**Estero Bay Aquatic Preserve Continuous Water Quality Metadata January 1, 2016 – December 31, 2016**

Latest Update: September 14, 2022

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the Aquatic Preserve office with any additional questions.

### Data Set and Research Descriptors

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### Entry verification

To begin, deployment data are uploaded from the YSI data logger (datasonde) to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CSV) and transferred into separate Microsoft Excel files by site, year, and month. Excessive pre- and post-deployment data are removed from the files at this time. The monthly files are then prepared, processed, and reviewed following the procedures in the Centralized Data Management Office’s (CDMO) National Estuarine Research Reserves (NERR) System-wide Monitoring Program (SWMP) Data Management Manual Version 6.3 (February 2010). Currently, Estero Bay Aquatic Preserve (EBAP) does not submit data to the CDMO and therefore does not apply the associated procedures. The monthly data file is then opened in Microsoft Excel and processed using the NERRQAQC macro. The macro automatically inserts station codes, combines date and time, creates metadata worksheets for flagged data, summary statistics, and graphs the data for review. It allows the reviewer to apply QA/QC flags and codes to the data and append files. During primary QA/QC, data are flagged and coded if they are missing, out of sensor range, or anomalous. Where deployment overlap occurs between files, the data produced by the newly calibrated datasonde (sonde) is generally accepted as being the most accurate. Data management is currently performed by Rebecca Cray.

Beginning in July 2018, data underwent additional Quality Assurance/Quality Control (QA/QC) procedures. An automated primary QA/QC process was performed by the CDMO and involved checking the standardized flags and codes that were previously applied to the data by the Aquatic Preserve Office. The process applied additional standardized flags to the data if values were outside sensor specifications and were not previously flagged. Yearly data files that completed the primary QA/QC process were returned to the Office of Resilience and Coastal Protection (RCP) staff for a secondary QA/QC procedure. Data were evaluated, and standardized flags and codes were either modified or new codes were applied to individual data points by insertion into the flag columns using the CDMO’s NERRQAQC Excel macro to provide further documentation of the data. Data files were then returned to the CDMO for ingestion into the Florida Aquatic Preserves database as provisional data. For more information on QA/QC flags and codes, see Sections 11 and 12 and for more information on NERRQAQC macro versions, see Section 14.

### Research objectives

In 2004, the Florida Department of Environmental Protection’s (FDEP) Office of Coastal and Aquatic Managed Areas (CAMA), now RCP, began a pilot program using extended deployed water quality monitoring devices, or datasondes, across several of its field offices. After the Estero Bay Aquatic Preserve (EBAP) office was selected, three datasonde monitoring sites were set up within the bay. There were several factors considered when selecting the monitoring sites including salinity gradients, water depth, freshwater inputs, tidal circulation patterns and the location of navigational markers. Additionally, to correlate existing data collection efforts and refrain from duplicating data, locations of other water quality studies were also taken into consideration.

The datasondes, located in a long, shallow estuary, are affected by saltwater inclusion from several Gulf of Mexico inlets and freshwater input from five tributaries. The passes are, from north to south: Hurricane Pass, Matanzas Pass, Big Carlos Pass, New Pass, Big Hickory Pass, and Wiggins Pass in Collier County. The tributaries are, from north to south: Hendry Creek, Mullock Creek, Estero River, Spring Creek, and the Imperial River. The watershed for Estero Bay spans 359.6 square miles and encompasses both the Southern Coastal Plain and Southern Florida Coastal Plain ecoregions, which comprise areas that are typical of low, flat, southern Florida lands dominated by wetlands and characterized by slow, sheet-flow drainage patterns. Natural communities include mangrove-dominated islands along the coast with salt marsh habitats occurring landward of the mangrove zone, pine flatwoods, cypress swamps, and cabbage palm hammocks. The communities within the bay include seagrass beds, mangrove islands, salt marshes, tidal flats, and oyster bars. In the past, the naturally dispersed water patterns distributed nutrients over broad areas of wetland vegetation and seasonal fluctuations in flow from rainfall created the necessary salinity regime in Estero Bay for good estuarine productivity. However, increased development in the area since the 1960’s has led to changes in the natural river systems around Estero Bay, altering freshwater inflow patterns. The watershed activities that potentially impact the bay include point-source wastewater discharge and non-point source runoff or leaching of pollution from roads, agriculture lands, urban areas, and un-vegetated lands which contain fertilizers, pesticides, herbicides, metals, sediments, petroleum compounds, and bacteria.

The datasonde data provides information on the overall health of Estero Bay on a continuous basis. Specifically, the data from these stations provide a baseline of water quality measurements for identifying, monitoring, and comparing differences in the parameters over time. The data also aid in the interpretation of changes observed in indicator organisms, bay communities, and for making comparisons to other geographical areas. The data may also assist with the understanding of effects from anthropogenic changes within the bay. The principle goal of the program is to attain baseline data on the overall water quality of Estero Bay for the purpose of preventing further degradation.

### Research methods

Beginning July 14, 2004 two water quality stations, EB01 (Tom Winter) in the north end of Estero Bay and EB02 (Spring Creek) in the central portion of the bay, were designated as permanent Continuous Water Quality Monitoring Program sites for Estero Bay Aquatic Preserve. A third water quality station, EB03 (Fish Trap Bay), was added on November 23, 2004 at the southern end of the preserve. The dataset from these three monitoring stations has been essentially uninterrupted since the first day of deployment.

