

WELLS (WEL) National Estuarine Research Reserve Water Quality Metadata
Report
January-December 1996
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I. Data Set & Research Descriptors

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2. Entry verification:

The data are directly downloaded in the YSI-PC6000 format (as a .dat file) and the Comma & ³ ³ Delimited format (as a .csv file) from the dataloggers to an IBM compatible lap-top (Epson Equity LT-286e). The data are reviewed using the PC6000 software. Graphs and basic statistics are then generated with the PC6000 program and the information is printed out for each data file. These graphs are used to determine any obvious data outliers and sonde and/or probe malfunction. All downloaded data files from the dataloggers (both raw unedited .dat and .csv files) are then transferred via disk to a Power Mac 7100, where all files are reviewed and formatted for CDMO and stored. Here the raw unedited .csv data files are imported into Microsoft Excel 5.0. After a complete month of data has been recorded, each file is ready to review which requires several steps. The NERR CDMO QA/QC Excel macros are used for all data. A data file is created (from the merged raw unedited .csv data files) in Excel format with a full month of data. The first step is to make sure that the parameter columns are in the correct order, specified by the NERR CDMO. If any parameters are not collected due to probe failure or other causes, the cells with this missing data are

filled in with periods (.) and documented and explained in the appropriate section of the metadata. Secondly, missing dates and times are inserted in the data file where data were not collected due to maintenance, sonde failure, etc., and the cells with this missing data are filled in with periods (.) and documented and explained in the appropriate section of the metadata. The first NERR CDMO QA/QC Excel 5.0 macro is then run to determine if there are any missing dates and times; and if so these missing dates and times are inserted. Next, the second NERR CDMO QA/QC Excel 5.0 macro is used to find and filter all data readings outside the sonde specification measuring range for each parameter. Here the 'outlier' data generated by the second macro are examined and determined as either explained or unexplained anomalies, as specified by NERR CDMO Operations Manual. All anomalous data (explained and unexplained) are documented and explained in the appropriate sections of the metadata. The explained anomalous data are then removed from the data file and replaced by periods. The unexplained anomalous data are investigated for validity based on weather data, field observations, instrument diagnostics, and PC6000 printouts. If these data are rejected from the file then these are removed and replaced by periods. Lastly, the third and final NERR CDMO QA/QC Excel 5.0 macro is used to reformat all the columns in the data file to the correct number of significant digits. After this last step, once the file has been completely formatted and edited as specified by NERR CDMO, the file is saved as a Tab delimited (.txt) text file and sent by FTP to the CDMO. The metadata form is also submitted with the data file to the CDMO. Scott Orringer is responsible for this task of entry verification with the analyses of suspect and anomalous data. Michele Dionne supervises, proofs and answers questions with the evaluation of suspect and anomalous data.

3. Research objectives:

The Webhannet River estuary is located in proximity to heavily used

beaches in Wells, Maine. It has a shoreline that is highly developed with residential and commercial structures. The estuary receives water from a 14 sq. mi. watershed that is well forested. We are measuring variations in hydrologic variables in the Webhannet River estuary at the head of tide and at the inlet. Data from head of tide will integrate surface and ground water inputs (from both point and non-point sources) from the freshwater watershed into the estuary. Data from the inlet will integrate surface and ground water inputs from the freshwater watershed and the estuarine watershed. Differences in data between the head of tide and the inlet will indicate inputs from the estuarine portion of the watershed (on the ebb tide), and inputs from the Gulf of Maine on the flood tide. The instruments will track runoff events via salinity, and will measure pollutant-carrying sediment particles via turbidity. Our working hypothesis is that the freshwater watershed is the primary source of sediment and therefore potential NPS pollutants in the estuary. These two variables will indicate the potential for non-point source pollutants to enter the estuary, and whether they are of upland, estuarine or Gulf of Maine origin. Other variables measured by the data loggers (DO, temperature, pH, specific conductivity, and water level) will provide important baseline data to track changes in the estuary's physico-chemical parameters over the long term. These variables can be affected by changes in human water use, and by natural or human induced changes in inlet and river channel morphology, climate, and organic loadings. The inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site. The head of tide site is relatively unimpacted, located just east of the Route One bridge, and is our ³roving² site.

Efforts are underway to restore tidal flow in New England salt marshes that were negatively impacted by tidal restrictions (Burdick et. al. 1997). The Wells NERR has been instrumental in identifying and measuring the damaging effects of tidal-restriction, due to roads and culverts, on salt marsh ecosystems. The second area of monitoring is known as Drakes Island Marsh, a

barrier island salt marsh in Wells, Maine, that was impounded with a road and culvert by farmers in the late 1800's. The Wells NERR began monitoring the natural restoration of this degraded marsh in 1988 after a neglected flapper valve failed and partial restoration of tidal flow occurred. Vegetation data including biomass and percent coverage and environmental data including salinity, water table, and tidal heights have been collected in several locations in the marsh since that time (Hoffman 1997). At the northernmost branch of the Webhannet River estuary in Drakes Island Marsh, two more data loggers have been deployed above (upstream) and below (downstream) a culvert in a road crossing that greatly restricts tidal flow. We want to determine if tidal restriction does influence water quality of the tidally restricted (upstream) marsh acreage, since changes in hydrology are also considered to be a type of non-point source pollution. The upstream site is the impacted or treatment site, and the downstream site is the control or reference site.

4. Research Methods

The Wells NERR YSI monitoring program began in April 1995 at one site and May 1995 at a second site in the Webhannet River estuary. Two more sites were added in April 1996. All four data loggers are installed with bottom moorings, as described below. Each data logger was placed in a 4 inch diameter, 2 1/2 ft. long PVC pipe housing for protection. Several holes were cut out near the bottom of the PVC pipe to allow water flow to the probes. There are three stainless steel bolts drilled into each PVC housing to hold the data logger in place. Two bolts near the top allow the YSI to hang by its bail and one bolt near the bottom is placed just under the sonde guard. Each PVC housing uses an underwater float and a surface buoy attached to the outer top bolt with 3 feet of rope. This allows the top end of the data logger to float freely while the probe-end is fixed to the bottom mooring. Before deployment, duct tape is used to keep bolt nuts secure and clean. Both data loggers have 1/4 inch vector mesh

placed on the outside (using rubber bands) and bottom (using cable ties) of the sonde guard to prevent fouling.

The head of tide site (HT) uses a steel sign post (hammered about 1.5 ft) for a bottom mooring, and two stainless steel clips are used to secure the probe-end of the data logger 0.30 meters (1.0 ft) off the bottom. One of these clips is attached to the sign post with a marine lock for security. A 4-lb. dansforth anchor is also clipped to the probe-end of the data logger with 20 ft of rope for secondary security measures.

The inlet site (IN) uses a 50 lb. mushroom anchor as a bottom mooring, with 15 ft of rope slack clipped and tied to the pier. The inlet site is secured at 1.0 meter (3.28 ft) off the bottom using a stainless steel link attached to the rope. The probe-end of the data logger was attached to this link with stainless steel clips (the buoys attached to other end of the housing).

The Drakes Island upstream site (UP) uses a steel sign post (hammered about 1.5 ft) for a bottom mooring, and two stainless steel clips are used to secure the probe-end of the data logger 0.30 meters (1.0 ft) off the bottom. One of these clips is attached to the sign post with a marine lock for security. A 4-lb. dansforth anchor is also clipped to the probe-end of the data logger with 20 ft of rope for secondary security measures.

The Drakes Island downstream site (DN) uses a steel sign post (hammered about 1.5 ft) for a bottom mooring, and two stainless steel clips are used to secure the probe-end of the data logger 0.23 meters (0.75 ft) off the bottom. One of these clips is attached to the sign post with a marine lock for security. A 4-lb. dansforth anchor is also clipped to the probe-end of the data logger with 20 ft of rope for secondary security measures.

Two to four week variable sampling periods were chosen due to limitations created by the life of the dissolved oxygen membrane and limited battery power. Measurements of temperature, specific conductivity, salinity, percent saturation, dissolved oxygen, depth, pH, and turbidity are recorded at 30 minute intervals throughout the deployment period.

After the deployment period, the data loggers are brought back into the

Wells Reserve Laboratory for downloading, cleaning, and calibration. These procedures are carried out to the methods described in the YSI Operating Manual. Calibration standards are needed and used for only specific conductivity (10mS/cm), pH (buffer solutions of pH 4, 7, and 10), and turbidity (0.0 and 200 NTU). Conductivity and pH standards are purchased from Fisher Scientific. Turbidity standards are purchased from Advanced Polymer Systems, Inc. (Redwood City, CA). The 200 NTU standard is diluted with distilled water to create 100 NTU standard. The dissolved oxygen membranes are replaced and sit 6-24 hours before each deployment. After approximately 6-24 hours of down time for cleaning, maintenance and recalibration, the YSI Data loggers are redeployed for another sampling period. Also, with our extra data sonde, we have been reducing the amount of time of missing data from calibrations and maintenance.

5. Site location and character

The Wells National Estuarine Research Reserve is located in York County, within the Town of Wells, on the coast of southern Maine and faces the Atlantic Ocean. The Wells NEER is approximately 31 km (20 miles) south of Portland, Maine and 110 km (70 miles) north of Boston, Massachusetts. The Reserve encompasses 1,690 acres along the Gulf of Maine coastline of tidally-flushed wetlands, riparian and transitional upland fields and forests within the Little River Estuary and the larger Webhannet River Estuary. Both estuaries arise in the sandy glacial outwash plain about eight miles inland. Both rivers empty into Wells Bay, a sandy basin stretching for approximately ten miles along the Atlantic coast. Bordering each river's inlet are double spit barrier beaches attached to the mainland. The backbarrier system is approximately 5 sq. km and is composed of large intertidal marshes (predominantly *S. patens* and *S. alterniflora*), intertidal sand and mud flats, and tidal channels. The watershed for the Webhannet River estuary covers an area of 35 sq. km and has a total of 6 streams, brooks or creeks which enter the estuary. These tributaries flow across sand and gravel deposits near the headwaters and the impermeable sandy

muds of the Presumpscot Formation in the lower reaches. The Webhannet River is connected to the ocean via Wells Inlet, which has a spring tidal prism of 28,200,000 cub. m (Ward 1993). The force and volume of tidal action affect the salinity level of both rivers. In the Wells region, the annual mean wave height is almost 20 inches. The estuarine system is dominated by semi-diurnal tides having a range of 8.5 to 9.8 feet. The volume of freshwater influx into both estuaries is moderate to low (on the order of 0.5 cubic meters/second), especially in the summer, because of the rivers¹ relatively small drainage areas and the presence of deep glacial deposits. The relatively low flows from these two rivers taken in with the 20 inch per year average runoff of the area surrounding the estuaries combine to form a fresh water flow which is dwarfed by tidal flushing. Twelve-foot tides dwarf the freshwater flow into the Webhannet estuary, which has a drainage area of 14.1 square miles. The Webhannet estuary, fed by both Blacksmith and Depot Brooks, is adjacent to the harbor and greatly developed land. It offers a valuable opportunity for comparison with the relatively pristine Little River estuary. The land use of the Webhannet estuary include a total of 15% for wetland, fresh water, and tidal marsh; a total of 63.7 % for woodland; and a total of 18.6% for developed land (compared to a total of 5.7% development in the Little River estuary) (WNERR RMA 1996; Holden 1997).

