Rookery Bay (RKB) National Estuarine Research Reserve (NERR) Nutrient Metadata (January 2014 – December 2014)

Latest Update: August 17, 2016

I. Data Set and Research Descriptors

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2) Research Objectives

The four primary SWMP stations were in estuaries affected by watersheds demonstrating different patterns of land-use. Their placement addresses priority resource management issues that were 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 different pattern of altered freshwater inflow.

a) Monthly Grab Sampling Program- The principal objective of the monthly grab sampling was 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 was 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 waterbody).

3) Research Methods

a) Monthly Grab Sampling Program

Monthly grab samples were collected at all four System-Wide Monitoring Program (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 (a Secondary SWMP station). 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 v 1.6. 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.

For analysis of dissolved inorganic nutrients, chlorophyll *a*, the samples were filtered in the field. 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 and chain of custody sheets were completed for tracking the samples during laboratory analysis and in the laboratory database. Water sampling device (peristaltic pump) tubing, carboys (for deionized water), and filter holders were pre-cleaned using a FDEP decontamination procedure (FDEP SOP FC1000/DEP-QAA-01/001) which involved: cleaning the 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 sampling station, grab samples for dissolved nutrients were collected 12 inches below the surface (near surface grab) using a peristaltic pump. The peristaltic pump tubing with a filter holder attached was used to filter for dissolved nutrients. Nitrile gloves were worn through the entire process of sample collection and filtering. For the chlorophyll *a* samples, HDPE amber sample bottles were rinsed three times with the sample water and then filled to the shoulder, capped, and immediately stored in a cooler with ice. For the dissolved phosphorus and nitrite, HDPE sample bottles were rinsed three times with the filtered water and then filled with the filtrate, capped, and immediately stored in a cooler with ice. The HDPE sample bottles for ammonium and nitrite + nitrate contained sulfuric acid for preservation and therefore were not rinsed before adding the filtrate. For total Kjelldahl nitrogen (TKN) and total phosphorus (TP) (analyzed for grab samples only), HDPE sample bottles were rinsed three times with the sample water and then filled to the shoulder, capped, and put on ice. To avoid cross contamination, the peristaltic pump tubing was rinsed thoroughly with deionized water after each sampling at each station and then rinsed three times with sample water before sampling at each new station. New gloves and filters were used at each site. Additionally, an equipment blank was performed at the end of each sampling event by following all the same procedures but with deionized water as the sample.

At each site physical/chemical water quality parameters were measured at the same depth as where the nutrient samples were taken. AYSI 600-OMS sonde and a hand held display (YSI model 650) were used to record the measurements. Recorded parameters included salinity (ppt), specific conductivity (mS/cm), temperature (°C), and dissolved oxygen (% and mg/L). Equipment calibration was done according to DEP-SOP 001/01.

b) Diel Sampling Program

Monthly diel samples (11) were collected at the depth of the water quality datasonde (6 inches above the bottom) every 2.5 hours over a lunar day (24hr:48 min) using an ISCO refrigerated auto-sampler (model 3700FR). 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 ISCO were washed following the same FDEP decontamination procedure as described above. 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 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 the dissolved ammonium and nitrite + nitrate, HDPE sample bottles were filled with the filtrate, capped, and immediately stored in a cooler with ice. For the dissolved phosphorus and nitrite, HDPE sample bottles were filled the filtrate, capped, and immediately stored in a cooler with ice. 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. New filters and syringes were used for each sample.

c) All Samples

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

4) Site location and character

Lower Henderson Creek (rkblhnut):

Lat/Long (Decimal Degrees): 26.0257 N, 81.7332 W

The Lower Henderson Creek water quality station is located at the mouth of Henderson Creek. The monitoring site is approximately 5 km downstream of a four-lane highway (SR 951) that crosses Henderson Creek. The water quality data logger is located within the creek channel at the "manatee caution" marker. The diel samples were taken off the Rookery Bay Dock located within Henderson Creek approximately 100 meters from the water quality station. 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 m to 2.76 m (average 1.06 m). Salinity at this site ranged from 6.5 to 37.6 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.

