Rookery Bay (RKB) NERR Nutrient Metadata
(January 2002 – December 2002)
Latest Update: May 19, 2025

I. Data Set and Research Descriptors

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2) Research Objectives

– The four stations selected are in estuaries with different land-use patterns within their watersheds. Their placement addresses priority resource management issues that are identified in the Reserve's management plan. Specifically, the data from these stations are providing valuable information concerning the affects of land-use activities on the quantity, quality and timing of freshwater inflow into the Reserve.

a) **Monthly grab-** The principal objective of the monthly grab sampling is to determine spatial and temporal differences in water quality within the Reserve.

b) Diel Sampling Program – The principal objective of the diel sampling is to determine the impact of tidal water exchange within Henderson Creek (the main source of freshwater into Rookery Bay).

3) Research Methods- Samples are collected in coordination with the Southeastern Environmental Research Center (SERC) Water Quality Monitoring Program – Florida International University (FIU).

a) **Monthly Grab Sampling Program** – Monthly grab samples are taken within 50 meters of all four SWMP water quality stations (Henderson Creek, Middle Blackwater River, Faka Union Bay and Fakahatchee Bay). Typically three types of water samples were taken 1) filtered soluable nutrient samples; 2) unfiltered total nutrient samples; and 3) chlorophyll-a samples. Clean 60 and 125 ml high density polyethylene (HDPE) bottles are used for filtered and total nutrient samples, respectively. These bottles, as well as all sample bottles are cleaned as per SOP SERC 004-98. Chlorophyll samples are stored in 1.8 ml microcentrifuge tubes, which are used once and then discarded. The unfiltered samples were collected 10 cm below the surface using 129 ml HDPE bottles and kept at ambient temperature in the dark. Duplicate (N=2) water samples for dissolved nutrient analysis were collected using acid washed and sample rinsed (x 3) 150 ml syringes and filtered in the field (SOP SERC 003-98) using 25 mm glass fiber GF/F filters. The sample water was then stored in acetone-washed and sample rinsed 60 ml HDPE bottles, which were capped and immediately stored on ice in the dark. The wet filters, used for chlorophyll a (Chl a) analysis, were placed in 1.8 ml plastic centrifuge tubes to which 1.5 ml of 90% acetone were added (Strickland and Parsons 1972); they were then capped and put into a dark bottle on ice for transport. (See SOP SERC 003-98).

Surface salinity (ppt) and temperature (°C) were measured using a combination salinity-conductivity-temperature probe (Orion model 140). Dissolved oxygen (DO, mg/L) was measured 10 cm below the surface using and oxygen electode (Orion model 840) corrected for salinity and temperature. (See SOP SER 005-98).

b) Diel Sampling Program - Monthly diel samples were collected every 2.5 hours over a lunar day (24hr:48 min) using and ISCO model 3700FR refrigerated autosampler. The sampler was stationed at the end of the Rookery Bay dock, approximately 100

meters from the water quality station. Collection of the samples began at slack low tide when ever possible. Prior to sampling the Polyethylene bottles were washed using (Liqui-Nox® soap), soaked in an acid bath (10% HCL) for at least 15 minutes and rinsed 3-6 times with distilled-deionized water and air dried. The siphon hose is rinsed 3 times with ambient water prior to set up. *Sample filtration:* Each polyethylene bottle was shaken to redistribute sediments in bottom. Using a large syringe, sample water was filtered through a 25 mm (0.7µm) Glass Microfibre filter (Whitman GF/F) into a 30 ml Nalgene/HDPE sample bottle and labeled. This was done for all 11 water samples. *Chlorophyll a:* The remainder of the water sample is passed through the filter until no more water is able to pass through the filter (this amount is noted on the chain-of-custody sheet). A known amount of air (66 cc) is forced through the filter twice to aid in drying. Using forceps, the filter is carefully folded and transferred to a 1.8 ml microcentrifuge tube and the tube is filled with 90% acetone (approx. 1.5 ml). The tube is labeled and placed in an Amber Nalgene HDPE bottle (dark). This procedure is repeated for all the water samples collected in the ISCO sampler. The samples are then transported in a cooler directly to the Analytical Laboratory at Florida International University (FIU).