There are four sampling sites in the Webhannet River estuary. These are located at the head of tide and at the inlet, and two sites at the northern-most branch of the Webhannet River estuary in Drakes Island Marsh, above (upstream) and below (downstream) Drakes Island Road. The tidal range at all of these sites is 2.6-2.9 meters.

The head of tide site is located 4 miles south of the Wells Reserve, just downstream of the Webhannet Falls (freshwater) and 10 feet east of Route One (43 deg 17¹ 00² Latitude, 70 deg 35¹ 30² Longitude). Route One is used heavily with traffic all year, especially during the summer tourist months. This site has soft mud, sand, and a rocky substrate, and the low and high tide depth is

relatively shallow. The salinity range here is 0-31 ppt, with a mean of 3.6 ppt. These head waters of the Webhannet are relatively undeveloped. This site is located just 10 feet east of the Route One bridge, and is our ³roving² site.

The inlet site is located 1.5 miles south of the Wells Reserve, at the Wells Harbor pier (43 deg 19¹ 12² Latitude, 70 deg 33¹ 50² Longitude). The mouth of the Webhannet estuary forms an extensive wetland/salt marsh area which is surrounded by development. Wells Harbor, which was most recently dredged in 1971, has moorings for approximately 200 commercial fishing and recreational boats. The mouth of the river flows between two jetties to the Atlantic Ocean. This channel was dredged in 1974. This site has a predominately sand substrate and is characterized by strong current during incoming and outgoing tides. The salinity range here is 7-35 ppt, with a mean of 31 ppt. The inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site.

The second area of monitoring is known as Drakes Island Marsh, a barrier island salt marsh in Wells, Maine, that was impounded with a road and culvert by farmers in the late 1800's. The Wells NERR began monitoring the natural restoration of this degraded marsh in 1988 after a neglected flapper valve failed and partial restoration of tidal flow occurred. Salt intolerant vegetation was soon killed across 40 percent of the 40 hectare (upstream) site. Both sites are composed of large intertidal marshes (predominantly *S. patens* and *S. alterniflora*), intertidal sand and mud flats, and tidal channels. The marsh formed landward of a barrier beach system in a lagoon estuary. Use of the 40 hectare upstream marsh as a pasture led to hydrographic manipulations since 1848 when a dike was built. A road providing access to the Drakes Island beach and running parallel to the dike had a box culvert with a water control structure that operated from the 1920s to the 1950s. Another beach access road was built at the north end of the marsh, preventing spring tides entering the marsh from the Little River estuary. The sedimentary record indicates that the impacted

area (upstream) was originally dominated by high marsh, and was similar to the adjacent salt marsh found downstream (reference area) of the road today (Burdick et. al. 1997). Drakes Island Marsh is located at the northern-most branch of the Webhannet River estuary, and the data loggers have been deployed above (upstream) and below (downstream) this 1.2 meter diameter culvert in Drakes Island road that greatly restricts tidal flow. Both sites are located 1.0 miles south of the Wells NERR. The upstream site is 43 deg 19¹ 50² Latitude, 70 deg 33¹ 25² Longitude, with the salinity range 9-35 ppt, with a mean of 30 ppt. The downstream site is 43 deg 19¹ 45² Latitude, 70 deg 33¹ 45² Longitude, with the salinity range 5-35 ppt, with a mean of 29 ppt.

6. Data collection period:

The Webhannet River head of tide (HT) site data collection was re-deployed (after being pulled in December 1995) on April 12 17:00, and pulled December 16, 9:30 for the winter months to prevent ice damage. This site gets a large amount of ice coverage from December through late March.

The Webhannet River inlet (IN) site data collection began May 29, 1995, 13:00. The IN datalogger is ongoing throughout the year and is considered our long-term monitoring site, as this site remains relatively ice-free.

The Drakes Island upstream impacted site (UP) data collection began April 23, 11:00, and was pulled December 16, 10:00, for the winter months to prevent ice damage. This site gets a large amount of ice coverage from December through late March.

The Drakes Island downstream control site (DN) data collection began April 23, 11:00, and was pulled December 16, 9:30:00, for the winter months to prevent ice damage. This site gets a large amount of ice coverage from December through late March.

We began measuring turbidity as soon as the data loggers were upgraded at YSI. The first turbidity measurement was taken at the inlet (IN) site on

February 16, 1996 at 12:30, and has been ongoing; and began with the HT, UP, and DN data loggers since their first 1996 deployment in April.

7. Associated researchers and projects

Ongoing research at the Wells Reserve is designed to address issues of concern to the Gulf of Maine management community; sea level rise, beach erosion, coastal water quality and nutrient enrichment, coastal habitat value, habitat restoration of shellfish and finfish, marsh plant community dynamics, and plant-soil-nutrient relationships. Active research topics include:

- € rates of accretion of salt marsh peat
- € hydrologic and ecological response of impounded marshes to restoration
- € assessment of shellfish resources in the Webhannet River flats
- € assessment of resident and migratory fish use of Little River estuary
- € use of large wading birds as indicators of salt marsh habitat health
- € watershed nutrient loading to Little and Webhannet River estuaries
- € linkage between estuarine nutrient enrichment and oxygen dynamics throughout coastal Maine
- € climatic versus competitive control of salt marsh plant communities
- € effects of climate on salt marsh plant phenology and phenotype
- € associations between marsh plant distribution, soil nutrients, and soil type

Although many of these projects are ongoing some of the findings to date are:

- € Impounded salt marshes can respond quickly to restored tidal flow, with early colonization by salt marsh vegetation and by resident and migratory marsh fishes.
- € Seed clam density declines with distance from the Webhannet River inlet, indicating an external as opposed to an internal source of recruitment to the clam population. There is a small but significant relationship between density and sediment organic matter.
- € Juvenile striped bass utilize the Little River estuary as a food resource; diet analysis indicates a preference for sand shrimp.

€ The Reserve's estuaries appear to be nitrogen limited; primary nitrogen source is ocean water. Nutrients from fresh surface water influence nutrient concentrations in the upper estuary. Ground water may be a significant source of nitrogen in the upper Webhannet River estuary.

€ Maine's estuaries and embayments show no serious oxygen depletion, with a few exceptions. Dissolved oxygen and nitrogen levels are related to freshwater runoff, indicating that activities in the watershed can influence the estuaries even in the face of the high tidal flushing rates typical of Maine's estuaries.

€ Salt marsh plant phenology varies significantly between Wells NERR and Prudence Island NERR; trends suggest possible genetic variation within species.

€ Soil nitrogen concentrations are directly related to forb distribution on the Reserve's salt marshes.

The Research Program's volunteer water quality monitoring program (W.E.T.) has been monitoring fecal coliform contamination and other water quality parameters in the estuaries since 1991. W.E.T. (Watershed Evaluation Team) was established to characterize and monitor the aquatic environment of the Little and Webhannet River estuaries. This program allows students from local schools and volunteers to participate in "hands-on" scientific research and management activities at the Reserve. Information yielded by this effort is valuable as baseline data for research conducted at the Reserve and may help in guiding current management priorities. Reserve staff with W.E.T. volunteers and students, working with the Town of Wells and the Maine Department of Marine Resources (DMR), have recently opened selected shellfish beds in the Webhannet River after seven years of closure. This was a direct result of monitoring fecal coliform contamination (and other water quality parameters), which is the major source of non-point source pollution in southern Maine. W.E.T. is part of a National Monitoring Program called Estuary-Net. This program allows students to share their data and compare their results with other monitoring groups via the web.

University of New Hampshire researchers completed a year long monitoring project measuring the volume, nutrient concentrations, and total suspended solids of freshwater discharge into the Webhannet River estuary, relating these inputs to precipitation, and measuring their effects on estuarine water quality; using a hydrolab. Research staff and students have completed a four year study of hydrology and vegetation of a degraded Webhannet River marsh recovering from roadway impoundment after restoration of tidal flow. In June of 1994, Reserve research staff and students completed an 18 month survey of larval fish distribution and abundance in the Wells Reserve's estuaries and in the near-shore waters of Wells Bay. University of New Hampshire researchers are working with eelgrass beds in Wells Embayment to develop criteria for siting and evaluating eel grass restoration projects. Both salt marsh and eelgrass are thought to be important habitats for many Gulf of Maine fishes. University of Maine Machias is collaborating with Reserve staff to determine the status of the soft-shell clam resource in the Reserve's estuaries. Reserve staff are working with the Maine Dept. of Environmental Protection to survey the dissolved oxygen status of 25 estuaries throughout Maine, using data sondes to measure oxygen depletion as an indicator of non-point source pollution (Coastal Hypoxia Study).

-Other publications/reports including the above sited ones:

Bryan, R., M.Dionne, R. Cook, J. Jones and A. Goodspeed (1997) Maine citizens guide to evaluating, restoring, and managing tidal marshes. Maine Audubon Society, Falmouth, ME.

Burdick, D., M.Dionne, R.Boumans and F.Short (1997) Ecological responses to tidal restoration in two New England salt marshes. Wetlands Ecology and Management 4:129-144.

Hoffman, C. 1997. Drakes Island Marsh Restoration Project Report. Contracted out by the Wells NERR.

Holden, W.F. 1997. Fresh water, suspended sediment and nutrient influx to the

Little River and Webhannet River Estuaries, Wells, Maine. Ph.D. dissertation,
Boston University. pp 1-179

Ward, L. G. 1993. Precipitation, streamflow, and water characteristics (physical and chemical) of the Webhannet River Estuary, Wells, Maine. Draft
final report by UNH, Jackson Estuarine Laboratory, Durham, NH. NOAA Technical
Memorandum, pp. 1-13.

WNERR RMA 1996. Wells NERR Management Plan. Prepared by the WNERR Management
Authority (RMA) and NOAA, SRD Division. pp. 1-120.

II. Physical Structure Descriptors

8. Variable sequence, range of measurements, units, resolution, and accuracy:

YSI 6000 datalogger

Variable	Range of Measurements	Resolution	
Accuracy			
Date	1-12, 1-31, 00-99 (Mo,Day,Yr)	1 mo, 1 day, 1 yr	NA
Time	0-24, 0-60, 0-60 (Hr,Min,Sec)	1 hr, 1 min, 1 s	NA
Temp	-5 to 45 (c)	0.01 C	+/-
0.15C			
Sp COND	0-100 (mS/cm)	0.01mS/cm	+/-0.5%
Of			
reading + 0.001mS/Cm			
Salinity	0-70 Parts per thousand (ppt)	0.01 ppt	+/- 1%
of			
Reading or 0.1 ppt, (whichever is greater)			
DO	0-200 (% air saturation)	0.1% @air sat	+/-2%
@air			
Saturation			
DO	200-500 (% air saturation	0.1% @ air sat	+/- 6%
@			
Saturation			
DO	0-20 (mg/l)	0.01 mg/l	+/-
0.2mg/l			
DO	20-50 (mg/l)	0.01 mg/l	+/-
0.6mg/l			
Depth (shallow)	0-9.1 (m)	0.001m	+/-
0.018m			
PH	2-14 units	0.01 units	+/-
0.2units			
Turb	0-1000 NTU	0.1 NTU	+/- 5%
of			
Reading or 2 NTU (whichever is greater)			

Data columns are separated by tabs.

