Narragansett Bay (NAR) National Estuarine Research Reserve Water Quality Metadata

January to December 2013

Last updated: Monday, November, 4, 2024

# I. Data Set and Research Descriptors

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## 2. Entry Verification

Deployment data are uploaded from the YSI data logger to a laptop 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.

Dr. Durant is the data manager.

Normally, sea-truthing is conducted by measuring water quality with an additional data logger taking real-time measurements at the time of deployment (except for the Nag Creek site). The data is recorded using a hand-held YSI 556-MPS data logger. Values for temperature, salinity, dissolved oxygen (% saturation and mg/L), and pH are recorded real-time at either 0.5 or 1.0 meter intervals between the surface and bottom at each deployment site. The calibration procedure for the data logger used in sea-truthing follows the same general procedure as that for data loggers used in deployments, and is the responsibility of the Reserve’s technician. However, due to technical problems with the YSI 556, sea-truthing was not possible from January to March; we resumed sea-truthing in April.

## 3. Research Objectives

YSI 6600 data loggers are being deployed off Prudence Island in Narragansett Bay as part of the National Estuarine Research Reserve's (NERR) System-Wide Monitoring Program (SWMP). The goal is to develop long-term data sets for representative estuarine systems in order to track changes in water quality over time. Because Prudence Island is located in the geographic center of Narragansett Bay, it is an ideal location for monitoring the status and trends in water quality in the Bay over time. One NERR water quality monitoring station has been established at Potter Cove, on the island's northeastern shore. This area is impacted by boat traffic and storm runoff from mainland urban and residential areas. The second NERR water quality monitoring station, T-Wharf, is situated on the southeastern shore of the island, facing the open waters of Rhode Island Sound. It is approximately 6 miles south of the Potter Cove site. Boat traffic is sparse at this site and storm runoff is less likely to have a significant impact on water quality. A third monitoring site was added in March 2002. This monitoring site is located in Nag Creek, a salt marsh tidal creek which flows into the West Passage of Narragansett Bay. The addition of this site completes our representation of dominant habitat types occurring in Narragansett Bay (i.e. marsh, cove, and open water). In July of 2002, the T-Wharf monitoring station was replaced with two new monitoring sites located a short distance from the original T-Wharf location. The new stations are situated on either side of a wharf support piling. One data logger records water quality near the surface (approximately 1.0m deep) while the second records water quality parameters approximately 1.0 meter off the bottom. This allows for the identification of both the frequency and duration of any stratification which may occur in the open waters of Narragansett Bay. The Narragansett Bay water quality monitoring program began in December 1995 at Potter Cove, and in September 1996 at T-Wharf (Section 5, Site Location and Character section for description of sites). YSI electronic data loggers were deployed to measure the water temperature, specific conductance, dissolved oxygen, pH, depth, and turbidity conditions at 30-minute intervals. However, since 2004, data have been collected at 15-minute intervals.

## 4. Research Methods

One data logger is deployed at each permanent monitoring station in Narragansett Bay. The instruments are deployed for approximately two weeks at a time, depending on the season, and measurements are taken every 15 minutes (see note below). The monitoring station at Potter Cove was originally constructed in 1995, and it consisted of a PVC pipe mounted vertically on a piling located approximately 6 feet west of a floating dock. To facilitate water flow across the sensors, openings were cut into the PVC pipes. The pipes were positioned to ensure that the sensors were less than 1 meter from the bottom. In 2006, the infrastructure at Potter Cove was replaced. It currently consists of a short PVC tube attached to an adjacent dock, with a line attached through the pipe to an anchor on the bottom. The sonde is attached to the anchor via a shackle and hook set-up, and a float is attached to the top of the sonde to keep it approximately 0.75 m off the bottom. With this setup, the sonde is free and clear of any pipe affects since the pipe does not extend to the bottom and serves only as a “decoy pipe” to prevent vandalism.

In 1996, the original T-Wharf station was put into service using a PVC pipe mounted on a piling attached to a pier. In 2002, the two replacement T-Wharf sites (Surface and Bottom) were also deployed in PVC pipes mounted to a piling. The sonde at the T-Wharf Surface station is maintained just below the surface by means of a buoy attached by rope to the adjacent wharf; the sonde at T-wharf bottom is maintained approximately 0.5 m off the bottom. The pipes are cleaned monthly with a chimney brush as needed but mostly during the warm months (May to October) to reduce the impact of biofouling on the data. On 10/11/06, the PVC deployment pipes and securing structures were replaced at the T-Wharf site. The design was similar to the previous pipe design and consisted of holes drilled through the pipe and large slits at the bottom of the pipe to allow for free water movement at the sonde. The T-Wharf Bottom pipe extends approximately 6 m though the water to the bottom of the site, where the sonde is kept approximately 1.0 m off the bottom. The T-Wharf Surface pipe extends approximately 2 m under the surface of the water (at low tide), where the sonde is attached to a float to keep it approximately 0.5 m below the surface of the water. After Tropical Storm Irene in August of 2011, the deploying structure was damaged; the PVC pipe was lost and the piling where it was attached to was damaged beyond repair. A temporary deploying structure was build consisting of a steel cable attached to the wharf with an anchor at the end to keep the cable straight and in place. The Surface and Bottom sondes were attached to the cable for each deployment and lowered into the water with a security line. The Reserve made the arrangements to build a permanent deploying structure; a new piling was installed on February 2012, two 4” diameter PVC pipes were installed in June (as recommended by YSI), and the sondes were deployed in July in these new structures. The Surface sonde was deployed to be approximately 1.0 m below the surface, and the Bottom sonde 1.0 m above the bottom substrate. Due to the narrow PVC pipes (4 inches in diameter), the Surface sonde was getting stuck inside the PVC pipe and not floating free; thus, the deployment was changed to a fixed one at approximately 0.5 m at low tide.

The Nag Creek sonde was originally deployed in a metal cage which was tethered to the bank. A permanent deployment structure was installed 12/31/02, consisting of a 4” x 4” pressure-treated post with a hinged 2” x 4” horizontal arm. On 09/08/06, the sonde deployment structure was redesigned and changed. The new structure consists of an L-shape wooden structure that held in place in the sediment by a large metal tripod sunk into the mud. The sonde is extended from the arm into the water via a cleat, eye and line system and hangs approximately 0.30 m off the bottom of the creek.

For each sampling period, each instrument is calibrated against standards: the specific conductivity probe is calibrated using conductivity calibrator 50,000 µS/cm; a three point calibration is done (4, 7, 10) for the pH probe using pH buffer 4, 7, and 10; a two point calibration (0, 126) is done for turbidity using deionized water, and 6073G turbidity standard; a one point calibration (0) with deionized water is done for chlorophyll fluoresces (data only available upon request). For EDS data loggers, the dissolved oxygen (DO) membrane is replaced for every deployment and allowed to stretch for a minimum of 12 hours before the Rapid Pulse DO sensor is calibrated in air-saturated water. The sonde is programmed to begin taking measurements approximately 10 hours in advance of planned deployment, allowing the DO membrane to stabilize. The file is checked for DO sensor drift before the DO probe is calibrated. Calibration of the dissolved oxygen sensor is usually done within 2 hours of deployment. The V2 sondes have optical DO probes (DO ROX) and membranes are changed annually or when readings become unstable; this sensor can be calibrated at the same time as the other sensors; however, it is usually done within 2 hours of deployment in air-saturated water. At the end of each sampling period, the data loggers are retrieved, and freshly calibrated instruments are deployed. The retrieved data loggers are brought back to the laboratory, post-deployment evaluations of the instrument are carried out, and the device is cleaned and serviced by methods outlined in the YSI Operating and Service Manual.