Currently, all sondes are YSI 6600 Extended Deployment System (EDS) with three that are the V2-2 model. Prior to deployment, the sondes are calibrated for pH, specific conductivity, turbidity, dissolved oxygen, and depth following the procedures outlined in the YSI Operating and Service Manual. Prior to the December 2011 deployment, the depth was calibrated using a barometric pressure value of 760 mmHg for each calibration, actual atmospheric pressure was not calculated. For the December 6, 2011 deployment a NIST certified barometer was used to obtain the actual atmospheric pressure and determine the depth offset value.

A two-point calibration is used for pH (YSI buffers 7 & 10) and turbidity (0 NTU distilled water & 126 NTU YSI, Inc.). A 0.5M KCL solution (YSI conductivity calibrator) is used to calibrate specific conductivity. Dissolved oxygen (DO) is calibrated in oxygen saturated water, using a bucket and an aerator. Prior to June 29, 2010, rapid pulse dissolved oxygen sensors were calibrated using water saturated air, using a small amount of water in a vented calibration cup. The percent saturation value is determined by using the current barometric pressure to convert to the adjusted value and entered into EcoWatch. ROX optical DO probes are deployed at all three sites. The depth is also calibrated by using the current barometric pressure to determine the depth offset value and entered into EcoWatch.

All sondes are deployed within 4-inch diameter PVC pipes, which are attached to either a private residential dock (EB01) or “aid-to-navigation” pilings (EB02 and EB03). The pipes are oriented vertically and attached with stainless steel rods molded to wrap around the piling and bolted to galvanized hangers. Up to three hangers are used depending on the height of the pipe. A stainless steel bolt is also installed at the end of the pipes to keep the sonde from falling through. The submerged end of the PVC has two rows of rectangular holes whose short ends are rounded (pill/stadium shaped). There are 4 holes per row measuring vertically approximately 8 inches tall and horizontally 2 inches wide. Sondes are secured by rope to an eyebolt in the top of the PVC caps. An additional hole is drilled through the top of the pipes and caps in order to insert a bolt and lock for security. The bottoms of the pipes are open and positioned such that the sensors are 0.5 meters above the bottom.

The sondes are further protected from crabs and other live organisms by attempting to restrict the openings on the sonde guard with plastic mesh screening. The plastic mesh (with 1/8 inch diamond-shaped holes) is attached to the outside of the sondes guard’s circumference using low- profile zip ties. In 2015, increased antifouling efforts were applied to guards in the form of copper tape on the exterior of the plastic guards plus copper alloy woven mesh (McNichols Co., 4 mesh, 0.047’’ woven square weave, 66% open area).

Sondes are deployed, generally, for two weeks to one month at a time. The sampling period is set for 15-minute intervals (readings are made every 15 minutes). The following physical water quality parameters are recorded: temperature (degrees Celsius), specific conductivity (mS/cm), salinity (parts per thousand), dissolved oxygen (mg/L and % saturation), depth (m), pH and turbidity (NTU). To test how well the sondes hold calibration, field measurements are performed using a handheld YSI instrument (YSI 85 2004-Feb. 2008, YSI556 Feb. 2008-July 2015, YSI ProDSS July 2015-present) which serves as a “spot check” at the time of deployment and retrieval. The parameters recorded are temperature, specific conductivity, conductivity, salinity, dissolved oxygen (mg/L and % saturation), and depth. Additionally, a post-deployment calibration verification is conducted in the lab. The parameters include temperature, pH (7.0 and 10.0), turbidity (0 NTU), specific conductivity (50 mS/cm), DO%, depth, and battery volts.

## NOTE: All data associated with this metadata file are reported in Local Standard Time (Oct- March) and NOT adjusted for daylight savings time.

### Site location and character

**EB01 (Tom Winter):**

Lat/Long (Decimal Degrees): 26.434944 -81.911389

Julies Island, and is the most northern of the three site locations. The Tom Winter labeling is to clarify the sonde location which is affixed to a residential dock (parcel 28-46-24- W3-0020B.0390) approximately 300 meters across the channel from Julie’s Island. The monitoring site is approximately 5.0 km (linear dimension) from Matanzas Pass Bridge to the northwest and 4.4 km from Big Carlos Pass to the southeast. The closest tributary is the Y- junction of the mouths of Hendry Creek and Mullock Creek, approximately 5.1 km northeast of the sonde location. Matanzas Pass is roughly 8.9 km long and has a mid-channel depth of approximately 1.0 to 3.6 meters at MHW. At the sampling site, the depth is 2.05 meters at MHW and the width of the water body is 335 meters. Tides at EB01 are mixed semidiurnal and range from 0.85 m to 1.39 m according to the NOAA Tides and Currents website; Estero Island, Estero Bay, FL Datum, Station ID 8725351, 1983-2001 Epoch. Salinities range from 2.2 ppt to 34.4 ppt and fluctuate daily with tides, wind, rainfall, and freshwater discharge (USGS Scientific Investigations Report 2007-5217, Estero Bay near Horseshoe Keys data, 10/1/2004 – 09/30/2005). The channel substrate is predominantly fine sand and there is no bottom vegetation. Generally, Estero Island’s shoreline, on the bay side, is sea walled and will not have any vegetation. The closest vegetation are red and black mangrove islands across the channel. The land to the north of the site contains a significant amount of protected state-owned preserve area known as Estero Bay Preserve State Park.

