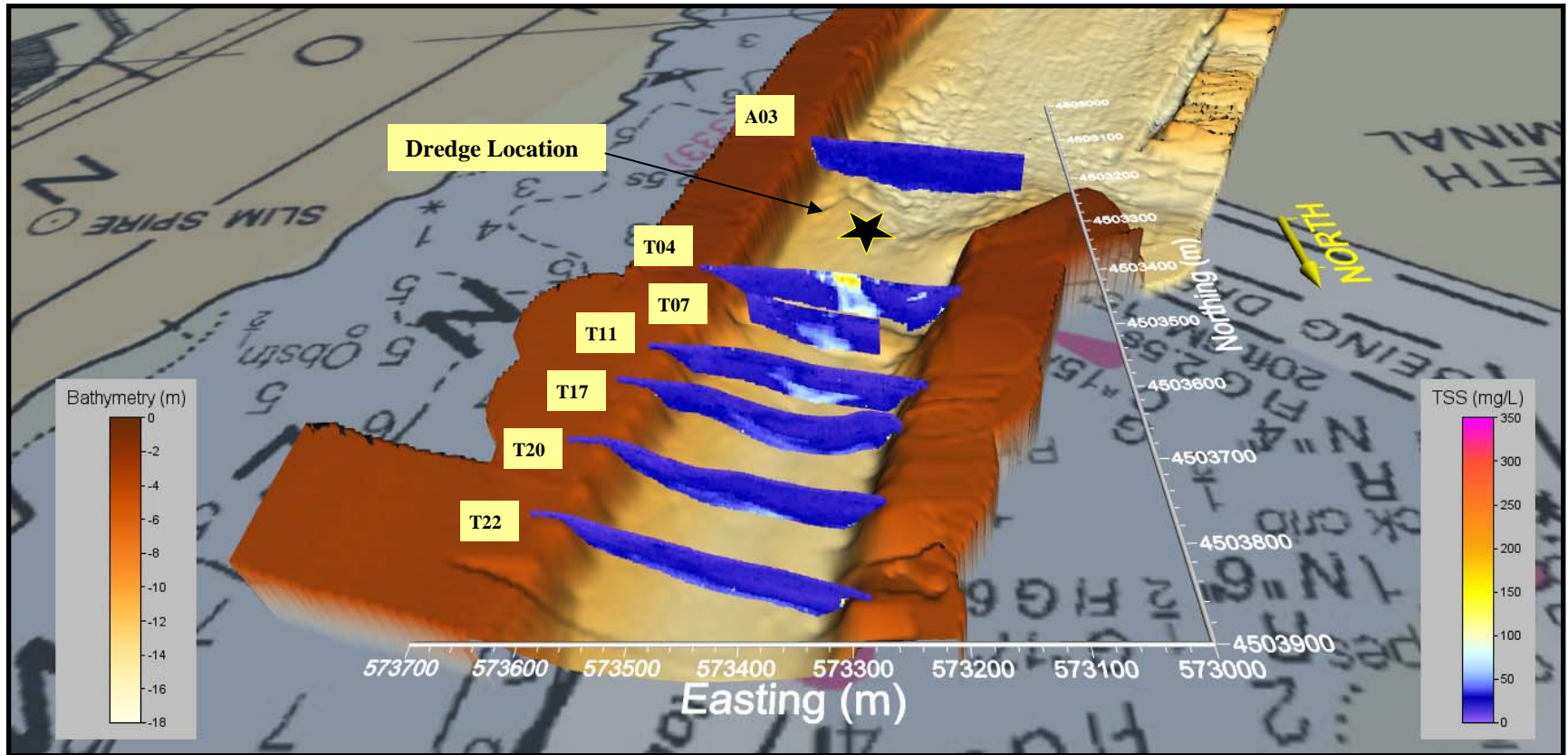
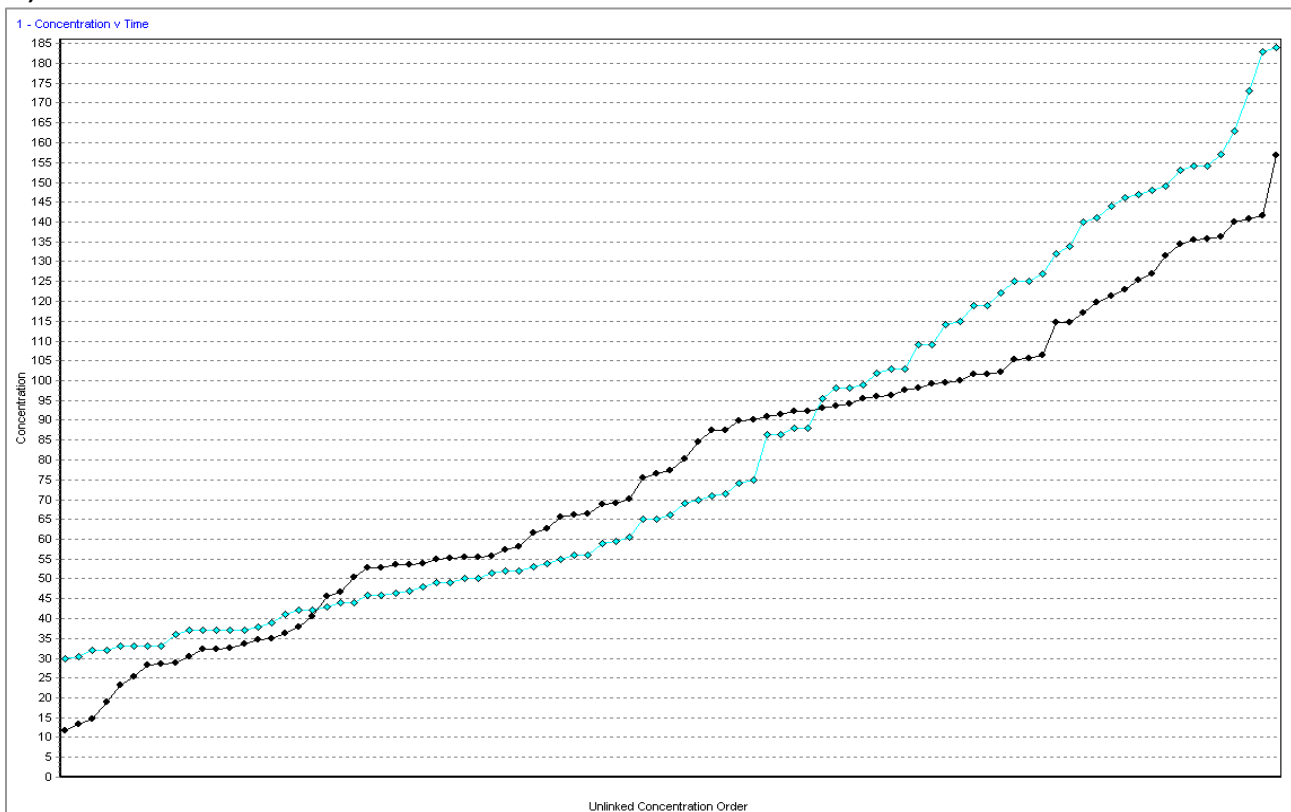


Figure 7c: ADCP Average TSS Values with Respect to their x, y and z Coordinates Superimposed on Channel Bathymetry. 14 February 2008 Far Field Survey - Flood Tide.

a) Rank Order



b) Paired Order

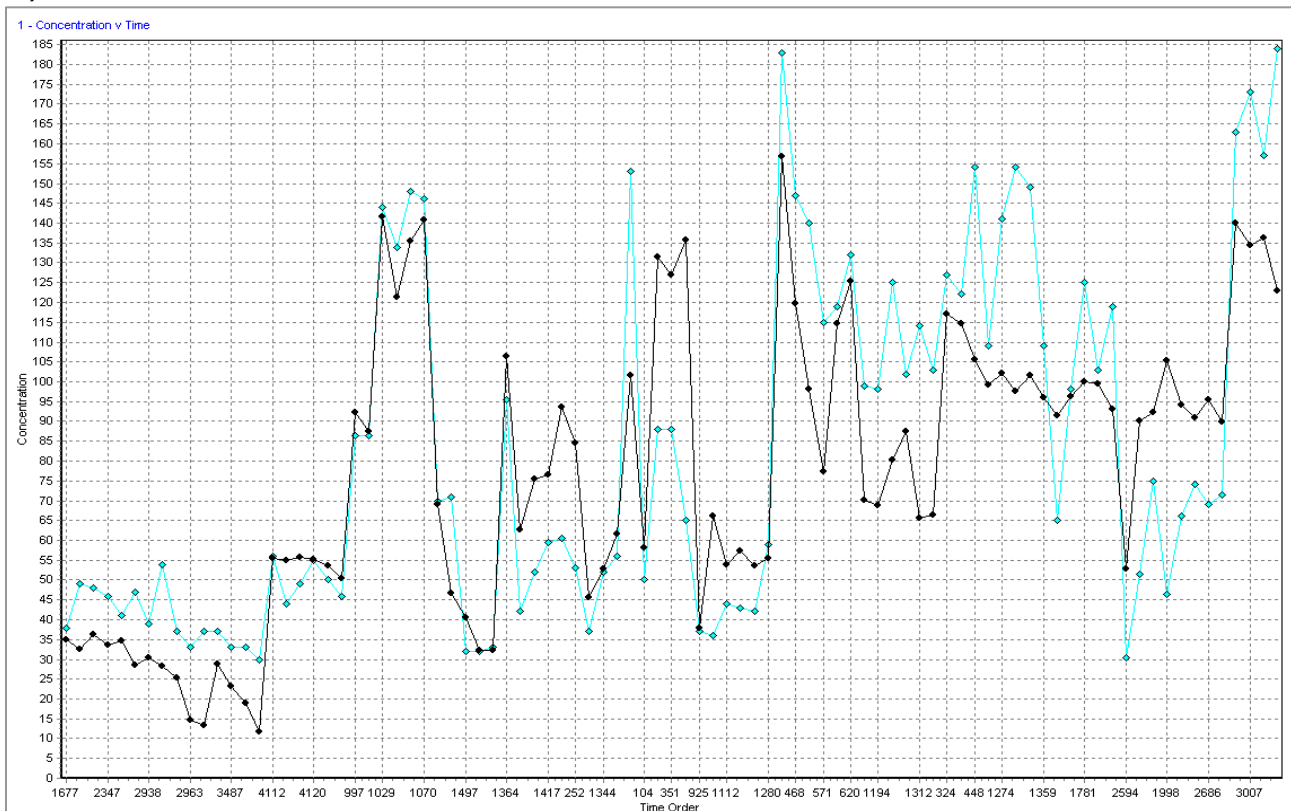


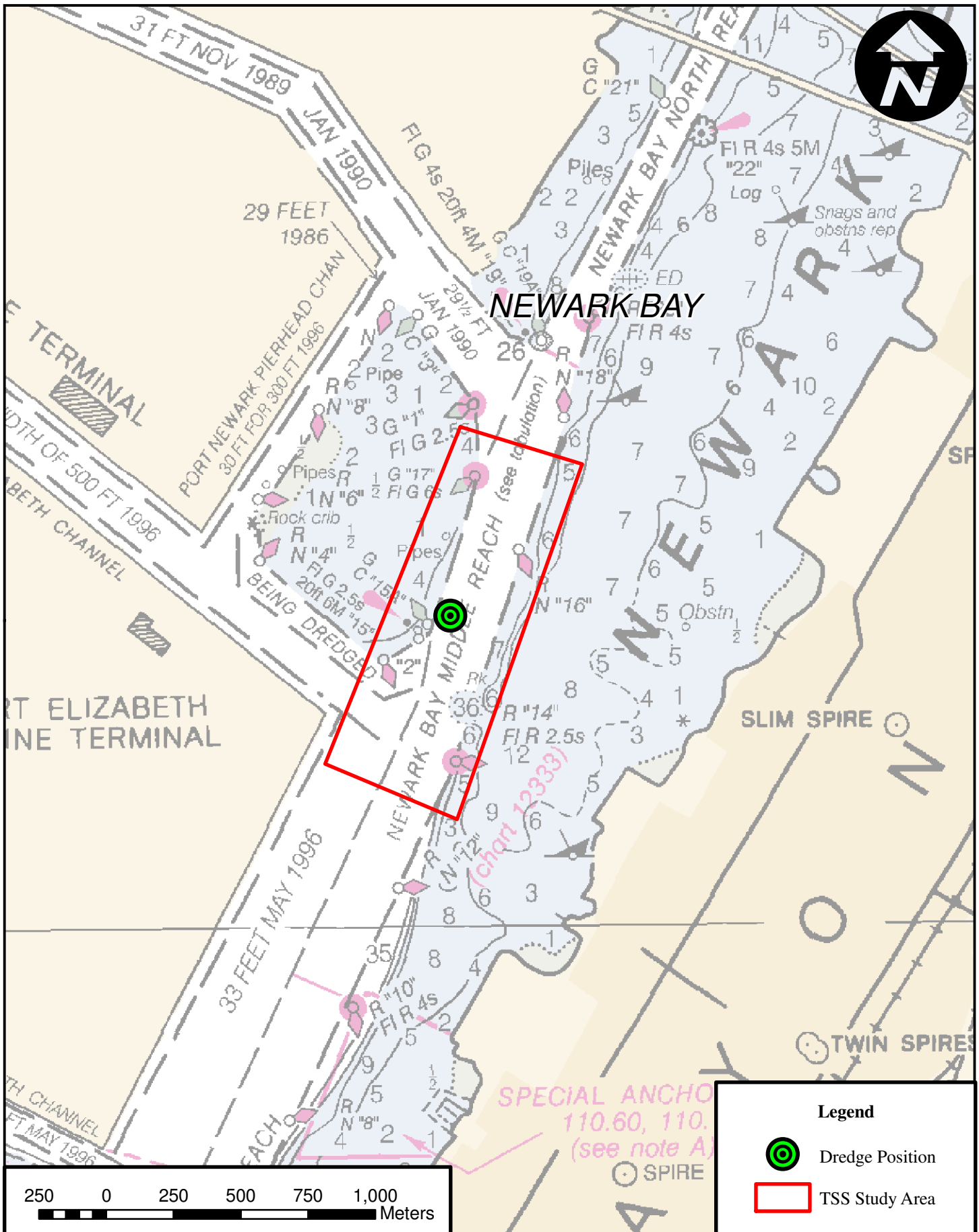
Table 4. Sediment Collection and Analyses Summary Table.

Area	Date Sampled	Grain Size Distribution ¹								Bulk Density ²		Atterberg Limits ³		
		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Moisture	Total Solids	Wet Bulk Density	Dry Bulk Density	Liquid Limit	Plastic Limit	Plasticity Index
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(g/cm3)	(g/cm3)			
Dredge Scow	1/29/2008	0.09	0.20	0.27	4.00	56.40	39.04	91	52	1.47	0.77	67	32	35
Dredge Scow	1/30/2008	0.00	0.03	0.41	4.30	53.95	41.31	98	50	1.46	0.74	68	32	36
Dredge Scow	1/31/2008	0.00	0.03	0.40	5.36	53.38	40.83	93	52	1.46	0.76	73	32	41
Dredge Field	1/31/2008	0.00	1.34	1.08	5.52	52.64	39.42	86	54	1.49	0.80	54	25	29
Dredge Scow	2/2/2008	0.00	0.19	0.51	4.79	52.93	41.58	119	46	1.40	0.64	77	32	45
Dredge Scow	2/7/2008	0.00	0.00	0.28	3.07	55.73	40.92	98	51	1.44	0.73	76	31	45
Dredge Scow	2/7/2008	0.00	0.00	0.28	3.28	56.53	39.91	98	51	1.45	0.73	76	31	45

¹ ASTM D422 Method

² EM 1110-2-1906 Method

³ ASTM D4318 Method



Legend		
	Dredge Position	
	TSS Study Area	



Newark Bay Far-Field Study Area

Job No.	Date	Figure
78698	6/6/08	1



Figure 1a: Showing the modified environmental bucket during typical dredging operations in Newark Bay during the Near-Field Pilot Study in February 2008.

Table 1. Laboratory Results of Water Samples

Sample Date	Sample Time	Location	Turbidity (NTU)	TSS (mg/l)
2/8/08	08:34:36	Ambient	11.5	38
2/8/08	08:34:56	Ambient	14.1	49
2/8/08	08:35:22	Ambient	7.4	31
2/8/08	08:49:38	Ambient	13.1	48
2/8/08	08:50:01	Ambient	12.8	46
2/8/08	08:50:11	Ambient	11.2	41
2/8/08	08:50:26	Ambient	8.1	47
2/8/08	08:50:47	Ambient	9.7	41
2/8/08	09:03:37	Plume	8.2	39
2/8/08	09:03:55	Plume	10.6	54
2/8/08	09:04:02	Plume	10.6	37
2/8/08	09:04:12	Plume	8.7	33
2/8/08	09:04:21	Plume	7.4	37
2/8/08	09:04:28	Plume	7.6	35
2/8/08	09:16:02	Plume	12.5	37
2/8/08	09:16:16	Plume	4.4	33
2/8/08	09:16:24	Plume	5.5	33
2/8/08	09:16:29	Plume	7.7	39
2/8/08	09:16:33	Plume	8.8	30
2/8/08	09:16:38	Plume	3.3	33
2/8/08	09:30:38	Plume	4.0	56
2/8/08	09:30:43	Plume	15.4	44
2/8/08	09:30:47	Plume	10.3	49
2/8/08	09:30:50	Plume	15.5	55
2/8/08	09:30:57	Plume	2.5	50
2/8/08	09:31:01	Plume	12.6	46
2/8/08	10:58:34	Plume	31.1	70
2/8/08	10:58:48	Plume	14.2	71
2/8/08	10:59:03	Plume	19.5	82
2/8/08	10:59:06	Plume	10.6	32
2/8/08	10:59:11	Plume	8.1	33
2/8/08	10:59:55	Plume	7.3	44
2/8/08	11:30:57	Plume	31.6	63
2/8/08	11:31:26	Plume	8.5	32
2/8/08	11:31:32	Plume	10.3	38
2/8/08	11:31:39	Plume	13.1	43
2/8/08	11:31:43	Plume	13.1	41
2/8/08	11:31:49	Plume	8.7	53
2/8/08	12:30:52	Plume	19.0	52
2/8/08	12:31:23	Plume	11.8	34
2/8/08	12:31:43	Plume	6.9	31
2/8/08	12:32:00	Plume	16.6	57
2/8/08	12:32:19	Plume	25.9	57
2/8/08	12:43:27	Plume	12.0	34
2/8/08	12:44:02	Plume	16.3	39
2/8/08	12:44:08	Plume	16.8	76
2/8/08	12:44:14	Plume	25.6	56
2/8/08	12:44:19	Plume	16.6	45

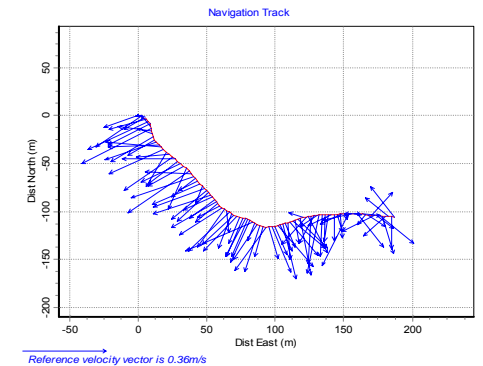
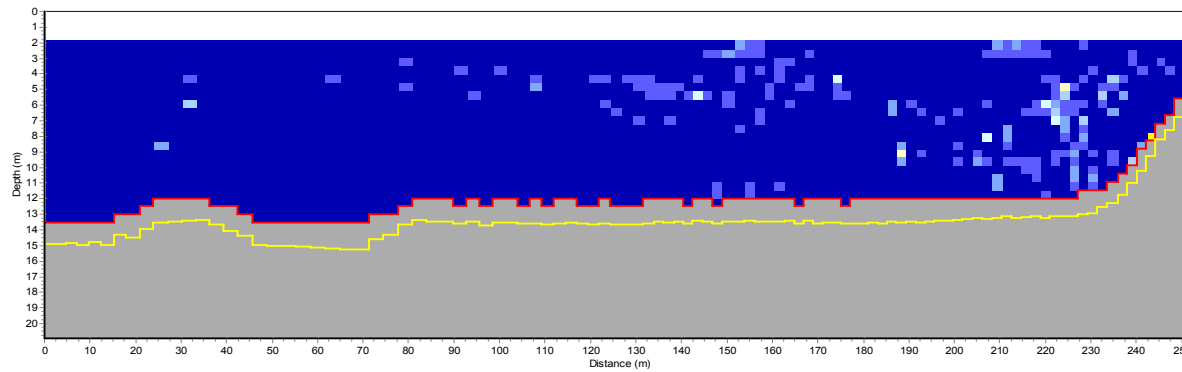
Sample Date	Sample Time	Location	Turbidity (NTU)	TSS (mg/l)
2/8/08	12:44:35	Plume	36.7	65
2/8/08	13:06:50	Plume	13.4	34
2/8/08	13:07:51	Plume	12.1	32
2/8/08	13:08:25	Plume	10.1	30
2/8/08	13:08:44	Plume	11.2	29
2/8/08	13:08:51	Plume	10.1	34
2/8/08	13:08:57	Plume	10.6	31
2/8/08	13:46:03	Plume	15.4	37
2/8/08	13:47:06	Plume	15.5	52
2/8/08	13:47:17	Plume	25.6	56
2/8/08	13:47:24	Plume	129.0	300
2/8/08	13:47:34	Plume	74.0	153
2/8/08	14:00:17	Plume	20.5	50
2/8/08	14:04:54	Plume	19.5	54
2/8/08	14:05:51	Plume	37.7	88
2/8/08	14:05:58	Plume	39.0	88
2/8/08	14:06:07	Plume	24.9	65
2/8/08	14:19:07	Plume	14.1	37
2/8/08	14:20:48	Plume	10.3	36
2/8/08	14:23:28	Plume	21.4	44
2/8/08	14:27:05	Plume	15.5	43
2/8/08	14:27:13	Plume	14.4	42
2/8/08	14:27:20	Plume	14.1	59
2/13/08	10:33:44	Plume	30.5	87
2/13/08	10:33:57	Plume	30.8	87
2/13/08	10:34:26	Plume	48.6	144
2/13/08	10:34:44	Plume	56.4	134
2/13/08	10:34:53	Plume	64.4	148
2/13/08	10:35:17	Plume	46.8	146
2/13/08	10:49:48	Plume	94.0	212
2/13/08	10:50:22	Plume	83.0	201
2/13/08	10:50:43	Plume	75.5	197
2/13/08	10:50:57	Plume	68.5	179
2/13/08	10:51:09	Plume	69.0	152
2/13/08	11:15:53	Plume	16.7	96
2/13/08	11:17:03	Plume	17.2	42
2/13/08	11:17:17	Plume	17.3	52
2/13/08	11:17:25	Plume	19.5	60
2/13/08	11:17:52	Plume	18.4	61
2/13/08	14:18:04	Plume	80.0	183
2/13/08	14:18:23	Plume	59.6	147
2/13/08	14:19:27	Plume	53.0	140
2/13/08	14:20:37	Plume	38.2	115
2/13/08	14:20:56	Plume	46.0	119
2/13/08	14:21:44	Plume	45.4	132
2/13/08	14:33:40	Plume	33.4	99
2/13/08	14:34:20	Plume	31.7	98
2/13/08	14:35:59	Plume	31.2	125
2/13/08	14:36:20	Plume	27.5	102
2/13/08	14:36:55	Plume	27.9	114

Sample Date	Sample Time	Location	Turbidity (NTU)	TSS (mg/l)
2/13/08	14:37:32	Plume	27.5	103
2/13/08	14:54:37	Plume	42.4	127
2/13/08	14:55:32	Plume	33.4	122
2/13/08	14:57:20	Plume	64.4	154
2/13/08	14:58:28	Plume	71.8	191
2/13/08	14:58:38	Plume	79.0	193
2/13/08	15:15:18	Plume	47.4	109
2/13/08	15:15:24	Plume	79.4	141
2/13/08	15:15:40	Plume	68.0	154
2/13/08	15:15:50	Plume	58.0	149
2/13/08	15:17:17	Plume	30.9	109
2/13/08	15:20:14	Plume	23.0	65
2/13/08	15:26:09	Plume	47.0	98
2/13/08	15:26:33	Plume	50.6	125
2/13/08	15:27:56	Plume	30.8	103
2/13/08	15:31:28	Plume	38.7	119
2/13/08	15:44:20	Plume	5.8	30
2/13/08	16:25:15	Plume	17.5	52
2/13/08	16:29:03	Plume	25.5	75
2/13/08	16:30:56	Plume	19.0	47
2/13/08	16:41:06	Plume	26.7	66
2/13/08	16:41:45	Plume	31.6	74
2/13/08	16:45:58	Plume	24.0	69
2/13/08	16:51:20	Plume	26.1	72
2/13/08	16:52:42	Plume	63.2	163
2/13/08	16:53:00	Plume	77.0	173
2/13/08	16:53:14	Plume	60.8	157
2/13/08	16:53:33	Plume	79.0	210
2/13/08	16:53:51	Plume	77.8	184

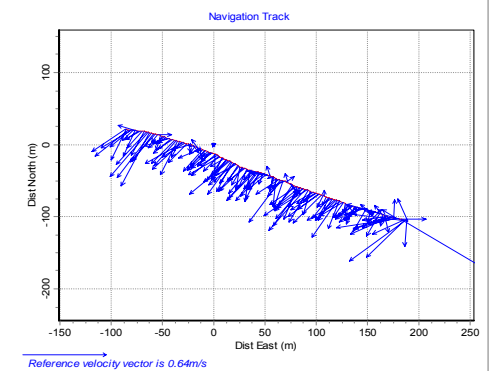
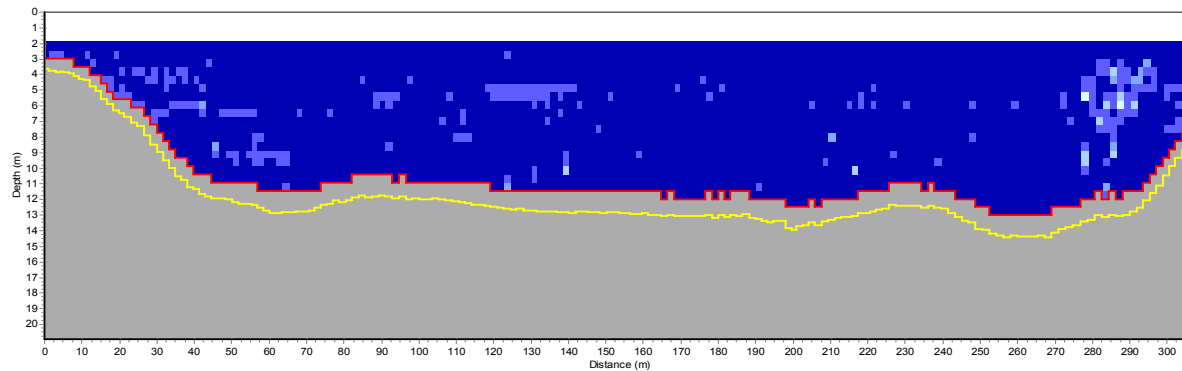
Table 2. 2 February 2008 Far Field Ebb Tide Survey Transect Summary Table