4) Site location and character-

Lower Henderson Creek (rkblhnut)– This site is located at the mouth of Henderson Creek. While this station receives most of its freshwater from a canal system that drains a watershed area approximately 50% development versus natural landscape, a weir controls most of the freshwater flow. This structure has been upgraded to mimic more natural conditions. The data logger is located within the creek channel at the “manatee caution” marker, (lat: N 26.0257 long: W-81.7332). The diel samples are taken off the Rookery Bay Dock located within Henderson Creek directly approximately 100 meters from the water quality station.

Tides at Henderson creek are mixed and range from 0 m to 2.76m (average 1.06m). The average mid-channel depth is approximately 2 m MHW, and an average width of 239 m. The salinity ranges from 0 ppt – 38.4 ppt, depending on the season. Creek bottom habitats are predominantly fine sand and mud. The dominant marsh vegetation near the sampling site is red mangrove. Watershed activities that potentially impact the site include non-point source pollution from road runoff, drift of mosquito control pesticides, and runoff from upstream agricultural areas as well as leachate from nearby residential septic systems.

Middle Blackwater River (rkbmbnut) - This site is located at the mouth of the river at navigational marker #17 within the channel (N 25.9343 W-81.5956). The average depth at this marker is approximately 2 meters at MHW. The "Middle" Blackwater labeling is to distinguish it from other historical sites.

The substrate within the channel is a mixture of silt, sand and oyster shell. Red mangroves dominate the surrounding vegetation at the site. Upstream influences consist of the Collier-Seminole State Park's boat basin, SR 41 canal, and some agricultural influences. Also, the historical flow seems to be altered by the Southern Golden Gate Estates Drainage Project.
Salinities range from 0 – 40.7ppt, depending on seasonal rainfall. Tidal ranges vary from 0.2 m to 1.8 m.

Faka Union Bay (rkbfunut) – This site is located at the mouth of the Faka Union Canal at the "Manatee Caution" marker within the main channel (N25.9005 W-81.5159).

The substrate within the channel is a mixture of sand and silt. Red mangrove forest and spoil islands dominate the area around the canal. Upstream influences consist of Port-of-the Islands development and marina. The upstream flow consists of an elaborated canal system (Southern Golden Gate Estates Drainage basin). This system has altered natural freshwater flow into Faka Union Bay and Blackwater River. Salinities range from 0 – 39 ppt, depending on seasonal rainfall. The average depth at this site is approximately 2 meters. Tidal ranges are between 0.2 – 1.6 meters.

Fakahatchee Bay (rkbfbnut)– This site is located between the mouths' of the Fakahatchee River and the East River, (N25.8922 W-81.4770).

The substrate within the channel is a mixture of sand, shell and silt. Red mangrove dominates the area vegetation. Upstream influences consists of minimal effects of the Prairie Canal and I-75 and US 41. The majority of the watershed is within the Fakahatchee Strand Preserve and Big Cypress National Park. Salinities range from 0 – 40 ppt, and tidal ranges are between 0.2 and 1.8 meters.

5) Code variable definitions-

rkblhnut **=** Lower Henderson Creek (monthly nutrients and diel sampling)
rkbmbnut = Middle Blackwater River (monthly nutrients)
rkbfunut = Faka Union Bay (monthly nutrients)
rkbfbnut = Fakahatchee Bay (monthly nutrients)

