Rookery Bay (RKB) National Estuarine Research Reserve (NERR) Nutrient Metadata (January 2020 – December 2020)

Latest Update: June 8th, 2021

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. The method comparisons were concluded July 2020 and the original spectrophotometer method was continued.

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 NERRS SWMP EXO SOP v2.0 and 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 0.51 m to 1.95 m (average 1.23 m). Salinity at this site ranged from 2.0 to 36.1 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 0.08 and 2.06 meters (average 1.08 m). Salinity at this site ranged from 4.2 to 37.8 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 0.00 and 1.88 meters (average 0.83 m). Salinity at this site ranged from 0.7 to 37.0 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 0.00 and 1.83 meters (average 0.79 m). Salinity at this site ranged from 3.0 to 37.6 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 1.71 meters (average 0.69 m). Salinity at this site ranged from 12.3 to 37.5 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 2020, the data collection period was limited from January to March and May to December due to COVID 19 closures.

Monthly Grab Sampling

Station Code	Date Time Stamp (rep 1)	Date Time Stamp (rep 2)
rkblhnut	1/8/2020 8:00	1/8/2020 8:15
rkblhnut	2/5/2020 8:15	2/5/2020 8:25
rkblhnut	3/4/2020 8:15	3/4/2020 8:20
rkblhnut	7/9/2020 11:23	7/9/2020 11:33
rkblhnut	8/26/2020 11:20	8/26/2020 11:25
rkblhnut	9/10/2020 11:26	9/10/2020 11:31
rkblhnut	10/21/2020 12:02	10/21/2020 12:07
rkblhnut	11/4/2020 12:39	11/4/2020 12:45
rkblhnut	12/8/2020 13:17	12/8/2020 13:23
rkbmbnut	1/8/2020 13:05	1/8/2020 13:10
rkbmbnut	2/5/2020 10:05	2/5/2020 10:10
rkbmbnut	3/4/2020 10:03	3/4/2020 10:09
rkbmbnut	7/9/2020 07:08	7/9/2020 07:14
rkbmbnut	8/26/2020 07:20	8/26/2020 07:25
rkbmbnut	9/10/2020 07:20	9/10/2020 07:26
rkbmbnut	10/21/2020 07:57	10/21/2020 08:01
rkbmbnut	11/4/2020 10:59	11/4/2020 11:05
rkbmbnut	12/8/2020 08:40	12/8/2020 08:47
rkbfunut	1/8/2020 10:40	1/8/2020 10:45
rkbfunut	2/5/2020 11:42	2/5/2020 11:485
rkbfunut	3/4/2020 11:30	3/4/2020 11:37
rkbfunut	7/9/2020 08:37	7/9/2020 08:42
rkbfunut	8/26/2020 08:38	8/26/2020 08:43
rkbfunut	9/10/2020 08:45	9/10/2020 08:52
rkbfunut	10/21/2020 09:59	10/21/2020 10:04
rkbfunut	11/4/2020 10:00	11/4/2020 10:05
rkbfunut	12/8/2020 10:27	12/8/2020 10:31
rkbfbnut	1/8/2020 11:20	1/8/2020 11:25
rkbfbnut	2/5/2020 12:15	2/5/2020 12:20

rkbfbnut	3/4/2020 12:05	3/4/2020 12:12
rkbfbnut	7/9/2020 09:15	7/9/2020 09:20
rkbfbnut	8/26/2020 09:08	8/26/2020 09:14
rkbfbnut	9/10/2020 09:15	9/10/2020 09:23
rkbfbnut	10/21/2020 09:28	10/21/2020 09:32
rkbfbnut	11/4/2020 09:29	11/4/2020 09:33
rkbfbnut	12/8/2020 11:00	12/8/2020 11:06
rkbpbnut	1/8/2020 12:10	1/8/2020 12:15
rkbpbnut	2/5/2020 11:05	2/5/2020 11:10
rkbpbnut	3/4/2020 10:50	3/4/2020 10:56
rkbpbnut	7/9/2020 08:00	7/9/2020 08:08
rkbpbnut	8/26/2020 08:06	8/26/2020 08:12
rkbpbnut	9/10/2020 08:10	9/10/2020 08:16
rkbpbnut	10/21/2020 08:43	10/21/2020 08:48
rkbpbnut	11/4/2020 08:45	11/4/2020 08:51
rkbpbnut	12/8/2020 09:50	12/8/2020 09:57

