St. Martins Marsh and Big Bend Seagrasses Aquatic Preserves (SMMAP & BBSAP)

**Water Quality Metadata Report**

January - December 2021
Latest Update: September 9, 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 Timothy.W.Jones@dep.state.fl.us with any additional questions.

**I. Data Set and Research Descriptors**

**1) Principal investigator & contact persons-**

Principal Investigator:

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**2) Entry verification-**

Deployment data are uploaded from the YSI data sonde to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF), EcoWatch Lite in a comma separated file (.CSV) or KOR Software in an Excel File (.XLS). Copies of these files and calibration and field logs and saved in the APWQ Data folder on the common drive, and then the Data Manager is notified by email of the new files. The Data Mangaer removes pre- and post- deployment readings and save the files in the limited.csv folder. Those files are uploaded to the NERRS Centralized Data Management Office (CDMO) Non-SWMP Data Upload Service where data undergo automated primary QAQC. 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. During primary QAQC, data are flagged if they are missing or out of sensor range. Primary QAQC files are merged into monthly files in the monthly.csv folder. The files are then returned to the Aquatic Preserve’s Principal Investigator for secondary QAQC where they are analyzed for malfunctions, suspect and/or anomalous data, and notes are made. Files are merged into monthly, quarterly, and annual files and saved on the common drive. Quarterly and annual metadata reports are also saved in the same folder. The Data Manager applies QAQC flags and codes to the quarterly data files using the Aquatic Preserve’s Principal Investigator’s notes and metadata reports. Upload after secondary QAQC results in ingestion into the Aquatic Preserve database as provisional data. The Data Manager reviews the annual files, metadata reports, calibration logs, and post-deployment checks; creates a document with suggested edits, emails it to the Aquatic Preserve’s Principal Investigator, and saves it in the tertiary QAQC folder on the common drive. A meeting is conducted between the Data Manager and Principal Investigator to make corrections and finalize the data and metadata. After tertiary QAQC, the data and metadata are assimilated into the Aquatic Preserve database as authenticated data.

**3) Research objectives-**

The objective of this effort is to establish baseline data by quantifying the spatial/temporal variability and trends, both seasonally and as a function of tidal force, of selected abiotic parameters within the Aquatic Preserves; to record changes in water quality due to major storm events such as hurricanes; and to use this water quality data to complement the annual seagrass monitoring conducted by the Aquatic Preserves.

**4) Research methods-**

Historically, YSI 600 OMS data sondes had been continuously operated (data collection interval: 30 minutes) at the Crystal River site since January 2004, at the Bennett Creek, Kings Bay, and Homosassa River monitoring stations since February 2004, and at the Withlacoochee monitoring station since March 2004. YSI 6600 EDS data sondes were operated at Cat Island and Lone Cabbage Key beginning in March 2004, and at Seahorse Key and Gomez Rocks beginning in April 2004. These models incorporate a specially designed wiper apparatus attached to the turbidity probe that reduces the oxygen and pH sensor fouling and thereby improves the quality of data collected. At each site, the sonde is contained within a 10 cm (inside diameter) housing pipe mounted vertically on a piling. To facilitate water flow across the sensors, several 2 cm diameter holes were drilled into the submerged portion of the pipe. Hole density is greatest near the base where the sonde sensors are located. In early 2005, the Cat Island and Lone Cabbage Key sites were removed. During most of 2005 and early 2006, data was sporadically collected at all sites due to lack of staff.

As of March 2006, all YSI 600 OMS sites were operational. In July 2006, the Gomez Rocks site was removed, and in August 2006, the Seahorse Key station became operational. In October 2006, the YSI 600 OMS was replaced with an YSI 6600 EDS sonde at the Kings Bay station. In March 2007, a 6600 EDS station was established in Dekle Beach. In early 2009, the data collection interval was changed to 15 minutes at all locations. In March 2009, an additional 6600 EDS station was installed at the mouth of the Suwannee River. In March 2010, the Kings Bay station was relocated due to the replacement of the piling the sonde was previously located at. In February 2012, all four YSI 6600 EDS sondes were upgraded from rapid pulse dissolved oxygen probes to ROX optical dissolved oxygen probes. In May 2015, the Crystal River site was broken down due to piling replacement, and the Seahorse Key site was deconstructed. The Homosassa site was upgraded from a YSI 600 OMS to a YSI 6600 EDS in August of 2015. The Kings Bay location was downgraded from a YSI 6600 EDS to a YSI 600 OMS outfitted with a turbidity probe. Due to insufficient staffing, data from 2015 to 2017 are intermittent, and all sites were decommissioned in 2017.