Transect Number	Figure Number	Time	Approximate Distance to Dredge (m)	Transect Length (m)	Plume Description	Additional Remarks
A00	2a	9:29:23	25	253	Ambient	Transects astern of dredge
A01	2b	9:32:18	50	308	Ambient	Astern of dredge
A02	2c	9:37:29	70	290	Ambient	Some prop wash astern of dredge
T00	2d	10:55:14	36	254	Plume approx. 50 m wide throughout the water column with max concentrations between 200-300 mg/l	Transects off the bow of the platform
T01	2e	10:58:35	51	176	Plume approx. 70 m wide with max concentrations near the surface between 200-300 mg/l	Short transect due to Green Buoy "15A"
T02	2f	11:01:30	76	272	Plume approx. 70 m wide with max concentrations near the surface between 200-300 mg/l	
T03	2g	11:05:00	101	299	Plume approx. 70 m wide with max concentrations between 100-150 mg/l	
T04	2h	11:09:19	126	261	Plume approx. 70 m wide with max concentrations < 80 mg/l	
T05	2i	11:12:53	151	274	Plume approx. 70 m wide with max concentrations < 80 mg/l	
T06	2j	11:16:20	176	274	Plume approx. 70 m wide with max concentrations < 80 mg/l near the surface	
T07	2k	11:19:59	201	276	Plume approx. 70 m wide with max concentrations < 80 mg/l near the surface	Tug prop wash towards end of transect
T08	2l	11:23:11	226	278	Plume approx. 70 m wide with max concentrations < 60 mg/l	Tug prop wash towards beginning of transect
T09	2m	11:26:57	251	294	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T10	2n	11:30:19	276	331	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T11	2o	11:34:39	301	301	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T12	2p	11:38:21	326	300	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T13	2q	11:42:21	351	302	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T14	2r	11:46:51	376	302	Plume approx. 70 m wide with max concentrations < 60 mg/l near the surface	
T15	2s	11:50:48	401	168	Plume approx. 50 m wide with max concentrations < 60 mg/l near the surface	Transect short, tug passing
T16	2t	11:56:50	426	318	Plume approx. 50 m wide with max concentrations < 60 mg/l near the surface	Prop wash from tug
T17	2u	12:02:20	451	311	Plume approx. 50 m wide with max concentrations < 60 mg/l near the surface	
T18	2v	12:06:38	476	339	Core of plume < 40 mg/l	
T19	2w	12:11:26	501	338	Core of plume < 40 mg/l	
T20	2x	12:15:43	551	317	Core of plume < 40 mg/l	50 meter transect increments
T21	2y	12:20:45	601	337	Core of plume < 40 mg/l	

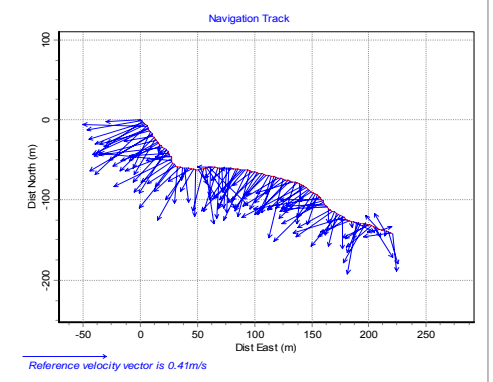
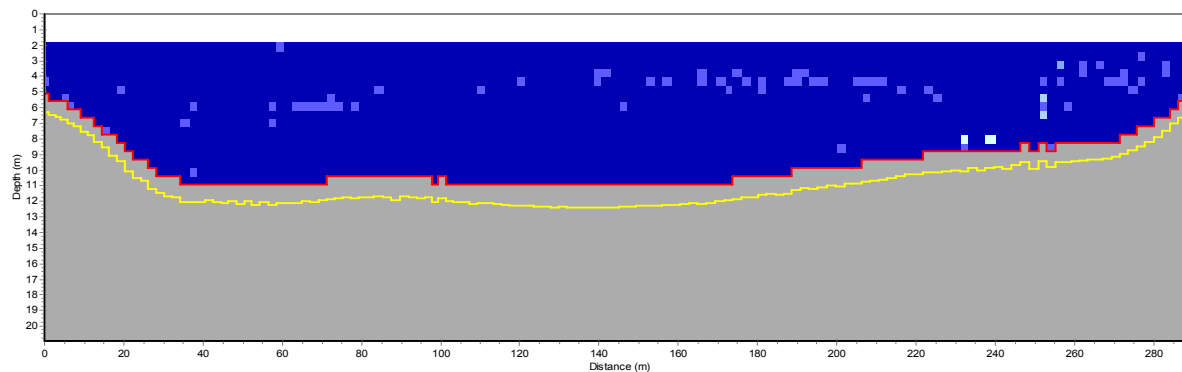
a) Ambient A00 - Upcurrent 25 m*



b) Ambient A01 - Upcurrent 50 m*



c) Ambient A02 - Upcurrent 75 m*



*Approximate distance upcurrent from source

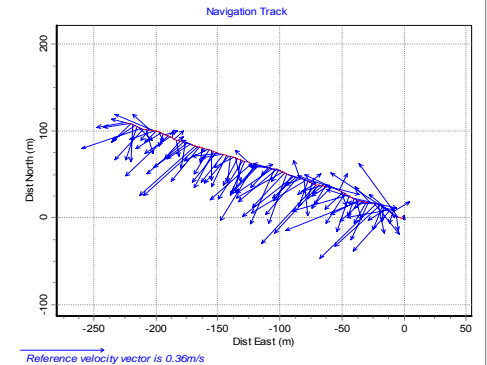
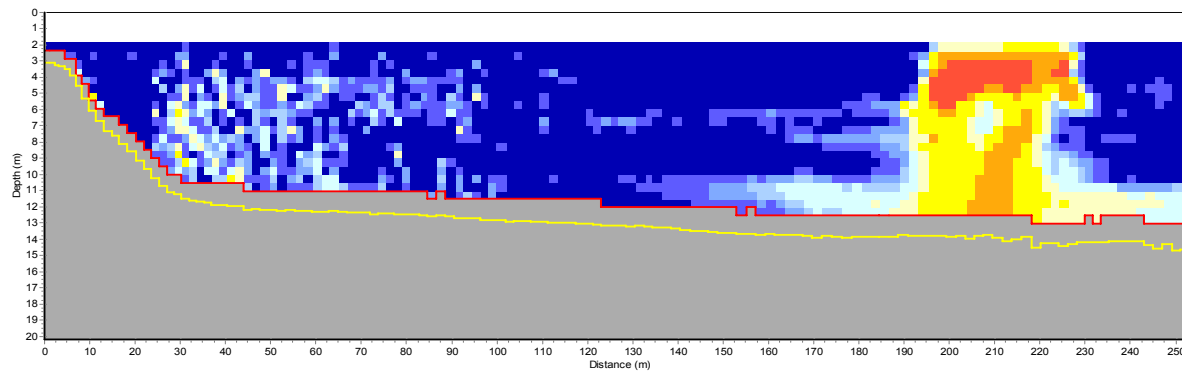
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



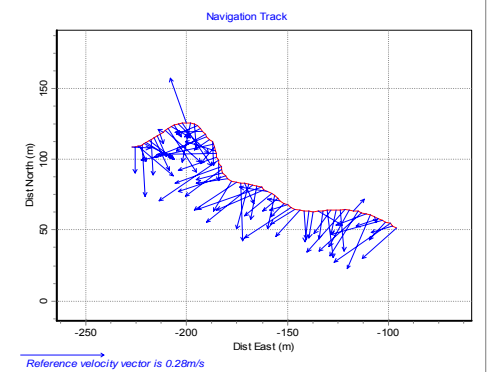
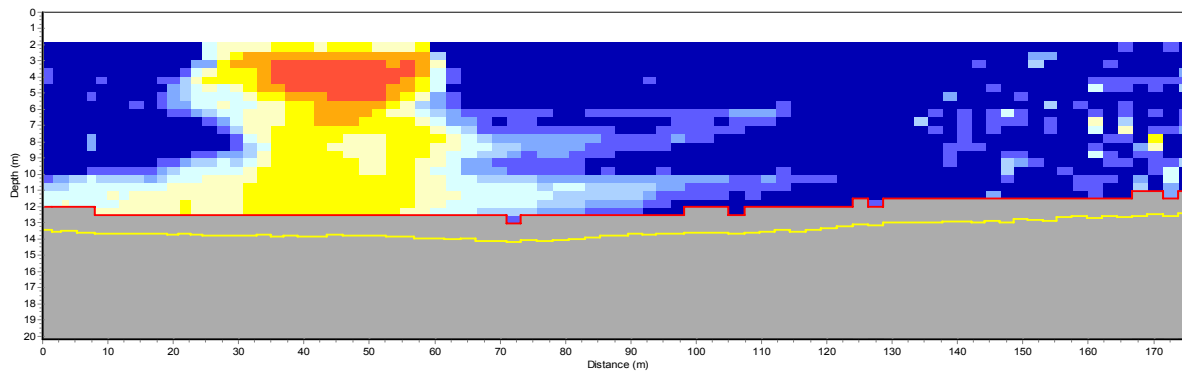
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2a-c

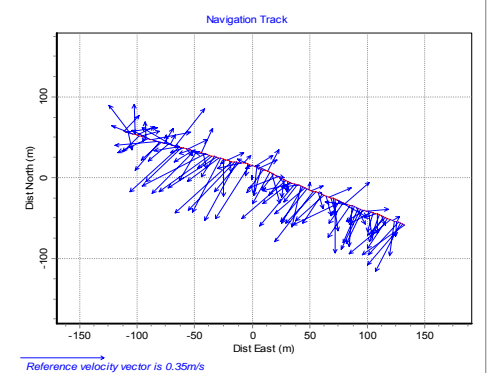
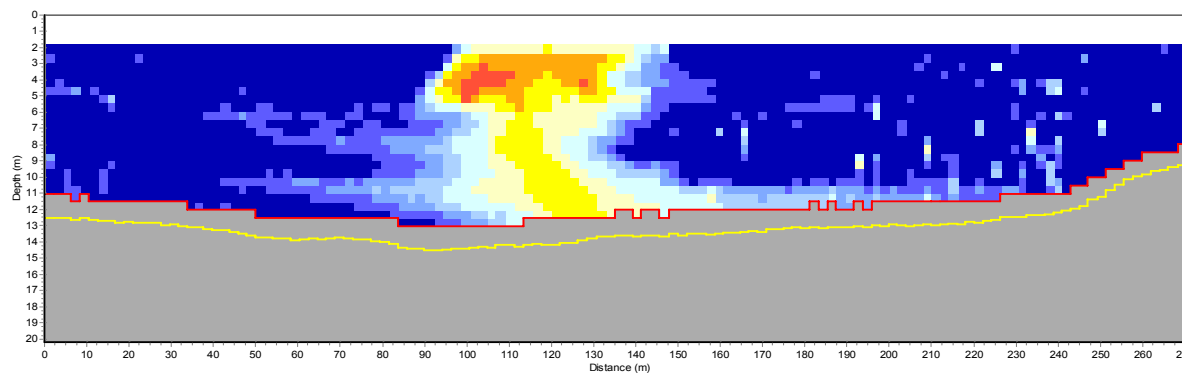
d) Transect T00 - Downcurrent 36 m*



e) Transect T01 - Downcurrent 51 m*



f) Transect T02 - Downcurrent 76 m*



*Approximate distance downcurrent from source

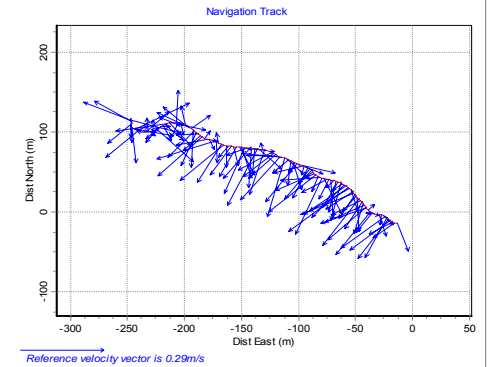
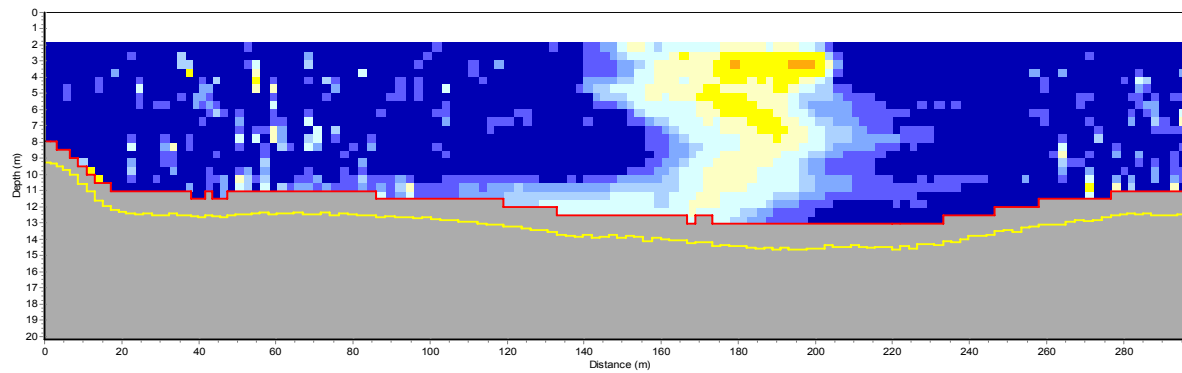
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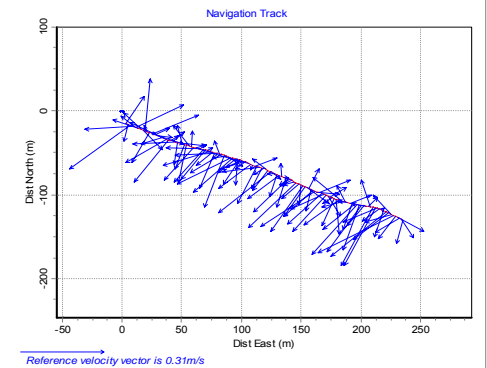
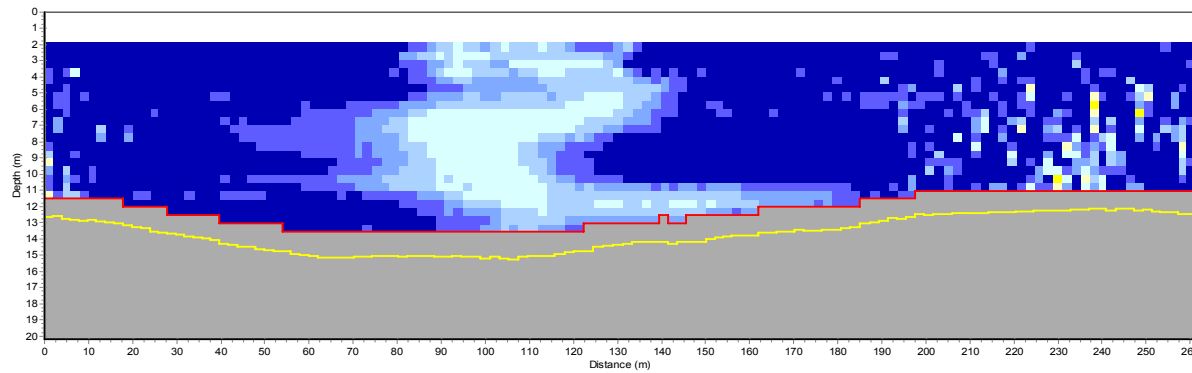
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2d-f

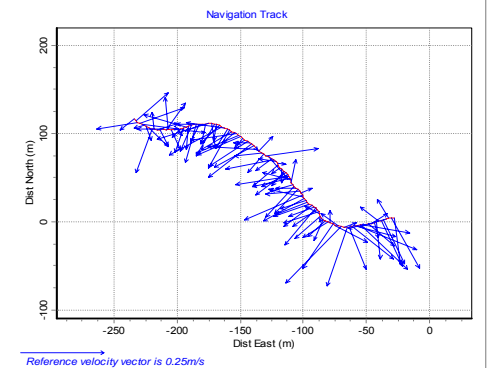
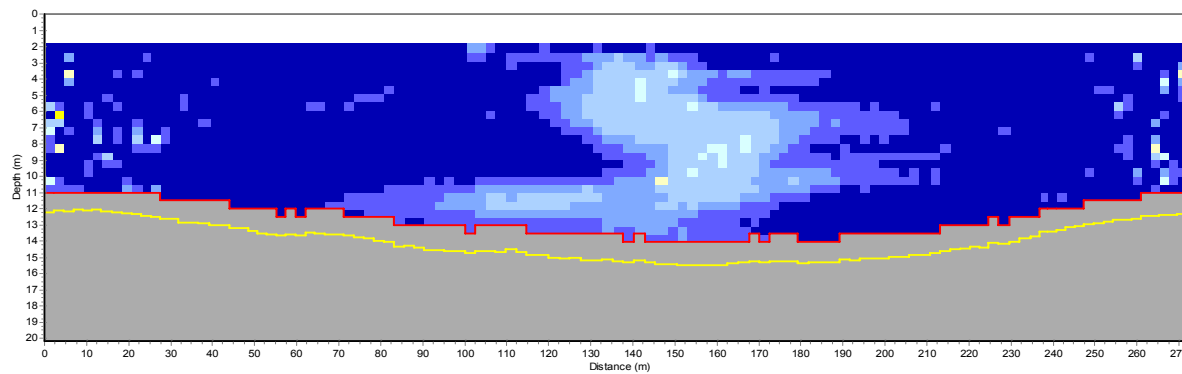
g) Transect T03 - Downcurrent 101 m*



h) Transect T04 - Downcurrent 126 m*



i) Transect T05 - Downcurrent 151 m*



*Approximate distance downcurrent from source

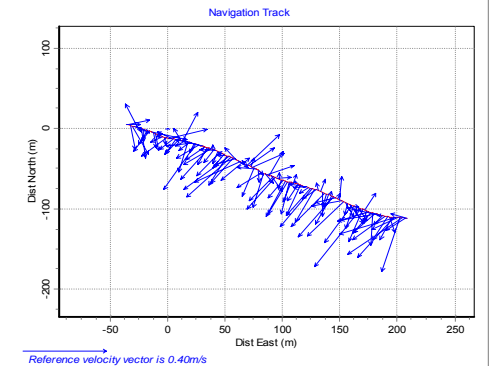
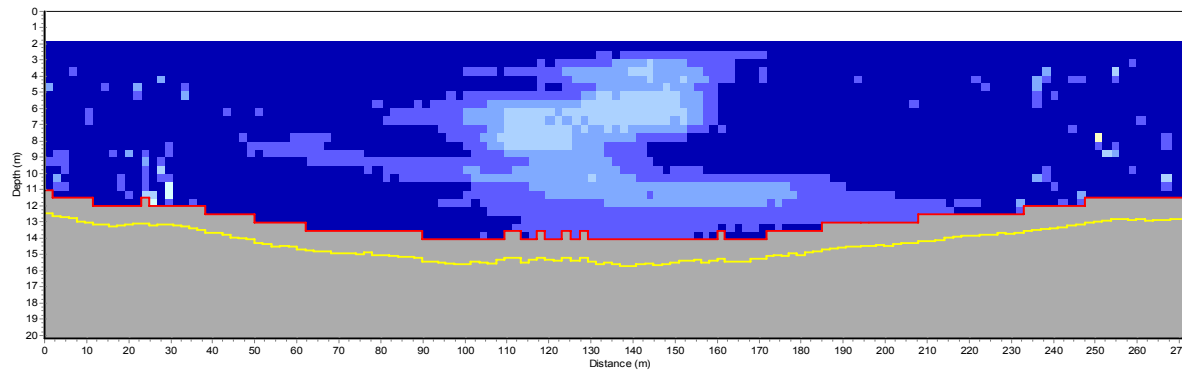
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



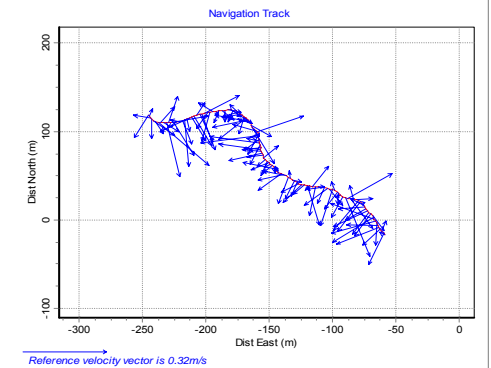
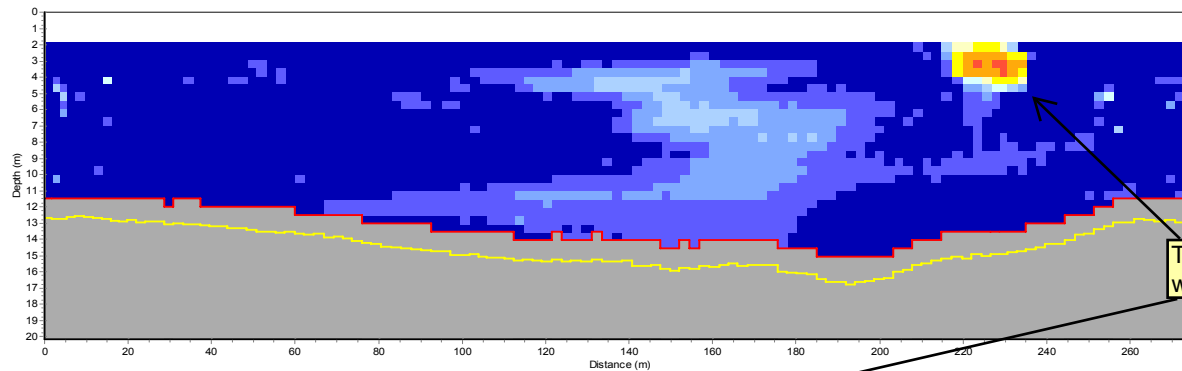
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2g-i

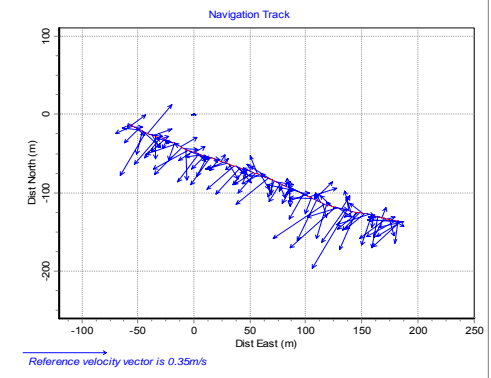
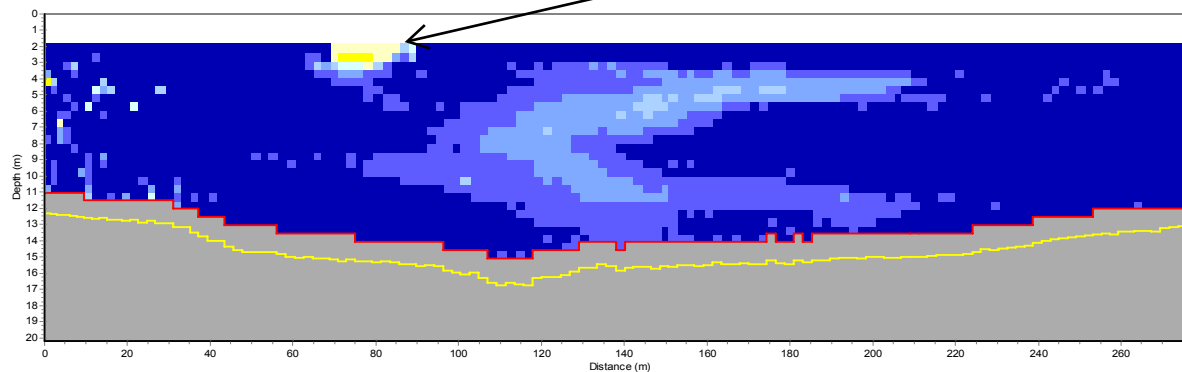
j) Transect T06 - Downcurrent 176 m*



k) Transect T07 - Downcurrent 201 m*



l) Transect T08 - Downcurrent 226 m*



*Approximate distance downcurrent from source

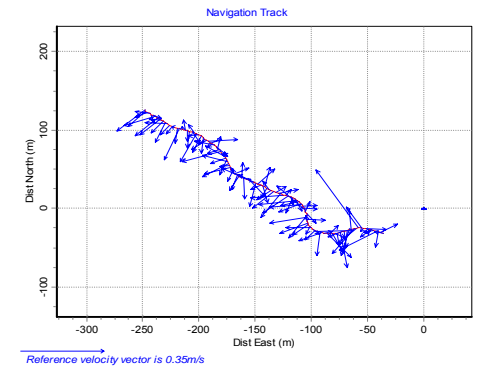
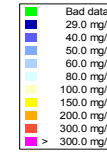
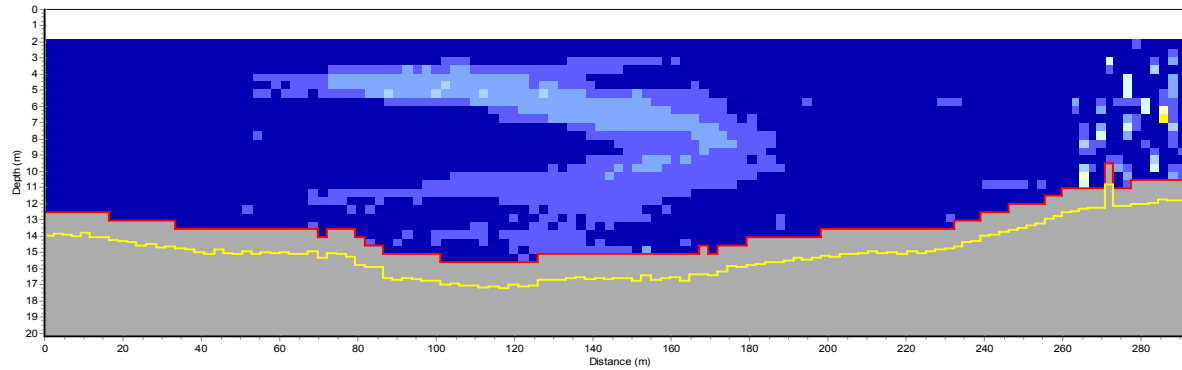
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



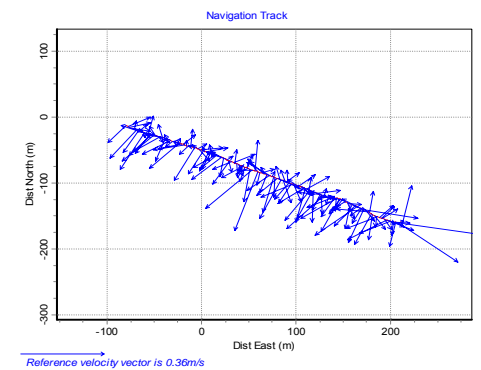
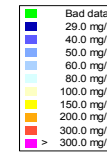
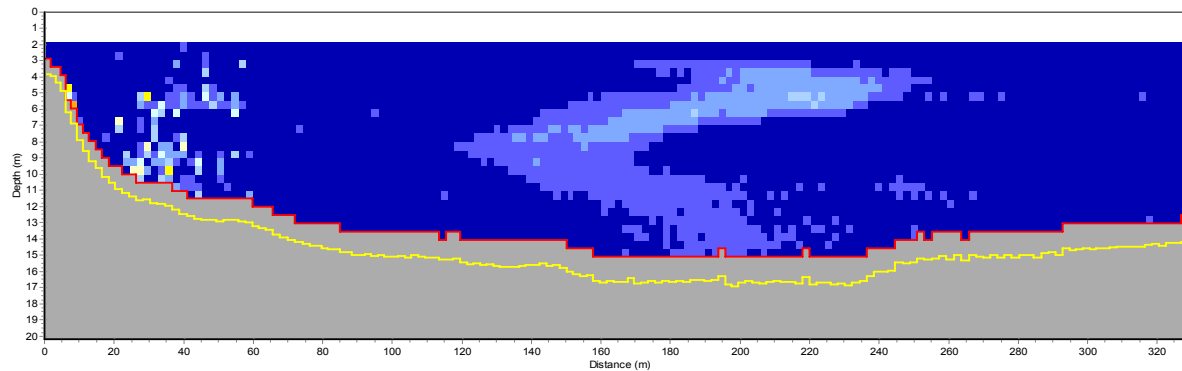
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2j-I