9. Coded variable indicator and variable code definitions:

Site definitions: HT = Head of Tide of Webhannet River

IN = Inlet at Webhannet River Mouth

UP = Drakes Island Upstream Impacted

Site

DN = Drakes Island Downstream Control

Site

File definitions: YSI deployment site/month/year (ex.: IN0795 =
Webhannet Inlet
data from July 1995).

10. Data anomalies:

January, 1996 Sampling Period

Head of Tide: None to report; sonde not deployed until April.

Inlet: None to report.

Drakes Island Upstream: None to report; sonde not deployed until April.

Drakes Island Downstream: None to report; sonde not deployed until April.

February, 1996 Sampling Period

Head of Tide: None to report; sonde not deployed until April.

Inlet:

The following were small negative turbidity values (logging period
recorded 90

anomalies), possibly due to a small calibration error. These data were
not
deleted.

2/16 21:30

2/25 16:30

2/26 5:30-6:30, 15:00-19:30

2/27 3:00-5:30, 6:30-8:30, 14:30, 15:30-20:30

2/28 0:00, 2:00-3:30, 4:30-8:00, 9:00-9:30, 16:00-16:30, 17:30-
22:00

2/29 3:30, 4:30-10:30, 17:30-22:30

Drakes Island Upstream: None to report; sonde not deployed until April.

Drakes Island Downstream: None to report; sonde not deployed until April.

March, 1996 Sampling Period

Head of Tide: None to report; sonde not deployed until April.

Inlet:

The following were small negative turbidity values (logging period
recorded 103

anomalies), possibly due to a small calibration error. These data were
not
deleted.

3/1 4:30-11:30, 18:00-23:30

3/2 0:00, 5:30, 6:30-8:30, 9:30-12:00

3/3 9:00, 10:00-10:30, 12:30, 20:30, 21:30-22:30

3/4 0:00, 9:30-12:00, 21:30-23:30

3/5 0:00-0:30, 4:30, 8:00, 9:00-13:30, 18:00, 22:30-23:30

3/6 0:00-2:00, 8:30, 11:00, 12:00, 13:00, 14:00

3/7 13:00

3/10 14:00-15:00

3/11 2:00-5:00, 14:30-16:00

Drakes Island Upstream: None to report; sonde not deployed until April.

Drakes Island Downstream: None to report; sonde not deployed until April.

April, 1996 Sampling Period

Head of Tide:

No data on 4/1 0:00 to 4/12 16:30; this was the first logger deployment (4/12 at

17:00) at this site.

The following were small negative turbidity values (logging period recorded 25

anomalies), possibly due to a small calibration error. These data were not deleted.

4/13 10:00, 13:00, 14:30, 16:00, 17:30, 19:00-21:00, 22:00-23:00

4/15 9:00-10:30, 11:30, 13:00-13:30, 17:00-18:30, 19:30

No turbidity data from 4/16 9:30 through 4/30 23:30:00 due to turbidity probe

malfunction. There was a turbidity probe wiper malfunction (the wiper was

parked over the optics), and seawater leaked into the turbidity probe aux port.

There was a large drop of normal readings to 665 high negative values (range -

719.3 to -739.4). These anomalous readings were due to a turbidity probe failure and these data were deleted. The turbidity probe was sent back and

replaced by YSI.

DO deleted from 4/12 17:00 to 23:30; first few records are high and appears that

the membrane may have still been settling.

Inlet:

No turbidity data from 4/12 17:00 to 4/25 10:00 because of turbidity probe wiper

malfunction. After logger retrieval, the wiper was observed parked on the

optics. The probe did malfunction and needed to be replaced at YSI.

These data

were deleted.

The following were small negative turbidity values (logging period recorded 79

anomalies), possibly due to a small calibration error. These data were not

deleted.

4/25 13:30-20:00, 22:00-23:00

4/26 1:00, 3:00-7:30, 19:30

4/27 19:00

4/28 5:00-9:30, 18:30, 19:30-20:00, 21:00-21:30, 22:30

4/29 5:30-12:00, 13:30, 14:30, 17:00-23:00

4/30 19:00, 20:30-21:30

Drakes Island Upstream:

No data on 4/1 0:00 to 4/23 10:30; this was the first logger deployment (4/23 at 11:00) at this site.

The following were small negative turbidity values (logging period recorded 128 anomalies), possibly due to a small calibration error. These data were not deleted.

4/23 17:00-18:30, 20:00, 22:00, 23:00
4/24 0:00, 1:00, 2:00, 3:00, 4:00, 5:00, 8:00, 9:00, 10:00, 11:00, 12:00, 13:00, 14:00, 23:00
4/25 0:00, 1:00, 2:00, 3:00, 4:00, 5:00, 6:00, 7:00, 8:00, 9:00, 18:30, 19:30, 20:30, 21:30, 22:30-23:30
4/26 0:30-2:30, 3:30-5:30
4/28 21:00
4/29 6:00, 7:30, 9:00-12:00, 13:00-23:30
4/30 0:00-23:30

There are suspect turbidity data from 4/23 11:00 (190.7) to 4/29 06:30 (129.3)

(280 values with a mean of 67.4; including small negative turbidity values), where turbidity values increased sharply and decreased sharply to small negative values. These data are suspect not only due to this unusual range of high values. The data also alternated (within the above range of dates and times) to a high positive value and then immediately decreased to a small negative value the next reading (a half an hour later). The value then returned to a high positive value on the next reading (a half an hour later), and continued. For

example, the turbidity values from 4/28 21:30 to 23:00, at every 30 minutes, were: 284.3, - 2.2, 291.9, -3.4. This could be from probe malfunction, but the data trailed off to small negative values by the end of the month. These data were not deleted.

Drakes Island Downstream:

No data on 4/1 0:00 to 4/23 10:30; this was the first logger deployment (4/23 at 11:00) at this site.

The following were small negative turbidity values (logging period recorded 102 anomalies), possibly due to a small calibration error. These data were not deleted.

4/23 15:00-17:00
4/24 2:00-5:00
4/25 2:30-6:30, 15:30-19:30
4/26 3:00-7:00, 16:30-20:30

4/27 4:30, 5:30-8:00, 19:00-20:30
4/28 7:00-7:30, 18:00-19:30, 20:30-21:30
4/29 6:00-10:30, 18:30-22:30
4/30 8:30-11:00, 19:30-23:30

There are suspect dissolved oxygen and percent saturation data from 4/23 11:00 through 4/30 23:30 due to a very gradual decrease of values. All DOmg and DOSat data, after a certain point, decreased steadily while fluctuating until reaching values of 7.4 and 70.8, respectively. These data were not deleted, however, since values did not decrease too low (i.e. negative values). These data continued to decrease gradually while fluctuating until the next calibration (5/9 13:30).

May, 1996 Sampling Period

Head of Tide:

No turbidity data from 5/1 0:00 through 5/9 8:00 due to turbidity probe malfunction (continuation from 4/30/96). There was a turbidity probe wiper malfunction (the wiper was parked over the optics), and seawater leaked into the turbidity probe aux port. There was a large drop of normal readings to 401 high negative values (range -725.4 to -740.2). These anomalous readings were due to a turbidity probe failure and these data were deleted. The turbidity probe was sent back and replaced by YSI. The following were small negative turbidity values (logging period recorded 107 anomalies), possibly due to a small calibration error. These data were not deleted.

5/11 14:30, 16:00-16:30, 19:30, 20:30, 22:30-23:00
5/12 11:30, 15:30, 16:30, 18:30, 19:30, 20:30-21:00, 23:00-23:30
5/13 0:00-0:30, 1:30-3:00, 4:30-6:30, 20:00-20:30
5/14 20:30-21:30
5/15 3:30, 22:00
5/16 21:30, 23:00
5/17 1:30-5:00, 6:00-9:00, 11:30, 13:00-13:30, 15:00
5/18 5:30, 23:30
5/19 4:00, 5:30-6:00, 7:30, 8:30
5/20 0:30, 2:30, 3:30-6:30, 7:30-8:00, 10:30, 11:30, 22:30
5/21 1:00
5/22 2:30, 7:30, 21:00
5/23 1:00, 8:30
5/25 10:00
5/30 13:30, 17:00-17:30, 19:30-20:00, 21:30
5/31 0:00-1:00, 2:30, 3:30-4:00, 6:00, 7:00-8:00, 9:00-10:00, 11:00, 15:00

Inlet:

The following were small negative turbidity values (logging period recorded 334 anomalies), possibly due to a small calibration error. These data were not deleted.

5/1 9:00-9:30, 10:30, 21:00
5/2 10:30-11:00, 21:00, 22:00-23:00
5/3 10:00, 11:30-12:00, 23:30
5/4 11:00
5/5 0:00, 12:00, 23:30
5/6 0:00-0:30, 1:30
5/7 0:00-1:30, 13:00-16:00
5/8 1:00-2:00, 3:00-4:00, 14:00, 15:00-16:00
5/9 2:00-4:30, 5:30, 14:30, 16:00-18:00
5/10 3:30-5:00, 16:00, 17:30
5/11 4:30, 5:30-6:30, 19:00
5/12 4:30-5:00, 6:00-7:30, 8:30, 18:00-20:00
5/13 5:00, 6:30-8:00, 9:30-10:00, 18:30, 19:30-20:00, 21:00-21:30
5/14 6:30-11:30, 17:30-23:00
5/15 8:00-11:30, 18:30-19:00, 20:00, 21:00-23:00
5/16 11:30-12:30, 20:30-23:30
5/17 0:00-0:30, 9:30, 10:30-13:00, 20:00, 21:00-23:00
5/18 0:00-1:00, 9:00, 10:30, 11:30-12:00, 13:00-14:30, 22:30
5/19 0:00-1:00, 11:30, 12:30
5/20 14:30
5/21 12:30
5/22 0:00-1:00, 11:30, 12:30-13:00, 14:00-14:30, 23:30
5/23 0:00-2:30, 12:30-15:00, 23:30
5/24 0:00-3:00, 13:00-15:00, 16:00
5/25 0:30-4:00, 5:00, 13:00-15:30, 16:30, 17:30-18:00
5/26 2:00-6:00, 8:00, 14:00-19:00, 20:00
5/27 3:00-8:30, 15:00-21:00
5/28 4:00-10:00, 16:30, 17:30-21:00
5/29 6:00-7:00, 8:00, 9:00, 10:00, 19:30-21:30
5/30 10:00, 19:00, 20:30-22:30
5/31 7:00-12:00, 18:30, 20:00-23:30

Drakes Island Upstream:

The following were small negative turbidity values (logging period recorded 412 anomalies), possibly due to a small calibration error. These data were not deleted.