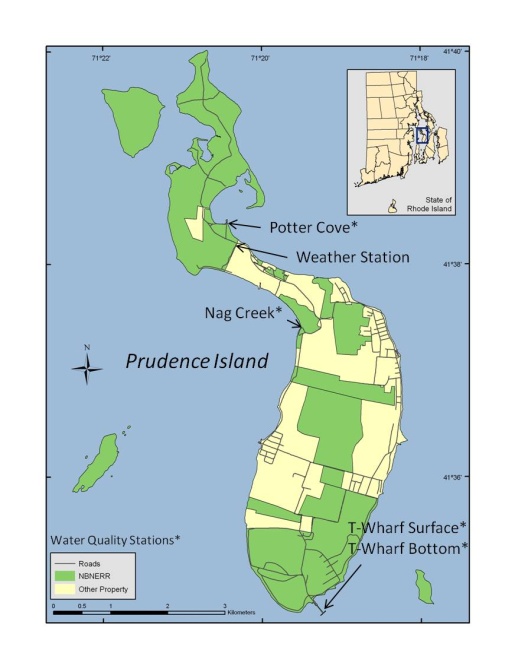
Note: Data from all stations was historically collected at 30-minute sampling intervals. In 2004, the Narragansett Bay NERR became involved with a statewide fixed site water quality monitoring program (refer to Section 8). Data collection at all stations was changed to 15 a minute sampling interval in order to be compliant with this local monitoring effort.

A Sutron Sat-Link2 transmitter was installed at the T-Wharf Bottom monitoring station on 07/27/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B0335EE. The transmissions are scheduled hourly and contain four (4) datasets 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](http://cdmo.baruch.sc.edu/).

## 5. Site Location and Character

The NBNERR consists of 4453 acres of diverse estuarine and terrestrial habitats ranging from deep water to salt marshes to forested uplands. The land holdings include 65% of Prudence Island, most of nearby Patience Island, and all of Hope and Dyer Islands. The Reserve is located close to the geographic center of Narragansett Bay in Rhode Island. The Narragansett Bay Watershed drains approximately 1,800 square miles and there are numerous and substantial freshwater inputs to the Bay.

Specific characteristics of the Narragansett Bay National Estuarine Research Reserve

Location: 41°38’30” N, 71°20’30” W

Tidal range: -0.2 to 1.7 meters MLW

Salinity: 15 to 32 ppt

Temperature: -1.0 to 26 C

Province: North temperate, Virginian bioregion

Specific characteristics of the Nag Creek site are:

Location: 41o 37' 29.458" N, 71o 19' 27.421" W

Depth: 0.1 to 1.4 meters

Bottom habitat: Organic mud

Pollutants: Negligible

Watershed: Narragansett Bay, West Passage

Specific characteristics of the Potter Cove site are:

Location: 41o 38' 25.984" N, 71o 20' 27.165" W

Depth: 0.9 to 3.9 meters

Bottom habitat: Sand, silt, some organic mud

Pollutants: Boaters’ wastes, storm runoff from mainland urban areas

Watershed: Narragansett Bay, North Prudence (4801 square km)

Specific characteristics of the T-Wharf Surface site are:

Location: 41o 34' 42.099" N, 71o 19' 16.049" W

Depth: 0.2 to 0.9 meters

Bottom habitat: Sand, silt, some organic mud

Pollutants: Negligible

Watershed: Narragansett Bay, South Prudence

Specific characteristics of the T-Wharf Bottom site are:

Location: 41o 34' 42.099" N, 71o 19' 16.049" W

Depth: 4.6 to 6.9 meters

Bottom habitat: Sand, silt, some organic mud

Pollutants: Negligible

Watershed: Narragansett Bay, South Prudence

## 6. Data collection period

### Nag Creek (Data collection ongoing since 2002).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sonde | Deployment | | Retrieval | |
| Date | Time | Date | Time |
| 02A0229AA-EDS | 12/11/12 | 10:15 | 01/02/13 | 13:45 |
| 01E0566AD-EDS | 03/27/13 | 13:30 | 04/02/13 | 10:00 |
| 02A0229AA-EDS | 04/02/13 | 10:15 | 04/16/13 | 09:15 |
| 01E0566AD-EDS | 04/16/13 | 09:30 | 05/15/13 | 09:30 |
| 01E0566AD-EDS | 05/15/13 | 09:45 | 05/29/13 | 09:30 |
| 02A0229AA-EDS | 05/29/13 | 10:15 | 06/13/13 | 09:30 |
| 01E0566AD-EDS | 06/13/13 | 09:45 | 06/25/13 | 09:00 |
| 05E1300AE-EDS | 06/25/13 | 09:30 | 07/09/13 | 10:00 |
| 02A0229AA-EDS | 07/09/13 | 10:30 | 07/23/13 | 13:00 |
| 05E1300AE-EDS | 07/23/13 | 13:15 | 08/06/13 | 09:45 |
| 02A0229AA-EDS | 08/06/13 | 10:00 | 08/20/13 | 10:30 |
| 05E1300AE-EDS | 08/20/13 | 10:45 | 09/04/13 | 09:30 |
| 02A0229AA-EDS | 09/04/13 | 09:45 | 09/18/13 | 11:00 |
| 05E1300AE-EDS | 09/18/13 | 11:15 | 10/01/13 | 09:15 |
| 02A0229AA-EDS | 10/01/13 | 09:45 | 10/16/13 | 09:15 |
| 05E1300AE-EDS | 10/16/13 | 09:30 | 10/29/13 | 09:00 |
| 02A0229AA-EDS | 10/29/13 | 09:15 | 11/14/13 | 10:15 |
| 05E1300AE-EDS | 11/14/13 | 10:30 | 11/26/13 | 10:15 |
| 02A0229AA-EDS | 11/26/13 | 10:30 | 12/11/13 | 11:30 |
| 05E1300AE-EDS | 12/11/13 | 14:15 | 12/24/13 | 07:45 |
| **1**  02A0229AA-EDS | 12/24/13 | 08:15 | 12/30/13 | 12:15 |

Notes

The creek was frozen from 01/02/13 to 03/27/13.