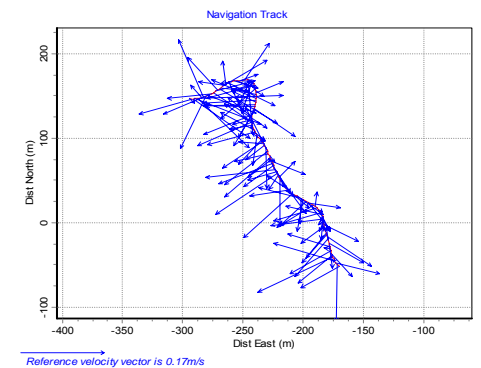
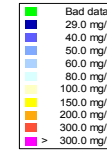
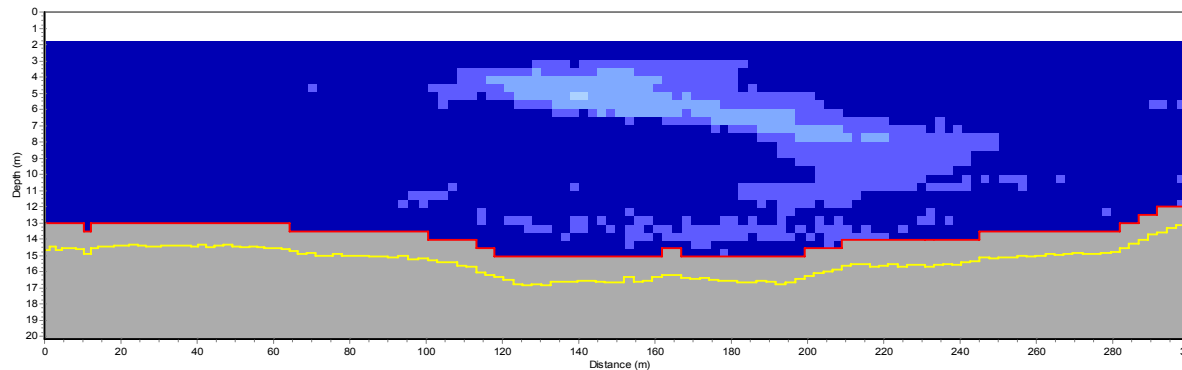
m) Transect T09 - Downcurrent 251 m*



n) Transect T10 - Downcurrent 276 m*



o) Transect T11 - Downcurrent 301 m*



*Approximate distance downcurrent from source

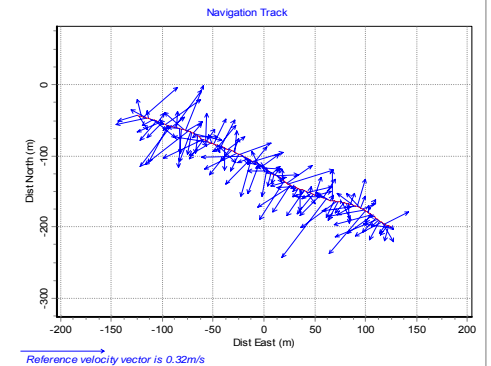
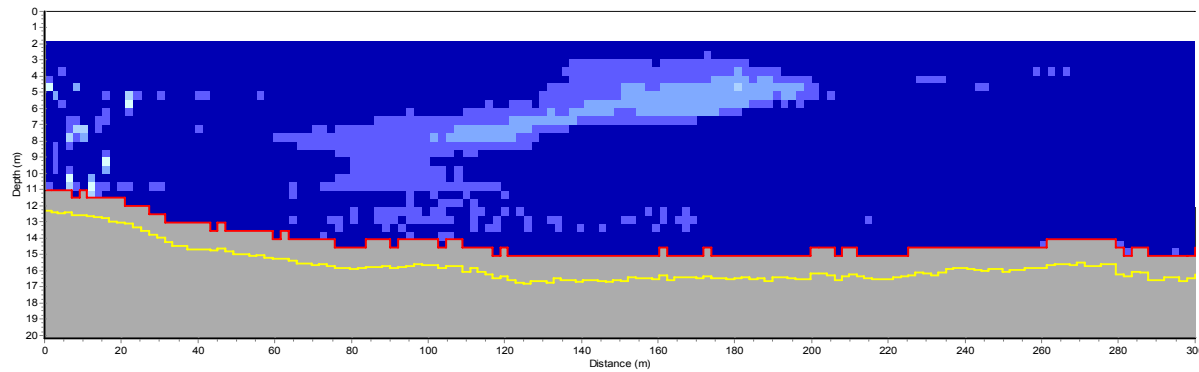
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



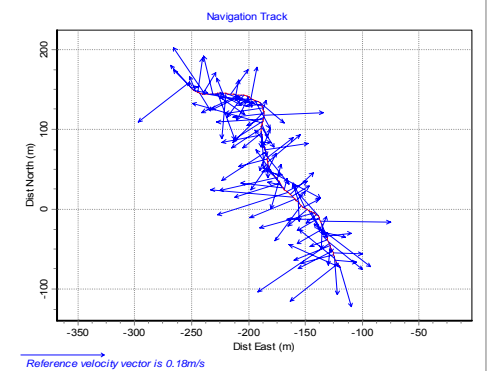
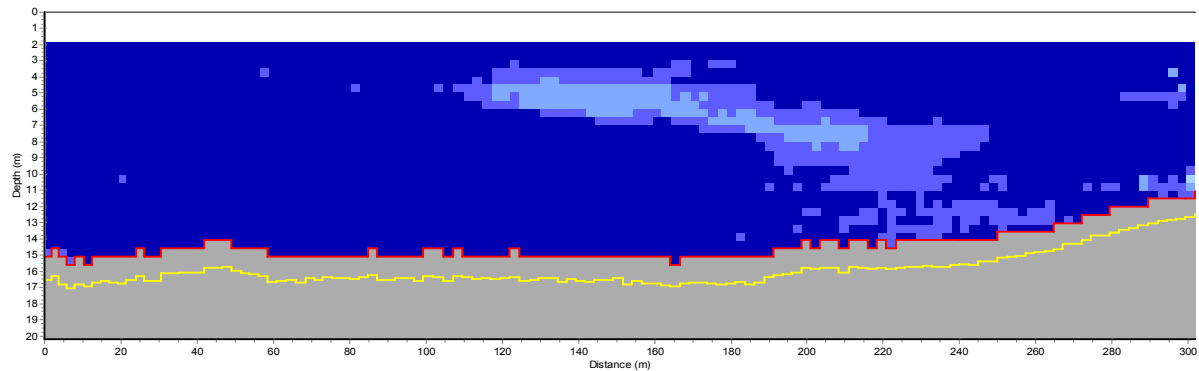
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2m-o

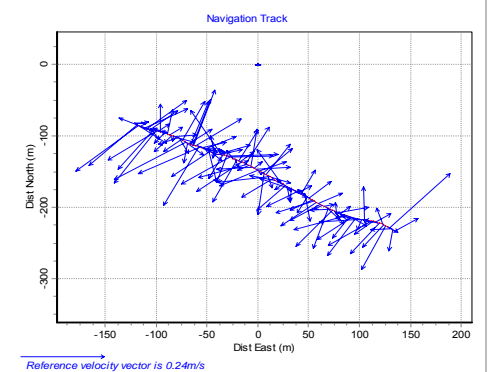
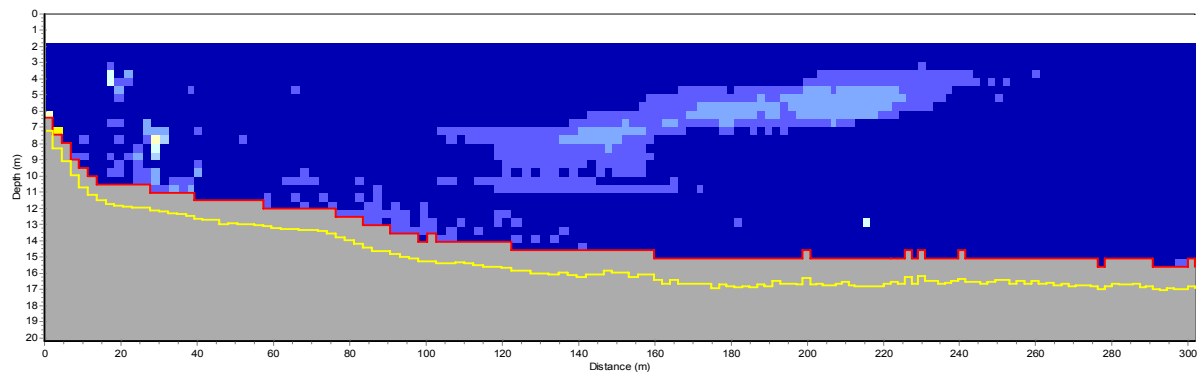
p) Transect T12 - Downcurrent 326 m*



q) Transect T13 - Downcurrent 351 m*



r) Transect T14 - Downcurrent 376 m*



*Approximate distance downcurrent from source

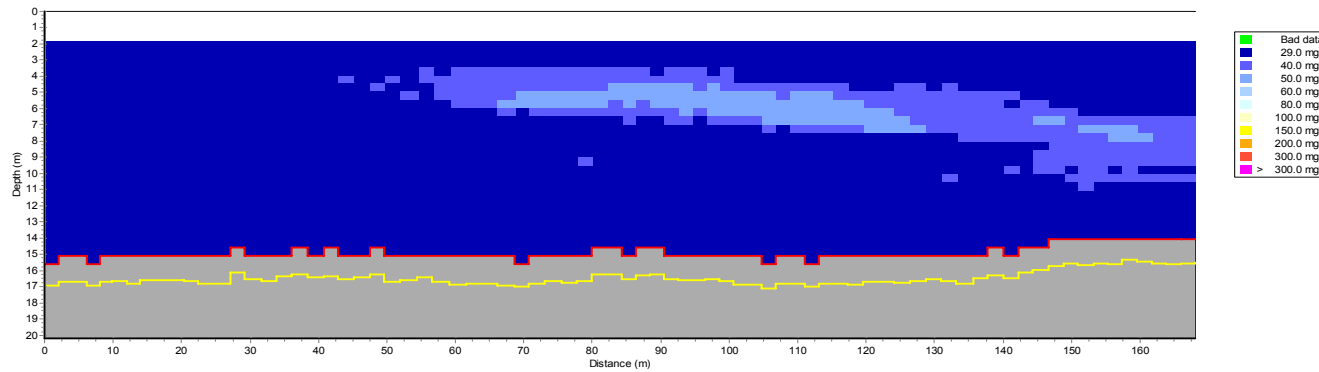
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



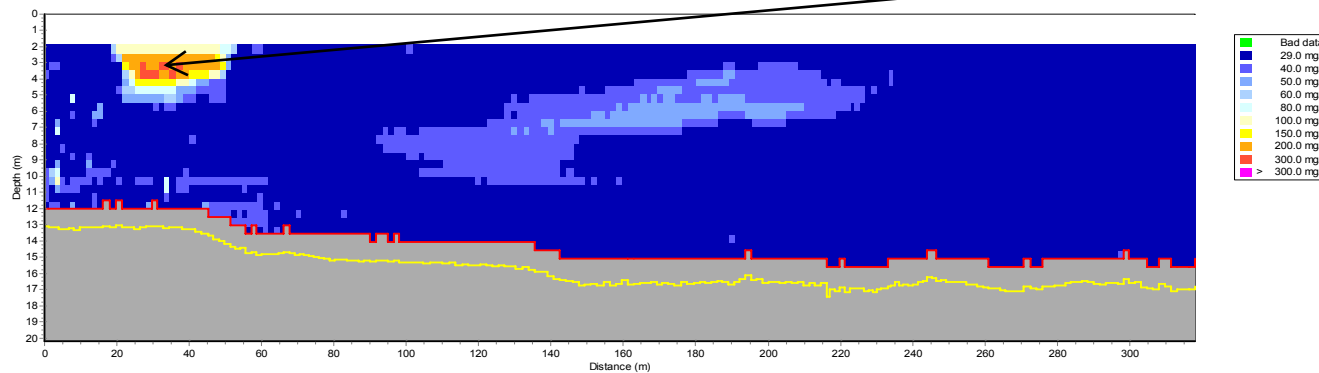
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2p-r

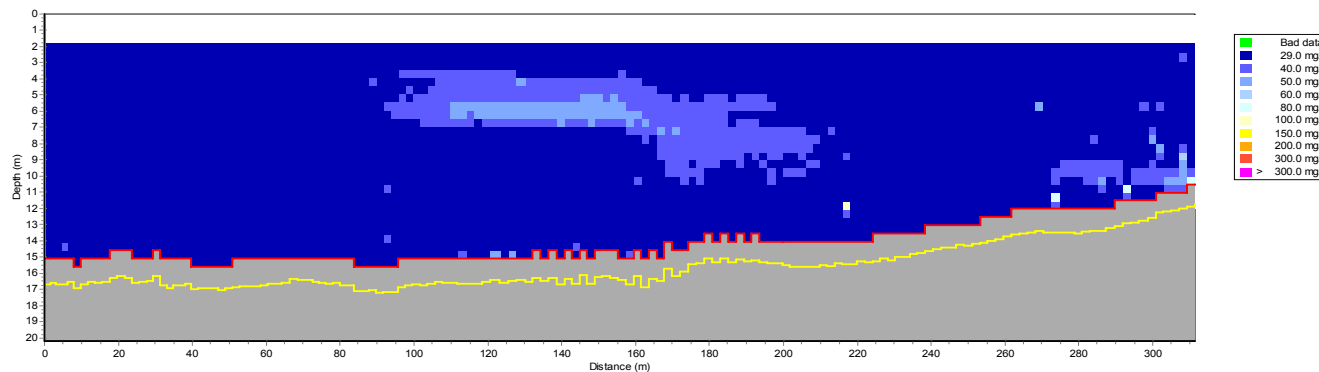
s) Transect T15 - Downcurrent 401 m*



t) Transect T16 - Downcurrent 426 m*



u) Transect T17 - Downcurrent 451 m*



*Approximate distance downcurrent from source

Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities

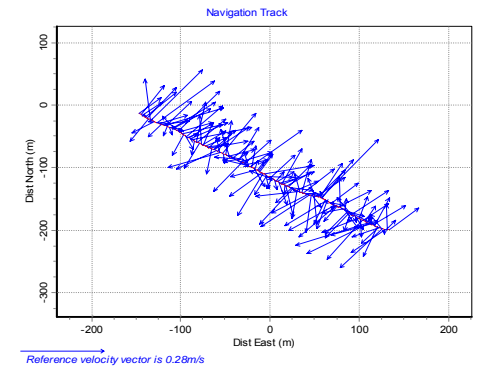
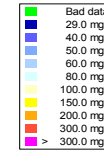
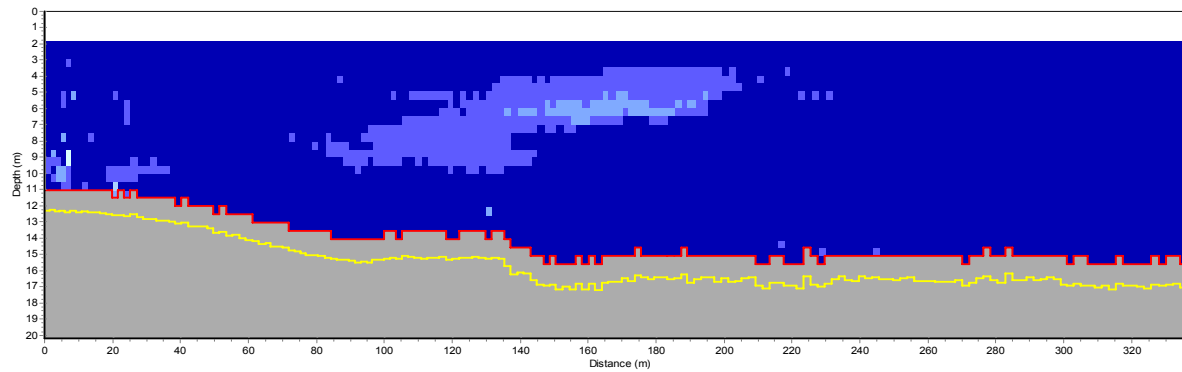


Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

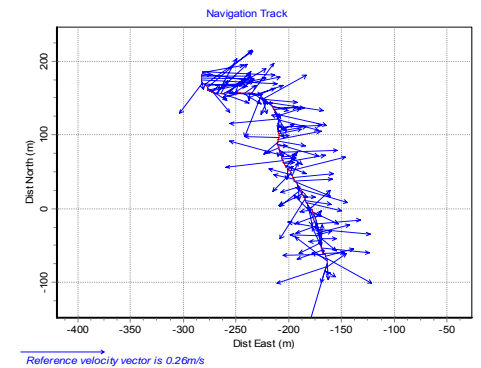
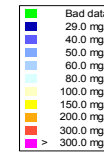
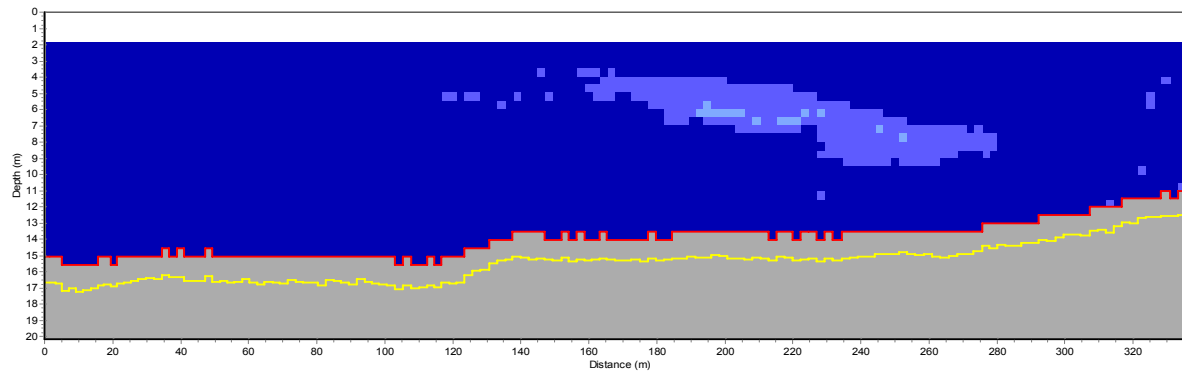
FIGURE

2s-u

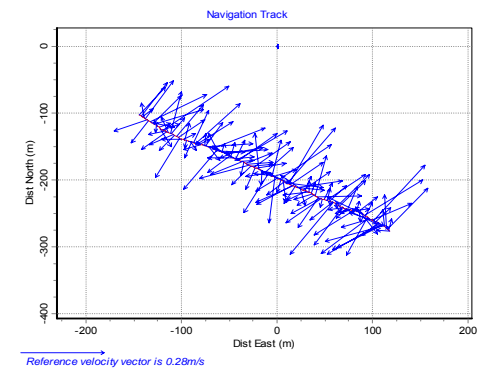
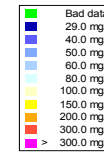
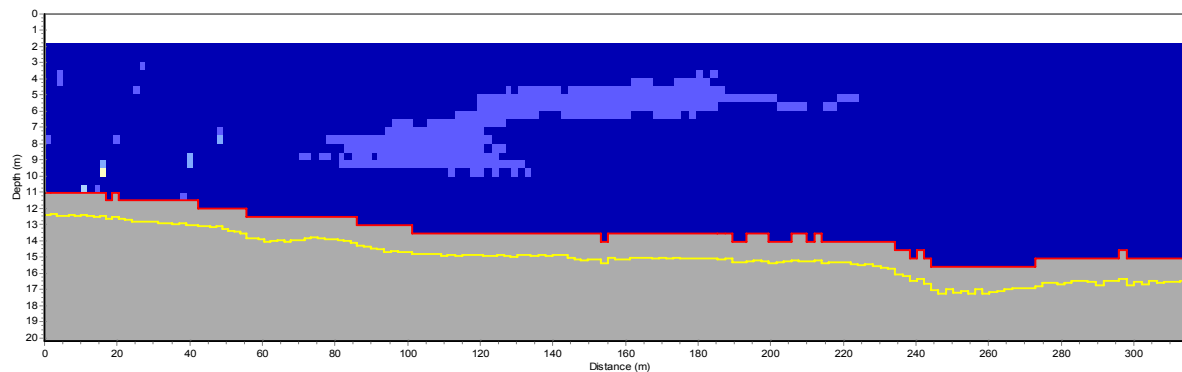
v) Transect T18 - Downcurrent 476 m*



w) Transect T19 - Downcurrent 501 m*



x) Transect T20 - Downcurrent 551 m*



*Approximate distance downcurrent from source

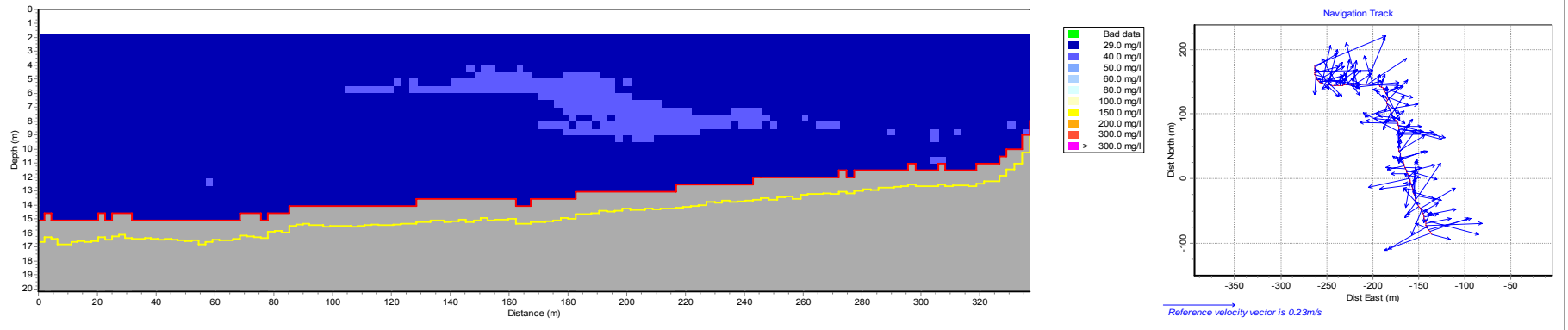
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

FIGURE
2v-x

y) Transect T21 - Downcurrent 601 m*



Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities

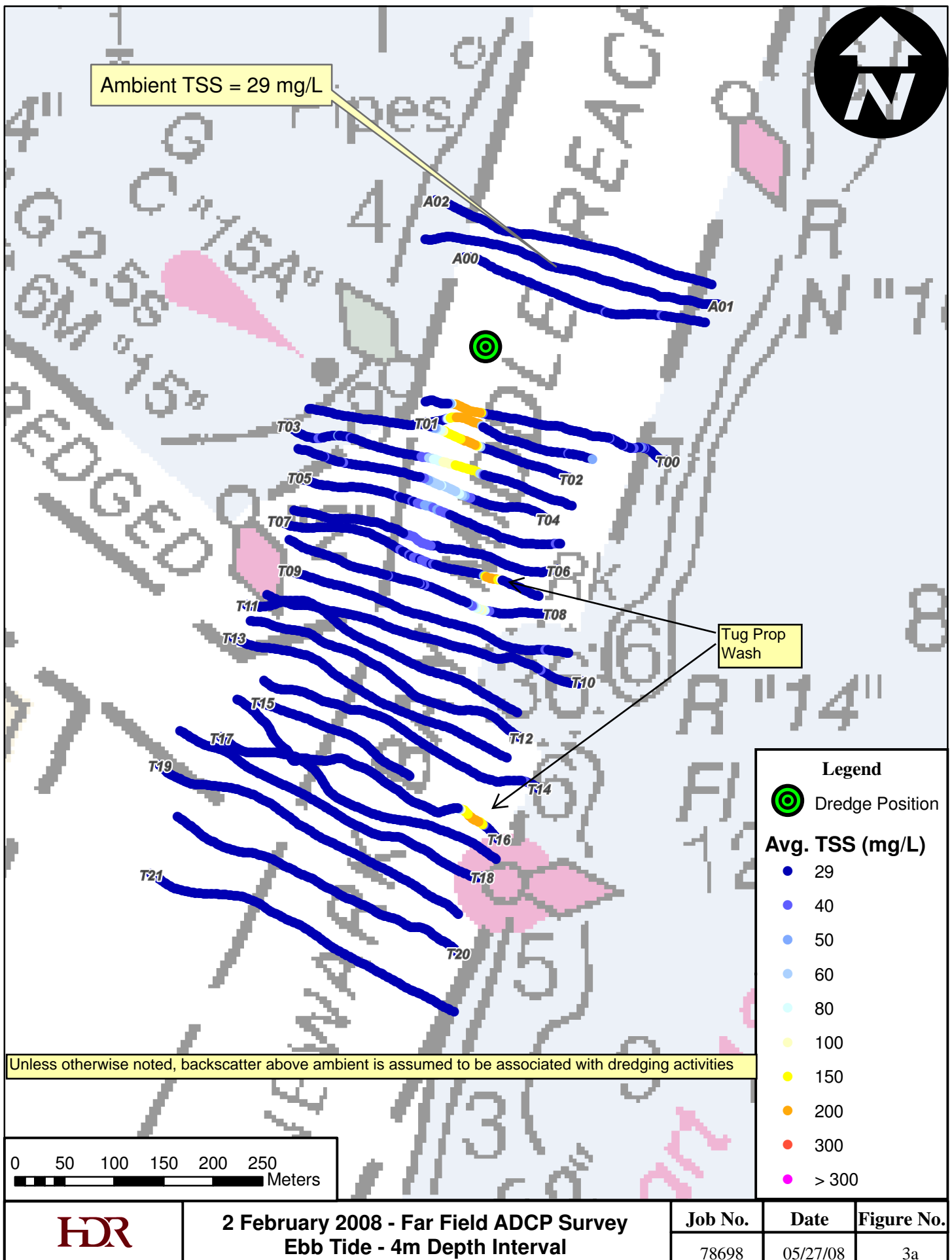
*Approximate distance downcurrent from source

