**Florida Keys National Marine Sanctuary (FKNMS) & Florida Keys Aquatic Preserves (FKAP) Water Quality Metadata**

**Document Coverage:**

**Latest Update:** 07/26/2024

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 Florida Keys Water Quality Program Manager at [Genevieve.Schave@FloridaDEP.gov](mailto:Genevieve.Schave@FloridaDEP.gov) with any additional questions.

**I. Data Set and Research Descriptors**

**1) Principal investigator and contact persons –**

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* Datasonde specialist, water quality data analyst, Quality Assurance/Quality Control (QAQC) officer, data handling, field assistance, datasonde calibration & deployment, staff trainer for water quality data collection and calibrations, field and lab logistics manager, metadata report preparer

**2) Entry verification –**

Deployment data are uploaded from the YSI datasonde to a Personal Computer (IBM compatible). Files are exported from KOR EXO v2.3.10.0 Software in a comma-separated file (.CSV) and uploaded to the National Estuarine Research Reserve System (NERRS) Centralized Data Management Office (CDMO) Non-System Wide Monitoring Program (SWMP) Data Upload Service where data undergo automated primary QAQC. All pre- and post-deployment data are removed from the file prior to upload.

During primary QAQC, data are flagged if they are missing or out of sensor range. Edited files are returned to the Office of Resilience and Coastal Protection (RCP) Data Coordinator and/or Aquatic Preserve office for secondary QAQC. Using Microsoft Excel, the files are opened and processed using the CDMO’s NERRQAQC Excel macro. The macro inserts station codes create a metadata worksheet for flagged data, summarized statistics, and graphed data for review. It allows the user to apply QAQC flags/codes to the data, remove any overlapping deployment data, append files, and export the resulting data files for upload to the Aquatic Preserve (AP) database.

After the secondary QAQC results are complete the file will be incorporated into the AP database as provisional plus data. A final tertiary QAQC will take place by the RCP’s Data Coordinator where the file will then be assimilated into the AP database as authenticated data. Any deployment overlaps between files will default to the data collected via the newly calibrated sonde. For more information on QAQC flags and codes, see Sections 11 and 12.

**3) Research objectives –**

The Florida Department of Environmental Protection, Office of Resilience and Coastal Protection (FDEP ORCP) oversees many waterways and the programs that support them however, the main focus in the Keys is the aquatic preserves, in addition to our presence within the Florida Keys National Marine Sanctuary.

The Florida Keys has two aquatic preserves that are managed via FDEP ORCP. These include:

1. Lignumvitae Aquatic Preserve (LKAP) was established in 1969 between Upper and Lower Matecumbe Key which encompasses 7,500 acres of seagrass meadows and deep-water channels. This area is jointly managed with the Lignumvitae Key Botanical State Park.
2. Coupon Bight Aquatic Preserve (CBAP) was established in 1969, located on the southern shore of Big Pine Key and encompasses 6,000 acres of seagrass meadows, hard bottom communities, mangrove wetlands, and coral patch reefs.

The Florida Keys National Marine Sanctuary and Protection Act was passed in 1990, bringing about a sanctuary wide management plan that was implemented in July of 1997. The 2900 square nautical miles of protected waters is jointly managed by the National Oceanic and Atmospheric Administration (NOAA), Florida Fish and Wildlife Conservation Commission (FWC), and FDEP.

With water quality being one of the public’s top concerns and priorities these datasondes allow us to collect daily data that can be used for long term management planning and emergent action if noticeable decline is observed. Both stations have unique flow patterns that can help us assess both localized and long-term issues. LKAP’s sonde captures the bayside flow exchange from an Everglades dominated outgoing tide to an Atlantic Ocean dominated incoming tide. CBAP’s sonde station sits at the opening of the bight, monitoring a backcountry/bight influenced outgoing tide versus an Atlantic Ocean incoming tide. These datasondes collect abiotic parameters every 15 minutes. Other correlating research includes:

* Monthly and quarterly water quality grab samples are taken at 4 different locations within LKAP (2 oceanside and 2 bayside) and 3 within CBAP (2 in the bight and 1 oceanside).
* Quarterly assessment of 16 benthic sites within LKAP which includes seagrass tissue sampling for elemental analyses and stable isotopes, Braun-Blanquet & cover abundance surveys, and YSI water quality data during tissue collection.

