Nassau River-St. Johns River Marshes and Fort Clinch Aquatic Preserves **Water Quality Metadata Report**

January - December 2010  
Latest Update: 09/17/2020

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 ([james.tomazinis@floridadep.gov](mailto:james.tomazinis@floridadep.gov)) with any additional questions.

**I. Data Set and Research Descriptors**

1. **Principal investigator & contact persons:**

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1. **Entry verification:**

Data are collected with a YSI Model 6600EDS-S data sonde and uploaded to a laptop PC in the water quality lab at the Nassau River-St. Johns River Marshes and Fort Clinch Aquatic Preserves office. Version 3.15 of Eco Watch software is used to plot the data and generate graphs. Graphs for each deployment are studied immediately for trends and anomalies. Then any unusual variations are noted as pertaining to individual probes, and the need for their reconditioning or replacement.

Each data file is exported as a comma delimited file (.cdf) using EcoWatch software. Two copies of this .cdf file are saved in the .csv format. One is used to archive the raw data, and one is edited to adjust all records of Eastern Standard Time to read exactly on the hour or half hour. This second file is also used to delete data at the beginning and end of each deployment period when the instrument was out of the water. These data can be identified by field notes that document the start and end times for each deployment, and from conductivity and depth readings near zero.

Monthly data files are then created from the edited .csv files and processed by various macros distributed by the Centralized Data Management Organization (CDMO) which handles all data sonde data collected by the National Estuarine Research Reserve System (NERRS). The macros check files for missing data points, fill all cells that do not contain data with periods, and convert the data columns to CDMO approved formats for time, date and numeric values. They also find all data that are out of acceptable range for the sensors, save the files as Excel worksheets, and generate single parameter monthly graphs.

Questionable data are evaluated to determine if they can be deemed valid or must be rejected. Data are flagged that have fallen either outside of the expected range for the given site or outside of the range of measurements established for the data sonde sensors (see Table 1). Anomalous data are investigated for validity based on field observations, weather data, quality control checks, and instrument diagnostics. If anomalies are attributed to sensor malfunction, they are rejected. These deletions can be the direct result of a physical defect in one of the data sonde probes, such as a DO membrane puncture or a ruptured pH sensor “bulb”. If the voltage reading of the probe is outside of the range established for the sensor, or if the sensor will not calibrate, data will also be rejected.

Beginning in July 2018, data underwent a two-step (primary and secondary) Quality Assurance/Quality Control (QA/QC) procedure as outlined in the NERRS CDMO Data Management Manual Version 6.6 (<http://cdmo.baruch.sc.edu/request-manuals/>).

The primary QA/QC process was performed by the CDMO and involved inserting flag columns into the data files for each water quality parameter, creating a flag record column, and creating an automated process that applied standardized flags to data if the values were outside sensor specifications as determined by YSI, the instrument manufacturer. Yearly data files that completed the primary QA/QC process were returned to Office of Resilience and Coastal Protection (RCP) staff for secondary QA/QC. Data were evaluated, and standardized flags and 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.

1. **Research objectives:**

Historic data does exist for this system, but until this point nothing equivalent to the type of data made possible by deployment of the YSI 6600 EDS-S data sonde. The instrument collects continuous readings on a half hour cycle during two-week deployments. At the conclusion of the deployment the sonde is retrieved and exchanged for a clean, newly calibrated unit. In this way there is a constant, unbroken recording of data, and therefore a much higher rate of consistency in the resultant tables and graphs.

The objective of this project is to take the data generated from these data sonde deployments and study them for potential trends in water quality and any unusual deviations from expected values. In addition, to report any incidences of variation from state water quality standards, and to see how the data relate to concurrently collected meteorological data.

1. **Research Methods:**

A YSI 6600 EDS-S data sonde has been continuously operating (collecting data every 30 minutes) at Kingsley Plantation since January 20, 2004, Clapboard Creek since September 17, 2004, and Lofton Creek since July 2005. Since operating this type of extended deployment instrumentation was new to staff, the month of February essentially served as a “break in” period for data sonde operation and rotation at the Kingsley Plantation. Though data was collected during February, it is not included in this report, and for all intents and purposes March 1, 2004 is considered the official start of data collection.

The sonde is housed within a vertical 10.16 cm (4-inch) diameter PVC pipe that is directly attached to one of the support pilings at the NE corner of the Kingsley Plantation dock. The sonde is lowered on an attached rope within the PVC tube until its probes are just barely exposed beyond the lower edge of the pipe. At this point it is suspended approximately one meter above the substrate. A sheet of plastic mesh (1/4-inch opening) surrounds the protective guard on the data sonde to prevent fish and crabs from entering the guard and damaging any of the probes. A locking cap on the dock end of the PVC tube prevents any unwanted tampering, and a 10.16 cm ( 4-inch)

stainless steel carriage bolt below the submerged edge prevents accidental slippage out of the other end should the rope or attachment hardware give way. Exchange of the data sondes (replacing an operating unit for a clean, calibrated unit at the end of a deployment period) usually takes about 5 - 10 minutes. Retrieval and replacement of the sondes never occurs within 5 minutes of a scheduled data recording in order to assure continuous collection of information. Field notes are also recorded during the exchange regarding weather conditions, tidal stage, condition of the retrieved sonde, and any unusual occurrences at the site.

