

Quality Manual
for
State of Florida Department of Environmental Protection (DEP)
Office of Resilience and Coastal Protection
Aquatic Preserve Continuous Water Quality Monitoring Program

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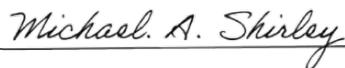
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Alex Reed, Director

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Michael Shirley, Deputy Director

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1. Scope of Work

The Office of Resilience and Coastal Protection's (RCP) Continuous Water Quality Monitoring Program began in 1995 and was expanded to the Aquatic Preserve (AP) sites in late 2003. Water quality stations were established to answer specific questions within the managed areas. Calibration and post-deployment readings were performed in accordance with methods outlined by either YSI's Operating and Service Manual, the NERR SWMP YSI EXO or 6-Series Multi-Parameter Water Quality Monitoring Procedure SOP, and/or the Florida Department of Environmental Protection's (FDEP) Division of Environmental Assessment and Restoration (DEAR) Specific Field-Testing Procedures FT 1000 through FT 3000. In 2018, under the Project of Special Merit (PSM), RCP coordinated with the Centralized Data Management Office (CDMO) and the AP offices to assess the historical and current AP water quality monitoring data in order to evaluate the quality of data, identify needs, and provide insight and recommendations about potential causes of data loss and how to improve data collections. All previously collected AP data files were reformatted to align with SWMP in order to provide a statewide standard for data comparison. By adopting the National Estuarine Research Reserves (NERR) System-Wide Monitoring Program's (SWMP) monitoring protocols and database management techniques, the existing high-frequency, near-continuous (every 15-minutes) AP water quality data seamlessly combines with the NERR water quality data and enables the AP continuous WQ monitoring program to integrate their data into important national and regional initiatives as well as Office of Resilience and Coastal Protection (RCP) data repositories including the Florida [Aquatic Preserve Data Portal](#) and the Statewide Ecosystem Assessment of Coastal and Aquatic Resources (SEACAR) [Data Discovery Interface](#).

The current AP continuous water quality monitoring program is conducted in accordance with the nationally-coordinated and standardized NERR SWMP. Xylem/YSI EXO datasondes are approved instruments for collecting data. Data are collected in 15-minute intervals for eight parameters—water temperature, specific conductivity, salinity, dissolved oxygen percent, dissolved oxygen mg/L, depth, pH, and turbidity. The NERR SWMP EXO SOP is the minimum SOP requirement and is used in conjunction with YSI's (instrument manufacturer's) user manuals. The APs perform calibration verifications and bracketing procedures as outlined by the field-testing protocols established by the FDEP.

2. Statement of Policy

This Quality Manual for the Aquatic Preserve Continuous Water Quality Monitoring Program states the procedures used by FDEP and the Florida APs to ensure that the data generated by the DEP are verifiable, and that the procedures used to generate data are designed to produce data that are reproducible, comparable, and defensible within known limits of precision and accuracy. The department's quality assurance requirements for analytical laboratories and field activities are codified in Chapter 62-160, Florida Administrative Code (F.A.C.), Quality Assurance (QA Rules), which defines quality assurance as an integrated system of management activities involving planning, implementation, documentation, assessment, reporting and quality improvement to ensure that a process, product or service meets defined standards of quality.

Data collected using the procedures established by the National Oceanic and Atmospheric Administration (NOAA) NERR SWMP follow quality assurance requirements that have been developed in accordance with known federal guidelines and/or standards for environmental data collection activities and oceanographic datasets (NOAA Administrative Order 216-101). For more information regarding the NOAA Office for Coastal Management Data Policy for the NERR's Monitoring Program, please visit: <http://cdmo.baruch.sc.edu/data/policy.cfm>.

Project funding provided by a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program, and by a Grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. NA17NOS4190167.

3. Ethics Statement

All employees and contract employees of the FDEP RCP are held to high professional ethical standards in the performance of their duties. All employees are required to read, understand, and sign an 'Ethics Statement' attesting to their commitment to honesty and integrity in performance of their duties. In addition, all employees are required to attend an annual ethics training class. Improper, unethical or illegal actions will be dealt with according to the published Administrative Directives of the DEP.

4. Organization and Responsibilities

The RCP continuous water quality monitoring program began in 1995 with the NERRs and was expanded to the Aquatic Preserves in late 2003. Today, RCP's Aquatic Preserve Program maintains continuous water quality monitoring stations in aquatic preserves across the state (Table 1) and the three NERRs.

Table 1: Aquatic Preserve Active Stations

Aquatic Preserve Office	Station Names	Aquatic Preserve
Big Bend Seagrasses APs	Steinhatchee (BBSST) Chassahowitzka (BBSCH)	Big Bend Seagrasses St. Martins Marsh
Biscayne Bay APs	Little River (LR03) Tuttle Basin (BB14) Tuttle Basin (JT71) Miami River (MRSC) Miami River (MRDW) Rickenbacker Basin (MRRB) Rickenbacker Basin (CWA4)	Biscayne Bay Biscayne Bay Biscayne Bay Biscayne Bay Biscayne Bay Biscayne Bay Biscayne Bay
Central Panhandle APs	Alligator Harbor 2 (CPAH2) FSU Marine Lab (CPFS) Windmark (CPWD)	Alligator Harbor Alligator Harbor Central Panhandle
Charlotte Harbor APs	Matlacha Pass 1A (MP1A) Matlacha Pass 2B (MP2B) Matlacha Pass 3C (MP3C) West Wall 1 (CHWW1)	Matlacha Pass Matlacha Pass Matlacha Pass Charlotte Harbor
Estero Bay AP	Tom Winter (EB01) Spring Creek (EB02) Fish Trap Bay (EB03) Hendry & Mullock Creeks (EB04)	Estero Bay Estero Bay Estero Bay Estero Bay
Florida Keys APs	Lignumvitae Key AP (FKLKAP) 7-Mile Bridge (FK7mi) Coupon Bight AP (FKCBAP)	Lignumvitae Key Coupon Bight
Northeast Florida AP	Edwards Creek (NEECF) Mickler (GMMK)	Nassau R.-St. Johns R. Marshes Guana River Marsh
Northwest Florida AP	Yellow River Marsh AP (YRMAP1)	Yellow River Marsh

Tomoka Marsh AP	Gamble Rogers (TMGR)	Tomoka Marsh
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Responsibilities of Key Personnel

Trained personnel are responsible for coordinating data submissions with the AP offices, addressing Quality Assurance/Quality Control (QAQC) activities, and managing the data portal (FloridaAPdata.org) to ensure that data produced and received adhere to DEP protocols.