**1** Sonde not deployed because the creek was frozen.

### Potter Cove (Data collection ongoing since 1995).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sonde | Deployment | | Retrieval | |
| Date | Time | Date | Time |
| 00E0937AD-V2 | 12/11/12 | 10:45 | 01/02/13 | 10:00 |
| 00F0937AB-V2 | 01/02/13 | 10:30 | 01/15/13 | 09:45 |
| 00E0937AD-V2 | 01/15/13 | 10:00 | 01/29/13 | 11:00 |
| 00F0937AB-V2 | 01/29/13 | 11:30 | 02/20/13 | 10:00 |
| 00E0937AD-V2 | 02/20/13 | 10:30 | 03/05/13 | 10:00 |
| 00F0937AB-V2 | 03/05/13 | 10:15 | 03/20/13 | 09:45 |
| 00E0937AD-V2 | 03/20/13 | 10:15 | 04/02/13 | 10:30 |
| 00F0937AB-V2 | 04/02/13 | 10:45 | 04/16/13 | 09:45 |
| 00E0937AD-V2 | 04/16/13 | 10:00 | 04/30/13 | 10:15 |
| 00F0937AB-V2 | 04/30/13 | 11:00 | 05/15/13 | 09:45 |
| 00E0937AD-V2 | 05/15/13 | 10:00 | 05/29/13 | 10:15 |
| 00F0937AB-V2 | 05/29/13 | 10:30 | 06/13/13 | 10:15 |
| 00E0937AD-V2 | 06/13/13 | 10:45 | 06/25/13 | 09:45 |
| 00F0937AB-V2 | 06/25/13 | 10:15 | 07/09/13 | 09:15 |
| 00E0937AD-V2 | 07/09/13 | 09:45 | 07/23/13 | 09:30 |
| 00F0937AB-V2 | 07/23/13 | 09:45 | 08/06/13 | 09:00 |
| 00E0937AD-V2 | 08/06/13 | 09:30 | 08/20/13 | 09:45 |
| 00F0937AB-V2 | 08/20/13 | 10:00 | 09/04/13 | 09:00 |
| 00E0937AD-V2 | 09/04/13 | 09:15 | 09/18/13 | 10:15 |
| 00F0937AB-V2 | 09/18/13 | 10:45 | 10/01/13 | 08:45 |
| 00E0937AD-V2 | 10/01/13 | 09:15 | 10/16/13 | 08:45 |
| 01E0566AA-V2 | 10/16/13 | 09:16 | 10/29/13 | 09:30 |
| 00F0937AB-V2 | 10/29/13 | 09:45 | 11/14/13 | 10:30 |
| 00E0937AD-V2 | 11/14/13 | 11:00 | 11/26/13 | 10:45 |
| 00F0937AB-V2 | 11/26/13 | 11:00 | 12/11/13 | 10:30 |
| 00E0937AD-V2 | 12/11/13 | 10:45 | 12/24/13 | 08:30 |
| 00F0937AB-V2 | 12/24/13 | 08:45 | 01/09/14 | 10:45 |

### T-Wharf Surface (Data collection ongoing since 2002).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sonde | Deployment | | Retrieval | |
| Date | Time | Date | Time |
| 01E0876AB-V2 | 12/18/12 | 10:15 | 01/08/13 | 09:45 |
| 01E0566AA-V2 | 01/08/13 | 10:15 | 01/22/13 | 11:15 |
| 01E0876AB-V2 | 01/22/13 | 11:30 | 02/05/13 | 10:00 |
| 01E0566AA-V2 | 02/05/13 | 10:15 | 02/28/13 | 11:30 |
| 01E0876AB-V2 | 02/28/13 | 11:45 | 03/12/13 | 08:45 |
| 01E0566AA-V2 | 03/12/13 | 09:00 | 03/27/13 | 09:30 |
| 01E0876AB-V2 | 03/27/13 | 10:00 | 04/09/13 | 08:45 |
| 01E0566AA-V2 | 04/09/13 | 09:00 | 04/23/13 | 10:00 |
| 01E0876AB-V2 | 04/23/13 | 10:15 | 05/08/13 | 09:00 |
| 01E0566AA-V2 | 05/08/13 | 09:30 | 05/21/13 | 10:00 |
| 01E0876AB-V2 | 05/21/13 | 10:30 | 06/04/13 | 09:15 |
| 01E0566AA-V2 | 06/04/13 | 09:45 | 06/20/13 | 09:30 |
| 01E0876AB-V2 | 06/20/13 | 10:00 | 07/02/13 | 08:30 |
| 01E0566AA-V2 | 07/02/13 | 08:45 | 07/16/13 | 08:30 |
| 01E0876AB-V2 | 07/16/13 | 09:00 | 07/31/13 | 08:30 |
| 01E0566AA-V2 | 07/31/13 | 09:00 | 08/14/13 | 09:00 |
| 01E0876AB-V2 | 08/14/13 | 09:30 | 08/27/13 | 10:45 |
| 01E0566AA-V2 | 08/27/13 | 11:15 | 09/10/13 | 08:45 |
| 01E0876AB-V2 | 09/10/13 | 09:15 | 09/24/13 | 08:30 |
| 01E0566AA-V2 | 09/24/13 | 09:00 | 10/08/13 | 08:15 |
| 00F0937AB-V2 | 10/08/13 | 08:45 | 10/22/13 | 08:15 |
| 01E0566AD-EDS | 10/22/13 | 13:30 | 11/05/13 | 10:15 |
| 01E0566AA-V2 | 11/05/13 | 10:30 | 11/19/13 | 10:30 |
| 01E0566AD-EDS | 11/19/13 | 10:45 | 12/04/13 | 10:15 |
| 01E0566AA-V2 | 12/04/13 | 10:45 | 12/17/13 | 10:00 |
| 01E0566AD-EDS | 12/17/13 | 10:15 | 12/31/13 | 10:30 |
| 01E0566AA-V2 | 12/31/13 | 10:45 | 01/15/14 | 10:30 |

### T-Wharf Bottom (Data collection ongoing since 2002).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sonde | Deployment | | Retrieval | |
| Date | Time | Date | Time |
| 06C1207AA-V2 | 12/18/12 | 10:45 | 01/08/13 | 10:00 |
| 05E1065AE-V2 | 01/08/13 | 10:30 | 01/22/13 | 11:30 |
| 06C1207AA-V2 | 01/22/13 | 12:15 | 02/05/13 | 10:15 |
| 05E1065AE-V2 | 02/05/13 | 10:30 | 02/28/13 | 11:30 |
| 06C1207AA-V2 | 02/28/13 | 12:15 | 03/11/13 | 08:45 |
| 05E1065AE-V2 | 03/11/13 | 09:15 | 03/27/13 | 09:45 |
| 06C1207AA-V2 | 03/27/13 | 10:15 | 04/02/13 | 09:15 |
| 05E1065AE-V2 | 04/02/13 | 09:30 | 04/23/13 | 10:15 |
| 06C1207AA-V2 | 04/23/13 | 10:45 | 05/08/13 | 09:15 |
| 05E1065AE-V2 | 05/08/13 | 09:45 | 05/21/13 | 10:00 |
| 06C1207AA-V2 | 05/21/13 | 10:30 | 06/04/13 | 09:30 |
| 05E1065AE-V2 | 06/04/13 | 10:00 | 06/20/13 | 09:45 |
| 06C1207AA-V2 | 06/20/13 | 10:45 | 07/02/13 | 08:45 |
| 05E1065AE-V2 | 07/02/13 | 09:45 | 07/05/13 | 10:15 |
| 06C1207AA-V2 | 07/05/13 | 10:15 | 07/16/13 | 08:45 |
| 05E1065AE-V2 | 07/16/13 | 09:30 | 07/31/13 | 09:00 |
| 06C1207AA-V2 | 07/31/13 | 09:30 | 08/14/13 | 09:15 |
| 05E1065AE-V2 | 08/14/13 | 10:00 | 08/27/13 | 10:45 |
| 06C1207AA-V2 | 08/27/13 | 11:30 | 09/10/13 | 09:00 |
| 05E1065AE-V2 | 09/10/13 | 09:30 | 09/24/13 | 08:45 |
| 06C1207AA-V2 | 09/24/13 | 09:30 | 10/08/13 | 08:45 |
| 05E1065AE-V2 | 10/08/13 | 09:00 | 10/22/13 | 13:15 |
| 06C1207AA-V2 | 10/22/13 | 13:45 | 11/05/13 | 10:30 |
| 05E1065AE-V2 | 11/05/13 | 11:00 | 11/19/13 | 10:30 |
| 06C1207AA-V2 | 11/19/13 | 11:00 | 12/04/13 | 10:30 |
| 05E1065AE-V2 | 12/04/13 | 11:00 | 12/17/13 | 10:00 |
| 06C1207AA-V2 | 12/17/13 | 10:30 | 12/31/13 | 10:45 |
| 05E1065AE-V2 | 12/31/13 | 10:30 | 01/15/14 | 11:00 |

## 7. Distribution

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

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:

National Estuarine Research Reserve System (NERRS). 2012.  System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: [www.nerrsdata.org](http://www.nerrsdata.org); *accessed* 12 October 2013.