Diel Sampling

Station Code	Date Time stamp (begin)	Date Time stamp (end)
rkblhnut	1/14/2020 11:00	1/15/2020 12:00
rkblhnut	2/11/2020 09:45	2/12/2020 10:45
rkblhnut	3/10/2020 09:30	3/11/2020 10:30
rkblhnut	7/14/2020 04:30	7/15/2020 05:30
rkblhnut	8/12/2020 04:00	8/13/2020 05:00
rkblhnut	9/23/2020 01:00	9/24/2020 02:00
rkblhnut	10/14/2020 11:00	10/15/2020 12:00
rkblhnut	12/16/2020 09:00	12/17/2020 10:00

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 and 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.

In 2021, Florida DEP started using water quality and nutrient data to create an internal departmental data analysis dash board to analyze the duration of hypoxia, trends and comparisons relating to dissolved oxygen (DO) and other analytes available for the continuous monitoring stations, change and patterns at those stations, including how the stations may relate to external factors. Florida DEP is also using SWMP data for the Statewide Ecosystem Assessment of Coastal and Aquatic Resources (SEACAR) project. The project will provide status and trends reporting through web-based access to data and assessments and a tiered reporting format for a variety of audiences.

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 2020.

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 2020 located at: Florida DEP Laboratory Quality Manual (state.fl.us))

2019 MDLs

Parameter	Variable	MDL	Approved
Orthophosphate	PO4F	0.004 mg/L	12/26/19-12/31/20
Total Phosphorus	TP	0.002 mg/L	12/31/20-12/31/20
Ammonium	NH4F	0.002 mg/L	12/30/19-12/31/20
Nitrite	NO2F	0.002 mg/L	12/30/19-12/31/20
Nitrite +Nitrate	NO23F	0.004 mg/L	12/07/18-12/31/20
Kjeldahl Nitrogen	TKN	0.08 mg/L	12/30/19-12/31/20
Chlorophyll *a*	CHLA	0.55 µg/L	09/30/19-12/31/20
Phaeophytin	PHEA	0.60 µg/L	09/30/19-12/31/20
Total Suspended Solids*	TSS	2 mg/L	12/17/19-12/31/20

*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 1/27/2020 (as presented in version BB-029-2.7 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 FLDEP Quality Manual and FDEP SOP LB-27 (available by request). The types of quality control (QC) checks and the frequency at which they are performed are listed in the method or test SOPs.

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 during every monthly grab sampling event to detect 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 2020: 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
01/08/2020 grab samples	1/9/2020	1/14/2020	1/9/2020	1/16/2020	1/15/2020	1/21/2020
01/14-01/15/2020 diel samples	1/16/2020	1/17/2020	1/16/2020	1/23/2020	1/23/2020	
02/5/2020 grab samples	2/7/2020	2/14/2020	2/7/2020	2/19/2020	2/13/2020	2/14/2020
02/11-02/12/2020 diel samples	2/13/2020	2/21/2020	2/13/2020	2/20/2020	2/19/2020	
03/04/2020 grab samples	3/5/2020	3/11/2020	3/5/2020	3/13/2020	3/9/2020	3/19/2020
03/10-03/11/2020 diel samples	3/12/2020	3/20/2020	3/12/2020	3/23/2020	3/18/2020	
07/09/2020 grab samples	7/10/2020	7/12/2020	7/13/2020	7/15/2020	7/16/2020	7/28/2020
07/14-07/15/2020 diel samples	7/16/2020	7/19/2020	7/16/2020	7/20/2020	7/21/2020	
08/12-08/13/2020 diel samples	8/14/2020	8/23/2020	8/14/2020	8/17/2020	8/27/2020	
08/26/2020 grab samples	8/27/2020	9/7/2020	8/27/2020	8/31/2020	9/2/2020	9/15/2020
09/10/2020 grab samples	9/11/2020	9/13/2020	9/11/2020	9/23/2020	9/11/2020	
09/23-09/24/2020 diel samples	9/25/2020	9/27/2020	9/25/2020	9/29/2020	9/30/2020	
10/14-10/15/2020 diel samples	10/15/2020	10/18/2020	10/15/2020	10/22/2020	10/21/2020	
10/21/2020 grab samples	10/22/2020	10/25/2020	10/22/2020	10/29/2020	10/30/2020	
11/04/2020 grab samples	11/5/2020	11/8/2020	11/5/2020	11/20/2020	11/12/2020	
12/08/2020 grab samples	12/10/2020	12/20/2020	12/10/2020	12/14/2020	12/16/2020	
12/16-12/17/2020 diel samples	12/18/2020	12/23/2020	12/18/2020	12/23/2020	12/22/2020	

Monthly QAQC Code explanations:

January

The Total Suspended Solids (TSS) grab sample for rkblhnut taken at 01/08/2020 8:00 was A-qualified, “Value reported is the mean of two or more determinations.”

