Rookery Bay (RKB) National Estuarine Research Reserve (NERR) Nutrient Metadata
(January 2019 – December 2019)
Latest Update: May 28th, 2020

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the CDMO (cdmosupport@belle.baruch.sc.edu) or Reserve with any additional questions.

I. Data Set and Research Descriptors

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2) Research Objectives

The four primary System Wide Monitoring Program (SWMP) stations and a secondary SWMP station are located in estuaries affected by watersheds demonstrating different patterns of land-use. Their placement addresses priority resource management issues that are identified in the Reserve's management plan. Specifically, the data from these stations provide valuable information concerning the effects of land-use activities on the quantity, quality, and timing of freshwater inflow into the reserve. Each bay studied exhibits a pattern of altered freshwater inflow.

a) Monthly Grab Sampling Program – The principal objective of the monthly grab sampling is to determine spatial and temporal differences in water quality between sites representing different land-use patterns.

b) Diel Sampling Program – The principal objective of the diel sampling is to quantify temporal variability over a lunar tidal cycle and to determine the impact of tidal water exchange within Henderson Creek (a source of freshwater into the Rookery Bay proper waterbody).

3) Research Methods

a) Monthly Grab Sampling Program

Monthly grab samples were collected at all four primary SWMP water quality stations: Henderson Creek, Middle Blackwater River, Faka Union Bay, and Fakahatchee Bay. Beginning in October 2012, grab samples were also collected at Pumpkin Bay which was designated a Secondary SWMP Station by the CDMO in October of 2016. Duplicate grab samples were taken every month at each of the water quality stations following the National Estuarine Research Reserve System Nutrient and Chlorophyll Monitoring Program and Database Design SOP v1.8. Slack low tide was generally not considered for the grab sampling events due to the travel time between sites and the time constraints with the contracted laboratory. Rainfall conditions prior to grab sampling were generally not considered due to constraints with the contracted laboratory.

Sample bottles were pre-cleaned by the contracted laboratory following their Quality Assurance Management Plan (available by request). The bottle kits for each station were labeled with a unique sample identification number and chain of custody sheets were completed for tracking the samples during laboratory analysis and in the laboratory database. Tubing for the water sampling device (peristaltic pump), carboys (for deionized water), and filter holders were pre-cleaned using a Florida Department of Environmental Protection (FLDEP) decontamination procedure (FLDEP SOP FC1000/DEP-QAA-01/001) which involved: cleaning with phosphate-free soap, rinsing three times with tap water, soaking from 4 - 24 hours in a 10% hydrochloric acid bath, rinsing three times with deionized water, and drying for 24 hours. One to two days prior to field sampling, the filter holders were assembled with in-line filters (0.7 µm glass microfiber filters and 0.45 µm membrane filters).

At each water quality station, grab samples for dissolved nutrients were collected 0.5 meter below the surface (near surface grab) using a peristaltic pump. A filter holder attached to the peristaltic pump tubing was used to filter for dissolved nutrients in the field. Nitrile gloves were worn through the entire process of sample collection and filtering. Unfiltered parameters included chlorophyll *a*, phaeophytin *a*, total phosphorous (TP), total Kjeldahl nitrogen (TKN), and total suspended solids (TSS). Filtered parameters included ammonium (NH4), nitrite + nitrate (NO2NO3), nitrite (NO2), and orthophosphate (PO4). Chlorophyll *a/* phaeophytin *a* and TSS sample bottles were rinsed three times with the sample water then filled to the shoulder, capped and immediately stored in a cooler with ice. The nitrite/ orthophosphate bottle was rinsed three times with filtered water and then filled with the filtrate, capped, and immediately stored in a cooler with ice. The sample bottles for ammonia, nitrite + nitrate, total Kjeldhal nitrogen, and total phosphorus contained sulfuric acid for preservation and therefore were not rinsed before adding the samples. All sample bottles were made of translucent high-density polyethylene (HDPE) with the exception of the chlorophyll *a*/ phaeophytin *a* bottle which was an opaque amber HDPE bottle. To avoid cross contamination, the peristaltic pump tubing was rinsed thoroughly with deionized water after each sampling and then rinsed thoroughly with sample water before sampling at each new station. New gloves and filters were used at each site. Additionally, an equipment blank using deionized water was performed at the end of each sampling event following all the same procedures. Samples were shipped overnight to the FLDEP lab in Tallahassee, FL.

Starting in January 2018, additional Chlorophyll *a* grab samples were collected at each site, using the same collection methods, in a different opaque amber HDPE bottles to compare the fluorometric and spectrophotometer method of analysis. The FLDEP lab reported the results for comparison purposes and the fluorometric data are available by request.

At each site physical/chemical water quality parameters were measured at the same depth as the nutrient samples were collected. A YSI EXO1 datasonde with hand held display were used to record the measurements. Recorded parameters included salinity (ppt), specific conductivity (mS/cm), temperature (°C), dissolved oxygen (% and mg/L), pH, and turbidity (NTU). Equipment calibration was done according to FLDEP SOP 001/01.

b) Diel Sampling Program

Monthly diel samples were collected at the depth of the water quality datasonde (0.25 meters above the bottom) every 2.5 hours over a lunar day (24hr:48 min) using an ISCO refrigerated auto-sampler (model 6712FR). The sampler was stationed at the Rookery Bay dock, approximately 100 meters from the water quality station. Prior to sampling, the polyethylene bottles used in the auto-sampler were washed following the same FLDEP decontamination procedure as described above in the grab sampling methods. A day before the sampling was to begin, the ISCO auto-sampler was set up and programmed. The siphon hose was rinsed with 900 ml ambient water prior to programming the auto-sampler. Sample bottles for the laboratory analysis were pre-cleaned by the contracted laboratory following their Quality Assurance Management Plan (available by request). Bottle kits for each sample interval (11) were labeled with a unique sample identification number and chain of custody sheets were completed for tracking the samples during laboratory analysis and in the laboratory database.

Sample filtration: Nitrile gloves were worn during sample processing. At Rookery Bay's laboratory, each polyethylene bottle containing 1000 ml of sample water was shaken to homogenize the sample. A peristaltic pump with a filter holder attached to the sampling tube was used to filter for dissolved nutrients. For dissolved phosphorus and nitrite, HDPE sample bottles were filled with the filtrate, capped, and immediately stored in a cooler with ice. For ammonium and nitrite + nitrate, the HDPE sample bottles contained sulfuric acid for preservation and therefore were not rinsed before adding the filtrate, capped, and immediately stored in a cooler with ice. New filters were used for each sample. For the chlorophyll *a* samples, HDPE amber sample bottles were filled with at least 500 ml of unfiltered sample, capped, and immediately stored in a cooler with ice. Samples were shipped overnight to the FLDEP lab in Tallahassee, FL.

c) All Samples

Samples are placed on ice immediately after collection and kept on ice while shipped overnight to the to the FLDEP lab in Tallahassee, FL. Once at the lab, they are inventoried and placed in the appropriate refrigerator/freezer. Refrigerators range from 0 to 6.0˚C and freezers from -30.0 to -5.0˚C.