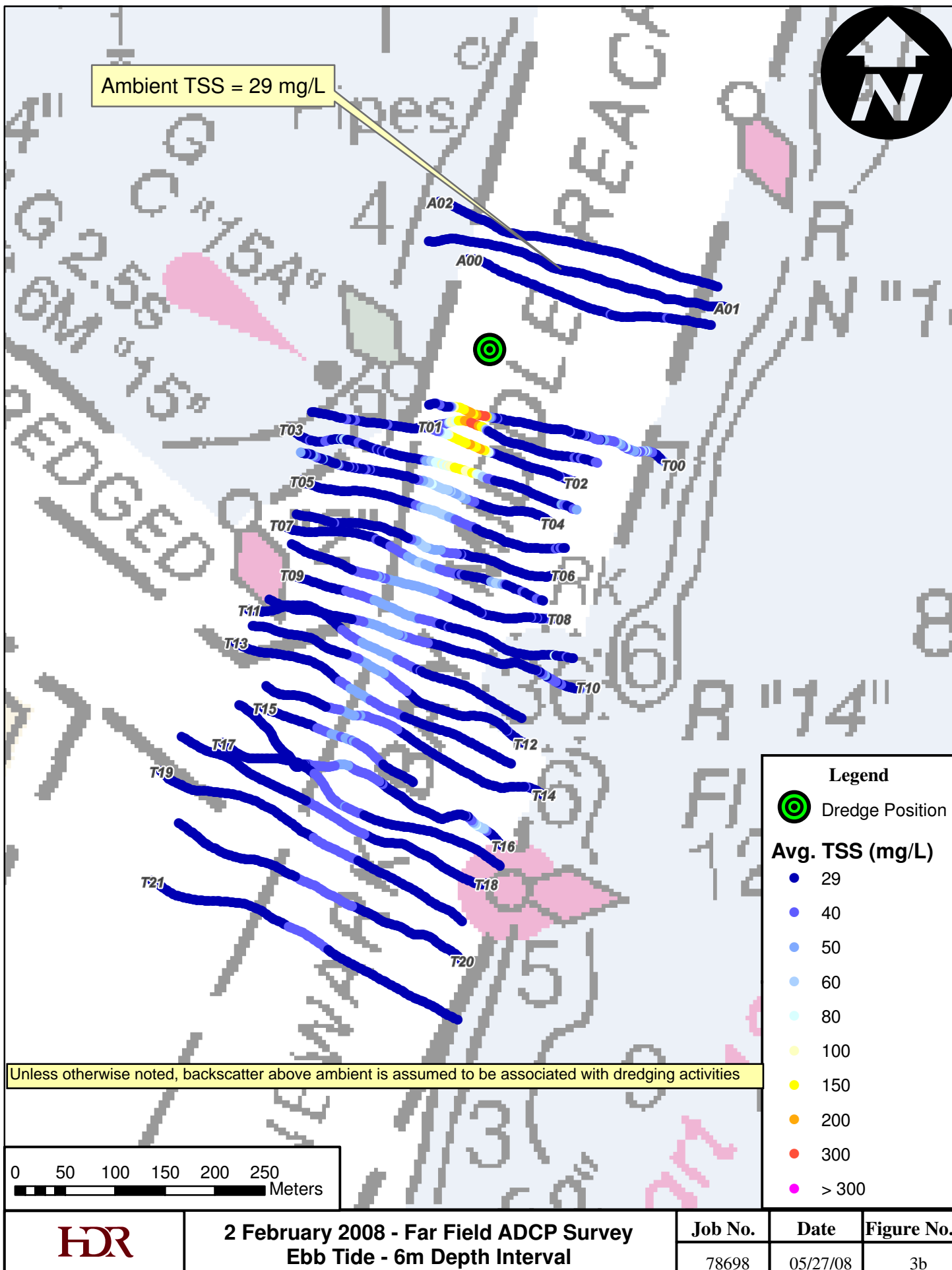


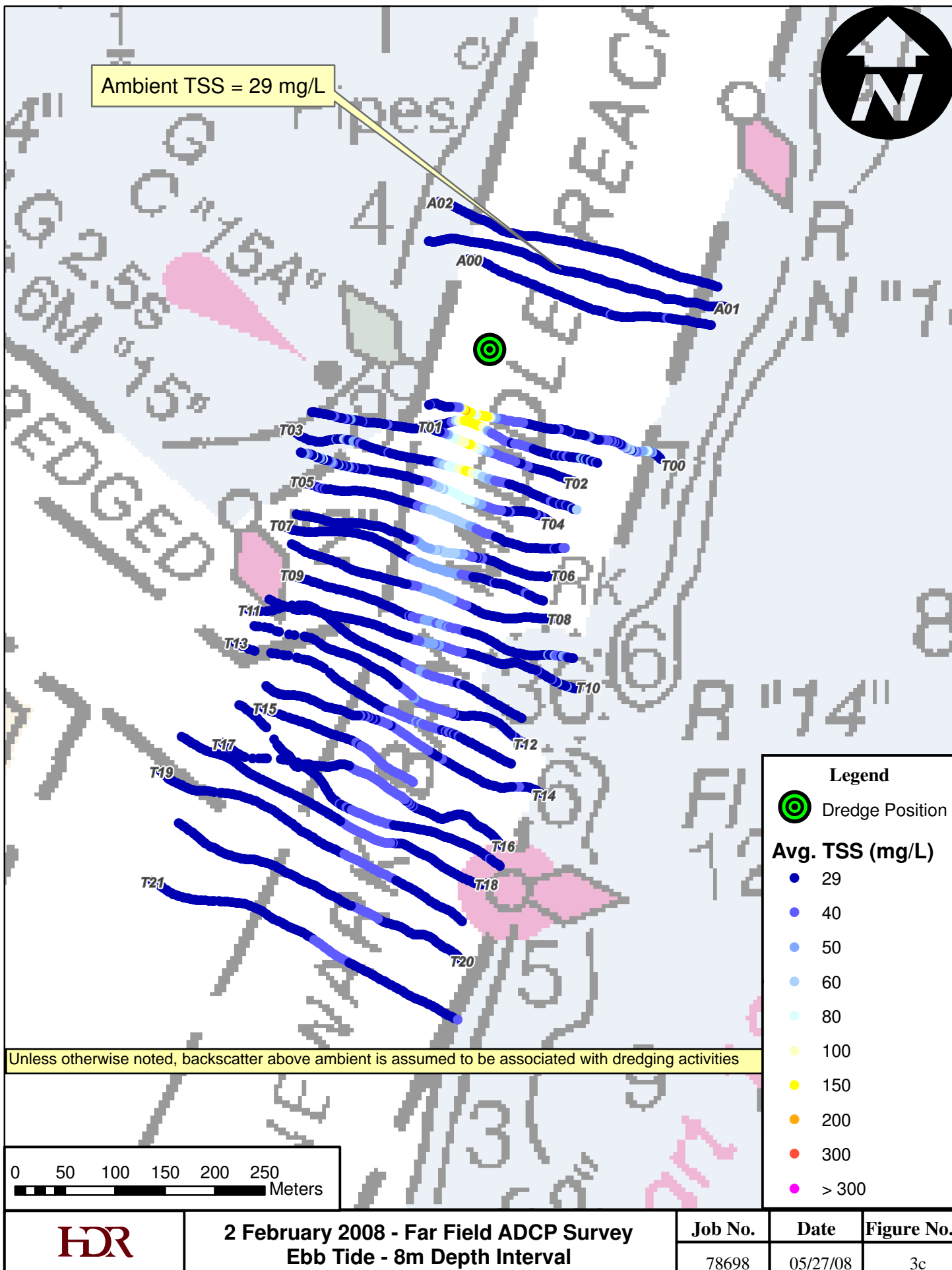
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
2 February 2008 Far Field Survey - Ebb Tide

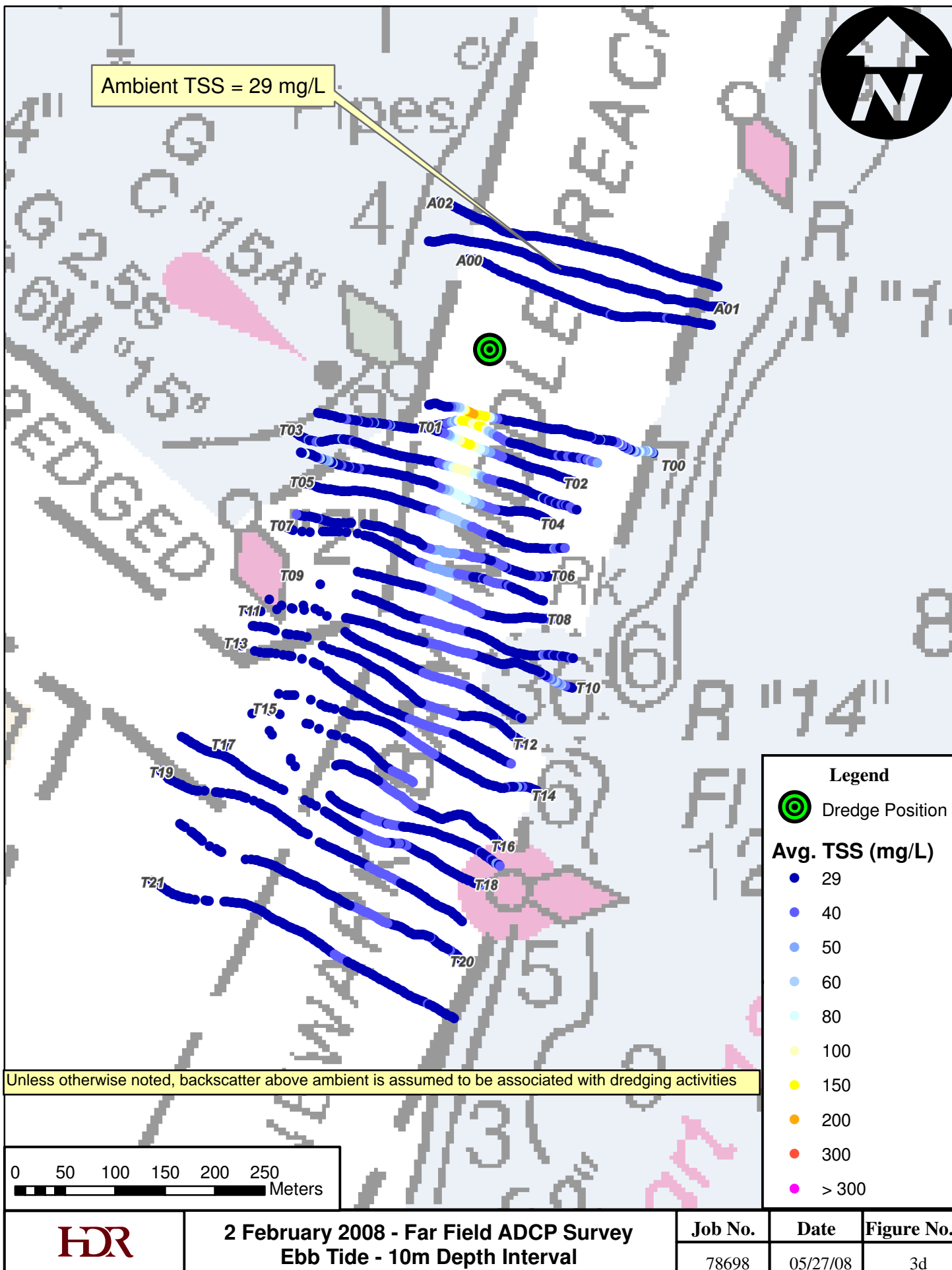
FIGURE

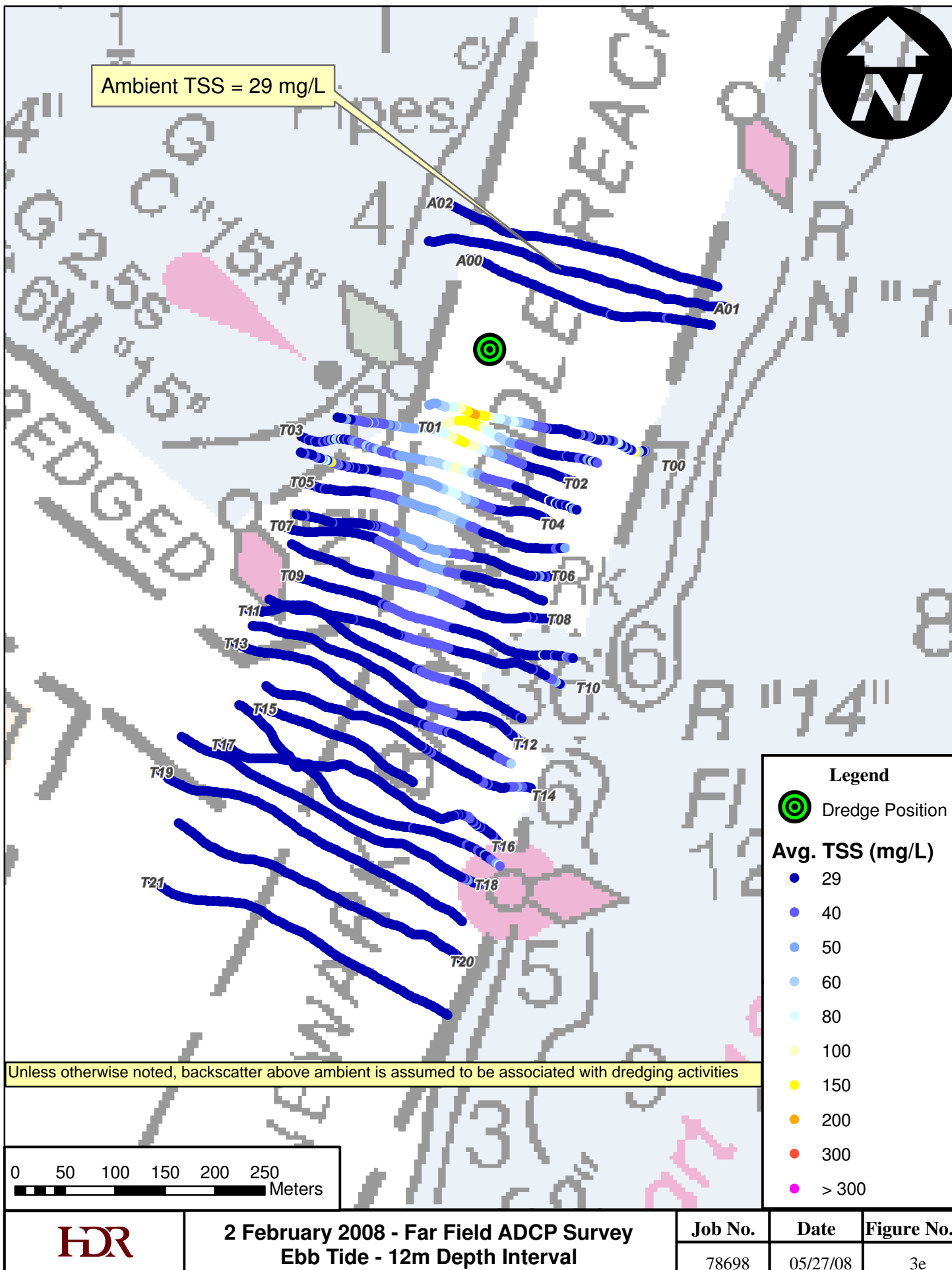
2y

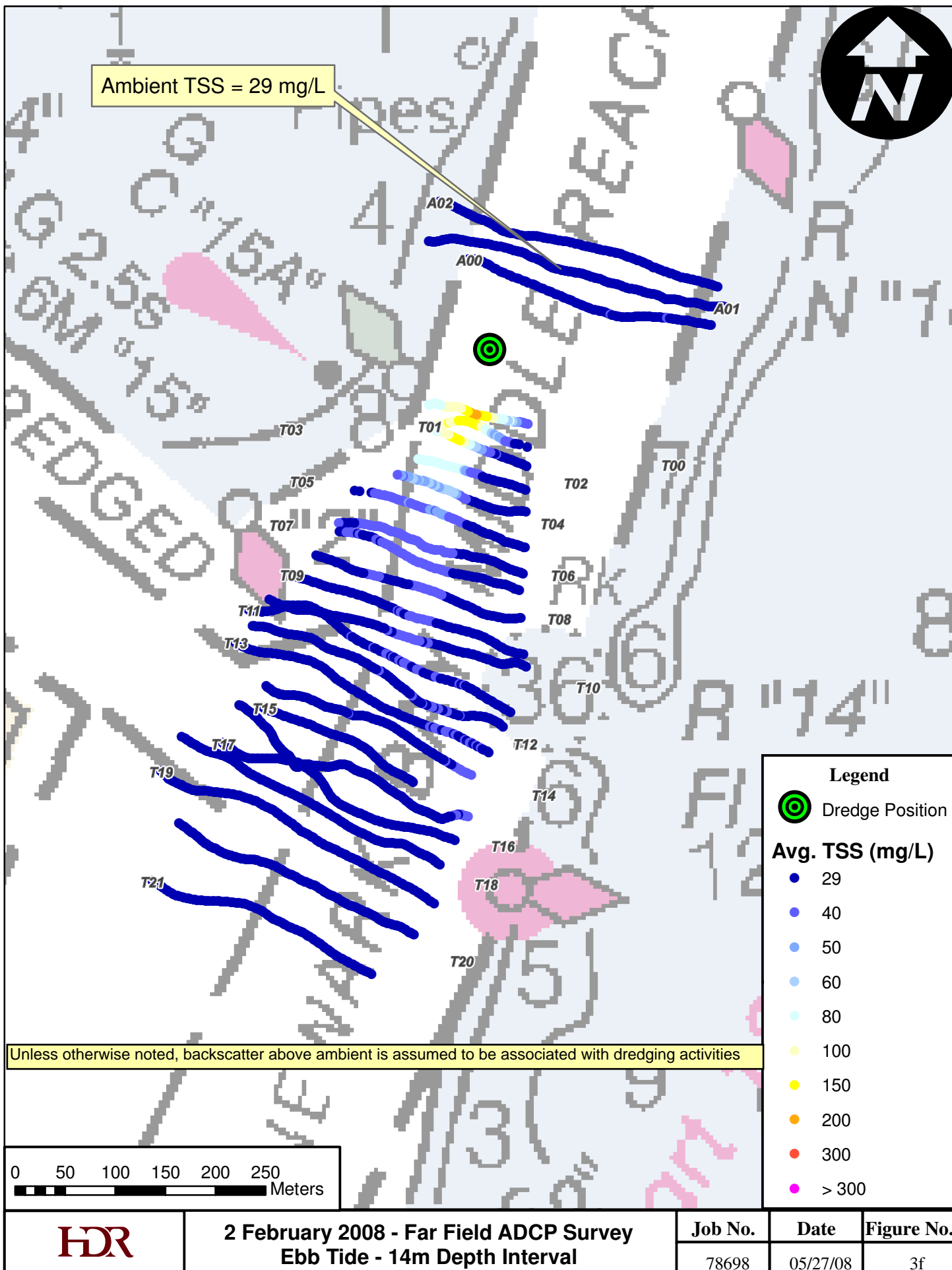


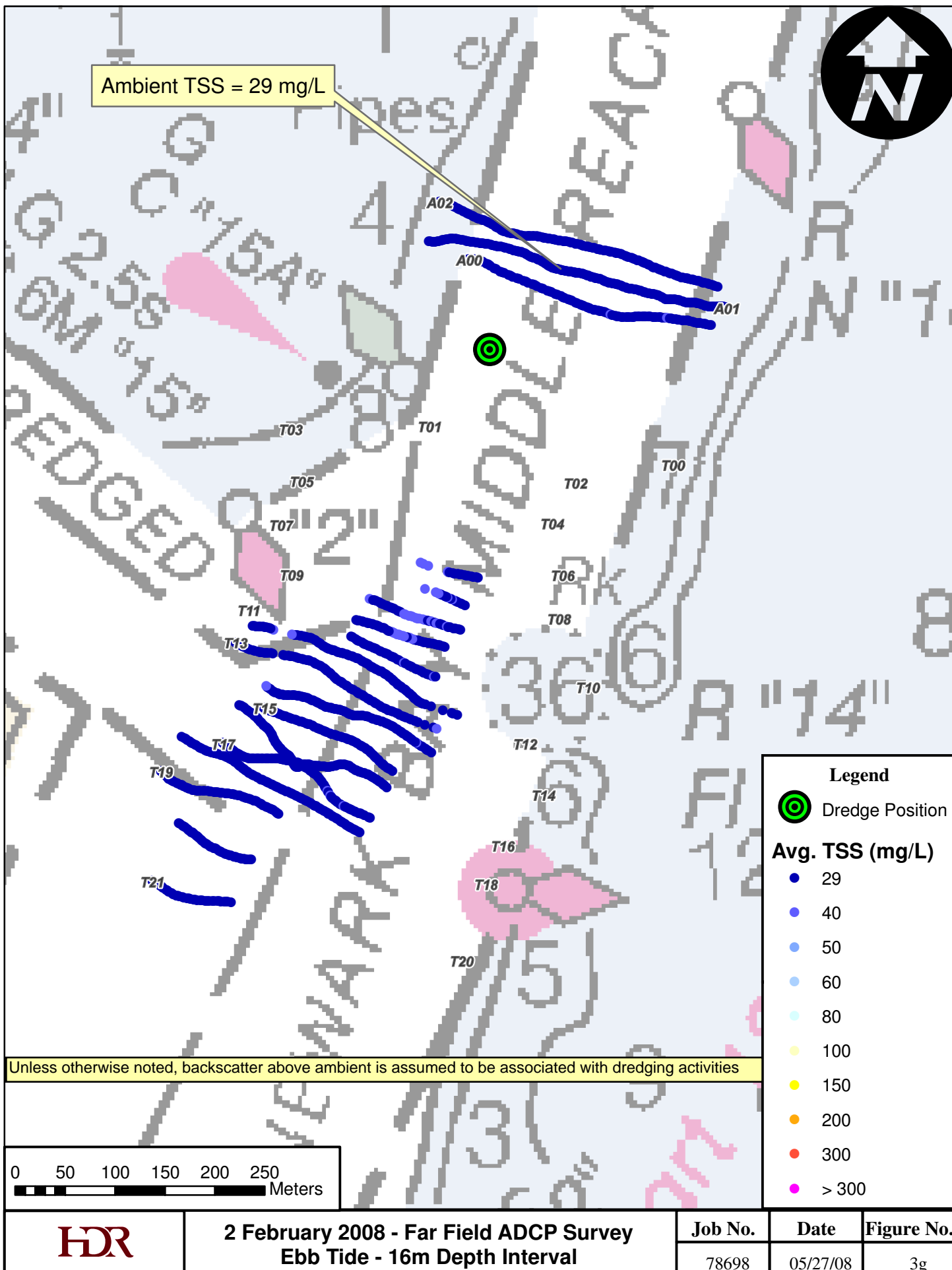


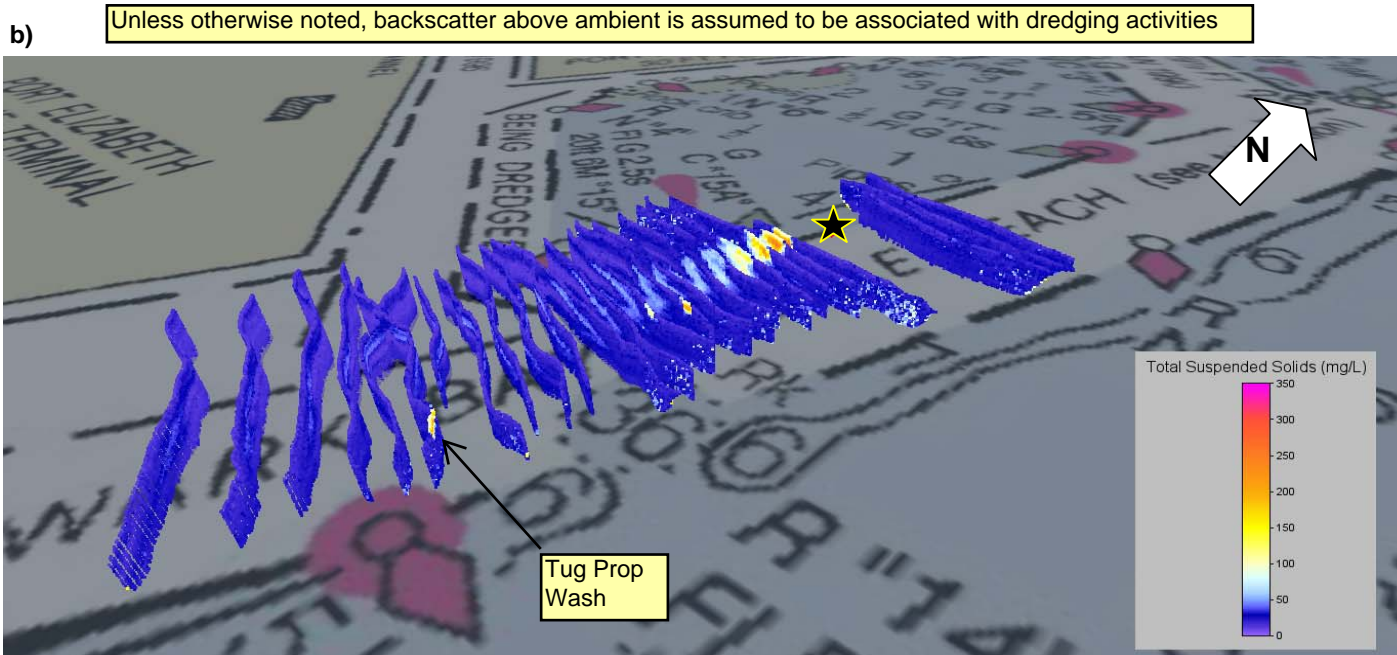
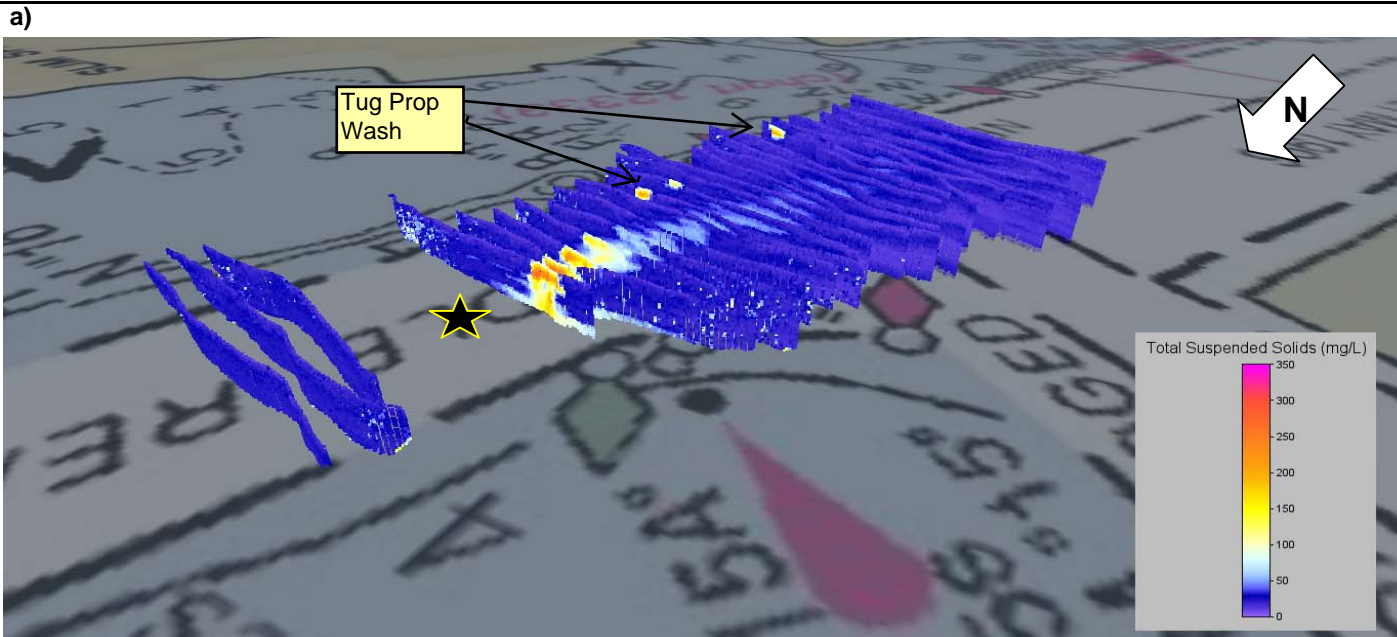












*Dredge position indicated by star



ADCP Average TSS Values with Respect to their x, y and z Coordinates
2 February 2008 Far Field Survey - Ebb Tide