5/1 0:00-23:30
5/2 0:00-23:30
5/3 0:00-23:30
5/4 0:00-23:30
5/5 0:00-23:30
5/6 0:00-23:30
5/7 0:00-23:30
5/8 0:00-23:30
5/9 0:00-12:00
5/18 2:30, 4:00
5/29 10:00

There was one high positive turbidity spike on 5/26 15:00 of 67.0 NTU; it is not consistent with the overall data record. This suspect datum was not deleted, as

we are not absolutely sure that this value is bad.

There is possible suspect percent saturation and dissolved oxygen data from 5/8

9:30 to 5/9 12:00. Percent saturation and dissolved oxygen data increased from

values of 88.3 and 8.5, respectively, on 5/8 9:00 to values of 133.3 and 12.8,

respectively, on 5/8 9:30. From 5/1 0:00 to 5/8 9:00, the percent saturation and dissolved oxygen data had average values of 92.7 and 8.9, respectively (355 values each).

From 5/8 9:30 to 5/9 12:00 (last data value before calibration), the percent

saturation and dissolved oxygen data had average values of 133.1 and 12.3,

respectively (54 values each). These data are possibly suspect because after

5/8 9:00 these data remained at these increased values. The data were not deleted.

Drakes Island Downstream:

The following were small negative turbidity values (logging period recorded 129

anomalies), possibly due to a small calibration error. These data were not deleted.

5/1 0:00, 7:00, 8:30-9:30, 20:00, 22:00-23:00

5/2 0:00, 8:30, 9:30, 10:30-11:30, 20:00-23:30

5/3 0:30-1:00, 7:30, 9:30-13:30, 23:00

5/4 2:00, 10:00-14:00, 22:00, 23:00-23:30

5/5 0:00-2:30, 11:00-14:30, 22:30, 23:30

5/6 0:00-3:30, 10:00, 11:30-12:00, 13:00-15:30, 23:30

5/7 0:00-4:00, 13:00, 14:00-16:30

5/8 0:30-5:00, 13:30-17:30

5/9 1:00-6:00

No turbidity data were collected from 5/13 14:30 to 5/31 23:30 due to a turbidity probe malfunction. This probe had to be replaced by YSI.

There are suspect dissolved oxygen and percent saturation data from 5/1 0:00

through 5/9 13:00 due to a very gradual decrease of values. All DOmg and DOsat

data, after a certain point, decreased steadily while fluctuating until reaching

values of 5.9 and 60.3, respectively, on 5/5 7:30. These data were not deleted,

however, since values did not decrease too low (i.e. negative values).

These data continued to decrease gradually while fluctuating until the next

calibration (5/9 13:30). This was a continuation from 4/23 11:00.

June, 1996 Sampling Period

Head of Tide:

The following were small negative turbidity values (logging period recorded 522 anomalies), possibly due to a small calibration error. These data were not deleted.

6/3 13:30, 14:30
6/4 4:00, 9:30
6/5 1:00, 4:30, 16:00
6/6 5:00, 10:30-23:30
6/7 0:00-3:00, 6:00-14:00, 15:30-16:00, 18:00-23:00
6/8 0:30-2:30, 7:00-16:00, 17:00, 18:30-23:30
6/9 0:00-18:00, 20:00-23:30
6/10 0:30-17:30, 18:30-23:30
6/11 0:00-10:00, 11:30-13:00, 14:00-20:00, 22:00-23:00
6/12 0:00-3:00, 4:00-5:30, 9:30-20:30
6/13 2:30, 7:00-12:30, 14:00-19:30, 20:30-21:00
6/14 3:30, 5:00, 6:30, 10:00, 11:00, 12:30-16:00, 17:00-18:30,
19:30,
20:30-21:30
6/15 5:00-5:30, 7:30-8:30, 9:30-12:00, 13:30, 14:30, 16:00, 18:00-
21:30
6/16 9:00, 10:30-11:00, 12:00-12:30, 14:30-15:30, 17:00. 19:00,
20:00-
20:30, 23:00
6/17 11:30, 13:00, 14:00-14:30, 16:30, 19:00, 20:00-21:30, 22:30
6/18 11:30-12:30, 17:00, 18:00
6/19 9:30, 12:00, 13:30, 14:30, 16:00-16:30, 17:30-18:00, 20:00-
21:00,
22:00
6/20 0:30, 7:30, 15:00-15:30, 18:30-19:00, 20:00-20:30, 21:30
6/21 0:00-0:30
6/22 11:00
6/26 2:30, 4:00-5:00, 6:00, 7:00, 8:30-9:00, 10:00-10:30, 11:30,
12:30-
17:30, 18:30-20:30, 21:30-
23:30
6/27 0:30, 2:00, 3:00-12:00, 13:00-13:30, 14:30-19:30, 20:30-22:30
6/28 0:00-0:30, 2:00, 4:00, 5:00-14:00, 15:00-17:30, 18:30-20:00
6/29 5:00-5:30, 7:00-9:30, 10:30, 12:30-13:30, 14:30-15:30, 16:30,
17:30-
18:30, 19:30-20:00
6/30 7:00

There was one high positive turbidity spike on 6/15 9:00 of 133 NTU; it is not

consistent with the overall data record. This suspect datum was not deleted, as

we are not absolutely sure that this value is bad.

No dissolved oxygen data or percent saturation data from 6/6 09:30 through 7/1

11:00 due to a suspected DO membrane puncture. All DOmg and DOSat data, after a

certain point, decreased steadily until reaching values of 0.0 followed by

negative values. These data were suspect and deleted.

Inlet:

No data logged on 6/29 23:00 to 23:30 due to a time gap; the final time reading

of 6/29 recorded was at 22:30 (data began logging again on 6/30 0:00). A time

gap occurred from 23:00 to 23:30, and was corrected in the data file.

The following were small negative turbidity values (logging period recorded 514

anomalies), possibly due to a small calibration error. These data were not

deleted.

6/1 7:30-13:00, 20:00, 21:00-23:30
6/2 0:00-0:30, 9:00-13:00, 21:30-23:30
6/3 0:00-1:00, 11:00-14:30, 22:00-23:30
6/4 0:00-2:30, 12:30, 13:30-14:00
6/5 0:00, 1:00-3:00, 12:00-14:30, 15:30
6/6 1:00-1:30, 13:00-17:00
6/7 2:00, 3:00-3:30, 4:30, 13:30, 14:30, 15:30-18:00
6/8 2:30-5:00, 15:30-19:00
6/9 3:00-7:00, 14:30-19:00, 20:00-20:30
6/10 3:30-9:00, 15:30-21:30
6/11 4:00-4:30, 5:30-10:00, 16:00-17:00, 18:00-22:00
6/12 5:30-11:00, 17:30-22:30
6/13 6:00-11:30, 18:00, 19:00-23:00
6/14 7:30-13:00, 19:00-23:30
6/15 0:00-1:00, 7:30-12:20, 13:30, 19:00-20:00, 21:00-23:30
6/16 0:00-1:30, 3:00, 8:00-14:30, 20:00-23:30
6/17 0:00-2:00, 5:30, 9:00-15:00, 20:30-23:30
6/18 0:00-3:30, 9:30-15:30, 21:00-23:30
6/19 0:00-3:00, 4:00, 10:00-15:30, 22:00-23:30
6/20 0:00-5:00, 11:00-14:00, 15:00-17:30, 22:30-23:30
6/21 0:00-1:00, 2:00-5:00, 11:30-18:00
6/22 0:30, 2:00, 3:00-3:30, 4:30, 15:30-18:00
6/23 2:30, 4:00, 5:00
6/24 4:30, 5:30, 16:30-19:00
6/25 4:30, 6:00-6:30, 7:30-8:00, 18:30, 19:30, 20:30
6/26 5:30, 7:00-8:30, 13:00, 18:30
6/27 1:00, 6:00-9:30, 10:30, 13:00, 15:00, 18:00-20:00, 21:30-22:00
6/28 7:00-11:00, 17:00, 19:00-21:30, 22:30
6/29 4:30, 8:00-11:30, 14:30, 18:00, 19:30-21:30

Drakes Island Upstream:

No data on 6/4 13:30 to 18:00 and 6/5 0:00 to 6/7 14:30 due to a battery crash;

and due to downtime for calibration, maintenance and downloading. The logger

stopped recording during these times (finally stopped for good on 6/5 0:00),

although there was a small amount of data recorded between 6/4 18:30 to 23:30. The battery voltage decreased to 6.0 volts at this time.

Drakes Island Downstream:

No turbidity data were collected from 6/1 0:00 to 6/7 9:30 due to a turbidity

probe malfunction. This probe had to be replaced by YSI (this was a

continuation from 5/13 14:30).

There were two high positive turbidity spikes on 6/22 21:00 (240.2) and 21:30

(252.0) that were not consistent with the overall data record. These suspect

data were not deleted, as we are not absolutely sure that these values were bad.

There are suspect pH data from 6/11 17:00 to 6/30 23:30, where pH values dropped

sharply to 6.6 (from 7.9 on 6/11 16:30) and then gradually decreased to values

fluctuating between 5.9-6.3. These data were not deleted. The post-calibration

readings were acceptable.

July, 1996 Sampling Period

Head of Tide:

No dissolved oxygen data or percent saturation data from 6/6 09:30 through 7/1

11:00 due to a suspected DO membrane puncture. All DOmg and DOsat data, after a

certain point, decreased steadily until reaching values of 0.0 followed by

negative values. These data were suspect and deleted.

The following were small negative turbidity values (logging period recorded 396

anomalies), possibly due to a small calibration error. These data were not

deleted.

7/1 11:30, 18:30-21:00

7/11 9:00-11:00, 12:00-14:30, 15:30-18:00, 19:00

7/12 6:30, 7:30, 8:30, 9:30-10:00, 11:00-12:30, 13:30, 14:30, 15:30, 19:30

7/22 16:00-23:30

7/23 0:00-23:30

7/24 0:00-23:30

7/25 0:00-18:30, 20:30-23:30

7/26 0:00-19:30, 22:00-23:30

7/27 0:00-20:00, 23:00-23:30

7/28 0:00-20:30

7/29 1:30-9:30, 12:30-21:00

7/30 5:00, 8:00-10:00, 14:30, 15:30-21:30

7/31 7:30-10:30, 17:00-19:00, 20:00-20:30, 21:30-22:30

There are suspect pH data from 7/13 20:00 to 7/18 1:30, where pH values dropped

sharply to 4.9 and then gradually increased back to normal values. These data

were not deleted. The post-calibration readings were acceptable.

There are suspect turbidity data from 7/13 15:30 to 7/15 12:30, where turbidity

values increased sharply to a high value of 138.5 and dropped back to normal

values. These data were not deleted. However, there was a large storm when

logger was deployed on 7/1 which could have been the cause.

Inlet:

The following were small negative turbidity values (logging period recorded 472 anomalies), possibly due to a small calibration error. These data were not deleted.