Alex Reed, Office of Resilience and Coastal Protection Director

The Office of Resilience and Coastal Protection is led by the Director, who oversees the administrative direction of the office.

Michael Shirley, Ph.D., Deputy Director

The Deputy Director is responsible for both the technical and administrative direction of the office.

Cheryl Clark, Coastal Projects Manager

Project Manager (PMP®) for the SEACAR Program, oversees projects and contracts included within SEACAR, the Florida Coastal Water Quality Assessment and Integration Project, and Habitat and Water Quality Improvements including the Florida Aquatic Preserve Data Portal and Water Quality Technician Training.

Samantha Howe, Aquatic Preserve Data Manager, RCP Quality Assurance Officer, Government Operations Consultant II

The AP Data Manager is responsible for coordinating data submittals with the aquatic preserves and handling the data that is submitted, which includes running QAQC checks and managing the data portal. The AP Data Manager provides support to the QA Office in helping to update manuals and ensuring that proper sampling methods are being used.

The Quality Assurance (QA) Officer serves as the lead QA Officer for RCP. The QA Officer is responsible for the production and revisions of the Quality Manual, providing quality assurance oversight, and ensuring that personnel adhere to proper sampling collection and analysis methods.

Tim Jones, Big Bend Seagrasses APs Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Big Bend Seagrasses Aquatic Preserves.

Trisha Green, Big Bend Seagrasses APs, Environmental Specialist II

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Catherine Puma, Big Bend Seagrasses APs, OPS Environmental Specialist II

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Biscayne Bay APs Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Biscayne Bay Aquatic Preserves.

Leah Leyland, Biscayne Bay APs, Environmental Specialist II

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Jonathan Brucker, Central Panhandle APs Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Central Panhandle Aquatic Preserves.

Michael Palandri, Central Panhandle APs, Environmental Specialist I

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Mindy Brown, Charlotte Harbor APs Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Charlotte Harbor Aquatic Preserves.

Mary McMurray, Charlotte Harbor APs, Environmental Specialist I

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Kayla Hayes, Charlotte Harbor APs, Environmental Specialist I

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Stephanie Erickson, Estero Bay AP Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Estero Bay Aquatic Preserve.

Rebecca Cray, Estero Bay AP, Environmental Specialist II

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Nicholas Parr, Florida Keys APs Manager, Program Consultant

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Florida Keys Aquatic Preserves.

Caitlyn Bozza, Florida Keys APs, Environmental Specialist III

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Jimmy Tomazinis, Northeast Florida APs Manager, Environmental Specialist II

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Northeast Florida Aquatic Preserves.

Chris Kurtz, Northeast Florida APs, Environmental Specialist I

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Olivia Roorbach, Northeast Florida APs, Biological Scientist II

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Beth Fugate, Northwest Florida APs Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Northwest Florida Aquatic Preserves.

Zach Schang, Northwest Florida APs, Environmental Specialist I

Implements resource management and ecosystem monitoring programs, and performs the role of water quality technician, responsible for data management and datasonde calibration, deployment, retrieval, and maintenance.

Ashley Hurley, Tomoka Marsh AP Manager, Environmental Specialist III

Oversees resource management and several ecosystem monitoring programs, including water quality monitoring for the Tomoka Marsh Aquatic Preserve.

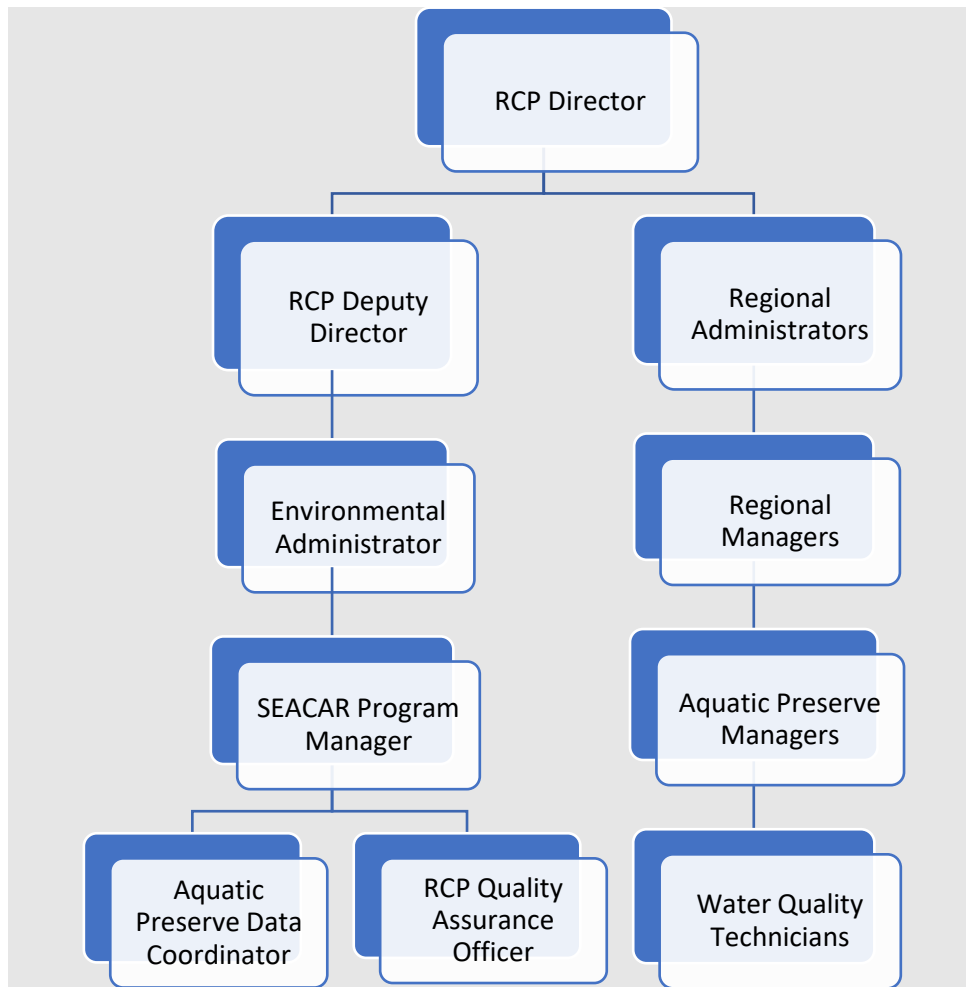


Figure 1: Organizational Chart

Approved Signatories

Approved signatories within the DEP are stated as:

- 1) Alex Reed, RCP Director
- 2) Michael Shirley, RCP Deputy Director

Employee Training

DEP staff who are responsible for AP sample collection are required to attend the AP's Continuous Water Quality Technician Training Workshop and the DEP FT1000 – FT1500 Field Testing Standard Operating Procedures (SOP) and basic data review trainings annually. Staff are also encouraged to virtually attend the NERRS SWMP Technician Training Workshop hosted by the Centralized Data Management Office (CDMO) annually. All employees are required to review training resources annually. Training resources for the Continuous Water Quality Technician Training Workshop and the NERRS SWMP Technician Training Workshop are available on the AP Data Portal training resources webpage: https://www.floridaapdata.org/training_online.php and DEP SOP training materials are located on the QA training webpage: <https://floridadep.gov/dear/quality-assurance/content/training-presentations>.

5. Documentation

Generation, Retention and Storage of Records

AP staff are required to use the [2022 APCWQ Calibration & Field Log](#) to document datasonde maintenance, calibration, sensor verifications, and other details about each deployment. The standard calibration and field log (APCWQ_Calibration&FieldLog_2022) can be found on the [APWQ SharePoint site](#), or in the Calibration Log folder in the Datasonde Program network folder. The structure and requirements of the calibration log are not to be edited. Calibration log requirements are based on the [DEP Field Testing General SOP](#). Date of receipt, acceptable verification of any standard used after its expiration date, vendor, catalog number, description, grade, manufacturer name, lot or serial number, or other standard information should be kept in an inventory tracking file.

The calibration & field log should be updated with a new tab for each deployment of the year by navigating to the [document tracking library](#) from the APWQ SharePoint site (see [help file](#)). Digital calibration logs produced by KOR software during datasonde calibrations should be archived quarterly in the document tracking library.

Raw data files must be submitted to the APWQ SharePoint [document tracking library](#) within two weeks of instrument retrieval from the field for automated QAQC. Automated primary QAQC may be performed by the AP Data Manager or the water quality technicians. Quarterly secondary QAQC reviewed data files and metadata documents must be submitted to RCP based on the following schedule:

- Quarter 1: May 1st
- Quarter 2: August 1st
- Quarter 3: November 1st
- Quarter 4: February 1st
- Annual: April 15th

Quarterly metadata reports should include cumulative data for the year through the quarter being submitted, for example:

- Quarter 1: January 1 – March 31
- Quarter 2: January 1 – June 30
- Quarter 3: January 1 – September 30
- Quarter 4: January 1 – December 31

The AP Data Manager or approved APs will append quarterly data submissions into yearly data files, perform a second and more intensive round of secondary QAQC, and submit these files to replace the quarterly files as provisional plus data. After the DEP performs the final tertiary QAQC, the data will be posted as authenticated.

All data files, metadata reports, and calibration logs are stored on the [AP Water Quality SharePoint document tracking library](#) for long-term storage. Provisional and authenticated data files as well as yearly and quarterly metadata reports are available for public download on the [AP Data Portal](#).

Staff are also required to record datasonde and probe maintenance and repairs in a maintenance log. The [APCWQ MaintenanceLog](#) template may be used to meet minimum requirement. A comparable log containing additional information may be used. The maintenance log must be uploaded and maintained on the [document tracking library](#).

Documentation Control and Maintenance

DEP generated SOP documents contain the SOP name, version number, effective date, review/revision date, and author. The draft watermark is removed from final SOP documents and can only be edited by the program manager or QA Officer.

For more information about the Florida DEP Standard Operating Procedures for Field Testing (FT1100, FT1200, FT1500), please visit <https://floridadep.gov/dear/florida-dep-laboratory/content/dep-laboratory-quality-assurance-manual-and-sops>.

For more information on CDMO Water Quality Management Procedures please visit https://www.floridaapdata.org/docs_training/CDMO_Data_Management_Manual_V6.6.pdf.

Data and Metadata documents are available for download on the AP Data Portal <https://www.floridaapdata.org/>.

Documentation/Reports Generated

1) *Aquatic Preserve Protocols*

- SOP for BBAP Datasonde Calibration (EXO) (2021)
- SOP for BBAP Datasonde Continuous Monitoring (2021)

2) *Quality Assurance Plans/Manuals*

- Biscayne Bay Aquatic Preserves QA Project Plan

3) *Literature & Reports*

- Dye et.al 2022. An agent-based model accurately predicts larval dispersal and identifies restoration and monitoring priorities for eastern oyster (*Crassostrea virginica*) in a Southwest Florida estuary. *Restoration Ecology*, Volume 30, No.1
- Petrinec, K., and Clark, C. 2019. Florida Coastal Water Quality Assessment and Integration Report. Florida Department of Environmental Protection, Tallahassee, FL 43 pp.
- Leary 2012. Robust and Powerful Trend Analyses for Continuous Water Quality Monitoring within Estero Bay Aquatic Preserve (2004-2011)
- Leary 2012. Robust and Powerful Trend Analyses for Continuous Water Quality Monitoring within Matlacha Pass Aquatic Preserve (2005-2011)

- Rickards, L. (2018). Seagrass Abundance and Distribution in relation to Changing Environmental Factors in Estero Bay, Florida [Masters dissertation, Florida Gulf Coast University]. FIU Digital Repository.
<https://fgcu.digital.flvc.org/islandora/object/fgcu%3A31528>

4) *Metadata Reports*

- Annual and Quarterly Metadata Reports

Supporting Documentation/Reports

1) *Sampling Documents*

- Digital calibration log produced by KorEXO software
- APCWQ Calibration & Field logs
- Equipment maintenance tracking

2) *Data Management and Analysis SOPs*

- NOAA CDMO NERR SWMP Data Management Manual
- NOAA NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring Standard Operating Procedure Version 2.1
- Quick Reference EXO Calibration Checklist
- Quick Reference EXO Post-Deployment Checklist
- Quick Reference EXO KOR V2 Calibration Checklist
- Quick Reference EXO KOR V2 Post-Deployment Checklist

3) *Manuals*

- EXO User Manual
- NOAA CDMO NERR SWMP Data Management Manual

6. Data Identification and Data Integrity

Nomenclature

Raw.CSV data files should follow the proper naming convention, which includes the AP code, station code, and the date of deployment (APcode_MMDDYY), for example, EB02_010120.csv.