4) Site Location and character

<u>Lower Henderson Creek (rkblhwq):</u>

Lat/Long (Decimal Degrees): 26.02749 N, -81.73361 W

The Lower Henderson site is located at the mouth of Henderson Creek. The "Lower Henderson" labeling is to clarify the site from other historical water quality stations. The sonde is affixed to a piling (manatee caution sign) located right of center (while facing downstream) of the creek channel, approximately 100 meters from RKB NERR's boat dock. The monitoring site is approximately 5 km downstream of a four-lane highway (SR 951) that crosses Henderson Creek. The creek is 5.8 km long (mainstream linear dimension), has an average mid-channel depth of approximately 2 meters at MHW, and an average width of 239 meters. At the sampling site, the depth is 2 meters at MHW and the width is 600 meters. Tides at Lower Henderson Creek are mixed and range from 0.44 m to 1.91 m (average 1.25 m). Salinity at this site ranged from 10.9 to 38.4 ppt during the year. Creek bottom habitats are predominantly fine sand and there is no bottom vegetation. The dominant marsh vegetation near the sampling site is red mangrove. The dominant natural vegetation of the watershed is hydric pine and cypress.

Upland land use near the sampling site includes residential areas with septic systems. Watershed activities that potentially impact the site include non-point source pollution from road runoff, drift of mosquito control pesticides, runoff from upstream agricultural areas and leachate from nearby residential septic systems and a weir structure located at SR 41. The amount of water released from this weir can sometimes mask natural tidal salinity patterns. The historic Henderson Creek watershed was approximately 50% under State ownership and much of this protected area had intact cypress sloughs and other wetland vegetation. Canals and water use for agriculture and human consumption have altered the hydroperiod of this watershed. Consequently, the Henderson creek watershed may receive non-point source pollution runoff from a variety of sources.

<u>Middle Blackwater River (rkbmbwq):</u>

Lat/Long (Decimal Degrees): 25.9343 N, -81.5946 W

The Middle Blackwater sonde is located at the mouth of Blackwater river. The "Middle Blackwater" labeling is to clarify the site from other historical water quality stations. The sonde is affixed to navigational marker #17 within the river channel. The average depth at this marker is approximately 2 meters at MHW. The tidal range for Middle Blackwater River varies between 0.05 and 1.90 meters (average 0.99 m). Salinity at this site ranged from 5.2 to 39.7 ppt during the year. Salinities fluctuate with the tides and watershed rainfall. The substrate within the channel is a mixture of sand and silt with oyster shell with some organic matter mixed in. Mature red mangrove forests dominate the banks of the river.

Upstream influences consist of the Collier-Seminole State Park boat basin and upstream agricultural fields adjacent to Blackwater River's main feeder canal (SR 41 canal). Nonpoint source pollution from agricultural operations and golf courses may affect this site. In addition, canals and roads built during the 1960's (Picayune Strand, formerly Southern Golden Gate Estates) may have caused significant disruptions to overland sheet-flow reducing the amounts of freshwater flowing to this estuary. Despite these alterations, the salinity fluctuations of this site suggest that seasonal fluctuations in salinity are more closely correlated to watershed rainfall patterns than salinities of estuaries with water control structures, such as Henderson Creek.

Faka Union Bay (rkbfuwq):

Lat/Long (Decimal Degrees): 25.9005 N, -81.5159 W

The Faka Union sonde is located at the mouth of the Faka Union Canal in the Faka Union Bay. The sonde is affixed to a manatee speed zone sign next to the main channel. The average depth at this site is approximately 2 meters at MHW. The tidal range for Faka Union Bay varies between 0.05 and 1.72 meters (average 0.82 m). Salinity at this site ranged from 0.5 to 39.0 ppt during the year. Salinities fluctuate daily with tides, seasonal rainfall, and management of upstream water control structures. The substrate within the channel is a mixture of sand and silt with some organic matter. Mature red mangrove forests and spoil islands dominate the banks of the canal and bay.

Upstream influences consist of the Port of the Islands development and marina. The watershed consists of an elaborate canal system (Picayune Strand, formerly Southern Golden Gate Estates) which has altered natural water drainage patterns into Faka Union Bay.

Fakahatchee Bay (rkbfbwq):

Lat/Long (Decimal Degrees): 25.8922 N, -81.4770 W

The Fakahatchee Bay sonde is located at the mouth of two rivers, Fakahatchee River and East River. The sonde is placed in a 4" PVC housing secured to a 6" PVC pipe jetted into the substrate. The average depth at MHW is approximately 1.0 meter. The tide range for Fakahatchee varies between 0.05 and 1.78 meters (average 0.79 m). Salinity at this site ranged from 8.3 to 40.1 ppt during the year. Salinities fluctuate daily with the tides and seasonal rainfall. The substrate within the channel is a mixture of sand, silt and some organic matter. Mature red mangrove forests dominate the banks of the rivers and bay. An oyster bar is located adjacent to the site.

Upstream there are minimal influences from the Picayune Strand State Forest with non-point source pollutants possible from the culverts under I-75 and US 41. Fakahatchee Strand State Preserve and Big Cypress National Park manage the headwaters of Fakahatchee Bay. Fakahatchee Bay's watershed is considered to be the least altered.

Pumpkin Bay (rkbpbwq):

Lat/Long (Decimal Degrees): 25.9141 N, -81.5404 W

The site is located at the mouth of the Pumpkin River. The tide range for Pumpkin Bay varies between 0.00 and 1.64 meters (average 0.67 m). Salinity at this site ranged from 12.9 to 39.9 ppt during the year. The bottom habitat is predominantly fine sand and there is no bottom vegetation. Mature red mangrove forests dominate the Pumpkin River and the bay. Upland land use is minimal with the main influence US 41 and the Picayune Strand State Forest canal system, which has diverted freshwater. Typically, this site does not receive enough freshwater inflow.

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
FB	P	Fakahatchee Bay	25.8922 81.477	01/01/2002 00:00 - current	NA	NA
FU	P	Faka Union Bay	25.9005 81.5159	01/01/2002 00:00 – current	NA	NA
LH	P	Lower Henderson Creek	26.0257 81.7332	01/01/2001 00:00 – current	NA	NA
MB	P	Middle Blackwater River	25.9343 81.5946	01/01/2000 00:00 – current	NA	NA
PB	S	Pumpkin Bay	25.9141 81.5404	07/06/2016 00:00 – current	NA	NA

5) Coded variable definitions

rkblhnut **=** Rookery Bay Lower Henderson nutrients (monthly grabs and diel sampling)
rkbmbnut = Rookery Bay Middle Blackwater nutrients (monthly grabs)
rkbfunut = Rookery Bay Faka Union nutrients (monthly grabs)
rkbfbnut = Rookery Bay Fakahatchee Bay nutrients (monthly grabs)
rkbpbnut = Rookery Bay Pumpkin Bay nutrients (monthly grabs, Secondary SWMP station)

Monitoring Codes:
monthly grab sample program = 1
monthly diel sample program = 2

Replicate grab samples were denoted as 1 for the first sample and 2 for the second sample at each station in the "*Rep*" column. Since 1 diel sample was collected every 2.5 hrs., the replicate number was always denoted as 1 in the "*Rep*" column.

6) Data Collection Period

The System-Wide Monitoring Program nutrient sampling began in January 2002 at all the primary SWMP sampling stations. Sampling began in October 2012 at the Secondary SWMP station, rkbpbnut. For 2016, the data collection period was from January to December.