FIGURE

4a-b

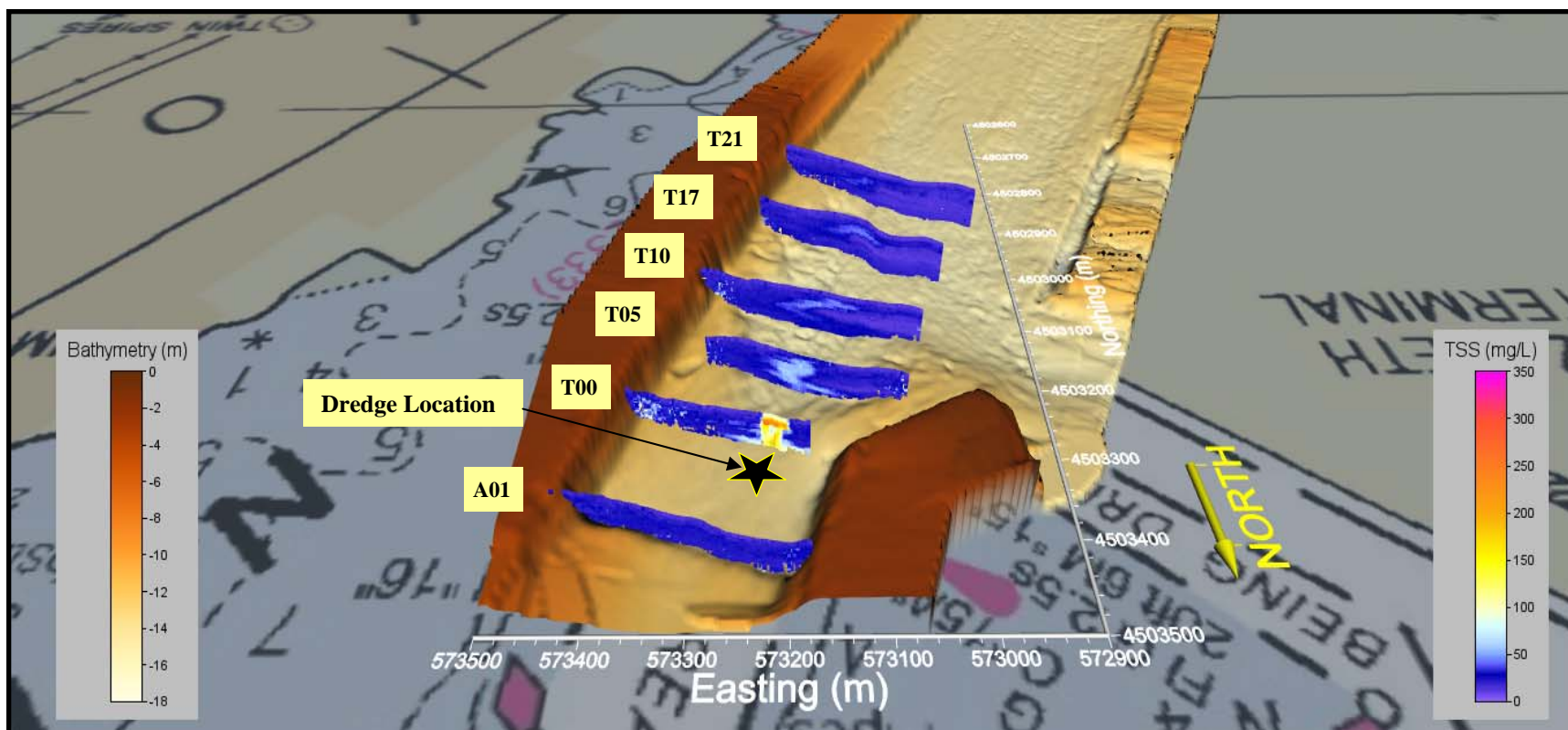
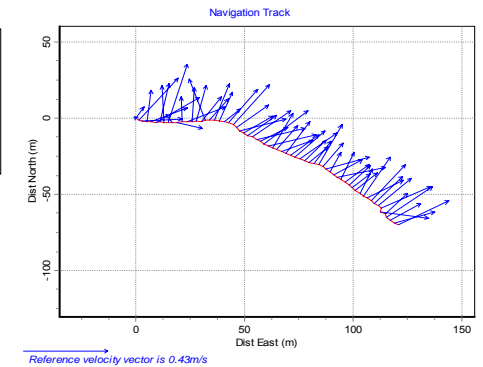
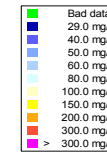
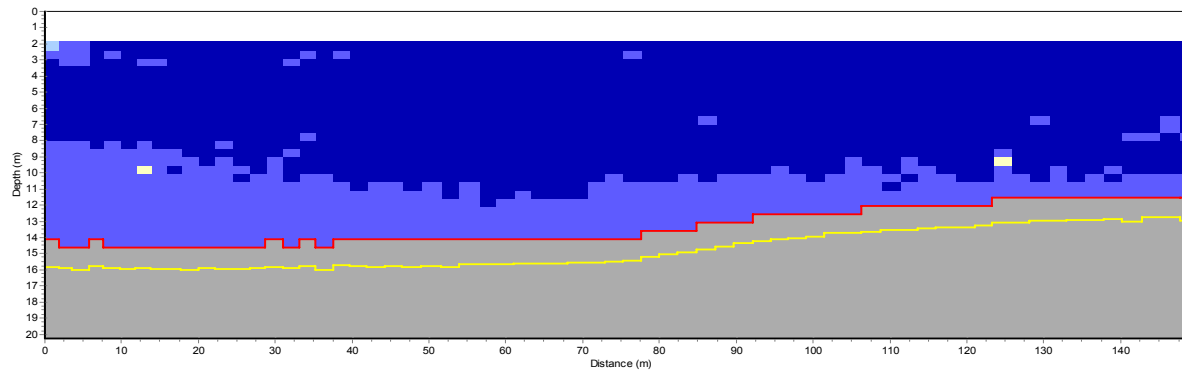


Figure 4c: ADCP Average TSS Values with Respect to their x, y and z Coordinates Superimposed on Channel Bathymetry. 2 February 2008 Far Field Survey - Ebb Tide.

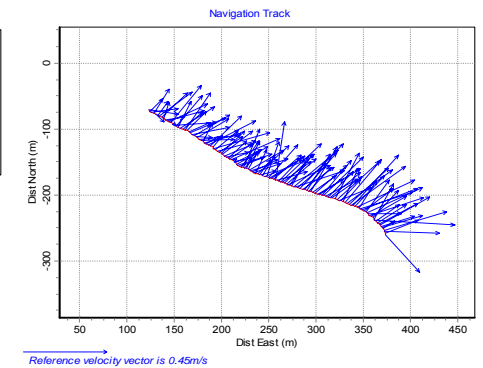
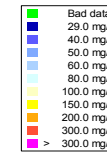
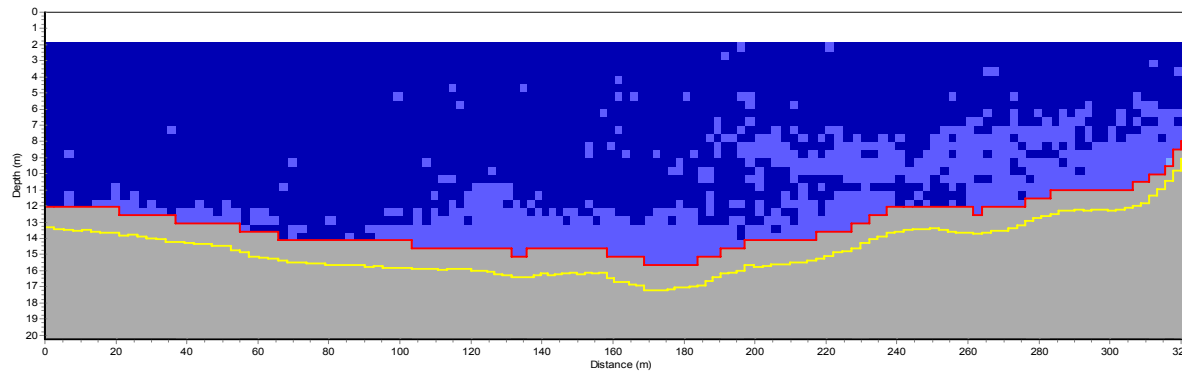
Table 3. 14 February 2008 Far Field Flood Tide Survey Transect Summary Table

Transect Number	Figure Number	Time	Approximate Distance to Dredge (m)	Transect Length (m)	Plume Description	Additional Remarks
A01	5a	10:02:42	62	150	Ambient	Transects off the bow of platform
A03	5b	10:09:05	112	325	Ambient	
A05	5c	10:17:29	162	232	Ambient	
T00	5d	11:13:52	5	109	Plume approx. 50 m wide throughout the water column with max concentrations <150 mg/l at the surface & bottom	Transect cut short due to vessel traffic
T01	5e	11:18:49	5	268	Plume approx. 50 m wide throughout the water column with max concentrations <150 mg/l at the surface	Transects off the stern of platform. Tug prop wash noted adjacent to the plume.
T02	5f	11:22:34	30	236	Plume approx. 50 m wide with core concentrations <100 mg/l	
T03	5g	11:26:16	55	170	Plume approx. 50 m wide with core concentrations <80 mg/l	Dredging halted/dredge rotated 180 degrees
T04	5h	12:36:35	42	415	Plume approx. 50 m wide throughout the water column with max concentrations <200 mg/l at the surface	Transects now off the bow of platform
T05	5i	12:41:55	67	225	Plume approx. 70 m wide with core concentrations <80 mg/l	
T06	5j	12:44:50	92	224	Plume approx. 70 m wide with core concentrations <80 mg/l	
T07	5k	12:47:50	117	177	Plume approx. 70 m wide with core concentrations <80 mg/l	
T08	5l	12:49:56	142	148	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T09	5m	12:52:08	167	116	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T10	5n	12:53:07	192	402	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T11	5o	13:00:02	217	341	Plume approx. 70 m wide with core concentrations <80 mg/l near the bottom	
T12	5p	13:17:58	242	379	Dredge plume signature masked	Visible plume from passing container ship
T13	5q	13:23:39	267	346	Dredge plume signature masked	Some survey vessel prop wash in shallows
T14	5r	13:28:51	292	426	Dredge plume signature masked	
T15	5s	13:41:18	317	340	Dredge plume signature masked	Remnant of container ship plume near bottom
T16	5t	13:55:36	342	400	Dredge plume signature masked	Tug prop wash near surface with remnant of ship plume near bottom
T17	5u	14:06:43	367	351	Dredge plume signature masked	Remnant of container ship plume near bottom
T18	5v	14:16:43	392	433	Dredge plume signature masked	Remnant of container ship plume near bottom
T19	5w	14:21:53	417	339	Dredge plume signature masked	Remnant of container ship plume near bottom
T20	5x	14:25:53	442	362	Dredge plume signature masked	Remnant of container ship plume near bottom
T21	5y	14:30:41	467	319	Dredge plume signature masked	Remnant of container ship plume near bottom
T22	5z	14:34:50	492	364	Dredge plume signature masked	Remnant of container ship plume near bottom
T23	5zz	14:39:19	517	633	Dredge plume signature masked	Remnant of container ship plume near bottom

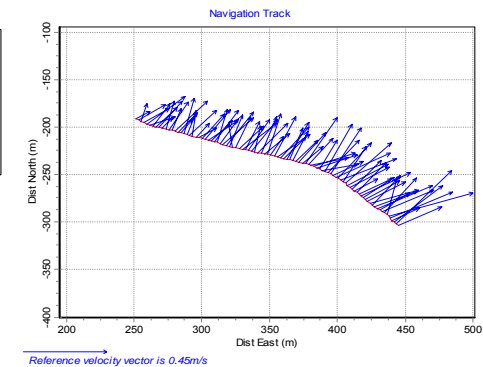
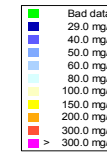
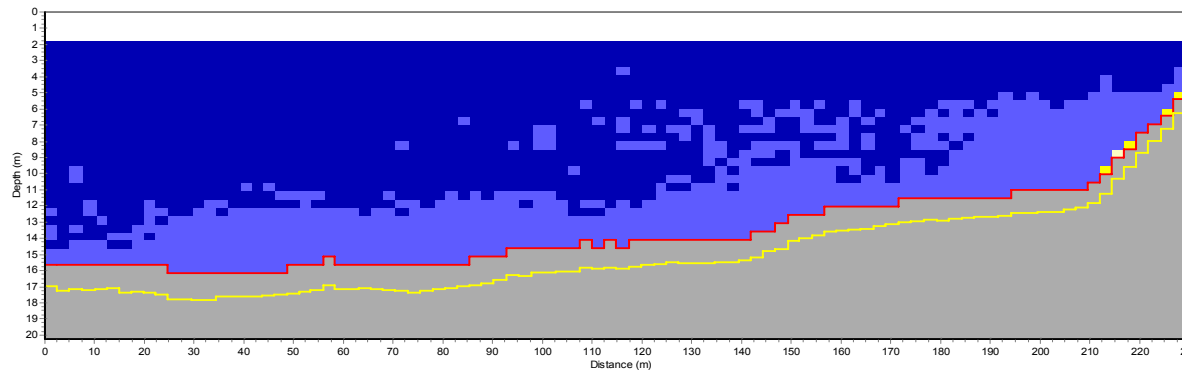
a) Ambient A01 - Upcurrent 62 m*



b) Ambient A03 - Upcurrent 112 m*



c) Ambient A05 - Upcurrent 162 m*



*Approximate distance upcurrent from source

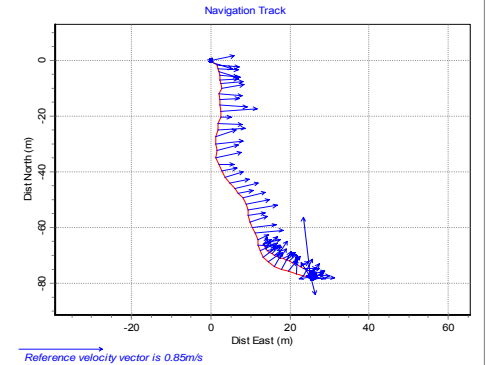
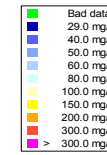
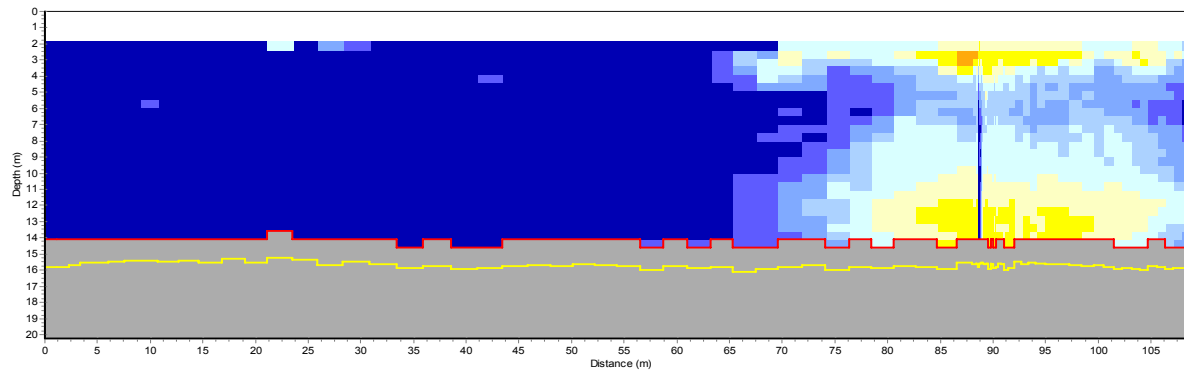
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



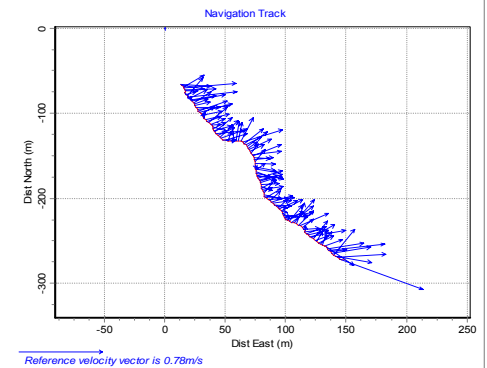
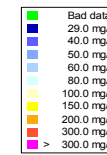
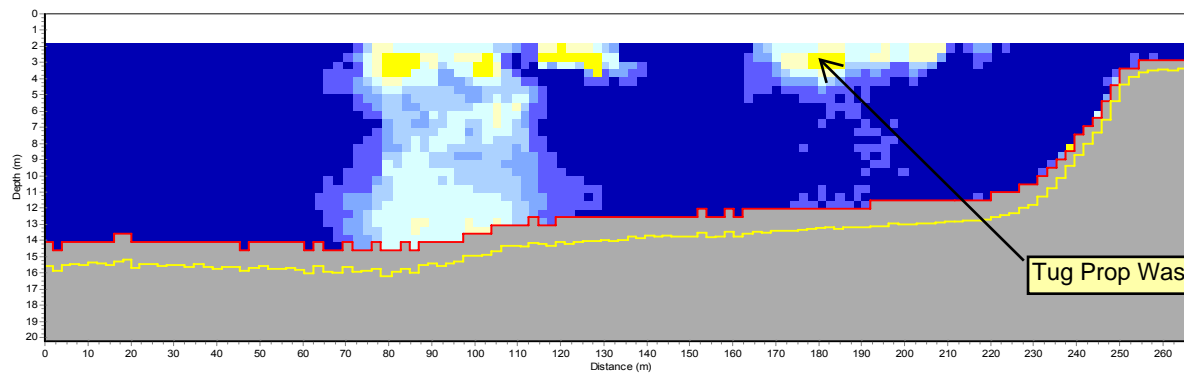
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5a-c

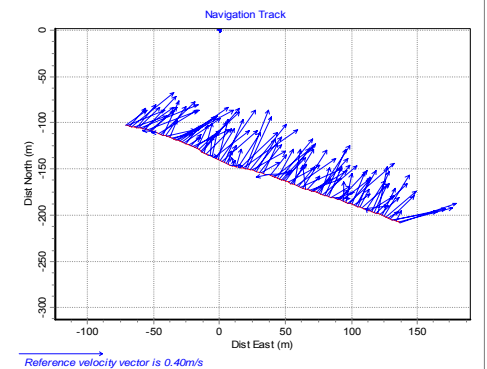
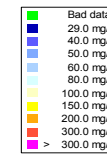
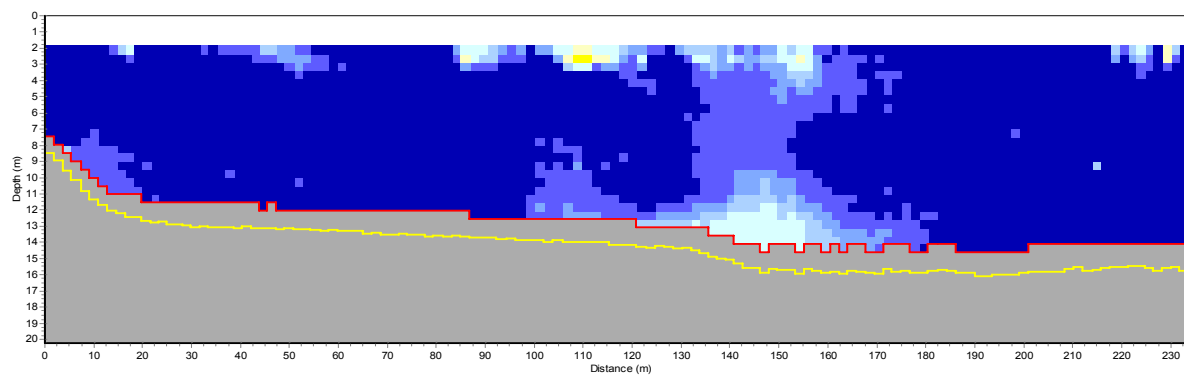
d) Transect T00 - Downcurrent 5 m*



e) Transect T01 - Downcurrent 5 m*



f) Transect T02 - Downcurrent 30 m*



*Approximate distance downcurrent from source

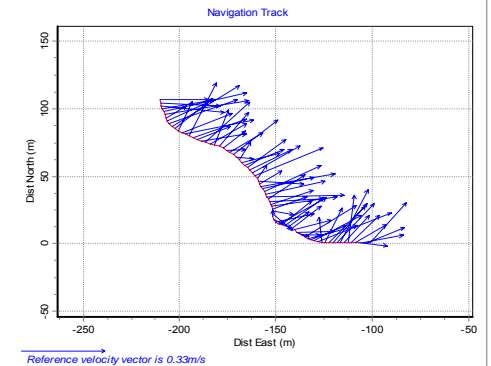
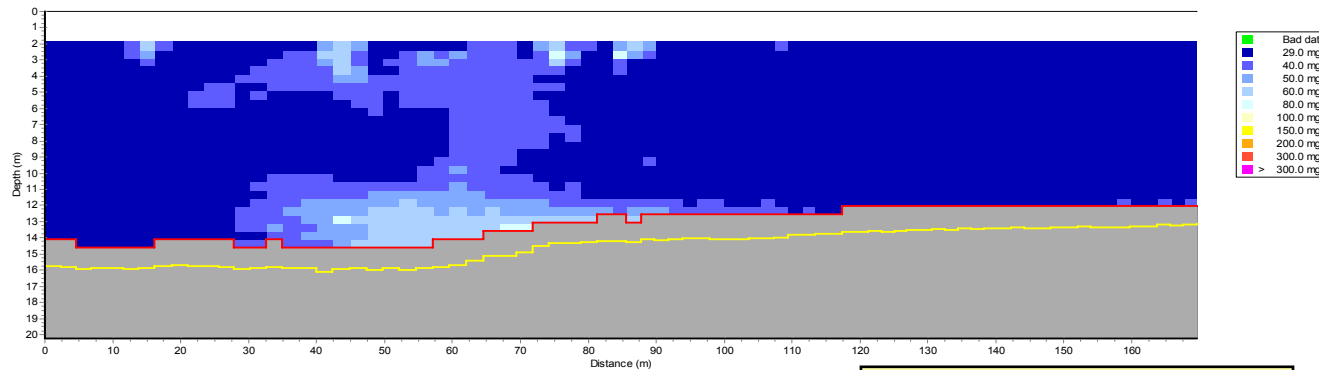
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

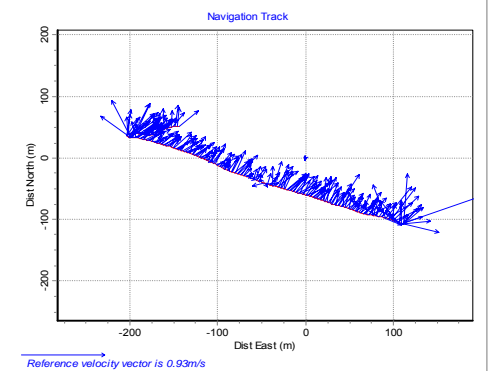
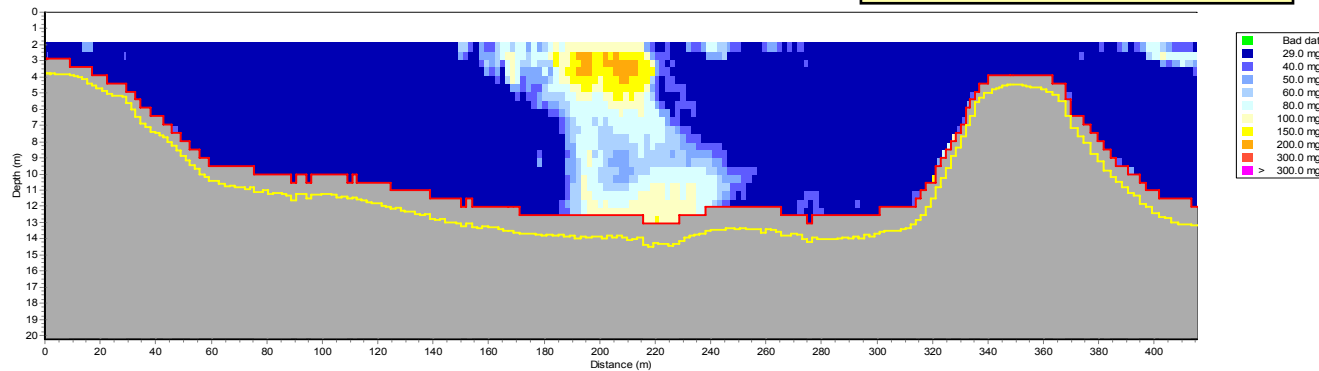
FIGURE
5d-f

g) Transect T03 - Downcurrent 55 m*

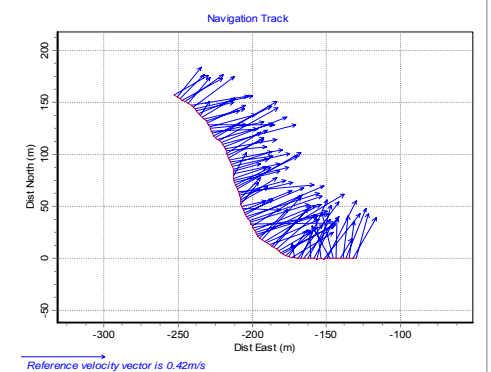
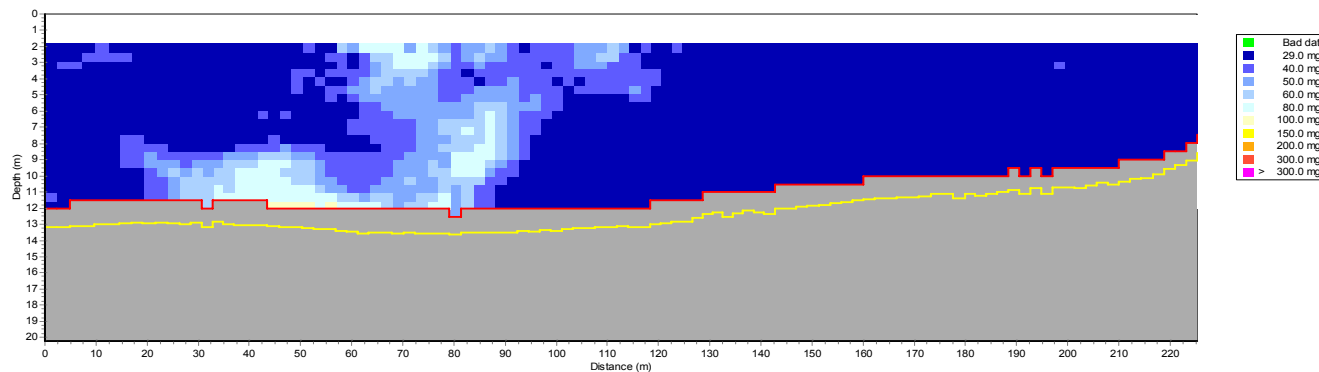


h) Transect T04 - Downcurrent 42 m*

First down-current transect after dredge platform was rotated 180 degrees



i) Transect T05 - Downcurrent 67 m*



*Approximate distance downcurrent from source

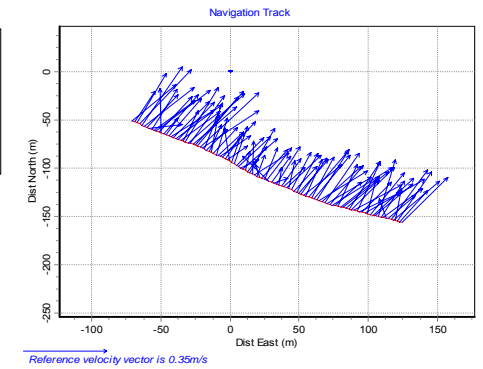
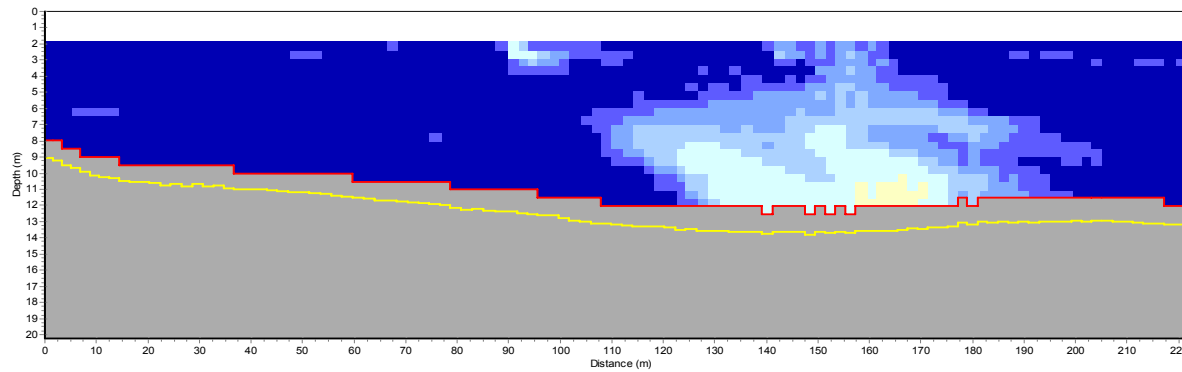
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