Middle Blackwater River (rkbmbnut):

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

The Middle Blackwater River water quality station is located at the mouth of the river at navigational marker #17 within the channel. The "Middle" Blackwater labeling is to distinguish it from other historical sites. The water quality data logger is affixed to marker #17. The average depth at this marker is approximately 2 meters

at MHW. The tidal range for Middle Blackwater River varies between 0.2 and 1.8 meters. Salinity at this site ranged from 2.0 to 37.4 ppt during the year. Salinity fluctuates with the tides and watershed rainfall. The substrate within the channel is a mixture of sand and silt with oyster shell and 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) 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 (rkbfunut):

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

The Faka Union Bay water quality station is located at the mouth of the Faka Union Canal. The water quality data logger is affixed to a manatee speed zone sign within the main channel. The average depth at this site is approximately 2 meters at MHW. The tidal range for Faka Union Bay varies between 0.2 and 1.6 meters. Salinity at this site ranged from 0.4 to 37.1 ppt during the year. Salinity fluctuates daily with tides, seasonal rainfall, and water management use 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.

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 (rkbfbnut):

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

The Fakahatchee Bay water quality station is located between the mouths' of the Fakahatchee River and the East River. The water quality data logger is placed in a 4" PVC housing secured to a 6" PVC pipe at this location. The average depth at MHW is approximately 2 meters. The tide range for Fakahatchee varies between 0.2 and 1.8 meters. Salinity at this site ranged from 3.3 to 37.6 ppt during the year. Salinity fluctuates 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.

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 the least altered.

Pumpkin Bay (rkbpbnut):

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

This Secondary SWMP site is located at the mouth of the Pumpkin River and does not have an associated water quality data logger. Mean high water is approximately 1 – 2 meters. The mean tide range is approximately 0.40 meters. Salinity at this site ranged from 11.4 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 diverts freshwater from Pumpkin Bay and it's tributary. Due to the altered fresh water

inflow, generally this iste can be freshwater limited.

5) Code variable definitions

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

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

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

6) Data Collection Period

The System-Wide Monitoring Program nutrient sampling began in January 2002 at all of the SWMP sampling stations. Sampling began in October 2012 at the Secondary SWMP station, rkbpbwq. For 2014, the data collection period was from January to December.

Monthly Grab Sampling

Station Code	Date Time Stamp (rep 1)	(rep 2)
rkblhnut	1/9/2014 9:17	1/9/2014 9:23
rkblhnut	2/6/2014 9:29	2/6/2014 9:35
rkblhnut	2/24/2014 14:10	2/24/2014 14:15
rkblhnut	3/6/2014 12:32	3/6/2014 12:35
rkblhnut	4/10/2014 12:57	4/10/2014 13:02
rkblhnut	5/7/2014 12:46	5/7/2014 12:50
rkblhnut	6/4/2014 11:01	6/4/2014 11:05
rkblhnut	7/1/2014 12:36	7/1/2014 12:40
rkblhnut	8/6/2014 11:27	8/6/2014 11:31
rkblhnut	9/3/2014 11:19	9/3/2014 11:23
rkblhnut	10/2/2014 11:52	10/2/2014 11:56
rkblhnut	11/5/2014 13:30	11/5/2014 13:34
rkblhnut	12/3/2014 13:30	12/3/2014 13:35
rkbfbnut	1/9/2014 11:02	1/9/2014 11:11
rkbfbnut	2/6/2014 10:16	2/6/2014 10:21
rkbfbnut	2/24/2014 12:02	2/24/2014 12:06
rkbfbnut	3/6/2014 10:23	3/6/2014 10:27
rkbfbnut	4/10/2014 9:49	4/10/2014 9:53
rkbfbnut	5/7/2014 10:41	5/7/2014 10:46
rkbfbnut	6/4/2014 9:06	6/4/2014 9:10
rkbfbnut	7/1/2014 10:03	7/1/2014 10:07
rkbfbnut	8/6/2014 9:11	8/6/2014 9:15
rkbfbnut	9/3/2014 9:23	9/3/2014 9:27
rkbfbnut	10/2/2014 9:42	10/2/2014 9:46
rkbfbnut	11/5/2014 10:29	11/5/2014 10:34
rkbfbnut	12/3/2014 11:28	12/3/2014 11:31

