

**North Carolina (NOC) NERR Water Quality Metadata**  
**January 1, 2019 – December 31, 2019**  
**Latest Update: April 20, 2021**

**I. Data Set and Research Descriptors**

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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), EcoWatch Lite in a comma separated file (CSV) or KOR Software in an Excel File (.XLS) 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. All QA/QC by the Reserve are performed by Heather Wells and Byron Toothman.

**3) Research objectives –**

Four long-term water quality monitoring stations have been established within the estuaries bordering Masonboro and Zeke's Islands of North Carolina's National Estuarine Research Reserve. Instruments are deployed vertically at all sites except East Cribbings, which was anchored to the bottom for the majority of 2012. The East Cribbings site was converted to a vertical deployment structure on December 4, 2012. Measurements are taken at 15-minute intervals for approximately two to four week periods continuously throughout the year. Parameters measured include Depth, Temperature, Salinity, Specific Conductivity, pH, Dissolved Oxygen, and Turbidity. The goal is to assess short-term variability and long-term changes (i.e., localized impacts of seasonal storm events, inter-annual differences from rainfall, magnitude of climatic influence from El Nino/La Nina events, etc.) in estuarine water parameters within relatively pristine sites.

#### 4) Research methods –

The Estuarine Water Quality Monitoring Program began on March 2, 1992 at the Research Creek site of the Masonboro Island component. A second Masonboro Island site, Loosin Creek, was added on February 26, 2002. Data collection started on May 19, 1994 at the Zeke's Island component (East Cribbings site) and an additional site, Zeke's Basin, was added March 1, 2002. The procedures described below were instituted in June 1995 and thus do not cover data recorded previously.

Two data loggers are assigned to each of the four permanent monitoring stations and are generally not interchanged among sites unless malfunctions occur. Before each YSI EXO2 or YSI 6600EDS sonde is deployed, calibration and maintenance is performed following the manufacturer's instructions. Calibration standards are required for pH, turbidity and salinity; all other parameter calibrations are performed as described in the manual. Buffer solutions for a two-point pH calibration (pH 7 and 10) are purchased pre-made from a scientific supply house. The conductivity and turbidity standards are obtained from YSI. Chlorophyll probes are calibrated with deionized water as single point calibration. The optical dissolved oxygen probes (ROX) require membrane changes yearly unless scratches or malfunctions occur prior to that time. All sites have been monitored using ROX dissolved oxygen probes since 2009, prior to that time rapid pulse dissolved oxygen probes were used. The rapid pulse membranes were replaced prior to each deployment and allowed to equilibrate prior to calibration.

Data sondes are wrapped in a wet, white towel and placed in a cooler for transport to the site. Monitoring stations are accessed using a small boat equipped with an outboard motor. During deployment the weather conditions and tide stage are recorded in the field observation log. The water quality instrument is placed inside a locked PVC tube that is attached to a piling if vertical deployment, and a steel cage if anchored horizontally approximately (15cm off the bottom). Every 15 minutes measurements are taken for Temperature, Specific Conductance, Salinity, Dissolved oxygen saturation, Dissolved oxygen concentration, Depth, pH, and Turbidity. All data are recorded in Eastern Standard Time. Vertical deployment structures were utilized at Research Creek beginning in 2008-2009, at Loosin Creek in 2009, and at Zeke's Basin in August 2010.

During 2019, chlorophyll data was collected at East Cribbings, Loosin Creek, and Research Creek stations. A two point (0 NTU and 66ug/L) chlorophyll calibration using DI water (0) and rhodamine standard (66 ug/L) was performed prior to sonde deployments. Chlorophyll spikes and negative values were rejected, while elevated values may be flagged as suspect depending on field conditions. Delete this last sentence - We do not currently calibrate with a known concentration of phytoplankton from fluorometric analysis, Rhodamine solutions, or adjust the data with any correction.

At the end of the sample period the water quality instrument is exchanged with a freshly calibrated instrument and transported back to the laboratory wrapped in a wet, white towel. The weather and water quality measurements are again noted in the field observation log. The calibration drift and the effect of biofouling on the water quality instrument are documented by post-calibration protocols. The water quality data are then uploaded, and sent to CDMO for primary QA/QC, and the instrument is cleaned and calibrated as noted

previously.

A Sutron Sat-Link2 transmitter was installed at the Research Creek station on August 7, 2006, and at the Zeke's Basin station on November 3, 2008. Both transmit data to the NOAA GOES satellite, NESDIS ID #3B032698. 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 components of North Carolina's National Estuarine Research Reserve (from north to south) are: Currituck Banks, Rachel Carson, Masonboro Island, and Zeke's Island. They are located along the southeast Atlantic coast of the United States. Currently, only data from Masonboro Island and Zeke's Island components are transferred to the CDMO. The four monitoring sites are:

### **A. Research Creek, Masonboro Island**

The first Masonboro Island site (formerly called Masonboro Island (MS)) is 0.72 km north east from the mouth of Whiskey Creek, and east of the Intracoastal Waterway (ICW), in a small navigable channel called Research Creek at 34°09'21.7" latitude and 77° 50'59.9" longitude. The site typically has a salinity range of 20-35 ppt and a tidal range that averages around 1.2 meters. The sole source of freshwater is rain and salinity values as little as 10 ppt have been recorded during periods of heavy rain. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.2 to 2.6 m. *Spartina* spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site experiences minimal boat traffic.

### **B. Loosin Creek, Masonboro Island**

The second Masonboro Island site (added in 2002) is 1.2 km east of the ICW, and 2.5 km south west of Masonboro Inlet, in a small navigable channel called Loosin Creek at 34° 10'20.0" latitude and 77° 49'58.1" longitude. The site generally has a salinity range of 22-35 ppt and a tidal range that averages 1.2 meters. The sole source of freshwater is rain and salinity values as little as 15 ppt have been recorded during periods of heavy rain. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.1 to 2.5 m. *Spartina* spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site experiences minimal boat traffic.