**4) Research methods –**

YSI datasondes are deployed monthly at two locations, LKAP and CBAP (currently a Temp CBAP site). Data is collected in 15-minute intervals. All sondes are calibrated before deployment and a pre-deployment calibration verification (ICV) is done as a QAQC check. Approximately every month, the deployed sondes are removed from the water and returned to the lab for data retrieval, cleaning, and post-deployment calibration verification (CCV). All necessary maintenance or repairs will be conducted at this time. Freshly calibrated sondes are swapped at the time of retrieval.

All time is reported as Eastern Standard Time.

In October of 2021 the LKAP continuous water quality monitoring site was established. The EXO2 datasonde mount is constructed using a 3-in PVC pipe that is vertically attached to the Lignumvitae Key visitor’s dock. Using wired rope to control the deployments position, the sonde is lowered down the PVC pipe until the sensors and guard are fully exposed to the water flow. The sensors are situated about one meter from the bay floor which allows the sensors to always remain submerged. The temporary CBAP sonde, established in September of 2021, is horizontally deployed on a 12-in height cinder block. A 3-in. PVC pipe attached to the cinder block houses the sonde body where the sensor and guard are completely exposed to the water flow.

Specific conductance, pH, turbidity, depth, chlorophyll-α and dissolved oxygen are calibrated on the EXO2s. Calibrations are conducted in the FKNMS/FKAP lab by FKNMS/FKAP staff.

Specific conductance is a 1-point calibration. Sonde calibration is done using 50,000 µS/cm standard (Ricca). The ICV is done using 70,000 µS/cm standard (Ricca) and the CCV is done using either the 50,000 or 70,000 µS/cm standard. pH is a 2-point calibration using pH7 standard (Ricca) and pH10 standard (Ricca). The ICV and CCV are done using one of the 2 standards. Turbidity is a 2-point calibration with 0 FNU/NTU Milli-Q water and 124 FNU standard (YSI). The ICV and CCV are done with both 0 and 124/126 FNU/NTU standards. Chlorophyll is a 2-point calibration with 0 ug/L Milli-Q water and a rhodamine WT dye standard (Kingscote). The Tal-PE sensor on the EXO 2 is calibrated for chlorophyll-a (ug/L). IVC and CCV are done using one of the 2 standards.

**5) Site location and character –**

All sonde locations within Florida Keys have very minimal freshwater input (ex. Rainfall) and are focused on water exchanges from the bayside to the oceanside. These areas are tidal influenced, however tidal range is dependent on the land formations nearby.

The LKAP sonde site is mounted to the Lignumvite Key visitor’s dock. This site captures the flow through Indian Key channel, which stretches from Florida Bay to the Atlantic Ocean. This channel, on both bayside and oceanside, is surrounded by plush seagrass flats.

* Location: 25.830030, -80.158600
* Average Tidal Range: 0.66 ft
* Salinity Range: 33.0 - 40.0 ppt
* Depth: 5.0 – 10.0 ft
* Bottom Habitat: muddy, soft sediment with sparse to patchy macro-algae and seagrass (*Thalassia testudinum, Syringodium filiforme, and Halodule wrightii* all present)
* Possible Pollutants: Everglades National Park has been a major contributor to nutrients shifts throughout the bay in past years, new restoration movements have helped lower nutrient influx throughout surrounding areas however this is still of major concern, storm water runoff and anthropogenic influences are of concern as well.

The TCBAP sonde site is located within the bayside area of CBAP, southeast of Seacamp. This mount is attached to cinder blocks that sit on the seafloor and capture the flow within the bight. Circulation around the sonde site is primarily based on oceanic tidal exchange however, Newfound Harbor channel runs through the western portion of the bight which can impact flow. The outskirt of the bight is seagrass dominated where the center is made up of muddy sediment with extremely sparse vegetation.