Raw .BIN files should be named with the AP and station code, station sensor ID, date of deployment, and time first sample logged. This naming convention should be automatically generated with file download. There should be one .bin file submitted for every raw .csv file.

Limited data files should be named identically to the raw data file, but should be distinguished by an _L following the original name, for example, EB02_010120_L.

Primary QAQC data file name should remain unchanged from the file returned during automated primary QAQC, which will be named identically to the limited file with the addition of _QC at the end of the name, for example, EB02_010120_L_QC.

Quarterly secondary QAQC data files appended by the AP Data Manager or submitted by the approved Aquatic Preserves should include the Aquatic Preserve and station code as well as the year

and cumulative quarters being submitted, in the following format (APSTATION_YYYY_Q1_Q2...), for example, quarter three for station EB02 in year 2020 would be formatted EB02_2020_Q1_Q2_Q3.

Annual secondary QAQC data files should be named by the station and year, for example, EB02_2020.

Tertiary review files should be named with the Aquatic Preserve, station code, year, and TQC indicating that tertiary QAQC has been performed, for example, EB02_2020_TQC.

Metadata reports (quarterly and annual) should include the Aquatic Preserve, month range for data included in the document, two-digit year, and m.prov, in the following format (APSTATIONMM-MM.YYm.prov) , for example, bbsap01-03.20m.prov for Q1 and bbsap01-12.20m.prov for Q4 and annual.

Calibration logs should be provided in .xls format as compilation of deployments from the year, with each tab in the excel file as a new deployment. The excel file should be named by AP station code and year_CalLog, for example, BBSCH_2021_CalLog. Tabs at the bottom should be updated after each deployment and should be named by the station code and deployment date, for example, BBSCH_010622, would be one tab name in the 2022 calibration log excel file.

Kor Digital Calibration logs should be submitted quarterly and should include the three deployments in that quarter. The submission should be named by the station code, first deployment date included, last deployment date included, and _kor. For example, quarter three Kor digital submission may be named EB01_070422_090722_kor.

Maintenance Logs should be named APCWQ_MaintenanceLog_(YourAP). It should be submitted to the APWQ SharePoint Document tracking library and maintained from that location as needed. See the [help file](#) for more information.

Data integrity

Appropriate supporting metadata files are required before a data file, data set, data layer, or database can be accepted by or made available via the AP water quality data portal. Data and metadata are available and can be downloaded from the [AP Water Quality Portal](#). Additional records can be provided upon request. Please contact samantha.howe@floridadep.gov.

7. Confidentiality

All records and documents generated by DEP RCP are public records and may be subject to disclosure according to guidelines and exceptions published in Chapter 119 of Florida Statutes.

8. Capabilities

Sampling capabilities

Trained AP staff are capable of planning, scheduling, and collecting high-quality data and managing all aspects of data review and reporting. The aquatic preserves are responsible for following SWMP continuous monitoring protocols in regard to datasonde calibration, deployment, post-deployment, and QAQC with the assistance from AP Data Manager. Determination of station set up and configuration is dictated by the individual Aquatic Preserves. Suggested methods include a

perforated PVC (or other plastic) tube attached to a piling or bridge abutment or a steel cage resting on the bottom. Probes must be between 0.25 to 0.50 meters above the substrate. YSI-recommended tube design is available on [SharePoint](#) along with other AP configurations.

Sampling procedures

Standardized instrument handling, maintenance, calibration, deployment, and post-deployment procedures are outlined in the NOAA [NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v2.1](#) regarding the collection of data using YSI/Xylem EXO Multi-Parameter Water Quality datasondes. Procedure for historically used YSI 6-Series datasondes can be found in the [YSI 6-Series Multi-Parameter Water Quality Monitoring Standard Operating Procedure Ver4.6](#), but use of these instruments was discontinued for all AP stations starting in 2022. The NERRS SWMP SOP should be used in conjunction with the Xylem/YSI datasonde user manual.

Water quality data are collected from stations within or adjacent to an aquatic preserve and are reported at 15-minute intervals. Mandatory field readings are water temperature (°C), specific conductivity (mS/cm), salinity (ppt), dissolved oxygen % saturation and concentration (mg/L), turbidity (NTU/FNU), pH, and depth (m).

Initial calibration verification and continuing calibrations for the following analytes: specific conductance ([FT 1200](#)) and pH ([FT 1100](#)) are conducted following DEP SOPs. Dissolved oxygen (mg/L) calibration is verified using the Solubility of Oxygen in Water at Atmospheric Pressure Table ([Table FT 1500-1](#)).

Collection frequency

Near-continuous water quality data are collected year-round at 15-minute intervals, historically 30-minute intervals, from stations within or adjacent to Aquatic Preserves. Maximum deployment time for EXO datasondes is 30 days before they must be replaced with calibrated and verified datasondes.