### **C. East Cribbings, Zeke's Island**

The first Zeke's Island site (formerly called Zeke's Island (ZI)) is located 1.8 km south of Federal Point boat launch in a tidal basin estuary at 33° 56'23.5" latitude and 77° 56'28.1" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water. The site typically has a salinity range of 15-33 ppt, although values as little as 10 ppt have been recorded. Tidal range averages 1.2 meters. Depth varies, but usually can be found to range from 0.5 to 2.7 meters. Bottom type substratum consists of large rocks ("the cribbings") with sand and detritus based sediment. There are no pollutants from land. Marsh and dunes surround the site. It is not accessible to road traffic but experiences minimal boat traffic.

### **D. Zeke's Basin, Zeke's Island**

The second Zeke's Island site (added in 2002) is located 0.8 km south east of the Federal Point boat launch in a tidal basin estuary at 33° 57'17.0" latitude and 77° 56'6.0" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water. The site has a characteristic salinity range of 12-30 ppt, but values below 10 ppt have been observed and are often associated with periods of heavy rainfall. Tidal range averages 1.2 meters. Depth varies, but typically

it can be found to range from 0.1 to 1.8 meters. Bottom type substratum consists of sand and detritus based sediment with a layer of soft sulfuric mud. Marsh and dunes surround the site. It is not accessible to road traffic but experiences minimal boat traffic.

SWMP Station Timeline

| Station Code | SWMP Status | Station Name   | Location                         | Active Dates       | Reason Decommissioned | Notes |
|--------------|-------------|----------------|----------------------------------|--------------------|-----------------------|-------|
| NOCECWQ      | P           | East Cribbing  | 33° 56' 23.64 N, 77° 56' 27.96 W | 01/01/2002 00:00 - | NA                    | NA    |
| NOCLCWQ      | P           | Loosin Creek   | 34° 10' 19.92 N, 77° 49' 58.08 W | 02/01/2002 00:00 - | NA                    | NA    |
| NOCRCWQ      | P           | Research Creek | 34° 9' 21.60 N, 77° 50' 59.64 W  | 01/01/2002 00:00 - | NA                    | NA    |
| NOCZBWQ      | P           | Zeke's Basin   | 33° 57' 16.92 N, 77° 56' 6.00 W  | 03/01/2002 00:00 - | NA                    | NA    |

## 6) Data collection period –

### East Cribbings

| Deployment |       | Retrieval  |       | Sonde Model | pH     | DO        | Turb      | Cond   | Chloro    |
|------------|-------|------------|-------|-------------|--------|-----------|-----------|--------|-----------|
| date       | time  | date       | time  | (Nickname)  |        |           |           |        |           |
| 12/12/2018 | 13:15 | 1/9/2019   | 14:45 | EXO2 (#1)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 1/9/2019   | 15:15 | 2/14/2019  | 14:30 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 2/14/2019  | 14:45 | 3/11/2019  | 12:15 | EXO2 (#1)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 3/11/2019  | 12:30 | 4/9/2019   | 13:00 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 4/9/2019   | 13:30 | 5/7/2019   | 13:45 | EXO2 (#1)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 5/7/2019   | 14:00 | 6/5/2019   | 13:00 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 6/5/2019   | 13:15 | 7/2/2019   | 10:30 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 7/2/2019   | 10:45 | 7/31/2019  | 10:00 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 7/31/2019  | 10:15 | 8/20/2019  | 14:30 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 8/20/2019  | 14:45 | 9/11/2019  | 9:30  | EXO2 (#1)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 9/11/2019  | 9:45  | 10/22/2019 | 15:15 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 10/22/2019 | 15:30 | 11/14/2019 | 11:00 | EXO2 (#1)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 11/14/2019 | 11:30 | 12/12/2019 | 11:30 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 12/12/2019 | 12:00 | 1/14/2020  | 12:45 | EXO2 (#1)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |

### Loosin Creek

| Deployment |       | Retrieval  |       | Sonde Model | pH     | DO        | Turb      | Cond   | Chloro    |
|------------|-------|------------|-------|-------------|--------|-----------|-----------|--------|-----------|
| date       | time  | date       | time  | (Nickname)  |        |           |           |        |           |
| 12/10/2018 | 12:00 | 1/9/2019   | 13:45 | EXO2 (#4)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 1/9/2019   | 14:00 | 2/13/2019  | 13:15 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 2/13/2019  | 13:30 | 3/11/2019  | 11:15 | EXO2 (#4)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 3/11/2019  | 11:30 | 4/9/2019   | 11:45 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 4/9/2019   | 12:15 | 5/8/2019   | 14:00 | EXO2 (#4)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 5/8/2019   | 14:30 | 6/5/2019   | 11:15 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 6/5/2019   | 11:30 | 7/2/2019   | 9:15  | EXO2 (#4)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 7/2/2019   | 9:30  | 8/7/2019   | 12:30 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 8/7/2019   | 12:45 | 8/20/2019  | 13:00 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 8/20/2019  | 13:15 | 9/11/2019  | 14:30 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 9/11/2019  | 15:00 | 10/21/2019 | 12:45 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 10/21/2019 | 13:00 | 11/12/2019 | 12:30 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 11/12/2019 | 12:45 | 12/11/2019 | 10:15 | EXO2 (#3)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 12/11/2019 | 10:30 | 1/15/2020  | 12:45 | EXO2 (#2)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |

## Research Creek

| Deployment |       | Retrieval  |       | Sonde Model | pH     | DO        | Turb      | Cond   | Chloro    |
|------------|-------|------------|-------|-------------|--------|-----------|-----------|--------|-----------|
| date       | time  | date       | time  | (Nickname)  |        |           |           |        |           |
| 12/11/2018 | 11:30 | 1/9/2019   | 13:30 | EXO2 (#9)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 1/9/2019   | 14:00 | 2/13/2019  | 13:30 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 2/13/2019  | 13:45 | 3/11/2019  | 10:45 | EXO2 (#9)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 3/11/2019  | 11:15 | 4/9/2019   | 11:30 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 4/9/2019   | 12:00 | 5/8/2019   | 13:30 | EXO2 (#9)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 5/8/2019   | 14:00 | 6/5/2019   | 11:00 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 6/5/2019   | 11:15 | 7/2/2019   | 9:00  | EXO2 (#9)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 7/2/2019   | 9:15  | 8/7/2019   | 12:15 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 8/7/2019   | 12:45 | 8/21/2019  | 14:00 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 8/21/2019  | 14:15 | 9/11/2019  | 14:15 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 9/11/2019  | 14:30 | 10/21/2019 | 12:30 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 10/21/2019 | 12:45 | 11/12/2019 | 12:15 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 11/12/2019 | 12:30 | 12/11/2019 | 10:00 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 12/11/2019 | 10:15 | 1/15/2020  | 15:15 | EXO2 (#6)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |

