

**US Army Corps
of Engineers
New York District**

**2001 Total Suspended Sediment and
Turbidity Monitoring in Newark Bay,
Kill van Kull, and Port Jersey**



November, 2002

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 STUDY AREA.....	2
3.0 PROGRAM DESIGN.....	6
3.1 "AMBIENT" WATER QUALITY MONITORING.....	6
3.2 STORM EVENT WATER QUALITY MONITORING (STORM DATE: MAY 21 – 23, 2001).....	7
3.3 CONTAINER SHIP PASSAGE.....	7
3.4 ACTIVE DREDGING ACTIVITIES.....	7
4.0 RESULTS	8
4.1 "AMBIENT" WATER QUALITY MONITORING.....	8
4.2 POST STORM EVENT WATER QUALITY MONITORING	8
4.3 CONTAINER SHIP PASSAGE.....	8
4.4 ACTIVE DREDGING ACTIVITIES.....	15
5.0 DISCUSSION	20
6.0 CONCLUSIONS	25
7.0 LITERATURE CITED	26

APPENDIX I: TSS, Turbidity and HydroLab[®] Raw Data

APPENDIX II: Field Notes

LIST OF FIGURES

Figure 1: Ambient water quality monitoring stations in the Newark Bay/Arthur Kill Complex, 2001 Total Suspended Sediment and Turbidity Monitoring in Newark Bay, Kill van Kull, and Port Jersey.....	4
Figure 2: Ambient water quality monitoring stations in the Upper New York Harbor/Port Jersey Complex, 2001 Total Suspended Sediment and Turbidity Monitoring in Newark Bay, Kill van Kull, and Port Jersey.....	5
Figure 3: Total Suspended Solids (TSS) values from active dredge sampling in the Kill van Kull.....	24
Figure 4: Total Suspended Solids (TSS) values from Newark Bay/Arthur Kill ambient stations.....	27
Figure 5: Total Suspended Solids (TSS) values from Upper New York Harbor/Port Jersey ambient stations.....	28
Figure 6: Turbidity values from Newark Bay/Arthur Kill ambient stations.....	29
Figure 7: Turbidity values from Upper New York Harbor/Port Jersey ambient stations.....	30
Figure 8: Dissolved Oxygen (DO) values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.....	31
Figure 9: Temperature values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.....	32
Figure 10: Salinity values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.....	33
Figure 11: pH values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.....	34
Figure 12: Total Suspended Solids (TSS) values from active dredge sampling in the Kill van Kull, April 26, 2001.	35
Figure 13: Turbidity values from active dredge sampling in the Kill van Kull, April 26, 2001.	36
Figure 14: Locations of container ship passage sampling, November 14, 2001.....	37

Figure 15: Locations of container ship passage sampling within the Kill van Kull, November 14, 2001.....	38
Figure 16: Locations of container ship passage sampling within Newark Bay, November 14, 2001.....	39
Figure 17: Locations of container ship passage sampling within the Port Reading reach of the Arthur Kill, November 14, 2001.....	40
Figure 18: Total Suspended Solids (TSS) values from container ship passage sampling, November 14, 2001.....	41
Figure 19: Turbidity values from container ship passage sampling, November 14, 2001.	42
Figure 20: Locations of active dredge sampling in the Elizabeth Channel, November 14, 2001.....	43
Figure 21: Total Suspended Solids (TSS) values from active dredge sampling in Elizabeth Channel, November 14, 2001.....	44
Figure 22: Turbidity values from active dredge sampling in Elizabeth Channel, November 14, 2001.	45
Figure 23: Locations of container ship passage sampling, March 14, 2002.....	46
Figure 24: Total Suspended Solids (TSS) values from container ship passage sampling, March 14, 2002.	47
Figure 25: Turbidity values from container ship passage sampling, March 14, 2002.	48

LIST OF TABLES

Table 1: Station location (latitude and longitude) and depth data for the 2001 Total Suspended Sediment and Turbidity Monitoring for Newark Bay, Kill van Kull, and Port Jersey.....	3
Table 2: TSS values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, March 2001 - March 2002.....	9
Table 3: Turbidity values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, March 2001 - March 2002.....	10
Table 4: Mean ambient water quality parameters from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, March 2001 - March 2002.....	11
Table 5: Storm event TSS values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, May 25, 2001.....	12
Table 6: Storm event turbidity readings from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, May 25, 2001.....	13
Table 7: Storm event water quality parameters from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, May 25, 2001.....	14
Table 8: TSS and turbidity values from container ship passage sampling efforts, November 14, 2001.....	16
Table 9: TSS values from container ship passage sampling efforts, March 14, 2002.....	17
Table 10: Turbidity readings from container ship passage sampling efforts, March 14, 2002.....	18
Table 11: TSS and turbidity values from active dredge in the Kill van Kull, April 26, 2001.....	19
Table 12: TSS and turbidity values from active dredge in Elizabeth Channel, November 14, 2001.....	21

LIST OF ACRONYMS

AK – Arthur Kill
DO – Dissolved Oxygen
USEPA – U.S. Environmental Protection Agency
KVK – Kill Van Kull
LMS – Lawler, Matusky & Skelly Engineers LLP
NB – Newark Bay
NJ – New Jersey
NTU – Nephelometric Turbidity Unit
NY – New York
NYCDEP – New York City Department of Environmental Protection
NYD – New York District
NYSDEC – New York State Department of Environmental Conservation
PANY/NJ – Port Authority of New York & New Jersey
PPT – Parts Per Thousand
TSS – Total Suspended Solids
USACE – U.S. Army Corps of Engineers
USFWS – U.S. Fish and Wildlife Service

1.0 Introduction

The Port of New York/New Jersey, located within the Hudson-Raritan Estuary, is one of the largest import/export destinations along the U.S. East Coast, occupying approximately 755 miles (1215 km) of shoreline and supporting over 160,000 jobs in the NY/NJ metropolitan region. The Port of NY/NJ is naturally shallow, with an average depth of 6 m (18 ft.). Since the late 19th Century, dredging has been necessary to allow the Port to remain competitive as an industrial and commercial shipping destination. Today there are more than 200 miles (321 km) of federally maintained navigation channels within the NY/NJ Harbor.

The existing Port Jersey, Newark Bay and Kill van Kull channels are presently at depths that do not provide for full and efficient use by the container vessels that import and export goods to and from the New York City metropolitan area. The present depths of these channels restrict container vessels from using all of their available design draft and from leaving port at times other than high tide. Consequently, container ships must transit these channels in a partially loaded condition or anchor in New York Harbor to await a favorable tide.

Dredging activities in Federal Navigation Channels, such as those within the Port of New York/New Jersey, have been scrutinized in recent years for their possible impacts on biological communities. Of particular interest are measurements of baseline total suspended solids (TSS), which when compared to changes in TSS concentration and the extent of dredging plumes, may be useful in predicting impacts to fish and benthic communities. Barry A. Vittor & Associates, Inc. (BVA) was contracted by the U.S. Army Corps of Engineers, New York District (USACE-NYD) to conduct an examination of

TSS levels as well as several other water quality parameters within the Arthur Kill and Newark Bay. This pilot project was initiated by the USACE to develop baseline sampling procedures for future analysis of potential impacts due to proposed navigation improvements. The primary focus of this analysis will be determination of baseline TSS levels within particular areas of the NY-NJ Harbor considered sensitive for winter flounder (*Pleuronectes americanus*) spawning and early development. Results of this study will be utilized in the analysis of potential biological impacts associated with proposed navigation improvements.

2.0 Study Area

The NY-NJ Harbor region is one of the most highly industrialized and densely populated coastal areas in the world. Large portions of the shoreline of Newark Bay, the Kill van Kull, the Arthur Kill and the Port Jersey Terminal are bulkheaded and riprapped. Average depths in the main shipping channels of the study range from 35 to 41 feet. Seasonal dissolved oxygen (DO) levels from surface and bottom waters range from 1.4 mg/L to 8.4 mg/L with seasonal hypoxia occurring throughout portions of both Newark Bay and the Arthur Kill (USACE 1997).

Water quality monitoring stations were located in the Newark Bay-Arthur Kill system and the Upper New York Harbor-Port Jersey system (**Table 1**). Stations in the Newark Bay-Arthur Kill system ranged from the Elizabeth Channel at Port Elizabeth south to the mouth of Old Place Creek (**Fig. 1**). Stations in the Upper New York Harbor-Port Jersey system ranged from the northern end of the Jersey Flats, south to Robbins Reef, and as far east as the center of the Anchorage Channel (**Fig. 2**). There are several sources of freshwater influx within the sampling areas. The Passaic and Hackensack

**Table 1: Station location (latitude and longitude) and depth data for the 2001
Total Suspended Sediment and Turbidity Monitoring for Newark Bay,
Kill van Kull, and Port Jersey.**

Station	Depth (m)	Latitude	Longitude
PJ - 1	3.0	40° 40' 18.4" N	74° 03' 56.6" W
PJ - 2	3.1	40° 39' 59.0" N	74° 03' 37.7" W
PJ - 3	12.8	40° 39' 30.0" N	74° 03' 03.9" W
PJ - 4	11.1	40° 39' 37.5" N	74° 03' 47.5" W
PJ - 5	10.8	40° 40' 01.3" N	74° 04' 21.2" W
PJ - 6	3.2	40° 39' 20.7" N	74° 04' 00.2" W
PJ - 7	2.4	40° 39' 36.0" N	74° 04' 36.3" W
NB - 1	2.2	40° 38' 10.4" N	74° 11' 42.8" W
NB - 2	1.8	40° 38' 43.1" N	74° 10' 37.1" W
NB - 3	1.8	40° 38' 42.3" N	74° 09' 57.7" W
NB - 4	11.0	40° 38' 48.8" N	74° 09' 59.4" W
NB - 5	1.4	40° 38' 54.2" N	74° 09' 59.3" W
NB - 6	2.0	40° 39' 22.8" N	74° 09' 14.0" W
NB - 7	11.5	40° 39' 31.4" N	74° 08' 38.9" W
NB - 8	2.0	40° 40' 11.8" N	74° 07' 56.6" W

Newark Bay / Arthur Kill

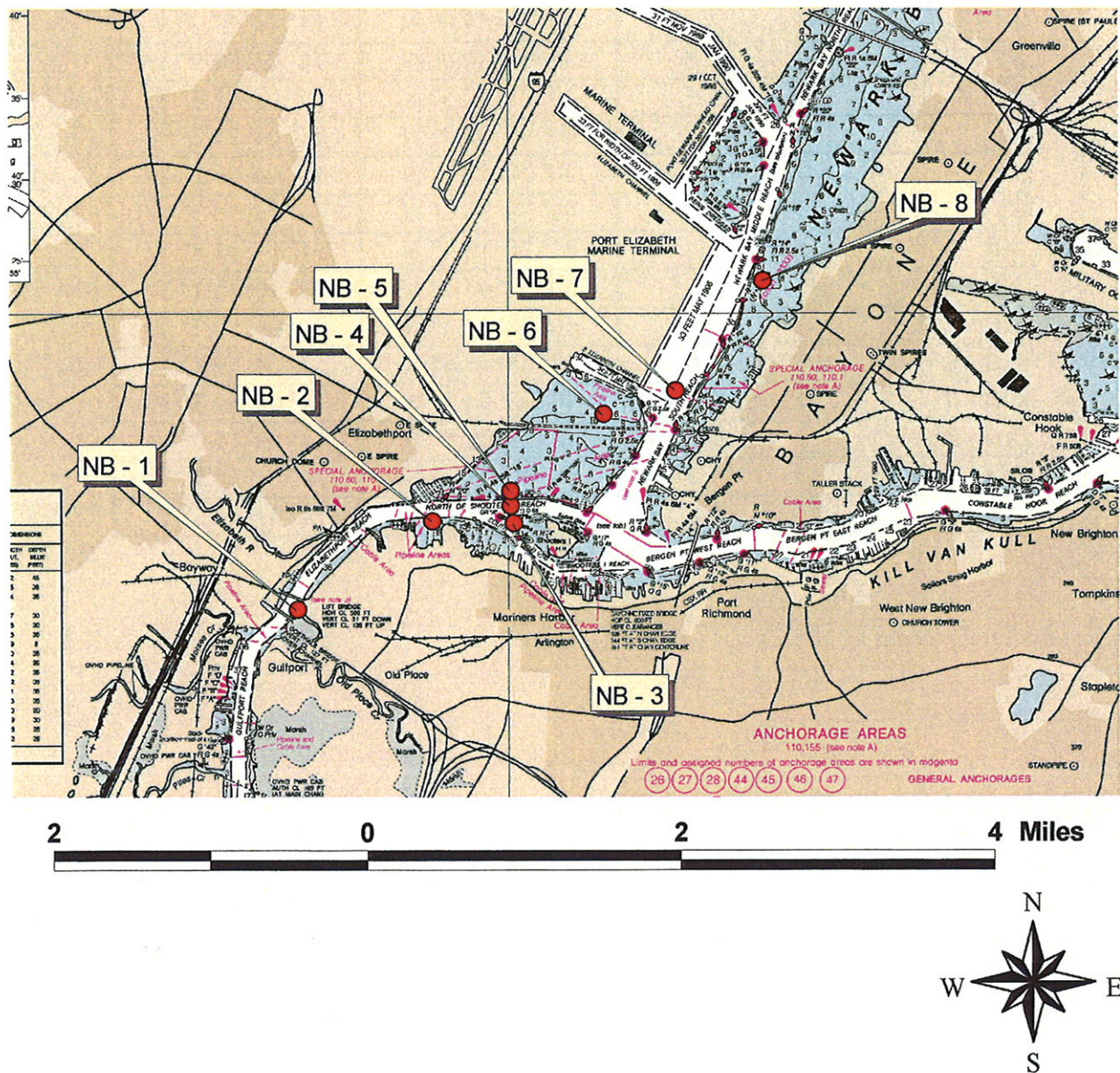


Figure 1: Ambient water quality monitoring stations in the Newark Bay/Arthur Kill Complex, 2001 Total Suspended Sediment and Turbidity Monitoring in Newark Bay, Kill van Kull, and Port Jersey.

Upper New York Harbor / Port Jersey

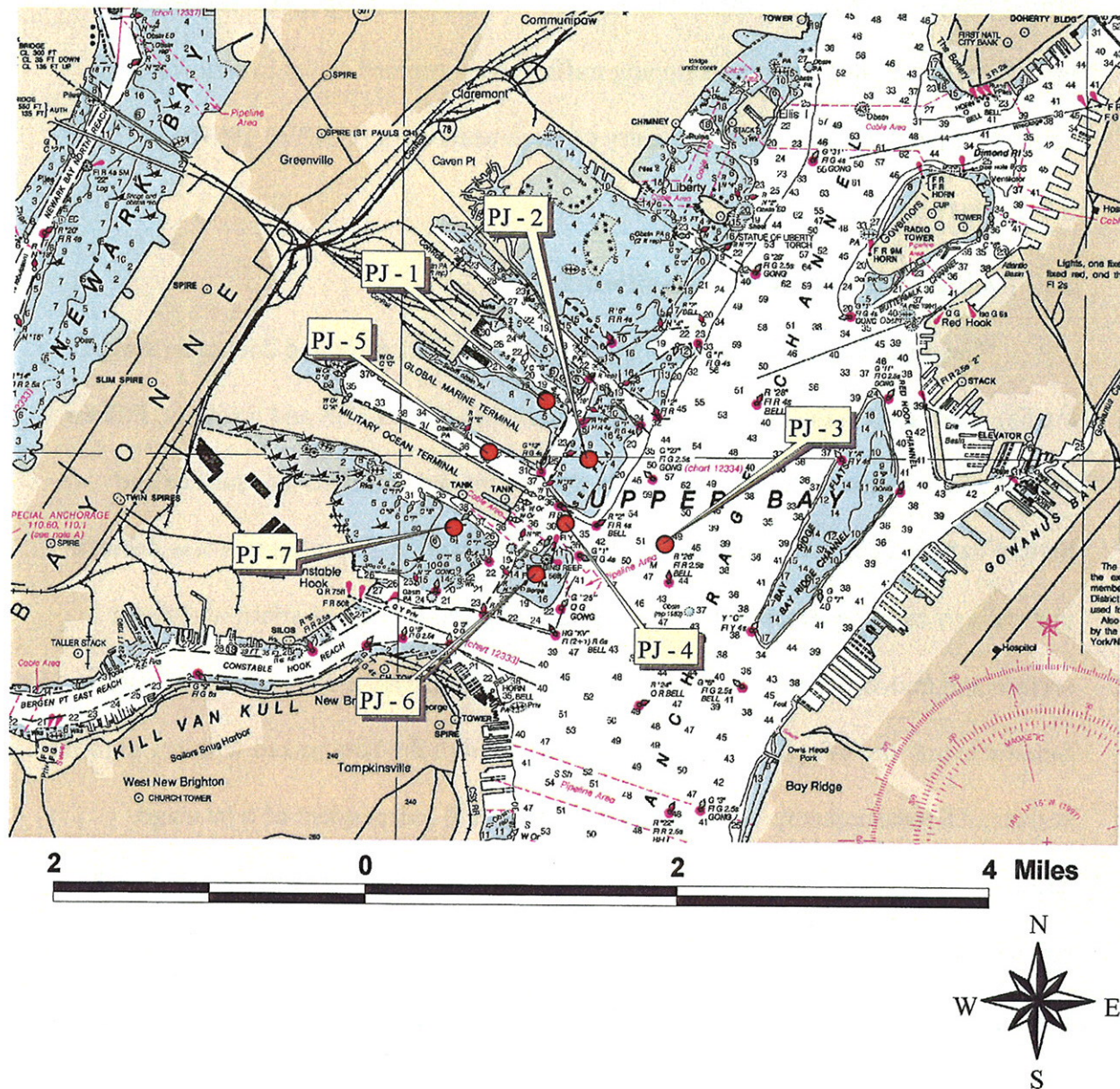


Figure 2: Ambient water quality monitoring stations in the Upper New York Harbor/Port Jersey Complex, 2001 Total Suspended Sediment and Turbidity Monitoring in Newark Bay, Kill van Kull, and Port Jersey.

Rivers both discharge into Newark Bay from the northern end. The Elizabeth River enters the system approximately at the middle of the Arthur Kill; and the Rahway River also discharges into the Arthur Kill. Both the Hudson and East Rivers discharge into the Upper New York Harbor from the northern end. The Upper New York Harbor and the Newark Bay systems are connected by the Kill van Kull. Anthropogenic influences, including industrial discharges, shipping traffic, and combined sewer overflows, also affect the hydrology and water chemistry of these waterways (USFWS 1997b).

3.0 Program Design

3.1 "Ambient" Water Quality Monitoring

The objectives of this sampling program were to monitor and document water quality conditions in the system, with particular emphasis on TSS and turbidity. Fifteen water quality stations were located within the system and stratified into surface and bottom depths. During most sampling efforts, a mid-water column sample was deemed unnecessary because the previous year's pilot study showed little variation between surface and mid-water column values within a station (USACE 2000). At each station, measurements and samples were taken within 1 m from the bottom and within 1 m of the surface. All measurements and samples were collected independent of tidal stage.

Triplicate water samples were collected for analysis of TSS from each station at each stratum using a 2.2 L Kemmerer bottle, stored in 1-L plastic bottles, and preserved on ice for transport to the laboratory. At the laboratory, the samples were analyzed using EPA test method 160.2 and TSS values were reported in mg/L. Turbidity was measured with a LaMotte® 2020 turbidimeter and values were reported in NTU. Temperature, salinity,

pH, and DO were also measured from each stratum at each station using a Hydrolab® Multiprobe.

3.2 Storm Event Water Quality Monitoring (Storm Date: May 21 – 23, 2001)

Measurements and samples were taken at each of the same stations used for the "ambient" water quality monitoring following a storm event (i.e., a large input of freshwater into the system over a brief period of time). This sampling was conducted on May 25, 2001, following a storm which produced just over two inches of rainfall over a three day period. TSS samples were collected and analyzed using the above procedure.

3.3 Container Ship Passage

Water samples for analysis of TSS were collected following the passage of an ocean-going container ship using the methods described above. The locations for sampling were based on visual observations of turbidity plumes created by container ship maneuvering activities. Sub-samples were placed in the LaMotte® 2020 turbidimeter and the resulting readings were recorded in NTU. The remainders of the samples were analyzed using EPA test method 160.2 and TSS values were reported in mg/L.

3.4 Active Dredging Activities

Water samples for analysis of TSS were also collected at various distances both up-current and down-current of active dredging activities using the methods described above. Samples were collected at pre-determined distances at bottom, mid-depth, and surface strata on both April 26, 2001 and November 14, 2001. Sub-samples were placed in the LaMotte® 2020 turbidimeter and the resulting readings were recorded in NTU. The remainders of the samples were analyzed using EPA test method 160.2 and TSS values were reported in mg/L.

4.0 Results

4.1 "Ambient" Water Quality Monitoring

Within the areas of the harbor monitored, TSS values at the bottom stratum ranged from 4.3 mg/L to 43.7 mg/L. TSS values at the surface ranged from 3.3 mg/L to 40.0 mg/L (**Table 2**). Bottom TSS values were generally higher than surface values. Turbidity values essentially mirrored TSS values among the monitoring stations (**Table 3**). DO levels were relatively high and ranged from 2.9 mg/L to 10.9 mg/L, while salinity ranged from 8.0 to 30.4 and temperature ranged from 4.4 °C to 26.6 °C (**Table 4**).

4.2 Post Storm Event Water Quality Monitoring

The May 25, 2001 sampling event followed a significant storm which occurred between May 21 and May 23, 2001. Mean TSS values at the bottom stratum ranged from 7.7 mg/L to 27.0 mg/L. Mean TSS values at the surface ranged from 5.7 mg/L to 12.3 mg/L (**Table 5**). Mean turbidity readings at the bottom stratum on that date ranged from 4.0 NTU to 13.3 NTU (**Table 6**). Mean DO levels ranged from 5.4 mg/L to 7.4 mg/L, mean temperature ranged from 14.2 °C to 17.6 °C, and mean salinity ranged from 17.9 to 26.7 (bottom and surface, **Table 7**).

4.3 Container Ship Passage

TSS values at the bottom stratum following the passage of container ships on November 14, 2001 ranged from 14.0 mg/L to 952.0 mg/L. TSS values at the mid-depth stratum ranged from 75.0 mg/L to 432.0 mg/L and TSS values at the surface ranged from 10.0 mg/L to 797.0 mg/L. Turbidity readings at the bottom stratum following the passage of a container ship on this date ranged from 5.4 NTU to 304.0 NTU. Turbidity readings at the mid-depth stratum ranged from 21.3 NTU to 123.0 NTU and turbidity readings at the

Table 2: TSS values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, March 2001 - March 2002.

Station	Stratum	Minimum TSS (mg/L)	Maximum TSS (mg/L)
NB - 1	Bottom	8.7	37.0
	Surface	4.0	22.3
NB - 2	Bottom	6.3	43.7
	Surface	4.0	40.0
NB - 3	Bottom	7.3	31.0
	Surface	4.0	18.3
NB - 4	Bottom	7.0	27.0
	Surface	3.7	19.7
NB - 5	Bottom	7.0	27.7
	Surface	4.3	23.7
NB - 6	Bottom	8.0	41.0
	Surface	3.3	27.7
NB - 7	Bottom	7.0	23.3
	Surface	4.0	20.7
NB - 8	Bottom	4.3	25.3
	Surface	3.7	16.0
PJ - 1	Bottom	6.3	29.0
	Surface	5.7	16.7
PJ - 2	Bottom	8.0	25.3
	Surface	7.0	27.3
PJ - 3	Bottom	8.7	26.3
	Surface	6.0	20.0
PJ - 4	Bottom	7.0	27.3
	Surface	6.3	14.3
PJ - 5	Bottom	6.0	38.0
	Surface	5.0	12.7
PJ - 6	Bottom	6.0	32.7
	Surface	6.7	19.3
PJ - 7	Bottom	8.0	20.7
	Surface	5.0	16.3

Table 3: Turbidity readings from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, March 2001 - March 2002.

Station	Stratum	Minimum Turb. (NTU)	Maximum Turb. (NTU)
NB - 1	Bottom	3.7	40.7
	Surface	2.2	6.0
NB - 2	Bottom	3.5	24.7
	Surface	1.7	15.0
NB - 3	Bottom	3.5	10.0
	Surface	1.8	5.6
NB - 4	Bottom	3.2	9.0
	Surface	1.7	5.9
NB - 5	Bottom	3.4	9.1
	Surface	1.8	6.2
NB - 6	Bottom	2.6	9.6
	Surface	1.8	6.6
NB - 7	Bottom	2.6	10.7
	Surface	2.2	7.2
NB - 8	Bottom	2.8	7.2
	Surface	1.8	6.3
PJ - 1	Bottom	3.3	11.7
	Surface	1.5	9.6
PJ - 2	Bottom	3.2	10.5
	Surface	1.7	14.0
PJ - 3	Bottom	1.6	10.7
	Surface	1.4	16.7
PJ - 4	Bottom	2.4	9.4
	Surface	1.6	10.6
PJ - 5	Bottom	2.6	12.7
	Surface	1.5	9.3
PJ - 6	Bottom	1.6	8.7
	Surface	1.5	12.7
PJ - 7	Bottom	2.0	12.0
	Surface	1.2	8.7

Table 4: Range of ambient water quality parameters from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, March 2001 - March 2002.

Station	Stratum	Depth (m)	Temp (°C)		Sal		pH		DO (mg/L)	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
NB - 1	Bottom	2.2	5.1	25.7	13.9	24.7	7.5	8.2	4.4	10.4
NB - 1	Surface	0.5	5.1	26.2	12.7	24.5	7.5	8.2	4.5	9.4
NB - 2	Bottom	1.8	5.2	25.6	14.7	24.4	7.6	8.2	3.8	9.1
NB - 2	Surface	0.5	5.2	25.8	13.1	24.4	7.6	8.2	3.9	9.4
NB - 3	Bottom	1.8	5.2	25.7	15.1	24.4	7.3	8.2	3.8	10.0
NB - 3	Surface	0.5	5.1	25.7	14.5	24.4	7.3	8.2	3.8	9.6
NB - 4	Bottom	11.0	5.2	25.1	18.0	25.7	7.5	8.2	3.7	9.1
NB - 4	Surface	0.6	5.4	25.6	13.9	24.7	7.5	8.2	4.0	9.7
NB - 5	Bottom	1.4	5.2	25.5	14.2	24.7	7.6	8.3	3.9	9.5
NB - 5	Surface	0.5	5.2	25.7	13.8	24.5	7.6	8.3	3.9	9.5
NB - 6	Bottom	2.0	4.9	25.3	15.2	25.1	7.6	8.3	3.9	9.8
NB - 6	Surface	0.5	4.9	25.7	13.0	25.1	7.6	8.3	3.9	10.0
NB - 7	Bottom	11.5	4.8	24.9	17.7	26.1	7.7	8.2	3.9	9.1
NB - 7	Surface	0.5	4.8	26.2	11.1	24.7	7.5	8.2	3.9	9.7
NB - 8	Bottom	2.0	4.8	25.8	13.2	24.3	7.4	8.3	3.8	10.2
NB - 8	Surface	0.5	4.8	26.6	11.7	24.2	7.5	8.3	4.1	10.4
PJ - 1	Bottom	3.0	4.9	24.6	9.2	26.4	7.5	8.1	3.8	10.7
PJ - 1	Surface	0.5	4.5	25.6	9.1	26.1	7.5	8.1	4.1	10.9
PJ - 2	Bottom	3.1	5.0	24.5	14.3	27.7	7.6	8.2	4.5	10.2
PJ - 2	Surface	0.5	4.8	24.5	9.5	27.8	7.6	8.2	4.5	10.6
PJ - 3	Bottom	12.8	4.8	24.0	26.5	30.4	7.8	8.3	4.3	9.6
PJ - 3	Surface	0.5	5.1	25.1	8.0	28.2	7.7	8.2	4.3	10.2
PJ - 4	Bottom	11.1	4.9	24.2	24.4	28.8	7.7	8.2	4.0	10.3
PJ - 4	Surface	0.5	5.1	25.8	10.2	26.3	7.7	8.2	3.7	10.4
PJ - 5	Bottom	10.8	4.9	24.1	23.9	29.9	7.3	8.2	2.9	9.0
PJ - 5	Surface	0.5	4.4	25.7	12.0	25.6	7.3	8.2	3.7	9.8
PJ - 6	Bottom	3.2	4.9	24.1	15.2	28.7	7.2	8.2	4.2	9.6
PJ - 6	Surface	0.5	5.0	24.8	11.1	27.4	7.4	8.2	4.0	10.1
PJ - 7	Bottom	2.4	5.0	24.6	13.4	26.4	7.4	8.2	3.7	9.9
PJ - 7	Surface	0.5	5.0	25.3	12.8	25.6	7.5	8.2	3.7	9.8

Table 5: Storm event TSS values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, May 25, 2001.