7/1 23:30
7/2 0:00, 10:30-13:30
7/3 12:00-14:00, 17:30-18:00
7/4 1:30-2:00, 13:00-15:00
7/5 2:00-2:30, 14:30-15:30, 19:00-20:00, 22:00-22:30
7/6 2:30-4:00, 15:30-16:00, 19:00-23:30
7/7 1:00, 3:00-5:30, 9:30-10:00, 11:30, 14:00-17:30, 18:30, 21:00-22:30
7/8 0:00-0:30, 2:30-7:30, 10:30, 12:30, 14:00-19:00, 23:30
7/9 1:30, 3:30-5:00, 6:00-7:30, 8:30, 11:00-12:30, 13:30, 15:00, 16:00-20:00, 22:00, 23:30
7/10 1:30-2:00, 5:00-6:30, 7:30-9:30, 11:30, 12:30-14:30, 16:00, 17:00-23:30
7/11 0:00, 1:00, 3:00-3:30, 4:30-13:30, 14:30-15:30, 17:00, 18:00-23:00
7/12 0:30, 1:30, 5:00-12:00, 14:30, 16:30, 18:30, 19:30-23:00
7/13 2:30, 4:00, 8:00-12:00
7/17 0:00
7/19 20:30
7/20 19:00-22:00
7/21 7:00-10:30, 20:30, 22:00-23:00
7/22 3:00-4:00, 16:00-17:30
7/23 0:30-7:30, 11:30, 12:30-19:00, 22:00
7/24 1:30-8:30, 10:00-12:00, 13:30-20:00
7/25 0:00, 2:30-9:00, 10:00-10:30, 12:30, 14:30-21:00
7/26 3:30-10:00, 15:30-21:30
7/27 4:30-11:00, 16:30-22:30
7/28 6:00-11:30, 18:30-22:30
7/29 8:00-12:00, 18:30-19:00, 20:30-23:30
7/30 0:00, 9:00-12:30, 16:00, 21:30, 22:30-23:30
7/31 0:00-0:30, 11:00-12:30

No data on 7/6 10:00 due to suspect of sonde probes being out of the water.

This was a period with an episode of shallow depth, low conductivity, low salinity, and a high turbidity spike. All data were suspect and deleted.

Drakes Island Upstream:

There were three high positive turbidity spikes on 7/22 6:00 (97.9), 6:30 (134.7), and 8:30 (118.0); these were not consistent with the overall data

record. These suspect data were not deleted, as we are not absolutely sure that

these values were bad.

The following were small negative turbidity values (logging period recorded 211

anomalies), possibly due to a small calibration error. These data were not deleted.

7/23 17:00-18:00, 19:00-19:30, 20:30-21:30, 22:30
7/24 5:00-11:30, 18:00, 19:00, 20:00-23:30
7/25 0:00, 1:00, 4:00, 6:30, 7:00-10:30, 11:30-12:30, 14:30, 19:00, 20:00-23:30

7/26 1:30, 7:00, 8:00-10:30, 12:00, 13:00, 20:00-23:30
7/27 0:00-2:00, 3:00-3:30, 7:00, 8:00-14:00, 15:00, 21:00-23:30
7/28 0:00-4:00, 5:00, 6:00, 7:00, 9:00-15:00, 21:30-23:30
7/29 0:00, 1:00-6:00, 11:30-12:30, 13:30, 21:30-23:30
7/30 0:00-7:00, 11:00-16:00, 17:00, 20:30, 22:00-22:30, 23:30
7/31 0:00-5:30, 6:30-7:00, 12:00-15:30, 16:30, 17:30-18:00, 23:30

Drakes Island Downstream:

The following were small negative turbidity values (logging period recorded 144

anomalies), possibly due to a small calibration error. These data were not deleted.

7/3 1:00, 14:30
7/4 1:30, 14:00, 15:00
7/5 4:00, 15:00
7/9 18:30
7/24 15:30-20:00
7/25 4:30-8:00, 16:00-21:00
7/26 5:30-9:00, 17:00-22:00
7/27 6:00-10:00, 18:00-22:30
7/28 7:30-11:00, 19:00-23:30
7/29 8:00-12:00, 20:00-23:30
7/30 0:00-1:00, 9:00-13:00, 21:00-23:30
7/31 0:00-1:30, 9:30-14:00, 22:00, 23:00

The following were high positive turbidity spikes that were not consistent with the overall data record.

These suspect data were not deleted, as we are not absolutely sure that these values were bad.

7/13 4:30 to 7:00 (range 29.3-165.6); 13:00 to 23:30 (range 38.9-545.1)
7/14 1:00 to 7:00 (range 22.2-173.3)
7/16 19:00 (329.3)
7/18 16:30 (478.9)

The following were high negative turbidity spikes that were not consistent with the overall data record.

This suspect data were not deleted, as we are not absolutely sure that these values are bad.

7/11 21:30 (-148.0)
7/14 0:00 (-770.6) to 0:30 (-1012.6)
7/20 9:30 (-117.1)

August, 1996 Sampling Period

Head of Tide:

The following were small negative turbidity values (logging period recorded 515 anomalies), possibly due to a small calibration error. These data were not deleted.

8/1 6:30, 7:30-8:00, 9:00-11:30, 16:00, 18:00-23:30
8/2 6:00-12:30, 16:30, 17:30-20:00, 21:00, 22:00-22:30, 23:30
8/3 0:00-0:30, 7:30-13:30, 16:00, 18:30-19:30, 20:30-23:30
8/4 0:00-2:00, 7:00, 8:00-14:30, 19:00-23:30
8/5 0:00-3:00, 7:00, 8:00-15:30, 20:30-23:30
8/6 0:00-16:30, 22:00-23:30
8/7 0:00-17:30, 21:00-23:30
8/8 0:00-19:00, 23:00-23:30
8/9 0:00-13:30, 14:30-20:00
8/10 6:30-20:30
8/11 5:00, 7:00, 8:00-11:30, 12:30-19:00, 20:00-21:00
8/12 6:00-10:30, 11:30-19:00, 21:00-21:30
8/13 5:30, 6:30-10:00, 11:00-19:00, 20:00-21:00, 22:00
8/14 8:00, 9:00, 10:00-17:00, 18:00-19:00, 20:00, 21:30-22:30
8/15 8:30-11:30, 14:00-15:30, 16:30-18:30, 20:30, 21:30-23:00
8/16 7:00, 8:30, 9:30-10:00, 11:00-12:00, 17:30, 23:00
8/17 8:30, 9:30-12:30, 16:30-17:00, 18:00, 22:30, 23:30
8/18 0:00, 10:00-13:00
8/19 10:00-12:00, 13:30-14:00
8/20 11:00-12:00, 13:00-14:30
8/21 8:00, 10:30-13:00, 14:00-14:30
8/26 17:00
8/27 7:30-8:00
8/28 8:30
8/29 8:00-9:30

There was one high negative turbidity spike on 8/26 23:30 of -207.5 NTU; it is

not consistent with the overall data record. This suspect datum was not deleted, as we are not absolutely sure that this value is bad.

Inlet:

The following were small negative turbidity values (logging period recorded 632 anomalies), possibly due to a small calibration error. These data were not deleted.

8/1 0:00-1:30, 12:30-13:30
8/2 0:30-2:00, 12:30, 13:30, 14:30, 18:30
8/3 0:30-3:30, 7:00, 8:00, 12:30-16:00, 19:00, 23:30
8/4 0:30-4:30, 12:30-17:00, 19:00, 20:00-20:30, 22:30
8/5 0:00-0:30, 1:30-6:30, 8:30, 9:00, 10:00-10:30, 12:30-13:00,
14:00-
18:00, 21:00, 22:00, 23:00-
23:30
8/6 0:00, 1:00-7:30, 9:00, 10:00-11:00, 13:00-19:30, 21:30, 23:00-
23:30
8/7 0:30, 1:00, 2:30-8:00, 11:30-12:30, 14:30-20:30, 23:00-23:30
8/8 3:00-3:30, 4:30-5:00, 6:00-9:00, 15:30-16:30, 17:30-21:00

8/9 4:30, 6:00-10:00, 11:00, 12:00, 13:30, 14:30, 16:30, 18:30,
19:30-
22:00
8/10 5:30, 7:00-12:00, 17:30, 19:00-21:00, 22:00-23:30
8/11 4:00, 9:30-11:30, 12:30, 13:30, 19:30-20:00, 21:00-23:30
8/12 7:30-11:30, 12:30, 19:00-23:30
8/13 0:00-1:00, 7:30-14:00, 15:00-15:30, 19:30, 21:00-22:30, 23:30
8/14 0:30-1:30, 9:30-13:30, 14:30, 15:30, 20:00-20:30, 22:00-23:30
8/15 0:00-2:00, 4:00, 10:30-12:00, 13:00-14:30, 15:30, 20:30,
23:00-23:30
8/16 0:00-2:30, 10:30-15:00, 18:00-18:30, 23:30
8/17 0:00, 1:00-2:00, 10:00, 12:00-15:00, 17:30, 19:30, 20:30,
22:00
8/18 0:00-3:30, 6:30, 7:30, 10:30, 13:30-16:00, 17:00, 19:00,
20:00, 21:00
8/19 0:00, 1:00-2:30, 3:30-4:30, 6:30, 13:00-13:30, 14:30-16:30,
23:30
8/20 1:00-6:00, 14:30-16:00, 17:00
8/21 3:30-6:00
8/26 14:30-23:30
8/27 0:00-3:30, 4:30, 6:00-23:30
8/28 0:00-1:00, 2:00-5:00, 7:00-13:30, 14:30-17:30, 19:00-23:30
8/29 0:00-1:00, 3:00-3:30, 4:30-5:00, 7:30-14:30, 15:30-17:30,
18:30,
20:30-23:30
8/30 0:00-2:00, 3:00, 4:00-6:30, 9:00-9:30, 10:30-18:00, 21:00-
23:30
8/31 0:30-3:00, 4:00, 5:00-7:00, 8:00-9:00, 10:00-21:00, 22:00

Drakes Island Upstream:

The following were small negative turbidity values (logging period
recorded 426
anomalies), possibly due to a small calibration error. These data were
not
deleted.

8/1 1:30, 3:00, 4:00-4:30, 6:00, 7:00-7:30, 15:30
8/2 3:30, 4:30, 6:30, 8:30, 14:00, 17:30
8/3 4:00, 16:00, 17:00
8/4 2:30-5:30, 7:00-8:00, 9:00-9:30, 15:00, 16:30-17:00, 18:00-
20:30
8/5 3:30, 5:00-7:00, 8:00-9:00, 16:00-18:00, 19:00-19:30, 21:00
8/6 6:30-7:00, 8:00-8:30, 9:30, 17:30-20:30, 21:30
8/7 6:30-7:00, 8:00-10:00, 20:30, 22:00-23:00
8/8 0:00, 8:00, 20:00-21:30, 23:00
8/9 10:00, 13:00, 20:30, 21:30-23:00
8/10 0:00-1:00, 2:30-3:00, 4:00, 5:00, 8:30, 10:30, 11:30-12:00,
13:30,
15:00, 21:30-22:30, 23:30
8/11 0:00-4:00, 11:00-11:30, 12:30-14:30, 22:00-23:30
8/12 0:00, 1:00, 2:00-3:30, 11:30, 14:00, 15:30-17:00, 22:30-23:30
8/13 0:00-1:00, 2:00-3:30, 4:30-5:30, 11:30-15:00, 22:30, 23:30
8/14 0:00-2:00, 3:00-4:00, 5:00, 6:00, 11:30, 12:30, 13:30, 15:00,
18:00-
18:30, 23:30
8/15 1:00-6:00, 7:30-9:30, 13:00-13:30, 15:30, 16:30-17:30

8/16 0:30-1:00, 2:00-5:00, 6:00-6:30, 7:30, 13:30-17:00
8/17 1:00-6:30, 13:30-14:30, 15:30-17:00, 18:00-20:00, 23:00
8/18 1:30-6:30, 7:30-8:30, 13:00, 14:00-22:00, 23:00
8/19 1:30-6:30, 7:30-9:00, 14:30-16:30, 18:00-20:00, 21:30
8/20 0:30, 2:30-9:00, 15:30-23:30
8/21 0:30, 3:30-8:30, 9:30, 15:00, 16:00-20:00, 21:00-22:30, 23:30
8/22 0:00-2:00, 4:30-9:00, 11:00
8/28 18:00-18:30, 19:30-21:00
8/29 5:30-6:00, 7:00-10:30, 19:00, 20:00-20:30, 22:00-22:30
8/30 5:30, 7:00-8:30, 9:30, 11:00, 20:00, 21:00-21:30, 22:30-23:30
8/31 0:00-0:30, 6:30-7:00, 8:00-8:30, 9:30-10:00, 11:00, 12:00,

23:00

Drakes Island Downstream:

The following were small negative turbidity values (logging period recorded 273 anomalies), possibly due to a small calibration error. These data were not deleted.