Monthly Grab Sampling

Station Code	Date Time Stamp (rep 1)	Date Time Stamp (rep 2)
rkblhnut	1/3/2019 8:47	1/3/2019 8:51
rkblhnut	2/14/2019 8:46	2/14/2019 8:48
rkblhnut	3/6/2019 8:39	3/6/2019 8:45
rkblhnut	4/3/2019 7:00	4/3/2019 7:05
rkblhnut	5/8/2019 12:05	5/8/2019 12:10
rkblhnut	6/5/2019 11:00	6/5/2019 11:05
rkblhnut	7/2/2019 6:35	7/2/2019 6:45
rkblhnut	8/6/2019 10:50	8/6/2019 10:55
rkblhnut	9/4/2019 11:22	9/4/2019 11:27
rkblhnut	10/2/2019 11:41	10/2/2019 11:46
rkblhnut	11/6/2019 8:20	11/6/2019 8:25
rkblhnut	12/4/2019 8:15	12/4/2019 8:20
rkbmbnut	1/3/2019 12:30	1/3/2019 12:33
rkbmbnut	2/14/2019 10:33	2/14/2019 10:38
rkbmbnut	3/6/2019 14:39	3/6/2019 14:46
rkbmbnut	4/3/2019 11:08	4/3/2019 11:14
rkbmbnut	5/8/2019 7:55	5/8/2019 8:02
rkbmbnut	6/5/2019 7:15	6/5/2019 7:20
rkbmbnut	7/2/2019 10:35	7/2/2019 10:45
rkbmbnut	8/6/2019 9:22	8/6/2019 9:27
rkbmbnut	9/4/2019 7:28	9/4/2019 7:32
rkbmbnut	10/2/2019 9:35	10/2/2019 9:40
rkbmbnut	11/6/2019 10:00	11/6/2019 10:05
rkbmbnut	12/4/2019 9:55	12/4/2019 10:00
rkbfunut	1/3/2019 11:20	1/3/2019 11:24
rkbfunut	2/14/2019 12:01	2/14/2019 12:06
rkbfunut	3/6/2019 11:20	3/6/2019 11:25
rkbfunut	4/3/2019 9:00	4/3/2019 9:09
rkbfunut	5/8/2019 9:10	5/8/2019 9:14
rkbfunut	6/5/2019 8:22	6/5/2019 8:27
rkbfunut	7/2/2019 9:23	7/2/2019 9:28
rkbfunut	8/6/2019 7:56	8/6/2019 8:01
rkbfunut	9/4/2019 8:38	9/4/2019 8:43
rkbfunut	10/2/2019 8:23	10/2/2019 8:27
rkbfunut	11/6/2019 11:15	11/6/2019 11:20

rkbfunut	12/4/2019 11:20	12/4/2019 11:25
rkbfbnut	1/3/2019 10:55	1/3/2019 10:59
rkbfbnut	2/14/2019 12:35	2/14/2019 12:40
rkbfbnut	3/6/2019 12:53	3/6/2019 12:58
rkbfbnut	4/3/2019 9:35	4/3/2019 9:40
rkbfbnut	5/8/2019 9:39	5/8/2019 9:44
rkbfbnut	6/5/2019 8:45	6/5/2019 8:50
rkbfbnut	7/2/2019 8:50	7/2/2019 8:58
rkbfbnut	8/6/2019 8:23	8/6/2019 8:28
rkbfbnut	9/4/2019 9:05	9/4/2019 9:11
rkbfbnut	10/2/2019 7:55	10/2/2019 8:00
rkbfbnut	11/6/2019 11:45	11/6/2019 11:50
rkbfbnut	12/4/2019 11:55	12/4/2019 12:00
rkbpbnut	1/3/2019 11:50	1/3/2019 11:54
rkbpbnut	2/14/2019 11:29	2/14/2019 11:34
rkbpbnut	3/6/2019 13:49	3/6/2019 13:55
rkbpbnut	4/3/2019 10:10	4/3/2019 10:16
rkbpbnut	5/8/2019 8:42	5/8/2019 8:47
rkbpbnut	6/5/2019 7:50	6/5/2019 7:55
rkbpbnut	7/2/2019 9:55	7/2/2019 10:00
rkbpbnut	8/6/2019 7:30	8/6/2019 7:35
rkbpbnut	9/4/2019 8:10	9/4/2019 8:15
rkbpbnut	10/2/2019 8:52	10/2/2019 8:57
rkbpbnut	11/6/2019 10:45	11/6/2019 10:50
rkbpbnut	12/4/2019 10:45	12/4/2019 10:50

Diel Sampling

Station Code	Date Time stamp (begin)	Date Time stamp (end)
rkblhnut	1/15/2019 3:00	1/16/2019 4:00
rkblhnut	2/20/2019 8:30	2/21/2019 9:30
rkblhnut	3/20/2019 7:30	3/21/2019 8:30
rkblhnut	4/9/2019 10:30	4/10/2019 11:30
rkblhnut	5/15/2019 6:00	5/16/2019 7:00
rkblhnut	6/26/2019 2:30	6/27/2019 3:30
rkblhnut	7/16/2019 7:00	7/17/2019 8:00
rkblhnut	8/14/2019 7:00	8/15/2019 8:00
rkblhnut	9/16/2019 9:00	9/11/2018 10:00
rkblhnut	10/15/2019 8:30	10/16/2019 9:30
rkblhnut	11/12/2019 7:30	11/13/2019 8:30
rkblhnut	12/10/2019 6:45	12/10/2019 7:45

7) Associated Researchers and Projects

As part of the SWMP, Rookery Bay NERR monitors 15-minute meteorological and water quality data which may be correlated with this nutrient/pigment dataset. The principal objective of these programs is to record long-term environmental data within Rookery Bay NERR in order to observe any changes or trends over time. The five water quality sites were also selected to represent various degrees of watershed hydrologic alteration. Both water quality and meteorological data are available at www.nerrsdata.org.

The nutrient data generated by Rookery Bay NERR are being used to analyze restoration targets established for the Picayune Strand Restoration Project (PSRP; formerly known as Southern Golden Gate Estates) which is a portion of the Comprehensive Everglades Restoration Plan (CERP). Additional datasets used in this analysis include a long-term fisheries survey (July 1998 to June 2013, October 2015 to the present), a shark demographics survey (May 2000 to the present), and an oyster reef/benthic crab survey (1999 to 2008). Florida DEP used the nutrient data to develop numeric nutrient criteria for the southwest region of Florida, which were approved by the Environmental Protection Agency.

8) Distribution

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR 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. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

Requested citation format:
NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; *accessed* 12 October 2019.

NERR nutrient data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page www.nerrsdata.org. Data are available in comma separated version format.

II. Physical Structure Descriptors

9) Entry Verification

The analytical results (electronic files) were provided monthly from the contracted laboratory to Julie Drevenkar, SWMP Manager. Upon receiving the results, the SWMP Manager reviewed the data for errors. The SWMP Manager was responsible for compilation and QA/QC of the final data set according to chapter 10 of the Centralized Data Management Office (CDMO) NERR SWMP Data

Management Manual v 6.6. The data reported from the lab were in the required units making it unnecessary to convert the data prior to entering it into Microsoft Excel.

Nutrient data are entered into a Microsoft Excel worksheet and processed using the NutrientQAQC Excel macro. The NutrientQAQC macro sets up the data worksheet, metadata worksheets, and MDL worksheet; adds chosen parameters and facilitates data entry; allows the user to set the number of significant figures to be reported for each parameter and rounds using banker's rounding rules; allows the user to input MDL values and then automatically flags/codes measured values below MDL and inserts the MDL; calculates parameters chosen by the user and automatically flags/codes for component values below MDL, negative calculated values, and missing data; allows the user to apply QAQC flags and codes to the data; produces summary statistics; graphs selected parameters for review; and exports the resulting data file to the CDMO for tertiary QAQC and assimilation into the CDMO's authoritative online database.

10) Parameter Titles and Variable Names by Category

Required NOAA/NERRS System-wide Monitoring Program water quality parameters are denoted by an asterisk "*".