## Zeke's Basin

| Deployment |       | Retrieval  |       | Sonde Model | pH     | DO        | Turb      | Cond   | Chloro    |
|------------|-------|------------|-------|-------------|--------|-----------|-----------|--------|-----------|
| date       | time  | date       | time  | (Nickname)  |        |           |           |        |           |
| 12/12/2018 | 13:30 | 1/9/2019   | 15:15 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 1/9/2019   | 15:30 | 2/13/2019  | 14:45 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 2/13/2019  | 15:00 | 3/11/2019  | 12:15 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 3/11/2019  | 12:45 | 4/9/2019   | 13:15 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 4/9/2019   | 13:30 | 5/7/2019   | 14:00 | EXO2 (#5)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 5/7/2019   | 14:15 | 6/5/2019   | 13:15 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 6/5/2019   | 13:30 | 7/2/2019   | 11:00 | EXO2 (#7)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 7/2/2019   | 10:45 | 7/31/2019  | 10:15 | EXO2 (#8)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 7/31/2019  | 10:30 | 8/20/2019  | 14:45 | EXO2 (#7)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 8/20/2019  | 15:00 | 9/11/2019  | 9:45  | EXO2 (#9)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 9/11/2019  | 10:00 | 10/22/2019 | 15:30 | EXO2 (#7)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |
| 10/22/2019 | 16:00 | 11/14/2019 | 11:30 | EXO2 (#9)   | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
| 11/14/2019 | 11:45 | 12/12/2019 | 11:45 | EXO2 (#7)   | 599702 | 599100-01 | 599101-01 | 599870 | 599103-01 |

|            |       |           |       |           |        |           |           |        |           |
|------------|-------|-----------|-------|-----------|--------|-----------|-----------|--------|-----------|
| 12/12/2019 | 12:00 | 1/14/2020 | 12:45 | EXO2 (#9) | 599702 | 599100-01 | 599101-01 | 599827 | 599103-01 |
|------------|-------|-----------|-------|-----------|--------|-----------|-----------|--------|-----------|

## 7) Distribution –

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. 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.

Requested citation format:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: <http://www.nerrsdata.org/>; accessed 12 October 2020.

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 [www.nerrsdata.org](http://www.nerrsdata.org). Data are available in comma delimited format.

## 8) Associated researchers and projects (link to other products or programs) –

As part of the SWMP core monitoring program, the North Carolina Reserve also collects weather data from a meteorological station located at the Research Creek monitoring site and water chemistry/nutrient data from all 4 of the water quality monitoring sites. These data may be correlated with this water quality dataset. These data are available at [www.nerrsdata.org](http://www.nerrsdata.org).

Additional research projects are ongoing and continually changing. Check with the Research Coordinator or other contact person for an updated list of research.

## II. Physical Structure Descriptors

### 9) Sensor specifications –

NOC NERR deployed Xylem Analytics EXO data sondes at all sites in 2019. All sondes used are the same model (EXO2) and employ the same sensor configuration except.

YSI EXO Sonde:

Parameter: Temperature

Units: Celsius (C)

Sensor Type: CT2 Probe, Thermistor  
Model#: 599870  
Range: -5 to 50 C  
Accuracy: -5 to 35: +/- 0.01, 35 to 50: +/- .005  
Resolution: 0.01 C

Parameter: Conductivity  
Units: milli-Siemens per cm (mS/cm)  
Sensor Type: CT2 Probe, 4-electrode cell with autoranging  
Model#: 599870  
Range: 0 to 200 mS/cm  
Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm; 100 to 200: +/- 1% of reading  
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependant)

Parameter: Salinity  
Units: practical salinity units (psu)/parts per thousand (ppt)  
Sensor Type: CT2 probe, Calculated from conductivity and temperature  
Range: 0 to 70 psu  
Accuracy: +/- 1.0% of reading pr 0.1 ppt, whichever is greater  
Resolution: 0.01 psu

OR

Parameter: Temperature  
Units: Celsius (C)  
Sensor Type: Wiped probe; Thermistor  
Model#: 599827  
Range: -5 to 50 C  
Accuracy:  $\pm 0.2$  C  
Resolution: 0.001 C

Parameter: Conductivity  
Units: milli-Siemens per cm (mS/cm)  
Sensor Type: Wiped probe; 4-electrode cell with autoranging  
Model#: 599827  
Range: 0 to 100 mS/cm  
Accuracy:  $\pm 1\%$  of the reading or 0.002 mS/cm, whichever is greater  
Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity  
Units: practical salinity units (psu)/parts per thousand (ppt)  
Model#: 599827  
Sensor Type: Wiped probe; Calculated from conductivity and temperature  
Range: 0 to 70 ppt  
Accuracy:  $\pm 2\%$  of the reading or 0.2 ppt, whichever is greater  
Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation  
Sensor Type: Optical probe w/ mechanical cleaning  
Model#: 599100-01  
Range: 0 to 500% air saturation  
Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% of reading  
Resolution: 0.1% air saturation

Parameter: Dissolved Oxygen mg/L (Calculated from % air saturation, temperature, and salinity)

Units: milligrams/Liter (mg/L)

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 50 mg/L

Accuracy: 0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater

20 to 50 mg/L: +/- 5% of the reading

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 33 ft (10 m)

Accuracy: +/- 0.013 ft (0.004 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

Model#: 599701(guarded) or 599702(wiped)

Range: 0 to 14 units

Accuracy: +/- 0.1 units within +/- 10° of calibration temperature, +/- 0.2 units for entire temperature range