rkbfunut	1/9/2014 11:29	1/9/2014 11:34
rkbfunut	2/6/2014 10:43	2/6/2014 10:46
rkbfunut	2/24/2014 11:35	2/24/2014 11:40
rkbfunut	3/6/2014 10:00	3/6/2014 10:06
rkbfunut	4/10/2014 10:13	4/10/2014 10:17
rkbfunut	5/7/2014 10:15	5/7/2014 10:19
rkbfunut	6/4/2014 8:41	6/4/2014 8:45
rkbfunut	7/1/2014 9:36	7/1/2014 9:41
rkbfunut	8/6/2014 8:45	8/6/2014 8:48
rkbfunut	9/3/2014 8:57	9/3/2014 9:02
rkbfunut	10/2/2014 9:20	10/2/2014 9:24
rkbfunut	11/5/2014 10:53	11/5/2014 10:57
rkbfunut	12/3/2014 11:03	12/3/2014 11:08
rkbpbnut	1/9/2014 11:47	1/9/2014 11:54
rkbpbnut	2/6/2014 11:09	2/6/2014 11:14
rkbpbnut	2/24/2014 11:09	2/24/2014 11:15
rkbpbnut	3/6/2014 9:40	3/6/2014 9:45
rkbpbnut	4/10/2014 10:43	4/10/2014 10:47
rkbpbnut	5/7/2014 9:40	5/7/2014 9:45
rkbpbnut	6/4/2014 8:17	6/4/2014 8:20
rkbpbnut	7/1/2014 9:07	7/1/2014 9:10
rkbpbnut	8/6/2014 9:41	8/6/2014 9:45
rkbpbnut	9/3/2014 8:35	9/3/2014 8:38
rkbpbnut	10/2/2014 8:52	10/2/2014 8:55
rkbpbnut	11/5/2014 11:16	11/5/2014 11:20
rkbpbnut	12/3/2014 10:38	12/3/2014 10:41
rkbmbnut	1/9/2014 12:31	1/9/2014 12:39
rkbmbnut	2/6/2014 13:37	2/6/2014 13:43
rkbmbnut	2/24/2014 10:26	2/24/2014 10:29
rkbmbnut	3/6/2014 11:06	3/6/2014 11:09
rkbmbnut	4/10/2014 11:19	4/10/2014 11:23
rkbmbnut	5/7/2014 8:58	5/7/2014 9:02
rkbmbnut	6/4/2014 7:41	6/4/2014 7:45
rkbmbnut	7/1/2014 10:56	7/1/2014 11:00
rkbmbnut	8/6/2014 8:05	8/6/2014 8:09
rkbmbnut	9/3/2014 7:56	9/3/2014 8:00
rkbmbnut	10/2/2014 8:06	10/2/2014 8:10
rkbmbnut	11/5/2014 12:05	11/5/2014 12:10
rkbmbnut	12/3/2014 9:56	12/3/2014 10:01

Diel Sampling

Station Code	Date Time Stamp (begin)	(end)
rkblhnut	1/15/2014 7:30	1/16/2014 8:30
rkblhnut	2/18/2014 9:30	2/19/2014 10:30
rkblhnut	3/18/2014 8:30	3/19/2014 9:30
rkblhnut	4/14/2014 7:00	4/15/2014 8:00
rkblhnut	5/12/2014 5:00	5/13/2014 6:00
rkblhnut	6/16/2014 9:30	6/17/2014 10:30
rkblhnut	7/14/2014 9:30	7/15/2014 10:30
rkblhnut	8/12/2014 8:00	8/13/2014 9:00

rkblhnut	9/9/2014 7:30	9/10/2014 8:30
rkblhnut	10/7/2014 7:30	10/8/2014 8:30
rkblhnut	11/11/2014 10:30	11/12/2014 11:30
rkblhnut	12/9/2014 9:30	12/10/2014 10:30

7) Associated Researchers and Projects

Rookery Bay NERR participates in the NERR SWMP for water quality and meteorological data collection. 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 four water quality sites were also selected to represent various degrees of watershed hydrologic alteration. Both water quality and meteorological data are available from the Research Coordinator or online at www.nerrsdata.org.