Data Category	Parameter	Variable Name	Units of Measure
Phosphorus and Nitrogen:			
	*Orthophosphate, Filtered	PO4F	mg/L as P
	Total Phosphorus	TP	mg/L as P
	*Ammonium, Filtered	NH4F	mg/L as N
	*Nitrite, Filtered	NO2F	mg/L as N
	*Nitrate, Filtered	NO3F	mg/L as N
	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N
	Dissolved Inorganic Nitrogen	DIN	mg/L as N
	Total Kjeldahl Nitrogen	TKN	mg/L as N
	Total Organic Nitrogen	TON	mg/L as N
Chemical Composition:			
	Total Suspended Solids	TSS	mg/L
Plant Pigments:			
	*Chlorophyll *a*	CHLA_N	µg/L
	Phaeophytin	PHEA	µg/L
Field Parameters (grabs only):			
	Water Temperature	WTEM_N	°C
	Specific Conductance	SCON_N	mS/cm
	Salinity	SALT_N	ppt
	Dissolved Oxygen	DO_N	mg/L
	%Dissolved Oxygen Saturation	DO_S_N	%
	pH	PH_N	pH units
	Turbidity	TURB_N	NTU/FNU

Notes:
1. Time is coded based on a 2400 clock and is referenced to Standard Time.

2. Reserves have the option of measuring either NO2 and NO3 or they may substitute NO23 for individual analyses if they can show that NO2 is a minor component relative to NO3.

11) Measured or Calculated Laboratory Parameters

a) Parameters Measured Directly

Phosphorus species:	PO4F, TP
Nitrogen species:	NH4F, NO2F, NO23F, TKN
Chemical Composition:	TSS
Plant Pigments:	CHLA and PHEA

b) Calculated Parameters

NO3F:	NO23F-NO2F
DIN:	NO23F +NH4F
TN:	TKN + NO2F
TON:	TKN – NH4F

12) Limits of Detection

Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, were established by the Florida Department of Environmental Protection (FLDEP) Laboratory. MDLs were determined using the U.S. Environmental Protection Agency MDL procedure found in Title 40 Code of Federal Regulations Part 136 (40 CFR 136, Appendix B, revision 2.0). Once the MDL was established using this method, verification was done prior to use. Verification included analyzing a known standard at 2-3 times the calculated MDL. Additionally, various checks and balances were used to ensure suitability of the MDL. Every quarter the labs employed verification checks on all MDLs. If the verification checks met the lab's acceptance criteria then the MDL remained unchanged. The MDL for all parameters were determined by the FLDEP Laboratory.

a) FLDEP laboratory MDL determination:

MDLs are set such that the risk of reporting a false positive is less than 1%. MDLs are determined using the method specified in the Federal Register, 40 CFR Part 136 Appendix B, revision 2.0. MDL determinations use both LCSs prepared near the estimated detection and method blanks to estimate methodological noise. Where the possibility exists for significant systematic bias from sample preparation and handling or from the analytical determinative step (typically inorganic analyses), bias is taken into account when calculating detection limits. Published MDLs may be set higher than experimentally determined MDLs to (1) avoid observed positive interferences from matrix effects or common reagent contaminants or (2) for reporting convenience (i.e., to group common compounds with similar but slightly different experimentally determined MDLs). MDLs are determined in a suitable analyte-free matrix when possible. For certain analytes and matrices, no suitable, analyte-free matrix may be available. In those cases, MDLs are determined in the absence of any matrix, but in the presence of all preparatory reagents carried through the full preparatory and determinative steps. LOD verification procedures may be found in SOP LB-031, Limit of Detection Verification. (From page 42 of FLDEP Laboratory Quality Manual 2019 located at: http://publicfiles.dep.state.fl.us/dear/labs/lab_qualitymanual_19.pdf

2019 MDLs

Parameter	**Variable**	**MDL**	**Approved**
Orthophosphate	PO4F	0.004 mg/L	01/01/19-12/31/19
Ammonium	NH4F	0.002 mg/L	01/01/19-12/31/19
Nitrite	NO2F	0.002 mg/L	01/01/19-12/31/19
Nitrite +Nitrate	NO23F	0.004 mg/L	01/01/19-12/31/19
Chlorophyll *a*	CHLA	0.55 µg/L	01/01/19-02/28/19
Chlorophyll *a*	CHLA	0.82 µg/L	03/01/19-12/31/19
Phaeophytin	PHEA	0.6 µg/L	01/01/19-02/28/19
Phaeophytin	PHEA	0.9 µg/L	03/01/19-12/31/19
Kjeldahl Nitrogen	TKN	0.08 mg/L	01/01/19-12/31/19
Total Phosphorus	TP	0.002 mg/L	01/01/19-12/31/19
*Total Suspended Solids	TSS	2 mg/L	01/01/19-12/31/19

*MDL for Total Suspended Solids is 3 when conductivity is > 15,000 µmhos/cm.

FLDEP MDLs for the chlorophyll suite of components may change by station and month based on the need to dilute samples during processing. The base MDL listed in the FLDEP SOP is based on the maximum filtration volume and minimum extract volume and will therefore be the lowest MDL. This MDL was last verified by the FLDEP laboratory 9/28/2018 (as presented in version BB-029-2.5 of the FLDEP SOP for *Spectrophotometric Determination of Corrected and Uncorrected Chlorophyll a and Phaeophytin*, available here: https://fldeploc.dep.state.fl.us/sop/sop3.asp?sect=BIOLOGY&cat=CHLOROPHYLL-BOD-SEDIMENT+GRAIN+SIZE&A1=Submit).

The sample MDL is calculated based on the number of times a sample must be diluted. For example, if a CHL_A sample must be diluted to twice its volume, the base MDL of 0.55 ug/L is multiplied by a dilution factor of two (0.55 ug/L x 2) thus resulting in an MDL of 1.10 ug/L. For samples that fall below the MDL and their MDL is greater than the base MDL, individual sample MDLs are listed in the table below. These data have been flagged and coded as -4 SBL in the dataset. A table of these instances can be found in the "Other Remarks/Notes" section of this metadata document.

13) Laboratory Methods

Chemical and biological analysis was performed by Florida Department of Environmental Protection Laboratory. FLDEP SOP hold times are as follows:

NH4F, Ammonia	Cool, ≤6 °C, H2SO4 to pH<2	28 days
NO2F, Nitrite	Cool, ≤6 °C	48 hours
NO23F, Nitrate-Nitrite	Cool, ≤6 °C, H2SO4 to pH<2	28 days
TP, Total Phosphorous	Cool, ≤6 °C, H2SO4 to pH<2	28 days
TKN, Total Kjeldahl Nitrogen	Cool, ≤6 °C, H2SO4 to pH<2	28 days
TON, Total Organic Nitrogen	Cool, ≤6 °C, H2SO4 to pH<2	28 days
PO4F, Orthophosphate	Cool, to ≤6 °C	Filter w/in 15 minutes; Analyze w/in 48 hours
TSS, Total Suspended Solids	Cool, to ≤6 °C	7 days

*Note that hold times INCLUDE time spent in transport and held at the laboratory.

a) Parameter: PO4F

EPA or other Reference Method: EPA 365.1

Method Reference: Standard Methods for Examination of Water and Wastewater, 20th ed.

Method Description: Ammonium molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phosphomolybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The color is proportional to the phosphorus concentration and is measured with a rapid flow autoanalyzer.