* Location: 25.846841, -80.182861
* Average Tidal Range: approximately 1.19 ft
* Salinity Range: 35.0 – 40.0 ppt
* Depth: 3.0 – 7.0 ft
* Bottom Habitat: hard bottom covered by muddy sediment, sparsely covered with macro-algae and coral (mainly *Porites and Siderastrea spp.*)
* Possible Pollutants: Storm water runoff and anthropogenic influences

The CBAP sonde site is mounted to a FDEP seagrass warning sign at the tip of Little Munson Island. This location captures the flow from bayside, via Newfound Harbor Channel, through the bight to the Atlantic Ocean. The outskirt of the bight is seagrass dominated where the center is made up of muddy sediment with extremely sparse vegetation.

* Location: 25.821730, -80.151250
* Average Tidal Range: approximately 1.33 ft
* Salinity Range: 35.0 – 40.0 ppt
* Depth: 8.0 – 15.0 ft
* Bottom Habitat: On the edge of a channel and seagrass bed, muddy sediment, thick seagrass bed (*Thalassia testudinum* dominated)
* Possible Pollutants:

**Florida Keys Station Deployment Timeline:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Station Code | Station Name | Location | Active Dates | Reason for Decommission | Notes |
| FKLKAP | Lignumvitae Key Aquatic Preserve (LKAP) | 25.830030, -80.158600 | 10/31/2021 - Present | N/A | EXO2 |
| FKTCBAP | Temporary Coupon Bight Aquatic Preserve (TCBAP) | 25.846841, -80.182861 | 9/16/2021 - Present | N/A | EXO2 |
| FKCBAP | Coupon Bight Aquatic Preserve (CBAP) | 25.821730, -80.151250 | 10/27/2023 – Present | N/A | EXO2 |

**6) Data collection period –**

**LKAP**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Deployment Date/Time** | | **Retrieval Date/Time** | | **Notes** |
| 10/31/21 | 13:45 | 12/3/21 | 10:45 | 30 min. intervals instead of 15 min. intervals  Deployment went past 30 days |
| 12/3/21 | 10:15 | 1/6/22 | 9:30 |  |
| 1/6/22 | 9:30 | 2/4/22 | 10:45 |  |
| 2/4/22 | 10:45 | 3/17/22 | 9:15 |  |
| 3/17/22 | 10:15 | 5/17/22 | 11:00 |  |
| 5/17/22 | 10:00 | 6/16/22 | 8:30 |  |
| 6/16/22 | 9:30 | 7/21/22 | - | \*\*\* Faulty ODO sensor, only 3 days of data |
| 7/21/22 | 14:15 | 10/14/22 | 9:15 |  |
| 10/14/22 | 9:00 | 11/14/22 | 12:00 |  |
| 11/14/22 | 11:00 | 12/15/22 | 11:15 |  |
| 12/15/22 | 11:15 | 1/12/23 | - | \*\*\*Sonde batteries died, stopped collecting data  12/29/22 at 6:15 |
| 1/12/23 | 9:45 | 2/9/23 | 12:45 |  |
| 2/9/23 | 12:45 | 3/7/23 | 10:15 |  |
| 3/7/23 | 10:00 | 4/6/23 | 12:15 |  |
| 4/6/23 | 13:00 | 5/9/23 | 10:15 |  |
| 5/9/23 | 10:15 | 6/5/23 | 13:45 |  |
| 6/5/23 | 13:45 | 6/16/23 | 10:30 |  |
| 6/16/23 | 10:30 | 7/21/23 | 13:45 |  |
| 7/21/23 | 13:30 | 8/25/23 | 10:15 |  |
| 8/25/23 | 10:45 | 9/24/23 | 11:00 |  |
| 9/24/23 | 11:00 | 10/20/23 | 11:00 |  |
| 10/20/23 | 10:15 | 11/17/23 | 11:00 |  |
| 11/17/23 | 9:30 | 12/18/23 | 10:00 |  |
| 12/18/23 | 9:00 | 1/25/24 | 11:30 | Sonde out longer then 30 days – boat under repair |
| 1/25/24 | 11:00 | 3/10/24 | 12:30 | Sonde out longer then 30 days – |
| 3/10/24 | 12:00 | 4/11/24 | 8:15 | \*\*Sp.Con. showed consistent cyclical drops mid tidal shift –  Possible ground water seepage from LK state park |
| 4/11/24 | 9:30 | 5/9/24 | 9:45 | \*\*Sp.Con. showed consistent cyclical drops mid tidal shift –  Possible ground water seepage from LK state park |
| 5/9/24 | 10:00 | 5/30/24 | 11:15 |  |
| 5/30/24 | 12:00 | 6/27/24 | 9:45 |  |
| 6/27/24 | 10:00 | 7/26/24 | 10:00 |  |
| 7/26/24 | 10:15 |  |  |  |
|  |  |  |  |  |