9. Equipment and Instruments

Equipment used is standardized and programs can only use Xylem/YSI EXO datasondes. Sampling equipment are consistent with the SOPs below:

Introduction for EXO datasondes

[NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v1.2](#)

[NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v2.0](#)

Data Collection Equipment and Software

Xylem/YSI EXO Multi-Parameter Water Quality datasondes

- Conductivity and Temperature sensor (wiped) (#599827)
- Conductivity and Temperature Digital Smart Sensor (non-wiped) (#599870)
- Dissolved Oxygen Probe (#599100-01)
- pH Digital Smart Sensor unguarded (#577602)
- Turbidity Probe (#599101-01)
- Total Algae (Chlorophyll) Probe (#599102-01)

- Smart Total Algae Sensor (Chlorophyll & BGA PE) (#599103-01)
- Smart FDOM (CDOM) Sensor (#599104-01)
- Central wiper (#599090-01)

Barometric Pressure Sensor

YSI Handheld instrument (Professional (Pro) Series) and probes

NIST-Traceable digital thermometer (accurate to 0.1°C)

NERRQAQC macro

KorEXO software (v2.3.10.0) & KorDSS Software (v1.7.4.0) or KOR (v1.1.8.0) only

Additional supplies: Wet white towel, cooler, cleaning materials, camera, tools and lock

Calibration and Standards

Datasonde sensors are calibrated by the AP water quality technicians or managers in the AP field office before each deployment. The temperature thermistor is confirmed using a NIST- certified temperature probe prior to calibration (*accuracy of thermometer must be comparable to accuracy of sensor*). A one-point calibration is used for specific conductivity (50.00 mS/cm standard solution), a two-point calibration for pH (7.00, 10.00 and/or 4.00 buffer solution), and a two-point calibration for turbidity (0 FNU DI water & YSI 124 FNU standard). Dissolved oxygen (DO) is calibrated in air-saturated water, using a bucket and an aerator. The percent saturation value is determined by using the current barometric pressure to convert to the adjusted value and entered into KorEXO or Kor software. Depth is also calibrated by using the current barometric pressure to determine the depth offset value and is entered into KorEXO (See [NERR SWMP EXO SOP](#), Appendix B). Sensors are verified by ensuring that the sensor diagnostics are within range immediately after calibration and an initial calibration verifications (ICVs) are performed on the specific conductivity, pH, dissolved oxygen, and turbidity sensors following DEP SOPs.

Information pertaining to lot numbers and manufacturer name and date of standards of buffers used in calibration procedures are documented in the KorEXO software and saved in a digital calibration sheet for each probe. Expiration dates of standards and buffers are required to be entered in the APWQ standard calibration log but can also be logged next to the Lot Number in the Kor Digital Calibration sheet, if desired. Digital Calibration sheets are required to be submitted to the [APWQ SharePoint](#) document tracking library (Submit a QAQC file) . They can be retrieved locally at the following location:

- Original Lab view KorEXO: This PC\Windows(C:)\Program Files (X86)\KOR-EXO\Data Files
- KorEXO 2.3.10.0 (latest version): This PC\Windows(C:)\Users\Username\Documents\YSI\EXO Exports\Archive
- For more information on how to export digital calibration sheets for multiple sensors, please visit the [KorEXO calibration log help file](#) on SharePoint

Approximately once a month, the deployed datasondes are removed from the water and returned to the AP's field lab for post-deployment continuing calibration verification (CCV), data retrieval, cleaning, and conducting any necessary maintenance or repairs. Newly calibrated datasondes are deployed at the time of retrieval during a 15-minute interval to maintain near-continuous readings.

For step-by-step SWMP calibration methods consult the [NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v1.2](#), [NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v2.0](#), and DEP SOPS ([FT 1100](#), [FT 1200](#), [Table FT 1500-1](#)).

Please consult the Quick Reference Guides for additional information:

- [Quick Reference EXO Calibration Checklist](#)
- [Quick Reference EXO Post-Deployment Checklist](#)
- [Quick Reference EXO KOR V2 Calibration Checklist](#)
- [Quick Reference EXO KOR V2 Post-Deployment Checklist](#)

Equipment Maintenance and Documentation

Datasonde cleaning and maintenance takes place in accordance with the methods outlined in the [NOAA NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP](#), or the [EXO User Manual](#) after each deployment. Instrument and probe maintenance occur once the sensors have been properly cleaned and is based on manufacturer recommendations, technician observations, sensor QC score, and data review.

Documentation of maintenance and repairs is required per DEP SOP FT 1000. Maintenance receipts should be kept in-house and a maintenance and repair log should be uploaded to the APWQ SharePoint tracking library where it should be updated as needed. For a template including the minimum requirements for maintenance documentation, download the [APCWQ MaintenanceLog](#) from the APWQ SharePoint site.

Please consult the following documents for additional maintenance information:

- [10 Tips to Prevent Biofouling on Water Quality Instruments](#)
- [Preventative Maintenance \(Maintaining EXO Sonde & Sensor Wetmate Connector\)](#)

10. Review and Assessment

Quality Control Measures

“Quality control” is defined as the overall system of technical activities that measures the attributes and performance of a process, product or service against defined standards to verify that they meet the established data quality objectives. AP staff use several quality control measures to ensure that high-quality data are being collected. Quality control samples assess the accuracy and precision of sampling and analytical techniques.

Field Quality Control

Sampling personnel are required to take discrete sample measurements in the field during instrument deployments. Calibrated and verified YSI EXO1, EXO2, EXO3, or YSI Handheld instruments (Professional (Pro) Series) may be used to collect discrete samples. Data collected during discrete sampling is then compared to the datasonde readings after deployment to verify the datasondes are properly calibrated and collecting accurate data. Required discrete samples are listed on the APCWQ Calibration & Field Log and include Depth (m), Temp (°C), DO%, DO mg/L, Salinity (psu), and pH.

At the end of each sampling period, datasondes are retrieved from the field, wrapped in a wet, white towel and placed in a cooler for transport. Once returned to the AP office, it is

recommended that post-deployment procedures do not begin until there are at least 2-hours of post-deployment data collected after retrieval. The retrieval data can be used to help verify that the datasonde was collecting accurate data.

Lab Quality Control

Expiration dates of standards and buffers used for calibrating datasondes are recorded on the front of each standard/buffer container as well as the APCWQ Calibration & Field Log. They can also be added to the same line as the lot number or to the notes section for each sensor in KorEXO, which will be automatically recorded on each calibration log generated in KOR. Expired standards/buffers are not to be used. Lot numbers are also included in the calibration log and should be entered into KorEXO software.

Quality Control Criteria

The AP data undergo a three-step (primary, secondary, and tertiary) QAQC process as outlined in the [NERRS CDMO Data Management Manual Version 6.6](#) and discussed in section 11, Data Review. This section details the specific quality control criteria pertinent to the data collection and review process.