Both water quality and nutrient data generated by Rookery Bay 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), a shark demographics survey (May 2000 to the present), and an oyster reef/benthic crab survey (1999 to 2008). These data are available from the Research Coordinator. 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 2012.

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 Brader Drevenkar, Water Quality Program Manager. Upon receiving the results, Julie reviewed the data for errors. Julie 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 asterisks "*".

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 Kjelldahl Nitrogen	TKN	mg/L as N
	Total Organic Nitrogen	TON	mg/L as N
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	%

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
Plant Pigments:	CHLA and PHEA

b. Calculated Parameters-

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

12) Limits of Detection

Method Detection Limits (MDL), the minimum concentration of a parameter that an analytical procedure can reliably detect, were established by the Florida Department of Environmental Protection, Bureau of Laboratories. 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 1.11). 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 year the labs employed verification checks on all MDLs. If the verification checks met the lab's acceptance criteria then the MDL was not recommended for change. The MDL for all parameters were determined by Florida Department of Environmental Protection, Bureau of Laboratories.

Parameter	**Variable**	**MDL**	**Approved**
Orthophosphate	PO4F	0.004 mg/L	01/01/14-12/31/14
Ammonium	NH4F	0.002 mg/L	01/01/14-12/31/14
Nitrite	NO2F	0.002 mg/L	01/01/14-12/31/14
Nitrite +Nitrate	NO23F	0.004 mg/L	01/01/14-12/31/14
Chlorophyll *a*	CHLA	0.55 µg/L	01/01/14-12/31/14
Phaeophytin	PHEA	0.4 µg/L	01/01/14-12/31/14
Kjelldahl Nitrogen	TKN	0.08 mg/L	01/01/14-12/31/14
Total Phosphorus	TP	0.002 mg/L	01/01/14-12/31/14

13) Laboratory Methods

Chemical and biological analysis was performed by Florida Department of Environmental Protection, Bureau of Laboratories. FL DEP 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
PO4F, Orthophosphate	Cool, to ≤6 °C	Filter within 15 minutes; Analyze within 48 hours.
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

*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 (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.
NOTE: This method measures total ammonia, NH3 is considered negligible

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: CHLA and PHEA
EPA or other Reference Method: SM 10200 H
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.

14) Field and Laboratory QAQC programs

Based on the FDEP SOP 5361 QAQC manual and FDEP Quality Manual (available by request).

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

i) **Field Variablity –** 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 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
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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 way below MDL values are handled in the NERRS SWMP dataset was 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.

For all 2014 grab samples, NH4F and NO23F samples were not filtered due to a mix up with the lab. As a result, analyses may have been skewed by the presence of microbes or particulates that may have interfered with sample analysis or introduced additional nutrients. Measured values are likely higher than they would have been from filtered samples. This also impacted calculated parameters NO3, DIN, TN, and TON. All grab samples for these parameters have been marked 1 CSM or GSM beginning July 2012 through January 2016.

From January through December for all sites and for both diel and grab programs, the NH4 data reported is actually total ammonia. The analysis was performed by a different laboratory during this period. Their explanation of the method is that through acidification of field samples, any available NH3 (un-ionized ammonia) is converted to NH4 (ammonium) and total ammonia is measured analytically. The ammonium present following acid preservation represents the total ammonia in the original sample.

The February grab samples were delivered 3 days late due to icy weather preventing FedEx from shipping. PO4F data and NO2F data were analyzed beyond acceptable hold time and it is unclear what temperature they

were at when delivered to the lab. CHLA and PHEA were not analyzed. PO4F, NO2F, and CHLA were resampled on 2/24/2014.

The samples recollected on 2/24/2014 for PO4, NO2, CHLA, PHEA were delivered on 2/26/2014, 1 day later than normal protocol. They were still within acceptable hold time per CDMO standards, though not for FL DEP standards. Data were not flagged suspect.

