North Inlet-Winyah Bay (NIW) **NERR Water Quality Metadata**
January 2009 – December 2009
Latest Update: 09/20/2012

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

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2) Entry verification

Deployment data are uploaded from the YSI data logger to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO where they undergo automated primary QAQC; automated depth/level corrections for changes in barometric pressure (cDepth or cLevel parameters); and become part of the CDMO's online provisional database. All pre- and post-deployment data are removed from the file prior to upload. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve for secondary QAQC where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove any overlapping deployment data, append files, and export the resulting data file for upload to the CDMO. Upload after secondary QAQC results in ingestion into the database as provisional plus data, recalculation of cDepth or cLevel parameters, and finally tertiary QAQC by the CDMO and assimilation into the CDMO's authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12.

3) Research objectives

The principal objective of this study is to record long-term water quality data for North Inlet/Winyah Bay in order to observe any physical changes or trends in water quality over time. Four sites were chosen; two to represent pristine sites and two to represent impacted sites. The Oyster Landing site is located near the center of the Reserve and is considered pristine. The Clambank site is located on a waterway that receives run-off from the undeveloped area of the reserve and is considered a pristine site. Debidue Creek and Thousand Acre are both located in waterways that receive run-off from heavily developed areas, and are therefore considered our impacted sites. Measurements were taken every 30 minutes over roughly two week collecting periods at the Oyster Landing, Debidue Creek, Clambank and Thousand Acre sites.

4) Research methods

YSI 6600 series sondes are currently mounted on either stand alone pilings (Debidue Creek, Oyster Landing) or bridge/dock pilings (Thousand Acre/Clambank Creek). Each sonde is deployed in a 4 inch

diameter PVC pipe which is strapped to the piling using stainless steel banding. The PVC pipe is offset from the pilings by inserting a 2x6 inch piece of treated lumber between the pipe and piling. This allows better flow over the sensors at the bottom of the pipes. The PVC pipe has a stainless steel stop bolt through its center 30 cm from the bottom of the pipe, ensuring that the sonde is seated 30 cm from the bottom of the creek. Directly above the stop bolt, 1 inch holes are drilled 0.5 cm apart within a 1 foot section of the pipe. This allows water flow over the sonde sensors. Four 1 inch holes are drilled perpendicular to each other at 1 foot intervals along the remaining length of the PVC pipe to allow for flushing. The bottom 3 feet of the pipe is painted inside and out with antifouling paint to minimize biofouling around the sensors. All pipes are switched out at least once a year (OL, CB, TA), while DC is usually switched out twice a year due to excessive fouling at that site.

Every 15 minutes measurements of specific conductivity, salinity, percent saturation, dissolved oxygen, water temperature, pH, turbidity, and water level are recorded. The two-week sampling interval was selected due to biofouling of the individual probes and expected battery life. Prior to deployment, the sondes are calibrated according to the procedures in the YSI Service Manual and the Standard Operating Procedures V4.1 provided by the NERR CDMO. Calibrations conducted prior to deployment of the instruments include a pH calibration using a two-point method with 7 and 10 unit standards. The turbidity calibration also uses a two-point method using 0 and 123 NTU standards. Specific Conductivity was calibrated using a one-point method with a 10 mS/cm standard that was purchased through YSI, Inc. Depth and dissolved oxygen are calibrated according to the barometric pressure at the time of calibration. Dissolved oxygen is calibrated using the air-saturated water method. The turbidity, ROX optical dissolved oxygen and chlorophyll probe wipers were changed before each deployment. Beginning in 2007, ROX optical dissolved oxygen probes were installed on instruments at Debidue Creek, Thousand Acre and Oyster Landing, and run in tandem with traditional rapid-pulse probes with the intention of switching all sondes over to ROX probes by early 2008 (see Section II. 9). At the end of each sampling interval, the sondes were brought back to the laboratory to be downloaded and cleaned. The sondes were allowed to continue recording data for at least 1 hour under lab conditions in a water-saturated air environment. Before the instruments were cleaned, a post calibration reading was taken from each instrument in fresh standard to see if any of the instruments exhibited drift (see Section 13). Post calibration readings of depth and dissolved oxygen are taken once sonde readings have stabilized in a bucket of bubbling (air saturated) tap water. Two sondes are assigned to each of the four monitoring stations to allow the sondes to be switched out the same day, and minimize data loss.

A Sutron Sat-Link2 transmitter was installed at the Oyster Landing station on 07/07/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B031302. A Sutron Sat-Link2 transmitter was installed at the Debidue Creek station on 04/28/09 and transmits data to the NOAA GOES satellite, NESDIS ID #3B049722. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The "real-time" telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO's authoritative online database. Provisional and authoritative data are available at http://cdmo.baruch.sc.edu.