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

Complementary to the existing long-term water quality monitoring program, the NERRS implemented a new nutrient and chlorophyll monitoring program in 2002. The two sub-components of this program include monthly grab sampling at each of the four water quality stations, and diel sampling once a month at one site. The grab sampling program requires the collection of duplicate water samples every month from each of the four long-term water quality monitoring stations with the purpose of quantify seasonal patterns of nutrient and chlorophyll concentrations in different estuarine habitats (marsh creek, cove, surface open water, bottom open water). The diel sampling program requires to collect a series of samples from one station over an approximately 24-hour period each month to examine how nutrient and chlorophyll concentrations change over diel and tidal cycles. Previously (from 2002 to 2010) the diel station was located at T-Wharf. However, after analyzing the historic data from the site, no significant trends or patterns were found over time. Therefore, the diel station was moved to Potter Cove in January of 2011 in order to characterize nutrients and chlorophyll from this site. All collected grab and diel samples are analyzed for concentrations of phosphates (PO4), ammonia (NH4), nitrite (NO2), nitrate (NO3), NO2+NO3, dissolved inorganic nitrogen (DIN), silicates (SiO4) and chlorophyll *a*.

Since 2001, meteorological data has been collected as part of the SWMP at the weather station (see image below) located on Prudence Island, approximately 389 m south of Potter Cove (41o 38’ 13.703” N, 71o 20’ 21.790” W, Trimble Geo XT, GeoExplorer 2008 Series; see map on section 5, Site Location and Character). Data on air temperature, relative humidity, barometric pressure, wind speed and direction, photosynthetic active radiation, and precipitation are collected. Meteorological data is continually used to complement the water quality, biological monitoring and scientific research efforts at NBNERR and at Narragansett Bay, and to assist educational activities around the Bay.

All this information is available to any interested party through the CDMO <http://cdmo.baruch.sc.edu/>, NBNERR <http://nbnerr.org/>, or directly contacting the Research Coordinator or the Marine Research Specialist II.

In 2004, the NBNERR became involved in the Bay Window Monitoring Program, which is a Bay-wide water quality monitoring program. Although the NBNERR is no longer involved with managing data from the Bay window program, NBNERR SWMP data are still shared with and used for analysis in the program. The NBNERR also provides SWMP data to:

Dr. Candace Oviatt at URI-GSO is using NAR NERR chlorophyll data to track the timing and magnitude of winter/spring blooms in Narragansett Bay.

Mrs. Heather Stoffel at URI-GSO is using NAR NERR data from T-Wharf Surface, T-Wharf Bottom, and Potter's Cove stations in a local monitoring network strategy partially funded through Bay Window and headed by RIDEM-OWR.

Christopher Gobler Ph.D., Professor at Stony Brook University, is using long-term pH and dissolved oxygen data to assess the co-occurrence of low hypoxia and acidification within coastal ecosystems for the purposes of understanding stress on finfish and shellfish populations in Narragansett Bay.

Cathleen Turner, MS candidate at the University of Rhode Island Graduate School of Oceanography is processing alkalinity, pH, and chlorinity dataset for Professors Steve D'Hondt and Art Spivack. For the first stage of quality control, Cathleen is using NBNERR pH data and comparing it to their pH values from the probe and pH values that are calculated using measured alkalinity, chlorinity, and DIC values. Cathleen is using pH data from February of 2010 to April of 2011.

# II. Physical Structure Descriptors

## 9. Sensor specifications

NAR NERR deployed YSI 6600EDS and 6600V2 data loggers from January through March in 2013. Only YSI 6600V2 sondes equipped with optical DO ROX sensors were deployed at T-Wharf Bottom during this period. YSI 6600V2 sondes equipped with optical DO ROX sensors were deployed at T-Wharf Surface and Potter Cove, while at Nag Creek YSI 6600EDS sondes equipped with rapid-pulse DO sensors were used during this period.

YSI 6600 V2 or EDS\* data sonde

Parameter: **Temperature**

Units: Celsius - oC

Sensor Type: Thermistor

Model #: 6560

Range: -5 to 50 °C

Accuracy: ± 0.15 °C

Resolution: 0.01 °C

Parameter: **Conductivity**

Units: milli-Siemens per cm (mS/cm)

Sensor Type: 4-electrode cell with autoranging

Model #: 6560

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)

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: **\*Dissolved Oxygen**

Units: Percent air saturation (%)

Sensor Type: Rapid Pulse – Clark type, Polarographic

Model #: 6562

Range: 0 to 500 % air saturation

Accuracy: 0-200 % air saturation, ± 2 % of the reading or 2 % air saturation, whichever is

greater; 200 to 500 % air saturation, ± 6 % of the reading

Resolution: 0.1 % air saturation

- or -

Sensor Type: **Optical probe with mechanical cleaning**

Model #: 6150 ROX

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: ± 15% of reading

Resolution: 0.1% air saturation

Parameter: \***Dissolved Oxygen** (Calculated from % air saturation, temperature and salinity)

Units: milligrams per Liter (mg/L)

Sensor Type: Rapid Pulse – Clark type, Polarographic

Model #: 6562

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

- or -

Sensor Type: **Optical probe with mechanical cleaning**

Units: milligrams per Liter (mg/L)

Model #: 6150 ROX

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: ± 15% of the reading

Resolution: 0.01 mg/L

Parameter: Non-Vented Level – Shallow (Depth)

Units: meters (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: **pH** (bulb probe)

Units: pH units

Sensor Type: Glass combination electrode

Model #: 6561

Range: 0 to 14 units

Accuracy: ± 0.2 units

Resolution: 0.01 units

Parameter: **Turbidity**

Units: Nephelometric turbidity units (NTU)

Sensor Type: Optical, 90° scatter, with mechanical cleaning

Model #: 6136

Range: 0 to 1000 NTU

Accuracy: ± 2 % reading or 0.3 NTU (whichever is greater)

Resolution: 0.1 NTU

Parameter: **Chlorophyll Fluorescence**

Units: micrograms/Liter

Sensor Type: Optical probe with mechanical cleaning

Model#: 6025

Range: 0 to 400 µg/Liter

Accuracy: Dependent on methodology

Resolution: 0.1 µg /L chl *a*, 0.1% FS

Dissolved Oxygen Qualifier (Rapid Pulse / Clark type sensor):

The reliability of dissolved oxygen (DO) data collected with the rapid pulse / Clark type sensor 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). Some Reserves utilize the YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. Optical DO probes have further improved data reliability. The user is therefore advised to consult the metadata for sensor type information and to exercise caution when utilizing rapid pulse / Clark type sensor DO data beyond the initial 96-hour time period. 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. If there are concerns about fouling impacts on DO data beyond any information documented in the metadata and/or QAQC flags/codes, please contact the Research Coordinator at the specific NERR site regarding site and seasonal variation in 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.