The PHEA grab samples for rkbmbnut taken at 01/08/2020 13:10 was A-qualified, “Value reported is the mean of two or more determinations.”

February

For the 02/05/2020 grab samples, PO4, NO2, CHLA and PHEA were Q-qualified, “sample held beyond normal holding time” by the lab due to the samples arriving a day later than expected. All affected samples were rejected due to the samples arrived above required temperature.

March

Diel samples on 03/10/2020 from 09:30 through 17:00 for NO2 were rejected due to the lab reported the sample’s results may be biased high because of background contamination. Samples were reanalyzed out of holding time because of analytical difficulties.

The Total Suspended Solids (TSS) grab sample for rkbfbnut taken at 03/04/2020 12:12 was A-qualified, “Value reported is the mean of two or more determinations.”

April - June
Nutrient samples were not collected from April through June due to the COVID19 pandemic. The mandated quarantine duration was unknown for us and the FL DEP laboratory, therefore, samples were not collected. Compliance logs were recorded for each site with the CDMO.

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

Grab sample on 07/09/2020 11:23 for NO2 was rejected due to the lab reporting the sample was reanalyzed out of holding time because of analytical difficulties.

The Total Suspended Solids (TSS) grab sample for rkbmbnut taken at 07/09/2020 07:14 was A-qualified, "Value reported is the mean of two or more determinations."

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

The Total Suspended Solids (TSS) grab sample for rkbfbnut taken at 08/26/2020 09:14 was A-qualified, "Value reported is the mean of two or more determinations."

The CHLA grab sample for rkblhnut taken at 08/26/2020 11:20 was A-qualified, "Value reported is the mean of two or more determinations."

September
The CHLA grab samples for rkblhnut taken on 09/10/2020 at 11:26 and 11:31 were A-qualified, "Value reported is the mean of two or more determinations."

The TSS grab samples for rkblhnut taken at 09/04/2020 11:22 and 11:27 were A-qualified, "Value reported is the mean of two or more determinations."

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

Diel samples from 10/14/2020 18:30 through 10/15/2020 09:30 for PO4, NH4, NO2, NO23 and 10/14/2020 18:30, 21:00 and 10/15/2020 07:00, 09:30 for CHL, PHEA were not taken because the ISCO broke during sampling.

The TSS grab samples for rkbmbnut, rkbfbnut and rkbfunut taken on 10/21/2020 at 07:57, 09:32 and 09:59 were A-qualified, "Value reported is the mean of two or more determinations."

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

The NH4 and NO23 grab samples for rkblhnut taken on 11/04/2020 12:45 were flagged suspect due to the water sample was not preserved to pH < 2 at arrival to the lab and was preserved by the laboratory.

The CHLA and TSS grab sample for rkbpbnut taken on 11/04/2020 at 08:45 were A-qualified, "Value reported is the mean of two or more determinations."

The CHLA and PHEA grab samples taken on 11/04/2020 from 09:33 through 12:45 were J- qualified, "Estimated value and/or the analysis did not meet established quality control criteria."

Diel samples were not taken due to a broken ISCO.

December
For the 12/08/2020 grab samples, PO4, NO2, CHLA and PHEA were Q-qualified, "sample held beyond normal holding time" by the lab due to the "sample expired upon receipt", but the samples were within the CDMO's hold time criteria.

The TKN grab samples taken on 12/08/2020 at 09:50 and 13:17 were J- qualified, "Estimated value and/or the analysis did not meet established quality control criteria."

Diel sample on 12/17/2020 10:00 was not taken because the ISCO broke during sampling.