8/1 0:00, 1:00-2:00, 11:00, 12:00, 13:00-14:30, 23:30
8/2 0:30, 1:30-3:00, 11:30, 12:30-15:30
8/3 0:30-4:00, 12:00-16:30
8/4 1:00-5:00, 13:00-17:00
8/5 2:30, 3:30-5:30, 14:30-15:30, 16:30-18:30
8/6 3:00-6:30, 15:30-19:00
8/7 4:00-7:30, 15:30-20:00
8/8 5:30-8:30, 17:00-21:00
8/9 6:30, 7:30-9:00, 17:30-22:00
8/10 7:00-10:30, 18:30-23:00
8/11 8:00-11:30, 19:30, 20:30-23:00
8/12 8:30-12:00, 20:00-23:30
8/13 0:00-0:30, 9:00-12:00, 13:00, 20:30-23:30
8/14 0:00-1:00, 10:00-13:30, 21:30-22:00, 23:00
8/15 0:00-1:30, 10:30, 11:30, 12:30, 13:30-14:00, 23:30
8/16 0:00-1:30, 13:00
8/28 23:00
8/29 0:30, 1:30-2:30, 10:00, 15:00
8/30 11:00-16:00, 23:30
8/31 0:00-4:00, 11:30-16:30

The following were high positive turbidity spikes (>400.0 NTU) that were not consistent with the overall data record. These suspect data were not deleted, as we are not absolutely sure that these values were bad.

8/20 23:30 (1012.3)
8/21 9:30 (1200.5); 12:00 (447.2); 21:30 (436.0); 23:30 (612.6)
8/22 0:00 (1018.9); 8:00 (956.8); 9:30 (1079.1); 10:30 (652.6)

The following were high negative turbidity spikes that were not consistent with the overall data record.

This suspect data were not deleted, as we are not absolutely sure that these values are bad.

8/21 10:00 (-819.4); 11:00 (-1067.1); 20:00 (-816.6); 23:00 (-820.9)

8/22 8:30 (-814.6) to 9:00 (-817.3); 10:00 (-822.0); 11:00 (-825.0)
to
11:30 (-826.8); 12:30 (-829.7) to
13:00 (-831.2); 8/22 23:30 (-822.9)

8/23 0:30 (-822.9) to 1:00 (-823.0); 2:00 (-822.6); 9:00 (-814.7)
The following were a range of positive turbidity spikes (<400.0 NTU, with
an
average of 116.9 not including the above listed high positive and high
negative
values) that were not consistent with the overall data record. These 189
turbidity anomalies were observed from 8/18 23:30 (31.6) continuous
through 8/23
9:30 (303.4), with a mean of 116.9 and a high value of 351.7. The dates
and
times of each anomaly are not listed due to the high number (189) of
readings.
These suspect data were not deleted, as we are not absolutely sure that
these
values were bad.

September, 1996 Sampling Period

Head of Tide:

The following were small negative turbidity values (logging period
recorded 190
anomalies), possibly due to a small calibration error. These data were
not
deleted.

9/3 6:30-13:30
9/4 13:00-13:30, 14:30-15:00
9/5 10:30, 13:30-16:00
9/6 7:00, 8:30-10:00, 11:00-12:30, 13:30-17:30
9/7 7:30, 10:00-18:00
9/8 9:00-10:30, 15:30, 17:00-18:00
9/9 8:00, 14:30, 15:30-16:00, 17:30-18:30
9/10 8:00-9:00, 16:30-18:00, 19:30
9/19 12:00, 13:00-13:30, 18:30-20:00, 21:00-23:30
9/20 0:00, 1:00-2:30, 5:30-14:30, 19:00-23:30
9/21 0:00, 1:00-4:00, 6:30-15:30, 22:30-23:30
9/22 0:30-4:30, 10:00-10:30, 11:30, 13:00-13:30, 14:30, 15:30-16:00
9/23 17:00
9/24 4:30-5:00
9/25 7:00
9/26 17:00, 19:00
9/30 9:30, 10:30-12:00

There were two high negative turbidity spikes on 9/10 1:30 (-292.4 NTU)
and 9/10

21:30 (-303.8 NTU); these were not consistent with the overall data
record.

This suspect data were not deleted, as we are not absolutely sure that
these
values are bad.

No data from 9/12 15:00 to 9/19 10:00 as there was a battery crash. No
data
were recorded.

Inlet:

The following were small negative turbidity values (logging period recorded 1,072 anomalies), possibly due to a small calibration error. These data were not deleted.

9/1 0:00-8:30, 10:00-11:00, 12:00, 13:00, 14:00-17:00, 18:00-21:00, 22:30-23:30

9/2 0:00-0:30, 4:00-10:30

9/3 7:30, 10:00, 15:30-16:00, 17:00-23:30

9/4 0:00-23:30

9/5 0:00-23:30

9/6 0:00-23:30

9/7 0:00-13:30, 14:30-23:30

9/8 0:00-23:30

9/9 0:00, 1:00-2:30, 3:30, 4:30-23:30

9/10 0:00-23:30

9/11 0:00-23:30

9/12 0:00-22:00, 23:00-23:30

9/13 0:00-5:30, 7:30, 13:00, 14:00, 15:00-18:00, 19:00, 23:30

9/14 0:00-3:00, 4:00-8:00, 11:00-20:30, 22:30-23:30

9/15 0:00-4:00, 5:30-22:00, 23:00-23:30

9/16 0:00-10:00

9/19 17:00-19:00, 20:30, 21:30-22:00, 23:00-23:30

9/20 0:00-0:30, 1:30-23:30

9/21 0:00-5:00, 6:00-10:00, 11:30-12:00, 13:00-21:30, 22:30-23:30

9/22 0:00-14:00, 16:00-21:30

9/23 0:00-2:30, 4:00, 5:30-12:30, 13:30-22:00

9/24 0:00-3:00, 4:30-15:00, 16:30-23:00

9/25 0:30-1:00, 2:30-4:30, 5:30-6:00, 7:00-11:30, 12:30-13:00, 14:00, 15:00-16:30, 18:30-23:30

9/26 2:30, 3:30-4:30, 6:30-13:00, 14:00-15:30, 19:00-23:30

9/27 0:00, 1:00, 2:30, 3:30, 6:00, 7:30-13:30, 15:00-16:30, 18:30, 20:00-23:30

9/28 0:00-6:00, 8:00-14:00, 16:00, 20:30, 22:30-23:30

9/29 0:00-3:00, 4:00, 5:00-6:00, 8:30-15:00, 16:00-19:00, 20:00, 21:30-23:30

9/30 0:00-23:30

Drakes Island Upstream:

The following were small negative turbidity values (logging period recorded 560 anomalies), possibly due to a small calibration error. These data were not deleted.

9/1 0:00-1:00, 2:00-6:00, 7:00-9:30, 10:30-11:30, 13:00-15:00, 16:00, 17:30, 18:30-19:00, 20:00, 21:00-22:30, 23:30

9/2 0:00, 1:30-3:00, 5:00-7:30, 8:30-11:00, 13:30

9/3 20:00, 21:30-23:00

9/4 0:30-1:00, 4:30, 5:30-7:00, 9:30-10:00, 13:30-17:00, 18:00-19:00, 21:00-22:00, 23:00-23:30
9/5 0:00, 1:00, 3:00-4:00, 5:00-7:30, 8:30-11:00, 12:00-13:00, 14:00-15:00, 16:00, 17:00-19:00, 20:00, 21:00-21:30, 22:30, 23:30
9/6 0:00-0:30, 1:30, 2:30, 5:30-6:00, 7:00-9:00, 12:30, 14:30-15:30, 18:30-19:30, 20:30, 22:30-23:30
9/7 0:00-1:00, 2:00-2:30, 7:30-8:00, 10:30-11:00, 12:00-13:30, 14:30, 16:00-17:00, 19:00-20:30, 22:00, 23:00-23:30
9/8 0:30-2:00, 8:00, 9:30-12:00, 13:30, 14:30, 15:30-17:00, 18:00-18:30, 20:30-22:00, 23:00
9/9 1:30, 2:30-3:30, 4:30, 8:30-9:00, 10:00, 11:30, 12:30-15:30, 17:30, 20:00-22:30, 23:30
9/10 2:00-4:00, 5:00-7:00, 8:30, 10:30, 11:30, 12:30-13:00, 14:00, 16:00-16:30, 17:30-19:00, 22:30-23:30
9/11 0:30, 1:30-2:00, 3:00, 4:00-5:00, 9:30-10:30, 13:00, 15:00-16:30, 18:00, 20:30, 23:00-23:30
9/12 0:00, 2:30-3:00, 5:00, 6:00-6:30, 8:30, 9:30-12:00, 16:30, 18:00-18:30
9/13 0:00-0:30, 2:30-3:30, 4:30, 5:30-7:00, 8:30, 10:00, 11:00-11:30, 13:00-14:00, 15:00-17:30, 19:00, 20:30, 23:00-23:30
9/14 0:30-2:00, 3:00, 4:30-6:00, 7:00-9:30, 12:00, 13:30, 15:00, 16:00-16:30, 17:30-18:30, 19:30, 22:30
9/15 0:30-1:30, 2:30, 3:30-5:00, 6:00-7:30, 9:00-10:00, 11:30-14:00, 17:30, 19:00, 20:00-20:30, 21:30, 22:30, 23:30
9/16 0:00-0:30, 4:00, 5:30-6:00, 7:00, 8:00-11:00, 12:30-13:00, 14:00-14:30, 16:00-16:30, 17:30-19:30, 20:30-21:30
9/17 3:00-4:30, 5:30, 6:30, 7:30-8:00, 9:00-9:30, 11:00, 14:30-15:30, 16:30, 18:00, 20:00-20:30, 22:30, 23:30
9/18 2:30-3:30, 4:30-6:30, 7:30-8:00, 10:30-11:30, 16:30-17:00, 18:00, 19:30, 20:30, 22:00, 23:00-23:30

9/19 0:30, 4:30, 6:00, 7:30, 8:30, 10:30-11:30, 13:30, 14:30,
16:00-16:30,
17:30, 20:00, 21:00-22:00,
23:30
9/20 0:00-1:30, 4:00, 5:30-6:30, 7:30, 8:30, 10:00-11:00
9/24 9:30-11:00, 12:00, 13:30-14:00, 20:00, 23:30
9/25 0:30-2:00, 3:30-4:00, 5:00-6:00, 11:00-11:30, 12:30-13:00,
14:00,
16:00-18:00, 22:30, 23:30
9/26 0:30-3:00, 4:30-5:30, 7:00, 11:00, 12:00-13:00, 14:00-16:00,
17:00
9/27 0:00, 1:00, 3:30, 5:30, 6:30, 11:00-14:00, 15:00-17:30
9/28 1:00, 2:30, 3:30-7:30, 12:00, 13:00, 15:30, 16:30-18:30
9/29 2:00-2:30, 4:00, 14:30, 15:30-18:30, 19:30
9/30 3:30, 14:30, 15:30-18:00, 20:00

No pH data from 9/1 0:00 to 9/20 11:00 due to a probe malfunction. The values decreased gradually to a reading of 6.3 on 9/20 11:00. After checking the post-calibrations, it was determined the pH probe failed. These data were deleted.