After retrieval from the sampling site, data sondes are returned to the laboratory where post deployment readings and reconditioning take place in accordance with methods outlined in the YSI Operating and Service Manual. [This process is similar, though somewhat less extensive, to the initial calibration process that is performed before each data sonde is taken out for deployment.] The sonde is rinsed with tap water then sequentially submersed in each of the various standards in order to obtain post deployment readings. Standards consist of pH (Fisher Scientific 7.00 buffer solution), conductivity (Exaxol 50.00 mS/cm standard) and 0.0 NTU turbidity (distilled water). The dissolved oxygen membrane, if requiring replacement, can also be exchanged at this point, as a period of at least 24 hours is required for it to equilibrate before its next deployment. These post deployment readings are then used to evaluate the validity of the data collected for that deployment period.

1. **Site location and character:**

Nassau River-St. Johns River Marshes Aquatic Preserve, located in Nassau and Duval counties, was designated an aquatic preserve on November 24, 1969, to protect the Nassau Sound area marshes and associated waters. Nassau River-St. Johns River Marshes and Fort Clinch Aquatic Preserves are in the northeastern part of the state along the Atlantic intracoastal waters of the St. Marys, St. Johns and Nassau rivers. This area consists of a vast saltmarsh estuary with numerous interconnecting tidal creeks, rivers and channels with some small tree islands. The aquatic preserve is approximately 69,000 acres.

Fort Clinch State Park Aquatic Preserve (also called Fort Clinch Aquatic Preserve), in northeastern Nassau County along Amelia Island, was designated on March 4, 1970, to provide an aesthetic buffer for the state park and historic Fort Clinch. The preserve surrounds the state park and is largely comprised of open waters around St. Marys Inlet, the Amelia River and a three-mile extension into the Atlantic Ocean off Amelia Island. The western edge of the preserve borders extensive saltmarsh along Amelia Island, and the preserve extends to the Florida-Georgia state line. This aquatic preserve is about 7,600 acres.

Ft. George River Inlet, one of the few remaining natural inlets in the state, is approximately 6 miles south of Nassau Sound and immediately north of the mouth of the St. Johns River in Northeast Florida’s Duval County. The inlet is bordered by Little Talbot Island to the north, and Ward’s bank to the south. Much of the land surrounding this system has remained relatively undeveloped due to its ownership by various governmental entities and its intended use of conservation and low impact public recreation.

Ft. George River connects to Simpson Creek a little more than a mile and a half from its mouth, and then another mile and a half to the west, the Intracoastal waterway which in turn flows north to the mainstem of the Nassau River. The surface area drained by this sub – basin of the Nassau River constitutes an area of approximately 6,2851 acres. Though this is not one of the largest freshwater contributors to the nearly 55-mile-long Nassau River, the Ft. George River drainage basin is a sizable system, and any major changes to it could exert a noticeable impact on the Nassau River as well.

The climate for the Ft. George Island area can be categorized as humid and sub-tropical with long summers of abundant rainfall, followed by comparatively dry winters and occasional frost. The average annual rainfall is approximately 53 inches, at least 50% of which occurs during the months of June through September. Data from weather stations in Jacksonville and Jacksonville Beach give the average yearly temperature for this area as 69 degrees, with 55.9 degrees as the lowest mean monthly temperature in January, and 82.6 as the highest mean monthly temperature in July. Prevailing winds in this coastal area tend to be out of the east and southeast throughout the summer months, and predominantly out of the northeast during the winter.

**Station description:**

Clapboard Creek is north of Heckscher Dr, midway between 9A and the St Johns River Ferry (30.44942° N, -81.52267° W). You can reach it via the Ferry and heading west, or 9A taking Heckscher Dr exit east. Clapboard Creek is a large body of water situated between Brown's Creek and Cedar Point Creek. It is relatively wide-open area with small islands, finger creeks, sand bars, oyster beds, and some deep holes. There is also a westerly section known as Little Clapboard Creek.

The Kingsley Dock (KD) site is located at the Kingsley Plantation boat dock (30.44115° N, 81.43903° W) within the NPS Timucuan Ecological and Historic Preserve on Ft. George Island. Surrounding land use is predominantly natural with very limited residential development on Ft. George Island and the neighboring Talbot Islands. This site and surrounding surface waters carry the dual designation of Class II Shellfish Harvesting Waters and Outstanding Florida Waters. The average depth at this site is 4.0m with a tidal range of 1.54m; the substrate type is muddy sand, with emergent oyster beds lining the immediate shoreline.