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

Accuracy: 0 to 999 FNU: 0.3 FNU or +/-2% of reading (whichever is greater); 1000 to 4000 FNU +/-5% of reading

Resolution: 0 to 999 FNU: 0.01 FNU, 1000 to 4000 FNU: 0.1 FNU

Parameter: Chlorophyll

Units: micrograms/Liter

Sensor Type: Optical probe

Model#: 599102-01

Range: 0 to 400 ug/Liter

Accuracy: Dependent on methodology

Resolution: 0.1 ug/L chl a, 0.1% FS

### **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 1.02 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.

**NOTE: older depth data cannot be corrected without verifying that the depth offset was in place and whether a vented or non-vented depth sensor was in use. No SWMP data prior to 2006 can be corrected using this method.** The following equation is used for corrected depth/level data provided by the CDMO beginning in 2010:  

$$((1013-BP)*0.0102)+Depth/Level = cDepth/cLevel.$$

#### **Salinity Units Qualifier:**

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report salinity in parts per thousand (ppt) units, the EXO sondes report practical salinity units (psu). These units are essentially the same and for SWMP purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the NERR System will assign psu salinity units for all data regardless of sonde type.

#### **Turbidity Qualifier:**

In 2013, EXO sondes were approved for SWMP use and began to be utilized by Reserves. While the 6600 series sondes report turbidity in nephelometric turbidity units (NTU), the EXO sondes use formazin nephelometric units (FNU). These units are essentially the same but indicate a difference in sensor methodology, for SWMP purposes they will be considered equivalent. Moving forward, the NERR System will use FNU/NTU as the designated units for all turbidity data regardless of sonde type. If turbidity units and sensor methodology are of concern, please see the Sensor Specifications portion of the metadata.

#### **Chlorophyll Fluorescence Disclaimer:**

YSI chlorophyll sensors (6025 or 599102-01) are designed to serve as a proxy for chlorophyll concentrations in the field for monitoring applications and complement traditional lab extraction methods; therefore, there are accuracy limitations associated with the data that are detailed in the YSI manual including interference from other fluorescent species, differences in calibration method, and effects of cell structure, particle size, organism type, temperature, and light on sensor measurements.

### **10) Coded variable definitions –**

| <u>Sampling station:</u> | <u>Sampling site code:</u> | <u>Station code:</u> |
|--------------------------|----------------------------|----------------------|
| Research Creek           | RC                         | nocrcwq              |
| Loosin Creek             | LC                         | noclcwq              |
| East Cribbings           | EC                         | nocecwq              |
| Zeke's Basin             | ZB                         | noczbwq              |

## 11) QAQC flag definitions –

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 –

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
- SCS Chlorophyll spike
- 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                               |

### 13) Post deployment information –

## East Cribbings

| Deployment | Sonde    | SpCond | DO      | pH    | pH     | Turb  | Depth           | Chlorophyll |
|------------|----------|--------|---------|-------|--------|-------|-----------------|-------------|
| Date       | nickname | (50.0) | (100.0) | (7.0) | (10.0) | (0.0) | (varies)        | (0.0)       |
| 1/9/2019   | #3       | 50.34  | 99.3    | 7.22  | 10.1   | 0.72  | 0.11(0.0)       | -0.07       |
| 2/14/2019  | #1       | 50.08  | 99.9    | 6.99  | 9.96   | -0.42 | -2.83(0.11)     | 0.09        |
| 3/11/2019  | #3       | 48.18  | *       | 6.95  | 10.01  | 0.46  | -0.032(-0.153)  | 0.31        |
| 4/9/2019   | #1       | 48.77  | 99.6    | 6.89  | 9.81   | 0.42  | 0.9(-0.014)     | 0.2         |
| 5/7/2019   | #3       | 51.34  | 96.8    | 7.18  | 10.11  | 0.21  | -0.032(-0.042)  | -0.08       |
| 6/5/2019   | #5       | 50.4   | 100.4   | 6.96  | 9.97   | -0.13 | 0.0030(-0.0040) | -0.25       |
| 7/2/2019   | #3       | 50.3   | 100.1   | 7.07  | 10     | 0.01  | 0.06(0.017)     | 0.01        |
| 7/31/2019  | #5       | 48.67  | 99.3    | 6.98  | 9.92   | -0.64 | -0.054(-0.052)  | -0.02       |
| 8/20/2019  | #1       | 50.66  | 101     | 7.09  | 10.01  | 1.43  | 0.011(0.017)    | 0.17        |
| 9/11/2019  | #5       | 50.89  | 100     | 7.02  | 9.93   | -0.67 | 0.081(0.0)      | 0.08        |
| 10/22/2019 | #1       | 50.2   | 101.9   | 7.18  | 10.01  | 0.87  | -0.039(-0.042)  | 0.12        |
| 11/14/2019 | #5       | 50.7   | 100.2   | 7.15  | 10.15  | -0.35 | 0.055(0.058)    | -0.36       |
| 12/12/2019 | #1       | 51.19  | 100     | 7.1   | 9.83   | 1.74  | 0.096(0.11)     | 0.14        |