# EB02 (Spring Creek):

Lat/Long (Decimal Degrees): 26.385917 -81.846333

The EB02 site is located northwest of the mouth of Spring Creek and south of Coconut Point. The sonde is affixed to navigational marker 9A within the Spring Creek access channel. The average depth at this site is approximately 1.70 meters at MHW. Tides at EB02 are mixed semidiurnal and range from 0.74 m to 1.27 m according to the NOAA Tides and Currents website; Coconut Point, Estero Bay, FL Datum, Station ID 8725319, 1983-2001 Epoch. Salinities range from 8.2 ppt to 35.9 ppt and fluctuate daily with tides, wind, rainfall, and freshwater discharge (USGS Scientific Investigations Report 2007-5217, Big Carlos Pass data, 10/5/2004 – 09/30/2005). The substrate within the channel is a mixture of sand and silt with no bottom vegetation. However, there is seagrass found in the vicinity. Mature red and black mangrove forests dominate the nearby banks of the bay and several mangrove islands are nearby. The mouth of Spring Creek is approximately 4.4 km downstream from where a six-lane highway (SR 41) crosses over the tributary.

# EB03 (Fish Trap Bay):

Lat/Long (Decimal Degrees): 26.354972 -81.844528

The EB03 site is located east of Broadway Channel and north of Intrepid Waters at the southern end of EBAP. The sonde is affixed to a piling (manatee caution sign) in the center of Big Hickory Bay. The mouth of the Imperial River is approximately 2.1 km to the south of the sonde’s location and is the closest tributary. The average depth at MHW is approximately

1.40 meters. Tides are mixed semidiurnal and range from 0.62m to 0.81m (NOAA Tides and Currents website; Fish trap Bay, Estero Bay, FL Datum, Station ID 8725272, 1983-2001 Epoch). Salinities range from 1.6 ppt to 33.6 ppt and fluctuate daily with tides, wind, rainfall, and freshwater discharge (USGS Scientific Investigations Report 2007-5217, Fishtrap Bay data, 10/1/2004 – 09/30/2005). The substrate within the channel is a mixture of sand and silt with no bottom vegetation. Mature red and black mangrove forests dominate the nearby banks of the preserve. The dominant natural vegetation of the watershed is hydric pine, scrubby flatwoods, and cypress. The mouth of Imperial River is approximately 2.1 km downstream from a six-lane highway (SR 41) and approximately 7.6 km from I-75, both of which cross over the tributary.

### Data collection period

Water quality data collection began July 14, 2004 at EB01 and EB02 and November 23, 2004 at EB03. This collection began January 1, 2016 and ended April 30, 2016. During this time period there have been 16 deployments at each site.

***EB01 (Tom Winter)***

|  |  |  |
| --- | --- | --- |
| **Deployment** | **Start Date** | **End Date** |
| 01122115 | 12/22/2015 12:42 | 1/13/2016 15:36 |
| 01011116 | 1/13/2016 15:36 | 2/3/2016 17:24 |
| 01020116 | 2/3/2016 17:24 | 2/29/2016 12:52 |
| 01022916 | 2/29/2016 12:52 | 3/23/2016 9:13 |
| 01032216 | 3/23/2016 9:13 | 4/20/2016 8:24 |
| 01041916 | 4/20/2016 8:24 | 5/10/2016 8:15 |
| 01050916 | 5/10/2016 8:15 | 6/1/2016 8:25 |
| 01053116 | 6/1/2016 8:25 | 6/23/2016 9:21 |
| 01062216 | 6/23/2016 9:21 | 7/20/2016 8:40 |
| 01071916 | 7/20/2016 8:40 | 8/11/2016 8:28 |
| 01081016 | 8/11/2016 8:28 | 9/7/2016 10:41 |
| 01090616 | 9/7/2016 10:41 | 9/28/2016 10:45 |
| 01092716 | 9/28/2016 10:45 | 10/25/2016 11:24 |
| 01102416 | 10/25/2016 11:24 | 11/22/2016 13:28 |
| 01112116 | 11/22/2016 13:28 | 12/14/2016 12:04 |
| 01121316 | 12/14/2016 12:04 | 1/5/2017 11:42 |

***EB02 (Spring Creek)***

|  |  |  |
| --- | --- | --- |
| **Deployment** | **Start Date** | **End Date** |
| 02122115 | 12/22/2015 10:55 | 1/13/2016 14:50 |
| 02011116 | 1/13/2016 14:50 | 2/3/2016 16:29 |
| 02020116 | 2/3/2016 16:29 | 2/29/2016 10:45 |
| 02022916 | 2/29/2016 10:45 | 3/23/2016 10:33 |
| 02032216 | 3/23/2016 10:33 | 4/20/2016 9:22 |
| 02041916 | 4/20/2016 9:22 | 5/10/2016 9:23 |
| 02050916 | 5/10/2016 9:23 | 6/1/2016 10:36 |
| 02053116 | 6/1/2016 10:36 | 6/23/2016 10:39 |
| 02062216 | 6/23/2016 10:39 | 7/20/2016 9:52 |
| 02071916 | 7/20/2016 9:52 | 8/11/2016 9:58 |
| 02081016 | 8/11/2016 9:58 | 9/7/2016 9:23 |
| 02090616 | 9/7/2016 9:23 | 9/28/2016 8:33 |
| 02092716 | 9/28/2016 8:33 | 10/25/2016 10:09 |
| 02102416 | 10/25/2016 10:09 | 11/22/2016 10:37 |
| 02112116 | 11/22/2016 10:37 | 12/14/2016 9:13 |
| 02121316 | 12/14/2016 9:13 | 1/5/2017 10:40 |