**TCBAP**

|  |  |  |
| --- | --- | --- |
| **Deployment Date/Time** | **Retrieval Date/Time** | **Notes** |
| 9/16/21 | 10/15/21 |  |
| 10/15/21 | 11/30/21 |  |
| 11/30/21 | 1/6/22 |  |
| 1/6/22 | 1/27/22 |  |
| 1/27/22 | 2/21/22 |  |
| 2/21/22 | 3/28/22 |  |
| 3/28/22 | 4/28/22 |  |
| 4/28/22 | 5/19/22 |  |
| 5/19/22 | 6/27/22 |  |
| 6/27/22 | 8/2/22 |  |
| 8/2/22 | 10/13/22 |  |
| 10/13/22 | 10/24/22 |  |
| 10/24/22 | 11/29/22 |  |
| 11/29/22 | 12/19/22 |  |
| 12/19/22 | 2/3/23 |  |
| 2/3/23 | 3/28/23 |  |
| 3/28/23 | 4/24/23 |  |
| 4/24/23 | 5/30/23 |  |
| 5/30/23 | 6/21/23 |  |
| 6/21/23 | 6/21/23 |  |
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**CBAP**

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| --- | --- | --- | --- | --- |
| **Deployment Date/Time** | | **Retrieval Date/Time** | | **Notes** |
| 10/31/23 | 10:15 | 11/28/23 | 10:00 | Chl failed CCV low and high range - data suspect -see Post-Depl chart bellow |
| 12/4/23 | 14:15 | 1/11/24 | 8:45 | Gap in data due to PVC pipe maintenance –  Sonde deployed more than 30 days - |
| 1/16/24 | 9:15 | 1/30/24 | 11:00 |  |
| 1/30/24 | 11:00 | 2/26/24 | 12:00 | \*2/18- 2/23 Voltage dip in batteries |
| 2/26/24 | 12:00 | 3/27/24 | 13:00 | \*3/19- 3/24 Voltage dip in batteries |
| 3/27/24 | 13:30 | 4/24/24 | 10:45 | \*\*Conductivity sensor showing random low Salinity and SpCon. values |
| 4/24/24 | 11:00 | 5/17/24 | 12:45 | \*\*Spc.Cond. sensor failed post by cal 5 mS each standard. 46.78mS & 65.53mS –  Flag as suspect – Possible fault calibration – Sonde PVC mount was tampered with  Lifted ½ meter to be at original monitoring depth. |
| 5/17/24 | 12:45 | 6/6/24 | 11:15 |  |
| 6/6/24 | 11:30 | 6/24/24 | 12:30 | Sonde stuck in PVC mount – took extra leveraging to remove |
| 6/24/24 | 12:45 | 7/22/24 | 13:15 | Sonde was stuck in mount again – took leveraging to loosen and swap Sondes |
| 7/22/24 | 13:15 |  |  |  |
|  |  |  |  |  |

\*\*\*Unexpected deployment failure (battery or sonde malfunction)

**7) Distribution –**

The Principal Investigator (PI) retains the right to be fully credited for having collected and processed the data.  Following academic courtesy standards, the Florida Department of Environmental Protection, and the Aquatic Preserve site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used.  The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement.  The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons.

Aquatic Preserve water quality data and metadata can be obtained from the Manager at the individual Aquatic Preserve site (please see Principal Investigators and Contact Persons) and online at the Aquatic Preserve’s data portal home page [www.floridaapdata.org](http://www.floridaapdata.org). Data are available in comma delimited format.

**8) Associated researchers and projects –**

There are several agencies conducting water quality monitoring within the Florida Keys National Marine Sanctuary (FKNMS). The following are the projects that we are aware of though there may be more.

