WELLS (WEL) National Estuarine Research Reserve Water Quality Metadata
January-December 2005
Latest Update: August 13, 2020
I. Data Set & Research Descriptors

1). Principal investigator & contact persons

Address:
Wells NERR, 342 Laudholm Farm Road Wells, ME 04090
Phone: (207)646-1555
FAX: (207)646-2930

Contact Persons:
Dr. Michele Dionne, Research Coordinator
E-mail: dionne@wellsnerr.org
Phone: (207) 646-1555 ext. 136

Jeremy Miller, Research Associate
E-mail: jmiller@wellsnerr.org
Phone: (207) 646-1555 ext. 102

2). Entry verification

The data are directly downloaded in the YSI-PC6000 format (as a .dat file) and the Comma Delimited format (as a .csv file) from the dataloggers to a PC lap-top. The data are reviewed using the PC6000 software (Eco-Watch). Graphs and basic statistics are then generated with the Eco-Watch program and the information is viewed 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 Dell Inspiron 4100 (before September 2004), or Panasonic CF-28 (after September 2004), where all files are reviewed and formatted for CDMO and stored. Here the raw unedited .csv data files are imported into Microsoft Excel 2000. After a complete month of data has been recorded, each file is ready to review, which requires several steps. The NERR CDMO Excel macros contained in the file “EQWinFormat.xls” are used for all data. Back up copies of all files are stored on a Maxtor One-Touch external hard drive, and the Wells NERR server.

The CDMO supplied macros are explained in the following quote from the CDMO NERR SWMP Data Management Manual (Version 5.1):
“The EQWin format macro will perform the following tasks:
a) Automatically check that the parameters are in the correct order (see Chapter 6 Overview of data collection for correct order).
b) Create a corrected timestamp column that reports the hours and minutes to the exact half- or quarter-hour and removes seconds.
c) Convert depth values recorded in feet to meters.
d) Format each parameter value to the correct number of decimal places.
e) Assign the file an identifying station code.”

Data is then put into a single Excel file, viewed, graphed and reviewed for discontinuities and any other anomalies. EQWin software is used to conduct further data checks, with the use of CDMO supplied queries. Anomalous data are investigated for validity based on field observations, instrument diagnostics and external checks by a YSI model 85 handheld. Data which are clearly erroneous are then removed from the data file, with deletions noted in section 12 below.

Data which appear to be anomalous but cannot be verified as such are left in the dataset, and documented in section 11 below.

The use of the Version 4.0 of the National Estuarine Research Reserve (NERR) System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in December 2005 when they became available. Data review and validation followed the subsequent CDMO NERR SWMP Data Management Manual (Version 5.1) released in December 2004. All Data QA/QC was performed by Jeremy Miller.

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 physicochemical 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 un-impacted, located just east of the Route One Bridge, and is our roving site. We also collect data at the Mile Road site, which is our creek site, as well as the Little River Mouth site, which is our comparative system site.

4). Research Methods

The Wells NERR YSI monitoring program began in April 1995 at one site (Head of Tide site-HT) and May 1995 at a second site (Inlet site-IN) in the Webhannet River estuary. Two additional sites were added in 2002, Mile Road (ML) site began in March in the Webhannet River estuary and Little River Mouth (LM) in April in the Merriland/Branch/Little River Estuary. For 2004, the Mile Road (ML) site was eliminated and a new site at Skinner Mill (SM) in the Merriland/Branch/Little River Estuary was added. Three data loggers (IN, LM, HT) are installed with bottom moorings, as described below. One data logger (SM) is installed horizontally. All data loggers have 1/4 inch black vector mesh wrapped on the outside of the probe protective housing (using rubber bands) of the sonde guard to prevent fouling and unwanted animals. All deployment structures (PVC tubes) described below are labeled with the Wells NERR information.

*IMPORTANT CHANGE TO ALL SITES: In 2004, the YSI Extended Deployment System was used for all deployments. This system consists of a small brush that sweeps all

the probes (except for depth) prior to each reading, greatly reducing the problem of biofouling. The Extended Deployment System is reflected in the “EDS” in the sonde model number.

The Inlet site (IN) deployment methods are different than the other sites (SM, HT, LM), due to the installation of a YSI telemetry unit in 1998. A 23 foot, 4 inch diameter high grade PVC tube was installed against a dock piling. Four steel flat bars with bolts were used to attach this 23 foot PVC tube against the dock piling. A 3 by 1.5 inch PVC transducer was glued on the inside bottom of the PVC tube to allow the sonde to sit exactly 1.0 meter (3.28 ft) off the bottom. Several vertical holes, representative of the sonde guard, were cut out the circumference near the bottom of the PVC pipe to allow water flow to the probes. An "L" shaped steel bar with two end-holes is placed through two created slits about a half foot from the top of the PVC tube. A stainless steel wire (1/16") is attached to the sonde bail using two stainless steel clips; and to one end of the "L" shaped steel bar for sonde deployment and retrieval. A marine lock is attached through the other end of the "L" shaped steel bar to hold the bar, wire, and sonde in place and for security. A PVC threaded cap screws in to the threaded top of the PVC tube, also for security. A hole was created in the PVC cap to allow the sonde to hook up with the telemetry unit using the 50 foot vented cable

Two other sites, Head of Tide (HT) and Little River Mouth (LM) are deployed similarly, except for sonde height off the bottom (see below). These sites use a 5 foot, 4 inch diameter high grade PVC tube. The PVC tube is attached to a 12 foot, heavy steel sign post using a stainless steel bolt at the bottom of the tube, a stainless steel cable wrap at the top, and several thick electrical cable ties in between. The steel sign post was pounded in about 6 feet into the river bottom, such that the bottom of the PVC tube was flat on the river bottom. The PVC tube has one 3 by 1.5 inch PVC transducer glued on the inside bottom of the PVC tube to allow the sonde to sit exactly at a certain height off the bottom (see below). Several vertical holes, representative of the sonde guard, were cut out the circumference near the bottom of the PVC pipe to allow water flow to the probes. An "L" shaped steel bar with two end-holes is placed through two created slits about a half of foot from the top of the PVC tube. A stainless steel wire (1/16") is attached to the sonde bail using two stainless steel clips; and to one end of the "L" shaped steel bar for sonde deployment and retrieval. A marine lock is attached through the other end of the "L" shaped steel bar to hold the bar, wire, and sonde in place and for security. A flotation buoy is tied to the PVC tubes incase the deployment structure ever gets dislodged. The deployment depth for these sites is such that the probe-end of the data logger is secured 0.30 meters (1.0 ft) off the bottom.