## Loosin Creek

| Deployment | Sonde    | SpCond | DO      | pH    | pH     | Turb  | Depth           | Chlorophyll |
|------------|----------|--------|---------|-------|--------|-------|-----------------|-------------|
| Date       | nickname | (50.0) | (100.0) | (7.0) | (10.0) | (0.0) | (varies)        | (0.0)       |
| 1/9/2019   | #2       | 50.63  | 99      | 7.2   | 10.11  | 1.07  | 0.107(0.1)      | 0.75        |
| 2/13/2019  | #4       | 50.98  | 98.8    | 6.83  | 9.87   | -0.81 | 0.104(0.11)     | 0.52        |
| 3/11/2019  | #2       | 50.57  | 99.4    | 7.02  | 10.06  | -0.96 | -0.039(-0.153)  | 0.32        |
| 4/9/2019   | #4       | 48.61  | 99.3    | 6.95  | 9.92   | 0.38  | -0.0020(-0.014) | 0.76        |
| 5/8/2019   | #2       | 50.74  | 97.9    | 7.22  | 10.15  | 2.36  | -0.047(-0.042)  | 0.09        |
| 6/5/2019   | #4       | 44.44  | 100.1   | 10.74 | 13.66  | 1.02  | 0.0090(-0.0040) | 0.49        |
| 7/2/2019   | #2       | 50.78  | 99.3    | 7.41  | 10.31  | 0.14  | 0.046(-0.052)   | -0.06       |
| 8/7/2019   | #3       | 48.84  | 99.2    | 7.35  | 10.17  | 0.97  | -0.056(-0.052)  | -0.03       |
| 8/20/2019  | #2       | 50.74  | 100.7   | 7.15  | 10.06  | 1.48  | 0.023(0.017)    | 0.29        |
| 9/11/2019  | #3       | 50.25  | 101.9   | 7.13  | 9.85   | 0.23  | 0.047(0.089)    | 0.29        |
| 10/21/2019 | #2       | 50.59  | 100.5   | 7.27  | 10.24  | 1.29  | -0.03(-0.042)   | 0.42        |
| 11/12/2019 | #3       | 50.83  | 100.7   | 7.3   | 10.28  | 0     | 0.05(0.058)     | -0.04       |
| 12/11/2019 | #2       | 54.83  | 100.5   | 6.87  | 9.81   | 1.3   | 0.104(0.11)     | 0.4         |

## Research Creek

| Deployment | Sonde    | SpCond | DO      | pH    | pH     | Turb   | Depth            | Chlorophyll |
|------------|----------|--------|---------|-------|--------|--------|------------------|-------------|
| Date       | nickname | (50.0) | (100.0) | (7.0) | (10.0) | (0.0)  | (varies)         | (0.0)       |
| 1/9/2019   | #6       | 51.23  | 100.9   | 6.93  | 9.97   | 0.05   | 0.104(0.1)       | 0.17        |
| 2/13/2019  | #9       | 0.05   | 121.5   | 7.28  | 9.91   | 0.18   | 0.139(0.141)     | -0.2        |
| 3/11/2019  | #6       | 50.28  | 98.7    | 7.11  | 10.1   | -0.19  | -0.042(-0.153)   | 0.38        |
| 4/9/2019   | #9       | 1.86   | 109.5   | 7.17  | 9.68   | 6.2    | 0.023(-0.014)    | 1.2         |
| 5/8/2019   | #6       | 49.3   | 56.1    | 7.24  | 10.07  | 312.75 | -0.035(-0.042)   | 7.87        |
| 6/5/2019   | #9       | 0.01   | 45.4    | 7.01  | 9.51   | 1.9    | -0.0030(-0.0040) | 1.26        |
| 7/2/2019   | #6       | 50.68  | 96.5    | 7.36  | 10.24  | 0.21   | -0.048(-0.052)   | 0.22        |
| 8/7/2019   | #8       | 50.24  | 100.6   | 7.07  | 10.03  | 1.5    | 0.046(0.0)       | 0.03        |
| 8/21/2019  | #6       | 50.82  | 102.7   | 7.29  | 10.19  | 1.67   | 0.046(0.017)     | 0.06        |
| 9/11/2019  | #8       | 50.7   | 99.2    | 7.27  | 9.92   | 0.23   | 0.026(0.089)     | 0.12        |
| 10/21/2019 | #6       | 50.7   | 99.3    | 7.25  | 10.13  | 0.45   | -0.039(-0.042)   | -0.06       |
| 11/12/2019 | #8       | 50.6   | 99.9    | 7.12  | 10.08  | 0.29   | 0.053(0.058)     | -0.13       |
| 12/11/2019 | #6       | 50.85  | 100.6   | 7.19  | 10.1   | 1.08   | 0.075(0.11)      | 0.61        |

#### Zeke's Basin

| Deployment | Sonde    | SpCond | DO      | pH    | pH     | Turb  | Depth           | Chlorophyll |
|------------|----------|--------|---------|-------|--------|-------|-----------------|-------------|
| Date       | nickname | (50.0) | (100.0) | (7.0) | (10.0) | (0.0) | (varies)        | (0.0)       |
| 1/9/2019   | #8       | 51.06  | 99.8    | 7.43  | 10.14  | 0.05  | 0.11(0.1)       | -0.03       |
| 2/13/2019  | #5       | 50.42  | 100.8   | 7.06  | 9.95   | 0.45  | 0.143(0.141)    | 0.92        |
| 3/11/2019  | #8       | 50.43  | 99.7    | 7.23  | 10.3   | 0.02  | -0.043(-0.153)  | 0.22        |
| 4/9/2019   | #5       | 50.91  | 99.8    | 7.03  | 9.93   | -0.58 | -0.026(-0.025)  | 1.08        |
| 5/7/2019   | #8       | 49.79  | 99      | 7.18  | 9.92   | 0.23  | -0.034(-0.042)  | -0.09       |
| 6/5/2019   | #7       | 50.66  | 103.2   | 6.99  | 10.01  | 5.24  | 0.0040(-0.0040) | 1.52        |
| 7/2/2019   | #8       | 50.49  | 100.4   | 7.18  | 10.14  | 0.38  | 0.06(0.017)     | -0.01       |
| 7/31/2019  | #7       | 50.33  | 101.3   | 7.18  | 10.12  | 2.65  | 0.035(0.038)    | -0.2        |
| 8/20/2019  | #9       | 50.23  | 98.3    | 7.44  | 10.22  | 1.13  | 0.052(0.017)    | 1.84        |
| 9/11/2019  | #7       | 27.1   | 99      | 7.18  | 10.07  | 0.47  | 0.039(0.089)    | 0.11        |
| 10/22/2019 | #9       | 50.47  | 99.8    | 7.12  | 9.87   | 0.96  | -0.03(-0.042)   | -0.12       |
| 11/14/2019 | #7       | 51.25  | 100     | 6.91  | 9.79   | 0.61  | 0.041(0.048)    | -0.51       |
| 12/12/2019 | #9       | 51.45  | 100.3   | 6.76  | 6.7    | -0.16 | 0.089(0.11)     | 0.64        |

\*Note: pH post-deployment readings are temperature dependent and minor variations are expected as a result.