Datasonde Probe Verification Acceptance Criteria

The EXO datasondes have a built-in smart sensor technology called SmartQC, a mechanism to normalize different sensors and to assess the current state of individual sensor performance relative to factory-defined performance parameters. Every EXO sensor has an embedded microprocessor which, along with calibration metadata, enables the EXO to warn users of calibration errors or when a sensor is unable to be calibrated due to age, fouling, or damage. For any sensor, a QC Score is presented as red, yellow, or green. A green SmartQC score means the sensor is calibrated properly and all parameters used to assess its performance state are within factory-defined limits. A yellow SmartQC score means that the sensor will still perform within factory-defined limits, but that during calibration, enough of an adjustment was required to suggest that the sensor is drifting from those limits or may soon require some adjustments. Technicians may use a sensor that has a green or yellow SmartQC score. However, it is not recommended to use a sensor with a yellow SmartQC score for long-term deployment. A red Smart QC score means that the sensor is not performing within factory-specified limits and must be addressed or replaced prior to deployment. For more information regarding the SmartQC technology please see the [Smart QC Handbook](#) and the [EXO User Manual](#), page 83.

Calibration Verification Acceptance Criteria

It is required to calibrate the datasonde sensors prior to each deployment. Immediately following calibration, an initial calibration verification (ICV) is performed to ensure that the sensor is reading accurately in a known standard. If the sensor reading falls outside of the acceptance criteria found in Table 3, then staff should recalibrate the sensor. If the sensor falls outside of the acceptance criteria after recalibrating, it is required to replace the sensor or begin the calibration process again. In addition to the ICV, a quantitative bracket is performed to verify that the samples are reading accurately in two known standards. The standards used for the quantitative bracket can be higher or lower than the standard used at calibration but should cover the range of measurements that you would expect to see when the datasonde is deployed in the field.

AP staff are required to perform post-deployment sensor verifications or continuing calibration verification (CCV) within 24 hours of retrieving the datasonde. These verifications draw attention to mechanical drift of the sensors during deployment or the effects of biofouling. This process is critical not only for data QAQC, but also for data users to know if the data were affected by biofouling, wear and tear, or other issues. It is also recommended that staff take pictures of the datasonde, datasonde guard, and probes at retrieval to help with identifying any issues related to biofouling or sensor malfunctions.

Sensors are to be verified by placing the sensor in a known standard and taking readings while the datasonde is in discrete mode. Sensors are to be verified post-deployment using the standards listed in Table 2. If the sensor does not meet the acceptance criteria listed in Table 3 during post-deployment verifications, the data are flagged and coded as suspect or are rejected. If the sensor does not meet the acceptance criteria because of a sensor malfunction the data may be flagged during the automated primary QAQC process. All data are reviewed by trained staff and the flags and codes are applied to the data and/or addressed during the secondary QAQC process.

Table 2: Calibration Verification Standards

Parameter	Calibration (SWMP)	Initial Calibration Verification (DEP)	Post-Deployment Verification (SWMP) or CCV (DEP)
Turbidity	2-Point Calibration: 0.0 in DI water 124 FNU standard	124 FNU Standard*	2-Point Check: 0.0 in DI water 124 FNU standard
pH	2-Point Calibration: 7 standard 10 standard	10 or 4 standard*	2-Point Check: 7 standard 10 standard
Specific Conductance	1-Point Calibration: 50 mS/cm standard	20 mS/cm standard*	1-Point Check: 50 mS/cm standard

**Recommended (other standards can be used that ensure proper bracketing of samples)*

Table 3: YSI Sensor Specifications for EXO Datasondes pertaining to the APWQ Program

Parameter	EXO Datasonde Sensor Specifications
Temperature	-5 to 35°C temperature range: difference between NIST and probe must be within $\pm 0.01^{\circ}\text{C}$ + NIST accuracy Wiped Sensor: within $\pm 0.2^{\circ}\text{C}$ + NIST accuracy <i>Note: The accuracy of the NIST device must be included in your temperature accuracy determination. NIST device must be as accurate as your probe ($\pm 0.1^{\circ}\text{C}$).</i>
Specific Conductance	Non-wiped sensor 0 to 100 $\mu\text{S}/\text{cm}$ standard: $\pm 0.5\%$ of the standard value Non-wiped sensor 100 to 200 $\mu\text{S}/\text{cm}$ standard: $\pm 1\%$ of standard value Wiped Sensor: $\pm 1\%$ of the standard value
pH	± 0.1 units within $\pm 10^{\circ}\text{C}$ of calibration temperature
Turbidity	0 to 999 FNU standard: 0.3 FNU or $\pm 2\%$ of reading (whichever is greater)
Dissolved Oxygen	Optical sensor 0-200% air sat: $\pm 1\%$ of reading or 1% of air saturation, whichever is greater 0-20 mg/L: ± 0.1 mg/L or 1% of the reading, whichever is greater

11. Data Review

A summary of the data review process and AP responsibilities can be found in the [Data Management Responsibilities](#) document.

Primary QAQC

Raw Data Entry

Discrete sampling values collected in the field are recorded in a field notebook or in the calibration & field log. After each deployment, data are downloaded from the datasonde onto a DEP-issued computer using the KorEXO or Kor software. Raw files are then exported in a .CSV as well as .BIN file format. Both raw files should be completely unaltered. If a unit conversion is required, re-export the data from KOR in the correct units. Any data corrections, for example, depth offsets or timestamp adjustments due to daylight savings time, must be performed only during secondary QAQC and must be properly documented in the flagging and coding, as well as in the metadata.

Values recorded during post-deployment verifications are written in the “Post-Deployment” section of the Calibration & Field log. It is required that a technician updates the Calibration & Field log for every instrument deployment. All calibration logs for a station and year should be kept in one Calibration & Field log with tabs at the bottom for each new deployment. The logs are completed and submitted to the [AP Water Quality SharePoint](#) document tracking library and updated from this location during and after each deployment. For information on how to submit files and update submitted files, visit the [Document Library Help File](#). To gain access to this folder please contact the AP Data Manager. The APs must also submit completely unaltered raw data files in the .CSV and .BIN file format to the document tracking library two weeks after retrieval. For information on how to retrieve .BIN files, visit the [KorEXO Calibration Log Help file](#).

Raw Data Validation

Raw data are reviewed by AP staff and the AP Data Manager. AP staff may use the datasonde software to view and visually check the data file and ensure that data were collected for each parameter while the instrument was deployed in the field. Staff also use the datasonde software to note any obvious errors or problems that occurred during the deployment. Staff can create graphs for each deployment to help identify errors, problems, or anomalies. Any notes pertaining to the graphs are useful during data reviews and should be documented in the metadata.