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
NH4F	12/16/2020 09:00	rkblhnut	0.020	mg N/L
NH4F	12/16/2020 14:00	rkblhnut	0.020	mg N/L
NH4F	12/16/2020 16:30	rkblhnut	0.010	mg N/L
NH4F	12/16/2020 21:30	rkblhnut	0.010	mg N/L
NH4F	12/17/2020 02:30	rkblhnut	0.010	mg N/L
CHLA_N	1/15/2020 02:00	rkblhnut	2.40	ug/L
CHLA_N	3/11/2020 12:30	rkblhnut	1.80	ug/L
CHLA_N	12/16/2020 07:00	rkblhnut	2.10	ug/L
PHEA	1/8/2020 08:00	rkblhnut	0.90	ug/L
PHEA	1/15/2020 02:00	rkblhnut	2.60	ug/L
PHEA	2/5/2020 12:20	rkbfbnut	1.30	ug/L
PHEA	3/10/2020 12:00	rkblhnut	1.00	ug/L
PHEA	3/11/20200 0:30	rkblhnut	2.00	ug/L
PHEA	7/9/2020 08:00	rkbpbnut	1.40	ug/L
PHEA	7/9/2020 08:08	rkbpbnut	1.40	ug/L
PHEA	7/9/2020 09:15	rkbfbnut	1.80	ug/L
PHEA	7/9/2020 09:20	rkbfbnut	1.60	ug/L

PHEA	7/9/2020 11:23	rkblhnut	0.90	ug/L
PHEA	7/9/2020 11:33	rkblhnut	0.90	ug/L
PHEA	7/15/2020 03:00	rkblhnut	1.10	ug/L
PHEA	8/12/2020 21:30	rkblhnut	2.10	ug/L
PHEA	8/12/2020 00:00	rkblhnut	2.00	ug/L
PHEA	8/13/2020 02:30	rkblhnut	1.80	ug/L
PHEA	8/13/2020 05:00	rkblhnut	1.80	ug/L
PHEA	8/26/2020 11:20	rkblhnut	1.10	ug/L
PHEA	8/26/2020 11:25	rkblhnut	0.90	ug/L
PHEA	9/10/2020 11:26	rkblhnut	1.30	ug/L
PHEA	9/10/2020 11:31	rkblhnut	0.90	ug/L
PHEA	10/14/2020 16:00	rkblhnut	1.30	ug/L
PHEA	10/15/2020 04:30	rkblhnut	1.30	ug/L
PHEA	10/15/2020 12:00	rkblhnut	1.30	ug/L
PHEA	10/21/2020 12:02	rkblhnut	0.90	ug/L
PHEA	10/21/2020 12:07	rkblhnut	0.90	ug/L
PHEA	12/16/2020 09:00	rkblhnut	1.70	ug/L
PHEA	12/16/2020 14:00	rkblhnut	1.10	ug/L
PHEA	12/16/2020 16:30	rkblhnut	0.99	ug/L
PHEA	12/16/2020 19:00	rkblhnut	2.20	ug/L
PHEA	12/16/2020 21:30	rkblhnut	1.00	ug/L
PHEA	12/17/2020 00:00	rkblhnut	1.00	ug/L
PHEA	12/17/2020 02:30	rkblhnut	1.00	ug/L
PHEA	12/17/2020 05:00	rkblhnut	1.30	ug/L

2020 weather conditions based on Big Cypress Basin (BCB) Hydrologic Reports:

January: January was almost completely dry except for the last day of the month. Rainfall for this month was below the normal average of 2.4 inches. Rainfall between January 1st – 30th totaled around 0.2 inches and January 31st totaled 1.6 inches for a Basin average of 1.8 inches. Rainfall in January was below normal which is in sharp contrast to a wet December and ended the month at 75% of normal. The basin-wide monthly average was **1.79 inches**, which is below the average 2.38 inches typically collected.

February: February was almost completely dry except some rainfall on the first and seventh. Conditions have been extremely dry and warm since February 7th. Surface and ground water levels throughout the Basin are declining with the absence of any rainfall. Rainfall in February was again below normal which continues the below average trend from January. The basin-wide monthly average was **1.11 inches (60% of normal)**, which is below the average 1.85 inches typically collected.

March: March was remarkably dry. It was the driest March on record for the Basin and also for the entire District's 89 year period of record. As a result of the prolonged hot and dry weather, surface and ground water levels have decreased throughout the Basin. Rainfall for the month totaled a paltry 0.08 inches (4% of normal), which is below the average 1.97 inches typically collected. Even with two record breaking dry months (September and March) this dry season, the water year (May 2019—April 2020) only has a 5.5 inch deficit (90% of normal).