(This Project) Florida Department of Environmental Protection (DEP) – FKNMS/Florida Keys Aquatic Preserves (FKAP)

* Currently, two deployed datasonde stations monitor abiotic parameters at 15-minute intervals.
* In addition to the datasondes, this project involves taking monthly and quarterly water quality grab samples at 21 sites, however only 7 are applicable to the sonde program.
* LKAP has 16 benthic assessment sites including seagrass tissue sampling for elemental analyses and stable isotopes, Braun-Blanquet & percent cover abundance surveys, and some abiotic factors. This program is sampled quarterly, and data can be acquired from Talia Bailey.
* <https://floridadep.gov/rcp/LVKey-AP>
* <https://floridadep.gov/rcp/aquatic-preserve/locations/coupon-bight-aquatic-preserve>
* LKAP does monthly rookery surveys at Shell Key from December to June. Data can be acquired from Talia Bailey.
* There is talk of adding telemetry at the LKAP and CBAP sites come summer 2024.

Florida Department of Environmental Protection (DEP) – Office of Resilience and Coastal Protection (ORCP)

* ORCP is heading a project to restore the tidal connection from bayside to oceanside in Curry Hammock State Park. In the early 20th century several tidal connections between Keys were filled-in in lieu of building bridges. These connections reduced tidal flushing within these areas, negatively impacted the water quality.
* An EPA grant was secured to (1) to gather three years of baseline environmental data, including continuous water quality monitoring and benthic community data, both at the project site and a reference site, and (2) to hire engineering consultants that will develop construction documents, a mitigation plan, and obtain the necessary permits.
* Further grants in future years will be necessary to break ground.

Florida International University (FIU)

* Datasonde monitoring with live telemetry through Dr. James Fourqurean and FIU’s Institute of Environment, Coastlines and Ocean Division.
  + <https://cloud.xylem.com/hydrosphere/public-sites>
* Long-term water quality sampling within FKNMS as part of the Southeast Environmental Research Center (SERC) Water Quality Monitoring Network.
  + <http://serc.fiu.edu/wqmnetwork/>
* FIU contract via the seagrass lab through Dr. Jim Fourqurean to assess FKNMS/FKAP collected samples of sediments and seagrass tissues.
  + <https://seagrass.fiu.edu/>
* Various graduate student projects within and around Florida Keys National Marine Sanctuary.

South Florida Water Management District (SFWMD)

* Long-term surface water quality monitoring in Florida Bay.
* Flow monitoring from Everglades National Park into Florida Bay.
* Data stored and accessible through DBHYDRO database.
  + <http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_menu>

Florida Department of Health (DOH)

* DOH Healthy Beaches program
* Sample monitoring for fecal indicator bacteria.
  + <http://www.floridahealth.gov/environmental-health/beach-water-quality/index.html>

Mission Iconic Reef & National Oceanic and Atmospheric Administration (NOAA)

* Have temperature trackers on the reef throughout FKNMS

**II. Physical Structure Descriptors**

**9) Sensor specifications –**

Currently, we have 9 YSI EXO2 (10m depth) Sondes and 2 YSI EXO2 (100m depth) Sondes that are interchangeably swapped monthly at each station.