For the March grab sample, rkblhnut field data were inadvertently not collected.

For the diel samples at rkblhnut on 04/14/2014 07:00 through 12:00, PO4F data, NO2F data, CHLA data and PHEA data were analyzed within acceptable hold time per CDMO standards, but not FL DEP standards. Data were not flagged suspect.

The April diel sample 00:30 was not collected due to a broken ISCO bottle.

The May diel sample 22:30 was not collected due to a broken ISCO bottle. The bottle was replaced for next collection date.

For the grab samples at rkblhnut 10/02/2014 11:52 and 11:56, CHLA data were flagged rejected due to anomalously high values.

For the diel sample at rkblhnut on 10/08/2014 08:30, CHLA data was flagged rejected due to anomalously high value.

For the diel samples at rkblhnut on 10/07/2014 07:30 through 10:00, PO4F data, NO2F data, CHLA data and PHEA data were analyzed within acceptable hold time per CDMO standards, but not FL DEP standards. Data were not flagged suspect.

Weather conditions based on Big Cypress Basin Hydrologic Summary Reports:

January: Although drier than normal hydrologic conditions prevailed across southwest Florida at the start of the year, the influence of larger frontal weather systems contributed to markedly wetter conditions for the latter part of January. The average rainfall for the month in the BCB area was 3.70 inches, or 220% above our historic January average of 1.68 inches. This Basin-wide weighted average, taken from 20 individual stations, indicated normal dry conditions for most of the month until the onset of an unusually persistent rainfall pattern which generated 2.69 inches during the last week of January.
February: Following the unusually wet conditions experienced at the end of the preceding month, normal rainfall patterns asserted themselves for most of February. The average rainfall for the month in the BCB area was 1.35 inches, or 30% below our historic February average of 1.93 inches. This Basin-wide weighted average, taken from 20 individual stations, indicated normal dry conditions for the month. However, accumulated rainfall totals remain above the norm so far this year. The BCB area has received 4.85 inches, or an excess of 1.24 inches above normal.
March: Although rainfall for February was somewhat below historic average, normal conditions prevailed for most of March. Frontal activity persisted across Southwest Florida, a pattern recurring with weekly regularity, and resulting in good rainfall totals for the month. The average rainfall for the month in the BCB area was 2.22 inches, statistically almost to par (-3%) with our historic March average of 2.29 inches. This Basin-wide average, taken from 20 individual stations, indicated normal dry season conditions for the month. However, accumulated rainfall totals remain above the norm so far this year. The BCB area has received 7.15 inches, or an excess of 1.25 inches above normal.
April: Rainfall over the BCB area was helped by continuing frontal activity, which brought much needed moisture throughout the month. Atmospheric conditions started changing somewhat by the end of April, with the increasing likelihood of late afternoon scattered thunderstorms, a typical rainfall pattern generally indicating the onset of the summer rainy season. Rainfall amounts for April were consistent with the historic

average for this time of year. The BCB received 2.22 inches, slightly less (-6%) than the April average of 2.37 inches. This Basin-wide average, taken from 19 individual stations, indicated normal dry season conditions for the month. However, accumulated rainfall totals remain above the norm so far this year. Aggregated totals indicate that through the month of April the BCB area had received 9.51 inches, or an excess of 1.26 inches, above normal for the year.

May: May rainfall for BCB area was helped by sporadic frontal activity, and by some level of afternoon thunderstorm activity, a typical rainfall pattern generally indicating the onset of the summer rainy season. The cumulative monthly totals, which had been well below average, were helped somewhat by frontal activity which occurred on the last weekend of the month. Rainfall amounts for May ended below the historic average expected for the month; the BCB received 2.50 inches, or 28% less than the recorded long term monthly average of 3.47 inches. This Basin-wide average, taken from 18 individual stations, was indicative of sub-par rainfall for May, normally a transitional month preceding the arrival of the wet season. However, accumulated rainfall totals for the year still remain on track. Aggregated totals indicate that by the end of the month the BCB area had received 11.95 inches, closely matching the 12.03 inches normally expected by this time of year.