***EB03 (Fish Trap)***

|  |  |  |
| --- | --- | --- |
| **Deployment** | **Start Date** | **End Date** |
| 03122115 | 12/22/2015 10:14 | 1/13/2016 14:11 |
| 03011116 | 1/13/2016 14:11 | 2/3/2016 16:06 |
| 03020116 | 2/3/2016 16:06 | 2/29/2016 11:34 |
| 03022916 | 2/29/2016 11:34 | 3/23/2016 11:31 |
| 03032216 | 3/23/2016 12:31 | 4/20/2016 10:04 |
| 03041916 | 4/20/2016 10:04 | 5/10/2016 10:20 |
| 03050916 | 5/10/2016 10:20 | 6/1/2016 9:56 |
| 03053116 | 6/1/2016 9:56 | 6/23/2016 11:30 |
| 03062216 | 6/23/2016 11:30 | 7/20/2016 10:43 |
| 03071916 | 7/20/2016 10:43 | 8/11/2016 10:48 |
| 03081016 | 8/11/2016 10:48 | 9/7/2016 8:41 |
| 03090616 | 9/7/2016 8:41 | 9/28/2016 9:22 |
| 03092716 | 9/28/2016 9:22 | 10/25/2016 9:28 |
| 03102416 | 10/25/2016 9:28 | 11/22/2016 11:40 |
| 03112115 | 11/22/2016 11:40 | 12/14/2016 10:15 |
| 03121316 | 12/14/2016 10:15 | 1/5/2017 9:57 |

### Distribution

Considerable effort has been made to ensure the accuracy of the information provided and meet quality assurance guidelines used by the Florida’s Department of Environmental Protection Estero Bay Aquatic Preserve program. Please note that the included data are estimates of actual conditions subject to improvements in accuracy and precision of field methods over time as well as infrequencies in sampling duration, rendering data in some instances, to be unsuitable for temporal or spatial comparisons. As a result, the user is responsible for interpretations based on supplied data.

Neither the State of Florida nor the Florida Department of Environmental Protection makes any warranty, expressed or implied, including the warranties of merchantability and fitness for a particular purpose arising out of the use or inability to use the data, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and Estero Bay Aquatic Preserve, where the data were collected, will 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.

Estero Bay Aquatic Preserve water quality data and metadata can be obtained from the Research Coordinator at the individual site (please see Principal Investigators and Contact Persons).

### Associated researchers and projects

In addition to this water quality dataset, Estero Bay Aquatic Preserve conducts epibenthic monitoring of five seagrass sites. Starting in 2002, five fixed stations located throughout the aquatic preserve are monitored twice a year, once in the dormant season and once in the growing season, using Braun-Blanquet techniques. Beginning in 2016, macroalgae has been collected at each of these transects during seagrass surveys. These samples are analyzed to determine species present and biomass of each species. Abundance scores are also applied to algae as part of the seagrass monitoring. Two of these seagrass sites are located within close proximity of the EB02 and EB03 sonde locations.

Since 1998, volunteers with the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network (CHEVWQMN) have collected water quality data once a month at up to 7 sites within Estero Bay (or 46 sites within the greater Charlotte Harbor region). This program is currently coordinated through the Charlotte Harbor Aquatic Preserves office in Punta Gorda, FL.

In 2008, EBAP began monitoring the nesting effort of wading and diving birds which use mangrove islands within the bay as rookeries.

Beginning in February 2012, red tide samples for Florida Fish and Wildlife Conservation Commission’s (FWC) Fish and Wildlife Research Institute (FWRI) have been collected by Estero Bay Aquatic Preserve staff during datasonde retrieval, by the CHEVWQMN volunteers, and/or more often as requested by FWRI.

Lee County and FDEP’s Division of Environmental Assessment and Restoration collect water quality samples within Estero Bay and the watershed.

### Physical Structure Descriptors

1. **Sensor specifications:**

Estero Bay Aquatic Preserve deploys YSI 6600 EDS and YSI 6600 – V2 (2) EDS datasondes

Parameter: Temperature Units: Celsius (C)

Sensor Type: Thermistor Model#: 6560

Range: -5 to 50 C

Accuracy: +/- 0.15

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 dependant)

Parameter: Salinity

Units: parts per thousand (ppt)

Sensor Type: Calculated from conductivity and temperature Range: 0 to 70 ppt

Accuracy: +/- 1.0% of reading pr 0.1 ppt, whichever is greater Resolution: 0.01 ppt

Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe w/ 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% or 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#: 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

Parameter: Non-vented Level - Shallow (Depth) Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge Range: 0 to 30 ft (9.1 m)

Accuracy: +/- 0.06 ft (0.018 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH – bulb probe or EDS flat glass probe Units: pH units

Sensor Type: Glass combination electrode Model#: 6561 or 6561FG

Range: 0 to 14 units Accuracy: +/- 0.2 units Resolution: 0.01 units

Parameter: Turbidity

Units: nephelometric turbidity units (NTU)

Sensor Type: Optical, 90 degree scatter, with mechanical cleaning Model#: 6136

Range: 0 to 1000 NTU

Accuracy: +/- 2% of reading or 0.3 NTU (whichever is greater) Resolution: 0.1 NTU

### Dissolved Oxygen Qualifier:

### The reliability of the dissolved oxygen (DO) data after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Many Aquatic Preserves have upgraded to YSI 6600 EDS data sondes, which increase DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this potential drift is not always problematic for some uses of the data (e.g., periodicity analysis). It should be noted that the amount of fouling is site specific and that not all data are affected. The Principal Investigator should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor. EBAP transitioned all dissolved oxygen sensors from rapid pulse to optical type sensors during the June 30, 2010 deployment.