5) Site location and character

The North Inlet-Winyah Bay National Estuarine Research Reserve is located on the Southeastern Atlantic coast of the United States in two tidal estuaries, North Inlet and Winyah Bay, near Georgetown, South Carolina. The North Inlet estuary, located approximately 10 km east of Georgetown, is a bar-built Class C type estuary (Pritchard, 1955). The North Inlet estuary is composed of numerous winding tidal creeks, and is considered a pristine tidal estuary due to minimal anthropogenic impacts. The watershed drains a 24.8 km2 area of mostly pine forest and a moderately developed residential watershed to the north. The Winyah Bay estuary, classified as a Class B type estuary by Pritchard (1955), which originates in the Blue Ridge Mountains of North Carolina, is one of the largest river-estuary ecosystems on the Eastern Seaboard. It is located 14.4 km south of North Inlet. Winyah Bay drains the sub-basins of 6 major rivers, which are heavily impacted by agriculture, mining, and industry. The rivers drain approximately 46,736 km^2 of uplands and marshes. Descriptions of the four sampling stations are as follows:

A) **Clambank Creek** (CB) - (lat 33:20:02, long 79:11:34). The Clambank Creek monitoring site is located roughly in the center of the reserve property. This site is surrounded by a Spartina marsh and drains associated uplands. Salinity can range from near fresh water concentrations following large rainfall events, to full strength seawater during most of the year. The creek width and depth at MHW at the sampling site are 40 m and 2.4 m respectively. The average depth of the creek at MHW is 2.0 m with an average tidal range of approximately 1.4 meters. The bottom is comprised mostly of oyster shell hash and some fine sediment. This site is considered a pristine site and is influenced by its close proximity to North Inlet.

B) **Debidue Creek** (DC) - (lat 33:21:37, long 79:10:05). The Debidue Creek monitoring site is considered an impacted site that is located approximately 1 km south of the Debidue Colony. The Colony is a large development built on man-made canals that directly drain into the northern portion of Debidue Creek. The DC site is also located in an ocean-dominated Spartina marsh that was formerly surrounded by pine-dominated uplands. Salinity can range from 0 to full strength seawater and an average tidal range of approximately 2 m. The approximate depth and width at MHW at the site is 2.2 and 70 m respectively. The bottom is comprised mostly of oyster shell hash with some fine sediment and detritus.

C) **Oyster Landing** (OL) - (lat. 33:20:58, long. 79:11:34). The Oyster Landing monitoring site is considered a fairly pristine and undisturbed area located at the end of the Oyster Landing pier, which is also where the NI-WB Bay NERR weather station site is located. The pier stretches into the upper reaches of Crabhaul Creek in the mid western portion of North Inlet. The sampling site is located approximately 2.8 km from the headwaters of Crabhaul Creek. The creek directly drains pine-forested uplands and wetlands. Salinity can range from 0 to full strength seawater depending on rainfall events and upland drainage. The average tidal range is approximately 1.44 m. The creek has an average depth of 2 m MHW and average width of 150 m MHW. The bottom is comprised mostly of oyster shell hash with some fine sediment and detritus.

D) **Thousand Acre** (TA) - (lat. 33:17:57, long. 79:15:36) The Thousand Acre monitoring site is located in Thousand Acre marsh tidal creek and is on the NW corner of the west bridge of Thousand Acre marsh (this site was relocated 07-19-99 to the current location due to heavy siltation and degrading data quality). The present site is about 15 m from the mouth of the creek. At the sampling site, creek depth is approximately 2 m MHW and creek width is approximately 10 m. The creek empties into the northeastern side of the mid portion of Winyah Bay and directly drains pine forested upland and wetlands. Salinity ranges from 0 to 30 ppt. and tidal range is approximately 1m. The bottom is composed mostly of fine sediments and detritus. Georgetown, 5 km upstream from the Thousand Acre site and on the southern side of Winyah Bay, is the homeport for a number of heavy industries including a steel plant, paper mill, chemical plant, and a coal fired power plant. A public sewage treatment plant, which discharges into the bay, is also located in Georgetown.

6) Data collection period

Thousand Acre data collection began January 1, 1995. Debidue Creek sampling began March 5, 1998. Oyster Landing data collection began in 1995; however, it was not considered a SWMP site until 1996 when the collection site was switched from Caledonia to Oyster Landing. Clambank sampling began in February 1981 through June 1995; however, it was not considered a SWMP site until sampling resumed on August 17, 2001. All sampling is ongoing.