#### 14) Other remarks/notes –

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.

#### **For all data**

New deployments were flagged as <0> (CND).

Temperature affected measurements (SpCond/Salinity, pH) were rejected anytime the temperature sensor was affected by out of water events (pronounced change in temp values during extreme low tide readings).

Data affected by low tide were coded (CLT). Lower SpCond/Salinity was addressed with <1> (CLT) due to the probability of fresher surface waters being measured as the water level decreased. Salinities approaching zero or less were addressed as <-3> [GOW] (CLT) and affected data were also rejected accordingly.

All depth data corresponding to rejected or suspect SpCond/Salinity data (due to low tide) were also rejected <-3> [SOW] (CLT). Depth sensor is located above Conductivity/Temperature (C/T) sensor and will be exposed when SpCond approaches 0.0. It is possible that some probes were still in the water during out of water events. The vertical orientation of the sondes means that shorter probes (pH, C/T) will be affected before longer probes (dissolved oxygen, turbidity).

All negative depth flagged and rejected unless affected by barometric pressure and coded as suspect <1> [SNV] (CAP).

Dissolved oxygen concentrations < 3 mg/L were coded <0> (CDA) along with corresponding values for DO% during hypoxic events.

Increased turbidity readings occurred throughout many deployments with unknown causes and were coded as such:

<-3> [STS] (CCU) = rejected turbidity spike

<1> [STS] (CCU) = suspect turbidity spike

Small negative turbidity values < -2 NTU were flagged as suspect, <1> (CAF).

Negative chlorophyll values were flagged as <-3> [SNV] (CSM).

Chlorophyll spikes were flagged as suspect <1> [SCS] (CCU), or rejected <-3> [SCS] (CCU).

#### Hurricane Dorian hits NC September 5, 2019

The East Cribbings station was subject to sedimentation immediately following the storm. DO, pH, turbidity, and chlorophyll sensors appear to have repeatedly been partially or totally buried for multiple days at a time following the storm through the end of the 9/11/19 – 10/22/19 deployment. At times, the data show that sediments may have been washed away. This station is subject to strong semi-diurnal tidal currents which may be responsible for the clearing of deposited sediments. Affected data are flagged suspect <1> (CMD) or rejected <-3> (CMD) based on the assessment of surrounding data from all sensors. All sensors post calibrated acceptably following these deployments further suggesting that the sensors were affected by sedimentation.

Dorian Storm Surge- Negative depth excursion occurred as a result of Hurricane Dorian’s strong sustained northerly winds blowing water out of the Cape Fear Estuary. Flagged <0> (CWE) 09/05/2019 00:00 - 09/07/2019 09:45.

## **East Cribbings**

### **General**

This site has had increasing problems with mud and silt in the deployment tube, affected readings and filling the guard above the level of the sensors.

This site is within a shallow lagoonal system and the sonde is subject to out of water events, especially at spring low tides. (Vertical deployment has been in place since 12/04/12.)

Data were missing due to sonde swap:

01/09/2019 15:00

04/09/2019 13:15

11/14/2019 11:15

12/12/2019 11:45

It seems the wiper was still cleaning the probes but wiper position was listed as not a number at times. The chlorophyll and turbidity data do not seem impacted or elevated prior to battery failure.

Station was negatively affected by silting during several extended periods. Mud and silt filled in the deployment tube, covering sensors and impacting data. These data were flagged as suspect or rejected, <-3> (CMD), for all parameters.

### **Depth**

There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative, but the sensors were still in the water.

Following the 02/14/2019 deployment the depth sensor was showing -2.83 when it should have been reading zero. The data appear to be fine within the deployment and perhaps some sediment dried within the depth sensor. This sensor was fine after cleaning for the next deployment. The depth data was flagged as <0> CSM.

The depth data for the 04/09/2019 deployment was not reported accurately. This sensor failed to pass the post calibration and read negative for the majority of the deployment. This sonde was returned to YSI for repair.

Hurricane Dorian hits NC September 5, 2019

The East Cribbings station was subject to sedimentation immediately following the storm. DO, pH, turbidity, and chlorophyll sensors appear to have repeatedly been partially or totally buried for multiple days at a time following the storm through the end of the 9/11/19 – 10/22/19 deployment. At times, the data show that sediments may have been washed away. This station is subject to strong semi-diurnal tidal currents which may be responsible for the clearing of deposited sediments. Affected data are flagged suspect <1> (CMD) or rejected <-3> (CMD) based on the assessment of surrounding data from all sensors. All sensors post calibrated acceptably following these deployments further suggesting that the sensors were affected by sedimentation.

### **SpCond/Salinity**

This site experiences out of water events and may sample a fresh water lens in advance or following this events.

### **Dissolved Oxygen**

Dissolved oxygen data can be quite variable. These cycles often correlate with tidal fluctuation, and may be accentuated by presence of invasive drift algae, *Gracilaria vermiculophylla*.

Values above 100% saturation are not uncommon and values above 200% may occur during warmer months. These reflect conditions at the site, occurring at the same time as elevated pH values and data were retained (unless affected by out of water events, potentially driven by *G. vermiculophylla* presence). Data were not flagged as suspect though some of the upper limits for percent saturation were surpassed.

Following the 05/07/2019 deployment, dissolved oxygen post calibrations were slightly lower than acceptable range. For most of the deployment, readings fit conditions for the site. In early June, turbidity and chlorophyll values were elevated and dissolved oxygen values may have been very slightly lower at the end of the deployment June 4-5, 2019.

Mud in the guard may have impacted dissolved oxygen levels during Hurricane Dorian in early September. There may have been additional mud impacts starting September 26, 2019 through October. Additionally, dissolved oxygen was impacted by mu in the guard at the end of November 2019.

## **pH**

pH post calibration was unacceptable for the following deployments causing data to be flagged as suspect or rejected.

12/11/2018 deployment, suspect (affects data from 01/01/2019 – 01/09/2019)

08/24/2019 06:45 and 08/24/2019 08:00 unexplained negative pH spikes. Surrounding data unaffected. Deployment post calibration values were okay. Rejected and flagged <-3> [SSM] (CSM).