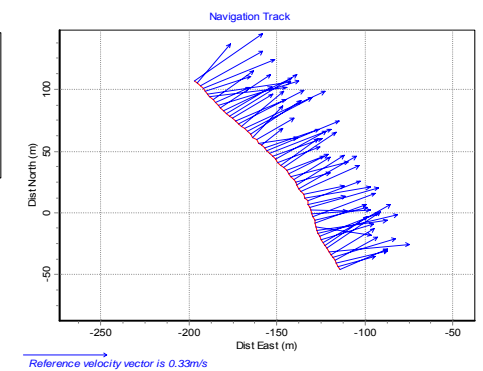
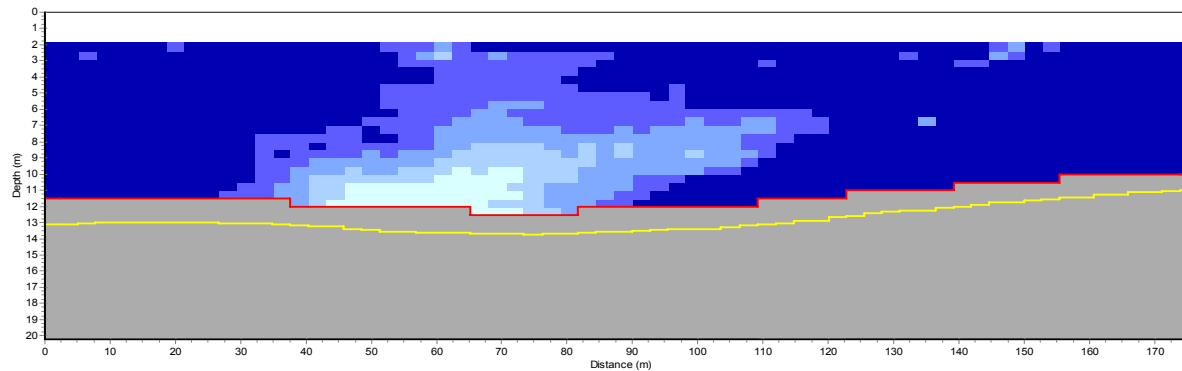
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5g-i

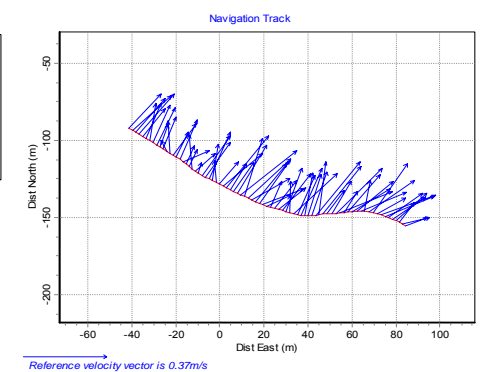
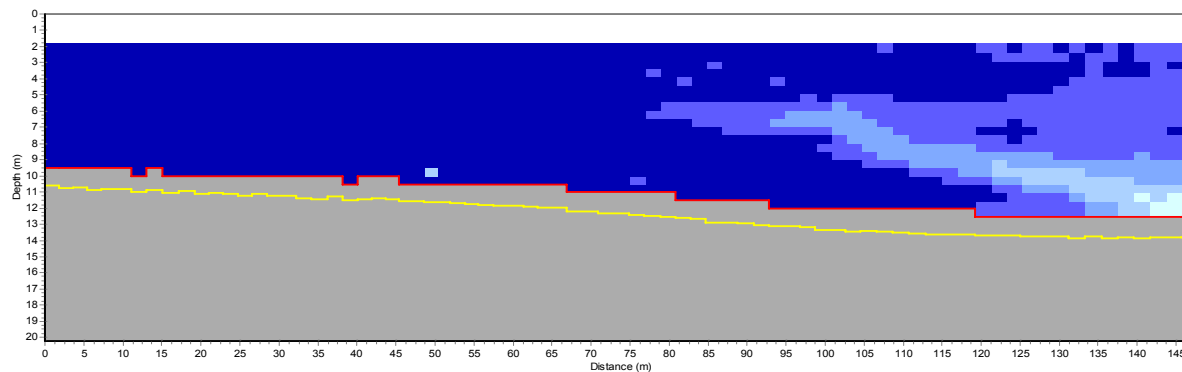
j) Transect T06 - Downcurrent 92 m*



k) Transect T07 - Downcurrent 117 m*



l) Transect T08 - Downcurrent 142 m*



*Approximate distance downcurrent from source

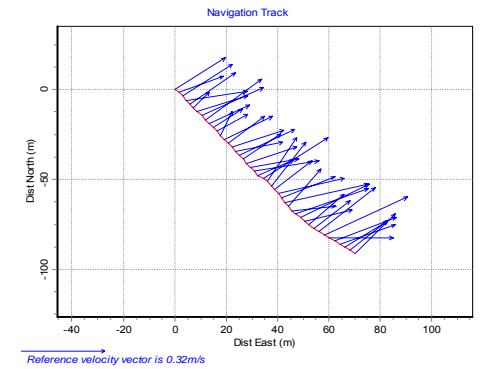
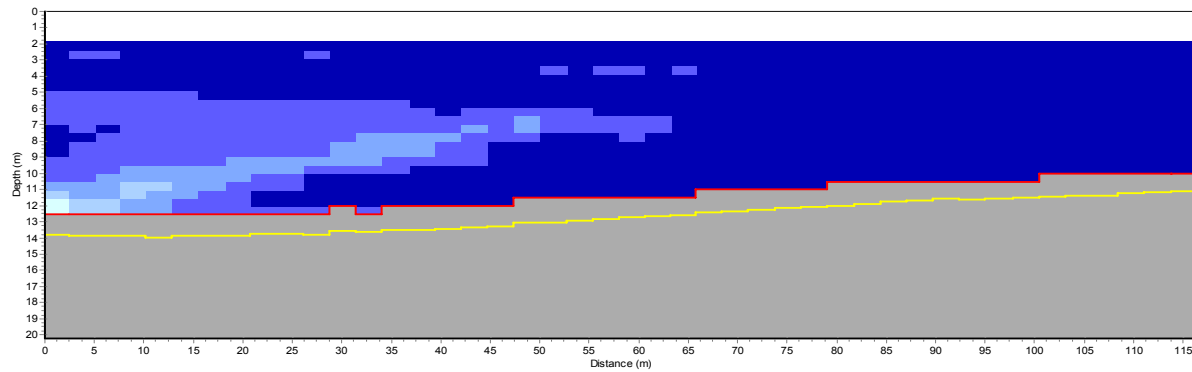
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



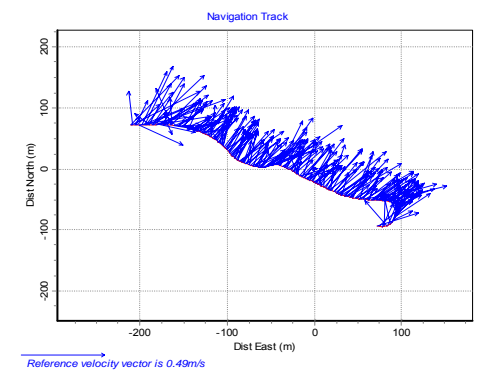
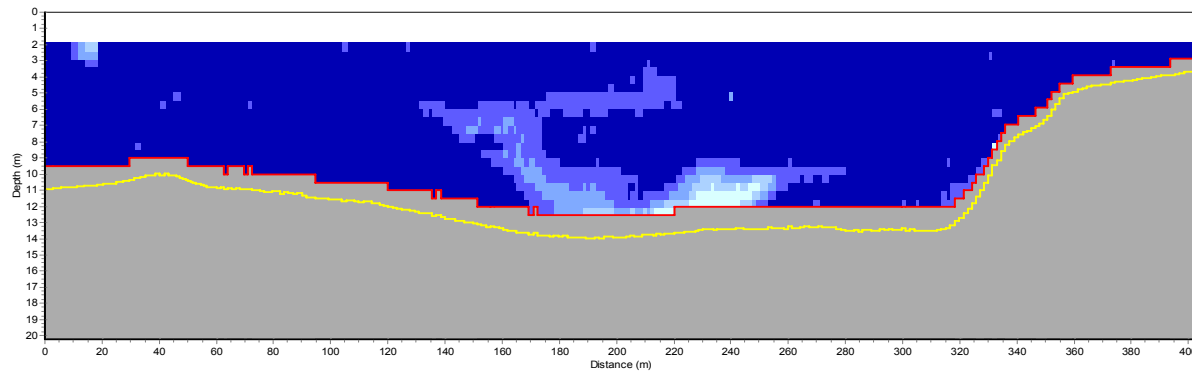
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5j-I

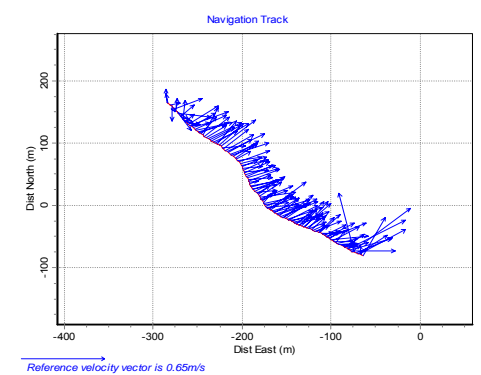
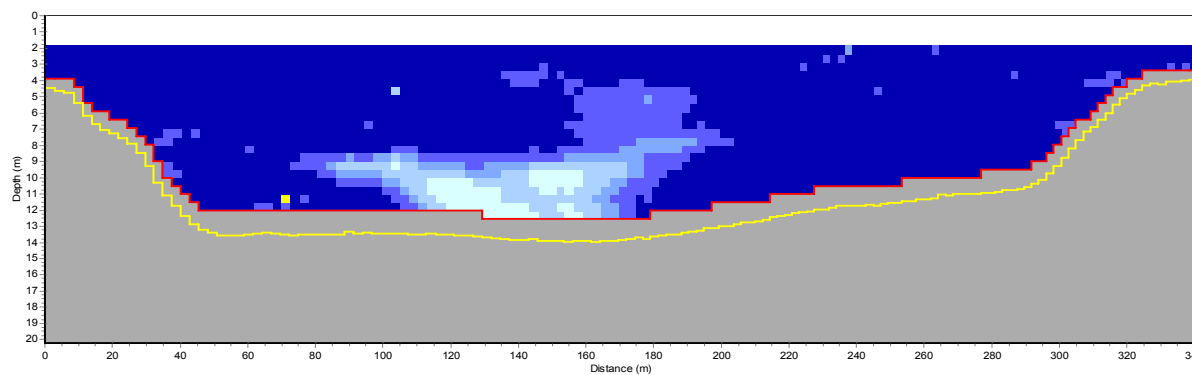
m) Transect T09 - Downcurrent 167 m*



n) Transect T10 - Downcurrent 192 m*



o) Transect T11 - Downcurrent 217 m*



*Approximate distance downcurrent from source

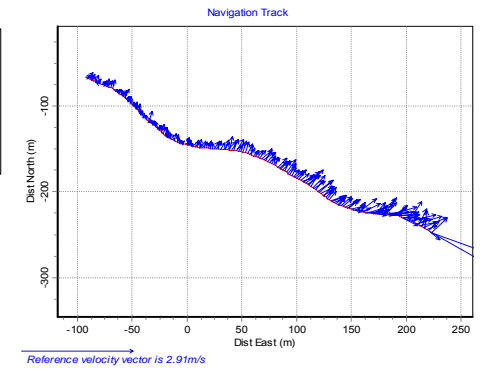
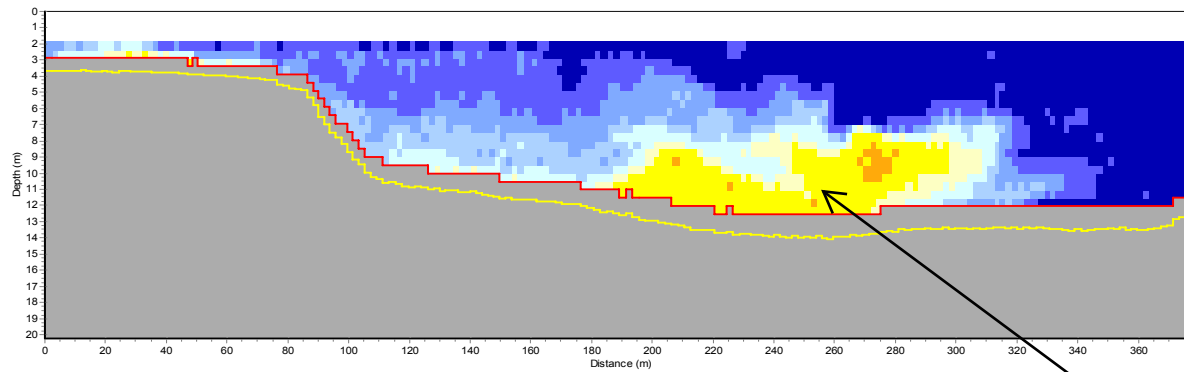
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



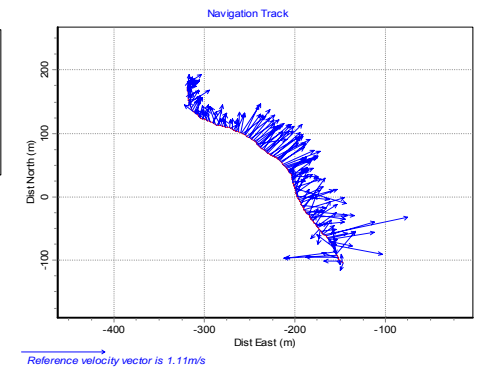
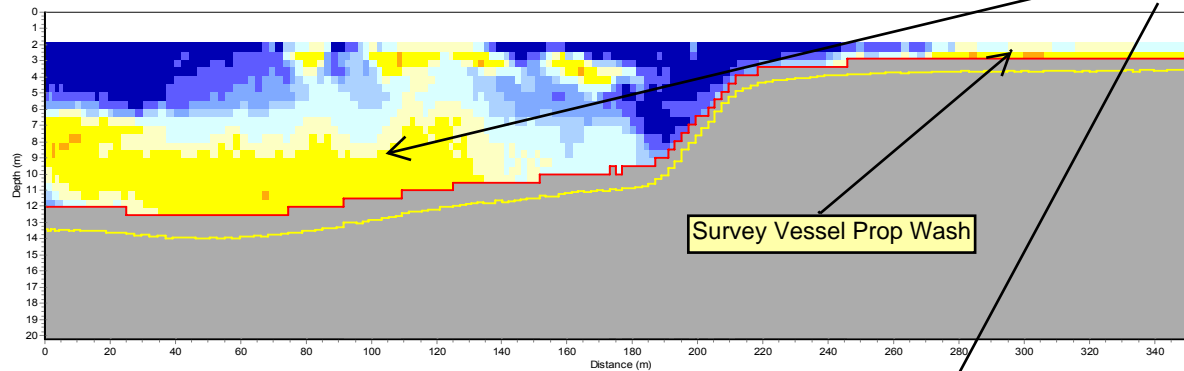
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5m-o

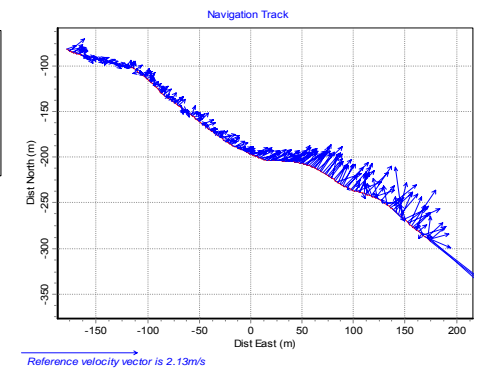
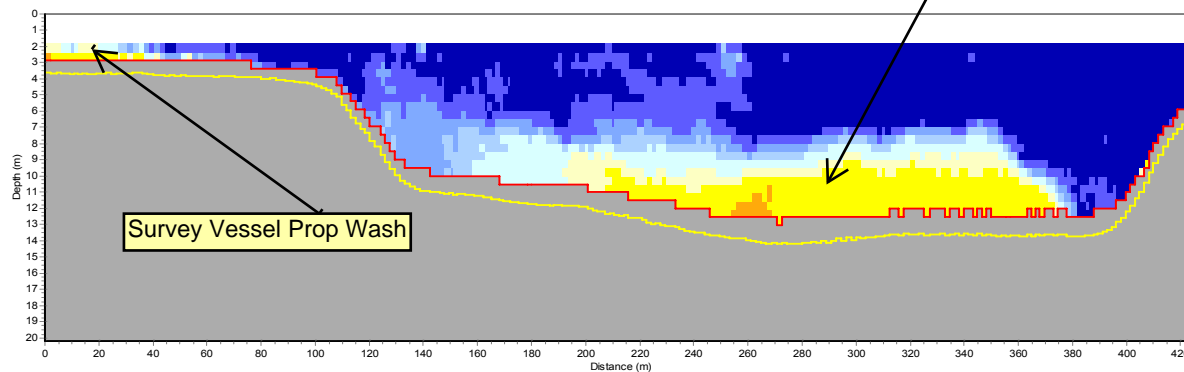
p) Transect T12 - Downcurrent 242 m*



q) Transect T13 - Downcurrent 267 m*



r) Transect T14 - Downcurrent 292 m*



*Approximate distance downcurrent from source

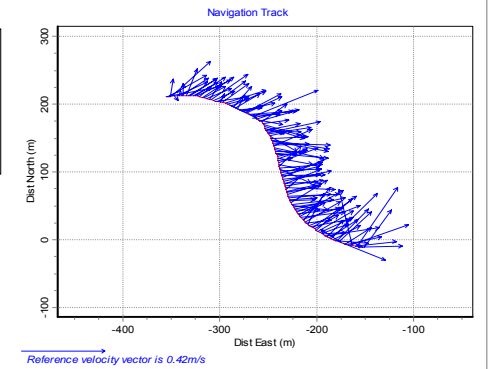
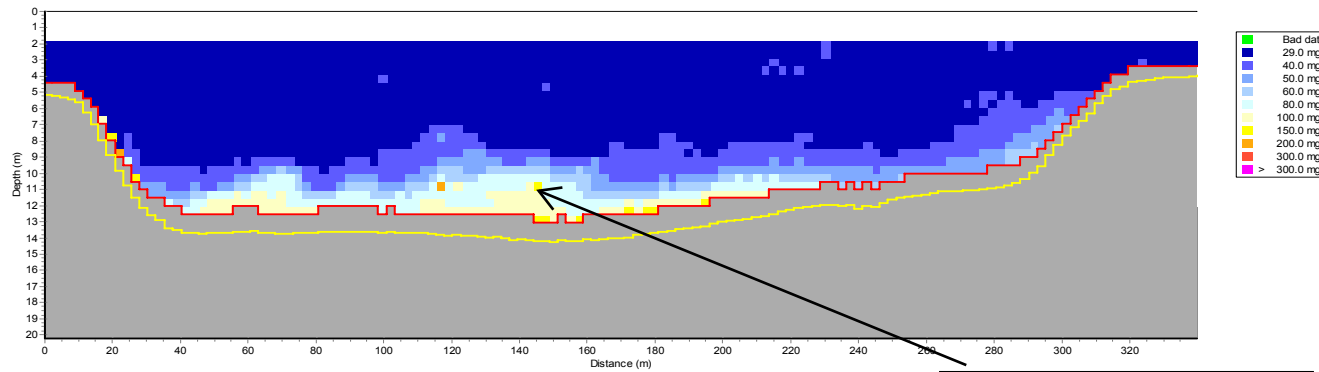
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



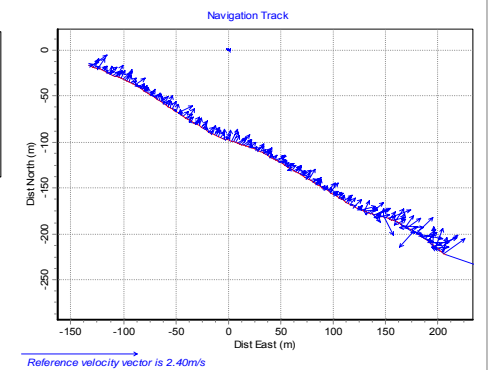
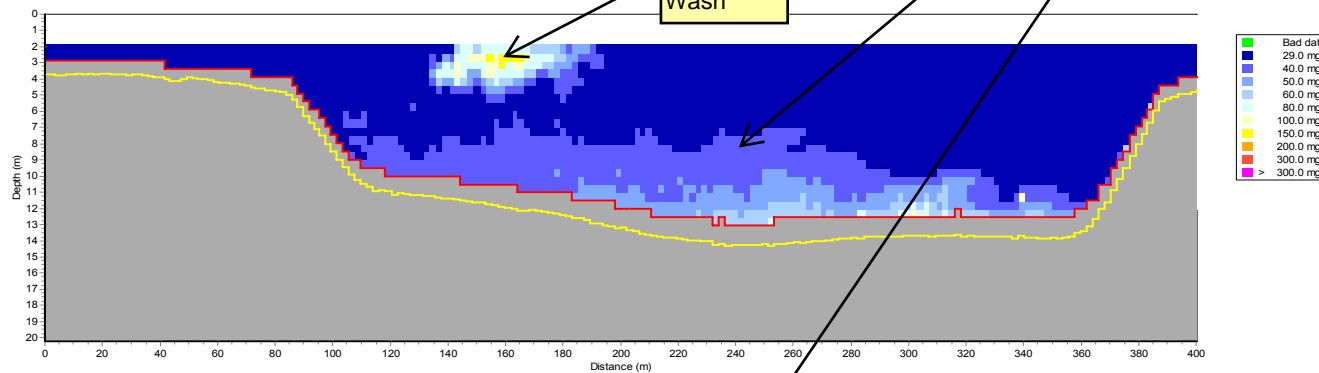
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5p-r

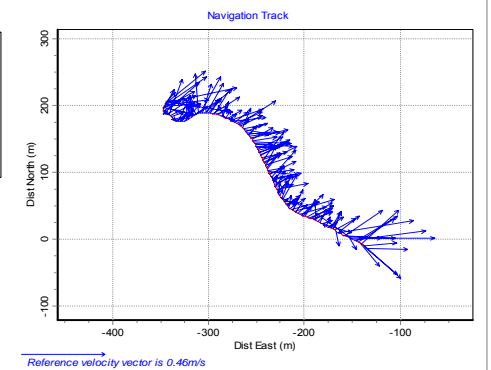
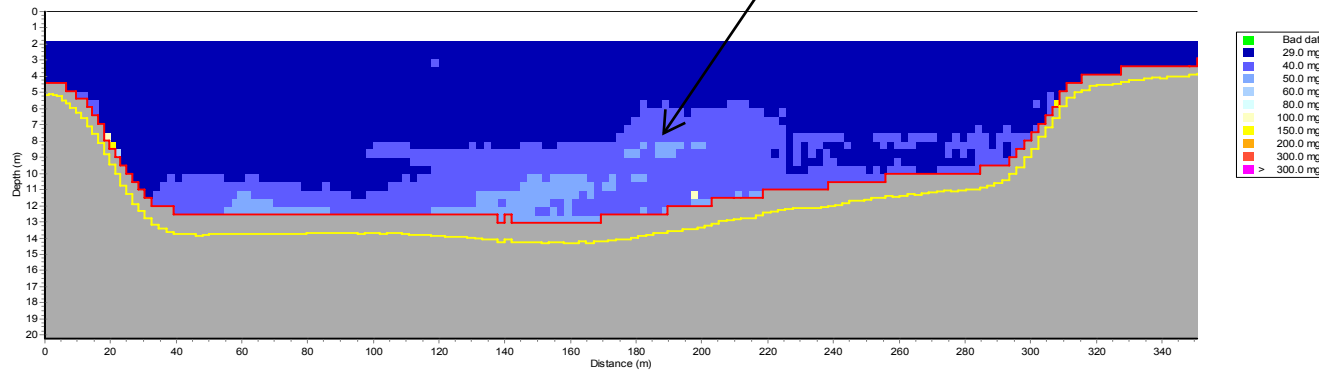
s) Transect T15 - Downcurrent 317 m*



t) Transect T16 - Downcurrent 342 m*



u) Transect T17 - Downcurrent 367 m*



*Approximate distance downcurrent from source

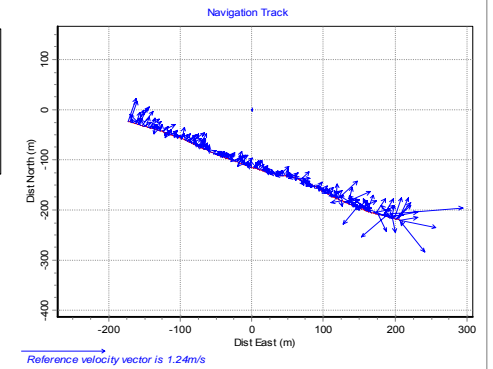
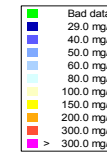
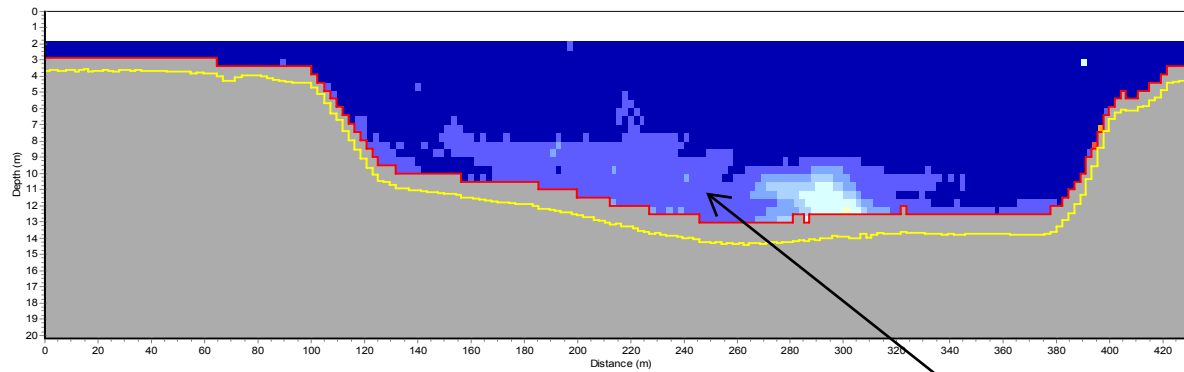
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