The Skinner Mill (SM) site, located just below the crossing of Skinner Mill Road with the Merriland River, a tributary to the Merriland/Branch/Little River estuary, was a new site in 2004. Due to low water levels and a rock substrate, the sonde is installed horizontally. It uses a 5 foot, 4 inch diameter high grade PVC tube with several longitudinal holes cut to allow water flow to and through the sonde guard. The tube is attached to two steel trapezoidal weights (window weights) which held the probes 10 inches off the bottom of the stream. Although every effort was made to place the sonde in the same place each deployment, it was not immovable. Thus, depth data may not exactly correspond from one deployment to the next, or even during deployments if the sonde had to be moved due to exceptionally high or low water (the timing and direction of all these movements are noted below).

Deployment and Data Intervals:

Two to four week variable sampling periods were chosen for all data sondes due to limitations created by the life of the dissolved oxygen membrane, probe fouling, limited battery power, and to minimize risk of lost data in the event of a malfunction. Measurements of temperature, specific conductivity, salinity, percent saturation, dissolved oxygen, depth, pH, and turbidity are recorded at 30 minute intervals throughout the deployment period.

Calibration and Standards Used:
After the deployment period, the data logger is 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 used for specific conductivity (10 mS/cm), pH (buffer solutions of pH 4, 7, and 10), and turbidity (123 NTU). The pH standards are purchased from Fisher Scientific. Conductivity and turbidity standards are purchased from YSI, Inc. The dissolved oxygen membranes are replaced and sit 6-24 hours before each deployment. During periods when we have an idle YSI logger, the deployments are continuous (retrieved logger is immediately swapped with a newly deployed logger). If no idle logger is available (for example, it is away for repair), after approximately 6-24 hours of down time for cleaning, maintenance and recalibration, the YSI Data logger is redeployed for another sampling period.

QA/QC of Instruments:
At each deployment and retrieval, a YSI Model 85 handheld unit collects temperature, DO mg/L, DO %, and salinity. These parameters are recorded on the calibration/deployment/retrieval data sheets and compared to the YSI data. In addition, at the end of each deployment, the data is immediately downloaded and a graph viewed of the data to look for periods of missing or anomalous data. “Post-calibration” data (using calibration standards) are also recorded, to verify that the probes are still measuring accurately after retrieval. The use of the newest (Version 3.0) National Estuarine Research Reserve (NERR) System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in December 2000 when they became available.

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 NERR 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 in the Webhannet River Estuary 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 watershed for the Little River estuary covers an area of 84 sq. km and has a total of 2 tributaries. The backbarrier system in the Little River Estuary is approximately 2.51 sq. km and is composed of large intertidal

marshes (predominantly S. patens and S. alterniflora), intertidal sand and mud flats, and tidal channels. 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 Little River is connected to the ocean by an unstructured, double spit system and is one of the few tidal inlets along the southern Maine coast that is not stabilized by either natural outcrops or artificial jetties. 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. These estuarine systems are 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 rivers' 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 Merriland River and Branch Brook meet south of Route 9 to form the Little River which drains an area of 10.75 sq. 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).

The following information regarding annual weather patterns in the area was supplied by Maine State Climatologist Professor Gregory A. Zielinski extracted from "Monthly Station Normals of Temperature, Precipitation, Heating and Cooling Degree Days 1971-2000", Climatography of the United States No. 81, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC. and "Daily Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000", Climatography of the United States No. 84: "Average monthly temperatures range from 21.6F in January to 66.7F in July with daily highs averaging just below freezing in January and lows around 11F. Daily highs in July average around 76F and daily lows around 57F. The sea breeze often keeps daily highs lower during the summer than areas inland. Annual average temperature is 44.6F. Annual precipitation is 47.07 inches, including the water equivalent of snowfall, with monthly averages ranging from 3.01 inches in July to 4.77 inches in October. August receives just 3.02 inches on average. Annual snowfall is around 66 inches." According to Zielinski, "cool ocean temperatures keep down the number of afternoon showers and especially thunderstorms resulting in low summer precipitation amounts."

There are two sampling sites in the Webhannet River estuary. These are located at the Head of Tide (HT) and at the Webhannet Harbor Inlet (IN). The tidal range at each of these sites is 2.6-2.9 meters.

The Head of Tide site (43 deg 17' 54.25227" N Latitude, 70 deg 35' 13.82728" W Longitude) is located 4 miles south of the Wells Reserve, just downstream of the Webhannet Falls (freshwater) and 10 feet east of Route One. 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 headwaters of the Webhannet are relatively undeveloped. This site is located just 10 feet east of the Route One bridge, and is our roving site.

The Skinner Mill (SM) site is located approximately 20 meters downstream from the intersection of the Merriland River (tributary to Merriland/Branch/Little River estuary) and Skinner Mill Road (at 43 deg 20' 47.69" N Latitude, 70 deg 33' 14.21" W Longitude). This site is approximately 3 meters downstream from the Watershed Evaluation Team (Educational water quality program at Wells NERR) site L5. Substrate is rock, salinities are always less than 1 ppt. Originally, the site was thought to have some tidal influence, although the data appears to show otherwise. We found that there was no tidal influence (depth or salinity) at this site and have since moved it approximately 200 yards downstream for the 2006 WQ collection to better emulate a head of tide scenario as well as make the site suitable for telemetry. There is little to no pollution occurring at this site.

The Inlet site is located 1.5 miles south of the Wells Reserve, at the Wells Harbor pier (43 deg 19' 12.44804" Latitude, 70 deg 33' 13.82728" 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 maximum depth of the Inlet site is 3 meters. 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 Little River Mouth site is located 0.4 miles from the Wells Reserve. The tidal range of the Little River estuary is 2.6-3.0 meters (Mariano and FitzGerald, 1988). The Little River sites existed in a shallow and relatively pristine system with a sandy to mud bottom and a salinity range of 0-32 ppt. There are two major freshwater inputs, the Merriland and Branch Brook Rivers, which converge to form the Little River.