Station	Stratum	Mean TSS (mg/L)	Std. Error
NB - 1	Bottom	15.0	4.2
NB - 1	Surface	7.7	0.7
NB - 2	Bottom	27.0	13.7
NB - 2	Surface	8.0	0.0
NB - 3	Bottom	11.3	0.9
NB - 3	Surface	6.3	0.9
NB - 4	Bottom	10.7	0.9
NB - 4	Surface	9.3	0.7
NB - 5	Bottom	11.0	1.5
NB - 5	Surface	12.3	0.9
NB - 6	Bottom	11.7	1.8
NB - 6	Surface	11.3	0.9
NB - 7	Bottom	12.3	1.5
NB - 7	Surface	9.7	0.3
NB - 8	Bottom	15.7	5.7
NB - 8	Surface	8.3	0.3
PJ - 1	Bottom	17.0	3.5
PJ - 1	Surface	8.0	0.0
PJ - 2	Bottom	16.0	1.0
PJ - 2	Surface	6.7	0.3
PJ - 3	Bottom	7.7	0.3
PJ - 3	Surface	7.3	0.3
PJ - 4	Bottom	24.7	3.2
PJ - 4	Surface	7.7	0.3
PJ - 5	Bottom	16.7	1.8
PJ - 5	Surface	5.7	0.3
PJ - 6	Bottom	10.7	0.3
PJ - 6	Surface	7.3	0.3
PJ - 7	Bottom	14.0	0.6
PJ - 7	Surface	7.0	0.0

Table 6: Storm event turbidity readings from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, May 25, 2001.

Station	Stratum	Mean Turbidity (NTU)	Std. Error
NB - 1	Bottom	8.4	2.3
NB - 1	Surface	4.5	0.1
NB - 2	Bottom	11.2	4.4
NB - 2	Surface	4.5	0.2
NB - 3	Bottom	7.1	1.0
NB - 3	Surface	3.0	0.1
NB - 4	Bottom	4.9	0.2
NB - 4	Surface	3.8	0.0
NB - 5	Bottom	5.9	0.1
NB - 5	Surface	5.5	0.1
NB - 6	Bottom	5.5	0.2
NB - 6	Surface	5.2	0.2
NB - 7	Bottom	6.5	0.2
NB - 7	Surface	4.8	0.3
NB - 8	Bottom	8.1	1.5
NB - 8	Surface	4.7	0.1
PJ - 1	Bottom	8.4	1.2
PJ - 1	Surface	4.7	0.1
PJ - 2	Bottom	8.4	0.2
PJ - 2	Surface	4.0	0.2
PJ - 3	Bottom	4.0	0.0
PJ - 3	Surface	4.1	0.1
PJ - 4	Bottom	13.3	0.3
PJ - 4	Surface	4.3	0.0
PJ - 5	Bottom	9.8	0.6
PJ - 5	Surface	2.6	0.1
PJ - 6	Bottom	5.9	0.4
PJ - 6	Surface	4.3	0.0
PJ - 7	Bottom	7.7	0.3
PJ - 7	Surface	4.4	0.1

Table 7: Storm event water quality parameters from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey stations, May 25, 2001.

Station	Stratum	Depth (meters)	Temp (°C)	Sal	pH	DO (mg/L)
NB - 1	Bottom	2.0	17.4	19.5	7.5	6.1
NB - 1	Surface	0.3	17.6	17.9	7.4	5.4
NB - 2	Bottom	1.6	16.8	20.3	7.5	6.0
NB - 2	Surface	0.4	16.9	20.3	7.5	5.6
NB - 3	Bottom	2.3	16.2	20.5	7.5	5.9
NB - 3	Surface	0.4	16.8	20.3	7.6	5.5
NB - 4	Bottom	12.1	14.8	22.6	7.7	6.0
NB - 4	Surface	0.3	16.7	20.2	7.6	5.6
NB - 5	Bottom	1.1	16.4	20.5	7.6	6.1
NB - 5	Surface	0.3	16.4	20.5	7.6	5.8
NB - 6	Bottom	2.5	16.1	20.5	7.3	6.7
NB - 6	Surface	0.3	16.0	20.6	7.4	6.6
NB - 7	Bottom	14.0	15.9	21.2	7.5	5.8
NB - 7	Surface	0.4	16.1	20.2	7.5	5.9
NB - 8	Bottom	2.6	16.1	20.2	7.5	5.9
NB - 8	Surface	0.4	16.2	19.9	7.5	5.8
PJ - 1	Bottom	3.0	14.6	23.3	7.5	7.4
PJ - 1	Surface	0.2	15.0	22.3	7.5	7.3
PJ - 2	Bottom	3.8	14.6	24.3	7.7	6.5
PJ - 2	Surface	0.2	14.7	23.7	7.6	6.5
PJ - 3	Bottom	14.9	14.3	26.7	7.8	6.4
PJ - 3	Surface	0.4	15.1	23.2	7.7	6.3
PJ - 4	Bottom	10.5	14.5	25.4	7.7	6.4
PJ - 4	Surface	0.4	15.0	23.4	7.7	6.2
PJ - 5	Bottom	11.6	14.2	25.5	7.7	6.0
PJ - 5	Surface	0.4	15.5	22.2	7.7	6.9
PJ - 6	Bottom	3.1	14.7	23.5	7.7	6.2
PJ - 6	Surface	0.4	15.2	22.8	7.7	6.1
PJ - 7	Bottom	1.9	14.8	23.2	7.6	6.1
PJ - 7	Surface	0.4	15.5	22.3	7.6	5.9

surface ranged from 4.0 NTU to 252.0 NTU (**Table 8**).

On March 14, 2002, TSS values at the bottom stratum following the passage of container ships ranged from 9.0 mg/L to 108.7 mg/L. TSS values at the mid-depth stratum ranged from 9.0 mg/L to 113.0 mg/L and TSS values at the surface ranged from 10.0 mg/L to 136.0 mg/L (**Table 9**). Turbidity readings at the bottom stratum following the passage of a container ship on this date ranged from 3.3 NTU to 34.0 NTU. Turbidity readings at the mid-depth stratum ranged from 3.2 NTU to 37.0 NTU and turbidity readings at the surface ranged from 3.3 NTU to 51.3 NTU (**Table 10**).

4.4 Active Dredging Activities

On April 26, 2001, TSS samples were taken up stream and down stream of an active dredge removing coarse material (“shot rock”) which was a result of the blasting of bedrock. Downstream samples were collected at various distances from the dredge. Samples were collected at the surface, mid-water column and at the bottom (**Table 11**). An interesting outcome of this effort was that the *relatively* higher levels of TSS were recorded at the surface at several of the stations. All the TSS values that were recorded fell within what can be considered ambient levels for the Harbor.

On November 14, 2001, TSS samples were taken under a similar sampling regime (although no surface samples were taken at this time) in regards to an active dredge removing fine materials from within the Port Elizabeth channel. As would be expected, the TSS values were generally much higher under this scenario. Close to the dredging operation, TSS was elevated with the bottom values being the greatest. TSS values dropped off quickly with distance downstream from the dredge, with mid-water values decreasing to a lesser degree than those at the bottom. At the last two sampling stations

Table 8: TSS and turbidity values from container ship passage sampling efforts, November 14, 2001.

Station	Stratum	TSS (mg/L)	Turbidity (NTU)
A1	Bottom	14	5.6
A2	Bottom	32	10.0
A3	Bottom	26	8.3
A4	Bottom	22	11.3
A4	Mid-depth	75	21.3
A4	Surface	52	17.9
A5	Bottom	423	125.0
A5	Mid-depth	432	94.0
A5	Surface	797	252.0
A6	Bottom	952	304.0
A6	Mid-depth	401	123.0
A6	Surface	168	49.4
A7	Bottom	27	5.4
A7	Surface	20	5.8
A8	Bottom	21	7.0
A8	Surface	18	5.8
A9	Bottom	24	7.4
A9	Surface	19	6.5
A10	Bottom	42	8.1
A10	Surface	20	5.2
A11	Bottom	31	10.0
A11	Surface	10	4.0
A12	Bottom	29	7.5
A12	Surface	32	9.1

Table 9: TSS values from container ship passage sampling efforts, March 14, 2002.

Station	Stratum	Mean TSS (mg/L)	Std. Error
C1	Bottom	25.5	
C1	Mid-depth	9.5	
C1	Surface	10.0	1.0
C2	Bottom	19.0	1.2
C2	Mid-depth	15.7	3.2
C2	Surface	19.3	2.3
C3	Bottom	11.0	
C3	Mid-depth	10.0	
C3	Surface	13.7	0.9
C4	Bottom	17.5	
C4	Mid-depth	18.0	
C5	Bottom	17.5	
C5	Mid-depth	31.0	
C5	Surface	136.0	34.4
C6	Bottom	47.0	29.6
C6	Mid-depth	15.7	3.4
C6	Surface	16.7	0.7
C7	Bottom	9.0	
C7	Mid-depth	9.0	
C7	Surface	10.0	1.0
C8	Bottom	108.0	
C8	Mid-depth	91.5	
C8	Surface	41.0	9.0
C9	Bottom	103.0	
C9	Mid-depth	113.0	
C10	Bottom	24.0	
C10	Mid-depth	22.5	
C10	Surface	28.3	1.5
C11	Bottom	108.7	33.5
C11	Surface	35.0	20.6
C12	Bottom	79.0	15.7
C12	Surface	52.7	3.5
C13	Bottom	25.0	7.4
C13	Mid-depth	18.0	4.0
C13	Surface	17.8	4.2
C14	Bottom	32.0	2.6
C14	Mid-depth	30.7	2.2
C14	Surface	29.7	8.3

Table 10: Turbidity readings from container ship passage sampling efforts, March 14, 2002.

Station	Stratum	Mean Turbidity (NTU)	Std. Error
C1	Bottom	4.9	0.3
C1	Mid-depth	3.8	
C1	Surface	3.3	
C2	Bottom	6.0	0.1
C2	Mid-depth	4.5	0.9
C2	Surface	6.0	0.5
C3	Bottom	3.5	0.4
C3	Mid-depth	3.6	
C3	Surface	6.1	
C4	Bottom	6.5	
C4	Mid-depth	7.1	
C5	Bottom	4.6	12.3
C5	Mid-depth	10.8	
C5	Surface	51.3	
C6	Bottom	18.4	10.4
C6	Mid-depth	7.4	1.5
C6	Surface	6.7	0.1
C7	Bottom	3.3	0.5
C7	Mid-depth	3.2	
C7	Surface	4.8	
C8	Bottom	28.0	2.8
C8	Mid-depth	28.5	
C8	Surface	12.8	
C9	Bottom	34.0	
C9	Mid-depth	37.0	
C10	Bottom	8.8	0.3
C10	Mid-depth	9.6	
C10	Surface	9.7	
C11	Bottom	32.0	9.7
C11	Surface	12.1	6.5
C12	Bottom	22.3	6.4
C12	Surface	17.7	1.2
C13	Bottom	6.8	1.6
C13	Mid-depth	5.5	1.5
C13	Surface	5.6	1.2
C14	Bottom	11.7	0.7
C14	Mid-depth	9.8	0.7
C14	Surface	11.4	2.9

Table 11: TSS and turbidity values from active dredge in the Kill van Kull, April 26, 2001.

Station	Stratum	TSS (mg/L)	Turbidity (NTU)
100 m upcurrent	Bottom	5	4.8
100 m upcurrent	Mid-water	6	5.0
100 m upcurrent	Surface	4	3.1
100 m upcurrent, mid-channel	Bottom	7	6.5
100 m upcurrent, mid-channel	Mid-water	4	3.4
100 m upcurrent, mid-channel	Surface	5	3.1
50 m downcurrent	Bottom	6	4.9
50 m downcurrent	Mid-water	6	5.0
50 m downcurrent	Surface	13	4.7
115 m downcurrent	Bottom	4	4.8
115 m downcurrent	Mid-water	5	4.1
115 m downcurrent	Surface	5	3.6
115 m downcurrent, mid-channel	Bottom	9	5.6
115 m downcurrent, mid-channel	Mid-water	5	3.3
115 m downcurrent, mid-channel	Surface	5	3.5
300 m downcurrent, mid-channel	Bottom	7	5.2
300 m downcurrent, mid-channel	Mid-water	5	4.9
300 m downcurrent, mid-channel	Surface	10	5.4

(those furthest from the dredge), TSS values observed at the mid-water column stratum were slightly higher than those at the bottom (**Table 12**).

5.0 Discussion

The range of ambient TSS values found in the Newark Bay-Arthur Kill system and the Upper New York Harbor-Port Jersey system are similar to ranges found in comparable estuaries within the northeast (Bond and Meade 1966). Generally speaking, Stations NB-1 through NB-3, which are the most westerly stations, had the highest mean annual TSS values. These stations are situated in the vicinity of the confluence of the Arthur Kill, Kill van Kull, and Newark Bay. NB-1 in particular is under the direct influence of Old Place Creek and always produced a higher TSS value at the bottom strata. Suspended sediment levels in estuarine waters vary seasonally (Ward and Twilley 1986; Gardner et al. 1989). It is assumed that during an “average” year, spring runoff from rain and snow melt would noticeably increase the TSS load in the water column. This study also tried to capture the effects of individual meteorological events on TSS, as it is suspected that powerful storms which would include strong winds and significant rainfall would have a significant influence on short term ambient TSS. Data was collected 48 hours after the passage of the storm event of May 21-23, 2001, but did not show elevations in TSS at most stations.

A recent study performed by Lawler, Matusky & Skelly Engineers (LMS) assessing TSS values in the Arthur Kill associated with dredging activities showed only slight increases with dredging activities when a closed “environmental” dredge bucket was used (LMS 1997). The study also reported significant resuspension of bottom sediments within navigation channels due to barge traffic. The present USACE study

Table 12: TSS and turbidity values from active dredge in Elizabeth Channel, November 14, 2001.

Station	Stratum	Mean TSS (mg/L)	Std. Error
B1	Bottom	27.3	12.9
B1	Mid-depth	12.3	1.9
B2	Bottom	78.0	36.4
B2	Mid-depth	30.0	4.4
B3	Bottom	59.3	36.6
B3	Mid-depth	30.0	9.5
B4	Bottom	12.7	0.9
B4	Mid-depth	19.7	1.5
B5	Bottom	9.7	1.3
B5	Mid-depth	12.7	1.8
B6	Bottom	8.0	1.5
B6	Mid-depth	15.0	1.5

Station	Stratum	Mean Turbidity (NTU)	Std. Error
B1	Bottom	8.1	1.2
B1	Mid-depth	6.7	0.5
B2	Bottom	33.1	13.9
B2	Mid-depth	12.1	0.4
B3	Bottom	24.5	13.0
B3	Mid-depth	13.0	1.9
B4	Bottom	7.9	0.8
B4	Mid-depth	11.3	0.1
B5	Bottom	6.6	0.2
B5	Mid-depth	9.7	0.2
B6	Bottom	7.0	0.3
B6	Mid-depth	7.8	0.6

would seem to verify those findings, however, the spatial extent of this resuspension was not studied.

The active dredges studied for this report were also of the closed bucket variety. Both dredge operations examined in this study do not appear to have raised TSS levels much beyond ambient conditions outside of the immediate vicinity of the dredge operation. In relationship to TSS levels, this method of dredging appears to be superior to conventional open clamshell bucket dredging which may produce an increase in suspended sediment levels in an extended plume (USACE 1996). Of course, the level of TSS change (under any dredging conditions) is also related to grain size, type of material, and current regime.

Two reports relating to water quality monitoring near active dredging operations were released as this report was being written. The “Boston Harbor Navigation Improvement Project: Phase 2 Summary Report” was released by the New England District USACE in May, 2002. In this report, results are given showing total suspended solids concentrations from a location 300-feet downstream of an “environmental bucket” dredge at various times during and following dredging operations within Boston Harbor. Background TSS concentrations were reported between 5 mg/L and 15 mg/L (USACE 2002). Concentrations were reported to be “higher than background by a factor of two to four at the 0.5 to 1.0 hour sampling times”, but “returned to near background levels at the 4-6 hour sampling time.” These results, along with results from this study, would tend to show that acute elevations in TSS concentrations due to dredging activities drop off quickly both with distance downstream from the dredge and with time after dredging activities have ceased.

The second report relating to water quality monitoring of active dredging was released by The Port Authority of New York & New Jersey (PANY/NJ) in February, 2002. This report lists total suspended solids data from the same stretch of the Kill van Kull as was sampled during the April 26, 2001 sampling event for this study. The Port Authority report showed an average background or “upcurrent” TSS value of approximately 21 mg/L, noticeably higher than any TSS levels recorded by BVA in April, 2001 (PANY/NJ 2002). These samples were taken some nine months later during a different type of dredging operation. Elevated (above background) levels of TSS were reported at downcurrent sampling locations closest to the active dredge (50m downcurrent), but dropping off with distance (100-200m). Although the results from April, 2001 are lower, the same trends can be seen; elevated TSS levels at approximately 50 m downcurrent and returning to background levels at approximately 100 m downcurrent (**Fig. 3**).

The routine water quality observations in the Newark Bay-Arthur Kill system and the Upper New York Harbor-Port Jersey system are consistent with recent New York City Department of Environmental Protection (NYCDEP) findings in this area and throughout the NY/NJ Harbor (NYCDEP 2000). Of all the DO readings taken in this study, three readings made on August 9, 2001 and all 30 of the readings made on August 23, 2001 were below the NY State Department of Environmental Conservation (NYSDEC) standard limit of 5.0 mg/L. Sustained DO levels below 5.0 mg/L are considered stressful to biotic communities and can lead to defaunated areas of the channel floor and water column (Diaz and Rosenberg 1995).

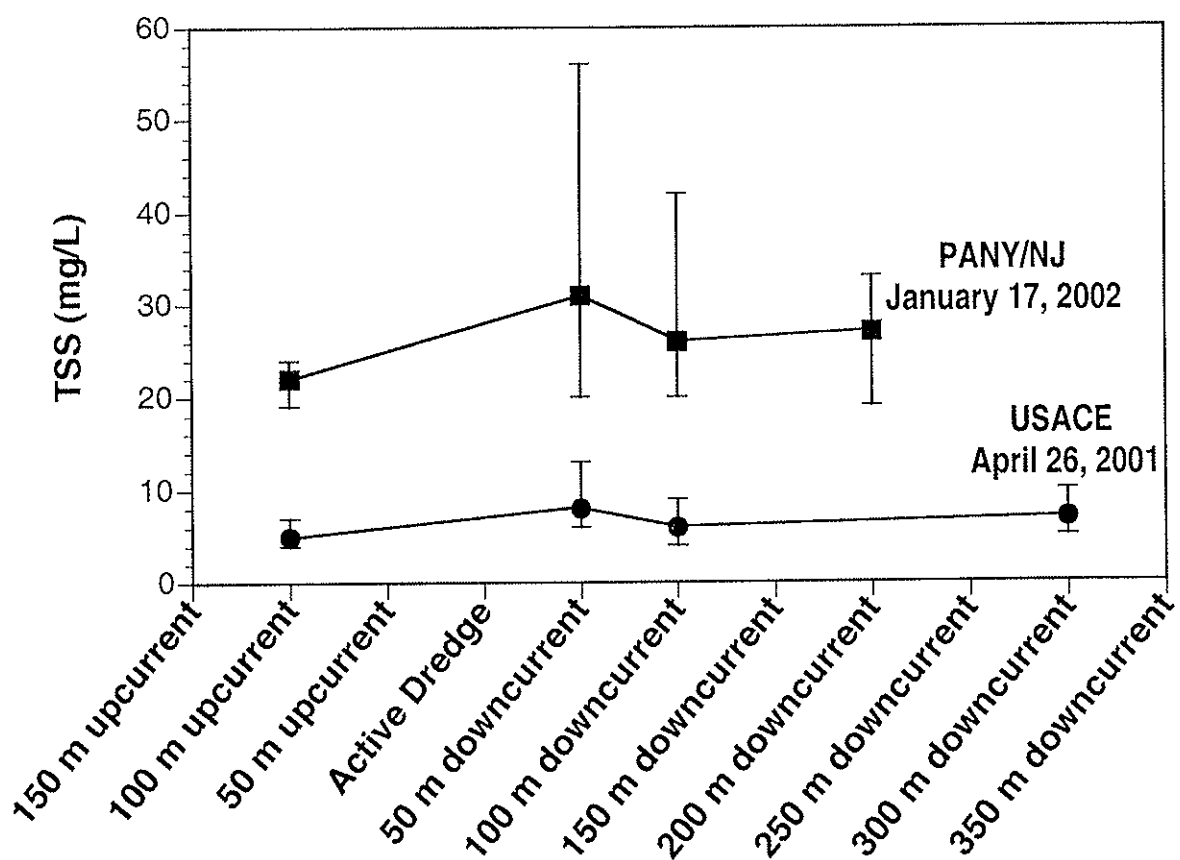


Figure 3: Total Suspended Solids (TSS) values from active dredge sampling in the Kill van Kull.

6.0 Conclusions

Suspended sediment levels within the Newark Bay, Arthur Kill and Port Jersey systems are within the expected range of values for the NY-NJ Harbor system.

Observations from this study reveal that the overall (all stations) average ambient (bottom) TSS level in the harbor system is about 15 mg/L. As stated earlier, it is assumed that during a powerful storm the TSS levels of the entire harbor are significantly elevated.

Using a closed type bucket to remove coarse material did not appear to exceed ambient conditions, except perhaps within 100 feet of the dredge operation. Similar dredging of fine sediments did show elevated levels of TSS, primarily at the bottom within the stations closest to the dredge. Outside of about 100 meters down current from the active dredge, bottom TSS levels returned to ambient levels, while surface observations remained slightly elevated.

The passage of cargo ships, and the orienting by tugboats that they require, was observed to have the greatest affect on localized TSS. Ships being turned in Newark Bay created very large plumes of suspended sediments which were observed in some cases to be as much as two orders of magnitude greater than ambient TSS levels. It is reasonable to assume that these incidents occur frequently.

7.0 Literature Cited

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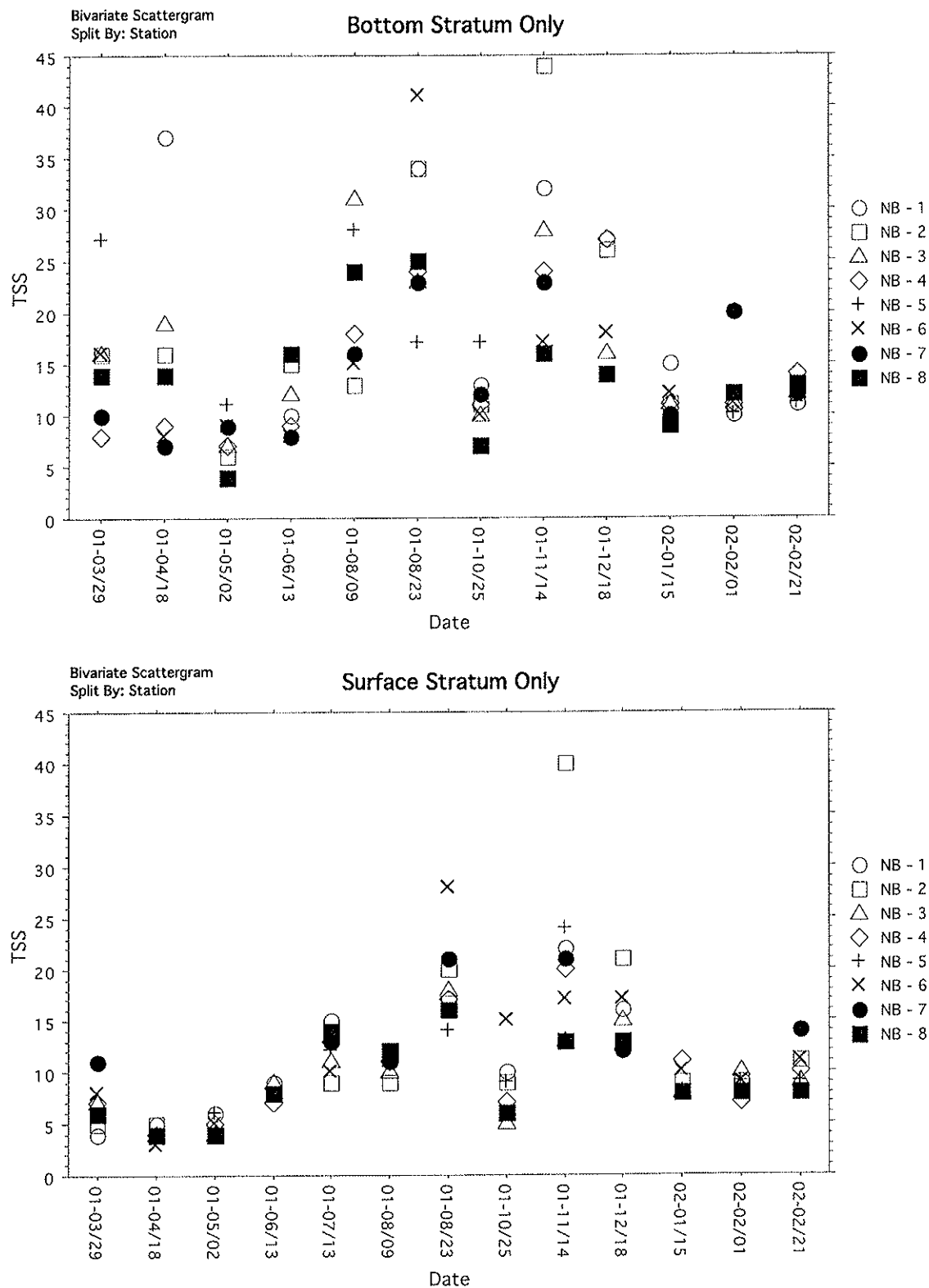


Figure 4: Total Suspended Solids (TSS) values from Newark Bay/Arthur Kill ambient stations.

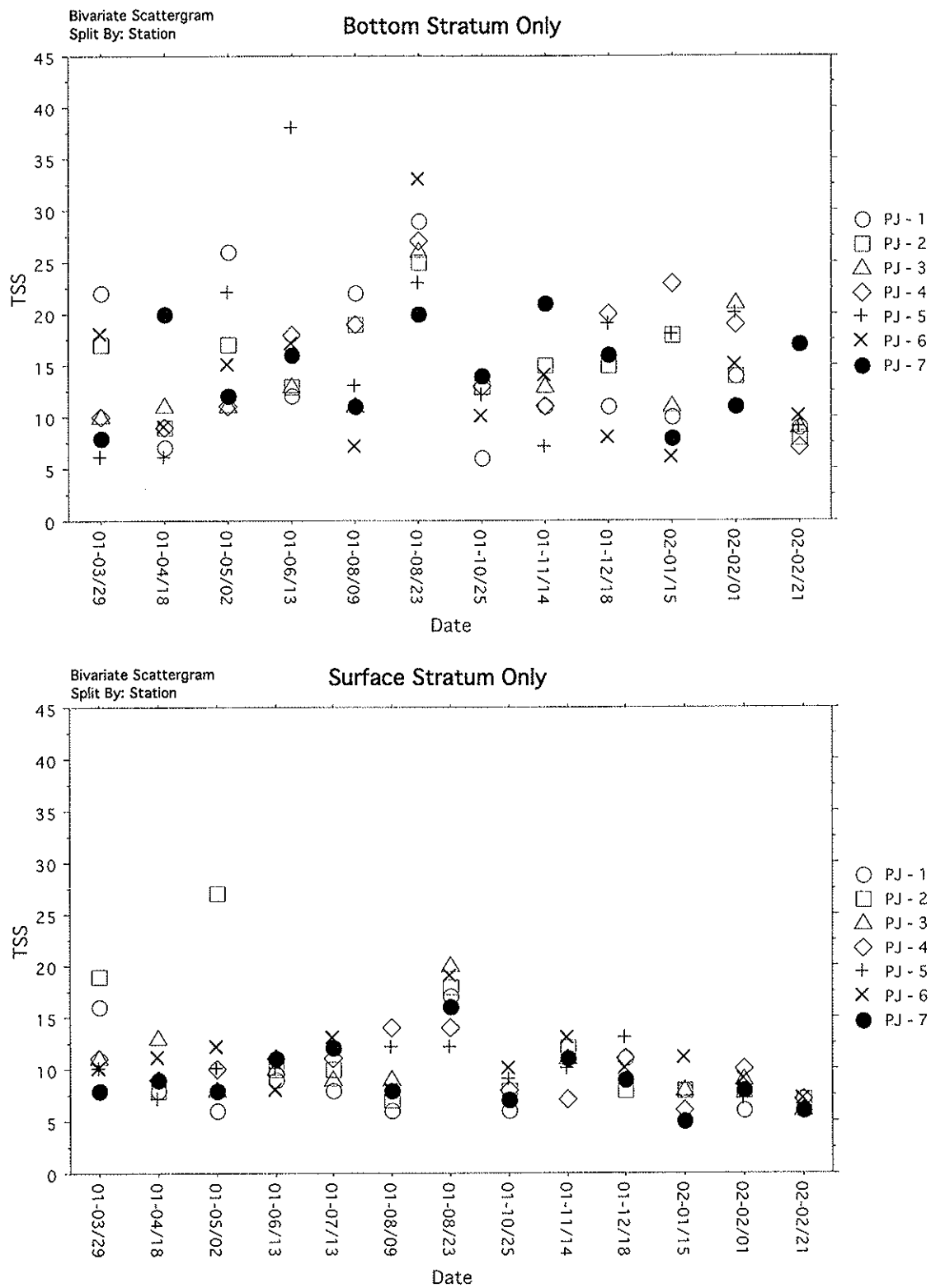


Figure 5: Total Suspended Solids (TSS) values from Upper New York Harbor/Port Jersey ambient stations.