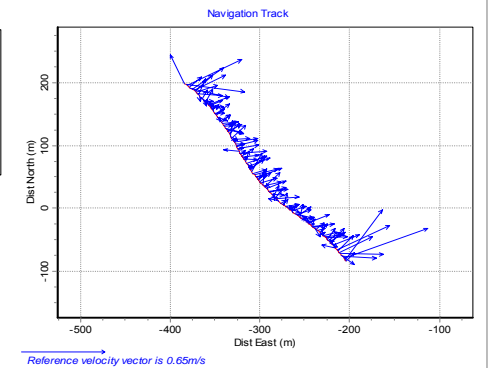
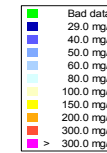
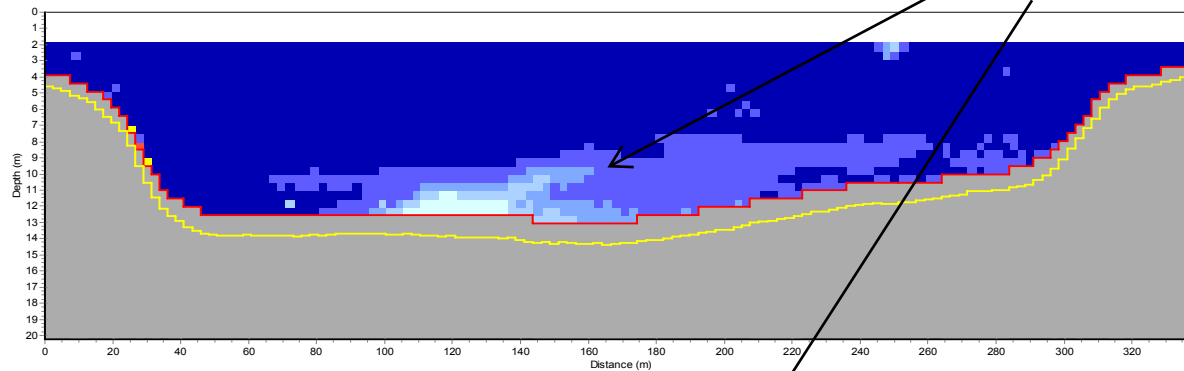
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5s-u

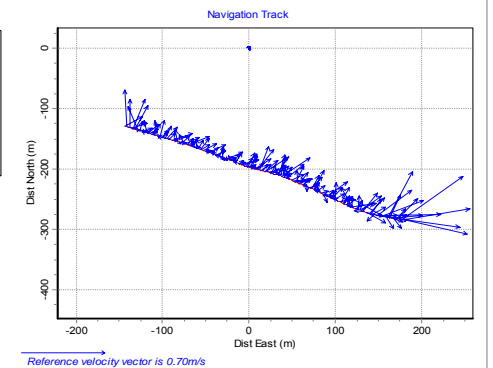
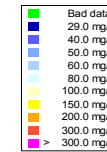
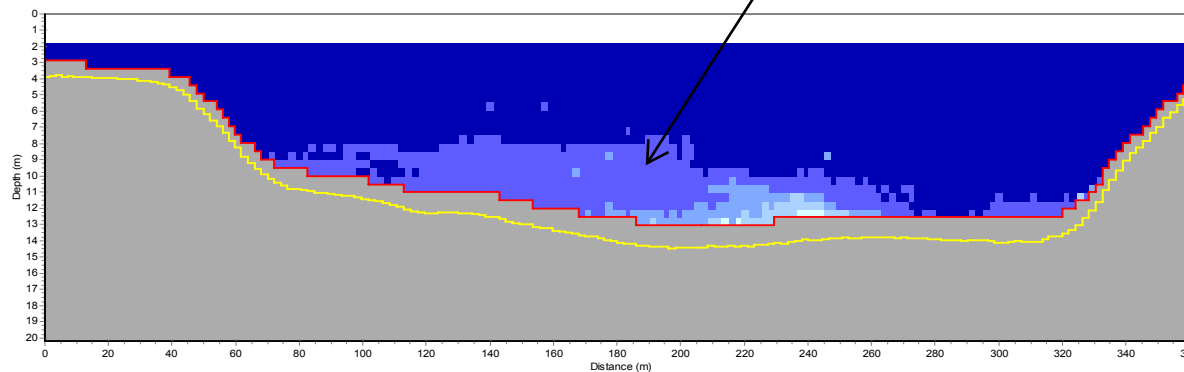
v) Transect T18 - Downcurrent 392 m*



w) Transect T19 - Downcurrent 417 m*



x) Transect T20 - Downcurrent 442 m*



*Approximate distance downcurrent from source

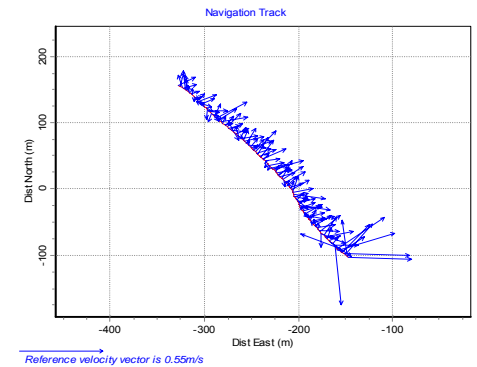
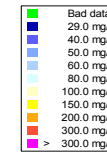
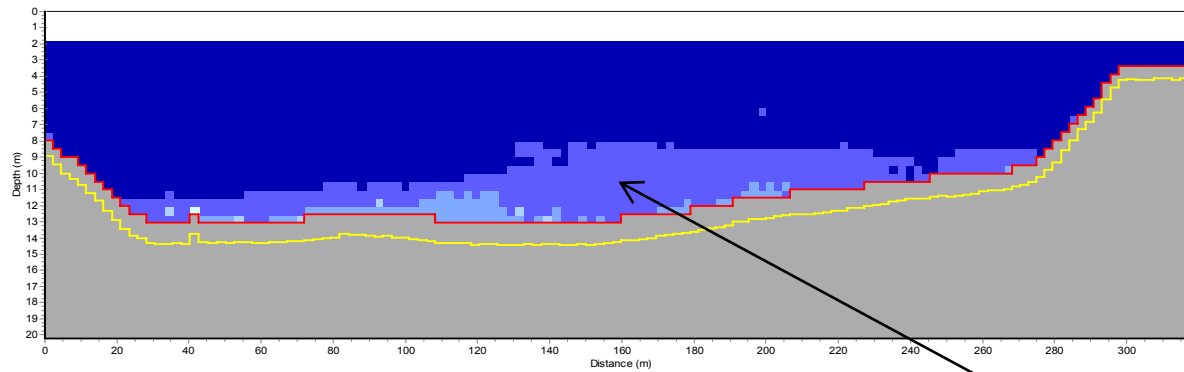
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities



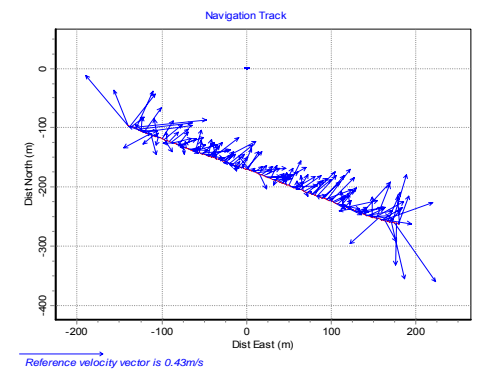
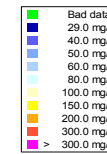
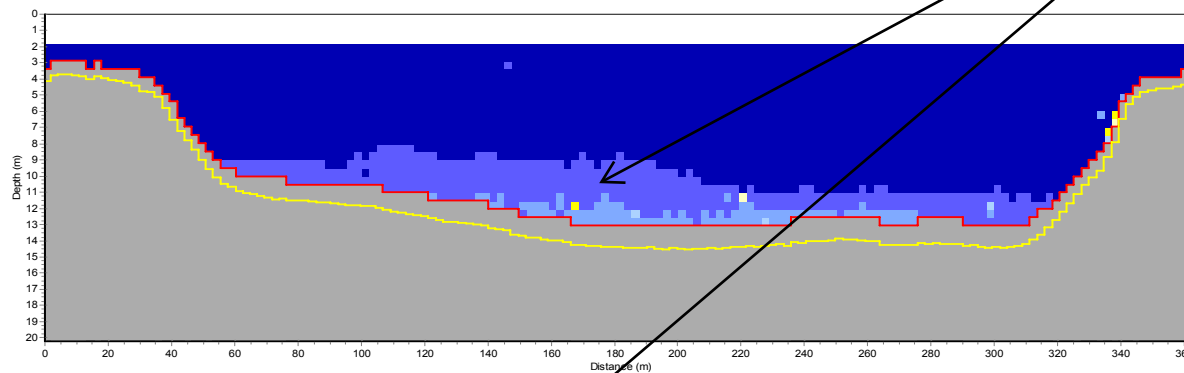
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

FIGURE
5v-x

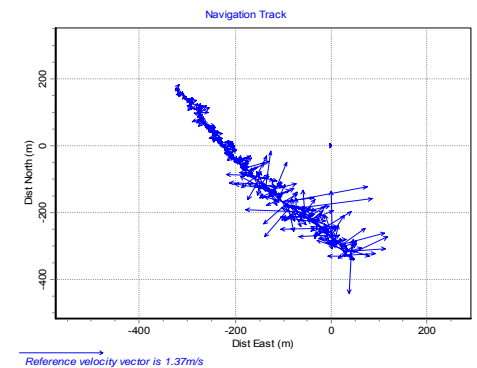
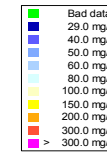
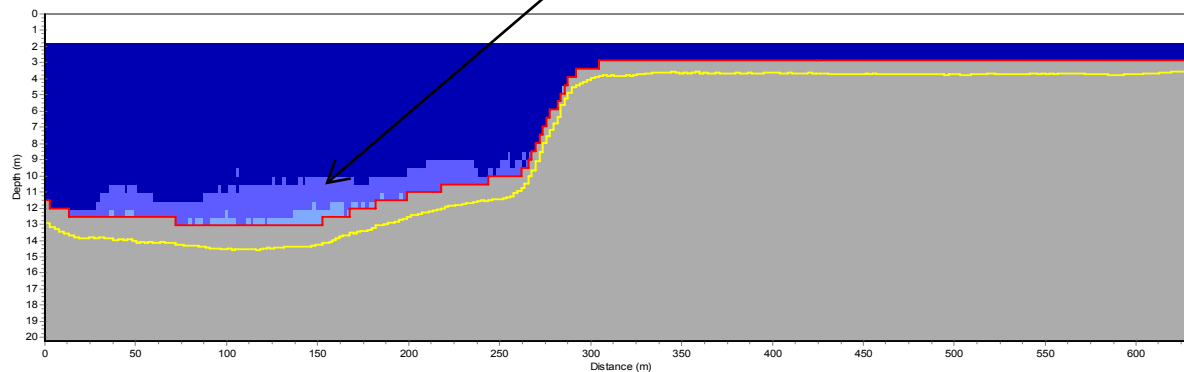
y) Transect T21 - Downcurrent 467 m*



z) Transect T22 - Downcurrent 492 m*



zz) Transect T23 - Downcurrent 517 m*



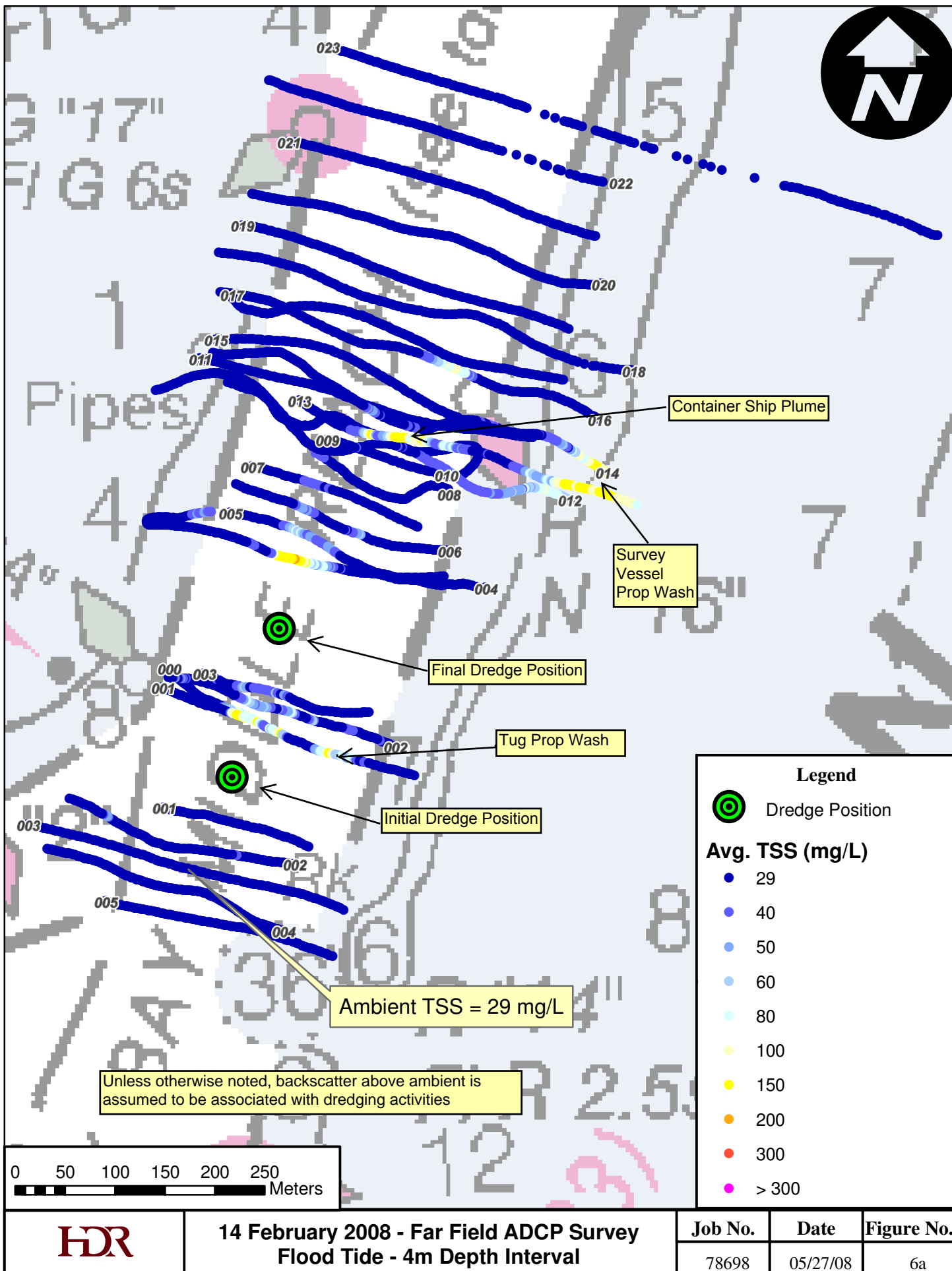
*Approximate distance downcurrent from source

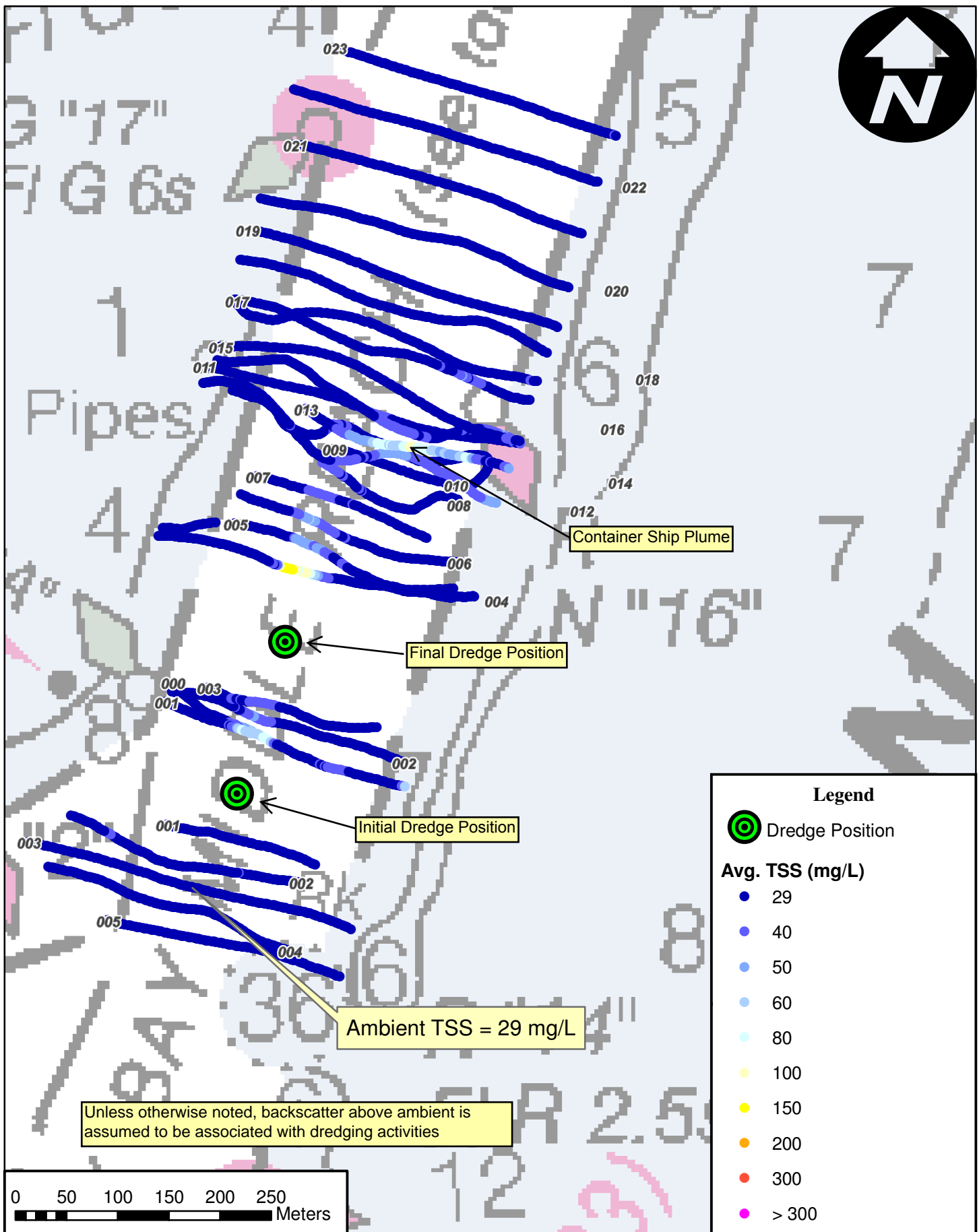
Unless otherwise noted, backscatter above ambient is assumed to be associated with dredging activities

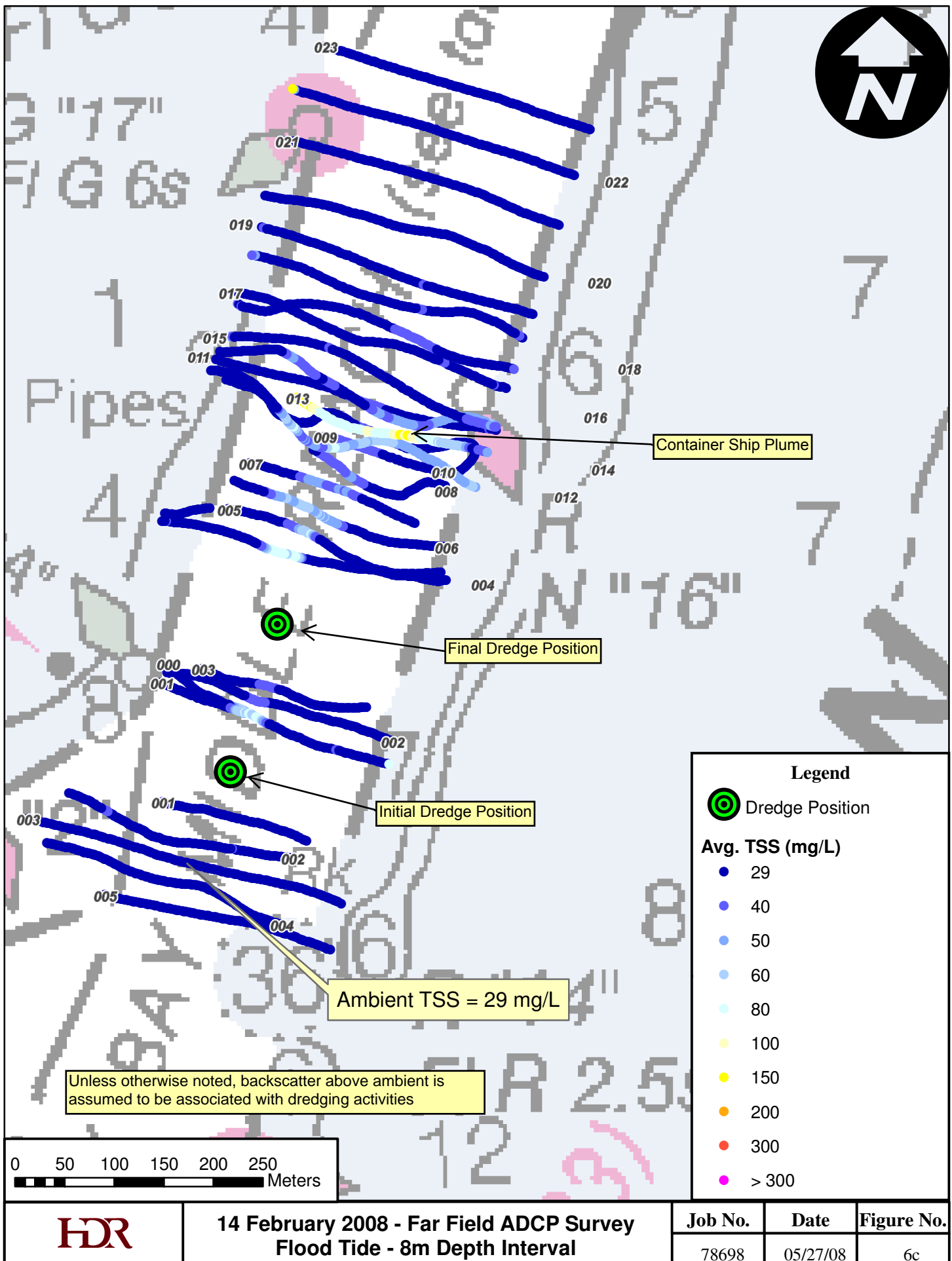


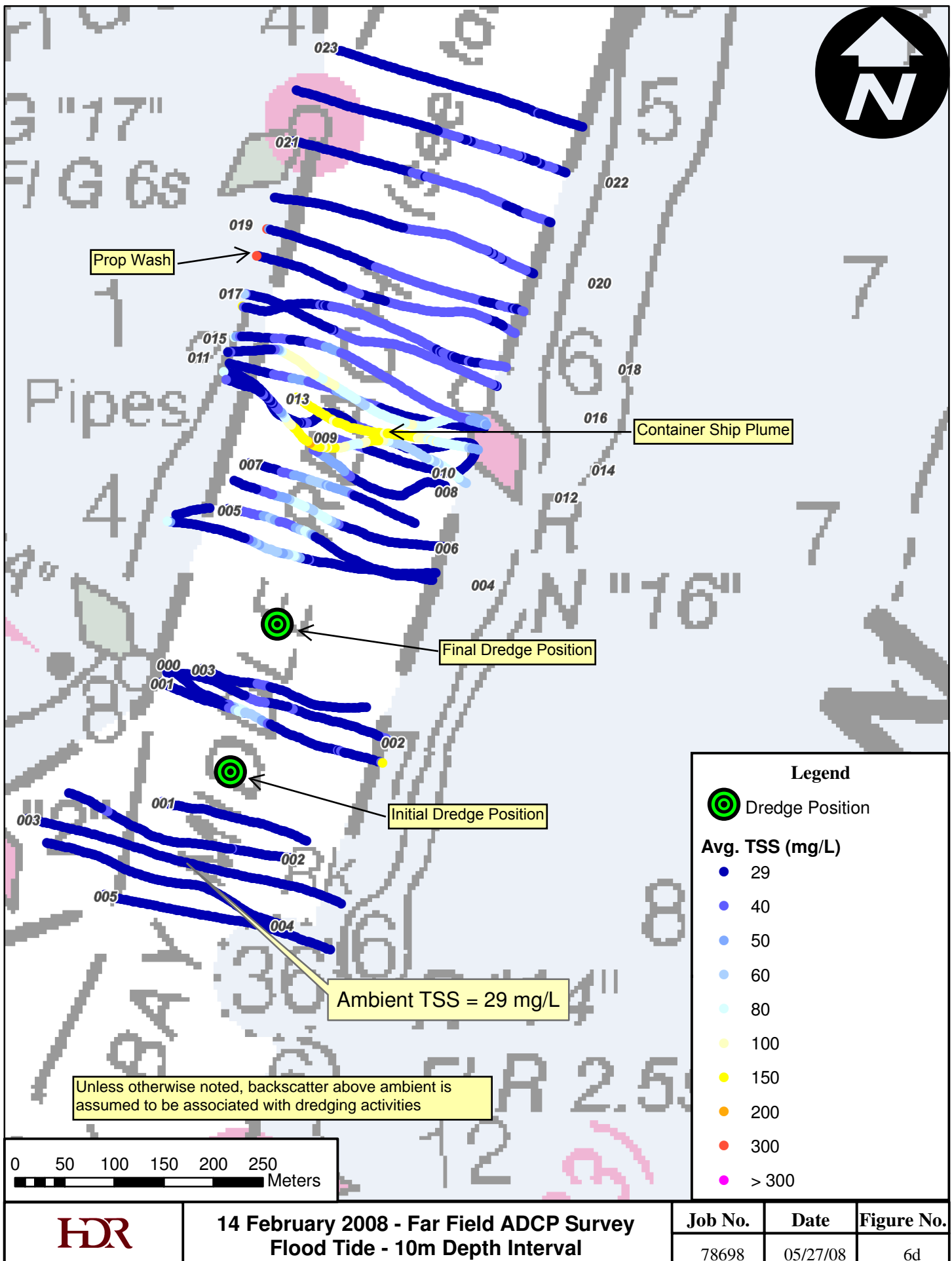
Vertical Profiles of ADCP Average TSS and Navigation Tracks with Depth Averaged Current Vectors
14 February 2008 Far Field Survey - Flood Tide