Limited Data Entry

The AP Data Manager (or approved AP staff) downloads the raw data file from the SharePoint document library onto their desktop or another location and then removes pre- and post- deployment readings, saving the file in this location with an _L at the end. Next, they upload the limited file to the document library as a new file with the limited file type. The AP Data Manager (or approved AP staff) then uploads the limited data file to the Centralized Data Management Office’s (CDMO) [Non-SWMP Data Upload Service](#) for primary QAQC.

The primary QAQC process performed by the CDMO's Non-SWMP Data Upload Service involves inserting flag columns into the data files for each water quality parameter, creating a flag record column, and creating an automated process that applies standardized flags to data if the values are outside of YSI sensor specifications. The resulting Primary QAQC file is emailed to the chosen recipients.

Limited Data Validation

The AP Data Manager reviews the Primary QAQC files and notifies the AP staff if any errors are detected. The AP Data Manager uploads the finalized file to the SharePoint document library. This file is referred to as a provisional data file.

The AP staff inspects deployment files for malfunctions, suspect and/or anomalous data and makes notes. The Data Manager or AP staff use the primary QAQC data files to create quarterly files by appending the primary files associated with that quarter together, cumulatively. Quarterly files are saved in the SharePoint document tracking library. AP staff then create a quarterly metadata report using the AP metadata template that can be found on the [metadata folder](#) on the AP Water Quality SharePoint site. The metadata should then be uploaded to the SharePoint document tracking library on the specified due dates.

Secondary QAQC

AP staff analyze the primary QAQC data files for malfunctions, suspect, and/or anomalous data and make notes in their quarterly metadata report. All Calibration & Field logs, metadata, and graphs of the data are used to verify the data.

Quarterly, AP staff evaluate data for validity based on weather data, field observations, QC checks, graphs and instrument diagnostics. Data are rejected if the anomalies are attributed to sensor malfunctions, excessive fouling, drift, or other issues. In addition to observations of any physical damage (e.g., compromised DO probe membrane), sensor malfunctions are detected if the reading of the probe is outside the range established for the sensor or if the post-deployment readings were out of range. AP staff make note of these instances in the metadata report. The information collected during the quarterly review is detailed on the quarterly metadata report and saved in the document tracking library.

The AP Data Manager or approved APs (Biscayne Bay APs, Estero Bay AP, Florida Keys APs, Northeast APs, and Tomoka Marsh AP) are required to review the quarterly and annual data files and apply standardized [QC flags and codes](#) by loading an annual or quarterly file into the [CDMO QAQC Macro](#). Determination of what data should be flagged is based off each AP's Calibration & Field Log checks, metadata, and graphs of the data. The AP Data manager or approved APs are responsible for reviewing and applying the standardized QC flags and codes to their data using the Macro. Using the macro, individual flags and codes are applied to the flag columns associated with each parameter, which inserted during automated primary QAQC. Using the Macro provides further reliability of the data as well as automated assistance in flagging out of range values, rounding values to the accuracy of the sensors, and truncating values to the specification of the database. Anomalies or data file mix-ups must be documented thoroughly in the metadata and Calibration & Field log as soon as the error has occurred. Failure to provide evidence of such an event may result in rejected deployments or data. The Data

Manager may prevent data upload to the AP Data Portal if the data or QAQC do not meet program standards (see Appendix B).

QC Flags

QC flags applied during the primary QAQC process are replaced with either rejected flags (if anomalies are attributed to sensor malfunctions or data checks fail post-deployment) or with suspect flags (for all other anomalous data). All rejected, suspect, and missing data are retained within the dataset and flagged appropriately. Each parameter column in a data file exported from the AP Data Portal is accompanied by a flag column. Below is a list of available QC flags and their descriptions.

- -5 Outside high sensor range
- -4 Outside low sensor range
- -3 Data rejected due to QAQC
- -2 Missing data
- -1 Optional parameter not collected
- 0 Passed initial QAQC checks
- 1 Suspect data
- 2 Reserved for future use
- 3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure
- 4 Historical: Pre-auto QAQC
- 5 Corrected data

QC Codes

QC codes are used in conjunction with the QC flags to provide additional documentation of the data. General error codes are used to document general problems with the deployment or datasonde; sensor error codes are used to document sensor errors; comment codes are used to further document conditions or problems with the data; and select comment codes are applied to the entire record using the flag record column. Only one flag, one error code (general or sensor), and one comment code can be applied to a data point, when applicable. Data that passed initial QC checks are flagged as good data and are not required to contain codes. Below is a list of available QC codes and their descriptions.

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 QAQC checks
- GSM See metadata

Corrected Depth/Level Data Codes

- GCC Calculated with data that were corrected during QAQC
- 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

*Indicates comments that can be applied to an entire record in the F_Record column.

For more information about the flags and codes process, please see the links below:

[NOAA CDMO NERR SWMP Data Management Manual](#)
https://www.floridaapdata.org/about_data_qaqc.php

Yearly, the quarterly data files are merged into annual files by the AP Data Manager or approved APs and uploaded to the SharePoint document library. The AP staff are notified that the annual files are ready for review. AP staff review the annual file for malfunctions, suspect, and/or anomalous data and make additional notes in the metadata report, if necessary. AP staff save the final yearly metadata report and data files to the SharePoint document library.

The AP Data Manager reviews the annual data files, metadata report, calibration logs, and post-deployment verifications and updates the dataset and/or metadata report, if necessary.

Database Management

After the flags and codes have been appropriately applied, the AP Data Manager uploads the file to the AP Data Portal, which automatically populates the Historical and ProvisionalPlus columns as follows:

Historical: 0 = indicates that the data have not been through tertiary review, 1 = data have been authenticated and completed the tertiary review

ProvisionalPlus: 0 = provisional data (completed primary QAQC), 1 = data have been through secondary QAQC by AP (provisional plus QAQC)

Quarterly data files and metadata reports then get uploaded as provisional plus data in the AP Data Portal (www.FloridaAPdata.org).

Annual data files and metadata reports then get uploaded as provisional plus data in the AP Data Portal (www.FloridaAPdata.org) and overwrite the quarterly data files and metadata reports.

The AP Data Manager updates AP Data Portal quarterly, annually, and upon request if AP makes any changes to data files or metadata reports.