**YSI EXO2 Datasonde:**

* Parameter: Dissolved Oxygen, % air saturation
  + Units: percent air saturation (%)
  + Sensor Type: optical sensor
  + Model#: YSI 599100-01
  + Range: 0 to 500% air saturation
  + Accuracy: 0 to 200%: +/1 1% of reading or 1% saturation, w.i.g.; 200 to 500% +/- 5% of reading
  + Resolution: 0.1% air saturation
* Parameter: Total algae
  + Units: micrograms/Liter (mg/L)
  + Sensor Type: optical sensor
  + Model#: YSI 599103-01
  + Range: 0 to 400 µg/L chl
  + Accuracy: Linearity: r2 ≥ 0.999 for Rhodamine WT across full range
  + Resolution: 0.01 RFU or 0.01 µg/L chl
* Parameter: Conductivity
  + Units: milli-Siemens per cm (mS/cm)
  + Sensor Type: 4-electrode nickel cell
  + Model#: YSI 599827
  + Range:0 to 200 mS/cm
  + Accuracy: 0 to 100: +/- 0.5% of reading or 0.001 mS/cm, w.i.g.; 100 to 200 +/- 1% of reading
  + Resolution: 0.0001 to 0.01 mS/cm
* Parameter: Turbidity
  + Units: formazin nephelometric units (FNU)
  + Sensor Type: optical sensor
  + Model#: YSI 599101-01
  + Range: 0 to 4000 FNU
  + Accuracy: 0 to 999 FNU: 0.3 FNU or +/- 2% of reading, w.i.g.; 1000 to 4000 FNU: +/- 5% of reading
  + Resolution: 0 to 999 FNU=0.01 FNU; 1000 to 4000 FNU=0.1 FNU
* Parameter: pH
  + Units: pH units
  + Sensor Type: unguarded
  + Model#: YSI 599702
  + Range: 0 to 14 units
  + Accuracy: +/- 0.1 pH units within +/- 10ºC of calibration temp; +/- 0.2 pH units for entire temp range
  + Resolution: 0.01 units
* Parameter: Temperature
  + Units: Celsius (°C)
  + Sensor Type: 4-electrode nickel cell
  + Model#: YSI 599827
  + Range: -5 to 35 ºC, 35 to 50 ºC
  + Accuracy: -5 to 35 ºC: +/- 0.01 ºC2, 35 to 50 ºC: +/- 0.05 ºC2
  + Resolution: 0.001 ºC
* Parameter: Depth
  + Units: meters (or ft)
  + Sensor Type: integral, non-vented depth sensor
  + Range: 0 to 10 m (0 to 33 ft)
  + Accuracy: +/- 0.004 m (+/- 0.013 ft)
  + Resolution: 0.001 m (0.001 ft)

OR

* Parameter: Depth
  + Unit: meter (or ft)
  + Sensor Type: integral, non-vented depth sensor
  + Range: 0 to 100 m (0 to 328 ft)
  + Accuracy: +/- 0.04 m (+/- 0.13ft)
  + Resolution: 0.001 m (0.001 ft)

**Sensor Disclaimers:**

**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, 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 the 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/NTU as the designated units for all turbidity data regardless of the 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:** |
| Lignumvitae Aquatic Preserve | LKAP | FKLKAP |
| Coupon Bight Aquatic Preserve (Temporary Station) | TCBAP | Info available upon request |
| Coupon Bight Aquatic Preserve | CBAP | FKCBAP |

**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** –

CCV values in red did not pass the established acceptance criteria (AC) for the Florida AP database. Data from the deployments that did not pass CCV were labeled as suspect. CCV values in **bold purple** fell 3x beyond the acceptance criteria and therefore were rejected for that deployment. Values in italics are standard values. Standard values for DO (mg/L), Chlorophyll (ug/L), BGA (ug/L) and BGA (RFU) are determined by temperature.

AC values prior to 2023:

* Specific Conductivity - ±5% of the standard value
* pH – Standard value ±0.1
* Turbidity – whichever is greater
  + Standard value ±0.3
  + ±5% of the standard value
* Dissolved Oxygen –
  + ±5% (DO %) of the standard value
  + Standard value ±0.1 mg/L (DO mg/L)
* Temperature - ±0.3 °C of the thermometer
* Chlorophyll-a - ±5% of their standard value

AC values from 2023 to present:

* Specific Conductivity - ±5% of the standard value
* pH – Standard value ±0.2
* Turbidity – whichever is greater
  + Standard value ±0.3
  + ±5% of the standard value
* Dissolved Oxygen –
  + ±5% (DO %) of the standard value
  + Standard value ±0.3 mg/L (DO mg/L)
* Temperature - ±0.6 °C of the thermometer
* Chlorophyll-a - ±5% of their standard value