In July 2018, a new station was installed in Chassahowitzka using a 6600 EDS with a 15-minute data collection interval. Parameters being recorded include time, date, temperature (°C), specific conductivity (mS/cm), salinity (ppt), dissolved oxygen (% and mg/L), depth (m), pH, and turbidity (NTU). On March 03, 2020, the Chassahowitzka station was upgraded from a 6600 EDS to an EXO3. Parameters being recorded remain the same, but turbidity is now collected in FNU and salinity is in psu. The data sonde tube is attached to a piling with hose clamps, and water flow through the tube is facilitated with a series of drilled out 2-in and 1-in holes in the submerged portion of the tube.

At the end of October 2019, a new station was installed in Steinhatchee. An EXO2 is being used with a 15-minute data collection interval. Parameters being recorded include time, date, temperature (°C), specific conductivity (mS/cm), salinity (psu), dissolved oxygen (% and mg/L), depth (m), pH, turbidity (FNU), and chlorophyll (RFU and µg/L). The data sonde tube is attached to a channel marker with hose clamps, and water flow through the tube is facilitated with a series of drilled out 2-in and 1-in holes in the submerged portion of the tube. This site was created to fill a data gap that exists in the Big Bend and was funded by an EPA grant awarded to BBSAP in 2019.

Sonde exchanges at the 6600 EDS sites are made at approximately two-week intervals, and sonde exchanges at the EXO sites are made at approximately 21-day intervals. At the end of a sampling period, sondes are returned to the laboratory where post-deployment readings and, if necessary, reconditioning take place in accordance with the methods outlined in the YSI Operating and Service Manual. The turbidity wiper brush is removed and replaced with a clean wiper to avoid contamination of standards during post-deployment procedures. After a superficial rinse of the sonde in tap water, post deployment readings are recorded for pH (RICCA 7.00 and 10.00 buffer solutions) and specific conductivity (RICCA 50.00 mS/cm standard). Post-deployment turbidity readings in 0.00 FNU standard (DI water) and 124.00 FNU (YSI standard) are recorded after a more thorough rinse of the turbidity sensor. Post-deployment chlorophyll readings in 0.00 RFU and µg/L standard (DI water) are recorded also. The results of these post-deployment readings are used to evaluate the validity of data (See Tables 2 and 3).

**5) Site locations and character-**

The St. Martins Marsh Aquatic Preserve was established on October 21, 1969. The St. Martins Marsh Aquatic Preserve covers open water areas from the Crystal River to the Homosassa River in coastal Citrus County. It is composed of approximately 28,400 acres of open water, several inlet bays, tidal rivers and creeks, salt marsh, and adjoins upland hammock islands. Nutrient exchange between the marshes and the Gulf of Mexico make the salt marsh a significant area of primary production and a nursery ground for commercial and recreational fish species. St. Martins Marsh Aquatic Preserve’s freshwater tributaries includes two, first-magnitude, spring-fed rivers: the Homosassa River to the south and the Crystal River to the north. Spring discharge does not fluctuate dramatically from season to season allowing a constant flow of freshwater into St. Martins Marsh’s productive and well-balanced estuary. The area’s vast coastal salt marshes, mud flats, oyster bars, mangrove islands, and seagrass beds are the southern terminus for migratory waterfowl of the Atlantic and Mississippi flyways. St. Martins Marsh provides stop-over and wintering areas for many migratory species. The Springs Coast is characterized by unique limestone outcroppings and exposed karstic features. Habitats associated with these areas are seagrass meadows and hardbottom. Hardbottom habitat is defined as an area of hard substrate, natural or artificial, where macroalgae, sponges, and corals can grow and attach using specialized holdfasts. See Table 1 for a description of the Chassahowitzka datalogger site in St. Martins Marsh Aquatic Preserve.