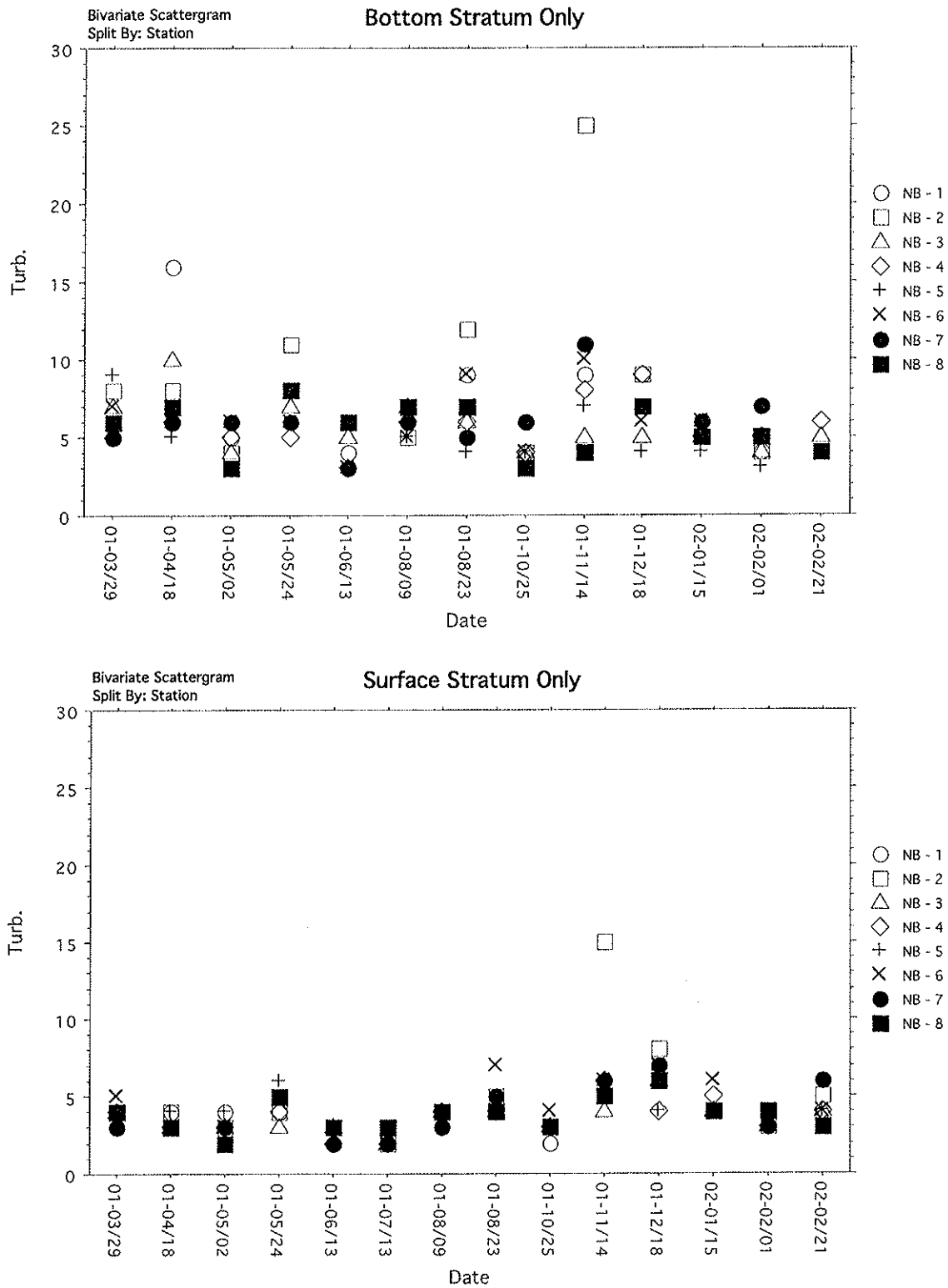


Figure 6: Turbidity values from Newark Bay/Arthur Kill ambient stations.

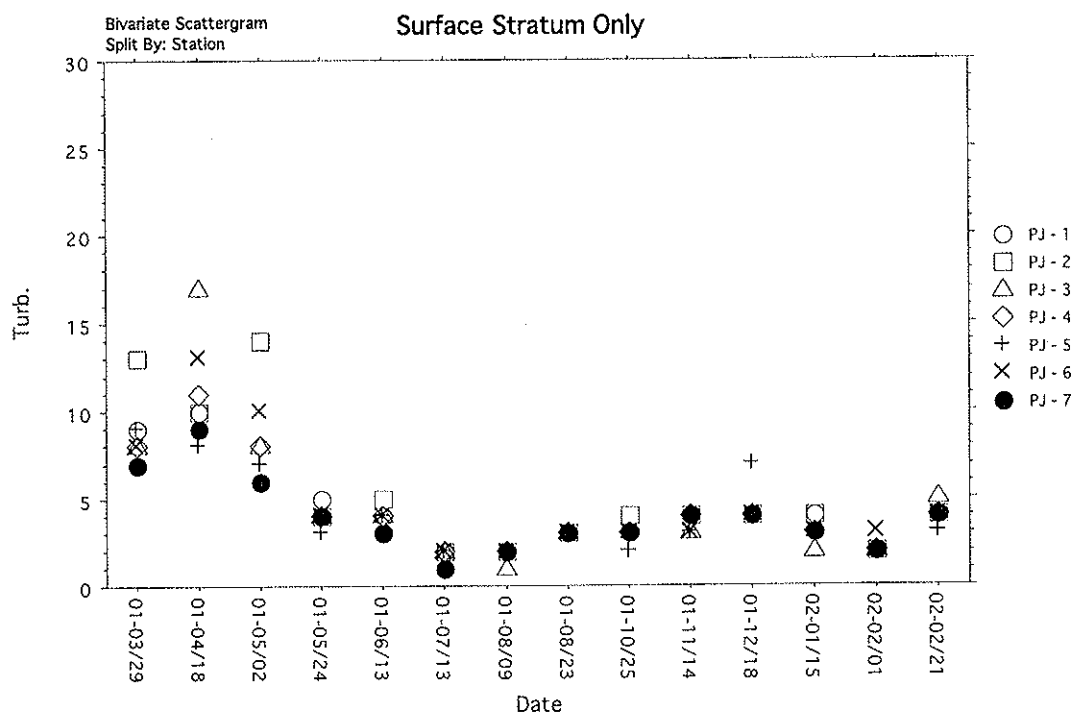
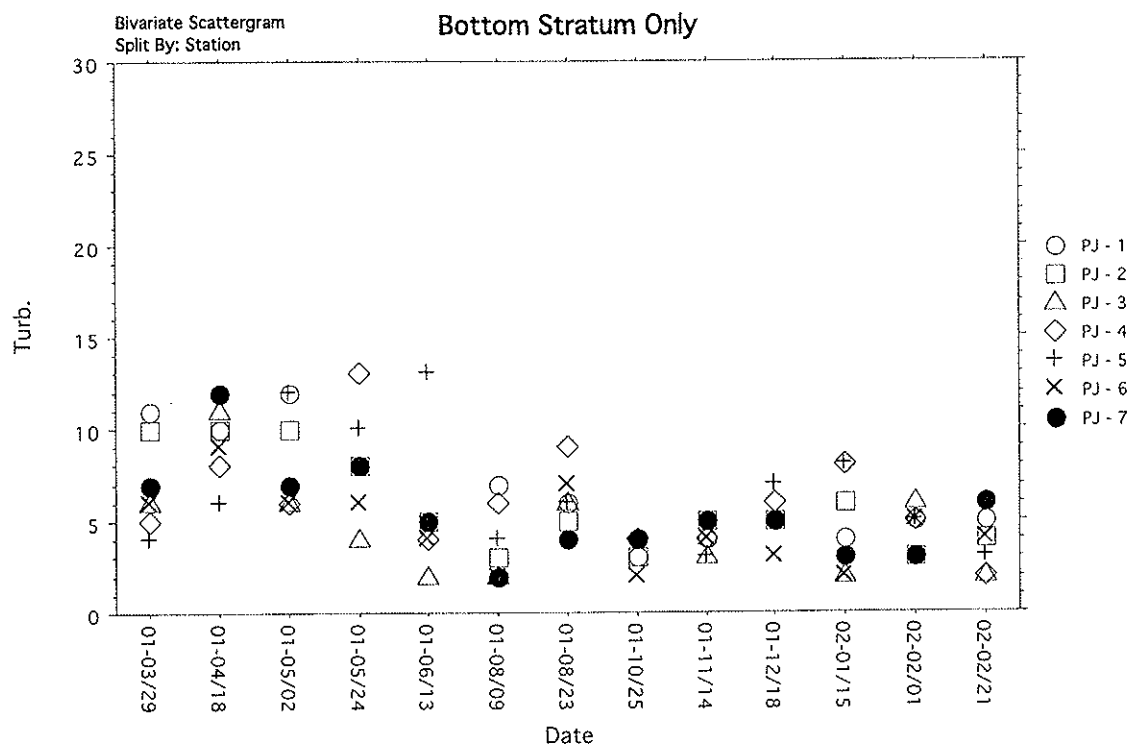


Figure 7: Turbidity values from Upper New York Harbor/Port Jersey ambient stations.

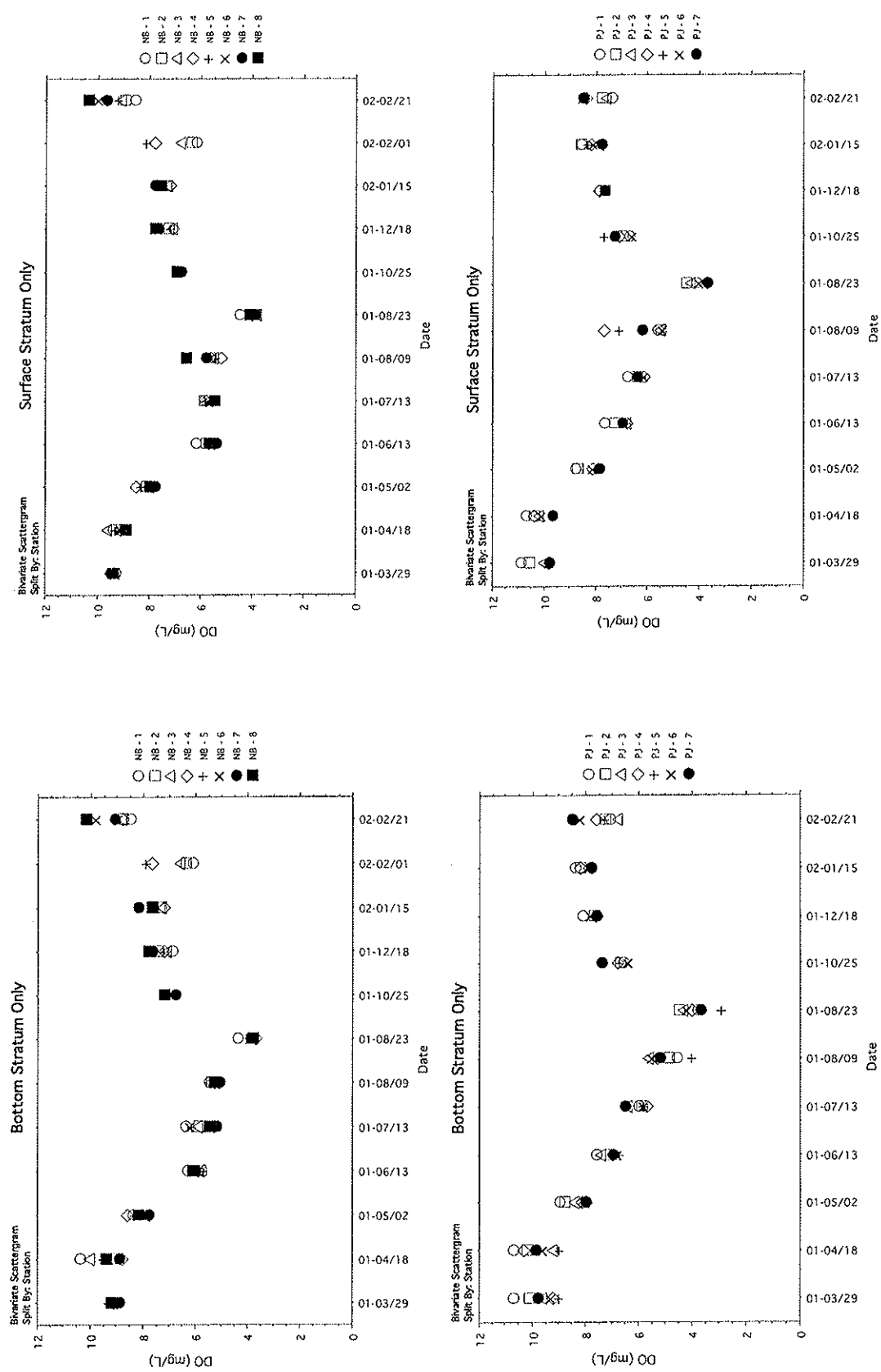


Figure 8: Dissolved Oxygen (DO) values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.

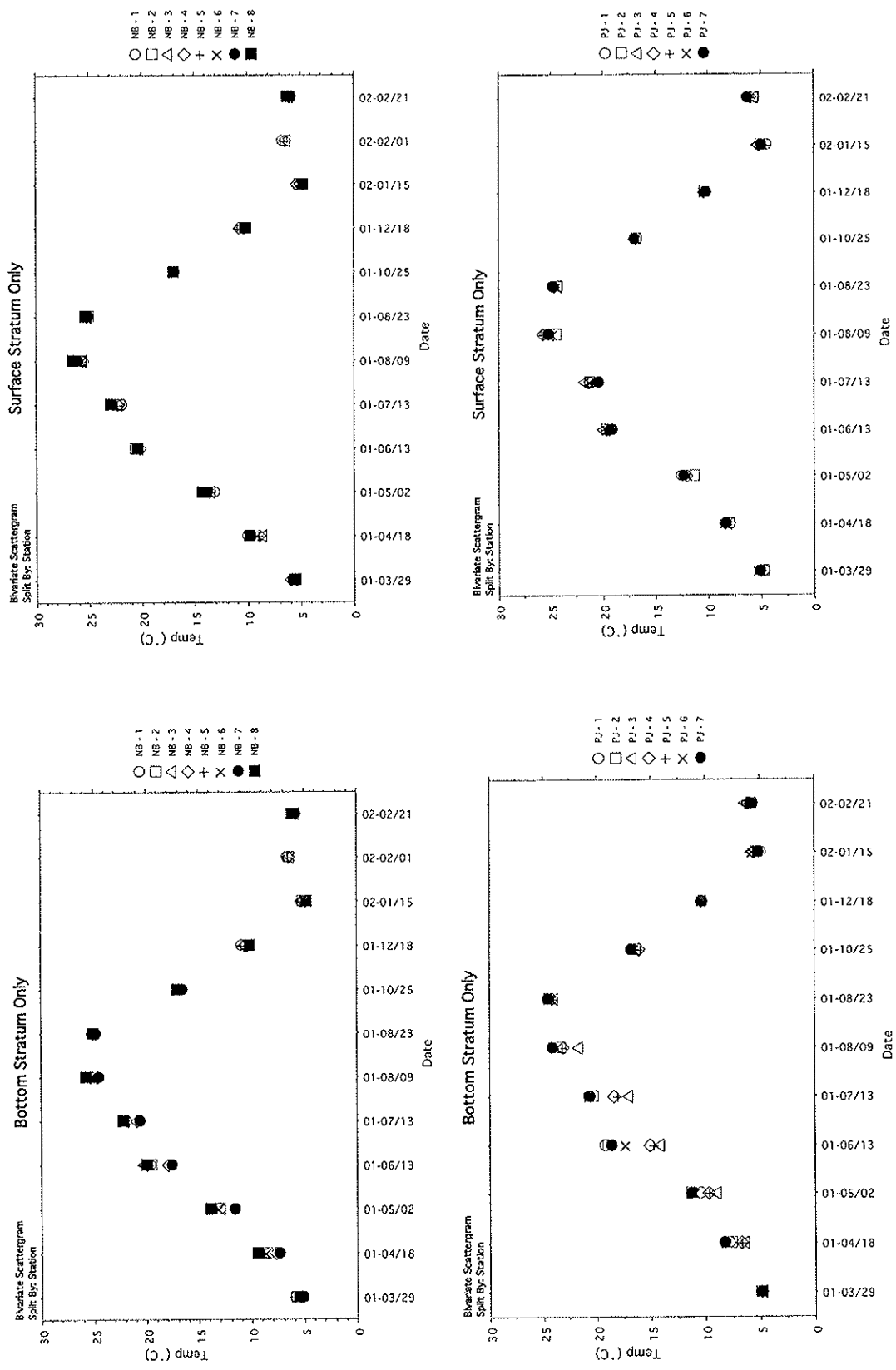


Figure 9: Temperature values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.

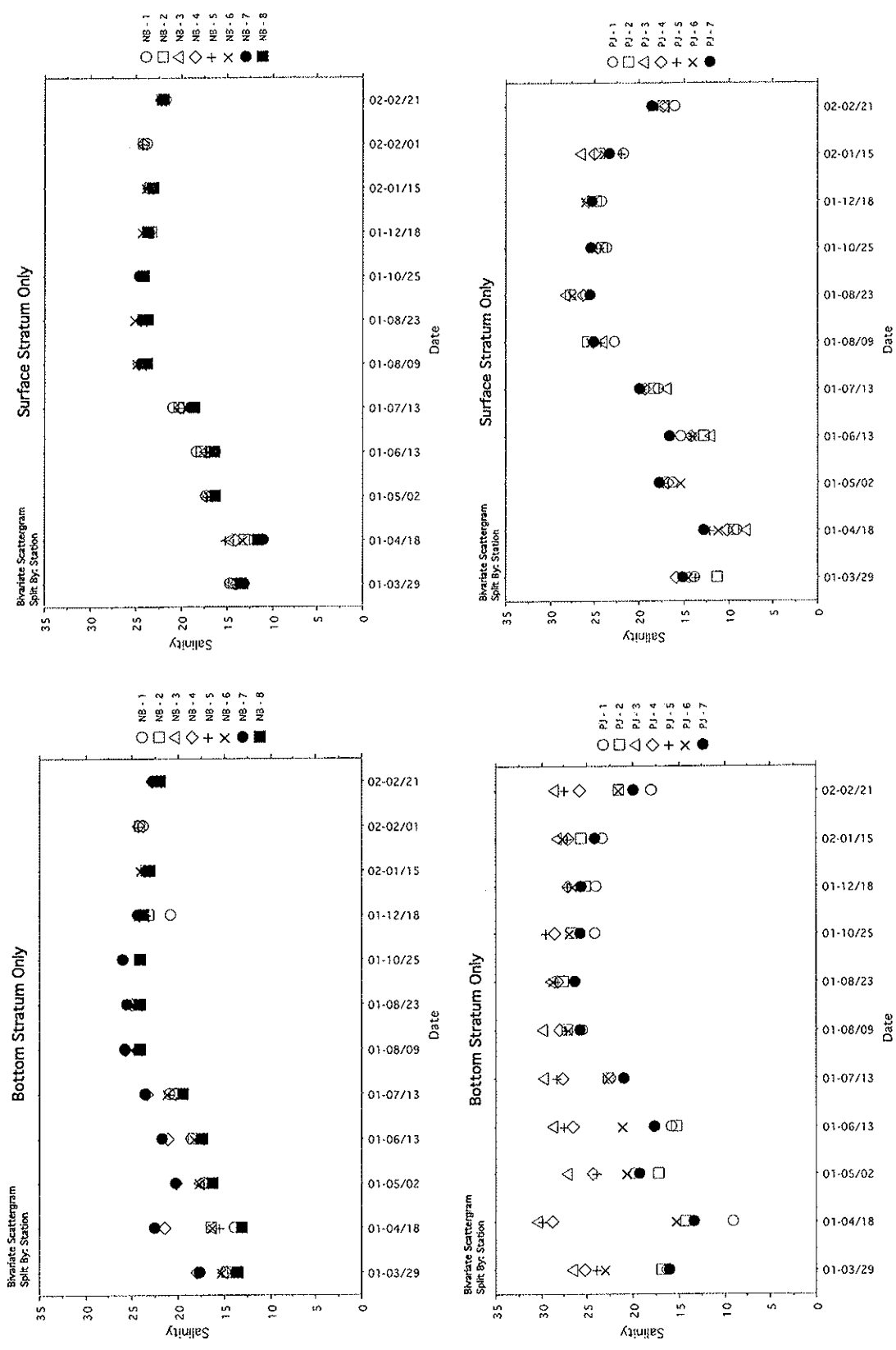


Figure 10: Salinity values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.

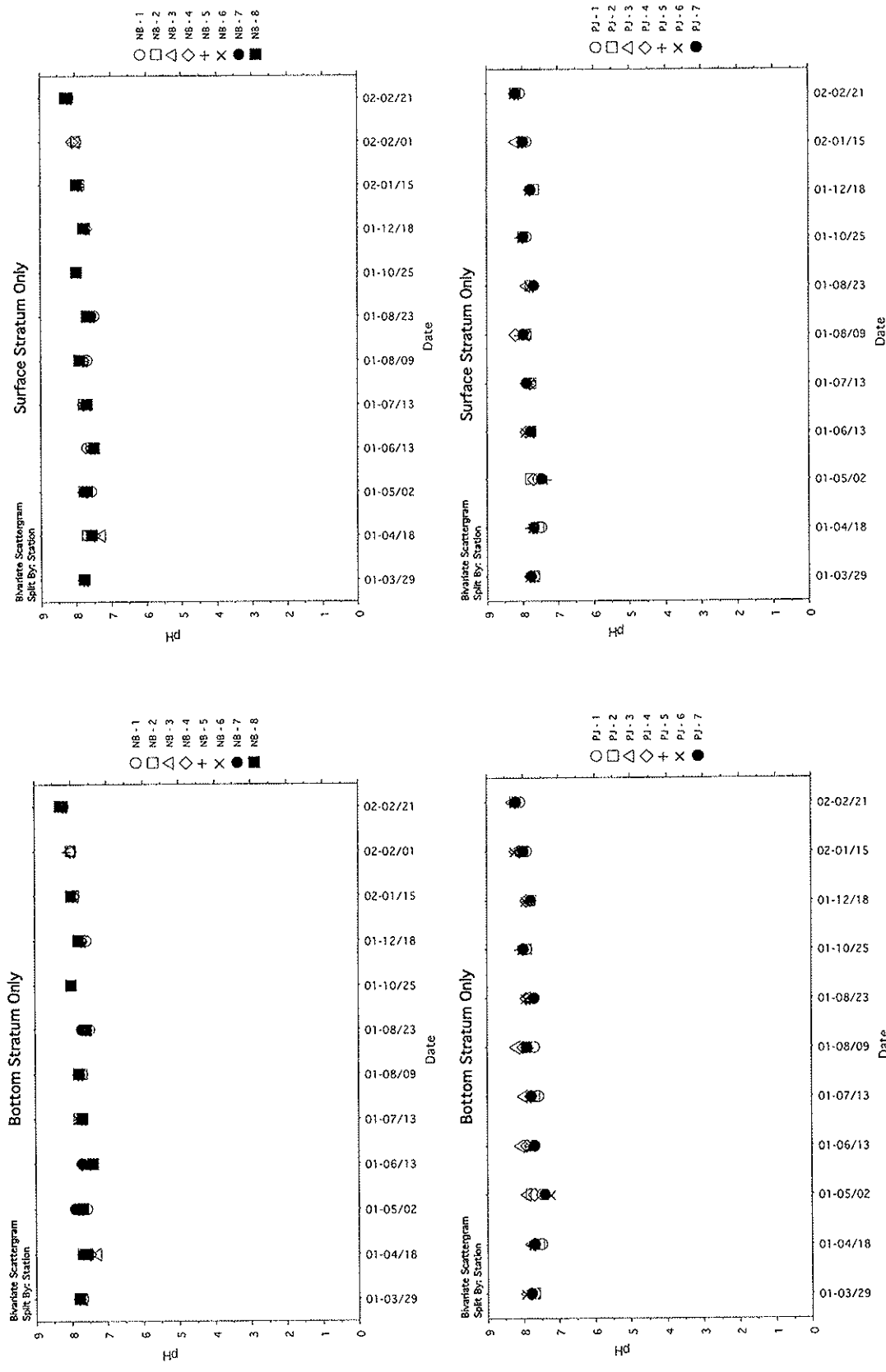


Figure 11: pH values from Newark Bay/Arthur Kill and Upper New York Harbor/Port Jersey ambient stations.

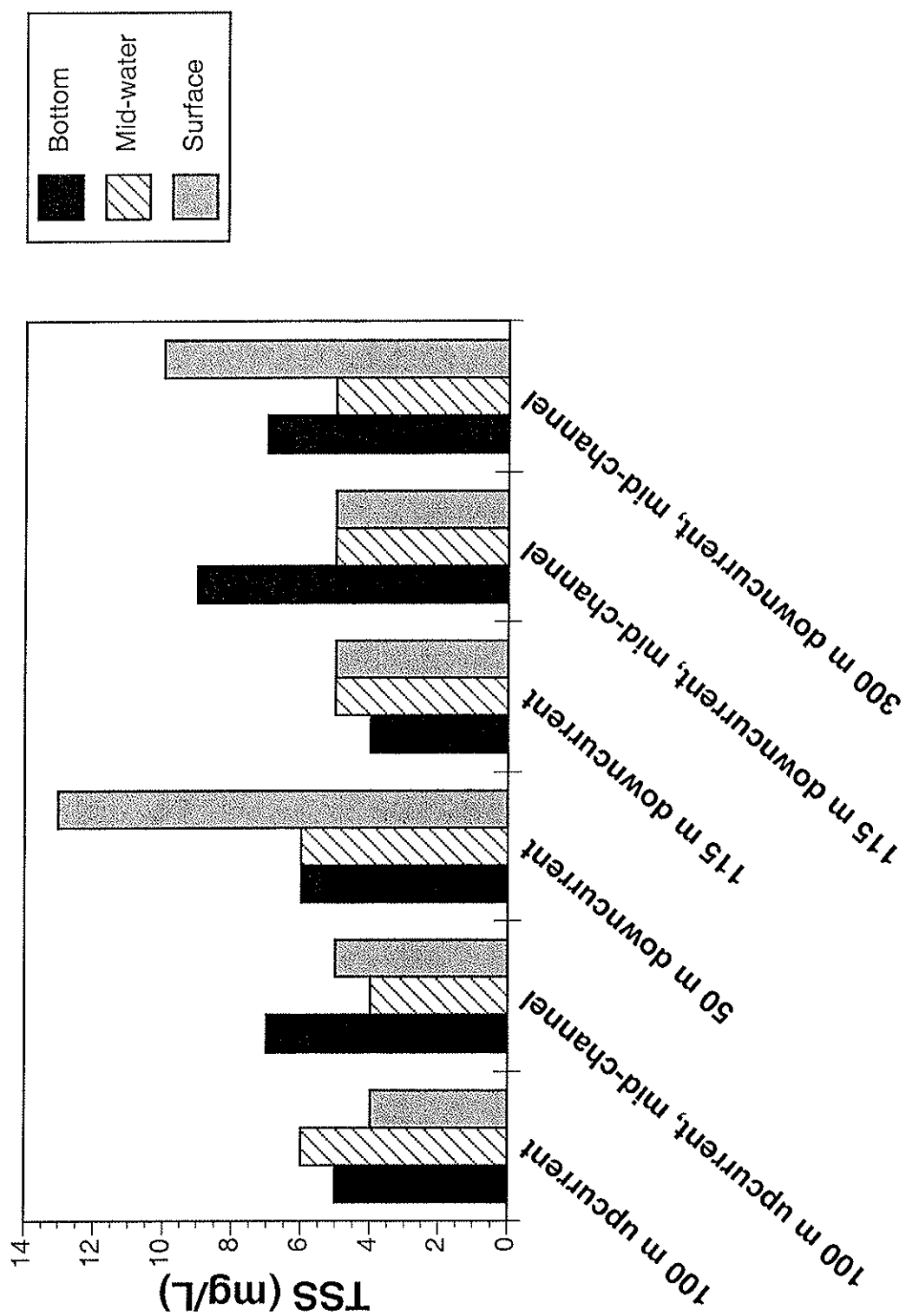


Figure 12: Total Suspended Solids (TSS) values from active dredge sampling in the Kill van Kull, April 26, 2001.