Tertiary QAQC

A third and final step of QAQC, tertiary QAQC, is conducted by the AP Data Manager.

The AP Data Manager reviews annual data file, metadata report, calibration logs, and post-deployment checks. The AP Data Manager creates a Data Review Questions and Comments

document with suggested edits and notes if all required accompanying documents have been submitted. The AP Data Manager emails the document to AP staff and saves correspondence and files in the SharePoint document tracking library.

The AP Data Manager conducts a tertiary review meeting with AP staff and makes corrections to the data and/or metadata, if needed. AP Data Manager finalizes data and metadata. After tertiary review is complete and metadata is finalized, AP Data Manager uploads data to the AP Data Portal as authenticated data overwriting previous versions. The authenticated metadata document is also created by removing the provisional statement at the top of the report as well as removing “.prov” from the file name.

Corrective Actions

- *Results of Audits*
Individual team leads or AP staff may elect to perform audits as needed.
- *Feedback from Data Users*
Users and AP staff are encouraged to review the data on the AP Data Portal and submit any feedback to the program.

Database Management

The University of South Carolina’s CDMO maintains the FloridaAPdata.org database and data portal under contract with the Department. Data files (.CSV) are imported into the database by the AP Data Manager using an automated web service. Metadata files are manually uploaded by CDMO at the request of the AP Data Manager. The database is occasionally query optimized (mainly useful after several large record imports by using the VACUUM ANALYZE and REINDEX commands) and backup is performed periodically.

12. Consumer Relations

All data and metadata are available on the AP Data Portal (www.FloridaAPdata.org). Users should contact Cheryl.P.Clark@floridadep.gov or Samantha.Howe@floridadep.gov if they have questions regarding the data or the QAQC process.

Appendix A

Manuals

- i. *Introduction for EXO datasondes*
- ii. *NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v2.1*
- iii. *NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v1.2*
- iv. *NERRS SWMP YSI/Xylem EXO Multi-Parameter Water Quality Monitoring SOP v2.0*
- v. *Introduction for 6-series datasondes*
- vi. *YSI 6-Series Multi-Parameter Water Quality Monitoring SOP v4.6*

Datasonde Maintenance

- i. *EXO User Manual*
- ii. *10 Tips to Prevent Biofouling on Water Quality Instruments*
- iii. *Preventative Maintenance (Maintaining EXO Sonde & Sensor Wetmate Connector)*

Data Management

- i. *NERRS SWMP Water Quality Calibration Log*
- ii. *Continuous WQ Field Log*
- iii. *Sensor inventory tracking spreadsheet*

Continuous Water Quality Training Tutorials and Materials

AP Continuous Water Quality Technician Training Workshop (TTW)

- i. *TTW 2020 training and presentation recordings*

SWMP Technician Training Workshop (TTW)

- i. *TTW 2019 training and presentation recordings*
 - 1) Mike Mensinger, WQ Data Collection Basics
 - 2) Curt Butler, YSI WQ Training Part 1
 - 3) Curt Butler, YSI WQ Training Part 2
 - 4) Mike Mensinger and Curt Butler, WQ Problem Data
 - 5) Chris Peter – New Technology for Old Problems
 - 6) Benjamin Ganon – EXO and ISCO Pairing to Sample Remotely
 - 7) Melissa Ide, SWMP Data Management Updates
- ii. *TTW 2020 training and presentation recordings*
 - 1) Day 1 (12/02/2020)
 - 2) Day 2 (12/04/2020)

Associated documentation

- i. *2019 TTW WQ SWMP Data Collection Basics Outline v1.0*
- ii. *2019 TTW WQ Problem Data Session Outline v1.0*

iii. *2019 TTW WQ Beginner Data Management Training for WQ Outline v1.0*

Appendix B

Program Requirements

In order to participate in this program and have data uploaded to the AP Data Portal, a program must submit the following items within the time periods specified in section 5, Documentation:

- i. *Raw, unaltered .CSV files that include the required parameters in the correct units*
- ii. *Raw .DAT or .BIN data files*
- iii. *Metadata for the station and time period of data submission*
- iv. *Station name and code, AP designation, coordinates, and station description*
- v. *Calibration logs for time period of data submission*
- vi. *Kor digital calibration logs*
- vii. *Staff training records of staff training*
- viii. *Equipment maintenance records*

Appendix C

Summary of Quality Plan Revisions

- i. *Organization and Responsibilities*
 - a. *Table 1 – six new monitoring stations*
 - b. *Key Personnel – six new staff members*
- ii. *Documentation*
 - a. *Creation of 2022 APCWQ Standard Calibration Log*
 - b. *Creation of APCWQ Maintenance Tracking Log and specified requirements*
 - c. *Creation of SharePoint Document Tracking Library*
 - d. *Documentation storage location update to SharePoint and added links throughout the document*
 - e. *EXO KOR v2 Quick Reference Calibration Guide updated*
 - f. *NERR SWMP SOP v2.1 added*
 - g. *Literature & Reports – four added*
- iii. *Data Identification and Data Integrity*
 - a. *Nomenclature updates to Raw .CSV files, primary QAQC data files, quarterly secondary QAQC files, and metadata reports*
 - b. *Addition of nomenclature requirements for Raw .BIN files, Limited data files, annual secondary QAQC files, calibration logs, Kor digital logs, and maintenance logs*
- iv. *Capabilities*
 - a. *Discontinued program-wide use of 6-series datasondes*
 - b. *Added parameter requirements*
- v. *Equipment and Instruments*

- a. Included accuracy requirement of NIST thermometer*
 - b. Added KOR software updates*
 - c. Updated requirements for location of standard/buffer exp dates*
 - d. Created 'help file' for how to export Kor digital logs*
- vi. Review and Assessment*
 - a. Added discrete sample requirements*
 - b. Updated Table 3 to include procedure on NIST device accuracy requirement and revised DO sensor specifications; removed YSI specifications not pertaining to our program*
- vii. Data Review*
 - a. Data Management Responsibilities document updated*
 - b. Removed monthly files requirement*
 - c. Updated Secondary QAQC language to specify the requirement for program standards to be met in order for data to be uploaded*
- viii. Added Appendix B: specific program requirements*
- ix. Added Appendix C: summary of Quality Plan revisions*