June: Rainfall activity was generally scant for the first part of June, slowly increasing to above-average levels by the end of the month. The typical pattern of afternoon thunderstorms was responsible for much of the rain, helped by frontal activity during the very last days of June, as we experienced some effects from Tropical Depression #1, the storm now named Arthur. The Basin-wide average, taken from 17 individual stations, measured 8.07 inches, or 13% less than the recorded long term of 9.27 inches. However, the cumulative rainfall amounts for the year are still consistent with the historic average. Aggregated totals indicate that by the end of the month the BCB area had received 20.21 inches, only slightly less than the 20.95 inches normally expected by now.

July: Rainfall activity remained below average for most of July. The typical pattern of afternoon thunderstorms, helped by some frontal activity, was mostly responsible for much of the rainfall. The BCB area experienced little effect from Hurricane Arthur and Tropical Depression Two, the tropical cyclones which formed in the Atlantic during the month. The Basin-wide rainfall average, taken from 17 individual stations measured 7.61 inches, or 13% less than the recorded long term of 8.72 inches. The accumulated rainfall amounts for the year are still below average. Aggregated totals indicate that by the end of the month the BCB area had received 27.83 inches, less than the 30.39 inches normally expected by now.

August: August was ushered in with a significant rainfall event on the 4th, which dropped over 6 inches of rain over portions of the City of Naples and coastal areas of Collier County. These localities experienced severe roadway and street flooding, principally due to the intensity of the rainfall. Precipitation rates recorded at the Naples Airport suggest that intensities may have exceeded the 50yr recurrence interval - typically characterized as events with a 2% chance of occurrence in any given year. However, the storm was not widely distributed, and rainfall amounts were considerably less for other parts of Collier County, including North Naples and Golden Gate Estates.

September: Following on the heels of a wet August, the season continued unabated throughout September. Although the tropics remained generally quiet, the normal patterns of afternoon and early evening thunderstorms, helped by some frontal activity, were sufficient enough to generate significant rain. Incident rainfall, as reported by 18 stations throughout the BCB, averaged 10.6 inches, almost 23% above the month's historic average of 8.6 inches. Rainfall was fairly well distributed, with the highest amounts recorded in the locality of southern Golden Gate Estates (SGGEWX), where 7 inches fell during the 3-day period of September 25th to 27th, an intensity approaching that of a 5-yr event. The accumulated precipitation for the year is now up to 48.39 inches, slightly more than the historic average of 48.16 inches.

October: As expected, the end of wet season generally coincided with the steady development of winter weather conditions in the BCB area. The typical convective pattern of afternoon and early evening thunderstorms gradually abated, replaced by more modest rainfall from incoming cold fronts. No major storms were reported, and incident rainfall, as recorded by 18 stations, averaged 2.08 inches, a striking 45% less than the month's historic average of 3.62 inches. Accumulated totals for the year are now up to 50.38 inches, slightly less than the historic average of 51.55 inches.

November: Predictably, the rainfall patterns this month were consistent with winter conditions; dependent on the arrival of cold fronts over the BCB. Also predictably, no major events were reported, and the incident rainfall recorded by 18 stations averaged 3.08 inches, an increase of 78% above the monthly historic average

of 1.73 inches. The accumulated total for the year is now up to 53.49 inches, slightly in excess of the area's historic normal of 53.28 inches, as measured at these BCB monitoring locations.

December: Rainfall this month was scant, consistent with winter conditions. The significant frontal activity experienced across South Florida did not help the BCB, and totals were below par for December. Incident rainfall recorded by 18 stations averaged 0.35 inches, 79% less than the monthly historic average of 1.64 inches. The accumulated total for the year is now up to 53.86 inches, slightly less than the area's historic normal of 55.00 inches, as measured at these BCB monitoring locations. The location with highest rainfall, the SGGE station in the Picayune Strand, which recorded a total of 73.71 inches for the year, as well as the lowest, 46.98 inches recorded at the Marco Utilities R.O. Plant on Marco Island.

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