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| **FKLKAP** | | **Specific Conductivity (mS/cm)** | | **pH** | | **Turbidity (FNU)** | | **Dissolved Oxygen (mg/L)** | | **Temperature (°C)** | | **Chlorophyll-a (µg/L)** | | |
| **Sonde** | **Date** | **50** | **70 or 100** | **7** | **10** | **0** | **124** | **DO CCV** | **Std** | **Sonde** | **Therm** | **0** | **Chl CCV** | **Std** |
| 3 | 12/3/21 | - | 101..992 | 6.99 | - | 0.25 | 125.71 | 8.72 | 8.578 | 23.416 | 23.2 | 0.01 | 68.54 | 66.12 |
| 2 | 1/6/22 | - | 101.422 | 7.24 | - | 1.26 | 124.89 | 8.70 | 8.578 | 23.093 | 23.1 | 0.01 | 64.35 | 65.00 |
| 3 | 2/4/22 | - | 99.717 | 6.99 | 9.99 | 0.65 | 123.64 | 8.36 | 8.34 | - | - | 0.07 | 68.21 | 64.875 |
| 4 | 3/17/22 | 49.622 | - | 7.03 | - | 0.22 | 124.571 | 8.36 | 8.263 | - | - | 0.03 | 64.57 | 64.54 |
| 1 | 5/17/22 | 50.302 | - | 7.16 | - | 0.62 | 126.51 | 8.62 | 8.66 | - | - | 0.21 | 61.87 | 62.95 |
| 3 | 6/16/22 | 49.900 | - | 6.99 | - | 0.07 | 124.57 | 8.23 | 8.263 | - | - | 0.01 | 63.46 | 63.75 |
| 2 | 7/21/22 | 49.942 | - | 7.04 | - | 0.3 | 122.40 | 8.89 | 8.83 | 21.50 | 21.5 | 0.14 | 63.68 | 64.25 |
| 4 | 10/14/22 | 50.442 | - | 7.10 | 10.10 | 1.25 | 124.10 | 8.92 | 8.830 | 21.526 | 21.5 | 0.3 | 62.28 | 63.875 |
| 1 | 11/14/22 | 49.934 | - | 7.12 | 10.03 | - | 124.72 | Failed % | - | - | - | - | 62.29 | 62.4 |
| 6 | 12/15/22 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 1/12/23 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 | 2/9/23 | 50.169 | 70.029 | 7.02 | 10.04 | 1.2 | 122.55 | 9.37 | 9.37 | 19.024 | 19.13 | 0 | 71.95 | 65.5 |
| 6 | 3/7/23 | 49.940 | 70.449 | 7.04 | 10.02 | 0.11 | 123.97 | 9.06 | 8.915 | 21.14 | 21.213 | -0.14 | 66.51 | 64.55 |
| 1 | 4/6/23 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 5/9/23 | 50.036 | 70.401 | 7.04 | 10.01 | 0.09 | 125.49 | 9.03 | 8.83 | 21.61 | 21.63 | 0.03 | 60.97 | 63.75 |
| 6 | 6/5/23 | 50.054 | 70.514 | 7.04 | 10.05 | 0.02 | 123.64 | 8.66 | 8.743 | 22.08 | 22.05 | -0.01 | 63.26 | 63.75 |
| 3 | 6/16/23 | 49.915 | 70.404 | 6.86 | 9.85 | -0.44 | 124.1 | 8.86 | 8.743 | 21.96 | 21.9 | 0.12 | 60.27 | 63.875 |
| 6 | 7/21/23 | 50.001 | 70.200 | 6.98 | 9.97 | 0.41 | 129.0 | 8.76 | 8.743 | 22.24 | 22.23 | -0.15 | 70.44 | 68.04 |
| 7 | 8/25/23 | 49.881 | 69.970 | 7.04 | 10.15 | 2.45 | 125.25 | 8.73 | 8.743 | 22.02 | 22.0 | -0.06 | 64.76 | 64.125 |
| 2 | 9/22/23 | 50.027 | 70.224 | 7.00 | 10.02 | 0.38 | 124.33 | 8.68 | 8.743 | 21.994 | 21.85 | 0.15 | 66.8 | 64 |
| 5 | 10/20/23 | 50.130 | 70.570 | 7.01 | 10.02 | 0.08 | 119.61 | 8.78 | 8.83 | 21.59 | 21.54 | 0.6 | 64.21 | 65.125 |
| 7 | 11/17/23 | 50.121 | 70.665 | 6.98 | 9.98 | 0.26 | 128.8 | 9.17 | 9.18 | 19.54 | 19.44 | -0.17 | 68.9 | 67.92 |
| 10 | 12/18/23 | 50.280 | 70.781 | 7.07 | 10.09 | 1.05 | 129.4 | 8.50 | 8.578 | 23.42 | 23.05 | -0.23 | 64.56 | 64.625 |
| 1 | 1/25/24 | 49.935 | 70.235 | 7.06 | 10.02 | 4.2 | 125.25 | 8.49 | 8.42 | 23.876 | 23.9 | -0.02 | 65.54 | 63.5 |
| 8 | 3/11/24 | 50.073 | 70.467 | 7.04 | 10.03 | 0.11 | 124.4 | 8.84 | 8.66 | 22.549 | 22.4 | -0.1 | 65.45 | 65.875 |
| 9 | 4/11/24 | 49.983 | 70.260 | 7.10 | 10.04 | 0.25 | 126.74 | 8.263 | 8.22 | 25.159 | 24.87 | -0.01 | 66.38 | 63.75 |
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| **FKTCBAP** | | **Specific Conductivity (mS/cm)** | | **pH** | | **Turbidity (FNU)** | | **Dissolved Oxygen (mg/L)** | | **Temperature (°C)** | | **Chlorophyll-a (µg/L)** | | |
| **Sonde** | **Date** | **50** | **70 or 100** | **7** | **10** | **0** | **124** | **DO CCV** | **Std** | **Sonde** | **Therm** | **0** | **Chl CCV** | **Std** |
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| **FKCBAP** | | **Specific Conductivity (mS/cm)** | | **pH** | | **Turbidity (FNU)** | | **Dissolved Oxygen (mg/L)** | | **Temperature (°C)** | | **Chlorophyll-a (µg/L)** | | |
| **Sonde** | **Date** | **50** | **70 or 100** | **7** | **10** | **0** | **124** | **DO CCV** | **Std** | **Sonde** | **Therm** | **0** | **Chl CCV** | **Std** |
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**14) Other remarks/notes –**