The Big Bend Seagrasses Aquatic Preserve was established in 1985. Its boundaries extend from the Withlacoochee River north to the St. Marks River and out nine nautical miles. The Preserve boundary encompasses all tidal lands, islands, seagrass beds, shallow banks, and submerged bottoms from the mean high-water line. Landward, it includes all-natural waterways tidally connected to the preserve to the extent of state jurisdiction. Spanning over 945,000 acres, the Big Bend Seagrasses Aquatic Preserve is the largest aquatic preserve and one of the most pristine places in Florida. The Big Bend Seagrasses Aquatic Preserve consists mainly of a large, remote, and undeveloped expanse of submerged seagrasses and nearshore marshlands located along approximately 180 miles of the northeast coast of the Gulf of Mexico where the Florida peninsula joins the panhandle. Numerous estuaries, which nurture a diverse flora and fauna, are formed at the confluence of the many rivers and streams that flow into the Preserve. Open waters and submerged bay bottoms of these estuaries provide habitat to a wide variety of sea and shore birds. This region supports a very important commercial shellfish industry including Cedar Key clams, scallops, oysters, pink shrimp, and blue crab. This area of Florida is also a popular destination for the recreational scallop season. The Suwannee River region supports Essential Fish Habitat (EFH) and the most viable population of the threatened Gulf sturgeon. Big Bend’s vast seagrass beds with mud and sand substrates are important marine habitats to this species. See Table 1 below for a description of the Steinhatchee datalogger site in Big Bend Seagrasses Aquatic Preserve.

**Table 1: Station Descriptions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Station Code** | **Site Name** | **Location** | **Active Dates** | **Reason Decommissioned** | **Notes** |
| BBSCH | Chassahowitzka | N 28.77514W 82.71631 | 07/2018- Present | N/A | Sand/mud bottom, near mouth of Homosassa River |
| BBSST | Steinhatchee | N 29.6625111 W 83.4289231 | 10/2019- Present | N/A | Mud bottom near the mouth of the Steinhatchee River |

**6) Data collection period-**

Individual sonde deployment and retrieval dates and times for 2021 data are as follows:

BEGAN ENDED

Chassahowitzka Site

12/29/2020, 10:00 01/20/2020, 09:00

01/20/2020, 09:15 02/10/2021, 12:00

02/10/2021, 12:15 03/09/2021, 12:30

03/09/2021, 12:45 03/31/2021, 08:00

03/31/2021, 08:15 04/19/2021, 08:30

04/19/2021, 08:45 05/10/2021, 08:15

05/10/2021, 08:30 06/03/2021, 08:45

06/03/2021, 09:00 06/25/2021, 10:15

06/25/2021, 10:30 07/15/2021, 07:45

07/15/2021, 08:00 08/06/2021, 07:30\*

08/06/2021, 07:45 08/27/2021, 08:30

08/27/2021, 08:45 09/15/2021, 10:30

09/15/2021, 10:45 10/07/2021, 08:00

10/07/2021, 08:15 11/02/2021. 08:45

11/02/2021, 09:00 11/23/2021, 10:15

11/23/2021, 10:30 12/20/2021, 08:45

12/20/2021, 09:00 01/12/2021, 10:15

Steinhatchee Site

12/28/2020, 09:45 01/22/2021, 10:30

01/22/2021, 10:45 02/12/2021, 10:00

02/12/2021, 10:15 03/05/2021, 09:15

03/05/2021, 09:30 03/30/2021, 09:00

03/31/2021, 09:30 04/21/2021, 08:30

04/21/2021, 08:45 05/12/2021, 11:15

05/12/2021, 11:30 06/01/2021, 10:15

06/01/2021, 10:30 06/22/2021, 08:30

06/22/2021, 08:45 07/13/2021, 09:00

07/13/2021, 09:15 08/04/2021, 09:30

08/04/2021, 09:45 08/24/2021, 09:30\*

08/24/2021, 09:45 09/14/2021, 08:30

09/14/2021, 08:45 10/08/2021, 07:45

10/08/2021, 08:00 11/01/2021, 08:45

11/01/2021, 09:00 11/22/2021, 09:30

11/22/2021, 09:45 12/13/2021, 11:15

12/13/2021, 11:30 01/05/2021, 09:00

\* indicates short term loss of data due to battery failure, out of water for maintenance, weather related causes, and/or other internal problems that occurred during deployment.

\*\* indicates long term loss of data due to sonde removal from field for long term repairs.

**7) Distribution-**

The Principle Investigator (PI) retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and Aquatic Preserve (AP) site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. 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. Water quality data and metadata can be obtained from the PI (please see Principal Investigators and Contact Persons) and online at the Aquatic Preserves’ data portal home page [www.floridaapdata.org](http://www.floridaapdata.org). Data are available in comma delimited format.