### Depth Qualifier:

The YSI datasondes utilized by Estero Bay Aquatic Preserve are equipped with non-vented depth/level sensors. Readings for 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. EBAP began calibrating depth with an offset with the December 6, 2011 deployment.

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). If accurate atmospheric pressure data are available, non-vented sensor depth measurements can be corrected. After 04/04/12, depth sensors were calibrated with an offset using local barometric pressure measured on site with a Fisher Scientific TM Traceable tm digital barometer.

**Salinity Units Qualifier:**

6600 series sondes report salinity in parts per thousand (ppt) units and the EXO sondes report in practical salinity units (psu). These units are essentially the same and for the AP water quality program purposes are understood to be equivalent, however psu is considered the more appropriate designation. Moving forward the AP program will assign psu salinity units for all data regardless of sonde type.

**Turbidity Qualifier:**

6600 series sondes report turbidity in nephelometric turbidity units (NTU) and the EXO sondes use formazin nephelometric units (FNU). These units are essentially the same but indicate a difference in sensor methodology, for AP water quality program purposes they will be considered equivalent. Moving forward, the AP program 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.

### Coded variable definitions

|  |  |  |
| --- | --- | --- |
| Sampling Station: | Sampling Site Code: | Station Code: |
| Tom Winter | EB01 | EB01 |
| Spring Creek | EB02 | EB02 |
| Fish Trap Bay | EB03 | EB03 |

1. **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 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

### 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. A short description of each flag and code combination also appears on the notes tabs of the excel file. 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 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

Sensor Errors

SBO Blocked optic

SCF Conductivity sensor failure SDF Depth port frozen

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 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

### Post deployment calibration information

***EB01 (Tom Winter)***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Deployment** | **SpCond** | **pH 7** | **pH 10** | **Turb (0)** | **Depth (cal val)** | **DO% (cal val)** |
| 01122115 | 49.51 | 6.98 | 9.88 | 313.7 | 0.008 ( -0.014) | 102.8(99.9) |
| 01011116 | 47.15 | 7.07 | 9.97 | 0.6 | -0.026 (-0.027) | 99.8(99.7) |
| 01020116 | 51.15 | 7.09 | 10.09 | 1.3 | -0.032 (-0.014) | 99.4(99.9) |
| 01022916 | 50.16 | 7.15 | 10.07 | -1.1 | 0.012 (0.000) | 99.0 (100.0) |
| 01032216 | 47.72 | 7.01 | 9.95 | 0.8 | -0.044 (-0.057) | 99.8 (99.5) |
| 01041916 | 48.15 | 7.06 | 9.93 | 0.2 | -0.021 (-0.027) | 98.1 (99.8) |
| 01050916 | 49.67 | 7.00 | 9.90 | 0.3 | -0.076 (-0.068) | 98.9 (99.3) |
| 01053116 | 50.25 | 7.09 | 10.02 | -0.7 | -0.041 (-0.041) | 99.5 (99.6) |
| 01062216 | 49.33 | 6.95 | 9.82 | 2.6 | -0.037 (-0.041) | 98.8 (99.6) |
| 01071916 | 49.12 | 6.88 | 9.80 | 1.5 | -0.058 (-0.068) | 99.7 (99.4) |
| 01081016 | 48.98 | 6.92 | 9.88 | -0.1 | -0.031 (-0.041) | 98.9 (99.6) |
| 01090616 | 49.48 | 7.06 | 10.0 | 7.4 | -0.085 (-0.095) | 98.4 (99.1) |
| 01092716 | 48.70 | 6.91 | 9.84 | -1.3 | -0.050 (-0.054) | 99.3 (99.5) |
| 01102416 | 49.39 | 7.13 | 10.00 | 1.0 | -0.045 (-0.054) | 99.5 (99.5) |
| 01112116 | 49.09 | 7.24 | 10.20 | -5.3 | -0.070 (-0.068) | 99.9 (99.3) |
| 01121316 | 49.25 | 7.08 | 9.99 | 2.8 | -0.126 (-0.109) | 98.6 (98.9) |