Preservation Method: Samples were filtered in the field and stored at 4 ºC until analysis.

b) Parameter: TP

EPA or other Reference Method: EPA 365.1

Method Reference: Standard Methods for Examination of Water and Wastewater, 20th ed.

Method Description: Ammonium molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phosphomolybdate complex. All of the phosphorus present in the sample regardless of forms is measured by the persulfate digestion procedure.

Preservation Method: Samples were preserved with H_2SO_4 and stored at 4 ºC until analysis.

c) Parameter: NH4F

EPA or other Reference Method: EPA 350.1 Rev. 2.0 (1993) (no distillation)

Method Reference: Methods for Chemical Analysis of Water and Wastes

Method Description: Alkaline phenol and hypochlorite react with ammonia to form indophenol blue that is proportional to the ammonia concentration. The blue color formed is intensified with sodium nitroprusside. The color's absorbance is directly proportional to analyte concentration and is measured with a rapid flow autoanalyzer.

Preservation Method: Samples were preserved with H_2SO_4 and stored at 4 ºC until analysis.

d) Paramter: NO2F

EPA or other Reference Method: EPA 353.2

Method Description: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that was originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, which is measured colorimetrically with a rapid flow autoanalyzer

Preservation Method: Samples were filtered in the field and stored at 4 ºC until analysis.

e) Parameter: NO23F

EPA or other Reference Method: EPA 353.2

Reference Method: Methods for Chemical Analysis of Water and Wastes

Method Description: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that was originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, which is measured colorimetrically with a rapid flow autoanalyzer

Preservation Method: Samples were preserved with H_2SO_4 and stored at 4 ºC until analysis.

f) Parameter: TKN
EPA or other Reference Method: EPA 351.2
Reference Method: Methods for Chemical Analysis of Water and Wastes
Method Description: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that was originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling with N-(1-naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye, which is measured colorimetrically with a rapid flow autoanalyzer.
Preservation Method: Samples were preserved with H_2SO_4 and stored at 4 ºC until analysis.

g) Parameter: TSS
EPA or other Reference Method: Standard Methods 2540 D-97
Method Description: A well-mixed sample is filtered through a pre-weighed glass fiber filter. The filter and any residue are then dried to a constant weight at 103-105 ºC. The filter is cooled in a desiccator, weighed and the result used to compute the TSS of the sample.
Preservation Method: Samples were stored at 4 ºC until analysis.

h) Parameter: CHLA and PHEA
EPA or other Reference Method: SM 10200 H and EPA 446.0
Method Reference: Standard Methods for the Examination of Water and Wastewater, 20th Edition
Method Description: An extractive spectrophotometric technique was used to determine chlorophyll *a* concentrations. Samples were filtered immediately at the laboratory. Filters were placed in a tissue grinder with 2-3 ml of 90% aqueous acetone. Extracts steeped for at least 2 hours at 4 °C in the dark. Extracts were analyzed using a UV/VIS Spectrophotometer.
Preservation Method: Stored at 4 ºC and filtered at the lab upon arrival.

h) Parameter: CHLA_FL
EPA or other Reference Method: EPA 445.0
Method Reference: Standard Methods for the Examination of Water and Wastewater, 20th Edition
Method Description: An extractive spectrophotometric technique was used to determine chlorophyll *a* concentrations. Samples were filtered immediately at the laboratory. Filters were placed in a tissue grinder with 2-3 ml of 90% aqueous acetone. Extracts steeped for at least 2 hours at 4 °C in the dark. Extracts were analyzed using a Fluorometer.
Preservation Method: Stored at 4 ºC and filtered at the lab upon arrival.

14) Field and Laboratory QAQC programs

Based on Collier County Pollution Control and Prevention Department (CCPCP) Laboratory's Quality Assurance Management Plan version 04-02-08 (available by request) and FLDEP SOP 5361 QAQC manual and FLDEP Quality Manual (available by request).

a) Precision: is defined as the agreement or closeness of two or more results.

i) **Field Variability –** Duplicates (successive grabs at each station) were taken every month at each station.

ii) **Laboratory variability –** The RPD for matrix duplicates was measured either by the instrument or the analyst. When the average value of the concentration was above the PQL then the RPD must be no more than 20 % in order to be acceptable.
iii) **Inter-organizational splits –** The laboratory participates in external audit programs including split sample analysis with both public and private laboratories.

b) Accuracy: is defined as the agreement between the analytical results and the know concentration.
i) **Sample spikes-** A representative sample was spiked with known quantities (preferably approximately 2 to 10 times the practical quantitation limit (PQL)) of the analyte before processing. Percent recoveries were calculated for the added analyte. Matrix spike recoveries were indicators of sample matrix interference and contamination. The confidence range was set at ± 15 % for water matrices.
ii) **Standard reference material analysis -** Standard curves were checked against certified or other independently prepared standards during each analytical run. Control standards were analyzed at least every 20 samples. The correlation coefficient for a standard curve should be 0.995 or greater and the recovery for each calibrant above the PQL should be ± 10 %.
iii) **Cross calibration exercised –** The laboratory participates in a number of Performance Testing (PT) studies and interlaboratory comparison studies every year. They include PT studies that are required as part of our lab's NELAC certification and others such as those conducted by the USGS. The results from these studies are posted at http://depnet/burlabs/ptinfo.htm. In addition, our nutrients group also participates in two round robins conducted by the Regional Ambient Monitoring Program (RAMP).

c) Other QAQC methods: Field equipment blanks were taken every monthly grab sampling event to indicate any potential contamination problems during sampling.

15) 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_). QAQC flags are applied to the nutrient data during secondary QAQC to indicate data that are out of sensor range low (-4), rejected due to QAQC checks (-3), missing (-2), optional and were not collected (-1), suspect (1), and that have been corrected (5). All remaining data are flagged as having passed initial QAQC checks (0) when the data are uploaded and assimilated into the CDMO ODIS as provisional plus data. The historical data flag (4) is used to indicate data that were submitted to the CDMO prior to the initiation of secondary QAQC flags and codes (and the use of the automated primary QAQC system for WQ and MET data). This flag is only present in historical data that are exported from the CDMO ODIS.

-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
4	Historical Data: Pre-Auto QAQC

5 Corrected Data

16) 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 sample or sample collection, sensor errors document common sensor or parameter specific problems, 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. However, a record flag column (F_Record) in the nutrient data allows multiple comment codes to be applied to the entire data record.

General errors

GCM	Calculated value could not be determined due to missing data
GCR	Calculated value could not be determined due to rejected data
GDM	Data missing or sample never collected
GQD	Data rejected due to QA/QC checks
GQS	Data suspect due to QA/QC checks
GSM	See metadata

Sensor errors

SBL	Value below minimum limit of method detection
SCB	Calculated value could not be determined due to a below MDL component
SCC	Calculation with this component resulted in a negative value
SNV	Calculated value is negative
SRD	Replicate values differ substantially
SUL	Value above upper limit of method detection

Parameter Comments

CAB	Algal bloom
CDR	Sample diluted and rerun
CHB	Sample held beyond specified holding time
CIP	Ice present in sample vicinity
CIF	Flotsam present in sample vicinity
CLE	Sample collected later/earlier than scheduled
CRE	Significant rain event
CSM	See metadata
CUS	Lab analysis from unpreserved sample

Record comments

CAB	Algal bloom
CHB	Sample held beyond specified holding time
CIP	Ice present in sample vicinity

CIF	Flotsam present in sample vicinity
CLE	Sample collected later/earlier than scheduled
CRE	Significant rain event
CSM	See metadata
CUS	Lab analysis from unpreserved sample