April: April finally brought the Basin out of the below normal rainfall trend, although not by much. Most of the rainfall for the Basin fell on April 1st and 30th which was associated with frontal passages and the remainder of the month was very dry. While the rainfall was beneficial, it was not enough to keep almost all of Collier and Lee counties from changing from moderate drought in early April to severe drought conditions in by end of April, as indicated by U.S. Drought Monitor. Rainfall in April was finally above normal which breaks the below normal rainfall trend from January. The basin-wide monthly average was **2.48 inches (111% of normal)**, which is above the average 2.24 inches typically collected.

May:

The first half of May brought a continued dry season pattern to the Basin, while the second half of the month brought a needed change as conditions transitioned into wet season. District meteorologists called the official start of the wet season on May 15th which is about 2 weeks earlier than normal. The early start to the wet season accounts for the above average rainfall for the month. Rainfall in May continued the above normal trend from April, mostly due to the early onset of wet season. The basin-wide monthly average was **6.29 inches (153% of normal)**, which is above the average 4.1 inches typically collected.

June:

June started with a typical summertime pattern of daily thunderstorms. Water levels throughout the Basin continued to increase from dry season lows in May. The last third of the month was abnormally dry as high pressure and an abnormally intense Saharan dust event kept rainfall activity very low. Rainfall for the month ended a couple inches below normal or 80% of average. Rainfall in June was below normal due to the long dry streak towards the end of the month. The basin-wide monthly average was **8.03 inches (80% of normal)**, which is below the average 9.97 inches typically collected.

July:

The first few weeks of July brought below average rainfall to the Basin. A strong and persistent southwest steering flow kept the majority of the rainfall to the east coast of Florida for the first few weeks of the month. Finally, the pattern shifted to an Atlantic sea-breeze pattern and the more normal afternoon thunderstorm pattern was established for the last couple weeks of the month. The month then ended with the threat of Hurricane Isaias, which first appeared like it would impact the Basin. Fortunately for the Florida, the track shifted off the east coast of Florida and did not make landfall, but it did intensify into a hurricane. The Basin was spared any impacts from the storm. Rainfall in July was below normal due to the dry streak towards the beginning of the month. The basin-wide monthly average was **7.5 inches (86% of normal)**, which is below the average 8.73 inches typically collected.

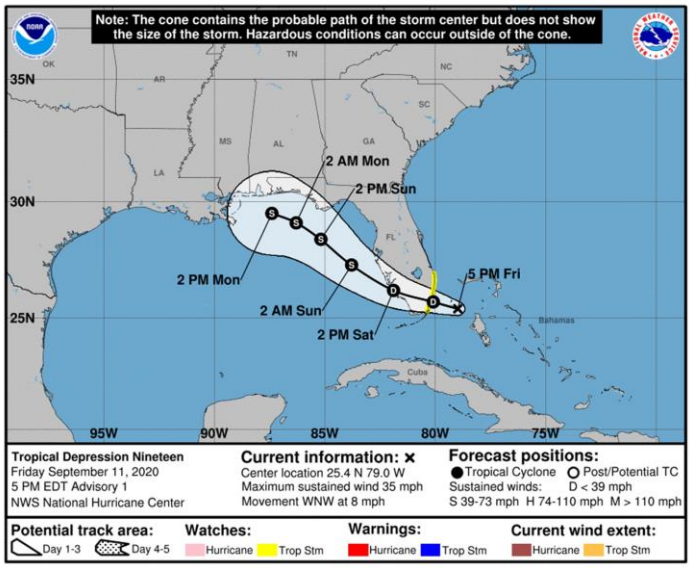
August:

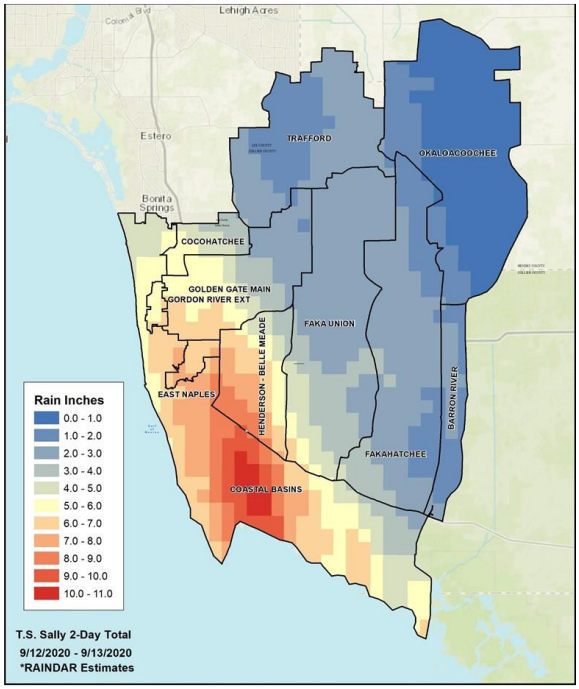
August rainfall for the Basin was highly variable. The beginning of the month had another dry spell, followed with a few days of heavy rainfall near the middle of the month, and then another decrease in rainfall towards the end of the month. The month ended with another below average rainfall total for the Basin. Tropical Storm/Hurricane Laura threatened the District in early forecasts, however Laura took a more southern track and Florida avoided any significant impacts from the storm. Rainfall in August was below normal due to the dry streak towards the beginning and end of the month. The basin-wide monthly average was **6.7 inches (67% of normal)**, which is below the average 9.9 inches typically collected.