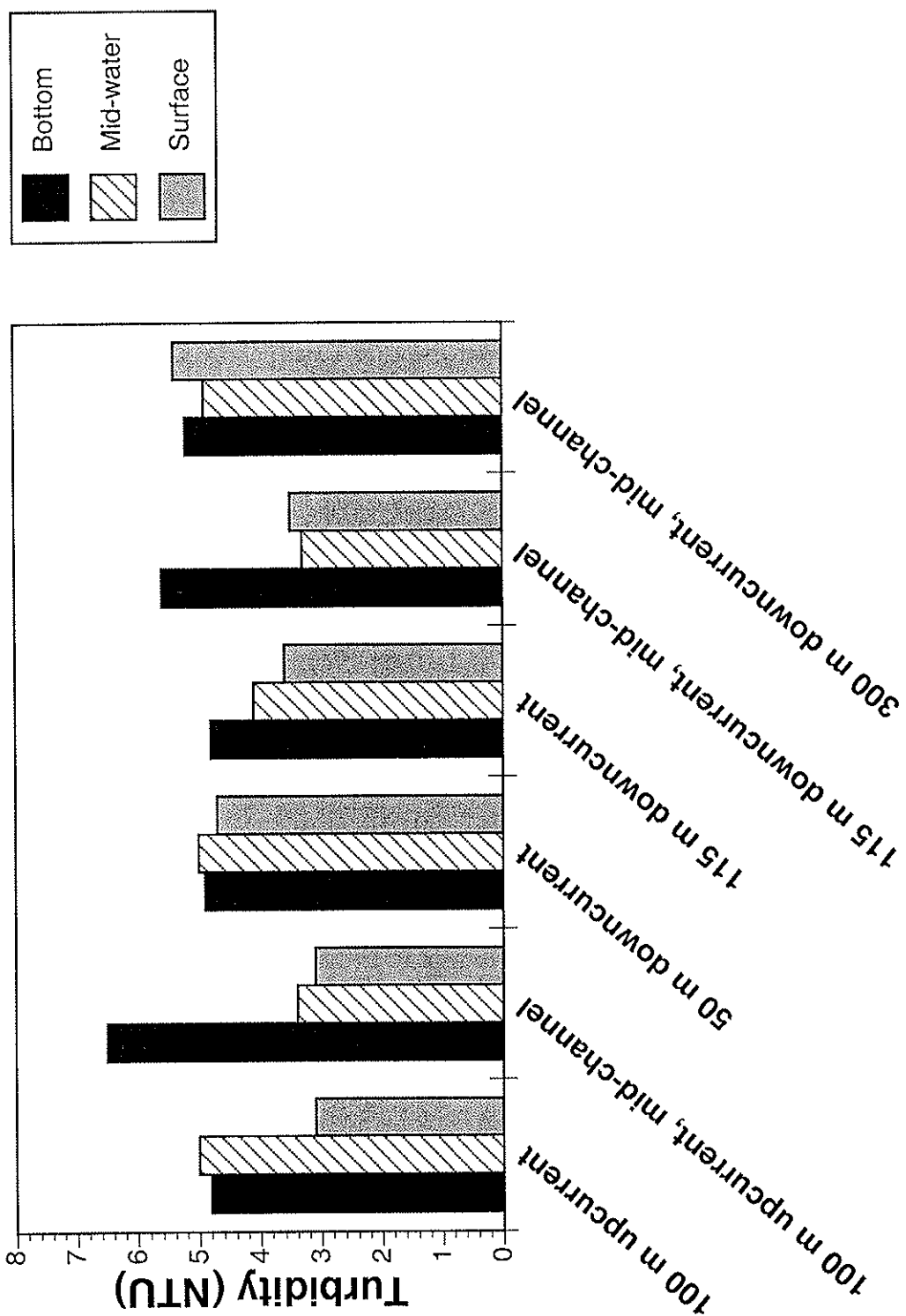


Figure 13: Turbidity values from active dredge sampling in the Kill van Kull, April 26, 2001.

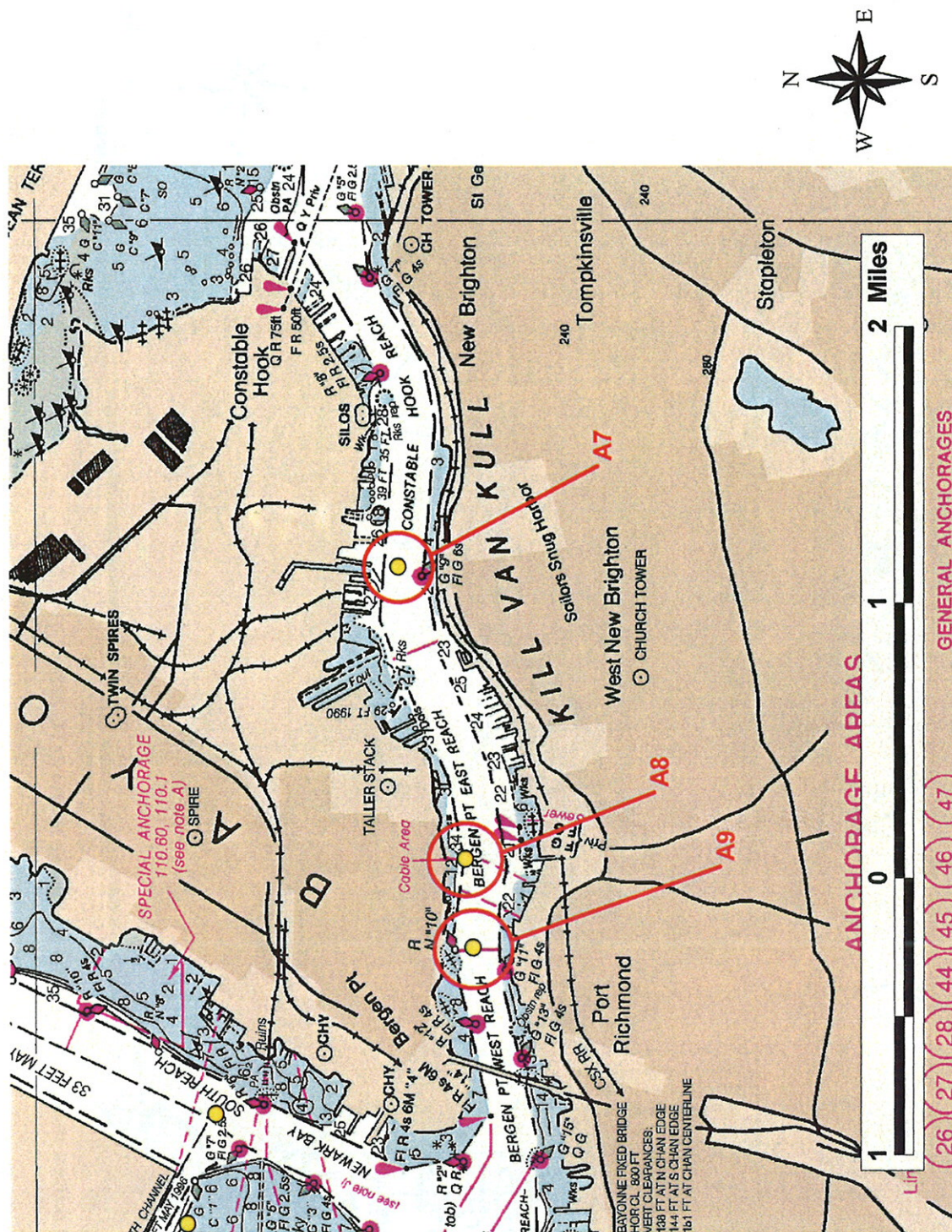


Figure 15: Locations of container ship passage sampling within the Kill van Kull, November 14, 2001

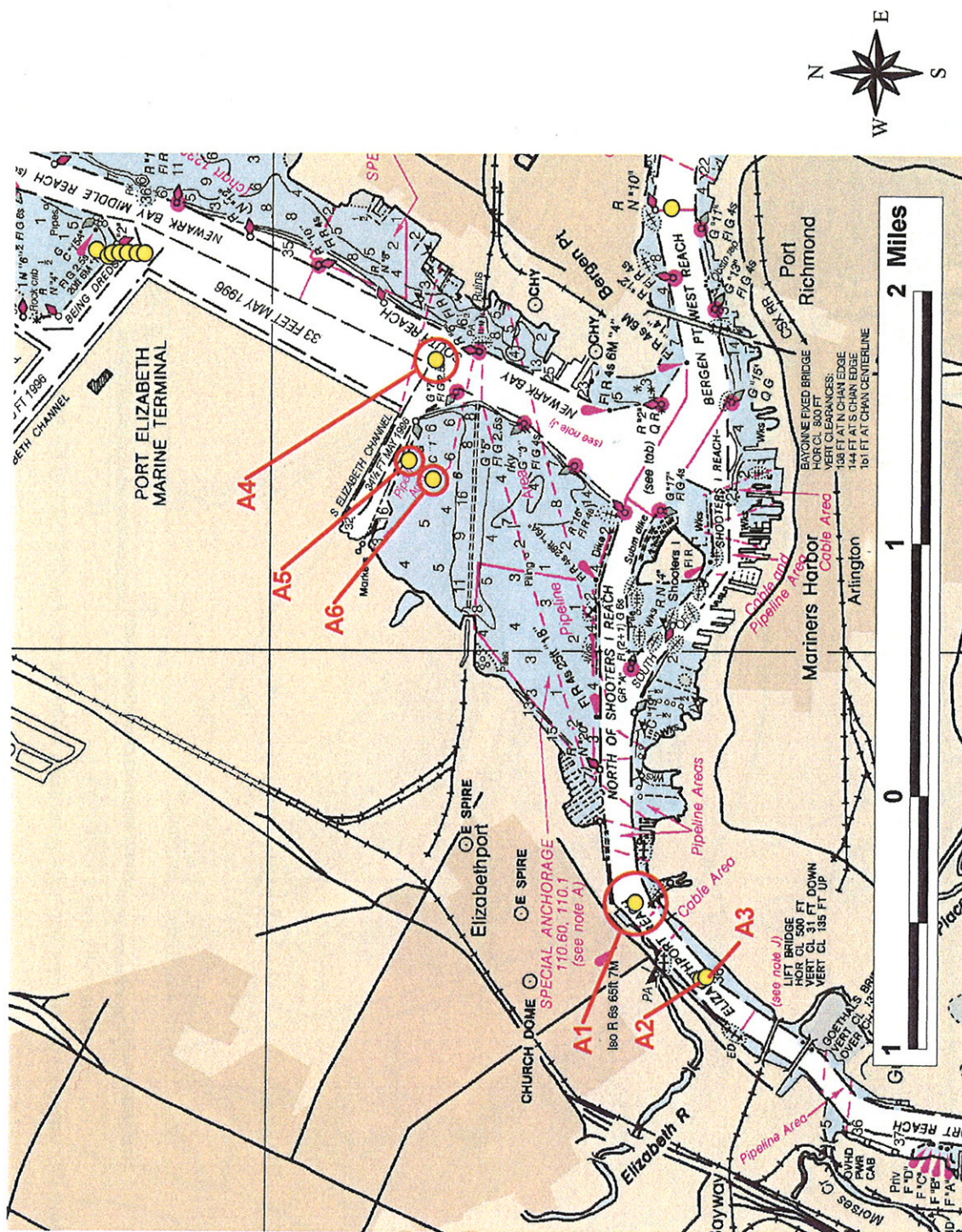


Figure 16: Locations of container ship passage sampling within Newark Bay, November 14, 2001

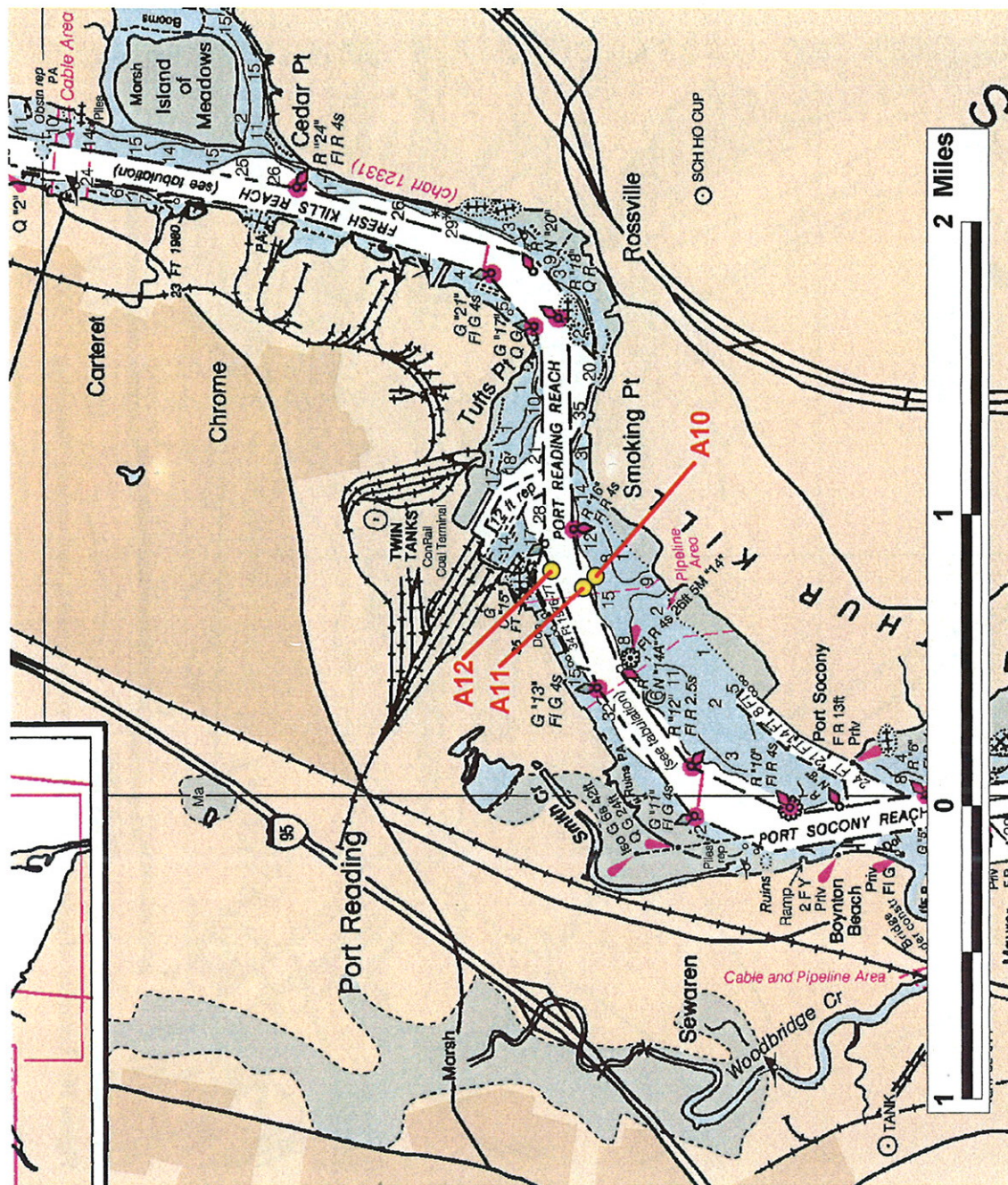


Figure 17: Locations of container ship passage sampling within the Port Reading reach of the Arthur Kill, November 14, 2001

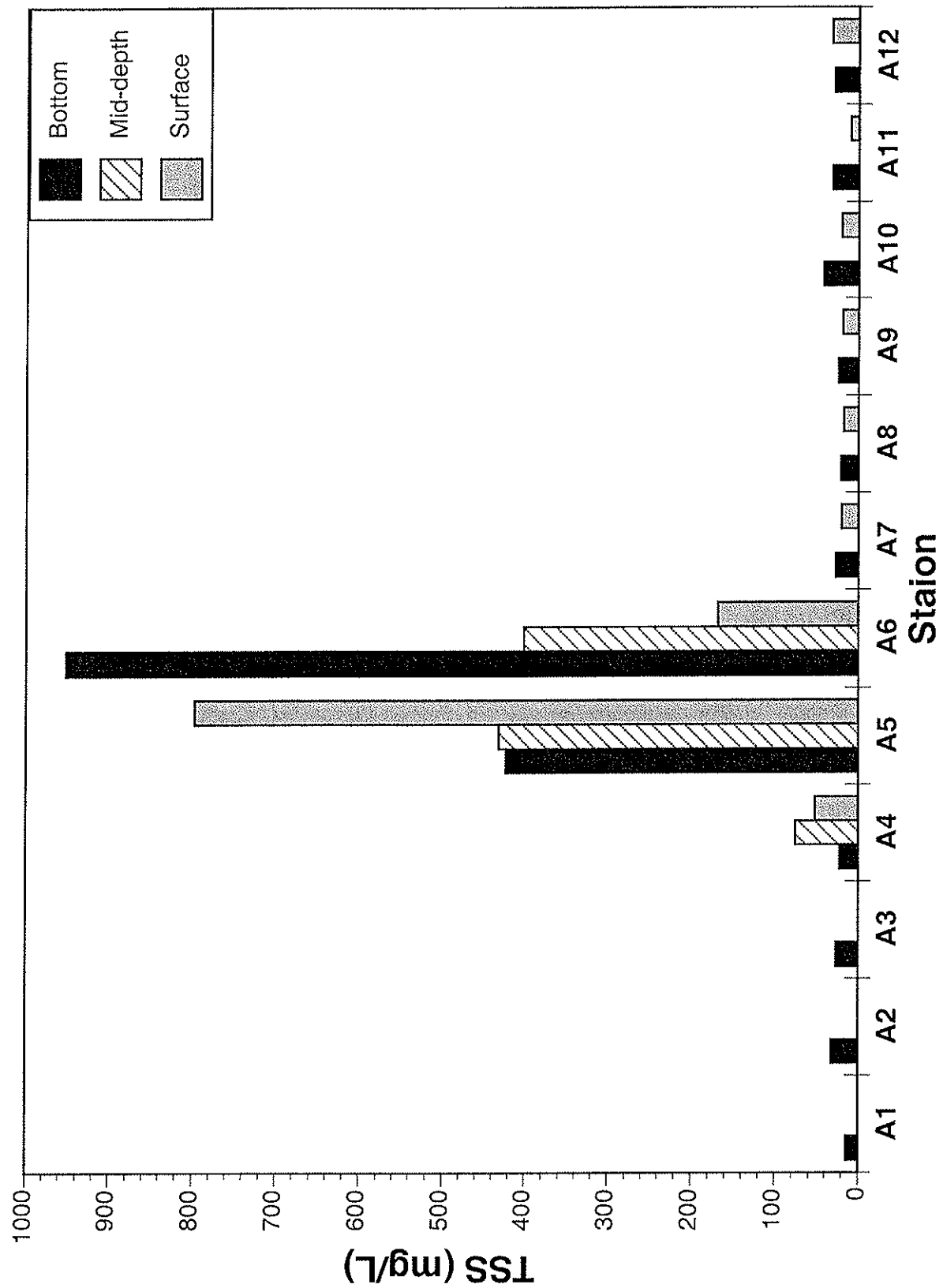


Figure 18: Total Suspended Solids (TSS) values from container ship passage sampling, November 14, 2001.

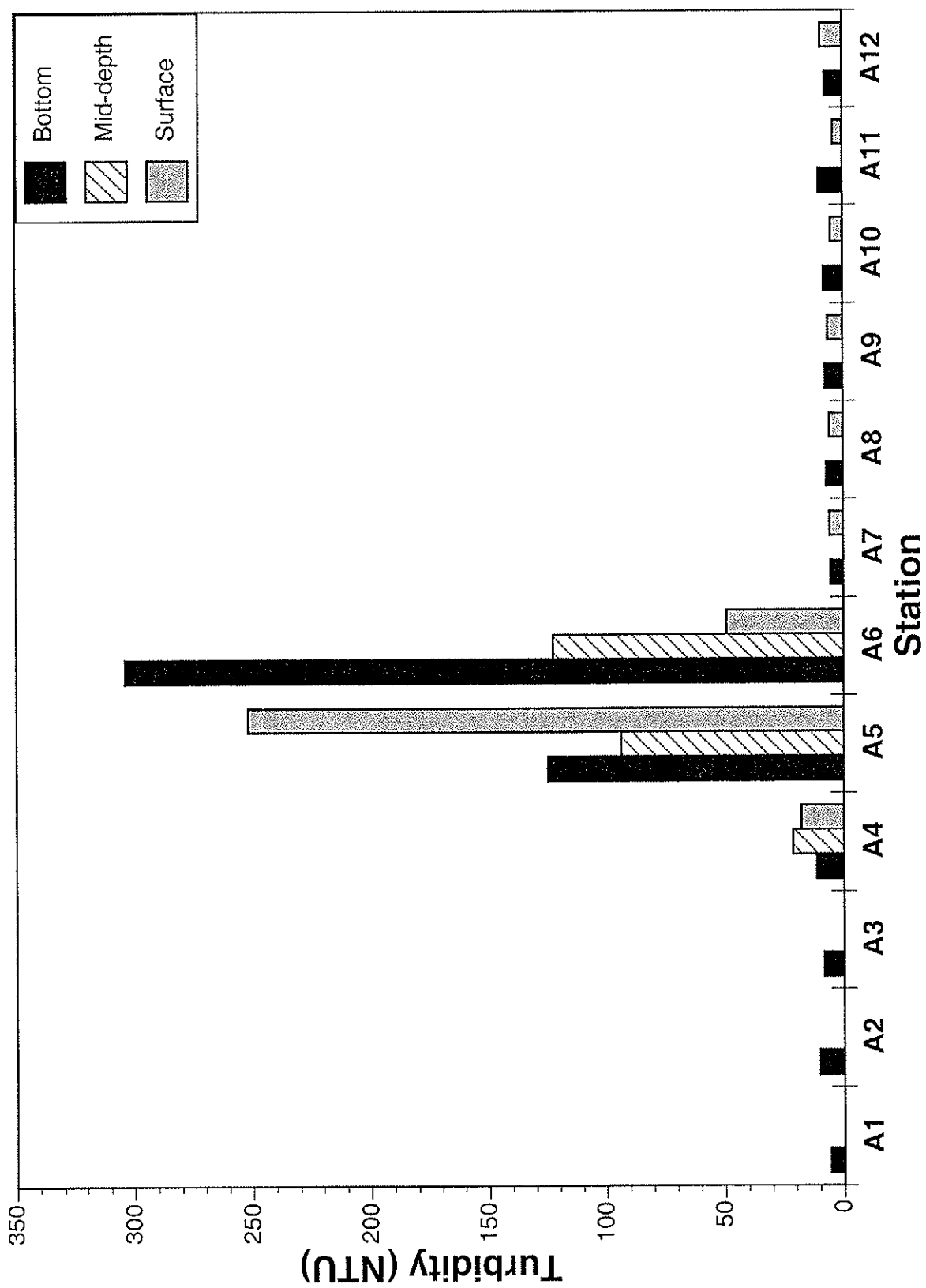


Figure 19: Turbidity values from container ship passage sampling, November 14, 2001.

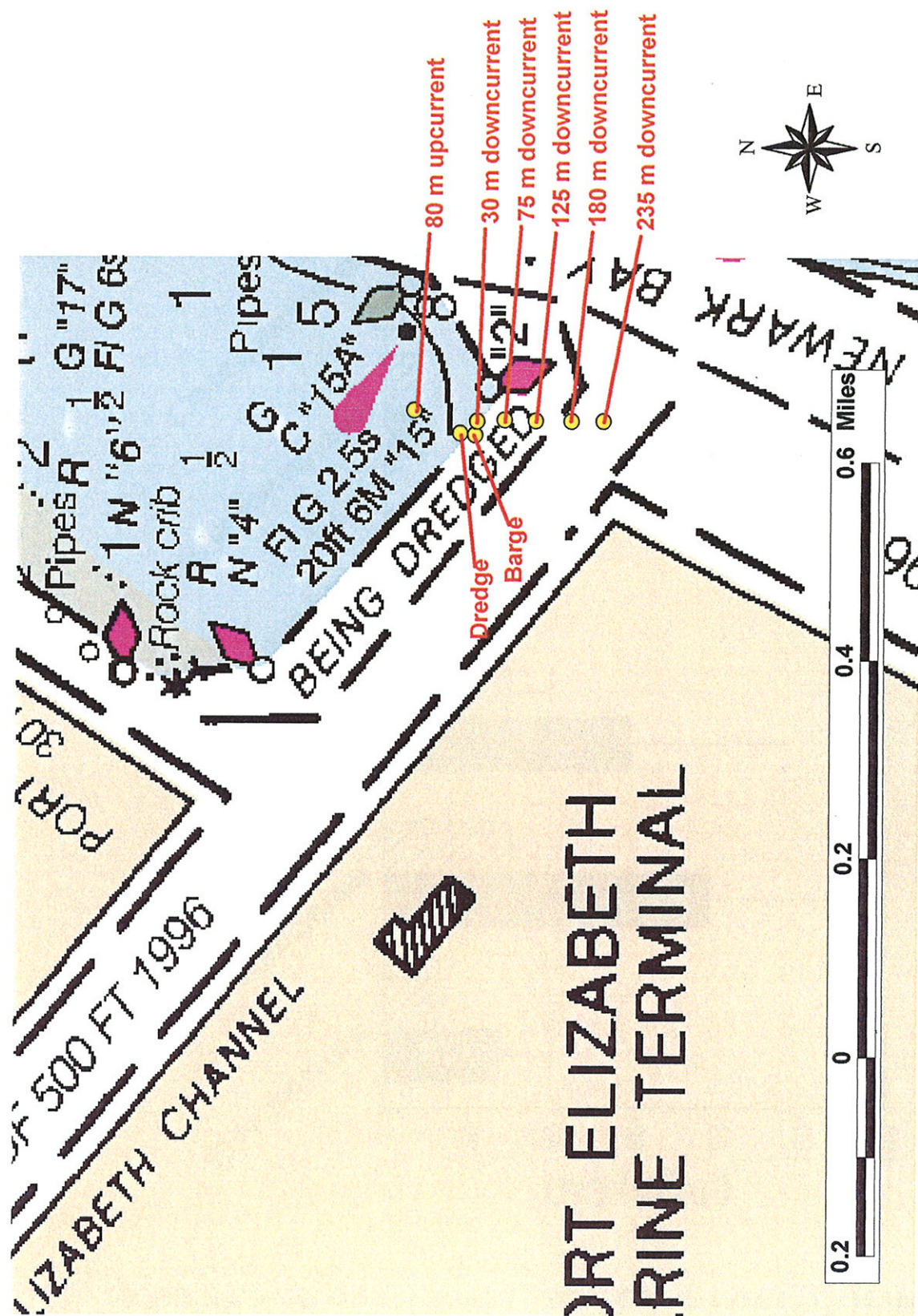


Figure 20: Locations of active dredge sampling in Elizabeth Channel, November 14, 2001.