Cloud cover

CCL	clear (0-10%)
CSP	scattered to partly cloudy (10-50%)
CPB	partly to broken (50-90%)
COC	overcast (>90%)
CFY	foggy
CHY	hazy
CCC	cloud (no percentage)

Precipitation

PNP	none
PDR	drizzle
PLR	light rain
PHR	heavy rain
PSQ	squally
PFQ	frozen precipitation (sleet/snow/freezing rain)
PSR	mixed rain and snow

Tide stage

TSE	ebb tide
TSF	flood tide
TSH	high tide
TSL	low tide

Wave height

WH0	0 to <0.1 meters
WH1	0.1 to 0.3 meters
WH2	0.3 to 0.6 meters
WH3	0.6 to > 1.0 meters
WH4	1.0 to 1.3 meters
WH5	1.3 or greater meters

Wind direction

N	from the north
NNE	from the north northeast
NE	from the northeast
ENE	from the east northeast
E	from the east
ESE	from the east southeast
SE	from the southeast
SSE	from the south southeast

S	from the south
SSW	from the south southwest
SW	from the southwest
WSW	from the west southwest
W	from the west
WNW	from the west northwest
NW	from the northwest
NNW	from the north northwest

Wind speed

WS0	0 to 1 knot
WS1	> 1 to 10 knots
WS2	> 10 to 20 knots
WS3	> 20 to 30 knots
WS4	> 30 to 40 knots
WS5	> 40 knots

17) Other remarks/notes

Data may be missing due to problems with sample collection or processing. Laboratories in the NERRS System submit data that are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDLs for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 12) of this document. Concentrations that are less than this limit are censored with the use of a QAQC flag and code, and the reported value is the method detection limit itself rather than a measured value. For example, if the measured concentration of NO23F was 0.0005 mg/l as N (MDL=0.0008), the reported value would be 0.0008 and would be flagged as out of sensor range low (-4) and coded SBL. In addition, if any of the components used to calculate a variable are below the MDL, the calculated variable is removed and flagged/coded -4 SCB. If a calculated value is negative, it is rejected and all measured components are marked suspect. If additional information on MDL's or missing, suspect, or rejected data is needed, contact the Research Coordinator at the Reserve submitting the data.

Note: The coding of MDL values in the NERRS SWMP dataset were changed in November of 2011. Previously, below MDL data from 2007-2010 were also flagged/coded, but either reported as the measured value or a blank cell. Any 2007-2011 nutrient/pigment data downloaded from the CDMO prior to November of 2011 will reflect this difference.

Sample hold dates for 2019: Samples are held at 4°C by the FLDEP Laboratory. NERRS SOP allows nutrient samples to be held for up to 24 hours at 4°C or 28 days at 4°C with acidification, plus up to 5 days for collecting, processing, and shipping samples. Samples held beyond that time period are flagged suspect and coded CHB. The dates recorded in the table below are the longest hold date that the FLDEP Laboratory analyzed each parameter.

	Date Analyzed					
Sample Descriptor	**PO4F**	**NH4**	**NO2**	**NO23**	**CHLA_N, PHEA**	**Fluoristic CHLA**
01/03/2019 grab samples	1/4/2019	1/9/2019	1/4/2019	1/8/2019	1/9/2019	1/22/2019
01/15-01/16/2019 diel samples	1/17/2019	1/25/2019	1/17/2019	1/22/2019	1/28/2019	
02/14/2019 grab samples	2/15/2019	2/21/2019	2/15/2019	2/21/2019	2/25/2019	2/26/2019
02/20-02/21/2019 diel samples	2/22/2019	2/28/2019	2/22/2019	3/1/2019	3/4/2019	
03/06/2019 grab samples	3/8/2019	3/12/2019	3/7/2019	3/14/2019	3/20/2019	3/11/2019
03/20-03/21/2019 diel samples	3/22/2019	3/28/2019	3/22/2019	3/28/2019	4/5/2019	
04/03/2019 grab samples	4/4/2019	4/9/2019	4/4/2019	4/8/2019	4/17/2019	4/15/2019
04/09-04/10/2019 diel samples	4/11/2019	4/18/2019	4/11/2019	4/23/2019	4/24/2019	
05/08/2019 grab samples	5/9/2019	5/15/2019	5/9/2019	5/14/2019	5/28/2019	5/20/2019
05/15-05/16/2019 diel samples	5/17/2019	5/23/2019	5/17/2019	5/28/2019	N/A	
06/05/2019 grab samples	6/6/2019	6/19/2019	6/6/2019	6/12/2019	6/25/2019	6/24/2019
06/26-06/27/2019 diel samples	6/28/2019	7/5/2019	6/28/2019	7/2/2019	7/9/2019	
07/02/2019 grab samples	7/3/2019	7/10/2019	7/3/2019	7/9/2019	7/16/2019	7/17/2019
07/16-07/17/2019 diel samples	7/18/2019	7/30/2019	7/18/2019	7/25/2019	7/29/2019	
08/06/2019 grab samples	8/7/2019	8/14/2019	8/7/2019	8/12/2019	8/13/2019	8/21/2019
08/14-08/15/2019 diel samples	8/15/2019	8/26/2019	8/15/2019	8/23/2019	8/23/2019	
09/04/2019 grab samples	9/5/2019	9/11/2019	9/5/2019	9/10/2019	9/10/2019	9/19/2019
09/16-09/17/2019 diel samples	9/18/2019	9/19/2019	9/18/2019	9/20/2019	9/24/2019	
10/02/2019 grab samples	10/3/2019	10/9/2019	10/3/2019	10/8/2019	10/8/2019	10/21/2019
10/15-10/16/2019 diel samples	10/17/2019	10/23/2019	10/17/2019	10/23/2019	10/28/2019	
11/06/2019 grab samples	11/7/2019	11/13/2019	11/14/2019*	11/13/2019	11/15/2019	11/25/2019
11/12-11/13/2019 diel samples	11/14/2019	11/19/2019	11/14/2019	11/18/2019	11/21/2019	
12/04/2019 grab samples	12/5/2019	12/12/2019	12/5/2019	12/11/2019	12/16/2019	12/17/2019
12/10-12/11/2019 diel samples	12/12/2019	12/18/2019	12/12/2019	12/19/2019	12/20/2019	

*sample held longer than allowed by NERRS protocols

Monthly QAQC Code explanations:

January

The CHLA grab sample for rkbpbnut taken at 01/03/2019 11:50 was A-qualified, “Value reported is the mean of two or more determinations.”

The TSS grab samples for rkbmbnut taken at 01/03/2019 12:30 and 12:33 were A-qualified, “Value reported is the mean of two or more determinations.”

February

For the 02/20/2019 rkblhnut diel samples, OP and NO2 at 08:30 and 11:00 and CHLA and PHEA at 08:30 were Q-qualified, “sample held beyond normal holding time” by the lab due to the samples arriving a day later than expected, but all samples were within the CDMO’s hold time criteria.

March

Diel sample on 03/21/2019 01:00 was not taken due to the cap was not removed from ISCO bottle.

May
The TP grab sample for rkbfunut taken at 05/08/2019 09:10 was J- qualified, “Estimated value and/or the analysis did not meet established quality control criteria.”

The TSS grab sample for rkblhnut taken at 05/08/2019 12:10 was A-qualified, “Value reported is the mean of two or more determinations.”

Diel samples on 05/16/2019 23:30 through 07:00 did not have CHLA or PHEA analyzed due to insufficient sample volume.

June
The TSS grab sample for rkblhnut taken at 06/05/2019 11:00 was A-qualified, “Value reported is the mean of two or more determinations.”