Deployment dates and times (in Eastern Standard Time) for 2009 follow:

Site: **Clambank Creek**

Deploy Date	Time	Retrieve Date	Time
12/17/2008	11:45	01/14/2009	09:00
01/14/2009	09:15	01/24/2009	11:45
01/28/2009	10:15	02/16/2009	09:45
02/16/2009	10:00	02/27/2009	10:00
02/27/2009	10:30	03/17/2009	12:30

03/17/2009	12:45	04/01/2009	13:00
04/01/2009	13:30	04/16/2009	10:30
04/16/2009	10:45	05/05/2009	08:45
05/05/2009	09:00	05/12/2009	10:00
05/12/2009	10:15	05/27/2009	09:45
05/27/2009	10:00	06/09/2009	08:30
06/09/2009	08:45	06/24/2009	09:30
06/24/2009	09:45	07/10/2009	09:45
07/10/2009	10:00	07/24/2009	10:30
07/24/2009	10:45	08/07/2009	09:30
08/07/2009	09:45	08/24/2009	11:15
08/24/2009	11:30	09/09/2009	09:00
09/09/2009	09:15	09/22/2009	10:00
09/22/2009	10:30	10/07/2009	08:45
10/07/2009	09:00	10/21/2009	09:45
10/21/2009	10:00	11/06/2009	09:30
11/06/2009	09:45	11/24/2009	13:30
11/24/2009	13:45	12/09/2009	10:45
12/09/2009	11:00	12/21/2009	13:15
12/21/2009	13:30	01/07/2010	10:15

Site: **Debidue Creek**

Deploy Date	Time	Retrieve Date	Time
12/17/2008	11:30	01/15/2009	12:00
01/15/2009	12:08	01/28/2009	09:30
01/28/2009	09:45	02/16/2009	13:15
02/16/2009	13:45	02/27/2009	09:00
02/27/2009	09:15	03/17/2009	11:45
03/17/2009	12:00	03/30/2009	20:30
03/31/2009	09:45	04/16/2009	13:00
04/16/2009	13:15	05/05/2009	16:15
05/05/2009	16:45	05/12/2009	09:45
05/12/2009	09:53	05/27/2009	09:15
05/27/2009	09:30	06/09/2009	08:15
06/09/2009	08:30	06/24/2009	08:45
06/24/2009	09:00	07/10/2009	09:30
07/10/2009	09:45	07/24/2009	09:30
07/24/2009	11:30	08/07/2009	09:00
08/07/2009	09:15	08/24/2009	10:45
08/24/2009	11:15	09/07/2009	09:49
09/07/2009	10:30	09/22/2009	09:45
09/22/2009	10:00	10/07/2009	08:30
10/07/2009	08:45	10/21/2009	09:15
10/21/2009	09:30	11/06/2009	09:00
11/06/2009	09:15	11/24/2009	13:00
11/24/2009	13:15	12/09/2009	13:45
12/09/2009	14:15	12/21/2009	12:15
12/21/2009	12:30	01/07/2010	13:00

Site: **Oyster Landing**

Deploy Date	Time	Retrieve Date	Time
12/17/2008	12:15	01/15/2009	13:00

01/15/2009	13:15	01/28/2009	10:15
01/28/2009	10:45	02/16/2009	13:45
02/16/2009	14;00	02/27/2009	10:30
02/27/2009	10:45	03/17/2009	11:15
03/17/2009	11:30	04/02/2009	12:15
04/02/2009	12:30	04/16/2009	13:15
04/16/2009	13:30	05/05/2009	16:30
05/05/2009	17:00	05/12/2009	10:15
05/12/2009	10:30	05/27/2009	11:00
05/27/2009	11:15	06/09/2009	09:00
06/09/2009	09:15	06/24/2009	09:45
06/24/2009	10:00	07/10/2009	11:00
07/10/2009	11:15	07/24/2009	11:15
07/24/2009	11:30	08/07/2009	10:45
08/07/2009	11:00	08/24/2009	12:15
08/24/2009	12:30	09/07/2009	10:30
09/07/2009	10:45	09/22/2009	11:00
09/22/2009	11:15	10/07/2009	09:45
10/07/2009	10:00	10/21/2009	11:00
10/21/2009	11:15	11/06/2009	10:30
11/06/2009	10:45	11/24/2009	14:30
11/24/2009	15:00	12/09/2009	14:00
12/09/2009	14:30	12/21/2009	13:45
12/21/2009	14:00	01/07/2010	13:30

Site: **Thousand Acre**

Deploy Date	Time	Retrieve Date	Time
12/17/2008	14:00	01/14/2009	09:45
01/14/2009	10:00	01/28/2009	11:15
01/28/2009	11:30	02/16/2009	09:00
02/16/2009	09:15	02/27/2009	09:45
02/27/2009	10:00	03/17/2009	09:00
03/17/2009	09:15	03/30/2009	02;00
04/01/2009	14:00	04/16/2009	11:00
04/16/2009	11:15	05/05/2009	09:15
05/05/2009	09:30	05/12/2009	12:15
05/12/2009	12:30	05/27/2009	10:15
05/27/2009	10:30	06/15/2009	10:30
06/15/2009	10:45	06/24/2009	09:30
06/23/2009	09:45	06/30/2009	18:30
07/10/2009	10:30	07/24/2009	10:15
07/24/2009	10:30	08/07/2009	10:00
08/07/2009	10:15	08/24/2009	11:45
08/24/2009	12:00	09/07/2009	08:45
09/07/2009	09:00	09/22/2009	10:30
09/22/2009	10:45	10/07/2009	10:30
10/07/2009	10:45	10/21/2009	10:15
10/21/2009	10:30	11/06/2009	10:00
11/06/2009	10:15	11/24/2009	14:00
11/24/2009	14:15	12/09/2009	10:00
12/09/2009	10:15	12/21/2009	13:00
12/21/2009	13:15	01/07/2010	09:45