6). Data collection period

Deployment and retrieval dates and times, model YSI 6-series sonde used for 2005:

BEGAN	ENDED	SONDE MODEL
Inlet Site (site code: IN)		
12/21/04, 10:30	01/10/05, 10:30	6600EDS-SV
01/10/05, 11:30	01/21/05, 10:00	6600EDS-SV
01/21/05, 11:00	02/25/05, 14:00	6600EDS-SV
02/25/05, 15:00	03/11/05, 11:30	6600EDS-SV
03/11/05, 12:00	04/06/05, 09:30	6600EDS-SV *
04/06/05, 10:30	04/27/05, 14:00	6600EDS-SV
04/27/05, 14:30	05/25/05, 11:00	6600EDS-SV
05/25/05, 13:00	06/27/05, 16:00	6600EDS-SV
06/28/05, 15:00	07/20/05, 10:00	6600EDS-SV
07/20/05, 10:30	08/16/05, 08:00	6600EDS-SV
08/16/05, 08:30	09/02/05, 09:30	6600EDS-SV
09/02/05, 10:00	09/28/05, 09:00	6600EDS-SV
09/28/05, 09:30	10/28/05, 08:30	6600EDS-SV
10/28/05, 09:30	11/17/05, 10:30	6600EDS-SV
11/17/05, 11:00	12/14/05, 09:30	6600EDS-SV
12/14/05, 10:00	01/05/06, 03:30	6600EDS-SV

Head of Tide Site (site code: HT)

03/22/05, 16:00	04/18/05, 12:30	6600EDS
04/18/05, 13:00	05/04/05, 13:00	6600EDS
05/04/05, 13:30	05/31/05, 09:30	6600EDS
05/31/05, 18:30	06/30/05, 09:30	6600EDS
06/30/05, 10:00	07/26/05, 10:00	6600EDS
07/26/05, 10:30	08/25/05, 09:30	6600EDS
08/25/05, 10:00	09/07/05, 10:00	6600EDS
09/07/05, 10:30	09/30/05, 09:00	6600EDS
09/30/05, 09:30	11/01/05, 13:30	6600EDS
11/01/05, 14:00	12/01/05, 11:00	6600EDS
12/01/05, 11:30	12/15/05, 12:00	6600EDS

Skinner Mill Site (site code: SM)

03/22/05, 11:30	04/15/05, 11:30	6600EDS
04/15/05, 12:0O	05/03/05, 08:30	6600EDS
05/03/05, 09:30	06/01/05, 18:00	6600EDS
06/02/05, 13:00	07/01/05, 10:30	6600EDS
07/01/05, 11:00	07/27/05, 10:00	6600EDS *
07/27/05, 11:30	08/26/05, 09:30	6600EDS
08/26/05, 10:30	09/22/05, 09:30	6600EDS
09/22/05, 09:30	10/12/05, 13:30	6600EDS
10/12/05, 13:30	11/03/05, 10:30	6600EDS
11/03/05, 11:00	12/06/05, 16:O0	6600EDS
12/06/05, 16:30	12/20/05, 11:00	6600EDS

Little River Mouth Site (site code: LM)

03/23/05, 17:00	04/20/05, 13:00	6600EDS
04/20/05, 13:30	05/11/05, 08:30	6600EDS
05/11/05, 09:00	06/07/05, 16:30	6600EDS
06/08/05, 10:30	07/06/05, 18:00	6600EDS
07/06/05, 18:30	08/09/05, 08:30	6600EDS
08/09/05, 09:00	09/01/05, 09:30	6600EDS
09/01/05, 10:00	09/27/05, 14:30	6600EDS
09/27/05, 15:00	10/26/05, 13:30	6600EDS
10/26/05, 14:00	11/29/05, 14:30	6600EDS
11/29/05, 15:00	12/23/05, 10:30	6600EDS *

* Intermittent data collected due to low battery

7). Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program:

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only

as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page http://cdmo.baruch.sc.edu/. Data are available in text tab-delimited format.

8). Associated researchers and projects

WELLS NATIONAL ESTUARINE RESEARCH RESERVE RESEARCH AT THE RESERVE for 2005 (Please visit our website: www.wellsreserve.org/research.htm for further information on the Wells NERR research program):

The Research Program at the Wells NERR conducts and supports research, monitoring, workshops, and research/resource management planning of relevance at local, regional and national levels. The overall aim of our work is to produce science-based information needed to sustain or restore Gulf of Maine coastal habitats and resources, especially those found in salt marsh estuaries and watersheds. During 2003-2004 many different studies involving scores of scientists, students, staff and volunteers focused on several related themes: 1) the quality of water resources in salt marsh estuaries and watersheds 2) land conservation strategies to protect coastal watersheds 3) factors controlling salt marsh accretion, erosion and plant community vigor 4) the value of salt marsh as habitat for fish, shellfish and birds, 5) restoration of salt marsh habitat degraded through human actions, and 6) understanding the ecology and functions of salt marsh habitat.

Estuarine Water Resource Quality

Water quality is monitored continuously at several stations with automated instruments as part of a NERRS systemwide monitoring program, as well as bimonthly at 15-20 stations through our WET volunteer monitoring program. The WET program also monitors two important biological parameters: fecal coliform bacterial contamination (an indicator of human health risk) and phytoplankton productivity (an indicator of estuarine health). These data have 1) allowed us to identify several bacterial "hot spots" that we will be working to eliminate, 2) are used to identify and open areas safe for shellfishing, and 3) have uncovered a relation between tides and low dissolved oxygen (a stressful condition for marine life) that needs further study. Our water quality work has contributed to the designation of several Priority Watersheds in coastal Southern Maine by the Maine Department of Environmental Protection.

Seacoast Watershed Information Manager (Project S.W.I.M.)

The Seacoast Watershed Information Manager (Project S.W.I.M.) will be an online resource to help local planners and the public evaluate, conserve, and restore coastal watershed resources along the Maine and New Hampshire seacoast by developing a website that describes the region and its resources, provides access to GIS data and other relevant information, and includes a decision-

support tool that examines the impact of growth and development on water resources. It will include:

- A Narrative that informs local resource planners and the public by describing development impacts, water resources, and land use.
- Socioeconomic Analysis focused on water resource use as it relates to human activities.
- Land Use Change Assessments focusing on shoreland and permeability.
- A Data Clearinghouse providing users access to key data needed for local and regional-scale resource management.
- A GIS-based Decision Support Tool to help communities manage and protect water resources by considering how water supply, water quality and land use change are affected by land use planning decisions.

The Project focuses on the coastal watersheds from the Cocheco and Salmon Falls River in New Hampshire to the Kennebunk River in Maine. These 15 watersheds include 38 municipalities and cover 1,800 square miles. The Wells National Estuarine Research Reserve is the lead partner with support from NOAA's Coastal Services Center Landscape Characterization and Restoration Program and the Great Bay National Estuarine Research Reserve.

Salt Marsh Habitats and Communities

Factors that control the dynamics and vigor of salt marsh plant communities and marsh peat formation consequently determine the ability of a salt marsh to persist in the face of sea level rise. Through a combination of experimental manipulations and long term monitoring, a number of multi-year studies are currently producing data to answer questions concerning the sustainability of salt marsh habitats in this region. These studies are looking at nutrient-plant relations, plant community responses to physical and hydrologic disturbance, and the relative contribution of short-term natural events (e.g. storms) and human activities (dredging, tidal restriction) on patterns of sediment accretion and erosion. The Reserve's marshes and beaches are already among the best studied sites in the U.S. with regard to long term accretion and erosion (over thousands of years).