Monitoring Programs: 1-Grab Sampling, 2-Diel Sampling

6) Data Collection Period-

Monthly Grab Sampling

Site	Start Date	Start Time	End Date	End Time

rkblhnut	02/14/02	13:58	02/14/02	13:59
rkblhnut	03/14/02	09:58	03/14/02	09:59
rkblhnut	04/26/02	14:49	04/26/02	14:50
rkblhnut	05/14/02	10:35	05/14/02	10:36
rkblhnut	06/05/02	10:28	06/05/02	10:29
rkblhnut	07/16/02	12:00	07/16/02	12:01
rkblhnut	08/28/02	13:32	08/28/02	13:33
rkblhnut	09/24/02	10:41	09/24/02	10:42
rkblhnut	10/22/02	11:28	10/22/02	11:29
rkblhnut	11/26/02	10:02	11/26/02	10:03
rkblhnut	12/17/02	09:45	12/17/02	09:46
rkbmbnut	01/24/02	11:15	01/24/02	11:16
rkbmbnut	02/21/02	10:55	02/21/02	10:56
rkbmbnut	03/20/02	11:10	03/20/02	11:11
rkbmbnut	04/11/02	11:27	04/11/02	11:28
rkbmbnut	05/23/02	10:15	05/23/02	10:16
rkbmbnut	06/18/02	09:58	06/18/02	09:59
rkbmbnut	07/24/02	13:20	07/24/02	13:21
rkbmbnut	08/16/02	09:17	08/16/02	09:18
rkbmbnut	09/20/02	10:52	09/20/02	10:53
rkbmbnut	10/03/02	10:31	10/03/02	10:32
rkbmbnut	11/04/02	10:12	11/04/02	10:13
rkbmbnut	12/12/02	10:18	12/12/02	10:19

rkbfunut	01/24/02	12:14	01/24/02	12:15
rkbfunut	02/21/02	11:40	02/21/02	11:41
rkbfunut	03/20/02	12:07	03/20/02	12:08
rkbfunut	04/11/02	12:06	04/11/02	12:07
rkbfunut	05/23/02	11:30	05/23/02	11:31
rkbfunut	06/18/02	10:45	06/18/02	10:46
rkbfunut	07/24/02	11:40	07/24/02	11:41
rkbfunut	08/16/02	09:56	08/16/02	09:57
rkbfunut	09/20/02	11:49	09/20/02	09:50
rkbfunut	10/03/02	11:51	10/03/02	11:52
rkbfunut	11/14/02	11:03	11/14/02	11:04
rkbfunut	12/12/02	09:10	12/12/02	09:11
rkbfbnut	02/21/02	12:00	02/21/02	12:01
rkbfbnut	03/20/02	12:30	03/20/02	12:31
rkbfbnut	04/11/02	16:38	04/11/02	16:39
rkbfbnut	05/23/02	14:35	05/23/02	14:36
rkbfbnut	06/18/02	15:10	06/18/02	15:11
rkbfbnut	07/24/02	14:18	07/24/02	14:19
rkbfbnut	08/16/02	10:06	08/16/02	10:07
rkbfbnut	09/20/02	11:59	09/20/02	12:00
rkbfbnut	10/03/02	12:02	10/03/02	12:03
rkbfbnut	11/14/02	11:16	11/14/02	11:17
rkbfbnut	12/12/02	08:53	12/12/02	08:54

Diel Sampling

Site	Start Date	Start Time	End Date	End Time
rkblhnut	02/04/02	08:00	02/05/02	08:45
rkblhnut	03/03/02	08:00	03/04/02	08:45
rkblhnut	04/02/02	09:15	04/03/02	10:00
rkblhnut	05/11/02	07:00	05/12/02	05:30
rkblhnut	06/09/02	11:00	06/10/02	09:30
rkblhnut	07/01/02	11:00	07/02/04	09:30
rkblhnut	08/05/02	11:00	08/06/02	09:30
rkblhnut	09/02/02	11:00	09/03/02	09:30
rkblhnut	10/06/02	09:00	10/07/02	07:30
rkblhnut	11/04/02	10:00	11/05/02	07:30
rkblhnut	12/07/02	10:00	12/08/02	09:30

7) **Associated Researchers and Projects-** The nutrient data collection and analysis is part of the Southeastern Environmental Research Center (SERC) Water Quality Monitoring Program. This program was established to address regional water quality concerns outside the boundaries of individual agencies. This "network" collects some 479 sites within the South Florida Region (for more information visit the website: http://serc.fiu.edu.