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

|  |  |  |
| --- | --- | --- |
| Sampling station | Sampling site code | Station code |
| Nag Creek | NC | narncwq |
| Potter Cove | PC | narpcwq |
| T-Wharf Surface | TS | nartswq |
| T-Wharf Bottom | TB | nartbwq |

## 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.

|  |  |
| --- | --- |
| Flag | Description |
| -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

Readings were taken using calibration standards immediately after retrieval (for exact day see post-calibration date column). Superscript numbers on the Deployment Date column are used for clarification; please refer to the notes at the end of the table. Blue cells in the ROX DO 1 and 2 columns indicate the use of YSI 6600 EDS sonde equipped with the rapid pulse DO probe; otherwise, a YSI 6600V2 sonde equipped with an optical DO (ROX) probe was used in the field. In any column, yellow indicates value is suspect at post-calibration. DO stands for dissolved oxygen.

**Nag Creek**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Post-calibration Date | Specific Conductivity | ROX DO 1 | ROX DO 2 | pH | | Turbidity | | Depth | Chl |
| mm/dd/yy | | mS/cm | Percent saturation | |  |  | NTU | | offset | µg L-1 |
| (50.00) | (100%) | | (7.0) | (10.0) | (0) | (126) | (m) | (0.0) |
| 12/11/12 | 01/02/13 | 49.88 | 109.6 | 109.6 | 7.1 | 10.1 | 0 | 127 | -0.009 | 0.3 |
| **1**  01/02/13 | 03/27/13 |  |  |  |  |  |  |  |  |  |
| 03/27/13 | 04/02/13 | 50.29 | 112.0 | 111.0 | 7.1 | 10.1 | 0 | 126 | -0.072 | 0.5 |
| 04/02/13 | 04/16/13 | 54.19 | 107.0 | 106.8 | 7.1 | 10.1 | 0 | 120 | 0.101 | 0.6 |
| 04/16/13 | 05/15/13 | 45.58 | 110.1 | 110.0 | 7.1 | 10.1 | 0 | 126 | -0.009 | 55.3 |
| 05/15/13 | 05/29/13 | 50.23 | 105.2 | 105.1 | 7.1 | 10.2 | 0 | 125 | 0.011 | 0.4 |
| **2** 05/29/13 | 06/13/13 | 51.79 | 107.7 | 107.7 | 7.2 | 10.2 | 0 | 124 | -0.093 |  |
| 06/13/13 | 06/25/13 | 50.14 | 80.6 | 79.0 | 7.1 | 10.1 | 0 | 121 | -0.067 | 0.2 |
| 06/25/13 | 07/09/13 | 54.69 | 89.8 | 88.0 | 7.0 | 10.1 | 0 | 118 | 0.012 | -0.7 |
| 07/09/13 | 07/23/13 | 51.44 | 100.9 | 100.6 | 7.1 | 10.2 | 0 | 121 | -0.152 | -3.2 |
| 07/23/13 | 08/06/13 | 51.28 | 93.0 | 86.7 | 7.0 | 10.0 | 1 | 102 | 0.050 | 0.5 |
| **3** 08/06/13 | 08/20/13 | 50.60 | 109.0 | 108.8 | 7.0 | 10.1 | 0 | 131 | 0.012 |  |
| 08/20/13 | 09/04/13 | 50.46 | 120.2 | 120.1 | 7.1 | 10.1 | 0 | 128 | -0.039 | 0.6 |
| 09/04/13 | 09/18/13 | 50.76 | 109.4 | 108.6 | 7.0 | 10.0 | 0 | 125 | 0.067 | 0.8 |
| 09/18/13 | 10/01/13 | 50.70 | 101.4 | 101.3 | 7.1 | 10.1 | 0 | 139 | -0.045 | 0.2 |
| 10/01/13 | 10/16/13 | 50.76 | 107.5 | 107.4 | 7.1 | 10.1 | 0 | 129 | 0.000 | 0.7 |
| 10/16/13 | 10/29/13 | 50.56 | 106.3 | 106.1 | 7.1 | 10.1 | 0 | 127 | 0.126 | 0.1 |
| 10/29/13 | 11/14/13 | 49.98 | 111.8 | 111.7 | 7.0 | 10.1 | 0 | 128 | 0.020 | 0.1 |
| 11/14/13 | 11/26/13 | 50.59 | 107.2 | 107.1 | 7.1 | 10.1 | 0 | 127 | 0.069 | -0.5 |
| 11/26/13 | 12/11/13 | 50.25 | 110.3 | 110.3 | 7.1 | 10.2 | 0 | 126 | 0.048 | -0.2 |
| 12/11/13 | 12/24/13 | 50.35 | 95.3 | 95.1 | 7.1 | 10.1 | 0 | 127 | 0.011 | 0.6 |
| **4**  12/24/13 | 12/31/13 |  |  |  |  |  |  |  |  |  |

Notes

**1, 4** Sondewasnotdeployed because the creek was frozen.

**2, 3** Sonde deployed without chlorophyll probe. Chlorophyll probe had malfunctioned and was sent for repair.

**Potter Cove**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Post-calibration Date | Specific Conductivity | ROX DO 1 | ROX DO 2 | pH | | Turbidity | | Depth | Chl |
| mm/dd/yy | | mS/cm | Percent saturation | |  |  | NTU | | offset | µg L-1 |
| (50.00) | (100%) | | (7.0) | (10.0) | (0) | (126) | (m) | (0.0) |
| 12/11/12 | 01/02/13 | 50.35 | 99.4 | 99.4 | 7.1 | 10.1 | 0 | 127 | -0.001 | 0.0 |
| **1** 01/02/13 | 01/15/13 | 50.65 | 101.2 | 101.2 | 7.2 | 10.2 | -5 | 131 | 0.125 | 0.0 |
| 01/15/13 | 01/29/13 | 49.28 | 99.9 | 99.9 | 7.1 | 10.1 | 0 | 127 | 0.052 | -0.3 |
| 01/29/13 | 02/20/13 | 51.09 | 99.5 | 99.5 | 7.2 | 10.2 | 1 | 126 | -0.080 | 0.2 |
| 02/20/13 | 03/05/13 | 49.35 | 98.0 | 98.0 | 7.1 | 10.1 | 0 | 127 | -0.006 | 0.6 |
| **2** 03/05/13 | 03/20/13 | 43.26 | 70.1 | 70.1 | 7.1 | 9.9 | 0 | 132 | -0.078 | -0.4 |
| 03/20/13 | 04/02/13 | 50.83 | 97.8 | 97.8 | 7.1 | 10.1 | 0 | 127 | -0.059 | 0.3 |
| 04/02/13 | 04/16/13 | 54.89 | 101.0 | 101.0 | 7.0 | 10.1 | 1 | 127 | 0.094 | 0.8 |
| 04/16/13 | 04/30/13 | 50.03 | 99.8 | 99.8 | 7.1 | 10.1 | 0 | 127 | 0.093 | 0.2 |
| 04/30/13 | 05/15/13 | 50.01 | 99.1 | 99.0 | 7.2 | 10.3 | 1 | 125 | -0.038 | 0.0 |
| 05/15/13 | 05/29/13 | 50.25 | 100.8 | 100.8 | 7.1 | 10.1 | 0 | 126 | 0.010 | 0.6 |
| 05/29/13 | 06/13/13 | 49.87 | 97.5 | 97.5 | 7.1 | 10.2 | 1 | 126 | -0.100 | -0.1 |
| 06/13/13 | 06/25/13 | 48.76 | 98.8 | 98.8 | 7.1 | 10.1 | -1 | 125 | -0.055 | 0.1 |
| 06/25/13 | 07/09/13 | 49.80 | 99.5 | 99.5 | 7.1 | 10.1 | 0 | 128 | 0.014 | -0.9 |
| 07/09/13 | 07/23/13 | 49.21 | 97.3 | 97.3 | 7.1 | 10.1 | -1 | 133 | -0.146 | -0.2 |
| 07/23/13 | 08/06/13 | 49.58 | 100.4 | 100.4 | 7.1 | 10.1 | -1 | 126 | 0.027 | 0.2 |
| 08/06/13 | 08/20/13 | 50.39 | 98.8 | 98.9 | 7.2 | 10.2 | -1 | 127 | 0.007 | -0.9 |
| 08/20/13 | 09/04/13 | 50.50 | 99.0 | 99.0 | 7.2 | 10.2 | 0 | 126 | -0.046 | -0.1 |
| 09/04/13 | 09/18/13 | 48.93 | 99.7 | 99.7 | 7.2 | 10.2 | -1 | 125 | 0.055 | -0.4 |
| 09/18/13 | 10/01/13 | 50.37 | 100.4 | 100.4 | 7.1 | 10.1 | 0 | 125 | -0.110 | -0.2 |
| 10/01/13 | 10/16/13 | 50.23 | 99.6 | 99.6 | 7.1 | 10.1 | 0 | 125 | -0.015 | 0.2 |
| 10/16/13 | 10/29/13 | 50.20 | 117.6 | 117.6 | 7.1 | 10.1 | 0 | 128 | 0.114 | 1.5 |
| **3** 10/29/13 | 11/14/13 | 50.10 | 99.7 | 99.7 | 7.2 | 10.3 | 0 | 126 | 0.009 |  |
| 11/14/13 | 11/26/13 | 50.83 | 101.4 | 101.4 | 7.1 | 10.2 | 0 | 117 | 0.077 | -1.0 |
| 11/26/13 | 12/11/13 | 50.52 | 100.1 | 100.1 | 7.1 | 10.1 | -1 | 125 | 0.057 | -0.1 |
| **4** 12/11/13 | 12/24/13 | 50.30 | 99.4 | 99.4 | 7.1 | 10.2 | 0 | 125 | 0.014 | 41.5 |
| 12/24/13 | 01/09/14 | 50.70 | 101.7 | 101.7 | 7.2 | 10.2 | -1 | 126 | 0.184 | 0.2 |