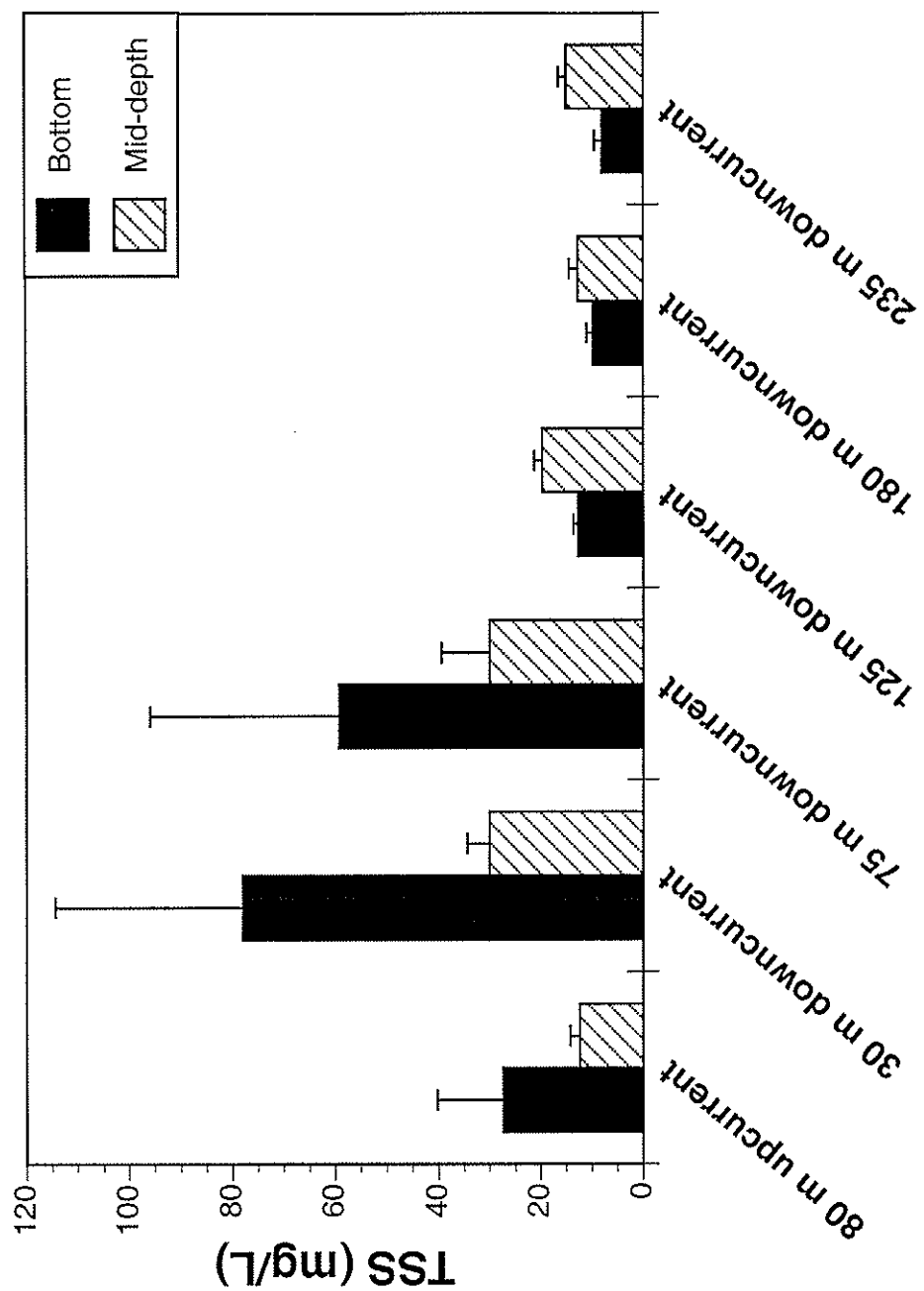


Figure 21: Total Suspended Solids (TSS) values from active dredge sampling in Elizabeth Channel, November 14, 2001.

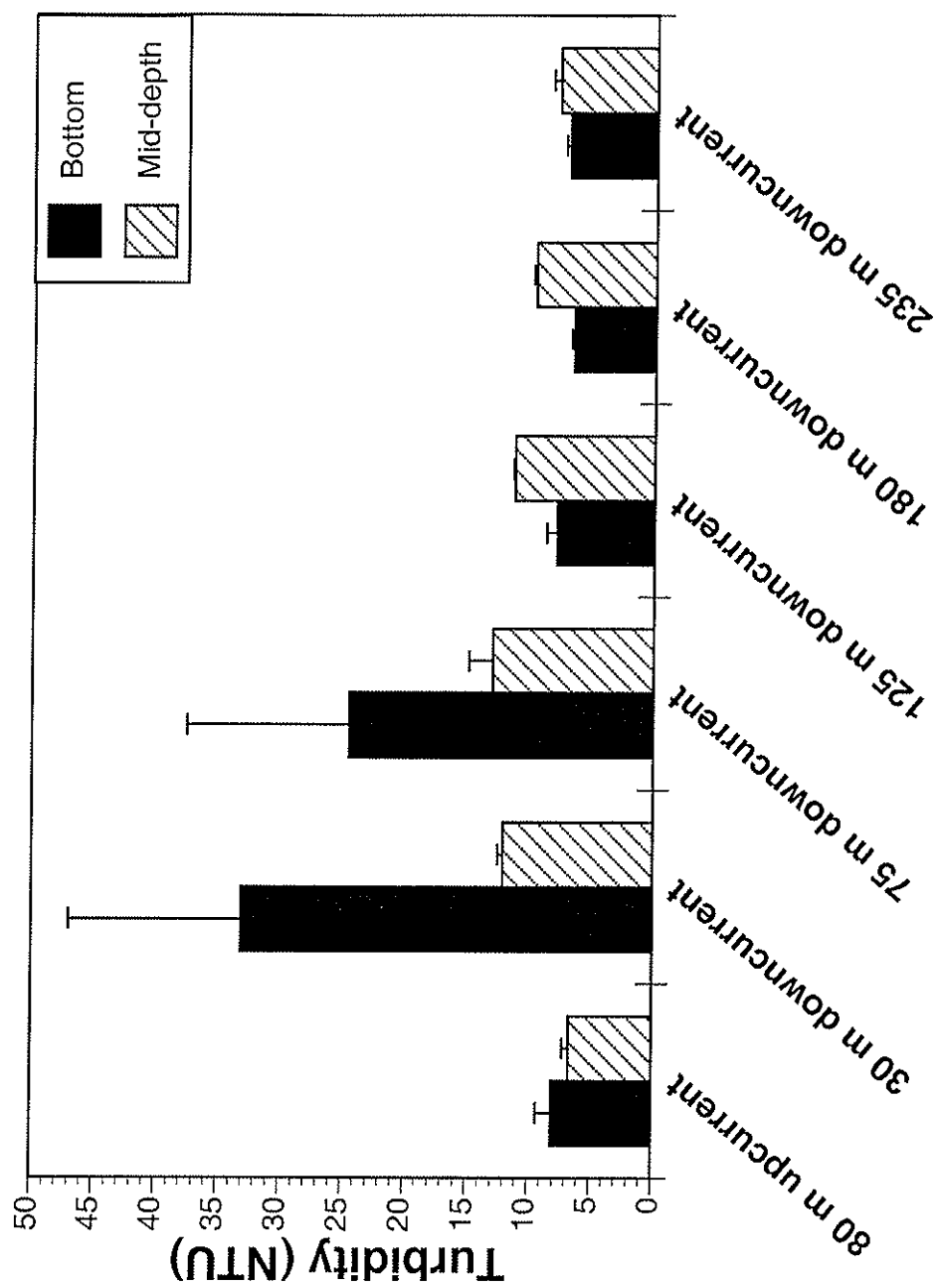


Figure 22: Turbidity values from active dredge sampling in Elizabeth Channel, November 14, 2001.

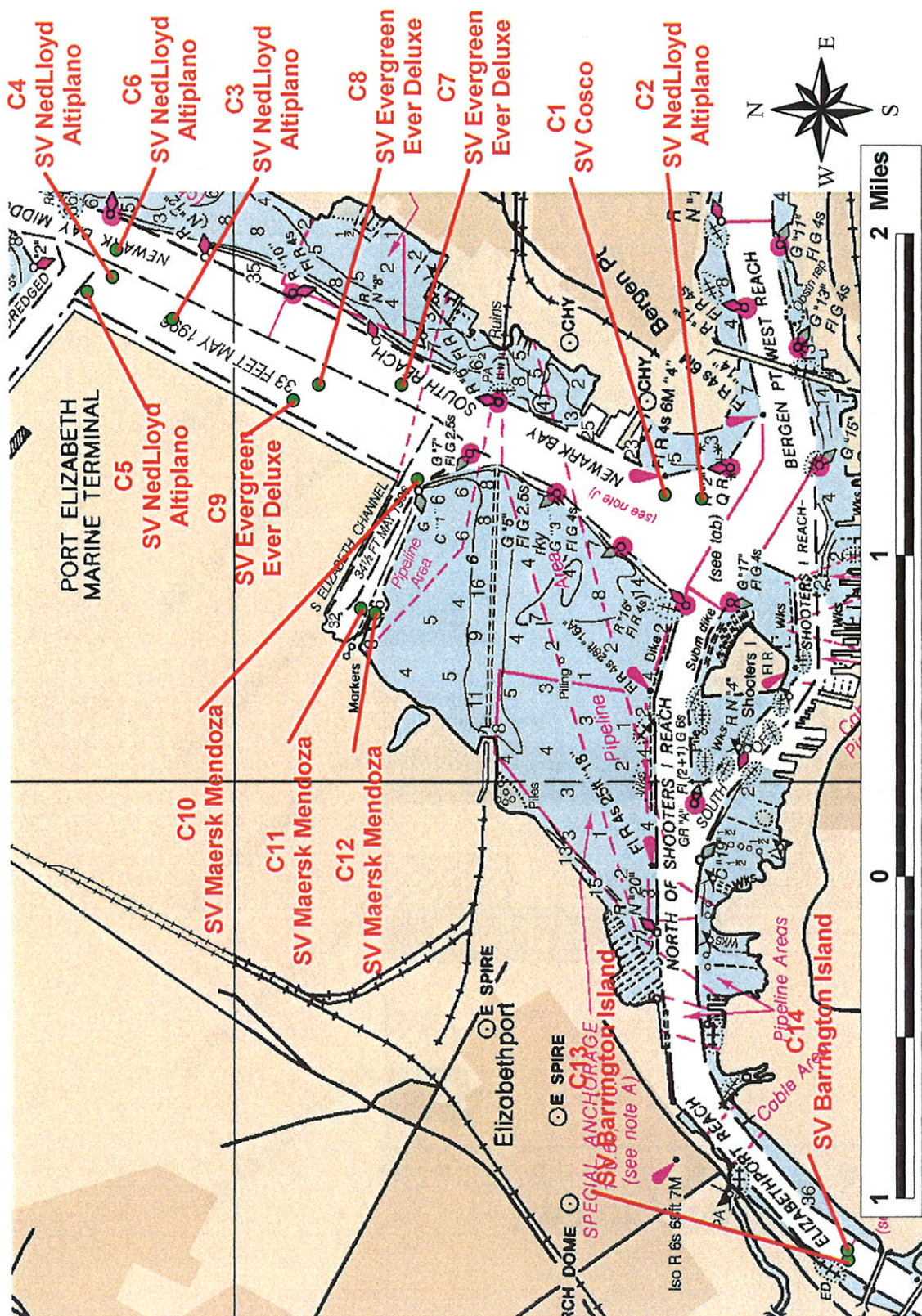


Figure 23: Locations of container ship passage sampling, March 14, 2002.

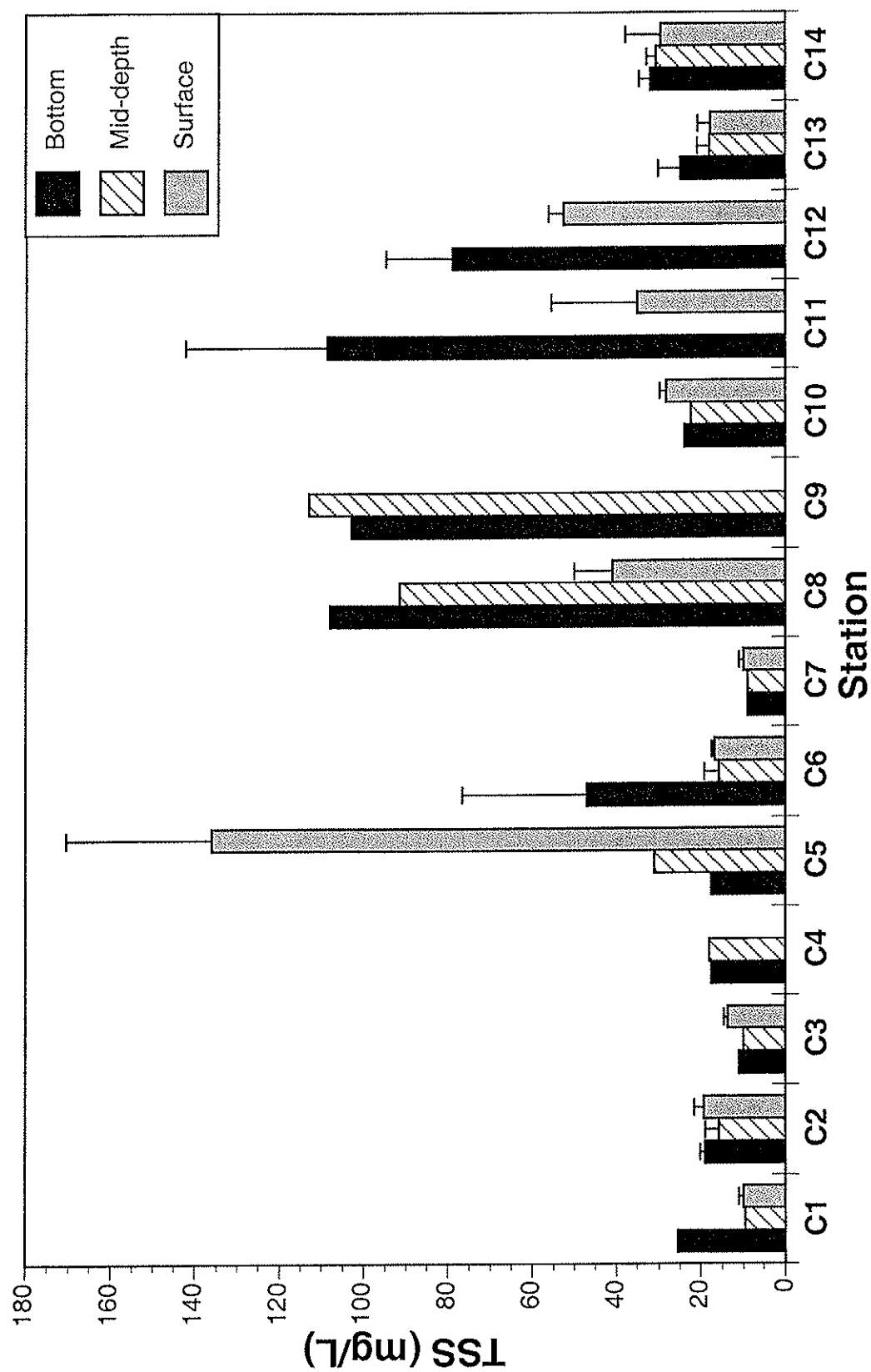


Figure 24: Total Suspended Solids (TSS) values from container ship passage sampling, March 14, 2002.

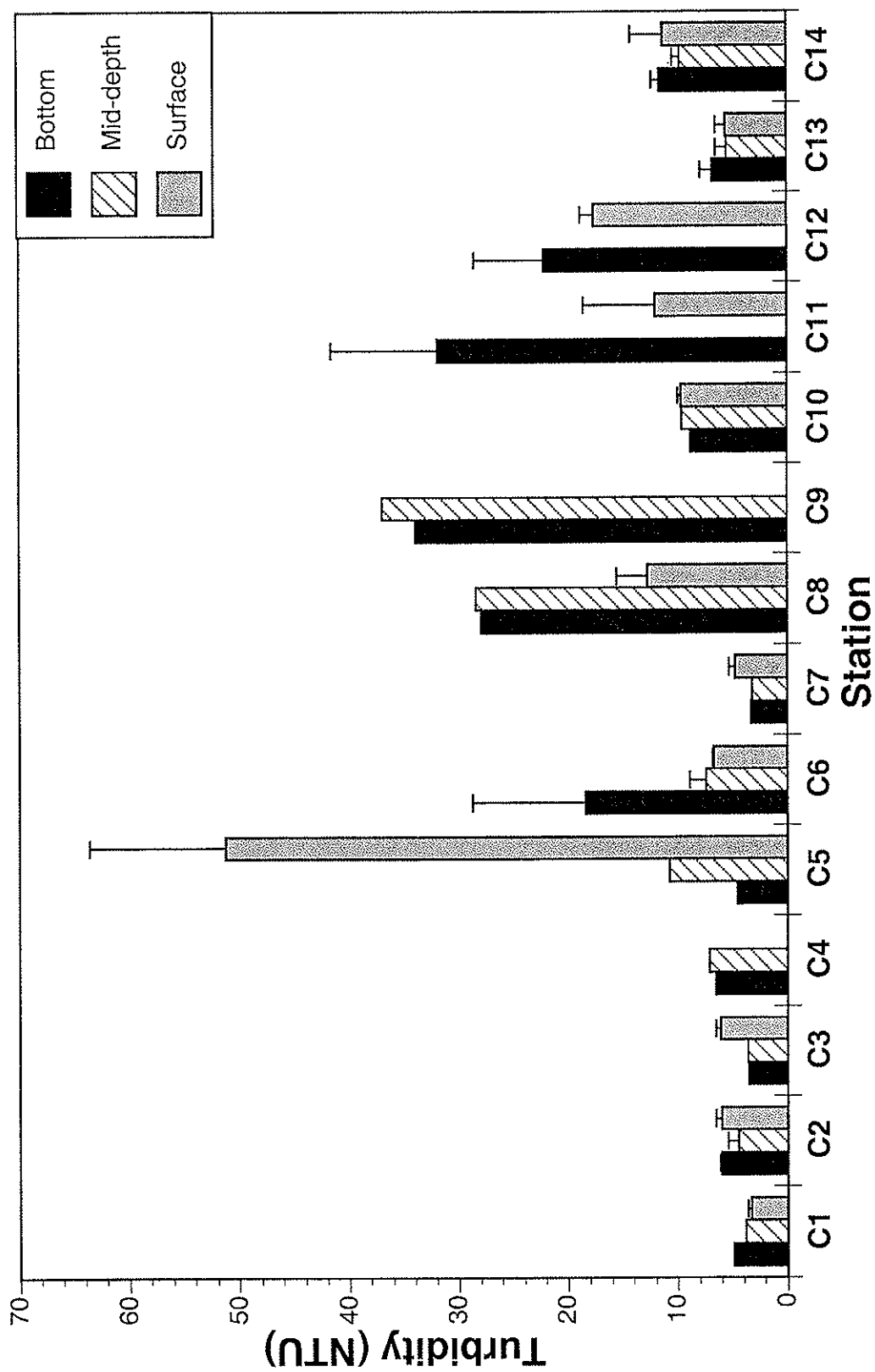


Figure 25: Turbidity values from container ship passage sampling, March 14, 2002.

Appendix I

TSS, Turbidity and HydroLab[®] Raw Data

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
March 29, 2001	NB - 1	Bottom	9.7	2.73	8	15	6
March 29, 2001	NB - 1	Surface	4.0	0.00	4	4	4
March 29, 2001	NB - 2	Bottom	15.7	2.19	13	20	14
March 29, 2001	NB - 2	Surface	4.7	0.33	5	4	5
March 29, 2001	NB - 3	Bottom	16.0	5.57	27	9	12
March 29, 2001	NB - 3	Surface	7.0	0.58	8	6	7
March 29, 2001	NB - 4	Bottom	8.3	0.88	8	10	7
March 29, 2001	NB - 4	Surface	7.3	0.33	7	8	7
March 29, 2001	NB - 5	Bottom	27.3	10.33	47	12	23
March 29, 2001	NB - 5	Surface	6.3	0.88	5	8	6
March 29, 2001	NB - 6	Bottom	16.0	3.46	10	22	16
March 29, 2001	NB - 6	Surface	8.0	0.00	8	8	8
March 29, 2001	NB - 7	Bottom	10.0	0.58	11	10	9
March 29, 2001	NB - 7	Surface	11.0	1.53	12	13	8
March 29, 2001	NB - 8	Bottom	14.0	3.79	21	13	8
March 29, 2001	NB - 8	Surface	6.3	0.33	6	7	6
March 29, 2001	PJ - 1	Bottom	21.7	2.96	16	23	26
March 29, 2001	PJ - 1	Surface	15.7	0.67	15	17	15
March 29, 2001	PJ - 2	Bottom	16.7	0.67	16	16	18
March 29, 2001	PJ - 2	Surface	18.7	0.88	20	19	17
March 29, 2001	PJ - 3	Bottom	10.3	0.33	10	10	11
March 29, 2001	PJ - 3	Surface	11.3	0.33	11	12	11
March 29, 2001	PJ - 4	Bottom	9.7	0.33	10	9	10
March 29, 2001	PJ - 4	Surface	11.3	0.67	12	12	10
March 29, 2001	PJ - 5	Bottom	6.0	0.58	5	6	7
March 29, 2001	PJ - 5	Surface	10.3	0.33	10	11	10
March 29, 2001	PJ - 6	Bottom	17.7	7.45	32	14	7
March 29, 2001	PJ - 6	Surface	9.7	1.20	12	9	8
March 29, 2001	PJ - 7	Bottom	8.0	1.15	6	10	8
March 29, 2001	PJ - 7	Surface	8.3	0.33	8	8	9

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
April 18, 2001	NB - 1	Bottom	37.0		22		52
April 18, 2001	NB - 1	Surface	5.3	0.33	6	5	5
April 18, 2001	NB - 2	Bottom	15.7	1.86	17	12	18
April 18, 2001	NB - 2	Surface	4.7	0.67	6	4	4
April 19, 2001	NB - 3	Bottom	19.3	13.84	47	6	5
April 19, 2001	NB - 3	Surface	4.0	0.00	4	4	4
April 19, 2001	NB - 4	Bottom	9.0	1.00	11	8	8
April 19, 2001	NB - 4	Surface	3.7	0.33	4	4	3
April 19, 2001	NB - 5	Bottom	7.0	0.58	6	7	8
April 19, 2001	NB - 5	Surface	4.3	0.33	5	4	4
April 19, 2001	NB - 6	Bottom	8.3	1.86	7	12	6
April 19, 2001	NB - 6	Surface	3.3	0.33	4	3	3
April 19, 2001	NB - 7	Bottom	7.0	1.15	5	9	7
April 19, 2001	NB - 7	Surface	4.3	0.33	4	5	4
April 19, 2001	NB - 8	Bottom	13.7	8.21	30	7	4
April 19, 2001	NB - 8	Surface	3.7	0.33	4	4	3
April 18, 2001	PJ - 1	Bottom	7.3	0.88	7	6	9
April 18, 2001	PJ - 1	Surface	8.0	0.00	8	8	8
April 18, 2001	PJ - 2	Bottom	9.3	1.86	13	8	7
April 18, 2001	PJ - 2	Surface	8.0	0.58	9	8	7
April 18, 2001	PJ - 3	Bottom	10.7	0.88	11	12	9
April 18, 2001	PJ - 3	Surface	13.0	0.58	14	13	12
April 18, 2001	PJ - 4	Bottom	8.7	0.33	9	8	9
April 18, 2001	PJ - 4	Surface	9.0	0.58	8	9	10
April 18, 2001	PJ - 5	Bottom	6.3	0.67	7	5	7
April 18, 2001	PJ - 5	Surface	7.0	0.58	6	8	7
April 18, 2001	PJ - 6	Bottom	8.7	0.67	10	8	8
April 18, 2001	PJ - 6	Surface	11.0	0.58	12	11	10
April 18, 2001	PJ - 7	Bottom	20.3	2.19	23	16	22
April 18, 2001	PJ - 7	Surface	8.7	0.67	10	8	8

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
May 2, 2001	NB - 1	Bottom	8.7	1.76	6	8	12
May 2, 2001	NB - 1	Surface	5.7	0.88	6	7	4
May 2, 2001	NB - 2	Bottom	6.3	0.88	5	8	6
May 2, 2001	NB - 2	Surface	4.0	0.00	4	4	4
May 2, 2001	NB - 3	Bottom	7.3	0.33	7	8	7
May 2, 2001	NB - 3	Surface	4.0	0.00	4	4	4
May 2, 2001	NB - 4	Bottom	7.0	0.00	7	7	7
May 2, 2001	NB - 4	Surface	4.7	0.33	5	5	4
May 2, 2001	NB - 5	Bottom	11.0	2.65	12	6	15
May 2, 2001	NB - 5	Surface	5.7	0.33	6	6	5
May 2, 2001	NB - 6	Bottom	9.0	0.58	9	8	10
May 2, 2001	NB - 6	Surface	4.7	0.67	6	4	4
May 2, 2001	NB - 7	Bottom	8.7	0.67	10	8	8
May 2, 2001	NB - 7	Surface	4.0	0.00	4	4	4
May 2, 2001	NB - 8	Bottom	4.3	0.33	5	4	4
May 2, 2001	NB - 8	Surface	3.7	0.67	3	5	3
May 2, 2001	PJ - 1	Bottom	26.0	12.58	51	11	16
May 2, 2001	PJ - 1	Surface	6.0	0.58	7	5	6
May 2, 2001	PJ - 2	Bottom	16.7	2.03	17	20	13
May 2, 2001	PJ - 2	Surface	27.3	2.40	26	32	24
May 2, 2001	PJ - 3	Bottom	11.0	1.53	9	14	10
May 2, 2001	PJ - 3	Surface	7.7	0.67	9	7	7
May 2, 2001	PJ - 4	Bottom	10.7	0.33	10	11	11
May 2, 2001	PJ - 4	Surface	9.7	0.67	9	11	9
May 2, 2001	PJ - 5	Bottom	21.7	7.17	14	15	36
May 2, 2001	PJ - 5	Surface	10.3	0.88	9	10	12
May 2, 2001	PJ - 6	Bottom	14.7	1.86	11	17	16
May 2, 2001	PJ - 6	Surface	12.0	0.00	12	12	12
May 2, 2001	PJ - 7	Bottom	12.3	0.67	13	13	11
May 2, 2001	PJ - 7	Surface	8.0	0.00	8	8	8

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
June 13, 2001	NB - 1	Bottom	10.0	1.73	7	13	10
June 13, 2001	NB - 1	Surface	9.0	0.00	9	9	9
June 13, 2001	NB - 2	Bottom	15.3	2.85	21	12	13
June 13, 2001	NB - 2	Surface	8.0	0.58	9	7	8
June 14, 2001	NB - 3	Bottom	11.7	1.67	15	10	10
June 14, 2001	NB - 3	Surface	8.7	0.33	8	9	9
June 14, 2001	NB - 4	Bottom	9.3	0.88	11	9	8
June 14, 2001	NB - 4	Surface	7.3	0.33	8	7	7
June 14, 2001	NB - 5	Bottom	15.7	3.28	11	14	22
June 14, 2001	NB - 5	Surface	8.0	1.00	9	6	9
June 14, 2001	NB - 6	Bottom	8.0	0.00	8	8	8
June 14, 2001	NB - 6	Surface	8.0	0.00	8	8	8
June 14, 2001	NB - 7	Bottom	8.3	0.67	9	7	9
June 14, 2001	NB - 7	Surface	8.3	0.33	9	8	8
June 14, 2001	NB - 8	Bottom	16.0	3.79	23	10	15
June 14, 2001	NB - 8	Surface	8.0	0.00	8	8	8
June 13, 2001	PJ - 1	Bottom	12.0	1.53	11	10	15
June 13, 2001	PJ - 1	Surface	9.0	0.58	9	10	8
June 13, 2001	PJ - 2	Bottom	13.0	0.58	13	14	12
June 13, 2001	PJ - 2	Surface	9.7	0.88	11	8	10
June 13, 2001	PJ - 3	Bottom	13.0	0.00	13	13	13
June 13, 2001	PJ - 3	Surface	10.3	0.33	10	10	11
June 13, 2001	PJ - 4	Bottom	18.3	0.88	18	20	17
June 13, 2001	PJ - 4	Surface	11.0	0.58	11	12	10
June 13, 2001	PJ - 5	Bottom	38.0	1.00	37	40	37
June 13, 2001	PJ - 5	Surface	10.0	0.58	9	11	10
June 13, 2001	PJ - 6	Bottom	17.3	6.17	29	15	8
June 13, 2001	PJ - 6	Surface	8.0	0.58	9	8	7
June 13, 2001	PJ - 7	Bottom	16.3	2.40	13	21	15
June 13, 2001	PJ - 7	Surface	11.3	0.33	12	11	11