8) **Distribution-**
NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the

data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Services, National Oceanic and Atmospheric Administration. 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 Recipients 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.

NERR water quality data and metadata can be obtained from the Research Coordinator at Rookery Bay NERR site (please see Section 1. Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under general information link on the CDMO home page) and online at the CDMO home page http://cdmo.baruch.sc.edu/. Data are available in text tab-delimited format, Microsoft Excel spreadsheet format and comma-delimited format.

II. Physical Structure Descriptors

9) **Entry Verification –** Nutrient data collection and analysis for Rookery Bay NERR is part of a partnership with Florida International University/ Southeast Environmental Research Center's Estuarine Water Quality Monitoring Network. Water quality data is collected monthly during the annual period of record (POR) from 28 stations in Florida Bay, 22 stations in Whitewater Bay, 25 stations in the Ten Thousand Islands, 25 stations in Biscayne Bay, and 28 stations in Cape Romano-Rookery Bay. The results and quarterly report (which includes Rookery Bay's SWMP sites) are submitted to Mike Shirley, Research Coordinator at RKBNERR and Vicki McGee, Water Quality Program Manager at RKBNERR as deliverables as par their annual purchase order agreement. For details on FIU/SERC laboratory QA/QC procedures please contact Dr. Joseph Boyer, Associate Director of SERC: boyerj@fiu.edu.
Upon receiving the quarterly reports Vicki McGee reviews and compiles the data according to CDMO Nutrient monitoring guidelines.

10) Parameter Titles and Variable Names by Data Category

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

Data Category	Parameter	Variable Name	Units of Measure
Phosphorus & Nitrogen:	Total Phosphorus	TP	mg/L as P
	*Orthophosphate	PO4F	mg/L as P
	Total Nitrogen	TN	mg/L as N
	Total Organic Nitrogen	TON	mg/L as N
	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N
	*Nitrite, Filtered	NO2F	mg/L as N
	*Nitrate, Filtered	NO3F	mg/L as N
	*Ammonium, Filtered	NH4F	mg/L as N
	Dissolved Inorganic Nitrogen	DIN	mg/L
Plant Pigments:	*Chlorophyll a	CHLA_N	µg/L
Carbon:	Total Carbon	TOC	mg/L
Other Lab Parameters:	Silicate	SiO4F	mg/L

Field Parameters:

Dissolved Oxygen	DO_N	mg/L
%Dissolved Oxygen	DO_S_N	SAT %
pH	PH_N	standard units
Salinity	SALT_N	ppt
Water Temperature	WTEM_N	°C
Turbidity	TURB_N	NTU

Notes: Time is coded based on a 2400 hour clock and is referenced to Eastern Standard Time (EST). Reserves have the option of measuring either NO23 or NO2 or NO3.

11) Measured and Calculated Laboratory Parameters –

a) Variables Measured Directly-

Nitrogen species: NO2, NO23, NH4
Phosphorous species: PO4
Other: CHLA, SiO4

b) Computed Variables-

NO3: NO23 –NO2
DIN: NO23 +NH4
TON: TN-NH4-NO23

12) Limits of Detection-

Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, have been established by the Florida International University/ Southeastern Environmental Research Center Analytical Laboratory. Table 1 represents the current MDL's; these values are reviewed and revised periodically.