Notes

**1** Incorrect calibration / contaminated standard affected turbidity readings during this deployment.

**2** The temperature sensor failed during this deployment.

**3** Sonde deployed without chlorophyll probe. Chlorophyll probe had malfunctioned and was sent for repair.

**4** Chlorophyll probe malfunctioned at the end of the deployment.

**T-Wharf Surface**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Post-calibration Date | Specific Conductivity | ROX DO 1 | ROX DO 2 | pH | | Turbidity | | | Depth | Chl |
| mm/dd/yy | | mS/cm | Percent saturation | |  |  | NTU | | | offset | µg L-1 |
| (50.00) | (100%) | | (7.0) | (10.0) | (0) | (126) | (m) | | (0.0) |
| 12/18/12 | 01/08/13 | 50.34 | 101.6 | 101.6 | 7.2 | 10.1 | 1 | 128 | 0.129 | | -0.5 |
| 01/08/13 | 01/22/13 | 49.89 | 97.5 | 97.5 | 7.1 | 10.2 | -1 | 126 | -0.036 | | 0.3 |
| 01/22/13 | 02/05/13 | 50.21 | 101.3 | 101.3 | 7.3 | 10.4 | 1 | 126 | 0.002 | | -0.3 |
| 02/05/13 | 02/28/13 | 52.98 | 87.8 | 87.8 | 7.1 | 10.2 | 0 | 126 | -0.144 | | -0.1 |
| 02/28/13 | 03/12/13 | 56.00 | 93.2 | 93.2 | 7.2 | 10.2 | 0 | 128 | 0.013 | | -2.4 |
| 03/12/13 | 03/27/13 | 47.08 | 99.5 | 99.5 | 7.1 | 10.1 | -1 | 126 | -0.097 | | -0.2 |
| 03/27/13 | 04/09/13 | 55.09 | 102.0 | 101.9 | 7.2 | 10.2 | 0 | 126 | -0.082 | | 0.4 |
| 04/09/13 | 04/23/13 | 50.45 | 101.4 | 101.4 | 7.1 | 10.1 | 1 | 128 | 0.099 | | 0.0 |
| **1**04/23/13 | 05/08/13 | 50.65 | 100.5 | 100.5 | 7.1 | 10.1 | 0 | 124 | 0.039 | |  |
| 05/08/13 | 05/21/13 | 50.36 | 104.5 | 104.4 | 7.1 | 10.1 | -1 | 125 | -0.044 | | 0.0 |
| 05/21/13 | 06/04/13 | 50.13 | 99.6 | 99.6 | 7.1 | 10.1 | 0 | 127 | -0.037 | | -0.8 |
| 06/04/13 | 06/20/13 | 49.47 | 100.7 | 100.7 | 7.1 | 10.1 | -1 | 125 | 0.066 | | -0.4 |
| 06/20/13 | 07/02/13 | 49.65 | 99.6 | 99.6 | 7.1 | 10.1 | 0 | 126 | 0.040 | | 0.0 |
| 07/02/13 | 07/16/13 | 50.52 | 98.4 | 98.4 | 7.1 | 10.1 | 0 | 128 | 0.020 | | -0.4 |
| 07/16/13 | 07/31/13 | 50.61 | 104.7 | 104.7 | 7.1 | 10.1 | 0 | 125 | 0.022 | | -0.6 |
| 07/31/13 | 08/14/13 | 50.25 | 95.4 | 95.4 | 7.1 | 10.1 | 1 | 128 | -0.097 | | 0.0 |
| 08/14/13 | 08/27/13 | 50.16 | 98.1 | 98.1 | 7.2 | 10.2 | 0 | 125 | -0.069 | | -0.2 |
| 08/27/13 | 09/10/13 | 50.70 | 97.4 | 97.4 | 7.1 | 10.1 | 0 | 125 | -0.080 | | -0.3 |
| 09/10/13 | 09/24/13 | 49.90 | 97.1 | 97.1 | 7.1 | 10.1 | 0 | 126 | -0.066 | | 0.2 |
| 09/24/13 | 10/08/13 | 50.52 | 98.0 | 98.0 | 7.1 | 10.0 | -1 | 124 | 0.052 | | -0.4 |
| 10/08/13 | 10/22/13 | 50.43 | 100.1 | 100.1 | 7.0 | 10.1 | 0 | 127 | -0.073 | | 0.1 |
| 10/22/13 | 11/05/13 | 32.18 | 85.2 | 85.1 | 7.1 | 9.8 | 0 | 127 | 0.214 | | 0.0 |
| 11/05/13 | 11/19/13 | 50.29 | 101.8 | 101.7 | 7.1 | 10.2 | 1 | 126 | -0.047 | | 0.7 |
| 11/19/13 | 12/04/13 | 49.02 | 101.0 | 100.9 | 7.1 | 10.1 | 0 | 128 | 0.009 | | 0.0 |
| 12/04/13 | 12/17/13 | 49.89 | 100.1 | 100.1 | 7.2 | 10.2 | -1 | 125 | 0.049 | | 0.2 |
| 12/17/13 | 12/31/13 | 46.91 | 100.8 | 100.7 | 7.1 | 10.2 | 0 | 128 | 0.001 | | 0.0 |
| 12/18/12 | 01/08/13 | 50.34 | 101.6 | 101.6 | 7.2 | 10.1 | 1 | 128 | 0.129 | | -0.5 |