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
July 13, 2001	NB - 1	Surface	15.3	0.88	17	14	15
July 13, 2001	NB - 2	Surface	9.3	0.67	8	10	10
July 13, 2001	NB - 3	Surface	11.3	0.67	12	12	10
July 13, 2001	NB - 4	Surface	13.0	1.00	14	11	14
July 13, 2001	NB - 5	Surface	12.3	0.33	12	13	12
July 13, 2001	NB - 6	Surface	10.0	2.08	13	6	11
July 13, 2001	NB - 7	Surface	13.0	0.58	13	12	14
July 13, 2001	NB - 8	Surface	13.7	0.88	15	14	12
July 13, 2001	PJ - 1	Surface	7.7	0.67	7	7	9
July 13, 2001	PJ - 2	Surface	10.0	0.58	9	10	11
July 13, 2001	PJ - 3	Surface	9.0	0.00	9	9	9
July 13, 2001	PJ - 4	Surface	10.7	0.67	10	10	12
July 13, 2001	PJ - 5	Surface	12.0	1.15	10	12	14
July 13, 2001	PJ - 6	Surface	13.0	1.00	12	15	12
July 13, 2001	PJ - 7	Surface	12.3	0.33	12	13	12

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
August 9, 2001	NB - 1	Bottom	16.3	2.03	13	20	16
August 9, 2001	NB - 1	Surface	10.7	0.88	9	12	11
August 9, 2001	NB - 2	Bottom	13.0	1.15	11	15	13
August 9, 2001	NB - 2	Surface	9.0	0.00	9	9	9
August 9, 2001	NB - 3	Bottom	31.0	8.50	48	22	23
August 9, 2001	NB - 3	Surface	9.7	0.88	11	10	8
August 9, 2001	NB - 4	Bottom	17.7	0.33	18	17	18
August 9, 2001	NB - 4	Surface	10.7	0.67	12	10	10
August 9, 2001	NB - 5	Bottom	27.7	13.68	55	15	13
August 9, 2001	NB - 5	Surface	11.7	0.33	12	11	12
August 9, 2001	NB - 6	Bottom	15.3	2.96	14	11	21
August 9, 2001	NB - 6	Surface	11.0	0.00	11	11	11
August 9, 2001	NB - 7	Bottom	15.7	0.88	14	16	17
August 9, 2001	NB - 7	Surface	11.3	2.85	17	9	8
August 9, 2001	NB - 8	Bottom	24.0	3.21	18	29	25
August 9, 2001	NB - 8	Surface	11.7	0.33	12	12	11
August 9, 2001	PJ - 1	Bottom	22.3	1.45	25	22	20
August 9, 2001	PJ - 1	Surface	6.0	0.58	5	7	6
August 9, 2001	PJ - 2	Bottom	19.0	3.79	18	13	26
August 9, 2001	PJ - 2	Surface	7.0	0.58	6	8	7
August 9, 2001	PJ - 3	Bottom	11.3	1.45	11	14	9
August 9, 2001	PJ - 3	Surface	8.7	1.45	11	9	6
August 9, 2001	PJ - 4	Bottom	19.3	2.33	20	23	15
August 9, 2001	PJ - 4	Surface	13.7	4.67	23	9	9
August 9, 2001	PJ - 5	Bottom	13.0	0.58	12	14	13
August 9, 2001	PJ - 5	Surface	11.7	2.33	7	14	14
August 9, 2001	PJ - 6	Bottom	7.0	0.58	6	7	8
August 9, 2001	PJ - 6	Surface	7.7	0.67	7	7	9
August 9, 2001	PJ - 7	Bottom	10.7	2.73	7	16	9
August 9, 2001	PJ - 7	Surface	7.7	0.67	7	7	9

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
August 23, 2001	NB - 1	Bottom	34.0	7.37	48	23	31
August 23, 2001	NB - 1	Surface	17.0	1.00	16	19	16
August 23, 2001	NB - 2	Bottom	34.3	6.89	29	26	48
August 23, 2001	NB - 2	Surface	20.0	0.58	21	20	19
August 23, 2001	NB - 3	Bottom	23.3	1.20	21	25	24
August 23, 2001	NB - 3	Surface	18.3	1.86	16	17	22
August 23, 2001	NB - 4	Bottom	24.3	1.86	28	23	22
August 23, 2001	NB - 4	Surface	17.3	0.33	17	17	18
August 23, 2001	NB - 5	Bottom	17.3	0.33	17	17	18
August 23, 2001	NB - 5	Surface	14.3	0.33	15	14	14
August 23, 2001	NB - 6	Bottom	41.0	3.79	48	40	35
August 23, 2001	NB - 6	Surface	27.7	2.19	25	26	32
August 23, 2001	NB - 7	Bottom	23.3	0.88	22	25	23
August 23, 2001	NB - 7	Surface	20.7	0.88	21	19	22
August 23, 2001	NB - 8	Bottom	25.3	2.03	22	25	29
August 23, 2001	NB - 8	Surface	16.0	1.00	17	14	17
August 23, 2001	PJ - 1	Bottom	29.0	5.69	18	37	32
August 23, 2001	PJ - 1	Surface	16.7	1.67	20	15	15
August 23, 2001	PJ - 2	Bottom	25.3	1.76	22	28	26
August 23, 2001	PJ - 2	Surface	18.3	0.33	18	19	18
August 23, 2001	PJ - 3	Bottom	26.3	3.93	24	34	21
August 23, 2001	PJ - 3	Surface	20.0	1.00	19	19	22
August 23, 2001	PJ - 4	Bottom	27.3	2.96	26	23	33
August 23, 2001	PJ - 4	Surface	14.3	0.33	15	14	14
August 23, 2001	PJ - 5	Bottom	23.0	3.61	16	28	25
August 23, 2001	PJ - 5	Surface	12.3	2.19	14	15	8
August 23, 2001	PJ - 6	Bottom	32.7	4.18	28	41	29
August 23, 2001	PJ - 6	Surface	19.3	1.33	18	18	22
August 23, 2001	PJ - 7	Bottom	19.7	1.20	22	19	18
August 23, 2001	PJ - 7	Surface	16.3	0.88	18	15	16

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
October 25, 2001	NB - 1	Bottom	13.0	2.52	11	10	18
October 25, 2001	NB - 1	Surface	10.0	0.58	10	11	9
October 25, 2001	NB - 2	Bottom	11.3	3.93	6	9	19
October 25, 2001	NB - 2	Surface	8.7	1.20	8	7	11
October 25, 2001	NB - 3	Bottom	9.7	2.73	15	8	6
October 25, 2001	NB - 3	Surface	5.3	0.33	5	6	5
October 25, 2001	NB - 4	Bottom	10.7	0.88	12	9	11
October 25, 2001	NB - 4	Surface	7.3	0.33	7	7	8
October 25, 2001	NB - 5	Bottom	17.0	5.77	7	17	27
October 25, 2001	NB - 5	Surface	8.7	1.20	11	8	7
October 25, 2001	NB - 6	Bottom	10.3	2.33	15	8	8
October 25, 2001	NB - 6	Surface	15.0	3.79	16	21	8
October 25, 2001	NB - 7	Bottom	11.7	2.91	7	11	17
October 25, 2001	NB - 7	Surface	6.5		8		5
October 25, 2001	NB - 8	Bottom	7.0	0.58	6	8	7
October 25, 2001	NB - 8	Surface	5.7	0.67	5	5	7
October 25, 2001	PJ - 1	Bottom	6.3	0.88	5	8	6
October 25, 2001	PJ - 1	Surface	5.7	0.67	7	5	5
October 25, 2001	PJ - 2	Bottom	13.3	4.33	9	22	9
October 25, 2001	PJ - 2	Surface	8.3	0.88	10	8	7
October 25, 2001	PJ - 4	Bottom	13.3	1.45	13	16	11
October 25, 2001	PJ - 4	Surface	7.7	1.20	10	6	7
October 25, 2001	PJ - 5	Bottom	11.7	2.03	8	12	15
October 25, 2001	PJ - 5	Surface	8.7	0.88	9	7	10
October 25, 2001	PJ - 6	Bottom	9.7	1.20	8	12	9
October 25, 2001	PJ - 6	Surface	10.0	1.73	7	10	13
October 25, 2001	PJ - 7	Bottom	14.0	1.53	16	15	11
October 25, 2001	PJ - 7	Surface	7.0		8		6

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
November 14, 2001	NB - 1	Bottom	32.0	7.23	44	33	19
November 14, 2001	NB - 1	Surface	22.3	2.96	28	21	18
November 14, 2001	NB - 2	Bottom	43.7	4.70	53	38	40
November 14, 2001	NB - 2	Surface	40.0	1.53	42	41	37
November 14, 2001	NB - 3	Bottom	27.7	4.10	29	34	20
November 14, 2001	NB - 3	Surface	13.0	2.08	17	10	12
November 14, 2001	NB - 4	Bottom	24.3	2.03	28	21	24
November 14, 2001	NB - 4	Surface	19.7	1.20	18	22	19
November 14, 2001	NB - 5	Bottom	22.7	3.84	17	30	21
November 14, 2001	NB - 5	Surface	23.7	2.96	28	25	18
November 14, 2001	NB - 6	Bottom	16.7	0.33	16	17	17
November 14, 2001	NB - 6	Surface	17.0	0.58	18	16	17
November 14, 2001	NB - 7	Bottom	23.3	2.19	19	26	25
November 14, 2001	NB - 7	Surface	20.7	2.67	18	26	18
November 14, 2001	NB - 8	Bottom	16.3	2.03	13	16	20
November 14, 2001	NB - 8	Surface	13.3	0.88	15	13	12
November 14, 2001	PJ - 1	Bottom	11.3	0.88	11	10	13
November 14, 2001	PJ - 1	Surface	11.3	0.88	11	13	10
November 14, 2001	PJ - 2	Bottom	14.7	0.88	13	16	15
November 14, 2001	PJ - 2	Surface	12.0	1.00	11	11	14
November 14, 2001	PJ - 3	Bottom	13.3	1.45	16	13	11
November 14, 2001	PJ - 3	Surface	11.0	1.53	8	13	12
November 14, 2001	PJ - 4	Bottom	11.0	0.58	11	12	10
November 14, 2001	PJ - 4	Surface	7.0	0.58	8	6	7
November 14, 2001	PJ - 5	Bottom	7.3	0.33	7	7	8
November 14, 2001	PJ - 5	Surface	10.0	2.00	6	12	12
November 14, 2001	PJ - 6	Bottom	13.7	0.88	12	14	15
November 14, 2001	PJ - 6	Surface	12.7	0.33	13	13	12
November 14, 2001	PJ - 7	Bottom	20.7	4.06	20	14	28
November 14, 2001	PJ - 7	Surface	10.7	0.33	11	11	10

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
December 18, 2001	NB - 1	Bottom	26.7	2.60	22	31	27
December 18, 2001	NB - 1	Surface	15.7	1.86	12	18	17
December 18, 2001	NB - 2	Bottom	26.3	3.18	32	26	21
December 18, 2001	NB - 2	Surface	20.7	1.86	23	22	17
December 18, 2001	NB - 3	Bottom	16.0	3.79	9	22	17
December 18, 2001	NB - 3	Surface	15.0	2.65	11	14	20
December 18, 2001	NB - 4	Bottom	27.0	5.51	17	28	36
December 18, 2001	NB - 4	Surface	12.3	3.84	9	20	8
December 18, 2001	NB - 5	Bottom	13.7	0.67	13	15	13
December 18, 2001	NB - 5	Surface	12.0	2.08	13	15	8
December 18, 2001	NB - 6	Bottom	18.3	2.19	21	20	14
December 18, 2001	NB - 6	Surface	17.3	4.33	25	17	10
December 18, 2001	NB - 7	Bottom	13.7	2.73	10	12	19
December 18, 2001	NB - 7	Surface	12.3	1.20	14	10	13
December 18, 2001	NB - 8	Bottom	13.7	1.67	12	12	17
December 18, 2001	NB - 8	Surface	12.7	0.33	12	13	13
December 18, 2001	PJ - 1	Bottom	11.3	0.33	11	11	12
December 18, 2001	PJ - 1	Surface	11.0	0.58	11	12	10
December 18, 2001	PJ - 2	Bottom	15.3	3.18	10	21	15
December 18, 2001	PJ - 2	Surface	8.3	0.88	8	10	7
December 18, 2001	PJ - 3	Bottom					
December 18, 2001	PJ - 3	Surface					
December 18, 2001	PJ - 4	Bottom	19.7	3.48	19	26	14
December 18, 2001	PJ - 4	Surface	10.7	2.19	8	15	9
December 18, 2001	PJ - 5	Bottom	19.0	1.53	17	22	18
December 18, 2001	PJ - 5	Surface	12.7	1.45	15	10	13
December 18, 2001	PJ - 6	Bottom	8.3	0.67	7	9	9
December 18, 2001	PJ - 6	Surface	10.3	1.20	12	8	11
December 18, 2001	PJ - 7	Bottom	16.0	3.79	15	10	23
December 18, 2001	PJ - 7	Surface	9.0	0.58	8	10	9

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
January 15, 2002	NB - 1	Bottom	14.7	3.28	10	13	21
January 15, 2002	NB - 1	Surface	8.0	1.00	9	6	9
January 15, 2002	NB - 2	Bottom	10.7	0.33	11	10	11
January 15, 2002	NB - 2	Surface	8.7	1.45	6	9	11
January 15, 2002	NB - 3	Bottom	11.3	0.67	12	10	12
January 15, 2002	NB - 3	Surface	8.3	0.88	7	8	10
January 15, 2002	NB - 4	Bottom	11.0	0.58	10	12	11
January 15, 2002	NB - 4	Surface	10.7	0.67	10	10	12
January 15, 2002	NB - 5	Bottom	8.7	0.33	9	8	9
January 15, 2002	NB - 5	Surface	7.7	0.67	7	9	7
January 15, 2002	NB - 6	Bottom	12.3	0.88	11	14	12
January 15, 2002	NB - 6	Surface	9.7	0.67	9	11	9
January 15, 2002	NB - 7	Bottom	10.0	0.58	11	10	9
January 15, 2002	NB - 7	Surface	8.0	1.15	8	10	6
January 15, 2002	NB - 8	Bottom	9.0	0.58	8	10	9
January 15, 2002	NB - 8	Surface	7.7	1.45	8	5	10
January 15, 2002	PJ - 1	Bottom	9.7	0.33	10	9	10
January 15, 2002	PJ - 1	Surface	8.0	1.00	9	9	6
January 15, 2002	PJ - 2	Bottom	18.3	1.86	16	17	22
January 15, 2002	PJ - 2	Surface	7.7	0.88	8	6	9
January 15, 2002	PJ - 3	Bottom	11.3	0.33	11	11	12
January 15, 2002	PJ - 3	Surface	7.7	1.20	7	10	6
January 15, 2002	PJ - 4	Bottom	23.0	1.53	21	22	26
January 15, 2002	PJ - 4	Surface	6.3	0.67	7	7	5
January 15, 2002	PJ - 5	Bottom	18.3	2.33	16	23	16
January 15, 2002	PJ - 5	Surface	5.0	0.58	6	4	5
January 15, 2002	PJ - 6	Bottom	6.0	0.00	6	6	6
January 15, 2002	PJ - 6	Surface	10.7	1.67	9	9	14
January 15, 2002	PJ - 7	Bottom	8.3	1.20	10	6	9
January 15, 2002	PJ - 7	Surface	5.0	1.15	7	5	3

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
February 1, 2002	NB - 1	Bottom	10.3	0.33	10	10	11
February 1, 2002	NB - 1	Surface	8.7	0.67	8	10	8
February 1, 2002	NB - 2	Bottom	11.0	0.58	10	11	12
February 1, 2002	NB - 2	Surface	9.3	1.86	8	7	13
February 1, 2002	NB - 3	Bottom	11.0	1.53	10	9	14
February 1, 2002	NB - 3	Surface	10.3	0.33	11	10	10
February 1, 2002	NB - 4	Bottom	11.3	0.33	11	12	11
February 1, 2002	NB - 4	Surface	7.3	0.67	8	6	8
February 1, 2002	NB - 5	Bottom	10.0	1.53	9	8	13
February 1, 2002	NB - 5	Surface	9.3	0.88	8	11	9
February 1, 2002	NB - 6	Bottom	11.3	0.67	12	10	12
February 1, 2002	NB - 6	Surface	9.3	0.33	9	10	9
February 1, 2002	NB - 7	Bottom	20.3	0.88	22	19	20
February 1, 2002	NB - 7	Surface	7.7	0.67	7	9	7
February 1, 2002	NB - 8	Bottom	11.7	2.33	16	11	8
February 1, 2002	NB - 8	Surface	8.3	0.67	9	7	9
February 1, 2002	PJ - 1	Bottom	14.3	3.76	8	21	14
February 1, 2002	PJ - 1	Surface	6.3	0.33	7	6	6
February 1, 2002	PJ - 2	Bottom	14.0	1.15	16	14	12
February 1, 2002	PJ - 2	Surface	7.7	1.20	7	6	10
February 1, 2002	PJ - 3	Bottom	20.7	1.45	18	21	23
February 1, 2002	PJ - 3	Surface	9.3	0.88	8	9	11
February 1, 2002	PJ - 4	Bottom	19.0	1.73	19	16	22
February 1, 2002	PJ - 4	Surface	9.7	2.19	8	7	14
February 1, 2002	PJ - 5	Bottom	20.3	3.93	15	28	18
February 1, 2002	PJ - 5	Surface	7.0	0.58	8	7	6
February 1, 2002	PJ - 6	Bottom	15.3	0.33	15	16	15
February 1, 2002	PJ - 6	Surface	9.3	0.33	9	10	9
February 1, 2002	PJ - 7	Bottom	11.3	0.33	11	11	12
February 1, 2002	PJ - 7	Surface	8.0	1.00	6	9	9

Date	Station	Stratum	TSS (mg/L)	Std Err	rep 1	rep 2	rep 3
February 21, 2002	NB - 1	Bottom	11.0	0.58	10	11	12
February 21, 2002	NB - 1	Surface	8.3	0.67	9	7	9
February 21, 2002	NB - 2	Bottom	11.7	0.33	12	11	12
February 21, 2002	NB - 2	Surface	10.7	0.88	12	9	11
February 21, 2002	NB - 3	Bottom	11.7	0.88	13	12	10
February 21, 2002	NB - 3	Surface	9.3	0.33	9	10	9
February 21, 2002	NB - 4	Bottom	14.3	0.33	14	15	14
February 21, 2002	NB - 4	Surface	10.3	0.33	10	10	11
February 21, 2002	NB - 5	Bottom	11.3	0.33	11	12	11
February 21, 2002	NB - 5	Surface	9.3	1.20	10	7	11
February 21, 2002	NB - 6	Bottom	12.3	1.33	15	11	11
February 21, 2002	NB - 6	Surface	11.3	0.33	11	12	11
February 21, 2002	NB - 7	Bottom	12.0	0.58	12	13	11
February 21, 2002	NB - 7	Surface	14.3	0.88	14	16	13
February 21, 2002	NB - 8	Bottom	12.7	2.19	17	11	10
February 21, 2002	NB - 8	Surface	7.7	0.33	8	8	7
February 21, 2002	PJ - 1	Bottom	9.3	2.03	6	13	9
February 21, 2002	PJ - 1	Surface	5.7	0.33	5	6	6
February 21, 2002	PJ - 2	Bottom	8.0	0.58	7	9	8
February 21, 2002	PJ - 2	Surface	7.3	0.88	7	6	9
February 21, 2002	PJ - 3	Bottom	8.7	2.19	6	7	13
February 21, 2002	PJ - 3	Surface	6.0	2.00	10	4	4
February 21, 2002	PJ - 4	Bottom	7.0	0.58	6	7	8
February 21, 2002	PJ - 4	Surface	7.3	0.67	8	8	6
February 21, 2002	PJ - 5	Bottom	9.0	1.00	8	11	8
February 21, 2002	PJ - 5	Surface	6.3	0.33	6	6	7
February 21, 2002	PJ - 6	Bottom	10.0	1.00	9	12	9
February 21, 2002	PJ - 6	Surface	6.7	0.88	7	8	5
February 21, 2002	PJ - 7	Bottom	17.3	0.88	19	17	16
February 21, 2002	PJ - 7	Surface	6.3	0.88	8	6	5

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
March 29, 2001	NB - 1	Bottom	5.5	1.01	5.3	7.3	3.8
March 29, 2001	NB - 1	Surface	3.0	0.07	3.1	2.9	3.1
March 29, 2001	NB - 2	Bottom	7.7	0.46	7.6	8.5	6.9
March 29, 2001	NB - 2	Surface	3.9	0.12	4.1	3.7	3.9
March 29, 2001	NB - 3	Bottom	7.1	2.02	11	4.3	5.9
March 29, 2001	NB - 3	Surface	3.7	0.09	3.7	3.8	3.5
March 29, 2001	NB - 4	Bottom	4.9	0.45	4.4	5.8	4.5
March 29, 2001	NB - 4	Surface	4.0	0.12	4.2	4	3.8
March 29, 2001	NB - 5	Bottom	9.1	3.05	15	4.9	7.3
March 29, 2001	NB - 5	Surface	3.2	0.09	3.2	3	3.3
March 29, 2001	NB - 6	Bottom	6.9	0.44	6.1	7.6	7
March 29, 2001	NB - 6	Surface	4.8	0.07	4.7	4.9	4.7
March 29, 2001	NB - 7	Bottom	4.8	0.06	4.7	4.9	4.8
March 29, 2001	NB - 7	Surface	3.4	0.18	3.3	3.7	3.1
March 29, 2001	NB - 8	Bottom	6.5	1.19	8.8	6	4.8
March 29, 2001	NB - 8	Surface	3.8	0.07	3.9	3.9	3.7
March 29, 2001	PJ - 1	Bottom	10.7	1.20	9	10	13
March 29, 2001	PJ - 1	Surface	9.4	0.17	9.1	9.6	9.6
March 29, 2001	PJ - 2	Bottom	10.1	0.87	8.4	11	11
March 29, 2001	PJ - 2	Surface	12.7	0.33	13	12	13
March 29, 2001	PJ - 3	Bottom	6.1	1.27	8.6	4.8	4.8
March 29, 2001	PJ - 3	Surface	7.8	0.03	7.8	7.7	7.8
March 29, 2001	PJ - 4	Bottom	4.7	0.56	4.3	4	5.8
March 29, 2001	PJ - 4	Surface	7.8	0.09	8	7.8	7.7
March 29, 2001	PJ - 5	Bottom	3.9	0.10	4	3.7	4
March 29, 2001	PJ - 5	Surface	9.3	0.12	9.5	9.1	9.2
March 29, 2001	PJ - 6	Bottom	5.7	1.66	8.8	5.3	3.1
March 29, 2001	PJ - 6	Surface	7.8	0.06	7.7	7.8	7.9
March 29, 2001	PJ - 7	Bottom	7.3	0.86	6.1	9	6.9
March 29, 2001	PJ - 7	Surface	7.2	0.15	7.1	7	7.5

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
April 18, 2001	NB - 1	Bottom	40.7	24.91	10	90	22
April 18, 2001	NB - 1	Surface	4.0	0.03	4.1	4	4
April 18, 2001	NB - 2	Bottom	8.5	0.64	9.8	7.7	8.1
April 18, 2001	NB - 2	Surface	3.7	0.03	3.7	3.6	3.7
April 19, 2001	NB - 3	Bottom	10.0	5.98	22	4.2	3.9
April 19, 2001	NB - 3	Surface	3.2	0.15	3.2	3	3.5
April 19, 2001	NB - 4	Bottom	6.3	0.47	7.2	5.6	6.1
April 19, 2001	NB - 4	Surface	2.8	0.10	3	2.7	2.7
April 19, 2001	NB - 5	Bottom	4.6	0.32	4.5	4.1	5.2
April 19, 2001	NB - 5	Surface	3.5	0.15	3.3	3.4	3.8
April 19, 2001	NB - 6	Bottom	5.8	0.43	5.4	6.7	5.4
April 19, 2001	NB - 6	Surface	3.0	0.22	3.4	2.8	2.7
April 19, 2001	NB - 7	Bottom	5.6	1.08	3.5	7.1	6.2
April 19, 2001	NB - 7	Surface	2.7	0.09	2.8	2.7	2.5
April 19, 2001	NB - 8	Bottom	7.2	3.93	15	3.8	2.7
April 19, 2001	NB - 8	Surface	2.9	0.09	2.9	2.8	3.1
April 18, 2001	PJ - 1	Bottom	9.7	0.09	9.7	9.6	9.9
April 18, 2001	PJ - 1	Surface	9.6	0.09	9.7	9.6	9.4
April 18, 2001	PJ - 2	Bottom	10.0	0.52	11	9.6	9.3
April 18, 2001	PJ - 2	Surface	9.9	0.07	9.8	10	9.8
April 18, 2001	PJ - 3	Bottom	10.7	3.17	7	17	8.1
April 18, 2001	PJ - 3	Surface	16.7	0.33	17	16	17
April 18, 2001	PJ - 4	Bottom	8.2	1.65	9.7	4.9	10
April 18, 2001	PJ - 4	Surface	10.6	0.68	10	9.9	12
April 18, 2001	PJ - 5	Bottom	6.5	0.82	7.4	7.3	4.9
April 18, 2001	PJ - 5	Surface	7.6	0.12	7.8	7.4	7.6
April 18, 2001	PJ - 6	Bottom	8.7	1.64	12	6.9	7.3
April 18, 2001	PJ - 6	Surface	12.7	0.33	13	13	12
April 18, 2001	PJ - 7	Bottom	12.0	0.58	12	11	13
April 18, 2001	PJ - 7	Surface	8.7	0.03	8.8	8.7	8.7

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
May 2, 2001	NB - 1	Bottom	5.2	0.69	4.2	4.8	6.5
May 2, 2001	NB - 1	Surface	3.6	0.10	3.5	3.8	3.5
May 2, 2001	NB - 2	Bottom	3.6	0.23	3.2	4	3.7
May 2, 2001	NB - 2	Surface	2.8	0.07	2.9	2.9	2.7
May 2, 2001	NB - 3	Bottom	4.2	0.43	3.8	5.1	3.8
May 2, 2001	NB - 3	Surface	2.8	0.07	2.7	2.9	2.9
May 2, 2001	NB - 4	Bottom	4.7	0.17	4.7	5	4.4
May 2, 2001	NB - 4	Surface	3.1	0.20	3.5	3.1	2.8
May 2, 2001	NB - 5	Bottom	5.6	1.20	6	3.3	7.4
May 2, 2001	NB - 5	Surface	3.5	0.15	3.5	3.8	3.3
May 2, 2001	NB - 6	Bottom	5.7	0.30	5.1	5.8	6.1
May 2, 2001	NB - 6	Surface	3.4	0.26	3.9	3.3	3
May 2, 2001	NB - 7	Bottom	5.7	0.27	6.2	5.5	5.3
May 2, 2001	NB - 7	Surface	2.9	0.10	2.8	2.8	3.1
May 2, 2001	NB - 8	Bottom	2.8	0.09	2.9	2.6	2.8
May 2, 2001	NB - 8	Surface	1.8	0.06	1.7	1.9	1.8
May 2, 2001	PJ - 1	Bottom	11.7	4.15	20	6.9	8.3
May 2, 2001	PJ - 1	Surface	5.6	0.23	5.6	6	5.2
May 2, 2001	PJ - 2	Bottom	10.5	0.79	10	12	9.4
May 2, 2001	PJ - 2	Surface	14.0	0.58	13	14	15
May 2, 2001	PJ - 3	Bottom	5.9	0.32	5.3	6.4	6
May 2, 2001	PJ - 3	Surface	8.5	0.23	8.9	8.1	8.4
May 2, 2001	PJ - 4	Bottom	6.2	0.21	6.5	6.3	5.8
May 2, 2001	PJ - 4	Surface	7.8	0.23	7.4	7.7	8.2
May 2, 2001	PJ - 5	Bottom	12.5	4.37	6.5	10	21
May 2, 2001	PJ - 5	Surface	7.2	0.30	6.6	7.3	7.6
May 2, 2001	PJ - 6	Bottom	6.4	0.42	5.9	7.2	6
May 2, 2001	PJ - 6	Surface	9.9	0.06	9.9	9.8	10
May 2, 2001	PJ - 7	Bottom	7.1	0.17	7.4	6.9	6.9
May 2, 2001	PJ - 7	Surface	6.3	0.15	6.1	6.3	6.6