HABITAT VALUE FOR FISH, SHELLFISH AND BIRDS

The Reserve combines long-term monitoring with periodic surveys and short-term experiments to identify species and measure trends and changes in populations of fish, crustaceans, clams and birds. We have 10 years of data on upland and shore birds with which to assess the status of resident and migratory avian populations, and several years of wading bird data that we use as a gross level indicator of salt marsh health, which appears to be stable. Our periodic larval, juvenile and adult fish surveys have produced the best available data for fish utilization of salt marsh estuaries in the Gulf of Maine. Since 1994 we have been conducting surveys and field experiments to look at the survival and growth of hatchery seed, juvenile and adult softshell clam with regard to habitat characteristics and predation by the invasive green crab. Benthic invertebrates have been sampled from a number of marshes from Wells to Casco Bay in hopes of gaining a better understanding of invertebrate assemblage and their value to higher trophic levels.

Salt Marsh Degradation and Restoration

Salt marsh ecosystems in the Gulf of Maine have sustained themselves in the face of sea-level rise and other natural disturbances for nearly five thousand

years. Since colonial times large areas of salt marsh (up to half of the total area) have been lost through diking, draining and filling. Today, the remaining marshland is fairly well protected from outright destruction, but during the past 100 years, and especially since the 1950's, salt marshes have been divided into fragments by roads, causeways, culverts and tide gates. Most of these fragments have severly restricted tidal flow, leading to chronic habitat degradation and greatly reduced access for fish and other marine species. Since 1991, the Wells Reserve has been studying the impact of these restrictions on salt marsh functions and values, and the response of salt marshes to tidal restoration. We have been working to promote an awareness of the damage being done and the benefits of salt marsh restoration throughout the Gulf of Maine.

Research Program Update: In addition to the Reserve-sponsored projects outlined above, numerous visiting investigators will be involved in on-site research. Topics include: the effects of land use, sea level, and climate on estuarine productivity; the relationship between soil nutrients and plant community patterns; the influence of soil salinity on plant community interactions; the effect of tidal restriction on marsh peat accretion; the comparative ecology of fringe marshes and back barrier marshes; habitat use by upland birds, and the ecology of lyme disease.

"Ecological Functions of Fringing Salt Marshes Susceptible to Oil Spills in Casco Bay, Maine". We examined the ecological function of 9 different fringing marsh systems in Casco Bay that ranged from undisturbed to disturbed. Physical parameters measured included sedimentation rates, total suspended solids, and tidal range. Biological parameters included primary production, macroinvertebrate community composition and secondary production (4cm sediment cores), and resident and transient nekton community composition (fyke net). The project is still under way.

The Wells NERR Research Department also worked on the following project: In partnership with the York Rivers Association and the Town of York, the Wells Reserve conducted a survey of the York River watershed. In this survey, volunteers looked for sources of pollution within a 250-foot buffer of the river and its tributaries (erosion, trash and debris and runoff from roads and lawns could have a negative impact on water quality). Most pollutants entering water bodies come from such undefined sources. Therefore, this type of survey is the best way to begin to address the problems of pollution in a water body. The idea of the project was to work with the community and landowners to help them understand the problems that come from these types of pollution and learn activities they might be able to do on their own land that would help prevent this pollution from entering the water. The results of the survey will become part of a Watershed Management Plan to improve and restore the water quality of the York River.

The Wells NERR Research Dept. is involved with the following CICEET* Projects:

Project Title: Estuarine Responses to Dredging: Analysis of Sedimentary and Morphological Change in Back Barrier Marsh to Aid Local Management and Develop a Regional Management Tool Principal Investigator (s): Michele Dionne, Wells NERR, ME; Duncan Fitzgerald, Boston University; Joe Kelley, University of Maine; David Burdick and Larry Ward, University of New Hampshire
Management Issue: Coastal management tool for assessing the impacts of dredging in estuaries. Project Summary: An adequate supply of sediment is essential for maintaining salt marshes. Human activities, such as channel dredging and tidal restriction due to road construction, can alter water flows in estuaries and

result in dramatic changes in salt marsh sediment supply, affecting the speed of salt marsh erosion. The objective of this project is to determine the impact of dredging and tidal restriction on salt marshes in the Wells NERR. A digital coastal management guide will be created on CD ROM, providing coastal managers with useful conceptual models for predicting the impacts of dredging and other activities that affect water flow and sediment deposition in salt marshes.

June Ficker Project Title: Monitoring avian productivity and survivorship

Outside Researchers: Theresa Theodose, Ph.D., University of Southern Maine Project Title: Relationships between soil nutrient availability and species composition of a high salt marsh in southern Maine.

David Burdick, Ph.D. and Roelof Boumans, Ph.D. University of New Hampshire, University of Maryland Project Title: Sediment dynamics in salt marshes: functional assessment of accretionary biofilters

Peter Rand, M.D., Chuck Lubelczyk, Robert Smith, M.D. Maine Medical Center Project Title: Ecological determinants of the spread of the tick vector of Lyme disease and other pathogens.

II. Physical Structure Descriptors

9). Sensor Specifications

Following specifications for 6600EDS and 6600EDS-SV data loggers are taken from YSI 6-Series Environmental Monitoring Manual, Appendix M (undated).

Date
Sensor Type: NA
Range: 1-12, 1-31, 00-99 (Mo,Day,Yr)
Resolution: 1 mo, 1 day, 1 yr
Accuracy: NA

Time
Sensor Type: NA
Range: 0-24, 0-60, 0-60 (Hr,Min,Sec)
Resolution: 1 hr, 1 min, 1 s
Accuracy: NA

Temperature
Sensor Type: Thermistor
Range: -5 to 45 (c)
Resolution: 0.01 C
Accuracy: +/-0.15C

Specific Conductivity
Sensor Type: 4 electrode cell with autoranging
Range: 0-100(mS/cm)
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependent)
Accuracy: +/-0.5% of reading + 0.001mS/Cm

Salinity
Sensor Type: calculated from conductivity and temperature
Range: 0-70 ppt
Resolution: 0.01 ppt
Accuracy: +/-1.0% of reading or + 0.1 ppt whichever is greater

Dissolved oxygen, % saturation
Sensor Type: Rapid pulse – Clarke type, polarographic
Range: 0 – 500% air saturation
Resolution: 0.1% air saturation
Accuracy: 0-200% air saturation, +/-2% of the reading or 2% air saturation, whichever is greater; 200-500% air saturation, +/-6% of reading