**8) Associated researchers and projects-**

The SMMAP and BBSAP have formed partnerships with other agencies and organizations actively involved in resource protection in the Preserves’ watershed. Cooperating managers of lands within the AP’s include the: 1) National Park Service (NPS), 2) Suwannee River Water Management District (SRWMD), 3) Southwest Florida Water Management District (SWFWMD), 4) Department of Environmental Protection (DEP) Division of Recreation and Parks/Florida Park Service (FPS), 5) United States Fish and Wildlife Service (USFWS), 6) DEP Aquatic Preserve Program, 7) Florida Fish and Wildlife Conservation Commission (FWC), 8) Florida Forest Service (FFS), and 9) Citrus, Taylor, Jefferson, Dixie, Levy, and Wakulla Counties.

Other water quality research and monitoring initiatives within the Aquatic Preserves include nutrient sampling from Homosassa to Keaton Beach in conjunction with DEP’s Division of Environmental Assessment and Restoration (DEAR).

**II. Physical Structure Descriptors**

**9) Sensor specifications-**

**YSI EXO Datasonde:**

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Wiped probe; Thermistor

Model#: 599827

Range: -5 to 50 C

Accuracy: ±0.2 C

Resolution: 0.001 C

Parameter: Conductivity

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

Sensor Type: Wiped probe; 4-electrode cell with autoranging

Model#: 599827

Range: 0 to 100 mS/cm

Accuracy: ±1% of the reading or 0.002 mS/cm, whichever is greater

Resolution: 0.0001 to 0.01 mS/cm (range dependent)

Parameter: Salinity

Units: practical salinity units (psu)/parts per thousand (ppt)

Model#: 599827

Sensor Type: Wiped probe; Calculated from conductivity and temperature

Range: 0 to 70 ppt

Accuracy: ±2% of the reading or 0.2 ppt, whichever is greater

Resolution: 0.01 psu

Parameter: Dissolved Oxygen % saturation

Sensor Type: Optical probe w/ mechanical cleaning

Model#: 599100-01

Range: 0 to 500% air saturation

Accuracy: 0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 5% 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#: 599100-01

Range: 0 to 50 mg/L

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

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

Resolution: 0.01 mg/L

Parameter: Non-vented Level - Shallow (Depth)

Units: feet or meters (ft or m)

Sensor Type: Stainless steel strain gauge

Range: 0 to 33 ft (10 m)

Accuracy: +/- 0.013 ft (0.004 m)

Resolution: 0.001 ft (0.001 m)

Parameter: pH

Units: pH units

Sensor Type: Glass combination electrode

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

Range: 0 to 14 units

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

Resolution: 0.01 units

Parameter: Turbidity

Units: formazin nephelometric units (FNU)

Sensor Type: Optical, 90 degree scatter

Model#: 599101-01

Range: 0 to 4000 FNU

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

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

Parameter: Chlorophyll

Units: micrograms/Liter

Sensor Type: Optical probe

Model#: 599102-01

Range: 0 to 400 ug/Liter

Accuracy: Dependent on methodology

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

**Depth Qualifier:**

YSI data sondes can be equipped with either vented or non-vented depth/level sensors.  Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth.  The error is equal to approximately 1.02 cm for every 1 millibar change in atmospheric pressure and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

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 Aquatic Preserve calibration sheet or digital calibration log.  This offset procedure standardizes each depth calibration. If accurate atmospheric pressure data are available, non-vented sensor depth measurements can be corrected. The Principal Investigator should be contacted in order to obtain information regarding atmospheric pressure data availability.

**Salinity Units Qualifier:**

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

**Turbidity Qualifier:**

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 Aquatic Preserve purposes they will be considered equivalent. Moving forward, the Aquatic Preserve program will use FNU 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:

 Chassahowitzka CH BBSCH

Steinhatchee ST BBSST

**11) QAQC flag definitions-**

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter’s associated flag column (header preceded by an F\_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is missing and above or below sensor range. All remaining data are then flagged 0, passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range