***EB02 (Spring Creek)***

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| **Deployment** | **SpCond** | **pH 7** | **pH 10** | **Turb (0)** | **Depth (cal val)** | **DO% (cal val)** |
| 02122115 | 49.6 | 7.12 | 10.09 | 2.2 | -0.017 (-0.014) | 101.6 (99.9) |
| 02011116 | 48.71 | 6.94 | 9.83 | -1.2 | -0.044 (-0.027) | 99.2 (99.7) |
| 02020116 | 49.54 | 7.18 | 10.00 | 3.0 | -0.024 (-0.027) | 99.8(99.8) |
| 02022916 | 54.80 | 6.94 | 9.92 | 0.8 | -0.015 (-0.014) | 99.5 (99.9) |
| 02032216 | 47.54 | 6.85 | 9.70 | 3.0 | -0.057 (-0.041) | 99.1 (99.6) |
| 02041916 | 48.10 | 7.24 | 10.15 | 678.8 | -0.015 (-0.027) | 99.4 (99.8) |
| 02050916 | 49.76 | 6.89 | 9.85 | 51.6 | -0.084 (-0.082) | 97.9 (99.2) |
| 02053116 | 48.19 | 7.03 | 9.98 | 14.7 | -0.052 (-0.027) | 99.1 (99.7) |
| 02062216 | 50.05 | 6.79 | 9.78 | 10.1 | -0.035 (-0.054) | 93.2 (99.5) |
| 02071916 | 0 | 6.94 | 6.94 | -22.7 | 4.681 (-0.068) | 0.0 (99.9) |
| 02081016 | 46.96 | 6.98 | 9.95 | 3.6 | -0.052 (-0.054) | 98.5 (99.5) |
| 02090616 | 55.75 | 6.91 | 9.83 | -2.7 | -0.061 (-0.082) | 99.2 (99.2) |
| 02092716 | 48.16 | 7.01 | 9.91 | -251.9 | -0.062 (-0.054) | 99.4 (99.5) |
| 02102416 | 50.31 | 7.47 | 10.26 | 4.1 | -0.038 (-0.054) | 99.0 (99.5) |
| 02112116 | 48.90 | 6.99 | 9.95 | -4.2 | -0.074 (-0.068) | 99.6 (99.3) |
| 02121316 | 48.91 | 7.04 | 9.99 | 0.9 | -0.128 (-0.122) | 98.3 (98.8) |

***EB03 (Fish Trap)***

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| **Deployment** | **SpCond** | **pH 7** | **pH 10** | **Turb (0)** | **Depth (cal val)** | **DO% (cal val)** |
| 03122115 | 48.84 | 7.18 | 10.11 | -12.9 | -0.013 (-0.027) | 0.0 (99.8) |
| 03011116 | 47.37 | 7.03 | 9.96 | 1.9 | -0.036 (-0.027) | 99.7 (99.7) |
| 03020116 | 49.35 | 7.00 | 9.65 | 9.2 | -0.029 (-0.027) | 100.1 (99.8) |
| 03022916 | 48.55 | 7.20 | 10.11 | 16.3 | -0.016 (0.000) | 99.8 (100.0) |
| 03032216 | 47.65 | 7.27 | 10.14 | 1428.9 | -0.046 (-0.054) | 0.0 (99.5) |
| 03041916 | 50.10 | 7.04 | 9.89 | 670.6 | -0.030 (-0.027) | 99.0 (99.8) |
| 03050916 | 50.94 | 7.18 | 10.27 | 1.9 | -0.114 (-0.095) | 99.5 (99.1) |
| 03053116 | 48.30 | 7.30 | 10.23 | 105.6 | -0.046 (-0.041) | 99.5 (99.6) |
| 03062216 | 44.11 | 6.91 | 9.88 | 1416.1 | -0.040 (-0.054) | 11.6 (99.5) |
| 03071916 | 47.95 | 7.05 | 10.05 | 100.2 | -0.059 (-0.068) | 98.3 (99.3) |
| 03081016 | 46.84 | 7.07 | 10.07 | 0.2 | -0.037 (-0.054) | 54.7 (99.5) |
| 03090616 | 50.33 | 6.63 | 9.54 | 14.7 | -0.087 (-0.095) | 99.7 (99.1) |
| 03092716 | 46.11 | 7.04 | 9.99 | 4.9 | -0.059 (-0.054) | 34.6 (99.5) |
| 03102416 | 50.60 | 7.06 | 9.97 | 3.8 | -0.044 (-0.041) | 99.8 (99.6) |
| 03112115 | 49.13 | 7.06 | 9.95 | NA | -0.079 (-0.068) | 99.0 (99.3) |
| 03121316 | 50.56 | 6.95 | 9.84 | 2.7 | -0.121 (-0.122) | 98.6 (98.8) |

1. **Other remarks/notes**

All data files are QAQC’d using the 2012 CDMO Excel macro. This macro automatically flags negative turbidity values between 0 and -2 NTU as Suspect <1> with the comment Acceptable Calibration/Accuracy Error of Sensor (CAF). In addition, the macro automatically flags DO values less than 3 mg/L as Passed Initial QAQC Checks <0> with the comment DO Hypoxia (<3 mg/L) (CDA). The DO flag is based on Federal standards. During the primary QAQC session, any reading that falls outside a sensor’s range (see section II. Physical Structure descriptors) is rejected (-3). For example, all turbidity readings over 1000 NTU are rejected (-3, SBO). Small negative depth readings where all other data is in line are marked suspect (1, SNV, CAP) per the CDMO manual since this is within the accuracy of the sensor. The shallow depth sensor is a non-vented probed that is susceptible to changes in barometric pressure when deployed in shallow estuaries, please refer to the depth qualifier under Section II. Additionally, negative turbidity readings between 0 and -2 have been flagged as suspect data (1, SNV, CAF) since the value is within the accuracy of the probe per the CDMO operations manual. Data form all out of water events (distinguished by both low SpCond values and low/negative depths) has all been rejected (-3, GOW, CLT)

Additionally, for Estero Bay, anomalous turbidity readings >126 NTU (the high calibration value), not within a well-defined turbidity peak (e.g., neighboring readings are not close), are marked as a suspect turbidity spike (1, STS). These readings may either be caused by optical interference by animals or fouling, or an unknown local disturbance. A description of all other flag/code combinations that appear in the dataset are noted below.