Dissolved oxygen, mg/L (calculated from % air saturation, temperature and salinity)
Sensor Type: Rapid pulse – Clarke type, polarographic
Range: 0 – 50 mg/L
Resolution: 0.01 mg/L
Accuracy: 0-20 mg/L, +/-2% of the reading or 2 mg/L, whichever is greater; 200-20-50 mg/L, +/-6% of reading

Level for 6600EDS shallow (non-vented):
Sensor Type: stainless steel strain gauge
Range: 0 – 30 ft (9.1 m)
Resolution: 0.001 ft (0.001 m)
Accuracy: +/-0.06 ft (0.018 m)

Level for 6600EDS shallow (vented):
Sensor Type: stainless steel strain gauge
Range: 0 – 30 ft (9.1 m)
Resolution: 0.001 ft (0.001 m)
Accuracy, 0-10ft: +/-0.01 ft (0.003 m)
Accuracy, 10-30ft: +/-0.06 ft (0.018 m)

pH
Sensor Type: Glass combination electrode
Range: 0-14 units
Resolution: 0.01 units
Accuracy: +/-0.2 units

Turbidity (probe model 6136)
Sensor Type: Optical, 90 degree scatter, with mechanical cleaning
Range: 0-1000 NTU
Resolution: 0.1 NTU
Accuracy: +/- 5% of reading or 2 NTU (whichever is greater), relative to calibration standards

Chlorophyll
Sensor Type: Optical, fluorescence, with mechanical cleaning
Range: 0-400µg/L Chl; 0-100 Percent Full Scale (%FS) Fluorescence Units
Resolution: 0.1 µg/L Chl; 0.1 %FS
Accuracy: No specifications provided

DISSOLVED OXYGEN QUALIFIER: The reliability of the dissolved oxygen (DO) data after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Many reserves have upgraded to the YSI 6600 EDS data sondes, which increases DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should

also be noted that the amount of fouling is very site specific and that not all data are affected. The Research Coordinator at the specific NERR site should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor.

DEPTH QUALIFIER: The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Both sensors measure water depth, but by convention, level sensors refer to atmospherically vented measurements and depth refers to non-vented measurements. Standard calibration protocols for the non-vented sensor use the atmospheric pressure at the time of calibration. Therefore, changes in atmospheric pressure between calibrations appears as changes in water depth. The error is equal to approximately 1.03cm for every 1 millibar change in atmospheric pressure. This error is eliminated for level sensors because they are vented to the atmosphere throughout the deployment time interval. If proper atmospheric pressure data are available, non-vented sensor depth measurements can be corrected for deployments between calibrations. Readings for both vented and non-vented are automatically compensated for water density changes due to variations in temperature and salinity. The Research Coordinator at the specific NERR site should be contacted in order to obtain information regarding atmospheric pressure data availability.

Sequence of both 6600EDS and 6600EDS-SV dataloggers:
Date, Time, Temperature, Specific Conductivity, Salinity, dissolved oxygen %, dissolved oxygen mg/L, Level (for water depth), pH, Turbidity, Battery voltage

NOTE: Chlorophyll data was also collected for the IN site from May 5, 2004, until the end of the year. CDMO has requested that the data not appear in our dataset. Please contact the Wells NERR directly for this data.

10). Coded variable definitions

Site definitions:

Sampling Station: Inlet at Webhannet River Mouth, at Wells Harbor
Sampling Site Code: IN
Station Code: welinwq

Sampling Station: Head of Tide of Webhannet River
Sampling Site Code: HT
Station Code: welhtwq

Sampling Station: Little River Mouth (Merriland/Branch/Little River estuary)
Sampling Site Code: LM
Station Code: wellmwq

Sampling Station: Skinner Mill (on Merriland R, tributary to Merriland/Branch/Little R estuary)
Sampling Site Code: SM
Station Code: welsmwq

File definitions: 3 letter NERR site code (WEL for Wells NERR); 2 letter YSI deployment site code (see above); data type code (WQ for water quality), year of deployment (ex: welhtwq2005 = Head of Tide water quality data for 2005).

11). Anomalous/Suspect Data

January:

Webhannet Inlet (IN) Site: There appears to be an anomaly with our DO readings at this site **for the entire year.** A trend has appeared of very low DO readings during the ebbing tide and hits a low for that tide right about and hour into incoming tide then shoots back up to reasonable readings. This is not a probe malfunction because the trend has been observed with different probes and sondes, and the probe post-calibrated fine on most of the retrievals. A good example of this anomaly can be seen in the following data from welinwq011905:

Station Code	Date	cTime	Temp	SpCond	Sal	DO_pct	DO_mgl	Depth	pH	Turb
welinwq	01/29/2005	16:00	01.2	052.37	33.1	098.9	11.1	3.73	08.0	0001
welinwq	01/29/2005	16:30	01.1	052.38	33.1	093.2	10.5	3.39	08.0	0000
welinwq	01/29/2005	17:00	01.0	052.44	33.1	085.7	09.7	3.03	07.9	0000
welinwq	01/29/2005	17:30	00.8	052.51	33.1	080.7	09.2	2.70	07.9	0001
welinwq	01/29/2005	18:00	00.5	052.60	33.1	074.6	08.6	2.42	07.9	0001
welinwq	01/29/2005	18:30	00.3	052.69	33.1	069.3	08.0	2.18	07.9	0002
welinwq	01/29/2005	19:00	00.1	052.73	33.1	064.6	07.5	2.05	07.9	0002
welinwq	01/29/2005	19:30	00.0	052.82	33.1	060.4	07.0	1.96	07.8	0002
welinwq	01/29/2005	20:00	-00.1	052.82	33.1	055.8	06.5	1.98	07.8	0002
welinwq	01/29/2005	20:30	-00.2	052.85	33.1	050.9	05.9	2.06	07.8	0002
welinwq	01/29/2005	21:00	-00.2	052.84	33.1	046.2	05.4	2.25	07.8	0003
welinwq	01/29/2005	21:30	-00.3	052.89	33.1	041.6	04.9	2.48	07.8	0003
welinwq	01/29/2005	22:00	-00.4	052.92	33.1	037.9	04.4	2.76	07.8	0003
welinwq	01/29/2005	22:30	-00.1	052.95	33.2	029.0	03.4	3.07	07.8	0003
welinwq	01/29/2005	23:00	00.8	052.52	33.1	082.5	09.4	3.38	07.9	0003
welinwq	01/29/2005	23:30	01.0	052.45	33.1	102.7	11.6	3.70	08.0	0003

Although we have no explanation for this trend we do believe it is an actual event and merits further investigation. This trend can be seen in the entire years data. Further question regarding DO data from the Inlet site should be directed to the author of this document.