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
June 13, 2001	NB - 1	Bottom	4.1	0.40	3.6	4.9	3.8
June 13, 2001	NB - 1	Surface	3.3	0.15	3.2	3.1	3.6
June 13, 2001	NB - 2	Bottom	6.3	1.02	8.3	5.1	5.4
June 13, 2001	NB - 2	Surface	2.8	0.25	3	2.3	3.1
June 14, 2001	NB - 3	Bottom	5.0	0.38	5	5.6	4.3
June 14, 2001	NB - 3	Surface	2.8	0.06	2.8	2.9	2.7
June 14, 2001	NB - 4	Bottom	3.2	0.41	3.9	2.5	3.1
June 14, 2001	NB - 4	Surface	2.4	0.15	2.5	2.1	2.6
June 14, 2001	NB - 5	Bottom	5.7	1.45	3.9	4.7	8.6
June 14, 2001	NB - 5	Surface	3.0	0.12	2.8	3.1	3.2
June 14, 2001	NB - 6	Bottom	2.6	0.12	2.8	2.6	2.4
June 14, 2001	NB - 6	Surface	2.6	0.09	2.6	2.7	2.4
June 14, 2001	NB - 7	Bottom	2.6	0.03	2.6	2.5	2.6
June 14, 2001	NB - 7	Surface	2.5	0.06	2.5	2.6	2.4
June 14, 2001	NB - 8	Bottom	6.2	1.30	8.6	4.1	6
June 14, 2001	NB - 8	Surface	2.6	0.07	2.5	2.7	2.7
June 13, 2001	PJ - 1	Bottom	4.9	0.36	5.1	4.2	5.4
June 13, 2001	PJ - 1	Surface	4.1	0.12	3.9	4.3	4.1
June 13, 2001	PJ - 2	Bottom	5.2	0.23	4.8	5.6	5.3
June 13, 2001	PJ - 2	Surface	4.8	0.06	4.9	4.7	4.8
June 13, 2001	PJ - 3	Bottom	2.5	0.19	2.6	2.7	2.1
June 13, 2001	PJ - 3	Surface	4.1	0.07	4.2	4	4
June 13, 2001	PJ - 4	Bottom	4.4	0.15	4.5	4.6	4.1
June 13, 2001	PJ - 4	Surface	4.0	0.03	4	4.1	4
June 13, 2001	PJ - 5	Bottom	12.7	0.88	14	11	13
June 13, 2001	PJ - 5	Surface	3.8	0.38	3	4.1	4.2
June 13, 2001	PJ - 6	Bottom	3.7	0.95	5.6	3.1	2.5
June 13, 2001	PJ - 6	Surface	3.9	0.06	4	3.8	3.9
June 13, 2001	PJ - 7	Bottom	5.0	1.03	3.6	7	4.4
June 13, 2001	PJ - 7	Surface	3.3	0.07	3.4	3.2	3.2

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
July 13, 2001	NB - 1	Surface	2.2	0.15	2.2	2	2.5
July 13, 2001	NB - 2	Surface	1.7	0.12	1.9	1.8	1.5
July 13, 2001	NB - 3	Surface	1.8	0.09	1.7	1.8	2
July 13, 2001	NB - 4	Surface	1.7	0.03	1.8	1.7	1.7
July 13, 2001	NB - 5	Surface	1.8	0.06	1.8	1.7	1.9
July 13, 2001	NB - 6	Surface	1.8	0.06	1.8	1.7	1.9
July 13, 2001	NB - 7	Surface	2.2	0.06	2.1	2.3	2.2
July 13, 2001	NB - 8	Surface	2.6	0.03	2.6	2.5	2.6
July 13, 2001	PJ - 1	Surface	1.8	0.03	1.7	1.8	1.8
July 13, 2001	PJ - 2	Surface	2.1	0.12	2.3	2	1.9
July 13, 2001	PJ - 3	Surface	2.5	0.03	2.5	2.4	2.5
July 13, 2001	PJ - 4	Surface	2.4	0.10	2.6	2.3	2.3
July 13, 2001	PJ - 5	Surface	2.0	0.15	2.3	1.9	1.8
July 13, 2001	PJ - 6	Surface	1.8	0.00	1.8	1.8	1.8
July 13, 2001	PJ - 7	Surface	1.2	0.12	1	1.4	1.2

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
August 9, 2001	NB - 1	Bottom	6.1	0.62	4.9	6.7	6.8
August 9, 2001	NB - 1	Surface	4.5	0.07	4.6	4.4	4.4
August 9, 2001	NB - 2	Bottom	5.2	0.24	4.7	5.3	5.5
August 9, 2001	NB - 2	Surface	4.1	0.03	4.2	4.1	4.1
August 9, 2001	NB - 3	Bottom	6.7	0.83	8.4	5.9	5.9
August 9, 2001	NB - 3	Surface	3.5	0.09	3.5	3.3	3.6
August 9, 2001	NB - 4	Bottom	6.0	0.07	5.9	6.1	6.1
August 9, 2001	NB - 4	Surface	3.7	0.22	4	3.9	3.3
August 9, 2001	NB - 5	Bottom	5.4	1.23	7.9	4.2	4.2
August 9, 2001	NB - 5	Surface	3.7	0.15	3.9	3.7	3.4
August 9, 2001	NB - 6	Bottom	5.4	0.70	4.8	4.6	6.8
August 9, 2001	NB - 6	Surface	3.6	0.07	3.7	3.7	3.5
August 9, 2001	NB - 7	Bottom	5.6	0.34	5.4	5.2	6.3
August 9, 2001	NB - 7	Surface	3.3	0.17	3.6	3.1	3.1
August 9, 2001	NB - 8	Bottom	7.0	0.74	6.1	6.5	8.5
August 9, 2001	NB - 8	Surface	4.4	0.12	4.2	4.5	4.6
August 9, 2001	PJ - 1	Bottom	7.4	0.37	8.1	6.9	7.1
August 9, 2001	PJ - 1	Surface	1.5	0.15	1.7	1.5	1.2
August 9, 2001	PJ - 2	Bottom	3.2	0.95	2.3	2.2	5.1
August 9, 2001	PJ - 2	Surface	1.7	0.06	1.7	1.6	1.8
August 9, 2001	PJ - 3	Bottom	2.5	0.13	2.8	2.4	2.4
August 9, 2001	PJ - 3	Surface	1.4	0.07	1.3	1.3	1.5
August 9, 2001	PJ - 4	Bottom	5.6	0.86	6.8	6	3.9
August 9, 2001	PJ - 4	Surface	1.6	0.09	1.8	1.6	1.5
August 9, 2001	PJ - 5	Bottom	3.5	0.38	2.7	3.9	3.8
August 9, 2001	PJ - 5	Surface	1.5	0.09	1.5	1.7	1.4
August 9, 2001	PJ - 6	Bottom	1.6	0.12	1.4	1.5	1.8
August 9, 2001	PJ - 6	Surface	1.5	0.09	1.6	1.5	1.3
August 9, 2001	PJ - 7	Bottom	2.0	0.21	1.6	2.3	2.1
August 9, 2001	PJ - 7	Surface	1.7	0.09	1.6	1.9	1.7

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
August 23, 2001	NB - 1	Bottom	9.4	1.61	12.5	7.06	8.78
August 23, 2001	NB - 1	Surface	4.4	0.06	4.43	4.46	4.27
August 23, 2001	NB - 2	Bottom	11.6	3.73	8.27	7.39	19
August 23, 2001	NB - 2	Surface	4.8	0.10	4.96	4.76	4.61
August 23, 2001	NB - 3	Bottom	6.0	0.45	5.34	6.88	5.9
August 23, 2001	NB - 3	Surface	4.3	0.24	3.81	4.59	4.41
August 23, 2001	NB - 4	Bottom	6.0	0.92	7.75	4.65	5.54
August 23, 2001	NB - 4	Surface	4.0	0.14	3.93	4.28	3.83
August 23, 2001	NB - 5	Bottom	4.3	0.31	4.36	4.78	3.71
August 23, 2001	NB - 5	Surface	3.6	0.09	3.58	3.75	3.44
August 23, 2001	NB - 6	Bottom	9.3	0.51	9.18	10.19	8.43
August 23, 2001	NB - 6	Surface	6.6	0.48	6.42	5.84	7.48
August 23, 2001	NB - 7	Bottom	5.2	0.06	5.19	5.25	5.06
August 23, 2001	NB - 7	Surface	5.0	0.02	4.97	5	5.05
August 23, 2001	NB - 8	Bottom	7.0	0.57	6.13	6.9	8.08
August 23, 2001	NB - 8	Surface	4.2	0.22	4.23	4.52	3.76
August 23, 2001	PJ - 1	Bottom	6.4	1.84	3.02	9.36	6.71
August 23, 2001	PJ - 1	Surface	2.7	0.07	2.8	2.68	2.56
August 23, 2001	PJ - 2	Bottom	5.4	1.12	3.61	5.02	7.46
August 23, 2001	PJ - 2	Surface	2.8	0.10	2.59	2.86	2.91
August 23, 2001	PJ - 3	Bottom	6.1	0.96	4.45	6.12	7.78
August 23, 2001	PJ - 3	Surface	2.7	0.12	2.49	2.63	2.89
August 23, 2001	PJ - 4	Bottom	9.4	0.50	8.67	10.33	9.11
August 23, 2001	PJ - 4	Surface	3.2	0.12	3.06	3.47	3.15
August 23, 2001	PJ - 5	Bottom	6.4	0.82	4.74	7.39	6.95
August 23, 2001	PJ - 5	Surface	2.7	0.08	2.89	2.62	2.72
August 23, 2001	PJ - 6	Bottom	7.3	1.72	5.08	10.72	6.23
August 23, 2001	PJ - 6	Surface	2.6	0.04	2.63	2.49	2.54
August 23, 2001	PJ - 7	Bottom	3.8	0.23	3.62	4.22	3.48
August 23, 2001	PJ - 7	Surface	3.3	0.17	3.2	3.1	3.66

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
October 25, 2001	NB - 1	Bottom	4.0	0.42	3.61	3.61	4.88
October 25, 2001	NB - 1	Surface	2.5	0.06	2.43	2.63	2.53
October 25, 2001	NB - 2	Bottom	3.5	0.55	3.32	2.57	4.47
October 25, 2001	NB - 2	Surface	2.7	0.03	2.66	2.75	2.65
October 25, 2001	NB - 3	Bottom	3.5	0.41	4.33	3.14	3.07
October 25, 2001	NB - 3	Surface	3.0	0.38	2.55	3.72	2.63
October 25, 2001	NB - 4	Bottom	4.1	0.36	3.99	3.47	4.7
October 25, 2001	NB - 4	Surface	2.8	0.06	2.89	2.69	2.78
October 25, 2001	NB - 5	Bottom	4.1	0.56	2.98	4.88	4.32
October 25, 2001	NB - 5	Surface	2.9	0.19	2.84	3.2	2.55
October 25, 2001	NB - 6	Bottom	3.9	0.25	3.42	4.29	3.98
October 25, 2001	NB - 6	Surface	3.5	0.22	3.59	3.77	3.04
October 25, 2001	NB - 7	Bottom	5.7	1.17	3.55	5.98	7.58
October 25, 2001	NB - 7	Surface	3.3	0.12	3.33	3.04	3.43
October 25, 2001	NB - 8	Bottom	3.1	0.07	3.26	3.13	3.01
October 25, 2001	NB - 8	Surface	2.8	0.03	2.77	2.7	2.82
October 25, 2001	PJ - 1	Bottom	3.3	0.09	3.47	3.26	3.15
October 25, 2001	PJ - 1	Surface	2.6	0.12	2.47	2.86	2.58
October 25, 2001	PJ - 2	Bottom	3.3	0.08	3.12	3.34	3.37
October 25, 2001	PJ - 2	Surface	3.5	0.23	3.93	3.3	3.2
October 25, 2001	PJ - 4	Bottom	4.1	0.71	3.16	3.6	5.49
October 25, 2001	PJ - 4	Surface	2.6	0.06	2.75	2.57	2.58
October 25, 2001	PJ - 5	Bottom	3.9	0.49	2.98	4.52	4.34
October 25, 2001	PJ - 5	Surface	2.4	0.01	2.44	2.47	2.43
October 25, 2001	PJ - 6	Bottom	2.5	0.31	2.99	2.69	1.95
October 25, 2001	PJ - 6	Surface	2.6	0.07	2.55	2.69	2.45
October 25, 2001	PJ - 7	Bottom	4.4	0.06	4.36	4.52	4.35
October 25, 2001	PJ - 7	Surface	3.0	0.12	3.02	3.22	2.8

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
November 14, 2001	NB - 1	Bottom	9.3	1.20	11	10	7
November 14, 2001	NB - 1	Surface	5.7	0.39	6.5	5.2	5.5
November 14, 2001	NB - 2	Bottom	24.7	7.17	17	39	18
November 14, 2001	NB - 2	Surface	15.0	1.53	16	17	12
November 14, 2001	NB - 3	Bottom	5.3	0.20	5.7	5.1	5.1
November 14, 2001	NB - 3	Surface	4.0	0.22	3.6	4.3	4.2
November 14, 2001	NB - 4	Bottom	8.5	0.98	9.8	6.6	9.2
November 14, 2001	NB - 4	Surface	5.9	0.09	6.1	5.9	5.8
November 14, 2001	NB - 5	Bottom	6.6	0.42	7.2	6.8	5.8
November 14, 2001	NB - 5	Surface	6.2	0.15	6.5	6	6.1
November 14, 2001	NB - 6	Bottom	9.6	2.62	7.5	6.5	14.8
November 14, 2001	NB - 6	Surface	6.0	0.12	6	5.8	6.2
November 14, 2001	NB - 7	Bottom	10.7	0.85	11	12	9.1
November 14, 2001	NB - 7	Surface	6.2	0.30	6.1	5.8	6.8
November 14, 2001	NB - 8	Bottom	4.5	0.12	4.3	4.7	4.6
November 14, 2001	NB - 8	Surface	4.6	0.17	4.4	4.4	4.9
November 14, 2001	PJ - 1	Bottom	4.0	0.12	4.2	3.8	4.1
November 14, 2001	PJ - 1	Surface	3.6	0.12	3.8	3.4	3.5
November 14, 2001	PJ - 2	Bottom	4.9	0.20	4.5	5.1	5.1
November 14, 2001	PJ - 2	Surface	3.9	0.07	3.8	3.8	4
November 14, 2001	PJ - 3	Bottom	3.4	0.43	3.7	2.6	4
November 14, 2001	PJ - 3	Surface	2.8	0.15	2.5	3	2.8
November 14, 2001	PJ - 4	Bottom	3.6	0.23	3.2	4	3.6
November 14, 2001	PJ - 4	Surface	3.7	0.12	3.5	3.9	3.7
November 14, 2001	PJ - 5	Bottom	3.2	0.12	3.1	3	3.4
November 14, 2001	PJ - 5	Surface	2.6	0.03	2.7	2.6	2.6
November 14, 2001	PJ - 6	Bottom	3.7	0.07	3.6	3.8	3.6
November 14, 2001	PJ - 6	Surface	3.3	0.06	3.4	3.3	3.2
November 14, 2001	PJ - 7	Bottom	4.7	0.97	3.9	3.5	6.6
November 14, 2001	PJ - 7	Surface	3.5	0.07	3.4	3.4	3.6

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
December 18, 2001	NB - 1	Bottom	9.2	0.58	8	9.8	9.7
December 18, 2001	NB - 1	Surface	6.0	0.09	6	5.9	6.2
December 18, 2001	NB - 2	Bottom	8.8	0.88	7.1	9.4	10
December 18, 2001	NB - 2	Surface	7.7	1.17	7.3	9.9	5.9
December 18, 2001	NB - 3	Bottom	5.4	0.58	4.6	6.5	5
December 18, 2001	NB - 3	Surface	5.6	0.47	4.9	5.4	6.5
December 18, 2001	NB - 4	Bottom	9.0	1.48	7.6	7.5	12
December 18, 2001	NB - 4	Surface	4.4	0.15	4.1	4.6	4.4
December 18, 2001	NB - 5	Bottom	4.3	0.24	3.8	4.4	4.6
December 18, 2001	NB - 5	Surface	3.9	0.03	3.9	3.9	4
December 18, 2001	NB - 6	Bottom	6.2	0.20	6.2	6.5	5.8
December 18, 2001	NB - 6	Surface	6.6	0.44	7.4	5.9	6.5
December 18, 2001	NB - 7	Bottom	7.1	0.42	7.3	6.3	7.7
December 18, 2001	NB - 7	Surface	7.2	0.18	7.5	7.3	6.9
December 18, 2001	NB - 8	Bottom	6.8	0.24	6.3	6.9	7.1
December 18, 2001	NB - 8	Surface	6.3	0.25	5.8	6.6	6.5
December 18, 2001	PJ - 1	Bottom	4.8	0.18	4.7	5.1	4.5
December 18, 2001	PJ - 1	Surface	4.3	0.18	4.4	4	4.6
December 18, 2001	PJ - 2	Bottom	4.6	0.57	4.1	5.7	3.9
December 18, 2001	PJ - 2	Surface	3.6	0.28	4.2	3.3	3.4
December 18, 2001	PJ - 4	Bottom	6.2	0.47	5.3	6.7	6.7
December 18, 2001	PJ - 4	Surface	4.0		3.8		4.1
December 18, 2001	PJ - 5	Bottom	7.0	0.55	7	6	7.9
December 18, 2001	PJ - 5	Surface	7.0	0.31	7.4	7.2	6.4
December 18, 2001	PJ - 6	Bottom	3.1	0.15	3.3	2.8	3.1
December 18, 2001	PJ - 6	Surface	3.5	0.23	3.4	3.1	3.9
December 18, 2001	PJ - 7	Bottom	4.9	0.85	6.6	4.1	4
December 18, 2001	PJ - 7	Surface	4.0	0.20	4.3	3.6	4

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
January 15, 2002	NB - 1	Bottom	6.4	1.29	4.8	5.49	8.97
January 15, 2002	NB - 1	Surface	4.3	0.16	4.65	4.24	4.11
January 15, 2002	NB - 2	Bottom	4.9	0.18	4.82	5.3	4.71
January 15, 2002	NB - 2	Surface	3.9	0.18	3.61	4.22	3.96
January 15, 2002	NB - 3	Bottom	5.0	0.09	4.97	5.18	4.86
January 15, 2002	NB - 3	Surface	4.5	0.06	4.45	4.57	4.36
January 15, 2002	NB - 4	Bottom	5.1	0.12	4.86	5.19	5.24
January 15, 2002	NB - 4	Surface	4.6	0.02	4.57	4.64	4.62
January 15, 2002	NB - 5	Bottom	4.5	0.24	4.93	4.5	4.09
January 15, 2002	NB - 5	Surface	4.1	0.08	4.13	4.02	4.28
January 15, 2002	NB - 6	Bottom	6.1	0.08	6.17	6.22	5.96
January 15, 2002	NB - 6	Surface	5.5	0.06	5.59	5.44	5.39
January 15, 2002	NB - 7	Bottom	5.7	0.41	6.42	5.51	5.02
January 15, 2002	NB - 7	Surface	4.0	0.02	4.01	4.04	4.08
January 15, 2002	NB - 8	Bottom	4.8	0.20	4.41	5.03	4.99
January 15, 2002	NB - 8	Surface	4.4	0.08	4.58	4.34	4.32
January 15, 2002	PJ - 1	Bottom	4.5	0.13	4.29	4.5	4.74
January 15, 2002	PJ - 1	Surface	4.3	0.32	4.59	4.59	3.63
January 15, 2002	PJ - 2	Bottom	5.8	0.12	5.6	5.82	6.01
January 15, 2002	PJ - 2	Surface	3.5	0.40	2.83	4.22	3.38
January 15, 2002	PJ - 3	Bottom	2.5	0.01	2.47	2.45	2.45
January 15, 2002	PJ - 3	Surface	1.8	0.08	1.94	1.76	1.65
January 15, 2002	PJ - 4	Bottom	8.5	0.60	7.31	8.84	9.3
January 15, 2002	PJ - 4	Surface	2.7	0.04	2.75	2.63	2.62
January 15, 2002	PJ - 5	Bottom	7.5	1.17	6.26	9.83	6.4
January 15, 2002	PJ - 5	Surface	2.6	0.12	2.56	2.41	2.82
January 15, 2002	PJ - 6	Bottom	2.1	0.13	2.31	1.96	1.89
January 15, 2002	PJ - 6	Surface	2.7	0.22	3.01	2.71	2.25
January 15, 2002	PJ - 7	Bottom	3.2	0.05	3.08	3.23	3.21
January 15, 2002	PJ - 7	Surface	2.7	0.03	2.7	2.6	2.66

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
February 1, 2002	NB - 1	Bottom	3.7	0.07	3.8	3.61	3.58
February 1, 2002	NB - 1	Surface	2.9	0.01	2.97	2.93	2.93
February 1, 2002	NB - 2	Bottom	3.6	0.05	3.72	3.55	3.58
February 1, 2002	NB - 2	Surface	3.3	0.16	3.62	3.09	3.18
February 1, 2002	NB - 3	Bottom	4.1	0.18	3.82	3.99	4.43
February 1, 2002	NB - 3	Surface	3.4	0.10	3.58	3.34	3.26
February 1, 2002	NB - 4	Bottom	4.8	0.19	4.4	4.95	4.97
February 1, 2002	NB - 4	Surface	3.2	0.18	3.5	3.3	2.88
February 1, 2002	NB - 5	Bottom	3.4	0.24	3.71	3.63	2.95
February 1, 2002	NB - 5	Surface	3.9	0.09	3.74	3.83	4.05
February 1, 2002	NB - 6	Bottom	4.8	0.02	4.79	4.74	4.75
February 1, 2002	NB - 6	Surface	3.1	0.21	3.34	3.35	2.72
February 1, 2002	NB - 7	Bottom	6.9	0.16	7.02	6.6	7.13
February 1, 2002	NB - 7	Surface	3.4	0.10	3.52	3.43	3.2
February 1, 2002	NB - 8	Bottom	5.3	0.49	6.25	4.58	5.12
February 1, 2002	NB - 8	Surface	3.8	0.29	4.03	4.05	3.18
February 1, 2002	PJ - 1	Bottom	4.8	1.43	2.58	7.46	4.29
February 1, 2002	PJ - 1	Surface	2.1	0.06	2.03	2.24	2.1
February 1, 2002	PJ - 2	Bottom	3.4	0.33	3.61	3.81	2.74
February 1, 2002	PJ - 2	Surface	2.3	0.09	2.46	2.25	2.14
February 1, 2002	PJ - 3	Bottom	6.4	0.24	6.8	5.97	6.49
February 1, 2002	PJ - 3	Surface	2.2	0.06	2.25	2.25	2.08
February 1, 2002	PJ - 4	Bottom	5.2	0.34	5.49	4.49	5.52
February 1, 2002	PJ - 4	Surface	2.3	0.11	2.07	2.46	2.3
February 1, 2002	PJ - 5	Bottom	5.2	1.36	3.81	7.9	3.85
February 1, 2002	PJ - 5	Surface	2.1	0.15	2.1	2.35	1.82
February 1, 2002	PJ - 6	Bottom	5.4	0.21	5.38	5.71	4.98
February 1, 2002	PJ - 6	Surface	2.9	0.03	2.82	2.84	2.93
February 1, 2002	PJ - 7	Bottom	3.3	0.23	2.94	3.26	3.72
February 1, 2002	PJ - 7	Surface	2.4	0.07	2.5	2.47	2.28

Date	Station	Stratum	Turb (NTU)	Std Err	rep 1	rep 2	rep 3
February 21, 2002	NB - 1	Bottom	4.1	0.07	4.2	4	4.2
February 21, 2002	NB - 1	Surface	3.9	0.15	3.6	4.1	3.9
February 21, 2002	NB - 2	Bottom	4.5	0.23	4.5	4.9	4.1
February 21, 2002	NB - 2	Surface	4.7	0.33	4.4	4.4	5.4
February 21, 2002	NB - 3	Bottom	5.0	0.25	4.8	5.5	4.7
February 21, 2002	NB - 3	Surface	4.3	0.15	4.5	4	4.3
February 21, 2002	NB - 4	Bottom	5.7	0.10	5.6	5.9	5.6
February 21, 2002	NB - 4	Surface	4.4	0.12	4.3	4.2	4.6
February 21, 2002	NB - 5	Bottom	4.5	0.09	4.3	4.5	4.6
February 21, 2002	NB - 5	Surface	4.5	0.18	4.8	4.6	4.2
February 21, 2002	NB - 6	Bottom	4.2	0.55	5.3	3.7	3.6
February 21, 2002	NB - 6	Surface	3.6	0.03	3.6	3.6	3.7
February 21, 2002	NB - 7	Bottom	4.2	0.03	4.2	4.2	4.1
February 21, 2002	NB - 7	Surface	5.5	0.23	5.9	5.4	5.1
February 21, 2002	NB - 8	Bottom	3.7	0.66	5	3.2	2.9
February 21, 2002	NB - 8	Surface	3.3	0.06	3.4	3.3	3.2
February 21, 2002	PJ - 1	Bottom	4.7	0.56	4.3	5.8	4
February 21, 2002	PJ - 1	Surface	3.9	0.00	3.9	3.9	3.9
February 21, 2002	PJ - 2	Bottom	4.3	0.37	5	4	3.8
February 21, 2002	PJ - 2	Surface	4.1	0.35	3.8	4.8	3.7
February 21, 2002	PJ - 3	Bottom	1.6	0.13	1.7	1.7	1.3
February 21, 2002	PJ - 3	Surface	5.2	0.74	6.7	4.3	4.7
February 21, 2002	PJ - 4	Bottom	2.4	0.12	2.6	2.4	2.2
February 21, 2002	PJ - 4	Surface	3.8	0.15	4.1	3.8	3.6
February 21, 2002	PJ - 5	Bottom	2.6	0.38	3.4	2.3	2.2
February 21, 2002	PJ - 5	Surface	3.3	0.07	3.4	3.4	3.2
February 21, 2002	PJ - 6	Bottom	3.9	0.15	4	4.1	3.6
February 21, 2002	PJ - 6	Surface	3.6	0.03	3.6	3.6	3.7
February 21, 2002	PJ - 7	Bottom	5.8	0.26	6.2	5.8	5.3
February 21, 2002	PJ - 7	Surface	4.4	0.06	4.4	4.5	4.3