7) Distribution

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

A water chemistry program is associated with the NIW core-monitoring program. Variables sampled include: chlorophyll, dissolved organic carbon, nitrate-nitrite, orthophosphate, and ammonia. (See documentation on the NIW WWW home page http://www.northinlet.sc.edu/ for further details). Thousand Acre is our permanent monitoring station for the NERR monitoring program, but Oyster Landing and Debidue Creek were also sampled beginning in 1998. Clambank Landing was added as a sampling station in August of 2001. These stations are also included in our NIW core-monitoring program. Ben Lakish (Research Specialist) is responsible for the collection and management of this data.

The NERR weather station is also located at the Oyster Landing site. Air temperature and humidity, barometric pressure, solar radiation (total and PAR), wind speed and direction, and precipitation are measured. Amy Willman (Research Specialist) is responsible for the collection and management of this data.

In conjunction with NERR water quality and water chemistry sampling, Oyster Landing is the site of an ongoing study of microbial metabolism (production, respiration and bacterial growth efficiency) in salt marsh tidal creek waters. Sampling is done on both ebb and flood tides coincident with NIW NERR diel (ISCO) nutrient sampling. Study objective include quantifying the factors that control the magnitude and variability in bacterioplankton metabolic rates and growth efficiencies, and the role of salt marsh exports (on tidal, seasonal, and interannual time scales) in fueling tidal creek heterotrophy. Dr. Erik Smith (NIW NERR Research Coordinator) is the principle investigator on this project.

A study of the optical characteristics of dissolved organic matter (DOM) is currently being conducted at Oyster Landing in association with the NIW NERR water quality and water chemistry sampling. Absorbance from 250 - 450 nm are quantified on filtered sub-samples of water collected during (ISCO) diel nutrient sampling and used to determine carbon-normalized DOM absorbance and spectral slope. Study objectives include using DOM optical characteristics as a tracer for the input of aromatic-rich DOM from higher plant and terrestrially-derived DOM sources to estuarine waters. Drs. Erik Smith (NIW NERR Research Coordinator) and Ralph Mead (Assistant Professor, UNCW) are the principle investigators on this project.

A long-term fish survey is also done at the Oyster Landing site bi-weekly. Species present, total weight, individual weights and standard lengths of fish that utilize the marsh at high tide are recorded. In the winter months (November through February), this sampling is done only once monthly. Dr. Dennis Allen (Director, Baruch Marine Lab) is the principal investigator on this project.

II. Physical Structure Descriptors

9) Sensor specifications

NIWB NERR deployed both 6600 EDS and 6600 V2-4 sondes in 2008. Please note that v2-4 sondes do not have model 6562 Dissolved Oxygen probes (rapid pulse-clark cell), only model 6150 (ROX optical) probes. EDS sondes can run both 6562 and 6150 Dissolved Oxygen probes. All times below are in EST.

CB

ROX probes were deployed at CB for the entire year of 2009.

DC

ROX probes were deployed at DC for the entire year of 2009.

OL

ROX probes were deployed at OL for the entire year of 2009.

TA

ROX probes were deployed at TA for the entire year of 2009.

YSI 6600 EDS-S Multi-parameter Water Quality Logger

Parameter:	Non-vented Level-Shallow (Depth)
Units:	feet or meters (ft or m)
Sensor Type:	Stainless steel strain gauge
Range:	0 to 30 ft (9.1 m)
Accuracy:	+/- 0.06 ft (0.018 m)
Resolution:	0.001 ft (0.001 m)

Parameter:	Temperature
Units:	Celsius (C)
Model #:	6560
Sensor Type:	Thermistor
Range:	-5 to 45 ^{o}C
Accuracy:	+/- 0.15 ^{o}C
Resolution:	0.01 ^{o}C

Parameter:	Dissolved Oxygen, Percent Saturation
Units:	percent air saturation (%)
Model #:	6562
Sensor Type:	Rapid Pulse - Clark type, polarographic
Range:	0 to 500 % 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
Resolution:	0.1 % air saturation

Parameter:	Dissolved Oxygen, mg/L (calculated from % air saturation, temperature & salinity)
Units:	milligrams/Liter (mg/L)
Model #:	6562
Sensor Type:	Rapid Pulse - Clark type, polarographic
Range:	0 to 50 mg/L
Accuracy:	0 to 20 mg/L, +/- 2% of the reading or 0.2 mg/L, whichever is greater, 20 to 50 mg/L, +/- 6% of the reading
Resolution:	0.01 mg/L