February:

See note from previous month for information regarding Anomalous DO data from the Webhanet Inlet (IN) site for the month of February.

March:

Webhannet inlet (IN) Site:The following DO data is considered suspect. Readings are very low for no apparent reason and remain that way throughout tidal changes. The post deployment showed a slightly high reading upon retrieval (108.4%) however DO Charge was fine as well as the DO Gain.
Welinwq 3/24/2005 16:30:00 through 3/25/2005 07:00:00
Welinwq 3/28/2005 08:00:00 through 4/6/2005 09:30:00 (Data is patchy due to battery failure)

Head of Tide (HT) Site: The following Turbidity data is considered suspect because they are unusually high. This could be due to animals in front of turbidity sensor or debris in the probe area.
Welhtwq 3/30/2005 09:30:00 through 4/2/2005 18:00:00

Skinner Mill (SM) Site: The following turbidity data is suspect because they are unusually high.
Welsmwq 3/30/05 11:30 384.1 NTU and 12:00 407.7 NTU

April:
Webhanet Inlet (IN) Site: The following DO percent saturation and mg/l data are suspect due to extremely low readings.

welinwq	04/06/2005	18:00	024.9	02.5
welinwq	04/06/2005	18:30	022.1	02.3
welinwq	04/06/2005	19:00	019.8	02.0
welinwq	04/06/2005	19:30	018.0	01.9
welinwq	04/06/2005	20:00	016.7	01.8
welinwq	04/06/2005	20:30	018.5	01.9
welinwq	04/27/2005	14:30	056.9	05.8
welinwq	04/27/2005	15:00	053.9	05.5
welinwq	04/27/2005	15:30	050.4	05.1
welinwq	04/27/2005	16:00	047.3	04.8
welinwq	04/27/2005	16:30	045.2	04.6
welinwq	04/27/2005	17:00	043.0	04.3
welinwq	04/27/2005	17:30	041.1	04.1
welinwq	04/27/2005	18:00	038.6	03.9
welinwq	04/27/2005	18:30	036.0	03.6
welinwq	04/27/2005	19:00	034.3	03.4
welinwq	04/27/2005	19:30	032.1	03.2
welinwq	04/27/2005	20:00	029.8	03.0
welinwq	04/27/2005	20:30	027.6	02.8
welinwq	04/27/2005	21:00	031.3	03.2

Skinner Mill (SM) Site: The following turbidity data is suspect due to its unusually high reading and the lack of corresponding turbidity in the preceding and following readings.
Welsmwq 4/27/2005 22:30:00 492 NTU

Little River Mouth (LM) Site: The following turbidity values seem suspect because they are very high and the rain event that cooreSpondes is minimal. Also the turbidty probe would not clean optics during post CAlabration. (see section 14)
Wellmwq 4/30/2005 01:00:00 through 5/16/2005 16:30:00

May:
Skinner Mill (SM) Site: The following DO% and mg/l data is suspect/anomalous. The readings jump from negative to very high numbers back and forth. May be probe malfunction. Post calibration showed low DO% (88.4).
Welsmwq 5/19/2005 06:30:00 through 6/1/2005 19:30

Little River Mouth (LM) Site: The following turbidity data is suspect because the readings are very jumpy and high at times
Wellmwq 5/1/2005 00:00:00 through 5/16/2005 16:30:00

June:
Webhannet Inlet (IN) Site: The following DO% and mg/l data should be considered suspect/anomalous due to the extremely low readings and lack of probe malfunction. The post deployment information (see section 14) shows a slightly

high post calibration (109%) and the membrane was not torn or damaged. The missing data was out of sensor range.
Welinwq 06/14/2005 07:00:00 through 06/27/2005 16:00:00.

July:
Webhanet Inlet (IN) Site: The following DO% and mg/l data is considered suspect due to the unusually low readings and the fact that they seem to stabilize at these low readings throughout tidal changes. The membrane showed no damage and the post deployment numbers show no indication of loss of electrolyte or low readings. Welinwq 7/28/2005 21:00:00 through 8/16/2005 08:00:00

Webhanet Inlet (IN) Site: The turbidity data from 7/27/2005 at 4:00 through 8/11/2005 at 6:00 seems to be suspect due to the length of positive readings and the rain events surrounding that time period being minimal at best.

Little River Mouth (LM) Site: The following DO% and mg/l data is considered suspect due to the isolated extremely low readings.

wellmwq	07/11/2005	00:00	033.0	02.8
wellmwq	07/12/2005	01:30	026.7	02.3
wellmwq	07/14/2005	03:00	037.1	03.0
wellmwq	07/16/2005	06:00	018.6	01.5
wellmwq	07/19/2005	11:30	025.7	02.1
wellmwq	07/20/2005	12:00	003.7	00.3

Little River Mouth (LM) Site: The following DO% and mg/l data is considered suspect. The readings dropped extremely low and stayed there for the remainder of the deployment and throughout tidal changes. No puncture was found on the probe membrane however the post deployment information shows bad post calibration readings indicating a probe malfunction of some sort.
Wellmwq 7/22/2005 15:30:00 through 08/09/2005 08:30:00

Skinner Mill (SM) Site: The following turbidity reading are suspect due to the wiper falling off the turbidity probe sometime during deployment.
Welsmwq 7/20/2005 12:30:00 through 7/22/2005 10:30:00

August:
Webhannet Inlet (IN) Site: See the July suspect/anomalous section above for DO data which overlaps into August.