The Lofton Creek (LC) site is located at (30.5475° N, -81.55278° W) just inside the mouth of creek from its confluence with the Nassau River. Lofton Creek is one of the largest tributaries of the Nassau River and transitions from sawgrass dominated cypress swamps to spartina and needlerush marshes within the aquatic preserve. The creek is mostly border by rural home sites with septic systems though large planned communities are being developed along the eastern bank. The meandering bends in the creeks yield steep banks and many shoals with sparse oyster growth along the more saline stretches.

The Nassau River (NR) site is located at (30.57364° N, -81.60653° W) just east of US Highway 17 and the border of the aquatic preserve. This stretch of river is much narrower and fresher than the lower reaches. The marshes are mostly needlerush dominated and only barnacles are present since the water is too fresh for oysters. The water is dark stained with tannins from the swamps and marshes to the west of Highway 17 and I-95.

**Station timeline:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Station Code** | **Station Name** | **Location** | **Active Dates** | **Reason Decommissioned** | **Notes** |
| CC | Clapboard Creek | 30.44942° N, 81.52267° W | 9/1/2004-5/31/2011 | Office Closure | N/A |
| KD | Kingsley Plantation (Dock) | 30.44115° N, 81.43903° W | 3/1/2004-5/31/2011 | Office Closure | N/A |
| LC | Lofton Creek | 30.54750° N, 81.55278° W | 7/1/2005-5/31/2011 | Office Closure | N/A |
| NR | Nassau River | 30.57364° N, 81.60653° W | 8/1/2009-5/31/2011 | Office Closure | N/A |

1. **Data collection period:**

Though the data sonde protective housing was installed at the Kingsley Plantation dock in mid-January of 2004, the first data sonde unit was placed in the housing by the end of that month, data for this study was not collected until March 1st, 2004. The month of February was used as a “break in period” for the staff working with the data sondes in terms of familiarization with calibration, deployment, data handling, and any possible trouble shooting for problems that might arise in the initial phase of the project. Since March 1, 2004, however, the station has remained in continuous service up until 2011. In contrast the Clapboard Creek sonde was deployed in September 2004 and remained in continuous service until 2011. Additionally, the Lofton Creek sonde was installed July of 2005 and remained in continuous service until 2011. Finally, the Nassua River sonde was deployed July 2009 and remained in continuous service until 2011.

**Kingsley (2010)**

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| --- | --- | --- | --- | --- | --- | --- |
| **Deployment** | **Retrieval** | **Data sonde Model Number** | **pH Model Number** | **DO Model Number** | **Turb Model Number** | **Cond Model Number** |
| **Date/Time** | **Date/Time** |
| 1/7/10, 14:00 | 1/25/10, 14:30 | 03F0943AF | 0415C | 08D100535 | 03F0511B | UNMARKED |
| 1/25/10, 15:00 | 2/8/10, 12:07 | 03F0943AI | 2008B | 09C100646 | 04E9009AP | 09F100150 |
| 2/8/10, 12:30 | 2/23/10, 14:00 | 04L1583AE | 1207D | 03E100883 | 09C100354 | 0309F |
| 2/23/10, 14:30 | 3/10/10, 11:30 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 3/10/10, 12:00 | 4/2/10, 9:30 | 04L1583AE | 1207D | 07E100883 | 09C100354 | 0309F |
| 4/2/10, 10:00 | 4/16/10, 9:30 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 4/16/10, 10:00 | 4/30/10, 14:30 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 4/30/10, 15:00 | 5/14/10, 10:30 | 04C4617AA | 2008A | 09C100645 | 08D100486 | 04E |
| 5/14/10, 11:00 | 5/28/10, 9:30 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 5/28/10, 10:00 | 6/10/10, 11:30 | 07B1572AA | 2008A | 09C100645 | 08D100486 | G |
| 6/10/10, 12:00 | 6/25/10, 10:30 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 6/25/10, 11:00 | 7/12/10, 12:30 | 03F0943AF | 0415C | 08D100536 | 03F0511B | UNMARKED |
| 7/12/10, 13:00 | 7/29/10, 12:00 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 7/29/10, 12:30 | 8/13/10, 13:00 | 03F0943AF | 0415C | 08D100535 | 03F0511B | UNMARKED |
| 8/13/10, 13:30 | 8/31/10, 12:00 | 04L1584AA | 1207A | 08D100534 | 09A130580 | A |
| 8/31/10, 12:30 | 9/14/10, 10:30 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | 41508 |
| 9/14/10, 11:00 | 9/29/10, 14:00 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 9/29/10, 14:30 | 10/20/10, 14:00 | 041584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 10/20/10, 14:30 | 11/2/10, NA\* | 03F0785AJ | 2008D | 07E100884 | 10K100051 | X |
| 11/2/10, 13:30 | 11/16/10, 12:30 | 03F0943AB | 0309A | 08D100536 | 09C100354 | 0309F |
| 11/16/10, 13:00 | 12/1/10, 11:30 | 03F0943AF | 0415C | 08D100536 | 03F0511A | UNMARKED |
| 12/1/10, 12:00 | 12/17/10, 11:30 | 04L1583AE | 510A | 08D100536 | 09C100354 | 0309F |
| 12/17/10, 12:00 | 1/7/11, 11:00 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |

**Clapboard Creek (2010)**

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| **Deployment** | **Retrieval** | **Data sonde Model Number** | **pH Model Number** | **DO Model Number** | **Turb Model Number** | **Cond Model Number** |
| **Date/Time** | **Date/Time** |
| 1/7/10, 15:00 | 1/20/10, 14:00 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 1/20/10, 14:30 | 2/3/10, 15:00 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 2/3/10, NA\* | 2/23/10, 15:00 | 03F0943AF | 0415C | 08D100535 | 03F0511B | UNMARKED |
| 2/23/10, 15:30 | 3/16/10,10:00 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 3/16/10, 11:00 | 3/31/10, 15:00 | 04C4617AA | 2008B | 08D100535 | 08D100486 | G |
| 3/31/10, 15:30 | 4/16/10, 12:30 | 03F0943AF | 0415C | 08D100535 | 03F0511B | UNMARKED |
| 4/16/10, 13:00 | 4/30/10, 11:00 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 4/30/10, 11:30 | 5/14/10, 9:30 | 03F0943AI | 2008B | 09C100646 | 09D100609 | 09F100150 |
| 5/14/10, 10:00 | 6/1/10, 13:00 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 6/1/10, 13:30 | 6/15/10, 13:30 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 6/15/10, 14:00 | 7/1/10, 10:30 | 07B1572AA | 2008A | 07E100884 | 03F0511A | L |
| 7/1/10, 11:00 | 7/16/10, 12:00 | 03F0943AB | 510A | 07E100883 | 09C100354 | 0309F |
| 7/16/10, 12:30 | 8/2/10, 12:00 | 07B1572AA | 2008A | 9C100645 | 08D100486 |  |
| 8/2/10, 12:30 | 8/17/10, 14:00 | 04E9087AB | 1207B | 08D100587 | 04L1237AE | G |
| 8/17/10, 14:30 | 9/1/10, NA\* | 03F0943AF | 0415C | 08D100536 | 03F0511A | UNMARKED |
| 9/1/10, 14:00 | 9/23/10, 10:00 | 03F0943AI | 2008B | 09C100646 | 09D100609 | 09F100150 |
| 9/23/10, 10:30 | 10/5/10, 9:30 | 04E9087AD | 0309B | 08D100536 | 09C100354 | 0309E |
| 10/5/10, 10:00 | 10/22/10, 9:30 | 03F0943AF | 0415C | 08D100535 | 03F0511A | UNMARKED |
| 10/22/10, 10:00 | 11/15/10,13:30 | 04L1584AA | 0309B | 08D100534 | 09A130580 | 0415B |
| 11/15/10, 14:00 | 12/08/10, 12:00 | 03F0785AJ | 2008D | 07E100884 | 10K100051 | X |
| 12/8/10, 12:30 | 12/31/10, 14:30 | 03F0943AI | 1010 | 09C100646 | 09D100609 | 0415B |
| 12/31/10, 15:00 | 1/11/11, 13:00 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |

**Lofton Creek (2010)**

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| **Deployment** | **Retrieval** | **Data sonde Model Number** | **pH Model Number** | **DO Model Number** | **Turb Model Number** | **Cond Model Number** |
| **Date/Time** | **Date/Time** |
| 1/14/10, 10:30 | 1/29/10, 11:00 | 04L1583AE | 1207D | 03E100883 | 03F0511A | 0309F |
| 1/29/10, 11:30 | 2/18/10, 14:30 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 2/18/10, 15:00 | 3/12/10, 9:00 | 04C4617AA | 2008A | 08D100535 | 08D100486 | 04E |
| 3/12/10, 9:30 | 3/26/10, 9:30 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 3/26/10, 10:00 | 4/5/10, 13:30 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 4/5/10, 14:00 | 4/21/10, 14:00 | 04C4617AA | 2008A | 09C100645 | 08D100486 | 04E |
| 4/21/10, 14:30 | 5/3/10, 14:30 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 5/3/10, 13:30 | 5/19/10, 14:30 | 04L1583AE | 0309C | 08E100883 | 09C100354 | 0309F |
| 5/19/10, 14:00 | 6/8/10, 8:30 | 04E9087AD | 0309B | 08D100536 | 09D100609 | 0309E |
| 6/8/10, 9:00 | 6/22/10, 9:30 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 6/22/10, 10:00 | 7/9/10, 8:30 | 04E9087AD | 0309B | 08D100536 | 09D100609 | 0309E |
| 7/9/10, 9:00 | 7/22/10, 7:00 | 03F0943AI | 2008B | 09C100646 | 09D100609 | 09F100150 |
| 7/22/10, 7:30 | 8/12/10, 13:30 | 04E9087AD | 0309B | 08D100536 | 09C100354 | 0309E |
| 8/12/10, 14:00 | 8/26/10, 11:00 | 03F0943AI | 2008B | 09C100646 | 09D100609 | 09F100150 |
| 8/26/10, 11:30 | 9/9/10, 13:00 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 9/9/10, 13:30 | 9/28/10, 12:00 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 9/28/10, 12:30 | 10/15/10, 13:00 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 10/15/10, 13:30 | 10/28/10, 13:00 | 07B1572AA | 812 | 09C100645 | 03F0511A | 0309D |
| 10/28/10, 13:30 | 11/10/10, 12:30 | 03F0943AF | 0415C | 08D100535 | 03F0511A | UNMARKED |
| 11/10/10, 13:00 | 11/23/10, 11:00 | 07B1572AA | 812 | 09C100645 | 03F0511A | 0309D |
| 11/23/10, 11:30 | 12/15/10, 15:30 | 04L1584AA | 0309B | 08D100534 | 09A130580 | 0415B |
| 12/15/10, 16:00 | 1/5/11, 10:30 | 03F0943AF | 2008B | 10K101300 | 03F0511 | UNMARKED |