-4 Outside Low Sensor Range

-3 Data Rejected due to QAQC

-2 Missing Data

-1 Optional SWMP Supported Parameter

 0 Data Passed Initial QAQC Checks

 1 Suspect Data

 2 *Open - reserved for later flag*

 3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure

 4 Historical Data: Pre-Auto QAQC

 5 Corrected Data

**12) QAQC code definitions**

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

General Errors

 GIC No instrument deployed due to ice

 GIM Instrument malfunction

 GIT Instrument recording error; recovered telemetry data

 GMC No instrument deployed due to maintenance/calibration

 GNF Deployment tube clogged / no flow

 GOW Out of water event

 GPF Power failure / low battery

 GQR Data rejected due to QA/QC checks

 GSM See metadata

Corrected Depth/Level Data Codes

 GCC Calculated with data that were corrected during QA/QC

 GCM Calculated value could not be determined due to missing data

 GCR Calculated value could not be determined due to rejected data

 GCS Calculated value suspect due to questionable data

 GCU Calculated value could not be determined due to unavailable data

Sensor Errors

 SBO Blocked optic

 SCF Conductivity sensor failure

 SCS Chlorophyll spike

 SDF Depth port frozen

 SDG Suspect due to sensor diagnostics

 SDO DO suspect

 SDP DO membrane puncture

 SIC Incorrect calibration / contaminated standard

 SNV Negative value

 SOW Sensor out of water

 SPC Post calibration out of range

SQR Data rejected due to QAQC checks

 SSD Sensor drift

 SSM Sensor malfunction

 SSR Sensor removed / not deployed

 STF Catastrophic temperature sensor failure

 STS Turbidity spike

 SWM Wiper malfunction / loss

Comments

 CAB\* Algal bloom

 CAF Acceptable calibration/accuracy error of sensor

CAP Depth sensor in water, affected by atmospheric pressure

 CBF Biofouling

 CCU Cause unknown

 CDA\* DO hypoxia (<3 mg/L)

 CDB\* Disturbed bottom

 CDF Data appear to fit conditions

 CFK\* Fish kill

 CIP\* Surface ice present at sample station

 CLT\* Low tide

 CMC\* In field maintenance/cleaning

 CMD\* Mud in probe guard

 CND New deployment begins

 CRE\* Significant rain event

 CSM\* See metadata

 CTS Turbidity spike

 CVT\* Possible vandalism/tampering

 CWD\* Data collected at wrong depth

 CWE\* Significant weather event

**13) Post deployment information-**

End of deployment post-calibration readings in standard solutions are taken prior to probe cleaning.

**Table 2. Post-deployment readings of EXO3 sondes deployed at the Chassahowitzka site** **during 2021.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **pH** | **pH** | **SpCond (mS/cm)** | **DO %** | **Turbidity (FNU)** | **Turbidity (FNU)** | **Depth (m)** |
| **Date/Std.** | **7.00** | **10.00** | **50.00** | **100.0** | **0.00** | **124.00** | **n/a** |
| 01/20/2021 | 7.08 | 10.01 | 49.989 | 99.3, 99.4 | -0.64 | 119.49 | 0.032 |
| 02/10/2021 | 7.01 | 10.00 | 49.906 | 102.8, 102.9 | 0.24 | 134.25 | 0.172 |
| 03/09/2021 | 6.96 | 9.93 | 49.619 | 100.5, 100.5 | 0.47 | 121.39 | 0.074 |
| 03/31/2021 | 7.09 | 10.09 | 50.085 | 100.0, 100.0 | -0.19 | 124.17 | 0.025 |
| 04/19/2021 | 6.92 | 9.91 | 49.974 | 100.1, 100.1 | -0.97 | 123.05 | 0.056 |
| 05/10/2021 | 6.99 | 10.01 | 49.844 | 99.7, 99.3 | 0.11 | 122.53 | 0.033 |
| 06/03/2021 | 7.09 | 10.07 | 50.089 | 99.9, 100.0 | 0.04 | 123.38 | 0.064 |
| 06/25/2021 | 7.10 | 10.14 | 50.222 | 100.7, 100.6 | 0.09 | 122.97 | 0.096 |
| 07/15/2021 | 7.06 | 10.00 | 50.388 | 101.7 | -0.34 | 123.29 | 0.073 |
| 08/06/2021 | 7.05 | 9.97 | 50.111 | 102.4, 102.5 | 0.03 | 122.64 | 0.041 |
| 08/27/2021 | 7.05 | 9.96 | 46.532 | 93.5, 93.5 | 0.02 | 122.99 | 0.010 |
| 09/15/2021 | 7.05 | 10.06 | 49.993 | 100.5,100.5 | -0.22 | 122.24 | 0.048 |
| 10/07/2021 | 7.01 | 9.99 | 50.031 | 99.9, 99.9 | 0.10 | 123.15 | 0.064 |
| 11/02/2021 | 7.10 | 10.06 | 50.020 | 100.5, 100.5 | 0.04 | 117.72 | 0.072 |
| 11/23/2021 | 7.06 | 10.00 | 49.858 | 101.4, 101.7 | 0.68 | 119.09 | 0.058 |
| 12/20/2021 | 7.13 | 10.13 | 49.948 | 100.7, 100.8 | 0.00 | 123.94 | 0.085 |