Parameter	Variable	MDL	Date in Use
Ammonium	NH4	0.0018 mg/L	2002
Nitrate + Nitrite	NO23	0.0013 mg/L	2002
Nitrite	NO2	0.0003 mg/L	2002
Orthophosphate	PO4	0.0009 mg/L	2002
Total Phosphorous	TP	0.0003 mg/L	2002
Total Organic Carbon	TOC	0.06 mg/L	2002
Total Nitrogen	TN	0.05 mg/L	2002
Silicate	SiO4	0.0006 mg/L	2002
Chlorophyll a	CHLA	0.1 ug/L	2002

13) Laboratory Methods:

a) **Laboratory Methods –** All laboratory analysis was preformed by Southeast Environmental Research Program Florida International University, Miami, Florida

i) Parameter: NH4
EPA or other Reference Method: *EPA350.1*
Method Reference: *SERC SOP #002-98*
Method Description: *Analysis for inorganic filtered nutrients (ammonium, nitrite, nitrate and soluable reactive phosphorus). Simultaneous wet chemical analysis were preformed using a four-channel Rapid Flow analyzer. The indophenol blue method for ammonium was used.*
Preservation Method: Samples filtered and stored at 4ºC up to 24 hours.

ii) Paramter: NO2
EPA or other Reference Method: *EPA353.2*
Method Reference: *SERC SOP #002-98*
Method Description: *Nitrite is determined as an azo dye formed by the reation of nitrite with sulfanilamide and subsequent coupling with N-1-naphthylethylenediamine (NEDA).*
Preservation Method: *Samples filtered and stored at 4ºC up to 24 hours.*

iii) Parameter: NO3
EPA or other Reference Method: *Substraction*
Method Reference: *SERC SOP #002-98*
Method Description: *Nitrate is determined by the quantitative reduction of nitrate to nitrite using an activated cadmium column.*
Preservation Method: *Samples filtered and stored at 4ºC up to 24 hours.*

iv) Parameter: Orthophosphate
EPA or other Reference Method: *EPA365.1*
Method Reference: *SERC SOP #002-98*
Method Description: *Soluable reactive phosphate is determined by reacting phosphate with molybdenum (IV) and antimony (III) in an acid medium to form a phosphoantimonyl-molybdenum complex; this complex is reduced with asorbic acid to form a colored dye.*
Preservation Method: *Samples are filtered and stored at 4ºC for up to 24 hours.*

v) Parameter: NO23
EPA or other Reference Method: *EAP353.2*
Reference Method: *SM4500-NO3F*
Method Description:
Preservation Method:

vi) Parameter: CHLA
EPA or other Reference Method: *SM10200H*
Method Reference: *SERC SOP #009-98*
Method Description: *An extractive fluorometric technique is used to determine chlorophyll-a concentrations. Acetone extracts of suspended material collected on filters (saturated magnesium carbonate is not added to filters as a preservative since acetone is added immediately) and excited with 435 nm light, and the fluorescent emission of light at 667 nm is measured using a spectrofluoromter. The amount of fluorescence is directly proportional to chlorophyll concentration as determined by a standard curve of chlorophyll prepared in 90% acetone solution.*
Preservation Method: *Filters are stored in 90% acetone and placed in the dark and stored at 4ºC for a minimum of 48 hours.*

vii)Parameter: TN

EPA or other Reference Method: *ANTEK*
Reference Method:
Method Description:
Preservation Method:

viii) Parameter: TP
EPA or other Reference Method: *EPA365.1*
Reference Method:
Method Description:
Preservation Method:

ix) Parameter: TOC
EPA or other Reference Method: *EPA415.1*
Reference Method:
Method Description:
Preservation Method:

x) Parameter: SiO4F
EPA or other Reference Method: *EPA370.1*
Reference Method:
Method Description:
Preservation Method:

xi) Parameter: Field Measurements
EPA or other Reference Method:
Reference Method: *SERC SOP #005-98*
Method Description: *This procedure applies to the measurements of temperature, pH, light, salinity/conductivity, and dissolved oxygen at the surface and bottom of the water column at each sampling station.*

14) Reporting of Missing Data and Data with Conentrations Lower than Method Detection Limits-

Nutrient/Chla comment codes and definitions are provided in the following table. Missing data are denoted by a blank cell " " and commented coded with an "M". Laboratories in the NERRS System submit data that are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDL's for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 14) of this document. Measured concentrations that are less than this limit are replaced with the minimum detection limit value and comment coded with a "B" in the variable code comment column. For example, the measured concentration of NO23F was 0.0005 mg/L as N (MDL=0.0008), the reported value would be 0.0008 with a "B" placed in the NO23F comment code column. Calculated parameters are comment coded with a "C" and if

any of the components used in the calculation are below the MDL, the calculated value is removed and also comment coded with a "B". If a calculated value is negative, the value is removed and comment coded with an "N".