## **Turbidity**

Elevated turbidity readings were rejected or flagged as suspect.

Mud in the guard may have impacted turbidity levels during Hurricane Dorian in early September. There may have been additional mud impacts starting September 27, 2019.

## **Chlorophyll**

Occasional chlorophyll spikes occurred and were flagged as suspect or rejected, cause unknown. Elevated chlorophyll readings were rejected or flagged as suspect.

Towards the end of the 05/07/2019 deployment chlorophyll values were elevated, cause unknown and flagged as suspect. On 06/05/2019 values increased and were rejected, cause unknown. Biofouling was light and field notes do not indicate that this sensor was heavily fouled. This sensor also read within acceptable range during the post calibration.

Chlorophyll data was rejected during the 11/14/2019 deployment, potentially from mud in the guard impacting readings.

## **Loosin Creek**

### **General**

This site typically has low turbidity values, occasionally these values approach zero and fit conditions of the site. Negative one readings were retained and marked as (CAF), acceptable calibration/accuracy error of the sensor.

Missing records due to sonde swap: 05/08/2019 14:15, 09/11/2019 14:45

Batteries failed and resulted in missing data 06/21/2019 7:00 – 07/02/2019 9:15. This sonde returned from the field with a broken pin on turbidity sensor.

### **Depth**

There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative but the sensors were still in the water.

During the 06/05/2019 deployment, SpCond failed and all dependent parameters were also rejected. The probe failed to post calibrate within acceptable range. When disassembling the sonde and sensors, pins were broken on the turbidity sensor and central wiper and may have been cause of erroneous data.

### **SpCond/Salinity**

The following deployments were flagged as suspect or rejected due to SpCond/Salinity post calibration values that were outside the acceptable range:

Following the 04/09/2019 deployment, the SpCond sensor post calibration values were just outside of acceptable range. This sensor failed on the next deployment and data were flagged as suspect.

During the 06/05/2019 deployment, SpCond failed and all dependent parameters were also rejected. The probe failed to post calibrate within acceptable range. When disassembling the sonde and sensors, pins were broken on the turbidity sensor and central wiper and may have been cause of erroneous data.

Following the 08/07/2019 deployment, the SpCond sensor post calibration values were just outside of acceptable range.

Following the 12/11/2019 deployment, the SpCond sensor values were elevated for post calibration. Data was rejected.

### **Dissolved Oxygen**

Following the 05/08/2019 deployment, values for dissolved oxygen were slightly lower than acceptable range.

During the 06/05/2019 deployment, SpCond failed and all dependent parameters were also rejected. The probe failed to post calibrate within acceptable range. When disassembling the sonde and sensors, pins were broken on the turbidity sensor and central wiper and may have been cause of erroneous data.

### **pH**

pH post calibration was elevated following:  
05/08/2019 deployment, suspect

06/05/2019 deployment, suspect  
07/02/2019 deployment, suspect  
08/07/2019 deployment, suspect  
10/21/2019 deployment, suspect  
11/12/2019 deployment, suspect  
12/10/2019 deployment, suspect.

### **Turbidity**

Elevated turbidity readings were rejected or flagged as suspect.

Turbidity readings crept up towards the end of the 05/08/2019 deployment. This sensor failed to pass post calibration within acceptable range. Data were flagged as suspect and seem minimally impacted.

### **Chlorophyll**

Negative chlorophyll values were flagged as <-3> [SNV].

Isolated chlorophyll spikes were retained unless above the sensor limit. These elevated values may result from macroalgae within the guard.

Towards the end of the 01/09/2019 deployment, chlorophyll a levels were elevated. Data was suspect from 02/11/2019 through the end of deployment.

### **Research Creek**

#### **General**

Missing data due to station maintenance:

01/09/2019 13:45  
03/11/2019 11:00  
05/08/2019 13:45

Missing due to instrument malfunction:

01/09/2019 23:45 – 00:45

### **Temperature**

SpCond/Salinity failure caused rejection of SpCond, Salinity, DO mg/L, and depth. All affected data flagged <-3> [SCF].

01/01/2019 - 01/09/2019 13:30  
02/13/2019 13:45 – 03/11/2019 10:45  
04/09/2019 12:00 – 05/08/2019 13:30

Catastrophic temperature sensor failure occurred during the 06/05/2019 deployment. All data were rejected beginning 06/16/2019 11:00.

### **Depth**

SpCond/Salinity failure caused rejection of Specific Conductivity, Salinity, DO mg/L, and depth. All affected data flagged <-3> [SCF].

01/01/2019 - 01/09/2019 13:30  
02/13/2019 13:45 – 03/11/2019 10:45

04/09/2019 12:00 – 05/08/2019 13:30  
06/05/2019 11:15 – 07/09/2019 13:30

### **SpCond/Salinity**

Dips in salinity occurred during low tide. There may have been some stratification and sensors may be measuring a fresh water lens as approaching the surface.

SpCond/Salinity failure caused rejection of Specific Conductivity, Salinity, DO mg/L, and depth. All affected data flagged <-3> [SCF].

01/01/2019 - 01/09/2019 13:30  
02/13/2019 13:45 – 03/11/2019 10:45  
04/09/2019 12:00 – 05/08/2019 13:30  
06/05/2019 11:15 – 07/09/2019 13:30

### **Dissolved Oxygen**

Dissolved oxygen concentrations were highly variable during March 2016, with values oscillating between 17 – 130% with tidal cycles. These occurred as the water temperature increased. Though turbidity values for this time were flagged as suspect or rejected, the increased turbidity and possibly presence of macroalgae affected dissolved oxygen.

Post calibration values not within acceptable range during the following the deployments and flagged suspect only <1> [SPC]:

05/08/2019 14:00 – 05/29/2019 14:30  
07/02/2019 9:15 – 08/07/2019 12:15  
08/21/2019 14:15 – 09/11/2019 14:15

Dissolved oxygen data rejected 05/29/2019 14:45 – 06/05/2019 11:00. The wiper was not on sonde upon retrieval, sensors were heavily fouled and DO failed to pass post calibration.