All CHLA grab samples were flagged suspect due to an elevated reading for the equipment blank sample.

July
The CHLA diel sample for rkblhnut taken at 07/16/2019 09:30 was A-qualified, “Value reported is the mean of two or more determinations.”

August
The NO2 grab sample for rkblhnut taken at 08/06/2019 10:50 was J- qualified, “Estimated value and/or the analysis did not meet established quality control criteria.”

The TSS grab sample for rkblhnut taken at 08/06/2019 10:55 was A-qualified, “Value reported is the mean of two or more determinations.”

Diel samples from 08/14/2019 17:00 through 08/12/2019 08:00 were not taken because the ISCO broke during sampling.

September
The TSS grab samples for rkblhnut taken at 09/04/2019 11:22 and 11:27 were A-qualified, “Value reported is the mean of two or more determinations.”

October
The TP grab sample for rkbfbnut taken at 10/02/2019 08:00 was J- qualified, “Estimated value and/or the analysis did not meet established quality control criteria.”

The CHLA and PHEA grab sample for rkblhnut taken at 10/02/2019 11:46 were A-qualified, “Value reported is the mean of two or more determinations.”

For the 10/15/2019 rkblhnut diel sample, NO2 at 08:30 was Q-qualified, “sample held beyond normal holding time” by the lab due to the “sample expired upon receipt”, but the sample was within the CDMO’s hold time criteria.

November
The TP grab sample for rkbpbnut taken at 11/06/2019 10:45 was J- qualified, “Estimated value and/or the analysis did not meet established quality control criteria.”

For the 11/06/2019 rkbfunut diel sample, NO2 at 11:15 was rejected and Q-qualified, “sample held beyond normal holding time” by the lab due to “Sample reanalyzed out of holding time because of analytical difficulties.”

December
The TSS grab samples for rkblhnut taken at 12/04/2019 08:15 was A-qualified, “Value reported is the mean of two or more determinations.”

The TSS grab samples for rkbfbnut taken at 12/04/2019 12:00 was A-qualified, “Value reported is the mean of two or more determinations.”

Monthly MDL Changes: Due to the need for sample dilution by the lab for the sample to be analyzed, chlorophyll *a*, pheaphytin *a*, nitrite+nitrate, and TSS MDLs may be elevated. Some values are flagged as below sensor limits <-4> [SBL] while the value reported is higher than the normal MDL. These samples are as follows:

Parameter	DateTimeStamp	Site	MDL	Units
CHLA_N	11/13/2019 3:30	rkblhnut	2.40	ug/L
PHEA	1/3/2019 12:30	rkblhnut	1.20	ug/L
PHEA	1/3/2019 12:33	rkblhnut	1.20	ug/L
PHEA	1/16/2019 1:30	rkblhnut	1.30	ug/L
PHEA	2/14/2019 11:29	rkblhnut	0.68	ug/L
PHEA	2/21/2019 7:00	rkblhnut	2.00	ug/L
PHEA	3/6/2019 8:39	rkbfbnut	2.10	ug/L
PHEA	3/6/2019 8:45	rkblhnut	2.10	ug/L
PHEA	3/6/2019 11:20	rkblhnut	2.00	ug/L
PHEA	3/6/2019 11:25	rkblhnut	1.80	ug/L
PHEA	3/20/2019 10:00	rkblhnut	1.40	ug/L
PHEA	3/20/2019 15:00	rkblhnut	1.40	ug/L
PHEA	4/9/2019 13:00	rkblhnut	1.80	ug/L
PHEA	4/10/2019 11:30	rkblhnut	2.00	ug/L
PHEA	5/15/2019 8:30	rkblhnut	1.80	ug/L
PHEA	5/15/2019 11:00	rkblhnut	1.80	ug/L
PHEA	6/5/2019 7:15	rkbmbnut	2.10	ug/L
PHEA	6/5/2019 7:50	rkbpbnut	1.00	ug/L
PHEA	6/5/2019 7:55	rkbpbnut	1.00	ug/L
PHEA	6/5/2019 8:22	rkbfunut	1.80	ug/L
PHEA	6/5/2019 8:45	rkbfbnut	1.00	ug/L
PHEA	6/5/2019 8:50	rkbfbnut	1.00	ug/L
PHEA	6/5/2019 11:00	rkblhnut	2.10	ug/L
PHEA	6/5/2019 11:05	rkblhnut	0.98	ug/L
PHEA	6/26/2019 2:30	rkblhnut	2.20	ug/L
PHEA	6/26/2019 9:00	rkblhnut	1.80	ug/L
PHEA	7/16/2019 19:30	rkblhnut	2.00	ug/L
PHEA	7/17/2019 3:00	rkblhnut	2.60	ug/L
PHEA	7/17/2019 5:30	rkblhnut	2.20	ug/L
PHEA	8/6/2019 7:35	rkbpbnut	1.80	ug/L
PHEA	8/6/2019 7:56	rkbfunut	1.00	ug/L
PHEA	8/6/2019 8:01	rkbfunut	1.00	ug/L
PHEA	8/6/2019 8:28	rkbfbnut	0.98	ug/L
PHEA	8/6/2019 9:22	rkbmbnut	1.30	ug/L
PHEA	8/6/2019 9:27	rkbmbnut	1.50	ug/L
PHEA	8/6/2019 10:50	rkblhnut	1.00	ug/L
PHEA	9/4/2019 7:28	rkbmbnut	1.80	ug/L
PHEA	9/4/2019 7:32	rkbmbnut	1.50	ug/L
PHEA	9/16/2019 9:00	rkblhnut	1.50	ug/L
PHEA	11/6/2019 8:25	rkblhnut	1.10	ug/L
PHEA	11/12/2019 12:30	rkblhnut	2.20	ug/L
PHEA	11/13/2019 3:30	rkblhnut	2.60	ug/L
PHEA	12/4/2019 11:20	rkbfunut	1.40	ug/L

<u>2019 weather conditions based on Big Cypress Basin (BCB) Hydrologic Reports</u>:

January: January rainfall was well above average for the Basin ending the month around 185% of average. The majority of the rainfall occurred during a 3 day rainfall the last weekend of the month. The storm brought beneficial rainfall which increased canal levels across the Basin. January's rainfall was sufficient to bring the Basin out of drought conditions. Meteorologists are anticipating a higher potential for above average rainfall in the 3-month outlook which would be beneficial as the dry season continues. January was an above average dry season month in terms of rainfall and was almost twice the historical average. The basin-wide monthly average was 3.88 inches, which is 185% of the normal 2.10 inches typically collected. Based on collected gage data, rainfall distribution across all BCB localities was very consistent in January.

February: February continued the Basin's above average rainfall trend for the year. Rainfall was above average for the Basin ending the month around 130%of average. Similarly, to January, the majority of the rainfall occurred during a single rainfall event towards the end of the month. The storm brought more beneficial rainfall which increased canal levels across the Basin. February's above average rainfall kept the Basin out of drought territory as indicated in the latest Drought Monitor summary. Meteorologists are anticipating equal chances for above and below average for the next 30 days. However, the 3 month forecast continues to show higher than normal chances for above average rainfall for April and May. February was an above average season month in terms of rainfall and was about 30% higher than the historical average. The basin-wide monthly average was 2.42 inches, which is 131% of the normal 1.85 inches typically collected.