**Nassau (2010)**

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| --- | --- | --- | --- | --- | --- | --- |
| **Deployment** | **Retrieval** | **Data sonde Model Number** | **pH Model Number** | **DO Model Number** | **Turb Model Number** | **Cond Model Number** |
| **Date/Time** | **Date/Time** |
| 1/14/10, 11:30 | 1/29/10, 13:00 | 04C4617AA | 2008A | 08D100535 | 08D100486 | 04E |
| 1/29/10, 13:30 | 2/18/10, 13:30 | 04L1584AA | 1207A | 08D100534 | 09A130580 | 0415B |
| 2/18/10, 14:00 | 3/4/10, 13:30 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 3/4/10, 14:00 | 3/26/10, 10:00 | 03F0943AF | 0415C | 08D100535 | 03F0511B | UNMARKED |
| 3/26/10, 10:30 | 4/5/10, 12:30 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 4/5/10, 13:00 | 4/21/10, 12:30 | 04L1583AE | 1207D | 03E100883 | 09C100354 | 0309F |
| 4/21/10, 13:00 | 5/3/10, 14:30 | 03F0943AF | 0415C | 08D100536 | 03F0511B | UNMARKED |
| 5/3/10, 15:00 | 5/19/10, 13:30 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 5/19/10, 15:00 | 6/3/10, 14:00 | 03F0943AF | 0415C | 08D100536 | 03F0511B | UNMARKED |
| 6/3/10, 14:30 | 6/22/10, 10:30 | 03F0943AB | 510A | 07E100883 | 09C100354 | 0309F |
| 6/22/10, 11:00 | 7/9/10, 10:00 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 7/9/10, 10:30 | 7/22/10, 10:00 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | G |
| 7/22/10, 10:30 | 8/12/10, 14:30 | 03F0785AJ | 2008D | 07E100884 | 03F0511A | X |
| 8/12/10, | 8/26/10, 13:00 | 07B1572AA | 812 | 09C100645 | 03F0511A | 0309D |
| 8/26/10, 13:30 | 9/9/10, 11:30 | 04E9087AD | 0309B | 08D100536 | 09C100354 | 0309E |
| 9/9/10, 12:00 | 9/28/10, 11:00 | 07B152AA | 812 | 09C100645 | 3F0511A | 0309D |
| 9/28/10, 11:30 | 10/21/10, 9:00 | 03F0943AI | 2008B | 09C100646 | 09D100609 | 09F100150 |
| 10/21/10, 9:30 | 11/3/10, 9:00 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | 41508 |
| 11/3/10, 9:30 | 11/17/10, 10:00 | 03F0943AI | 2008B | 09C100646 | 09D100609 | 09F100150 |
| 11/17/10, 10:30 | 12/3/10, 9:30 | 04E9087AB | 1207B | 08D100537 | 04L1237AE | 41508 |
| 12/3/10, 10:00 | 12/21/10, 11:30 | 07B1572AA | 812 | 09C100645 | 03F0511 | 0309D |
| 12/21/10, 12:00 | 1/5/11, 11:30 | 04L1583AE | 510A | 08D100536 | 09C10054 | 0309F |

1. **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 (see section 1).

1. **Associated researchers and projects:**

The Office of Resilience and Coastal Protection’s Northeast Florida Aquatic Preserves office, aside from coordinating with other sections within the Department of Environmental Protection, works cooperatively with other resource protection agencies and organizations in the Nassau and St. Johns Rivers watershed. Some of these include the: 1) National Park Service (NPS), 2) St. Johns River Water Management District (SJRWMD), 3) US Army Corp. of Engineers (USACOE), 5) City of Jacksonville (COJ), 6) The Nature Conservancy (TNC), 7) DEP Division of Parks and Recreation (FPS), 8) Florida Fish and Wildlife Conservation Commission (FWCC), and 9) US Fish and Wildlife Service (USFWS).