Head of Tide (HT) Site: The following DO% and mg/l data is considered suspect and anomalous due to the isolated high readings. Post deployment shows no probe damage or malfunction.

welhtwq	08/23/2005	12:30	265.6	21.5
welhtwq	08/24/2005	13:30	244.3	19.7
welhtwq	08/25/2005	14:30	246.3	20.4
welhtwq	08/26/2005	15:30	219.8	18.0
welhtwq	08/27/2005	16:30	248.5	20.4

Head of Tide (HT) Site: The following pH values corresponded with the above DO% and mg/l data. These pH readings are isolated high readings that correspond with sharp jumps in DO.

welhtwq	08/23/2005	12:30	08.5

welhtwq 08/24/2005 13:30 08.3
welhtwq 08/25/2005 14:30 08.3
welhtwq 08/26/2005 15:30 08.6
welhtwq 08/27/2005 16:30 08.7

Head of Tide (HT) Site: The following turbidity reading is suspect due to its high value and isolated occurrence.
welhtwq 08/19/2005 01:00 0376

Skinner Mill (SM) Site: The following turbidity data is suspect because the numbers continually rise from 8/10 all the way to 8/19 at a slow and steady rate then starts bouncing all around. There were a few small rain events but nothing that would cause that kind of runoff and suspended particles.
Welsmwq 8/10/2005 01:00:00 through 8/25/2005 00:30:00

Little River Mouth (LM) Site: see July section of deleted/anomalous data section for information on suspect DO readings that overlapped into August

Little River Mouth (LM) Site: The following pH value is considered suspect/anomalous because they are low isolated readings.
wellmwq 08/13/2005 13:00 04.1

September:
None

October:
Skinner Mill (SM) Site: The following Turbidity data is suspect because of the unusually high readings and lack of corresponding rain events.
Welsmwq 10/31/2005 12:00:00 through 23:30:00

Skinner Mill (SM) Site: The following DO% and mg/l reading is considered suspect because of its high value and isolated occurrence.
welsmwq 10/06/2005 12:00 026.5 02.7

Little River Mouth (LM) Site: The following turbidity reading is considered suspect/anomalous because it is an isolated high reading with no corresponding rain event.
wellmwq 10/20/2005 11:00 0234

November:
Webhannet River Inlet (IN) Site: The following DO% and mg/l data is suspect due to the low readings throughout tidal changes. There was no apparent damage to the membrane or probe upon retrieval and the post deployment information looks fine with the exception of a high DO charge (see section 14).
Welinwq 11/13/2005 06:30:00 through 11/13/2005 17:30
Welinwq 11/15/2005 19:30:00 through 11/16/2005 07:30:00
Welinwq 11/27/2005 13:00:00 through 11/28/2005 05:30:00
Welinwq 11/28/2205 09:30:00 through 11/29/2005 11:00:00

Skinner Mill (SM) Site: The following Turbidity data is suspect because of the unusually high readings and lack of corresponding rain events.
Welsmwq 11/1/2005 00:00:00 through 11/3/2005 10:30:00

Little River Mouth (LM) Site: The following DO% and mg/l data is considered suspect because the data becomes very unstable and choppy. The post deployment information (see section 14) showed an unstable DO reading upon retrieval and slight corrosion on one electrode of the probe.
Wellmwq 11/12/2005 10:00:00 through 11/29/2005 14:30:00

December:
Webhannet River Inlet (IN) Site: The following DO% and mg/l data are suspect because they are very low and show no jumps in value with incoming tides etc. Post deployment information shows no problems.
Welinwq 12/4/2005 03:00:00 through 12/14/2005 09:30:00

Little River Mouth (LM) Site: The following turbidity data are suspect because the readings are very high with no corresponding rain or runoff. The readings also take place very close to battery failure toward end of deployment.
Wellmwq 12/17/2005 02:30:00 through 12/17/2005 07:30:00

12). Deleted data

All deleted data that is not listed here is deleted due to readings being out of the specifications of the probes. See Section 9 for sensor specifications. This data is considered "absolute rejection" and was deleted from the files before upload into our database. Each instance was not included here due to the large amount of individual negative depth and DO readings from multiple sites. Any questions regarding deleted or missing data should be directed to the author of this document.

Webhannet River Inlet (IN) site: The following DO% and mg/l data were deleted because of a punctured membrane upon retrieval.
Welinwq 4/6/2005 23:30:00 through 4/27/2005 14:00
Welinwq 5/5/2005 10:00:00 through 5/25/2005 12:30:00

Skinner Mill (SM) Site: DO% and mg/l data as intermittently deleted due to readings being outside of probe range. The readings jump from negative to very high numbers back and forth. May be probe malfunction. Post calibration showed low DO% (88.4).
Welsmwq 5/19/2005 15:30:00 through 6/1/2005 17:30

Skinner Mill (SM) Site: The following DO% and mg/l data was deleted because the membrane was punctured during deployment.
Welsmwq 10/20/2005 16:00:00 through 11/03/2005 10:30:00

Little River Mouth (LM) Site: The following data was deleted due to a battery failure within the sonde. This was probably caused by the extreme cold.
Wellmwq 12/17/2005 10:30:00 through 12/23/2005 10:30.

Head of Tide (HT) Site: All deleted data from this site is because the readings were outside of the probes specifications and therefore qualifies as absolute rejection.

13). Missing data

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. For more details on deleted data, see the Deleted Data Section (12.). If additional information on missing data are needed, contact the Research Coordinator at the reserve submitting the data.

14). Post deployment information

End of Deployment "post-calibration" readings in the following standard solutions:

DO% is recorded in calibration cup with few millimeters of water and two tiny sponges in bottom.
SpCond (specific conductivity) solution is 10 mS/cm.
pH solution is 7.0
turb (turbidity) and chl (chlorophyll) recorded in deionized water (pre-deployment calibrated to 0.0).

site	Date	SpCond	DO%	DOchg	level	pH	Turb
IN	1/21/2005	9.904	101.7	52.3	-0.001	6.97	1.7
IN	2/25/2005	10.55	101.5	53.3	0.001	7.12	-0.5
IN	3/11/2005	10.28	104.8	50.2	-0.005	6.97	0.3
IN	4/6/2005	9.881	108.4	65.5	-0.001	7.04	0.6
IN	4/27/2005	8.5	57.3	29.8	-0.002	7.03	2.1
IN	7/8/2005	9.706	119.1	59.4	-0.026	7.05	-2.7
IN	6/27/2005	10.04	109.1	46.1	-0.005	6.97	0.3
IN	7/20/2005	9.889	104.7	68.6	-0.001	7.16	0.1
IN	8/16/2005	10	113.7	99.2	0.003	7.17	0.6
IN	9/2/2005	10.22	102	99.2	-0.002	7.01	0.2
IN	9/28/2005	10.15	106.2	55.3	0.001	7.12	0.3
IN	10/28/2005	9.723	102.7	36.9	-0.001	6.94	0.1
IN	11/17/2005	10.09	98.6	54.3	-0.052	7.19	0.1
IN	12/14/2005	9.894	97.8	98.2	-0.001	6.83	-0.8
IN	1/5/2006	10.02	106.1	99.6	0.611	7.21	0.4

NOTES on IN post deployment information:
4/27/20005: DO membrane punctured upon retrieval. (see deleted data section 12)
7/8/2005: Post calibration done on this date due to problem with sonde. Had to ship back to YSI because technician could not communicate with the sonde to post calibrate. Punctured DO membrane found on 5/25/2005 when sonde was retrieved.
8/16/2005: High DO charge upon retrieval.
9/2/2005: High DO charge upon retrieval.
9/28/2005: slightly high DO reading.
12/14/2005: High DO charge upon retrieval.