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
March 29, 2001	NB - 1	Bottom	4.3	6.0	15.0	7.7	9.1	10
March 29, 2001	NB - 1	Surface	0.3	5.9	14.8	7.8	9.3	5
March 29, 2001	NB - 2	Bottom	1.8	5.9	14.7	7.8	9.0	10
March 29, 2001	NB - 2	Surface	0.3	5.8	14.3	7.8	9.4	5
March 29, 2001	NB - 3	Bottom	1.8	5.8	15.1	7.7	9.1	5
March 29, 2001	NB - 3	Surface	0.3	5.8	14.5	7.8	9.3	15
March 29, 2001	NB - 4	Bottom	12.3	5.2	18.0	7.8	9.1	10
March 29, 2001	NB - 4	Surface	0.3	6.0	13.9	7.8	9.5	0
March 29, 2001	NB - 5	Bottom	1.1	6.0	14.2	7.8	9.3	5
March 29, 2001	NB - 5	Surface	0.3	5.9	13.8	7.8	9.5	10
March 29, 2001	NB - 6	Bottom	1.9	5.4	15.2	7.8	9.0	5
March 29, 2001	NB - 6	Surface	0.3	5.7	13.0	7.8	9.4	10
March 29, 2001	NB - 7	Bottom	11.9	5.2	17.7	7.8	8.9	5
March 29, 2001	NB - 7	Surface	0.3	5.7	13.1	7.8	9.5	0
March 29, 2001	NB - 8	Bottom	1.7	5.6	13.6	7.8	9.2	5
March 29, 2001	NB - 8	Surface	0.3	5.6	13.5	7.8	9.4	10
March 29, 2001	PJ - 1	Bottom	3.9	4.9	16.3	7.7	10.7	15
March 29, 2001	PJ - 1	Surface	0.3	4.8	13.8	7.7	10.9	20
March 29, 2001	PJ - 2	Bottom	3.0	5.0	16.9	7.7	10.1	10
March 29, 2001	PJ - 2	Surface	0.3	4.8	11.3	7.7	10.6	0
March 29, 2001	PJ - 3	Bottom	11.9	4.8	26.5	7.9	9.6	5
March 29, 2001	PJ - 3	Surface	0.3	5.1	14.7	7.8	10.0	5
March 29, 2001	PJ - 4	Bottom	12.7	4.9	25.3	7.8	9.2	10
March 29, 2001	PJ - 4	Surface	0.4	5.1	15.9	7.8	9.8	5
March 29, 2001	PJ - 5	Bottom	11.7	4.9	23.9	7.8	9.0	5
March 29, 2001	PJ - 5	Surface	0.3	5.0	13.6	7.8	9.8	10
March 29, 2001	PJ - 6	Bottom	4.0	4.9	23.0	7.9	9.3	5
March 29, 2001	PJ - 6	Surface	0.3	5.3	14.4	7.8	9.8	15
March 29, 2001	PJ - 7	Bottom	2.6	5.0	16.1	7.8	9.8	10
March 29, 2001	PJ - 7	Surface	0.3	5.2	15.2	7.8	9.8	5

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
April 18, 2001	NB - 1	Bottom	2.0	9.3	13.9	7.7	10.4	4.2
April 18, 2001	NB - 1	Surface	0.4	10.1	12.7	7.7	9.4	4.3
April 18, 2001	NB - 2	Bottom	1.8	8.6	16.5	7.7	9.1	6.6
April 18, 2001	NB - 2	Surface	0.4	9.9	13.1	7.7	9.1	4.4
April 19, 2001	NB - 3	Bottom	2.0	8.7	16.4	7.3	10.0	7.5
April 19, 2001	NB - 3	Surface	0.3	8.6	14.8	7.3	9.6	0
April 19, 2001	NB - 4	Bottom	11.7	7.7	21.5	7.5	8.8	17.2
April 19, 2001	NB - 4	Surface	0.3	8.9	14.1	7.5	9.1	37.2
April 19, 2001	NB - 5	Bottom	1.2	8.8	15.4	7.6	9.5	3.4
April 19, 2001	NB - 5	Surface	0.4	8.9	15.1	7.6	9.3	4.9
April 19, 2001	NB - 6	Bottom	1.8	8.6	16.2	7.6	9.3	8.5
April 19, 2001	NB - 6	Surface	0.4	9.1	13.1	7.6	9.1	4.9
April 19, 2001	NB - 7	Bottom	12.8	7.5	22.7	7.7	8.9	7.3
April 19, 2001	NB - 7	Surface	0.5	9.8	11.1	7.6	9.0	0
April 19, 2001	NB - 8	Bottom	1.7	9.5	13.2	7.6	9.4	5.7
April 19, 2001	NB - 8	Surface	0.5	9.9	11.7	7.6	8.9	32.1
April 18, 2001	PJ - 1	Bottom	2.1	7.9	9.2	7.5	10.7	28
April 18, 2001	PJ - 1	Surface	0.4	8.0	9.1	7.5	10.7	9.5
April 18, 2001	PJ - 2	Bottom	2.7	7.7	14.3	7.6	10.2	28.1
April 18, 2001	PJ - 2	Surface	0.4	8.1	9.5	7.6	10.4	14.3
April 18, 2001	PJ - 3	Bottom	13.5	6.5	30.4	7.8	9.2	5.2
April 18, 2001	PJ - 3	Surface	0.4	8.2	8.0	7.7	10.2	1.6
April 18, 2001	PJ - 4	Bottom	11.2	6.8	28.8	7.7	10.3	10.1
April 18, 2001	PJ - 4	Surface	0.5	8.4	10.2	7.7	10.4	38.4
April 18, 2001	PJ - 5	Bottom	12.2	6.7	29.9	7.8	9.0	9.8
April 18, 2001	PJ - 5	Surface	0.5	8.3	12.0	7.8	9.7	6.6
April 18, 2001	PJ - 6	Bottom	3.4	8.1	15.2	7.7	9.6	9.3
April 18, 2001	PJ - 6	Surface	0.4	8.4	11.1	7.7	10.1	12.7
April 18, 2001	PJ - 7	Bottom	2.2	8.3	13.4	7.7	9.9	9.5
April 18, 2001	PJ - 7	Surface	0.3	8.4	12.8	7.7	9.7	10.1

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
May 2, 2001	NB - 1	Bottom	1.2	13.1	17.4	7.6	8.4	10
May 2, 2001	NB - 1	Surface	0.3	13.2	17.4	7.6	8.2	5
May 2, 2001	NB - 2	Bottom	2.0	13.1	17.0	7.7	8.1	10
May 2, 2001	NB - 2	Surface	0.4	13.6	16.7	7.8	8.1	5
May 2, 2001	NB - 3	Bottom	1.9	12.9	17.6	7.8	7.9	5
May 2, 2001	NB - 3	Surface	0.3	13.5	17.0	7.8	8.0	5
May 2, 2001	NB - 4	Bottom	11.8	11.7	20.3	7.8	8.6	15
May 2, 2001	NB - 4	Surface	0.5	13.6	17.3	7.7	8.5	0
May 2, 2001	NB - 5	Bottom	1.1	13.4	17.2	7.8	8.3	5
May 2, 2001	NB - 5	Surface	0.3	13.4	17.2	7.8	8.3	0
May 2, 2001	NB - 6	Bottom	1.6	13.1	17.6	7.7	8.1	10
May 2, 2001	NB - 6	Surface	0.4	13.6	16.9	7.7	8.0	0
May 2, 2001	NB - 7	Bottom	13.0	11.7	20.4	7.9	7.8	15
May 2, 2001	NB - 7	Surface	0.6	13.9	16.4	7.8	7.8	5
May 2, 2001	NB - 8	Bottom	1.6	13.9	16.4	7.7	8.2	5
May 2, 2001	NB - 8	Surface	0.4	14.3	16.3	7.7	8.0	0
May 2, 2001	PJ - 1	Bottom	4.5	10.5	19.9	7.5	9.0	10
May 2, 2001	PJ - 1	Surface	0.4	12.6	16.3	7.6	8.8	5
May 2, 2001	PJ - 2	Bottom	2.4	11.4	17.3	7.8	8.8	30
May 2, 2001	PJ - 2	Surface	0.4	11.4	17.4	7.8	8.7	55
May 2, 2001	PJ - 3	Bottom	12.1	9.0	27.1	7.9	8.4	5
May 2, 2001	PJ - 4	Bottom	10.2	9.7	24.4	7.7	8.1	10
May 2, 2001	PJ - 4	Surface	0.4	12.1	16.8	7.7	8.1	0
May 2, 2001	PJ - 5	Bottom	8.4	9.6	23.9	7.3	7.9	5
May 2, 2001	PJ - 5	Surface	0.4	12.1	17.3	7.3	8.0	10
May 2, 2001	PJ - 6	Bottom	2.8	11.0	20.6	7.2	8.0	10
May 2, 2001	PJ - 6	Surface	0.5	12.0	15.3	7.4	8.1	0
May 2, 2001	PJ - 7	Bottom	2.2	11.4	19.3	7.4	8.0	5
May 2, 2001	PJ - 7	Surface	0.4	12.5	17.8	7.5	7.9	0

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
June 13, 2001	NB - 1	Bottom	3.4	19.7	18.7	7.6	6.3	5
June 13, 2001	NB - 1	Surface	0.2	20.5	18.4	7.7	6.2	0
June 13, 2001	NB - 2	Bottom	2.2	19.6	18.4	7.6	5.8	10
June 13, 2001	NB - 2	Surface	0.4	20.7	17.9	7.6	5.8	30
June 14, 2001	NB - 3	Bottom	1.4	20.3	17.6	7.6	5.8	10
June 14, 2001	NB - 3	Surface	0.4	20.3	17.4	7.6	5.6	0
June 14, 2001	NB - 4	Bottom	11.8	17.9	21.2	7.7	5.9	10
June 14, 2001	NB - 4	Surface	0.5	20.2	17.3	7.6	5.7	5
June 14, 2001	NB - 5	Bottom	0.9	20.4	17.3	7.6	5.7	5
June 14, 2001	NB - 5	Surface	0.4	20.4	17.3	7.6	5.6	5
June 14, 2001	NB - 6	Bottom	1.5	19.8	18.2	7.6	5.9	5
June 14, 2001	NB - 6	Surface	0.4	20.3	17.0	7.6	5.7	5
June 14, 2001	NB - 7	Bottom	12.1	17.6	21.9	7.7	6.0	5
June 14, 2001	NB - 7	Surface	0.4	20.5	16.4	7.5	5.4	5
June 14, 2001	NB - 8	Bottom	1.5	20.0	17.5	7.4	6.1	5
June 14, 2001	NB - 8	Surface	0.4	20.5	16.5	7.5	5.7	10
June 13, 2001	PJ - 1	Bottom	2.9	19.3	15.9	7.7	7.6	15
June 13, 2001	PJ - 1	Surface	0.4	19.4	15.4	7.8	7.7	0
June 13, 2001	PJ - 2	Bottom	2.7	19.0	15.3	7.8	7.1	10
June 13, 2001	PJ - 2	Surface	0.5	19.7	12.8	7.8	7.3	0
June 13, 2001	PJ - 3	Bottom	14.9	14.2	28.7	8.1	7.4	5
June 13, 2001	PJ - 3	Surface	0.3	20.0	12.0	7.8	6.8	40
June 13, 2001	PJ - 4	Bottom	11.4	15.1	26.5	7.9	7.0	10
June 13, 2001	PJ - 4	Surface	0.5	19.4	14.2	7.9	6.8	5
June 13, 2001	PJ - 5	Bottom	11.1	14.7	27.5	7.8	6.7	15
June 13, 2001	PJ - 5	Surface	0.4	19.7	14.1	7.8	6.8	5
June 13, 2001	PJ - 6	Bottom	3.6	17.4	21.1	7.8	6.8	5
June 13, 2001	PJ - 6	Surface	0.5	19.6	14.0	7.9	6.9	5
June 13, 2001	PJ - 7	Bottom	2.6	18.7	17.7	7.7	7.0	5
June 13, 2001	PJ - 7	Surface	0.4	19.2	16.7	7.8	7.0	0

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
December 18, 2001	NB - 1	Bottom	0.9	11.0	20.9	7.6	6.9	5
December 18, 2001	NB - 2	Bottom	1.3	10.5	23.3	7.7	7.5	10
December 18, 2001	NB - 2	Surface	0.5	10.3	23.4	7.8	7.3	15
December 18, 2001	NB - 3	Bottom	1.5	10.7	23.7	7.7	7.1	5
December 18, 2001	NB - 3	Surface	0.7	10.7	23.7	7.7	7.1	0
December 18, 2001	NB - 4	Bottom	9.6	10.6	24.2	7.7	7.2	5
December 18, 2001	NB - 4	Surface	0.8	10.8	23.6	7.7	7.1	5
December 18, 2001	NB - 5	Bottom	1.8	10.9	23.5	7.7	7.2	5
December 18, 2001	NB - 5	Surface	0.6	10.9	23.4	7.7	7.2	0
December 18, 2001	NB - 6	Bottom	2.1	10.2	24.2	7.8	7.7	10
December 18, 2001	NB - 6	Surface	0.7	10.2	24.2	7.8	7.7	15
December 18, 2001	NB - 7	Bottom	9.2	10.2	24.5	7.8	7.7	10
December 18, 2001	NB - 7	Surface	0.8	10.2	23.8	7.8	7.7	10
December 18, 2001	NB - 8	Bottom	2.6	10.2	24.0	7.8	7.8	10
December 18, 2001	NB - 8	Surface	0.7	10.2	23.8	7.8	7.8	5
December 18, 2001	PJ - 1	Bottom	2.6	10.3	24.1	7.8	8.1	5
December 18, 2001	PJ - 1	Surface	0.6	10.2	24.4	7.8	7.9	5
December 18, 2001	PJ - 2	Bottom	3.7	10.4	25.3	7.8	7.7	5
December 18, 2001	PJ - 2	Surface	0.7	10.4	24.9	7.7	7.7	5
December 18, 2001	PJ - 4	Bottom	11.2	10.4	27.1	7.9	7.6	5
December 18, 2001	PJ - 4	Surface	0.6	10.4	25.7	7.8	7.9	5
December 18, 2001	PJ - 5	Bottom	11.7	10.4	27.1	7.9	7.5	5
December 18, 2001	PJ - 5	Surface	0.8	10.2	25.3	7.8	7.7	5
December 18, 2001	PJ - 6	Bottom	2.9	10.4	26.5	7.9	7.8	5
December 18, 2001	PJ - 6	Surface	0.7	10.4	26.0	7.8	7.7	10
December 18, 2001	PJ - 7	Bottom	2.2	10.4	25.7	7.8	7.6	5
December 18, 2001	PJ - 7	Surface	0.7	10.3	25.4	7.8	7.7	10

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
January 15, 2002	NB - 1	Bottom	1.2	5.1	23.6	8.0	7.7	5
January 15, 2002	NB - 1	Surface	0.6	5.1	23.5	8.0	7.7	5
January 15, 2002	NB - 2	Bottom	1.6	5.2	23.6	7.9	7.4	5
January 15, 2002	NB - 2	Surface	0.6	5.2	23.6	7.9	7.4	10
January 15, 2002	NB - 3	Bottom	2.0	5.2	23.6	7.9	7.3	5
January 15, 2002	NB - 3	Surface	0.7	5.1	23.6	7.9	7.3	10
January 15, 2002	NB - 4	Bottom	12.4	5.3	23.7	7.9	7.2	10
January 15, 2002	NB - 4	Surface	0.6	5.4	23.7	7.9	7.2	5
January 15, 2002	NB - 5	Bottom	2.0	5.2	23.4	8.0	7.6	5
January 15, 2002	NB - 5	Surface	0.6	5.2	23.4	8.0	7.5	45
January 15, 2002	NB - 6	Bottom	2.2	4.9	24.0	8.0	7.6	10
January 15, 2002	NB - 6	Surface	0.7	4.9	23.8	8.0	7.5	25
January 15, 2002	NB - 7	Bottom	7.7	4.8	23.6	8.0	8.2	15
January 15, 2002	NB - 7	Surface	0.6	4.8	23.3	8.0	7.8	10
January 15, 2002	NB - 8	Bottom	1.4	4.8	23.2	8.0	7.7	5
January 15, 2002	NB - 8	Surface	0.6	4.8	23.2	8.0	7.6	5
January 15, 2002	PJ - 1	Bottom	2.5	5.0	23.5	7.9	8.4	5
January 15, 2002	PJ - 1	Surface	0.7	4.5	21.8	7.9	8.6	5
January 15, 2002	PJ - 2	Bottom	3.6	5.4	25.7	8.0	8.2	10
January 15, 2002	PJ - 2	Surface	0.5	5.1	24.6	8.0	8.6	5
January 15, 2002	PJ - 3	Bottom	8.0	5.8	28.3	8.2	7.9	5
January 15, 2002	PJ - 3	Surface	0.5	5.4	26.5	8.2	7.9	0
January 15, 2002	PJ - 4	Bottom	11.9	5.6	27.1	8.1	8.2	10
January 15, 2002	PJ - 4	Surface	0.7	5.2	25.0	8.0	8.2	5
January 15, 2002	PJ - 5	Bottom	11.0	5.6	27.1	8.1	7.8	5
January 15, 2002	PJ - 5	Surface	0.7	4.4	22.0	8.0	8.3	5
January 15, 2002	PJ - 6	Bottom	4.0	5.7	27.7	8.2	7.9	5
January 15, 2002	PJ - 6	Surface	0.7	5.0	23.9	8.0	8.1	0
January 15, 2002	PJ - 7	Bottom	2.7	5.2	24.2	8.0	7.8	5
January 15, 2002	PJ - 7	Surface	0.7	5.0	23.5	8.0	7.8	0

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
February 1, 2002	NB - 1	Bottom	5.9	6.7	23.9	8.0	6.1	5
February 1, 2002	NB - 1	Surface	0.7	6.8	23.9	8.0	6.2	5
February 1, 2002	NB - 2	Bottom	2.6	6.5	24.3	8.0	6.4	5
February 1, 2002	NB - 2	Surface	0.8	6.5	24.2	8.0	6.4	5
February 1, 2002	NB - 3	Bottom	2.6	6.4	24.3	8.0	6.6	5
February 1, 2002	NB - 3	Surface	0.7	6.4	24.3	8.0	6.8	5
February 1, 2002	NB - 4	Bottom	10.5	6.5	24.4	8.0	7.7	5
February 1, 2002	NB - 4	Surface	0.9	6.5	24.3	8.1	7.8	5
February 1, 2002	NB - 5	Bottom	2.1	6.5	24.3	8.1	7.9	5
February 1, 2002	NB - 5	Surface	0.9	6.5	24.3	8.1	8.1	5

Date	Station	Stratum	Depth (m)	Temp (°C)	Salinity	pH	DO (mg/L)	Turb (NTU)
February 21, 2002	NB - 1	Bottom	1.7	5.9	22.3	8.2	8.5	5
February 21, 2002	NB - 1	Surface	0.7	6.4	21.8	8.2	8.6	5
February 21, 2002	NB - 2	Bottom	1.6	6.1	22.3	8.2	8.8	5
February 21, 2002	NB - 2	Surface	0.7	6.1	22.3	8.2	9.0	5
February 21, 2002	NB - 3	Bottom	1.9	5.8	22.3	8.2	8.8	5
February 21, 2002	NB - 3	Surface	0.7	6.1	22.2	8.2	9.1	5
February 21, 2002	NB - 4	Bottom	10.9	5.8	22.9	8.2	8.8	10
February 21, 2002	NB - 4	Surface	0.8	6.1	22.3	8.2	9.7	10
February 21, 2002	NB - 5	Bottom	1.7	6.0	22.3	8.3	9.1	5
February 21, 2002	NB - 5	Surface	0.7	6.0	22.2	8.3	9.2	5
February 21, 2002	NB - 6	Bottom	2.3	6.1	22.3	8.3	9.8	5
February 21, 2002	NB - 6	Surface	0.7	6.3	22.2	8.3	10.0	5
February 21, 2002	NB - 7	Bottom	11.0	5.9	22.9	8.2	9.1	10
February 21, 2002	NB - 7	Surface	0.7	6.0	22.3	8.2	9.7	10
February 21, 2002	NB - 8	Bottom	2.3	6.2	22.1	8.3	10.2	5
February 21, 2002	NB - 8	Surface	0.7	6.3	22.1	8.3	10.4	5
February 21, 2002	PJ - 1	Bottom	2.2	5.7	18.1	8.1	7.1	5
February 21, 2002	PJ - 1	Surface	0.8	5.7	16.1	8.1	7.4	5
February 21, 2002	PJ - 2	Bottom	2.2	5.8	21.6	8.2	7.3	5
February 21, 2002	PJ - 2	Surface	0.7	5.7	17.4	8.2	7.8	15
February 21, 2002	PJ - 3	Bottom	11.4	6.4	28.6	8.3	6.8	5
February 21, 2002	PJ - 3	Surface	0.8	5.7	17.1	8.2	7.6	10
February 21, 2002	PJ - 4	Bottom	8.4	6.1	25.8	8.2	7.6	5
February 21, 2002	PJ - 4	Surface	0.8	6.0	17.4	8.2	8.4	10
February 21, 2002	PJ - 5	Bottom	10.3	6.3	27.4	8.2	7.3	5
February 21, 2002	PJ - 5	Surface	0.9	5.9	18.0	8.2	8.4	10
February 21, 2002	PJ - 6	Bottom	3.0	5.8	21.5	8.2	8.2	5
February 21, 2002	PJ - 6	Surface	0.8	6.0	18.4	8.2	8.5	0
February 21, 2002	PJ - 7	Bottom	2.0	5.9	20.0	8.2	8.5	5
February 21, 2002	PJ - 7	Surface	0.8	6.4	18.6	8.2	8.5	10

Appendix II

Field Notes

March 29, 2001

Slightly overcast and cold. Air temp. in lower 40's. Windy. Choppy waters and very strong currents in the Upper Bay and Newark Bay.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations.

April 18, 2001

Clear and cold. Air temp. in lower 50's. Some wind. Strong currents in Upper Bay.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations.

April 26, 2001

Cloudy. Air temp. upper 50's to lower 60's. Calm winds and water.

Took turbidity and TSS samples and HydroLab® readings around one of the two working dredges. Samples and readings taken at 30m upcurrent of dredge, 30m upcurrent and 90m laterally toward center of channel, 15m downcurrent of dredge, 35m downcurrent of dredge, 35m downcurrent and 90m laterally toward center of channel, and 90m downcurrent and 90m laterally toward center of channel. All other planned sampling efforts could not be completed due to dynamite being placed in the immediate area and treats from working crews on barges to call coast guard authorities.

Material being removed by dredges was observed to be mostly rock.

May 2, 2001

Haze burning off by early afternoon. Hot. Air temp. in 80's. Strong currents in Upper Bay.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Two container vessels (B.NO.120 and Skogafoss) past while at station PJ3, but samples were already taken for that station. A large container vessel (Washington Senator) past as bottom samples were being taken at station PJ5. Although a rise in turbidity was recorded in turbidity and TSS samples, no noticeable rise in turbidity was recorded in HydroLab® readings which were taken approximately 30m off vessels starboard side at a depth of approximately 8m from the time the vessel past to about 5 minutes after passing. During this time, turbidity readings did not rise above 5.0 NTU.

May 24, 2001

Cloudy and hazy. Air temp. in upper 60's. Choppy conditions especially in Upper Bay. 90% cloud cover at 09:30 clearing to 50-60% cloud cover by 13:00.

Storm Event. Just over 1 in. of precipitation recorded in 48 hours prior to sampling. Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Also took turbidity and TSS samples and HydroLab® readings at four locations around the mouths of the Hackensack and Passaic Rivers.

June 13, 2001

Morning haze burning off by early afternoon. Air temp. in lower 80's. Windy conditions. Strong currents in Upper Bay.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations.

July 13, 2001

Light haze in morning. Air temp. in upper 70's. Calm.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Surface samples taken at all stations, but subsurface samples could not be taken due to an equipment failure.

August 9, 2001

Slightly hazy and very hot. Air temp. reaching 105°F. Slight breeze.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Also took turbidity and TSS samples and HydroLab® readings in wake of large container vessel (German S, 777 feet long) as it entered and docked at the Global Marine Terminal in the Port Jersey Channel. Although a distinct rise in turbidity was visually noticeable around the maneuvering activities (two tug boats were used to maneuver the vessel), it was very hard to put the boat used for sampling in the right place to document this rise. Safety issues prevented the sampling boat from getting closer than 30m from the container vessel.

August 10, 2001

Slightly hazy and very hot. Air temp. in upper 90's.

Took turbidity and TSS samples around a working dredge. Samples taken at 45m upcurrent of dredge, 45m upcurrent and 60m laterally toward center of channel, 25m downcurrent of dredge, 40m downcurrent of dredge, 75m downcurrent of dredge, 75m downcurrent and 60m laterally toward center of channel, 140m downcurrent of dredge, and 175m downcurrent of dredge. The location, at confluence of Newark Bay, Arthur Kill, and Kill van Kull, did not lend well to this type of experiment as the currents in the area were "swirling" to the point where a well defined plume would not be expected.

Material being removed by dredges was observed to be mostly rock.

Sampling had to be stopped due to a scheduled closing of the area at 13:00 hours for blasting being performed in dredging operations.

August 23, 2001

Clear skies. Air temperature low to mid 80's.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations.

Sampling Event scheduled for September 13, 2001 was cancelled due to the events of September 11

October 25, 2001

Scattered clouds and windy. Air temperature in mid 70's

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Unable to retrieve any data from station PJ-3 due to high currents.

Unable to collect HydroLab® readings from stations NB-1, NB-2, NB-3, NB-4, NB-5, or NB-6 due to equipment failure.

November 13, 2001

Clear skies and cold. Air temperature high 40's to low 50's.

7:05 am. Followed shipping container vessel Newport Bay of the P&O NedLloyd shipping line. Took TSS samples and turbidity readings on its approach to Howland Hook Terminal, and as tug boats were maneuvering the ship into dock.

7:50 am. Followed shipping container vessel Mathilde Maersk of the Maersk shipping line. Took TSS samples and turbidity readings as tug boats turned the ship around and brought it into dock. Sediment plume was very noticeable during this operation. Highly elevated turbidity readings recorded and TSS samples were of a dark brown color.

10:00 am. Took TSS samples and turbidity readings around active dredge along channel just north of Port Elizabeth. Clamshell dredge was observed to be pulling up muddy sediment. Samples and readings taken upcurrent from dredge and at 5 different intervals downcurrent from dredge. Normal to slightly elevated turbidity readings were observed downcurrent from dredge.

November 14, 2001

Clear skies. Air temperature in mid to upper 50's.

Took TSS samples and turbidity readings at regular ambient stations.

November 15, 2001

Increasing cloud cover with rain starting around noon. Air temperature in lower to mid 60's.

Followed shipping vessel St. Clemens from Kill van Kull down Arthur Kill to Port Reading. Cargo onboard vessel was not confirmed, but the vessel looked like an oil tanker and eventually docked at the Hess facility in Port Reading. Took TSS samples and turbidity readings as ship was underway, and as tug boats were maneuvering the ship into dock.

Attempted to take samples and readings around active dredge operated by Great Lakes Dredging Operations within the Kill van Kull, but currents were too strong to allow for sampling.

December 18, 2001

Overcast, cold, and very windy. Air temperature in lower to mid 50's. Wind gusts 20 to 30 mph. Peak wind speed of 44 mph.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Unable to retrieve samples or readings from station PJ-3 due to excessive

wind exposure and high currents. Attempted to sample around shipping vessel Hong Kong Senator scheduled to arrive at Global Terminal in Port Jersey, but the ship could not be found and the sampling efforts had to be called off due to safety concerns over the weather.

January 15, 2002

Scattered clouds and cold. Air temperature in mid to high 30's in the morning, warming to high 40's by afternoon. Winds 0-5 mph in the morning, increasing to 15-20 mph by afternoon.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations. Visually observed large brown turbidity plume in the channel in Newark Bay near the northern end of Port Elizabeth. The plume was suspected to have come from 2 tug boats that were maneuvering a container vessel into docking area. It is not entirely certain that the tugs created the plume as there was other traffic in the area, including a tug boat with a barge and a tug boat with what appeared to be a small oil tanker.

February 1, 2002

Overcast, foggy, and cold. Air temperature in upper 30's all day. Wind 5-10 mph. Light rain falling in the morning, increasing in late afternoon after sampling was completed.

This sampling event was scheduled in anticipation of a large storm predicted to hit the area. The storm, however, was pushed to the north and only a small amount of rain fell in the area, 0.1 inches of precipitation within 48 hours previous to sampling.

Turbidity and TSS samples, as well as HydroLab® readings, were taken at the ambient stations.

February 11, 2002

Cloudy, cold, and very windy. Cloud cover over 80% at 7:00 am. Air temperature at 7:00 am in the mid 40's and dropping. Wind speeds 20-25 mph with gusts up to 35 mph by 9:00 am.

Waters very rough, white caps throughout the Upper Harbor and Newark Bay as well as certain areas of the Kill van Kull. Conditions were determined to be unsafe and the sampling event was called off, to be rescheduled later in the month.

February 21, 2002

Low clouds / light fog increasing towards noon. Air temperature in mid-50s to low 60's. Winds 10-15 mph.

Took turbidity and TSS samples and HydroLab® readings at regular ambient stations.