Parameter:	Dissolved Oxygen
Model #:	6150
Sensor Type:	optical, self-cleaning
Units:	percent air saturation (%)and milligrams/Liter (mg/L)
Range:	0 to 500 % air-saturation; 0 to 50 mg/L
Accuracy:	0 to 200 % air-saturation, +/- 1 % of the reading or +/- 1 % air-saturation, whichever is greater; 200 to 500 % air-saturation, +/- 15 % of the reading 0 to 20 mg/L, +/- 1 % of the reading or +/- 0.1 mg/L, whichever is greater; 20 to 50 mg/L, +/- 15 % of the reading
Resolution:	0.1 % air-saturation; 0.01 mg/L

Parameter:	Conductivity
Units:	milli-Siemens per cm (mS/cm)
Model #:	6560
Sensor Type:	4 electrode cell with autoranging
Range:	0 to 100 mS/cm
Accuracy:	+/- 0.5% of reading + 0.001 mS/cm
Resolution:	0.001 mS/cm to 0.1 mS/cm (range dependent)

Parameter:	Salinity
Units:	parts per thousand (ppt)
Model #:	6560
Sensor Type:	Calculated from conductivity and temperature
Range:	0 to 70 ppt
Accuracy:	+/- 1.0% of reading or 0.1 ppt, whichever is greater
Resolution:	0.01 ppt

Parameter:	pH
Units:	pH units
Model #:	6561 or 6561FG (flat glass)
Sensor Type:	Glass combination electrode
Range:	0 to 14 units
Accuracy:	+/- 0.2 units
Resolution:	0.01 units

Parameter:	Turbidity
Units:	nephelometric turbidity units (NTU)
Model #:	6136
Sensor Type:	Optical, 90o scatter, with mechanical cleaning
Range:	0 to 1000 NTU
Accuracy:	+/- 5% reading or 2 NTU (whichever is greater), relative to calibration standards
Resolution:	0.1 NTU

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 vented or non-vented depth/level sensors. Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.03 cm for every 1 millibar change in atmospheric pressure, and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

Beginning in 2006, NERR SWMP standard calibration protocol calls for all non-vented depth sensors to read 0 meters at a (local) barometric pressure of 1013.25 mb (760 mm/hg). To achieve this, each site calibrates their depth sensor with a depth offset number, which is calculated using the actual atmospheric pressure at the time of calibration and the equation provided in the SWMP calibration sheet or digital calibration log. This offset procedure standardizes each depth calibration for the entire NERR System. If accurate atmospheric pressure data are available, non-vented sensor depth measurements at any NERR can be corrected.

In 2010, the CDMO began automatically correcting depth/level data for changes in barometric pressure as measured by the Reserve's associated meteorological station during data ingestion. These corrected depth/level data are reported as cDepth and cLevel, and are assigned QAQC flags and codes based on QAQC protocols. Please see sections 11 and 12 for QAQC flag and code definitions.

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Clambank Creek	CB	niwcbwq
Debidue Creek	DC	niwdcwq
Oyster Landing	OL	niwolwq
Thousand Acre	TA	niwtawq

11) QAQC flag definitions – This section details the automated and secondary QAQC flag definitions. Include the following excerpt**:**

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). During

primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is missing and above or below sensor range. All remaining data are then flagged 0, passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range
-4 Outside Low Sensor Range
-3 Data Rejected due to QAQC
-2 Missing Data
-1 Optional SWMP Supported Parameter
0 Data Passed Initial QAQC Checks
1 Suspect Data
2 *Open - reserved for later flag*
3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
4 Historical Data: Pre-Auto QAQC
5 Corrected Data

12) QAQC code definitions – This section details the secondary QAQC Code definitions used in combination with the flags above. Include the following excerpt:

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the deployment or YSI datasonde, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors

GIC	No instrument deployed due to ice
GIM	Instrument malfunction
GIT	Instrument recording error; recovered telemetry data
GMC	No instrument deployed due to maintenance/calibration
GNF	Deployment tube clogged / no flow
GOW	Out of water event
GPF	Power failure / low battery
GQR	Data rejected due to QA/QC checks
GSM	See metadata

Corrected Depth/Level Data Codes

GCC	Calculated with data that were corrected during QA/QC
GCM	Calculated value could not be determined due to missing data
GCR	Calculated value could not be determined due to rejected data
GCS	Calculated value suspect due to questionable data
GCU	Calculated value could not be determined due to unavailable data

Sensor Errors

SBO	Blocked optic
SCF	Conductivity sensor failure
SDF	Depth port frozen
SDG	Suspect due to sensor diagnostics
SDO	DO suspect