Data are missing due to equipment/probe related failures, necessary maintenance or servicing, equipment or standard supply chain shortages, limited staff, etc... If additional information on missing data is needed, contact the Aquatic Preserve office. Copies of the calibration/deployment logs can be obtained through the Water Quality Program Manager.

All data files are QAQC’d using the 2012 CDMO Excel macro. This macro automatically flags DO values less than 3 mg/L as Passed Initial QAQC Checks with the comment DO Hypoxia (<3 mg/L) (0, 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). Additionally, negative turbidity readings between (0) and (-2) have been automatically flagged as suspect data (1, CAF) since the value is within the accuracy of the probe per the CDMO operations manual. All negative chlorophyll readings are labeled as (-4) since they fall outside the chlorophyll sensor range and are manually rejected during QAQC (-3, SNV). All the first data points for each new deployment are labeled (0, CND).

The parameters that are QC’d are depth (m), temperature (°C), salinity (ppt), specific conductance (mS), turbidity (FNU), pH (SU), DO (mg/L and %) and chlorophyll (µg/L). All other parameters have not been QC’d.

All data collected after the 30-days in each deployment is noted in the F\_Record column of the dataset with {CSM}.

All turbidity readings over 124 FNU are rejected (-3, STS) since they are out of the calibration range that FKNMS/FKAP applies (0-124 FNU). All chlorophyll readings over the upper calibration value are rejected (-3, SCS) since they are out of the calibration range (varies by deployment). Additionally, for FKNMS/FKAP, anomalous turbidity and chlorophyll spikes are labeled suspect (1, STS/SCS) if BOTH of the following conditions apply:

1. Data point is not within a well-defined peak (e.g., there is no incremental increase before data point or decrease after data point based on the neighboring readings)
2. The previous and next data points are BOTH less than the data point by the calculated value: STANDARD DEVIATION\*3 (SD calculated after rejected data removed)

**15) Acknowledgement:**

The data included in this document was collected by the staff of the Florida Keys Department of Environmental Protection. Any products derived from this data should clearly acknowledge this source (please use the attached logos). This recognition is important for ensuring that this long-term monitoring program continues to receive the necessary political and financial support.