Although occurring just slightly behind schedule to coincide with the most recent phase, the current monitoring program is producing data that may be of assistance for the next cycle of FDEP’s Total Maximum Daily Load program for the Nassau River. The existing sampling sites are located within segments of the river that do not have abundant background or historic information, and additional sites are planned for the near future. This type of continuous data may help give staff a clearer picture of conditions within certain stretches of the Nassau River and therefore assist in regulatory determinations.

The City of Jacksonville’s Ambient Water Quality Section monitors the Ft. George River bi-monthly in its 12-site monitoring program within the Timucuan Preserve. Though not sampling all of the same parameters as the COJ, the aquatic preserve’s program can offer continuous data from sites within the same region. In so doing, the city’s long running program may be bolstered with information of prevailing conditions surrounding the collection of their “grab” samples that require laboratory analysis.

In cooperation with Richard Bryant, Chief of Resources Stewardship for the NPS Timucuan Preserve, approximately a dozen photo points have been established around Ft. George Inlet in attempts to document rudimentary changes in flow and channel morphology. In lieu of aerial photos which would be preferable (albeit economically unfeasible), the photos help record physical conditions at the time of the sonde’s water quality data collection. Taken quarterly, usually at the lowest possible tide stage during a given season, it is hoped that these photos coupled with the collected data will give a better overall view of what has been occurring, hydrologically, in the Ft. George River Inlet.

**II. Physical Structure Descriptors**

1. **Sensor specifications**: (Refer to Section 6)

### Table 2. YSI 6600 EDS data sonde

Parameter: Temperature

Units: Celsius (C)

Sensor Type: Thermistor

Model #: 6560

Range: -5 to 45 °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 % saturation

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; 200-500 % air saturation, +/- 6 % of the reading

Resolution: 0.1 % air saturation

Parameter: Dissolved Oxygen mg/L (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

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 (specify whether EDS probe or not)

Units: 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: +/- 5 % reading or 2 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 at should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor.

Depth Qualifier: The water quality monitoring program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Both sensors measure water depth, but by convention, level sensors refer to atmospherically vented measurements and depth refers to non-vented measurements. Standard calibration protocols for the non-vented sensor use the atmosphere pressure at the time of calibration. Therefore, changes in atmospheric pressure between calibrations appear as changes in water depth. The error is equal to approximately 1.03 cm for every 1millibar change in atmospheric pressure. This error is eliminated for level sensors because they are vented to the atmosphere throughout the deployment time interval. If proper atmospheric pressure data is available, non-vented sensor depth measurements can be corrected for deployments between calibrations. Readings for both vented and non-vented sensors are automatically compensated for water density changes due to variations in temperature and salinity. The Principal Investigator should be contacted in order to obtain information regarding atmospheric pressure data availability. All data sondes used at all 6600 sites in 2006 were non-vented models.

1. **Coded variable definitions:**

**Site definitions:**

|  |  |  |
| --- | --- | --- |
| **Sampling Station:** | **Sampling Site Code:** | **Station Code:** |
| Clapboard Creek | CC | NECC |
| Kingsley Plantation (Dock) | KD | NEKD |
| Lofton Creek | LC | NELC |
| Nassau River | NR | NENR |

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 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

1. **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

1. **Post deployment information:**

**Kingsley (2010)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Temp (°C) | SpCond (mS/cm) | ROX DO % | pH | Turbidity (NTU) | Depth (m) |
| Std. | N/A | 50 | 100 | 7 | 0 | N/A |
| 1/7/2010 | 20.78 | 50.25 | 98.9 | 7.12 | -0.4 | -0.085 |
| 1/25/2010 | 19.56 | 49.19 | 100.1 | 7.05 | 0.2 | 0.01 |
| 2/8/2010 | 21.82 | 49.49 | 97.7 | 6.88 | 0.5 | -0.109 |
| 2/23/2010 | 20.78 | 49.62 | 98.7 | 7.03 | 0 | -0.024 |
| 3/10/2010 | 21.22 | 49.45 | 99.4 | 7.05 | 0 | 0.02 |
| 4/2/2010 | NA\* | 49.7 | NA\* | 7.02 | 0.4 | 0.061 |
| 4/16/2010 | 22.65 | 50.26 | 98.6 | 6.87 | -0.3 | -0.014 |
| 4/30/2010 | 22.94 | 50.46 | 100.7 | 6.93 | -0.1 | 0.108 |
| 5/14/2010 | 23.91 | 50.42 | 98.1 | 6.92 | -0.1 | -0.049 |
| 5/28/2010 | 23.19 | 50.02 | 99.5 | 6.98 | 0.5 | 0.024 |
| 6/10/2010 | 24.05 | 46.3 | 100 | 7.05 | 0.5 | 0.028 |
| 6/25/2010 | 23.94 | 49.75 | 99.3 | 7.12 | 4.8 | -0.032 |
| 7/12/2010 | 24.03 | 49.88 | 97.3 | 6.99 | 2.2 | 0.007 |
| 7/29/2010 | 23.41 | 49.81 | 98.7 | 6.82 | -2.2 | -0.034 |
| 8/13/2010 | 22.27 | 49.82 | 100.4 | 7.02 | 1.3 | 0.062 |
| 8/31/2010 | 23.96 | 49.43 | 100.3 | NA\* | 0.3 | 0.033 |
| 9/14/2010 | 21.11 | 49.84 | 97.3 | 6.92 | 0.4 | -0.151 |
| 9/29/2010 | 21.32 | 49.88 | 97.5 | 7.05 | 1.7 | -0.032 |
| 11/2/2010 | 21.66 | 49.54 | 98.9 | 7.03 | 1.2 | -0.049 |
| 11/16/2010 | 22.41 | 49.33 | NA\* | 7.04 | -2.1 | 0.042 |
| 12/1/2010 | 20.61 | 49.82 | 99.3 | 7.02 | 1.6 | 0.027 |
| 12/17/2010 | 20.24 | 49.63 | 99.7 | 7.13 | -0.6 | -0.131 |