**Table 3. Post-deployment readings of EXO2 sondes deployed at the Steinhatchee site** **during 2021.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **pH** | **pH** | **SpCond (mS/cm)** | **DO %** | **Turbidity (FNU)** | **Turbidity (FNU)** | **Depth (m)** | **Chlor. (RFU)** | **Chlor. (µg/L)** |
| **Date/Std.** | **7.00** | **10.00** | **50.00** | **100.0** | **0.00** | **124.00** | **n/a** | **0.00** | **0.00** |
| 01/22/2021 | 7.02 | 10.01 | 49.135 | 99.8, 99.9 | 0.08 | 117.59 | 0.024 | -0.09 | -0.42 |
| 02/12/2021 | 7.10 | 10.10 | 49.848 | 99.5, 100.4 | -0.02 | 134.51 | 0.034 | 0.00 | 0.04 |
| 03/05/2021 | 7.02 | 9.98 | 49.915 | 99.7, 99.8 | -0.16 | 120.57 | 0.088 | -0.12 | -0.47 |
| 03/30/2021 | 6.95 | 9.93 | 49.908 | 99.8, 99.8 | 0.04 | 122.04 | 0.034 | -0.09 | -0.27 |
| 04/21/2021 | 6.89 | 9.90 | 50.065 | 99.8, 99.9 | -0.20 | 122.43 | 0.068 | 0.05 | 0.11 |
| 05/12/2021 | 7.04 | 10.00 | 49.795 | 100.4, 100.4 | 0.82 | 124.25 | 0.055 | -0.12 | -0.46 |
| 06/01/2021 | 6.96 | 9.96 | 11.134 | 99.9, 100.0 | -0.25 | 122.14 | 0.035 | -0.04 | -0.02 |
| 06/22/2021 | 6.94 | 9.96 | 49.719 | 100.3, 100.4 | -0.02 | 122.97 | 0.088 | -0.09 | -0.28 |
| 07/13/2021 | 7.16 | 10.10 | 50.088 | 100.6, 100.6 | 0.24 | 124.62 | 0.030 | -0.07 | -0.42 |
| 08/04/2021 | 7.02 | 10.02 | 49.758 | 101.4, 101.4 | -0.06 | 120.98 | 0.051 | -0.09 | -0.36 |
| 08/24/2021 | 7.03 | 10.05 | 49.804 | 100.8, 100.8 | 0.27 | 123.38 | 0.041 | -0.05 | -0.31 |
| 09/14/2021 | 7.08 | 10.02 | 49.420 | 100.3, 100.4 | -0.10 | 119.33 | 0.032 | -0.10 | -0.43 |
| 10/08/2021 | 7.06 | 10.07 | 50.187 | 103.6, 103.7 | 0.04 | 123.51 | 0.071 | -0.02 | -0.38 |
| 11/01/2021 | 7.04 | 10.04 | 50.007 | 100.5, 100.5 | 0.01 | 122.30 | 0.010 | -0.10 | -0.55 |
| 11/22/2021 | 7.00 | 9.97 | 49.708 | 101.4, 101.7 | -0.32 | 120.49 | 0.117 | 0.01 | -0.46 |
| 12/13/2021 | 6.96 | 9.99 | 49.738 | 99.7, 99.7 | 0.42 | 121.07 | 0.044 | -0.06 | -0.32 |

**14) Other remarks/notes:**

1. Two dissolved oxygen values are recorded during the post-deployment evaluation process.
2. This style of metadata was formerly used by National Estuarine Research Reserve program; more specifically, this report was modeled after metadata reports created at the Guana Tolomato Matanzas National Estuarine Research Reserve.
3. Copies of calibration/deployment logs can be obtained through the Principal Investigator.
4. Accreditation must be given to Florida Department of Environmental Protection’s Office of Resilience and Coastal Protection staff of the St. Martins Marsh and Big Bend Seagrasses Aquatic Preserves for all data used.
5. On the morning of July 7, 2021, Tropical Storm Elsa, downgraded from a Category 1 hurricane, made landfall in Keaton Beach just north of Steinhatchee. Steinhatchee experienced prolonged river flooding. TS Elsa’s storm surge was up to four feet and brought 3-5 inches of rainfall in Taylor County.
6. On August 9, 2021, Tropical Storm Fred passed the Chassahowitzka and Steinhatchee sites dumping even more rainwater to the already saturated coast. Steinhatchee’s river flood warning remained in effect for most, if not all, of August.