Note: The way below MDL values are handled in the NERRS SWMP dataset was changed in November of 2011. Previously, below MDL data from 2002-2006 were also coded with a B, but replaced with -9999 place holders. Any 2002-2006 nutrient/pigment data downloaded from the CDMO prior to December November of 2011 will contain -9999s representing below MDL concentrations.

Comment Code	Definition
A	Value above upper limit of method detection
B	Value below method detection limit
C	Calculated value
D	Data deleted or calculated value could not be determined due to deleted data, see metadata for details
H	Sample held beyond specified holding time
K	Check metadata for further details
M	Data missing, sample never collected or calculated value could not be determined due to missing data
P	Significant precipitation (reserve defined, see metadata for further details)
U	Lab analysis from unpreserved sample
S	Data suspect, see metadata for further details

15) QA/QC Programs - For details on precision and accuracy see Table 6.1 in **Nutrient Chemistry Laboratory Quality Manual.**

a) Precision:

i) **Field Variablity –** Two successive grab samples are collected for each monthly sampling event. Field duplicates and splits are treated as individual samples and are not considered analytical duplicates.

ii) **Laboratory variability –** At least one replicate is ran per analytical batch and every 20 samples thereafter.

iii) **Inter-organizational splits –** see attached manual for details.

b) Accuracy:

i) **Sample spikes-** Matrix samples are generally used for this purpose. If the analyte concentration is <10 times the MDL, then a matrix spike duplicate maybe used instead.

ii) **Standard Reference material analysis –** Standard stocks are received by the laboratory staff, initialed, dated and stored in designated areas. The preparation dates of in-house primary stock solutions are recorded in a log book along with the

following information: analyte, concentration, supplier, date opened, expiration data and date of disposal. Preparation logs are maintained for each standard stock.

iii) **Cross calibration exercised -** none

16) Other Remarks –

On 5/19/2025 this dataset was updated to include embedded QAQC flags and codes for anomalous/suspect, rejected, missing, and below detection limit data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than using the original single letter codes used for the nutrient and pigment dataset along with the detailed sections in the metadata document for suspect, missing, and rejected data. Please note that prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all. Suspect, missing, rejected and below minimum detection flags and appropriate three letter codes were embedded retroactively for dataset consistency. The QAQC flag/codes corresponding to the original letter codes are detailed below.

Flag/code	*If also C*	Historic Letter Code	Historic Code Definition
<1> [SUL]		A	Value above upper limit of method detection
<-4> [SBL]	<-4> [SCB]	B	Value below method detection limit
no need to flag/code unless combined		C	Calculated value
<-3> [GQD]	<3> [GCR]	D	Data deleted or calculated value could not be determined due to deleted data, see metadata for details
<1> (CHB)		H	Sample held beyond specified holding time
<0> (CSM) unless other flag		K	Check metadata for further details
<-2> [GDM]	<-2> [GCM]	M	Data missing, sample never collected or calculated value could not be determined due to missing data
<-3> [SNV] and <1> [SCC] for components (CRE) or F_Record {CRE}		N	Negative calculated value
<0> (CUS)		P	Significant precipitation (reserve defined, see metadata for further details)
<1> (CSM)		U	Lab analysis from unpreserved sample
		S	Data suspect, see metadata for further details

The year started out with near normal rainfall, although March was the driest in 25 yrs. April had coastal rainfall mostly. Rainy season was generally drier than normal. Nov/Dec was dominated by El Nino effects with significant rainfall.