SpCond/Salinity failure caused rejection of Specific Conductivity, Salinity, DO mg/L, and depth. All affected data flagged <-3> [SCF].

01/01/2019 - 01/09/2019 13:30  
02/13/2019 13:45 – 03/11/2019 10:45  
04/09/2019 12:00 – 05/08/2019 13:30  
06/05/2019 11:15 – 07/09/2019 13:30

### **pH**

Post calibration values not within acceptable range during the following the deployments:

04/09/2019 suspect  
07/02/2019 suspect  
08/21/2019 suspect  
09/11/2019 suspect  
10/21/2019 suspect.

Catastrophic temperature sensor failure occurred during the 06/05/2019 deployment. All data were rejected beginning 06/16/2019 11:00.

### **Turbidity**

Turbidity spikes were rejected or flagged as suspect.

While turbidity passed post calibration within range, the 01/09/2019 deployment had elevated turbidity reading for the entire deployment. Data for this deployment was flagged as suspect, cause unknown.

Elevated turbidity values were rejected towards the end of the 04/09/2019 deployment beginning on 04/27/2019.

Following the 05/08/2019 deployment, the wiper was not on sonde upon retrieval, sensors were heavily fouled and turbidity failed to pass post calibration. Data was flagged as suspect from 05/08/2019, then rejected from 05/29/2019 through the end of deployment.

Catastrophic temperature sensor failure occurred during the 06/05/2019 deployment. The turbidity and chlorophyll values dropped to zero or negative at the end of this deployment and data were rejected beginning 06/16/2019 11:00.

Elevated turbidity values during 10/21/2019 deployment flagged as suspect.

### **Chlorophyll**

Elevated chlorophyll values were rejected towards the end of the 04/09/2019 deployment beginning on 05/02/2019.

Following the 05/08/2019 deployment, the wiper was not on sonde upon retrieval, sensors were heavily fouled and chlorophyll values failed to pass post calibration. Data was flagged as suspect from 05/08/2019, then rejected from 05/29/2019 through the end of deployment.

Catastrophic temperature sensor failure occurred during the 06/05/2019 deployment. The turbidity and chlorophyll values dropped to zero or negative at the end of this deployment and data were rejected beginning 06/16/2019 11:00.

### **Zeke's Basin**

#### **General**

This site is within a shallow lagoonal system and the sonde is subject to out of water events, especially at spring low tides.

Growth of invasive *Gracilaria vermiculophylla* has been heavy around this site. Increased biomass, sedimentation, and decaying organic material are becoming a chronic problem in this location. Optical probes are increasingly affected.

Missing data due sonde swap:  
03/11/2019 12:30

Accumulation of mud in the sonde deployment tube/guard resulted in rejected and suspect data for DO, Turbidity, and Chlorophyll. Mud may affect probes individually. Most of these data are flagged as suspect <1> [SBO] (CMD) or <-3> [SBO] (CMD) when data are obviously affected by mud or outside the sensor range.

#### **Depth**

There were several times that changes in barometric pressure affected the depth sensor. The depth records were flagged as suspect, <1> [SNV] (CAP) when the values were negative, but the sensors were still in the water.

An out of water event occurred on 06/19/2019 13:00. This data point was rejected for all parameters.

### Hurricane Dorian

Dorian Storm Surge- Negative depth excursion occurred as a result of Hurricane Dorian's strong sustained northerly winds blowing water out of the Cape Fear Estuary. Flagged <0> (CWE) 09/05/2019 00:00 - 09/07/2019 09:45.

Low salinity, hypoxia, elevated chlorophyll remained present for this time.

### **SpCond/Salinity**

For the following deployment SpCond vales were low during post calibration:

09/11/2019 barnacles were on the sensor upon retrieval.

11/14/2019 and 12/12/2019 deployments had slightly elevated post calibration values. Data appears to fit conditions for the site.

### **Dissolved Oxygen**

Especially during summer months, oxygen data can be quite variable. These cycles often correlate with tidal fluctuation and were likely driven by presence of drift algae (*Gracilaria vermiculophylla*).

High values were recorded for dissolved oxygen, sometimes surpassing 200% saturation. These reflect conditions at the site, occurring at the same time as elevated pH values and data were retained (unless affected by out of water events, potentially driven by *G. vermiculophylla* presence). Data were retained.

Post calibration values were slightly elevated following the 06/05/2019 deployment. Entire deployment flagged as suspect.

### **pH**

Several pH values >9.0 were associated with high dissolved oxygen concentrations and presumed to be resulting from high rates of photosynthesis and a large standing crop of macrophytic algae, *G. vermiculophylla*, in the area. The algal biomass is not ephemeral and therefore not considered an "algal bloom". These data were closely scrutinized and retained after determining the cause.

pH failed to pass post calibrations in one or more standard within acceptable range for the following deployments.

|            |                                                                                                                          |
|------------|--------------------------------------------------------------------------------------------------------------------------|
| 12/12/2018 | both pH 7 & 10 slightly elevated, slope not within acceptable range                                                      |
| 01/09/2019 | pH 7 elevated                                                                                                            |
| 03/11/2019 | both pH 7 & 10 slightly elevated, slope was within acceptable range                                                      |
| 08/20/2019 | pH appears to be calibrated 0.2 higher than surrounding deployments and failed to postcalibrate within acceptable range. |

### **Turbidity**

Periods of elevated turbidity values were crosschecked with weather data to determine if they were driven by weather. Turbidity at Zeke's Basin station is particularly sensitive to high or sustained winds due to winds during periods of low water and is a normal occurrence. All data above 1000 NTU were rejected <-3> [STS].

Turbidity failed to pass post calibrations within acceptable range for the following deployments. The entire deployment was flagged as suspect.

06/05/2019

07/31/2019

### **Chlorophyll a**

Isolated chlorophyll spikes were retained unless above the sensor limit. These elevated values may result from macroalgae within the guard.

Two periods of chlorophyll spikes during Q3. Values > 1000ug/L rejected <-3> [SCS] (CSM), values >200ug/L flagged suspect <1> [SCS] (CSM)

August 21-23, 2019 These are unexplained.

September 5-7, 2019 These are explained by the approach of Hurricane Dorian.