Drakes Island Downstream:

The following were small negative turbidity values (logging period recorded 132 anomalies), possibly due to a small calibration error. These data were not deleted.

9/1 1:00-5:00, 12:30-13:00, 14:00-17:30
9/2 1:00-5:30, 16:00-17:30
9/3 16:30-18:00
9/4 3:30-7:30, 15:00-20:00
9/5 3:30, 4:30-8:30, 16:00-21:00
9/6 5:00-9:30, 15:30, 17:00-22:00
9/7 6:00-10:00, 17:30-23:00
9/8 6:30-11:30

The following were a range of high positive turbidity spikes that were not consistent with the overall data record. These 9 turbidity anomalies were observed from 9/2 20:00 continuous through 9/3 0:00, with a range from 44.8 to 174.8 NTU. The dates and times of each anomaly are not listed due to the high number (9) of readings. These suspect data were not deleted, as we are not absolutely sure that these values were bad. No data from 9/8 18:00 to 9/20 11:30 due to a battery crash.

October, 1996 Sampling Period

Head of Tide:

The following were small negative turbidity values (logging period recorded 644 anomalies), possibly due to a small calibration error. These data were not deleted.

10/1 8:30-13:00
10/2 6:30, 7:30-11:30, 12:30-14:00
10/3 2:30-3:00, 9:00-10:00, 11:00-14:30, 15:30, 17:30, 18:30-23:30
10/4 0:00, 1:00-23:30
10/5 0:00-23:30
10/6 0:00-23:30
10/7 0:00-20:00, 22:00-23:30
10/8 0:00-8:00, 9:30-19:30
10/9 1:00
10/10 17:30-23:30
10/11 0:00-23:30
10/12 0:00-23:30
10/13 0:00-12:00, 13:30-23:30
10/14 0:00-11:30, 15:00-23:30
10/15 0:00-2:30, 3:30-13:00, 14:30-23:30
10/16 0:00-13:00, 16:00-23:30
10/17 0:00-13:30, 20:00-23:30
10/18 0:00-14:00, 22:30-23:30
10/19 0:00-3:30, 8:00-10:30

Logger was also unretrievable (10/19 17:00 to 10/31 17:30) because of the extreme high tide, due to a large storm hitting the northeast coast (10/19-

10/22), where the town 15 miles north of Wells (Biddeford) received approximately 18 inches of rain. The batteries for this sonde crashed and was

unable to retrieve it, until after the storm.

Inlet:

The following were small negative turbidity values (logging period recorded 697

anomalies), possibly due to a small calibration error. These data were not

deleted.

10/1 0:00-5:30, 6:30-23:30
10/2 0:00-23:30
10/3 0:00-10:00, 11:00-23:30
10/4 0:00-23:30
10/5 0:00-17:00, 18:00-18:30, 20:00-23:30
10/6 0:30-11:00, 12:00-18:00, 19:00-23:30
10/7 0:00-23:30
10/8 0:00-23:30
10/9 0:00-0:30, 3:30
10/10 5:00, 14:00-14:30, 15:30-17:00
10/11 11:30, 14:30-18:00, 22:00
10/12 3:00-7:00, 9:30-10:00, 11:00, 12:00-14:00, 15:30-16:00,
17:00-20:00,
21:00-22:30; 23:30
10/13 1:00-1:30, 3:30-6:30, 7:30-13:30, 16:00-21:00, 22:00-23:30
10/14 0:00, 2:30, 5:00-5:30, 6:30-15:00, 18:00-20:00, 21:00-23:30
10/15 0:00-3:30, 4:30-8:00, 9:00, 10:00-20:00, 21:00-23:30
10/16 0:00-6:00, 7:00-17:00, 18:00-19:30, 21:30-23:30
10/17 0:00-23:30
10/18 0:00-7:00, 8:00-20:00, 21:00-21:30, 22:30-23:30
10/19 0:00-7:30, 9:00, 10:00, 11:00-11:30

Turbidity values from 10/22 14:00 to 10/31 23:30 were higher than usual for this length of time (3,868 readings with a range of 88.9 NTU decreasing gradually to 1.2 NTU, mean of 8.5 NTU). This was probably due to a large storm hitting the northeast coast (10/19-10/22), where the town 15 miles north of Wells (Biddeford) received approximately 18 inches of rain. These data were not deleted.

Drakes Island Upstream:

The following were small negative turbidity values (logging period recorded 228 anomalies), possibly due to a small calibration error. These data were not deleted.

10/1 3:00-5:00, 7:00-7:30, 15:00-16:30, 17:30-18:00
10/2 5:00, 6:00, 16:30-19:00
10/3 17:30-19:30
10/4 6:00-6:30, 7:30, 17:30, 18:30, 19:30, 21:00
10/5 7:30-8:00, 9:30, 19:30-20:30, 21:30
10/6 20:30, 21:30-22:30, 23:30
10/7 0:00, 9:00-11:00, 20:00, 21:00-23:30
10/8 1:00, 9:30-10:30, 13:00, 20:30, 21:30-23:00
10/11 12:30, 14:30, 15:30, 17:00
10/12 0:00, 1:00, 2:00, 10:00, 11:30, 12:30, 14:00, 15:00-17:30,
18:30,
19:30, 20:30-21:00
10/13 1:00, 2:00, 3:00, 4:00-5:30, 6:30-7:00, 8:00, 9:30, 11:00-
11:30,
13:00-13:30, 15:00-18:00,
19:00-21:00, 22:00, 23:00
10/14 2:00, 3:00-4:00, 5:00, 7:00-7:30, 16:30, 18:30
10/15 2:30, 3:30, 4:30, 12:30, 13:30, 14:30-15:00, 16:00-18:00,
21:30
10/16 2:30-5:30, 8:00-8:30, 12:30, 14:30-17:00, 18:00-20:30, 21:30,
23:00
10/17 2:30, 3:30-6:30, 7:30-8:30, 9:30, 13:30-23:00
10/18 2:30-3:00, 4:00, 5:00-8:30, 16:00-23:00
10/19 5:00-7:00, 8:30

Logger was also unretrievable (10/20 15:30 to 10/25 16:30) because of the extreme high tide, due to a large storm hitting the northeast coast (10/19-

10/22), where the town 15 miles north of Wells (Biddeford) received approximately 18 inches of rain. The batteries for this sonde crashed and was

unable to retrieve it, until after the storm.

No turbidity data were collected from 10/25 17:00 to 10/31 23:30. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe available for this deployment.

There are suspect pH data from 10/1 00:00 to 10/20 15:00, where pH values dropped gradually to 6.4 and then sharply increased back to normal values.

These data were not deleted. The post-calibration readings were acceptable.

Drakes Island Downstream:

Logger was also unretrievable (10/20 12:30 to 10/25 16:30) because of the extreme high tide, due to a large storm hitting the northeast coast (10/19-

10/22), where the town 15 miles north of Wells (Biddeford) received approximately 18 inches of rain. The batteries for this sonde crashed and was

unable to retrieve it, until after the storm.

No turbidity data were collected from 10/25 17:00 to 10/31 23:30. We had a

malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment.

November, 1996 Sampling Period

Head of Tide:

The following were small negative turbidity values (logging period recorded 424

anomalies), possibly due to a small calibration error. These data were not deleted.

11/18 17:30, 20:00-23:30

11/19 0:00-4:30, 6:30, 7:30-16:30, 20:00-23:30

11/20 0:00-5:00, 9:00-17:30, 21:00-23:30

11/21 0:00-5:00, 11:00-19:30, 21:00-23:30

11/22 0:00-7:00, 8:00, 9:00, 11:30-20:30, 21:30-23:30

11/23 0:00-9:30, 12:30-23:30

11/24 0:00-23:00

11/25 0:00-4:00, 5:00-11:00, 14:00-23:30

11/26 0:00-5:30

11/28 3:00, 4:30-5:00, 6:00-10:00, 11:00-11:30, 12:30-13:00, 14:00, 16:30, 17:30-22:30

11/29 0:00-21:30, 22:30-23:30

11/30 0:00-21:00, 22:30-23:30

Inlet:

No turbidity data collected from 11/19 11:00 to 11/30 23:30 due to a turbidity

probe malfunction. This probe had to be replaced by YSI.

Drakes Island Upstream:

No turbidity data were collected from 11/1 0:00 to 11/30 23:30. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment (this was a continuation from 10/25 17:00).

Drakes Island Downstream:

No turbidity data were collected from 11/1 0:00 to 11/18 11:30. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment (this was a continuation from 10/25 17:00).

No temperature, specific conductivity, salinity, percent saturation, dissolved

oxygen, and pH data from 11/8 18:00 to 11/18 11:00 due to a malfunction of the temperature probe. There was a sharp jump in temperature data on 11/8 18:00

(53.1 degrees) from previous normal readings. In accordance with the YSI manual, all values except depth and turbidity should be viewed as suspect and eliminated from the record, because of the ubiquity of temperature compensation.

The following were small negative turbidity values (logging period recorded 14 anomalies), possibly due to a small calibration error. These data were not deleted.

11/22 7:30-9:00, 11:00, 17:30, 23:30

11/23 9:30-11:30, 23:30

11/24 12:30

There were two high positive turbidity spikes on 11/18 20:00 (73.1) and 20:30

(52.5); these were not consistent with the overall data record. These suspect data were not deleted, as we are not absolutely sure that these values were bad.

The following were a range of high positive turbidity spikes that were not

consistent with the overall data record. These 7 turbidity anomalies were

observed from 11/26 5:30 through 8:30, with a range from 46.1 to 97.2 NTU. The

dates and times of each anomaly are not listed due to the high number (7) of

readings. These suspect data were not deleted, as we are not absolutely sure

that these values were bad.