**Missing data**

 **Station BBSCH:**

 **August 1-31, 2021**

1. Missing data 08/03/2021 09:15, 08/04/2021 14:30- 08/06/2021 07:30; intermittent power issues towards the end of the deployment and ultimately resulted in power failure.

**Station BBSST:**

**August 1-31, 2021**

1. Missing data 08/17/2021 19:00, 08/18/2021 07:15, 08/24/2021 09:45- 08/24/2021 09:30; one instance of the power disconnect issue we continue to experience and ultimately resulted in power failure.

**Anomalous/suspect/rejected data**

**Note #1:** Slight shifts in data are sometimes correlated with sonde exchanges. These shifts are most noticeable in pH, specific conductivity, salinity, DO% and DO conc, and may be related to sensor drift (e.g., due to fouling) and/or calibration/performance differences between sondes.

**Note #2:** Turbidity “outliers” (i.e., values that are negative or greater than 1000 NTU for 6600 series sondes and 4000 NTU for EXO series sondes) were not deleted from the monthly records. Readings greater than 1000 NTU for 6600 series sondes and 4000 NTU for EXO series sondes are considered out of range and are rejected. They have been left in the database to provide users with a complete dataset and to allow true visual representation of the data in graphs. Negative turbidity values occur throughout the year at all sites. Some of these negative values are within the accuracy range of the sensor (+/- 2.0 %) and, therefore, were not removed from the dataset. They were marked suspect with the CAF code.

**Note #3**: Turbidity data is subject to single and clusters of spikes that occur in the beginning and middle of deployments. Turbidity values that fall between 500 and 1000 are not specifically indicated as suspect data, but possibly could be interpreted as suspect. Turbidity spikes may be associated with wiper malfunction but mostly the reason is unknown. Data users should exercise caution when interpreting turbidity data that fall within this range.

**Note #4:** Time series profiles of the dissolved oxygen data at all monitoring stations sometimes exhibits brief “spikes” of reduced DO concentrations. These events appear to be coupled with the occurrence of slack tide conditions as well as the level of fouling associated with the sonde.

**Note #5:** All times in data files at all sites had to be adjusted post-deployment; more specifically, times were altered such that the readings occurred on the hour and half hour. It has been determined that this clock error is a software issue and has been resolved.

**Station BBSCH**

**January 1-31, 2021**

1. Suspect turbidity data 02/01/2021 00:00- 02/10/2021 12:00; post-deployment verification failed in turbidity standard 124 FNU; however, the data appears to fit conditions. Later found out from YSI that the 124 FNU turbidity standard expires earlier than the date on the bottle once you open the bottle, so the calibration in 124 FNU was slowly getting worse over the course of a few months.

**March 1-31, 2021**

1. Shift in turbidity data due to sensor drift. Shift coincides with swap of sondes on 03/09/2021 at 12:45.

**April 1-30, 2021**

1. Reject turbidity data 04/19/2021 08:45- 04/30/2021 23:45; concluded later that calibration standard expired.

**May 1-31, 2021**

1. Reject turbidity data 05/01/2021 00:00- 05/10/2021 08:15; concluded later that the calibration standard expired.
2. Reject depth data 05/10/2021 08:30-08:45; sonde was hung over the side of boat while the tube was being cleaned as to not lose data continuity during a major station cleaning event. Depth readings are surface readings rather than station’s depth readings. Site is relatively shallow, so the other parameters were not affected.

**June 1-30, 2021**

1. Suspect specific conductivity and salinity data 06/22/2021 07:45; anomalous readings.

**July 1-31, 2021**

1. Note: On the morning of July 7, 2021, Tropical Storm Elsa traveled through BBSCH dropping several inches of rain, increasing depth and turbidity while decreasing temperature, specific conductivity, and salinity. The BBSCH site has been experiencing heavy amounts of rainfall during the month of July overall.
2. Note: Both BBSCH EXO3 sondes, 19E101880 and 19E101881, were sent in for annual maintenance in July 2021.