Notes

**1** Sonde deployed without chlorophyll probe. Chlorophyll probe had malfunctioned and was sent for repair.

**T-Wharf Bottom**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Post-calibration Date | Specific Conductivity | | ROX DO 1 | ROX DO 2 | pH | | Turbidity | | Depth | Chl |
| mm/dd/yy | | | mS/cm | Percent saturation | |  |  | NTU | | offset | µg L-1 |
| (50.00) | (100%) | | (7.0) | (10.0) | (0) | (126) | (m) | (0.0) |
| 12/18/12 | 01/08/13 | 50.51 | | 101.7 | 101.7 | 7.1 | 10.1 | 0 | 128 | 0.135 | -0.1 |
| 01/08/13 | 01/22/13 | 49.97 | | 96.7 | 96.7 | 7.1 | 10.2 | -1 | 128 | -0.036 | -0.3 |
| 01/22/13 | 02/05/13 | 50.34 | | 100.6 | 100.6 | 7.0 | 10.1 | 0 | 126 | 0.008 | -0.2 |
| 02/05/13 | 02/28/13 | 51.40 | | 97.2 | 97.2 | 7.1 | 10.2 | 0 | 128 | -0.133 | -0.6 |
| 02/28/13 | 03/11/13 | 56.79 | | 102.9 | 102.9 | 7.0 | 10.1 | -1 | 128 | 0.026 | 0.5 |
| 03/11/13 | 03/27/13 | 46.92 | | 99.7 | 99.7 | 7.1 | 10.1 | 0 | 117 | -0.095 | 0.0 |
| **1** 03/27/13 | 04/02/13 | 27.47 | | 59.9 | 59.9 | 7.0 | 9.7 | 1 | 160 | -0.055 | 1.0 |
| 04/02/13 | 04/23/13 | 54.46 | | 100.6 | 100.6 | 7.1 | 10.1 | 0 | 125 | 0.096 | -0.1 |
| 04/23/13 | 05/08/13 | 48.74 | | 100.6 | 100.6 | 7.1 | 10.1 | 1 | 127 | 0.043 | 0.1 |
| 05/08/13 | 05/21/13 | 50.59 | | 102.7 | 102.6 | 7.1 | 10.1 | -1 | 124 | -0.051 | -0.5 |
| 05/21/13 | 06/04/13 | 50.52 | | 99.4 | 99.4 | 7.0 | 10.1 | -2 | 125 | -0.033 | -0.7 |
| 06/04/13 | 06/20/13 | 49.72 | | 100.6 | 100.6 | 7.1 | 10.1 | -1 | 122 | 0.072 | -0.2 |
| 06/20/13 | 07/02/13 | 50.43 | | 97.2 | 97.2 | 7.0 | 10.0 | -1 | 126 | 0.043 | -1.0 |
| **2** 07/02/13 | 07/05/13 | 50.29 | | 100.4 | 100.3 | 7.1 | 10.1 | 0 | 125 | 0.032 |  |
| 07/05/13 | 07/16/13 | 50.51 | | 98.3 | 98.3 | 7.1 | 10.1 | 0 | 129 | 0.022 | 0.0 |
| 07/16/13 | 07/31/13 | 51.72 | | 100.3 | 100.3 | 7.1 | 10.1 | 0 | 120 | 0.018 | -0.4 |
| 07/31/13 | 08/14/13 | 49.97 | | 99.1 | 99.1 | 7.1 | 10.1 | -1 | 126 | -0.089 | -0.1 |
| 08/14/13 | 08/27/13 | 49.08 | | 97.6 | 97.5 | 7.2 | 10.2 | 0 | 126 | -0.071 | 0.2 |
| 08/27/13 | 09/10/13 | 51.01 | | 97.4 | 97.5 | 7.0 | 10.1 | -1 | 125 | 0.033 | -0.6 |
| **3** 09/10/13 | 09/24/13 | 49.76 | | 99.7 | 99.7 | 7.1 | 10.1 | 0 | 119 | -0.045 |  |
| 09/24/13 | 10/08/13 | 45.71 | | 101.0 | 101.0 | 7.1 | 10.1 | 0 | 126 | 0.053 | 0.3 |
| 10/08/13 | 10/22/13 | 50.71 | | 98.9 | 98.9 | 7.1 | 10.1 | -2 | 132 | -0.106 | 12.9 |
| 10/22/13 | 11/05/13 | 46.02 | | 103.6 | 103.6 | 7.1 | 10.2 | 0 | 125 | 0.202 | 0.1 |
| 11/05/13 | 11/19/13 | 50.26 | | 99.4 | 99.4 | 7.1 | 10.2 | 0 | 113 | -0.031 | -6.6 |
| 11/19/13 | 12/04/13 | 50.23 | | 99.8 | 99.8 | 7.0 | 10.1 | 1 | 129 | 0.015 | -0.4 |
| 12/04/13 | 12/17/13 | 50.05 | | 99.3 | 99.3 | 7.0 | 10.0 | 1 | 127 | 0.022 | 25.2 |
| 12/17/13 | 12/31/13 | 50.42 | | 99.1 | 99.1 | 7.0 | 10.1 | 0 | 126 | -0.001 | -0.1 |
| 12/31/13 | 01/15/14 | 50.27 | | 99.7 | 99.7 | 7.1 | 10.1 | 1 | 128 | -0.023 | 0.6 |

Notes:

**1** Temperature/Specific Conductivity probe failed at the end of the deployment.

**2** Chlorophyll probe failed and was causing erratic readings on the other probes.

**3** Post calibration chlorophyll reading was not possible due to wiper malfunction.

## 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.

Slight depth anomalies occurred at the T-Wharf Surface monitoring station. The datalogger at this station is suspended from the bottom of a float attached by rope to the adjacent wharf. On occasion it became apparent that the sonde and/or float had become caught up in the rope, but never to such an extent that the sonde came out of the water unless otherwise noted. Wave action during periods of high winds may be responsible for some of the depth variation. Because this sonde is attached to a float it is readily impacted by heavy wave action. Deployment near the surface also allows for depth measurements to be altered by changes in atmospheric pressure. At no time were the variations in depth considered sufficient to alter the validity of the data.

Slight depth anomalies frequently occur at the Nag Creek deployment location. Depth at this site may have been influenced to some extent by changes in atmospheric pressure because the sonde was situated in very shallow waters. On occasion, the combination of low atmospheric pressure and shallow water resulted in negative depth values. Weather station data appear to support this theory. It is also suspected that due to its shallow location and location in a salt marsh, freshwater runoff from the island may affect specific conductivity/salinity readings several days after a rain event has occurred. Specific conductivity, salinity, and dissolved oxygen can also vary greatly in Nag Creek over tidal and diel cycles. Nag creek is a very shallow site and is highly affected by tides and rain events. On some occasions, dissolved oxygen (DO) is recorded as negative values at the Nag Creek deployment location. Dissolved oxygen frequently ranges between supersaturation and complete anoxic conditions (DO = 0 % saturation) at this site during the summer months. Ice is also common in Nag Creek. There have been occasions where ice has affected all sonde parameters and are marked in the data as “see metadata”.