September:

The biggest highlight for the Basin in September was the passage of Tropical Storm Sally. Sally developed just east of Florida late on Friday, September 11th and passed through the Basin on Saturday and Sunday as a tropical depression (figure below). Sally brought heavy rains to over two

days to portions of the Basin. The heaviest rains fell downstream of the primary canal system near Goodland which received about 11 inches of rain over two days. Areas southwest of a line from Port of the Islands and Immokalee Rd/Collier Blvd intersection received an average of 6-7 inches of rain over two days. Totals dropped off significantly north and east of that line (figure right). Rainfall in September was above normal due to the passage of Tropical Storm Sally. The basin-wide monthly average was **10.2 inches (118% of normal)**, which is above the average 8.7 inches typically collected.





October:

October was a transitional month where the weather pattern shifted from the summer thunderstorm pattern to a fall and winter drier pattern. Unlike most years, an exact date to the end of the wet season has not been determined since the Basin transitioned to the dry season over the last couple weeks of the month. In addition to the upcoming dry season, a strengthening La Nina is

expected to bring drier than normal conditions to the region during the winter. Rainfall in October was above normal due a slightly delayed end to the wet season which occurred near the end of the month rather than the more typical middle of the month timeframe. The basin-wide monthly average was **4.4 inches (126% of normal)**, which is above the average 3.5 inches typically collected.

November:

A typical dry season pattern was in place over the Basin during November with one major exception when Tropical Storm Eta visited Florida. The vast majority of November's rainfall was attributed to T.S. Eta. The storm had a very unusual path and brought two different periods of impacts. One occurred as it moved across the Florida Keys and again a few days later as it turned around and moved north (see below). The Basin received beneficial rainfall from Eta since surface water levels were already starting their winter recession. The rainfall totals from T.S Eta ranged from 2.5 inches to 10.5 inches in the northeastern portion of the Basin. Fortunately, the Basin did not receive the brunt of the storm's rainfall. Other areas of south Florida received closer to 20 inches of rainfall from the event. Other than T.S. Eta, November's weather was fairly typical and brought mostly warm and sunny conditions to the area. The end of November brought the official end of the very busy 2020 hurricane season, which yielded 30 named storms. Fortunately, the Basin was spared major impacts from any of the storms this year. Rainfall in November was well above normal due Tropical Storm Eta. The basin-wide monthly average was **4.35 inches (265% of normal)**, which is above the average 1.64 inches typically collected.

December: A typical dry season pattern remained in place over the Basin during December. A series of cold fronts that made their way through the region brought little rainfall except for one stronger front that moved through the first few days of the month. The early month front brought almost all of the month's above average rainfall in a couple days. That beneficial rain event once again topped off surface and groundwater levels throughout the region. As the year ended, water levels throughout the region remain well above normal for this time of year and are in an excellent position to weather the expected drier periods of the winter and spring. Rainfall totals for 2020 came in at 56.1 inches which is 99% of average. The wetter than average September through

December offset the deficit the region had from the spring drought. Rainfall in December was above normal due a strong early December cold front. The basin-wide monthly average was **3.23 inches (193% of normal)**, which is above the average 1.67 inches typically collected.

Acknowledgement: The data included with this document were collected by the staff of the Florida Department of Environmental Protection at the Rookery Bay National Estuarine Research Reserve with funding through NOAA's Estuarine Research Division. Any products derived from these data should clearly acknowledge this source (please use the attached logos). This recognition is important for ensuring that this long-term monitoring program continues to receive the necessary political and financial support.