SDP	DO membrane puncture
SIC	Incorrect calibration / contaminated standard
SNV	Negative value
SOW	Sensor out of water
SPC	Post calibration out of range
SQR	Data rejected due to QAQC checks
SSD	Sensor drift
SSM	Sensor malfunction
SSR	Sensor removed / not deployed
STF	Catastrophic temperature sensor failure
STS	Turbidity spike
SWM	Wiper malfunction / loss

Comments

CAB*	Algal bloom
CAF	Acceptable calibration/accuracy error of sensor
CAP	Depth sensor in water, affected by atmospheric pressure
CBF	Biofouling
CCU	Cause unknown
CDA*	DO hypoxia (<3 mg/L)
CDB*	Disturbed bottom
CDF	Data appear to fit conditions
CFK*	Fish kill
CIP*	Surface ice present at sample station
CLT*	Low tide
CMC*	In field maintenance/cleaning
CMD*	Mud in probe guard
CND	New deployment begins
CRE*	Significant rain event
CSM*	See metadata
CTS	Turbidity spike
CVT*	Possible vandalism/tampering
CWD*	Data collected at wrong depth
CWE*	Significant weather event

CWE*

13) Post deployment information

Clambank Creek

Date	Sp.Con. (0 mS/cm)	Salinity (0 psu)	pH (7)	Depth	Turbidity (0 NTU)	BP (mm Hg)	ODO% (% air sat.)
01/14/2009	0.008	0.00	6.82	0.183	0.3	766.4	100.9
01/28/2009	0.014	0.01	7.11	0.001	0.2	758.9	100.2
02/16/2009	0.007	0.00	7.07	0.074	0.3	765.8	101.4
02/27/2009	0.017	0.01	6.98	0.046	0.7	764.6	100.4
03/17/2009	0.009	0.00	6.85	0.082	0.3	766.4	101.0
04/01/2009	0.011	0.00	7.02	-0.036	-0.8	758.4	102.1
04/16/2009	0.006	0.00	6.93	0.145	0.2	771.0	99.8
05/05/2009	0.006	0.00	7.15	0.020	0.0	763.0	100.3
05/12/2009	0.014	0.01	6.91	0.082	0.0	766.5	103.6
05/27/2009	0.015	0.01	7.10	0.026	0.0	758.8	100.0
06/09/2009	0.037	0.02	6.89	0.005	-0.2	760.9	98.5
06/24/2009	0.011	0.00	7.07	-0.001	0.1	765.4	99.1

07/10/2009	0.013	0.01	7.09	0.202	-1.3	768.0	102.2
07/24/2009	0.014	0.00	7.06	0.012	0.0	760.1	99.5
08/07/2009	0.014	0.01		0.065	0.9	765.3	100.7
08/24/2009	0.061	0.03	7.13	0.012	-1.8	762.5	100.0
09/09/2009	n/a						
09/22/2009	0.022	0.01	6.96	0.088	-0.1	763.7	99.7
10/07/2009	0.013	0.00	7.04	-0.012	4.7	759.2	99.8
10/22/2009	0.040	0.02	6.96	0.089	1.5	767.5	96.7
11/06/2009	n/a						
11/24/2009	0.057	0.03	7.12	0.063	0.1	764.6	100.4
12/09/2009	0.033	0.01	7.14	-0.117	0.0	752.5	95.6
12/21/2009	0.030	0.01	7.06	0.118	0.6	768.3	101.1
01/07/2010	0.017	0.01	6.98	0.021	0.1	761.1	102.8

Debidue Creek

Date	Sp. Cond. (0 mS/cm)	Salinity (0 psu)	pH (7)	Depth	Turbidity (0 NTU)	BP (mm Hg)	ODO% (% air sat.)
01/15/2009	0.013	0.00		0.094	0.0	767.4	99.5
01/28/2009	0.005	0.00	7.04	0.080	-0.3	759.4	100.3
02/16/2009	0.013	0.00	7.05	0.078	3.6	765.8	101.4
02/27/2009	0.010	0.00	7.06	0.066	0.3	764.4	100.6
03/17/2009	0.015	0.01	6.85	0.087	523.8	766.4	101.3
03/31/2009	0.009	0.00	7.03	0.015	-0.3	764.0	103.5
04/16/2009	0.060	0.03	7.05	0.154	0.1	771.1	92.0
05/05/2009	0.002	0.00	7.05	0.054	0.0	763.8	98.5
05/12/2009	0.058	0.03	6.98	0.087	0.1	766.6	97.3
05/27/2009	0.005	0.00	7.16	-0.018	0.0	759.0	100.2
06/09/2009	0.101	0.05	7.00	0.001	-0.3	760.7	101.2
06/24/2009	0.005	0.00	7.09	0.000	0.2	765.5	100.1
07/10/2009	0.064	0.03	7.06	0.206	-0.9	767.8	101.0
07/24/2009	0.002	0.00	7.18	0.002	0.5	760.0	99.8
08/07/2009	0.063	0.03	7.03	0.074	0.3	765.3	100.7
08/24/2009	0.004	0.00	7.07	0.042	0.3	762.7	99.0
09/07/2009	0.066	0.02	7.06	0.013	-0.1	761.2	98.0
09/22/2009	0.007	0.00	6.93	0.069	205.6	763.9	100.3
10/07/2009	0.058	0.03	7.01	-0.008	-0.6	759.4	99.2
10/21/2009	0.019	0.01	7.08	0.108	-0.5	767.7	94.8
11/06/2009	n/a						
11/24/2009	0.015	0.01	7.11	0.057	0.1	764.0	93.5
12/09/2009	0.067	0.03		-0.092	-0.1	753.8	99.3
12/21/2009	0.042	0.02	7.04	0.126	-0.6	768.0	100.7
01/07/2010	0.073	0.03	7.07	0.020	0.3	761.2	100.6