December, 1996 Sampling Period

Head of Tide:

The following were small negative turbidity values (logging period recorded 345

anomalies), possibly due to a small calibration error. These data were not

deleted.

12/1 0:00-5:30

12/4 18:00, 20:00, 23:30

12/5 2:00, 6:30-7:00, 8:00-8:30, 9:30-10:30, 11:30-15:30, 16:30-17:30, 18:30-23:30

12/6 0:00-1:00, 2:00-2:30, 3:30-12:30, 13:30-14:30, 15:30-16:00, 18:00-23:30

12/7 0:00-2:00, 3:00-20:30

12/10 10:30, 21:00, 23:00-23:30

12/11 1:00, 2:00-2:30, 3:30, 6:00-17:30, 19:00-23:30

12/12 0:00-1:00, 2:30-15:00

12/13 0:00-2:00, 5:00, 7:00, 9:00-9:30, 10:30-15:30, 16:30-20:00,
21:00-
23:30

12/14 0:00-23:30

12/15 0:00-23:30

12/16 0:00-3:00, 4:30, 5:30-6:00, 7:00-9:30

There was one high positive turbidity spike on 12/8 9:00 of 284.5 NTU; it is not consistent with the overall data record. This suspect datum was not deleted, as

we are not absolutely sure that this value is bad.

Inlet:

No turbidity data collected from 12/1 0:00 to 12/17 9:00 due to a turbidity

probe malfunction. This probe had to be replaced by YSI (this was a continuation from 11/19 11:00).

Drakes Island Upstream:

No turbidity data collected from 12/1 0:00 to 12/16 10:00. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment (this was a continuation from 10/25 17:00 and all through November).

Drakes Island Downstream:

The following were two ranges of high positive turbidity spikes that were not

consistent with the overall data record. There were 6 turbidity anomalies were

observed from 12/1 7:30 through 10:00, with a range from 27.2 to 77.0 NTU.

There were also 5 turbidity anomalies observed from 12/8 1:00 through 3:00,

with a range from 84.3 to 221.3. The dates and times of each anomaly are not

listed due to the high number (11) of readings. These suspect data were not

deleted, as we are not absolutely sure that these values were bad.

11. Missing data:

January, 1996 Sampling Period

Head of Tide: No data in January; sonde not deployed until April.

Inlet:

No turbidity data 1/1 0:00 to 1/31 23:30; as turbidity probe was not deployed.

No data on 1/13 14:00 to 1/22 14:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream: No data in January; sonde not deployed until April.

Drakes Island Downstream: No data in January; sonde not deployed until April.

February, 1996 Sampling Period

Head of Tide: No data in February; sonde not deployed until April.

Inlet:

No turbidity data on 2/1 00:00 to 2/16 11:30 due to just receiving the YSI

turbidity probes and turbidity upgrades. Turbidity data began logging on 2/16

12:30.

No data on 2/16 12:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream: No data in February; sonde not deployed until April.

Drakes Island Downstream: No data in February; sonde not deployed until April.

March, 1996 Sampling Period

Head of Tide: No data in March; sonde not deployed until April.

Inlet:

No data on 3/11 16:30 to 17:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream: No data in March; sonde not deployed until April.

Drakes Island Downstream: No data in March; sonde not deployed until April.

April, 1996 Sampling Period

Head of Tide:

No data on 4/1 0:00 to 4/12 16:30; this was the first logger deployment (4/12 at

17:00) at this site.

No turbidity data from 4/16 9:30 through 4/30 23:30 due to turbidity probe malfunction.

DO deleted from 4/12 17:00 to 23:30; first few records are high and appears that

the membrane may have still been settling.

Inlet:

No data on 4/10 18:00 to 4/12 16:30 due to downtime for calibration, maintenance and downloading.

No turbidity data from 4/12 17:00 to 4/25 10:00 because of turbidity probe wiper malfunction.

No data on 4/25 10:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No data on 4/1 0:00 to 4/23 10:30; this was the first logger deployment (4/23 at

11:00) at this site.

Drakes Island Downstream:

No data on 4/1 0:00 to 4/23 10:30; this was the first logger deployment (4/23 at

11:00) at this site.

May, 1996 Sampling Period

Head of Tide:

No turbidity data from 5/1 0:00 through 5/9 8:00 due to turbidity probe malfunction.

No data from 5/9 8:30 to 5/10 16:30 due to downtime for calibration, maintenance and downloading.

Inlet:

No data on 5/16 8:00 to 11:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No data from 5/9 12:30 to 5/10 16:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Downstream:

No data from 5/9 13:30 to 5/13 14:00 due to downtime for calibration, maintenance and downloading.

No turbidity data were collected from 5/13 14:30 to 5/31 23:30 due to turbidity probe malfunction.

June, 1996 Sampling Period

Head of Tide:

No data on 6/6 09:00 due to downtime for calibration, maintenance and downloading.

No dissolved oxygen data or percent saturation data from 6/6 09:30 through 7/1

11:00 due to a suspected DO membrane puncture.

Inlet:

No data on 6/10 10:30 to 15:00 due to downtime for calibration, maintenance and downloading.

No data logged on 6/29 23:00 to 23:30 due to a time gap.

No data on 6/30 7:30 to 23:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No data on 6/4 13:30 to 18:00 and 6/5 0:00 to 6/7 14:30 due to a battery crash;

and due to downtime for calibration, maintenance and downloading.

Drakes Island Downstream:

No turbidity data were collected from 6/1 0:00 to 6/7 9:30 due to turbidity

probe malfunction. This probe had to be replaced by YSI (this was a continuation from 5/13 14:30).

No data on 6/7 10:00 due to downtime for calibration, maintenance and downloading.

July, 1996 Sampling Period

Head of Tide:

No dissolved oxygen data or percent saturation data from 6/6 09:30 through 7/1

11:00 due to a suspected DO membrane puncture.

No data on 7/1 11:30 because YSI was out of the water.

No data on 7/22 10:00 to 15:30 due to downtime for calibration, maintenance and downloading.

Inlet:

No data on 7/1 0:00 to 14:30 due to downtime for calibration, maintenance and downloading.

No data on 7/6 10:00 due to suspect of sonde probes being out of the water.

No data on 7/22 10:30 to 15:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No data on 7/2 8:00 to 16:30 due to downtime for calibration, maintenance and downloading.

No data on 7/23 10:30 to 15:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Downstream:

No data on 7/2 7:30 to 16:00 due to downtime for calibration, maintenance and downloading.

No data on 7/23 10:30 to 7/24 9:00 due to downtime for calibration, maintenance and downloading.

August, 1996 Sampling Period

Head of Tide:

No data on 8/21 16:00 to 8/26 14:00 due to downtime for calibration, maintenance and downloading.

Inlet:

No data on 8/21 16:30 to 8/26 14:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No data on 8/22 16:30 to 8/28 9:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Downstream:

No data on 8/23 10:00 to 8/28 16:30 due to downtime for calibration, maintenance and downloading.

September, 1996 Sampling Period

Head of Tide:

No data from 9/12 15:00 to 9/19 10:00 as there was a battery crash. No data were recorded.

Inlet:

No data from 9/16 11:30 to 9/19 16:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No pH data from 9/1 0:00 to 9/20 11:00 due to a probe malfunction.

No data from 9/20 11:30 to 14:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Downstream:

No data from 9/8 18:00 to 9/20 11:30 due to a battery crash; and due to downtime for calibration, maintenance and downloading.

October, 1996 Sampling Period

Head of Tide:

No data from 10/19 11:00 to 10/31 17:30 due to downtime for calibration, maintenance and downloading. Logger was also unretrievable.

Inlet:

No data from 10/19 17:30 to 10/22 13:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No data from 10/20 15:30 to 10/25 16:30 due to downtime for calibration, maintenance and downloading. Logger was also unretrievable.

No turbidity data were collected from 10/25 17:00 to 10/31 23:30. We had a

malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment.

Drakes Island Downstream:

No data from 10/20 12:30 to 10/25 16:30 due to downtime for calibration, maintenance and downloading. Logger was also unretrievable.

No turbidity data were collected from 10/25 17:00 to 10/31 23:30. We had a

malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment.

November, 1996 Sampling Period

Head of Tide:

No data from 11/18 14:30 to 16:00 due to downtime for calibration, maintenance and downloading.

Inlet:

No data from 11/19 8:30 to 10:30 due to downtime for calibration, maintenance and downloading.

No turbidity data collected from 11/19 11:00 to 11/30 23:30 due to a turbidity

probe malfunction. This probe had to be replaced by YSI.

Drakes Island Upstream:

No turbidity data were collected from 11/1 0:00 to 11/30 23:30. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe

available for this deployment (this was a continuation from 10/25 17:00).

No data on 11/18 14:00 due to downtime for calibration, maintenance and downloading.

Drakes Island Downstream:

No turbidity data were collected from 11/1 0:00 to 11/18 11:30. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe available for this deployment (this was a continuation from 10/25 17:00). No temperature, specific conductivity, salinity, percent saturation, dissolved oxygen, and pH data from 11/8 18:00 to 11/18 11:00 due to a malfunction of the temperature probe. No data on 11/18 11:30 due to downtime for calibration, maintenance and downloading.

December, 1996 Sampling Period

Head of Tide:

No data from 12/16 10:00 to 12/31 23:30. This datalogger was pulled for the year (winter months) to prevent ice damage.

Inlet:

No turbidity data collected from 12/1 0:00 to 12/17 9:00 due to a turbidity

probe malfunction. This probe had to be replaced by YSI (this was a continuation from 11/19 11:00).

No data on 12/17 9:30 due to downtime for calibration, maintenance and downloading.

Drakes Island Upstream:

No turbidity data collected from 12/1 0:00 to 12/16 10:00. We had a malfunctioning probe that was sent back to YSI for repair; did not have a probe available for this deployment (this was a continuation from 10/25 17:00 and all through November).

No data from 12/16 10:30 to 12/31 23:30. This datalogger was pulled for the year (winter months) to prevent ice damage.

Drakes Island Downstream:

No data from 12/16 10:00 to 12/31 23:30. This datalogger was pulled for the year (winter months) to prevent ice damage.

12. Other Remarks/Notes:

-We began measuring turbidity as soon as the data loggers were upgraded at

YSI. The first turbidity measurement was taken at the inlet (IN) site on February 16, 1996 at 12:30, and has been ongoing; and began with the HT, UP, and DN data loggers since their first 1996 deployment in April.

-Turbidity values for the inlet (IN) logger from 10/22 14:00 to 10/31

23:30 were higher than usual for this length of time (3,868 readings with a

range of 88.9 NTU decreasing gradually to 1.2 NTU, mean of 8.5 NTU). This was probably due to a large storm hitting the northeast coast (10/19-10/22), where the town 15 miles north of Wells (Biddeford) received approximately 18 inches of rain. These data were not deleted.

-In October the Head of Tide (HT), Drakes Island Upstream (UP), and Drakes Island Downstream (DN) loggers were all unretrievable because of the extreme high tide, due to a large storm hitting the northeast coast (10/19-10/22), where the town 15 miles north of Wells (Biddeford) received approximately 18 inches of rain. The batteries for all sondes crashed and was unable to retrieve these sondes, until after the storm.