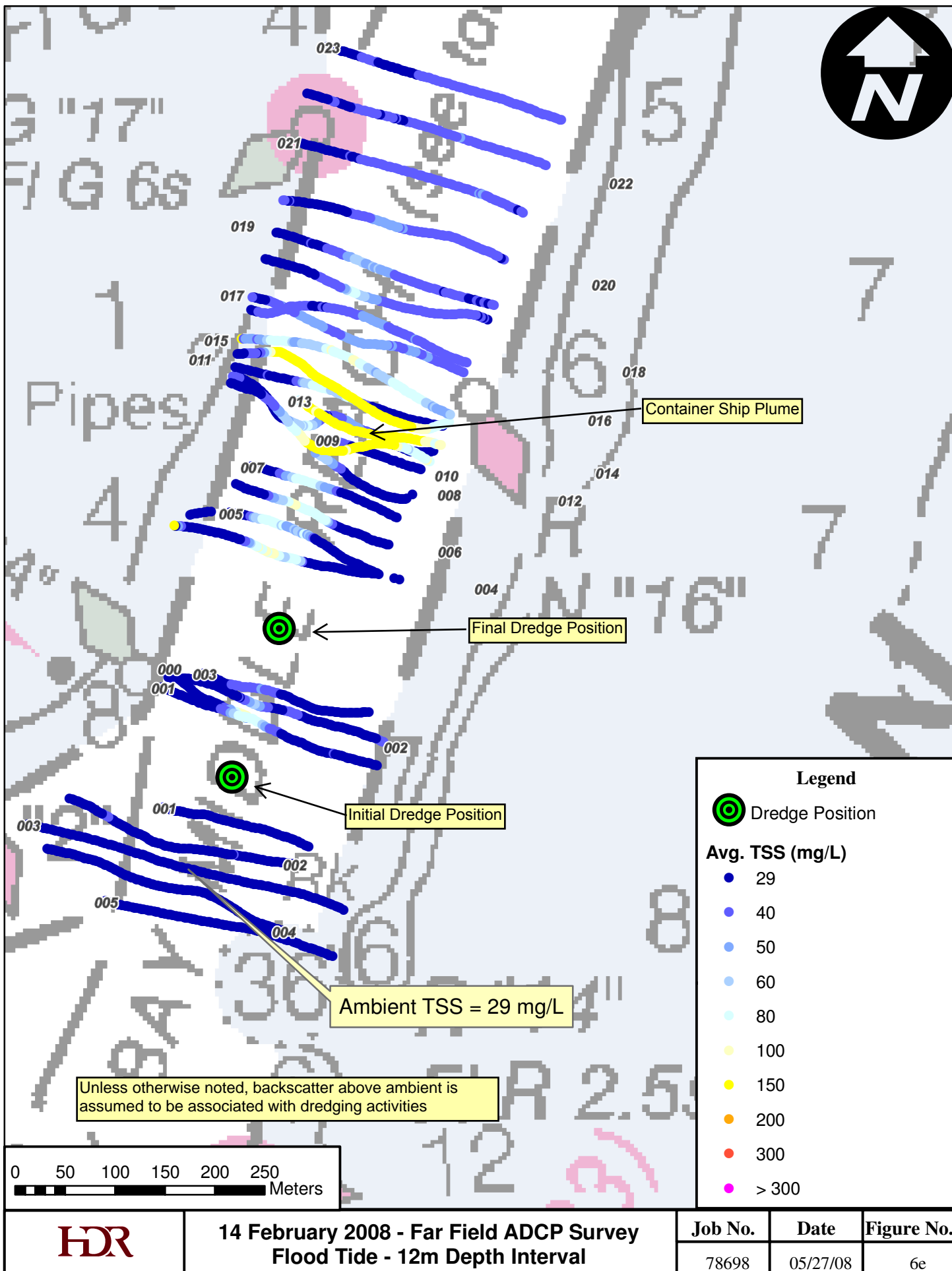
FIGURE
5y-zz

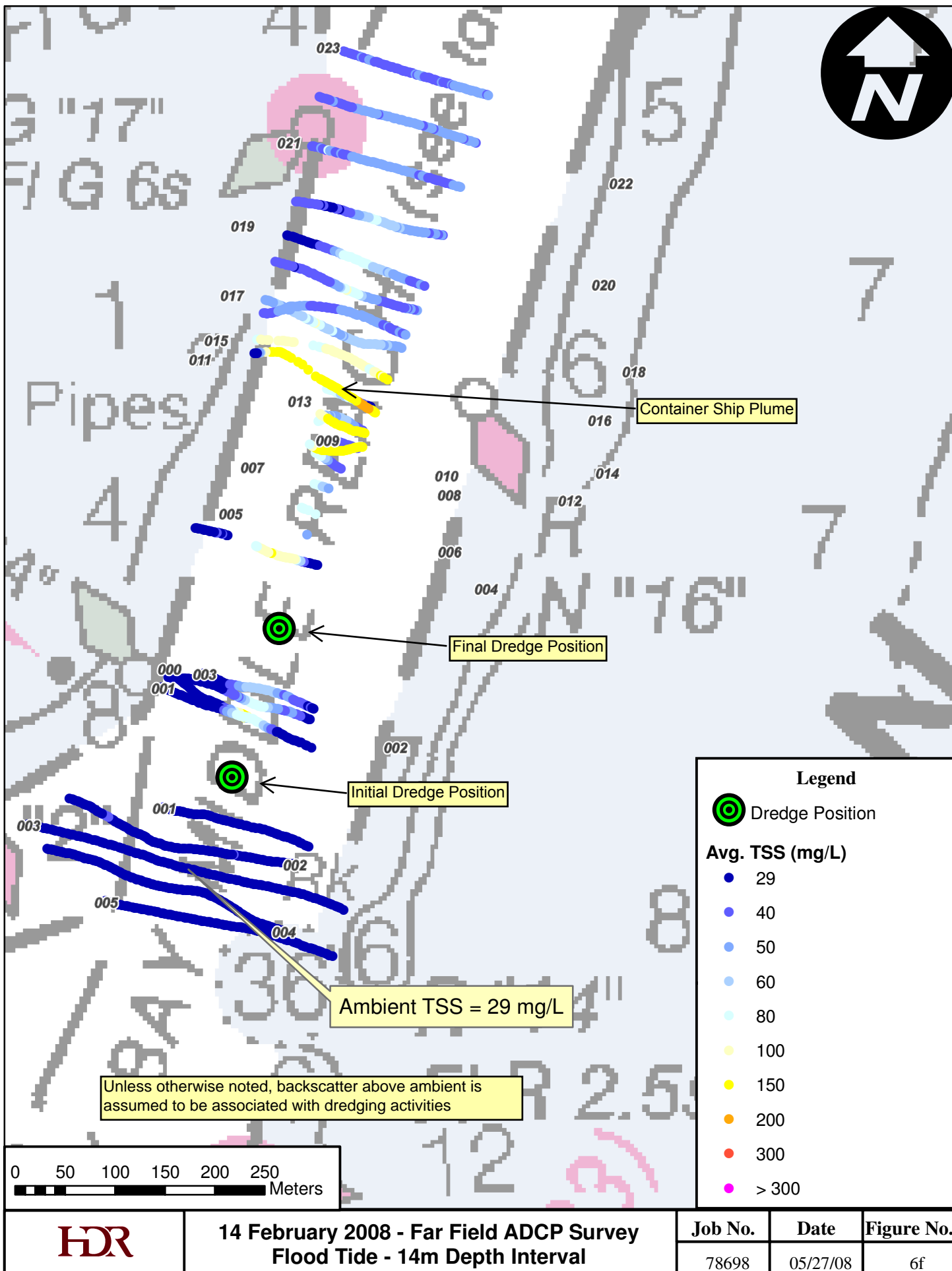


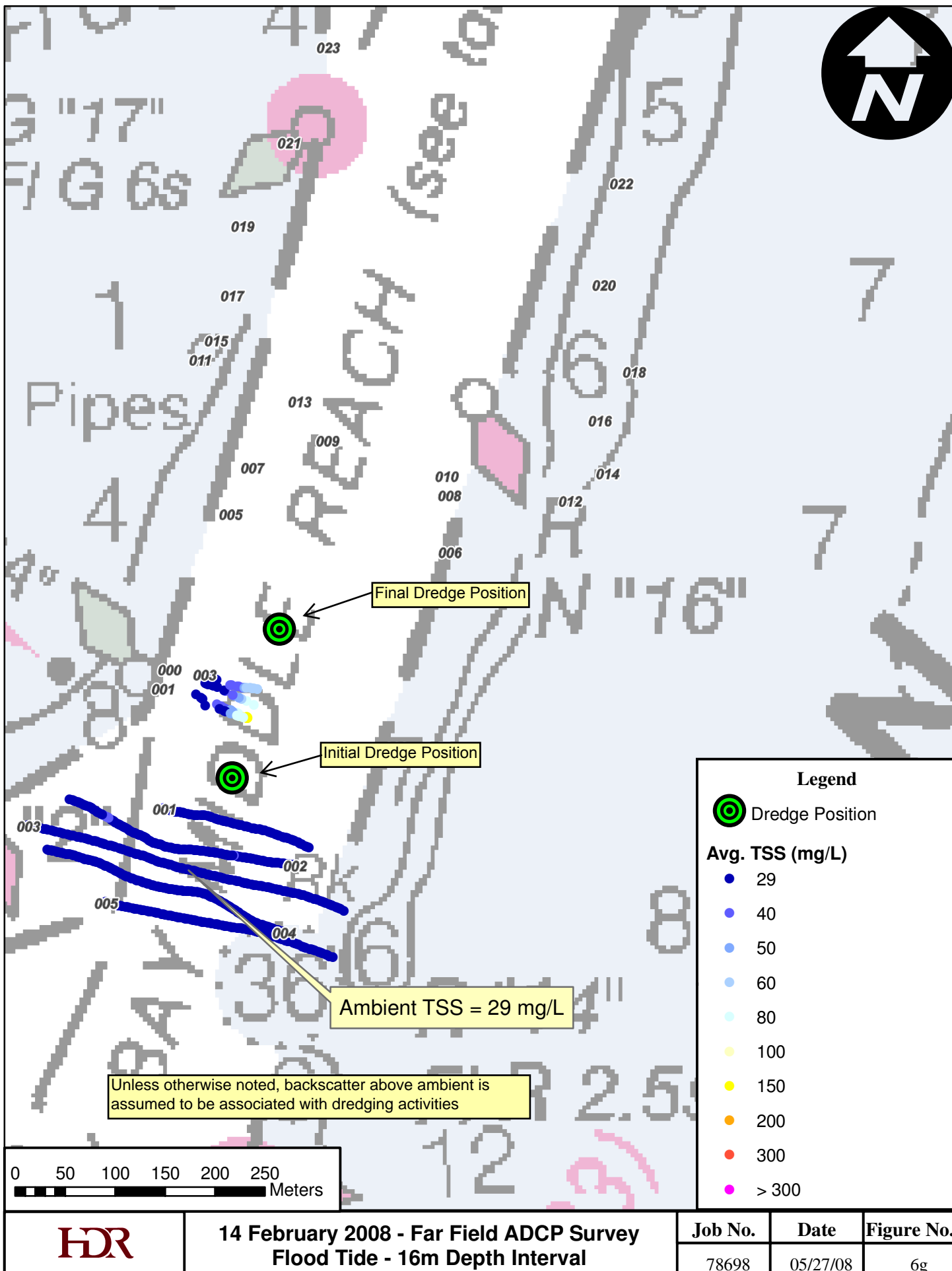


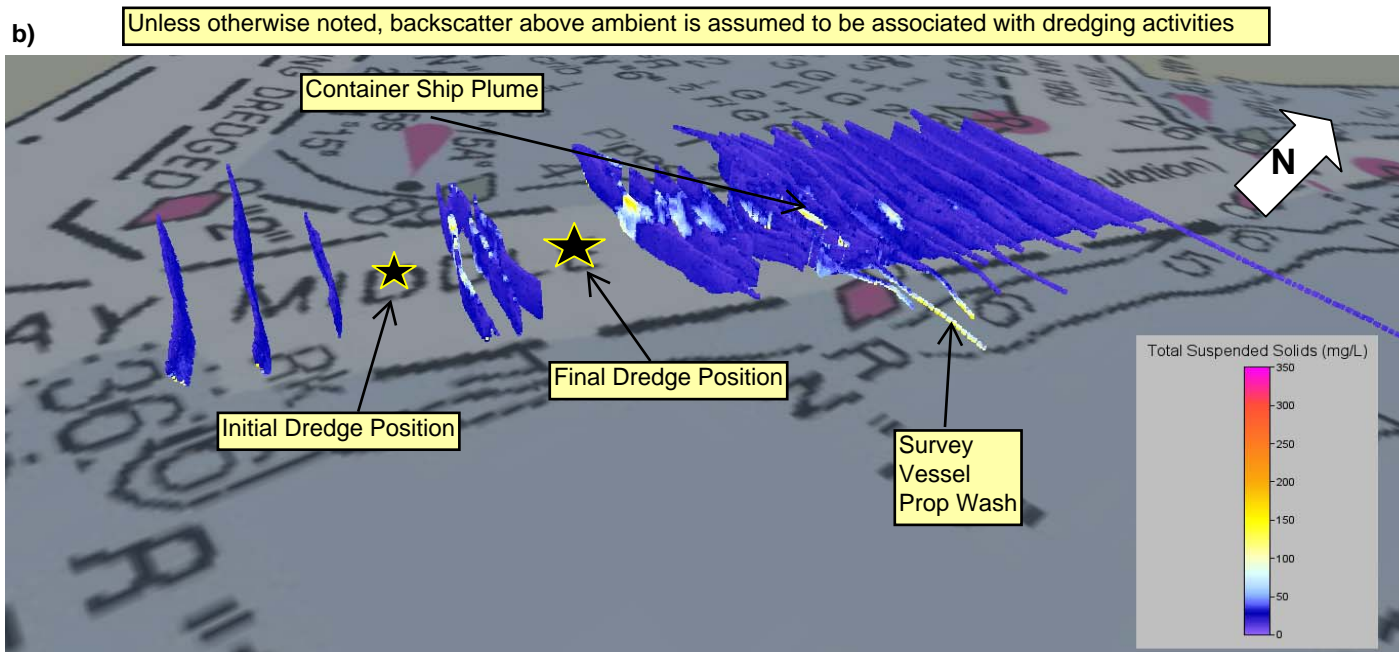
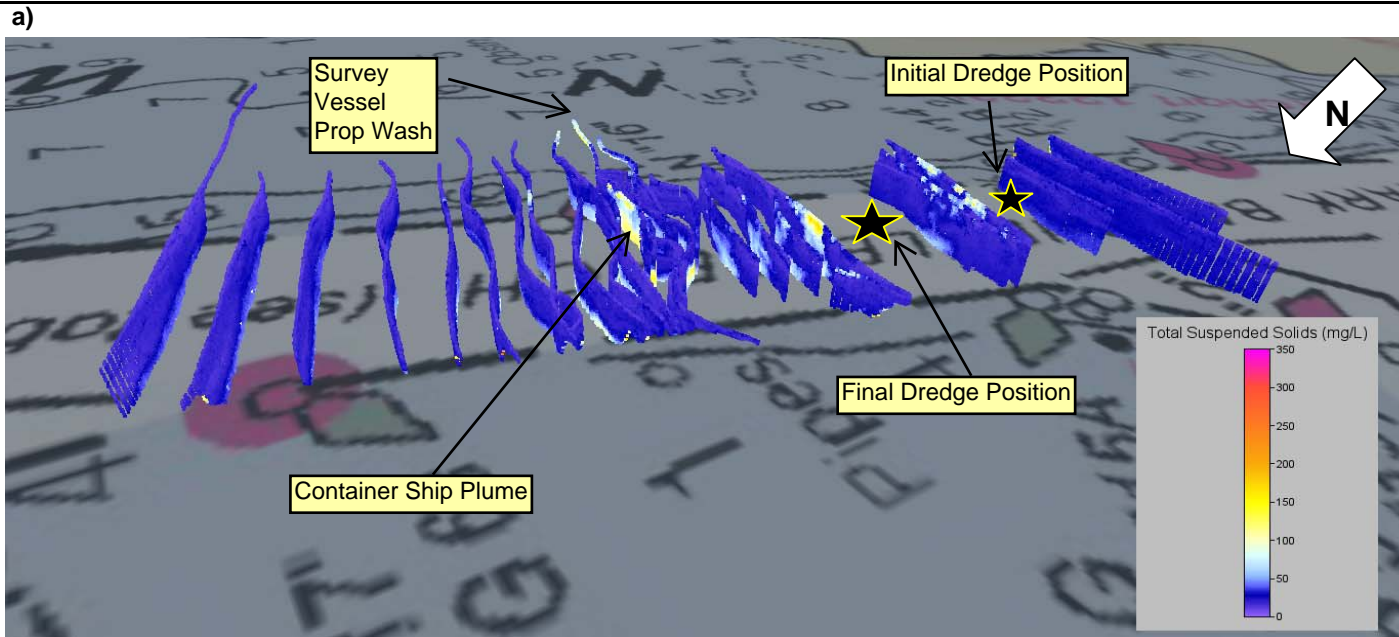












*Dredge position indicated by star



ADCP Average TSS Values with Respect to their x, y and z Coordinates
14 February 2008 Far Field Survey - Flood Tide

FIGURE

7a-b

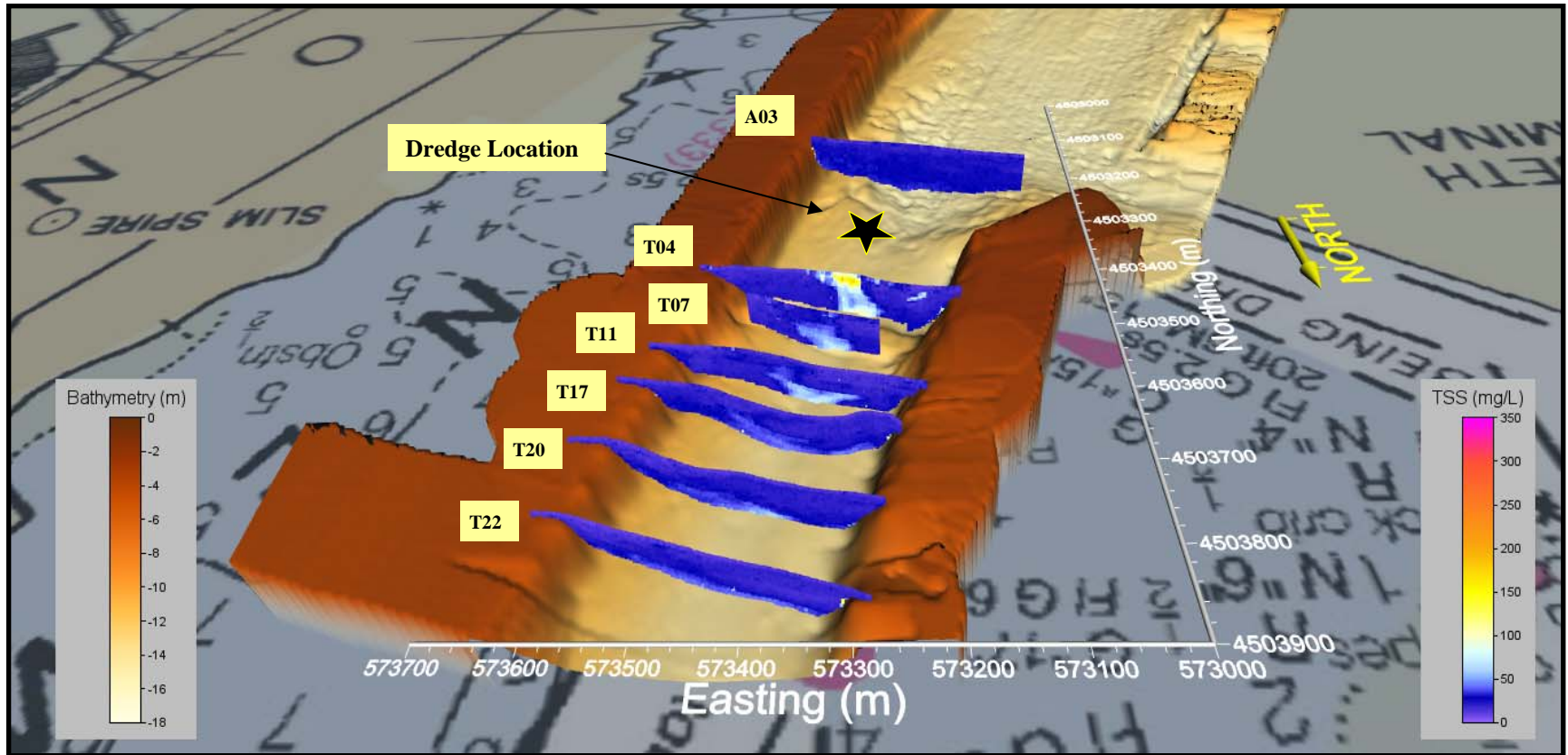
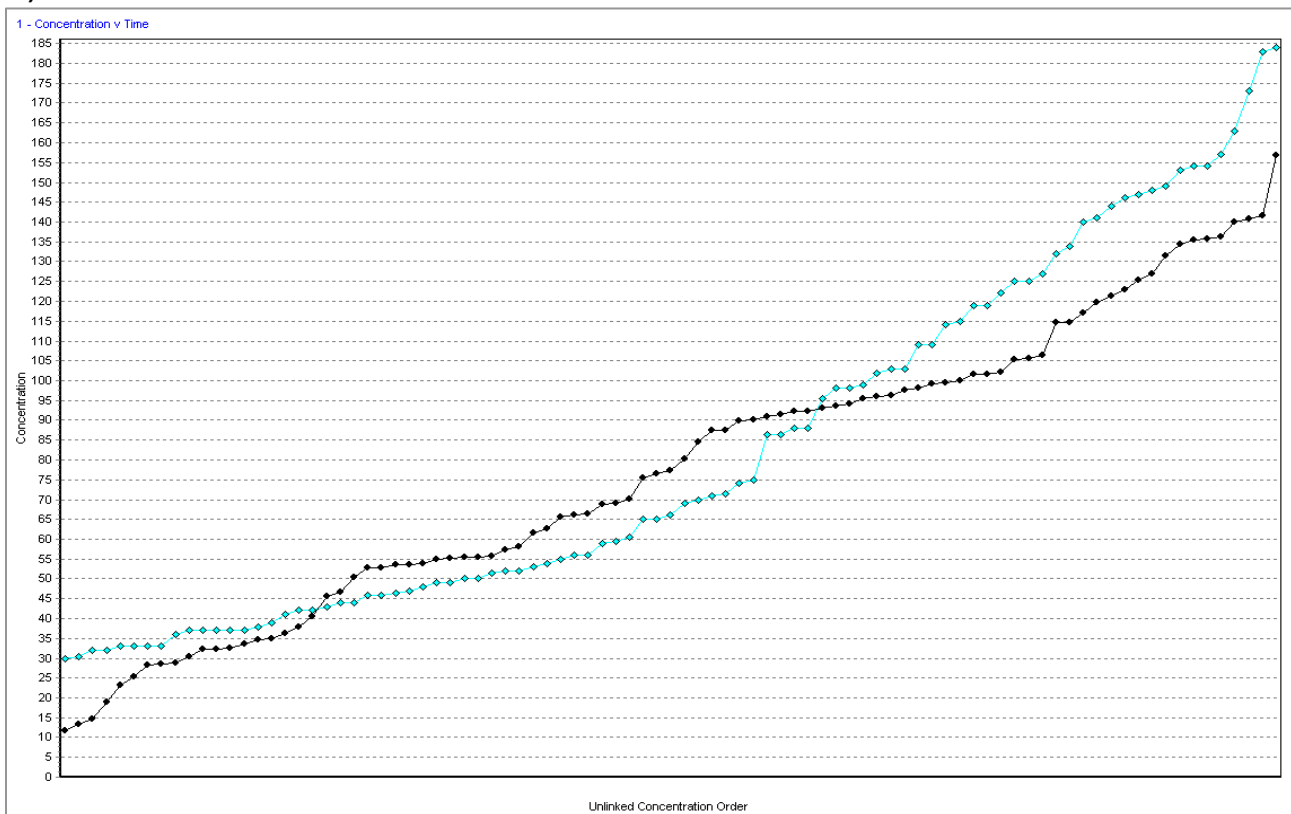


Figure 7c: ADCP Average TSS Values with Respect to their x, y and z Coordinates Superimposed on Channel Bathymetry. 14 February 2008 Far Field Survey - Flood Tide.

a) Rank Order



b) Paired Order

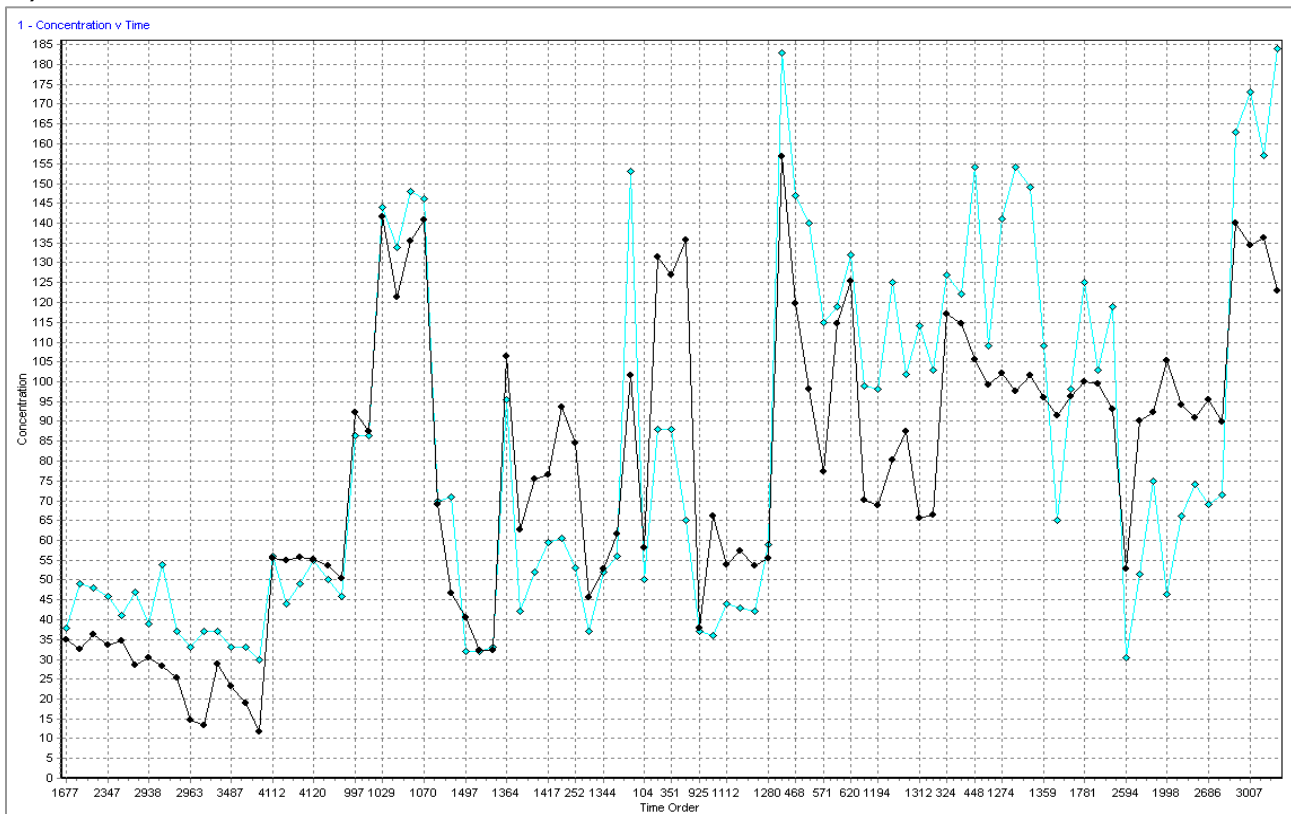


Table 4. Sediment Collection and Analyses Summary Table.

Area	Date Sampled	Grain Size Distribution ¹								Bulk Density ²		Atterberg Limits ³		
		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt	Clay	Moisture	Total Solids	Wet Bulk Density	Dry Bulk Density	Liquid Limit	Plastic Limit	Plasticity Index
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(g/cm3)	(g/cm3)			
Dredge Scow	1/29/2008	0.09	0.20	0.27	4.00	56.40	39.04	91	52	1.47	0.77	67	32	35
Dredge Scow	1/30/2008	0.00	0.03	0.41	4.30	53.95	41.31	98	50	1.46	0.74	68	32	36
Dredge Scow	1/31/2008	0.00	0.03	0.40	5.36	53.38	40.83	93	52	1.46	0.76	73	32	41
Dredge Field	1/31/2008	0.00	1.34	1.08	5.52	52.64	39.42	86	54	1.49	0.80	54	25	29
Dredge Scow	2/2/2008	0.00	0.19	0.51	4.79	52.93	41.58	119	46	1.40	0.64	77	32	45
Dredge Scow	2/7/2008	0.00	0.00	0.28	3.07	55.73	40.92	98	51	1.44	0.73	76	31	45
Dredge Scow	2/7/2008	0.00	0.00	0.28	3.28	56.53	39.91	98	51	1.45	0.73	76	31	45

¹ ASTM D422 Method

² EM 1110-2-1906 Method

³ ASTM D4318 Method