It is likely that some of the variability in specific conductivity at Nag Creek is due to freshwater entering the marsh from the red maple swamp abutting it to the east (across the road). The amount of fresh groundwater inflow has not been quantified, but evidence for it comes in the form of 1) the presence of brackish vegetation species along the upland borders of the marsh in areas abutting the swamp, and 2) new data from a salinity mapping project conducted by Dr. Rick McKinney (EPA Atlantic Ecology Division) that quantifies lower salinities along those same borders. The variability is surely exacerbated due to the shallow nature of the creek in which the sonde is located. After rain events, salinities are likely to be relatively high at high tide due to the influx of Bay water, and then correspondingly low at low tide when the surface freshwater predominates.

Chlorophyll and fluorescence data were collected along with the data presented in this document, but because chlorophyll and fluorescence are not part of the NERR SWMP Water Quality Program, the data are not reported within this dataset. Chlorophyll fluorescence data are available upon request by contacting the Reserve.

At the TS and TB stations, there were frequent discontinuities in pH data across consecutives deployments. Pre- and post-calibrations showed all probes and sondes to be working properly, unless stated otherwise. The reasons for these discontinuities are unknown; regardless, all data fall within the normal range of pH exhibited at these stations. Please contact the Reserve with any questions.

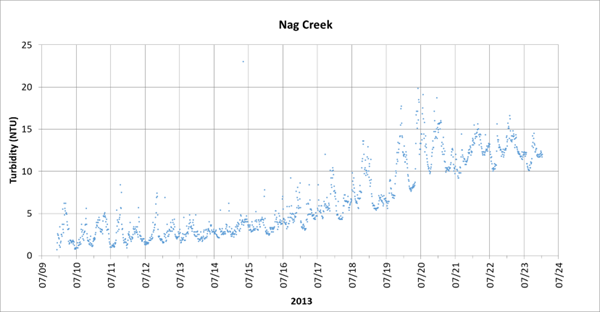
The following are description of different events that happened during deployment and explanations to the CSM (Comment-See Metadata) code for the four water quality station data files from January to December of 2013.

**Nag Creek**

GIC – The sonde at Nag Creek was pulled out of the water because the low temperatures froze up the creek from January 02 to March 27.

CSM F\_Record column

* **03/27 13:30**: The turbidity recorded during this time might have been caused by disturbed sediment during and after Reserve staff went in the creek to install the deploying structure and deploy the datalogger. The data were considered suspect and flagged and coded 1 GSM CMC.
* **Apr 16 to May 15:** Corrected date; sonde was programed with incorrect date.
* **07/18 07:00 – 07/23 13:00**: Heavy algal growth was found at the site and on the datalogger after retrieval which might explain the steady increase in turbidity during this period (see graphs below). Turbidity data were considered suspect and flagged and coded 1 GSM CBF.



* **Oct 01 to 16:** The wiper brush combo used on this sonde was found at the bottom of the deployment cup at the end of the deployment. This is and EDS sonde. EDS’s sondes use a wiper-brush combo to keep clean of biofouling all the probes on the sonde. However, since turbidity was low for most of the deployment, this incident did not affect the water quality data collected during this period.
* **11/24 00:15 – 11/26 10:15**: The on and off ice formation in the creek affected all parameters during this period. Data were considered suspect and flagged and coded 1 GSM CIP.
* **11/26 10:30 to 12/03 14:30**: The on and off formation of ice in the creek affected all the water quality parameters during this period. In addition, the datalogger continued collecting data after the deploying structure fell in the creek a few days after deployment. All data were rejected and flagged and coded (-3) GSM CIP.
* **Dec 01 to 03, Dec 21 to 24, Dec 28 to 30:**  The on and off formation of ice in the creek caused the deploying structure and sonde to fall in the creek. Other than depth, the water quality parameters should not have been affected; the data may be highly variable reflecting the formation and thawing of ice in this very shallow creek.
* **12/15 07:45 – 12/24 07:45**: Several events happened during this period due to the on and off ice formation in the creek.
* **12/15 07:45 – 11:30**: ice forming in the creek affected all data collected. Data were considered suspect and flagged and coded 1 GSM CIP.
* **12/15 11:45 – 12/21 02:15**: data on temperature, depth and salinity showed that the datalogger might have been covered by ice in the creek. All water quality parameters data were rejected and flagged and coded -3 GSM CIP.
* **12/21 02:30 – 12/24 07:45**: deploying structure and datalogger were found on the bottom of the creek at the moment of swapping instruments on 12/24. The data collected were rejected and flagged and coded -3 GSM CIP.
* **12/25 03:45 – 12/30 12:15**: deploying structure and datalogger were found on the bottom of the creek at the moment of swapping instruments on 12/30 due to ice in the creek. It seems it fell in shortly after deployment on 12/24 08:15. The data collected were rejected and flagged and coded -3 GSM CIP.

**Potter Cove**

We observed the on and off formation of ice in the Cove and at the deploying structure during the months of January, February, March and December; hence, water quality (i.e., specific conductivity, salinity, etc.) might show high variability during these months.

* **04/02 10:45 – 04/16 09:45**: A new temperature/conductivity probe was installed on the datalogger that didn’t respond well during its first extended deployment. This data were considered suspect, and flagged and coded 1 SSM CSM.

**T-Wharf Surface**

GSM

* **05/08 09:30 to 06/20 09:30, and 10/22 13:30 to 11/06 11:00**: The dataloggers were deployed at a shallower depth due to an obstruction caused by a chimney brush head getting stuck in the deploying structure when cleaning biofouling on the inside of the deploying PVC pipe. The dataloggers were, approximately, 30 cm shallower; the length of the chimney brush head. Even though this site is a shallow, well mixed site, water quality parameters could have been affected by this issue. Depth data, and any other parameter that were considered affected by this issue were considered suspect and flagged and coded 1 GSM CWD. For parameters not affected, 0 GSM CWD was used. On 11/06 11:00, the datalogger was brought to the surface and the chimney brush head was removed. Data collected at this time was rejected and flagged and coded -3 GSM CMC.
* **07/02 08:45 – 09:45**: It seems the sonde was stuck at a shallower depth after deployment at 08:45 until 09:45 after which, it seems, the problem solved itself. Water quality parameters were not affected; however, depth were considered suspect. The first reading of this deployment (08:45) was flagged and coded 0 GSM CND and the rest as 0 GSM CWD; for depth, 1 GSM CND and 1 GSM CWD, respectively.
* CSM F\_Record column
* **May 08 to Jun 20:** The sondes were slightly shallower than usual during these deployments. The water quality parameters collected during this period were not affected by this issue.

**Turbidity Correction**

YSI notified the Reserve that the turbidity standard (YSI 6073G, Lot Number 12H254538) had the wrong formulation. Turbidity data affected per site during 2013was:

* T-Wharf Surface Jan 01 00:0 to Mar 27 09:30
* T-Wharf Bottom Jan 01 00:0 to Mar 27 09:45
* Nag Creek Jan 01 00:0 to Jan 02 13:45
* Potter Cove Jan 01 00:0 to Mar 20 09:45

YSI provided information on how to solve the problem by post-correcting the data with the following formula: Multiply the collected data by 0.94. With this information, we were able to correct the affected data collected during the period mentioned above. The data was flagged and coded <5> (CSM) unless coded otherwise.

CRE – Record column indicates rain events specific to Prudence Island.

Total Precipitation per month on Prudence Island. Data from NBNERR Weather Station.