**Clapboard Creek (2010)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Temp (°C) | SpCond (mS/cm) | ROX DO % | pH | Turbidity (NTU) | Depth (m) |
| Std. | N/A | 50 | 100 | 7 | 0 | N/A |
| 1/7/2010 | 19.21 | 50.14 | 98.9 | 7.05 | -0.2 | -0.038 |
| 1/20/2010 | 20 | 49.73 | 99.7 | 7.16 | 0.4 | 0.034 |
| 2/3/2010 | 21.62 | 50.38 | 99.3 | 7.03 | 1.2 | -0.109 |
| 2/23/2010 | 20.37 | 49.5 | 99.1 | 6.96 | 0.3 | 0.124 |
| 3/16/2010 | 21.89 | 49.76 | 100.4 | 6.93 | 0.2 | 0.002 |
| 3/31/2010 | 22.5 | 49.3 | 99.7 | 7.05 | 0.7 | 0.048 |
| 4/16/2010 | 23.39 | 50.11 | 99.4 | 6.99 | 0.6 | -0.022 |
| 4/30/2010 | 23.2 | 49.33 | 100 | 7 | 0.1 | 0.085 |
| 5/14/2010 | 23.95 | 50.02 | 99.9 | 6.82 | 0.8 | -0.005 |
| 6/1/2010 | 21.72 | 50.19 | 97.3 | 6.75 | 0.4 | -0.007 |
| 6/15/2010 | 23.54 | 49.77 | 99.4 | 6.99 | 0.1 | 0.016 |
| 7/1/2010 | 23.83 | 49.4 | 90.7 | 6.92 | 0.3 | 0.041 |
| 7/16/2010 | 24.05 | 49.1 | 98.1 | 7.03 | 0.8 | -0.004 |
| 8/2/2010 | 23.64 | 50.3 | 98.4 | 6.67 | 0.3 | -0.005 |
| 8/17/2010 | 23.84 | 49.43 | 99 | 6.72 | 2227.1 | 0.011 |
| 9/1/2010 | 24.1 | 49.86 | 101.4 | 6.95 | -0.1 | 0.071 |
| 9/23/2010 | 22.34 | 49.63 | 100.2 | 7.05 | 0.2 | 0.064 |
| 10/5/2010 | 20.86 | 49.34 | 100.1 | 6.97 | 0 | 0.057 |
| 10/22/2010 | 18.73 | 49.75 | 97.3 | 7.12 | 0.5 | -0.008 |
| 11/15/2010 | 16.34 | 50.23 | 101 | 7.08 | 0.4 | 0.045 |
| 12/8/2010 | 20.18 | 49.59 | 101.5 | 6.81 | 0 | 0.065 |
| 12/31/2010 | 16.78 | 51.4 | 100 | 7.18 | 0.1 | 0.051 |