Monthly Diel sampling started in February 2002. The following parameters were not analyzed in the diel samples (TP, TN, TON, TOC and SiO4F).

Daily, Monthly, and Annual Precipitation Totals

rkbhcmet **Henderson Creek Weather**

	Daily Precip Totals (mm)
01/02/2002	8.1
01/06/2002	4.1
01/07/2002	0.3
01/14/2002	5.8
01/15/2002	8.6

Monthly Total (mm) 26.9

02/14/2002	0.3
02/16/2002	43.4
02/22/2002	0.3
02/23/2002	18.8
02/27/2002	0.5

Monthly Total (mm) 63.3

03/04/2002	1.8
03/07/2002	15.2
03/30/2002	1.0
03/31/2002	0.5

Monthly Total (mm) 18.5

04/12/2002	6.4
04/16/2002	25.1
04/17/2002	10.4
04/18/2002	4.3

Monthly Total (mm) 46.2

05/14/2002	1.5
05/16/2002	1.8
05/19/2002	36.8
05/20/2002	0.5
05/27/2002	18.3
05/31/2002	0.3

Monthly Total (mm) 59.2

06/04/2002	0.8
06/08/2002	39.9
06/09/2002	0.3
06/12/2002	11.2
06/13/2002	9.9
06/14/2002	46.5
06/15/2002	126.7
06/16/2002	13.5
06/17/2002	0.8
06/18/2002	0.5
06/20/2002	27.9
06/21/2002	3.0
06/22/2002	21.1
06/23/2002	0.3
06/24/2002	17.3
06/27/2002	4.3
06/28/2002	0.3

06/29/2002	6.4

Monthly Total (mm) 330.7

07/06/2002	47.8
07/07/2002	74.9
07/08/2002	19.8
07/09/2002	2.0
07/10/2002	5.1
07/11/2002	0.5
07/17/2002	5.1
07/18/2002	0.5
07/24/2002	7.9
07/25/2002	8.6
07/26/2002	4.8
07/27/2002	6.1
07/28/2002	2.8
07/29/2002	2.0

Monthly Total (mm) 187.9

08/04/2002	1.3
08/07/2002	4.1
08/08/2002	1.8
08/14/2002	14.7
08/15/2002	1.5
08/16/2002	3.6
08/17/2002	7.6
08/18/2002	1.0
08/19/2002	1.5
08/20/2002	3.6
08/21/2002	1.0
08/22/2002	4.6
08/26/2002	1.5
08/27/2002	0.5
08/28/2002	2.5
08/29/2002	0.5
08/30/2002	10.7
08/31/2002	19.3

Monthly Total (mm) 81.3

09/02/2002	3.0
09/03/2002	1.5
09/04/2002	0.3
09/05/2002	18.3
09/06/2002	5.1
09/08/2002	2.0
09/10/2002	24.1
09/11/2002	65.3
09/12/2002	3.0

09/15/2002	2.5
09/17/2002	2.8
09/18/2002	3.3
09/19/2002	2.0
09/20/2002	5.6
09/21/2002	0.5
09/23/2002	16.0
09/24/2002	1.0
09/26/2002	3.8
09/28/2002	5.6
09/29/2002	1.5

Monthly Total (mm) 167.2

10/02/2002	22.1
10/03/2002	0.3
10/12/2002	6.6
10/13/2002	0.5
10/14/2002	3.6
10/15/2002	33.3
10/16/2002	0.3
10/23/2002	2.3
10/28/2002	0.3

Monthly Total (mm) 69.3

11/06/2002	7.4
11/13/2002	0.5
11/16/2002	99.6
11/17/2002	22.1
11/20/2002	0.8
11/21/2002	2.8
11/22/2002	6.4

Monthly Total (mm) 139.6

12/01/2002	4.1
12/09/2002	15.0
12/10/2002	13.0
12/13/2002	19.8
12/20/2002	4.6
12/31/2002	1.0

Monthly Total (mm) 57.5

Annual Total (mm) 1247.6