**August 1-31, 2021**

1. Note: On August 9, 2021, Tropical Storm Fred passed by dropping more rain on the saturated coast.

Reject temperature, specific conductivity, salinity, depth, pH, and dissolved oxygen data 08/27/2021 08:45- 08/30/2021 23:45; sonde failed its temperature, dissolved oxygen, and specific conductivity post-calibrations. Upon inspection, the specific conductivity sensor was cracked. The spot check at the swap matched up close enough to the sonde’s first reading, but the last reading did not match up with the latter spot check. It seems it was damaged sometime during the deployment since it calibrated fine initially, and I would have noticed this crack before deployment. I cannot decipher when this damage happened because the impacts are very small.

**September 1-30, 2021**

1. Reject temperature, specific conductivity, salinity, depth, pH, and dissolved oxygen data 09/01/2021 00:00- 09/15/2021 10:30; sonde failed its temperature, dissolved oxygen, and specific conductivity post-calibrations due to cracked wiped conductivity sensor.

**October 1-31, 2021**

1. Reject specific conductivity and salinity data 10/22/2021 17:00, 10/23/2021 11:45; anomalous data readings with a new wiped conductivity sensor. Will monitor.

**November 1-30, 2021**

1. Suspect pH data 11/23/2021 10:30; anomalous reading at datasonde swap.

**Station BBSST:**

**January 1-31, 2021**

1. Suspect turbidity data 02/01/2021 00:00- 02/12/2021 10:00; post-deployment verification failed in turbidity standard 124 FNU; however, the data appears to fit conditions. Later found out from YSI that the 124 FNU turbidity standard expires earlier than the date on the bottle once you open the bottle, so the calibration in 124 FNU was slowly getting worse over the course of a few months.

**February 1-28, 2021**

1. Slight upward shift in turbidity and chlorophyll data on 2/15/2021 due to large rain event. Large drop in salinity, specific conductivity, and pH supports this. Shift does not coincide with a swap of sondes.

**March 1-31, 2021**

1. Suspect turbidity data 03/27/2021 19:00; anomalous reading.

**May 1-31, 2021**

1. Suspect turbidity data 05/28/2021 20:15; anomalous reading.

**June 1-30, 2021**

1. Reject specific conductivity and salinity data from deployment 06/01/2021 10:30- 06/22/2021 08:30; wiped specific conductivity/temperature sensor had moderate biofouling issue on conductivity electrodes causing a gradual decrease in specific conductivity and salinity readings soon into the deployment. Inspection of port and probes suggest maybe arching or electric shortage occurred due to damage on pins and port. Marks around the central wiper suggest it was involved also. Sonde 19K100552 was sent in for service.
2. Suspect dissolved oxygen and depth data 06/01/2021 10:30- 06/22/2021 08:30; passed post-calibration verifications but marked suspect due to issue with the central wiper and wiped C/T sensor.
3. Note: the central wiper may have been shorting out during the 06/22/2021- 07/13/2021 deployment. About a dozen files downloaded from the sonde. Although the files were split up, no data was missing. Sonde 19K100551 was sent in for service.

**July 1-31, 2021**

1. Note: On July 7, 2021, Tropical Storm Elsa made landfall just north of Steinhatchee and caused severe river flooding on the Steinhatchee River for at least a week after the storm passed. The specific conductivity and salinity data coincide with incoming tide (saltwater increases at site) and outgoing tide (freshwater increases at site). Although the salinity values near zero numerous times, they are valid. A large drop in water temperature can be observed on July 7 also, which coincides with the arrival of the storm and a high volume of rain falling. Stormwater continues to trickle down from North Florida and empty into the Steinhatchee River causing prolonged flood conditions.
2. Reject all data 7/13/2021 09:00; sonde out of water due to complications at swap.

**August 1-31, 2021**

1. Reject all data 8/04/2021 09:45; sonde out of water due to complications at swap. Problem should be fixed now; modifications were made to field guard to eliminate field guard screen from getting caught in the holes in the PVC tube.
2. Note: The Steinhatchee River flooding continues into the month of August. On August 9, 2021, Tropical Storm Fred passed by dropping more rain on the saturated coast. Turbidity values remain higher than normal due to the runoff.