**Lofton (2010)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Temp (°C) | SpCond (mS/cm) | ROX DO % | pH | Turbidity (NTU) | Depth (m) |
| Std. | N/A | 50 | 100 | 7 | 0 | N/A |
| 1/14/2010 | 20.36 | 49.45 | 98.5 | 7.11 | -0.3 | -0.005 |
| 1/29/2010 | 18.99 | 49.43 | 99.9 | 7.02 | 3.7 | 0.14 |
| 2/18/2010 | 20.67 | 48.84 | 98 | 7.09 | 0.1 | -0.139 |
| 3/12/2010 | 22.2 | 50 | 98.8 | 7.04 | -0.2 | -0.078 |
| 3/26/2010 | 23.01 | 49.79 | 100.3 | 6.91 | 0.3 | 0.068 |
| 4/5/2010 | 22.22 | 50.19 | 99.7 | 7.04 | 0.9 | -0.082 |
| 4/21/2010 | 24.23 | 49.6 | 100.1 | 6.93 | 0 | -0.006 |
| 5/3/2010 | 23.92 | 49.94 | 97.5 | 6.74 | 0.6 | -0.046 |
| 5/19/2010 | NA\* | 50.25 | NA\* | 6.76 | 0.1 | 0.044 |
| 6/8/2010 | 23.72 | 49.04 | 100.3 | 6.93 | 0.4 | 0.06 |
| 6/22/2010 | 24.45 | 50.25 | 98 | 6.92 | 5.9 | -0.003 |
| 7/9/2010 | 24.05 | 56.03 | 99.6 | 7.01 | -0.5 | 0.054 |
| 7/22/2010 | 23.9 | 47.17 | 96.3 | 6.56 | 0.9 | -0.032 |
| 8/12/2010 | 24.04 | 48.63 | 99 | 7.02 | 1 | 0.001 |
| 8/26/2010 | 21.15 | 50.53 | 97 | 6.77 | -0.1 | -0.034 |
| 9/9/2010 | 21.56 | 49.8 | 97.5 | 6.95 | 0.4 | NA\* |
| 9/28/2010 | 22.57 | 50 | 100.3 | 6.95 | 0 | -0.022 |
| 10/15/2010 | 23.82 | 49.77 | 98.7 | 6.89 | -1 | 0.003 |
| 10/28/2010 | 20.69 | 49.64 | NA\* | 7.09 | 2 | 0.038 |
| 11/10/2010 | 22.34 | 48.9 | 99.7 | 7.02 | -1.5 | 0.038 |
| 11/23/2010 | 16.72 | 49.97 | NA\* | 6.9 | 0.1 | 0.046 |
| 12/15/2010 | 19.12 | 49.18 | 100.7 | 7.18 | -0.2 | -0.01 |

**Nassau (2010)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Deployment Date | Temp (°C) | SpCond (mS/cm) | ROX DO % | pH | Turbidity (NTU) | Depth (m) |
| Std. | N/A | 50 | 100 | 7 | 0 | N/A |
| 1/14/2010 | NA\* | 49.62 | 99.8 | 7.01 | 0 | 0.009 |
| 1/29/2010 | 19.57 | 49.71 | 99.4 | 7.05 | 1.4 | -0.001 |
| 2/18/2010 | NA\* | 49.53 | 99.43 | 7.18 | -0.6 | -0.027 |
| 3/4/2010 | 22.3 | 49.83 | 99 | 7.08 | 4.1 | -0.094 |
| 3/26/2010 | 22.62 | 49.29 | 100.3 | 6.85 | -0.4 | 0.052 |
| 4/5/2010 | 22.45 | 49.69 | 97.4 | 6.82 | 2.1 | -0.086 |
| 4/21/2010 | 23.94 | 49.83 | 99.5 | 6.88 | 4.7 | -0.008 |
| 5/3/2010 | 22.53 | 50.38 | 97.1 | 6.98 | -0.1 | -0.045 |
| 5/19/2010 | 23.87 | 51.48 | 100.4 | 6.83 | 3.3 | -0.038 |
| 6/3/2010 | 23.93 | 51.77 | 97.9 | 6.98 | 0.5 | 0.046 |
| 6/22/2010 | 22.35 | 49.79 | 98.4 | 6.99 | 1.9 | -0.022 |
| 7/9/2010 | 23.01 | 50.39 | 99.9 | 7.14 | -0.2 | 0.045 |
| 7/22/2010 | 21.62 | 49.99 | 95.6 | 6.9 | -2 | -0.04 |
| 8/12/2010 | 24.11 | 49.48 | 98.3 | 7.01 | 0 | -0.003 |
| 8/26/2010 | 23.64 | 51.77 | 97.3 | 6.94 | -0.3 | -0.017 |
| 9/9/2010 | 23.77 | 49.55 | 98 | 7.02 | 0.3 | -0.088 |
| 9/28/2010 | 22.32 | 50.36 | 99.5 | 7 | -0.2 | 0.014 |
| 10/21/2010 | 22.97 | 49.59 | 100 | 7.05 | -0.6 | 0.02 |
| 11/3/2010 | 23.73 | 47.6 | 99.8 | 6.53 | 0.4 | 0.021 |
| 11/17/2010 | 20.43 | 50.09 | 102.7 | 7.06 | 1.6 | 0.052 |
| 12/3/2010 | 99.99 | 17.74 | 33.7 | 7.01 | 1 | 0.037 |
| 12/21/2010 | 18.67 | 49.42 | 100 | 7.05 | 0.3 | -0.013 |

\*Missing information due to probe malfunction.

1. **Other remarks/notes:**

**Missing Data**

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 Principal Investigator.

**Rejected Data:**

Obvious outliers, data associated with probe malfunction, and/or calibration (both pre and post) problems are rejected as specified below. For more details about rejected data, contact the Principal Investigator.

**See Metadata “CSM” “GSM” Notes/Comments from Data Files**

**Anomalous/Suspect 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 four 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.