Oyster Landing

Date	Sp. Cond. (0 mS/cm)	Salinity (0 psu)	pH (7)	Depth	Turbidity (0 NTU)	BP (mm Hg)	ODO% (% air sat.)
01/15/2009	0.012	0.00		0.101	-0.8	767.4	101.0
01/28/2009	0.009	0.00	7.15	-0.008	0.6	759.4	100.6
02/16/2009	0.019	0.01	7.09	0.086	0.7	766.3	101.1
02/27/2009	0.023	0.01	7.08	0.061	0.2	764.5	100.3
03/17/2009	0.017	0.01	7.04	0.084	0.8	766.4	100.8
04/02/2009	0.007	0.00	7.05	-0.066	-0.1	756.6	103.4
04/16/2009	0.022	0.01	7.04	0.150	0.6	771.1	100.8
05/05/2009	0.007	0.00	7.08	0.061	0.1	763.9	99.7

05/12/2009	0.038	0.02	7.02	0.087	0.1	766.4	101.8
05/27/2009	0.020	0.00	7.12	0.002	-0.5	758.4	99.7
06/09/2009	0.091	0.04	7.01	-0.001	0.1	760.2	99.1
06/24/2009	0.016	0.01	7.19	-0.020	0.2	765.3	99.8
07/10/2009	0.075	0.03	7.15	0.209	-0.2	767.9	88.1
07/24/2009	0.024	0.01	7.22	0.000	0.1	760.0	100.1
08/07/2009	0.086	0.04	7.05	0.078	1.0	765.5	107.8
08/24/2009	0.066	0.03	7.06	0.029	0.5	762.3	99.5
09/07/2009	0.010	0.01	7.17	0.018	-0.7	761.2	97.5
09/22/2009	0.022	0.01	7.28	0.043	-0.1	763.9	100.4
10/07/2009	0.037	0.02	7.12	-0.006	1.1	759.1	99.9
10/21/2009	0.035	0.01	7.08	0.075	0.7	767.2	101.9
11/06/2009	n/a						
11/24/2009	0.046	0.02		0.052	-0.2	763.7	100.6
12/09/2009	0.032	0.01		-0.097	-0.4	753.1	99.1
12/21/2009	0.022	0.01	7.11	0.117	-1.1	768.0	95.9
01/07/2010	0.019	0.01	7.07	0.016	0.3	761.8	100.7

Thousand Acre

Date	Sp. Cond. (0 mS/cm)	Salinity (0 psu)	pH (7)	Depth	Turbidity (0 NTU)	BP (mm Hg)	ODO% (% air sat.)
01/14/2009	0.055	0.02	6.96	0.076	0.1	766.3	97.4
01/28/2009	0.009	0.00	7.04	-0.015	-0.1	759.1	100.4
02/16/2009	0.054	0.02	7.10	0.069	0.4	766.0	101.7
02/27/2009	0.010	0.00	7.00	0.060	0.0	764.5	98.9
03/17/2009	0.074	0.03	7.11	0.090	-0.1	766.3	101.2
04/01/2009	0.005	0.00	7.01	-0.026	-0.1	758.3	102.9
04/16/2009	0.016	0.01	7.06	0.087	0.3	770.9	97.9
05/05/2009	0.005	0.00	7.08	0.041	0.5	763.0	101.4
05/12/2009	0.009	0.00	7.06	0.046	-0.4	766.4	100.5
05/27/2009	0.014	0.01	7.00	-0.019	0.2	758.8	100.4
06/15/2009	0.004	0.00	7.03	-0.021	-1.0	767.7	99.5
06/24/2009	0.024	0.01	7.12	0.001	0.3	765.4	99.9
07/10/2009	0.014	0.01	7.10	0.183	-0.9	767.8	98.0
07/24/2009	0.016	0.01	7.07	0.000	0.1	760.0	99.0
08/07/2009	0.017	0.01	7.10	0.054	0.2	765.3	100.3
08/24/2009	0.007	0.00	7.11	0.033	0.0	762.5	99.7
09/07/2009	0.022	0.01	7.08	0.003	1.8	761.2	95.3
09/22/2009	0.030	0.01	7.37	0.056	-0.3	763.9	100.5
10/07/2009	0.029	0.01	7.15	-0.028	-2.2	759.0	99.7
10/21/2009	0.015	0.01	7.10	0.103	-0.1	767.8	95.7
11/06/2009	n/a						
11/24/2009	0.015	0.01	7.05	0.050	0.3	764.4	
12/09/2009	0.010	0.00	7.04	-0.132	-0.5	752.2	97.8
12/21/2009	0.005	0.00	6.82	0.120	-1.6	768.0	100.7
01/07/2010	0.011	0.00	7.06	0.006	0.0	761.5	101.1