site	Date	SpCond	DO%	DOchg	level	pH	Turb
HT	4/18/2005	9.955	98.7	67.6	-0.028	7.04	0.4
HT	5/4/2005	9.951	113.3	49.2	0.161	7.01	1.1
HT	5/31/2005	9.914	100.9	52.3	-0.059	7.05	-0.4

HT	6/30/2005	9.944	104.6	54.3	-0.072	7.12	0.2
HT	7/26/2005	9.979	102.1	58.4	-0.057	6.92	0.2
HT	8/25/2005	10.05	101.1	49.2	0.124	6.94	0.3
HT	9/7/2005	9.992	103.3	51.2	0.026	7.16	-0.2
HT	9/30/2005	9.962	100.5	51.2	-0.058	6.98	0.8
HT	11/1/2005	9.962	104.9	54.3	-0.109	7.22	-0.5
HT	12/1/2005	9.962	98.5	52.5	-0.087	6.98	-0.1
HT	12/19/2005	9.95	96.9	43.1	-0.012	7.44	-0.1

Notes on HT post deployment information:
12/19/2005: pH a little high but could be due to the fact that the probes where out of the water for a period toward the end of deployment.

site	Date	SpCond	DO%	DOchg	level	pH	Turb
LM	4/20//2005	9.988	100.3	53.3	-0.182	7.05	3.1
LM	5/11/2005	9.903	99.4	66.5	0.111	7.03	N/A
LM	6/7/2005	10.06	102.8	49.2	-0.151	7.1	0.2
LM	7/6/2005	9.998	101.6	49.2	0.057	7.03	0.2
LM	8/9/2005	9.969	-99.9	-0.8	0.014	7.26	0.1
LM	9/1/2005	9.966	100.1	53.2	-0.133	7.07	0.9
LM	9/27/2005	10.03	112.1	45.1	0.092	6.92	0.2
LM	10/26/2005	9.963	97.9	53.3	-0.122	7.08	0.2
LM	11/29/2005	9.97	100.3	43.3	0.277	7.22	0.2
LM	12/23/2005	9.915	99.6	56.3	-0.141	7.03	0.1

NOTES on LM post deployment information:
5/11/2005: Turbidity probe malfunction on retrieval won't clean optics.
8/9/2005: DO probe malfunction. Post calibration never stabilized and was reading anywhere from +100 to -99. (see section 11 and 12)
9/27/2005: slightly high do% upon retrieval and post calibration.
11/29/2005: DO% readings where a little jumpy and there was visible corrosion on one of the DO probe electrodes. (see section 11)

site	Date	SpCond	DO%	DOchg	level	pH	Turb
SM	3/21/2005	N/A	106	48.2	0.143	7.03	0.1
SM	4/14/2005	9.97	101.2	52.3	-0.2	7.04	8.2
SM	4/28/2005	10.01	88.4	44.1	0.131	6.98	1.9
SM	6/1/2005	9.98	97	45.1	-0.141	7.03	0
SM	6/30/2005	10.02	101.2	53.3	-0.072	7.16	-0.2
SM	7/26/2005	9.99	101.1	56.3	0.133	7.01	0
SM	8/25/2005	9.989	108.4	56.3	-0.028	7.06	0
SM	9/21/2005	10.04	100.6	70.6	0.11	6.94	0.5
SM	10/11/2005	9.962	0.2	1.2	-0.237	6.94	0.1
SM	11/2/2005	9.917	100.6	52.3	-0.025	7.08	-1.7
SM	12/5/2005	9.96	100.4	54.3	-0.046	7.13	0.4

NOTES on SM post deployment information:
6/1/2005: DO% readings very low and climbed from 85% to 88%. Some corrosion on one of the electrodes. Required heavy sanding to clean. (see section 11)
9/22/2005: DO% readings a little jumpy +/- 2 units.

11/03/2005: Tear found in DO membrane. Post deployment readings are extremely low.(See section 11 and 12)

15). Other Remarks/Notes

On 08/13/2020 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2006, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

Three of our four sites (SM, LM, and HT) are discontinued through the winter months due to icing in the rivers. See section 6 data collection period for times of site deployment.

Webhannet Inlet (IN) site: There was an anomalous trend happening at our IN site for the entire year (See section 11 for example). A trend has appeared of very low DO readings during the ebbing tide and hits a low for that tide right about and hour into incoming tide then shoots back up to reasonable readings. This is not a probe malfunction because the trend has been observed with different probes and sondes, and the probes post-calibrated fine on most of the retrievals. Although we have no explanation for this trend we do believe it is an actual event and merits further investigation. This trend can be seen in the entire year's data. Further question regarding DO data from the Inlet site should be directed to the author of this document.

Head of Tide (HT) Site: High turbidity readings from 5/22 through 5/23 are due to a rain event

Head of Tide (HT) Site: The majority of the negative depth readings at this site (deleted data) were probably a result of the depth probe being out of the water while the other probes remained submerged. This site experiences low water levels at times and could be the cause of the negative depth readings.

Head of Tide (HT) Site: The month of October saw a very heavy rain events on the 7th and 8th as well as on the 16th. These events account for shifts in parameters seen around these times.

Head of Tide (HT) Site: This site had to be discontinued through the winter months due to icing up of the river. There is no data from 1/1/2005 through 3/22/2005 at 15:00, and none after 12/15 at 12:00.

Little River Mouth (LM) Site: Around the time of October 26th there was a large storm system off the coast causing heavy surf and lots of rain. The data from the LM site reflects this showing little to no depth change during this period as well as very low salinities through periods of "high tide" even though water levels did not change. The site was unaffected by tides during this time.

Skinner Mill (SM) Site:
Heavy rain event on 9/15/05 around 14:00 and 15:00 hours caused the turbidity spike and water level changes seen in this file.

Skinner Mill (SM) site: This was a very low water site with rocky substrate which prevented the installation of a fixed, vertical pole in the stream. Consequently, deployment of the logger occurred in a horizontal PVC tube, with sensors 18-26 cm from stream bottom (depending on their location on the sonde). Every attempt was made to place and anchor the deployment tube in the same spot at each deployment. However, it is possible that unusual deployment conditions resulted in the sonde being in slightly different locations. In addition, high water flow or debris in the water column may have caused the deployment tube to shift during deployment. As a result, it is important to note when the logger was switched (see section 6 for discrete deployment times, across which depths may not correlate precisely). This site is being switched in 2006 for a more favorable site better reflecting a head of tide scenario.