## EB01 (Tom Winter)

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| **Deployment** | **Other Notes** |
| 01122115 | Datasonde not deployed at bottom of the tube. All parameters flagged as suspect (<1><CWD>) due to wrong deployment depth. In cases where other flags for rejection or suspicion exist, those were left in place; however, consider all parameters during the deployment suspect due to incorrect depth. Turbidity read consistently above 250 duringpost cal but fluctuated and never stabilized. All turbidity readings have been rejected. |
| 01011116 | Post calibrated DO, Depth and Temp on 02/03 at 19:46; pH, SpC and Turb on 02/05 12:07. Because specific conductivity read out of range during post calibration, all specific conductivity, salinity, and DO (mg and %) readings rejected. |
| 01020116 | Crab guard had slid up about 3 in. Anomalous turbidity readings (between 126 and 1000 NTU) were marked as suspect (<1><STS>) and those >1000 NTU were marked as rejected (<- 3><SBO>). |
| 01022916 | Two anomalous turbidity spikes on 3/20 were marked as suspect because the readings exceed 126 NTU (<1><STS>). |
| 01032216 | No other notes |
| 01041916 | Light fouling upon retrieval: barnacles, algae, bryozoans, tunicates, oysters. Turbidity spikes>1000 NTU have been rejected and those >126 have been flagged as suspect. Turbidity readings <-2 have been rejected and those -2<x<0 have been flagged suspect. |
| 01050916 | A few high turbidity readings marked as suspect or rejected. |
| 01053116 | No other notes |
| 01062216 | pH probe heavily fouled but did not seem to affect readings. Negative turbidity readings marked as suspect or rejected. All turbidity readings over 1000 rejected, and all between 126 and 1000 marked as suspect (unless within a defined turbidity event). |
| 01071916 | Fouling over turbidity probe window, but readings mostly still appear normal. All turbidity readings >1000 NTU rejected. Readings less than 1000 NTU but greater than 126 NTU marked as suspect. |
| 01081016 | Depth fluctuating a little bit during post-calibration--likely due to barnacle in port. All turbidity readings >1000 NTU rejected. Readings less than 1000 NTU but greater than 126 NTU marked as suspect. |
| 01090616 | All turbidity data rejected since post-calibration value was above the acceptable range. When retrieved, the turbidity probe had a crustose fouling and barnacles on it, including some over the window. |
| 01092716 | Turbidity post-calibration value negative. Retrieval notes: some fouling on DO and turbidity wipers but sensors clean. Lots of anomalous turbidity readings. All greater than 1000 NTU rejected and those between 126 and 1000 NTU marked suspect. |
| 01102416 | Some anomalous turbidity readings: between -2 and zero marked suspect and one reading over 1000 NTU rejected (11/21/2016 18:15). |
| 01112116 | Turbidity post-calibration value out of acceptable range. All turbidity readings for this deployment rejected. |
| 01121316 | First pH reading of deployment (12/14/16 12:30) rejected since it appears that pH took a little bit to acclimate. The reading is much lower than those following it and does not match the field reading taken onsite. |

***EB02 (Spring Creek)***

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| **Deployment** | **Other Notes** |
| 02122115 | Light fouling (attached algae, slime, colonial tunicates) and crabs, including one stone crab, in guard. |
| 02011116 | Post calibration done on two days: DO, Depth and Temp on 02/03 at 19:57; SpC, pH and Turb 02/05 at 13:20; pH slope a bit low. Turbidity readings above 126 NTU on 1/22 marked suspect since they exist outside a well-defined peak. Other readings above 126 NTU left unflagged because they look to be part of a peak. |
| 02020116 | Barnacles encrusting probes, one on corner of turbidity window. Turbidity outside of acceptable range during post-calibration, so all turbidity readings were rejected. Outside of tube cleaned w/ new sonde inside. |
| 02022916 | Medium fouling; lots of crabs in guard. Also found baby shrimp, barnacles, tunicates, worms. Specific conductivity high during post-calibration, so all specific conductivity, salinity, dissolved oxygen and depth data were rejected. Turbidity readings above 1000 NTU were rejected. Readings above 126 NTU outside of defined peaks were marked suspect, as was the case 3/14/16 at 11:00, 3/18/16 at 19:00, and 3/22/16 at 13:30. The turbidity peak on 3/21/16 was likely caused by weather. |
| 02032216 | Tube cleaned at beginning of deployment; medium fouling; crabs, oyster spat, tube worms, limpets and tunicates. Turbidity outside of acceptable range during post-calibration, so all turbidity readings should be rejected. |
| 02041916 | Could not initially access during post-cal (batteries must have been dead). Once changed, good. Turbidity out of range--maybe from fouling. Fouling medium: tunicates, algae, limpets, amphipods, 10-20 crabs. Both wipers fouled with tunicates. All turbidity data have been rejected (<-3>[SPC]). |
| 02050916 | Tunicate colony had completely overgrown turbidity probe. Medium fouling by tunicates, barnacles, algae, and bryozoans. Tunicate also had overgrown the DO wiper, but it was still functioning. Post calibration turbidity readings out of range, likely due to fouling by tunicate, so all turbidity readings have been rejected (<-3>[SPC]). Between deployments (5/10 9:45 and 10:00), all readings marked as rejected for in-field maintenance since both sensors were out of water while tube was cleaned. |
| 02053116 | Turbidity wiper partially covered by tunicate. Biofouling likely resulted in the post-calibration reading being out of acceptable range and the rejection of all turbidity data from the deployment. |
| 02062216 | Depth sensor fouled by barnacles, pH 10 took long time to stabilize (pH probe encrusted by tunicate). All turbidity readings rejected since post-calibration value out of acceptable range. All dissolved oxygen readings rejected because post-calibration value out of range. Disjunct between previous deployment's and this one's pH readings. |
| 02071916 | All readings rejected (<-3>[GIM]). Depth port overgrown by barnacles, wipers on optical probes not working, no probes taking readings. Post-calibration values outside accepted range for all parameters. |
| 02081016 | Rejected turbidity readings as well as conductivity readings (and therefore salinity, depth, and dissolved oxygen readings) because post-calibration values were out of range. |
| 02090616 | Rejected conductivity readings and therefore associated salinity, depth, and dissolved oxygen readings. Turbidity readings >1000 NTU marked rejected, between 126 and 1000 NTU marked suspect. Negative turbidity readings marked suspect |
| 02092716 | Rejected turbidity readings because it read out of range on post-calibration. Wiper was not rotating correctly. |
| 02102416 | Rejected turbidity readings because it read out of range on post-calibration. |
| 02112116 | Turbidity readings rejected because the readings for post-calibration were out of acceptable range. In post-cal, DO initially read only zero but started reading normally once I forced wipers a few times. It appears to have just read zero in the field and therefore these readings have been rejected, attributed to sensor malfunction. |
| 02121316 | 4 instances of turbidity readings >1000 NTU flagged as rejected. A few negative depths marked as suspect. |