March: March was a fairly average month in terms of rainfall for the Basin. March rainfall came in at around 80% of average for the month, however 2019 so far is above average at 133% of normal. The majority of the rain fell in one event near the middle of the month. The rain event did occur although not with as much vigor as predicted. Meteorologists are anticipating above average chances for rainfall for the next 30 days. Also, the 3 month long term forecast continues to show higher than normal chances for above average rainfall for April, May, and June. The basin-wide monthly average was 1.67 inches, which is 80% of the normal 2.06 inches typically collected. Based on collected gage data, rainfall distribution across all BCB localities was mixed in March.

April: April was a calm month in terms of rainfall for the Basin. April rainfall came in around 78% of average for the month, however 2019 so far is slightly above average at 118% of normal. Meteorologists are anticipating above average chances for rainfall for the next 30 days. Also, the 3 month long term forecast no longer shows an above average chance for higher than average rainfall. Most of Florida now has equal chances for above or below average rainfall for June, July, and August. The basin-wide monthly average was 1.80 inches, which is 78% of the normal 2.25 inches typically collected.

May: May was relatively normal for a transition month into wet season. The monthly rainfall was slightly below normal at 88%. May is now the third consecutive month with below average rainfall for the Basin. Even with this trend, the Basin is still running a slight surplus of rainfall for 2019 at 108% of normal. Most water levels continued the downward trend and ended the month below wet season levels but above the 50th percentile, which positions the Basin nicely for the upcoming rain season. Meteorologists are anticipating equal chances for above or below average rainfall for the next 30 days.

Also, the 3 month long term forecast continues the equal chances for above or below average rainfall for all of Florida. The basin-wide monthly average was 3.58 inches, which is 88% of the normal 4.06 inches typically collected.

June: Wet season conditions developed across the Big Cypress Basin throughout June as compared to May. A typical summer daily pattern of scattered afternoon and evening thunderstorms accounted for June rainfall. As the month ended, rainfall totals across the Basin were just above the historic average coming in at 10.3 inches. Meteorologists are anticipating equal chances for above or below average rainfall for the next 30 days. Also, the 3 month long term forecast continues the equal chances for above or below average rainfall for all of Florida. June was just above average in terms of rainfall reporting and at about 105% of normal. the basin-wide monthly average was 10.27 inches, which is 105% of the normal 9.73 inches typically collected. Based on collected gauge data, rainfall distribution across all BCB localities showed higher levels of rainfall in the middle region of the basin from the southwest (Marco Island) to north (Bird Rookery). The coastal areas and far eastern areas had smaller totals. The month's highest total was collected at Rookery Bay (Site R-10), which received 15.64 inches. The lowest rainfall was recorded at two stations Ave Maria (Site R-20) and GG-7 (Site R-22) with 7.24 inches.

July: Wet season conditions persisted across the Big Cypress Basin throughout July. A typical summer daily pattern of scattered afternoon and evening thunderstorms accounted for July rainfall. As the month ended rainfall totals across the Basin were practically the same as June's rainfall and just above the historic average coming in at 10.3 inches. Looking forward, meteorologists are forecasting a slightly elevated chance for above average rainfall for south Florida for the next 30 days. The 3 month long term forecast shows equal chances for above or below average rainfall for all of Florida. July was a bit above average in terms of rainfall reporting and ended the month at 120% of normal. The basin-wide monthly average was 10.3 inches, which is 120% of the normal 8.6 inches typically collected.

August: Typical wet season conditions persisted across the Big Cypress Basin throughout most of August. A typical summer daily pattern of scattered afternoon and evening thunderstorms accounted for the majority of August rainfall with two notable events. As August started, a tropical wave was approaching South Florida which was forecast to bring significant widespread rainfall (5"-7") across the Basin. The actual rainfall totals were drastically lower (~2 inches) than forecasted amounts. As the month came to a close, all attention was diverted towards Hurricane Dorian. South Florida was first shown in probable path of Dorian on August 26th at which time it was forecast to be a tropical storm. As the storm matured, it mostly missed Hispaniola and Puerto Rico which allowed it to rapidly intensify into a major hurricane. On August 30th, it was forecast to make landfall somewhere from the Florida Keys to South Carolina as a Category 4 storm. Given the uncertainty of the path, BCB along with all other portions of the District made some pre-storm operations in anticipation of the event. As the storm slowed forward movement, it started turning north and the risk to BCB, but not to other parts of Florida and Bahamas, significantly decreased. As September started, the storm began tracking off the east coast of Florida avoiding widespread impacts to Florida but left a devasting wake through parts of the Bahamas. Looking forward, meteorologists are forecasting an elevated chance for above average rainfall for south Florida for the next 90 days. August ended the month at 101% of normal. The basin-wide monthly average was 10.03 inches, which is 101% of the normal 9.98 inches typically collected.

September: September started with Hurricane Dorian moving just off-shore the eastern coast of Florida. The District and Basin were largely spared any significant impacts from the storm. A significant dry period followed the passing of Hurricane Dorian and Hurricane Humberto (which moved through mid-month), both of which stayed east of Florida. This dry period brought an abrupt transition from wet season to dry season. The dry period was so prolongated that the month ended as the driest September on record (1990-2019) for the Basin and for the entire District (1932-2019). The BCB system transitioned about one month earlier than normal to dry season settings to conserve water. Looking forward, meteorologists are forecasting an elevated chance for above average rainfall for south Florida for the next 30 days and equal chances for above, below, or average rainfall for following 90 days. September ended the month at 26% of normal. The basin-wide monthly average was 2.39 inches, which is 26% of the normal 9.04 inches typically collected.

October: October was a transition month in terms of weather for the Basin. There were 3 notable wet periods associated with some wet season and dry season style events during October. First, was a stalled front that brought enhanced rainfall in early October. Second was Tropical Storm Nestor which came ashore mid-month in the panhandle. Nestor did bring beneficial rain to the Basin. Lastly, there was a late season tropical wave that enhanced rainfall at the end of the month. The month concluded with just above average rainfall. Looking forward, meteorologists are forecasting an equal chances for above average, average, or below average rainfall for south Florida for the next 30 days and 90 days. October was a fairly average month for rainfall and ended the month at 108% of normal. The basin-wide monthly average was 3.8 inches, which is just above the average 3.5 inches typically collected.

November: November was a typical dry season month with mostly pleasant dry weather patterns. The small amount of rain that did fall was a result of passing cold fronts. Looking further ahead into the dry season, the 30 day outlook is calling for below average rainfall and the 3 month outlook for January, February, and March is indicating equal chances for above, average, or below normal rainfall. November continued the mostly average rainfall pattern and ended the month at 88% of normal. The basin-wide monthly average was 1.4 inches, which is just below the average 1.6 inches typically collected.

December: December's above average rainfall was very atypical for dry season and was the third wettest December on record for the Basin. The majority of the rain occurred with storm systems on December 12th, 18th, and 22nd. The remainder of the month had sporadic light rain showers. The forecasted rainfall for the December 22nd storm was significant, with 3 inches average and 6 inch local maximum. While the forecasted amount did not occur, the Basin did receive a very beneficial 2 inch average rainfall with that event. It's worth noting that overnight on December 22nd, portions of the east coast received 9 inches in about four hours. Total 2019 Basin rainfall came in at 56.0 inches or 99% of the Basin's average 56.6 inches. Even with the extremely average total rainfall, January, September, and December totals are notable compared to typical rainfall. Looking forward, the 30 day outlook and 3 month outlook for February, March, and April are indicating equal chances for above, average, or below normal rainfall. Rainfall in December halted the near average rainfall pattern and ended the month at 264% of normal. The basin wide monthly average was 4.47 inches, which is more than twice the average 1.69 inches typically collected.

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