14) Other remarks/notes

A) Clambank Landing – Note that several periods of specific conductivity and salinity data were coded as <0> (CSM). This site is more prone to reductions in salinity and conductivity from the movement of Winyah Bay water into the North Inlet system than from rainfall events. Movement of low salinity Winyah Bay water into the western portion of the North Inlet system can occur during short yet strong westerly wind events or prolonged periods of

westerly winds. Therefore, periods of reduced specific conductity and salinity for Clambank Landing were flagged as CSM rather than CRE (significant rain event). During these strong westerly wind events the water is often stirred up in the system which may result in increases in turbidity values. A comparison of the water quality data from Clambank Landing to precipitation, wind speed and wind direction data from the Oyster Landing MET station will give an indication as to the origin of the fresh water affecting salinity at this site.

B) Debidue Creek- From 10/7 8:45 to 10/21 9:15 DO data is marked 1 SDO CSM. There was water found under the membrane that affected data during this time period. The readings post cal'd normal after removing that water

C) Debidue Creek- The DC station fouled heavily in 2009 resulting in the sonde often getting hung up on oysters and barnacles growing in the tube. During the following dates/times the sonde was hung up on fouling inside the tube when first deployed. After noting the issue via telemetry staff went out to the station and pushed tube down to correct depth.

a. 1/15 12:15 to 13:00
b. 4/28 13:15 to 4/29 11:15
c. 5/12 10:00 to 5/13 12:00

D) Thousand Acre - Note that for the period of 12/18/2009 07:30-12/19/2009 04:45 data at Thousand Acre were coded as <0> (CSM). There was a significant rain event that occurred during this period; however, the strong winds associated with this event forced more saline ocean water into Winyah Bay causing an increase in salinity at Thousand Acre during the storm event.

E) 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. Any NANs in the dataset stand for "not a number" and are the result of low power, disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

F) The following are daily rainfall totals > 2.54 mm for the year of 2009 recorded at the NIWB-NERR weather station at Oyster Landing. Note that significant rainfall amounts can affect all measured parameters, most noticeably salinity, turbidity and pH. Please note that tropical events are associated with heavy winds that may also affect tidal depth.

Date	**Total Daily Precip (mm)**
01/04/2009	3.30
01/13/2009	10.92
01/18/2009	9.40
01/24/2009	5.33
02/02/2009	3.05
02/14/2009	8.89
02/18/2009	6.10
02/19/2009	15.24
03/01/2009	36.58

03/16/2009	14.73
03/25/2009	13.97
03/27/2009	4.32
03/28/2009	12.95
04/02/2009	46.48
04/11/2009	4.32
04/13/2009	2.79
04/14/2009	4.57
05/07/2009	9.40
05/10/2009	2.03
05/17/2009	11.18
05/18/2009	7.11
05/26/2009	8.38
06/04/2009	5.59
06/05/2009	7.11
06/06/2009	4.83
06/10/2009	8.13
06/11/2009	9.65
06/12/2009	11.43
06/16/2009	22.86
07/05/2009	4.57
07/06/2009	6.10
07/07/2009	3.30
07/08/2009	5.59
07/13/2009	37.85
07/17/2009	3.30
07/29/2009	29.46
07/30/2009	3.56
08/02/2009	54.10
08/03/2009	12.70
08/12/2009	4.06
08/13/2009	5.08
08/21/2009	9.91
08/22/2009	2.79
08/28/2009	44.96
08/31/2009	19.30
09/06/2009	3.05
09/25/2009	22.86
10/05/2009	26.42
10/10/2009	3.56
10/12/2009	5.59
10/14/2009	7.62
10/16/2009	10.41
10/23/2009	5.08
10/26/2009	11.43
10/28/2009	22.61
10/31/2009	8.38
11/11/2009	74.17

11/18/2009	9.40
11/22/2009	3.30
12/02/2009	59.18
12/04/2009	5.84
12/05/2009	16.26
12/12/2009	6.10
12/13/2009	19.05
12/15/2009	5.08
12/18/2009	117.60
12/25/2009	13.72
12/30/2009	3.30
12/31/2009	12.95