***EB03 (Fish Trap)***

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| **Deployment** | **Other Notes** |
| 03122115 | Minor fouling on turbidity sensor; turbidity wiper not rotating properly during post-cal; pH slope off, but not so low as to reject. Datasonde may not have been at bottom of tube, so depth data marked suspect. Turbidity and DO% post calibration values are outside theacceptable range so these data were rejected. |
| 03011116 | Post calibration conducted on separate days: Do, Depth and Temp on 02/03 at 20:03; SpC, pH and Turb 02/05 at 13:54. Specific conductivity out of range, so all specific conductivity, salinity, dissolved oxygen, and depth data were rejected. High turbidity readings (>126 NTU) were left unflagged as they appear to be part of high turbidity events (likely due to winds) on 1/23, 1/24 and 1/25. |
| 03020116 | Fouling: algae and small barnacles, probes may have been exposed at low tides. Turbidity outside of acceptable range during post-calibration, so all turbidity data was rejected. |
| 03022916 | Light fouling: algae and barnacles, a few crabs. Turbidity outside of acceptable range during post-calibration, so all turbidity data was rejected. Some data rejected for out of water events (those in which depth read negative and SpC was also very low). |
| 03032216 | Tube cleaned at beginning of deployment; Medium fouling: tunicates, algae; crabs; turbidity wiper not at 180 when retrieved and resetting during post-cal did not rectify issue. During postcal, turbidity wiper did not rotate correctly. Turbidity and DO outside of acceptable range during post-calibration, so all turbidity and DO data were rejected. Some data rejected for out of water events (readings for which depth was negative and SpC was really low). |
| 03041916 | pH mv Low slope; Turbidity wiper not rotating properly (parking over window). Light fouling: bryozoans, algae, barnacles. Turbidity outside of acceptable range during post-calibration, so all turbidity data should be rejected. All readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (<- 3>[GOW]). |
| 03050916 | Between deployment (10:30 on 5/10) rejected since both sondes were out of water during tube cleaning (<-3>[GOW][CMC]). Some fouling on turbidity wiper, but post calibration readings within normal range. Light fouling overall by barnacles, bryozoans, and algae. Some crabs in guard. All readings from when sonde was exposed during very low tides (marked by low conductivity + low/negative depth readings) have been rejected (<-3>[GOW]). |
| 03053116 | Fouling on turbidity likely caused readings to be high. Turbidity readings rejected. |
| 03062216 | DO wiper fell off, turbidity probe heavily fouled. Turbidity, DO, SpC, salinity, and depth readings all rejected. |
| 03071916 | Turbidity probe heavily fouled and readings were rejected. |
| 03081016 | DO never stabilized (fluctuated between -99.0% and 5551.5%). Turbidity occasionally spiked then read normal. All SpC, salinity, depth and dissolved oxygen readings rejected. Turbidity spike on 9/6 marked suspect. Two turbidity readings on 9/4 and 9/5 rejected since greater than 1000 NTU. |
| 03090616 | One of the probes was draining the power so only 10 days logged. All turbidity readings taken were marked suspect since the post-cal readings were too high, but the readings appeared normal and fouling likely occurred once the battery had drained and the wipers stopped.Barnacles were fouling the probe, including the optical window. |
| 03092716 | Rejected Specific Conductivity, Salinity, Dissolved Oxygen, and Turbidity readings because they read out of range on post-calibration. Depth also rejected since it is dependent upon specific conductivity. The probes were heavily biofouled and wipers were not rotating properly. |
| 03102416 | Turbidity too high on post-calibration therefore rejected. A few negative depth readings marked suspect. |
| 03112116 | No turbidity probe. On the mornings of 11/27 and 11/28, there were out of water events marked by incredibly low specific conductivity readings and negative depths. |
| 03121316 | Very low tides caused several out of water events, marked as rejected. |

**Acknowledgement:** The data included with this document were collected by the staff of the Florida Department of Environmental Protection at the Estero Bay Aquatic Preserve. Any products derived from these data should clearly acknowledge this source (please use the attached logo). This recognition is important for ensuring that this long-term monitoring program continues to receive the necessary political and financial support.

